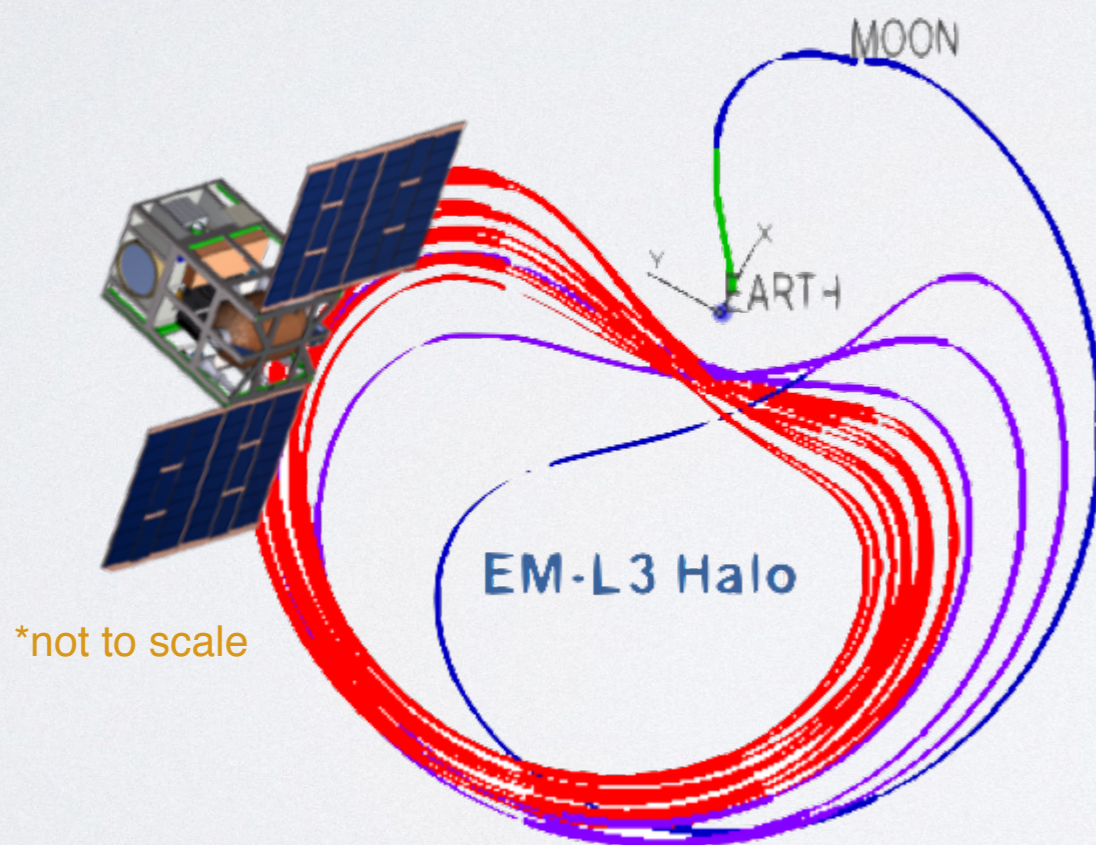




MOON BEAM

LATEST STATUS



C. Michelle Hui (NASA/MSFC)
on behalf of the MoonBEAM team

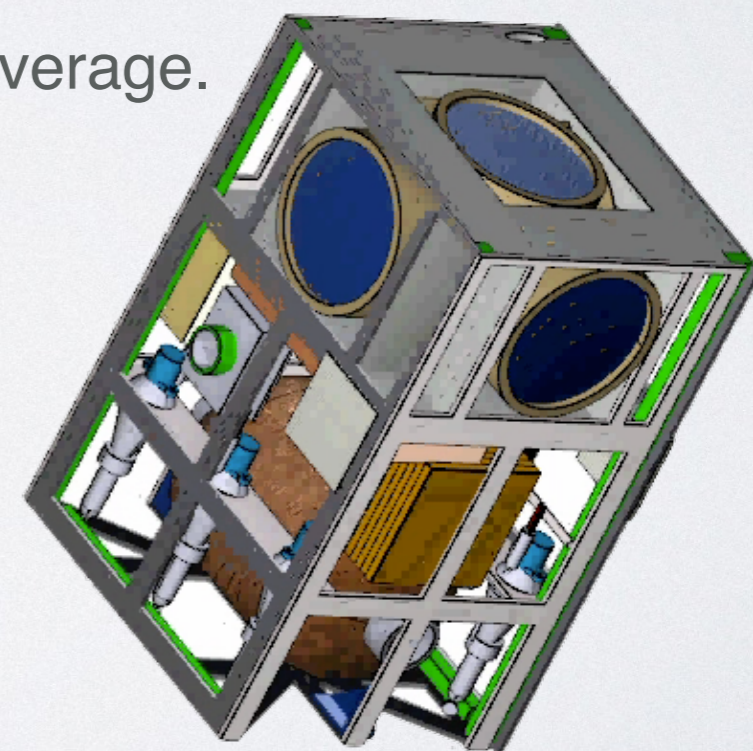
GRB nanosats meeting
2020-03-25

Mission Goals

- Detect short gamma-ray bursts associated with gravitational wave events to study