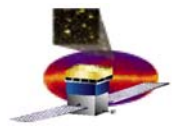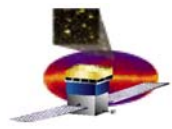# LAT Data Processing Facility

- **Automatically process Level 0 data through reconstruction (Level 1).**

- **Provide near real-time feedback to IOC.**

- **Facilitate verification and generation of calibration constants.**

- **Produce bulk Monte Carlo simulations.**

- **Backup all data that passes through.**
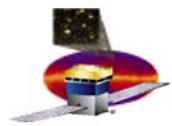
LAT Data Processing Facility

Some Important Numbers.

- **Downlink rate – 300 Kb/sec $\longrightarrow$ 3 GB/day $\longrightarrow$ 1 TB/year.**

- **Data plus generated products ~ 3 – 5 TB/year.**

- **Over 5 years ~ 15-30 TB.**

- **Average event rate in telemetry ~ 30 Hz (γ,background).**

- **Current reconstruction algorithm.**

  ~ 0.2 sec/event on a 400 MHz Pentium processor.

- **Assuming 4 GHz processors by launch ~ 0.02 sec/event.**

- **~ 5 processors more than adequate to keep up with incoming data as well as turning around a days downlink in ~ 4 hours.**

- **Represents only about ~1 % of current capacity of SLAC Computing Center.**
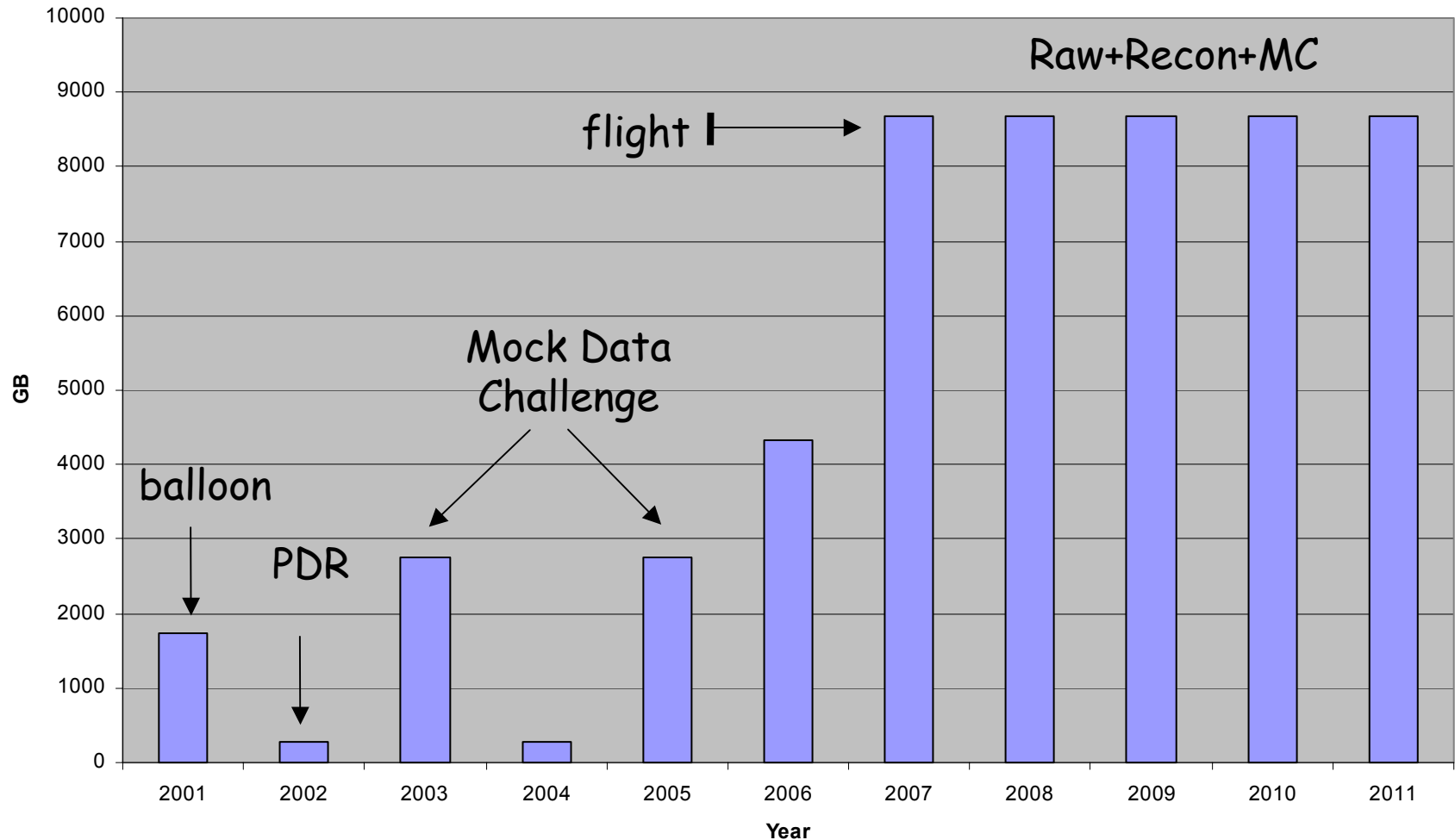
LAT Data Processing Facility

