

The National Laboratory System

# DOE transforms HPC



U.S. DEPARTMENT OF  
**ENERGY**

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The logo for SLAC (Stanford Linear Accelerator Center), consisting of the letters "SLAC" in a bold, red, sans-serif font with horizontal lines through the letters.

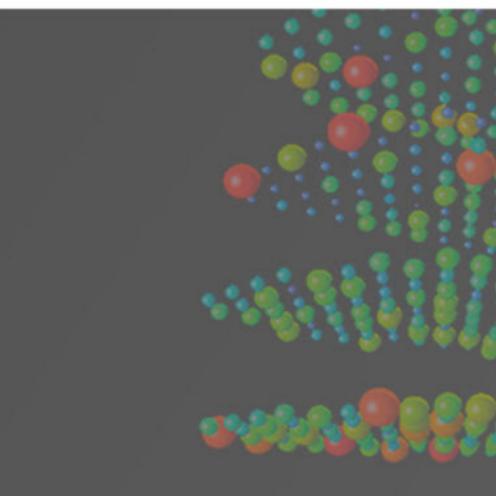
Large Synoptic  
Survey Telescope  
Data Management

A visualization showing a dense field of colorful dots (red, yellow, green, blue) arranged in a grid-like pattern, representing astronomical data.

Extending the  
Dimensions  
of the  
Scientific Data

A visualization showing a dense field of colorful dots (red, yellow, green, blue) arranged in a grid-like pattern, representing scientific data.

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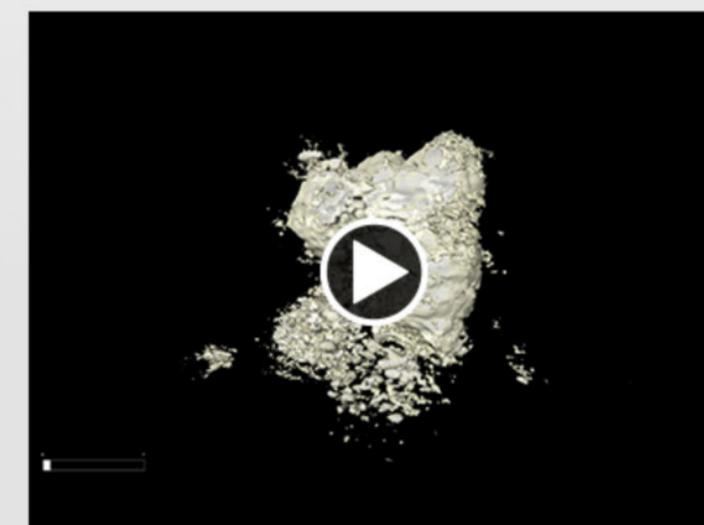
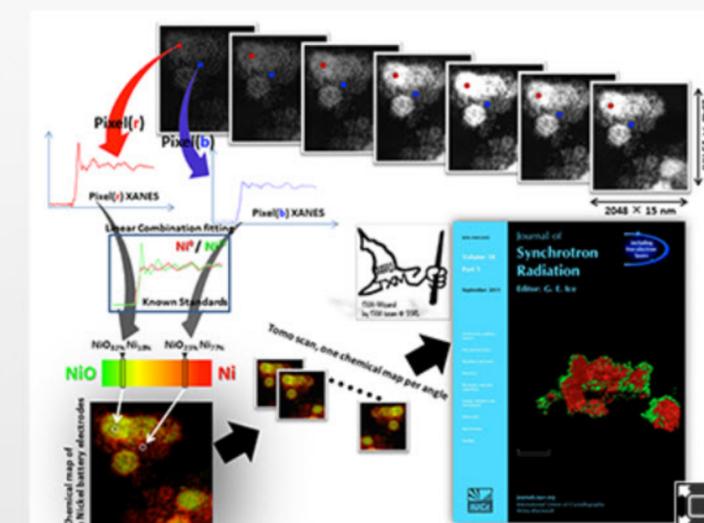
## Extending the Dimensions of the Scientific Data

The novel X-ray microscopy technique allows the visualization of the samples in 3D with elemental/chemical sensitivity under controlled sample environments at different length scales.