astrophysical jets and probe fundamental physics from neutron star merger events.
- Improve localization to enable faster afterglow detection to study kilonova evolution and the origin of heavy elements.

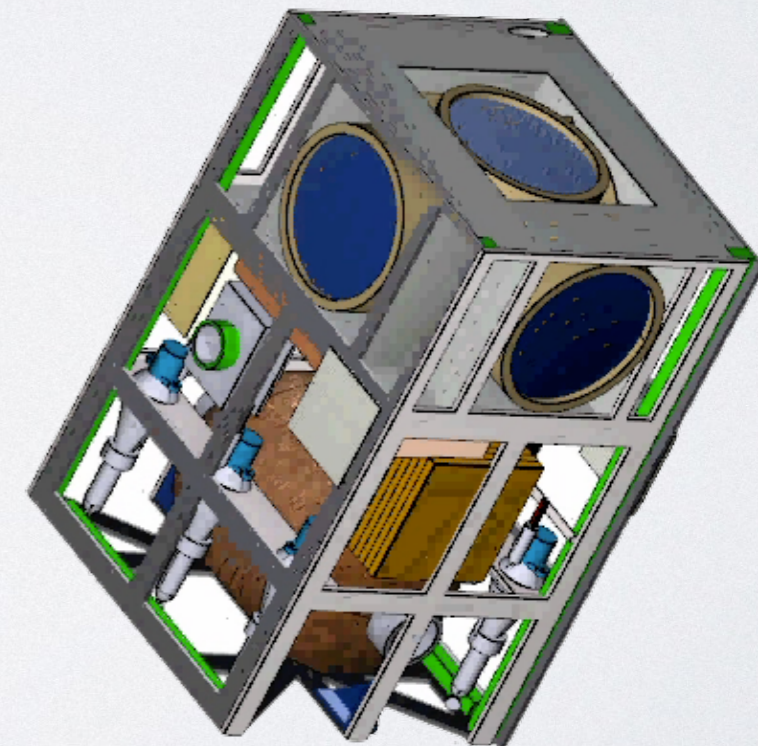
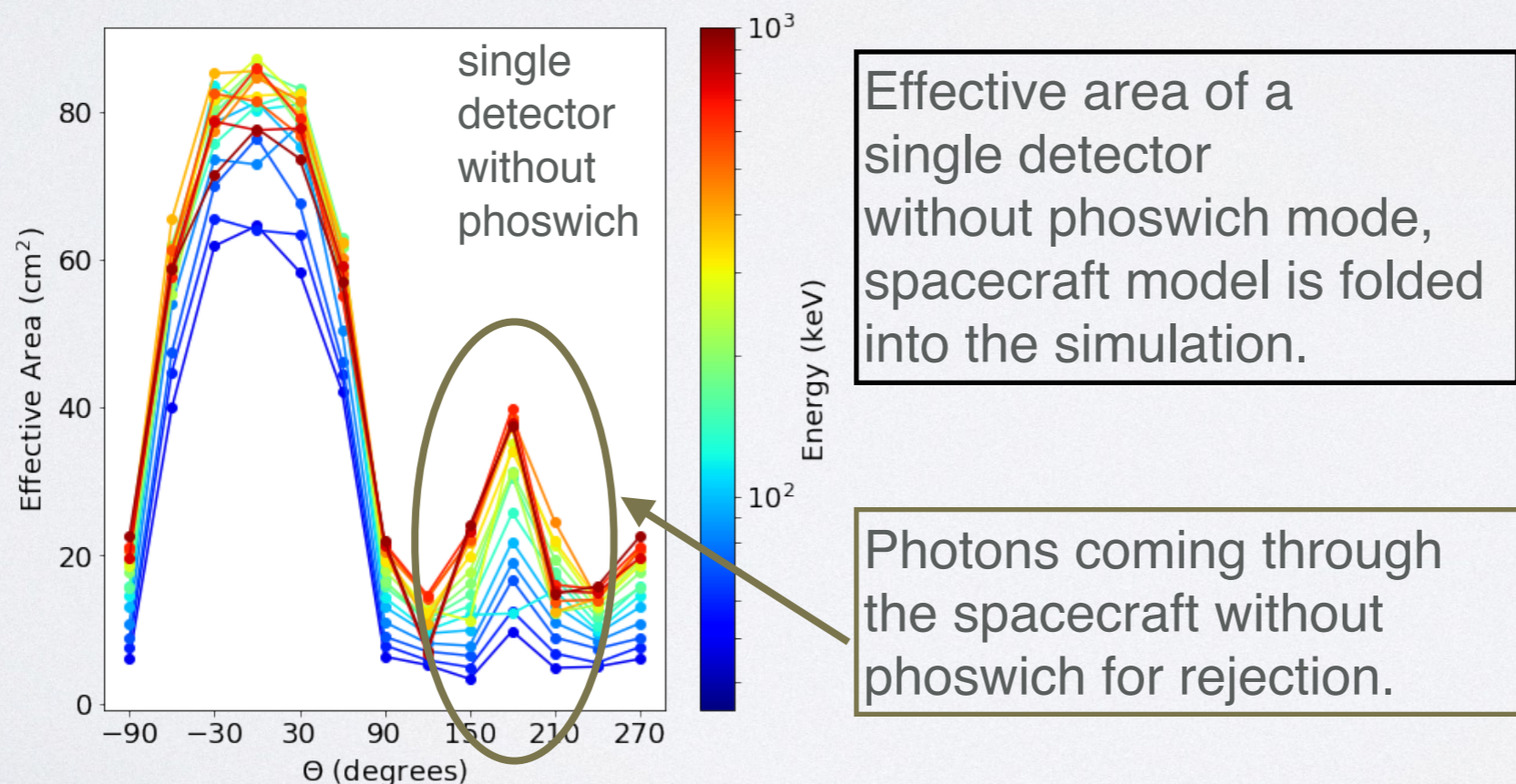
Mission Description