- **Even inflating estimates by considering re-processing data concurrently with prompt processing, a conservative estimate of resource requirements over the life of the mission is:**

  ~ a few tens of processors.

  ~ 50 TB of disk.

- **SLAC Computing Center is officially committed to providing these resources at no explicit expense to GLAST.**
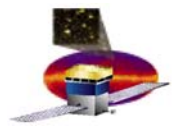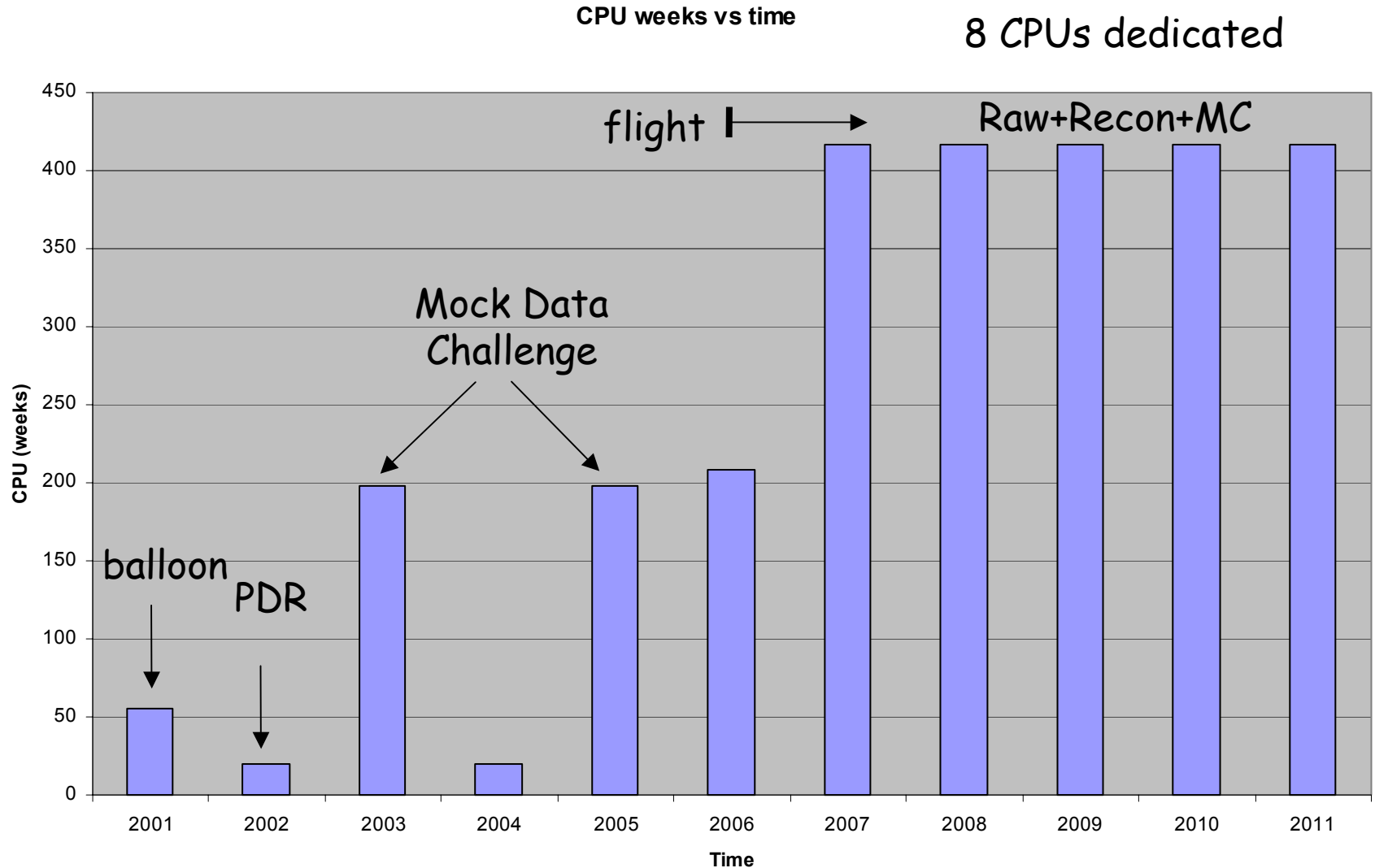
LAT Data Processing Facility
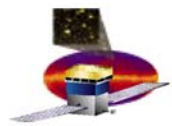

