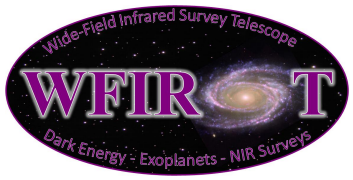


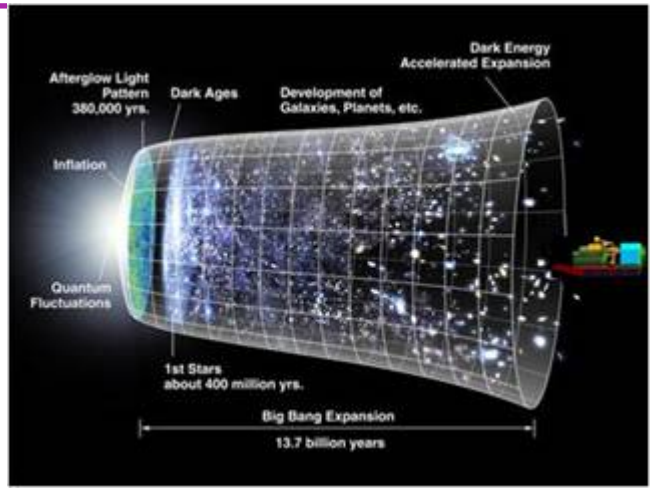
WFIRST Status Update

Neil Gehrels

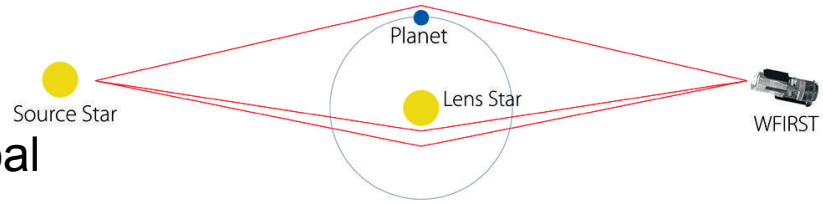
WFIRST Study Scientist

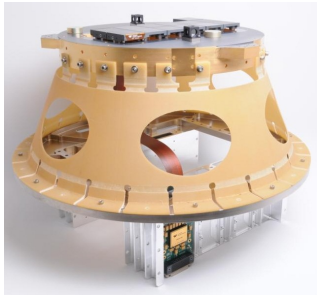
August 15, 2012

WFIRST Summary



- ❖ WFIRST is the highest ranked large space mission in NWNH, and plans to:
  - complete the statistical census of Galactic planetary systems using microlensing
  - determine the nature of the dark energy that is driving the current accelerating expansion of the universe
  - survey the NIR sky for the community
  - conduct a guest observer program
- ❖ Earth-Sun L2 orbit, 5 year lifetime, 10 year goal
- ❖ Measurements are
  - NIR sky surveys for BAO and weak lensing and
  - NIR monitoring for SNe and exoplanets
- ❖ Space-qualified large format HgCdTe detectors are US developed technology and flight ready





H2RG EDU FPA

H4RG Mosaic Plate

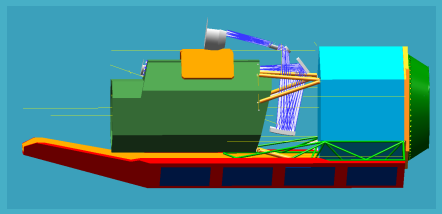
WFIRST Happenings

- WFIRST created by NWNH EOS panel from JDEM (dark energy), MPF (exoplanet microlensing) and NIRSS (IR surveys)
  (JDEM Omega configuration, 1.5m telescope)
- Science Definition Team (SDT) formed November 2010
  Co-Chairs Jim Green & Paul Schechter
- SDT interim report June 2011 (arXiv 1108.1374)
  (IDRM – off-axis telescope version of JDEM-Omega)
- Discussion of using NRO telescope with 2.4m telescope
- SDT final report August 2012
  (DRM1 & DRM2 – off-axis telescopes, single instrument)

