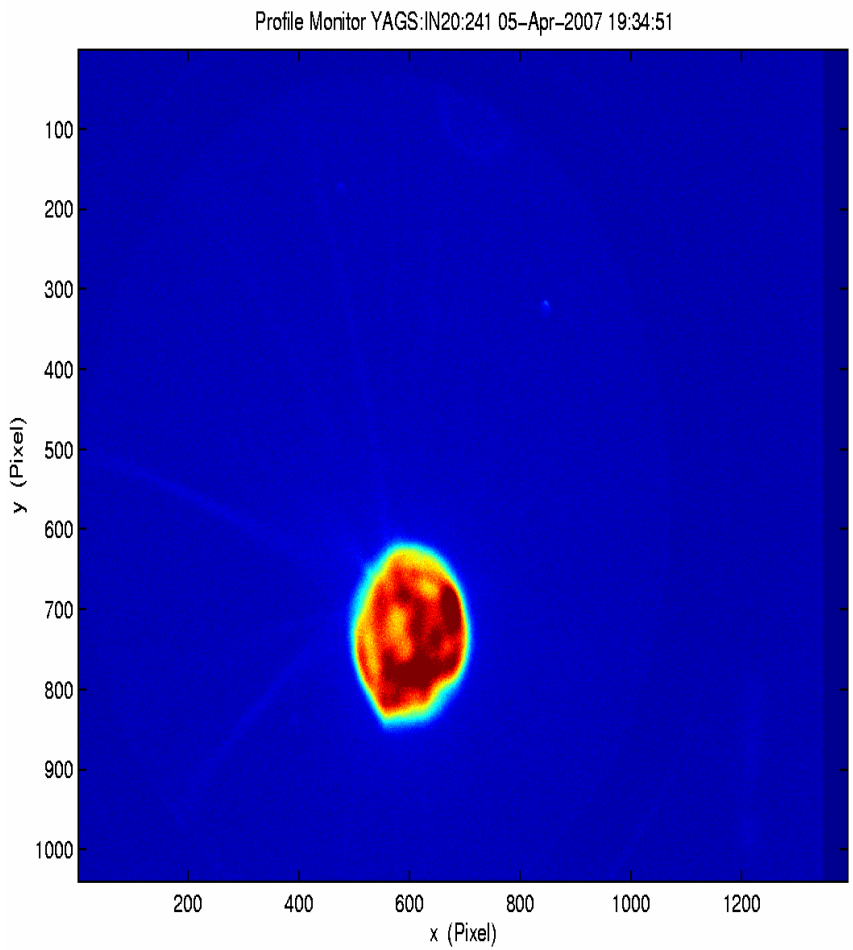
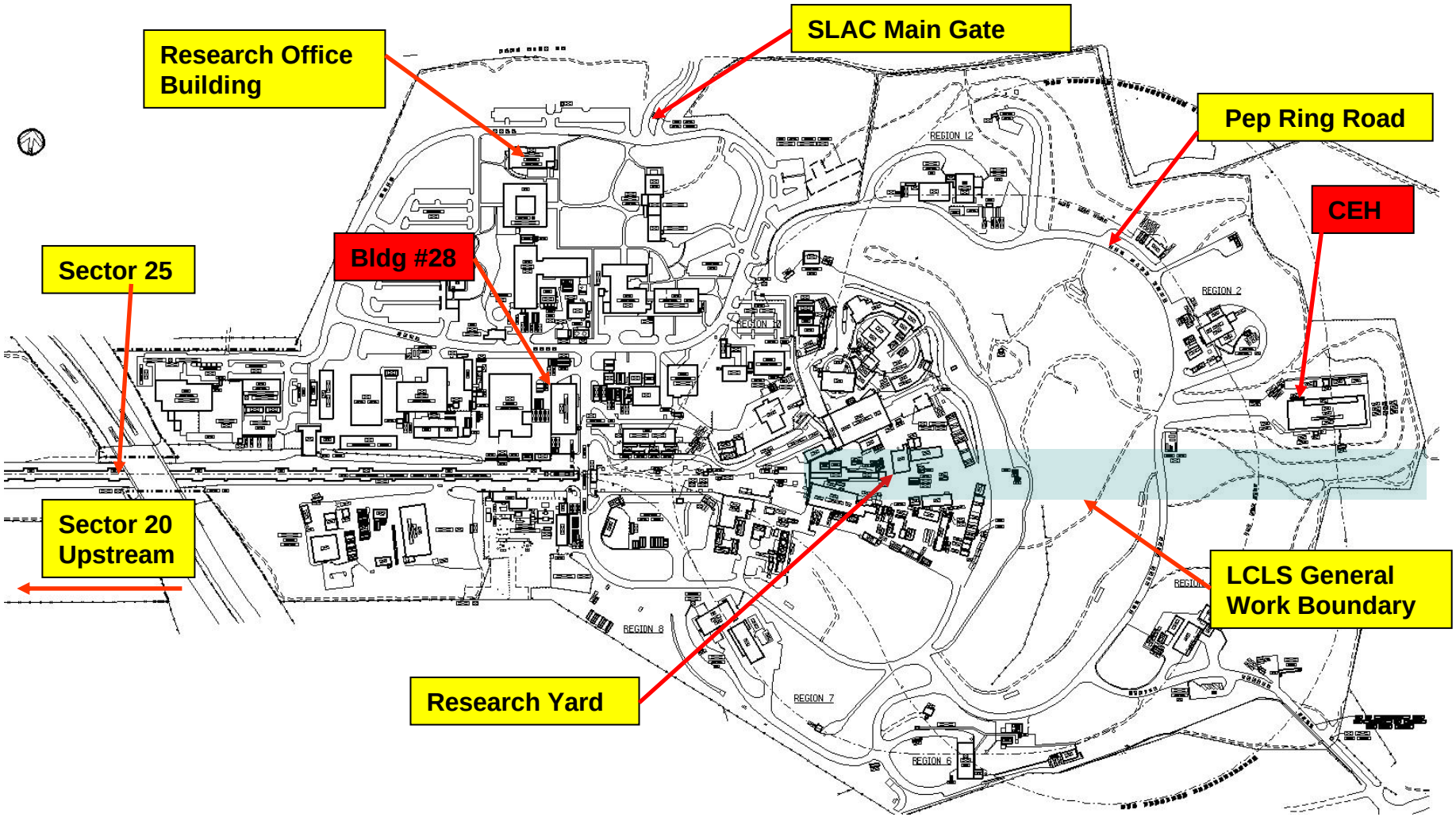
LCLS Status and Plans

First Beam

- LCLS commissioned a new injector with beam
- AND commissioned a new Control System



SLAC Site Plan



Scope of Construction

- Systems Description remain unchanged
  - Sector 20 Injector Facility – completed in May 2006
  - Magnetic Measurement Facility – completed in April 2006
  - Linac Improvements – to be completed in 07 shutdown
  - Beam Transport Hall – in process ~ 15% complete
  - Undulator Hall – in process ~ 5% complete
  - Front End Enclosure – in process 5% complete
  - Electron Beam Dump – in process ~ 5% complete
  - Near Experimental Hall – in process ~ 35% complete
  - X-Ray Transport & Diagnostics Tunnel – in process ~ 5% complete
  - Far Experimental Hall – in process ~ 10% complete
  - Lab infrastructure - design is imminent

Beam Transport Hall – 227m long above grade facility to transport the electron beam through the existing RSY

Undulator Hall – 170m long underground tunnel housing undulators and ancillary equipment