Disk Usage (GB)

8.5 TB/year

Raw+Recon+MC

flight

Mock Data Challenge

balloon

PDR

(BABAR temp space is 25 TB)

LAT Data Processing Facility

CPU weeks vs time

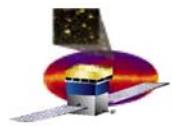8 CPUs dedicated

flight ⟶ Raw+Recon+MC

Mock Data
Challenge

balloon
PDR

(SLAC Computing Services will have ~2000 CPUs for BABAR)

Processing Pipeline

WWW

IOC — Level 0 —→ ORACLE

Batch system

HSM

Automated Tape Archive

Level 0
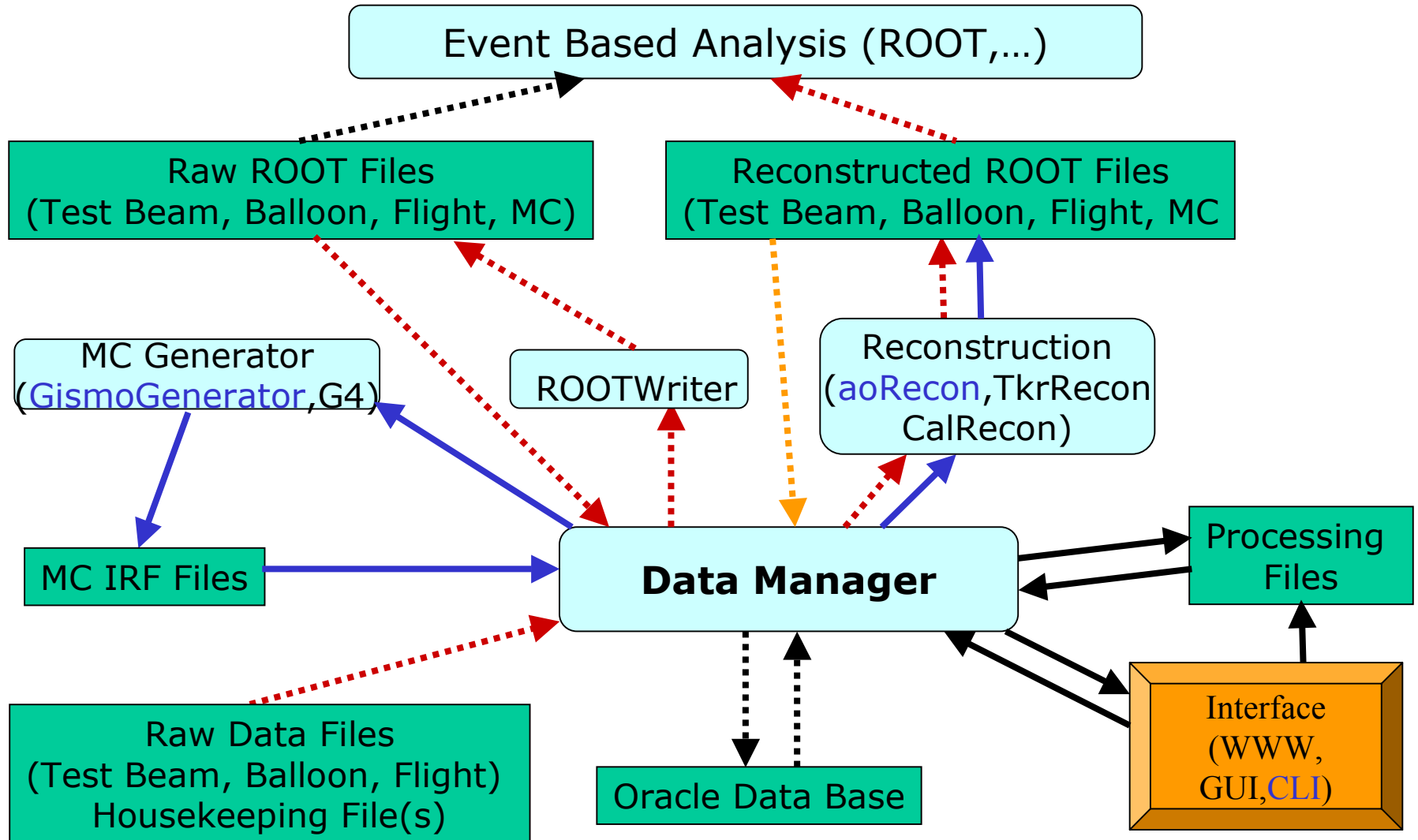
Level 1, diagnostics

50-100 CPUs; ~50 TB disk by 2010
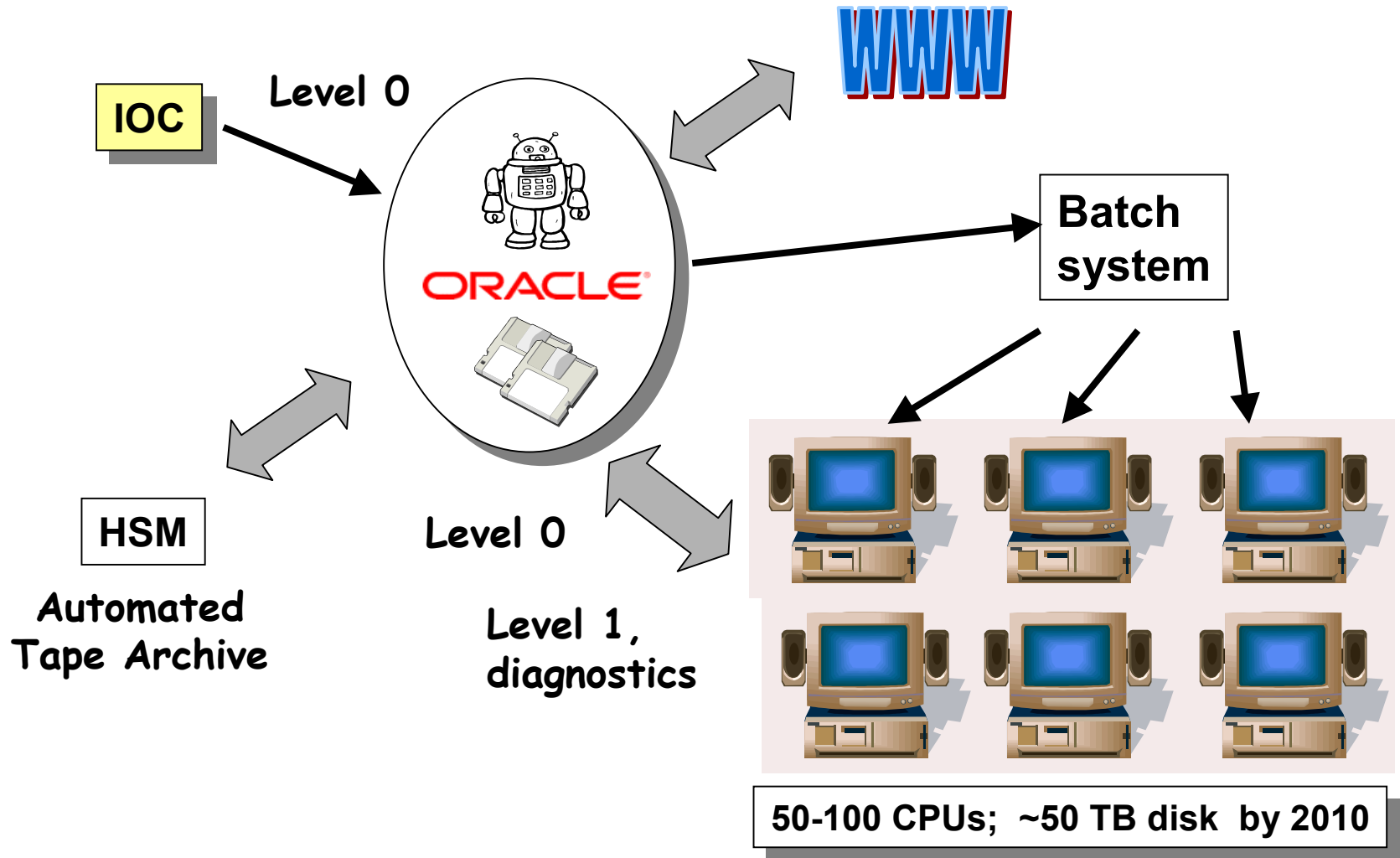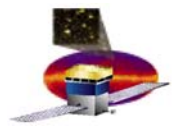
LAT Data Manager

LAT Data Manager

Automated Server (Data Manager)

Initial specification:

**http://www.slac.stanford.edu/~kyoung/DataManagerSpec/Spec.htm**

- **Dispatches files in various states to appropriate processes.**

- **Tracks state of processing for all datasets in system (completed, pending, failed, etc.) and logs this information to the database.**

- **Provides near real-time feedback to the IOC by performing rapid, high level diagnostic analyses that integrate data from all subsystems.**

LAT Data Manager

Automated Server (Data Manager) - cont.

