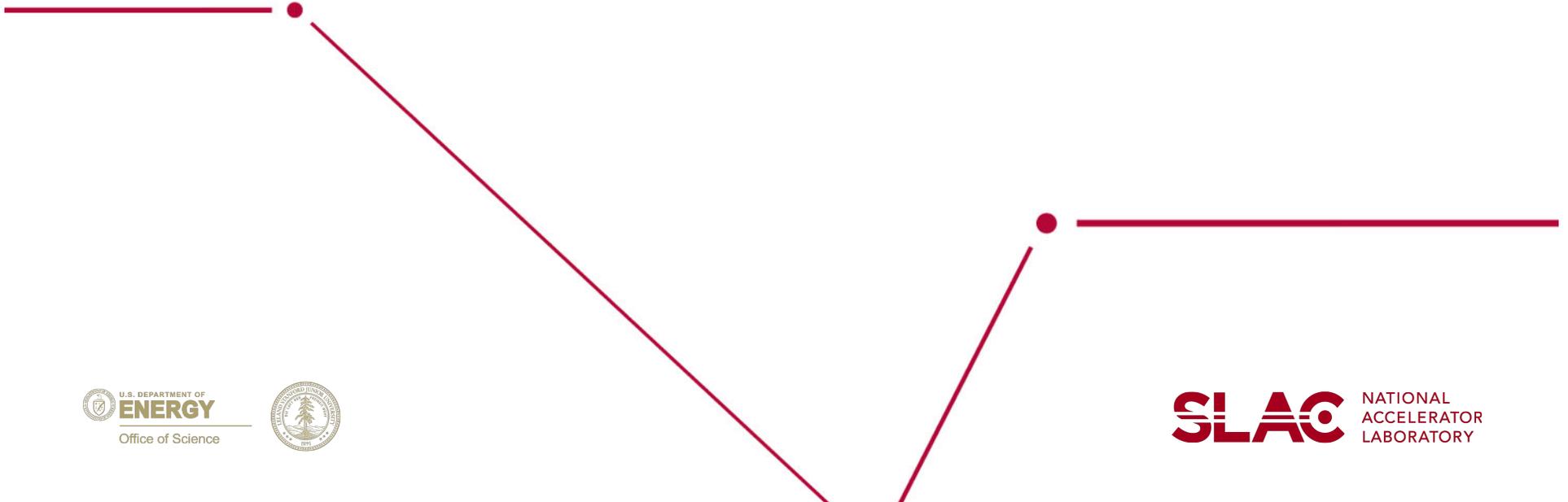


ASCR Intelligent Optical Network Infrastructure Workshop, August 5-6th 2014

LCLS Data Management

Amedeo Perazzo
SLAC



Coherent Light Source

Electron Energy: 2.5 – 14.7 GeV Injector at 2-km point

Existing 1/3 Linac (1 km)
(with modifications)

