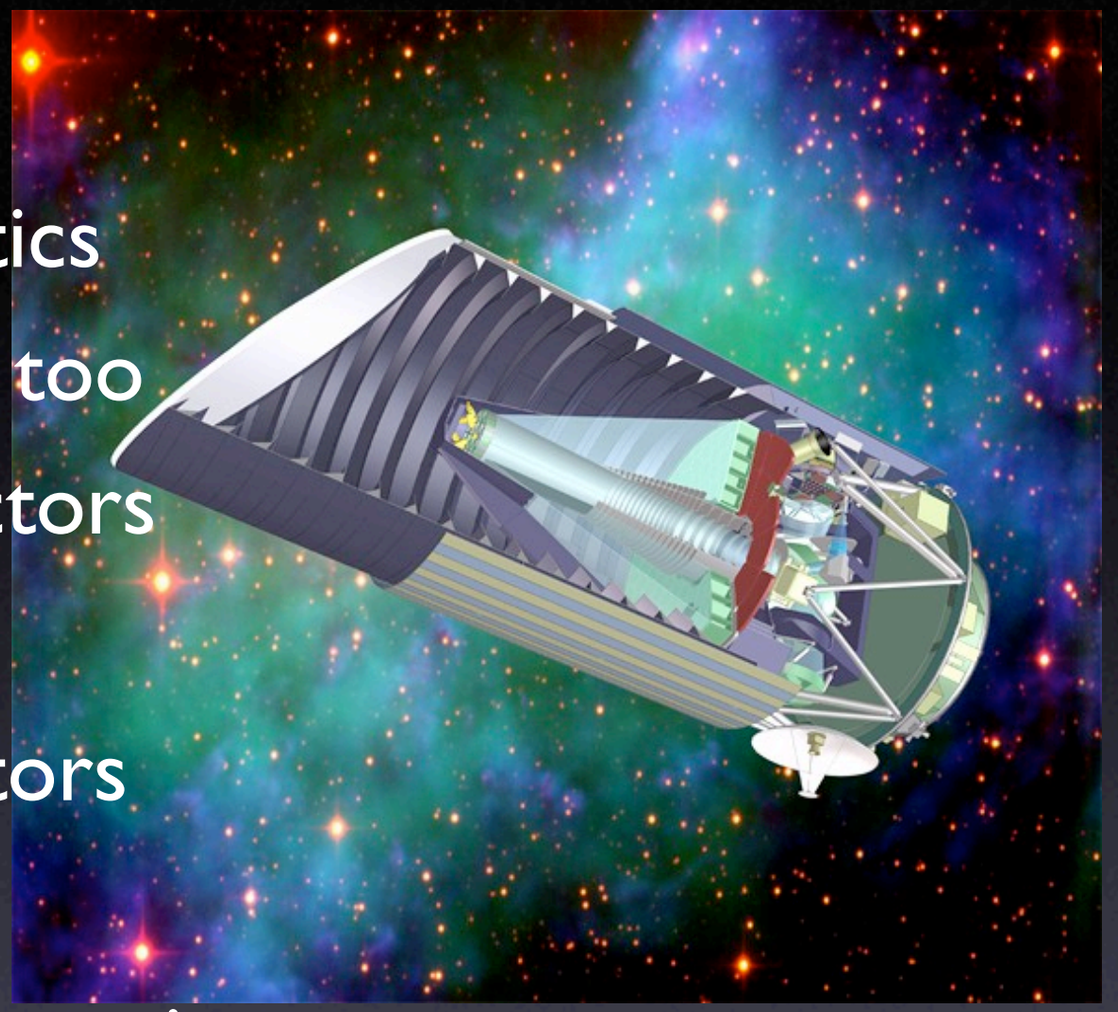
# Supernova Acceleration Probe (SNAP) WL