- 2-year SmallSat mission concept to detect gamma-ray bursts.
- Science instrument is 5 detector modules (NaI/CsI phoswich + SiPM) positioned to maximize sky coverage.
- Cislunar orbit at L3 point of Earth-Moon system (95,500 — 665,000 km from Earth).



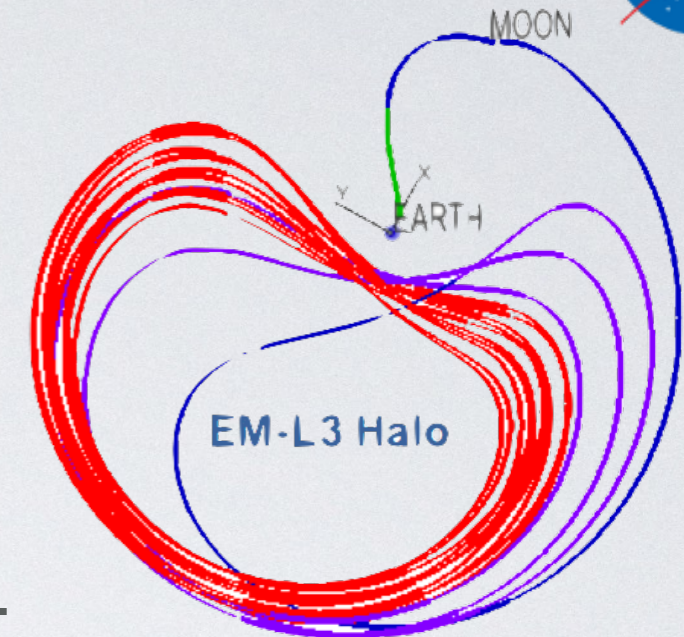
Mission Description

- 2-year SmallSat mission concept to detect gamma-ray bursts.
- Science instrument is 5 detector modules (NaI/CsI phoswich + SiPM) positioned to maximize sky coverage.
 - ▶ phoswich design to distinguish background from photons coming through the spacecraft.
- Cislunar orbit at L3 point of Earth-Moon system (95,500 — 665,000 km from Earth).



