GLAST Large Area Telescope:

Overview

I&T Science Verification Analysis and Calibration (SVAC) Peer Review

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Outline of Talks

Introduction – 2 min (Elliott) not more !

Overview and Requirements – 20 min (Eduardo)
1. Requirements
2. Organization
3. Data Taking Plans and Activities

Code Management – 5 min (Anders)
1. Code Acceptance and Release
2. Updates and CCB
3. Validation of Calibration Data

Data Processing & Archival – 15 min (Warren)
1. Requirements
2. Scripts and Development

Calibrations – 15 min (Xin)
1. Requirements
2. Calibration Types
3. EM Examples and Status

Trending Database – 5 min (Xin)
1. Requirements
2. Calibration Types
3. Status

Electronic Log and Runs Database – 10 min (Xin)
1. Requirements
2. Examples and Status

Data Analysis Infrastructure – 15 min (Anders)
1. Requirements
2. Geometry and Examples
3. Event Display and Examples

Data Analysis – 15 min (Eduardo)
1. Examples – Run Reports
2. Proposal for E2E pass/fail analysis
3. Examples – Data Analysis Tasks

Summary and Concerns – 15 min (Eduardo)
1. External Dependencies
2. Overall Status
3. SVAC Need Dates
4. Deliverables and SVAC work to 2 towers
5. Top 4 concerns

Outline

10:00 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

Overview for the Reviewers

- During this Peer Review we will
  - Describe the SVAC requirements and documentation tree
    - Highlight our external dependencies
  - Demonstrate the ability to exercise the full data analysis chain to
    - process, calibrate and analyze the LAT data
  - Summarize our main concerns
  - Discuss plans and schedule
    - And what is missing for the 2 tower integration

Overview of High Level Requirements

- During LAT Integration, the I&T SVAC Department shall
  - Process, archive and verify the integrity of data taken with Cosmic rays and VDG photons
    - Data runs are specified in the VG and CR Data Runs for LAT Integration LAT-MD-04136 (See Particle Test Peer Review) - draft
  - Generate calibrated data analysis files and update, improve and track changes in the calibration constants used by the SAS reconstruction during I&T
    - Types are specified in the LAT SVAC Plan (LAT-TD-00446) and references within – released and in process of being updated
  - Characterize Low Level Performance for Cosmic Rays and VDG photons
    - Details to appear in the LAT SVAC Plan for LAT Integration at SLAC (LAT-TD-00575) and references within- draft
  - Validate MC simulations for Cosmic Rays and VDG photons
    - Details to appear in the LAT SVAC Plan for LAT Integration at SLAC (LAT-TD-00575) and references within- draft

List of Documents

	LAT DOCS	Responsibility	Need Date
LAT SVAC Plan	LAT-MD-00446	SVAC	3-Aug
SVAC Plan for LAT Integration at SLAC	LAT-MD-00575	SVAC	13-Aug
SVAC Contributed Manpower	LAT-MD-00613	SVAC	3-Aug
LAT Calibration Algorithms	LAT-MD-01590	SAS	1-Sep
LAT Geometry for MC Simulation	LAT-MD-03674	SAS	1-Sep
SVAC Database for LAT Integration	LAT-MD-01588	SVAC	13-Aug
I&T/SAS ICD for LAT Integration	LAT-MD-00572	SVAC	3-Aug

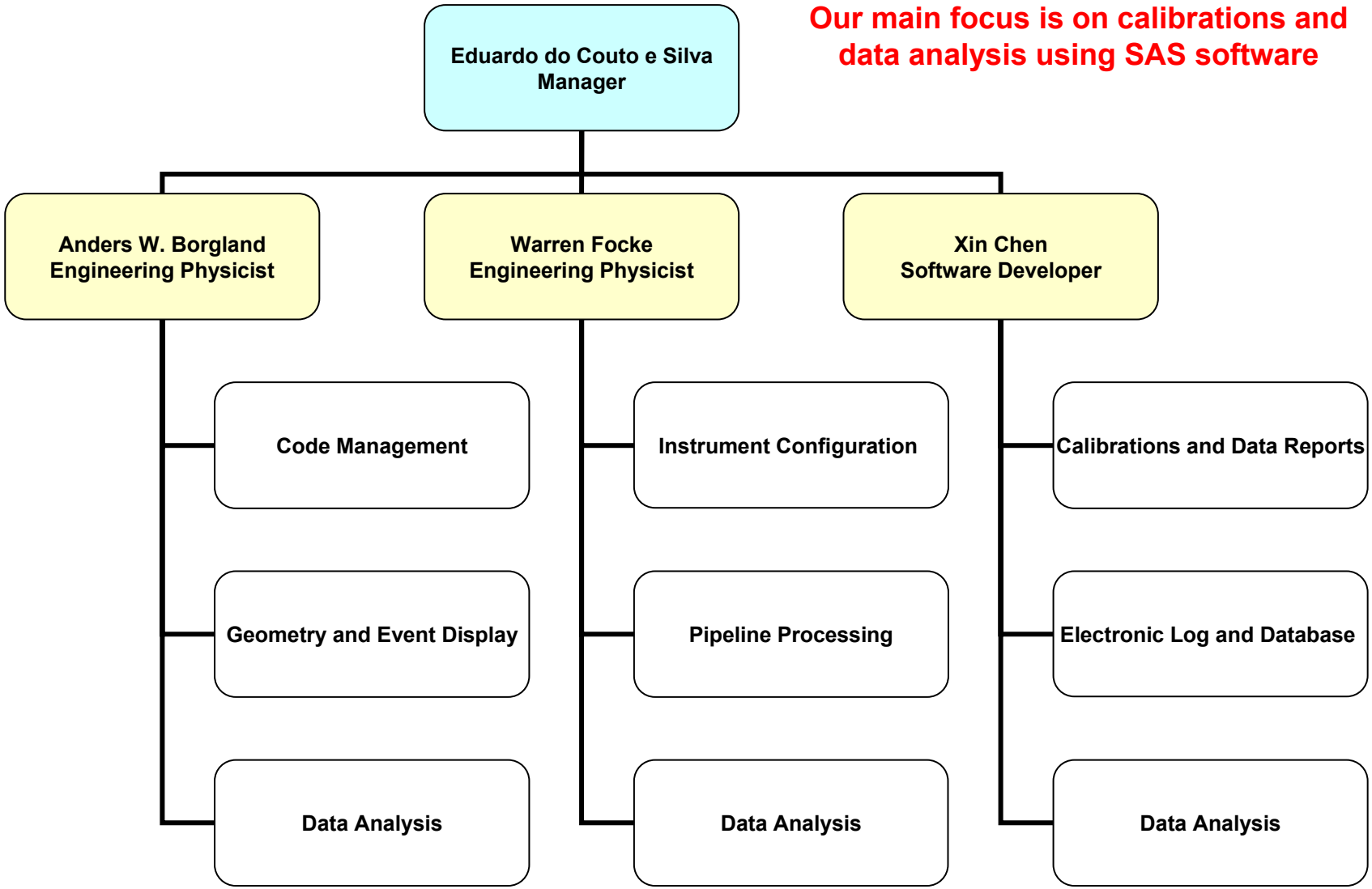
- Level 3 documents are needed by IRR, need help from subsystem managers
  - SVAC Plan
  - SVAC Contributed Manpower
  - SVAC/SAS ICD for LAT Integration
- SVAC would like feedback from subsystems on the
  - SVAC Plan for LAT integration at SLAC
- SVAC would like feedback from ISOC
  - SVAC Database for LAT integration

SVAC Plan – LAT-MD-00446

- The I&T SVAC Activities
  - Support the verification of the LAT Science Requirements
  - Are described by the L3 document, LAT SVAC Plan (LAT-MD-00446), which is the master plan and needs to be updated
- Update the SVAC Plan from LAT-MD-00446-05 to LAT-MD-00446-06
  - We request subsystems to approve the following changes prior to the I&T IRR Aug 3
    - Section 5.3 Table 1. (SVAC Compliance)
      - » Move LII,III,IV requirements traceability to SE documents
      - » Rename TKR items per LAT-TD-02730
    - Sections 6.4.1 to 6.4.4 (Data taking after I&T at SLAC)
      - » Merge all into 6.4.1. and remove airplane test
    - Sections 7.3 Table 3 (Post Launch Test matrix)
      - » Move to ISOC Operations Plan – LAT-SS-01378
      - » Update all references to on-orbit tests to ISOC Operations Plan LAT-SS-01378
    - Ensure flow is consistent with beam test after LAT integration
    - Ensure Science Verification strategy is updated

SVAC Organization

Our main focus is on calibrations and data analysis using SAS software



Redundancy – Risk Reduction

- To reduce risks due to the tight schedule the goal is to develop redundancy in the SVAC Department, so that any task can be performed by at least 2 persons

Redundancy achieved

• Calibrations	*Xin/Anders*
• Geometry	*Anders/Xin*
• Code Management	*Anders/Xin*

Redundancy process in progress

• Data Processing and Archival	*Warren/Xin*
• Data Reports	*Xin/Anders*
• Event Display	*Anders/Warren*

Redundancy process not yet started

• Data Configuration Parser	*Warren/Anders*
• LDF verification	*Xin/Warren*
• Electronic Logbook (ORACLE)	*Xin/ISOC hire*
• Trending Database (ORACLE/JAS)	*Xin/ISOC hire*

- ISOC is hiring a database expert to help SVAC and Online since Xin is oversubscribed

Science Requirements Verification (1)

- **Responsibilities:**
  - **Peter Michelson, as Principal Investigator**
    - **ensure the requirements are met**
  - **Delegated to Steve Ritz, as Instrument Scientist.**

- **Requirements Verification**
  - **Done by analysis using the instrument simulation**
    - **Include estimates of the uncertainties in the results of the analysis**
  - **Presented at the Pre-Ship Review (PSR)**
    - **prior to delivery to Spectrum Astro**
  - **Beam test will be used to tune the MC**
    - **occurs after the Pre-Ship Review (PSR)**

Science Requirements Verification (2)

- Responsibilities for the analysis for the verification
  - Carried out by members of the LAT collaboration
  - I&T SVAC will be responsible to perform
    - characterization of the low-level instrument performance
      - » using cosmic rays
    - comparison of the simulation and data
      - » using cosmic rays and 18 MeV photons from the VDG
    - both of these items will be used to reduce the systematic errors of the MC predictions of the analysis verifying the science requirements prior to PSR.
  - SAS
    - Support analysis in the context of the Analysis Group
      - Include characteristics of the real instrument in the simulation used for the analysis.
        - » e.g. update estimates of the noise, non-linearities, bad channels
    - Support I&T SVAC and Instrument Analysis Group
      - deliver to I&T a production-quality, configuration-controlled version of the simulation and reconstruction by a mutually-agreed date

Data Taking Plans for the LAT

- **Concept**
  - **Data taking will occur at different levels of increased complexity**
    - **Mechanical**
    - **Electronics modules (and FSW)**
    - **SAS software**

- **Hardware Configurations for SVAC Data Analysis**
  - **For this review we focus on 1 and 2 tower configurations**
    - **1 tower**
    - **2 towers**
    - **8 towers (TBR)**
    - **16 towers**
    - **LAT**

Increase in complexity

Data Analysis Activities

- During LAT Integration there will be three main activities involving offline data analyses by the SVAC Department
  - PASS/FAIL Analyses — I&T
  - CALIBRATIONS — I&T
  - DETAILED Analyses — Instrument Analysis Group
- These activities will lead to two main efforts which will be captured in the "Results for the LAT Integration at SLAC" (LAT-TD-01595) after LAT assembly
  - Comparisons with simulation MC/DATA (CR and VDG) — I&T
  - Characterization of Low Level Performance (CR and VDG) — I&T
- All the above will serve as input to the
  - Science Requirement Validation — Instrument Scientist

PASS/FAIL Analyses

- PASS/FAIL Analyses
  - Requirements
    - Support the analysis of the data from trigger and data flow tests for the LAT when is fully assembled as recommended by the End-to-end Committee report
  - Datasets
    - Obtained using Cosmic Rays and VDG photons as particle sources
    - will be produced by changing configuration settings as defined in the End-to-End Committee Report and captured in LAT-MD-04136 (See Particle Test Peer Review)
  - Results
    - Reports automatically generated at the end of the run
    - Reports contain tables and plots to identify *coarse* problems and establish that data is analyzable
    - Final acceptance and sign-off occurs at LAT level
  - Timescale for Results
    - few hours (TBR) after completion of the data taking
      - » Turn around is determined by the complexity of tasks
      - » Preliminary verification will be performed for 1, 2 and 8 Towers (TBR) during LAT integration

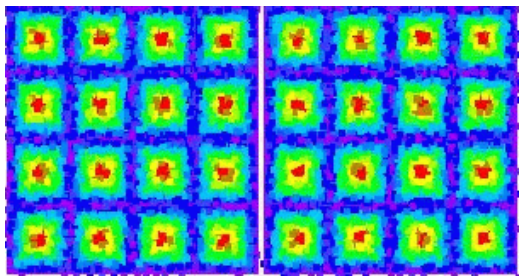
Calibrations

- CALIBRATIONS
  - Requirements
    - Perform calibrations involving offline analysis using SAS software
  - Datasets
    - Are obtained using Cosmic Rays and VDG photons as particle sources
    - Data taking period is usually 24 hours at nominal settings, but may be longer to acquire sufficient statistics for particular tests (see LAT-MD-04136 controlled by the I&T Particle Test Dept)
    - Some input information may be needed from the online tests (e.g. TKR TOT Conversion parameter)
  - Results
    - During initial phases of I&T will be manually generated
      - » Automation may be possible but not for all types
    - will be used to generate calibrated reconstructed data files
  - Timescale for Results
    - few hours (TBR) after completion of the data taking
      - » Depends on complexity of calibrations
      - » Experience will be developed throughout integration until final calibrations are performed when the LAT is assembled

DETAILED Analyses

- DETAILED Analyses
  - Requirements
    - Look for serious, and probably subtle, problems
      - » A problem is deemed serious if it compromises the quality of the science data
    - A mechanism will be in place to provide feedback to the LAT Integration team (discussed later in this review)
  - Datasets
    - obtained using Cosmic Rays and VDG photons as particle sources
    - Use a subset of the same data taken for PASS/FAIL analyses
  - Results
    - Discussed on weekly basis by Instrument Analysis Group chaired by Eduardo
    - Reviewed by Analysis Group chaired by Steve Ritz
  - Timescale for Results
    - 2 weeks (TBR) after completion of the data taking
    - Determined by time available between delivery of towers
    - On-going support through the Instrument Analysis Workshop Series

Instrument Analysis Workshop Series



Kickoff Meeting @ SLAC

June 7-8, 2004

Used to simulate data from first 2 towers

The Workshop Series

- Instrument Analysis Workshop 1 (June 7-8, 2004)
  - Kick off meeting
  - Homogenize the knowledge from people who will do the data analysis
  - Assign "projects" using Monte Carlo simulated data
- Instrument Analysis Workshop 2 (September, 2004 - TBR)
  - Discuss results from projects assigned during Workshop 1
  - Discuss results from projects derived from REAL data collected with the Engineering Model 2 (ACD, CAL and TKR) (TBR)
  - Develop a list of instrumental effects that could have an impact on science data analysis
  - Pretty much "our Readiness Review" for Flight Integration
- Instrument Analysis Workshop 3 (November, 2004 - TBR)
  - Analysis of real data from the first two towers
- Instrument Analysis Workshop 4 (Summer, 2005 - TBR)
  - Analysis of real data from XX-towers (TBD)
- "Instrument Analysis Workshop 5" – Collaboration Meeting (Full LAT- TBD)
  - LAT Data Analysis (and to validate Monte Carlo simulation)

Priority List of Studies

(number does not reflect priority)

○ on-going!