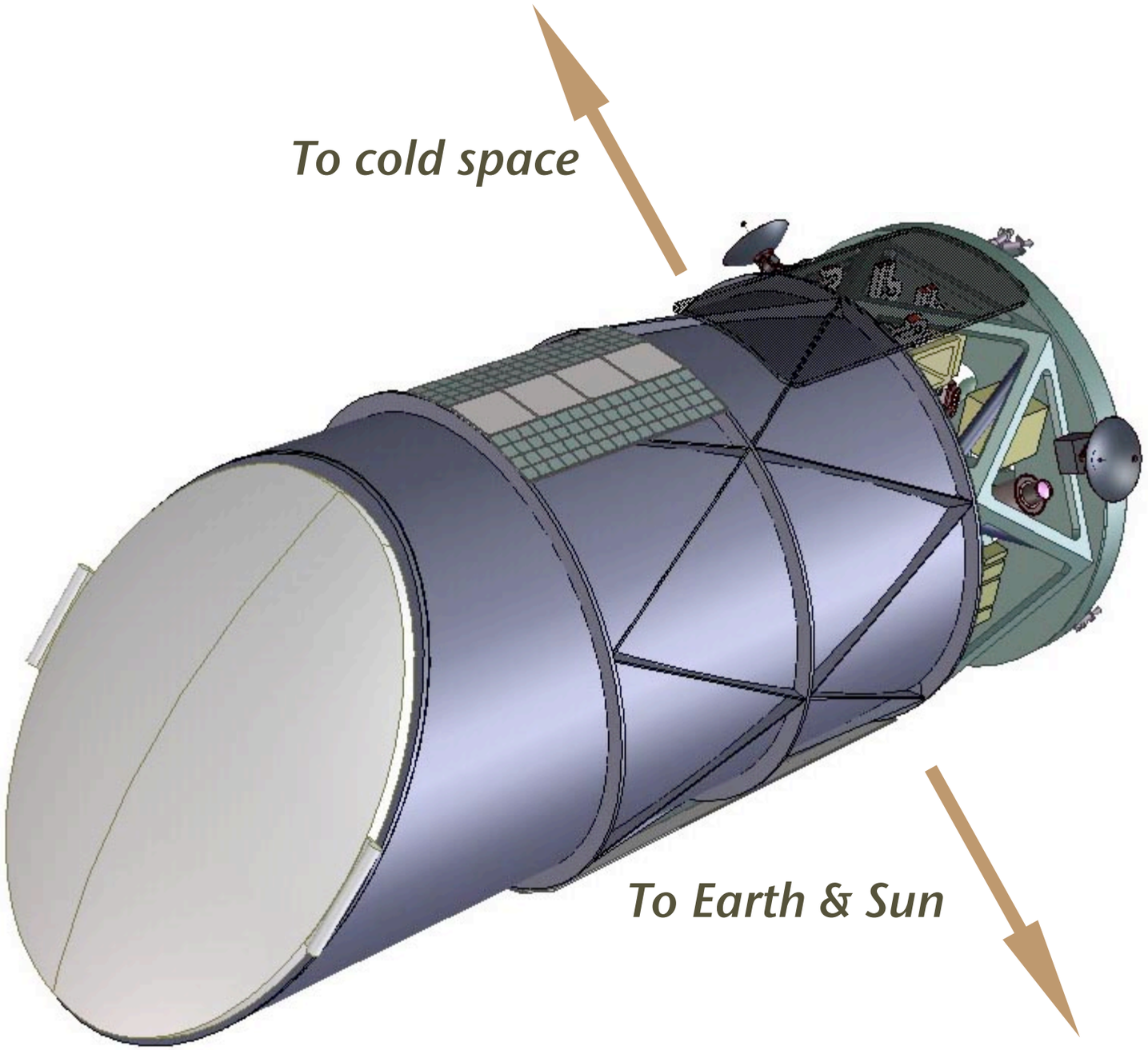
Presented by G. Bernstein, 8/23/2007
on behalf of SNAP WL group.