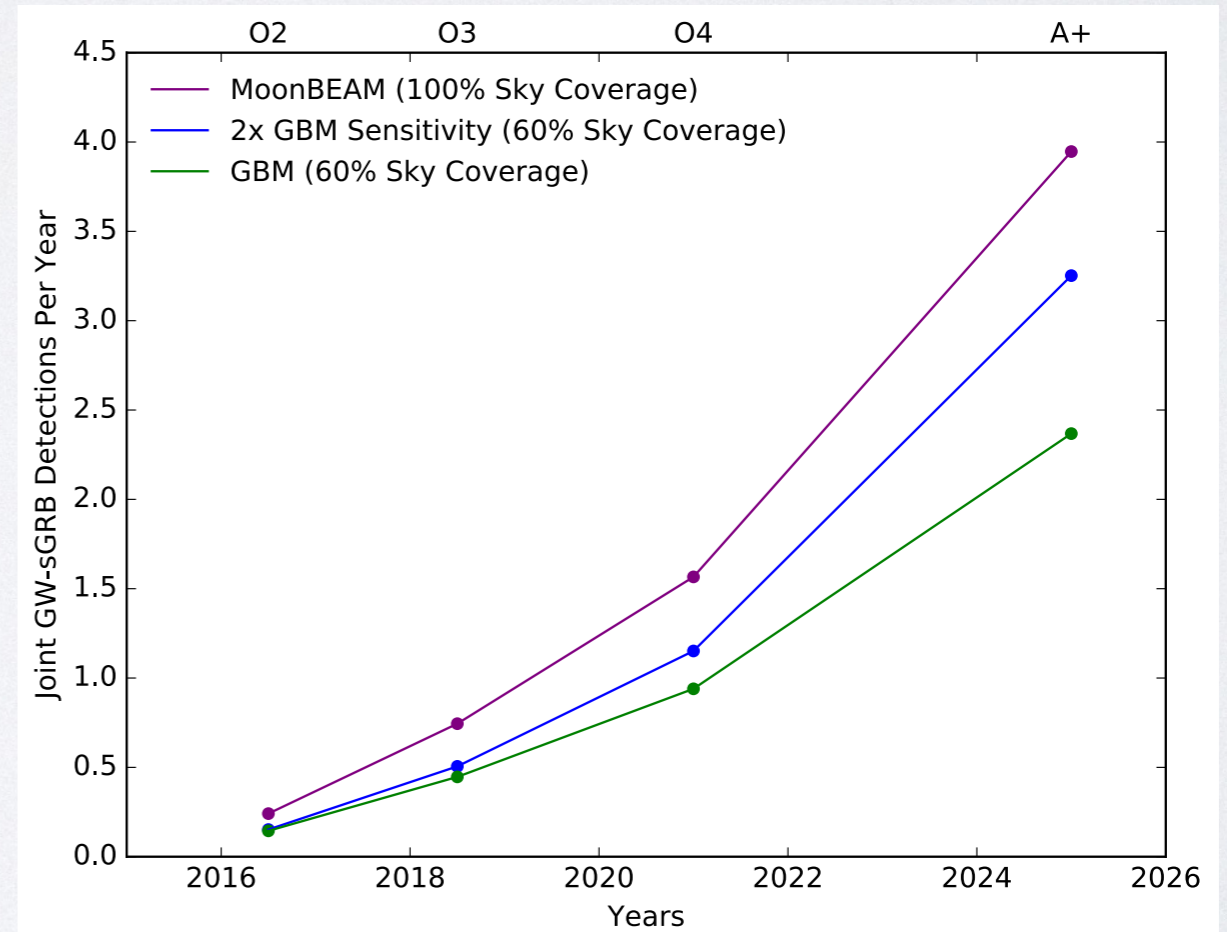
