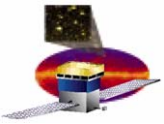


GLAST Large Area Telescope

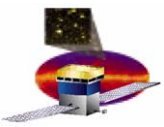
Instrument Science Operations Center Status

Rob Cameron
ISOC Manager
Stanford Linear Accelerator Center
rac@slac.stanford.edu
650-926-2989



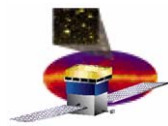
Outline

- ❑ Overview
- ❑ ISOC Organization
- ❑ Operations Summary
- ❑ System Development Progress
 - Architecture and Interfaces
 - Data Processing: science and non-science
 - Ancillary Products: SAA Definition
- ❑ Facility Planning
- ❑ Schedule
- ❑ Budget

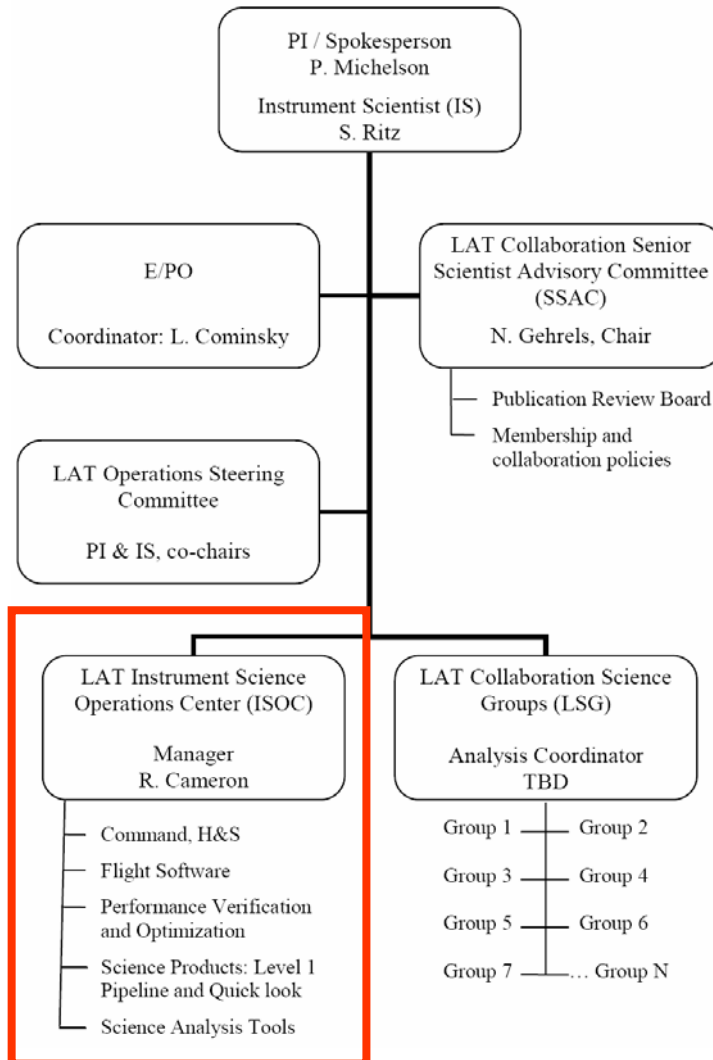


LAT ISOC Objectives

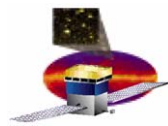
- ❑ **The LAT ISOC is organized to:**
 - **Safely operate the instrument**
 - **Produce LAT Level 1 and selected Level 2 science data products**
- ❑ **Main Functions:**
 - **Command planning and construction**
 - **Instrument health and safety monitoring**
 - **Maintain and modify FSW and the LAT Testbed**
 - **LAT performance verification and optimization**
 - **Process and archive Level 1 and Level 2 data**
 - **Maintain and optimize the software that produces science data products**