# Instrument Properties

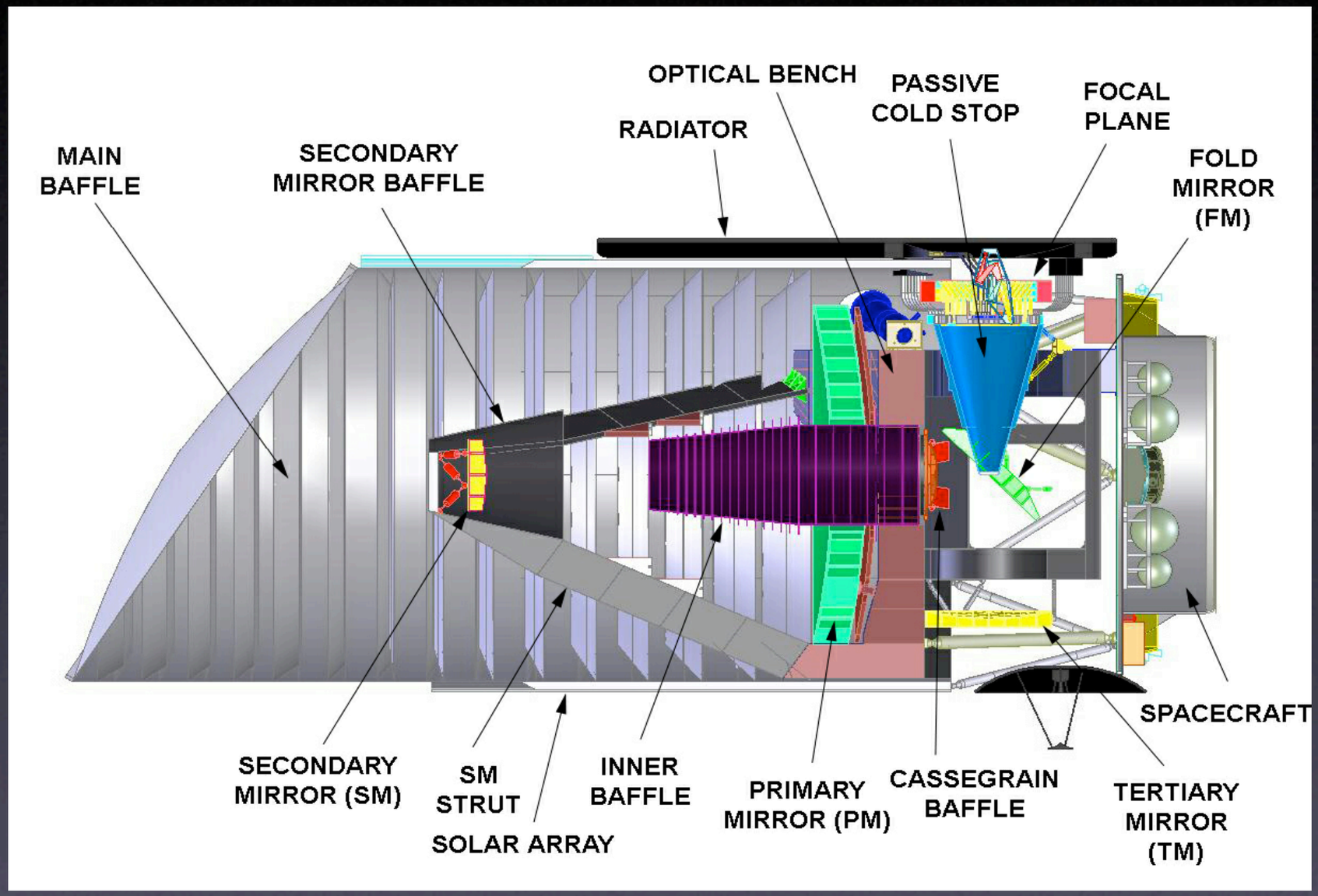


- ~2.0-meter diffraction-limited optics
  - But PSF degraded by detectors too
- 0.34 sq deg of HgCdTe NIR detectors
  - 3 fixed filters, 1.0-1.7 microns
- 0.34 sq deg of CCD visible detectors
  - 6 fixed filters, 0.35-1.0 microns
- High-efficiency R~100 image-slicing prism spectrograph, 0.4-1.7 microns
- L2 orbit with fixed solar aspect: >80% observing efficiency, high thermal stability
- Filters are overlapping and logarithmically scaled for minimal K-corrections and uniform photo-z.

