National Aeronautics and Space Administration
NASA
Fermi
Gamma-ray Space Telescope
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Fermi Gamma-ray Space Telescope

Design and implementation of the Fermi LAT level 1 pipeline

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SLAC SCA

Fermi

- Orbital gamma-ray telescope
  - Launched June, 2008
- We want to turn the data around quickly
  - Because something might be happening right now
- But it's in orbit
  - Which means data delivery to us is bursty and, well...
    - Sometimes the data arrives out of order
    - Sometimes they send it twice (or more)
    - Sometimes it arrives late
    - Sometimes it never comes (this is rare)

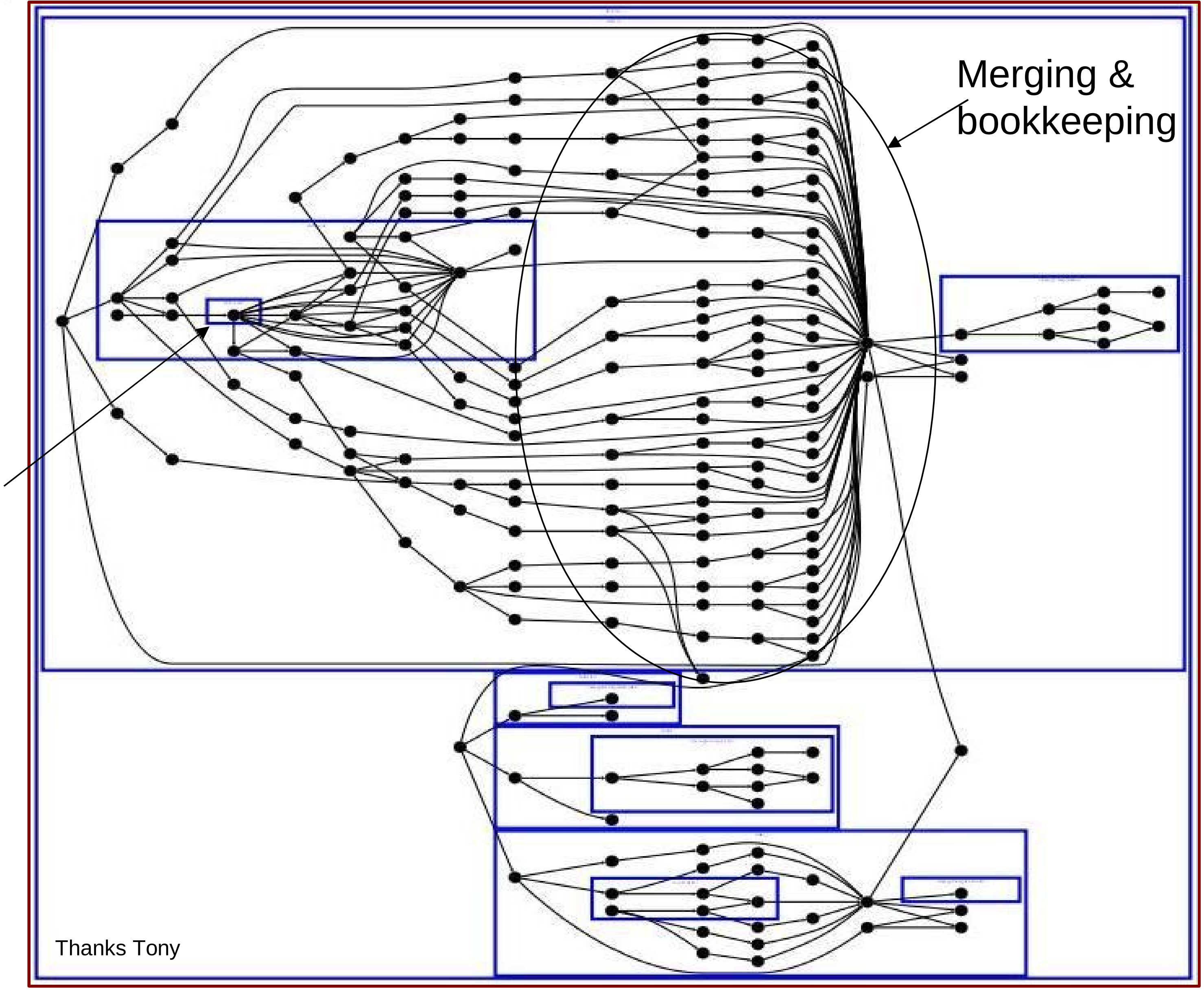
Data Flow

- TDRSS
    - NASA's near-Earth space network
- White Sands
    - TDRSS base station
- NASA Goddard
    - Fermi Mission Operations Center
- SLAC
    - Fermi LAT Instrument Science Operations Center
        - Up to here it's been data straight out of the spacecraft recorder.
        - Now we turn it into photons and send them to...
- NASA Goddard
    - Fermi Science Support Center

