



WFIRST

Wide Field Infrared Survey Telescope

Josh Peek

(intro slides from J. Kalirai)

The Next Great Observatory

WFIRST Key Features

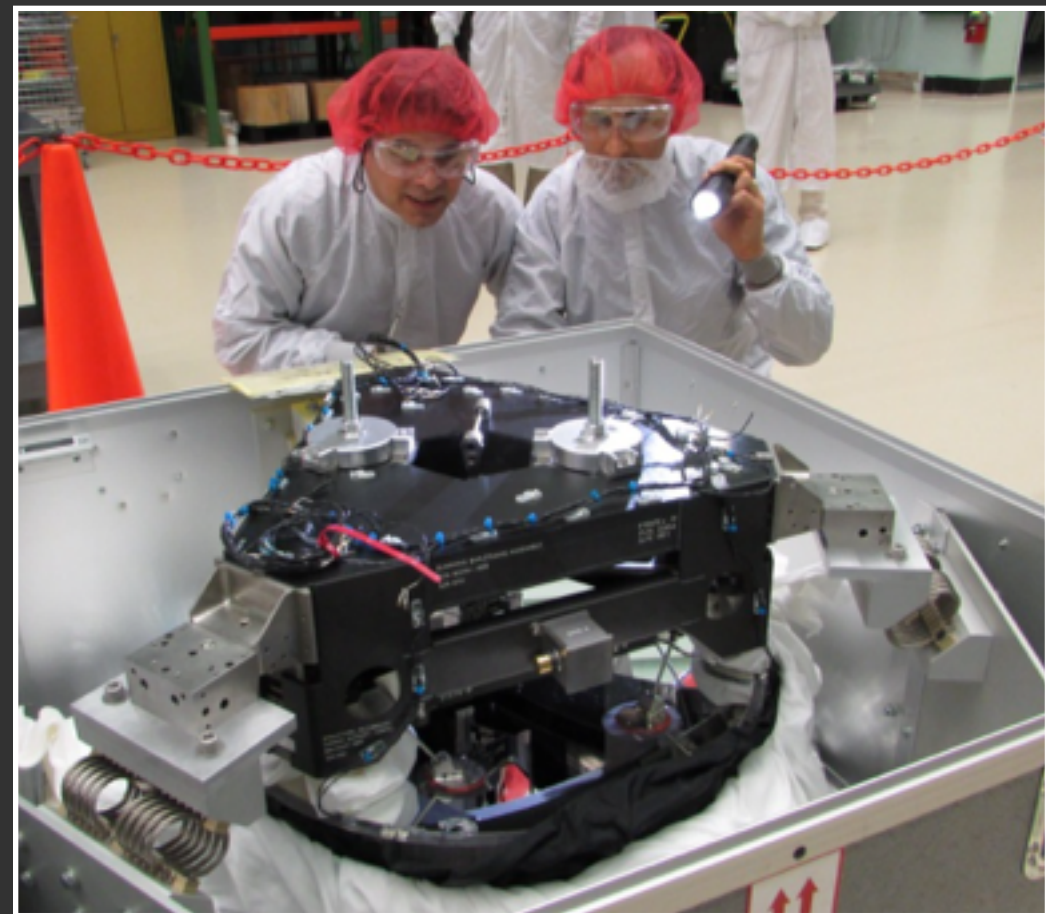
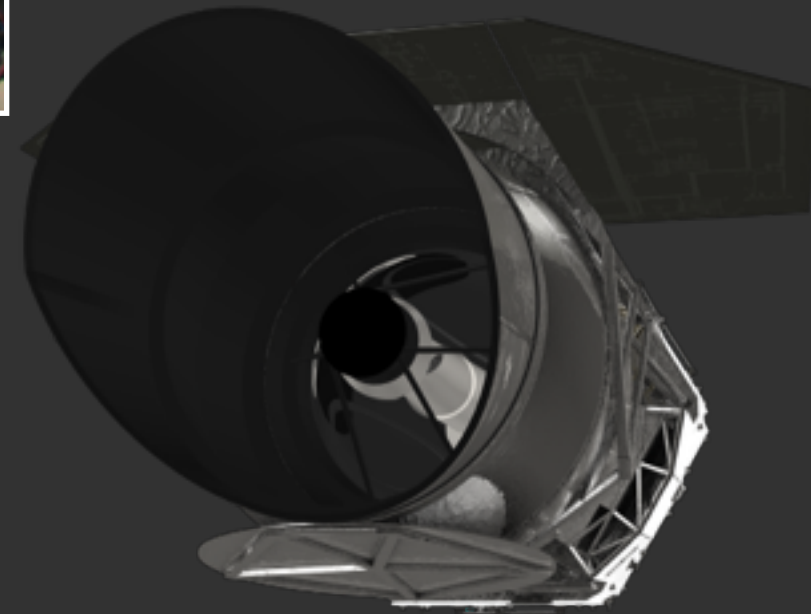
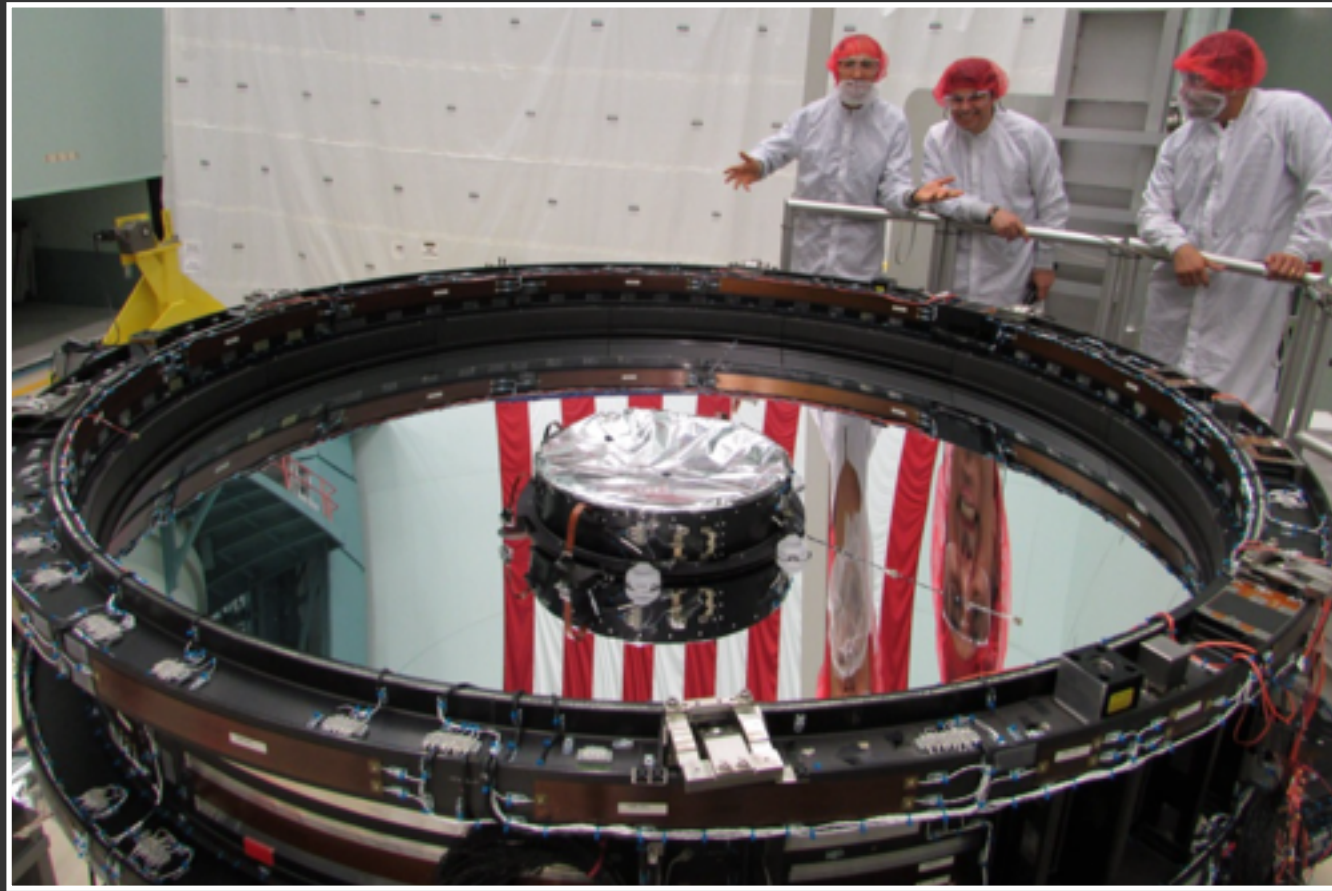
- ★ 2.4 meter telescope donated from NRO
 - Hubble's power and resolution, with 100x the field of view (0.281 sq deg field of view and 0.11" pixels)
- ★ Wavelength: 0.5-2 micron sensitivity
- ★ 5 sigma AB mag imaging depth (1000s):
Z = 27.15, Y = 27.13, J = 27.14, H = 27.12, F184 = 26.15, W149 = 27.67
- ★ Science programs includes
 - High Latitude Imaging and Spectroscopic Survey
 - Galactic Bulge Microlensing Planet Survey
 - Supernova Survey
 - Wide Field Guest Observer Program
 - Coronagraph Participating Scientist Program
- ★ Instrumentation
 - Wide Field Camera:
 - imaging, slitless spectroscopy, IFU
 - Coronagraph Technology Demonstration:
 - "proof of concept" for light suppression/future large telescopes
- ★ Launch plan: 2025



