Prospects for an ACIS Bakeout

Paul P. Plucinsky
Smithsonian Astrophysical Observatory

On Behalf of the Larger Team

There is a large group working on this issue:

Northrup-Grumman Space Technologies (the company formerly known as TRW)

MIT ACIS team, PSU ACIS team, CXC SOT, CXC FOT,

MSFC Project Science, and Neil Tice (LMA)

Summary of Efforts of the last Year

Characterization of the Contaminant – **chemical composition, spatial distribution, thickness vs. time**

Identification of Contaminant – **partial identification only, F edge implicates Braycote lubricant, however most of the contaminant is a carbon-based material, impossible to identify the exact material since so many materials on the spacecraft contain C. Most likely, the contaminant is a mixture.**

Materials test – **determine evaporation properties (thermal desorption) of Braycote and "sticking factor" at relevant temperatures**

Thermal Models – **model the focal plane and OBF temperatures for various bakeout scenarios. The goal is to get the OBF as warm as possible, with the FP as cold as possible, and still have an effective bakeout**

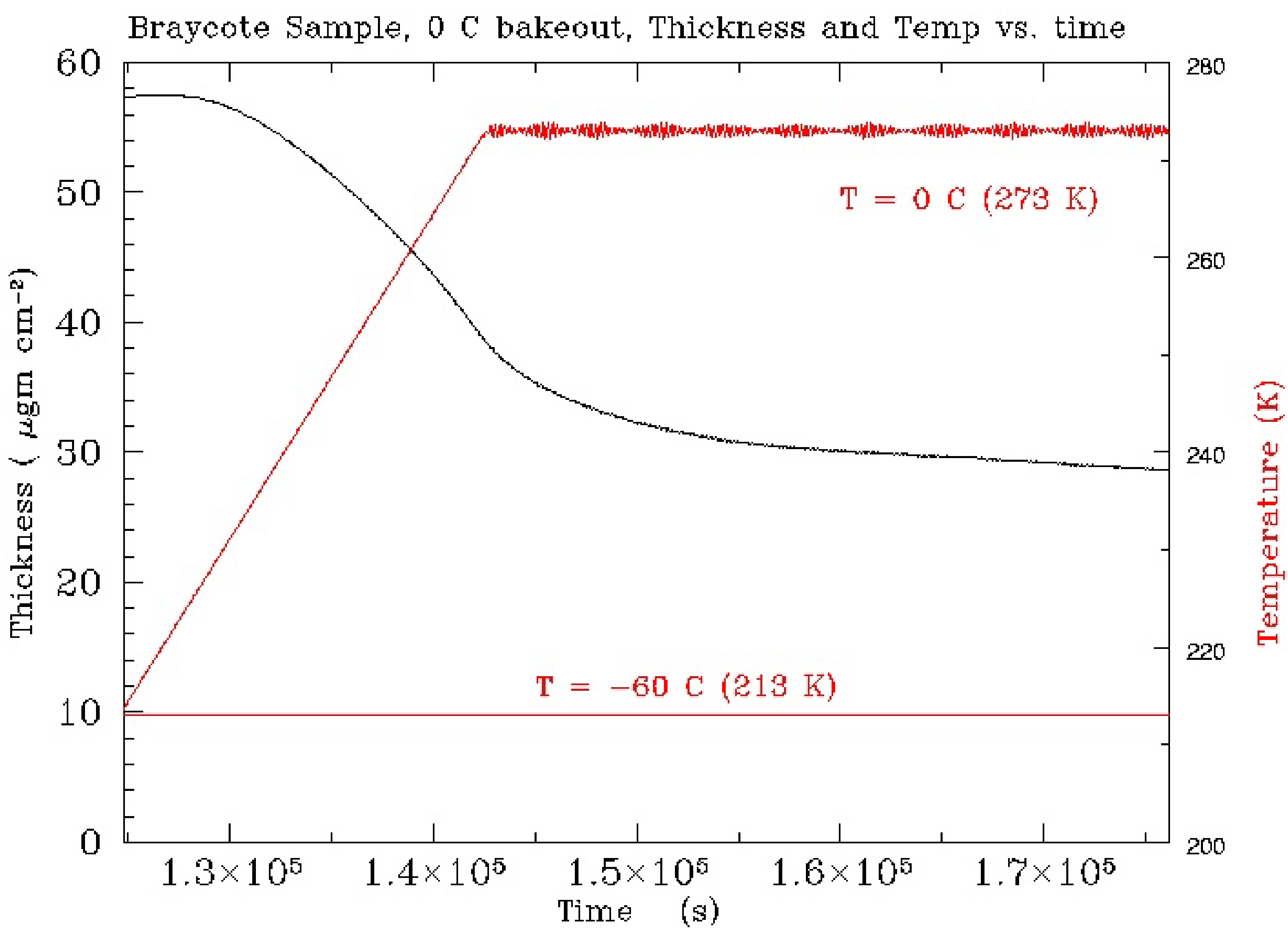
Model Bakeout Scenarios – **SW model developed by NGST to predict the effectiveness of different bakeout scenarios**