# The SNAP spacecraft



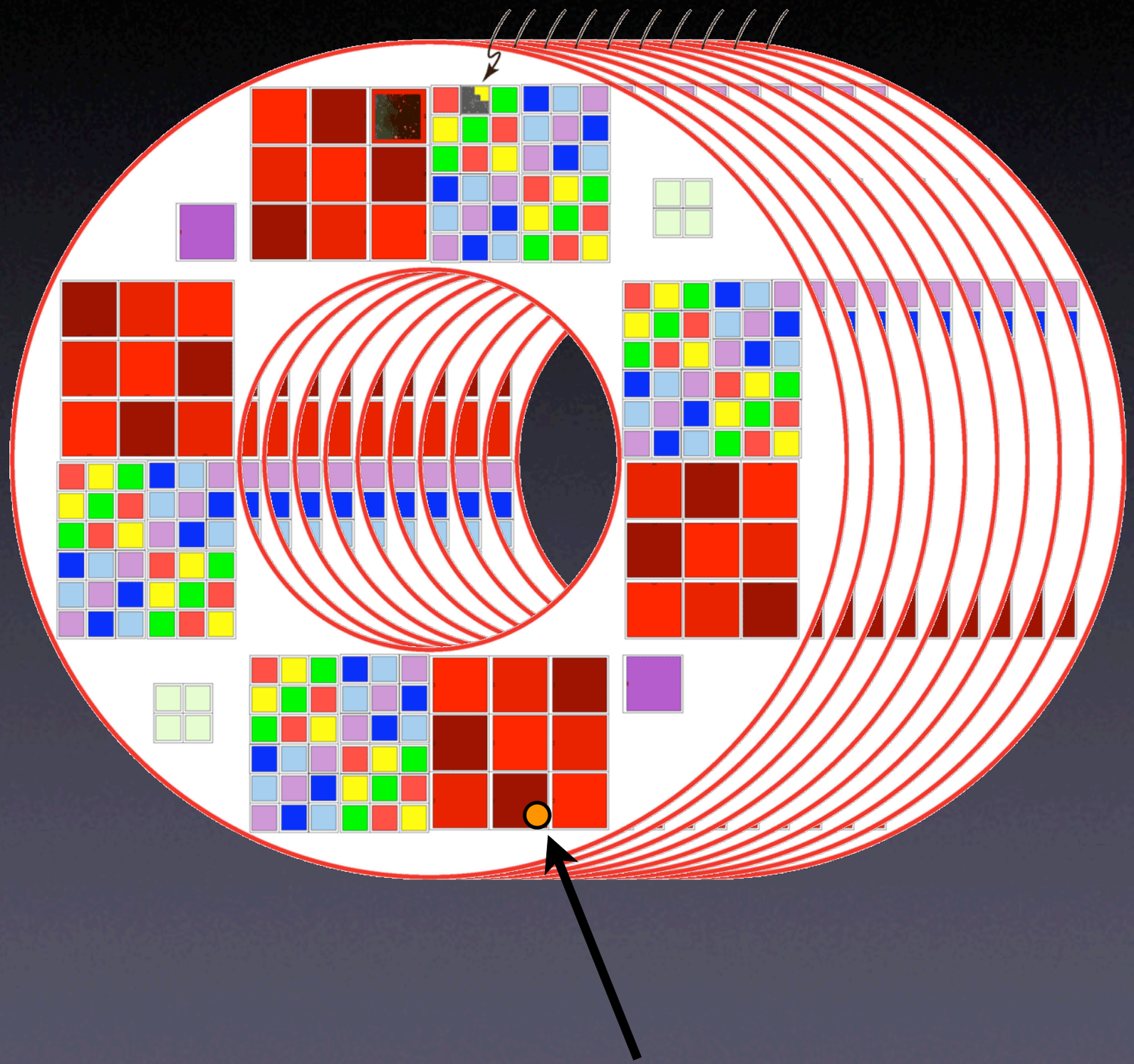
# The SNAP Spacecraft




# *Survey plans*

- All imaging modes use step-and-stare to cover all galaxies with all filters.
- 300s exposures, 30s readout, 2x2 dithering to reach Nyquist sampling at 800 nm.
- Spectrograph can conduct serendipitous photo-z calibration survey during all imaging!
- ***Supernova mode***:
  - repeat same ~7 sq degrees every 4 days for 22 months.
  - 40% of time devoted to long spectroscopic followup exposures of 2000 SNe
  - 60% of time for imaging gives ~20,000 pointings.
- ***Weak Lensing Mode:***
  - Continuous imaging yields ~1000 sq deg/year
  - 1 year in baseline mission
  - +3 year "extended" mission-> 4000 sq deg

