WFIRST Scheduling Issues

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Pasadena (September 15, 2016)

Current Status

- Scheduling systems are a Science Center responsibility
- Working group co-chaired by Mark Giuliano (STScI) and Chris Hirata (OSU)
- Leveraging past efforts:
  - SDT "proof of principle" exercise (GEO and L2)
  - STScI scheduling study (2015)
  - Existing expertise on coronagraph scheduling
- No final decisions on the footprint or survey strategy are being made yet.
  - We do need to have an existence proof at every stage.
  - Optimization of the survey design will continue at least through commissioning.

WFIRST Challenges

- Lots of science programs trying to fit into the schedule, each with their own constraints:
  - High latitude survey – multiple passes over large chunk of the sky; avoid Galactic plane, ~2 years of mission time
  - Supernovae – low dust, low zodi, interspersed visits spanning the whole annual cycle, selection of IFC targets
  - Microlensing – continuous use of the telescope during ~6 "seasons" where Galactic Bulge well placed
  - Coronagraph – ~1 year total, interspersed through the mission, maybe in large chunks
  - GO – as selected by the TAC
- Everyone would like to get more time early in the mission

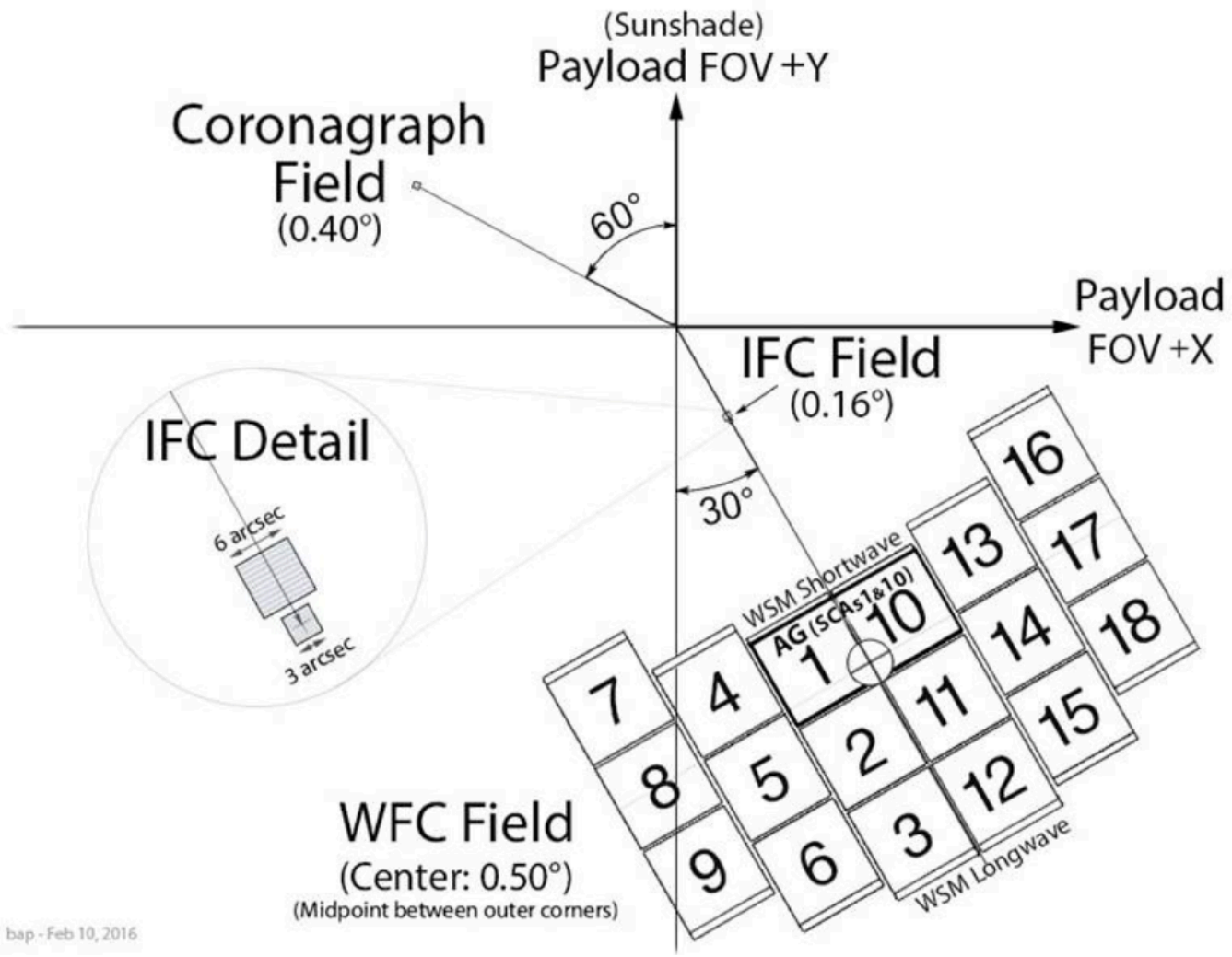
WFIRST Challenges

- Observatory constraints – can point 54—126° from Sun, roll ±15°; Sun moves according to annual cycle
- Sky – brightness minimum near Ecliptic poles, maximum in plane near the Sun. Galactic Plane is tilted ~60° to Ecliptic (bulge near Ecliptic).
- Ground overlap – with South (e.g. LSST), North (e.g. Subaru). Best would be the equator but this is highest sky brightness.
- Tiling – with modest number of dither positions, roll constraints, and "arced" 6x3 field, surveys require careful attention.
- ~~Geosynchronous orbit constraints – Earth (daily), Moon (monthly), orbit precession (secular)~~ We're going to L2.

WFIRST-~~AFTA~~ Instrument Field of View Layout

Sky Projection

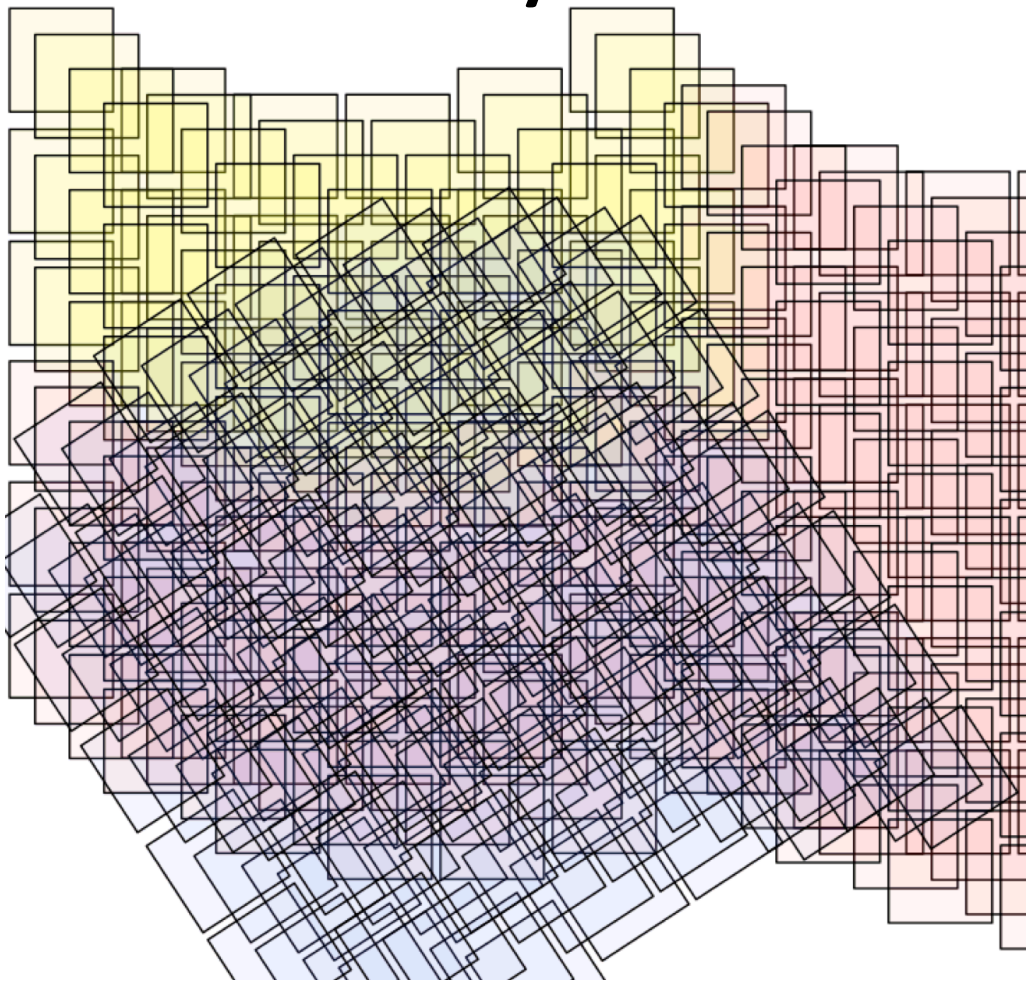
MCR Design (v.6.5.9b)



http://wfirst.gsfc.nasa.gov/science/Inst_Ref_Info_Cycle6.html

High Latitude Survey

- Notional survey is 4 filters (Y, J, H, 1.8μm)
- 5—7 observations per filter, split among 2 roll angles observed at different epochs
- Similar for the grism but would use 4 roll angles
- Placed within LSST footprint and far from the Galactic Plane

