

Time-Domain Studies

(Some Plans)

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Your Name Here ...

First Light Science Requirements Example

“First Protostellar Variables Uncovered at 860 GHz”

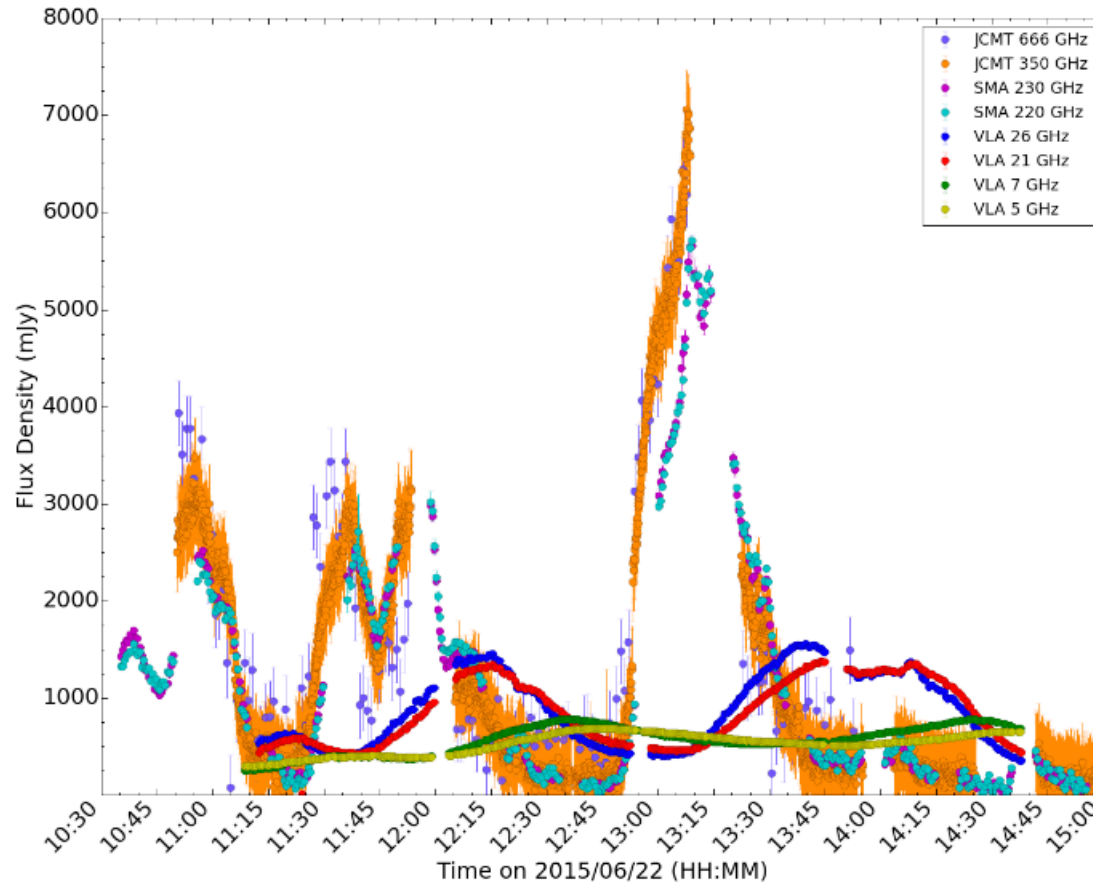
- 860 / 350 GHz preferred modules
- 100 / 10 mJy bm^{-1} RMS per epoch
- 10 sq deg field of Orion Star-forming Region
 - 2 sq deg 860 / 350 GHz commensal
 - 8 sq deg extra for full 350 GHz coverage
- 1 hr (850 GHz) + 0.8 hr (350 GHz) per epoch
with early science instrumentation
- 7 day cadence (14 days ok if epochs are deeper)
 - 50 hrs (850 GHz) + 40 hrs (350 GHz) per yr
- **Relative calibration scheme to a few percent**