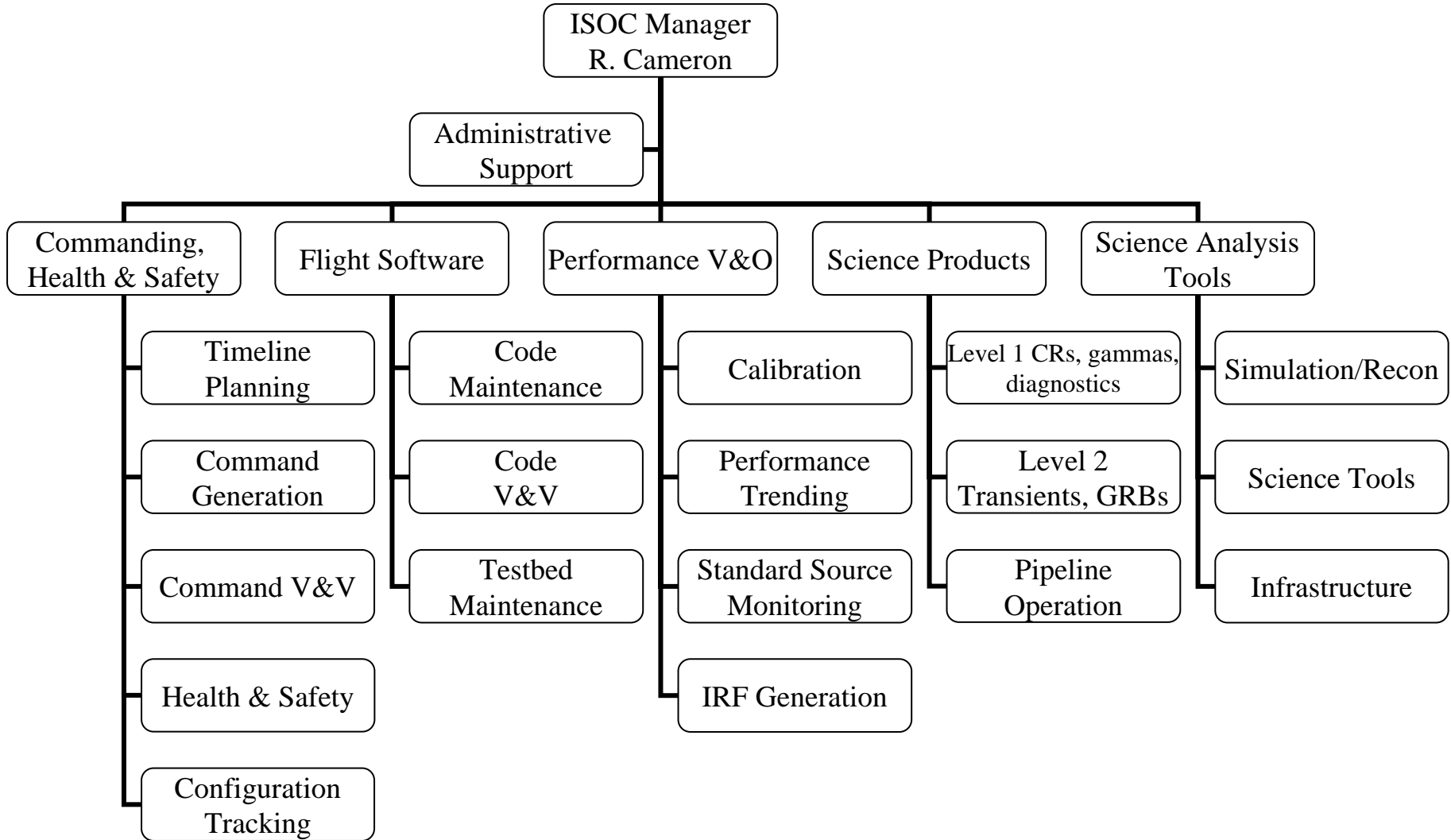
The ISOC in the LAT Collaboration

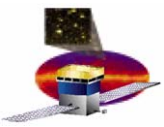


- ❑ **ISOC has close connections to LAT Science Groups**
 - e.g. Working with Calibration and Analysis Methods Group to incorporate improvements to event reconstruction into ISOC processing and products
- ❑ **ISOC has broad involvement in the LAT collaboration**
 - e.g. instrument performance analysis and tool development are coordinated by the ISOC across the collaboration