# SNAP Scan Mode

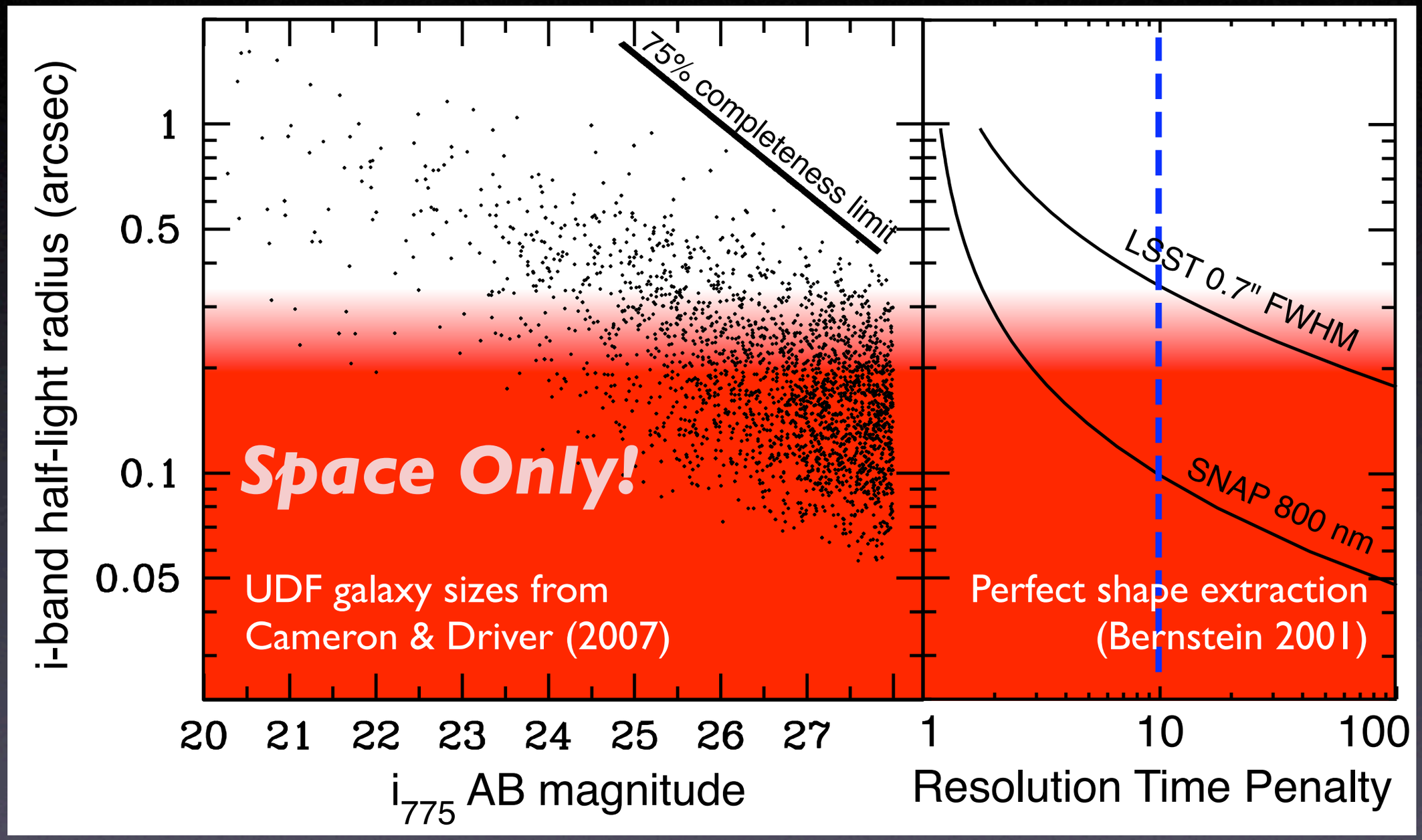


# *Weak Lensing Statistics*

- In Filter 4 (800 nm), EE50=0.10”=pixel size
- Noise mag in 4x300s = 28.25. As deep in filters 1-5, deeper in NIR, so noise for shape measure at least sqrt(2-3) deeper, say 28.7 (TBD)
- DJ formula gives Q~1200

$$Q \approx 1200 \left(\frac{\mathrm{EE50}}{0.10}\right)^{-0.56} \left(\frac{T}{1200\mathrm{s}}\right)^{-0.29}$$