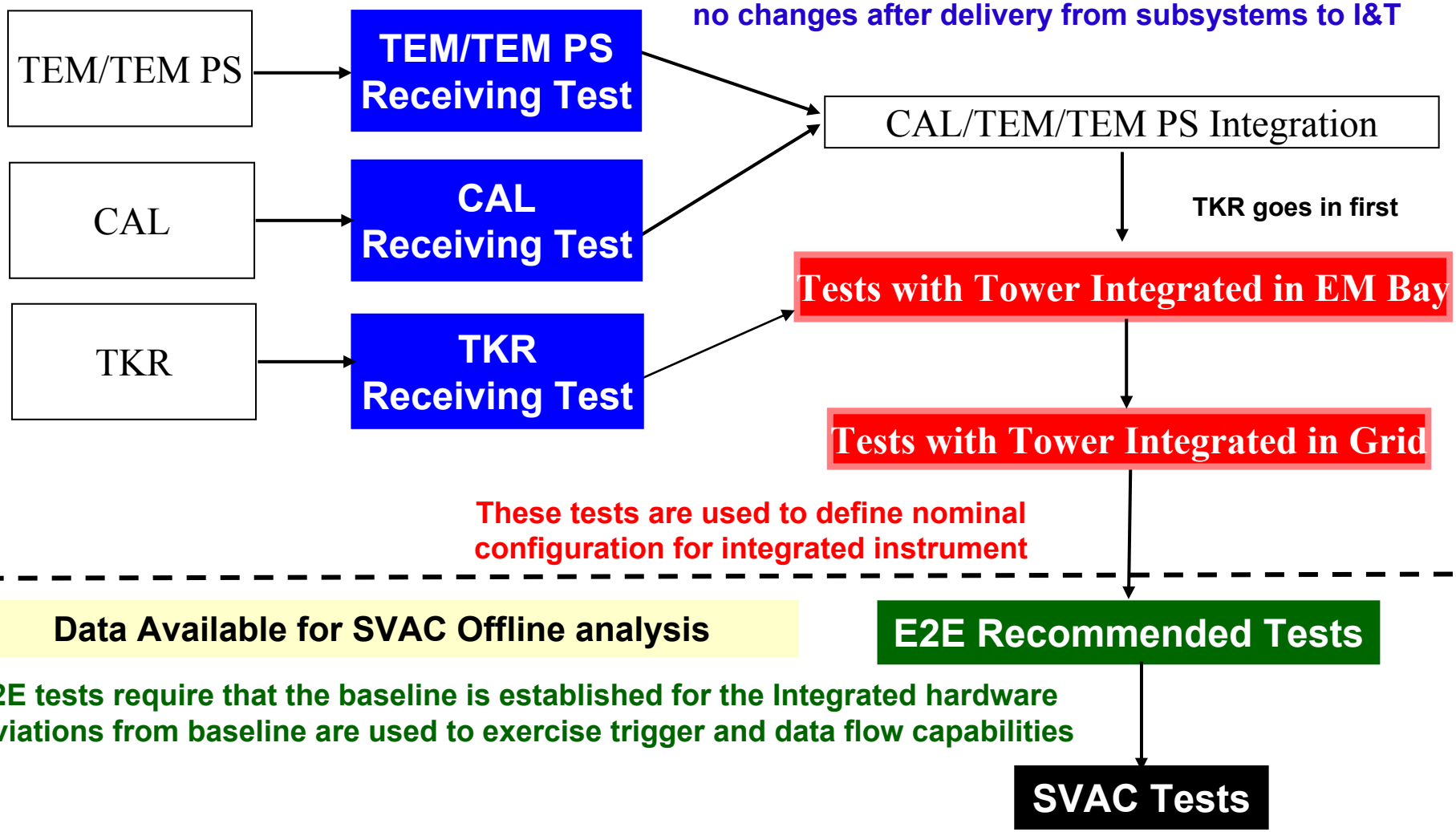
1. Implement dead channels in the tracker for imaging Luca
2. Revisit the spectrum of sea-level cosmic rays Toby
3. Define strategy for implementing Deadtime in MC Steve/Richard/Elliott/Toby
4. Validate Energy Scales using CAL EM MC/DATA Pol
5. Compare numbers from alignment procedure to those from metrology at SLAC Larry
6. Calculate the tracking efficiency of each tower using track segments Leon
7. Calculate residuals by comparing CAL and TKR locations Leon
8. Make images of the CAL layers (to expose uniformity of response of the CAL) Benoit
9. Make image of TKR layers to identify location of shorted strips and broken wirebonds Bill
10. Implement simulated trigger primitive information into MC Luis
11. How well do we find MIPs (e.g. at several angles, within a tower, across towers)? David
12. What is the light output of tracks crossing diodes? Sasha
13. What are the effects to the data when zero suppression is applied? Traudl
14. What is a “clean” muon definition? Claudia
15. Can we find gamma rays and π^0 from showers? SAS

Will send a student as part of the long term plan and will get back to us soon – Per/Staffan

MC Validation and Low Level Performance

- **MC Verification and Low Level performance tasks are intertwined**
  - **Goal**
    - **Validate LAT MC simulations and low level performance using cosmic rays and VDG photons**
  - **Datasets**
    - **Obtained after the LAT is assembled at nominal settings**
  - **Results**
    - **Presented as a form of report to LAT instrument Scientist (LAT-TD-01595) at the end of the LAT integration**
  - **Timescale for Results**
    - **8 weeks (TBR) after completion of the data taking**
      - » **Depends on complexity of tasks**
      - » **Preliminary verification will be performed for 1, 2 and 8 towers (TBR) throughout LAT integration**

Integration Flow – How does SVAC get data?



End-to-end Datasets

There are two types of Data used by SVAC

- **Datasets from the E2E recommended tests for data handling**
  - **will by taken by varying only one parameter at the time, while keeping the others fixed at their nominal values (See Particle Test Review for a complete list)**
    - **Current list of proposed parameters are (TBR)**
      - » **Hit, veto and zero suppression thresholds**
      - » **Time delays**
      - » **Trigger types**
      - » **Trigger rates (with and without CPU generated triggers)**
      - » **Flight software filter (e.g. ON/OFF)**
      - » **Temperatures (e.g. cold/hot)**
      - » **Non-regulated Spacecraft voltage (e.g. min/max)**
- **Datasets obtained during SVAC tests**
  - **will correspond to longer periods (TBD) to acquire sufficient statistics at nominal settings (e.g. calibrations with SAS software)**

SVAC Requests for Data Taking

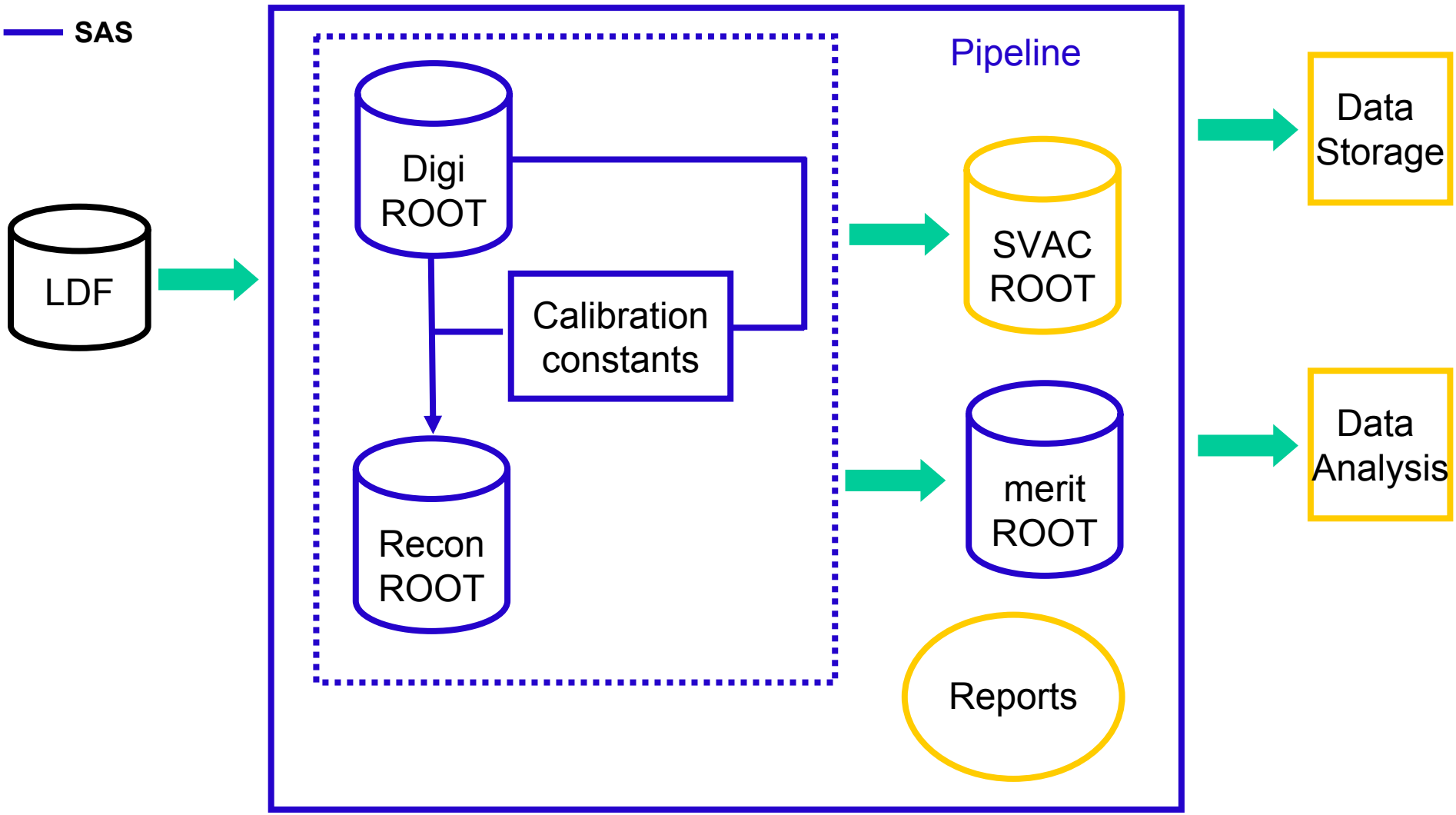
From SVAC Plan during LAT Integration at SLAC – LAT-MD-00575 (TBR)

- The current data taking plan for the first two towers requires the following hardware configurations for calibrations
  - Tower A in a grid - vertically oriented
  - Tower A in a grid - horizontally oriented for VDG studies
  - Towers A and B in a grid - vertically oriented
- A run of 24 hours with nominal settings will be used for offline calibrations
  - For calibration types see Calibration talk
- MC simulations have been generated for all these configurations
  - See Instrument Analysis Workshop Series
  - New MC will be generated using the released code for integration

Overview of Activities

I&T/SVAC
I&T/Online
SAS

Strong dependency on SAS and to a lesser extent on the I&T Online



Next Talk

10:20 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

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Code Management

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SAS single Point of Contact for I&T

- SVAC interacts with other subsystems <u>via SAS</u>

JIRA: software tracking tool

The mechanism established by SAS (JIRA) has proven to be a useful way to provide feedback from I&T to SAS

Code Acceptance and Release to I&T

- The process consists of the following steps
  - ACD, CAL, TKR and I&T SVAC
    - provide SAS with definitions for tasks to be implemented
  - SAS
    - implements requests,
    - develops system tests and documentation and
    - provide a release tag (within CVS)
    - informs SVAC code managers (Anders/Xin) that release is available
  - I&T SVAC
    - Verifies that documentation matches code implementation
    - Tests released tag
    - Provides feedback to SAS
    - Approves release for use during I&T LAT Integration

SAS Production Software Release Updates

- The process for major updating of the SAS software during Integration & Test activities involves the following steps
  - Review by Instrument Scientist
    - Presentations in Analysis meeting chaired by Steve Ritz to justify need for a change
  - CCB for approving major changes
    - Required Board Members
      - Richard Dubois (chair)
      - Steve Ritz
      - Bill Atwood
      - Eduardo do Couto e Silva
    - Optional Board Members
      - ACD,TKR, CAL representatives
  - Required Board Members of CCB can approve minor changes to SAS software (TBR)

Validation of Calibration Data

- I&T SVAC/SAS proposal (TBR)
  - SAS calibrations during I&T
    - Use reference/previous calibration data (if first time use subsystem delivered data)
    - Perform reconstruction
    - Present results in the Instrument Analysis Meeting
    - CCB approves results for production release
    - SVAC loads into SAS database and provide validity time and tag as “production level”
- Need to initiate discussions in the Instrument Analysis Group to define metric validation of calibration data
  - Can use EM2 as a prototype

Next Talk

10:25 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

GLAST Large Area Telescope:

Data Processing and Archival

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Data Processing Facility (DPF)

- The DPF developed by SAS will consist of pipelines for the
  - I&T Online group to
    - Transfer Level 0 (LDF) from clean room to SLAC's Central File Server (see Online Peer Review for more details)
  - I&T SVAC group to
    - Generate calibrated data analysis files from Level 0 data (LDF)
    - Generate quality reports on the data
    - Parse and display data taking configuration
- The pipeline shall have
  - a scheduler and a batch-submitter to control the pipeline flow
  - a web page to view pipeline processing

Tasks Requirements

- The I&T SVAC pipeline shall be configured to run the following tasks in an automated way
  - data processing
    - Convert raw data (LDF) into digitized representation (ROOT)
    - Produce calibrated reconstructed data
    - Produce data analysis ntuples from digitized and reconstruction data
    - Produce backup datasets by archiving all data into tapes
  - data analysis support
    - Produce graphical or tabular representations of the instrument configuration settings (e.g. thresholds and GTRC splits)
    - Generate data quality reports
- To ensure continuous flow, the data processing tasks shall not depend on the data analysis support tasks

Data Archival Requirements

- All EGSE Data shall be stored in the central file system
- All Pipeline products shall be stored in disks in the central file system
- A backup for all data shall be produced for archival into tapes

SAS is the single point of contact to the SLAC Computer Center to manage computer resources (i.e. disks, tapes)

Data Reports Requirements

- A data run shall be accompanied by a report which indicates whether the run is analyzable or not
- Data reports shall be produced in the environment used for the batch system (e.g. Linux at the SLAC Central File System)
- Data Reports shall
  - manipulate data from root files to perform calculations
  - include plots and tables
  - highlight information
  - be generated in html, postcript and PDF formats

Examples will be provided later in the Data Analysis Talk

Data Configuration Requirements

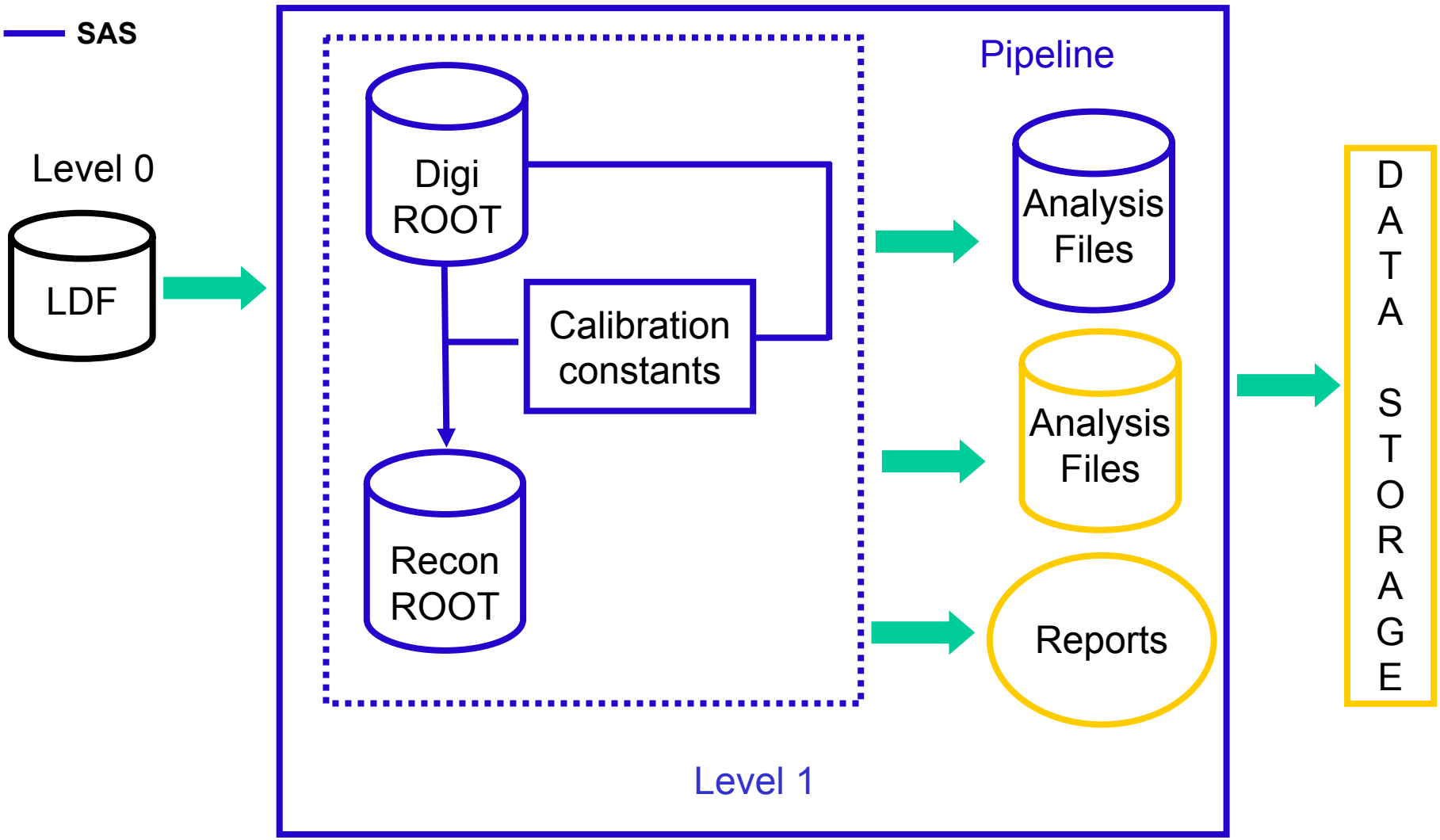
- The data configuration produced by the EGSE shall be parsed into a format readable by data analysts without knowledge of EGSE coding rules
- Parsing of data configuration shall be produced in the environment used for the batch system (e.g. Linux at the SLAC Central File System)
- Data Configuration shall describe
  - TKR, CAL and ACD thresholds and time delays
  - TKR GTRC splits

