



# THE INTERPLANETARY NETWORK DATABASE

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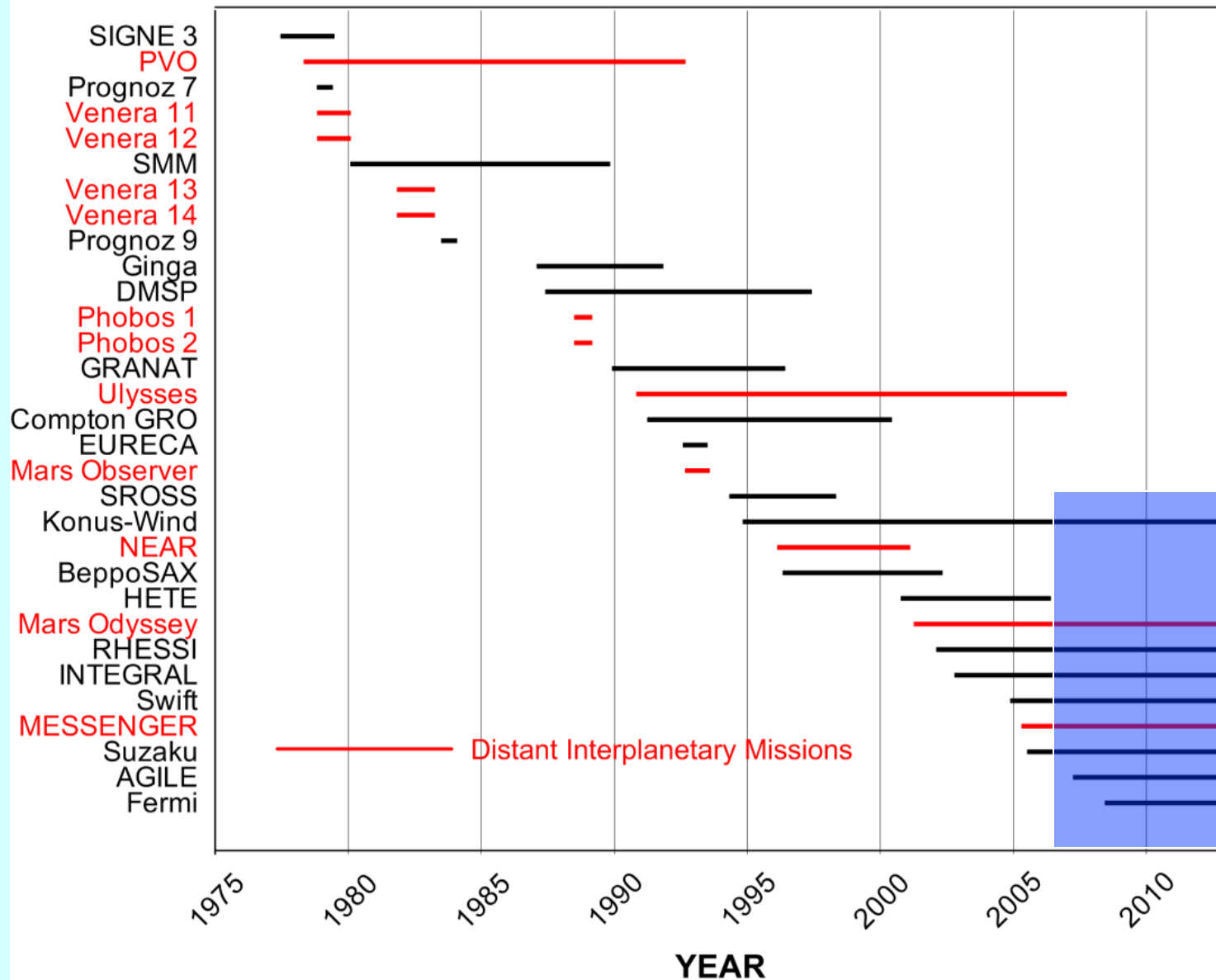
And the current IPN team:

T. Cline (Mars Odyssey, Konus), I. G. Mitrofanov, D. Golovin, M. L. Litvak, and A. B. Sanin (HEND-Odyssey), W. Boynton, C. Fellows, K. Harshman, H. Enos, and R. Starr (GRS-Odyssey), S. Golenetskii, R. Aptekar, E. Mazets, V. Pal'shin, D. Frederiks, D. Svinkin (Konus-Wind), D. M. Smith, R. P. Lin, J. McTiernan, R. Schwartz, W. Hajdas (RHESSI), A. von Kienlin, X. Zhang, A. Rau (INTEGRAL SPI-ACS), K. Yamaoka, M. Ohno, Y. Hanabata, Y. Fukazawa, T. Takahashi, M. Tashiro, Y. Terada, T. Murakami, and K. Makishima (Suzaku WAM), S. Barthelmy, J. Cummings, N. Gehrels, H. Krimm, and D. Palmer (Swift-BAT), J. Goldsten (MESSENGER GRNS), E. Del Monte, M. Feroci, F. Lazzarotto, M. Marisaldi (AGILE), V. Connaughton, M. S. Briggs, and C. Meegan (Fermi GBM)

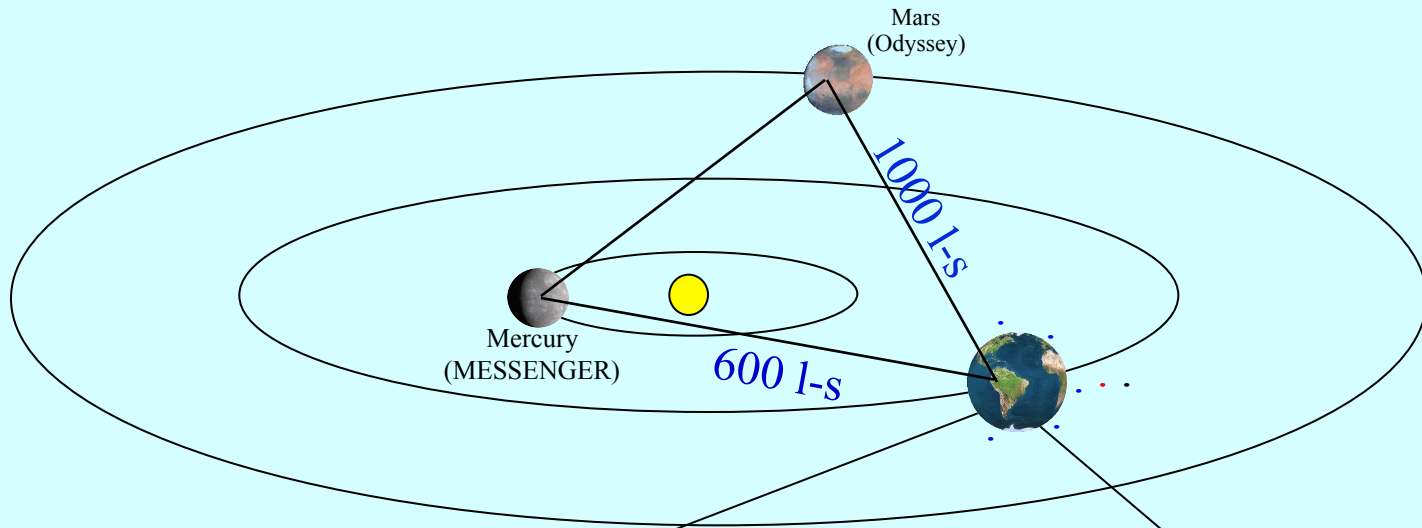
# In The Beginning (ca. 1975 A.D.)...

- The only way to get arcminute GRB positions was by triangulation
- So the IPN has a long history, and over 30 spacecraft have participated in it
- But it also has a present, and a future