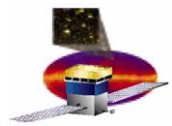
ISOC Organization



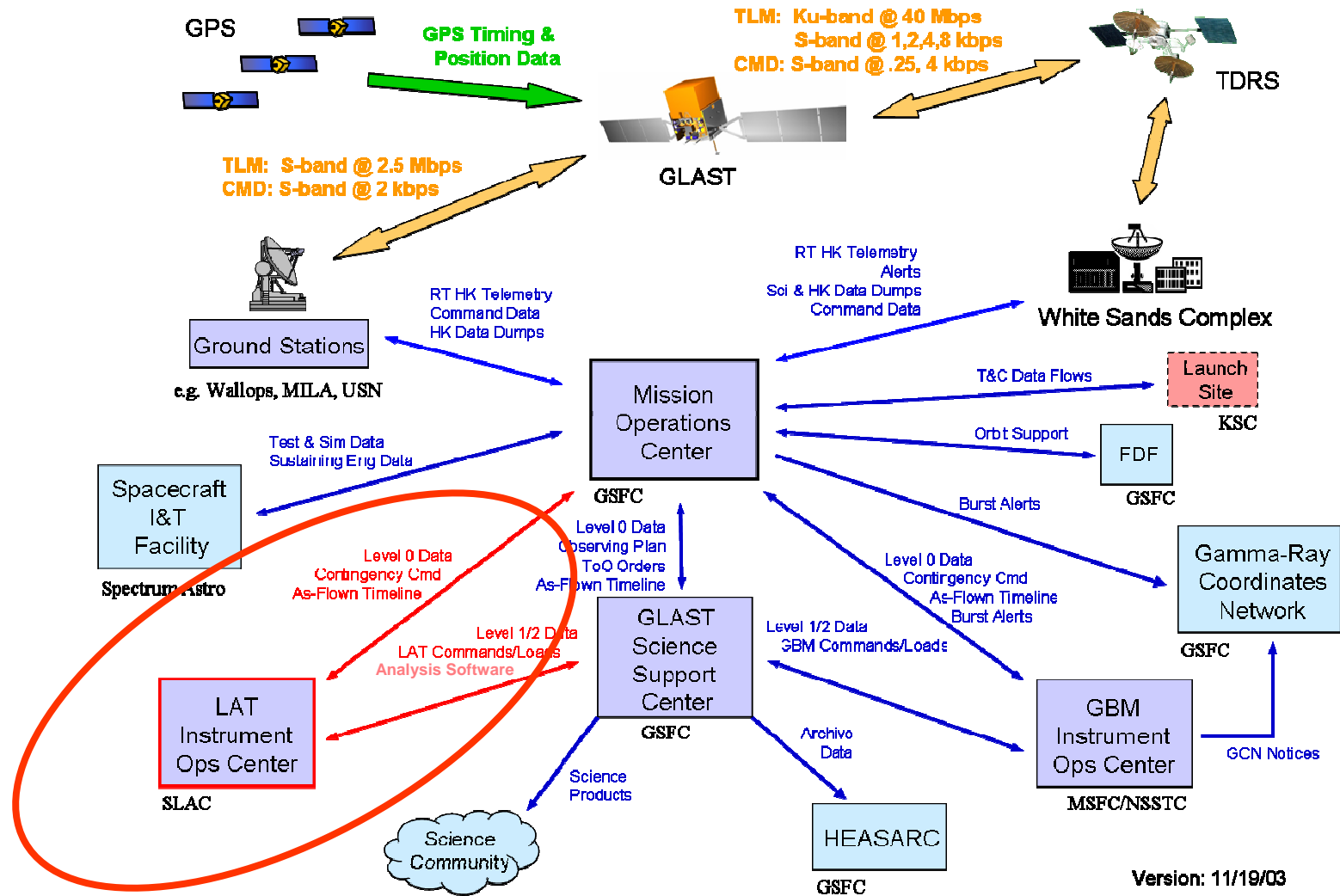


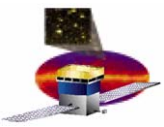
ISOC Growth

- ❑ **ISOC will grow in size and responsibility as a result of the transition from the instrument development phase into the operations phase**
- ❑ **CHS: Current focus of development within ISOC. Emphasis on development of interfaces to other GLAST ground elements: MOC, GSSC**
- ❑ **FSW is delivered as part of LAT. FSW maintenance is taken into ISOC after FSW delivery.**
- ❑ **The core PVO team is already in place for LAT I&T SVAC activities, but LAT PVO will include broader collaboration involvement, e.g. Analysis workshop on 3/10/2005**
- ❑ **Science Analysis Tools, including data processing pipeline are currently in active development by Science Analysis Software (SAS) team. Testing driven by Data Challenges. Early versions in use to support I&T.**