Engineering Assessment of Risk – **minimal risk to HW, only concern is the OBF itself, instrument has been thermally-cycled 4 times during the mission.**

Chandra X-Ray Observatory

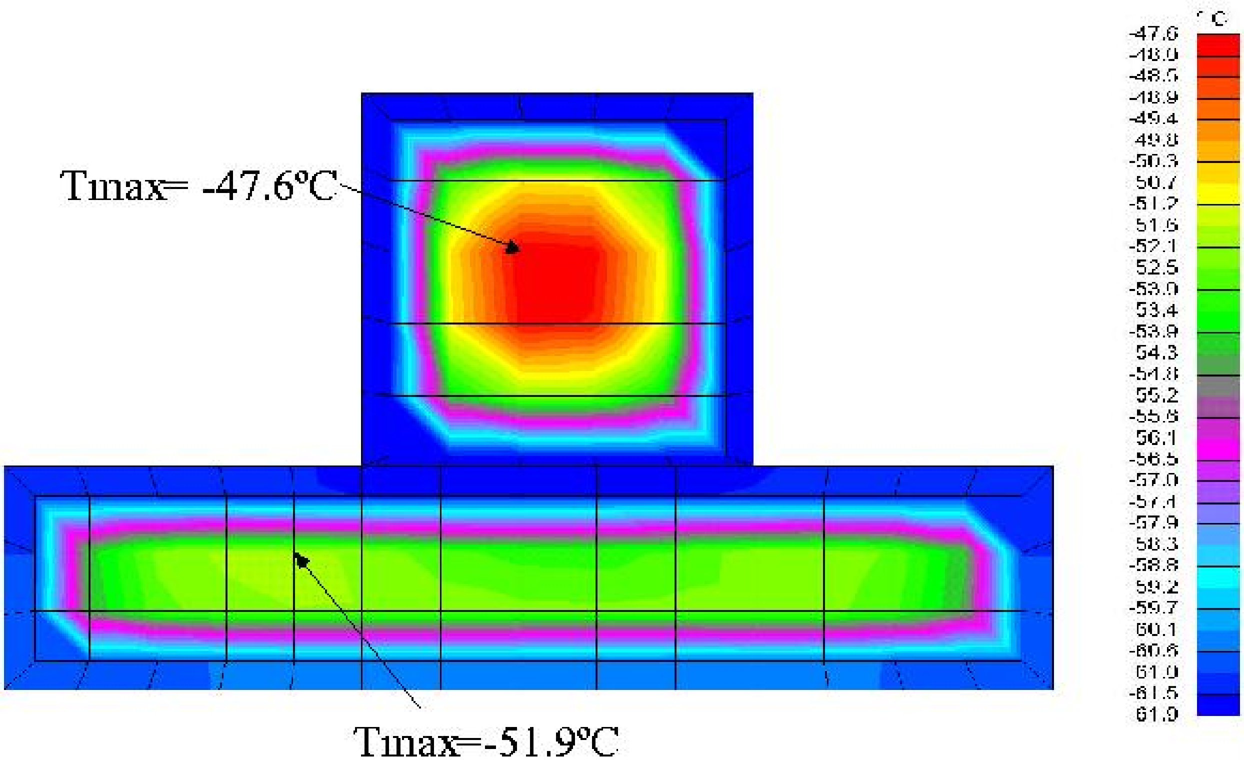
CXC

Mach (NGST)



