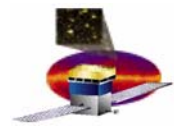


EMI/EMC Requirements & Open Issues

Design Approach

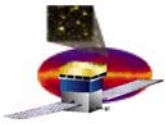
Sept 2, 2003

**Stanford Linear Accelerator Center
Stanford CA**



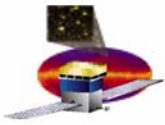
Design Issues (1)

- **Aluminum & Titanium surface preparation**
- **Grid**
- **RF Shield**
- **X-LAT Plate**
- **Radiators**
- **Space craft**
- **ACD**
- **Calorimeter**
- **Tracker**
- **DAQ**
- **Copper Tape**



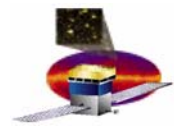
Surface preparation (1)

- **Aluminum/Titanium Surface Preparation**
 - **Chem-film (Alodine)-Mil-C-5541D Class 3**
 - Grand fathered into systems design, everyone does it
 - Easy to use, Cheap
 - 5 milli-Ohm/in²
 - People routinely scrape off alodine to improve electrical contact.

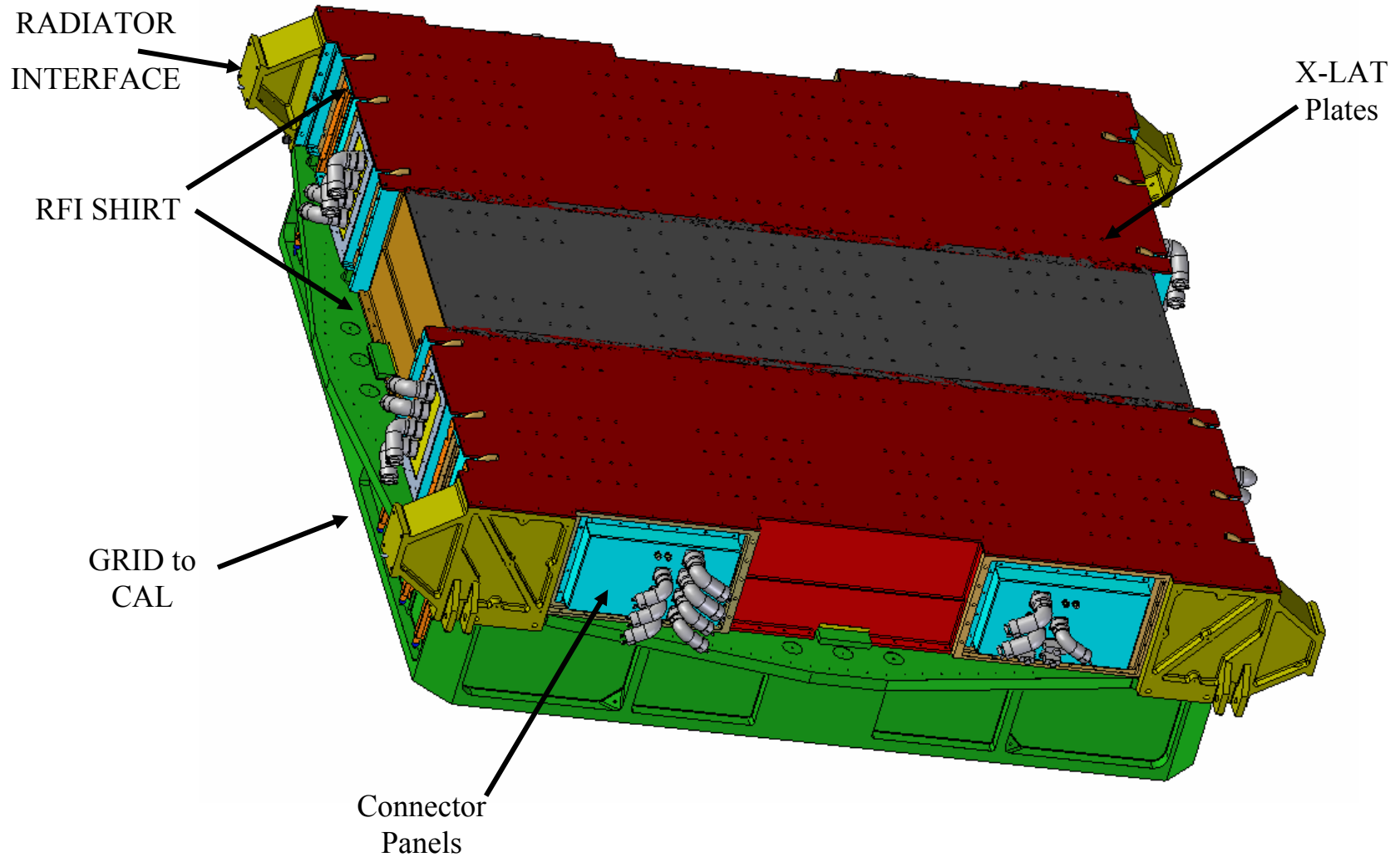


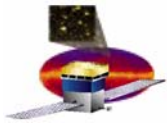
Surface preparation(2)