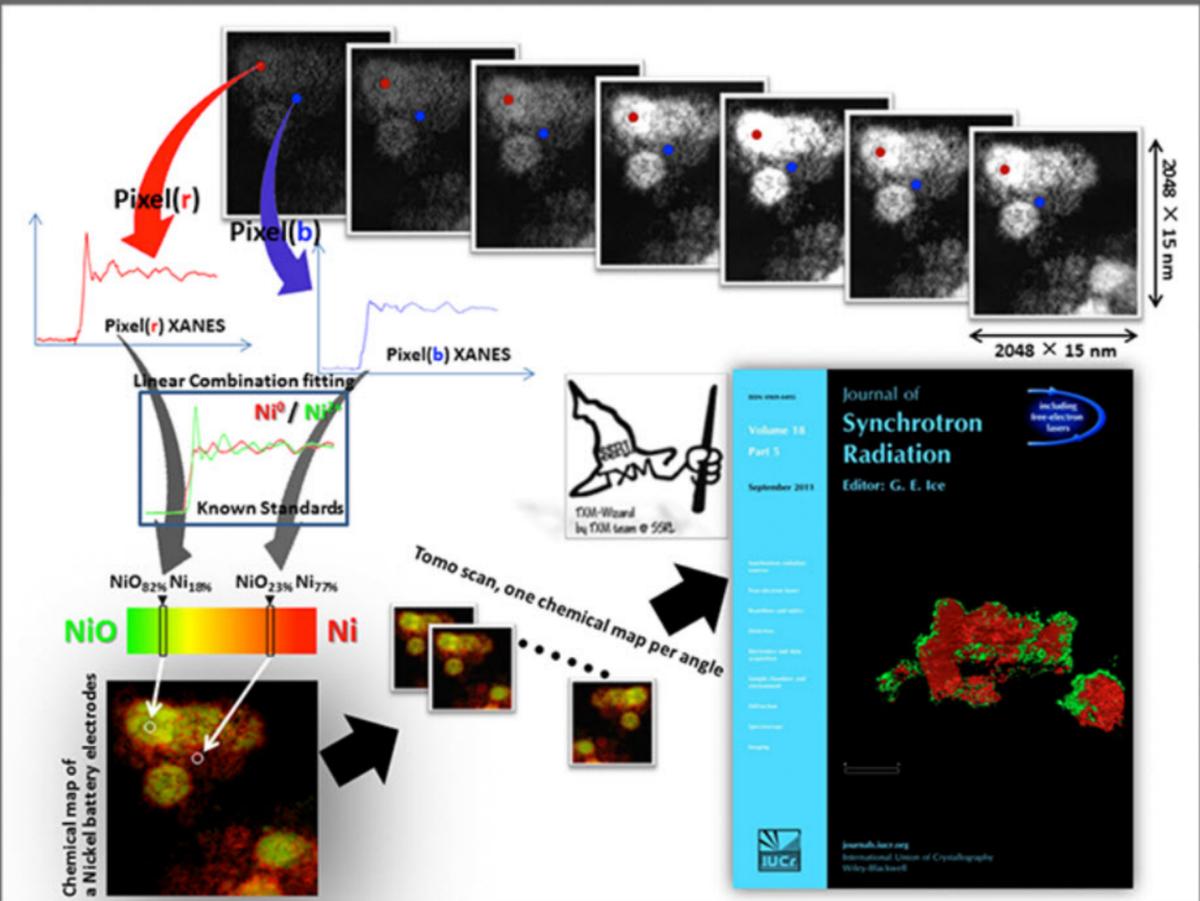
With the use of 3rd generation synchrotron sources, a large amount of microscopic data could be acquired in relatively short time frames. For example, in a full-field XANES imaging experiment, ~4 million pixels XANES are collected in about 10 minutes. When tomography is employed, about 1 Billion voxel XANES are collected in an overnight experiment. In addition to the 3 spatial dimensions (x, y, and z) and the energy tunability (E) provided by Synchrotrons, the control of sample environments extends the dimension/complexity of the imaging data and has a lot to offer to the scientific case studies.

SSRL scientists have developed a scientific software package known as TXM-Wizard to handle the multiple dimensional X-ray imaging data.

TXM-Wizard has greatly improved the efficiency in both data acquisition and reduction. Being made freely available, TXM-Wizard has been downloaded for over 2500 times spread worldwide to over 45 countries.