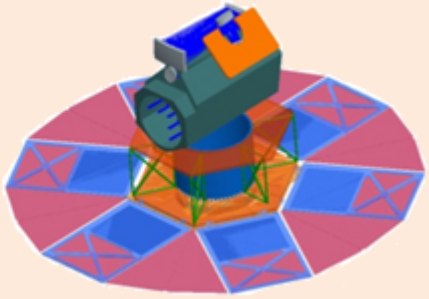
Design Reference Mission Options

- **IDRM**
  - 1.3 meter off-axis telescope
  - 3-channel payload
  - 5 year mission
  - Atlas V Launch Vehicle

- **DRM1**
  - 1.3 meter off-axis telescope
  - Single channel payload
  - 5 year mission
  - Atlas V Launch Vehicle



- **DRM2**
  - 1.1 meter off-axis telescope
  - Single channel payload
  - 3 year mission
  - Falcon 9 Launch Vehicle



SDT original Charter

"The SDT is to provide **science requirements, investigation approaches, key mission parameters**, and any other scientific studies needed to support the definition of an optimized space mission concept satisfying the goals of the WFIRST mission as outlined by the Astro2010 Decadal Survey."

"In particular, the SDT report should present assessments about how best to proceed with the WFIRST mission, covering the cases that the Euclid mission, in its current or modified form, proceeds to flight development, or that ESA does not choose Euclid in the near future."

SDT Charter for Final Report

- December 7, 2011 Letter to SDT
  1. **Finalize IDRM analysis started in 2011**
     - Examine other options for reducing overall cost of mission
     - Launch capable by end of calendar year 2022
  2. **Assess options to leverage off Euclid science**
     - Develop a DRM that does not duplicate Euclid and LSST capabilities
     - **Examine options for reducing overall cost of the mission**
     - Launch capable by end of calendar year 2022
  3. SDT augmented with up to 6 new members

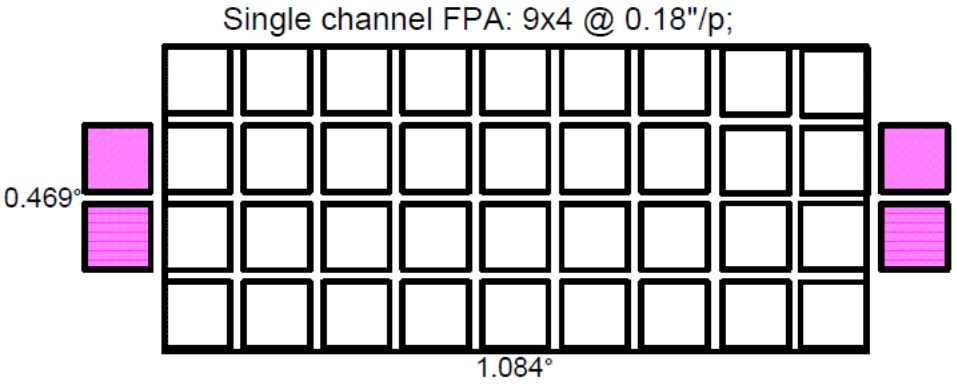
- March 1-2nd SDT Meeting
  1. Additional direction from HQ to develop a **DRM that does not duplicate the capability of JWST along with Euclid and LSST.**

H4RG-10 Mosaic Plate with WFIRST Science Definition Team, NASA HQ, and Project Office Team February 3, 2012

DRM1 Field of view & focal plane layout

Channel field layout for WFIRST DRM1

1.3m uTMA, 9x4 single channel @0.18"/H2RG pixel
The Field of view of the single imaging & spectroscopy channel is shown to scale with the Moon, HST, and JWST. Each square is a 4Mpix vis-NIR sensor chip assembly (SCA)



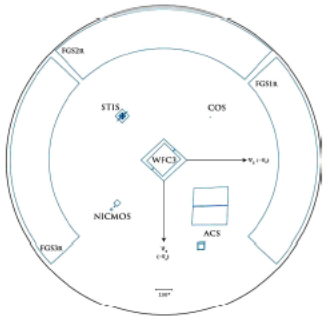
H2RG detectors

Auxiliary Fine Guidance System

WFIRST-JWST Focal plane Comparison
- Area is 145x larger than NIRCAM (0.375 vs. 0.00259 sq degrees
- Focal plane has 5x more pixels than NIRCAM short wave cameras (150 vs 33 Mpix)

