

XMM

XMM Proposers' Guide and Remote Proposal Submission Software Users' Manual

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1 Glossary

For more information on frequently used technical terms, see also the **XMM** Glossary.

Acronym	Explanation
AO	Announcement of Opportunity (AO-1)
AMS	Archive Management Subsystem
<i>AXAF</i>	Advanced X-ray Astrophysics Facility
CCD	Charge Coupled Device
Co-I	Co-Investigator
DEC	Declination, δ (J2000)
EPIC	European Photon Imaging Camera
ESOC	European Space Operations Centre
ESTEC	European Space Research and Technology Centre
FAQ	Frequently Asked Question
FITS	Flexible Image Transport System
FOV	Field Of View
<i>FWHM</i>	Full Width at Half Maximum
GO	Guest Observer
GSFC	Goddard Space Flight Center
GT(O)	Guaranteed Time (Observer)
GUI	Graphical User Interface
HEASARC	(NASA) High Energy Astrophysics Science Archive Research Center
<i>HEW</i>	Half Energy Width
HER	RGS High Event Rate (selectable mode)
HTR	High Time Resolution (mode of the RGS)
LSF	Line-Spread Function
MOC	XMM Mission Operation Centre
MOS	Metal Oxide Semi-conductor
ODF	Observation Data File
OM	Optical Monitor
OTAC	Observatory Time Allocation Committee
QLA	Quick Look Analysis (software)
PHS	Proposal Handling Subsystem
PI	Principal Investigator
PIMMS	Portable, Interactive Multi-Mission Simulator
PSF	Point-Spread Function
PV	Performance Verification
RA	Right Ascension, α (J2000)
RFC	RGS Focal Camera
RFS	Refreshed Frame Store mode of EPIC MOS
RGA	Reflection Grating Assembly (of the RGS)
RGS	Reflection Grating Spectrometer
XRPS	Remote Proposal Submission
SAS	Science Analysis Subsystem

SER	RGS Split Event Reconstruction (selectable mode)
SES	RGS Single Event Selection (selectable mode)
SOC	XMM Science Operations Centre
SSC	Survey Science Centre
TBC	To Be Confirmed
TBD	To Be Determined
TOC	Table of Contents
ToO	Target of Opportunity
UHB	XMM Users' Handbook
URL	Unique Resource Location
W90	90% Energy Width
WWW	World Wide Web
XMM	X-ray Multi-Mirror Mission
XRPS	XMM Remote Proposal Submission

2 Introduction

The **XMM** Remote Proposal Submission software (XRPS) has been developed for ESA (ESOC) under contract by Logica UK Limited. It is an online proposal submission software package, which is accessible via the URL <http://www.xmmsoc.ops.esa.int/>. The software is not downloadable. All **XMM** proposals must be submitted remotely via XRPS. Because of the potential high load on the system close to the deadline of AO-1, the **XMM** SOC strongly encourages **XMM** proposers to **submit proposals well before the deadline**. Details on the first Call for **XMM** Proposals can be found in the SOC's AO-1 documentation.

XMM proposal submission via XRPS is a single-phase process, meaning that all observation details are provided at the time of submission. **BEFORE submitting** an **XMM** proposal, please read the relevant sections of this document and the **XMM** Users' Handbook (UHB). The **XMM** Users' Handbook can be found via the URL http://astro.estec.esa.nl/XMM/user/uhb_top.html, where users can choose between HTML, PS and PDF versions of the document.

2.1 Scope of this document

This document is the aide to guide users through the **XMM** proposal submission process with XRPS. Users should follow the steps outlined here closely. Following the guidelines presented below, proposing for **XMM** observations should be easy and straight-forward. The XRPS Users' Manual is available in three different formats:

HTML online at http://astro.estec.esa.nl/XMM/user/rpsman/rps_man.html

PostScript (PS) at <ftp://astro.estec.esa.nl/pub/XMM/documents/RPSMAN.ps.gz>

Portable Data Format (PDF) at <ftp://astro.estec.esa.nl/pub/XMM/documents/RPSMAN.pdf>

The **XMM** SOC advises users to use the online version whenever possible to take advantage of the hyperlinks in the text of this document to the appropriate sections of the UHB and also because it might be useful to have this Users' Manual available in one viewer while making the XRPS entries in a separate viewer session.

2.2 Document structure

This Users' Manual (UM) first suggests a straightforward way to plan **XMM** science observations (§ 3). Then we provide general information on XRPS (§ 4). This is followed by a detailed step-by-step guide on how to submit an **XMM** proposal (§ 5). § 5 follows very tightly the order in which inputs into the XRPS form sheets should be made (because the order, in particular at the level of individual exposures within an observation, can be important). In § A examples are given with screen shots of filled-in proposal formsheets. § 7 is just a brief note on the implications of SOC proposal enhancement requests. § 8 outlines how to obtain information on **XMM** Targets of Opportunity. In § 9 we list some missing XRPS functionalities that would be nice to have, but are not available yet; § 10 contains a caveat about the expected XRPS performance close to the deadline. Finally, § 11 lists XRPS-related documents and other information.

At many points where users might need information on which entries to make (for example from the **XMM** Users' Handbook [UHB]), hyperlinks are provided to the location of that

information. Users can then always use the “back” button of their viewer to return to this UM when finished reading the background information. This document is thereby embedded in the SOC web server. Using the online version of this manual, at the URL http://astro.estec.esa.nl/XMM/user/rpsman/rps_man.html, readers will have a screen setup, based on “frames”, with the table of contents on the left-hand side and the currently viewed document page on the right. This provides exactly the same “look-and-feel” as in the **XMM** UHB.

2.3 XMM help and feedback

If lost or in case of doubt, please collect information to describe your problem in detail and direct questions and requests for help on XRPS to the XMM Helpdesk. Feedback, i.e., suggestions and/or criticism, should also be sent to the XMM Helpdesk. For details on XMM Helpdesk services and mailing lists, please consult the XMM Helpdesk web page, at the URL http://astro.estec.esa.nl/XMM/news/xmmhelp_top.html.

3 Before entering XRPS

Before entering XRPS, users should first assess the technical feasibility of the intended observations, based on the available information (primarily the UHB) and tools from the SOC web server at the URL <http://astro.estec.esa.nl/XMM/>.

Based on the feasibility calculations a scientific justification should be prepared, following the Policies and Procedures for AO-1, which are available via anonymous ftp or web browser at the URL <ftp://astro.estec.esa.nl/pub/XMM/documents/policies.ps.gz>. This will be included in the online submission of the proposal using XRPS (§ 5.8).

3.1 Planning an XMM observation

Many trade-offs in the analysis of data may be made at leisure on the ground, subject to availability of suitable tools and calibration knowledge (see, e.g., the UHB sections on EPIC pile-up and points of concern). At the present stage, PIs must be aware only of those issues which irretrievably corrupt the data taken in-orbit and transmitted to ground and plan & prepare their observations accordingly. Corruption of data can, e.g., take the form of:

- Confusion or mixing of the source photons with those from another source in or near the field of view,
- corruption of the reported energy data due to piling up of more than one photon per pixel per CCD readout frame or to excessive optical loading of the X-ray CCDs,
- loss of data due to pile-up effects, or due to saturation of telemetry rates,
- loss of calibration accuracy due to photons lost at CCD chip edges.

Generally to appreciate these issues, the observer needs only to consider the target of interest from the point of view of a simple matrix of properties, namely if the source is bright or faint, if one is interested primarily in spatial, spectral or temporal information and whether the target is extended or point-like.

For each type of XMM instrument (EPIC, RGS, OM) the user must then consider the optimal choice of instrument setup to maximise the scientific return of the observation. General preparatory steps to be taken are:

1. As a minimum calculate the expected count rates using the information contained in the UHB or the PIMMS (Portable Interactive Multi-Mission Simulator) software from the Goddard Space Flight Center, at the URL <http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html>,
2. using the catalogue interface of SciSim and other catalogues, determine the brightest optical object in the field of view; if any source beyond the OM brightness limit should be in its field of view (FOV), the OM must be pt in the “GO-off” mode;
3. using the catalogue interface of SciSim and other catalogues, determine the presence of nearby X-ray bright objects which may cause straylight degradation and

4. using the **XMM** Target Visibility Tool, determine the maximum duration of continuous visibility available in any orbit.

If the planned observations depend very critically on one of the above parameters and the level of accuracy provided by the existing **XMM** online documentation is not sufficient to show whether the observations would be feasible, observers should consider performing a detailed simulation with the **XMM** Science Simulator (SciSim) to ray-trace the whole observation, and analyse the data in an appropriate manner (e.g., with XSPEC). SciSim is available via the URL <http://astro.estec.esa.nl/XMM/scisim/scisim.html>.

We will now describe – in the form of checklists – which aspects of an **XMM** observation must be considered when planning an observation for different kinds of targets. § A (below) contains examples for the possible choices for some crucial input parameters, depending on the target properties. An example for how to prepare filling in the XRPS form sheets based on such considerations and parameter choices is presented in § 3.2.

3.1.1 General considerations

1. Choice of prime instrument

Users must first decide which is the main science goal and with which of the **XMM** science instruments this goal can be best achieved.

2. Science mode of prime instrument

Next, the best-suited instrument mode with which to conduct the observations, depending on the target properties, must be chosen. More on this will follow in § 3.1.2, immediately below.

3. Integration time

Then it must be decided how much integration time is needed for the prime instrument, operated in the selected mode, to achieve the science goals.

4. Pointing direction

For extended targets the optimal pointing direction (which might not coincide with the catalogued target coordinates) must be chosen. The pointing should be chosen in such a way that the target is optimally located on the detector of the prime instrument. Thus, if there is a certain region, e.g., in an extended target that is of particular interest, the coordinates of that particular point should be chosen as the boresight coordinates.

5. Avoidance of nearby sources

XMM science data (both X-ray and optical/UV) can be contaminated by radiation from nearby sources. In case that such exist and must be avoided, this might, e.g., lead to position angle constraints on the observations (for example in order to prevent spectral overlaps).

Users must check for the presence of bright optical/UV sources in the OM FOV. In case a source violates the OM brightness limits, which are listed in UHB Table 19, OM observations may not be conducted and the instrument must be put in the “GO-OFF” mode of operation (blocked filter position).

3.1.2 Instrument setup

3.1.2.1 For a faint extended source

6. Possible adjustment of optimal pointing position

If it is important to ensure that any particular part of the extended object does not fall on a CCD gap, users must choose the pointing direction appropriately (see UHB sections on EPIC pn chip array and EPIC MOS chip array).

7. Science mode of all instruments

For each of MOS and pn, it must be decided if any part of the source is bright enough to give rise to local photon pile-up that would degrade the calibration beyond the science goals when using the full frame imaging mode (see UHB section on EPIC pile-up). If not, the full frame mode should be used.

RGS data of faint extended sources are compromised by low total count numbers and a reduced energy resolution. It should be left on in the default SPECTROSCOPY mode for serendipitous background information (see UHB section on RGS modes).

For a faint extended source the OM should be best operated in its imaging mode. It must be decided if a specific field of view coverage is needed or if the default OM sequence of 5 exposures per filter is adequate. If yes, a default configuration should be chosen (see § 3.3 and also the UHB sections on OM modes and OM default configurations).

8. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods. Other criteria for the split of an observation could be optimal filling of gaps between CCDs, or a calculation to fit in a certain sequence of OM filters observed with one of the OM default configurations (i.e., with exposure multiples of five per filter).

9. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical targets. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

10. RGS readout sequence

For standard SPECTROSCOPY mode observations with RGS no inputs are necessary to choose a non-default CCD readout sequence (see UHB section on RGS modes).

11. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary for the science or if the recommended filter sequence is adequate (see UHB section on OM default configurations and OM optical elements).

12. Length of exposures

While no limits are expected on the length of exposures for the X-ray instruments while observing faint sources (except for visibility constraints and the length of the observation), OM exposures are further constrained by telemetry and memory capacity limits (§ 5.3.3.5).

3.1.2.2 For a bright extended source

6. Possible adjustment of optimal pointing position

If it is important to ensure that any particular part of the extended object does not fall on a CCD gap, users must choose the pointing direction appropriately (see UHB sections on EPIC pn chip array and EPIC MOS chip array).

7. Science mode of all instruments

For each of MOS and pn, it must be decided if any part of the source is bright enough to give rise to local photon pile-up that would degrade the calibration beyond the science goals when using the full frame imaging mode (see UHB section on EPIC pile-up). In the case of a bright extended source, pile-up might be a concern. Then the user must decide whether full frame imaging with pile-up in the brightest parts should be performed or partial frame imaging on one chip to avoid pile-up, at the loss of imaging data over part of the extended object.

Even for bright sources, in particular when extended, photon pile-up should not be a problem in RGS observations. Therefore, it should in most cases be possible to leave it in the default SPECTROSCOPY mode (see UHB section on RGS modes).

For a bright extended source the OM should be best operated in its imaging mode. It must be decided if a specific field of view coverage is needed or if the default OM sequence of 5 exposures per filter is adequate. If yes, a default configuration should be chosen (see UHB sections on OM modes and OM default configurations).

8. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods. Other criteria for the split of an observation could be optimal filling of gaps between CCDs, or a calculation to fit in a certain sequence of OM filters observed with one of the OM default configurations (i.e., with exposure multiples of five per filter).

9. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical targets. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

10. RGS readout sequence

For standard SPECTROSCOPY mode observations with RGS no inputs are necessary to choose a non-default CCD readout sequence. In case of particularly strong emission lines, observers might want to read out individual CCDs more often than others (see § 5.3.3.4).

11. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary for the science or if the recommended filter sequence is adequate (see UHB section on OM default configurations).

12. Length of exposures

While no limits are expected on the length of exposures for the X-ray instruments while observing faint sources (except for visibility constraints and the length of the observation), OM exposures are further constrained by telemetry and memory capacity limits (§ 5.3.3.5).

3.1.2.3 For a bright point source

6. Science mode of all instruments

For each of MOS and pn, it must be decided if the source is bright enough to give rise to photon pile-up that would degrade the calibration beyond the science goals when using the full frame imaging mode (see UHB section on EPIC pile-up). In the case of a bright point source, pile-up is likely to be a concern. Then the user should choose the partial window mode with the largest FOV that minimises pile-up or, for the very brightest sources, use the timing mode.