- **Design is simplified by having all datasets always on disk, at least virtually – utilizes HSM provided and supported by SLAC computing center.**

- **Utilizes load balancing LSF batch system at SLAC to dispatch processing jobs in parallel.**

- **Provides a WWW interface for dispatching and tracking processes.**

- **Current prototype at SLAC, written in perl, is used for processing MC runs.**
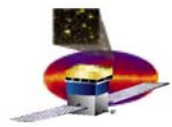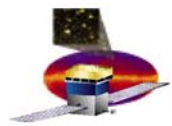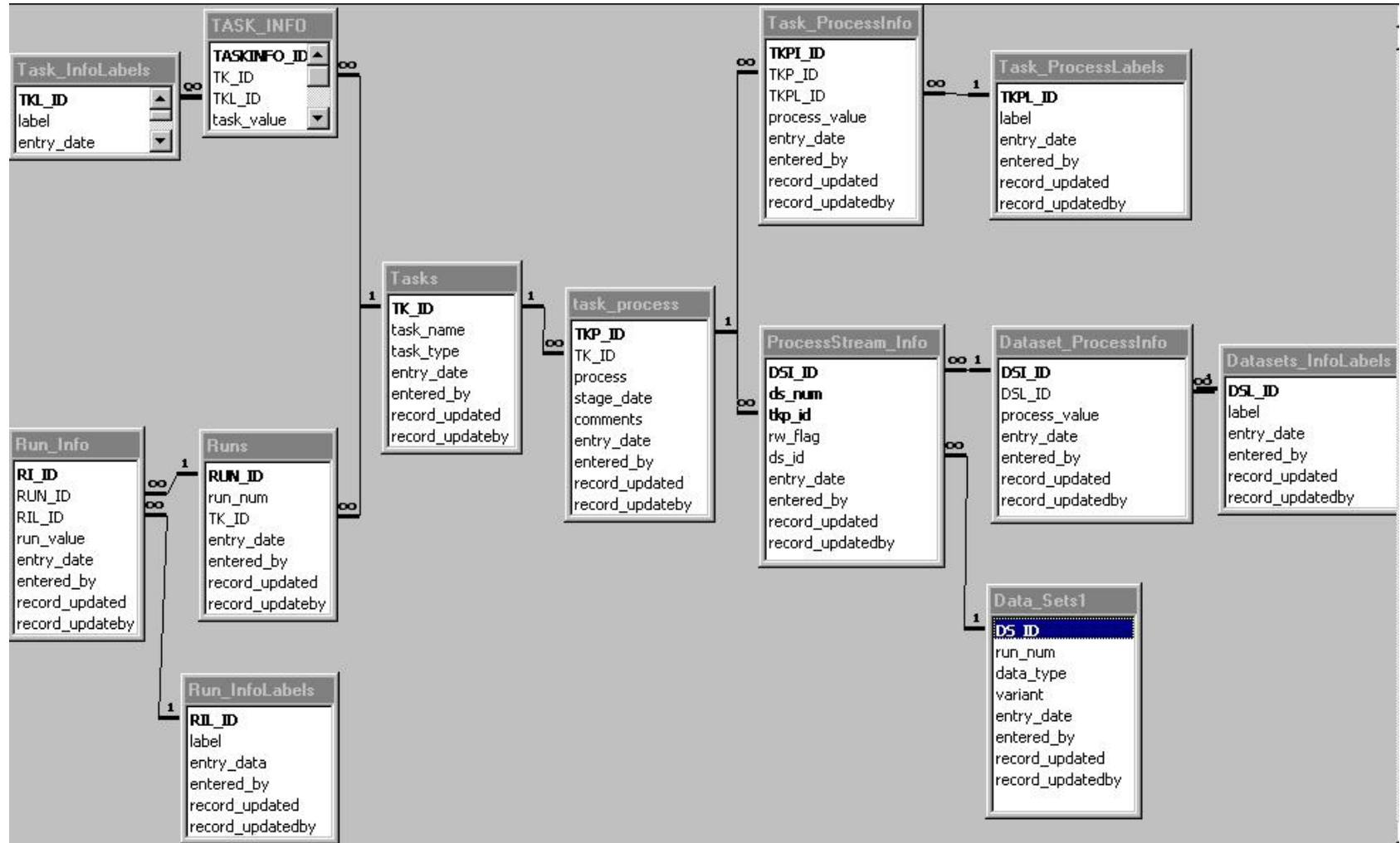
LAT Data Processing Database