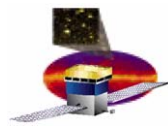
The ISOC Role in GLAST Operations



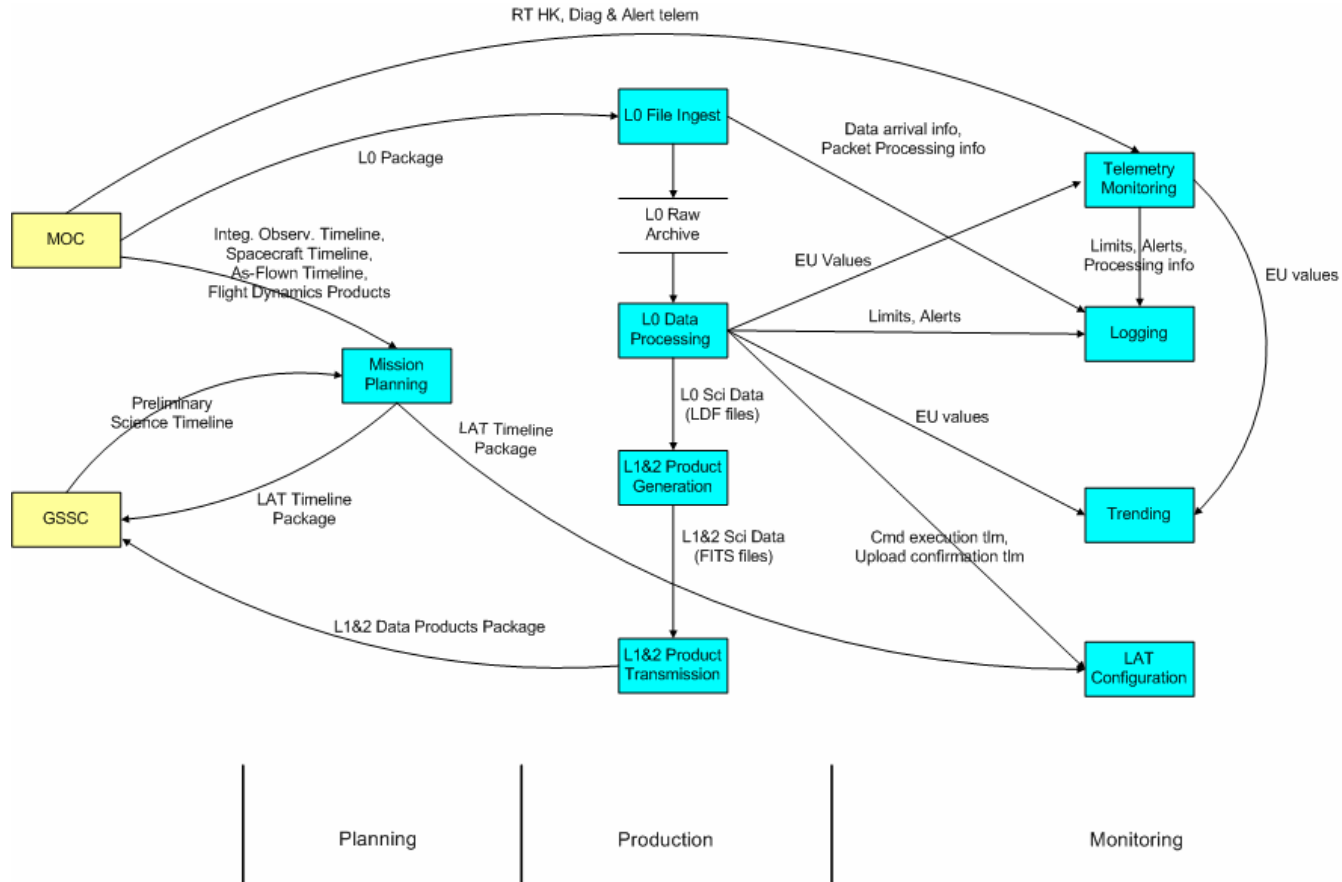


ISOC System Development

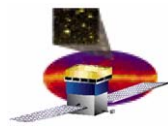
- ❑ Top-level architecture is defined, capturing all processing elements and tasks within ISOC
- ❑ External interfaces defined through Interface Control Documents: Operations Data Products, Science Data Products
- ❑ Data transport between GLAST elements: FastCopy (COTS software)
 - installed on SLAC servers; informal interface testing to external elements just starting; formal interface testing starts with GRT #2 to MOC at GSFC in June
- ❑ Prototyping of ISOC processing is using LAT data from I&T
 - provides service to I&T: archiving and access of LAT data
 - I&T data serve as development model for ISOC data ingest and processing tasks
- ❑ ISOC design implementation approach:
 - use common resources, user interfaces and services where possible, e.g. pipeline, data server, web services