First Light Science Requirements Example

“First Protostellar Variables Uncovered at 860 GHz”

- 860 / 350 GHz preferred modules
- 100 / 10 mJy bm^{-1} RMS per epoch
- 10 x 1 sq deg fields of Galactic star-forming regions
 - 10 x 1 sq deg extra for full 350 GHz coverage
- 1 hr (860 GHz) + 1 hr (350 GHz) per epoch
with early science instrumentation
- 7 day cadence (14 days ok if epochs are deeper)
 - 50 hrs (860 GHz) + 50 hrs (350 GHz) per yr
- Relative calibration scheme to a few percent
- Efficient observing strategy for ‘small’ maps

Microquasar V404 Cyg in 2015



Tetarenko et al. 2017

First Light Science Requirements Example

“Rapid 860 GHz Flaring of the Microquasar TBD”

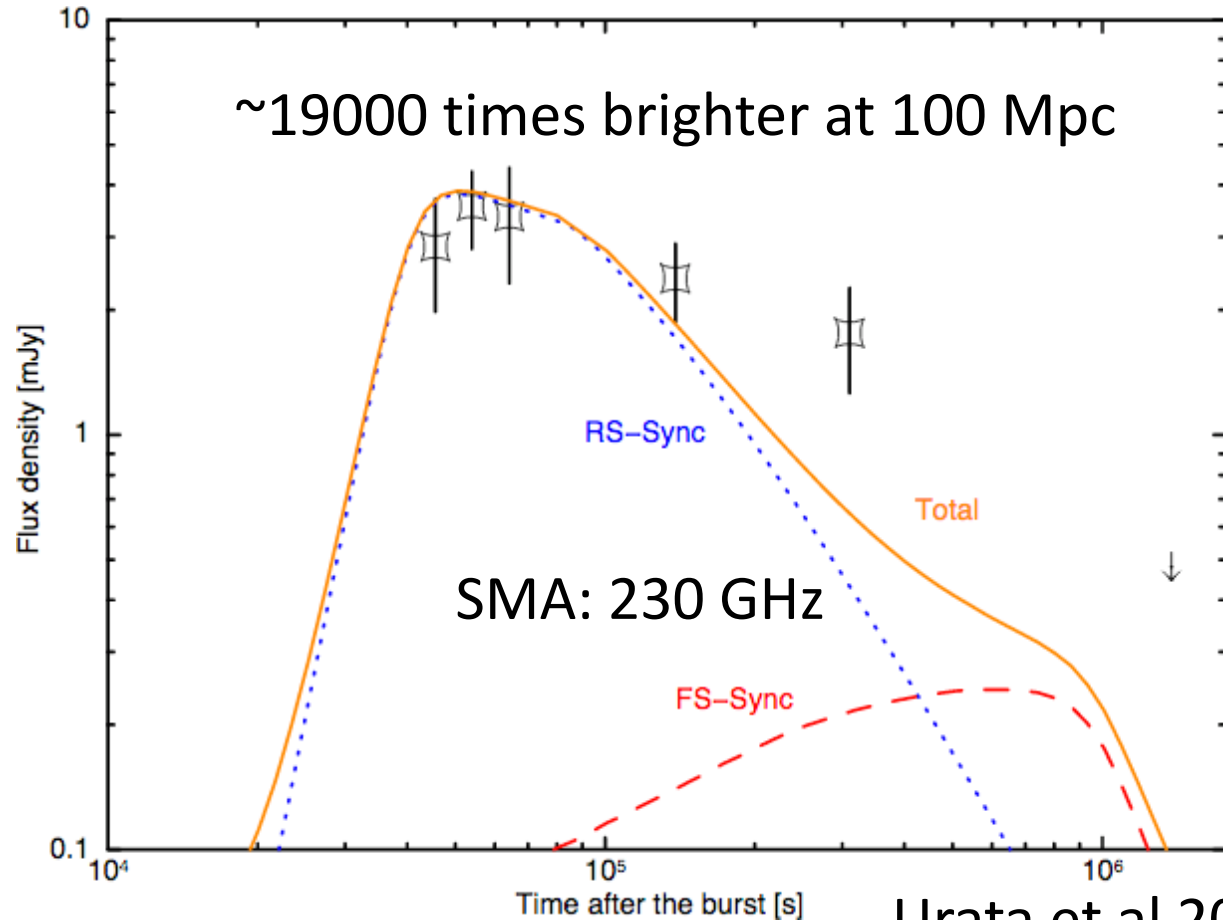
- 860 / 270 GHz modules [Q2 weather]
- $\sim 500 / 30 \text{ mJy bm}^{-1}$ RMS time bins every 1-min
 - 2 X lower than that of JCMT 666 GHz
- 1 x 4 sq deg fields of a Southern Galactic Microquasar per yr
 - 270 GHz will be simultaneous with 850 GHz
- 6 hr per epoch *with early science instrumentation*
 - Set by source variability timescales
- 1 Day cadence for 10 days per trigger
 - 60 hrs / yr
- **Special requirements on next page**