- **Electro less Nickel SAE AMS-2404**
 - “Gold over nickel or electro less nickel are the preferred plating for GSFC applications” PPL-21 Connectors
 - Easy to use, Cheap
 - Micro-Ohms/in²
 - Issues
 - Adhesion for bonding heaters/paint
 - Plating titanium, Dr. Stefanie Harvey from SLAC’s Physical electronics group has written a proposal to address Spectrum’s concerns.



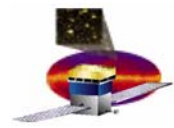
LAT Assembly, TKR & ACD not shown





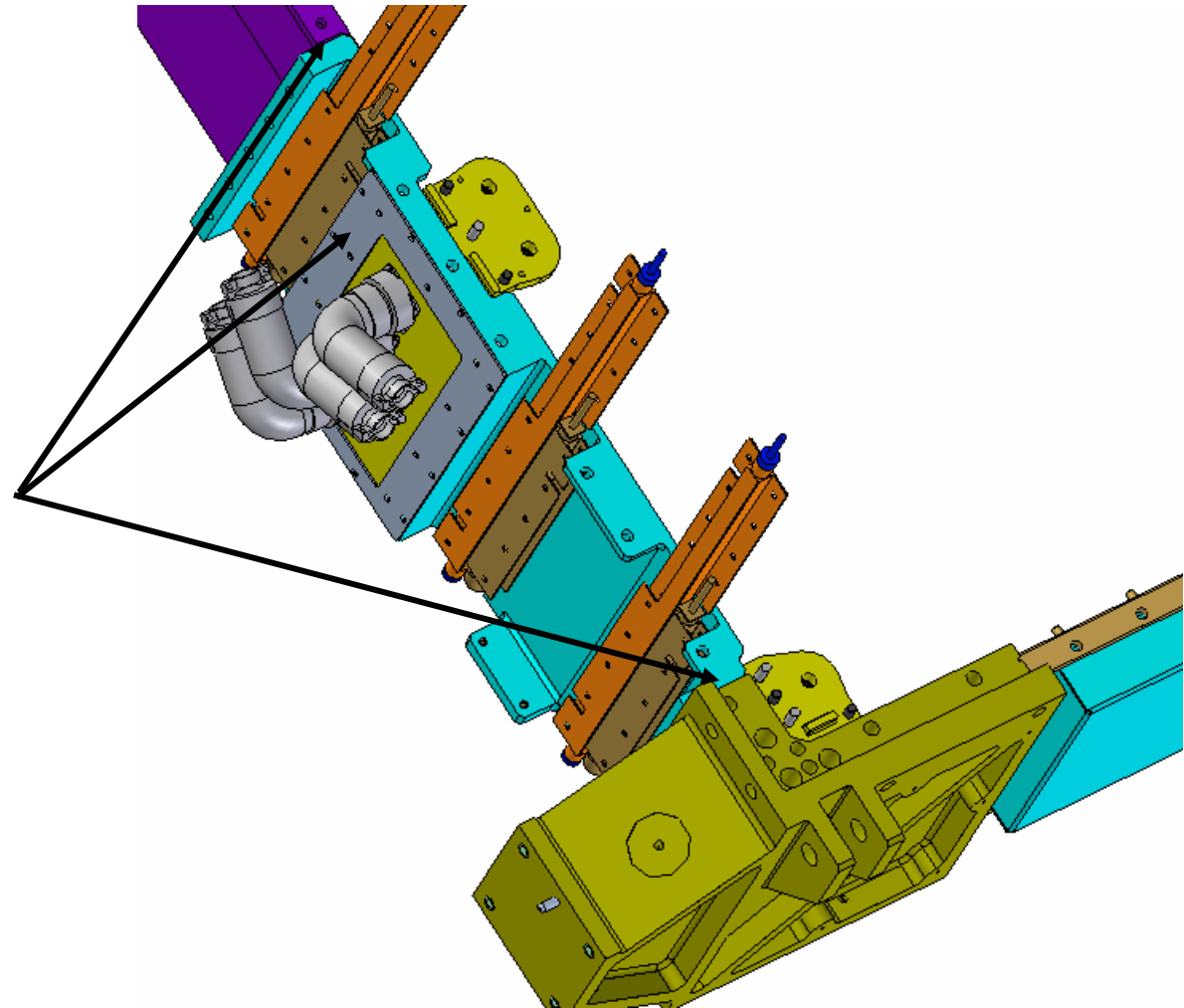
Grid, RF Shield & X-LAT Plate

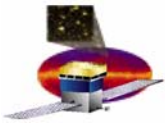
- **Grid & RF Shield**
 - **Plating**
 - **Currently no plating or Alodine**
 - **Request electro less nickel**
 - **Assembly interfaces**
 - **All joints are butted**
 - **Request tongue & grove joints**
 - » **Allows for EMI gasket if needed**
 - **Vent holes**
 - **Currently four 2"X2" vent holes on EMI skirt.**
 - **Request no vent holes due to adequate venting through CAL base plate/grid/tracker towers. (TBR)**