WFIRST Status

The Telescope

Hubble-sized 2.4m Telescope
Donated to NASA and Undergoing Testing



The Instruments

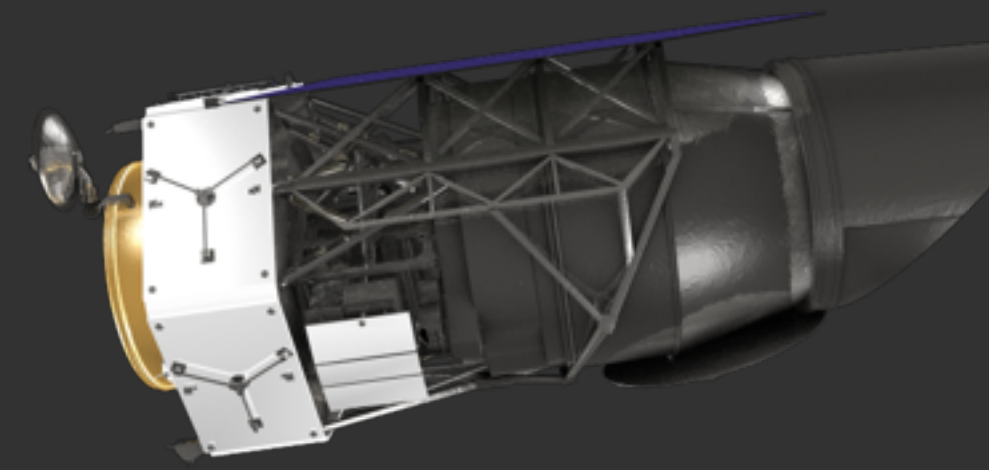
Wide Field Instrument and Coronagraphic
Technology Demonstration Instrument are under
Development