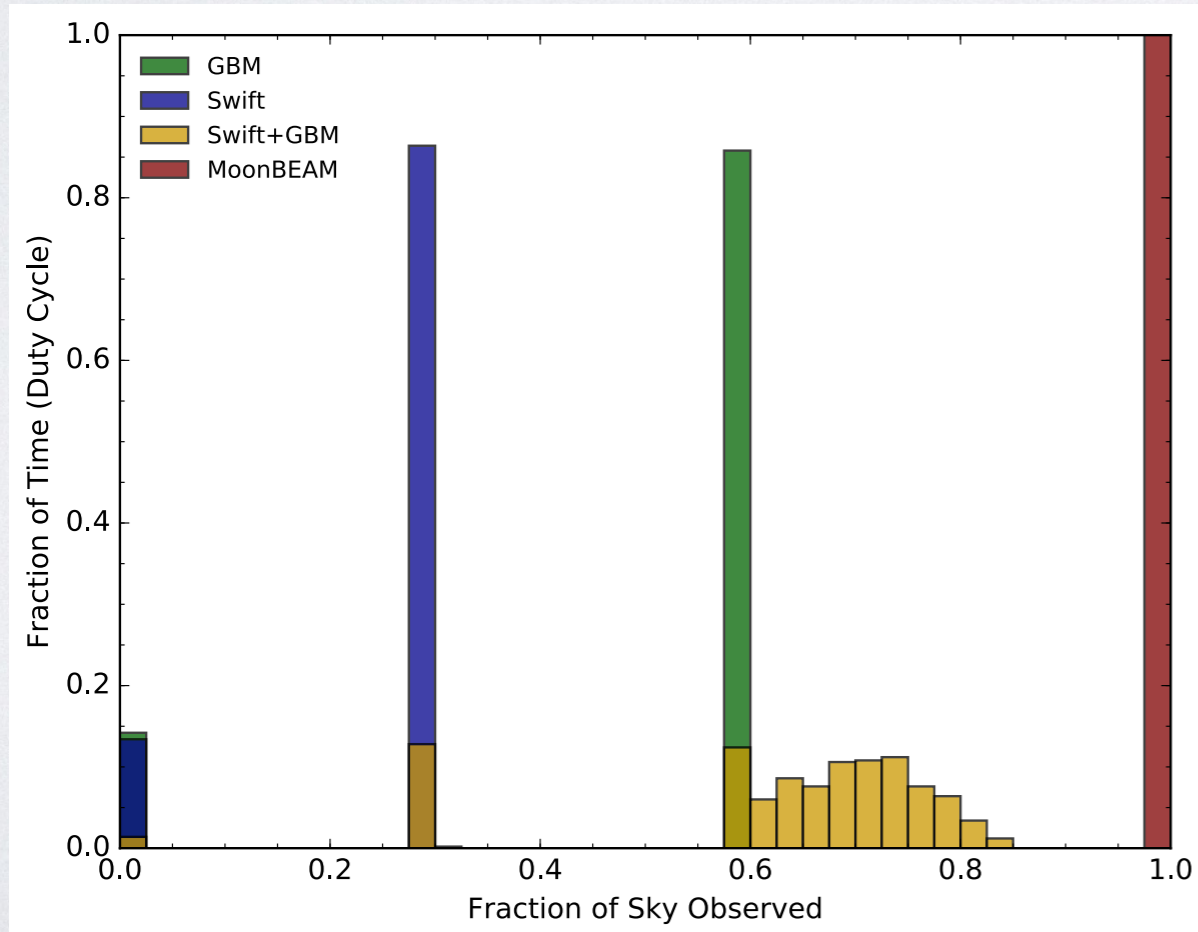
Mission Description