First Light Science Requirements Example

“Rapid 860 GHz Flaring of the Microquasar TBD”

- Target of Opportunity / Targeted Followup Mode
 - Commensally creates intermediate tier “survey” data
- Typical (SMA/JCMT/ALMA-like) response (< 72 hrs)
- Preferred: Coordination with other facilities

GRB 120326a ($z = 1.8$)

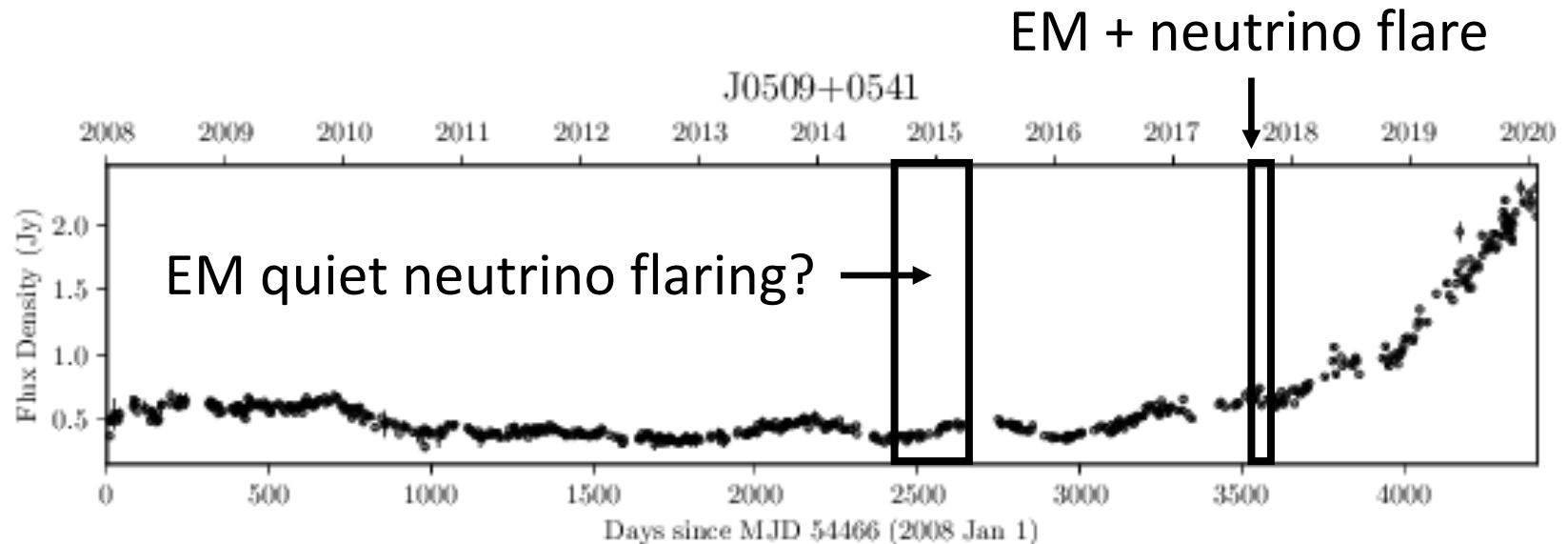


First Light Science Requirements Example

“100 Mpc-distant GW Source Localization Enabled by its Evolving Reverse and Forward Shock”

- 270 / 350 / 850 GHz modules [Q3 / Q3 / Q2 weather]
- $\sim 125 / 140 / 160$ mJy bm^{-1} RMS time bins every 1-min / 7.5-min / 75-min) observing time
 - SNR ~ 10 -20 at $t < 12$ hrs scaled to GRB 120326a
- 10 x 50 sq deg fields of Binary NS Candidate GW Sources
 - 30 sq deg commensal
 - 4.5 hr per epoch *with early science instrumentation*
- Daily cadence for 3 days after 10 triggers
- 135 hrs total
- Rapid response / continuum image data delivery (< ~ 6 hours / 24 hours)

TXS 0506 +056: Only likely-known Very High Energy Neutrino Source



OVRO 40-m monitoring program
(Richards, J. L. et al. 2011, ApJS, 194, 29)

Full Science Requirements Example

“Secular Variations and Flares in the sub-mm of Blazars associated with Very High Energy Neutrinos”

- 270 GHz modules [Q2 weather]
- ~ 30 mJy bm^{-1} per epoch
 - SNR > 5 for $> 20\%$ TXS 0506+056 (2017-Sep; $\frac{\partial f^\nu}{\partial \nu} = 0$)
- 4000 sq deg blind survey (could go to 12000 sq deg)
- Completely commensal!
- 3 deg / s scanning preferred for eventual 12000 sq deg