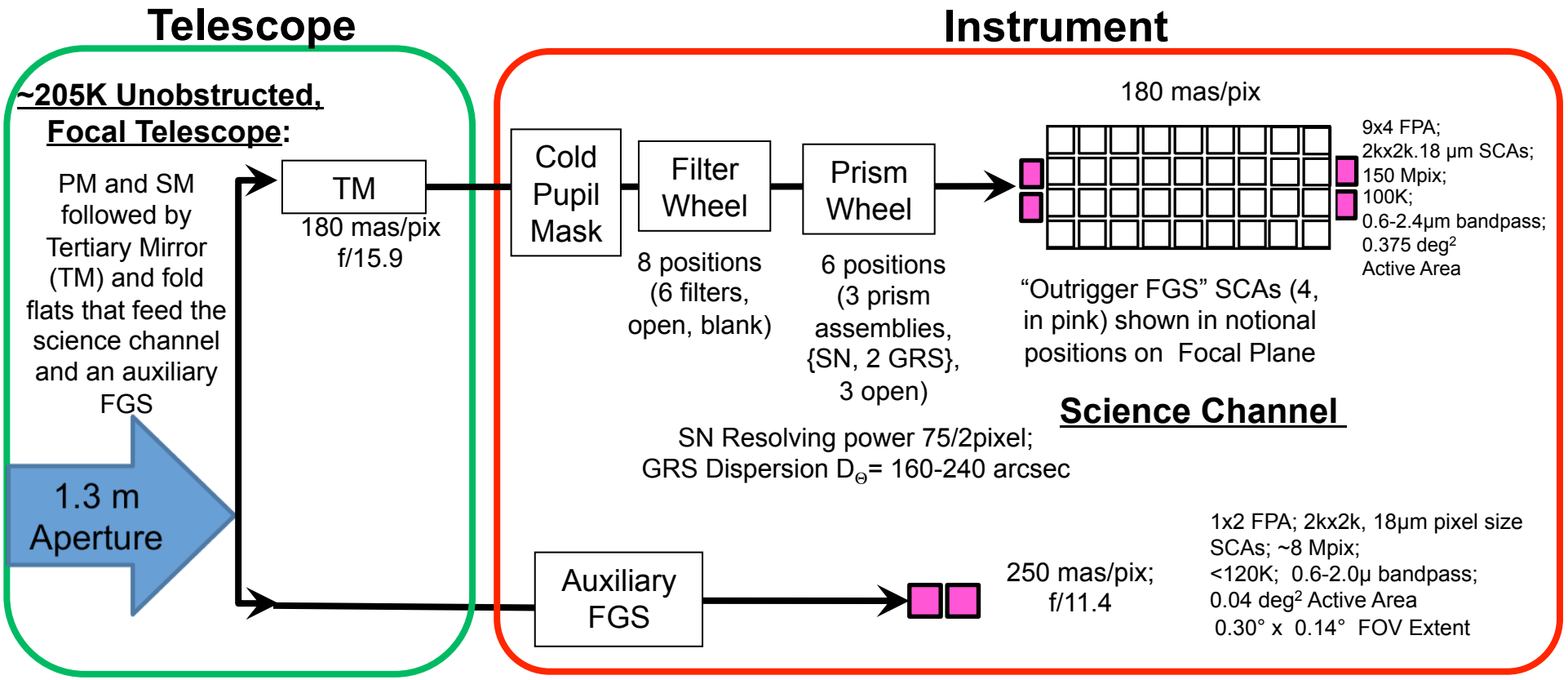
Moon (average size seen from Earth)

JWST [all instruments]



HST [all instruments]