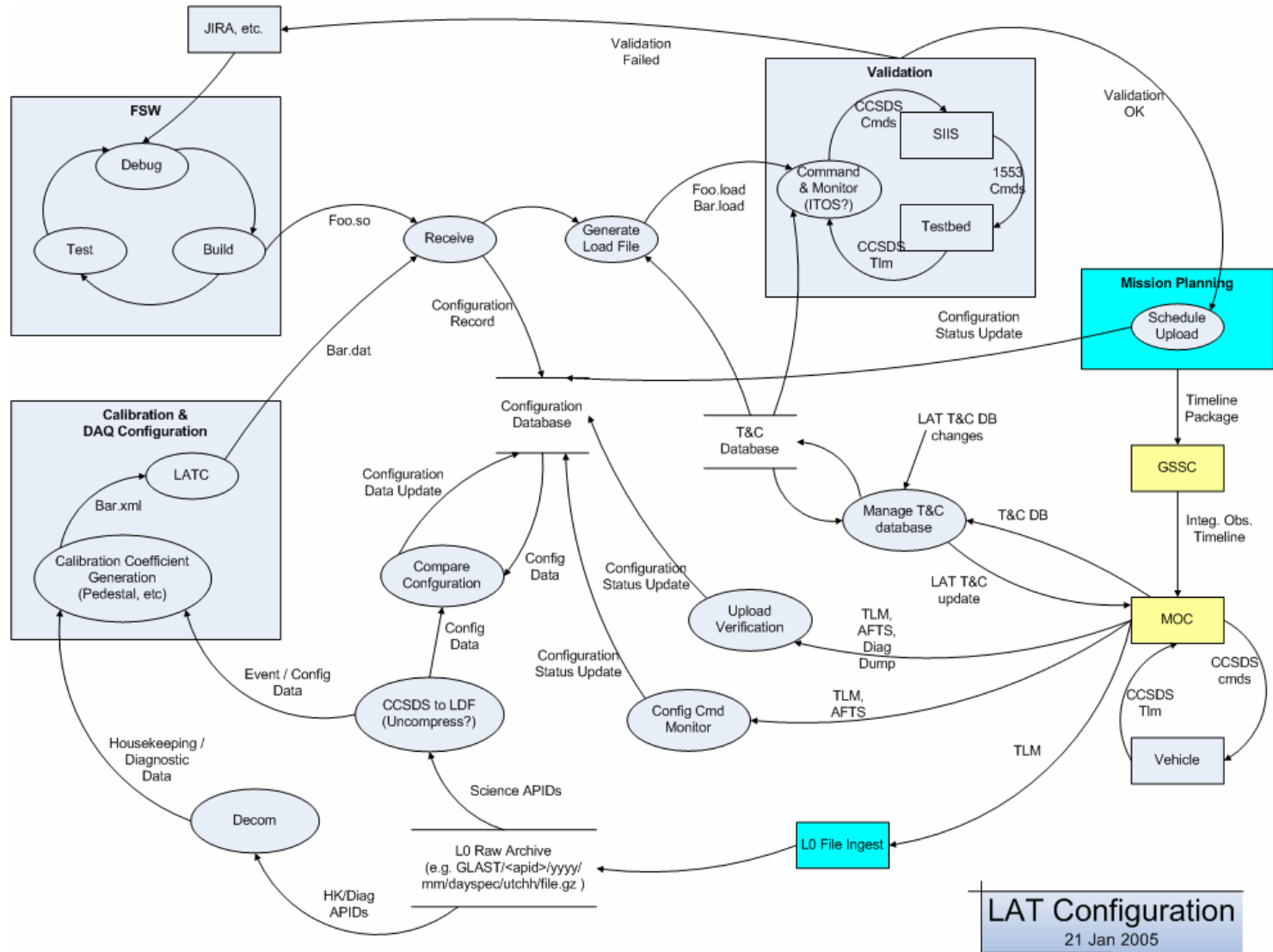
Top-level ISOC Data Flows



Top-Level ISOC Data Flows
9 Feb 2005



Instrument Configuration Control and Use

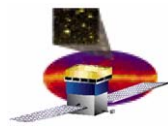


LAT Configuration
21 Jan 2005



LAT Housekeeping Data Processing

- ❑ **ISOC has developed housekeeping database and interfaces as a high priority task, to support I&T needs**
- ❑ **Pipeline task is in place to regularly ingest HK data from LAT tests. ISOC will provide long-term archive for these data.**
- ❑ **With the delivery of FSW and the transition to operation of the LAT via FSW, the ingested data stream will move to flight-like format, providing greater fidelity for development and test of the ISOC.**
- ❑ **Eventually, LAT science data from tests will be transferred from I&T to the ISOC via a similar path**
- ❑ **This data transport and processing mechanism should carry forward through LAT ground testing at NRL and beyond.**



LAT Housekeeping Database

ISOC:Trends:FetchMenu - Microsoft Internet Explorer

Address: http://glst-ground.slac.stanford.edu/isoc/latrends/fetchDataMenu.cfm

(index) | Help

Disclaimer. This page is under construction. Use at your own risk. Data collected earlier than 1 Feb 2005 is likely incorrect, for demonstration only.

Request Menu

All Source Statistics(5min) Archive

2005-02-27 22:08:40 UTC Begin

2005-03-09 22:08:40 UTC End

%TEMO%emp%raw Channels Expression (use % for wildcard, matches mnm or short desc)

User Limits | 0 RedLow | 0.3 YelLow | 0.6 YelHigh | 1 RedHigh

Submit

Current Request

Source All

Beg 2005-02-27 22:08:40 = 38410.9226852

End 2005-03-09 22:08:40 = 38420.9226852

Tot 10 days

Table Statistics

There are 24 items matching the Channels Expression. Click on the option links to retrieve the data for that channel.

name	option (samples)	short	long
LHKTOCALAF0T0	Tabulate Plot (534)	TEMO CAL AFEE0 Temp 0 raw	A 12 bit raw ADC value.
LHKTOCALAF0T1	Tabulate Plot (534)	TEMO CAL AFEE0 Temp 1 raw	A 12 bit raw ADC value.
LHKTOCALAF1T0	Tabulate Plot (534)	TEMO CAL AFEE1 Temp 0 raw	A 12 bit raw ADC value.
LHKTOCALAF1T1	Tabulate Plot (534)	TEMO CAL AFEE1 Temp 1 raw	A 12 bit raw ADC value.
LHKTOCALAF2T0	Tabulate Plot (534)	TEMO CAL AFEE2 Temp 0 raw	A 12 bit raw ADC value.
LHKTOCALAF2T1	Tabulate Plot (534)	TEMO CAL AFEE2 Temp 1 raw	A 12 bit raw ADC value.
LHKTOCALAF3T0	Tabulate Plot (534)	TEMO CAL AFEE3 Temp 0 raw	A 12 bit raw ADC value.
LHKTOCALAF3T1	Tabulate Plot (534)	TEMO CAL AFEE3 Temp 1 raw	A 12 bit raw ADC value.
LHKTOTKRC0T0	Tabulate Plot (534)	TEMO TKR Cable 0 Temp 0 raw	A 12 bit raw ADC value.
LHKTOTKRC0T1	Tabulate Plot (534)	TEMO TKR Cable 0 Temp 1 raw	A 12 bit raw ADC value.
LHKTOTKRC1T0	Tabulate Plot (534)	TEMO TKR Cable 1 Temp 0 raw	A 12 bit raw ADC value.
LHKTOTKRC1T1	Tabulate Plot (534)	TEMO TKR Cable 1 Temp 1 raw	A 12 bit raw ADC value.