Near Experimental Hall – underground facility whose primary function is to house 3 experimental hutches, prep and shops

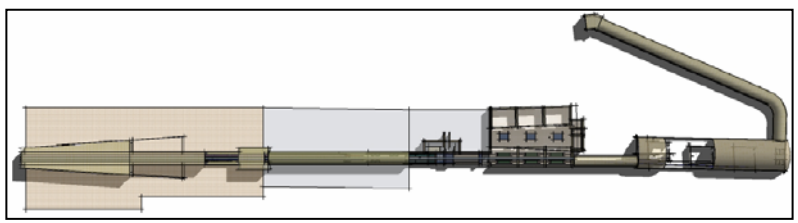
Far Experimental Hall – underground single 46' cavern to house 3 experimental hutches and prep space

Electron Beam Dump – 40m long underground facility used to separate the electron and x-ray beams

Front End Enclosure – 40m long underground facility to house various diagnostic equipment in support of the photon beam

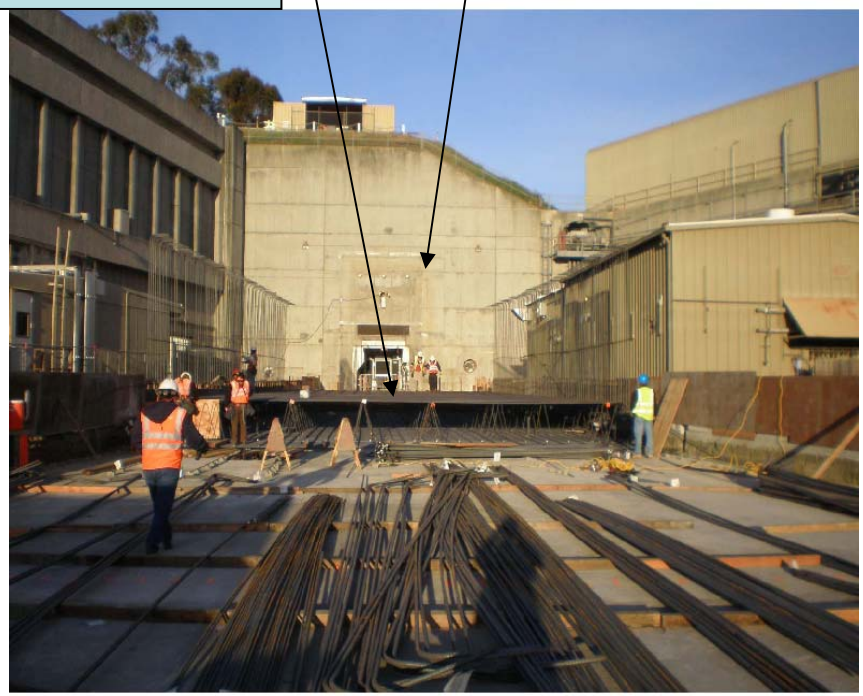
X-Ray Transport & Diagnostics Tunnel – 200m long underground tunnel used to transport photon beams from NEH to FEH