WFIRST DRM1
Payload Optics Block Diagram

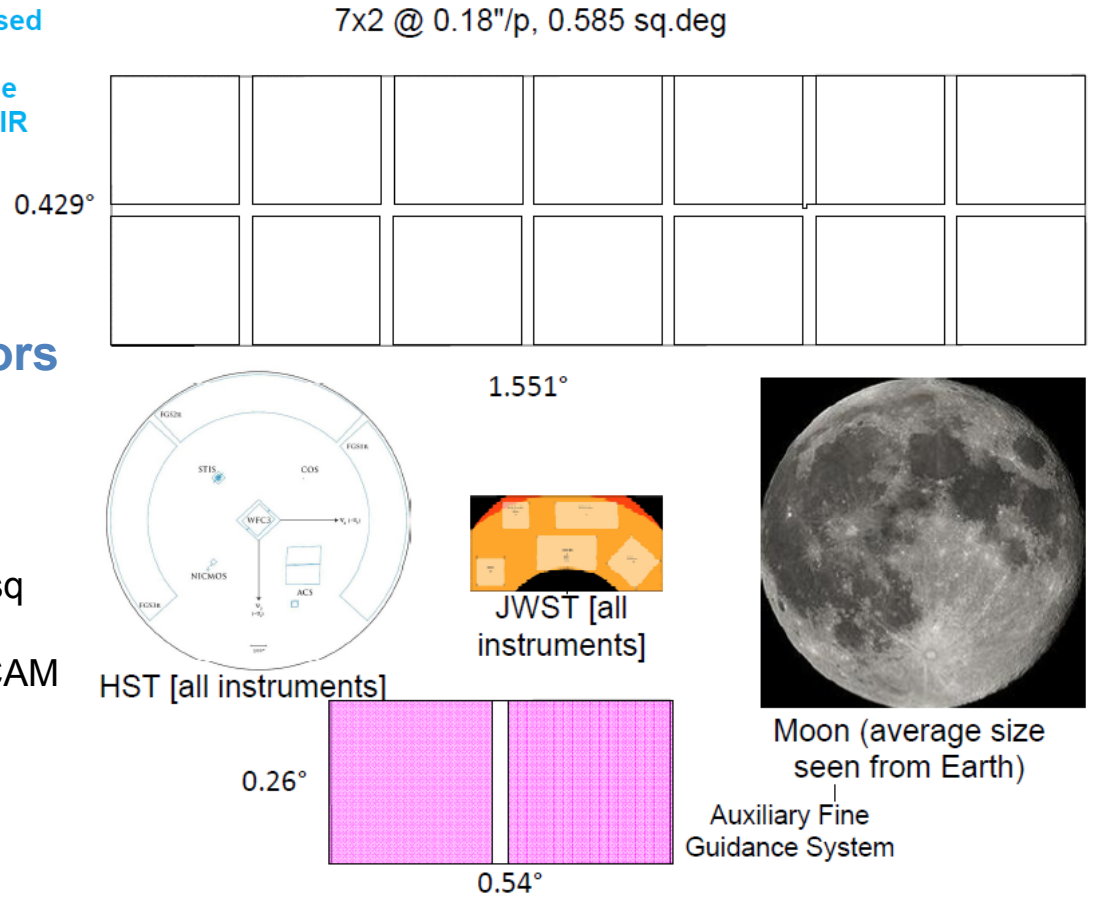


GRS = Galaxy Redshift Survey
FGS = Fine Guidance Sensor: Outrigger FGS used during imaging, Auxiliary FGS used during spectroscopy
SN = Type1a Supernovae

DRM2 Field of view & focal plane layout

Channel field layout for WFIRST "DRM2"

The Field of view of the single channel which can be used in imaging (Im), BAO spectroscopy (Sp), or SN spectroscopy (SNSp) mode is shown to scale with the Moon, HST, and JWST. Each square is a 16Mpix vis-NIR sensor chip assembly (SCA), 10 um pixels