Processing

- Takes ~125 hours of CPU to process 1 hour of data
  - Plus waiting for disks, network, ...
  - So ~150-175 core-hours
- Data is delivered ~ every 3 hours (3 hours worth)
  - And the project wants that processed in an hour
    - Which we almost manage
  - So we need ~500 cores
  - OCIO gives us 800
- Where does the time go?
  - Mostly reconstruction
  - Plus lots of instrument health monitoring
  - 2000-3000 jobs every 3 hours
    - About half of them are recon
- Multiple levels of parallelism
  - We try to make most jobs take 5-30 minutes
  - Change block sizes, shuffle jobs between levels to achieve this
- This is mostly Python wrappers around other people's code
  - Including a library of things useful to most pipeline users that's shared with MC, reprocessing, and Automated Science Processing
    - GPLtools – ask me or Tom Glanzman

Dependency Flow



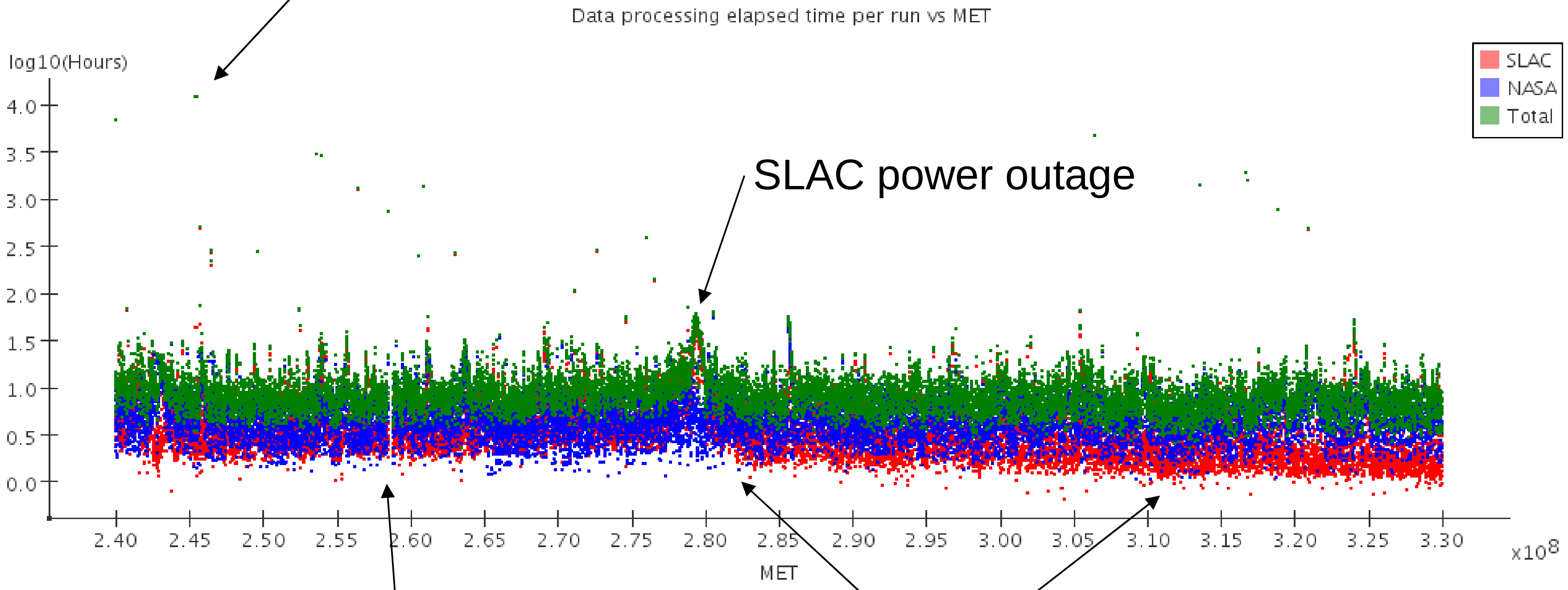
Merging & bookkeeping

recon

Thanks Tony

Performance vs Time

Misplaced 4 hours – found it 2 years later



SLAC power outage

Load shed - SEU?

I/O upgrades