~100' location of tunneling to date in access tunnel

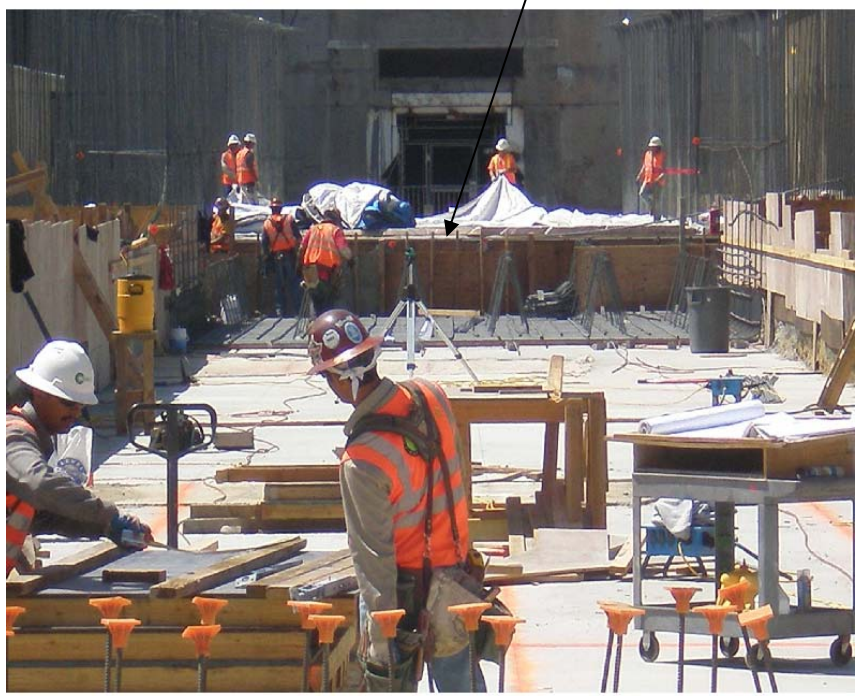


BTH Head-house Rebar at Slab

Headwall



BTH Head-house Slab



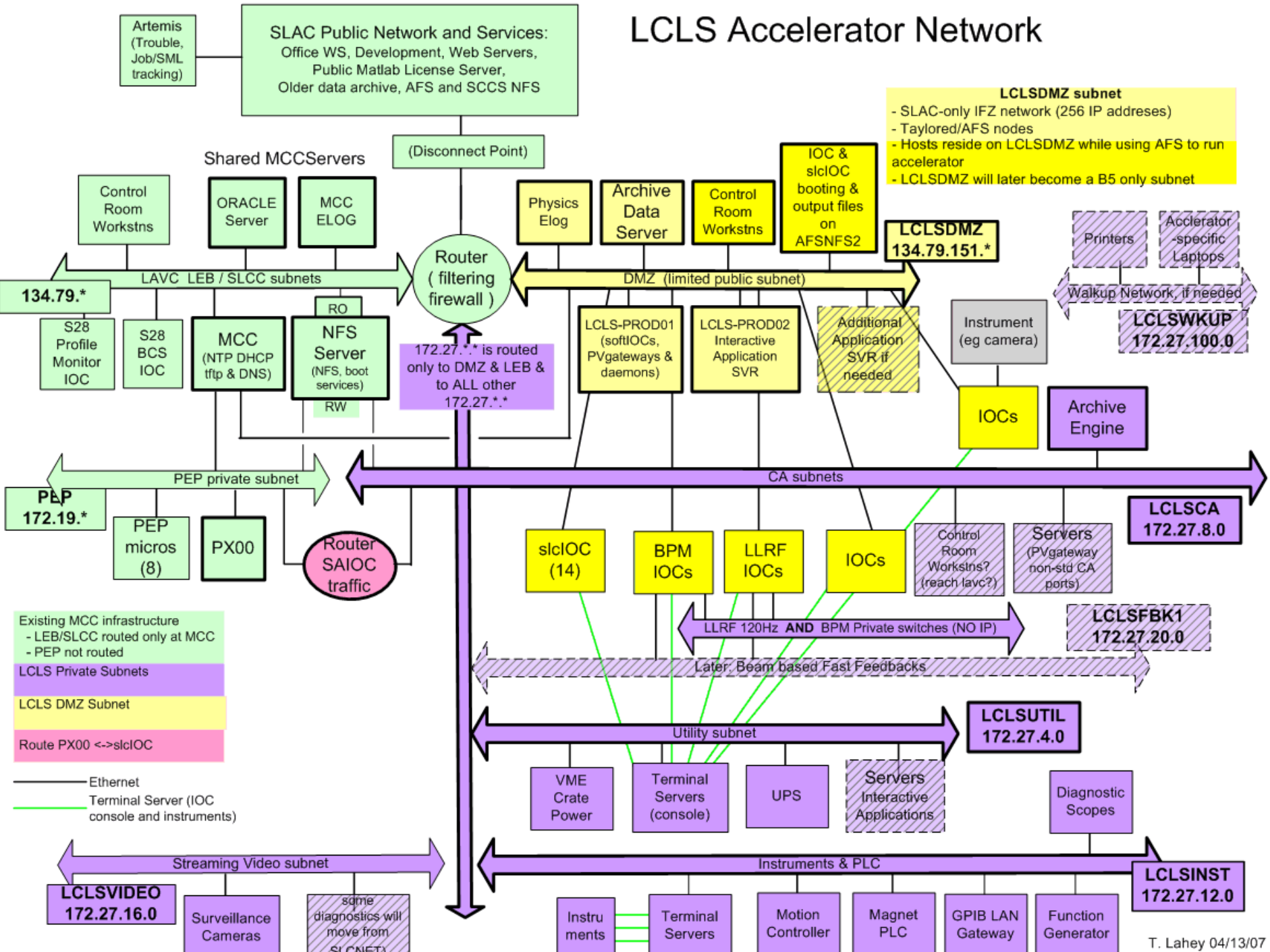
Road header for UH

UH initial penetration of portal

Accomplishments in the past six months

- Field installation of large amount of cable plant, networking, racks, electronics and software for injector control
- Development of detailed plans for linac and BC2 installation
- Coordination and re-planning of undulator control with ANL
- Development of a conceptual design for X-ray End Stations DAQ and Controls
- AIP projects for MCC networks upgrade, LCLS MPS and Linac BPM
- Starting the design of next generation applications software

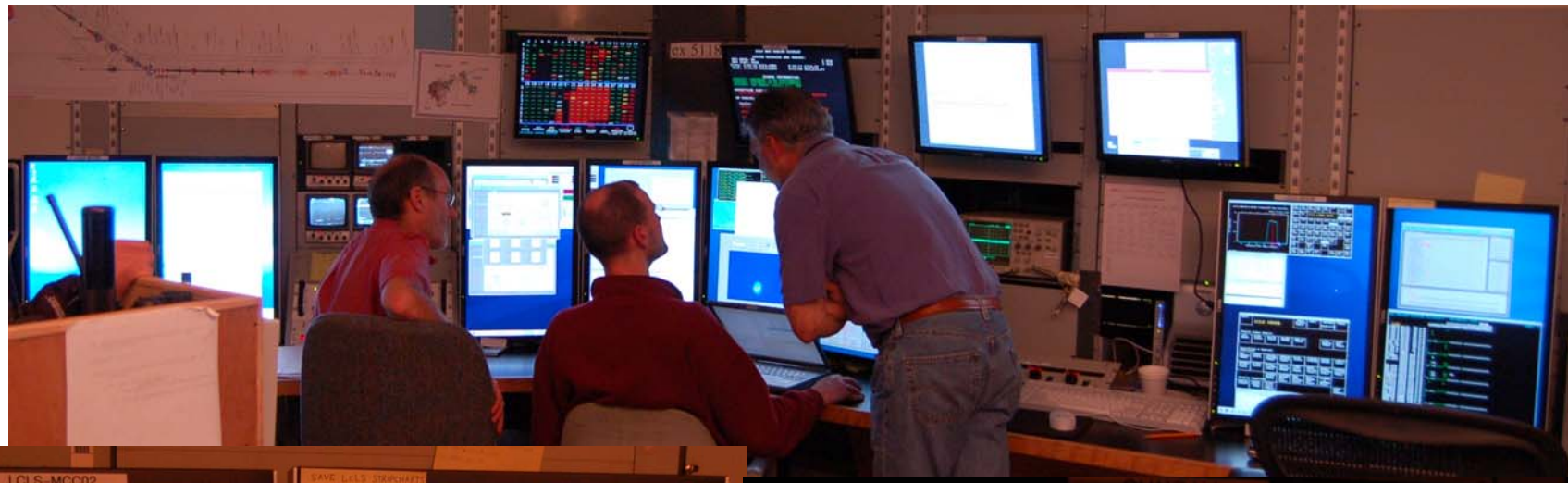
LCLS Accelerator Network



MCC, Networks, Servers, & Workstations

- Production Systems Delivered
  - Networks at S20 RF Hut & MCC: physical and wireless
    - LCLSDMZ, LCLS private, wireless
  - MCC infrastructure upgrade: power & racks
  - LINUX Servers for applications and EPICS data archiving
  - Control Room Linux Workstation
  - MCC and S20 Laser Room are actively in use for commissioning