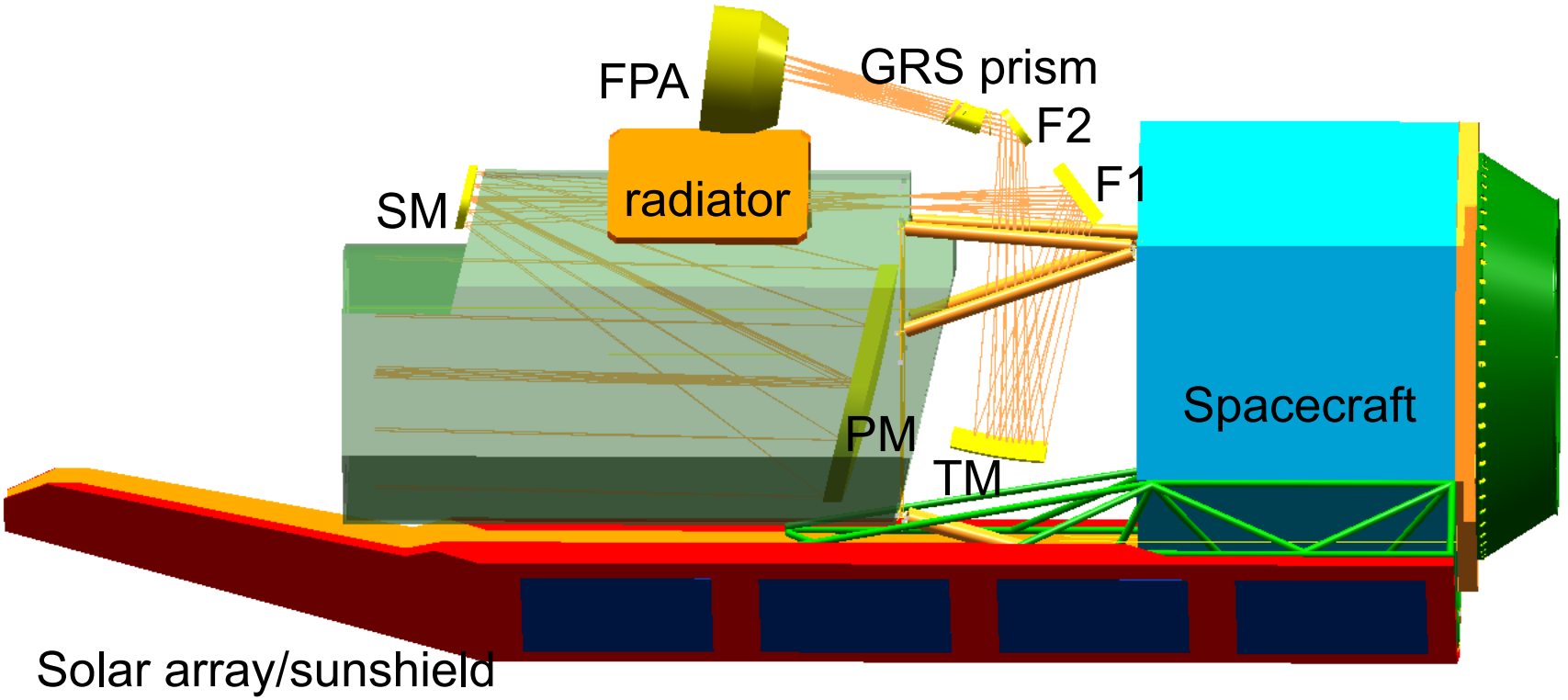


H4RG detectors

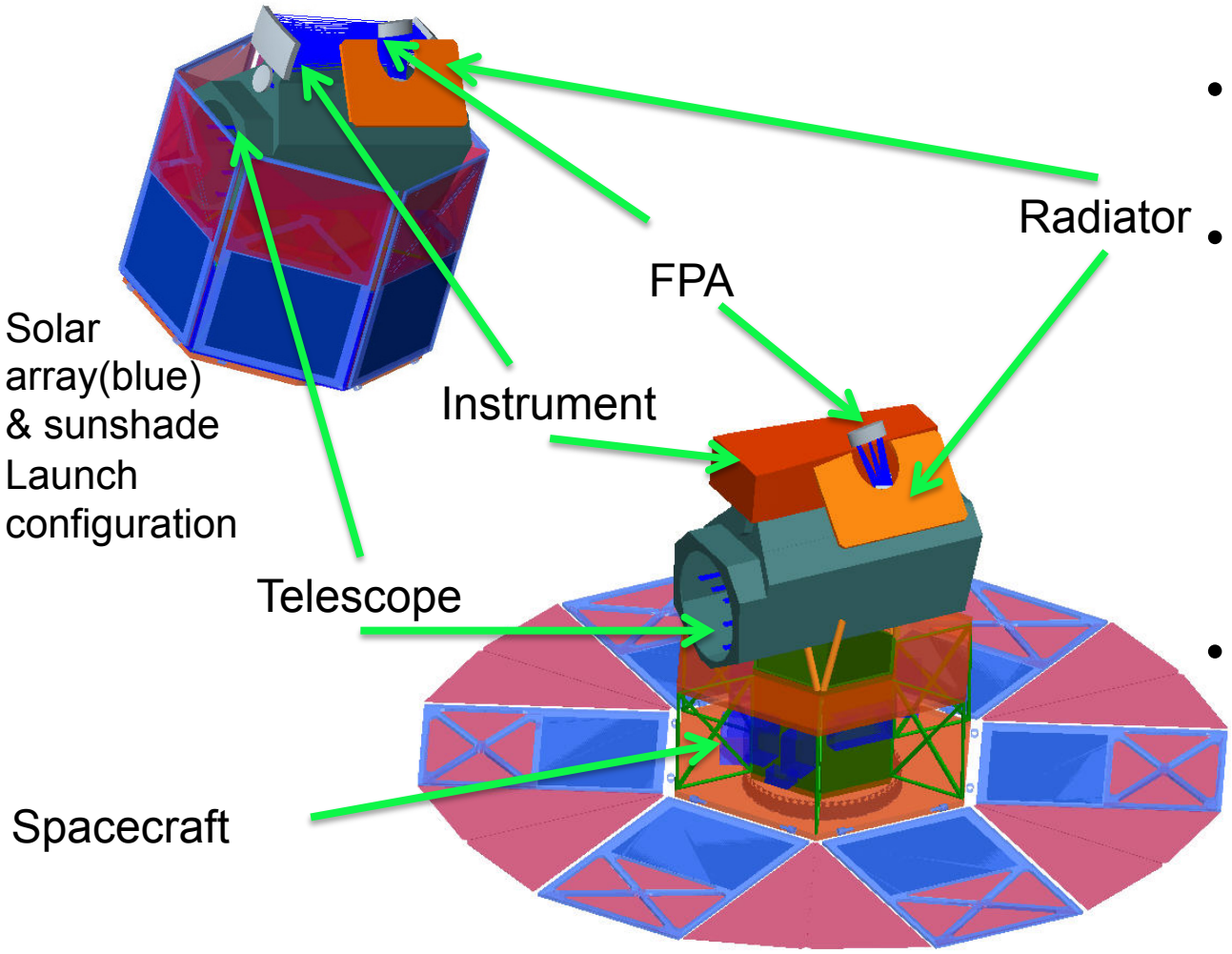
WFIRST-JWST Focal plane Comparison

- Area is 226x larger than NIRCAM (0.585 sq vs 0.00259 degrees)
- Focal plane has 7x more pixels than NIRCAM short wave cameras (235 vs 33 Mpix)