# How does 1200 s on 2-meter beat 10,000s on 8m?

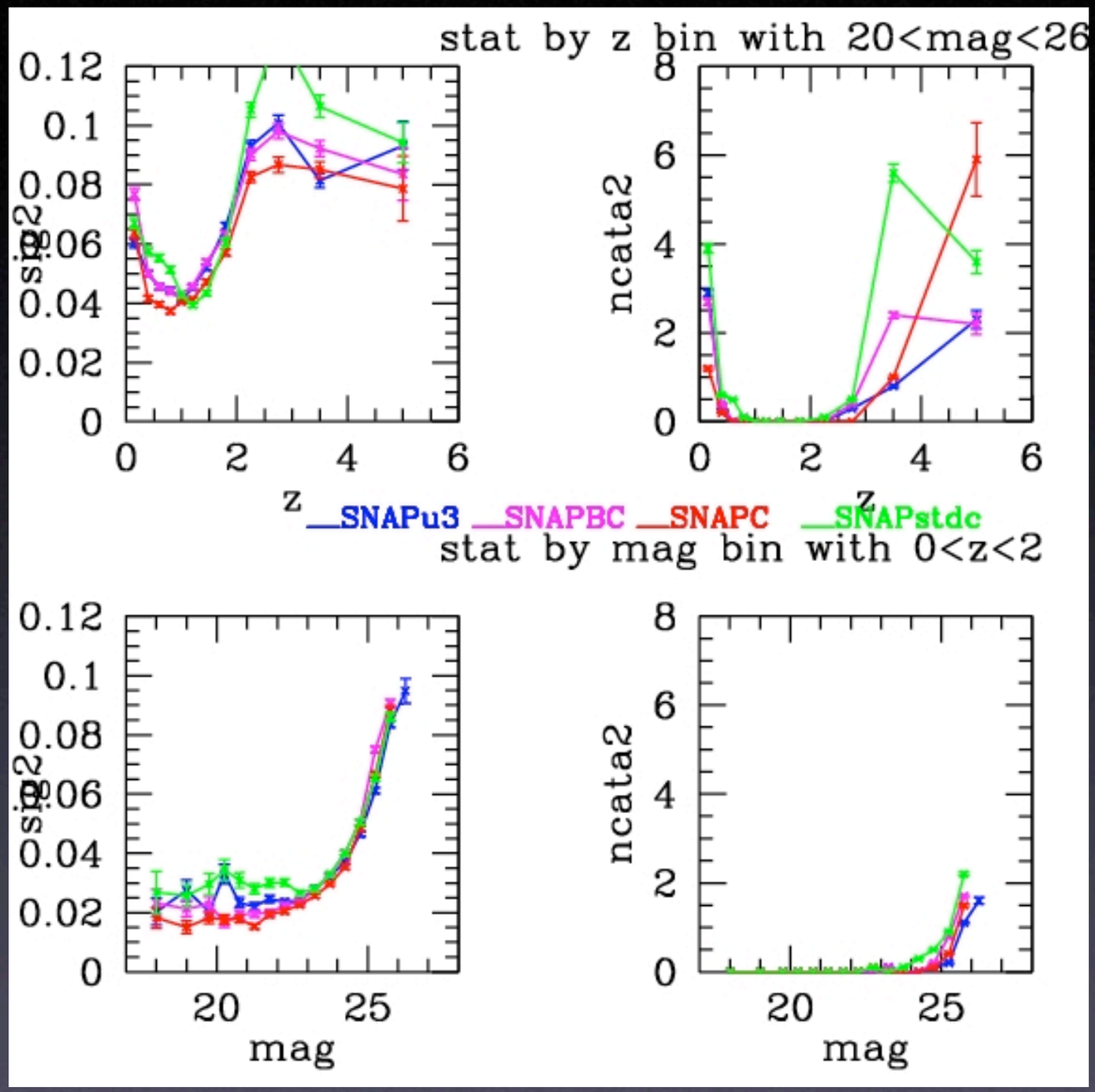



Ground-based PSF pays severe penalty for $r_h$<0.3”,
essentially impossible for $r_h$<0.2”.
Misses 1/2 of galaxies at $i_{AB}$=25

# *Weak lensing systematics*

- Compact, stable PSF, Nyquist-sampled
- Characterized by hundreds of stars per exposure
- Filter bandwidth ~0.25, color terms in PSF well characterized
- 9-band vis/NIR photo-z for every galaxy
- ~100,000-galaxy vis+NIR spectroscopic survey feasible from SNAP parallel spectra