Wide Field Instrument

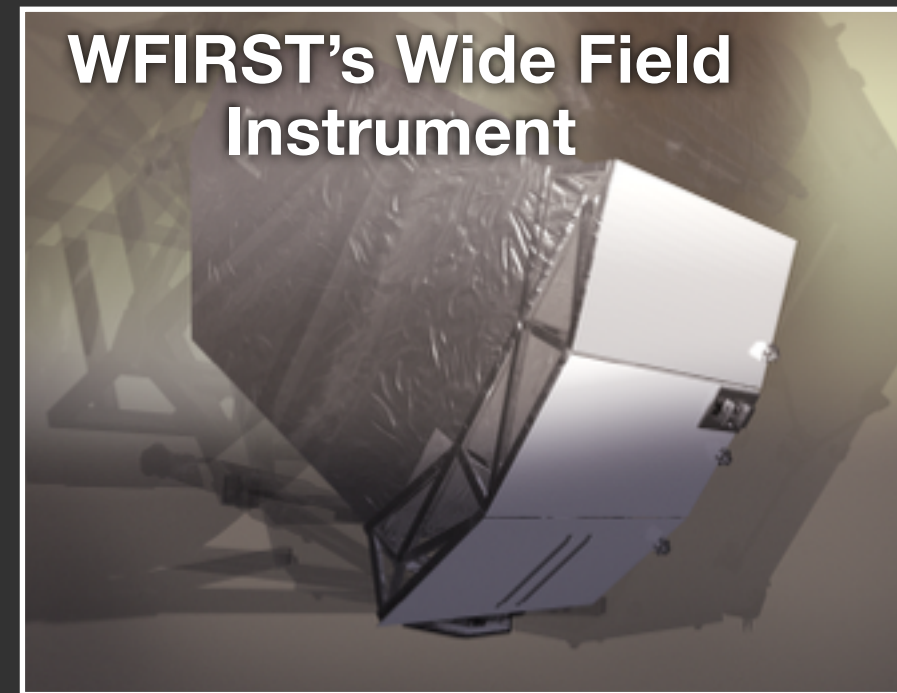
- 300M pixel camera w/ 18 4K detectors
- 100x the Hubble FoV, w/ 0.1" pixels
- Space "Big Data" complement to LSST
- Highly synergistic w/ JWST

Coronagraph Instrument

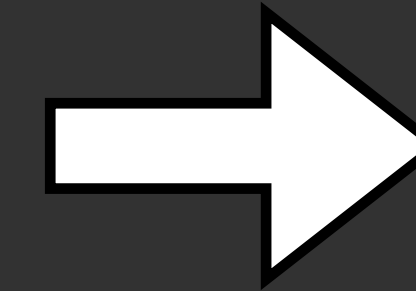
- Starlight suppression by factors up to 1 billion to 1
- Builds the foundation for future large telescopes to search for biosignatures on nearby worlds



WFIRST's Wide Field
Instrument



WFIRST's Coronagraph

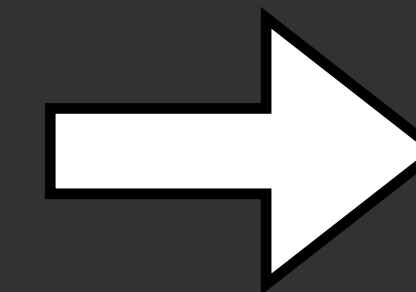


100x the Hubble Field of View
(at the same sensitivity and

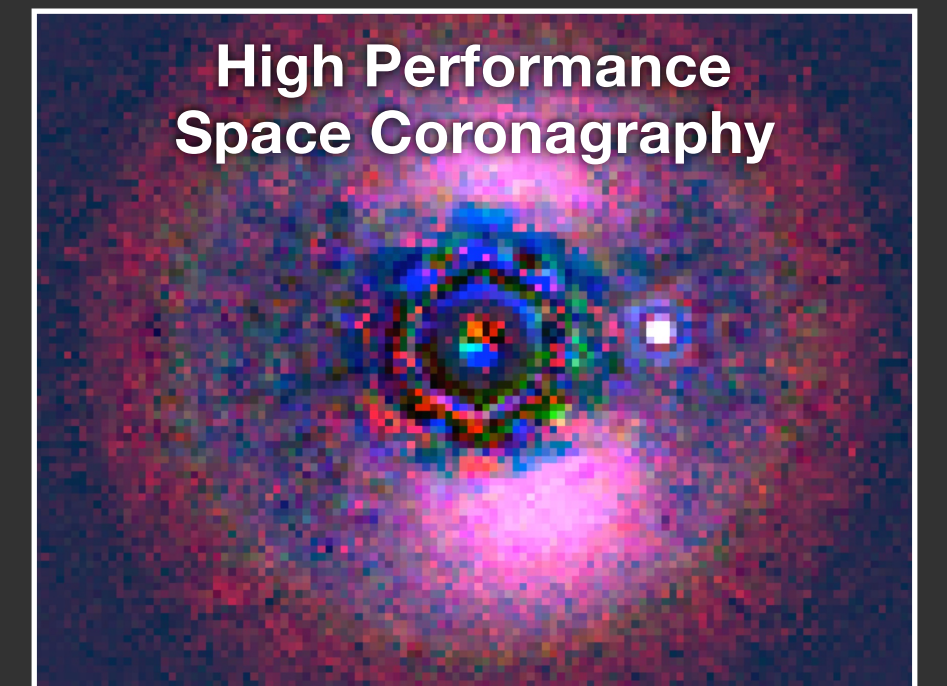
Hubble's



WFIRST's
Camera



High Performance
Space Coronagraphy



The Observing Program

Possible Survey Implementations

High Latitude Survey (2000 sq deg at 27th mag in YJHF184 + spectra)

Dark Energy — Cosmic Lensing — High-z Galaxies — Galactic Halo Substructure

Deep Field Surveys (~10 deg² fields at 28-29th mag, with high cadence)

Supernova Discovery — First Light — Galaxy Evolution

Guest Observer Surveys (user specified instrument, depth, area, ...)