Examples will be provided later in the Data Analysis Talk

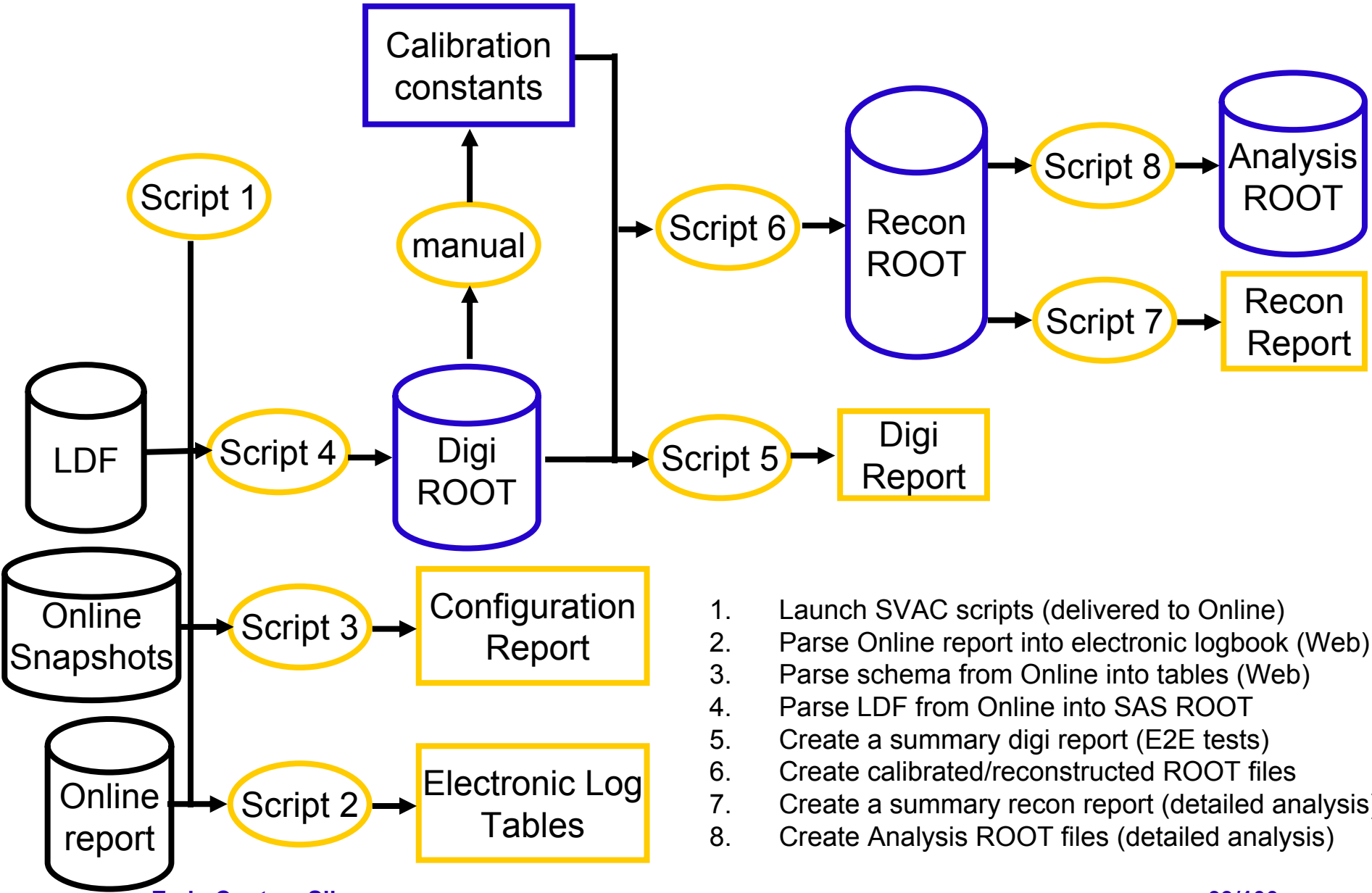
Data Processing Overview

I&T/SVAC
I&T/Online
SAS

The pipeline is developed by SAS and tailored to meet I&T SVAC needs



Scripts for the Data Processing



1. Launch SVAC scripts (delivered to Online)
2. Parse Online report into electronic logbook (Web)
3. Parse schema from Online into tables (Web)
4. Parse LDF from Online into SAS ROOT
5. Create a summary digi report (E2E tests)
6. Create calibrated/reconstructed ROOT files
7. Create a summary recon report (detailed analysis)
8. Create Analysis ROOT files (detailed analysis)

Status of Software Scripts for Pipeline

SCRIPT DESCRIPTION	define	document	implement	test	wrap	create a DBtask	final test
Launch SVAC tasks (deliver to Online)							
Parse LDF from Online into SAS ROOT							
Produce calibration constants							
Create calibrated/reconstructed ROOT files							
Create a summary digi report							
Create analysis ROOT files							
Create a summary recon report							
Parse online report into elog							
Parse schema from online into tables							

ready
in progress
not started

Standalone test for manual processing

Script wrapping is a simple task

All files will be automatically backed-up

Web based system to track processes is required

Tasks in RED depends on delivery of pipeline which may occur this week

Additional resources may be required in order to meet schedule

Pipeline Status

- Preliminary implementation of pipeline
  - was not adequate to support I&T (Online and SVAC)
    - needed directory structures on per run basis
  - Next delivery scheduled for this week (not final)
  - Final delivery must include
    - Web interface to track processes
- SVAC need date for pipeline delivery is Aug 13
  - Finish all scripts
  - Wrap scripts and create DB tasks
- To be done by First flight hardware delivery (Sep 13)
  - Data pipeline tested by SVAC
- To be started after Sep 13
  - Implementation of MC pipeline

Next Talk

10:40 am

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GLAST Large Area Telescope:

Calibrations

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Calibrations - Introduction

- SAS offline Calibration algorithms
  - in development by ACD, CAL and TKR with SAS
- Electronic calibrations are produced with charge injection using EGSE scripts (see Online Peer Review)
  - SVAC needs TKT TOT Conversion parameter from EGSE output
- Format
  - SVAC work is INDEPENDENT of the format of the calibration output
    - due to the nature of the SAS interface (thanks Joanne!)
- Databases
  - SAS holds the primary database, which is used for reconstruction
  - SVAC/ISOC holds trending database

Calibration Requirements

- Calibration delivery shall include
  - Algorithms for calibrations
  - an executable that combines data from different runs
  - runs on the SLAC batch farm
  - reference datasets
  - Documentation describing usage and algorithm description

- SAS Calibration types are defined in the SVAC Plan LAT-MD-00446
  - TKR
    - Dead and Noisy strips
    - TOT Conversion Parameter (produced by EGSE scripts)
    - TOT MIP Conversion
  - CAL
    - Pedestals
    - Gains (muon peaks)
    - Light asymmetry (muon slopes)
    - Light attenuation (light taper)
    - Integral Linearity
    - Dead and Noisy Channels

Status of Calibrations

SVAC Need date is 1 month prior to Data Taking so that we can test the code

CALIBRATION TYPE		ALGORITHM CODE	ALGORITHM DOCUMENTATION	DATA SVAC TESTS	DATA REFERENCE SET	SAS RECON	SAS DATABASE LOAD	SAS DATABASE RETRIEVE	SVAC DATABASE LOAD	SVAC DATABASE DISPLAY
Dead Strips	TKR	ready	ready	ready	not started	ready	ready	ready	ready	not started
Noisy Strips	TKR	ready	ready	ready	not started	ready	ready	ready	ready	not started
TOT Conversion Parameter	TKR	in progress	ready	not started	not started	in progress	not started	not started	not started	not started
TOT MIP Conversion	TKR	in progress	ready	not started	not started	in progress	not started	not started	not started	not started
Pedestals	CAL	ready	in progress	ready	not started	ready	ready	ready	ready	not started
Gains	CAL	ready	in progress	ready	not started	ready	ready	ready	ready	not started
Light Asymmetry	CAL	ready	in progress	ready	not started	not started	ready	ready	ready	not started
Light Attenuation	CAL	ready	in progress	ready	not started	ready	ready	ready	ready	not started
Integral Linearity	CAL	not started	in progress	not started	not started	not started	not started	not started	not started	not started
Dead and Noisy Channels	CAL	not started	not started	not started	not started	not started	not started	not started	not started	not started
Pedestals	ACD	in progress	ready	not started	not started	not started	not started	not started	not started	not started
Gains	ACD	in progress	ready	not started	not started	not started	not started	not started	not started	not started

We are working with ACD and SAS to produce these by EM2 but it is not needed for a couple of months (but this is the right time to get started)

Reference sets are expected to be delivered prior to integration

Need help from ISOC to develop interface to retrieve metadata from SAS

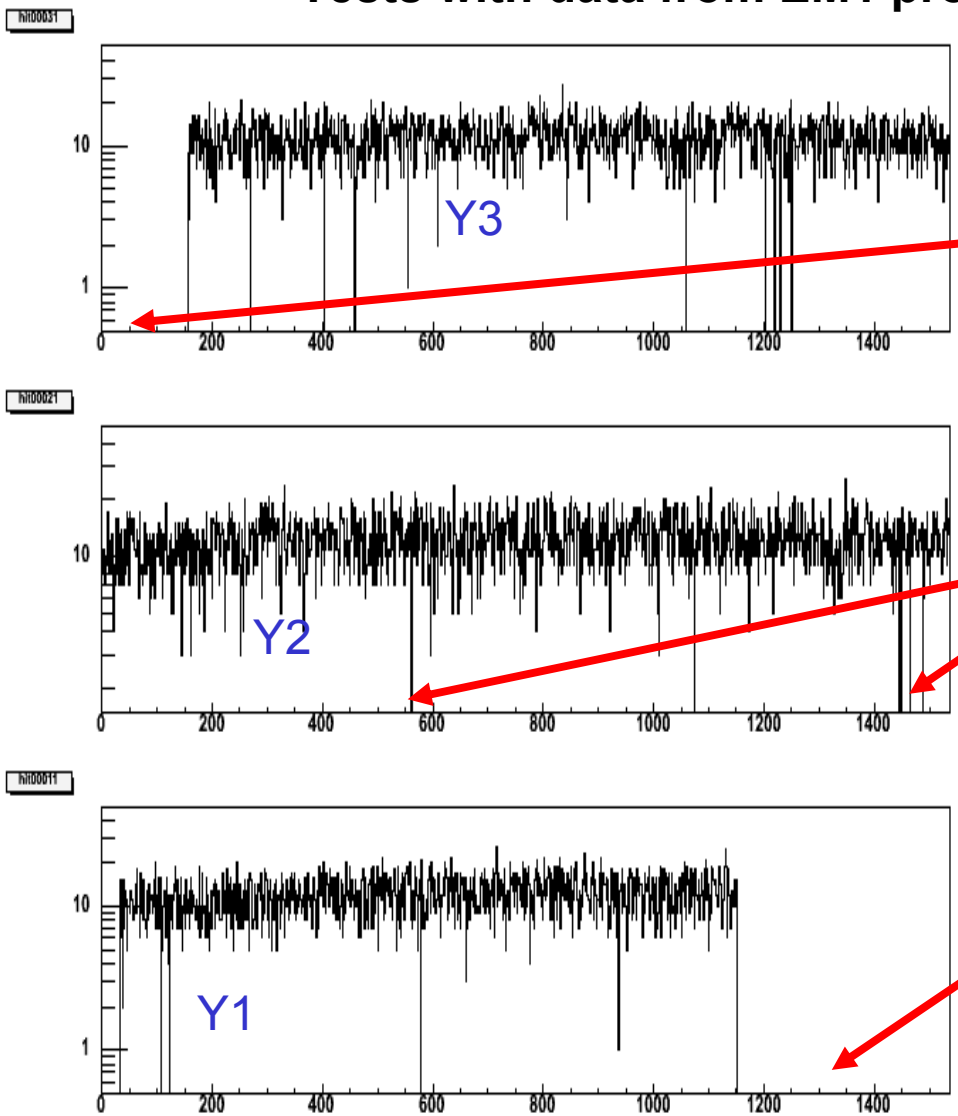
ready
in progress
not started

We decided to change the interface from Servlets to JSP to make it easier to maintain

I&T produced a document (LAT-TD-01590) which is now being reviewed by subsystems. This is the master document were information is kept and SAS will work with subsystems to keep it up to date

TKR calibrations (dead strips in EM1)

Tests with data from EM1 prototype



Dead strip xml file

Output Calibration data

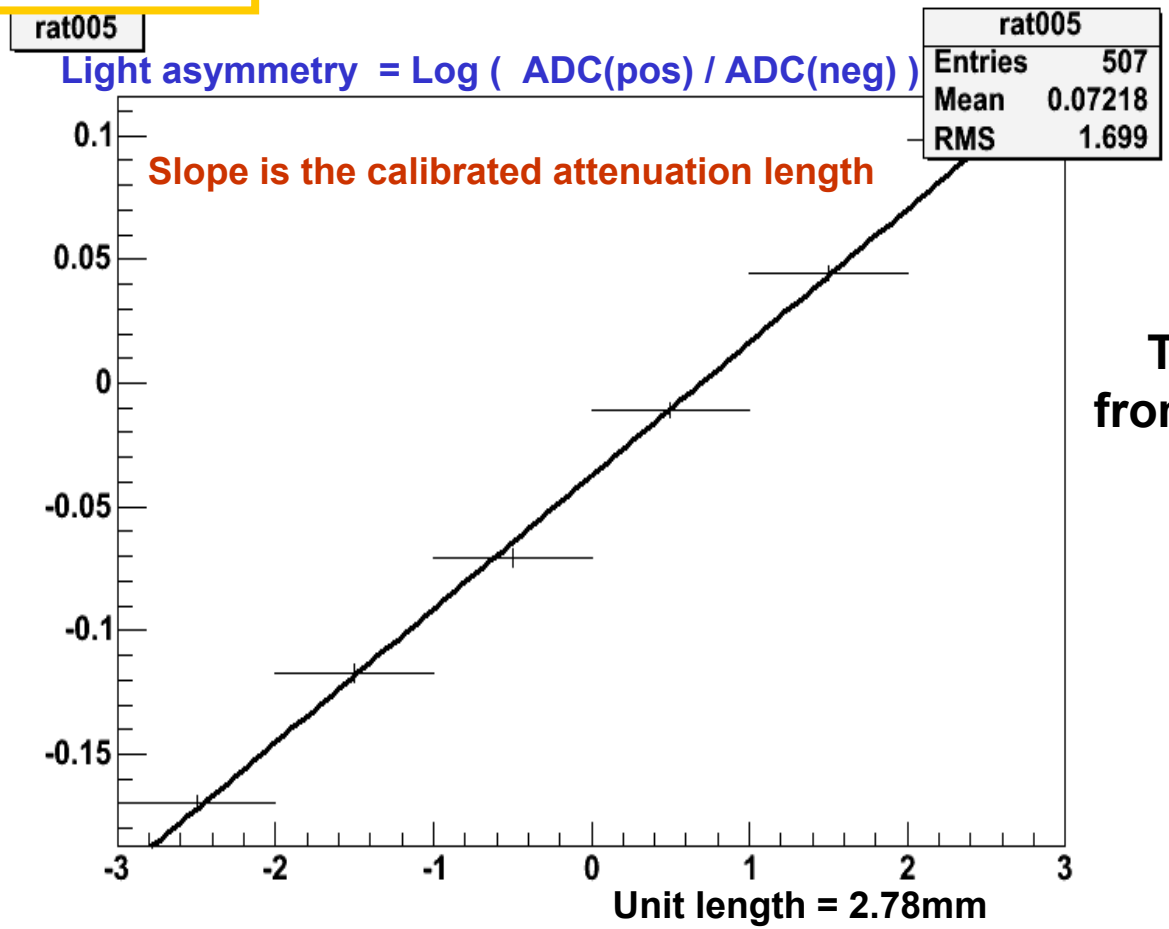
<uniplane tray="4" which="bot" >
<stripSpan first= "0" last= "156" />
</uniplane>

<uniplane tray="2" which="top" >
<stripList strips= " 561 1073 1445 1449 1464 1487 " />
</uniplane>

<uniplane tray="2" which="bot”>
<stripSpan first= "1151" last= "1535" />
"</uniplane>

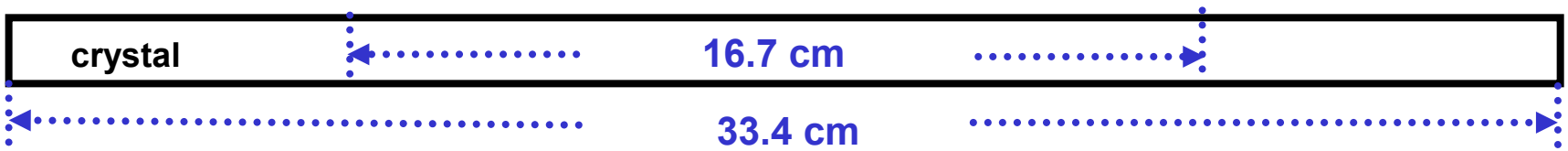
CAL Calibrations (light asymmetry in EM1)

Output Calibration data → <muSlope slope="1032.68" range="LEX8" />



Assume edges Have the same behavior Final algorithm will address calibration at the edges

Tests with data from EM1 prototype



Calibration Status

- We have tested preliminary releases of the calibration software needed for the first two towers

- Need dates by I&T SVAC for SAS delivery
  - TKR algorithms (Aug 13)
    - TOT Conversion Parameter
    - TOT MIP Conversion
    - Reference values of calibration constants for TKR Flight module
  - CAL algorithms (Sep 1)
    - Ability to calibrate multiple towers
    - Light taper (date TBD)
    - Integral Non linearity (date TBD)
    - Reference values of calibration constants for CAL Flight module
  - Documentation
    - SVAC initiated the process (see LAT Calibration Algorithms LAT-TD-01590)