- **Heart of data processing facility is a database to handle state of processing, as well as an automated server. Entity diagram for prototype at:**

  http://www-glast.slac.stanford.edu/LAT/balloon/data/db4/erm_Jan_02.htm

  – **relational database tracks state of file based datasets throughout lifetime in the system, from arrival at IOC or MC generation, through Level 1 output.**

  – **Automated server will poll IOC generated database entries for new Level 0 datasets and take immediate action, as well as generate MC data, and log all actions to the database.**

Prototype DB ERM
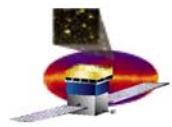
LAT Data Processing Database

Database

- **Three categories of relational tables**
  1. **Tasks**
  2. **Processes**
  3. **Datasets**

- **Tables allow for grouping of similar datasets**

- **"Values" entries in "info" tables allow customization of tables by task, hopefully allowing for different metadata for MC, flight, test beam,… data**

- **Current prototype based on experience with similar data pipeline used for SLD experiment at SLAC**
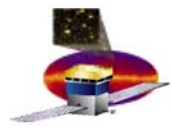
LAT Data Processing Database
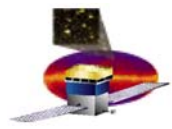
Database Tables I
Tasks

- **Major groupings of datasets, e.g. flight data, BFEM data, or particular MC simulations, (eg 50M background events using pdrApp v7)**

- **Allows grouping of datasets associated with these tasks**

- **Tasks will have differing types of metadata describing them, particularly for MC simulations**
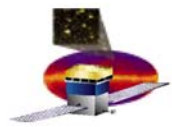
# LAT Data Processing Database

Database Tables II
Processes

- Series of processes will be applied to each input dataset to produce the final output (note that for simulations the input 'dataset' may be an initial random number seed or seed sequence)

- Database will track the sequence of processes as well as all datasets generated by them

- Different tasks may require different processes and, indeed, different sequences

- Executable and its version number should be identified in the database

- Properties of processes (jobs) should also be tracked, for example memory used, CPU time, node name

LAT Data Processing Database
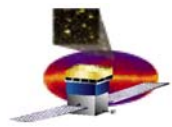
Database Tables III
Datasets

- **Data will be handled as files (on disk or tape)**

- **Datasets will be the inputs and outputs of processes in the sequences**

- **Processes can generate multiple datasets**

- **Processes in a sequence may depend on particular output datasets of precursor processes**

- **Properties of datasets will be recorded, eg location, size, status**

- **Datasets may also contain metadata (different for different tasks)**
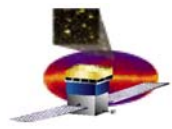
Data Manager Prototype

Existing Data Manager Prototype is set of perl scripts that:

• **Performs automated MC batch processing using LSF and SLAC batch farm (e.g. produced 50 M background events, 10 M gammas for PDR studies)**

• **Provides utilities for processing, filtering , and displaying results of MC runs**

• **Provides very preliminary scripts for entering results of MC runs into Oracle tables**

• **Will evolve into Data Manager for Data Processing Facility (DPF) by being split into a server and set of utility packages as described in Data Manager spec**

Manpower & Schedule

- **Budget cut for '02 delays official start until FY '03**
  - **Starting anyways with prototypes**
  - **Use student help and steal time**
- **Manpower Estimates**
  - **Server – 1 FTE for 1 year**
  - **Diagnostics – 1 FTE for 6 months**
  - **Web interface – 1 FTE for ~ 2 months**
  - **Support – 0.5 FTE**

- **Schedule**
  - **We'll see how the student help works out. Want a system in place now to track MC processing.**
  - **Diagnostics - delay start until nearer launch. May need to set up for Qual unit in late '03.**