In order to assess possible pile-up in individual emission lines in RGS data of bright targets, SciSim should be used for modeling the source spectrum; in case photon pile-up is not a problem, the RGS should (for standard spectroscopy) be left in the default SPECTROSCOPY mode. If high time resolution is required, the HIGH TIME RESOLUTION mode should be chosen (see UHB section on RGS modes).

For a bright point source the user might consider using the OM's fast mode, if high time-resolution photometry is required. For each of the science instruments as prime there is one fast mode default configuration. The user should consider whether the time resolution of OM fast mode data is important for the observations and choose the time slice duration accordingly. In case of OM grism observations with a fast mode window on the zeroth order image of the target, OM should be declared prime.

7. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods. Other criteria for the split of an observation could be optimal filling of gaps between CCDs, or a calculation to fit in a certain sequence of OM

filters observed with one of the OM default configurations (i.e., with exposure multiples of five per filter).

8. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical sources and the science target itself. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

9. RGS readout sequence

In case of SPECTROSCOPY mode observations of a target with particularly strong emission lines, observers might want to read out individual CCDs more often than others (see § 5.3.3.4). In case of HIGH TIME RESOLUTION mode observations it must be decided whether one or all nine CCDs shall be read out.

10. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary for the science or if the recommended filter sequence is adequate (see UHB section on OM default configurations).

11. Length of exposures

Telemetry and onboard memory limits place upper and lower boundaries on the duration of single OM exposures as listed in § 5.3.3.5.

3.1.2.4 For timing observations

6. Science mode of all instruments

For EPIC users must check that any neighbouring bright sources are not in the same CCD row/column as the desired object by selecting an appropriate position angle, if necessary, in order to avoid contamination of the target data.

If high time resolution is required, the RGS HIGH TIME RESOLUTION mode should be chosen (see UHB section on RGS modes). Fastest readout (on part of the spectrum) is achieved if only one CCD is read out.

For each of the science instruments as prime there is one OM fast mode default configuration. The user should consider whether the time resolution of OM fast mode data is important for the observations and choose the time slice duration accordingly. In case of OM grism observations with a fast mode window on the zeroth order image, OM should be declared prime.

7. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods. Other criteria for the split of an observation could be optimal filling of gaps between CCDs, or a calculation to fit in a certain sequence of OM filters observed with one of the OM default configurations (i.e., with exposure multiples of five per filter).

8. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical sources and the science target itself. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

9. RGS readout sequence

In case of HIGH TIME RESOLUTION mode observations it must be decided whether one or all nine CCDs shall be read out.

10. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary for the science or if the recommended filter sequence is adequate (see UHB section on OM default configurations).

11. Length of exposures

Telemetry and onboard memory limits place upper and lower boundaries on the duration of single OM exposures as listed in § 5.3.3.5.

3.2 Preparing an XMM observation

As described above, preparing **XMM** observations starts with a technical feasibility calculation, using primarily the information provided in the **XMM** Users' Handbook (online version: UHB) and the tools introduced there.

The scientific goal of the proposal determines the choice of prime science instrument and the total integration time required. It is expected that in all cases either EPIC or RGS will be the most important instrument for the proposed science, i.e., the instrument driving the feasibility calculations (even if, in order to centre the zeroth order image of a source properly in a small OM fast mode window, OM should formally be declared "primary"). Having determined the total integration time needed for the primary instrument, one must consider in which mode they want this instrument to be operated and how many exposures (possibly in different modes) should be taken during the intended observation. Then the use of the other instruments is planned, which will be operated in parallel.

We illustrate this in the following with an example: an RGS HIGH TIME RESOLUTION mode (HTR) observation of a variable X-ray source, let's say, with the aim to monitor its X-ray (and, in parallel, optical/UV) variability over a time period of 23.6 ks (i.e., about six and a half hours; Fig 1).

RGS HTR observations should always be accompanied by a SPECTROSCOPY mode exposure to locate the incident spectrum on the CCD chips. However, such an exposure is added automatically by the SOC. Users therefore do not need to consider this at all.

Then one can prepare parallel EPIC exposures. Assuming that there are no special requirements for this observation, in almost all cases only one exposure per instrument is necessary. This is shown in Fig. 2. The only entries that must be made for each EPIC exposure (besides the exposure time) are the choice of EPIC filters for blocking optical light and the operating mode.

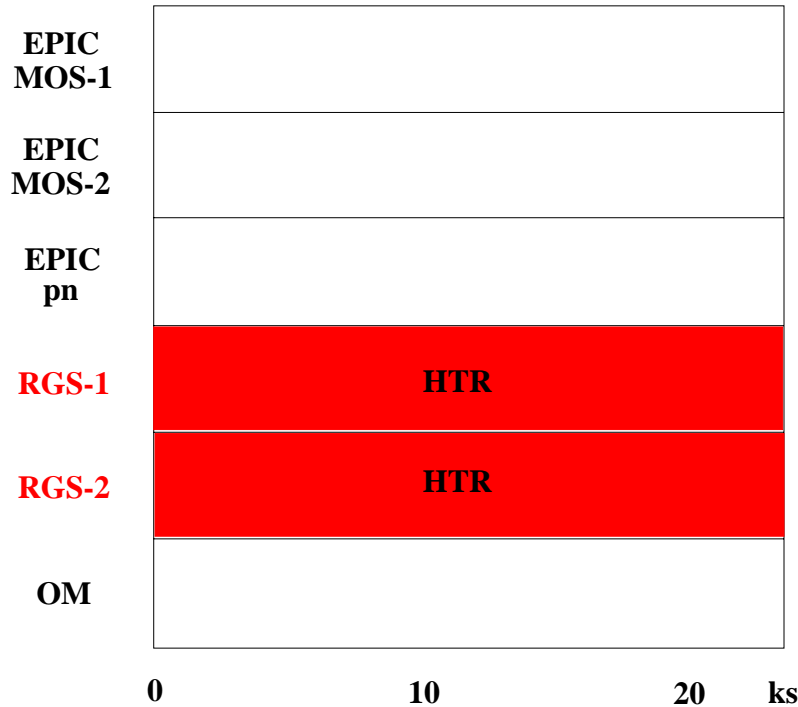


Figure 1: *Preparing an RGS observation using the High Time Resolution (HTR) mode, with an exposure time of 23.6 ks. The RGS observation is assumed to be the science driver of the observation; therefore, it is prepared first and determines the length of the observation.*

Once the X-ray observations are defined, users can start thinking about how to make the best use of OM’s capabilities. First it must be checked whether there are any bright stars within the OM FOV. In case of the presence of a bright source (see UHB Table 19 for the limits for all OM optical elements) the source must either be placed outside the OM FOV by offset pointing **XMM** or OM must be put in the blocked filter position, “GO-OFF”. In case simultaneous OM observations are possible in parallel to the X-ray observations, proposers are **strongly** encouraged to make use of OM’s default configurations because of the instrument’s inherent complexity (see § 5.3.3.5)! Let us assume that in the present example the observer would be interested in parallel OM imaging mode observations, with RGS-1 as the primary instrument. The OM observations could then be prepared in the following fashion:

1. First decide in which OM modes the observations should be carried out (details on this can be found in § 5.3.3.5 and references therein). In the present example, the choice would be “RGS 1 IMG”.
2. Then decide upon the choice of OM filters. The recommendation is: U, UVW1, B, UVW2 (see UHB section on OM default configurations).
3. Next, consulting UHB Table 14, choose the correct order of filter sequence. Throughout the observation filters with increasing filter wheel positions must follow each other so as to minimise the wear and tear on the OM’s mechanical

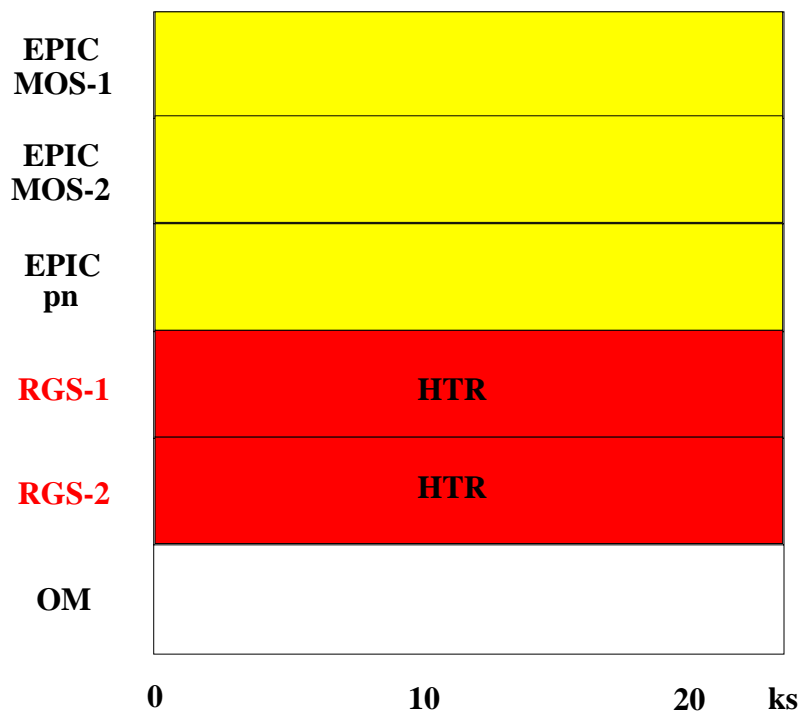


Figure 2: In most cases, the EPIC cameras will run parallel to primary RGS observations, with one exposure covering the entire duration of the observation. Thus, only one exposure each must be entered for the three EPIC instruments. The choice of EPIC operation mode depends primarily on the target's X-ray brightness.

parts. In the present example, this is: U, B, UVW1 and UVW2 (at filter wheel positions 3, 4, 7 and 9; see UHB section on OM optical elements).

- Then, based on the relative OM filter throughput as shown in UHB Fig. 69, decide upon the optimal exposure time. The recommended OM exposure time is 1000 s. In the present example, 800 s were chosen for both the B and U filter, 1000 s for UVW1 (because of the lower throughput) and 2120 s for UVW2, which has by far the lowest throughput of the four filters. In this way, similar limiting magnitudes can be reached with all filters.

For OM default configuration observations the exposure time limits tabulated in § 5.3.3.5 apply.

- If, as recommended, a default mode has been chosen, 5 science windows are defined, which will be observed in 5 consecutive exposures, each with the specified exposure time. Thus, each default mode observation takes five times the “exposure time” specified by the XRPS user. (Mosaicing later the five science windows, there IS – technically speaking – only one exposure, covering 92% the OM FOV).

Therefore, the times for each filter are 4 ks ($= 5 \times 800$ s), 4 ks, 5 ks and 10.6 ks, summing up to 23.6 ks (matching the RGS exposure time).

This leads to the sequence of default mode exposures depicted in Fig. 3. More details on

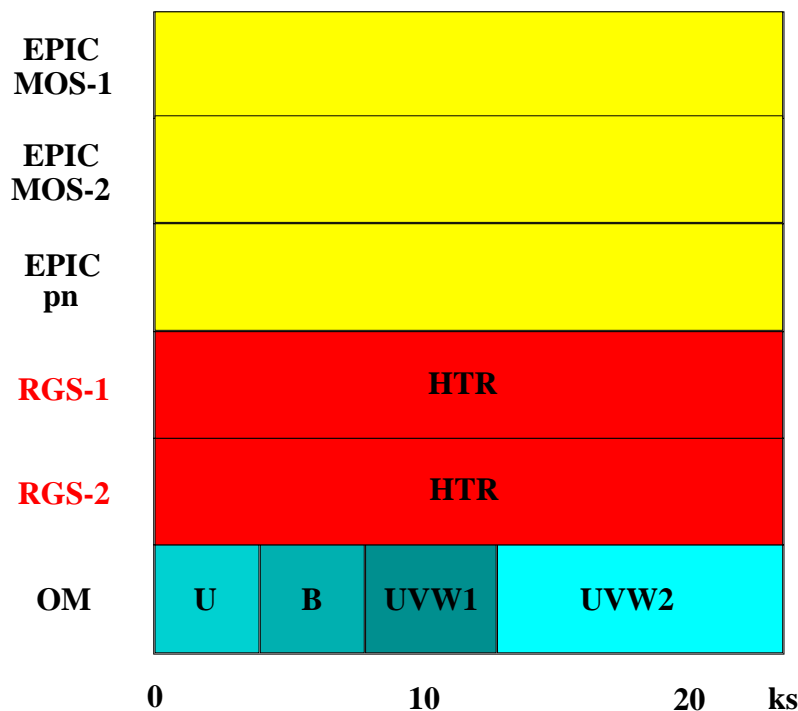


Figure 3: *Parallel to the X-ray observations, OM exposures can now be prepared, using integration times and filter sequences determined as described in the text.*

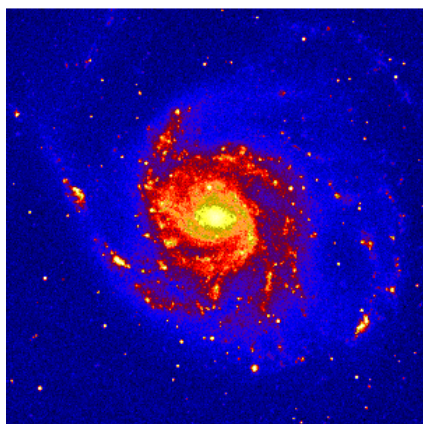
the required inputs will follow in appropriate sections of § 5.

One of the science goals of **XMM** is to conduct serendipitous surveys. To achieve this, all **XMM** science instruments should be operating whenever permitted by constraints (such as, e.g., visibility constraints, target brightness, etc.). This implies that **exposures should be defined for each instrument for the entire duration of an observation**, as demonstrated above.

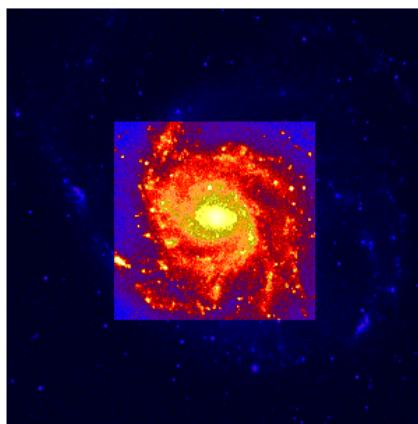
3.3 Default vs. non-default XMM observations

For **XMM**'s X-ray instruments we highlight in the tables in §§ 5.3.3.1, 5.3.3.2 and 5.3.3.3 (in boldface characters) those modes of instrument operation that are strongly recommended for use during AO-1. The use of the other modes is discouraged, as the order of mode commissioning and calibration depends on the complexity and the foreseen need of these modes. Therefore, the necessary SOC support is not always possible and the required calibration accuracy may not be reached, at least in the early mission phases.