Main Control Center is in full operation



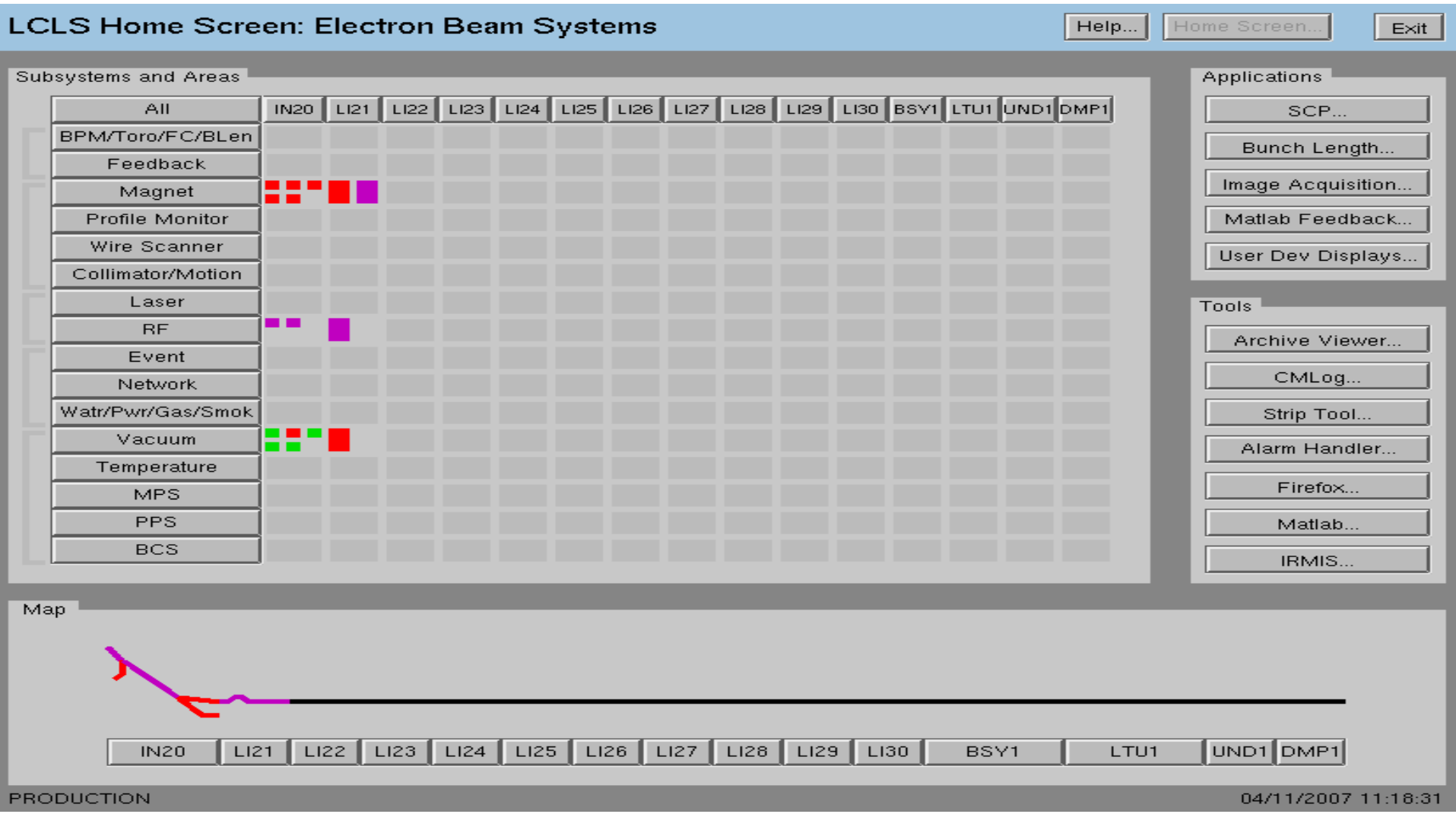
Controls Sub-Systems installed

- ✓ Cable Plant, Racks, etc.
- ✓ Networking
- ✓ MCC infrastructure
- ✓ Magnet power supply
- ✓ Vacuum Controls
- ✓ LLRF
- ✓ Timing
- ✓ Laser control
- ✓ Laser alignment
- ✓ OTR/YAG image acquisition
- ✓ BPM
- ✓ Toroid
- ✓ Wire Scanners

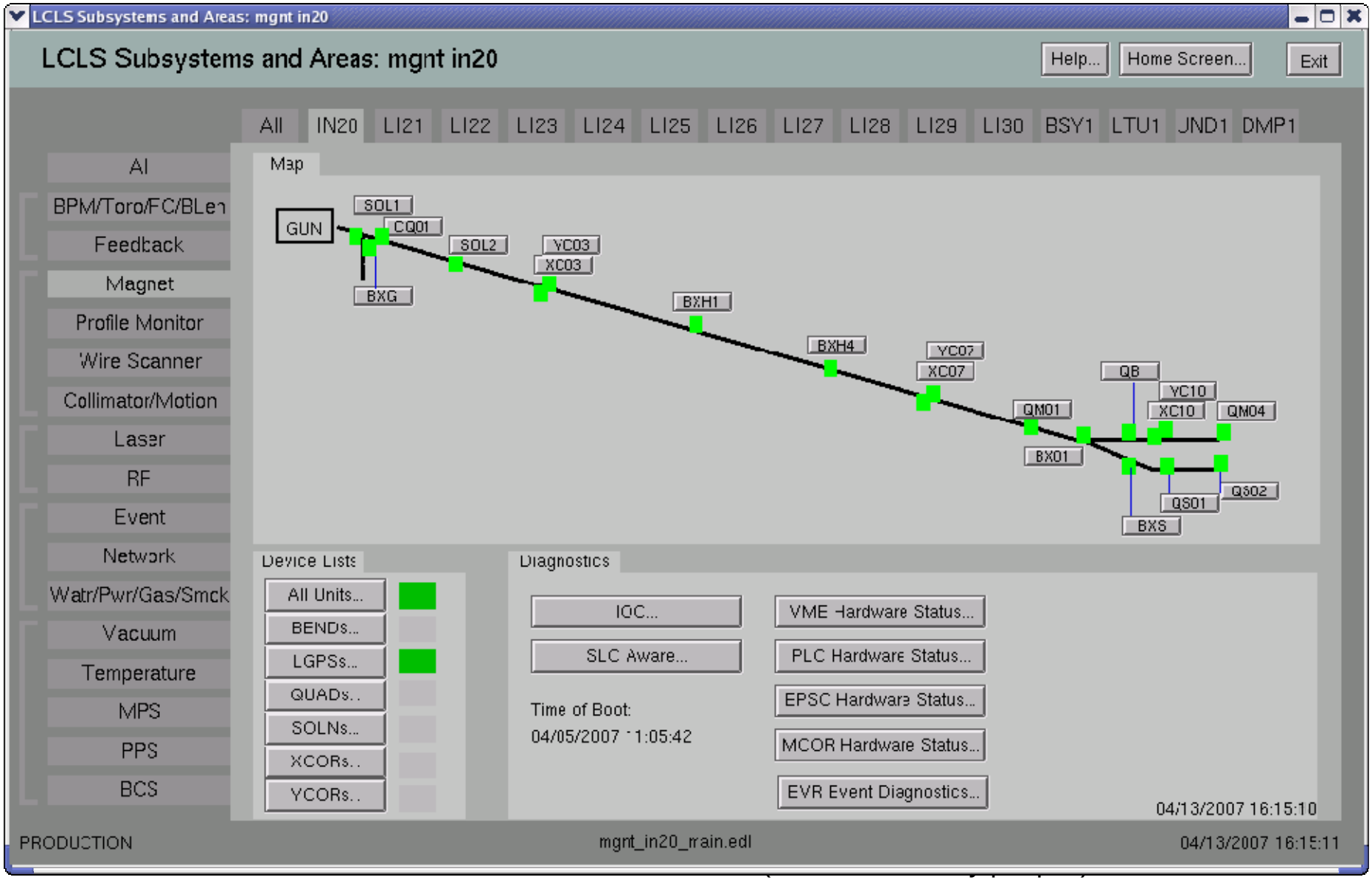
- ✓ Faraday Cup
- ✓ Cerenkov monitor
- ✓ Moveable collimator
- ✓ BC1 beamline control
- ✓ Bunch length monitor
- ✓ LSS
- ✓ PPS
- ✓ MPS
- ✓ BCS
- ✓ Gun Temp stabilization
- ✓ Image management
- ✓ Online Models
- ✓ MATLAB interface