FUNDING & CREDITS



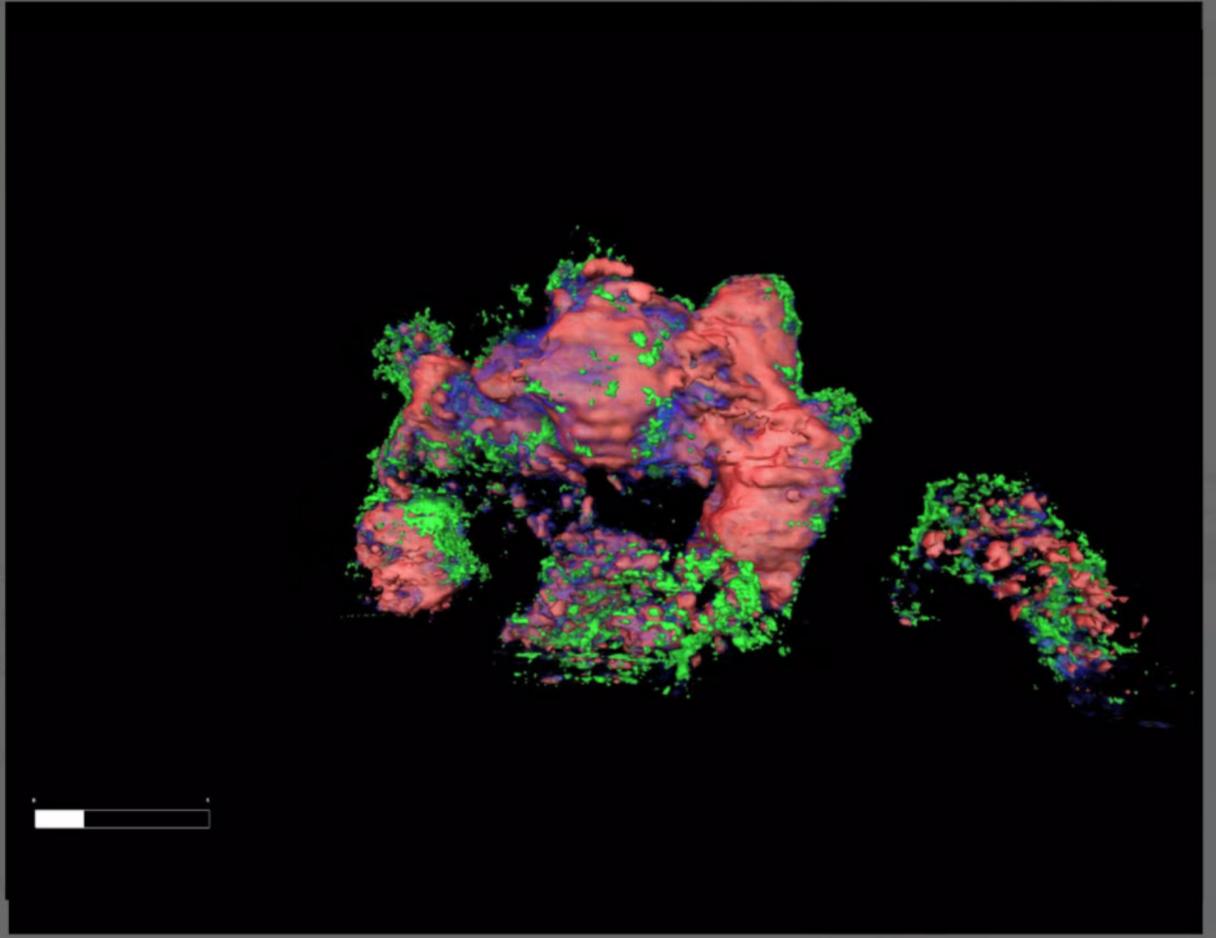
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FUNDING AGENCY: Basic Energy Sciences

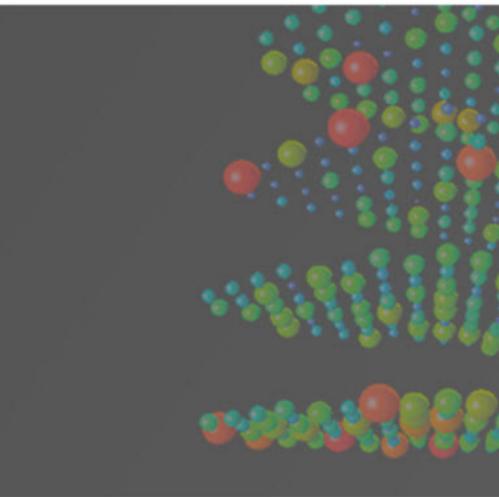
FUNDING ACKNOWLEDGEMENT: Office of Science of the U.S. Department of Energy under contract DE-AC02-76SF00515.