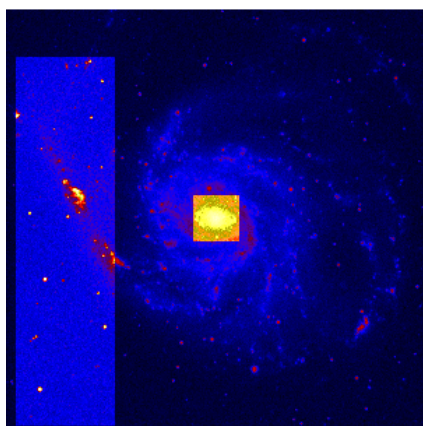
Non-default mode OM observations in AO-1 are in general strongly discouraged. For such, a special scientific justification is required. Note that a number of OM default configurations has been established, which are offered as such in XRPS. Descriptions of these can be found in § 5.3.3.5 and in the OM default configurations section of the UHB. An example for an OM default configurations observation is presented in Fig. 4. Each panel displays a $17' \times 17'$ FOV centred on the nucleus of M 101. The centre of the FOV is always covered by a small science window. In the case of imaging mode observations as shown in the figure, this is an imaging mode window, while for a fast mode default



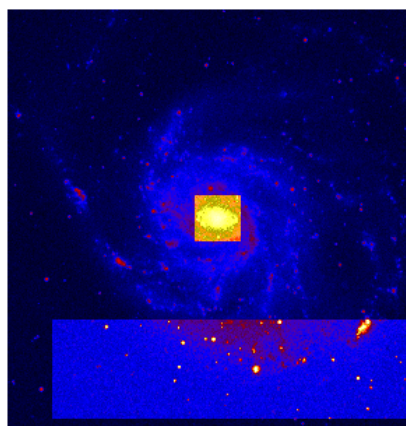
M101 OM Full Field



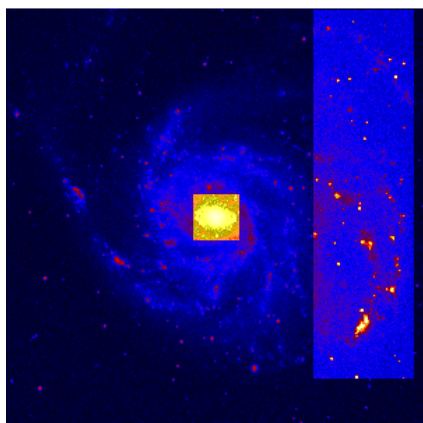
Exposure 1 – FOV Centre



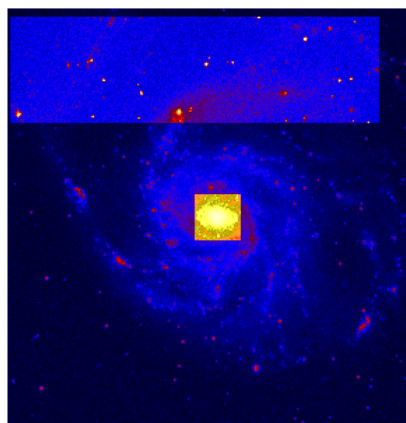
Exposure 2– left edge+ Centre



Exposure 3– bottom edge+ Centre



Exposure 4– right edge+ Centre



Exposure 5– top edge+ Centre

Figure 4: *Sequence of OM science windows covering the FOV in an imaging mode observation. Figure prepared by D. Lumb (XMM SOC).*

configuration there would be a ($12'' \times 11''$) fast mode window at the centre. In addition, a second window, which is in all cases operated in imaging mode, is defined. A default

mode observation consists of five sub-exposures, with that second imaging window first covering the central part of the FOV, then one outer quadrant and so on, until almost the entire (the limit is for practical reasons is 92%) OM FOV has been imaged. Except for the total FOV (upper left), each panel highlights the sky coverage of one of the 5 sub-exposures comprising an OM default configuration exposure. The exposure time entered in the XRPS form sheets refers to one sub-exposure so that each point on the sky will be observed as long as specified by the user's entry. At the centre of the FOV the total integration time will thus be 5 times as long, because this location will constantly be covered by a (small) science window (as best visible in the middle and lower panels).

Note: In case users should nevertheless decide to conduct non-default OM observations, it is their responsibility to obtain all necessary information and to fill out all appropriate XRPS forms correctly. Since there are no adequate defaults for observations with the OM grisms including a fast mode window to monitor the zeroth order image of the target, this case is explicetly explained in § 5.3.3.7.

4 General XRPS instructions

The following general advice should be taken into account when using XRPS. It is recommended to read this chapter **before** starting up XRPS and while using it.

4.1 XRPS down times

In order to avoid problems that might occur if entries in the **XMM** proposal database are changed while it is being backed up, the system is taken offline for a short period of time each night, between 02:00 and 02:30 GMT. Please make sure that you have finished your session by that time.

4.2 XRPS caching

If caching is enabled on a user's browser, it can happen that pages (like the navigation tool or the check results reported to the user; see below) are not updated correctly. In order to avoid this, the size of both the disk cache and the memory cache of the browser should be set to 0 while using XRPS.

4.3 Signing up as an XRPS user

Everybody planning to submit an **XMM** observing proposal as Principal Investigator (PI) **must** register as a user of XRPS. Upon entry into XRPS from the XRPS entry page at the URL <http://www.xmmsoc.ops.esa.int/>, each user can choose between two options:

- New proposal
- Load proposal

Obviously, upon first entry there is nothing yet to load. Therefore, one selects the “New proposal” option. The software then assumes that the user wants to register as Principal Investigator (PI) of an **XMM** proposal. **Upon first entry, please leave the User ID field empty; you will be assigned a User ID automatically.** Please choose a password (it is typed in clear text on the screen and no validation check is performed). **Only alphanumeric keys should be used, because punctuation keys, such as e.g. # or !, can lead to XRPS performance problems!** Then make an entry in each field marked with an asterisk. Asterisks mark the mandatory input fields. Additional information requested in the other, voluntary input fields is welcome, because it can help the SOC (e.g., getting in touch with an observer quickly if necessary).

Once this is done, press the “commit” button at the bottom of the page to send your input to an intermediate memory (more details on this will follow in § 4.4). If all entries are supplied as requested, XRPS will return a success message (text displayed in blue), telling the user which User ID has been assigned. Users should immediately make careful note of their ID and password.

Some users might want to use more than one User ID (e.g., when preparing a proposal not only for themselves, but also somebody else). In such a case, it is **NOT** possible to enter XRPS, from one browser window, under a user ID other than the one entered first. In order to enter under a new user ID, the browser session must be exited and a new one started. This is a safety procedure, because XRPS works with cookies to identify the

user accessing it via a browser. Once all applications of the session are closed down, the cookie is removed. A new session can then be started with a new cookie, which is then the identifier of the current user ID.

4.4 The concept of an intermediate memory

All information that is entered into any of the XRPS web interfaces is, when pressing the “commit” button, stored in a memory. The commit button is always located at the bottom of the right frame of the web interface. From this memory entries can be loaded again later, as sketched in Fig. 5. This implies that XRPS users have no access to the proposal database itself.



Figure 5: *Illustration of the concept of an intermediate memory for proposal information that has not yet been submitted into the proposal database.*

Each user can have up to 20 proposals in memory that have not yet been submitted to the proposal database.

The submission procedure is described in § 5.9. Note that the list of proposals by each PI in the XRPS memory does not contain any information on whether a proposal has already been submitted or not (because the memory is just a working area, not a proposal submission database). Submission will only be acknowledged by email upon receipt of the submitted proposal in the primary database.

4.4.1 Successful memory entries

Successful “committal” of the information contained in a formsheet is acknowledged by a blue message at the top of the screen. Entries can still be changed (errors might still exist and not be identified as such, because XRPS cannot, for example, check for typos in users’ addresses) and re-committed.

4.4.2 Errors upon committal of entries into memory

Formal input errors and missing mandatory entries will cause XRPS to report an error when trying to “commit” the contents of the page. Error messages are always returned in red at the top of the screen. In case of an error, XRPS exits from the usual frames (see below), until all entries have been made correctly. Then a (blue) success message is returned to the user and XRPS returns to its usual frames layout.

4.4.3 Forgetting to press the commit button

When finished with all entries on one particular form sheet, users **must** press the commit button – this will enter the information into the working memory. **Failure to “commit” information before exiting a page, or just resizing the viewer, will cause loss**

of all information entered. Upon loss of input (at least) all mandatory fields must be filled in again.

4.5 The frames of the XRPS web interface

XRPS uses frames to subdivide the viewer window. This frames environment is invoked as soon as a PI has successfully entered his/her personal information and is registered as a user – and thus ready to enter more details on the planned observations, for which the “Proposal details” page is loaded. As illustrated in Fig. 6, there are in total four frames.

Figure 6: Screen shot of the top-level page containing details about an observing programme, the so-called “Proposal Details” page. This is the first page arranged in the frames setup typical of XRPS forms.

The top frame just displays which software application is used. The other frames are described briefly in the following subsections.

4.5.1 Right centre frame

The right frame of XRPS is the main frame where users type in all entries. Here all the form sheets are displayed which must be filled in. At the top of each page its title is provided for easy identification.

4.5.2 Left centre frame

The left frame of XRPS contains a navigation tool, which in principle consists only of a directory listing, showing all filled-in and committed entry forms, which are stored either as files or directories. The entries in the navigation tool are live hyperlinks, which can be clicked on to access a certain page. More information on navigation will follow in § 4.6.

4.5.3 Bottom frame

In the bottom frame a number of click-on buttons are displayed, which have the following functions:

- “Check Proposal”
This button can be used at any time to perform a formal check on the proposal draft stored in the intermediate memory. Proposals that are returned with formal errors must be corrected before they can be submitted.
- “Postscript Version of Proposal”
This allows the user to create a PS version of the proposal. More details on this option are provided in § 5.7.
- “Download Help”
The Download Help button offers two options.
 - “XRPS Users’ Manual”: A hyperlink to this document.
 - “On-line help”: A short Software User Manual (SUM) for XRPS produced by the software provider. It can serve as additional information to this document, but it cannot replace it.
- “Proposal List” Hyperlink leading back up to the list of proposals of the PI. From there one can also go back up to the XRPS entry page.

4.6 Navigating within XRPS

4.6.1 Moving within XRPS

4.6.1.1 Moving down in XRPS

Movements down to the next lower level are always easy, because special function keys (buttons) are offered at the bottom of the higher-level page (web interface).

A PI can choose one of the proposal drafts from the list left in memory previously by clicking on the proposal title. At the next level (the observation level), two buttons are offered named “Add Co-I” and “Add Observation”. The “Add Co-I” button is used to enter personal information for each Co-Investigator on the proposal. The “Add Observation” key leads the user to the level where information about the target of a proposed observation is entered.

One level lower, function keys are offered again to “Add Time Constraints” and “Add EPIC MOS”, “Add EPIC pn”, “Add RGS”, “Add OM”. The first is used to enter time constraints, if any. The latter four allow the user to enter exposures for the different types

of XMM science instruments. Note that **there are two EPIC MOS cameras and also two RGS detectors**, for each of which exposures must be defined. This is the level of input at which the schematic with the pre-planned sequence of exposures within an observation (§ 3.1) comes in handy.

In addition to the above function keys, two more are available at this level, namely “Copy Observation” and “Delete Observation”. The names are self-explanatory.

At the end of each exposure page one also finds the functional buttons to add exposures or to copy/delete the current one. These operations do not lead to a lower level, but create or remove entries at the same (i.e., the exposure) level.

4.6.1.2 Moving up in XRPS

There are no buttons on low-level pages leading the user back up to a level above. Instead, the entries in the navigation tree in the left-hand frame (Fig. 7) should be used. In case no change is required on a page that has been opened, using the navigation tool on the left-hand side allows users to proceed to another XRPS page.

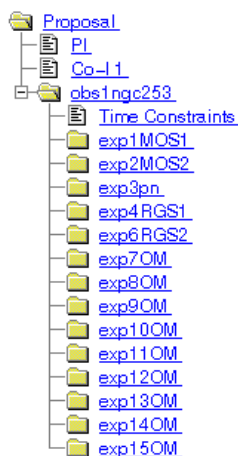


Figure 7: *Screen shot of the XRPS navigation tree. Observations are entered as directories carrying the first 8 characters of the object name. Each exposure is identified by a running index within the observation and the name of the instrument that it belongs to. In this example exposure 5 was deleted again from the list, leaving slot #5 empty because exposures are not renumbered after a deletion.*

Normally, the “back” or “forward” buttons of the viewer should **not** be used to navigate, unless mentioned explicitly as an exception.

Note: Do not forget to commit all entries made on the current page before moving on to another!

By using the navigation tool in the left-hand frame, users can move as high up in the hierarchy as the proposal level. In order to return to any higher level (XRPS entry page or list of stored proposals), use the “Proposal List” button in the bottom frame, from where also the XRPS entry page can be reached again.

4.6.1.3 Arbitrary moves in XRPS

The navigation tool (Fig. 7) allows users to move anywhere, i.e., reload any page that had previously been committed to memory, up to the proposal level. Each entry in the directory tree carries a hyperlink leading to that particular page. To go back higher up, above the proposal level, see instructions above.

4.7 Recommended order of entries

Based on the schematic for an observation suggested in § 3.2 and on the navigation tools provided by XRPS, it is advantageous to insert a proposal by making entries in the following order:

1. First fill in all details on Co-Investigators.
2. Once the list of Co-Is is complete, start working on the first planned observation by filling out the Observation page. Time constraints can also be provided at this point, but may also be added later.
3. On the Observation page the above-mentioned (§ 4.6.1.1) buttons are available to add exposures for the different **XMM** science instruments.