Next Talk

10:55 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

GLAST Large Area Telescope:

Trending Database - Calibrations

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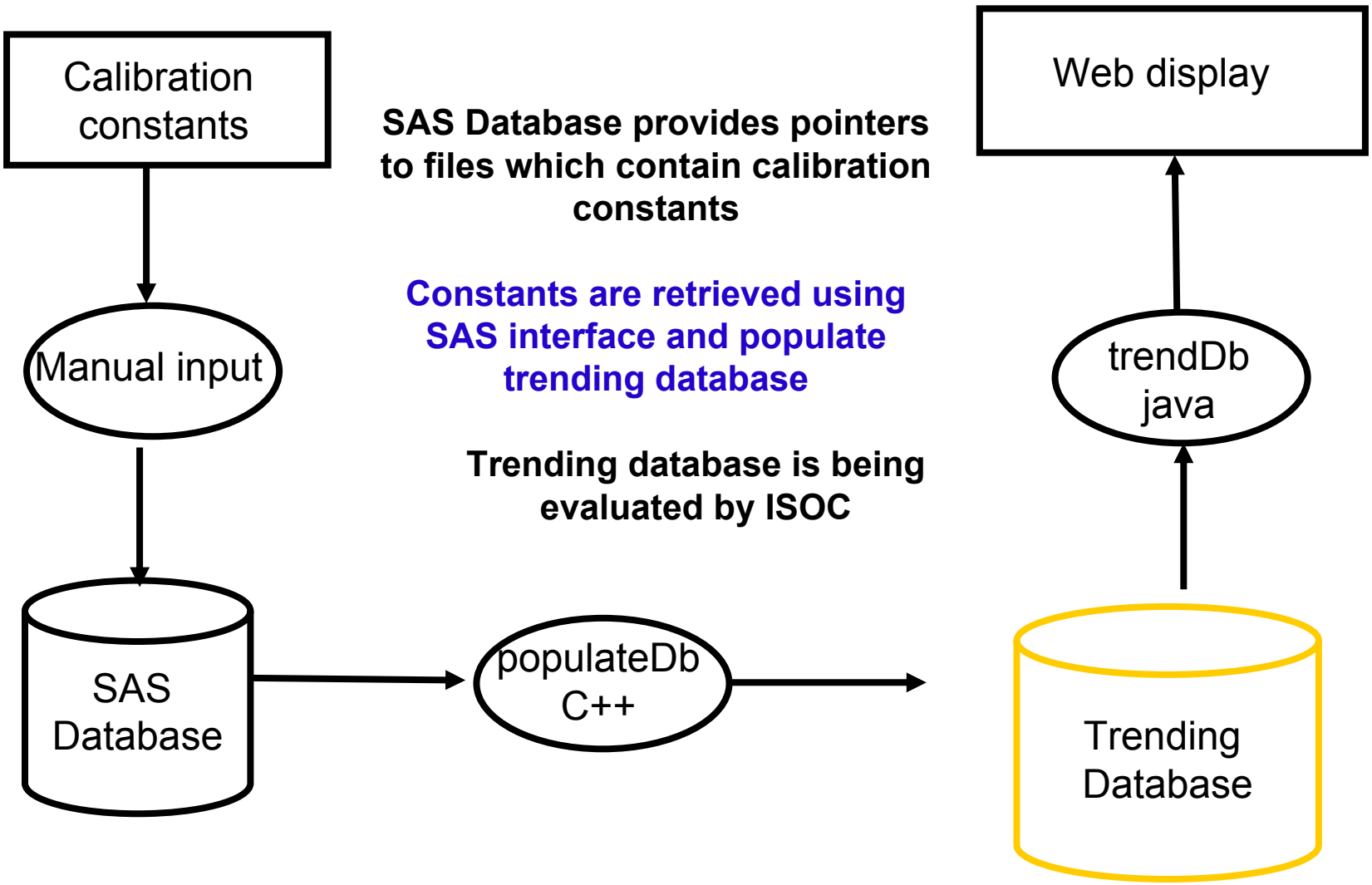
Trending Requirements

- **Calibration constants shall be trended to monitor changes as a function of time**
  - **The query system shall display the results from**
    - **the latest calibrations**
    - **for history of all calibrations**
  - **The query system shall have web based capabilities**
    - **that produces plots and tables**

Software infrastructure



SAS Database provides pointers to files which contain calibration constants

Constants are retrieved using SAS interface and populate trending database

Trending database is being evaluated by ISOC

Main Trending Database Software

For reference only

- Code:
  - PopulateDB
- Functionality:
  - extract constants from the SAS's database to the trending database
- Implementation:
  - Written in C++
    - Gaudi framework
  - Documentation
    - Available in Doxygen
  - Use interface developed by SAS (Joanne)
    - independent of the format of the calibration files
  - Use Oracle's OCI library
    - industry standard
- Status:
  - First version in CVS
    - ready to use
    - Tested on five calibration types (TKR and CAL)
  - At the moment, the metadata are not transferred.
    - Need more methods in the SAS's interface to extract the meta data. In discussion with SAS and ISOC.

- Code:
  - trendDB
- Functionality:
  - query constants from the trending database and generate tables/plots dynamically on the web
- Implementation:
  - Written in JSP (Java Server Pages)
    - industry standard
  - Documentation
    - Available in Doxygen
  - Separate web presentation (html) from data manipulation (java)
    - for easy coding and maintenance
  - With wide range of library supports
    - e.g. AIDA tag library developed at SLAC
- Status:
  - Learning JSP technology
    - a simple demo has been written
  - Implementation in progress
    - expected to be completed within 4 weeks.

Calibration Trending Status

- We have created a prototype
  - for two calibration types (TKR dead/noisy channels)
- The database version is ready
  - definition is being evaluated by ISOC
  - ISOC will provide manpower to aid development
- Code to Populate Database
    - Ready to use
    - Tested on five prototype calibration types (TKR and CAL)
    - Need interface to extract the meta data
      - In discussion with SAS and ISOC
- Code to Trend Constants with a Web interface
    - Learning JSP technology
      - a simple demo has been written
    - Implementation in progress
      - Not needed until end of September

Next Talk

11:00 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

GLAST Large Area Telescope:

Electronic Log Book - Runs Database

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Runs Database - Overview

- The runs database is
  - used to support the data analysis
  - part of the electronic logbook
    - for details on other usage see the Online Peer Review
- The runs database stores information about
  - Data runs
  - Instrument settings
  - Trigger conditions

Runs Database Requirements

- Shall read data from SVAC pipeline output files
- Data shall be transferred in an automated way to avoid human errors
- Shall have a web interface with query capabilities that return a list of runs with hyperlinks

- The following information for each data run shall be stored in a database
  - Run number
  - Start Date
  - Name of test script
  - LDF.FITS filename
  - Duration of test in seconds
  - Number of L1 triggers
  - Particle type (e.g. cosmic rays, photons)
  - Hardware type (e.g. 1 tower, EM, LAT)
  - Orientation (e.g. horizontal, vertical)
  - Completion status (e.g. success, failed, abort, undefined)
  - Links to test reports
  - Position of tower in a grid
  - Serial number of CAL, TKR and TEM modules

All these are available through the online EGSE output files

Software infrastructure

No data run info is entered manually

All info comes directly from EGSE output files

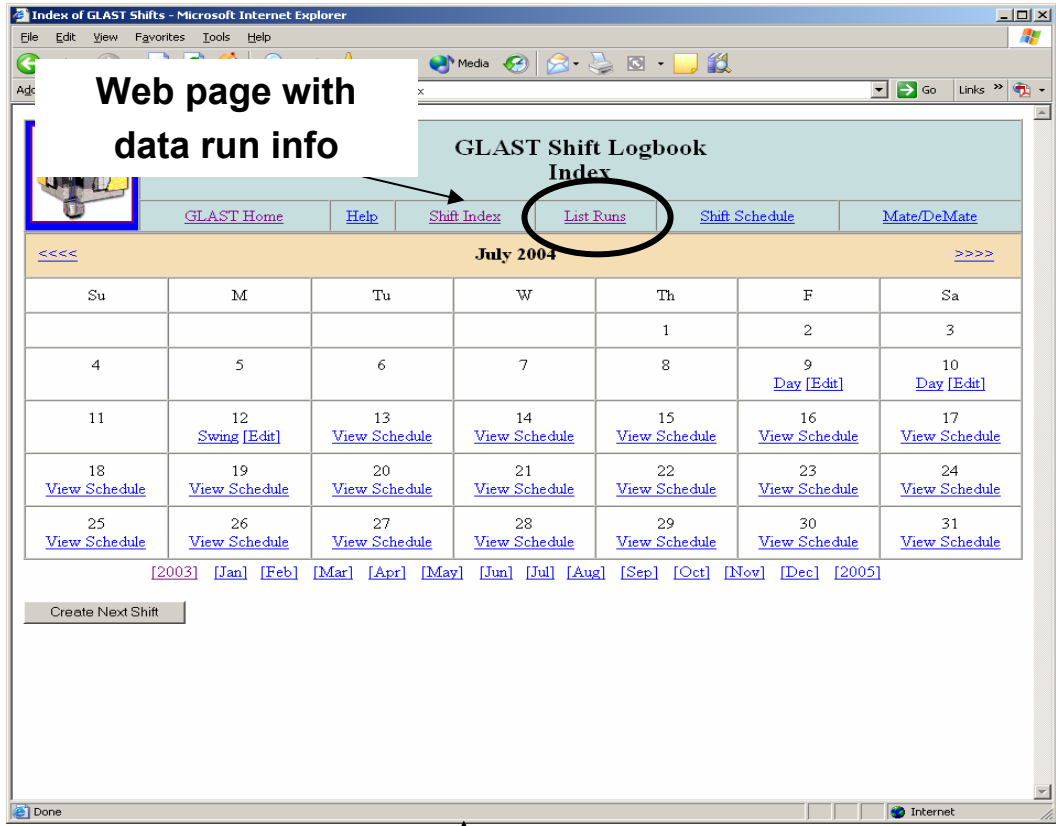
Report/snapshot files from EGSE

eLog feeder (python)

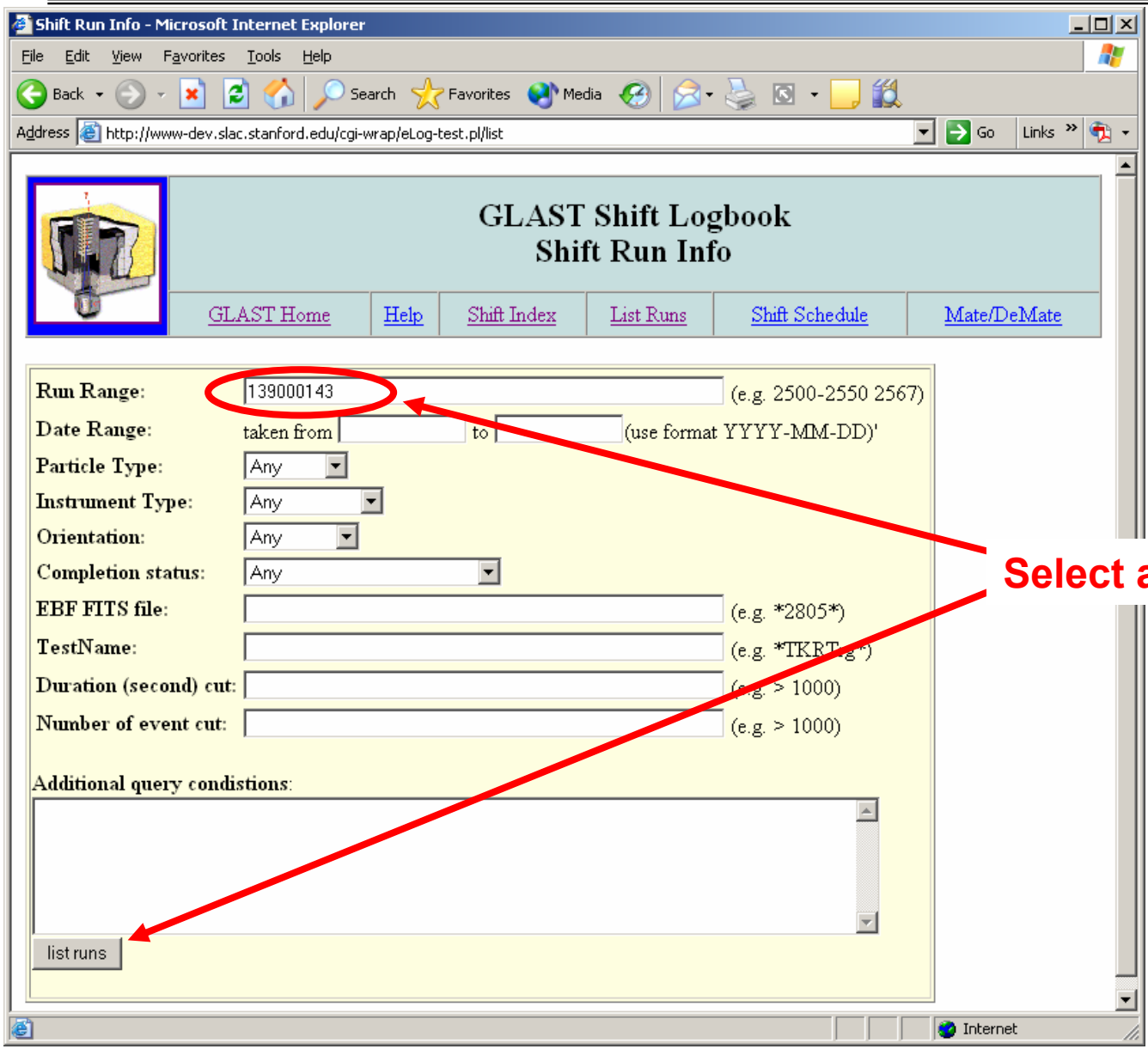
Runs Database

eLog (perl)

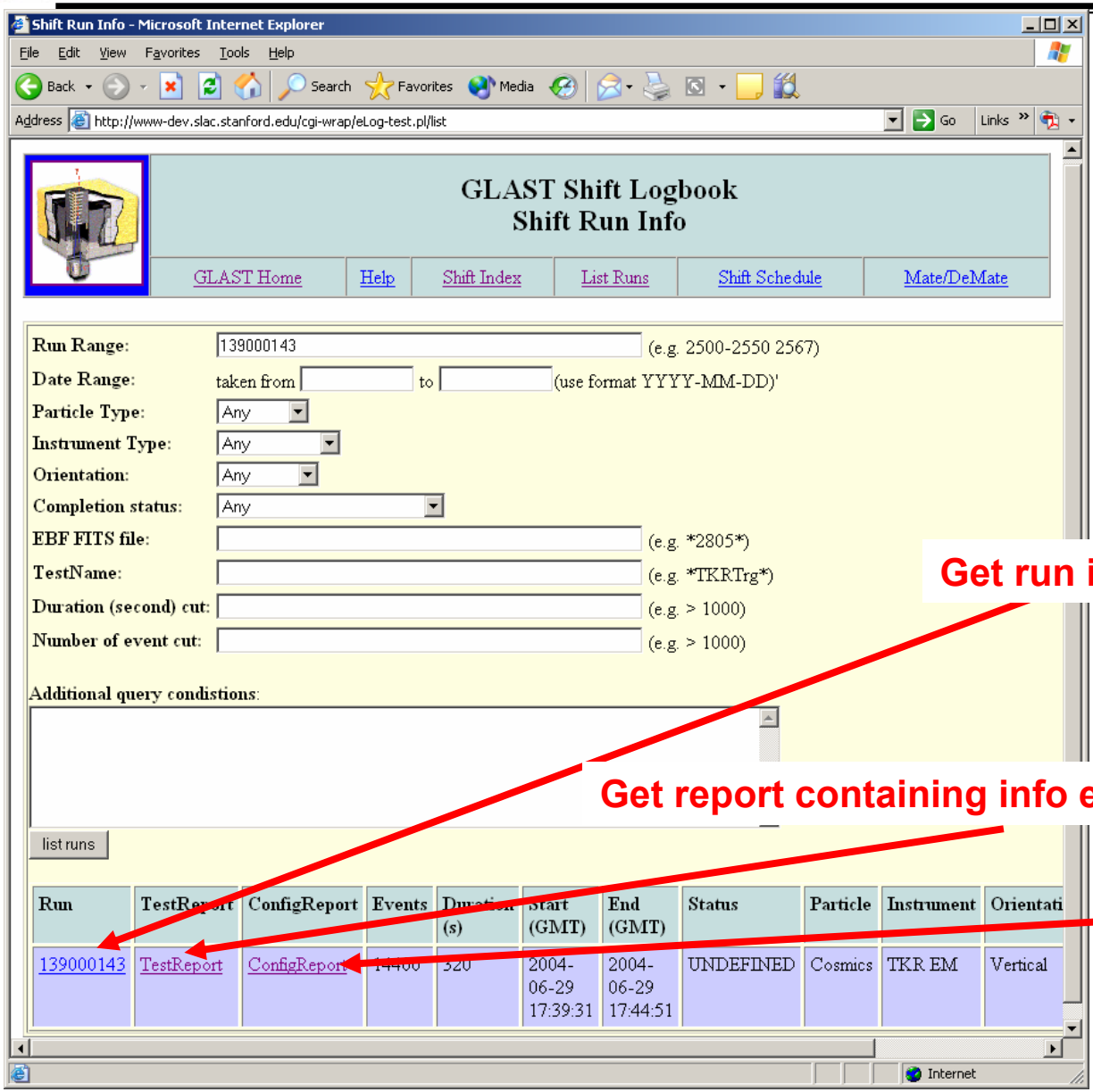
Web page with data run info



Run selection (1)