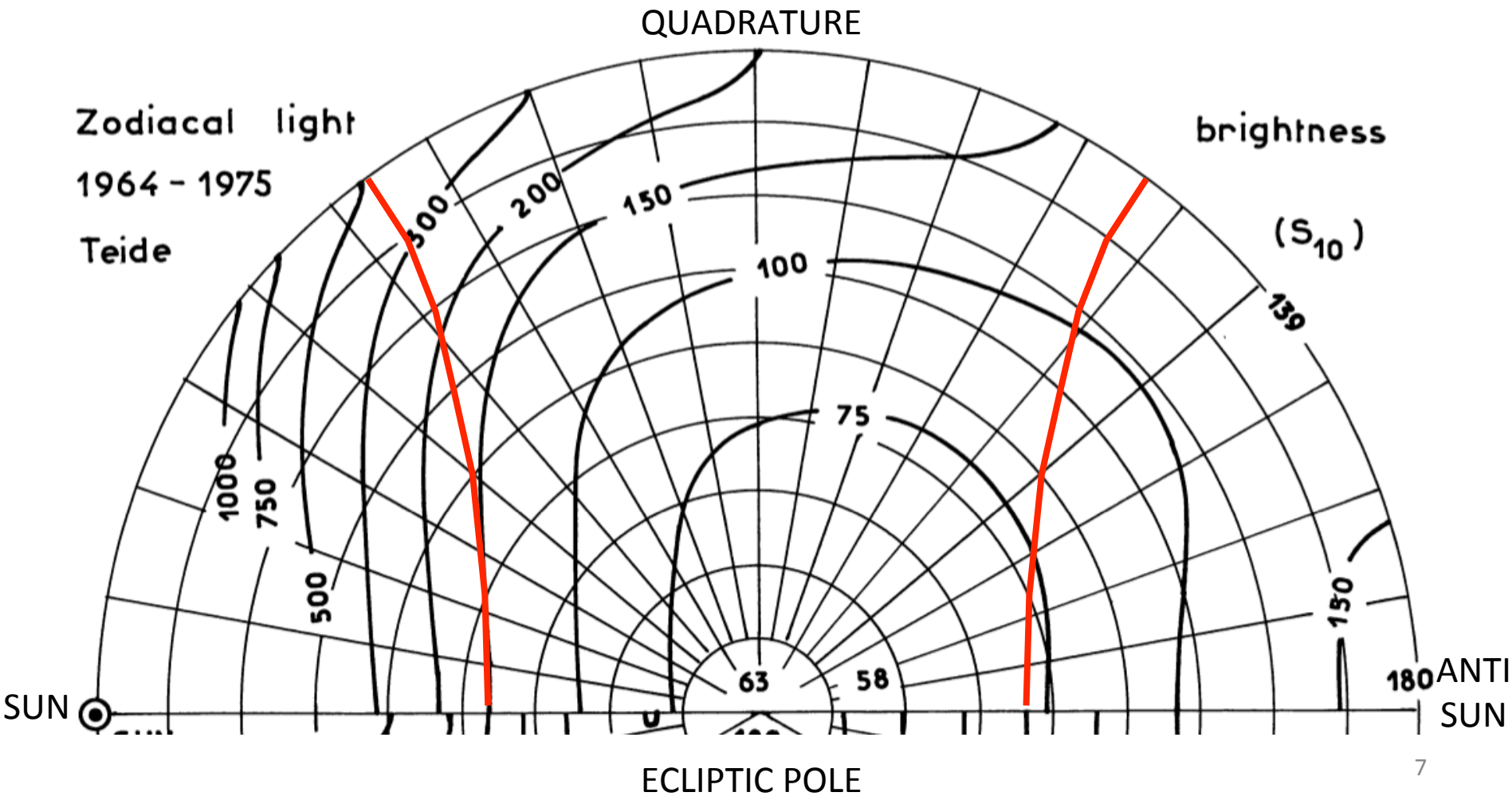


- All details (# dithers/rolls; exposure time vs. area; footprint location) to be refined going forward, up to the time the survey begins.

(Average) zodiacal brightness

[Dumont & Sánchez 1976]

Red lines indicate WFIRST observing limits.