- Cislunar orbit at L3 point of Earth-Moon system (95,500 – 665,000 km from Earth).
 - ▶ Earth occults $< 0.1\%$ of sky at maximum.
 - ▶ High duty cycle, no SAA passage.
 - ▶ More stable background compared to Low Earth Orbit.
 - ▶ Additional localization improvement with IPN-like timing triangulation.



More sky coverage

More joint detection

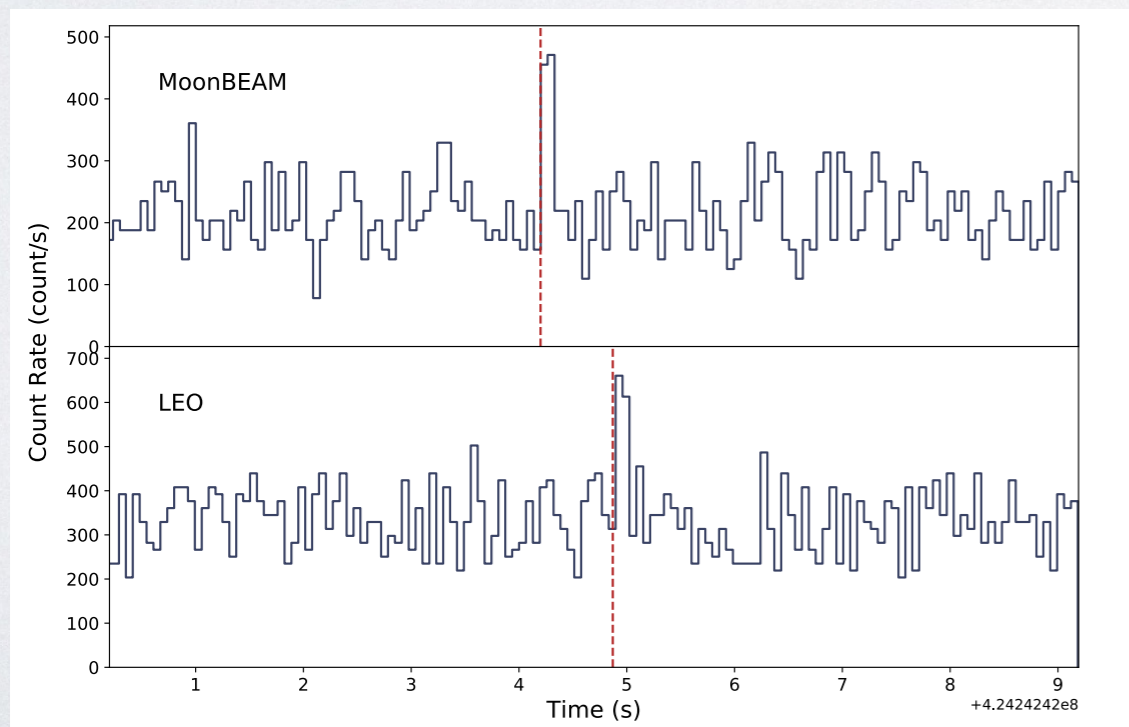


Mission Description

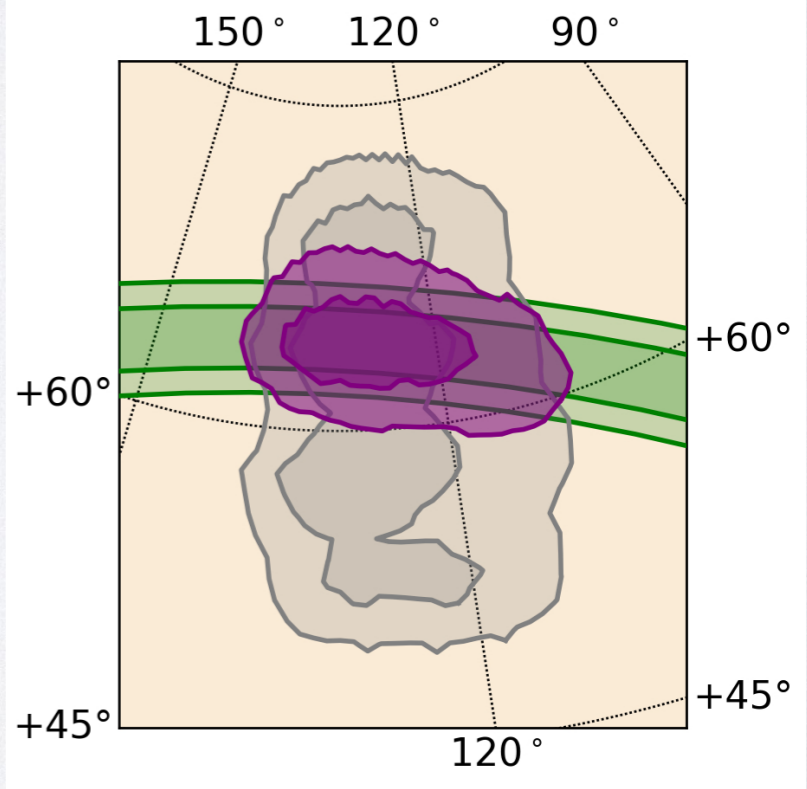
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SGRB rate estimate
30-70/year
 *assuming single-crystal detector

Median-bright GRB at 45deg baseline
 MoonBEAM average distance from Earth



MoonBEAM localization of an average GRB
MoonBEAM + LEO instrument timing annulus
 Combined posterior (loc area reduced by factor of 3)



- Mission concept submitted to the 2019 Astrophysics SmallSat Concept Study call in Dec 2019.
 - ▶ Refine spacecraft design in terms of propulsion and communication.
 - ▶ Additional viable orbits to be evaluated in trade study.
- Ongoing lab work on NaI/CsI phoswich
 - ▶ Evaluating pulse shape discrimination parameter and optimal settings.
 - ▶ Additional combination being investigated for front/back photon discrimination.