Run selection (2)



Get run info produced by on line

Get report containing info extracted from digi root file

Get configuration info

Runs Database Status

- The runs database is already in place and ready for 2 tower testing
  - Already tested for EM1 and EM2
    - We will continue to modify it based on experience acquired
- Modifications on the queries and table definition will probably occur as we learn about the data taking
- The infrastructure is ready for 2 tower testing

Next Talk

11:10 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

GLAST Large Area Telescope:

Data Analysis Infrastructure – Event Display and Geometry

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Data Analysis Infrastructure

- **Geometry description (Data and MC)**
  - required by the SAS reconstruction package to identify nominal position of active and passive elements in the instrument
- **Material description (MC)**
  - required by the SAS reconstruction package to simulate physics processes as particles propagate through active and passive elements
- **Event Display**
  - required to visualize geometry implementation and event topology to aid during LAT data analysis

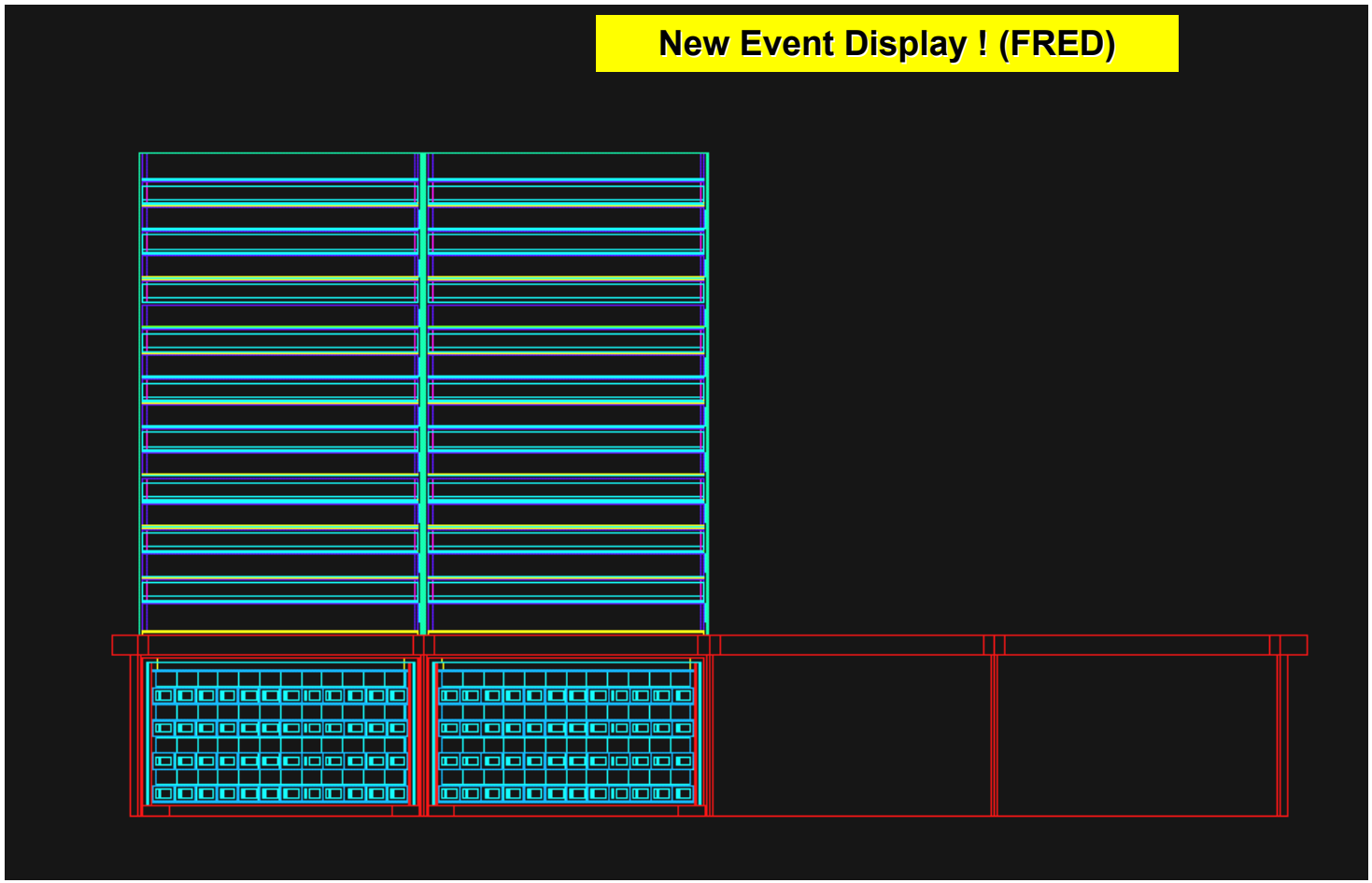
Geometry Requirements

- **Flexibility**
  - SAS software shall have the flexibility to incorporate the geometry of any of the hardware configurations used during integration
    - e.g. EM1, EM2 with 2 ACD tiles, 2 towers, 16 towers, LAT
- **Software**
  - XML files describing the geometry shall refer to the geometry document in LAT-DOCS
- **Documentation**
  - Shall provide a description of the geometry and materials used by LAT as-built
  - Shall contain a description of software variables and corresponding engineering name with metric system units

Geometry Status

- Single and Two Tower geometries
  - ready since the Instrument Analysis Workshop in June
- SVAC is able to produce any geometry required for the LAT integration
- Work in Progress (special case)
  - Implementing two ACD tiles to EM2 geometry

Two Tower Simulation



Simulations of 1 and 2 towers in the assigned position in the grid have already been implemented for the Instrument Workshop Analysis (June 7,8)

EM2 with Two ACD Tiles Geometry

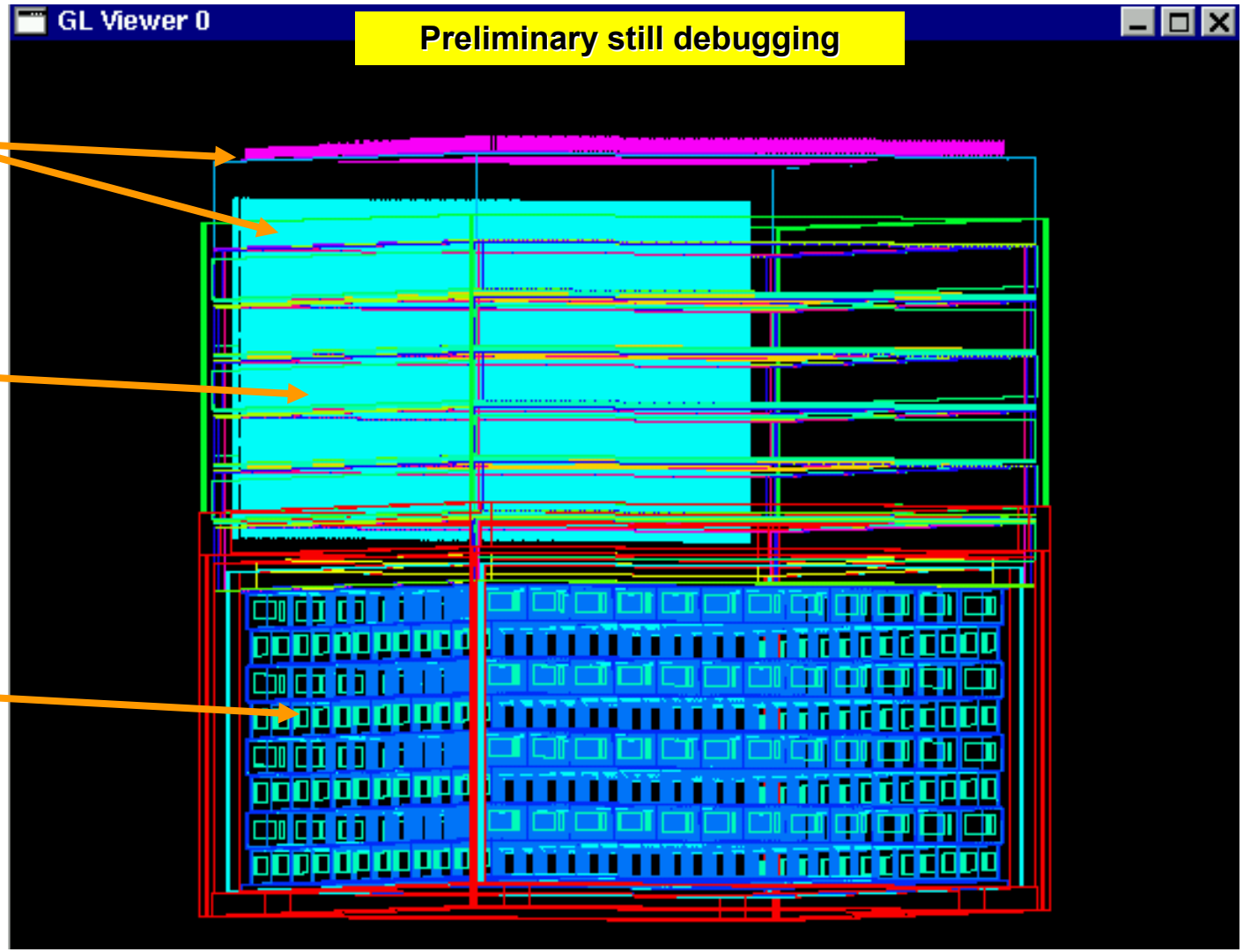


Figure is rotated and tilted for graphical purposes

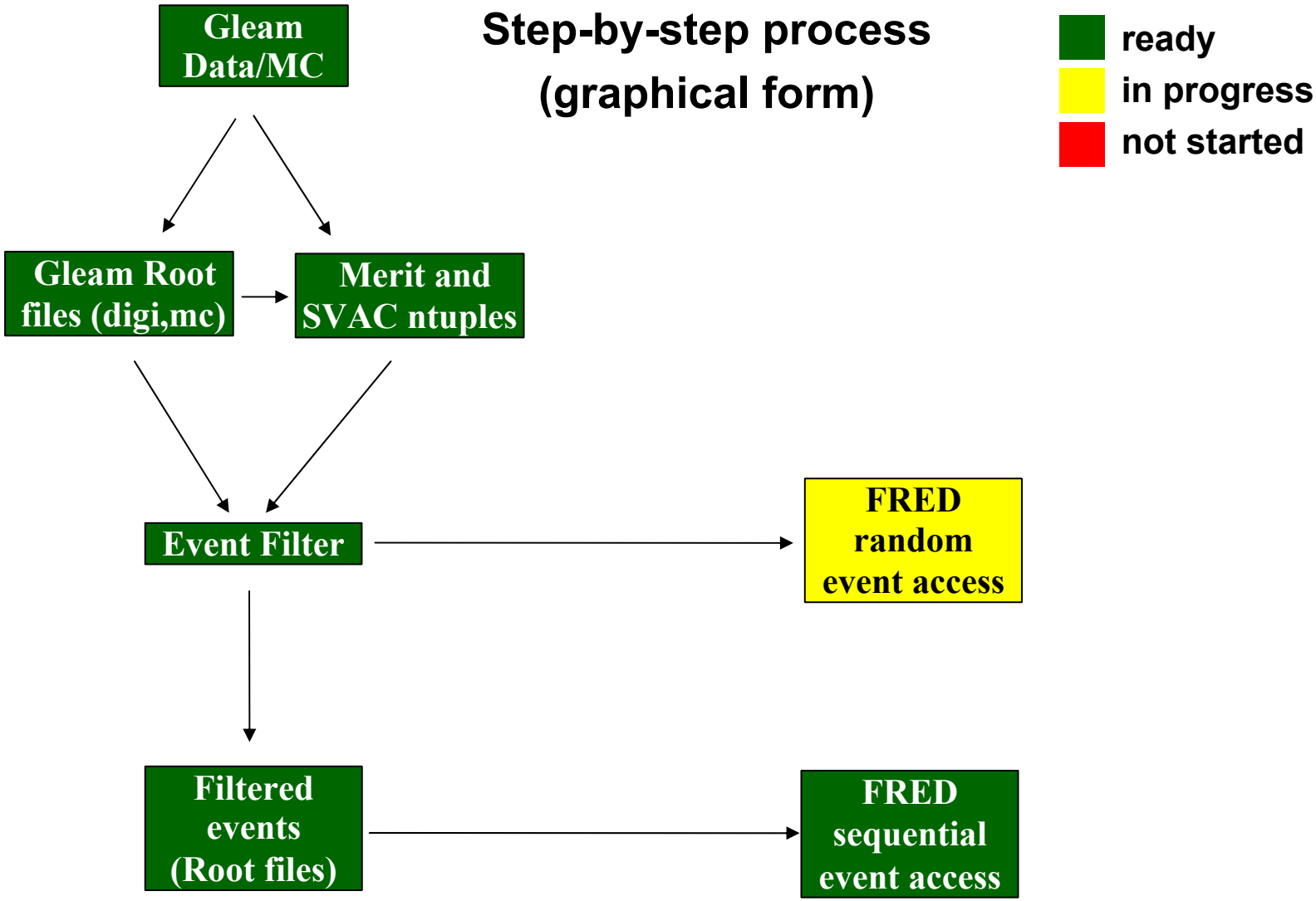
Event Display as an Analysis Tool

Step-by-step process for reference only

- **Geometry debugging**
  1. **Create an XML file for input into the Event Display (FRED)**
     - **no need of full SAS infrastructure (.e.g Gleam)**
  2. **Verify coarse features of geometry implementation and compare with description in the geometry document in LAT-DOCS**
  3. **Problems are reported to SAS via JIRA (software tracking tool)**

- **Data Analysis (see next slide for graphical representation)**
  1. **Search for subtle problems in the data distributions**
  2. **Parse selected events from a digi file into another data file**
  3. **Use the Event Display (FRED) to study the event topology**
     - **with sequential event access**
     - **directly with random event access using the event id**
  4. **Problems are reported to SAS via JIRA (software tracking tool)**
  5. **If it is not a simple software bug, this triggers a detailed data analysis project**

