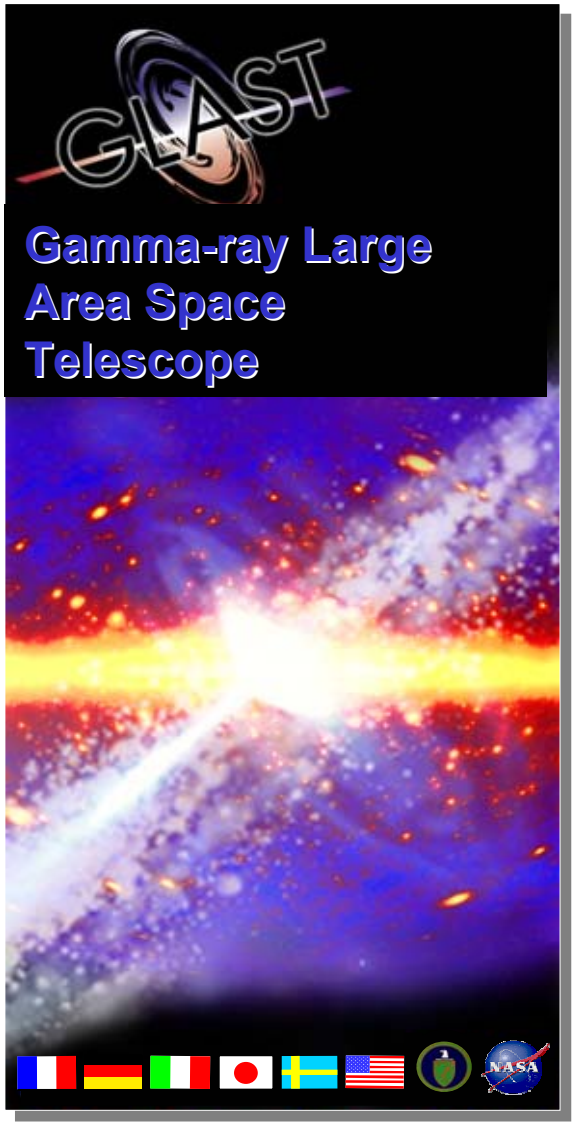


GLAST Large Area Telescope

Risk Mitigation Trades

End to End Performance Verification

LAT Systems Engineering

Identified Risks

Risk: On-orbit particle flux is not adequately simulated in the existing test plans leading to a hardware and/or software problem that is not detected until on-orbit

- **Higher than expected:**
  - **Trigger Rate** p=0.25
  - **Data Volume** p=0.25
  - **Event Distribution** p=0.25
- **Event Timing and pile-up effects** p=0.25
- **Poor Instrument End to End performance** p=0.25

IMPACT

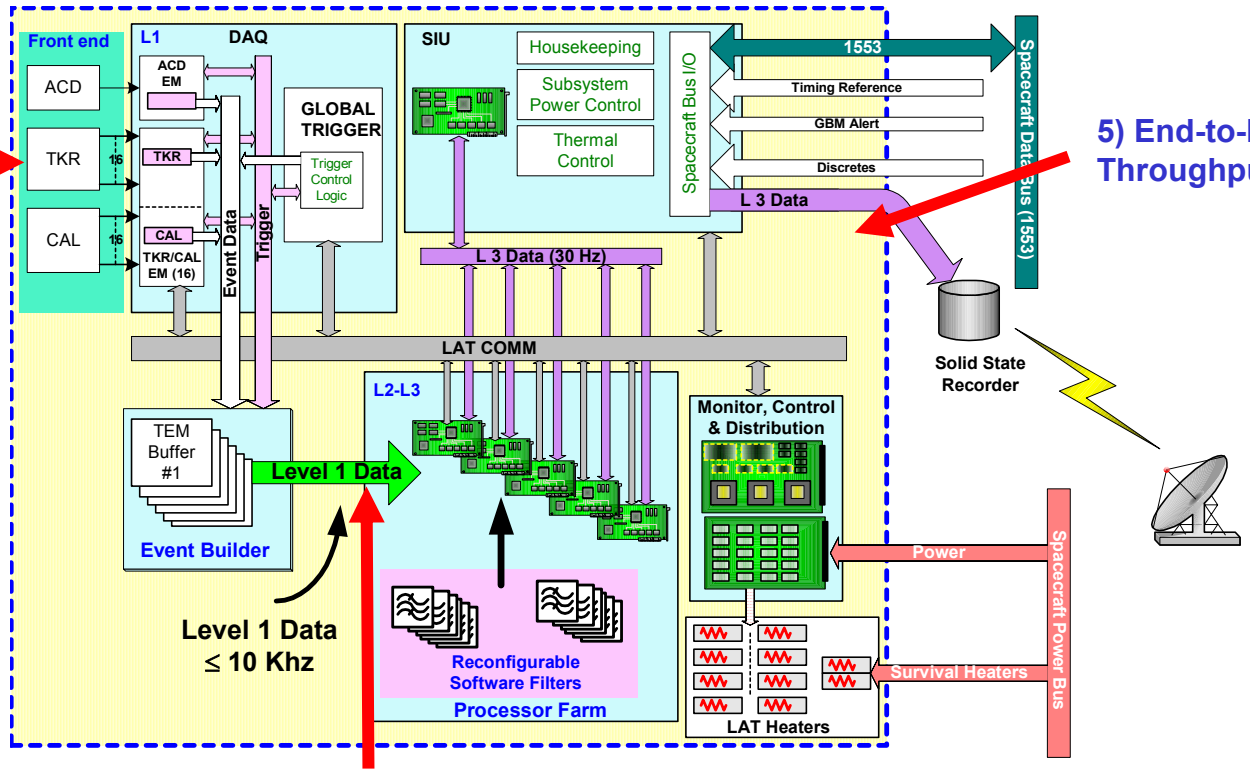
- ***Re-work of flight software on orbit***
- ***Extended instrument check-out period due to open performance issues***