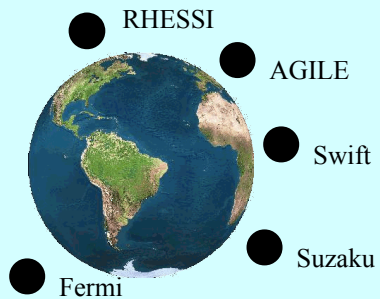
# IPN MISSION TIMELINES, 1977 - PRESENT



# THE CURRENT IPN



LEO Spacecraft  
24 light-ms



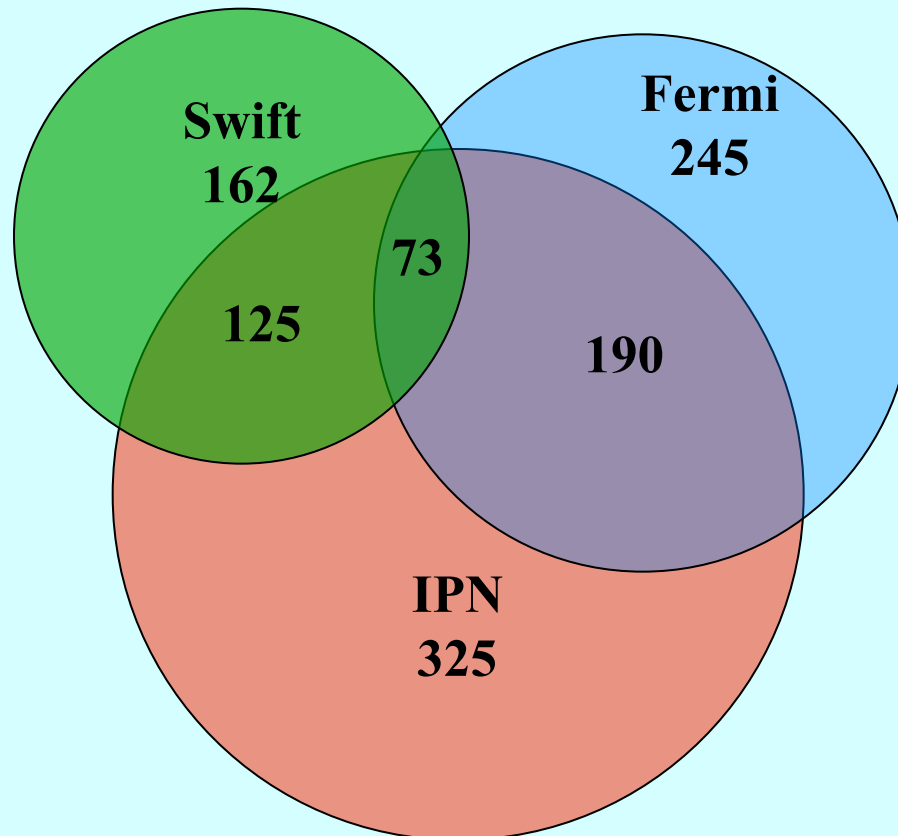
INTEGRAL  
0.5 light-s

WIND  
6 light-s

## THE CURRENT IPN

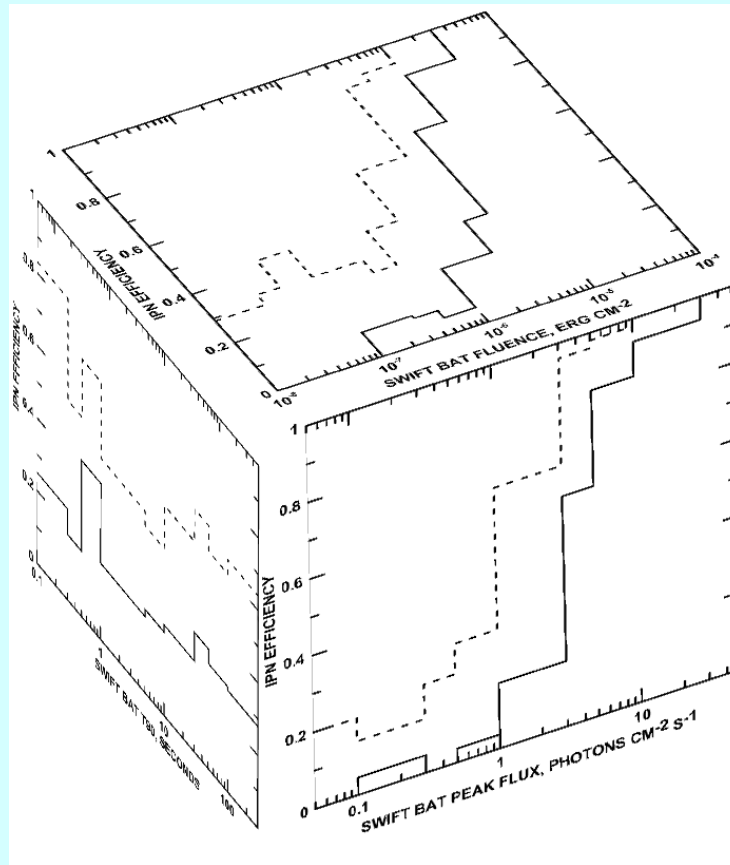
- Comprises 9 spacecraft (AGILE, Fermi, INTEGRAL, MESSENGER, Odyssey, RHESSI, Suzaku, Swift, Wind) – an excellent configuration
- Detects 325 GRBs/year
- Effectively acts as a *full-time, all-sky* monitor for gamma-ray transients (mainly SGRs and GRBs)
- There is no time when all the spacecraft are off, and 3 of the missions (INTEGRAL, MESSENGER, and Wind) have no planet-blocking