The SOC **strongly** suggests to follow your observing schematic (§ 3.2) by rows, i.e., fill in first all exposures for one instrument (say, EPIC MOS-1), then the next (EPIC MOS-2 and EPIC pn), followed by those for RGS-1, RGS-2 and OM. For each of the six science instruments, the exposures should best be sorted chronologically. Exposure details, if any, can be added to exposures at any time. This order of making entries is favourable for various reasons:

- Filling in exposures on a by-instrument basis, it is easiest to ensure that each instrument is used during the entire duration of the observation, thus maximising the efficiency of the instrument use.
 - Identifying exposures, when going back to make changes, is easiest when they are sorted first by instrument (Fig. 7).
4. Only once one observation is completely finished, users should start making entries for the next. In case of similar observations (e.g., when observing a sample of objects with similar properties) it is then possible to copy the first observation and reuse the template created this way and just edit (change) the entries to apply the required adjustments. Adding exposures (at the end of the list) is easy, deleting unwarranted exposures is also possible, using the “Delete Exposure” button.

Note: When deleting exposures, XRPS does not automatically rename all others to fill the resulting gap in the numbering scheme. A new exposure, even if it is meant to fill a gap produced by a deletion, will be appended at the end of the exposure list of an observation, with a number 1 higher than that of the last exposure in the existing list. Therefore, if an exposure (or the detailed information associated with it) must be changed, it is much better to edit the entries accordingly instead of deleting and replacing it.

The following chapter (§ 5) is a step-by-step guide through XRPS; examples are provided in § A.

5 Filling in the form sheets – a step-by-step guide

Based on the above general advice the use of XRPS is now illustrated step by step, i.e., page by page and entry by entry.

5.1 XRPS entry page

The XRPS entry page prompts users to specify whether they want to enter a new proposal or (re-)load an old one. First time users will always choose the option “New proposal” (§ 5.1.1).

5.1.1 New proposal

The procedure to follow here depends on whether one has already stored the personal information in memory or not. A first time user who has not stored his/her personal details in memory must first choose a password (and make sure to remember it...) and then fill in personal details (cf. § 4.3). Once *at least* all fields marked (with an asterisk) as mandatory are filled in, XRPS will accept the input when clicking on the “commit” button. This will enter the information in the intermediate memory described in § 4.4.

In case an entry in a “mandatory” field is missing, an error message will be returned, specifying which field does not contain a proper entry. In such a case, change it accordingly and try again to commit the information to memory. Please make sure that all contact information is correct and up-to-date. Here, as elsewhere, additional (non-mandatory) information is always welcome, because it can help the **XMM** SOC, e.g., in getting in touch with an observer.

When coming back at a later time, when the personal information has already been stored in memory, a user just needs to type in User ID and password to reenter XRPS and reuse the personal details entered previously.

5.1.2 Load proposal

When accessing an old proposal, only the user ID and password are asked for first. Make the appropriate entries and use “commit” to enter the information. Successful identification will lead to the display of a list of all proposals of the PI. From this list, the proposal to be changed can be chosen by clicking on the title. This will lead to the top-level page of the proposal, called the “Proposal Details” page (see § 5.3).

5.2 Principal Investigator page

On this page the address information of the Principal Investigator (PI) is entered. Although not all entries are marked as compulsory, this form should be filled in completely to make it easy for the **XMM** SOC to get in touch with the observer in case of need. A screen shot is shown in Fig. 8. The use of acronyms for the institute names (e.g., “ESTEC” instead of “European Space Technology and Research Centre”) is permitted if necessary to save space.

5.3 Proposal details page

The proposal details page is the first page to show the typical frames layout of the XRPS forms, as described in § 4.5 and displayed in Fig. 6. It contains the first entries made in

Principle Investigator 1025

Title	<input type="text" value="Mr"/>	*
First name	<input type="text" value="Michael"/>	*
Surname	<input type="text" value="Dahlen"/>	*
Institute	<input type="text" value="ESA/ESTEC"/>	*
Address Line 1	<input type="text" value="BCI-8AX"/>	*
Address Line 2	<input type="text" value="Postbus 299"/>	
Town	<input type="text" value="Noordwijk"/>	*
State	<input type="text"/>	
Country	<input type="text" value="NETHERLANDS"/>	*
	<ul style="list-style-type: none">AFGHANISTANALBANIAALGERIAAMERICAN SAMOAANDORRA	
Post Code	<input type="text" value="2200 AG"/>	*
Email	<input type="text" value="mdahlen@astro.estec.esa.nl"/>	*
Telephone	<input type="text" value="+31-71-565-5908"/>	
Fax	<input type="text" value="+31-71-565-4690"/>	
	<input type="button" value="Cancel"/>	

Figure 8: Screen shot of the “PI personal information” page.

a proposal. Once this has been committed to memory successfully, the proposal as such exists in memory, meaning that now the user can leave XRPS, leaving the information in memory, and come back later (providing only user ID and password). By choosing the option “Load proposal”, one can load the input back from memory and start working on the proposal again whenever convenient.

The functional buttons at the bottom of this page have been described in § 4.5.3. Input for each proposal starts with the proposal details page, where the following information is required (those items marked with asterisks being mandatory input again):

1. The proposal title

The maximum allowed length of a title is 80 characters.

2. Proposal type

Choose between GO and Pilot/Follow-up. Pilot/follow-up are observations with first one (or several periodic) short observations are performed to check the state of an X-ray source (e.g., whether an AGN is in its high luminosity

state), followed by a longer observation if a user-defined success criterion for the pilot run is fulfilled (see item 8). More details are provided in § 5.4. Such observations are highly non-standard and disruptive in terms of scheduling. Therefore, their use during AO-1 is strongly discouraged; the user's choice here should then in (almost) all cases be "GO".

Please refer to the AO-1 web page to read the policies for pilot/follow-up observations as well as Targets of Opportunity (ToOs), linked and concatenated observations.

3. Proposal category

XRPS offers a choice of proposal categories matching the composition of the XMM Observatory Time Allocation Committee (OTAC) panels. Thus users can choose by which OTAC panel their proposal will be reviewed. The available categories are:

- **Stars, white dwarfs and solar system**
- **White dwarf binaries, neutron star binaries, cataclysmic variables and black holes**
- **Supernovae, supernova remnants, diffuse (galactic) emission, ISM and isolated neutron stars**
- **X-ray background and all (deep, galactic etc.) surveys**
- **Galaxies, AGNs, QSOs and BL Lacs**
- **Clusters and superclusters of galaxies**

Due to a last-minute change, there is a minimal mismatch between the entries in the XRPS pull-down menu and those listed above. The categories tabulated here represent the final and official version.

4. Abstract

Please enter the proposal abstract using the editor window provided (max. 800 ASCII characters).

5. Associated proposals

In case one proposal depends heavily on the outcome of another, the other ("associated") proposal should be mentioned here. If you have received back an email acknowledging receipt of the associated proposal (including a proposal identification number), please provide first the number, followed by the proposal title (max. 80 characters altogether).

6. Target of Opportunity (ToO)

It has been decided by the Project Scientist that requests for ToO observations must be sent in via a different mechanism, because XRPS will be taken offline after the deadline of AO-1; see the Policies and Procedures for details. **The ToO flag MUST be left at its default value, which is "false"!**

7. Optical Follow-up

Choose between SSC and GO. The meaning of “SSC follow-up” is explained in the following:

Selecting the “SSC” Follow-up option

By choosing this option proposers indicate that they are willing for the **serendipitous** content of their **XMM** EPIC observations to be included in the follow-up programme being conducted by the **XMM** Survey Science Centre (SSC) as part of its responsibilities to the **XMM** project. In this context “**serendipitous**” refers to X-ray sources detected within the EPIC field of view but **not associated** with the target of the observations. A summary of the SSC Follow-up Programme and other SSC activities is given in the **XMM** User’s Handbook (UHB). The overall goal of the SSC programme is to support the community’s access to, and exploitation of, the serendipitous data from **XMM**, and as such all the results will be made public through the **XMM** science archive. It should be stressed that the SSC programme involves the follow-up/identification of only a small fraction of the serendipitous sources that **XMM** will detect. The emphasis of the SSC programme is on the characterisation of the **XMM** source population through the detailed follow-up of well-defined, small subsamples.

Agreeing to this option does not alter the observer’s proprietary rights for the intended target of the observation. For the serendipitous source content of the field it indicates that the observer allows access to the **non-target** sources by the SSC for the specific purposes of the follow-up programme, and those purposes only. **XMM** serendipitous source data only enters the public domain once the proprietary period expires. *This applies equally where the observer grants follow-up permission: there is no question of such data entering the public domain at an earlier stage.*

Except where there are alternate plans to conduct a follow-up programme based on the serendipitous X-ray source content of their **XMM** fields, observers are encouraged to agree to the SSC follow-up option. This will help to ensure the success of the SSC’s programme which is being conducted for the benefit of the whole community. Where any uncertainty exists in the precise definition of the intended target of the **XMM** proposal the SSC will always undertake to clarify this with the observer, via the **XMM** Project Scientist.

8. Success/fail Criteria for Pilot Observation

For pilot/follow-up observations a success or fail criterion **must** be defined for the pilot run by the proposer, based on which a follow-up observation shall be carried out. The idea is that a pilot observation (i.e., either one or a periodic repetition of more than one short test observations) is carried out to determine whether a variable X-ray source is in a state fulfilling the pre-defined success/fail criterion. If not, **XMM** will continue with its scheduled observations (which is the default procedure) without executing a follow-up run. If the criterion should be fulfilled, a new schedule will be developed as fast as possible, the preplanned schedule interrupted and a longer follow-up observation of the target of the pilot run conducted.

Still within the main input window of the page, the three functional buttons “Commit”,

“Add Co-I” and “Add Observation” are displayed, which offer the following functionality.

- Commit

As before; commit the proposal details that were entered into the form to the working memory. If you do not commit your entries to memory before moving on, you may lose what you have typed in.

- Add Co-I

Up to now only the PI personal information has been entered. All details about each Co-Investigator must be entered too. Fill in a separate page for each Co-I (see § 5.3.1).

- Add Observation

After providing general proposal information the proposer can now continue by entering details about the proposed science observations into an observation page (§ 5.3.2), choosing the “Add Observation” option.

Note: An **XMM** proposal can consist of one or more observations. An “observation” is defined as a pointing to one particular position on the sky, including all sub-units of the observations, which are called “exposures”. For example, a second pointing towards a slightly offset position compared to the first observation (because, e.g., the target does not fit into the EPIC field of view) is a second, independent observation. Pointing towards a new target or position is, by definition, always a new observation, because **XMM** has no capability to perform raster scans.

5.3.1 Co-I details page

The same information as for the Principal Investigator of the proposed project is required for each Co-Investigator, except for the user identification giving access to the proposals in the working memory. When finished with a page, use the commit button, as usual, to commit the information to memory.

At the bottom of each Co-I details page there is a “Delete Co-I Entry” button to remove a Co-I from the list of authors again.

When finished, and after committing information to memory, use the navigation tool to go back up by one level to the proposal level (§ 5.3). There, either more Co-Is may be added, or users can proceed to the “Add Observation” option, to enter observation details.

5.3.2 Observation details page

This is the top-level page for each observation within a proposal (i.e., in almost all cases, the top-level page for observations of one particular target), see Figs. 9 and 10. At this level, the following information is required (all fields marked with asterisks being mandatory again).

1. Target name

Please use the most commonly used name of the target. The first eight characters will be used in the navigation tool (left frame) as identifier of the observation.

Observation 2

Target Name	<input type="text" value="NGC 891"/>	★
Observation Type	<input type="text" value="Fixed"/>	★
Right Ascension	<input type="text" value="00"/> H <input type="text" value="47"/> M <input type="text" value="33.1"/> S (J2000)	★
Declination	<input type="text" value="-25"/> D <input type="text" value="17"/> M <input type="text" value="18"/> S (J2000)	★
Observation Duration (sec)	<input type="text" value="45000"/>	★
Alternative Names	<input type="text" value="UGCA 013"/>	
Boresight RA	<input type="text" value="00"/> H <input type="text" value="47"/> M <input type="text" value="33.1"/> S (J2000)	
Boresight DEC	<input type="text" value="-25"/> D <input type="text" value="17"/> M <input type="text" value="18"/> S (J2000)	
Prime Instrument	<input type="text" value="EPIC pn"/>	★
Inclusive Lower Position Angle Constraint	<input type="text"/>	
Inclusive Higher Position Angle Constraint	<input type="text"/>	

Figure 9: Screen shot of an “Observation” page (top part).

2. Observation Type

Depending on the proposal type specified above (GO or Pilot/Follow-up), the type of observation intended must be filled in here. This is either “Pilot” or “Follow-up” for a Pilot/Follow-up proposal. In case of a normal GO proposal the choice is between “Fixed” or “Non-fixed”, referring to the time of the planned observation. An observation is “Fixed” if it must be carried out (due to the object’s properties or a certain required constellation) at a specific date and time, at predefined intervals or if there are position angle (PA) constraints. More details on which entries are required for fixed observations follow in § 5.3.2.2. Observations without time constraints are “Non-fixed”. In particular, an observation of a target that is visible only during part of the AO-1 observing period is NOT fixed.

Note: A Pilot/Follow-up proposal must consist of exactly one pilot run (which can be executed repetitively by defining a repetition sequence in the time constraints page) and one follow-up run. Therefore, a Pilot/Follow-up proposal must contain exactly two observations. A mixture between GO and Pilot/Follow-up observations in one proposal is not allowed.

3. Right ascension and Declination (J2000)

All coordinate entries MUST be made in the J2000 equinox, in the “hh mm ss.ss” format for right ascension hours, minutes and seconds and in

Source Extent (deg)

Variable Source True False

Source X-Ray Flux (ergs/sqcm/s)

Lower Flux Band Limit (keV)

Upper Flux Band Limit (keV)

X-Ray Spectral Model

Determining Model Parameter (kT or alpha_E)

Hydrogen Column Density (atoms/sqcm)

Optical Spectral Type (O, B, A, F, G, K, M; 0-9)

Visible Magnitude

SOC Enhance Request Yes No

Figure 10: Screen shot of an “Observation” page (bottom part).

the “[sign]dd mm ss.s” format for declinations in degrees, minutes and seconds of arc.