Options

- No Additional Testing
  - Original plan
- Airplane (End to End) Test
  - Power on test during an airplane flight
- Additional Test Bed testing
  - Expand test bed capability to address specific performance risks identified

Risk Assessment

1) Trigger rate risk



5) End-to-End Throughput risk

2) Data Volume risk

3) Event Distribution risk

4) Event Pile-up risk

Level 1 data not as predicted resulting in poor performance of instrument

Risk Assessment continued

- Electronics position is that the only risk is in event distribution
  - Trigger rate, Data Volume, Event Timing& Pile up may be adequately simulated in the test bed
  - Instrument End-to-End performance may be derived by scaling test bed results. System is scalable
  - Event Distribution only element not able to be adequately simulated
- These on-orbit risks are not directly observable during LAT ground testing
- No affect on LAT electrical performance, environmental or T/V testing
- The software risk elements are *reconfigurable on orbit*

Proposed Mitigation (1)

No Additional Testing

Advantages

- No additional cost
- No special efforts

Disadvantages

- May require more time to put instrument in service due to changing and uploading new filters or other software modifications

Proposed Mitigation (2)

Airplane Test

Test LAT at near orbital conditions for <5 hours on a cargo aircraft

Advantages

- **Adequately provides stimulus for all 5 risks**
- **Allows for a high fidelity End-to-End test**
- **Gets operational performance information earlier**

Disadvantages

- **Puts flight instrument at risk to environments which are not the design reference mission**
  - **Operation during vibration (ie:performance, thermal, damage)**
- **More complex M-GSE and E-GSE**
- **Difficult to predict cost impacts to program**
- **Adds work to the program at a critical phase**

Proposed Mitigation (3)

Additional Test Bed Testing

Perform additional testing in the Test Bed to address risks 1-5

Advantages

- **Potentially less expensive**
- **No risk to flight hardware**
- **Earlier insight into problems**

Disadvantages

- **Does not exercise whole instrument, only sections and select pathways**
- **Will not completely eliminate the End-to-End performance risk**

Other Comments

- DAQ performance is the responsibility of the Electronics & Flight software Subsystem
  - Electronics does not see the need for option 2
  - Flight Software sees option 2 as beneficial
- Testing not required by MAR or Instrument Performance Requirements Verification

Systems Engineering Recommendation

- Electronics and Flight Software re-assess the DAQ risks
  - Probability and impact to program of these risks
- Electronics & FSW develop plans for specific risk reduction in the test bed
  - Test Plan for risk reduction
  - Impact and cost to improve test bed
  - Cost to perform additional risk mitigation tests
- I&T&C to develop a design, cost and risk assessment in parallel for performance of the Airplane Test
  - E-GSE required
  - M-GSE Required
  - Risk Assessment to LAT on environmental conditions
- Baseline Risk Mitigation efforts in test bed
- Carry Airplane test as a back-up test if issues in test bed are un-resolvable
- Determine “drop dead date” for Airplane test go/no go