Broad astrophysics from Solar System exploration to cosmology

Galactic Bulge Survey (2.2 sq deg at high cadence)

Exoplanet Census — Free Floating Planets — Stellar Pops — Galactic Structure

Exoplanet (+ Other Objects) PS Program (10⁹ contrast ratio direct imaging)

Exoplanet Discovery and Characterization — Disks — Massive Star Atmospheres

Guest Investigator Surveys (funded archival research from survey data)

Broad astrophysics from Solar System exploration to cosmology

WFIRST is a new NASA facility for the entire astronomical community

100% of WFIRST's observing time is available

The specific implementation of core surveys and all Guest Observer time, as well as associated funding, remain to be competed and selected through peer review

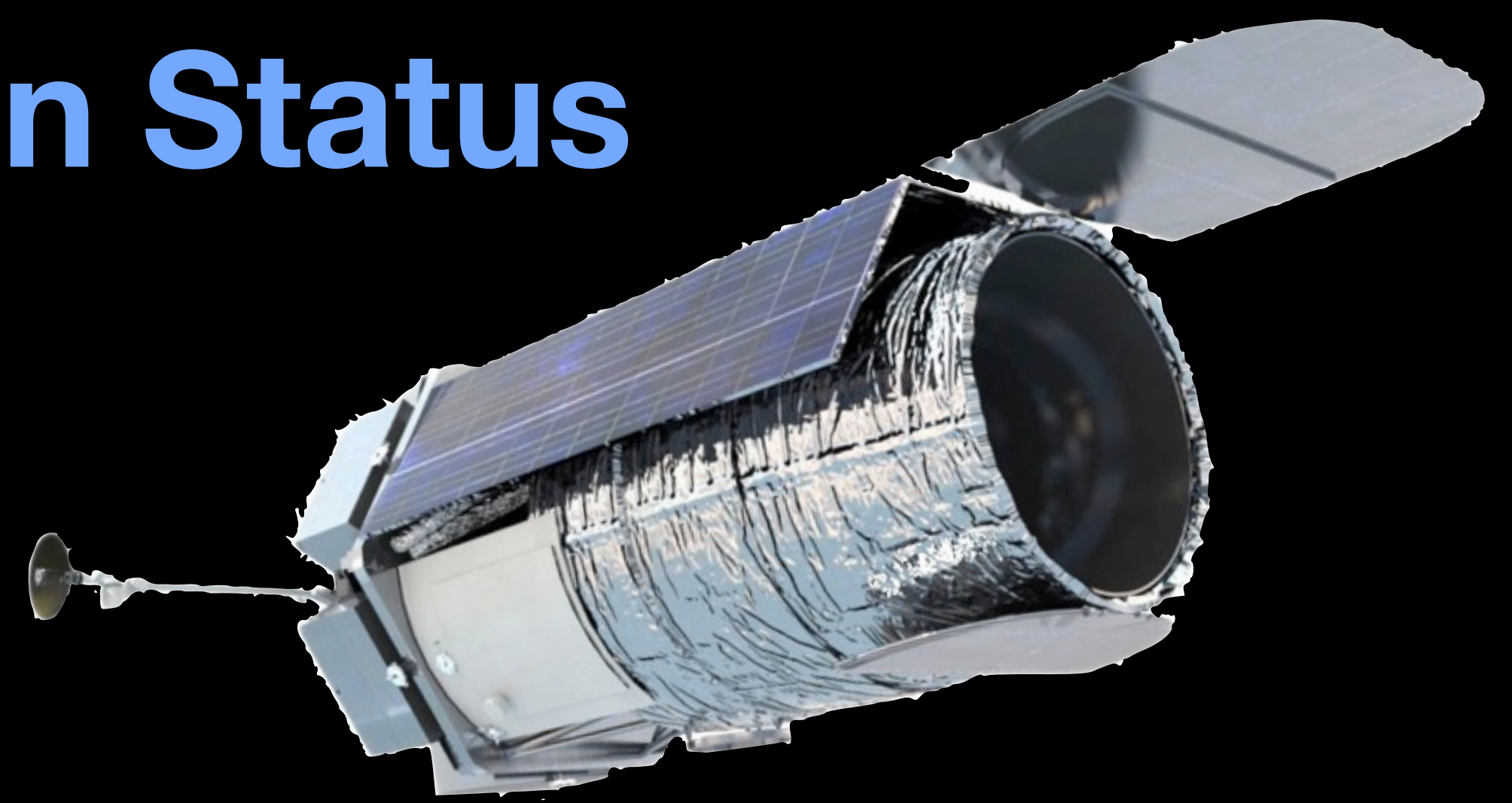
The WFIRST science teams for the operational mission phase remain to be selected

The current Formulation Science Working Group (FSWG) will be disbanded in early 2021

All WFIRST data will be non-proprietary and publicly available through MAST

Selected science teams will help define the WFIRST observing plan, but will not have privileged data access

WFIRST Mission Status



Entered Phase A (Concept Development) Feb 2016

Mission Concept design, Mission and Science Requirements definition

STScI developing science operations concepts, leading trade and technical studies, developing simulation tools

Independent External Technical Review conducted in summer and fall 2017

Key findings: confirm that WFIRST will provide a “tremendous science capability,” recommended changes be made to reduce cost and risk

Project has responded: coronagraph changed to a Technology Demonstration Instrument, other descopes made to reduce estimated lifetime cost

System Requirements Review and Mission Definition Review

These reviews will be held in late February 2018, in advance of the decision to enter Phase B (Preliminary Design); anticipated late April 2018.

WFIRST @ STScI

STScI is the Science Operations Center (SOC), with delegated functions to other supporting elements (including IPAC and foreign partners)

Specific STScI Responsibilities:

Scheduling and Archiving of all WFIRST observations

Including wide field imaging and spectroscopy, and coronagraph observations

Support for Wide Field imaging

Proposal planning and preparation tools

Calibration and data reduction pipeline (shared responsibilities with other partners and SITs)

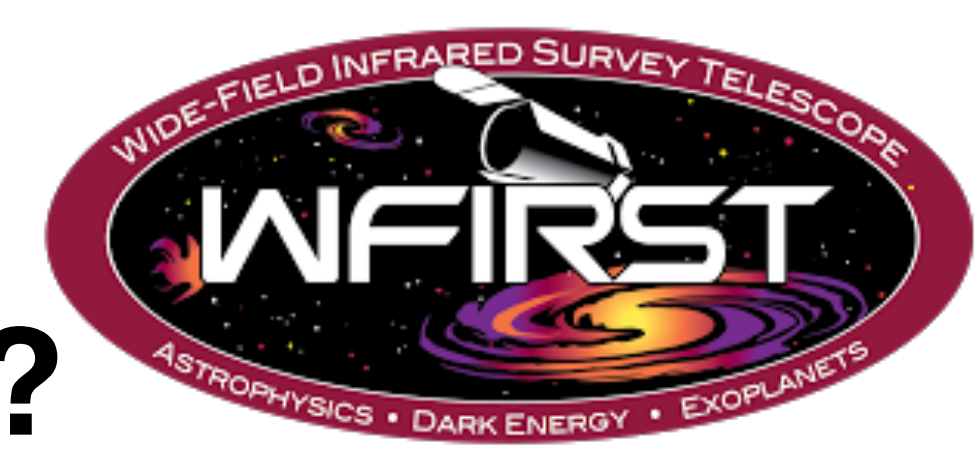
Guest Observer and Investigator support

Support of High Latitude Imaging and Supernova Survey Teams

Astronomical Community Engagement and Public Outreach



What is the WFIRST Archive?