WFIRST DRM1
Observatory Layout & Ray Trace



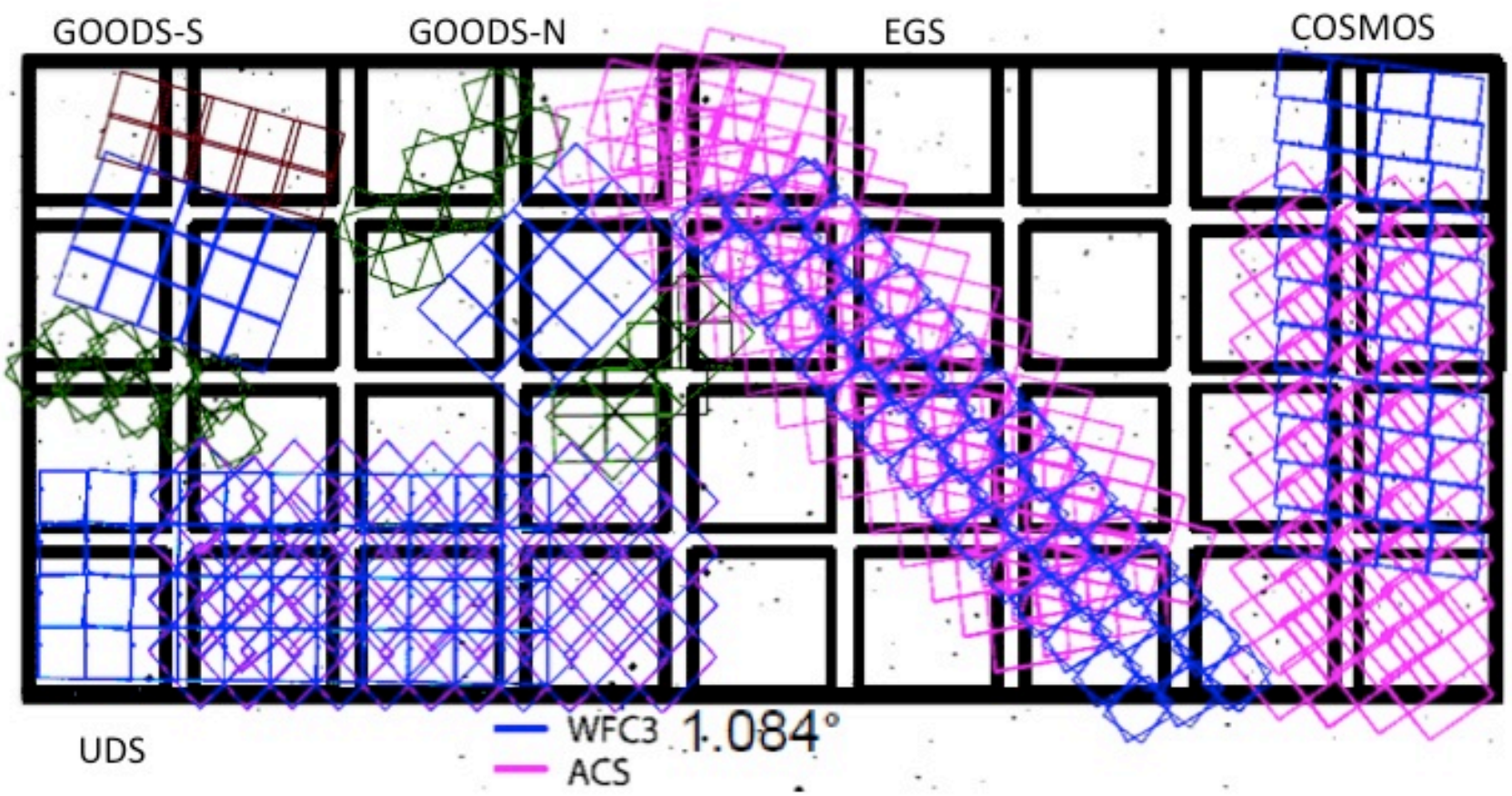
WFIRST DRM2 Observatory Layout



Solar array(blue) & sunshade, deployed

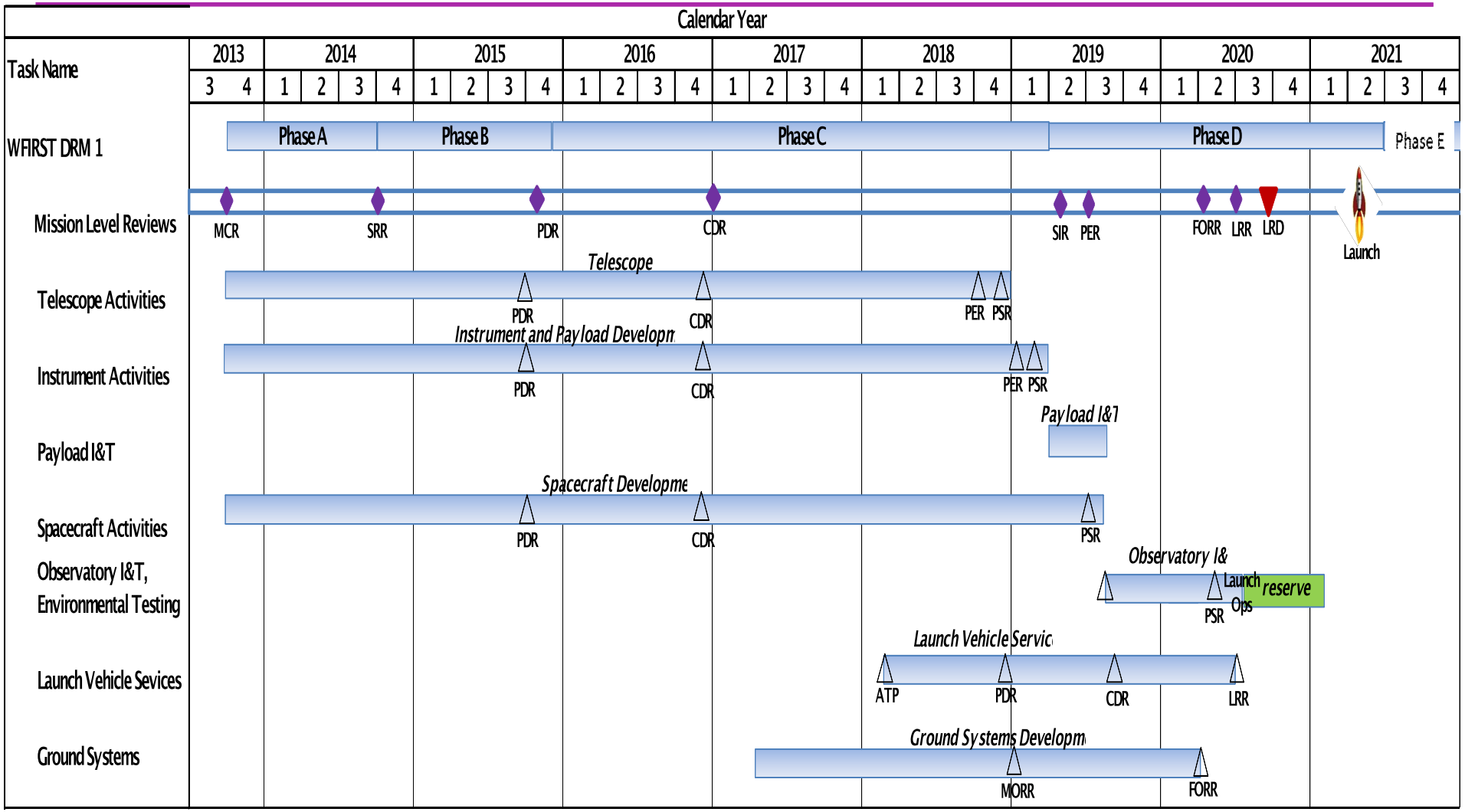
- Sun is at bottom in this view
- WMAP-like progression from warm solar array (300K) to cold focal plane (100K) from bottom to top
- Overall dry mass 500+ kg less than DRM1

CANDELS fields on DRM1 focal plane



from J. Kruk

WFIRST DRM1 Schedule Estimate



- 79 month development schedule
- Start of Phase B FY 15
- Launch Readiness Date Sept ember 2020
- 7 month schedule reserve

Funded Schedule Reserve

Cost Estimates

- The WFIRST Independent Cost Estimate by Astro2010 (based on JDEM configuration) was $1.6B
- The Project Office cost estimates indicate that DRM1 would have a full cost less that $1.6B due to single instrument channel and reduced mass.
- The Project Office cost estimates indicate that DRM2 would have a full cost of ~$1B due to the smaller telescope, significantly reduced mass, 3 year operation, Falcon 9 launch
- NASA HQ has funded the Project for an Independent Cost Estimate of DRM2.

Conclusion

- The SDT and Project have completed the action of developing two compelling mission concepts.
- DRM1: Fully responsive to the objectives of NWNH at reduced cost
- DRM2: Capable low-cost near-infrared survey opportunity. The limited 3 year life precludes full compliance with NWNH goals.
- Recommended path forward:
  - Refine the innovations developed in DRM2 into a “DRM1-like” mission concept; determine whether performance of this new concept can be fully responsive to NWNH.
  - Urgent need to develop 4kx4k IR detectors for wide-field applications