ACIS Filter Temperatures for Standard Conditions

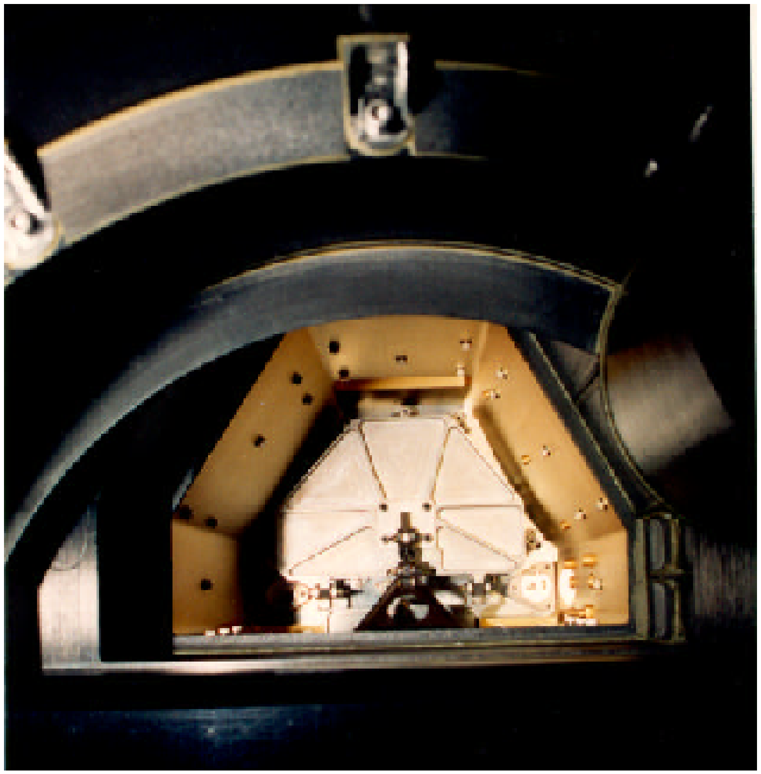
ACIS Housing -60°C, FP -120°C



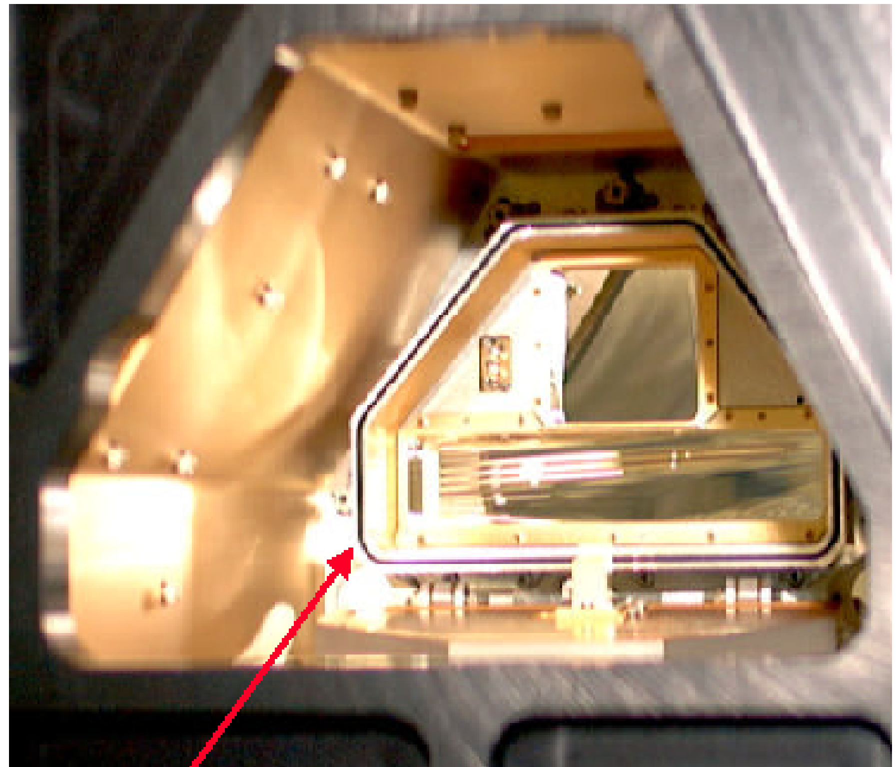
Tice

(LMA)