*The WFIRST Archive is the **data, services, and environment** required to support the WFIRST community in meeting mission goals*

What is the WFIRST Community?

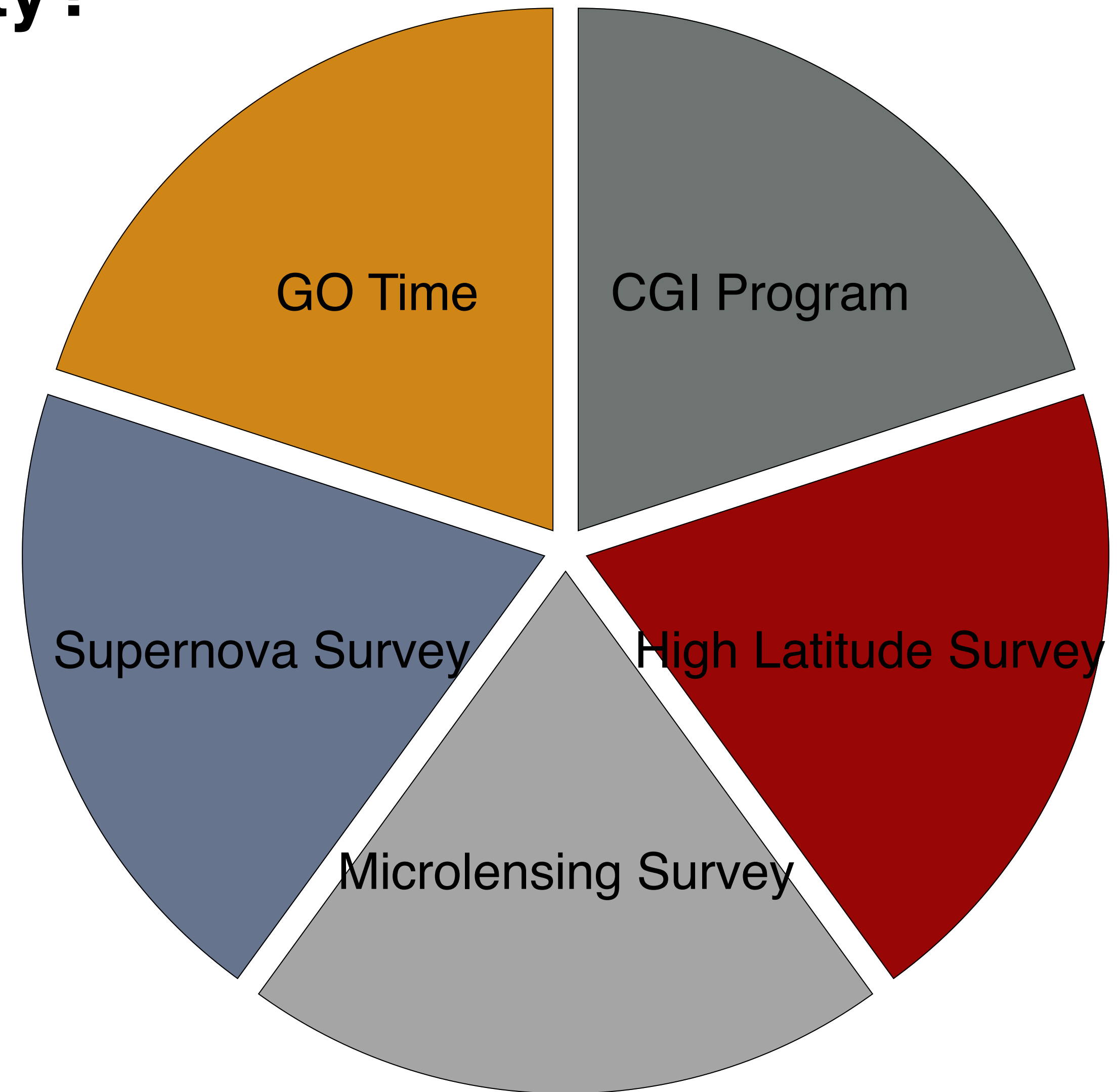


The WFIRST community is a diverse group of expert investigators studying

weak lensing, galaxy redshifts, supernovae, microlensing, exoplanets, and general astrophysics

who will use WFIRST in diverse ways:

- as an experiment
- as a survey
- and as an observatory



The WFIRST (quasi) - Oligopsony



The WFIRST Archive Challenge



- To provide access to all the data and tools of data processing for survey experts
- To provide access to high quality well reduced data sets for the broader GO/GI community
- ***To provide these in a cost constrained environment***

The WFIRST Archive *Concept*



- **For Data Storage and Data Access**

- Repurpose JWST infrastructure for archive ingest for lower-level (Level 0-2) products with no “deep archive”.
- Repurpose MAST’s JWST infrastructure to provide access to spectra and images. This includes high-level data access APIs
- Repurpose MAST Pan-STARRS infrastructure for direct object database access

- **For Services**

- Generate powerful API services for access to a limited set of high-priority databases, such as a PSF database, calibration reference database
- Generate powerful API services for archive ingest of higher level science products (Level 3 & 4, High Level Science Products)