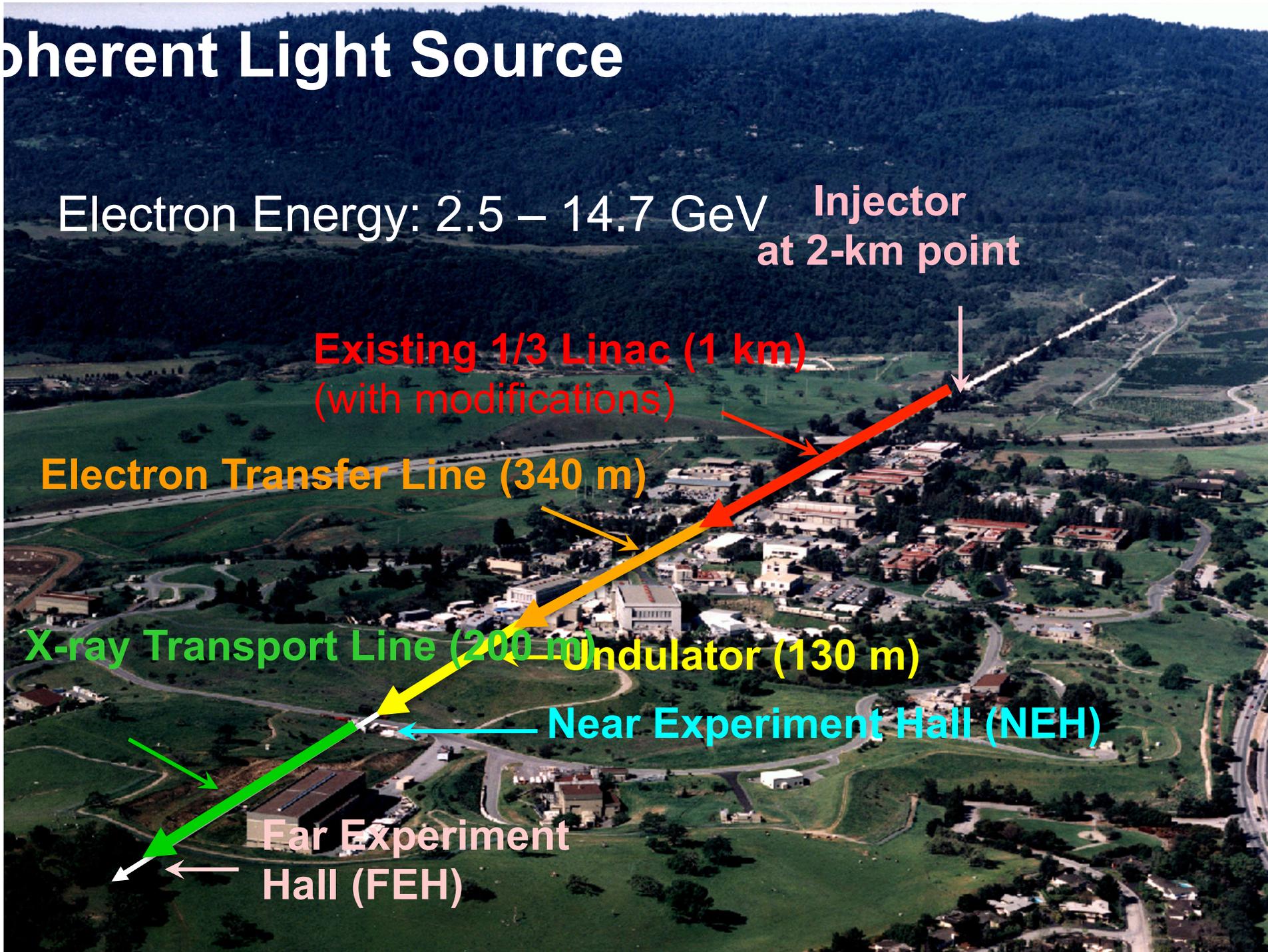
Electron Transfer Line (340 m)

X-ray Transport Line (200 m)