- Every 2 day cadence matches existing blazar radio monitoring
- Preference: live, public sub-mm variability catalog of brightest sub-mm point sources

Full Science Requirements Example

“350 GHz Properties of GRBs at Rapid ($t < 12$ hr) Timescales: Characterizing GRB Reverse Shocks”

- 350 GHz modules [Q2 weather]
- ~ 70 mJy bm^{-1} per epoch
 - SNR > 5 for $d < 1$ Gpc GRB scaled to GRB 120326a
- 4000 sq deg blind survey (could go to 12000 sq deg)
- Completely commensal!
- 3 deg / s scanning preferred for eventual 12000 sq deg
- Every 2 day cadence provides a 25% chance of catching the GRB at the right time
- Preference: Astronomer's Telegram or VOEvent announcement when each is detected

The Unknown Sub-mm Landscape

Full Science Requirements Example

“The Variable Sub-mm Universe: Paper N”

- 860 / 405 / 350 / 270 / 220 GHz modules [Q2 weather]
- ~470 / 140 / 70 / 30 / 25 mJy/bm RMS per epoch
- 4000 sq deg blind survey (could go to 12000 sq deg)
- Completely commensal!
- ~1 s on source-per epoch
- ~520 epochs to reach 20-min per sq deg on-source time
- 3 deg / s scanning
- Every 2 day cadence -> a wide survey takes ~3 years to complete

Full Science Requirements Example

“The Variable Sub-mm Universe: Paper N”

- 860 / 405 / 350 / 270 / 220 GHz modules [Q2 weather]
- ~235 / 70 / 35 / 15 / 13 mJy/bm RMS per epoch
- 4000 sq deg blind survey (could go to 12000 sq deg)
- Completely commensal!
- ~4 s on source-per epoch
- ~175 epochs to reach 20-min per sq deg on-source time
- 1 deg / s scanning
- Every 8 day cadence -> a wide survey takes ~4 years to complete