- **For Environments**

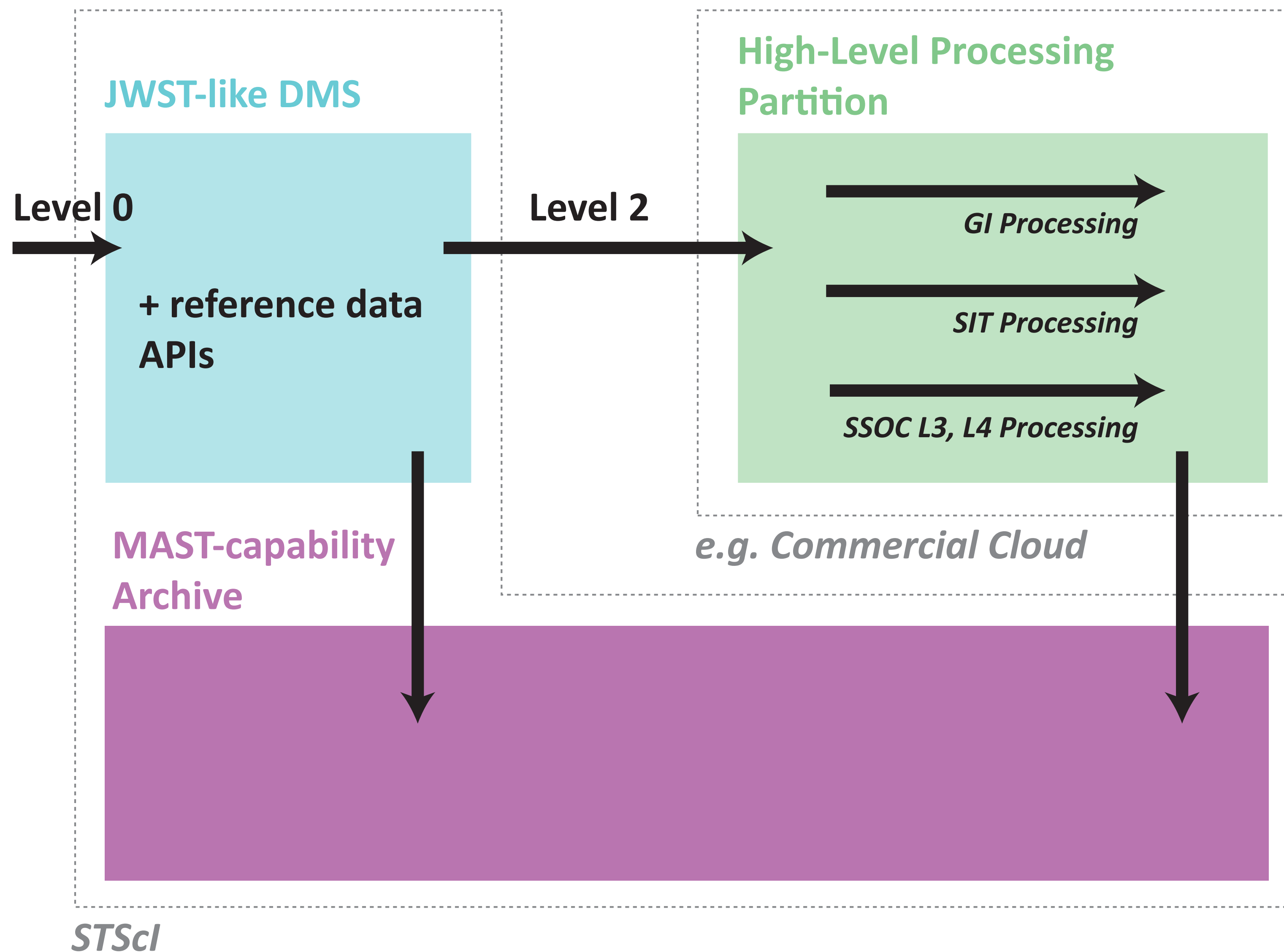
- Create a portable, commodity cloud-based high-level processing environment for SSOC and community data processing from corrected exposure-level data (level 2) onwards.