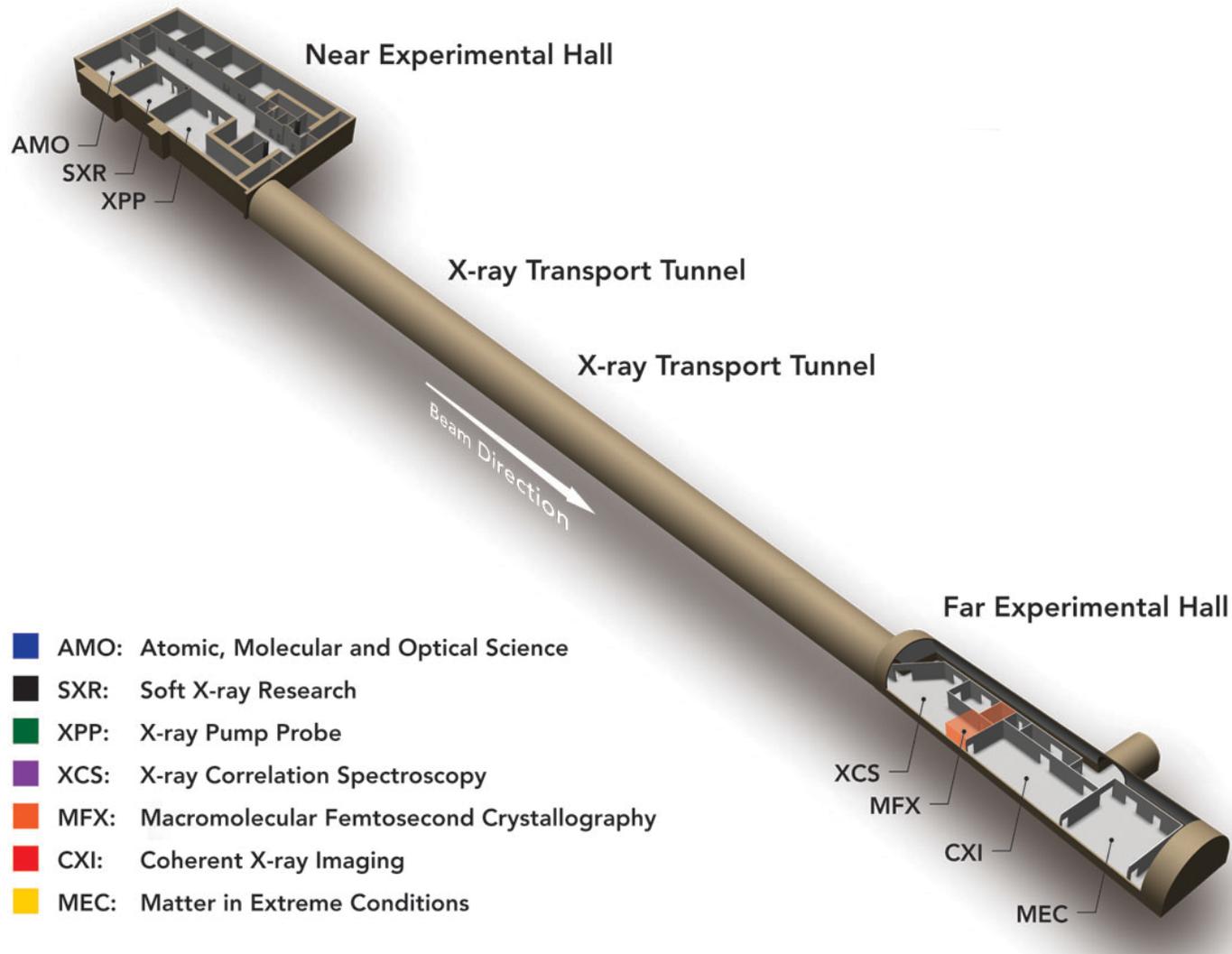
Undulator (130 m)

Near Experiment Hall (NEH)