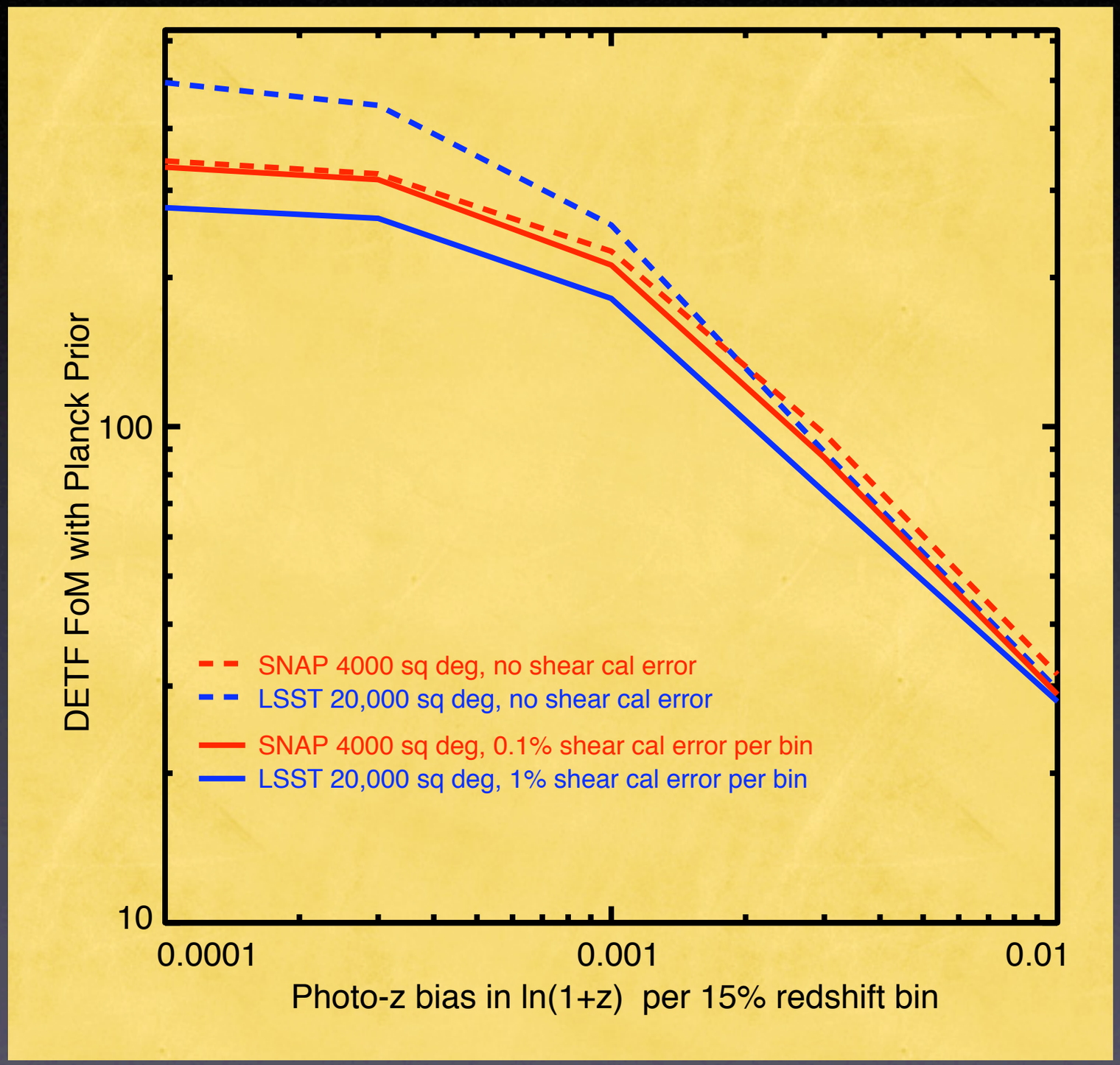
# SNAP photo-z quality




Dispersion of error in ln(1+z) and catastrophic error rates (%) for simulated SNAP photo-z's
Stephanie Jouvel & Jean-Paul Kneib

# *Trade of depth and area*

- Assume space has 3x higher source density & higher median source redshift than ground survey.
- With *no measurement systematics*, 20,000 sq deg ground has same DE power as 6500 space sq degrees
- With *expected 10x shear calibration difference*, 4000 sq deg space matches 20,000 sq deg ground survey *if the redshift systematics are the same*.
- Strong dependence on photo-z systematic error.
- These are nominal LSST 10-year survey and SNAP 4-yr "Extended wide survey."




(Uncertainties from baryonic physics & intrinsic alignments included)