SAS Overview

• The Big Picture
  – Reminder of the SAS mission, data flow, etc

• Simulation/Reconstruction Directions

• New in 2001

• Who’s Doing What?

• Calibrations Planning

• Early Science Tools directions

• Short- and long-term schedules

• Management Stuff

• Worries
Our Mission

• shall perform prompt processing of Level 0 data through to Level 1
• shall provide near real time monitoring information to the IOC.
• shall facilitate monitoring and updating instrument calibrations.
• shall maintain state and performance tracking.

• shall create high level science products from Level 1 for the PI team.
• shall perform reprocessing of instrument data.
• shall provide access to event and photon data for higher level analysis.
• shall perform bulk production of Monte Carlo simulations.

• shall interface with mirror PI team site(s) (sharing data and algorithms).
• shall interface with the SSC (sharing data and algorithms).
• shall support design of LAT instrument with simulations.

• Production event processing is performed in the Data Processing Facility.
### Mission Ops Center (MOC)
- Raw data from Malindi
- S/C, LAT and GBM Level 0 processing
- Spacecraft health and safety
- Instrument safety
- Commanding
- Alert data handling
- Ground station/TDRSS scheduling
- Acquisition data generation

### Science Support Center (SSC)
- High level data processing
- Science data distribution
- Data archiving
- Calibration archiving
- Software archiving
- Observation planning and scheduling
- Target of Opportunity selection
- Exposure maps
- Participation in LAT software generation
- Multi mission analysis tools
- Level 1 processing for GBM
- Backup Level 1 processing for LAT

### LAT Instrument Ops Center (IOC)
- Instrument monitoring
- Instrument ops planning
- Instrument calibration
- Instrument command load generation
- Instrument software generation
- Ground algorithms/software
- Instrument team product generation
- Level 1 processing
- Selected higher level processing
- Maintenance of calibration files and tools
- Transient detection

### GBM Instrument Ops Center
- Instrument monitoring
- Instrument ops planning
- Instrument calibration
- Etc, etc
Data Flow

Data recon + MC on disk. Abstract full-recon output into L1 DB for analysis

Parts of L2 processing also automated

Fully automated server, with RDB for data catalogue + processing state. Uses SLAC batch CPU and disk farms.
Instrument Simulations and Reconstruction

3 GeV gamma interaction

Source Fluxes → Particle Transport → “Raw” Data → Instrument data

Geometry → Recon → 3 GeV gamma recon

Background Rejection - Particle ID

CAL Detail
Processing Pipeline

- IOC (Level 0)
- HSM (Level 0)
- Automated Tape Archive
- Level 0
- Oracle
- Batch system
- Level 1, diagnostics

~50 CPUs; ~50 TB disk by 2010
Sim/Recon Toolset

Root, IDL – analysis

TkrRecon, CalRecon, AcdRecon – test beam era versions; Rewrites being planned & executed

gismo – simulation package
GEANT4 – on its way

xml – geometry, parameters

Root – object I/O

Gaudi – code framework

VC++ – Windows IDE
gnu tools - Linux

vcmt – Windows gui

CMT – package version management

cvs – file version management

ssh – secure cvs access

utilities
2001 in a Nutshell

• New code framework – Gaudi
  – Bulk of the software has been moved in
  – Some useful features not moved yet
    • eg Sawyer’s “time history” code
•(tb) recon versions of TkrRecon and CalRecon ported and tweaked
• Geometries updated to match new baseline
• Sources updated
• All PDR studies run in this new environment

• GEANT4 just brought online – first version
  – EM physics validation performed
• And, of course, PDR report, budgets, schedules, PMCS etc

• Using Root for object I/O system
  – More descriptive and efficient format, suited to event data
  – proto Recon tree & ntuples so far
• Code systems operational again on 2 OS – Windows + Linux
  – Windows & Linux standard installs at UW & SLAC
• Data Manager prototype running
  – Scripts produced simulation runs for PDR
  – exercised SLAC batch farm
  – Relational database is ready to use for tracking processing. Undergoing some tweaks
• Release Manager prototype could be turned on
  – Automated code builds & limited testing
  – Nightly runs – notify package owners of problems
Institutional Responsibilities

• Management – SLAC
• Code Architect – U Washington
• Subsystems
  – ACD – GSFC
  – CAL – NRL, France
  – TKR – SLAC, UCSC, Italy
• Infrastructure – GSFC, SLAC, UW
• GEANT4 – Italy
• Event Display – Italy, UW
• Sources – SLAC, UW, Japan
• DPF – SLAC, Stanford

• Science Tools – Stanford lead + collaboration + SSC
Who’s Doing What?