Far Experiment Hall (FEH)

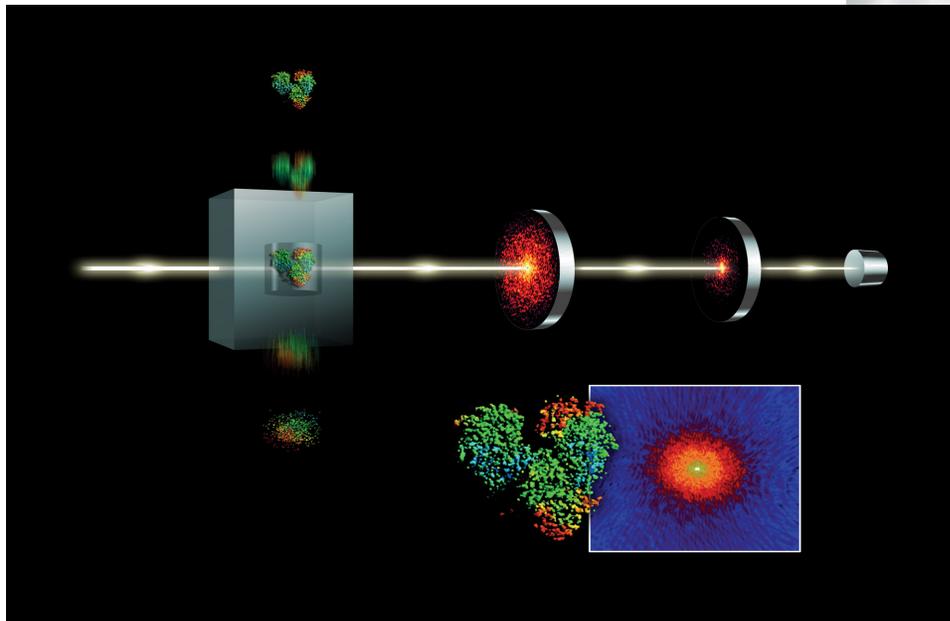
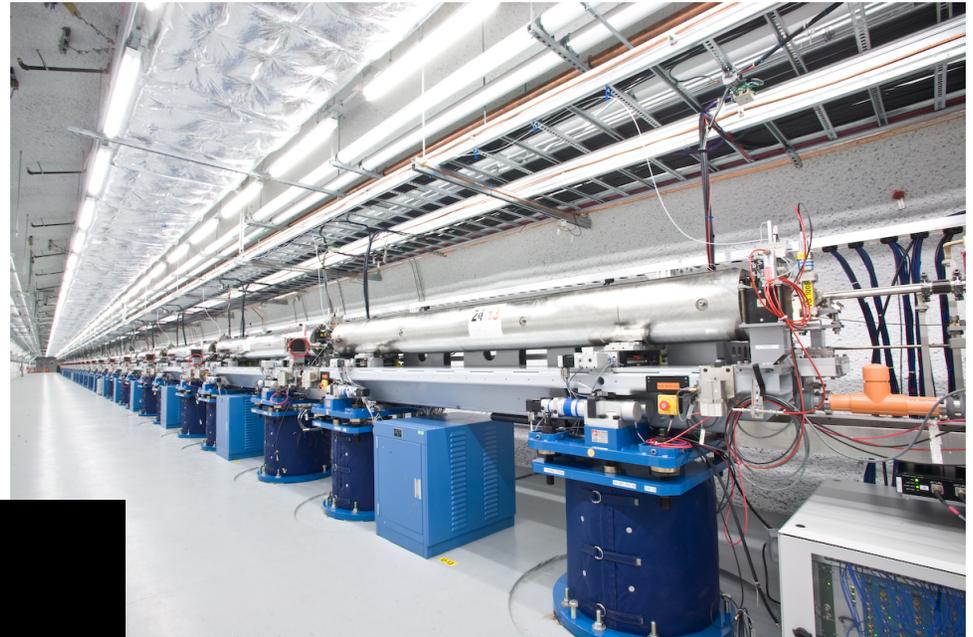