4. Observation Duration ([s])

The **total** proposed length of the observation, including all exposures, in units of seconds. This time is the **NET** science integration time and must not include any estimates for operational and instrument calibration overheads. Users are not required to calculate the overhead times, but might want to have a rough estimate, based on the numbers provided in the UHB, to get an overview of the orders of magnitude. The maximum allowed value for the observation duration is 75600 s. The minimum value for **XMM** observations, in order to keep the observatory efficiency high, is 5000 s.

Users requiring a total integration time for an observation of more than 75600 s (which is the approximate maximal continuous visibility of **XMM** for any point on the sky) are requested to split their programs into as many individual observations of up to 75600 s as needed to reach the required total integration time.

XRPS will calculate the sum of all exposure times for each of the **XMM** instruments per observation and compare this with the observation duration.

If the sum is higher than the observation duration, XRPS will raise an error condition; if the sum for any of the science instruments is more than 10% lower than the total observation duration, a warning will be issued (this is not an error, because OM observations might, for example, be prohibited by the presence of an optically bright source in its FOV).

5. Alternative Names

Other object names, if any.

6. Boresight RA and DEC (J2000)

The coordinates of the direction in which **XMM** will actually be pointing. The requested boresight coordinates can differ from the target's centre coordinates, e.g., in case of extended targets (if the observer wants to point to an off-centre position within the extended target (for which still the centre coordinates should be listed above under item 3)).

The boresight coordinate input fields may be left empty. If so, the target coordinates will, when hitting the commit button, automatically be propagated. The format is the same as in the target coordinate input fields above. However, please note that when the target coordinates are changed again AFTER first committing them to memory, the updated information is NOT automatically propagated into the boresight fields again. In such a case, the boresight coordinates must also be manually updated.

It should always be kept in mind that when pointing off-axis, the calibration of the RGS may not be optimal due to shifts in the wavelength scale as a function of source position. For off-axis angles of $\geq 2'$ (in the RGS's cross-dispersion direction) the spectrum of a source will not fall on the RGS chips. See also the comments below regarding the choice of prime instrument.

Note that also the OM default configurations are optimised for on-axis targets.

7. Prime instrument

Choosing the instrument that is most important to achieve the proposed scientific goals will ensure proper placement of the target on the prime detector for optimal data quality. This is necessary, because the six science instruments onboard **XMM** might be slightly mis-aligned with respect to each other (in the worst case by up to $2'$) such that when a target is optimally placed on the detector of one instrument, its radiation might fall on a chip boundary of another. See the UHB chapter on instrument alignment for details.

In case EPIC should be chosen as prime, it is recommended to make the pn camera the prime instrument to ensure that the target is placed properly on one of its chips. This will ensure optimal use of the pn camera, which is the most sensitive EPIC unit. Proper placement of a target on the pn array is important, because it is the EPIC unit that has its on-axis position closest to a chip boundary, while the chip boundaries of the MOS arrays are far away from the on-axis position (see the UHB sections on EPIC pn chip array and EPIC MOS chip array).

Users with a strong interest in RGS dispersive spectroscopy should declare RGS the prime instrument. Proper placement of the source spectrum on

the chip array will ensure optimal wavelength calibration. RGS-1 having the better spectral resolution of the two RGS units, it should be declared prime for all observations with an emphasis on RGS.

The OM will normally not be prime for an observation. The only possible exception are OM grism observations with simultaneous fast mode monitoring of the target's zero order image.

8. Inclusive Lower and Upper Position Angle Constraint

Especially in case of crowded fields or bright sources in the vicinity of the science target, users will want to avoid these sources, in particular during dispersive spectroscopic observations. Therefore, observers must make sure that nearby sources do not interfere with the science target's spectrum by being located along the dispersion direction of the RGS.

More details on how to determine the range of permitted position angles (PAs) are provided in the UHB, in the sections describing the SciSim GUI and the definition of the satellite position angles. The PA runs from 0 (North) to 360 degrees counterclockwise.

Note: PA constraints translate into time constraints and thereby make an observation "fixed" (in time; see item 2, above)!

The following entries, which are not mandatory, are requested by the SOC to assist the **XMM** user support astronomers in conducting feasibility studies for the execution of the proposed programme, which are used as technical input for the OTAC to review.

- Source Extent

Extent of the source's X-ray emission, if extended, in units of degrees; if not circular, please enter mean value. This is used for count rate calculations and to see whether an extended source will fit into the FOV.

- Variable Source

Flag that will help in technical feasibility studies and make sure that varying count rates do not come as a surprise in the Quick Look Analysis (QLA) of the incoming data.

Please specify 'X-ray variability = yes', if the source flux in the **XMM** energy band (0.1–15 keV) is expected to vary (during the observation), on the basis of known source characteristics, by a factor of 2 or more. If photon pile-up is a concern, users should orient their pile-up calculations for variable sources at the UPPER end of the expected flux range. If not sure about source variability, leave the flag at its default value ("false").

- Source X-ray Flux

In units of $\text{erg s}^{-1} \text{cm}^{-2}$, over the passband to be defined below. Entries can be made as $1.5\text{e-}13$ for $1.5 \times 10^{-13} [\text{erg s}^{-1} \text{cm}^{-2}]$. For count rate conversion from previous satellite missions and flux to count rate conversions the PIMMS software is recommended, in addition to the appropriate plots in the UHB.

If the source extent should exceed 30' (diameter), please provide the flux within a 30' region, centred on the boresight coordinates.

- Lower Flux Band Limit (keV) and Upper Flux Band Limit (keV)
Energy range over which the above X-ray source flux has been determined.
- X-ray Spectral Model
X-ray spectral model approximating the source spectrum in the energy range from 0.1 to 15 keV (the **XMM** passband); choose between
 - Black Body (BB),
 - Thermal Bremsstrahlung (TB),
 - Power Law (PL) or
 - Raymond-Smith (RS) thermal plasma model,if any of these provides an acceptable approximation, in particular in the energy range that is most important for the proposed science.
- Determining Model Parameter
Depending on the above X-ray spectral model, enter here the best-fitting value of the characteristic parameter, i.e.,
 - kT (keV) for all thermal models or
 - α_E energy spectral index for power laws (following the convention $S_\nu \propto \nu^{-\alpha_E}$).
- Hydrogen Column Density
Absorbing column density, in units cm^{-2} ; if known, please provide a fit result from existing X-ray data. For extragalactic sources with either negligible or highly inhomogeneous internal absorption, please provide the value for the Galactic foreground absorption. Exponential notation is again possible, e.g.: 3.78e20 for $3.78 \times 10^{20} \text{ cm}^{-2}$.
- Optical Spectral Type
Especially for planning OM observations it is important to know the spectral type of stars, in particular bright ones. UHB Table 19 lists OM brightness limits for a number of spectral types. In case these brightnesses are exceeded (and **it is the user's responsibility to check for the presence of bright sources in the OM field of view**) OM **MUST** be put in the "GO off" position, i.e., with a blocking filter in the lightpath. No OM data will then be acquired during the observation. Allowed types range from O to M, with subclasses from 0 to 9; O9 is the earliest stellar type for input.
- Visible Magnitude
Johnson V magnitude of target, if known. For extended targets, like e.g. galaxies, please provide maximum surface brightness, in units of V magnitudes per square arcsec.

- SOC Enhance Request

In case of doubt about the optimal observation setup, users can request SOC assistance for optimising an observing programme. However, **please read § 7** before filling in this field.

Finally, use the commit button to enter the information into memory.

By now, the navigation tool (§ 4.6) in the left window should show one file per Investigator, with the PI in first place, followed by a directory which has just been created for entries regarding the first observation of the proposal (cf. Fig. 7).

5.3.2.1 Functional buttons at the bottom of the proposal details page

At the bottom of each observation page two rows of functional buttons can be found. Those in the upper row will be described in the following section. But before doing so, here is a brief description of the functions offered by the keys in the lower row. These are: “Copy Observation”, “Add Time Constraints” and “Delete Observation”.

- “Copy Observation”

In many programmes including more than one observation, the different observations are likely to be similar with respect to the observation details (such as, e.g., the number of exposures per observation, the prime instrument, the choice of filters, etc.). Thus, once all details of one observation (including all exposures, as described below) have been filled in, it can be used as a template for other, similar ones to minimise the manual input and thus the amount of time spent on filling out the proposal formsheets.

Copying an observation will lead to an update of the navigation tree on the left-hand side. When subsequently changing entries in a copied observation (in particular the target name) or in an exposure form, no existing page is deleted or new page created. Thus, XRPS is not triggered to automatically update the navigation tree. If the target name should have changed, press “Reload” on your browser to update the navigation tree.

In case it should be easier to just type in the details of different observations manually, instead of copying, please first commit all data to memory before clicking on the “Proposal” directory in the navigation tree on the left (Fig. 7) to go back up to the top-level “Proposal Details” page and use the “Add Observation” function key to proceed from there (§§ 5.3 and 5.3.2).

- “Delete Observation”

Pressing this button, a whole observation, including all its exposures and associated time details (if any), is deleted. A verification request will appear before performing the deletion.

- “Add Time Constraints”

Time-critical observations need additional entries to specify when they must be conducted. These entries are made in a special time constraints page (§ 5.3.2.2).

5.3.2.2 Filling in time constraints

For each “Fixed” (i.e., fixed-time) observation, a special details form must be filled in. A screen shot of this page is displayed in Fig. 11.

Time Constraints : Observation 1

Time Details			
Con. No.	E.S.T.	L.S.T.	Action
1	2000.100.00.00.00	2000.101.00.00.00	Edit

Add New Constraint

Earliest Start Time (YYYY.DDD.HH24.MI.SS)
Latest Start Time (YYYY.DDD.HH24.MI.SS)
Complete following only if you require a periodic insertion
Repeat Every
Repeat **times**

Figure 11: Screen shot of the “Time Constraints” page in which entries for time-constrained observations must be made.

Inputs can be made either in the “Earliest Start Time” and “Latest Start Time” input field (where absolute times are required) or in the “Start at orbit” and following fields (where a start orbit number and relative timing information is required). Entry of a set of numbers on this page will, after successful committal of the information to memory, lead to an update of the upper part of the main frame, in which the newly specified time details will be listed. For repetitions, there will be one line per requested observation. Either absolute or relative values can be entered. For absolute entries, values from 2000.021.00.00.00 to 2019.359.23.59.59 are allowed. Either absolute or relative time constraints can be defined for an observation; combinations of both are not permitted. Accordingly, the form sheet returned to the user after the first entry will contain only the input fields for the appropriate type of constraint. For relative entries the allowed range of start orbits for AO-1 is 4–432.

Example: To ask for repeated observations, spaced at certain time intervals, but at no particular time, enter an earliest start time of 2000.021.00.00.00, a latest start time of 2010.001.00.00.00 and specify at which intervals (orbits or hours) and how often the ob-

ervation should be repeated. Note that if intervals are chosen in units of hours, all repetitions must be within one (48-hour) orbit. If more are needed, a second set of entries must be made.

The XMM SOC will handle absolute and relative time entries into XRPS in the following way:

Observations which MUST be conducted at a fixed time For observations which MUST be conducted at a fixed time, like e.g. an occultation experiment, absolute time entries must be entered into the proposal database via the “Time Constraints” page. The required format, as displayed on the formsheet, is YYYY.DDD.HH24.MI.SS (i.e., four digits for the year, three digits for the day of the observations [the number of the day in that year] and hours, minutes and seconds in the 24 hours format. The separator is a dot, not a colon. The absolute entry can be used by the SOC to check whether the target will be visible. If so, the observations, if accepted by the OTAC, will be scheduled at precisely the requested date and time. A visibility check should also already be performed by the proposer, using the XMM Target Visibility Tool, and mentioned in the proposal text.

Time-constrained observations that are not fixed to a particular date/time For proposals to observe a source, for example, repetitively, but not necessarily at always exactly the same time interval (which might not be schedulable!), a conversion of the start orbit and related entries into absolute times constitutes an unnecessary restriction. Therefore, relative time entries are not translated by XRPS into absolute times instantaneously, but at a later stage (in the process of proposal optimisation for execution), when the exact orbital parameters are known.

Note: In the case of repeated observations, the science duration specified on the observation page applies to each observation. It is not the sum over all repeated observations (because each is, as the name suggests, handled as an individual observation).

5.3.3 Entering exposure details

Before starting to enter exposure details, it is worth considering how XRPS will handle entries internally. Within an observation, a subdirectory is opened for each exposure. For each of the XMM science instruments at least one exposure must be specified. The suggested order (as mentioned already in § 4.7) is

1. EPIC MOS-1,
2. EPIC MOS-2,
3. EPIC pn,
4. RGS-1,
5. RGS-2 and
6. OM at last.

Thus, the recommended sequence of steps to fill out the exposure details for an observation, using the top row of functional keys at the bottom of the observation details page, is to first proceed to “Add EPIC MOS” and, once finished with all EPIC MOS-1 and EPIC MOS-2 exposures, to “Add EPIC pn”, before going to “Add RGS” and “Add OM”, as often as necessary to fill in all required exposures (see the following paragraphs). Alternatively, a functional button at the bottom of each exposure page can be used to copy exposures. Also at the bottom of the page there is a button to delete each exposure again.

XRPS will count all exposures belonging to one observation consecutively. The name of the instrument for which an exposure has been defined will be part of the file name visible in the navigation tool.

5.3.3.1 Filling in EPIC MOS details

Fig. 12 displays a screen shot of an EPIC MOS exposure form sheet. The following (mandatory) entries must be made there.

MOS camera unit When first entering this page, the “Instrument” query will have the two options “EPIC MOS 1” and “EPIC MOS 2” from which users must choose one, because exposures are defined independently for both instruments. Once specified, and once all entries have been made and successfully committed to memory, this is not a selectable parameter anymore, but the fixed entry will appear on the form sheet, as displayed in Fig. 12. Therefore, it is not possible to copy a MOS-1 exposure and then change it to MOS-2.

EPIC optical blocking filters The allowed choice of filters is presented in Tab. 1.

Table 1: *EPIC filters*

Filter ¹	Description
OPEN	No blocking filter
THIN	Thin aluminium
MEDIUM	Medium aluminium
THICK	Thick aluminium Polypropylene
CLOSED ¹	Blocked filter position

Note to Table 1:

1) Only the highlighted filters are recommended for use.

MOS modes of operation The descriptions of the EPIC modes in the UHB and XRPS differ because of the changes that the modes and their names have undergone with time. The mapping of mode names is tabulated in Tab. 2.