Butted Joints

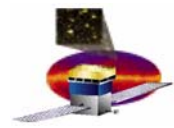
Butted
Joints



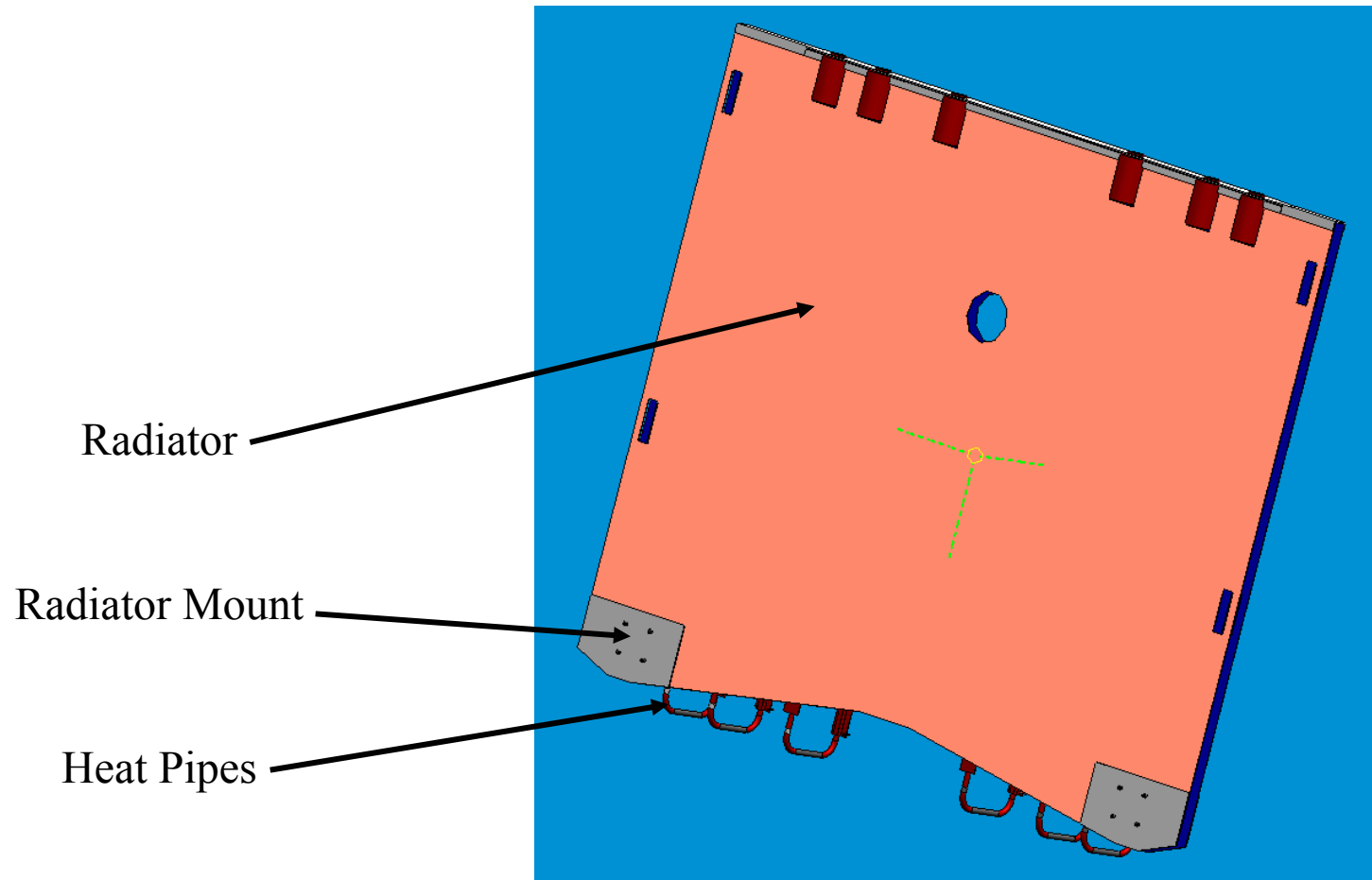


Radiators(1)

- **Interface to Radiator mount**
 - **Currently G10 Thermal Insulator**
 - Request Ti/Al/Cu shim stock wrapped around G10 to get low resistance and inductance
 - **Heat pipes are thermally connected but not electrically**
 - Request to include electrical connection as well