ISOC:Trends:LHKTOTKRC1T0 - Microsoft Internet Explorer

Address: http://glst-ground.slac.stanford.edu/isoc/latrends/fetchAny.cfm?form=tab&tableName=All&mem=LHKTOTKRC1T0&begtime=2005-02-27%22:08:40&endtime=2005-03-09%22:08:40&valTable=Statistics&userIm=off&colored=0&loyel=0.3&h

(index) | (back)

UTC

Source All (All) days 1899 days 1970 secs 1970

beg 2005-02-27 22:08:40 38410.9226852 12841.9226852 1109542120

end 2005-03-09 22:08:40 38420.9226852 12851.9226852 1110406120

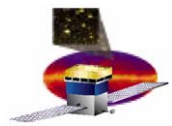
tot 10 864000

Table Statistics

Statistics Data for LHKTOTKRC1T0

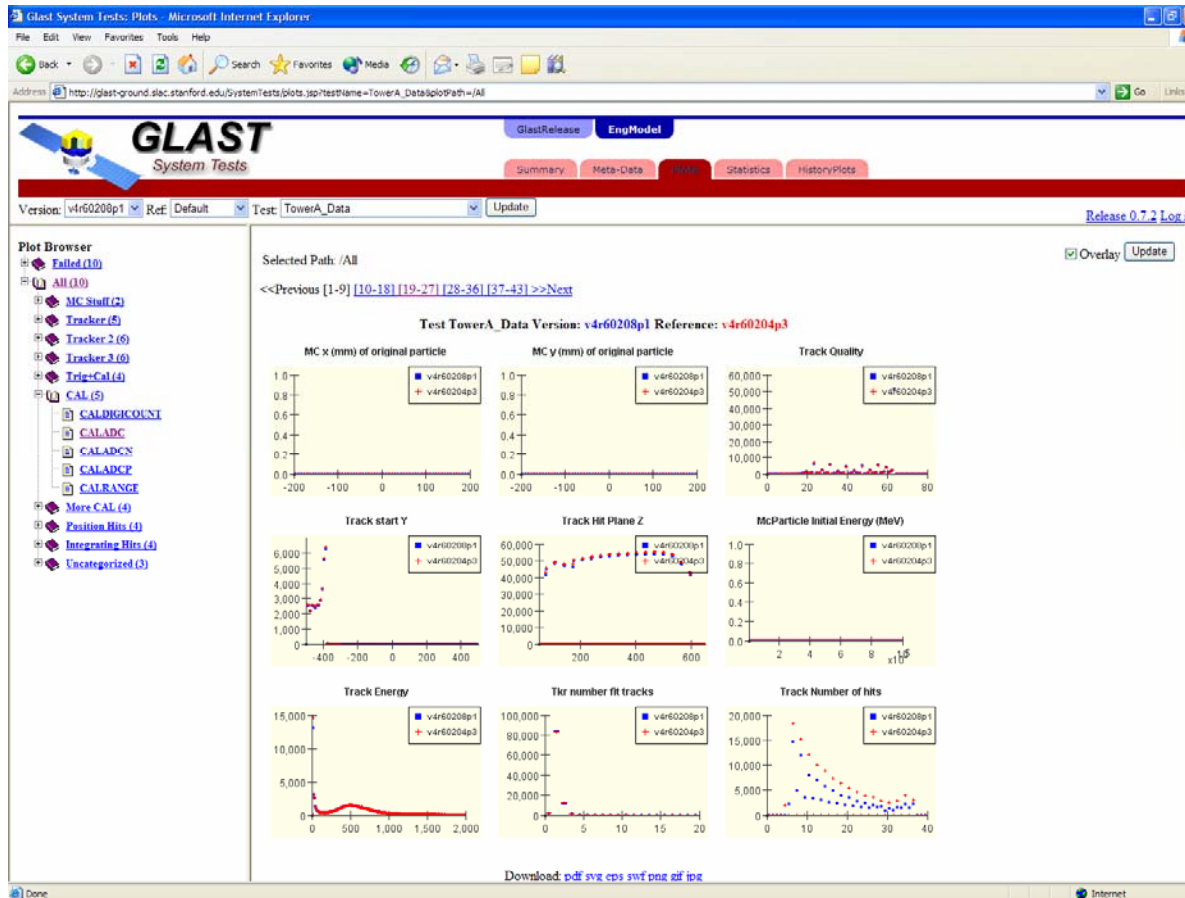
There are 534 data points for [LHKTOTKRC1T0 "TEMO TKR Cable 1 Temp 0 raw"]