LCLS Experimental Floor



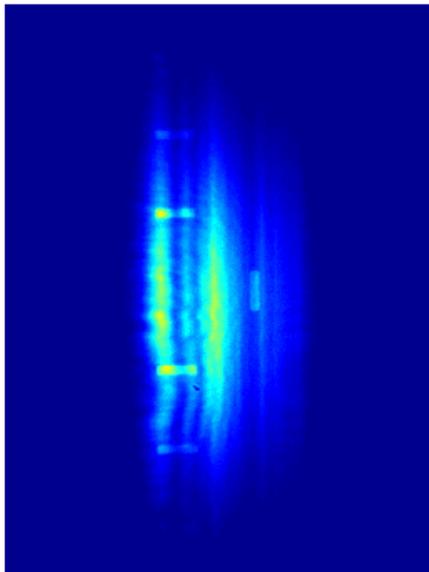
LCLS Parameters

X-Ray range	250 to 11,300 eV
Pulse length	< 5 - 500 fs
Pulse energy	~ 4 mJ
Repetition Rate	120 Hz

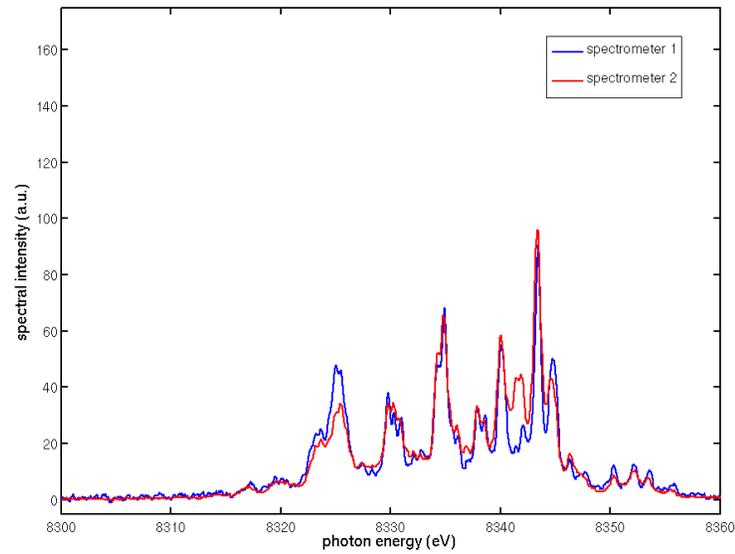


LCLS Source Fluctuations

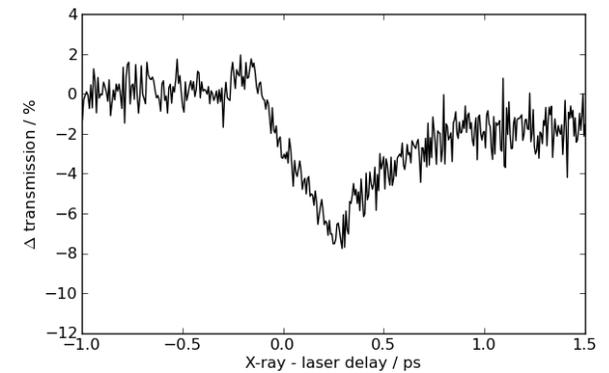
Spatial



Spectral

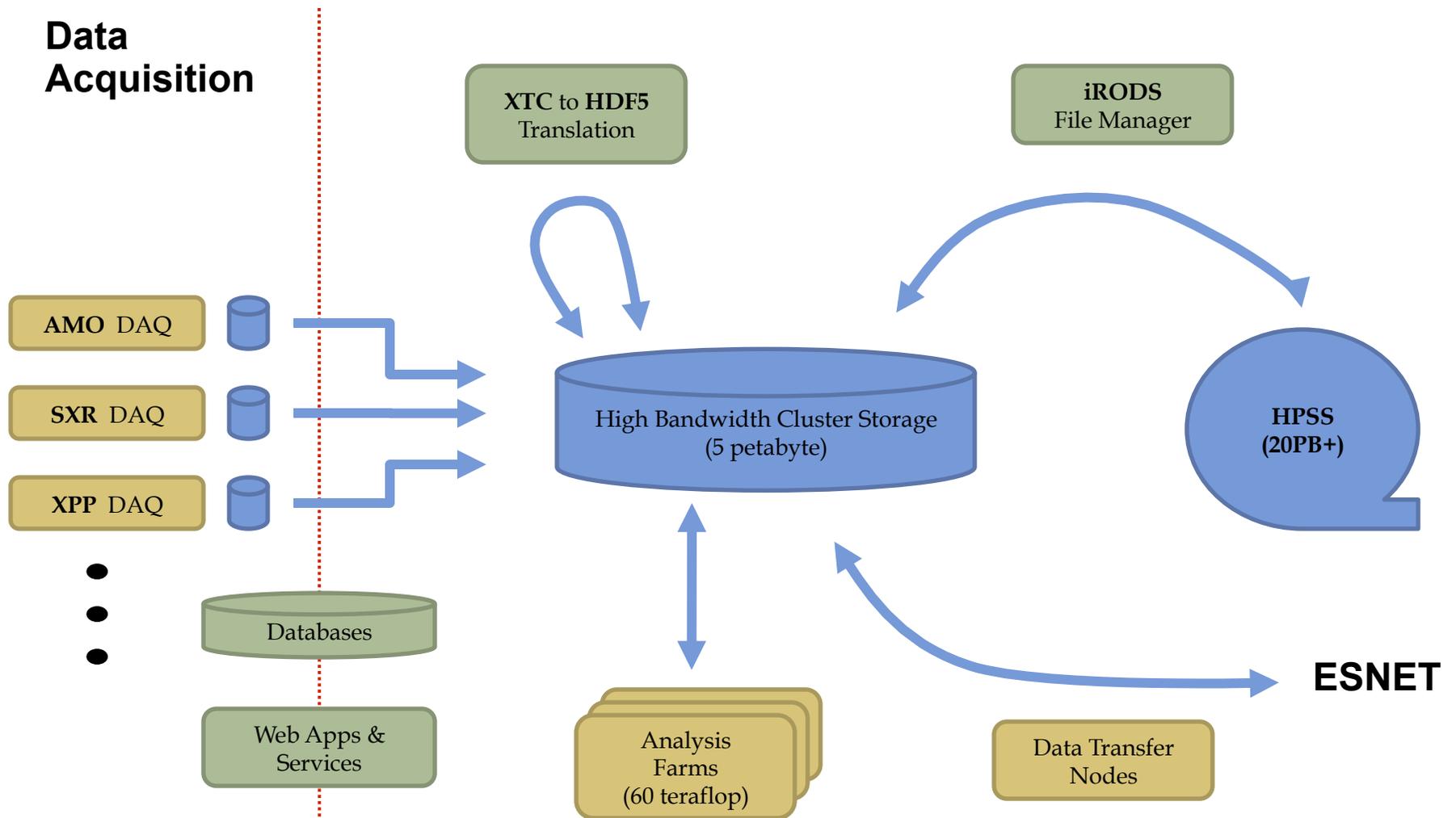


Temporal



Per pulse readout of detectors and diagnostics is crucial

Data Systems Architecture



LCLS Computing Needs

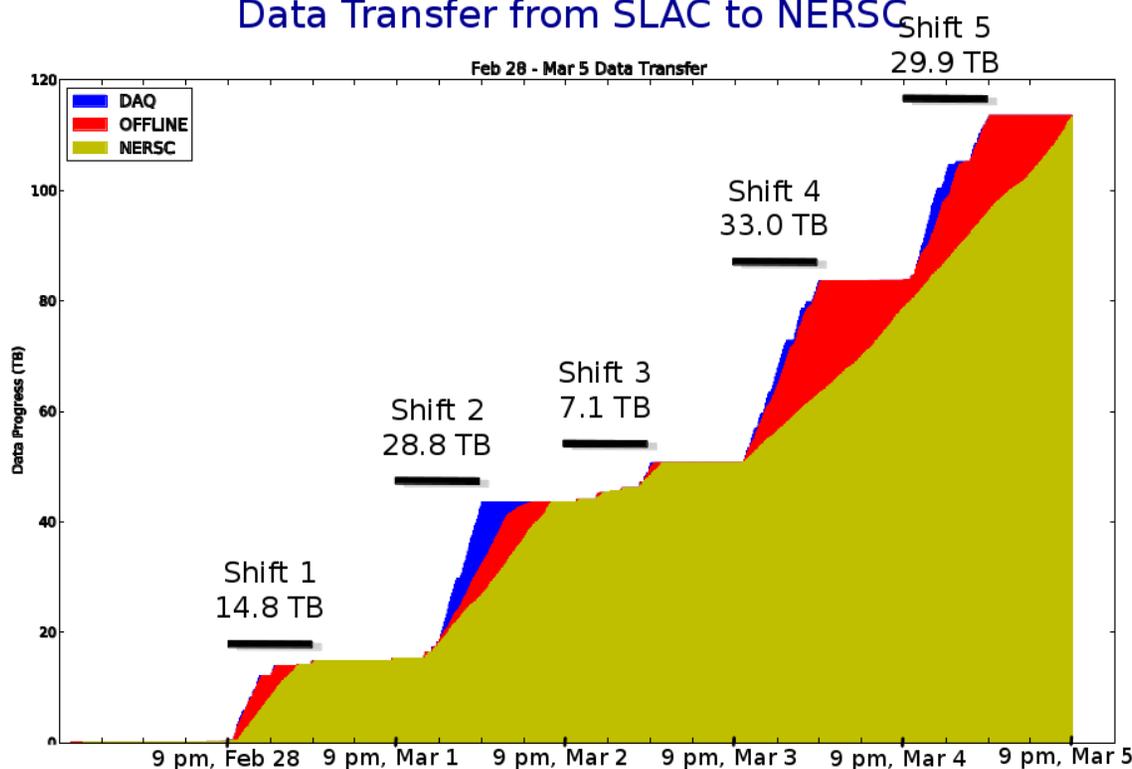


- **Current LCLS data system can handle fast feedback and offline analysis requirements for most LCLS experiments**
 - DAQ throughput ranges 0.1 – 10 GB/s, typically 1GB/s
 - CSPAD detector: 2 x 2.3 Mpixel @ 120Hz = 1.1 GB/s
 - 60 teraflop and 6 PB
 - Most cycles are given out to other SLAC groups because of the bursty nature of LCLS experiments
- **Predictions for future LCLS data throughput are not obvious**
 - Dictated by project cost, more than physics requirements
 - My guess:
 - One order of magnitude in 4 years time scale
 - 2 x 16Mpixel @ 120Hz
 - Two orders of magnitude in 8 years time scale
 - 2 x 4 Mpixel @ 4KHz
 - 100K points @ 100KHz

LCLS/NERSC Data Pilot

- In 2012 LCLS requested and obtained a NERSC allocation under the “Data Intensive Computing Pilot Program”
- LCLS provided data-movers and web-based monitoring to automatically transfer the data for a CXI experiment to NERSC
 - Moved data from SLAC to NERSC at around 700MB/s (ie half of data taking rate)
- Ported LCLS analysis framework to Carver (NERSC farm)