 - **Request to shield heaters and wiring**
 - EMI measurement shows approx 15uVdB electric field noise emitted from one six watt heater using 50mV peak 500KHz signal.



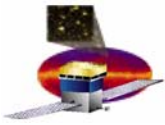
Radiators(2)



Radiator

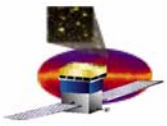
Radiator Mount

Heat Pipes



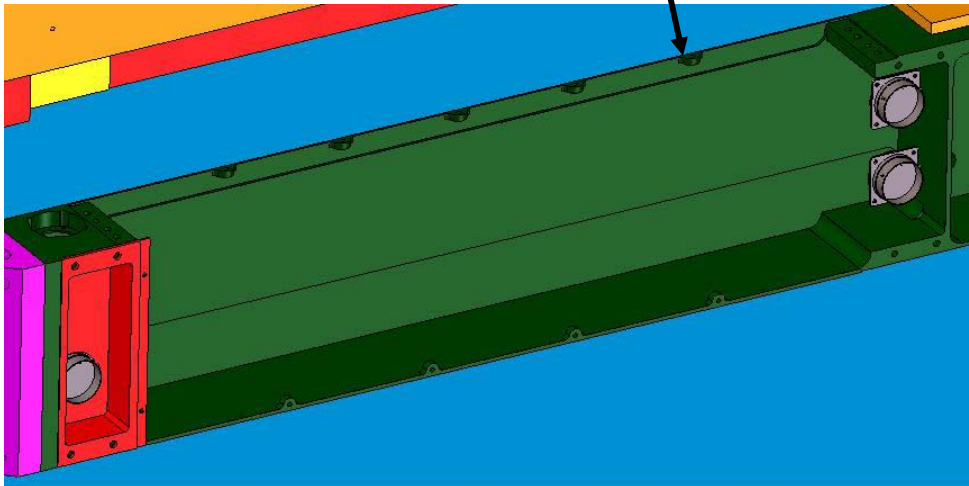
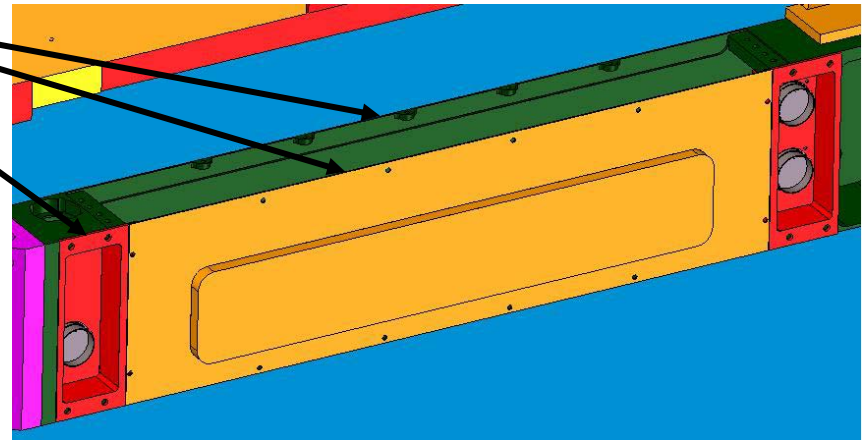
Space craft Interface