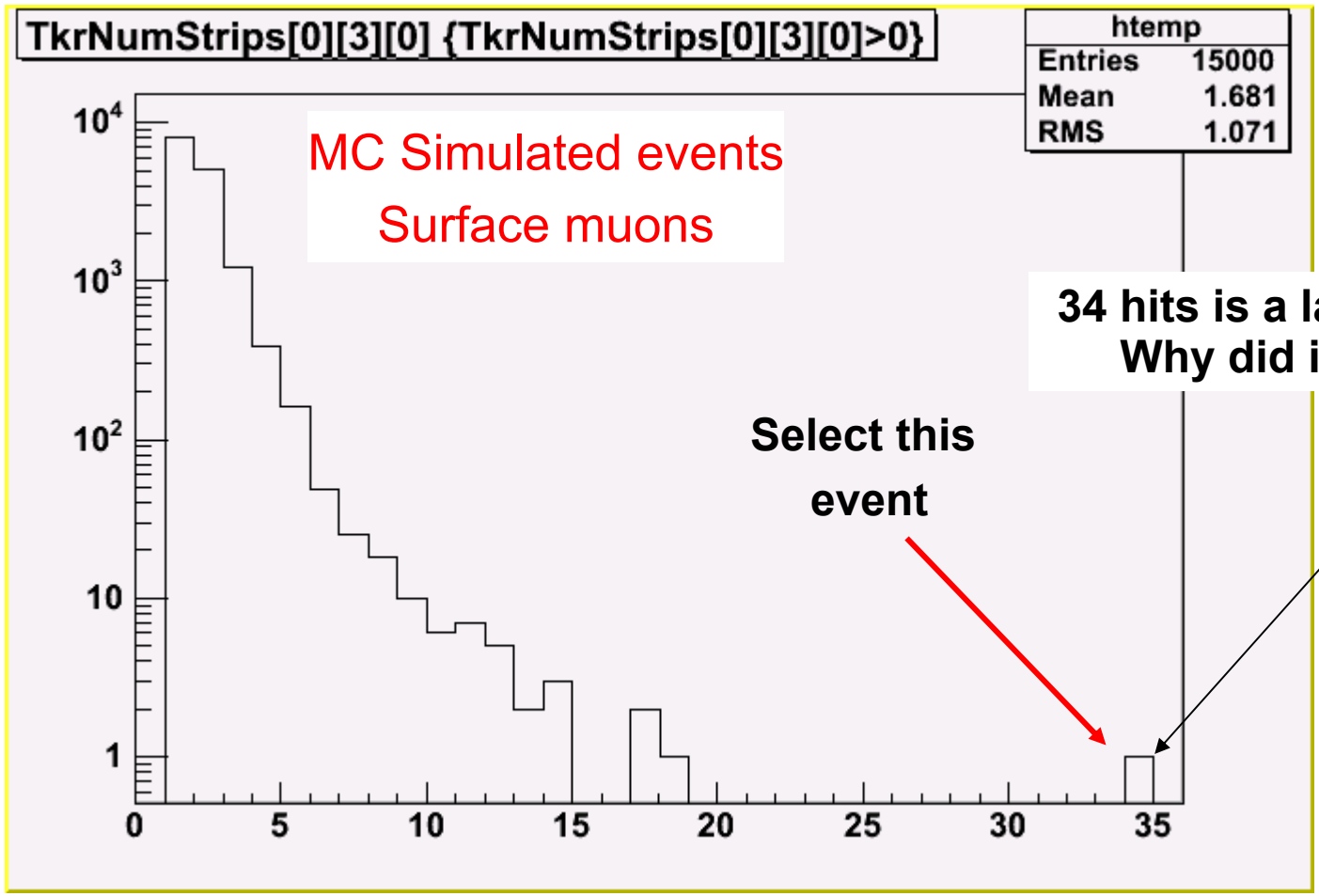
Analysis and Event Display Chain



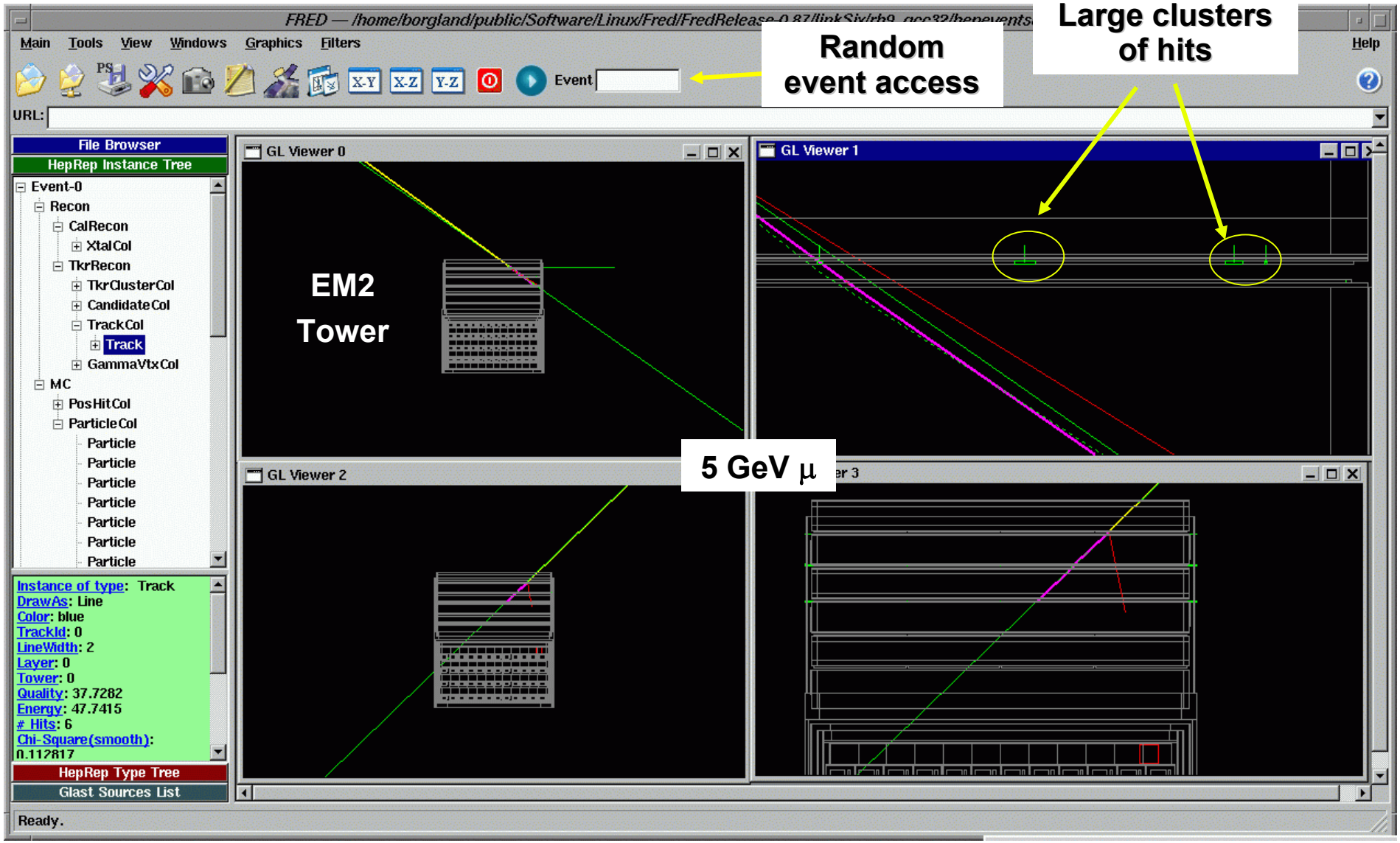
Analysis and Event Display Chain

Use EM2 as prototype test

Number of strips hit in a TKR layer for events that triggered within the tracker.

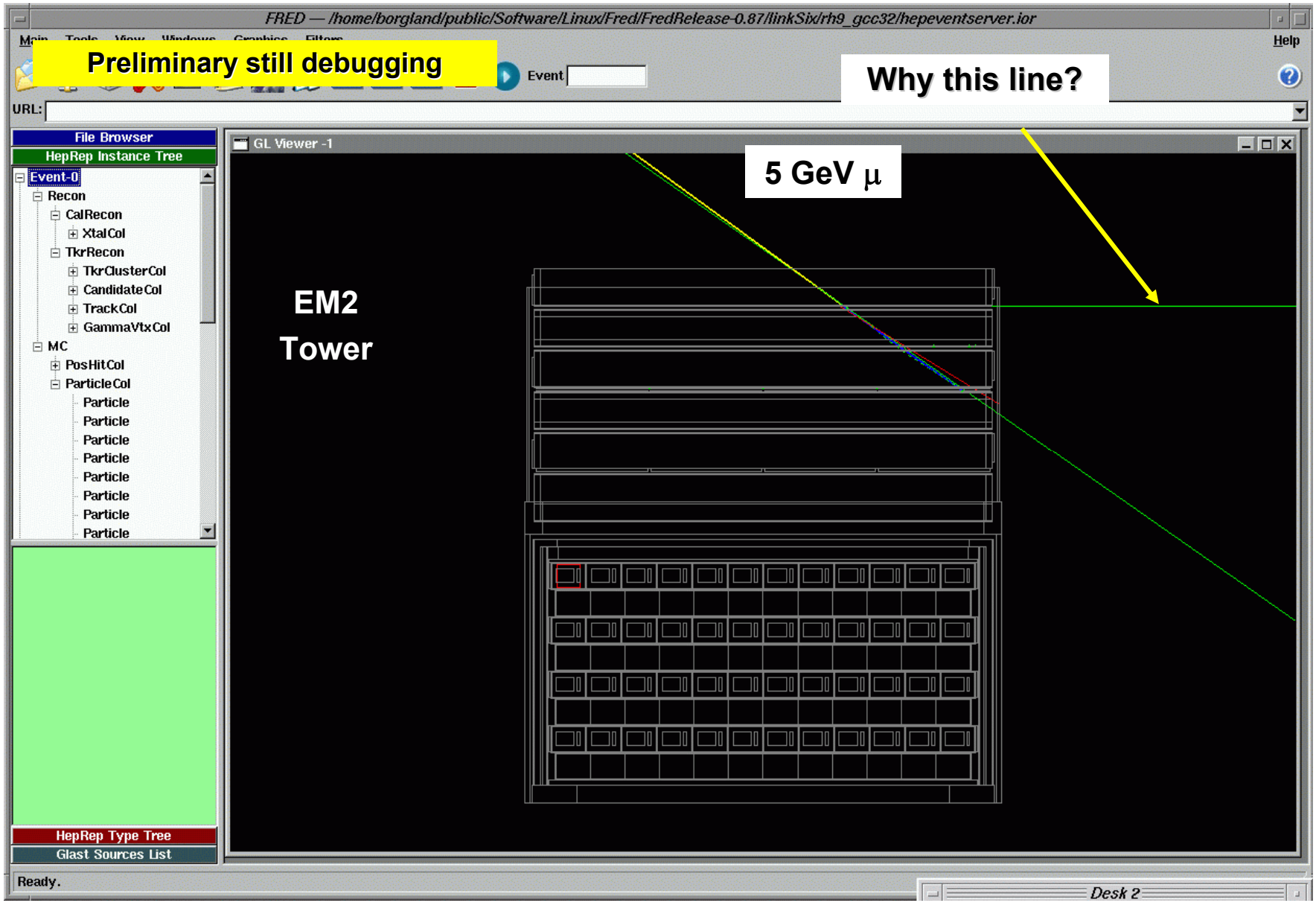


Analysis and Event Display Chain cont'



FRED: Huge Clusters

FRED: Finding Geometry Problems



Status of Code Event Display and Geometry

DESCRIPTION	define	document	implement	test
Generate Data Analysis ntuples				
Filter out selected events				
Read selected events into FRED				
randomly search for a particular event with FRED				

ready
in progress
not started

So far SVAC is the main beta-tester of FRED

Special Thanks to SAS (Riccardo INFN/Udine)
for being so responsive to our needs

Geometry and Event Display Deliverables

- SVAC Need date for SAS deliverables
  - Official release of FRED with documentation (Aug 13)
    - SVAC testing was done with beta version
  - Agreement with SAS for geometry documentation (Aug 4)
    - Release and update mechanisms
  - Geometry document (Sep 1)

Next Talk

11:25 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

GLAST Large Area Telescope:

Data Analysis

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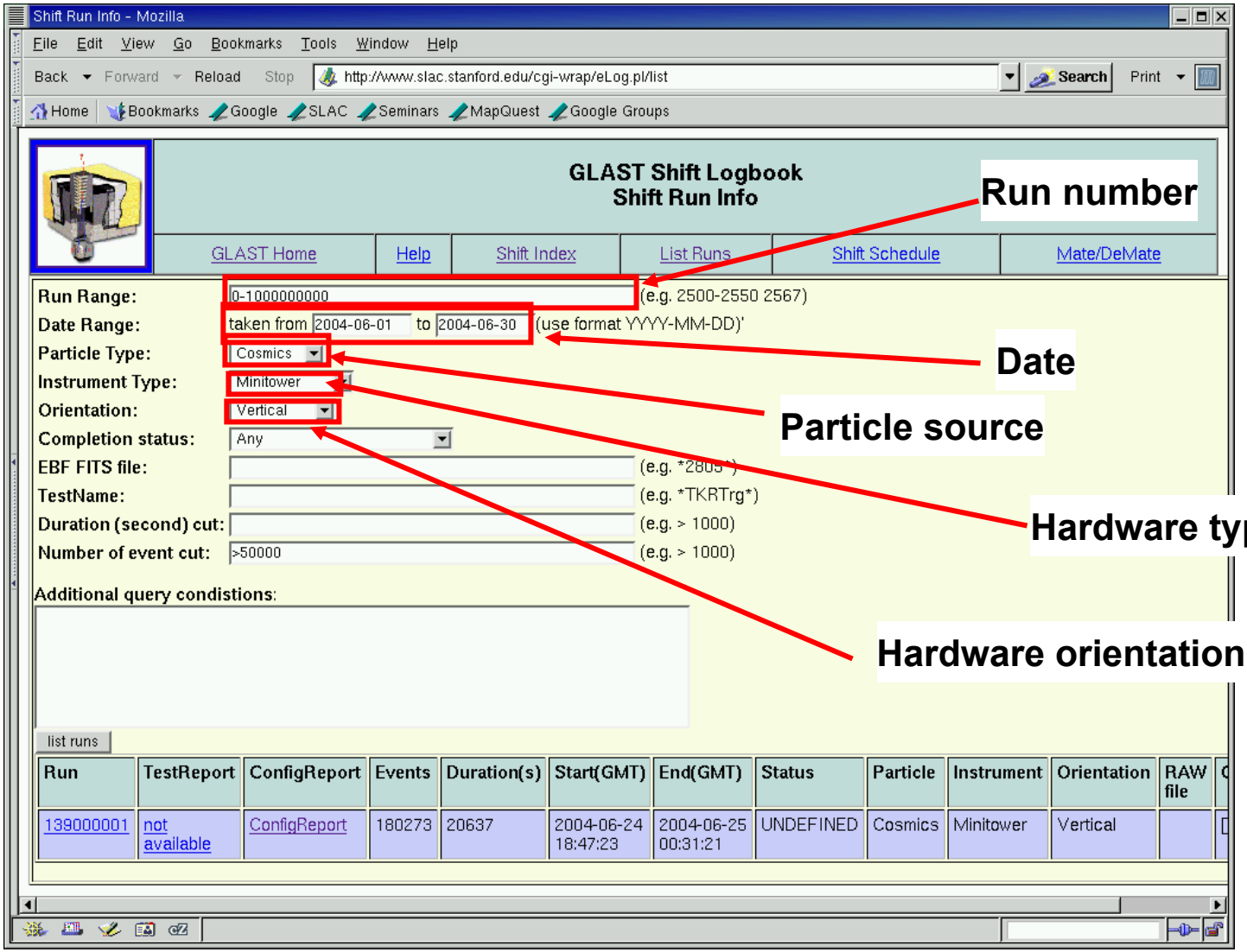
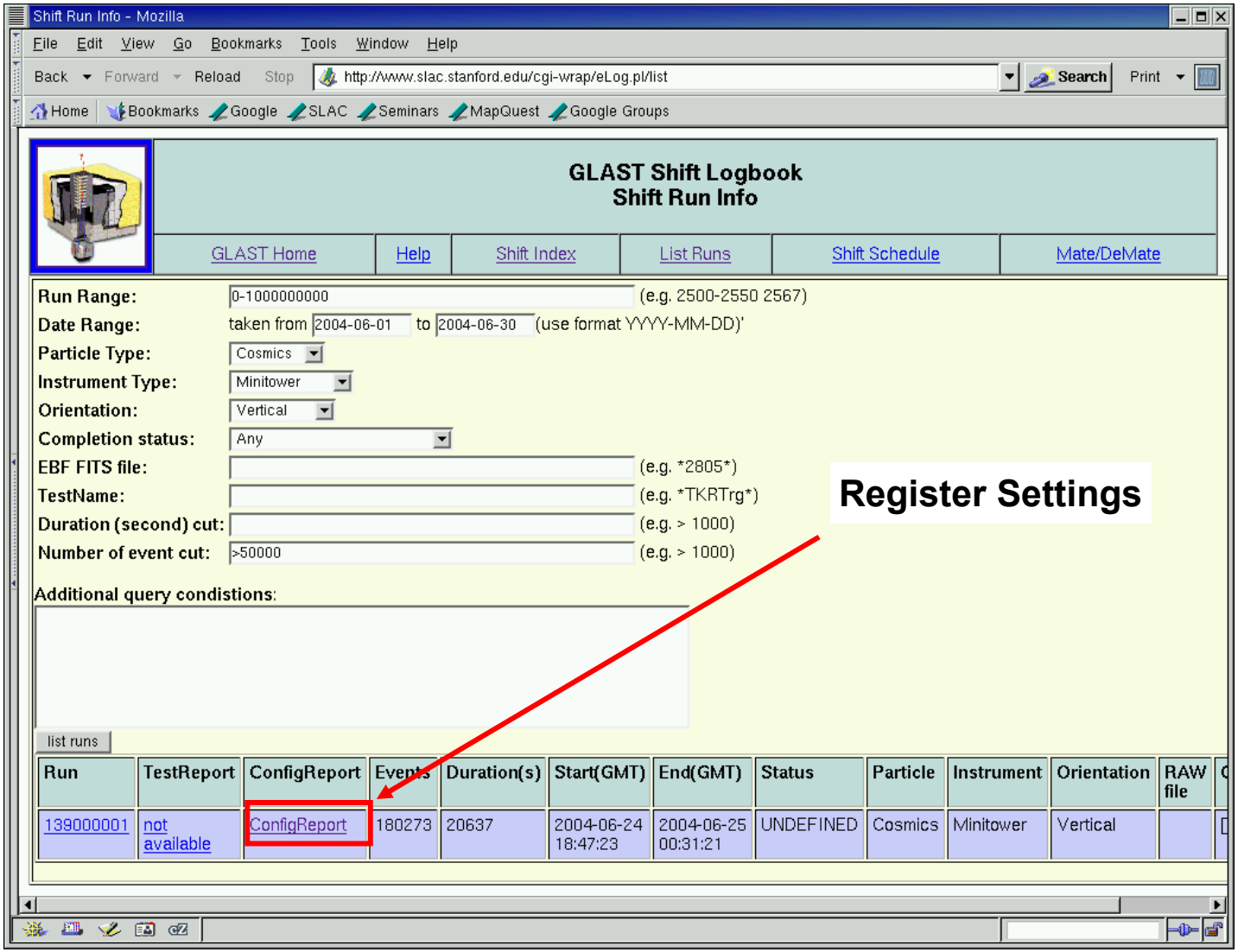
Data Analysis

- Every data run to be analyzed must have information available on the web for easy access on
  - Hardware configurations (see talk on Electronic Database)
  - Register settings used for data taking
  - Quality reports for digitized data
  - Quality reports for reconstructed data

