UNIT**:** OAP2

DATE: January 20, 2003

REVISION: 01

DOCUMENT: D:\cxm_sxt_assy\OAP2_FEA_Results_Jan_20_2003.doc

AUTHOR: W. Podgorski, W. Davis

DESCRIPTION: Thermal Gradient and Bending Moment Results, January 20, 2003

Summary

We have analyzed the effects of thermal gradients on OAP2 performance. The results are summarized in the table below.

Case	**HPD(50 Deg Aperture)**
Axial (X) Gradient	1.5
Transverse(Y) Gradient	7.3
Vertical(Z) Gradient	0.2
Radial (R)-Gradient	6.1
Theta(θ) Gradient	0.4
Thermal soak(1), per C	0.3
1) Done earlier.	

Table 1 – Thermal Results Summary

The performance results have been incorporated into the performance prediction.

Thermal Gradient Sensitivities

Thermal gradients were applied to the OAP2 finite element model. **Figure 1** shows the FEA model with transverse gradient results superimposed. Imposed gradients were +/- 1 degree C (2 degree delta) in the following directions:

- Axial(X) – Primary entrance to secondary exit.
- Transverse (Y) – Inner to outer OAP2 wall.
- Vertical (Z) – Lower radial wall to upper radial wall.
- Radial (R) – Inner radius to outer radius.
- Theta (θ) – Radial wall to radial wall.

Mirror displacements for these cases were fit with splines and raytraced. Results are summarized in Table 1, scaled to be per one degree C gradient in the directions indicated.

The OAP2 has large gradient sensitivities in the transverse and radial directions (the radial is very close to being the same as the transverse for this geometry). In these cases the Titanium OAP2 housing expands axially but by different amounts along the inner and outer walls. We therefore get a "hot-dogging" effect as shown in Figure 2. This "hot-dogging" creates P-to-H tilts which affect the performance.

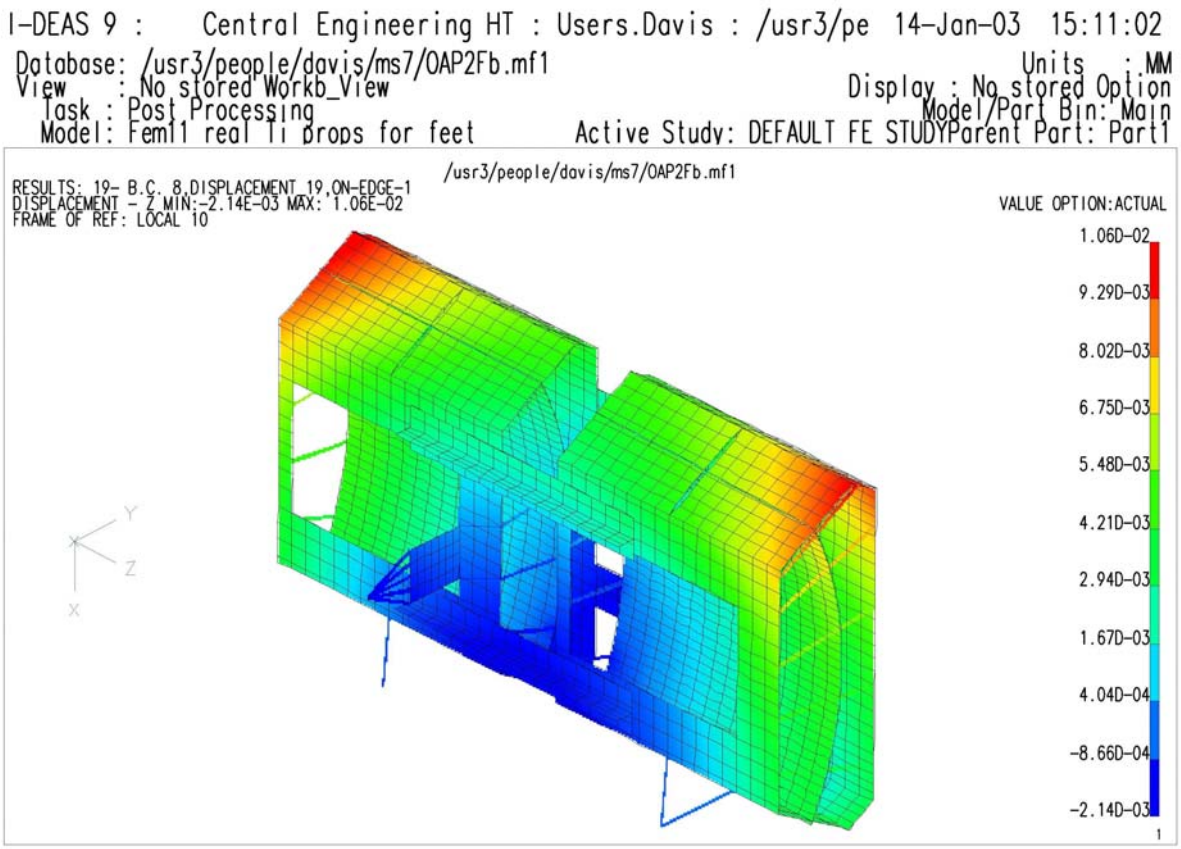

Figure 1 – Thermal Gradient Model

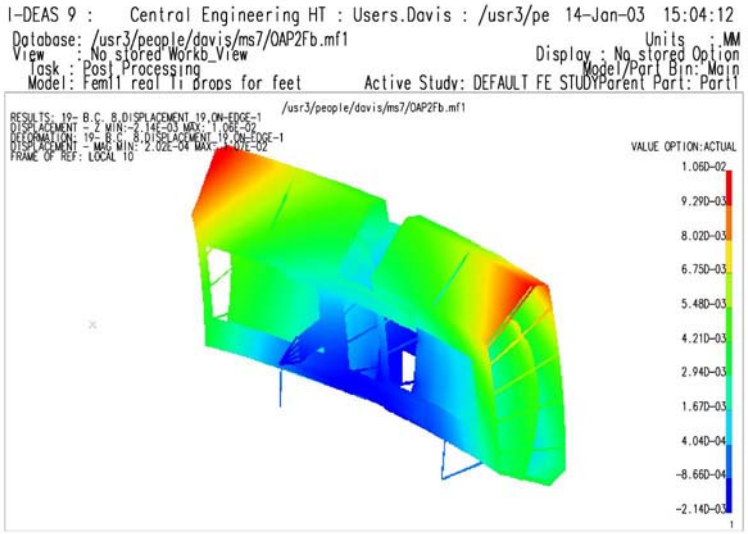

Figure 2 – Transverse Gradient Displacement Plot