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

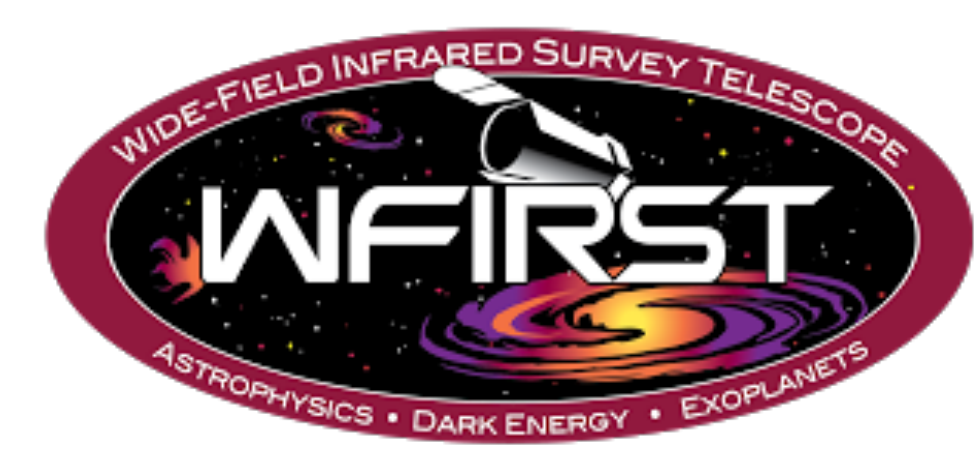


The WFIRST Data Management Concept



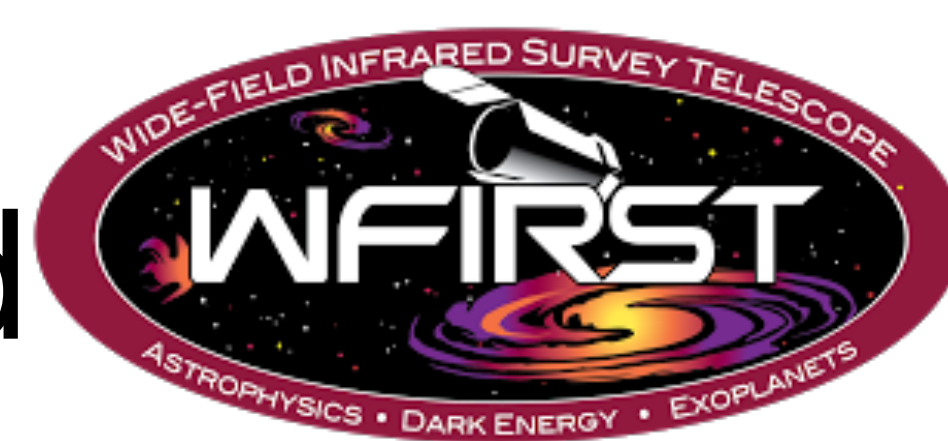


High-Level Processing Partition



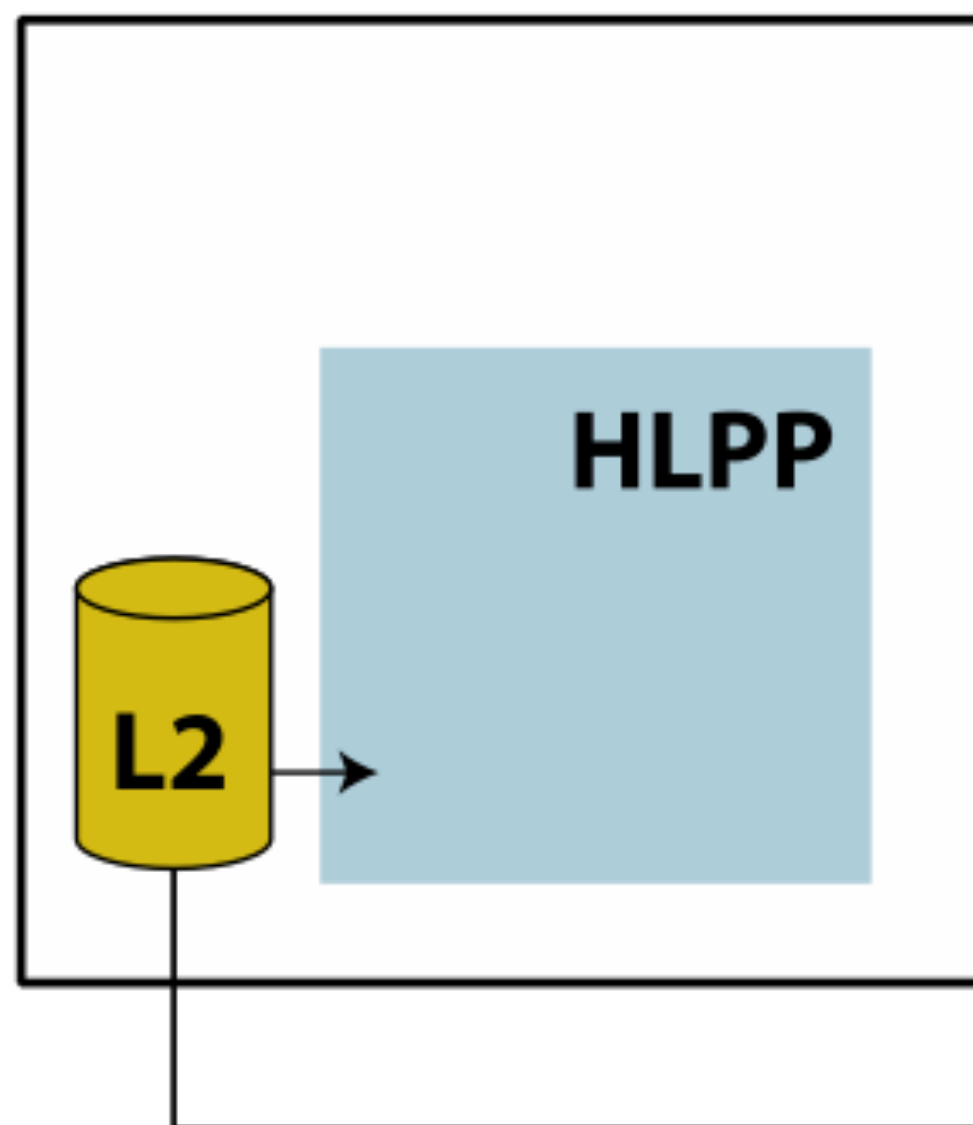
- Uses “off-the-shelf” technology for
 - containerization and container orchestration
 - access control and resource allocation
 - data abstraction layer
 - *job management*
 - notebook environments
- Operates on Level 2 Products
- Includes installation of up-to-date versions of SSOC DPS software for L2 → L4 processing
- Provides an area for SIT / GO / GI collaborative software development and implementation
- Is deployable close to NASA data, commercial compute, or academic compute resources
- ***Is the same environment SSOC will use to do L2 → L4 processing***