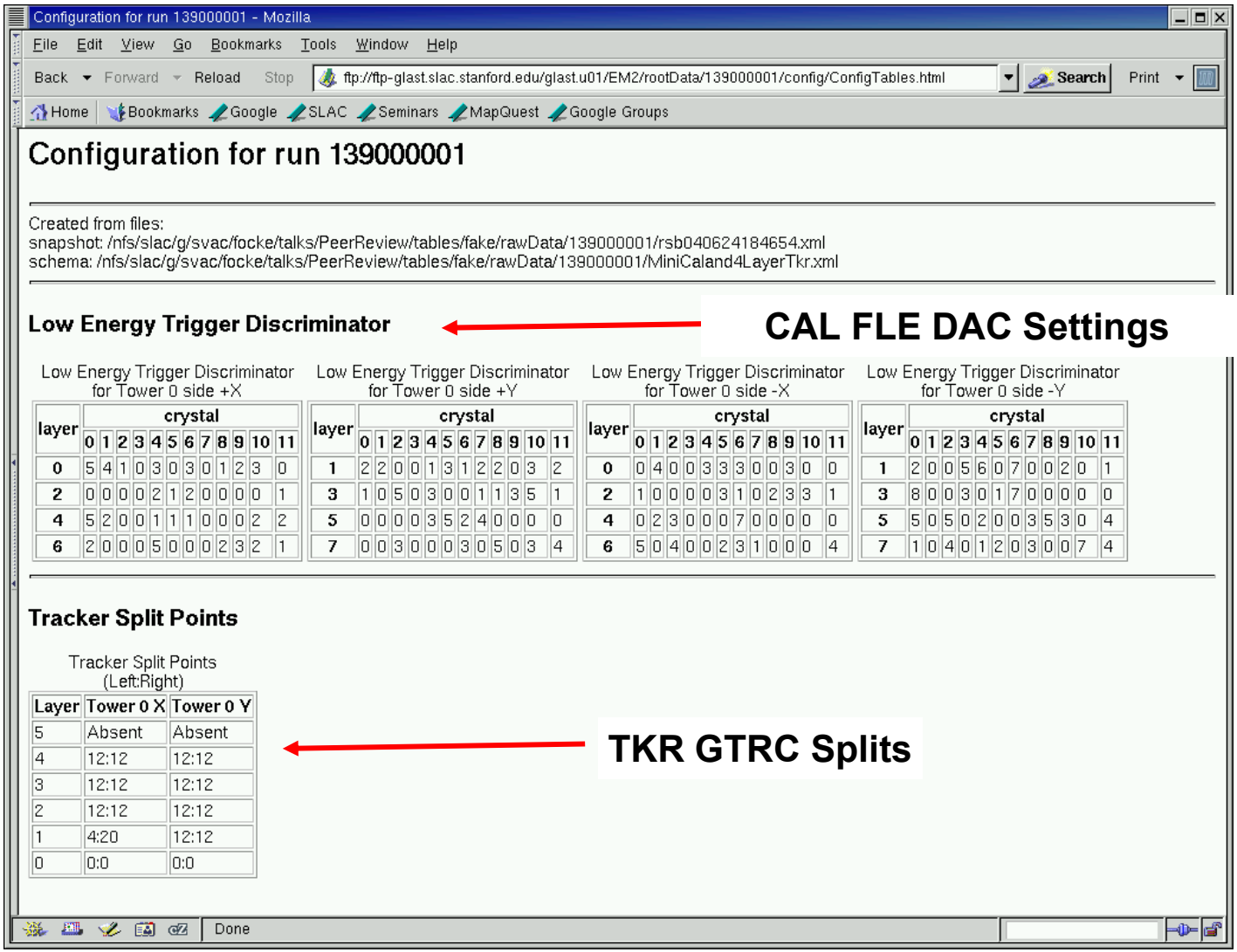
Query List of Runs via the Web



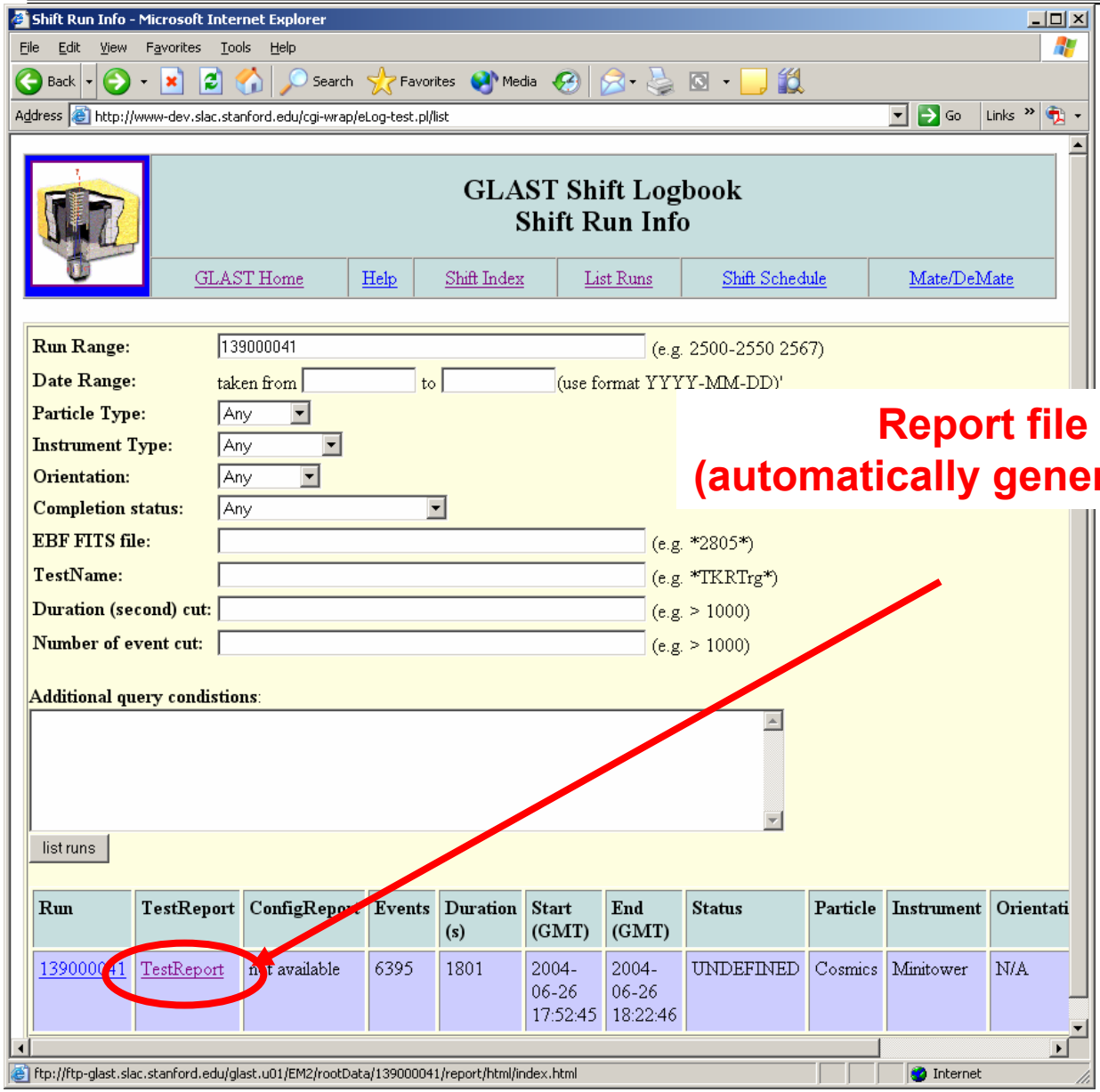
Configuration Report



Register settings



Quality Report (1)



Report file for the digi data (automatically generated after each data run)

Qulity Report (2)

Run Test Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address ftp://ftp-glast.slac.stanford.edu/glast.u01/EM2/rootData/139000041/report/html/index.html Go Links

Run Test Report

1.0

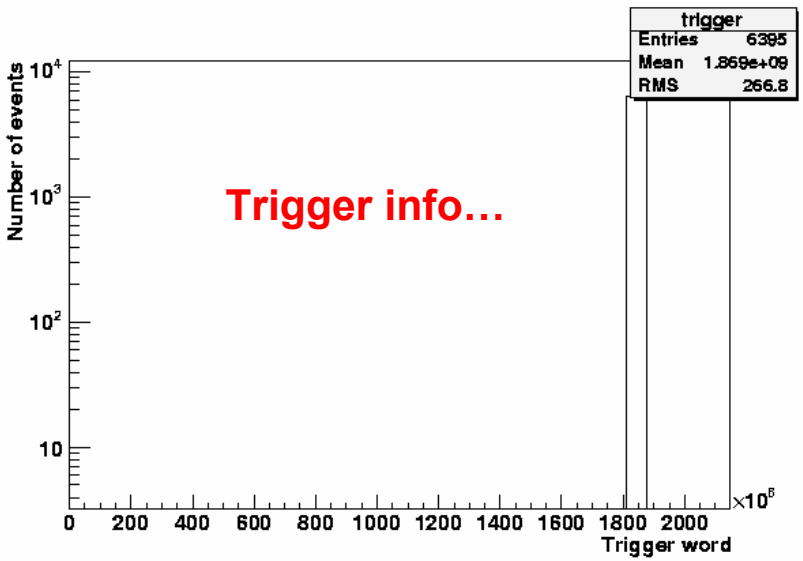
PS file PDF file

Author:
{automatically generated}

Summary

There are **6395** events in */nfs/farm/g/glast/u01/EM2/rootData/139000041/em_v3r0402p16/040626175242_digi.root*.

Trigger



Trigger info…

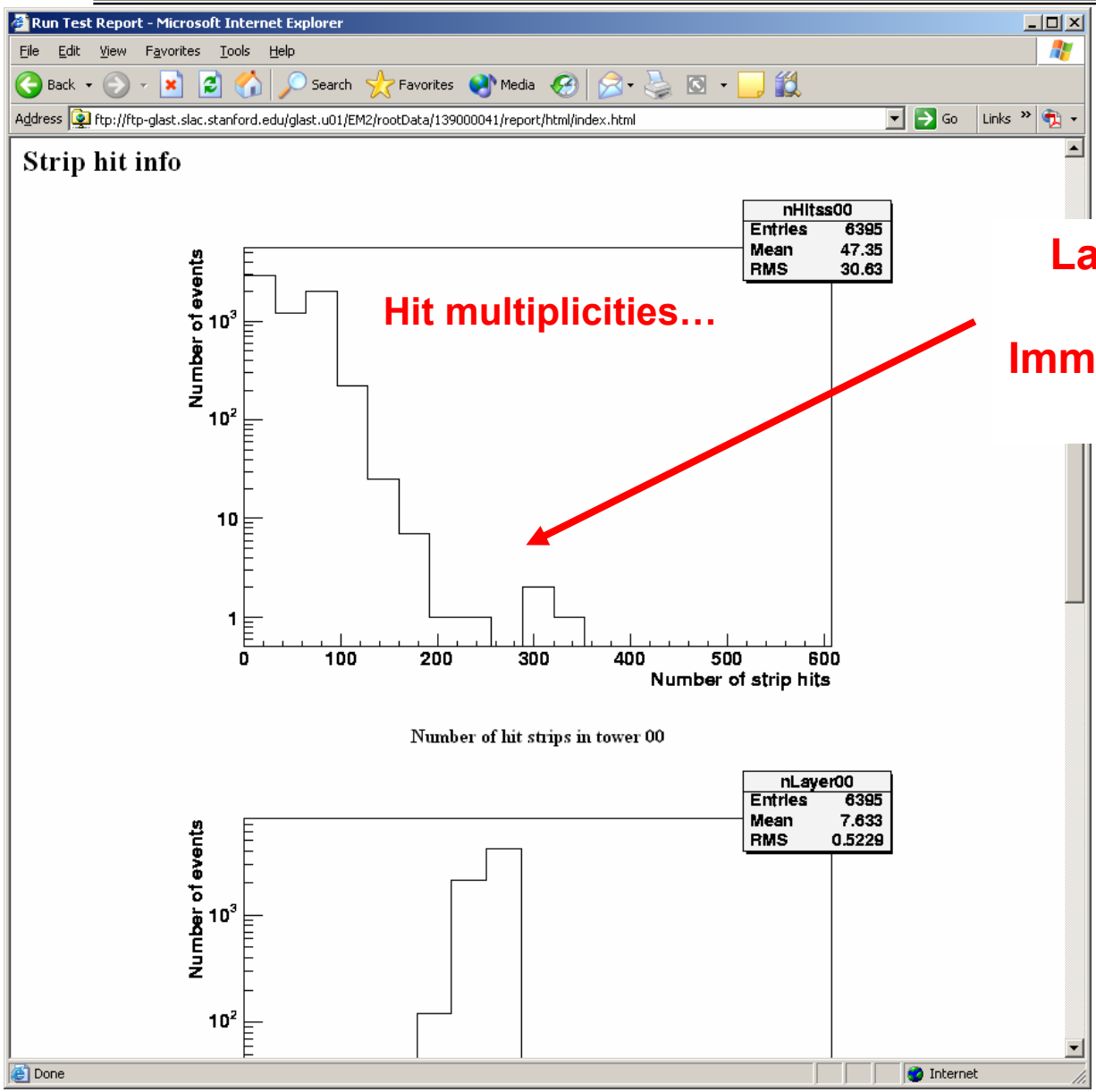
Done Internet

Cosmic ray data

EM2

Report file can be downloaded in both Postscript and pdf formats

Quality Report (3)



Cosmic ray data

EM2

Large number of hits events seen in EM2 data Immediately caught the attention (as designed!)

PASS/FAIL Criteria E2E tests

Preliminary proposal (TBR)

- Quality reports shall verify that data is analyzable
- Plots and tables shall contain
  - Identify if there is a large set (TBD) of events with the following characteristics
    - With many dead/noisy strips
    - With 3 in a row trigger but less than 6 digis
    - With low trigger efficiency
    - With saturated TOT
    - With 64 strip hits per GTRC
    - with zero TOT in one plane but nonzero number of strip hits in that plane
    - with nonzero TOT on one plane but no strip hits in that plane.
  - Unphysical detector IDs
    - » Search for TKR strips, layers and towers out of range
    - » Search for CAL columns, layers and towers out of range
  - Detector Hit maps
    - » Check if distributions are consistent with geometrical expectations (TBR)
  - Hit multiplicity
    - » Check for coarse (TBD) deviations in hit multiplicity from expected values
  - More to be added as we test data with
    - » EM2
    - » First data taken from tower tests with cosmic rays at Pisa

Data Analysis Tasks - Examples

Tasks will be determined by available manpower

- In order to acquire knowledge to design data analysis tests we need to use data from
  - EM2 Hardware (CAL, 4 xy TKR planes, 2 ACD tiles) to
    - Study GASU data (trigger primitives, deadtime)
    - Study TKR imaging capabilities with ACD
      - Make negative image of ACD and look for reconstructed tracks that point inside the image.
        - » How many should be there from the software inefficiencies?
        - » How many should come from hardware?
    - MIP definition (angle, position) with TKR and CAL
      - What is the efficiency for defining a clean MIP?
    - TKR cluster sizes data and MC
      - Measure difference between predicted and reconstructed cluster sizes
      - Check angular dependence
    - CAL calibrations with and without TKR tracks
  - Data from First TKR Tower (courtesy of Pisa prior to delivery to SLAC)
    - Update reports with full 1 tower data
    - Study uniformity of response for different trigger combinations
    - MIP definition (angle, position) with TKR
      - What is the efficiency for defining a clean MIP?

Detailed Analysis Status

- Projects are on-going but we need more muscles
  - SVAC should soon be done with the infrastructure development and will start doing data analysis
  - Instrument Analysis Workshop effort is ramping up
    - Starting weekly VRVS meetings Friday 8 am (PDT)

- To be done by IRR (Aug 3)
  - Identify commitments from the Collaboration
    - To be captured in the LAT-MD-00613 SVAC Contributed Manpower Plan
  - Define contents for quality reports and data analysis tasks
    - To be captured in the LAT-MD-00575 SVAC Plan for LAT Integration at SLAC

Priority List of Studies

(number does not reflect priority)

○ on-going!