LCLS Controls Home Screen

Schuh
Norum

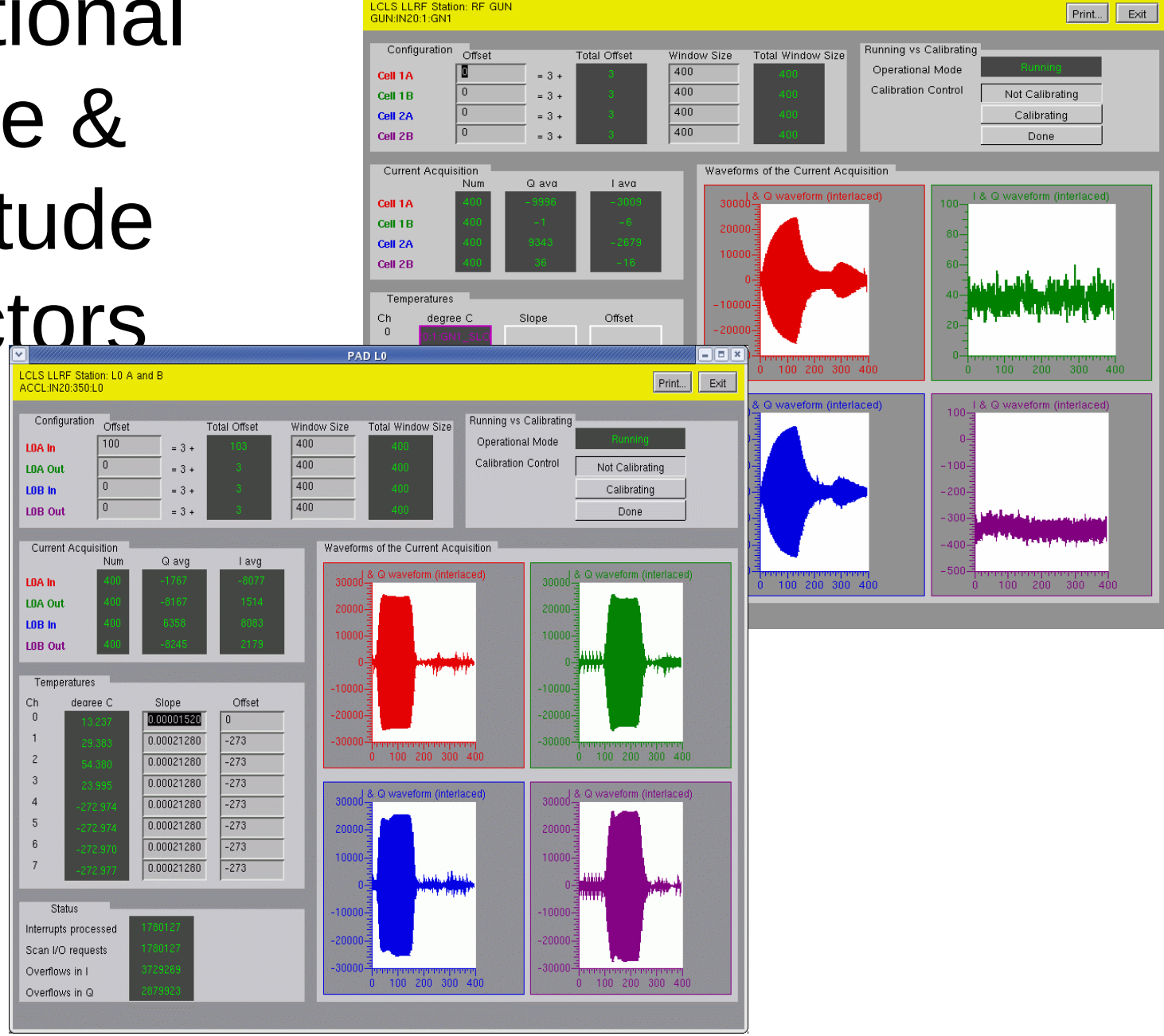


Magnet Controls



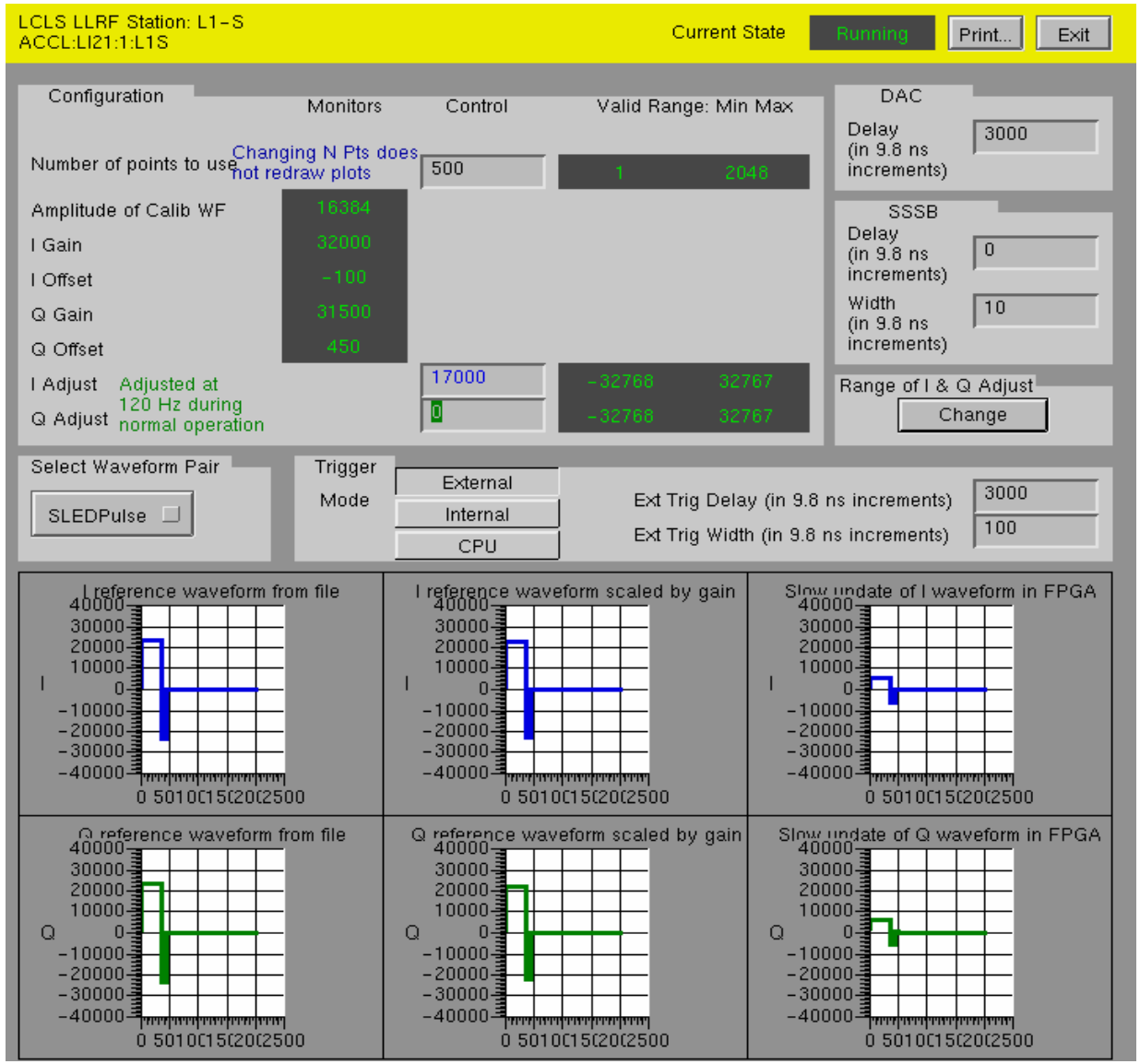
Operational Phase & Amplitude Detectors

- S-Band Ref System
- Laser
- Gun
- L0 (A&B)
- L1-S



Operational Phase & Amplitude Controllers

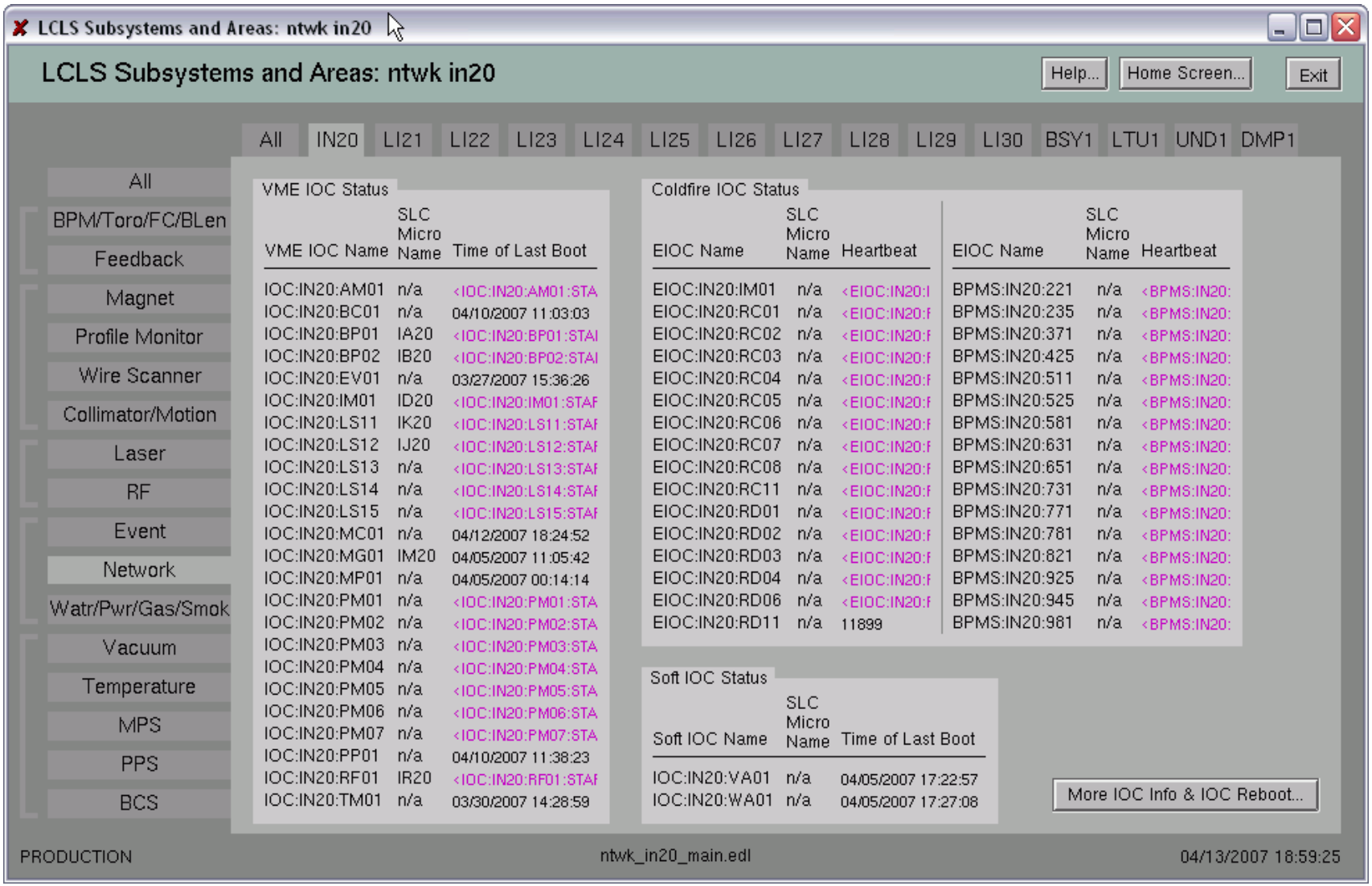
- S-Band Reference System
- Laser
- Gun
- L0-A
- L0-B
- L1-S



April 24, 2007

EPICS Collaboration Meeting
DESY – R. Chestnut (Slides from many people!)

Monitoring IOCs



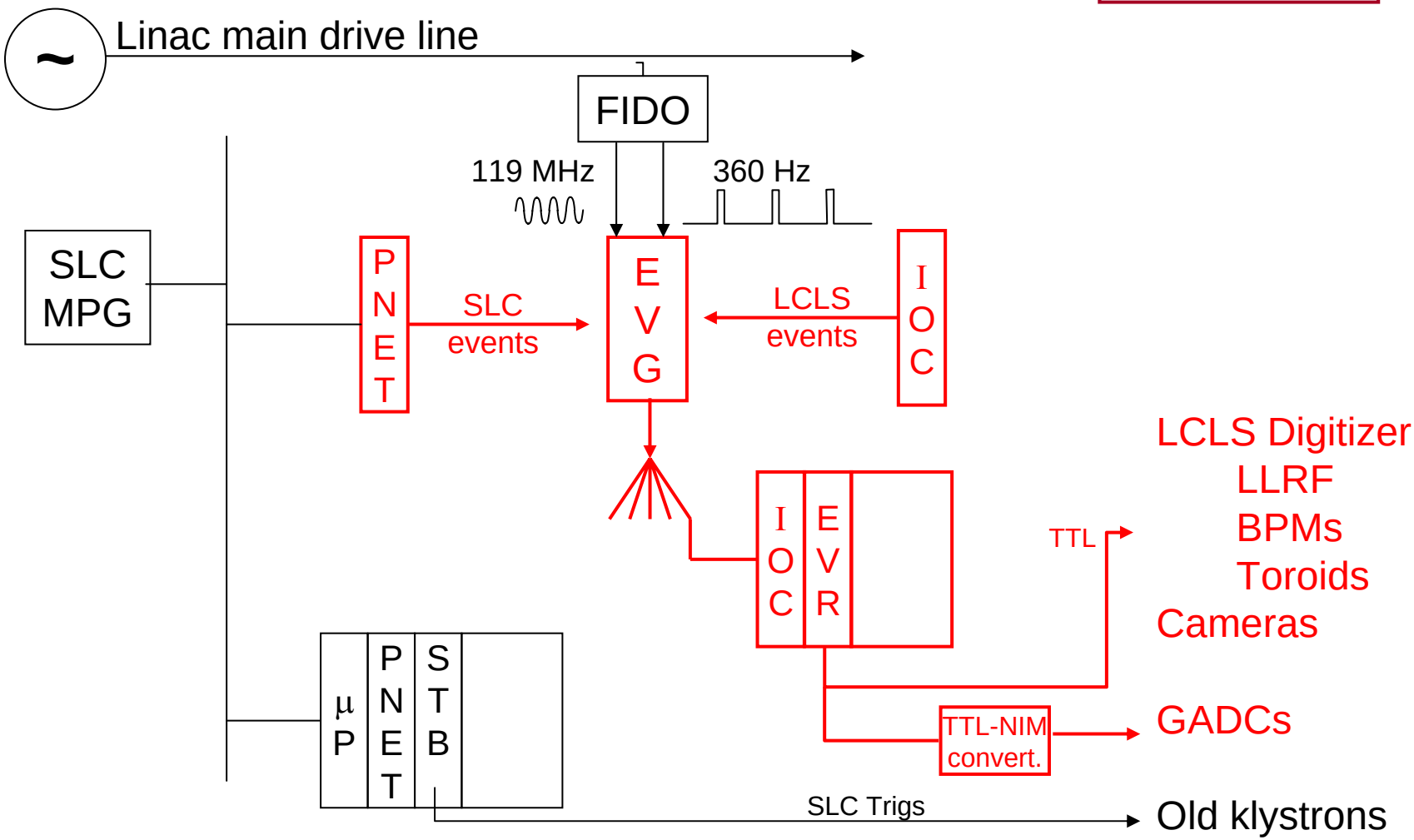
Injection Laser Control System

- The injector laser stabilization system includes two feedback loops
  - The first loop includes two mirrors, each with two actuators and one camera. It stabilizes laser traveling through a 10-meter tube
  - The second loop includes one mirror with two actuators and adjusts the laser position on the cathode.
- The IOC reads the image from camera, calculates the laser's position error and applies a correction to the actuators.
- The loop operates @ 1 Hz, and the camera is synced to 120Hz.