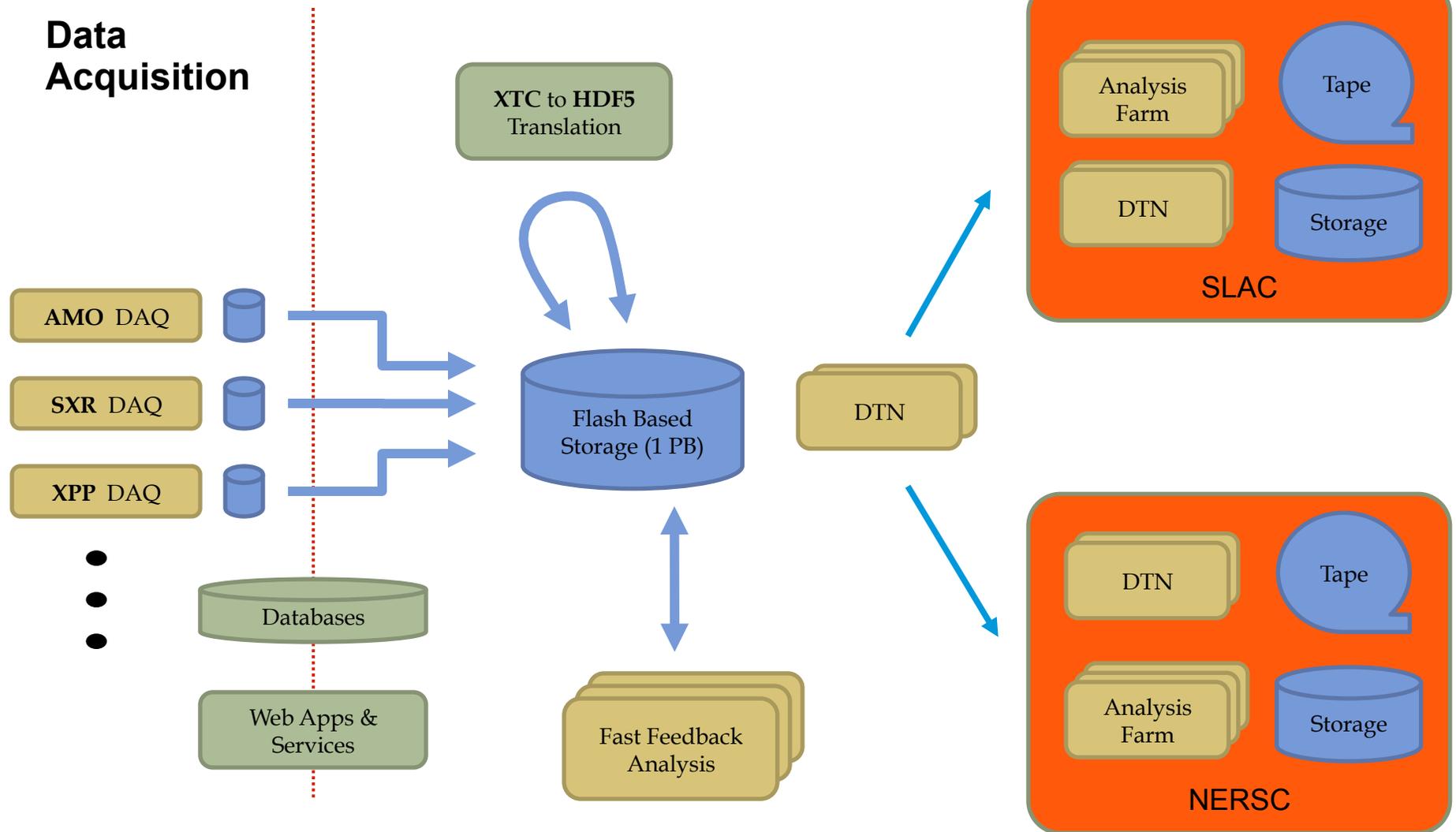
Data Transfer from SLAC to NERSC



Collaborations beyond the data pilot will require 100Gb connection between SLAC and ESNET

Data Systems Architecture: Evolution

SLAC



NERSC/LCLS Collaboration Requirements (Examples)



- **Users will be able to use the LCLS experiment web portal to manage their raw data, independently of where the data files are located**
- **Remote login/analysis pools must allow users to log in with their SLAC UNIX account password**
 - Membership to the POSIX experimental groups must be available at all locations
- **Remote login/analysis pools will provide one common, shared home**