1. Implement dead channels in the tracker for imaging Luca
2. Revisit the spectrum of sea-level cosmic rays Toby
3. Define strategy for implementing Deadtime in MC Steve/Richard/Elliott/Toby
4. Validate Energy Scales using CAL EM MC/DATA Pol
5. Compare numbers from alignment procedure to those from metrology at SLAC Larry
6. Calculate the tracking efficiency of each tower using track segments Leon
7. Calculate residuals by comparing CAL and TKR locations Leon
8. Make images of the CAL layers (to expose uniformity of response of the CAL) Benoit
9. Make image of TKR layers to identify location of shorted strips and broken wirebonds Bill
10. Implement simulated trigger primitive information into MC Luis
11. How well do we find MIPs (e.g. at several angles, within a tower, across towers)? David
12. What is the light output of tracks crossing diodes? Sasha
13. What are the effects to the data when zero suppression is applied? Traudl
14. What is a “clean” muon definition? Claudia
15. Can we find gamma rays and π^0 from showers? SAS

Will send a student as part of the long term plan and will get back to us soon – Per/Staffan

Next Talk

11:40 am

• Overview and Requirements	*Eduardo*	*(20 min)*
• Code Management	*Anders*	*(5 min)*
• Data Processing and Archival	*Warren*	*(15 min)*
• Calibrations	*Xin*	*(15 min)*
• Trending Database	*Xin*	*(5 min)*
• Electronic Log & Runs Database	*Xin*	*(10 min)*
• Data Analysis Infrastructure	*Anders*	*(15 min)*
• Data Analysis	*Eduardo*	*(15 min)*
• Summary and Concerns	*Eduardo*	*(15 min)*

GLAST Large Area Telescope:

Summary and Concerns

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External Dependencies

There are many external dependencies in the SVAC Department that can affect schedule

Deliverables to SVAC	*Delivered by*
• LDF to ROOT parser	I&T Online/SAS
• Data Pipeline	*SAS*
• Data Storage and Backup Disks	*SAS*
• Calibrations Algorithms	*ACD,CAL,TKR (via SAS)*
• Geometry Description	*ACD,CAL,TKR (via SAS)*
• Information for Runs Database	I&T Online/Particle Tests

- **Requirement:** deliverables receive continuous support after delivery

Infrastructure	*Supported during I&T by*
• Trending Database	*ISOC*
• Java Analysis Studio	*SCS/SLAC*
• ORACLE	*SCS/SLAC*

Status of Software Development

NAME	SOFTWARE DESCRIPTION	CATEGORY	CVS	DOC	EM	1	2
LDFConverter	Parse LDF from Online into SAS ROOT	Reconstruction	SAS				
Engineering Model	Create calibrated reconstructed ROOT filles	Reconstruction	SAS				
EngineeringModelRoot	Create SVAC data analysis file	Reconstruction	SAS				
Engineering Model	Create analysis ROOT files	Reconstruction	SAS				
TKRCalibGen	Produce calibration constants	Calibration	SAS				
CALCalibGen	Produce calibration constants	Calibration	SAS				
ACDCalibGen	Produce calibration constants	Calibration	SAS				
RunReport	Create a summary digi report	Electronic Log	Online				
TBD	Create a summary recon report	Electronic Log	Online				
eLogfeeder	Parse online report/snapshot into elog database	Electronic Log	Online				
eLog	Create Web page for elog	Electronic Log	Online				
ConfigTables	Parse schema from online into tables	Electronic Log	Online				
populateDB	Query SAS database and populate trending database	Trending Database	SVAC				
trendDB	Produce tables and plots from trending database	Trending Database	SVAC				
evtFilter	Select events from data analysis files	Data Analysis	SAS				
TBD	Launch SVAC tasks (deliver to Online)	Data processing	SAS				
TBD	Script to launch parser for LDF from Online into SAS ROOT	Data processing	SAS				
TBD	Script to launch production of calibration constants	Data processing	SAS				
TBD	Script to launch creation of calibrated/reconstructed ROOT filles	Data processing	SAS				
TBD	Script to launch creation of a summary digi report	Data processing	SAS				
TBD	Script to launch creation of analysis ROOT files	Data processing	SAS				
TBD	Script to launch creation a summary recon report	Data processing	SAS				
TBD	Script to launch parser for online report into elog	Data processing	SAS				
TBD	Script to launch parser for schema from online into tables	Data processing	SAS				

There is a good chance that all of the software needed for two tower tests will be in place by the delivery of the first tower (Sep13, 2004)

ready
in progress
not started

Summary - SVAC Need Dates

- Aug 4 (I&T IRR)
  - SVAC documentation
    - Planning and manpower
    - I&T/SAS ICD (to be defined)
- Aug 13
  - TKR deliverables (via SAS)
    - Calibrations (in negotiation for TOT)
  - SAS deliverables with corresponding system/unit tests
    - LDF converter (in negotiation for unit test)
    - Pipeline with web interface
    - Reconstruction release tag
    - Event Display with versioning
- Sep 1
  - CAL deliverables (via SAS)
    - Calibrations (in negotiation for non-linearity)
  - SAS deliverables
    - Geometry documentation

Deliverables to SVAC – Towers A and B

- Deliverables are due 1 month prior to First Flight Hardware delivery
  - LDF Parser
    - » Systems tests
  - Data Pipeline and Archival (SAS)
    - » Capabilities to implement SVAC tasks
    - » Web based capabilities to track processed tasks
  - Reconstruction (SAS,CAL,TKR)
    - » Digi.ROOT files with GEM and TEM Diagnostics information and corresponding system tests
    - » Systems tests for the released tag for 1 and 2 tower tests
  - Calibrations (SAS,CAL,TKR)
    - » CAL and TKR algorithms with ability to track serial number and grid location
    - » TKR algorithms (TOT)
    - » Ability to read online calibration data from EGSE into SAS infrastructure
    - » Documentation and reference sets for first tower
    - » system tests for algorithms
  - Electronic Logbook (Particle Tests/Online)
    - » Definition of queries for towers during I&T
    - » Implementation of serial numbers and tower locations in grid
  - Data Analysis Infrastructure (SAS)
    - » A released tag of the Event Display with random search capabilities
  - PASS/FAIL Data Analysis (Particle Tests/SE)
    - » Lists of data taking tests and corresponding configurations for 1 and 2 towers
    - » List of register baseline configurations for data taking
    - » Do we have high rate Poisson distributions?
    - » Do we have scripts to force some of the TKR layers on?

SVAC Work for Integration of Towers A and B

- **Work required by SVAC prior to first tower tests (Sep 13, 2004)**
  - **Management**
    - » Finalize agreements with SAS and with LAT Collaboration for Contributed Manpower to SVAC by IRR (Aug 3)
    - » Update Roadmap for IRR (Aug 3)
  - **Documentation**
    - » Update L4 documentation LAT-MD-00573, LAT-MD-00575, LAT-MD-01589, LAT-MD-01590, LAT-TD-Coding rules
    - » Release updated L3 documents LAT-MD-00446, LAT-MD-00613
  - **Data Pipeline and Archival**
    - » Implement, wrap and test all data processing scripts
  - **Reconstruction**
    - » Test LDF with GEM and TEM Diagnostics information using EM2 and one tower data from Pisa
    - » Study contents of SAS systems tests for 1 and 2 tower tests
  - **Calibrations**
    - » Test (Aug 13, 2004 delivery) algorithms: verify algorithm matches documentation and runs in pipeline, generate output , load SAS database and trending database and display results
  - **Trending Database**
    - » Implement Web base queries for the algorithms above
  - **Electronic Logbook**
    - » Update database to include serial number and grid location information (including queries)
  - **Data Analysis Infrastructure**
    - » Test Event Display with random search capabilities
    - » Define, implement and test recon reports
  - **PASS/FAIL Data Analysis**
    - » Review of plots and tables for E2E tests for digi and recon reports
  - **Detailed Data Analysis**
    - » Prepare a list of detailed analysis tests related to performance by studying EM2 data and one tower data from Pisa
    - » Start holding weekly meetings for instrument data analysis

Top 4 Concerns

- **Some of our main concerns**
  - **Pipeline delivery (SAS)**
    - » **Concern: pipeline delivery is late and we have no previous experience from EM tests**
  - **Calibrations (SAS)**
    - » **Concern: need to finalize calibration implementation to address tower number/serial number of calibrated tower**
  - **Data Analysis (SVAC)**
    - » **Concern: no previous experience using GASU data, never seen a full tower data , but have EM experience. Need some time to understand data from first flight tower**
  - **Trending Database (SVAC)**
    - » **Concern: need 4 weeks to implement new interface**

Summary

- We have exercised the full data analysis chain
  - All delivered software has been tested either with data from EM models or from MC simulations
  - All scripts needed by the pipeline have been tested manually
- We are in the process of finalizing agreements
  - For software releases during I&T
  - For contributed manpower to SVAC related work from LAT Collaboration
- If SVAC need dates are met
  - we will be ready for First Tower Delivery (Sep 13, 2004)

Back up slides

Reprocessing

- Reasons for reprocessing
  - Major software update (EM package, Calibration algorithm)
  - New calibration constants
- Since it may be time consuming to reprocess all the data, a review is required to decide whether it is necessary to do the reprocessing
- Procedure to do the reprocessing
  - Determine appropriate directory tree to hold reprocessed data
  - Create a new version of task in the pipe line
  - Run the new task
  - SAS database will automatically track multiple versions of the "same" data product
  - Determine whether the reprocessed data should be present on the web (the eLog can only display one set of data)

SVAC Requests for Data Taking

From SVAC Plan during LAT Integration at SLAC –LAT-MD-00575 (TBR)

- **The current data taking plan requires the following 13 hardware configurations for calibrations**
  - Tower A in a grid - vertically oriented
  - Tower A in a grid - horizontally oriented
  - Towers A and B in a grid - vertically oriented
  - Towers A, B, 1 and 2 in a grid - vertically oriented
  - Towers A, B, 1, 2, 3 and 4 in a grid - vertically oriented
  - Towers A, B, 1, 2, 3, 4, 5, and 6 in a grid - vertically oriented
  - Towers A, B, 1, 2, 3, 4 , 5, 6, 7 and 8 in a grid - vertically oriented
  - Towers A, B, 1, 2, 3, 4 , 5, 6, 7, 8, 9, and 10 in a grid - vertically oriented
  - Towers A, B, 1, 2, 3, 4 , 5, 6, 7, 8 , 9 , 10, 11 and 12 in a grid - vertically oriented
  - Towers A, B, 1, 2, 3, 4 , 5, 6, 7, 8 , 9 , 10, 11, 12, 13, and 14 in a grid - vertically oriented
  - Towers A, B, 1, 2, 3, 4 , 5, 6, 7, 8 , 9 , 10, 11, 12, 13, and 14 in a grid and ACD - vertically oriented
  - Towers A, B, 1, 2, 3, 4 , 5, 6, 7, 8 , 9 , 10, 11, 12, 13, and 14 in a grid and ACD - horizontally oriented
  - Towers 15 and 16 (spares) in an engineering grid– vertically oriented

Used for detailed analysis and MC simulations

Numbers do not correspond to bay locations but to Flight Module “serial numbers”

Software Development – LAT Integration

NAME	SOFTWARE DESCRIPTION	CATEGORY	CVS	DOC	EM	1	2	8	16	LAT
LDFConverter	Parse LDF from Online into SAS ROOT	Reconstruction	SAS							
Engineering Model	Create calibrated reconstructed ROOT filles	Reconstruction	SAS							
EngineeringModelRoot	Create SVAC data analysis file	Reconstruction	SAS							
Engineering Model	Create analysis ROOT files	Reconstruction	SAS							
TKRCalibGen	Produce calibration constants	Calibration	SAS							
CALCalibGen	Produce calibration constants	Calibration	SAS							
ACDCalibGen	Produce calibration constants	Calibration	SAS							
RunReport	Create a summary digi report	Electronic Log	Online							
TBD	Create a summary recon report	Electronic Log	Online							
eLogfeeder	Parse online report/snapshot into elog database	Electronic Log	Online							
eLog	Create Web page for elog	Electronic Log	Online							
ConfigTables	Parse schema from online into tables	Electronic Log	Online							
populateDB	Query SAS database and populate trending database	Trending Database	SVAC							
trendDB	Produce tables and plots from trending database	Trending Database	SVAC							
evtFilter	Select events from data analysis files	Data Analysis	SAS							
TBD	Launch SVAC tasks (deliver to Online)	Data processing	SAS							
TBD	Script to launch parser for LDF from Online into SAS ROOT	Data processing	SAS							
TBD	Script to launch production of calibration constants	Data processing	SAS							
TBD	Script to launch creation of calibrated/reconstructed ROOT filles	Data processing	SAS							
TBD	Script to launch creation of a summary digi report	Data processing	SAS							
TBD	Script to launch creation of analysis ROOT files	Data processing	SAS							
TBD	Script to launch creation a summary recon report	Data processing	SAS							
TBD	Script to launch parser for online report into elog	Data processing	SAS							
TBD	Script to launch parser for schema from online into tables	Data processing	SAS							

ready
in progress
not started

Calibrations during LAT Integration

Calibrations will occur at least once per module up to a maximum of 11 times

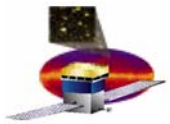
SVAC ID LAT-MD-00446	CALIBRATION TYPE	TOWER NUMBER																	
		A	B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	ACD
C10	TKR Noisy channels	11	10	9	9	8	8	7	7	6	6	5	5	4	4	3	3	1	1	0
C11	TKR Dead channels	11	10	9	9	8	8	7	7	6	6	5	5	4	4	3	3	1	1	0
C18	CAL pedestals	11	10	9	9	8	8	7	7	6	6	5	5	4	4	3	3	1	1	0
C19	CAL gains	11	10	9	9	8	8	7	7	6	6	5	5	4	4	3	3	1	1	0
C14	CAL light asymmetry	11	10	9	9	8	8	7	7	6	6	5	5	4	4	3	3	1	1	0
C12	TKR TOT Conversion Parameter	11	10	9	9	8	8	7	7	6	6	5	5	4	4	3	3	1	1	0
C13	TKR TOT MIP Conversion/GTFE	11	10	9	9	8	8	7	7	6	6	5	5	4	4	3	3	1	1	0
C6	TKR Tray Alignment	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
C7	TKR Tower Alignment	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
C15	Cal light attenuation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
C13	TKR TOT MIP Conversion/strip	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
C8	LAT & Observatory Alignment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
C3	ACD pedestals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
C4	ACD gains	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

From SVAC Plan during LAT Integration at SLAC –LAT-MD-00575. Most calibrations and performance can be performed in parallel using the same data – Typically require 24 h for each of the 13 configurations listed in the previous slide. **Special request at the end of LAT assembly:** 10 days of data taking for final MC validations, performance and calibrations (TBR by Systems Engineering's meeting led by Pat Hascall)

Data Taking - Time Estimates

From SVAC Plan during LAT Integration at SLAC –LAT-MD-00575 (TBR by Particle Tests and Subsystems)

SVAC ID LAT_MD-00446		REQUIREMENT	TRIGGER TYPE	SELECTION EFFICIENCY (MC AND/OR EM)	L1T/TOWER (30 HZ)	TIME (H)
C6	TKR Tray Alignment				$8.6\ 10^5$	24
C7	TKR Tower Alignment				$8.6\ 10^5$	24
C8	LAT & Observatory Alignment				$8.6\ 10^5$	24
C9	TKR single-hit MIP efficiency (on-axis)				TKR	TKR
C10	TKR Noisy channels	~30 hits/strip,	TKR	30%	$1.5\ 10^5$	1.5
C11	TKR Dead channels	~30 hits/strip,	TKR	30%	$1.5\ 10^5$	1.5
C30	TKR TOT gain per strip	~1000 hits/strip,	TKR	single hit/layer	$2.6\ 10^8$	240
C30	TKR TOT gains per GTFE	~1000 hits/64 strips	TKR		$4\ 10^5$	4
C18	CAL pedestals	~10000 hits/PIN Diode	CAL-LO @ 4 MeV		$1\ 10^4$	0.1
C19	CAL gains	~1000 muon events/crystal	CAL-LO @ 4 MeV	10%	$5.4\ 10^5$	10
C14	CAL light asymmetry	~1000 muon events/crystal	CAL-LO @ 4 MeV	10%	$5.4\ 10^5$	10
C15	CAL light attenuation	~1000 muon events/center bin of the crystal	TKR	8 mm bin along each CAL crystal	$1.5\ 10^8$	140
C3	ACD pedestals				TBD	TBD
C4	ACD gains				TBD	TBD



Example of E2E Configuration – Baseline CR

From Eduardo and Gary (in progress)

E2E ID	Config	Test	FSW			S/C		ACD				TKR			CAL			
			Filter	Prescale	Throttle	Temp (C)	non - regulated source (V)	Veto DAC	CNO DAC	TACK delay	Zero Suppress DAC	Strip DAC	TACK delay	GTRC split	LowE DAC	HighE DAC	TACK delay	Zero Suppress DAC
1	1	BCR	OFF	OFF	OFF	nom	nom	nom	nom	nom	nom	nom	nom	nom	nom	nom	nom	nom

Trigger										LAT16 Total [hrs]		LAT1 Total [hrs]		LATn 1<n<16 Total [hrs]		Weekly Total [hrs]
Open Trigger Window OR																
Solic	ROI	Tkr	Cal Low	Cal High	CNO	Trigger Lookup Table	Rate [KHz]	L1T	Time [hrs]	83	Time [hrs]	44	Time [hrs]	36	Time [hrs]	1
No	No	Yes	Yes	Yes	Yes	AllZs	0.5	1.80E+06	1	1	1	1	1	1	24	1

nom=nominal value
nom=DAC settings to be used in orbit
nom=TACK settings determined by doing Procedure to Set the LAT Timing Registers(LAT-PS-04134)

All TREQ delays are left set to their values determined by doing Procedure to Set the LAT Timing Registers(LAT-PS-04134)

ROIc= ROI condition configured as a conincidence by setting bit 0 of the GEM Configuration Register
ROIv= ROI condition configured as a veto by clearing bit 0 of the GEM Configuration Register

Trigger Message Lookup Table:

All = Issue a TACK Bit if: ROIc .or. Tkr .or. Cal Low .or. Cal High .or. CNO .or. Solicited
AllZs= Issue a TACK and Zero Suppress Bit if: ROIc .or. Tkr .or. Cal Low .or. Cal High .or. CNO .or. Solicited
All4r = Issue a TACK and 4 Range Readout Bit if: ROIc .or. Tkr .or. Cal Low .or. Cal High .or. CNO .or. Solicited
Veto = Issue a TACK and Zero Suppress Bit if: ROIv .and. (Tkr .or. Cal Low .or. Cal High .or. CNO .or. Solicited)