

## **SOLAR – B EIS Radiator Thermal Study MSSL**

### **Preliminary study of radiator positioned mid-way along EIS**

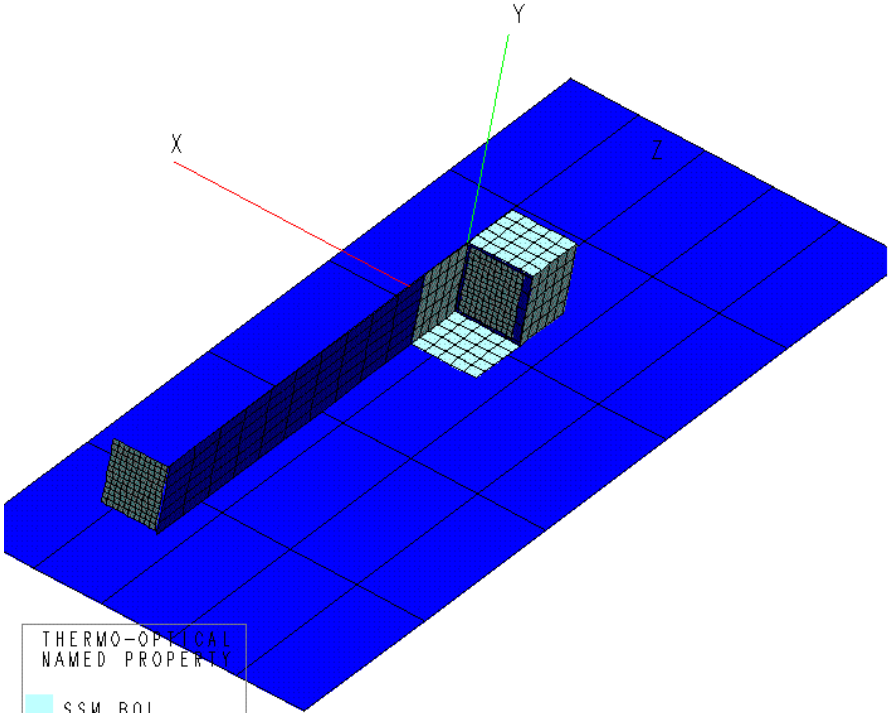
- **CCD temperature aim: -80°C**
- **CCD dissipation: 2 x 0.5W**
- **No other dissipation considered**

## **EIS CONFIGURATION STUDIED**

## **THERMAL ENVIRONMENT and ASSUMPTIONS**

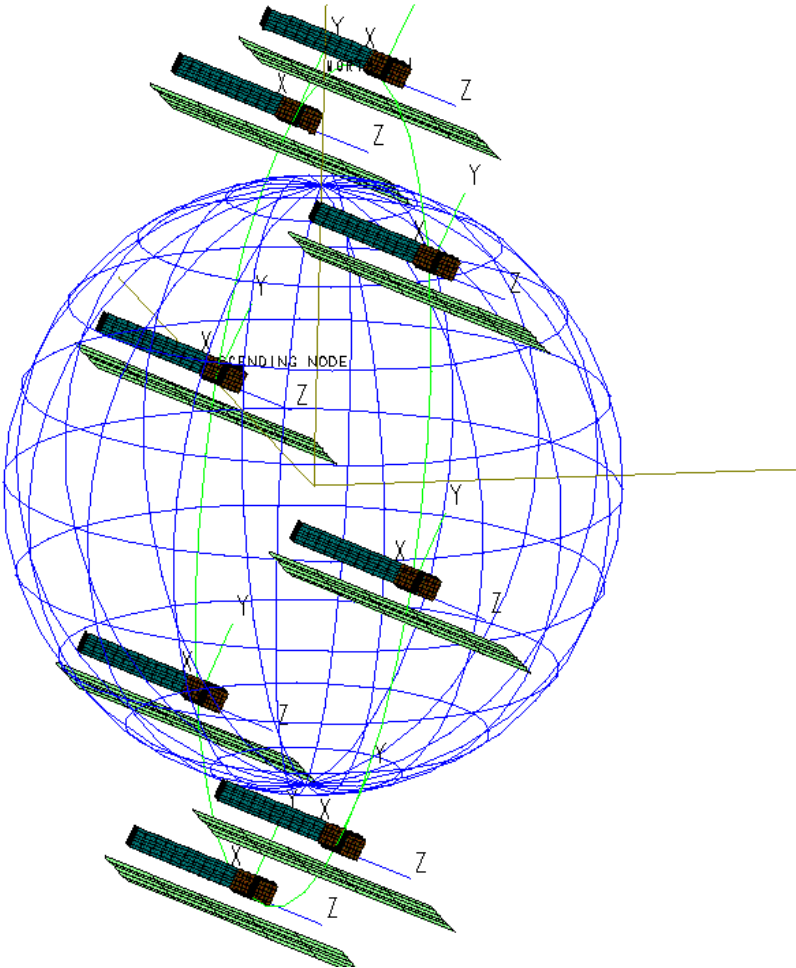
- **Orbit: 600 x 600 km,  $i = 97.8^\circ$ , 6pm ascending node.**
- **Winter Solstice (provisional hot case)**
- **Spacecraft Sun-pointing**
- **Total isolation of radiator from structure assumed**
- **No heat load from camera electronics**