Exposure offset entry The exposure offset should be left at its default value of 0 s to ensure continuous operation of the instrument. Only under special circumstances, under which one would **not** want the instrument to operate for a certain amount of time, an offset with respect to the previous instrument exposure, if any, would be defined here.

Table 2: *Mapping of EPIC MOS mode names*

UHB name	XRPS name ¹
FULL WINDOW (600×600)	PRI FULL MOS
REFRESHED FRAME STORE (600×600) ²	PRI PART RFS
PARTIAL WINDOW (100×100) ³	PRI PART W2
PARTIAL WINDOW (300×300) ³	PRI PART W3
PARTIAL WINDOW (100×100) ⁴	PRI PART W4
PARTIAL WINDOW (300×300) ⁴	PRI PART W5
FULL WINDOW 2 NODES (600×600)	PRI PART W6
TIMING	FAST UNCOMP

Notes to Table 2:

- 1) During AO-1 only the highlighted modes are recommended for use.
- 2) Variable live time for full field imaging of bright extended sources. About 200 ms duty cycle; 6–7% live time.
- 3) 1 node readout.
- 4) Free running readout.

Exposure 1 : EPIC MOS

Filter Wheel ★

Exposure Time (secs) ★
Offset is from the end of the previous exposure

Exposure Offset (secs) ★

Instrument **EPIC MOS 1**

Instrument Mode ★
This number is based on the same instruments in this observation.

Order (ins. based) **1**

Add New Exposure

Figure 12: Screen shot of an EPIC MOS exposure form sheet for a FULL WINDOW imaging exposure with a length of 45 ks and an offset with respect to the previous exposure of 0 s. The THIN optical blocking filter was chosen.

5.3.3.2 Filling in EPIC pn details

In Fig. 13 a screen shot of an EPIC pn exposure formsheet is displayed.

Exposure 3 : EPIC pn

Filter Wheel ★

Exposure Time (secs) ★
Offset is from the end of the previous exposure

Exposure Offset (secs) ★

Instrument **EPIC pn**

Instrument Mode ★

Frame Time Parameter
This number is based on the same instruments in this observation.

Order (ins. based) **1**

Add New Exposure

Figure 13: Screen shot of an EPIC pn exposure form sheet. Mode *PRI FULL PN*, in conjunction with Frame Time Parameter = 5, defines the *FULL WINDOW EXTENDED* mode, which has a longer live time and less out-of-time events (see *UHB* section on points of concern) than the normal *FULL WINDOW* mode, but potentially higher pile-up rates.

The selectable parameters for the pn camera are again the EPIC filters, exposure time, exposure offset (which should normally be 0) and the EPIC modes.

Optical blocking filters The choice of optical blocking filters is the same as for EPIC MOS (see Tab. 1, in § 5.3.3.1).

pn modes of operation The descriptions of the EPIC modes in the UHB and XRPS differ because of the changes that the modes and their names have undergone with time. The way the UHB and XRPS names map onto each other is described in Tab. 3.

The UHB modes *TIMING* and *BURST* are two flavours of the EPIC fast mode, where the *BURST* mode has an extremely short duty cycle. Both modes operate on one CCD (the one on which the nominal on-axis boresight falls).

Table 3: *Mapping of EPIC pn mode names*

UHB name	XRPS name ¹
FULL WINDOW (400×384)	PRI FULL PN ³
FULL WINDOW EXTENDED ²	PRI FULL PN ⁴
LARGE PARTIAL WINDOW (200×256)	PRI LGE WIN
SMALL PARTIAL WINDOW (64×64)	PRI SML WIN
TIMING	FAST TIMING
BURST	FAST BURST

Notes to Table 3:

- 1) During AO-1 only the highlighted modes are recommended for use.
- 2) “Extended” means that the image collection time is extended by a programmable parameter (not user-selectable).
- 3) With “frame time parameter” value 0.
- 4) With “frame time parameter” value 5.

Frame time parameter The XRPS mode PRI FULL PN comes in two flavours, depending on the frame time parameter. A frame time parameter of 0 represents the default imaging mode. A value of 5 extends the frame readout time by a factor of 5, thereby reducing the percentage of so-called “out of time events” (i.e., photons registered while the CCD is being read out). The “FULL WINDOW EXTENDED” mode of pn (i.e., “PRI FULL PN” with frame time parameter = 5) should be used in particular for relatively faint extended sources, see the UHB section on points of concern. Currently only the values 0 and 5 are allowed.

Exposure offset This should be 0 again in order to avoid times during which the instrument is idle.

pn camera unit There is only one EPIC pn camera, therefore the instrument unit is not a selectable parameter.

5.3.3.3 Filling in RGS details

Similar to the EPIC exposures, a few details must be defined for each RGS exposure. Fig. 14 provides an example for an RGS exposure formsheet.

For RGS the following inputs must be provided: exposure time, exposure offset (should normally be 0), RGS unit and RGS modes.

RGS modes The descriptions of the RGS modes in the UHB and XRPS differ because of the changes that the modes and their names have undergone with time (see Tab. 4).

The users’ choice for RGS is between “SPECTR+Q” and “HTR SINGLE CCD” or “HTR MULTIPLE”. SPECTROSCOPY without Q data (i.e., Q memory calibration data based on which the optical loading of the RGS CCDs is monitored) is not recommended, because then the optical loading of the

Exposure 6 : RGS

Exposure Time (secs) ★

Offset is from the end of the previous exposure

Exposure Offset (secs) ★

Instrument **RGS 2**

Instrument Mode □ ★

This number is based on the same instruments in this observation.

Order (ins. based) **1**

Add New Exposure

Figure 14: Screen shot of an RGS exposure form sheet for a 45 ks exposure of RGS-2 in the recommended mode for standard spectroscopy.

CCD chips cannot be calibrated properly offline. Use of the other configurations of the spectroscopy mode (HER, HER+SER, HER+SES) reduces the instrument telemetry by reducing the level of detail to be transmitted per event. HER applies an onboard event threshold; onboard split event reconstruction (SER) further reduces the telemetry rate; the highest data reduction in a spectroscopy mode is reached with HER plus single event selection (SES). Use of these options is not suggested, unless there is concern that the instrument telemetry is likely to exceed the allocated limit. This should then be stated clearly in the scientific justification. When the telemetry rate is exceeded in the SPECTR+Q mode, the first alternate choice should be HER observations. The recommended modes are highlighted in Tab. 4. Note that there is an additional page which must be filled out in case special observation details are required (§ 5.3.3.4).

Exposure offset Should be 0 again in order to avoid times during which the instrument is idle.

RGS unit As in the case of EPIC MOS, there are also two RGS units. When first entering the RGS exposure form sheet the RGS unit is a selectable parameter. When re-entering the page again later (after successful committal of the input to memory), this parameter is fixed. Exposures must be defined for both RGS units independently. It is not possible to copy an RGS-1 exposure for use with RGS-2.

Table 4: *Mapping of RGS mode names*

UHB name	XRPS name¹
SPECTROSCOPY ²	SPECTROSCOPY ³
SPECTROSCOPY²	SPECTR+Q⁴
SPECTROSCOPY ²	HER ⁵
SPECTROSCOPY ²	HER+SES ⁶
SPECTROSCOPY ²	HER+SER ⁷
HIGH TIME RESOLUTION (HTR)	HTR MULTIPLE⁸
HIGH TIME RESOLUTION (HTR)	HTR SINGLE CCD⁹

Notes to Table 4:

- 1) During AO-1 only the highlighted modes are recommended for use.
- 2) The SPECTROSCOPY mode comes in 5 different flavours (see text for details).
- 3) Not recommended for use, no Q calibration data transmitted with the science data.
- 4) Default and recommended SPECTROSCOPY mode. Q calibration data are telemetered interleaved with the science data to monitor the optical CCD loading.
- 5) HIGH EVENT RATE spectroscopy mode. Reduction of data rate by onboard application of an event threshold. No Q data are transmitted. Not recommended for use in AO-1.
- 6) HER + Single Event Reconstruction; only single pixel events are telemetered. Not recommended for use in AO-1.
- 7) HER + Split Event Reconstruction. Split events are reconstructed onboard before transmission to ground. Not recommended for use in AO-1.
- 8) Readout of all 9 CCDs.
- 9) Readout of only a single CCD.

5.3.3.4 Filling in RGS exposure settings

For RGS more details must be specified, depending on the instrument mode in which observations are to be carried out. These can be defined on a dedicated page, which is accessed by pressing the “Add Details” button at the bottom of the exposure page.

At present, only the RGS CCD readout sequence is a user-selectable parameter. For normal observations over the whole energy range of the RGS, this sequence should not be changed. Only if users want to perform spectroscopy only over a part of the RGS passband or read out one or more chips faster than others, a different sequence can be chosen here. Each RGS has 9 CCD chips, but is read out in a cycle with up to 12 readout slots. The energy ranges covered by the different RGS CCDs in different grating orders are described in the UHB chapter about RFC arrays (RFC standing for RGS Focal Camera). If a user should wish to read out a chip onto which a particularly strong and scientifically important line falls (e.g., no. 3) more often than all others, a readout sequence of, e.g., [3 1 2 3 4 5 3 6 7 3 8 9] could be chosen, with which chip #3 is read out 4 times as often as the others. In this manner photon pile-up in bright emission lines can be avoided, if it should be a concern for the proposed science.

When the “HTR SINGLE CCD” mode is used, only one CCD is read out. Accordingly, all readout slots must have the same CCD number in this case. Please fill the number of the CCD that should be read out into the form.

5.3.3.5 Filling in OM details

For an OM exposure users must choose one of the OM optical elements, the exposure time for that optical element, exposure offset (normally 0) and one from a list of OM modes/OM default configurations. For a screenshot of an OM exposure form sheet, see Fig. 15.

Exposure 7 : OM

Filter Wheel ★

Exposure Time (secs) ★

Offset is from the end of the previous exposure

Exposure Offset (secs) ★

Instrument OM

Instrument Mode ★

This number is based on the same instruments in this observation.

Order (ins. based) **1**

Add New Exposure

Figure 15: Screen shot of an OM exposure form sheet for an exposure with the U filter (filter wheel position 3), in imaging mode, using the default configuration for EPIC pn as prime instrument, with 1000 s exposure time for each of the five sub-exposures comprising a default configuration exposure.

OM exposure time limits Due to internal memory capacity and telemetry bandwidth restrictions OM science exposures have a limited range of allowed exposure times. For the default configurations (see below) these limits are:

Mode	Allowed range [s]
IMAGING mode	800–5000
FAST (1 window)	1000–4400

For non-default configuration observations exposure times within these ranges are also valid. The allowed ranges will be wider, depending on target and OM science window properties.

Choice of OM modes/configurations Because of the complexity of OM, **default configurations** have been defined for its two basic science modes, i.e., the imaging

mode and the fast mode (see Table 5). However, the list of OM instrument configurations does not only contain two default configuration options, but 12. This arises from the fact that there are five X-ray instruments which can be chosen as prime, and the OM itself. Because of the potentially small size of the OM science windows (in particular for fast mode observations) and the expected instrument misalignment, separate default configurations have been defined for each OM mode for each instrument as prime. The modes EPIC PN IMG (FST) are the default configurations for the modes IMAGING (and FAST), with EPIC pn as prime. IMAGE and IMAGE FAST are the default configurations for OM as prime, with either only an IMAGING mode window or a FAST mode window embedded in an IMAGING mode window. See the UHB for details on OM default configurations. An example is also displayed in § 3.3. When choosing one of the OM default configurations users do not need to specify any further details (and thus do not need to press the “Add Details” button, but can proceed to the next OM exposure.

The mapping of the OM mode names used in the UHB and by XRPS is described in Tab. 5.

XRPS will read the choice of prime instrument made by the user and will offer in the OM modes pull-down menu only those that are compatible with that prime instrument. Thus, the user will see only part of the configurations/modes from Tab. 5 listed in the pull-down menu on the screen. Reconsidering the choice of prime instrument AFTER having specified OM exposure details, one must go back and change these entries in compliance with the newly defined prime instrument. Otherwise the exposures are invalid (XRPS will flag an error condition).

SCI USER DEF is the option to choose any mode (IMAGE or FAST or a combination of both by having different windows operate in different modes) and customised window sizes without a default configuration. More details on how to fill in non-default OM observations follow in § 5.3.3.6.

Note: The OM science mode SCI USER DEF is the only way to request grism observations with the zeroth order image covered by a fast mode window, as described in § 5.3.3.7, below.

Choice of OM optical elements and the correct sequence This has been described in § 3.2; users should follow the five steps outlined there. In § 3.2 links are provided to the relevant sections of the UHB.

OM camera unit There is only one OM camera; the instrument unit is therefore not a user-selectable parameter.

5.3.3.6 Filling in OM exposure settings

For the OM a number of details must be specified, if non-default configuration observations should be carried out. These can be defined on a special page by pressing the “Add Details” button at the bottom of the exposure page. The appropriate formsheet is displayed in Figs. 16.

Table 5: *Mapping of OM mode names*

UHB Name	XRPS Name ¹	Prime Instrument
Non-default obs. ²	SCI USER DEF	Any
GO-OFF	GO-OFF ³	Any
IMAGING ⁴	EPIC MOS 1 IMG	EPIC MOS-1
FAST ⁵	EPIC MOS 1 IMG FST	EPIC MOS-1
IMAGING ⁴	EPIC MOS 2 IMG	EPIC MOS-2
FAST ⁵	EPIC MOS 2 IMG FST	EPIC MOS-2
IMAGING ⁴	EPIC pn IMG	EPIC pn
FAST ⁵	EPIC pn IMG FST	EPIC pn
IMAGING ⁴	RGS 1 IMG	RGS-1
FAST ⁵	RGS 1 IMG FST	RGS-1
IMAGING ⁴	RGS 2 IMG	RGS-2
FAST ⁵	RGS 2 IMG FST	RGS-2
IMAGING ⁶	IMAGE	OM
FAST ⁷	IMAGE FAST	OM

Notes to Table 5:

- 1) During AO-1 only the highlighted modes are recommended for use.
- 2) Non-default observations are discouraged; however, see § 5.3.3.7 regarding OM grism observations.
- 3) Safe position to protect OM from bright sources in the field of view.
- 4) Default configurations (see text) have been defined to ease the use of the OM. There is one default configuration for each X-ray instrument as prime.
- 5) The same as for the IMAGING mode. Here, the correct choice of configuration (to match the choice of the prime instrument) is even more important than for IMAGING mode observations, because OM FAST mode windows are only about $11'' \times 12''$ in size (compared to a possible misalignment of up to $2'$).
- 6) IMAGING mode default configuration for OM as prime instrument.
- 7) FAST mode default configuration for OM as prime instrument.