Source timeUTC	relTime	nSamples	low	mean	high	range	sdev
140 1109610184.3930 28-Feb-05 17:03:04 68064.3929999	14	21.75076	21.76300	21.92215	0.17139	0.0458056	
140 1109610302.7380 28-Feb-05 17:05:02 68182.7379999	36	21.75076	21.86498	21.95651	0.20575	0.0608053	
140 1109610607.5550 28-Feb-05 17:10:07 68487.5550001	35	21.95651	22.03420	22.09426	0.13774	0.0428747	
140 1109610903.23 28-Feb-05 17:15:03 68783.23	36	22.09426	22.18060	22.26708	0.17283	0.0441127	
140 1109611208.3590 28-Feb-05 17:20:08 69088.359	35	22.23246	22.31860	22.37113	0.13867	0.0406587	
140 1109611504.0660 28-Feb-05 17:25:04 69384.066	36	22.40587	22.46095	22.51026	0.10439	0.0419010	
140 1109611808.07 28-Feb-05 17:30:08 69688.0699999	35	22.54511	22.60196	22.68483	0.13971	0.0456786	
140 1109612103.6520 28-Feb-05 17:35:03 69983.652	36	22.68483	22.74710	22.82501	0.14018	0.0489250	
140 1109612404.2650 28-Feb-05 17:40:04 70284.2650001	36	22.82501	22.89725	22.96566	0.14065	0.0444329	
140 1109612708.2690 28-Feb-05 17:45:08 70588.2690001	35	22.96566	23.04526	23.10678	0.14112	0.0455583	
140 1109613004.1010 28-Feb-05 17:50:04 70884.1010001	41	23.10678	23.18013	23.24837	0.14159	0.0450529	
140 1109613300.0790 28-Feb-05 17:55:00 71180.079	36	23.24837	23.33220	23.39044	0.14207	0.0458458	
140 1109613605.2120 28-Feb-05 18:00:05 71485.2119999	35	23.39044	23.47694	23.53298	0.14254	0.0408122	
140 1109613901.4050 28-Feb-05 18:05:01 71781.405	36	23.53298	23.59749	23.64020	0.10722	0.0350422	
140 1109614205.60 28-Feb-05 18:10:05 72085.5999999	35	23.64020	23.66885	23.71183	0.07163	0.0242575	
140 1109614501.8790 28-Feb-05 18:15:01 72381.8789999	36	23.71183	23.76464	23.81950	0.10767	0.0303156	
140 1109614805.8570 28-Feb-05 18:20:05 72685.8570001	35	23.81950	23.84210	23.89143	0.07193	0.0262896	
140 1109615101.3210 28-Feb-05 18:25:01 72981.3210001	36	23.89143	23.90743	23.96348	0.07205	0.0200873	
140 1109615406.0620 28-Feb-05 18:30:06 73286.062	35	23.92744	23.96142	23.99955	0.07211	0.0194403	
140 1109615702.2230 28-Feb-05 18:35:02 73582.223	31	23.96348	24.01702	24.03565	0.07217	0.0205691	



Data Display

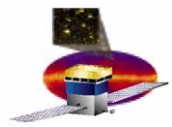
- ❑ System Test interface is good model for ISOC data interfaces
 - ISOC will use similar interfaces for other data, e.g. LAT housekeeping