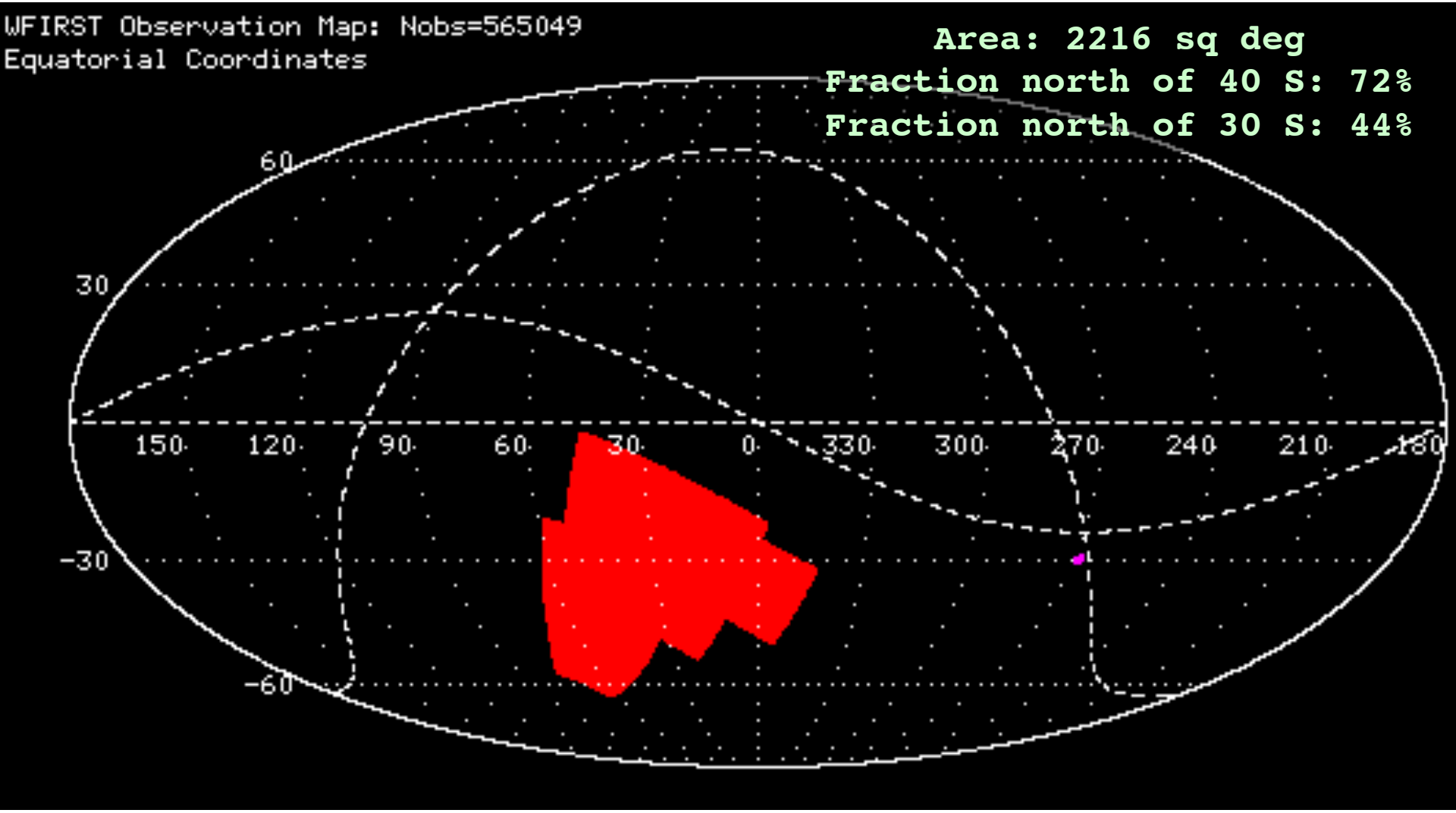


Example Schedules

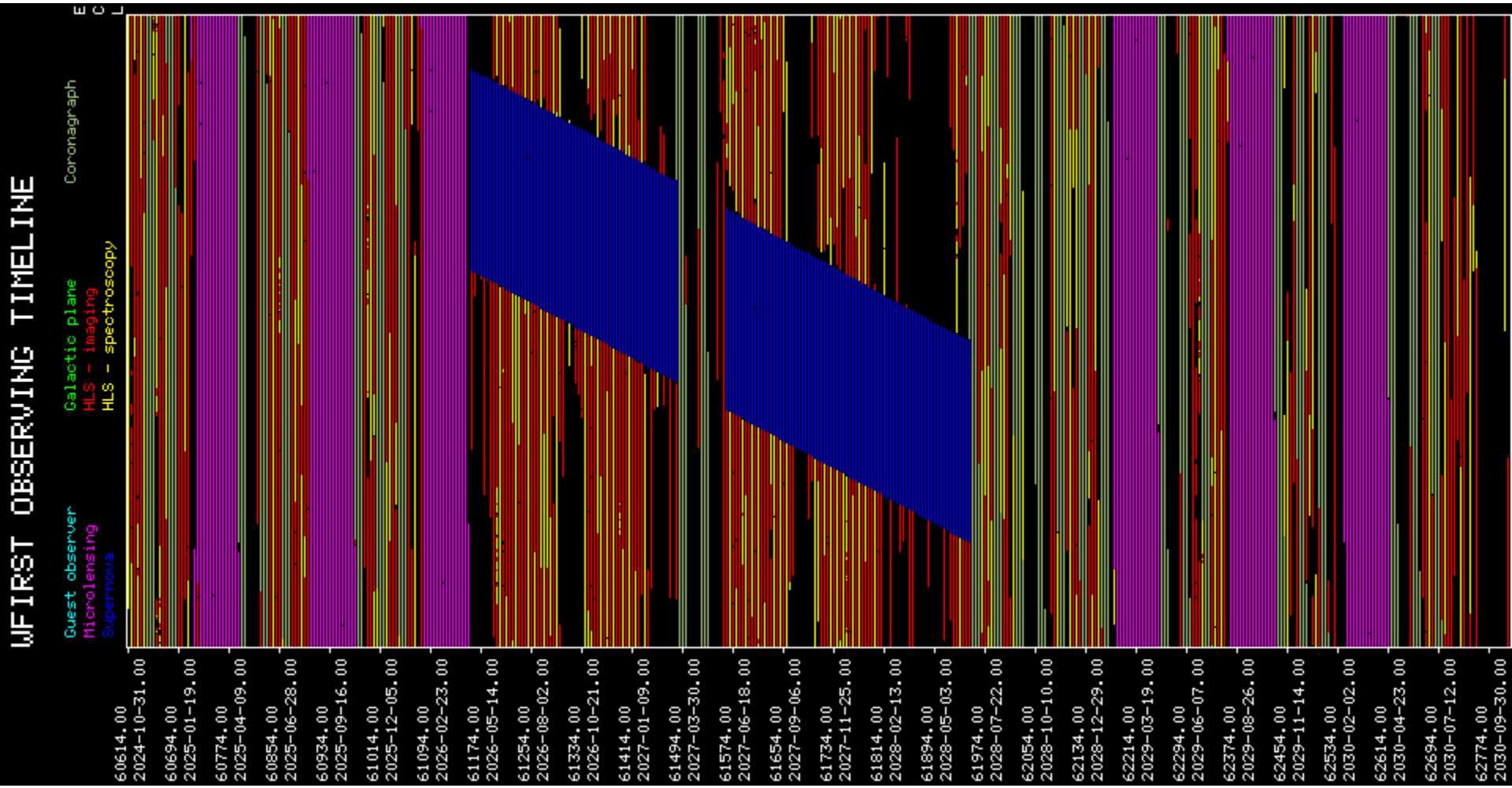
- Carried out to show that WFIRST could conduct the planned surveys without collisions
  - Not fully optimized, not with the software that we will use for the final schedule (latter to be developed)
  - We expect changes (maybe significant) to the survey strategy from each science area as informed by new discoveries, lessons learned from other projects, and the realized observatory performance
- This is not a policy decision – e.g. the example schedule weighted strategic programs early in the mission, other variants also work.

Example Footprint

[Equatorial Coordinates]



Example (2015)



Significant Issues

- Need to account for all demands on time
  - Currently re-working allocations for calibration and losses (transitioning from notional allocations to bottoms-up estimates)
- (Potential) conflicts
  - DE and μlensing are happy to observe at different times of year
  - HLS is a big program and preferentially occupies certain months.
  - Does this change depending on the SN strategy, coordination with ground-based observatories?
  - Long coronagraph characterization observations not consistent with 5 day cadence for SNe
- Operational issues, e.g.:
  - How dynamic is the scheduling?
  - What is done by science teams vs. Science Center?

Significant Issues II

- HLS Placement and timing
  - Could move farther north to improve fraction accessible from Subaru, at expense of zodi brightness
  - GI science with the HLS, especially astrometry
- Significant dependence on when we launch?
  - Microlensing, HLS availabilities are on a yearly cycle
  - L2 orbit geometry/phase?
- Policy guidance from Project/HQ
  - Our working group doesn't make policies, we implement them

… more?

Discussion