X-Ray View of ACIS Door and Detector



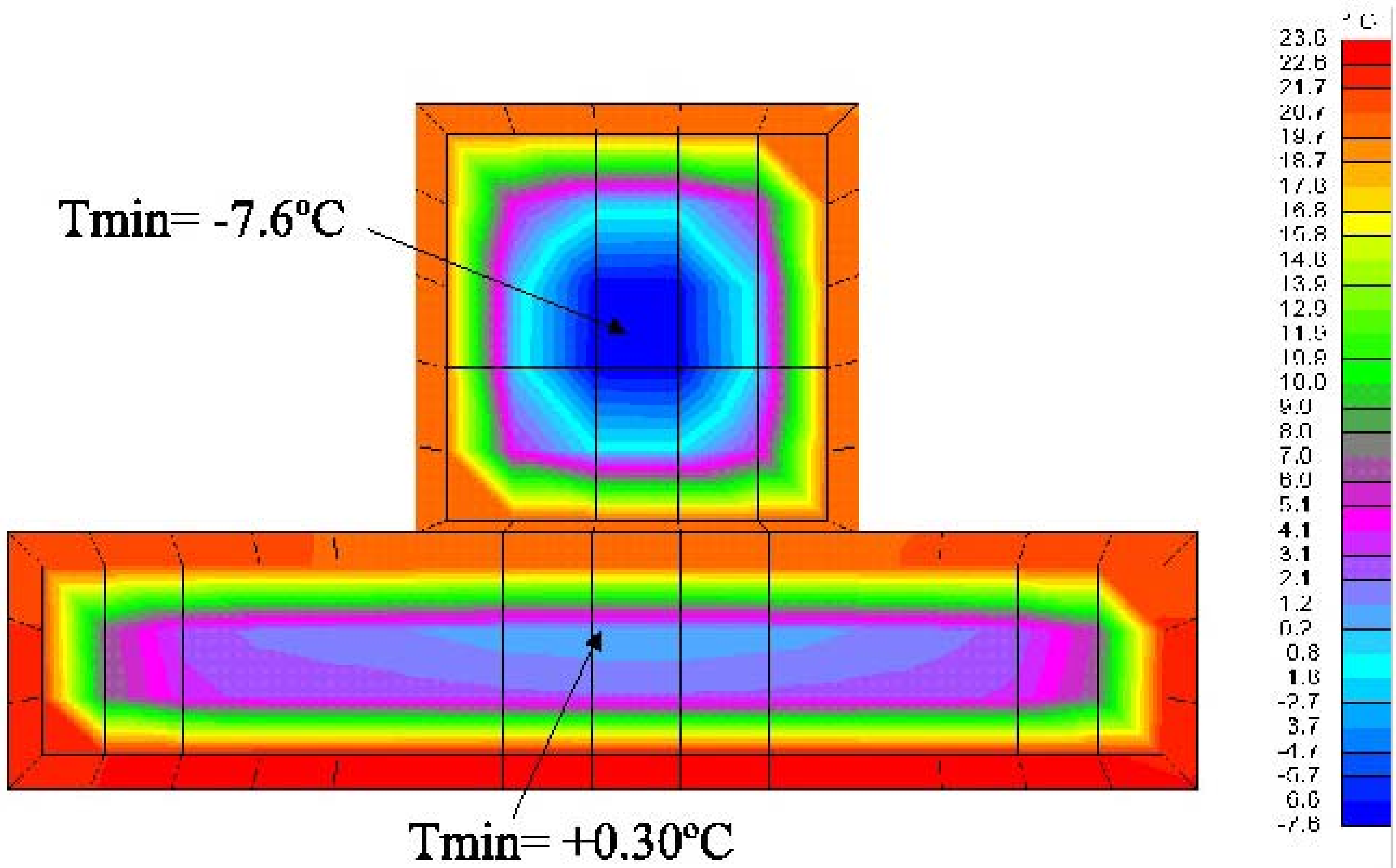
Door Closed while Mounted to ISIM



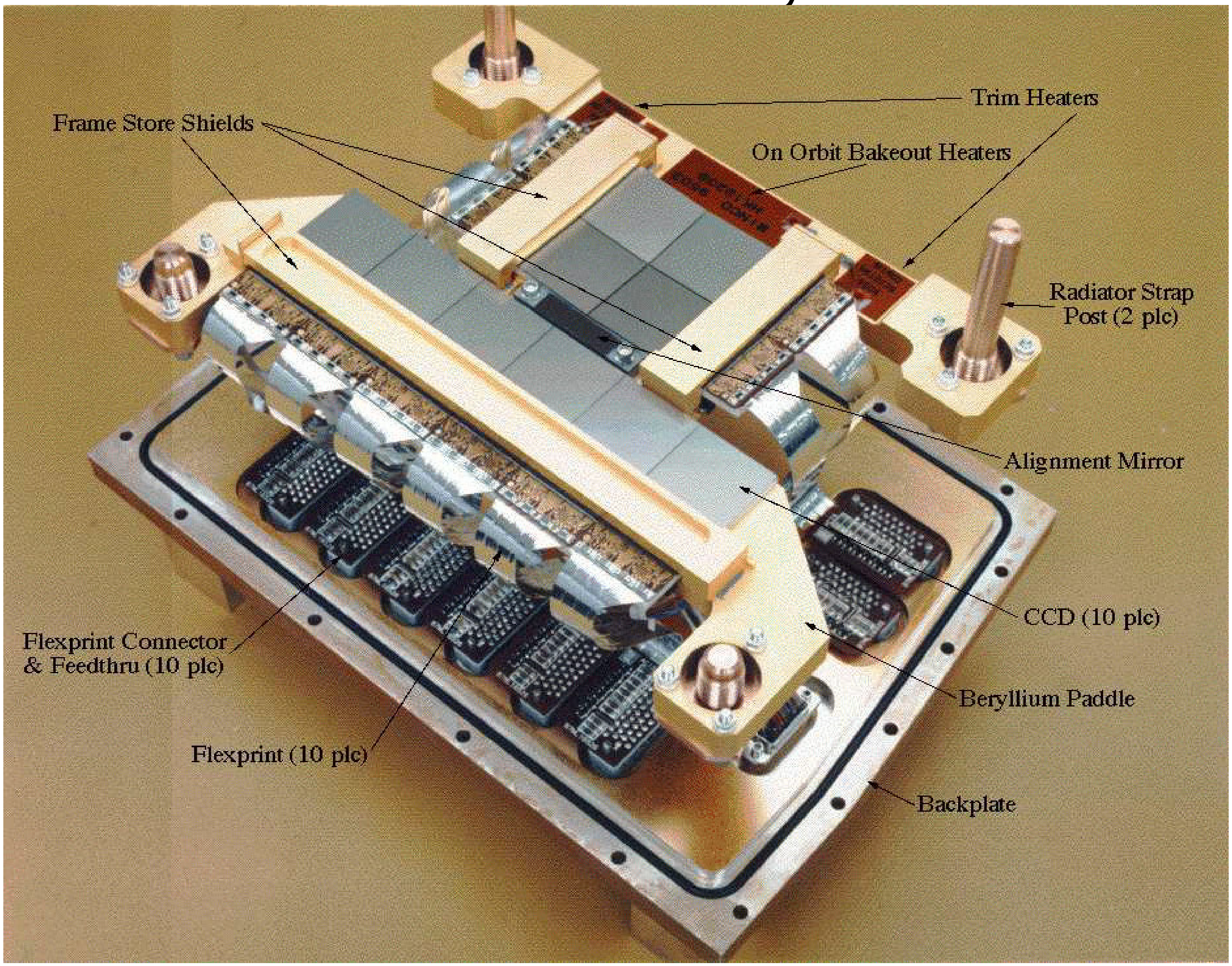
Door Open at LMA

Viton O-ring

ACIS Housing 25°C, FP -60°C



View of ACIS as seen by HRMA

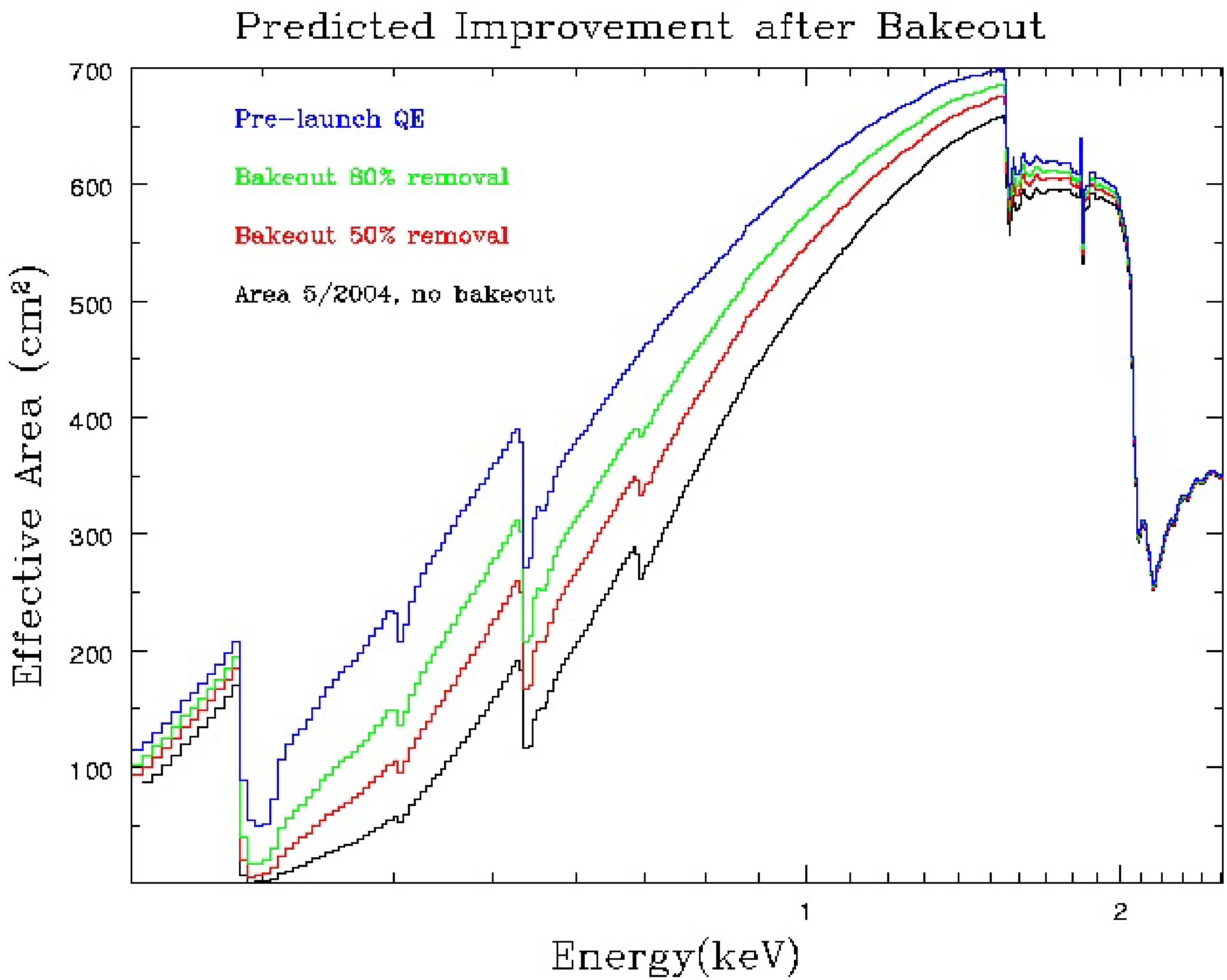


Evaluation of a FP = -60 C and DH = +20 C Bakeout

- **It is clear that a large fraction of the contaminant should desorb at +20 C**
- **Unfortunately, the centers of the OBFs will be the coldest surface during the bakeout, the concern is that some of the contaminant might migrate to the centers of the filters and the bakeout could result in a thicker layer in the centers.**