- **Core**
  - Everything – Toby
  - xml & geometry – Joanne
  - detModel – Riccardo
  - Sources - Sean
  - Root stuff – Heather
  - Data Manager, Release Manager – Karl
  - CMT, librarian – soon to be Alex
  - Calibrations – will be Joanne
  - Event Display – led by Riccardo
- **ACD**
  - Heather
- **GEANT4**
  - Validation – Alessandro, Francesco, Riccardo, Claudia, Tune
  - To Gaudi – core + Monica
  - Geometry - Riccardo
  - Hits – Riccardo, Francesco
- **BFEM**
  - Heather
  - Event Display – Nick, Gloria
- **TKR**
  - Tracy, Leon, Bill Atwood
  - Alignment - Hiro
  - Digis – folks at Bari
  - Vertexing – folks at Pisa
- **CAL**
  - Sasha, Eric, Malcolm, Regis, Arache
  - Calibrations – Sasha, Eric
- **PDR Instrument Studies**
  - Steve, Bill, Tracy + core
- **User Support**
  - Documentation Task Force – Heather
  - “binaries” distributions – Alex
  - Bug tracking - Karl
Doc & User Support

• Documentation Task Force
  ❖ Commissioned in Dec ’01
  ❖ Group of 7. Heather Kelly (GSFC) chair.
  ❖ Charged with riding herd on all forms of doc
    ❖ Web, inline, Users and Developers manuals
    ❖ Defining procedures for maintenance
      http://www-glast.slac.stanford.edu/Software/core/documentation/

• “Binary” Code Distributions
  ❖ rpms and tarballs now available on Linux
  ❖ Winzip files on Windows
  ❖ Greatly reduce difficulty of install for non-experts

• Bug Tracking
  ❖ Currently just instituted simple majordomo mailing list
  ❖ Investigating use of Remedy for ‘real’ tracker. Will be a learning experience.
1. Data Structures

- Commissioned in Dec ’01. Time is right, since TKR & CAL are rethinking their recons. Match to May/Oct ’02 major code releases.
  - May require iteration

- About 10 members provide broad representation of subsystems, core and science. Leon Rochester (SLAC) chair.

- Charged with revisiting all transient/persistent store structures in sim + recon
  - Content
  - standards

http://www-glast.slac.stanford.edu/Software/DataStructuresTF/
Data Structures Task Force (2)

- **Content**
  - Add missing information
  - Remove unneeded or duplicate information
  - New classes
    - Volume ID’s
    - Event info (time, position, instrument status, etc.)

- **Uniformity**
  - Coding rules
  - File templates
  - Member function names
  - Private data names

- Monitor implementation
- Document design and implementation
Calibrations Planning

- Instrumental Calibrations
  - ACD pedestals & gains
  - CAL pedestals, gains, light tapers
  - TKR hot/dead channel lists, alignments

- Schedule Drivers
  - EM1 unit Aug ’02
  - Qualification Unit Nov ’03

- High Level Calibrations
  - Instrument Response Functions – resolution and efficiency parametrizations
  - Used for astronomy

- Work in conjunction with Integration & Test group
  - SAS writes algs, I&T runs them
  - Test plans in prep for creating calibs for engineering units
  - Test plans in prep for verification of MC against cosmics and beam tests.

- Current PSF, A_eff shown in Steve Ritz’s Day 1 talk
  - Will repeat and refine this work annually
# Calibrations: SVAC Data

(being reviewed by subsystems)

## Science verification
- Number of reconstructed photons (Effective Area)
- Absolute Energy
- Energy Resolution
- Single Photon Angular Resolution
- Background Rejection (CAL+TKR)
- Monte Carlo tuning (hit distributions, energy deposition, …)

## High Level Calibration
### ACD
- Detection Efficiency
- High Threshold detection

### TKR
- Single Hit Efficiency
- SSD Alignment
- Ladder Alignment
- Tray Alignment
- Tower Alignment
- Inter Tower Alignment
- LAT & Observatory Alignment