OM science mode First the science mode for each window defined must be chosen. The choice for non-default OM observations is limited to “IMAGING”, “FAST” and “GO-OFF” (see Tab. 5).

OM science window coordinates There are two columns of input fields, only one of which must be filled in. The left column asks for sky coordinates and a window size in angular units. The default coordinates for the centre of an OM science window are the boresight coordinates defined above at the observation level. The window size (DX,DY), in units of arcmin, is limited to $0' - 17'$. The complex boundary conditions that apply to non-default non-default OM science windows are described in the UHB. The right column requires inputs in detector coordinates (pixels). Upon committal of a set of entries defining a science window the top part of the window in Fig. 16 is filled automatically. For the OM up to 5 science windows may be defined in total, of which up to 2 may be operated in the fast mode.

OM Setting : Exposure 7

OM SCI Win Details									
Win No.	Mode	X0	Y0	DX	DY	Time Slice	BIN X	BIN Y	Action
1	Image	960	752	128	368	n/a	1	1	Edit Delete

Add New Win

Window Mode ★

Center Position of Window *Lower Left Position of Window*

(X0) Right Ascension H M S (J2000) ★ In Pixels ★

(Y0) Declination D M S (J2000) ★ In Pixels ★

Size of Window **OR** *Size of Window*

(DX) In Arcmin ★ In Pixels ★

(DY) In Arcmin ★ In Pixels ★

Only complete following if using a Fast mode setting (values will be ignored)

Time Slice Duration (ms)

Only complete following if using an Image mode setting (values will be ignored)

DPU Binning in X Direction

DPU Binning in Y Direction

Figure 16: Screen shot of an OM exposure details page. Entries for one science window have already been committed to memory; those for a second window are still in the input fields. Committal of these will add a second entry in the upper part of the form.

DPU binning In the lower part of the OM exposure settings page only the pixel binning in the Digital Processing Unit (DPU) must be specified. The choice is between values from 0 to 2. They stand for the power of 2. Value 0 represents $2^0 = 1$ pixels, $2^1 = 2$ and $2^2 = 4$. Since only equal binning in both the X and Y direction makes sense, the choice is between binnings of 1×1 , 2×2 and 4×4 original 0.5" (DPU) pixels. Default binning is 2×2 pixels.

Time slice duration For each fast mode window the time slice duration must be specified, i.e., the length of individual readouts within an exposure. The allowed range is 50–90000 ms.

More details on the required input for non-default OM science windows are provided in the appropriate UHB chapter. The correct specification of OM science windows, which are

constrained by various observation-dependent parameters, is very complicated. Still, **it is the user's responsibility to provide correct entries**. Users proposing observations with non-default OM science windows should ask for SOC enhancement support. However, note that the available SOC support to help users will be limited. This is the reason why OM default configurations have been developed and their use is strongly recommended!

Note: Although in principle OM grism observations can be performed using an imaging mode default configuration, there is in practise no ADEQUATE default (because most of the time the central part of the FOV would not be read out, as described in § 3.3). Therefore, users who want to perform such observations, must choose the SCI USER DEF mode and fill in window settings manually on the OM exposure settings page. Detailed instructions follow in § 5.3.3.7, immediately below.

5.3.3.7 OM grism observations

For OM grism exposures no default configuration has been established yet, mainly due to a lack of data on the grism performance. This means that users planning on conducting observations with the OM grisms must enter all details (OM modes, science window location and size, etc.) manually on the OM settings page for each exposure.

BEFORE starting an OM grism exposure, an image should be obtained of the field of view in order to render possible an identification of the dispersed spectra with sources in the field of view. For the imaging exposure a default configuration (as described above in § 5.3.3.5) should be used. Note that different brightness limits apply to observations with the OM filters, the magnifier and the OM grisms, as listed in UHB Table 19.

There are two grisms on the OM filter wheel, named Grism 1 and 2, covering the UV and the optical wavelength range, respectively (see UHB chapter on OM optical elements). The dispersion direction of both grisms is the detector y-axis. The dispersed first-order spectra of both grisms 1 are centred with their reference wavelength (260 nm and 420 nm, respectively) on the detector location that the target would have with a non-dispersive filter in place. Each grism has a zero- and a first-order image. The spectra of the two grisms differ in size (in both orders). The positions of the spectra, with respect to the reference point, y_0 , are summarized in Tab. 6. Note that the exact positions can only be determined after detailed inflight calibration. It is therefore recommended to define windows as large as possible around the dispersed spectra, as described in the following.

Table 6: *Positioning of the OM grism spectra with respect to the reference position, y_0 , of the first order image.*

	1st order image					0th order image	
	Wavelength [nm]			Position ¹ of		Position ¹ of	
	at Ref. Pos.	λ_{min}	λ_{max}	λ_{min}	λ_{max}	λ_{min}	λ_{max}
Grism 1	260	160	290	-260	+78	-811	-709
Grism 2	420	290	550	-282	+282	-767	-699

1) Relative to the reference position, y_0 , of the 1st order image, along the dispersion direction (=detector y-direction), in units of subpixels.

Preparing an OM grism exposure

Acquiring a target spectrum without further timing information Only one OM science window is defined.

- The centre of the OM window is defined equal to the target position (use RA and DEC). **Note** that the target position must be within 3.2' of the **XMM** boresight coordinates.
- The width of the window in x-direction is set to 1'.
- Depending on whether the optical or UV grism is used, the width of the window in y-direction is set to
 - 4.8' for Grism 1 (UV)
 - 5.2' for Grism 2 (optical)
- DPU binning is optional.

Obtaining additional timing information from the zero order spectrum Assuming that OM is prime instrument and the target is on-axis, two windows are defined:

- The windows are defined in the detector coordinate system.

Win.#	Grism 1 (UV)					Grism 2 (optical)				
	X0	Y0	DX	DY	Mode	X0	Y0	DX	DY	Mode
1	960	752	128	368	image	960	736	128	576	image
2	1022	208	4	112	fast	1021	256	6	80	fast

- This requires that the position of the spectrum be known in the OM detector coordinate system at the time of proposal submission, which is only the case **either for position angle-constrained observations or for on-axis observations with OM as prime instrument**.
- Window 1 provides the coverage of the first-order spectrum, while window 2 provides fast mode data. The appropriate entries for an observation with Grism 1 are displayed in Fig. 16. The entries for the first window have been made previously and committed to memory; they now show in the upper part of the form. The entries for the second window are still in the input fields, ready to commit.

5.4 Pilot/Follow-up observations

Pilot/Follow-up proposals must consist of exactly two observations, the first being the pilot run, the second the follow-up. The two observations are treated as separate entities by XRPS and no consistency checks are performed on the input to both. Therefore, users must make sure that all target- and observation-related information is entered consistently in both observation forms. The easiest way to do this is to copy the pilot observation (which **MUST** be done **BEFORE** any time constraints are added to it!) and then re-define the copied, second observation to the follow-up in the “Observation Type” field. For the pilot observation time constraints must then be provided (see § 5.3.2.2). None may be given for the follow-up observation, because it must follow the pilot run immediately, IF the success criterion defined previously is fulfilled.

5.5 Formal checks on a proposal

When all entries are made and all proposal pages have been successfully committed to memory, have XRPS go through all observations again to perform a few basic checks by hitting the “Check Proposal” button.

If all entries are formally correct and no compulsory entries are missing, XRPS will report an “OK” status for each observation individually. An example is displayed in Fig. 17. In this example the user is warned that OM is not used during the entire observation.

Check Proposal

Check Summary

Observation 1

Observation Duration = 15000

EPIC MOS 1 Duration = 15000

EPIC MOS 2 Duration = 15000

EPIC pn Duration = 15000

OM Duration = 3000 Warning: Max. Exposure Duration is at least 10% less than
Observation Duration

RGS 1 Duration = 15000

RGS 2 Duration = 15000

Observation 1 is ok

End of check – PASSED

Figure 17: *Screen shot of a proposal that has passed the formal XRPS check, with a warning that OM is not used during the entire observation. The sum of all user-defined OM exposures (3000 s) is much smaller than the observation duration of 15000 s.*

In case of formal errors or omission of mandatory information, XRPS will return error messages and ask the user to update the appropriate entries. This procedure must be repeated by using the navigation tool in the left-hand frame to go back to the pages and apply the necessary changes until the proposal passes the checks.

5.5.1 Hitting the “check proposal” button accidentally

In case the “Check Proposal” button is hit accidentally, the recovery procedure is to use the “reload” function of the web browser to go back to the page that had been loaded.

5.6 Modifying a proposal

Please note that **reloading proposals for subsequent editing is only possible from the intermediate memory! Once a proposal has been submitted to the proposal database, it cannot be retrieved from there again** (it will continue to exist in the working memory, however).

5.7 Producing a postscript version of the proposal

At this time (i.e., when all XRPS forms have been filled in completely and correctly), it is also possible to create a postscript version of the proposal by pressing the “Postscript Version of Proposal” button. This allows users to view/print or download to their home sites a postscript version of the proposal. Doing this serves two purposes:

1. The postscript output provides the user with a control printout for checking inputs once again.

At this point it is still possible to go back to any of the proposal pages to change, add or delete information. The new version of each page must be committed to memory again before proceeding to the next step.

2. The postscript file serves as the author’s copy of the proposal.

It is not foreseen that the XMM SOC will provide proposers with a printed version of their proposal(s).

Note that this PS version of the proposal will contain only the XRPS forms, not the scientific justification (that the user has as a separate file at his/her home site anyway).

5.8 Uploading the scientific justification

Once all observations of a proposal have passed the formal checks, a small pop-up window will appear with which the scientific justification can be uploaded from the user’s site. **The allowed maximum overall volume of the scientific justification, including figures, tables etc. is 4 pages. BEFORE including a file, please read the AO-1 Policies and Procedures**, in which instructions are provided. XRPS does not contain any mechanism to check whether an included file is a formally valid scientific justification (or even a postscript file).

5.9 Submitting a proposal

There is no “submit” button in XRPS. Submission of a proposal is performed by hitting the “upload file” button at the bottom of the web page reporting the check results, where one can enter the path to the file containing the scientific justification (see above). As soon as the scientific justification has been uploaded, a message will appear on the screen notifying the user of the proposal submission and prompting him/her to return to the XRPS entry page.

Note: Successful submission does not imply that all details of the proposal are formally correct or complete, because the formal checks performed by XRPS are not complete.

5.10 Adding another proposal

To enter another proposal into XRPS, go back to the XRPS entry page, choose the “New Proposal” button, identify yourself with your personal ID and password, and start anew (§ 5.1).

6 Acknowledgement of receipt

Upon successful submission of a proposal to the database, users will be notified via email (at peak times this might take a while). This email will contain the assigned proposal number – which should be mentioned, if already known at the time of submission, in case other, associated proposals are submitted.

Users who do not receive an email within 24 hours after submitting a proposal, please

- do **NOT** re-submit the proposal,
- verify that there is no typo in the email address that was entered into XRPS,
- then try to verify that the mail server at your home institution was up and running.

If neither of these indicates a problem, please get in touch with the SOC via the XMM Helpdesk, using the subject “Missing proposal submission verification” and identifying your proposal by PI name and full title.

7 SOC enhancement requests

XMM SOC user support will be provided by only three full-time astronomers. The size of this small team makes it immediately obvious that SOC enhancement requests and also other manual interactions with the proposal database must be limited to a minimum.

SOC enhancement WILL be required for the following types of observations:

- Observations with non-default OM science windows,
- concatenated observations,
- linked observations.

8 Submitting ToO requests

Normally, requests to observe a Target of Opportunity (ToO) are not submitted via XRPS, because it is taken offline after the deadline of an AO. The process of ToO submission is described in the Policies and Procedures document and this route should be followed in all cases.

9 Missing XRPS functionality

A few features that one might wish to have in XRPS are not yet implemented. Among these are:

- The XRPS does not know about “concatenated” (i.e., back-to-back) **XMM** observations. Although users are strongly discouraged to propose such observations, they can be performed. Requests should be stated explicitly in the proposal text (scientific justification).

- No check of validity of exposure details (like, e.g., pixel ranges defined as science windows [OM]) is performed.
- There is no possibility to copy information from one proposal to another.

10 XRPS performance

As mentioned briefly in the introduction (§ 2), XRPS is a pure online submission system, which depends on the performance of the computer links to the XMM SOC as well as the machines running the software. The performance of XRPS, as experienced at the user's institution, is hard to predict. Therefore, it is strongly recommended that proposers try to avoid submitting very late during the AO-1, close to the deadline. Early submission will help to alleviate such problems.

11 Related documents, tools and online services

Related documents, tools and other XMM online services can be found at the following addresses:

1. XRPS online
<http://www.xmmsoc.ops.esa.int/>
2. This document
http://astro.estec.esa.nl/XMM/user/rpsman_top.html
3. XMM Users' Handbook
http://astro.estec.esa.nl/XMM/user/uhb_top1.html
4. AO-1 documents
http://astro.estec.esa.nl/XMM/news/A0/ao1_top.html
5. Policies and Procedures
<ftp://astro.estec.esa.nl/pub/XMM/documents/policies.ps.gz>
6. XMM Target Visibility Tool
http://astro.estec.esa.nl/XMM/user/vis/vis_top.html
7. The XMM Science Simulator (SciSim)
<http://astro.estec.esa.nl/XMM/scisim/scisim.html>
8. PIMMS (HEASARC)
<http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html>
9. XMM Helpdesk
http://astro.estec.esa.nl/XMM/news/xmmhelp_top.html
10. XMM Latest News
http://astro.estec.esa.nl/XMM/news/news_top.html

Additional information on XMM can always be obtained from other locations under the SOC home page, at the URL <http://astro.estec.esa.nl/XMM/>.

A Observation examples

In this chapter we provide a few examples for **XMM** observations of selected generic target categories. The crucial entries that must be made in XRPS are listed. The examples follow those presented above for planning **XMM** observations (§ 3.1).