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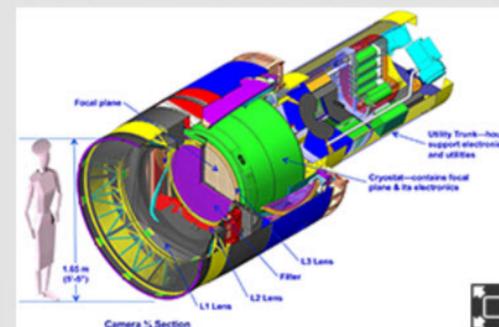
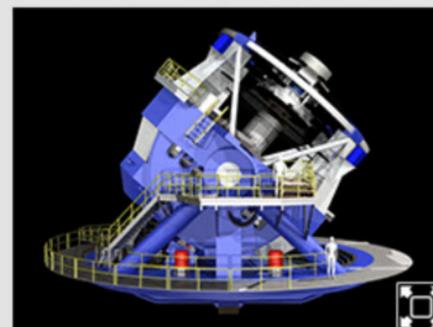
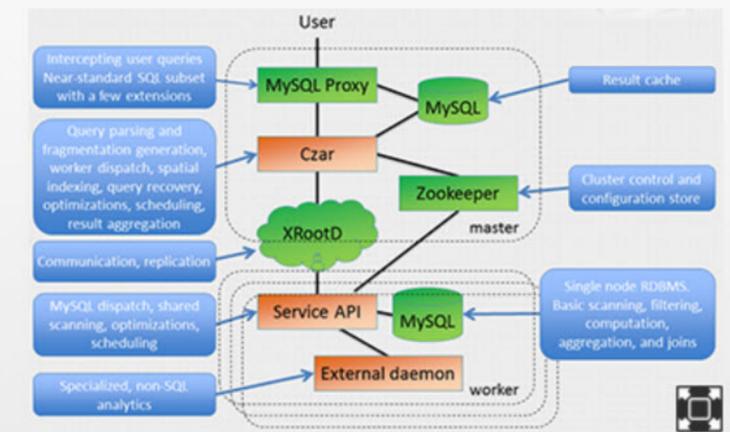
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## Large Synoptic Survey Telescope Data Management

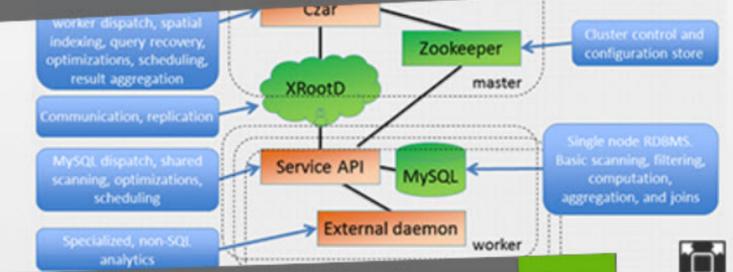
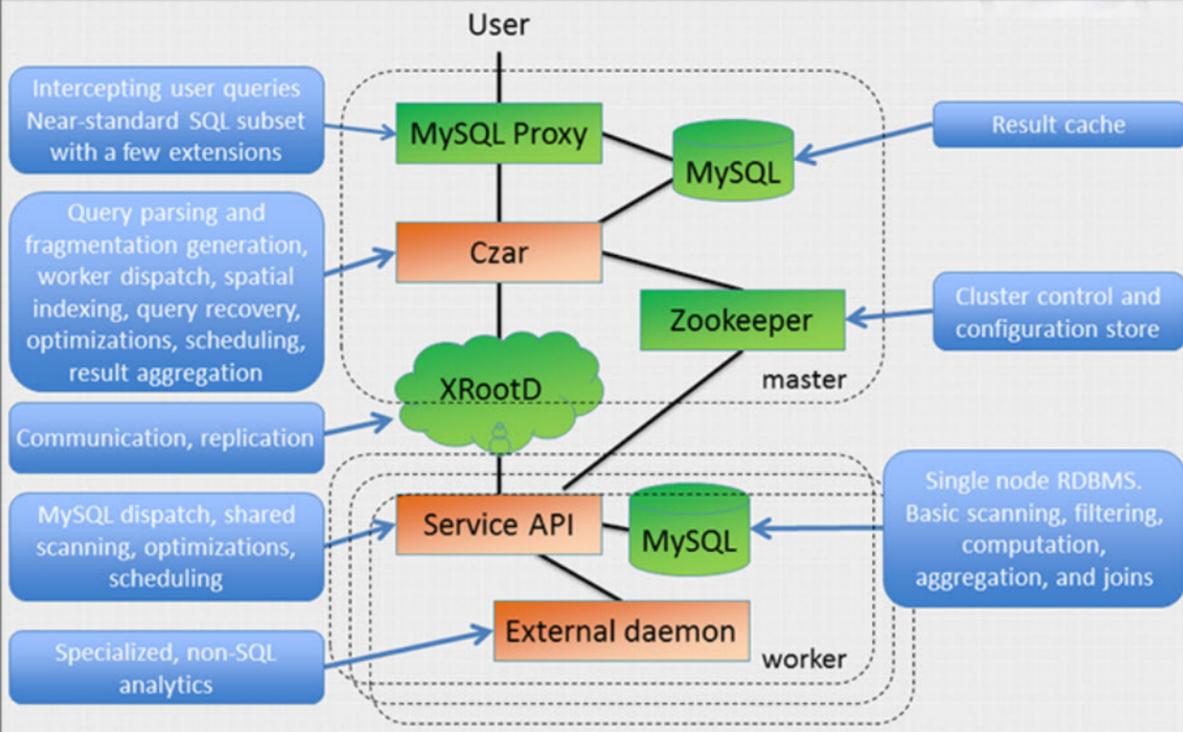
LSST will perform a comprehensive optical survey of the southern sky of 18,000+ sq. deg in 6 bands from the near-IR through near-UV.