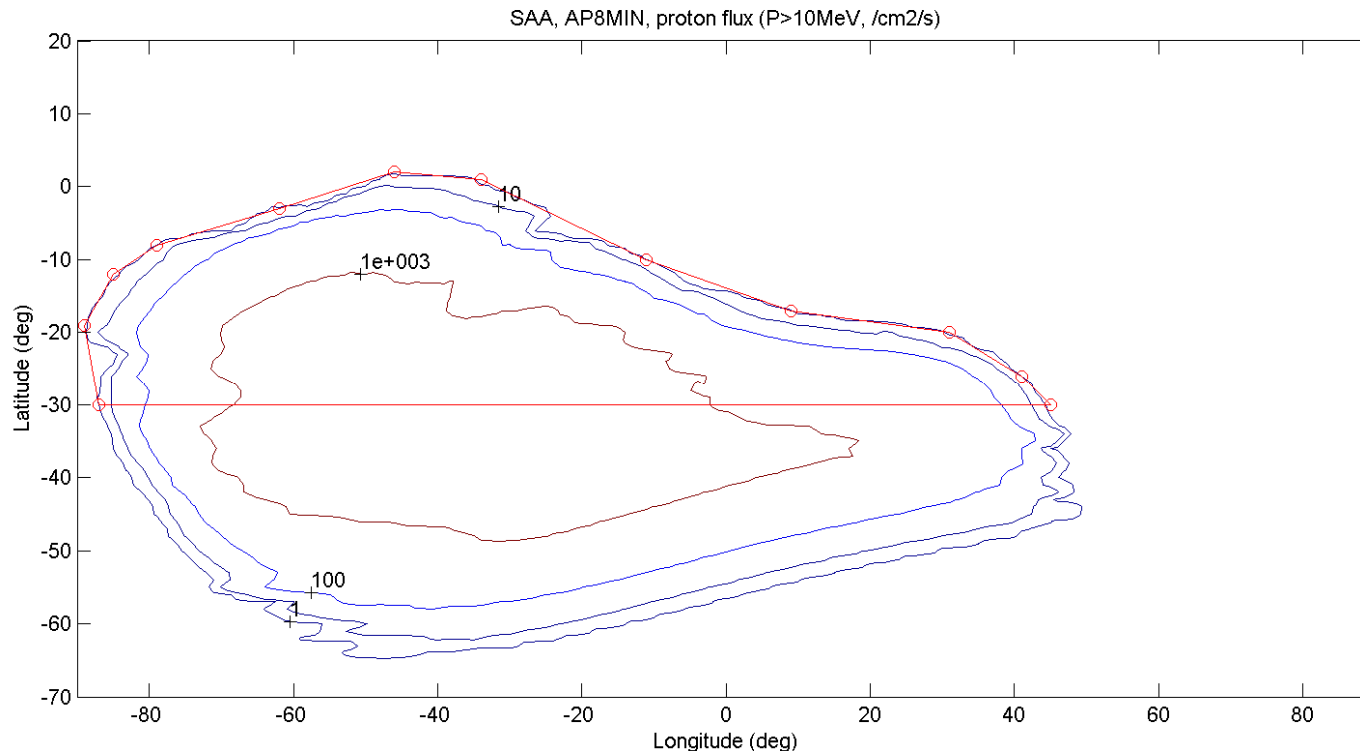
Science Data Production Planning

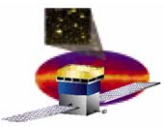
- ❑ **Data Challenges** are key driver for development and test of end-to-end science data processing
 - DC1 very successful; DC2 planning underway
 - Model for broad collaboration interactions for ISOC
- ❑ **Delivered science data products** controlled by NASA ICD
- ❑ **Science data production and serving** uses SLAC SCS computer farm
 - SAS is moving forward with purchase of needed computer resources
 - 25 CPUs per year, with 3 year replacement cycle
 - ramp up to 40TB disk space per year
- ❑ **Pipeline development**
 - Planning migration from Perl to Java implementation, to improve maintenance and flexibility
 - I&T processing through pipeline is providing valuable experience in pipeline performance needs
- ❑ **Data Server**
 - DC2 is driving improvements
 - Data Handling in general is moving to Java implementation
- ❑ **Possible future developments**
 - SLAC SCS is considering TeraRAM compute servers, which may be available for LAT processing
 - Mirroring of data through remote servers



SAA Region Definition

- ❑ ISOC must provide pre-launch polygon definition for SAA boundary for LAT
- ❑ First cut: AP8MIN model used with nominal GLAST BOL orbit, to estimate >10 MeV proton flux in SAA region
- ❑ Newer trapped proton models are being investigated



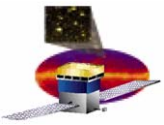


ISOC Facility Planning

- ❑ **Short term: now until early 2006**
 - **ISOC Operations Development Lab established in Building 210 at SLAC**
- ❑ **Long term: 2006 and beyond**
 - **Consolidation of LAT activity into broad operations support and research support activity**
 - **Aim for logical grouping of these LAT activities with other SLAC elements**
 - **ISOC Operations Support consolidated in Central Lab Annex: CHS, FSW, pipeline support**
 - **SLAC and KIPAC see benefits in grouping LAT researchers with KIPAC researchers in (or near) new KIPAC building at SLAC. In concept stage: build out of extra office space for LAT use in Kavli is being explored**
 - **ISOC presence on Stanford campus**
 - **Varian 2 building in construction on campus: mostly for research office space, but with small operations presence**

ISOC Software Releases & Ground System Tests

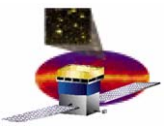
Date	What	Release	Required ISOC capabilities
15-Jun-05	GRT 2	ISOC 1 (17 May 05)	receive real-time HK data from MOC, provide basic LAT P&S (Planning & Scheduling)
15-Aug-05	GRT 3	“	level 0 data processing on science data, IOC processes science level 0 data into level 1 products
1-Nov-05	GRT 4	“	receive level 0 data from MOC
17-Jan-06	GRT 5	ISOC 2 (9 Dec 05)	provide level 1 and 2 data products to GSSC, provide more complex LAT P&S, provide LAT file uploads to GSSC, provide simulated science data
8-Feb-06	ETE 1	“	provide Level 1 data products to GSSC, receive Level 0 files from MOC (post-test)
17-May-06	GRT 6	ISOC 3 (17 Apr 06)	contingencies added
4 May-06	ETE 2	“	provide instrument commands and file loads, support memory dumps of instrument
1-Jul-06	Mission Sims	“	full ISOC capabilities to support Mission Sims (from May 2006 through launch)
12-Jul-06	GRT 7	“	clean-up and regression tests
15-Jun-06	ETE 3	“	support basic observatory operations
24-Aug-06	ETE 4	“	instrument turn on
16-Oct-06	ETE 5	“	regression test and contingencies
1-May-07	ETE 6	ISOC 4 (30 Nov 06)	final ETE at launch facility



DOE Funding for ISOC

- ❑ Separation of costs for ISOC operations support and LAT research scientists at SLAC
- ❑ DOE applies \$5M p.a. cap for ISOC operations
- ❑ Current planned funding profile (TBR)

Fiscal Year	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	Total
DOE Funding Ops	3,251	2,892	2,939	4,300	3,602	5,000	5,000	4,214	4,362	35,560
DOE Research Scientists					2,609	2,656	2,763	2,859	2,959	13,847
Total Current Funding					6,211	7,656	7,763	7,074	7,321	36,024



Summary

- ❑ **ISOC development activity is progressing well. Overall architecture is in place, and interface definitions are stabilizing.**
- ❑ **ISOC is benefiting from task sharing and coordination with other LAT program elements.**
- ❑ **The ramp-up of hardware in I&T and the resultant data and its processing will exercise LAT ground element software, to the benefit of the ISOC.**
- ❑ **ISOC staffing plans are being actively worked. The details of the transition from the instrument development phase to the operations phase will be set in the next few months. This will include defining continuing support activities from NRL, GSFC, and the rest of the collaboration.**