NRC Committee on the Assessment of a Plan for U.S. Participation in Euclid
2012 February

Finding: Both Euclid and WFIRST should make important contributions to the understanding of cosmic acceleration. While Euclid should advance our understanding of dark energy, WFIRST has the more robust and powerful approach. WFIRST should make significant advances in dark energy research beyond Euclid's own contributions.

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2012 February

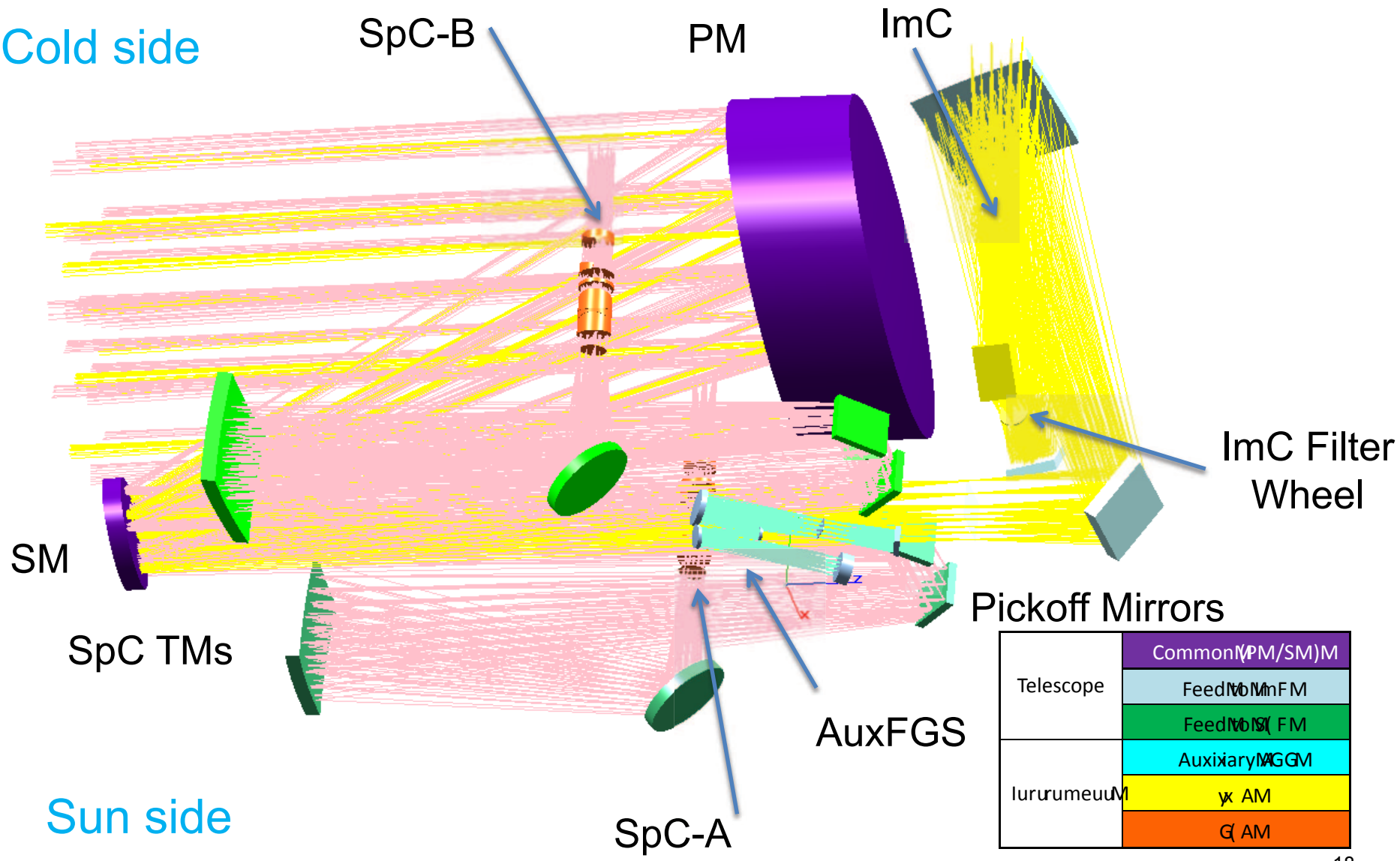
Finding: Critical elements of the WFIRST mission are outside the scope of the Euclid core mission. WFIRST's guest observer program will enable a broad range of astronomical science; its gravitational microlensing survey for exoplanets will provide an essential complement to Kepler in detecting Earth-mass planets at a wide range of separations, from the habitable zone to infinity; and its deep infrared surveys are well matched to the LSST optical survey. Among the unique aspects of the WFIRST mission are its supernova survey and its survey of the galactic plane.