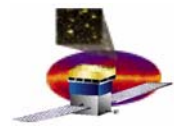
- **Current design**
 - **Titanium flexures Aldine coating**
 - **Electrical resistance with Aldine is 9 milli-Ohm per Spectrum Astro**
 - **Request Electro less nickel**
 - **The 433-RQMT-0005 requires a maximum of 2.5 milli-Ohm per connection**
 - **SLAC is looking into issues of electro less nickel onto titanium, See slides 3 & 4**



ACD Issues

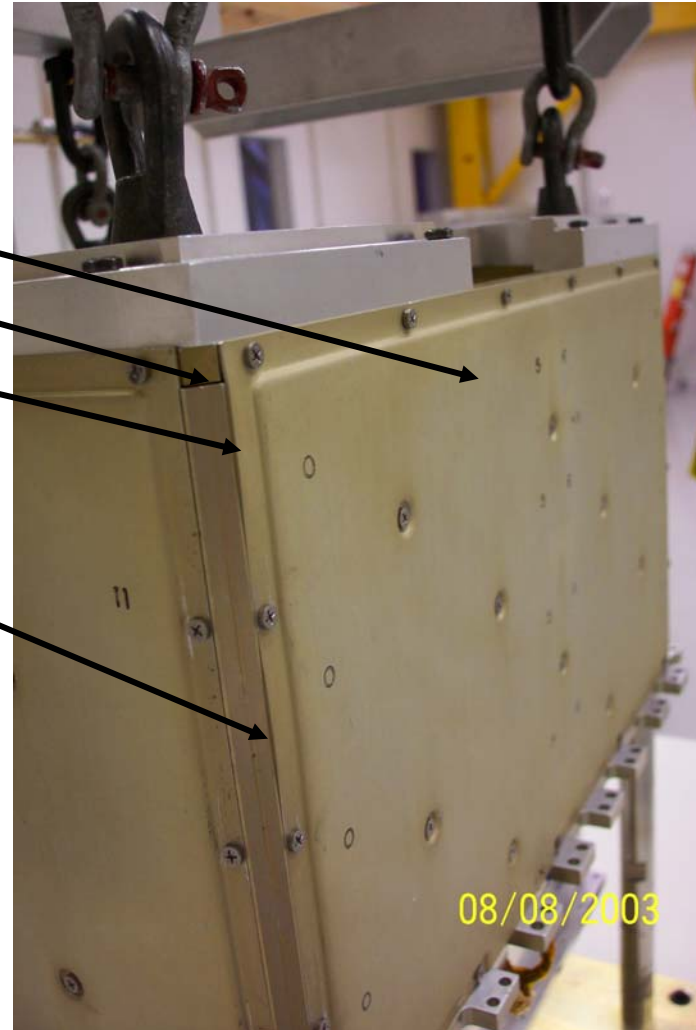
- Butted joints in BEA assembly
- ACD is looking into this
- Alodine
 - Request E-Nickel
- Look at BEA mounting

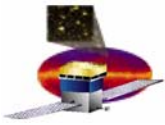




Calorimeter Issues

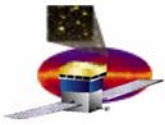
- **Current design**
 - Alodine
 - Request E-Nickel
 - Joints are not EMI tight
 - Butted joints
 - N. Johnson stated that gaps in panels due to improper assy.
- **Issues**
 - Low Freq 3.3V CMOS Switching noise escapes
 - Request EMI gaskets or Copper tape





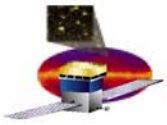
Tracker Issues

- To copper tape or not to copper tape
 - Issues
 - Calorimeter people claim that copper/aluminum tape is not allowed.
 - Either the Cal can or the Tracker can't ???
 - » We are one system after all
- EMI close out to prevent radiated EMI from DAQ and Calorimeter.
 - Cal base plate is an EMI sieve that can travel through the gaps between the Tracker towers.
 - Request the Calorimeter to shield against their low frequency 3.3V CMOS noise per slide 12
 - May need additional EMI shielding between towers



DAQ Issues

- Titanium standoffs between Cal base plate and DAQ TEM
 - Electro less nickel issues from slide 3&4
- The EMI filters on power feeds should take care of 433-RQMT-0005
- Power feed impedance
 - Spectrum Astro has modified there requirements
 - More work
- DC resistance issues between Spectrum Astro and the LAT due to voltage measurements that is referenced to LAT/system ground
 - Open issue



Conductive Tape

- The Calorimeter people claim conductive tape is not allowed
 - Either the Calorimeter can use it or the Tracker can't ???