- **Bakeout should be effective for the edges of the filters.**
- **NGST SW modeling indicates that the net mass removed or gained during the bakeout is critically dependent on the "sticking factor''. Since, we cannot uniquely identify the contaminant, we cannot be sure of its properties.**
- **NGST SW modeling also indicates that perhaps only a small fraction of the contaminant gets out of the collimator. Again this depends on the sticking factor of the material which is unknown. It raises the concern that the benefits of the bakeout may be short-lived.**
- **The *Chandra* project is currently deciding how to proceed in light of the uncertainties. A decision will be made in November on a possible bakeout in December.**

Remaining Tasks before a Bakeout Decision

- **Tests on flight spare OBFs at NGST, accumulate a thick layer of the contaminant, warm the OBF up, cool it back down and verify that the OBF survives**
- **Development of new flight procedures, scheduling of realtime COM**
- **Project review and approval of bakeout**
- **first opportunity is December 7 and 8th**
- **many calibration observations before and after the bakeout, this will cause a disruption in the science observing schedule for *Chandra***


Predicted Improvement after Bakeout
Pre-launch QE
Bakeout 80% removal
Bakeout 50% removal
Area 5/2004, no bakeout
Effective Area (cm²)
Energy(keV)
700
600
500
400
300
200
100
1
2