### CAL
- Light Attenuation
- Light Asymmetry

## Low Level Calibration
### ACD
- Pedestals

### TKR
- Noisy Strips
- Dead Strips
- Time-Over-Threshold

### CAL
- Pedestals
- Scintillation efficiency
- Energy range: Electronic Gain
- Energy range: Integral non linearity
- Energy range: Differential non linearity

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SVAC = Science Verification and Calibration

From I&T – E. do Couto e Silva
Science Tools Progress

• At Feb review
  – Already had list of tools and rough estimate of needed manpower
    • ~40 MY effort estimated – to be drawn from the collaboration and SSC
    • Seen by IPO as “Level of Effort” – after critical items are in hand.
  – SSC did not exist
    • Was awarded to Goddard during summer; starting to staff up

• Since then
  – Negotiations with Goddard on LAT interface to SSC and deliverables
  – Draft Project Data Management Plan
  – Working on formalizing collaboration and internal science effort
  – Working with SSC on requirements for Event Database used for astronomy
  – Planning on a Science Tools workshop in Feb/March
Budget = Manpower Profile

USA

• On project
  – 1.25 FTE NRL
  – 1 FTE GSFC, increasing to 2 in FY03
  – 1 FTE Stanford, increasing to 2 in FY03

• Off Project
  – 7 FTE SLAC
  – 1 FTE UW
  – 1/2 FTE UCSC

France

• 2 ½ FTE

Italy

• 2 ½ FTE (and probably more, see TKR)

Japan

• ½ FTE

Profile shows dropoff in out years:
• no Science Tools work yet
• some lack of imagination about tasks that far out!
2002 Schedule

- Milestones submitted to IPO
  - Prototype Code Release Manager - 3/02
  - ACD Calibration algorithm ready 4/02
  - Major Post-PDR Code Release (G4, flexible geometry) - 4/02
  - CAL Calibration algorithm ready 6/02
  - TKR Low level calibration alg ready 6/02

- Calibration milestones are in response to I&T needs – EM1 module in 10/02
- Major Code Release 5/02
  - First G4 ready by 1/02
  - Significant fraction of new TKR, CAL recons
  - Next iteration on infrastructure
  - Partially updated output structures

- Major Code Release 10/02
  - G4 stable
  - New TKR, CAL recons done
  - Fully updated output structures

- CDR in 8/02!
Timeline

- **Major code releases**
  - Balloon
  - GlastSim/G4 Event Display
  - Release Manage
  - Performance Tuning, Tracking
  - Data Production Facility, near real-time monitoring
  - Calibrations
  - Event DB Technology & Design
  - Science Tools, Analysis Platforms

Management Stuff

- **Scope**
  - Full WBS exists
  - Critical areas (ie all but Science Tools) defined in Level 3 & 4 requirements.
  - Calibrations defined in concert with I&T group
    - SAS writes algs, I&T runs them

- **Resource Loaded schedule**
  - ’02 and beyond loaded bottoms up. On- & off-project effort accounted for. (’01 loading is very approximate)
  - Much use of “ongoing support” to indicate tweaking of “finished” projects
  - Science Tools resources & schedule in as place holders from initial estimate

- **Responsibilities**
  - All areas have clear line of responsibility
  - Work packages defined to scope out details in combination with tasks
    - Will be signed off by institutions, including non-US
    - On-project folks report time per work package (started October)
    - Off-project still to be worked out. IPO only requires reporting to top level WBS.
Manpower Projection

Note: ’06 is only ½ year

• excludes Science Tools effort buildup
Worries

• Manpower
  – Budget cuts in FY02 cost in User Support and DPF
    • Stretching existing manpower (eg Documentation TF, and using students to help with DataManager)
  – Situation in France is in flux
    • Unknown effect on CAL and ripple on NRL
  – Single code architect is a risk
    • Toby Burnett is overloaded. Too much support work on top of design.
    • We need another ‘architect class’ person on board to assist Toby

• Science Tools
  – Collaboration not yet organized for this effort
  – Negotiating roles with Science Center now
    • Not ready to devote much manpower to it yet, but SSC raring to go!
Backup Slides
Manpower Estimates

SLAC FTEs
excluding Science Tools

Fiscal Year

FTE

Management
Calibration
DPF
Engineering Models
Analysis Tools
Sources, Sim, Recon

FY00 FY01 FY02 FY03 FY04 FY05 FY06

R.Dubois
Manpower – France

- expect greater contribution to Science Tools later
Manpower - Italy

- excludes potential Science Tools effort
- continuing contribution to TKR not yet defined