# EIS Radiator Preliminary Thermal Model (1)



THERMO-OPTICAL NAMED PROPERTY	
SSW_BOL	
VDA	
Black_point	
Black_MLI	

# EIS Radiator Preliminary Thermal Model (2)



## **CONFIGURATIONS ANALYSED**

- 1. 190 x 230 mm radiator**
- 2. With Earth shield around radiator**
- 3. Radiator angled away from spacecraft**
- 4. Radiator extensions on +Y and -Z faces**
- 5. Additional extensions -Z side of main radiator**
- 6. 190 x 230 mm radiator at -Z end of EIS**

## THERMAL PREDICTIONS

**Radiator temperature predictions (max. and min. around orbit):-**

**Note: Model has low heat capacity - true orbital variations will reduce.**

<b>Config. 1 (baseline)</b>	<b>-80°C to -12°C</b>	<b>(average -45°C)</b>
<b>Config. 2 (Earth shields)</b>	<b>-70°C to -10°C</b>	<b>(average -40°C)</b>
<b>Config. 3 (angled radiator)</b>	<b>-83°C to -7°C</b>	<b>(average -45°C)</b>
<b>Config. 4 (radiator extensions)</b>	<b>-70°C to -30°C</b>	<b>(average -50°C)</b>
<b>Config. 5 (additional extensions)</b>	<b>-70°C to -30°C</b>	<b>(average -50°C)</b>
<b>Config. 6 (rear radiator)</b>	<b>-65°C to -45°C</b>	<b>(average -55°C)</b>
<b>Comparison: XRT</b>	<b>-75°C to -55°C</b>	<b>(average -65°C)</b>

## **DISCUSSION**

- **Current radiator position seems inadequate for  $-80^{\circ}\text{C}$  on CCD**
- **Earth shields and alternative thermal finishes are not effective**
  - ➔ **due to blockage of view factor to Space by rear of EIS and spacecraft**

**Radiator on rear face of EIS is more effective due to uninterrupted view to Space – does receive more Earthshine & Albedo**

- ➔ **Optimisation (pointing angle, Earth shields) should reduce temperatures to  $-65^{\circ}\text{C}$  average, in line with XRT analysis.**



## **WAY FORWARD**

- **Optimise current radiator with extensions / active louvres**  
**→ Unlikely to achieve -80°C**
- **Heat pipe link to rear radiator**  
**→ Not enough power to activate heat pipe?**
- **Peltier (Thermo-electric) cooler and heat pipe to rear radiator**  
**→ Power, mass & complexity implications**
- **Redesign instrument with rear-mounted radiator**
- **Review -80°C CCD temperature requirement**