S. Peng

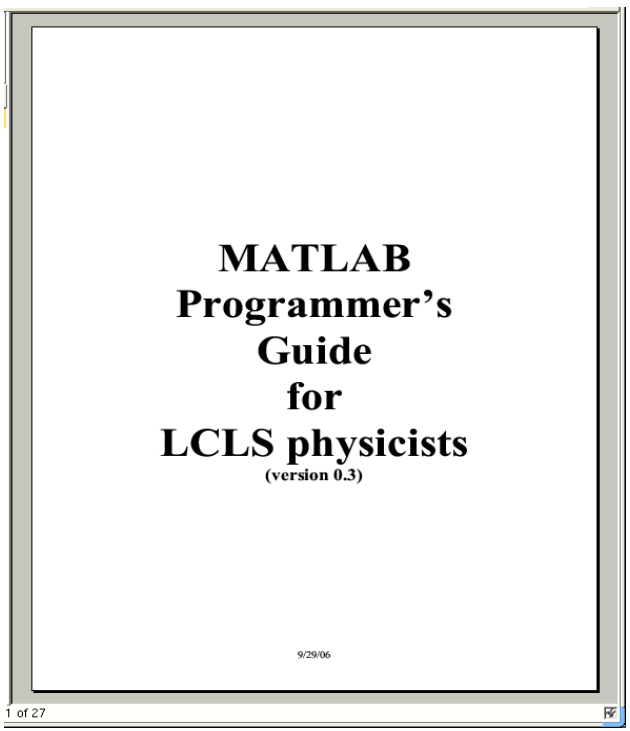
Timing System

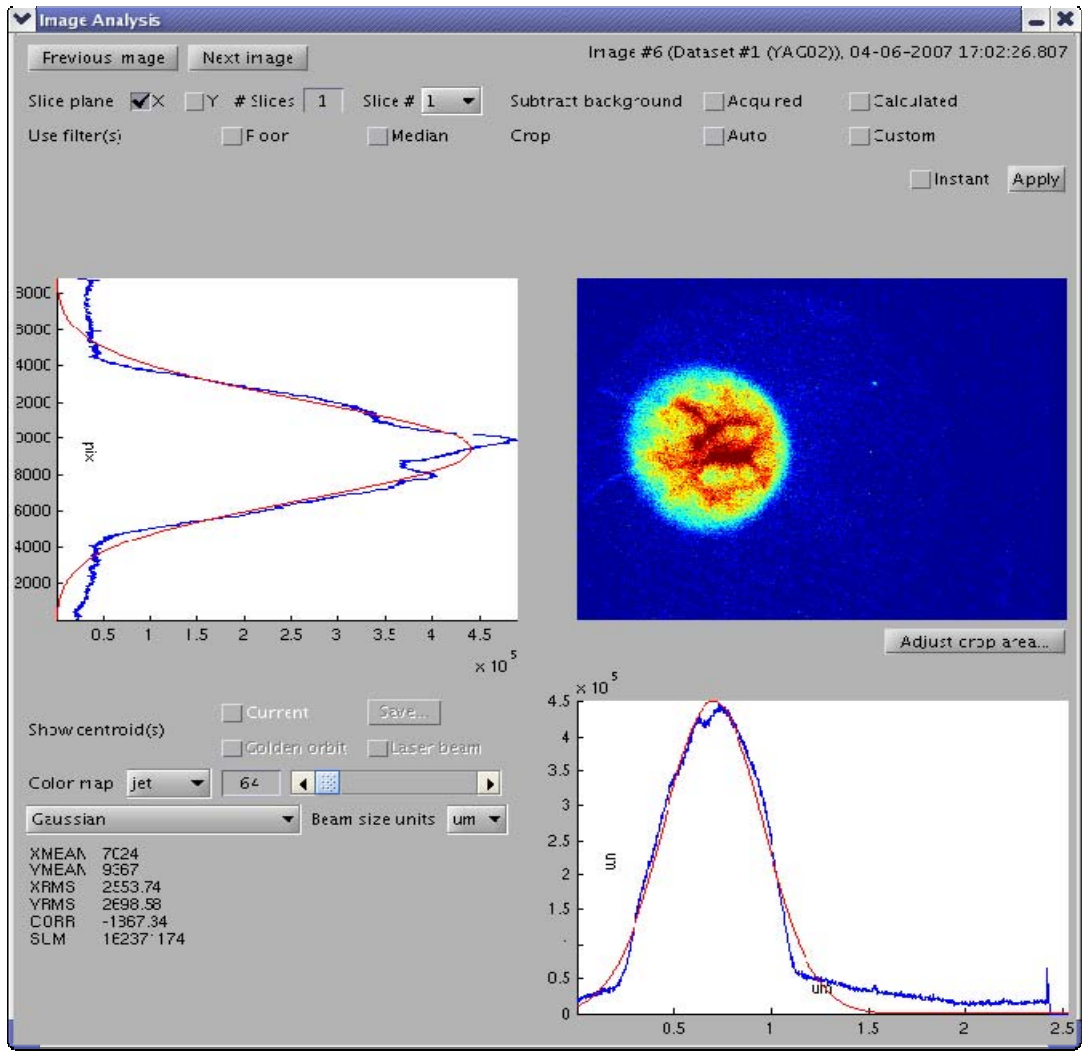
Stephanie



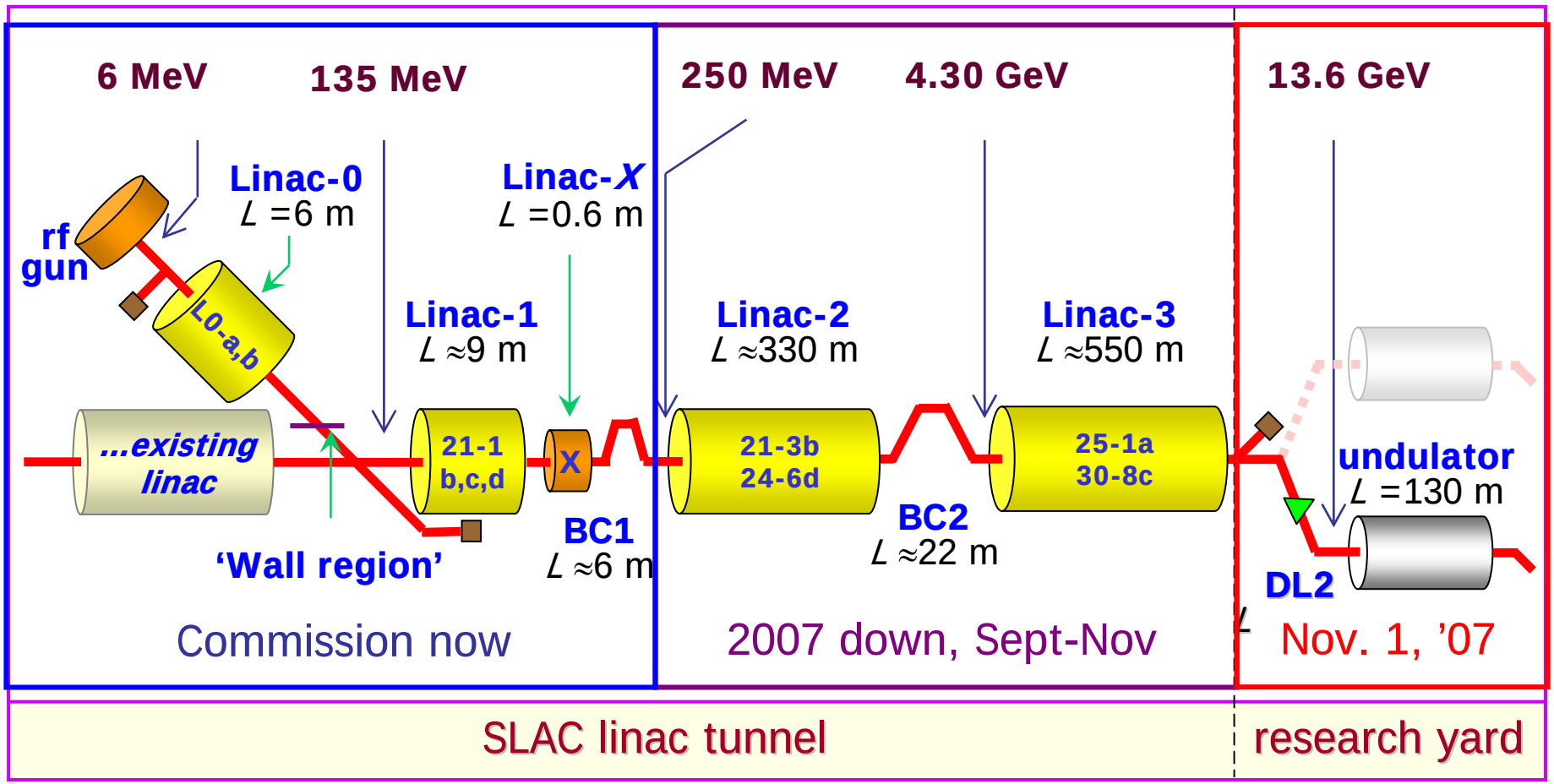
Applications provided in MATLAB

- Image Management
- Bunch Length Measurement
- Emittance and Energy Application

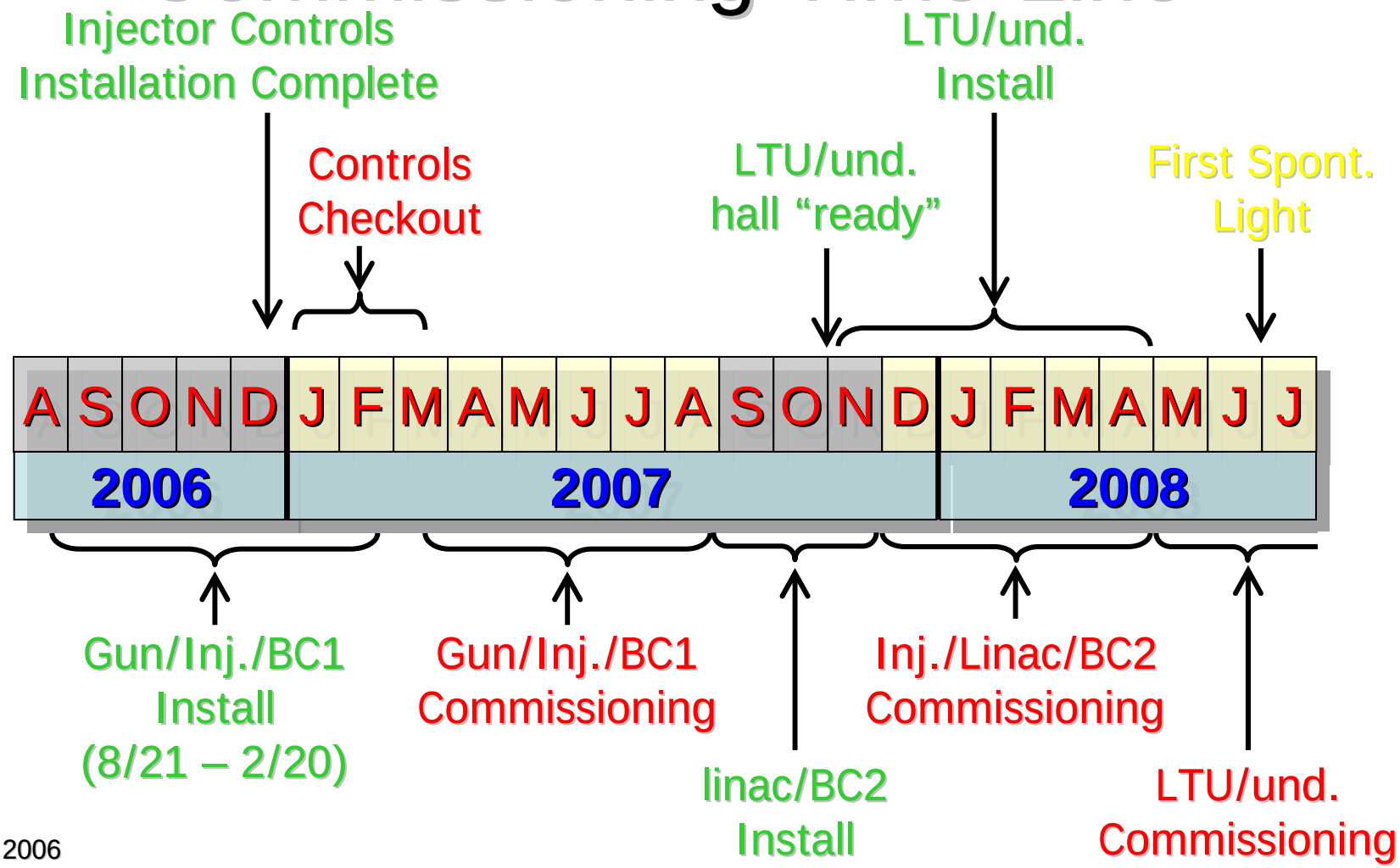




LCLS Accelerator Regions



LCLS Installation and Commissioning Time-Line



Oct. 19, 2006

Linac & BC2 Controls Installation (Fall '07)

- BC2 installation, similar scope to BC1
- Very little engineering development
- The biggest challenge is meeting the schedule
- The scope includes
  - Extending the new timing system
  - Safety systems (MPS, BCS)
  - Adding new magnets including pulsed horizontal dipole magnet
  - Adding BPM, x-collimator, OTR screen
  - BPM electronics upgraded (resolution improved)

Other Developments

- Hamid Shoaee now Controls Department Head (former LCLS Controls now fully integrated)
- New hires
  - Chris Larrieu
  - Paul Chu
  - Ernest Williams
- PEP shutting off Sept. 30, 2008
- SLAC becoming a Basic Energy Science lab (with some High Energy Physics activity)

Plans for the Next Six Months

- Complete the majority of Linac BC2 installation
- Develop detailed plans for LTU, Undulator installation
- Complete the design of XES controls, DAQ and data management
- Complete Accelerator Improvement Projects
- Detailed design for next generation high level applications

Long Term Plans

- LUSI – 6 experimental areas to support
- LCLS-2 – add a second undulator + more experimental areas
- Higher energy electrons -> lower wavelength X-rays; build new injector at sector 10
- Plenty to do at SLAC for the next decade

X-Ray End Station DAQ & Controls

- Developed a conceptual design for end station data acquisition and control
- Held a Conceptual Design Review
- Developed a detailed task list and a project plan

- The AMOS experiment may eventually take data @120Hz producing ~700 MB/second or 2.4 TB/hour or ~**58 TB/24 hour**
- The plan is to build on previous experience.
- Initially use commercial digitizer and COTS CPU for spectrometer data.
- Use scalable technology developed for LSST for CCD data.

- Capitalize on years of BaBar experience with hierarchical storage and management of HEP data.
  - ~1 TB/day raw data.
  - ~1 TB/day derived data.
  - ~1.5 PB total Babar data.

- **Extend/integrate several SLAC-developed Java-based technologies for data retrieval and analysis.**

Long Term Plans