A.1 Example for an observation of a faint extended source

As an example for a faint extended X-ray source one might consider observing a cluster of galaxies, at relatively low redshift, z . Input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument There might be a cooling flow at the centre. If moderate resolution spectroscopy is most important for the proposed science, the observer might want it to be imaged in the 'aim point' of the EPIC pn camera. Alternatively, if high-resolution spectroscopy is intended, (s)he may want to centre it on the RGS-1 instrument (which is the RGS unit with the highest energy resolution).

Science mode of the prime instrument If the source is weak, all EPIC cameras can be assumed to have no problems with photon pile-up. In that case, they can all be used in the standard FULL WINDOW imaging mode. RGS could be used in its standard SPECTROSCOPY mode.

Total integration time requirement Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known) into the **XMM** band (0.1–15 keV), and enter these, together with, e.g., X-ray spectral model = Raymond-Smith, $kT = 6$ keV, $N(H) = 3e20$ cm⁻² and the lower and upper limit of the energy band over which the X-ray flux was observed into XRPS.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM** orbit, using the **XMM** Target Visibility Tool. In case the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates Assuming that the cooling flow is located at the core of the cluster, no boresight coordinates need be entered and thus the target coordinates will automatically be propagated into the boresight fields. Otherwise, the boresight would be chosen to be directed towards the location of brightest/most important feature to be observed. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. If any such

sources exist and must be avoided, this might lead to a position angle constraint (which in turn makes the observation “fixed” in time).

Science modes of the other instruments The expected RGS count rates are lower than those for EPIC. There will thus be no need for fast readouts and RGS would be used in its standard SPECTROSCOPY mode.

Assuming that the cluster fits into the OM’s 17’ FOV, a default configuration (matching the choice of either EPIC pn or RGS-1 as prime instrument!) would be chosen (“EPIC pn IMG” or “RGS 1 IMG”).

EPIC filters Since the source is assumed to be weak (both in X-rays and the optical/UV) the “THIN” optical blocking filter can be used. Observations without any filter might be contaminated by optical radiation (diffuse background or bright optical sources) compromising the accuracy of the EPIC energy calibration.

RGS readout sequence In case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. CCDs 1–9 will then be read out sequentially.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM’s FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 19. If any such source should exist (and it cannot be avoided by, e.g., reducing the OM FOV by using the magnifier as optical element), the OM MUST be put in the “GO-OFF” mode (which corresponds to the blocked filter position) to protect it from radiation damage.

OM filters If the observer has no particular interest in specific wavelength ranges, the recommended OM filters (as listed in the UHB section on OM default configurations) should be chosen.

Length of exposures All X-ray observations of faint sources can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.3.3.5 and the OM chapter of the UHB. An example for how OM default configurations work is shown above, in § 3.3.

A.2 Example observation of a bright extended source

Consider as an example for a bright extended X-ray source a relatively compact supernova remnant (SNR). In addition to trivial input like, e.g., target name, catalogued position, etc., some more input parameters must be chosen:

Choice of prime instrument There might be a bright knot near the desired field centre. If moderate resolution spectroscopy is most important for the proposed science, the observer might want it to be imaged in the ‘aim point’ of the EPIC pn camera. Alternatively, if high-resolution spectroscopy is intended, (s)he may

want to centre it on the RGS-1 instrument (which is the unit with the highest energy resolution). Let us, for the time being, assume that RGS-1 is prime.

Science mode of the prime instrument RGS can probably be used in its standard SPECTROSCOPY mode. In case of doubt, i.e., if the source has prominent emission lines, SciSim should be used to model the spectrum and check for potential pile-up problems.

Total integration time requirement Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with, e.g., X-ray spectral model = thermal bremsstrahlung, $kT = 5$ keV, $N(H) = 1e20$ cm⁻² and the lower and upper limit of the energy band over which the X-ray flux was observed.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM** orbit, using the **XMM** Target Visibility Tool. In case the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates Assuming that the bright knot is not located at the centre of the SNR, its coordinates must be entered into the boresight fields. This is the position on which the prime instrument will be centred. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. If any such sources exist and must be avoided, this might lead to a position angle constraint (which in turn makes the observation “fixed” in time).

Science modes of the other instruments The science modes of the instruments will mostly be determined by the level of photon pile-up to be expected. As mentioned above (in § 5.3.2), EPIC pile-up calculations should be oriented at the brightest emission region’s count rate. In the case of a bright knot in a known SNR, this could be done by estimating from (for example) *ROSAT* images the brightness within one **XMM** Point-Spread Function (PSF; see UHB section on **XMM** X-ray PSF). For the PSF a Full Width at Half Maximum (FWHM) of 6'' can be assumed.

For the pn camera we compare the merits of three modes: Full Frame Mode could be used if the pile-up constraints are acceptable for the science goals. Extended Full Frame could be used if there is a high dynamic range in brightness and if image smearing of order 10% of photons is unacceptable. Large Window Mode can be used for sources up to 15' extent, and where exterior to this range there are no bright regions that would smear onto the desired image.

For MOS we compare the merits of three modes as well: Full Frame Mode could be used if the pile-up constraints are acceptable for science goals. The Large Window (300 × 300 pixels) can be used for sources up to 6' extent, Refreshed Framestore mode can be used for a full central CCD extent of 11'

and pile-up is high with the normal mode, accepting that a low duty cycle obtains.

The expected RGS count rates are lower than those for EPIC. Therefore, RGS can in most cases be operated in its SPECTROSCOPY mode.

If no high time resolution is required for the OM observations, an imaging mode default configuration should be chosen (in this case, since RGS-1 is prime instrument, RGS 1 IMG). The optical surface brightness of the brightest region of the target must be compared with the OM brightness limits (UHB Table 19).

EPIC filters Using the instructions provided in the UHB on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science. Observations without any filter, especially of bright sources, should not be conducted, because they will be contaminated by optical radiation compromising the accuracy of the EPIC energy calibration.

RGS readout sequence In case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. CCDs 1–9 will then be read out sequentially. However, there might be strong emission lines, which the user wants read out faster than the rest of the spectrum. One way of doing this would be to use the RGS SPECTROSCOPY mode and a readout sequence of [3 1 2 3 4 5 3 6 7 3 8 9], in which CCD #3 is read out 4 times more often than all others (assuming that the bright line would be registered on chip 3; see the UHB section on RFC arrays).

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 19. If any such source should exist (and it cannot be avoided by, e.g., reducing the OM FOV by using the magnifier as optical element), the OM MUST be put in the "GO-OFF" mode (which corresponds to the blocked filter position) to protect it from radiation damage.

OM filters If the observer has no particular interest in specific wavelength ranges, the recommended OM filters (as listed in the UHB section on OM default configurations) should be chosen.

Length of exposures Targets with extremely high count rates might lead to very high telemetry rates. The limits listed in the UHB section on EPIC modes apply. If these are not exceeded, X-ray observations can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.3.3.5 and the OM chapter of the UHB. For the OM imaging mode each exposure must have a length of 750–5000 s. An example for how OM default configurations work is shown above, in § 3.3.

A.3 Imaging observation of a point source

Many users might be interested in observing a bright point source (like, e.g., an unresolved AGN, binary or stellar object). In addition to trivial input like, e.g., target name, catalogued position, etc., some more input parameters must be chosen:

Choice of prime instrument The prime instrument is chosen according to the importance of data from either type of **XMM** instrument: either EPIC pn, if imaging with moderate resolution spectroscopy is crucial, or RGS-1, if the highest possible spectral resolution must be achieved, or even OM, if simultaneous optical/UV fast mode data are mandatory. Let us, for the time being, assume that RGS-1 is prime.

Science mode of the prime instrument Depending on the required science data (either standard spectroscopy or high time-resolution spectro-photometry), RGS can be operated either in its standard SPECTROSCOPY or the HIGH TIME RESOLUTION mode. In case SPECTROSCOPY is used and if the source has prominent emission lines, SciSim modeling of the spectrum should be performed to check for potential pile-up problems.

Total integration time requirement Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with, e.g., X-ray spectral model = power law, $\alpha_E = 0.7$, $N(\text{H}) = 3e21 \text{ cm}^{-2}$ and the lower and upper limit of the energy band over which the X-ray flux was observed.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM** orbit, using the **XMM** Target Visibility Tool. In case the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates No boresight coordinates need be entered to centre the target on the prime instrument, because the target coordinates will be propagated automatically into the boresight fields, if no other values are provided. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. If any such sources exist and must be avoided, this might lead to a position angle constraint (which in turn makes the observation “fixed” in time).

Science modes of the other instruments The science modes of the instruments will mostly be determined by the level of photon pile-up to be expected. As mentioned above (in § 5.3.2), EPIC pile-up calculations should be oriented at the brightest emission region’s count rate. In the case of a bright knot in a known SNR, this could be done by estimating from (for example) *ROSAT* images the brightness within one **XMM** Point-Spread Function (PSF; see UHB section

on XMM X-ray PSF). For the PSF a Full Width at Half Maximum (FWHM) of $6''$ can be assumed.

For the pn camera we decide that the Small Window Mode is necessary to accommodate the source brightness without pile-up degradation (using the information provided in the UHB section on EPIC modes). This mode offers a total of $4'$ field coverage. We note the effect of significant dead time, which must be taken into account to obtain the correct exposure time (PIMMS and the plots provided in the UHB account for this).

For MOS we compare the merits of two modes: Partial Window Mode (100×100 pixels) is able to accommodate the point source spatially, although consideration should be given then to using the MOS as prime instrument to ensure minimal pointing acquisition errors. If the mode is not able to accommodate the expected flux without significant pile-up, then the Timing Mode must be considered.

The expected RGS count rates are lower than those for EPIC. Therefore, RGS can in most cases be operated in its SPECTROSCOPY mode.

If no high time resolution is required for the OM observations, an imaging mode default configuration should be chosen (in this case, since RGS-1 is prime instrument, RGS 1 IMG). For parallel fast mode optical/UV monitoring, the RGS 1 IMG FST default configuration should be chosen.

EPIC filters Using the instructions provided in the UHB on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science. Observations without any filter, especially of bright sources, should not be conducted, because they will be contaminated by optical radiation compromising the accuracy of the EPIC energy calibration.

RGS readout sequence In case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. CCDs 1–9 will then be read out sequentially. However, there might be strong emission lines that the user wants read out faster than the rest of the spectrum. One way of doing this would be to use the RGS SPECTROSCOPY mode and a readout sequence of, e.g. [3 1 2 3 4 5 3 6 7 3 8 9], in which CCD #3 is read out 4 times more often than all others (assuming that the bright line would be registered on chip #3; see the UHB section on RFC arrays). In case the HIGH TIME RESOLUTION mode should be chosen, the user must determine whether one single CCD or all nine RGS CCDs shall be read out.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 19. If any such source should exist (and it cannot be avoided by, e.g., reducing the OM FOV by using the magnifier as optical element), the OM MUST be put in the "GO-OFF" mode (which corresponds to the blocked filter position) to protect it from radiation damage.

OM filters If the observer has no particular interest in specific wavelength ranges, the recommended OM filters (as listed in the UHB section on OM default configurations) should be chosen.

Length of exposures Normally the X-ray observations can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.3.3.5 and the OM chapter of the UHB. An example for how OM default configurations work is shown above, in § 3.3.

A.4 Timing observation of a variable source

Consider observing a bright point source, as above (like, e.g., an unresolved AGN, binary or stellar object), but now with a special interest in high time resolution measurements. In addition to trivial input like, e.g., target name, catalogued position, etc., input parameters to be chosen are:

Choice of prime instrument The prime instrument is chosen according to the importance of data from either type of **XMM** instrument: either EPIC pn, if imaging with moderate resolution spectroscopy is crucial, or RGS-1, if the highest possible spectral resolution must be achieved, or even OM, if grism observations with simultaneous flux monitoring via a fast mode window covering the zero-order image are mandatory. Let us, for the time being, assume that EPIC pn is prime.

Science mode of the prime instrument For high time-resolution observations the EPIC pn TIMING mode is a suitable choice.

Total integration time requirement Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with, e.g., X-ray spectral model = power law, $\alpha_E = 0.7$, $N(\text{H}) = 3\text{e}21 \text{ cm}^{-2}$ and the lower and upper limit of the energy band over which the X-ray flux was observed.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM** orbit, using the **XMM** Target Visibility Tool. In case the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates No boresight coordinates need be entered to centre the target on the prime instrument, because the target coordinates will be propagated automatically into the boresight fields, if no other values are provided. The best data quality will be achieved in the aim point of the prime instrument.

Science modes of the other instruments Based on the nature of the example, one can assume that all instruments will be operated in their fast modes. EPIC

pn reaches a time resolution of 0.03 ms in its TIMING mode, MOS reaches a resolution of 1.5 ms. Note that the pn camera in its Small Partial Window mode already reaches a time resolution of 6 ms, which would at the same time render possible imaging of the target. RGS would be operated in the HIGH TIME RESOLUTION mode and OM in the fast mode default configuration EPIC pn IMG FST.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. In particular when the EPIC TIMING mode and also the RGS HIGH TIME RESOLUTION mode is used, one must ensure that nearby sources do not contaminate the target data. There must be no nearby source in the same column of the EPIC cameras as the science target. However, note that the two MOS cameras are mounted orthogonal to each other. For the RGS there must be no source along the dispersion direction of the target spectrum. If any such sources should exist and must be avoided, this might lead to a position angle constraint (which in turn makes the observation “fixed” in time).

EPIC filters Using the instructions provided in the UHB on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science. Observations without any filter, especially of bright sources, should not be conducted, because they will be contaminated by optical radiation compromising the accuracy of the EPIC energy calibration.

RGS readout sequence The user must determine whether one single CCD (if yes, which one) or all nine RGS CCDs shall be read out. The whole spectral range (all 9 CCDs) can be read out in about 150 ms.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM’s FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 19. If any such source should exist (and it cannot be avoided by, e.g., reducing the OM FOV by using the magnifier as optical element), the OM MUST be put in the “GO-OFF” mode (which corresponds to the blocked filter position) to protect it from radiation damage.

OM filters If the observer has no particular interest in specific wavelength ranges, the recommended OM filters (as listed in the UHB section on OM default configurations) should be chosen.

Length of exposures Targets with extremely high count rates might lead to very high telemetry rates. The limits listed in the UHB section on EPIC modes apply. If these are not exceeded, X-ray observations can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.3.3.5 and the OM chapter of the UHB. An example for how OM default configurations work is shown above, in § 3.3.