- 825 images of each 9.6 sq. deg. field over 10 years
- First light in 2022
- Data Products enables detection of transient phenomena on many time scales (40sec-10 years)
- Enables detection of faint objects by coaddition over the full survey
- Tens of billions of stars, galaxies – tens of trillions of individual measurements requires very careful control of systematics for photometry, astrometry, and shape measurement
- Science Drivers: Investigation of Dark Energy Detection and use of supernovae as standard candles
- Comprehensive statistical survey of galaxy shape correlations and clustering for Weak Lensing, Baryon Acoustic Oscillation, and the evolution of structure.
- LSST data products include 38 petabytes persisted images, 0.5 exabyte virtual images, 83 petabyte database (incl. all Data Releases). Largest table will contain ~50 trillion rows.
- Data analytics range from trivial to very complex, and often involve full sky spatial and/or temporal correlations
- The Data Management system is expected to handle over 1 million queries daily.
- Custom system based on open source components (MySQL, zookeeper, XRootD). Custom features (scalable spherical geometry, optimized spatial joins, shared scans)



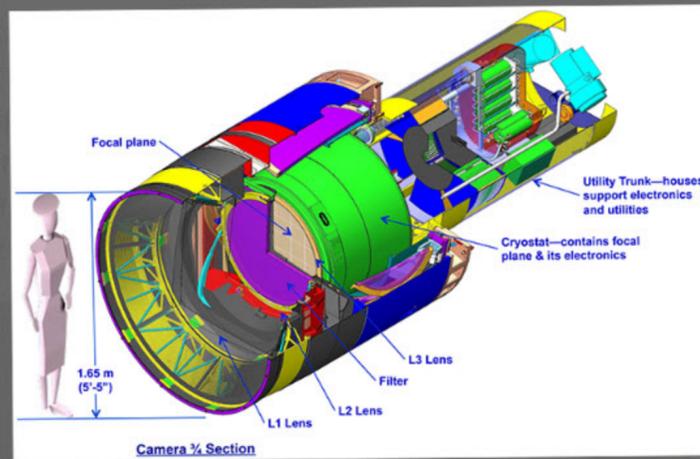
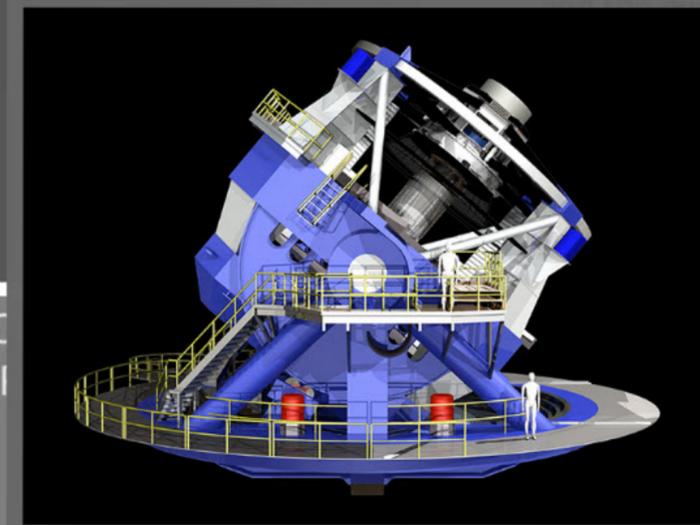
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