HLPP can be instantiated anywhere



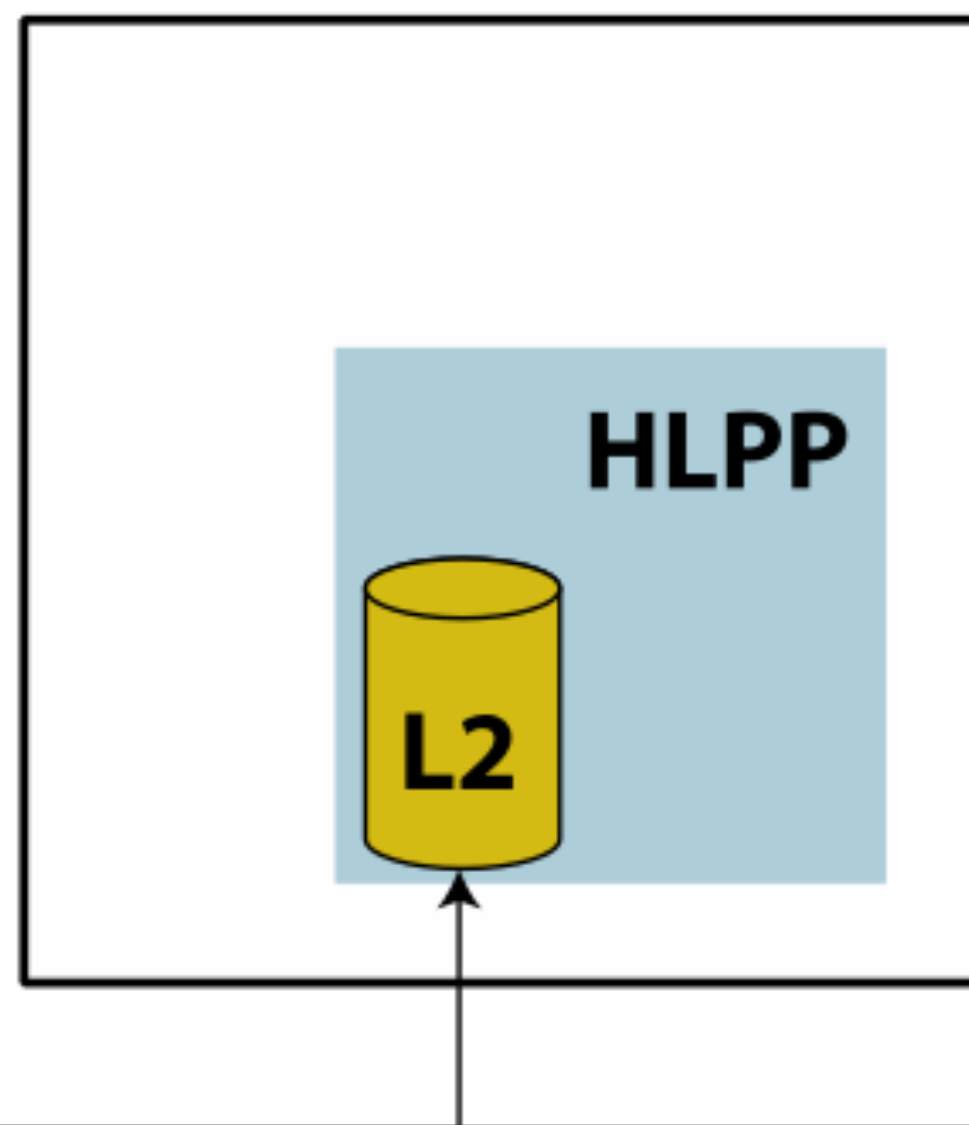
SSOC

(e.g. at ST)



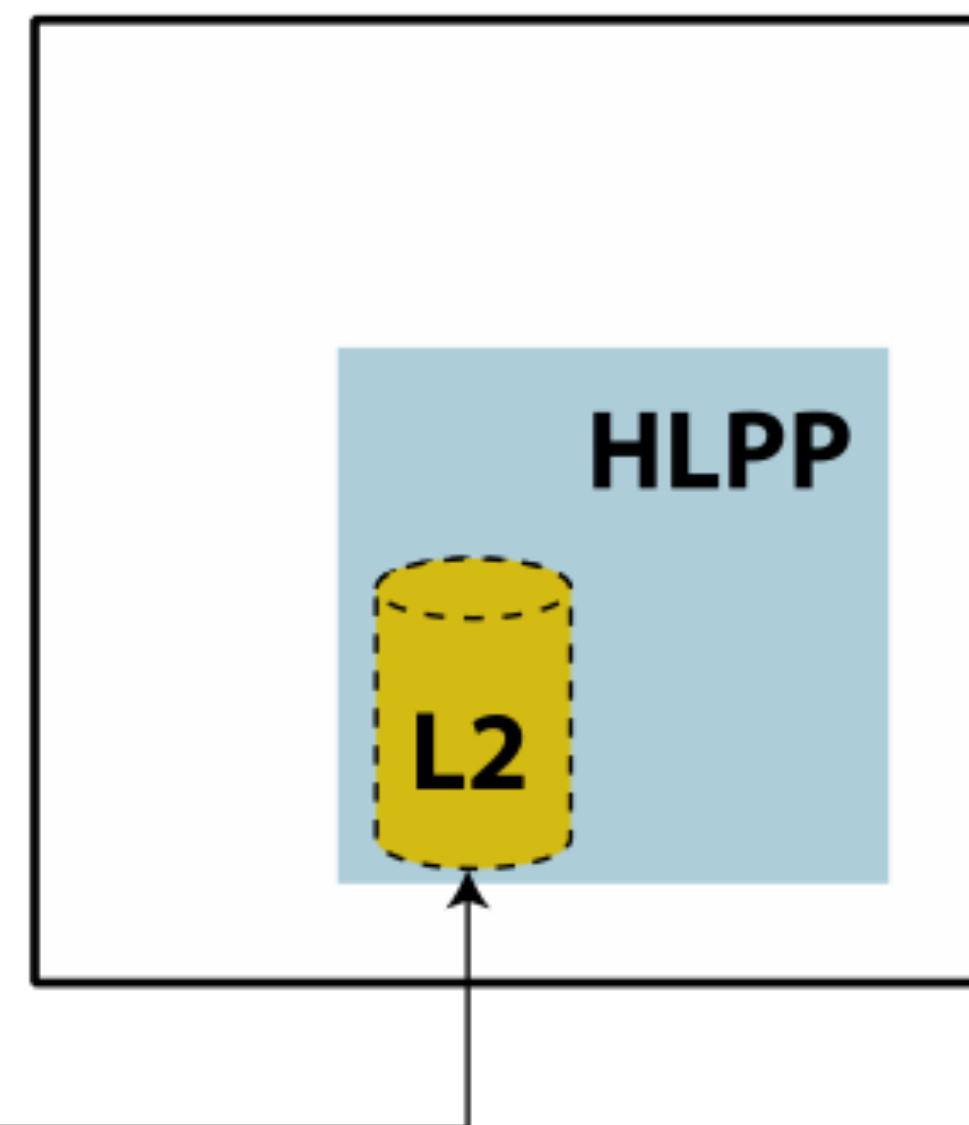
"Cloud"

(e.g. AWS, Azure)



SIT/GI/GO System

(e.g. supercomputer)





Some Questions for the MUG



- How do we optimize the WFIRST archive / DM experience for the broader community?
- Are there other aspects of a completely open survey that change how users will interact with the data?
- How should we talk about the WFIRST archive and MAST?