Changes in WFIRST from IDRM to DRM1

1. **Spectroscopic channels eliminated;**
2. **Red limit pushed to 2.5 microns;**
3. **BAO deeper but less wide.**

and beyond: Hawaii-4RG

IDRM Payload Optics – Ray trace



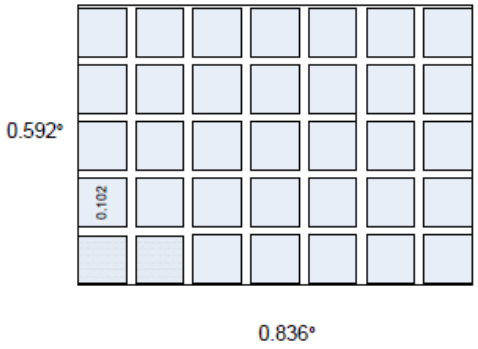
H2D2 layout

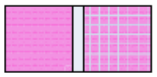
Moon (average size seen from Earth)

Channel field layout for WFIRST "H2D2"

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)

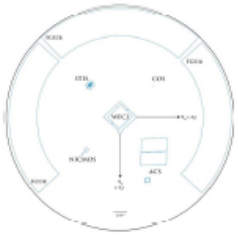
ImC: 7x5 @ 0.18"/p;
[xfield center, yfield center, degrees]





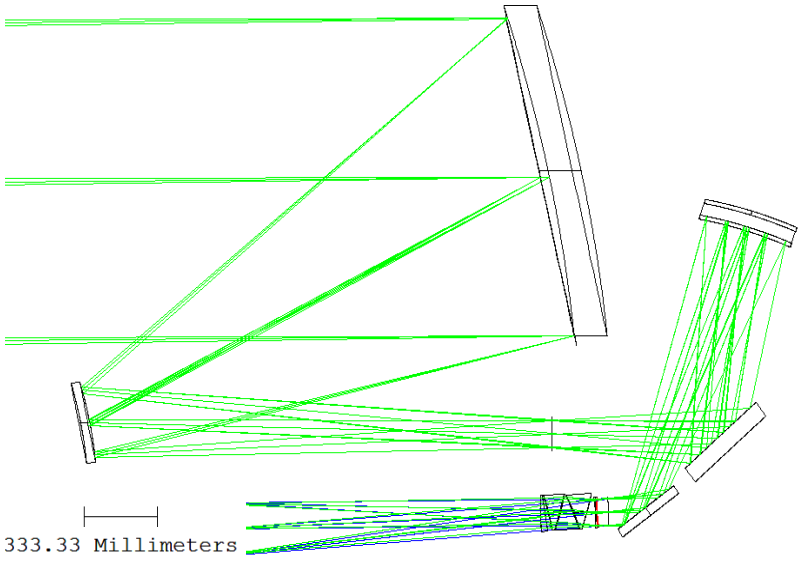
Auxiliary Fine Guidance System: 2@0.25"/p [0°, -0.6°]

JWST [all instruments]



HST [all instruments]

Each square shown is physically a 2040 x 2040 x 18um HgCdTe array [H2RG-18]



Optical ray trace layout for H2D2

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Why is the WFIRST approach preferred for weak lensing?

weak lensing is the riskiest program:

$$\begin{pmatrix} \textbf{uncertainty in local} \\ \textbf{mean image ellipticity} \end{pmatrix} < 0.0002$$

1. **Progressive CCD charge transfer inefficiency elongates images.**
2. **CCDs allow only one very broad "riz" filter; galaxy shapes and PSF vary within bandpass.**
3. **Requirements on optics and jitter are specified relative to diffraction limit and are a factor of two less demanding in IR.**
4. **Unobscured design produces cleaner diffraction pattern.**
5. **Galaxies are less irregular in the red than in the blue.**
6. **Unless systematic ellipticity errors are within the requirement, additional area provides little or no benefit.**