# IPN, SWIFT, AND FERMI YEARLY BURST RATES

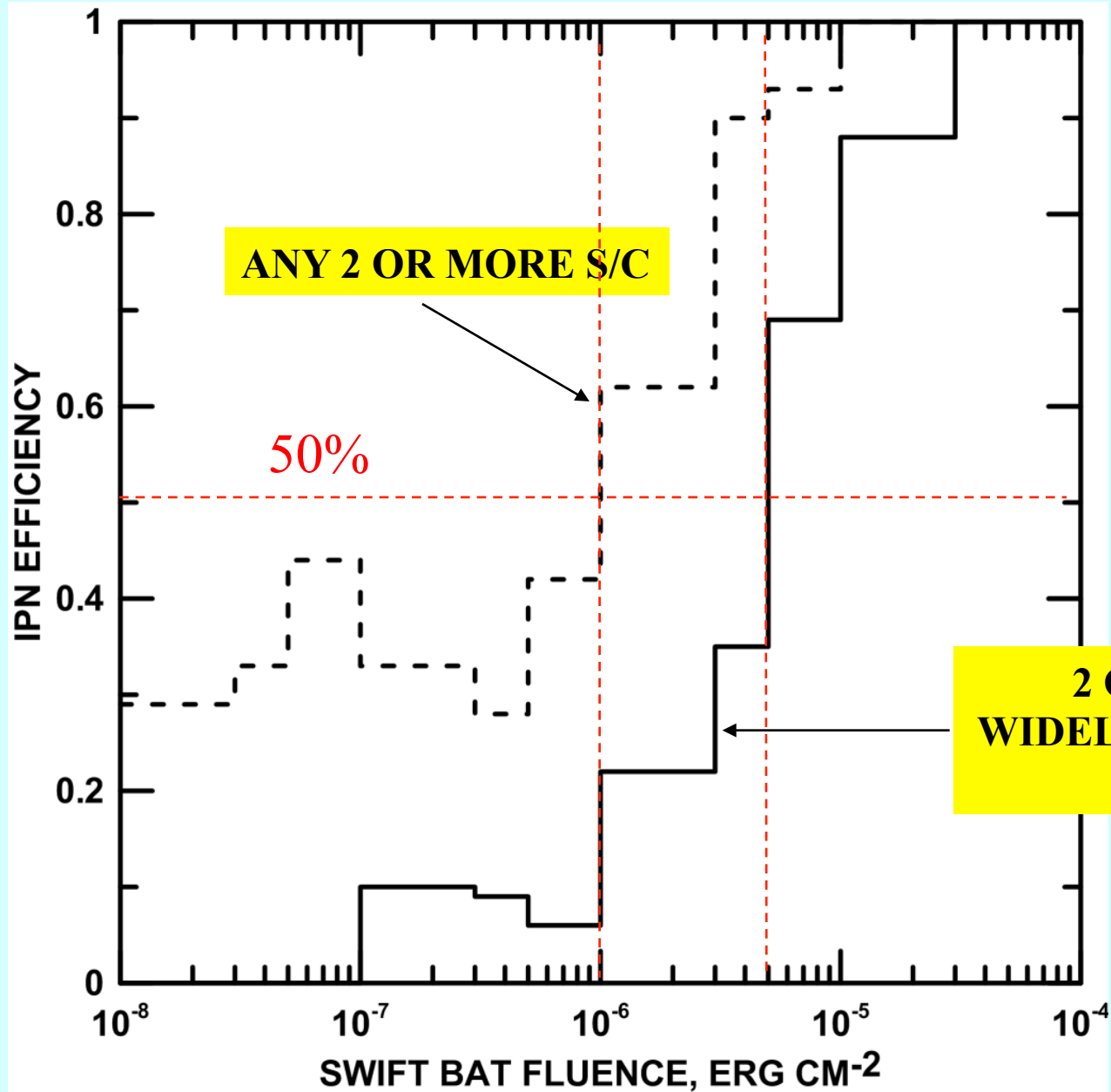


**~100 BURSTS/YEAR ARE NOT LOCALIZED BY SWIFT OR FERMI**

# IPN SENSITIVITY IS A FUNCTION OF GRB PEAK FLUX, FLUENCE, DURATION, AND OTHER VARIABLES



# IPN EFFICIENCY (PROBABILITY OF DETECTING A GRB)

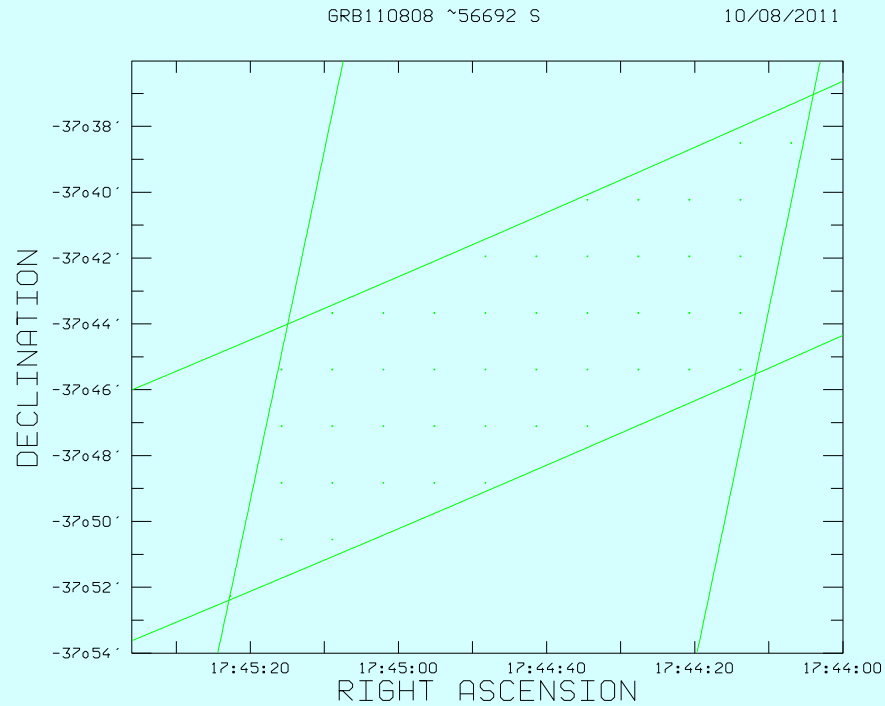




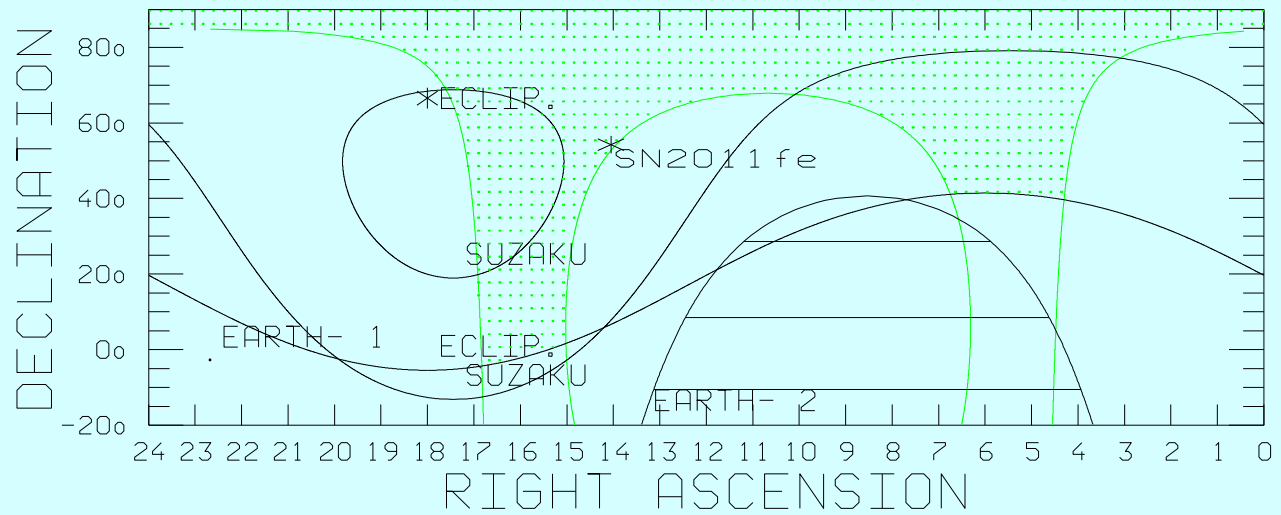
## **THE IPN DATABASE IN A FEW NUMBERS** **([ssl.berkeley.edu/ipn3/index.html](http://ssl.berkeley.edu/ipn3/index.html))**

- 11,000 publication bibliography (1972 – 2012)
- Table of 25,000 events (cosmic, SGR, solar) – dates, times, which spacecraft detected them (1990 – 2012)
- 7000 GRB localizations (1990 – 2012)
- The database is updated on a roughly daily basis

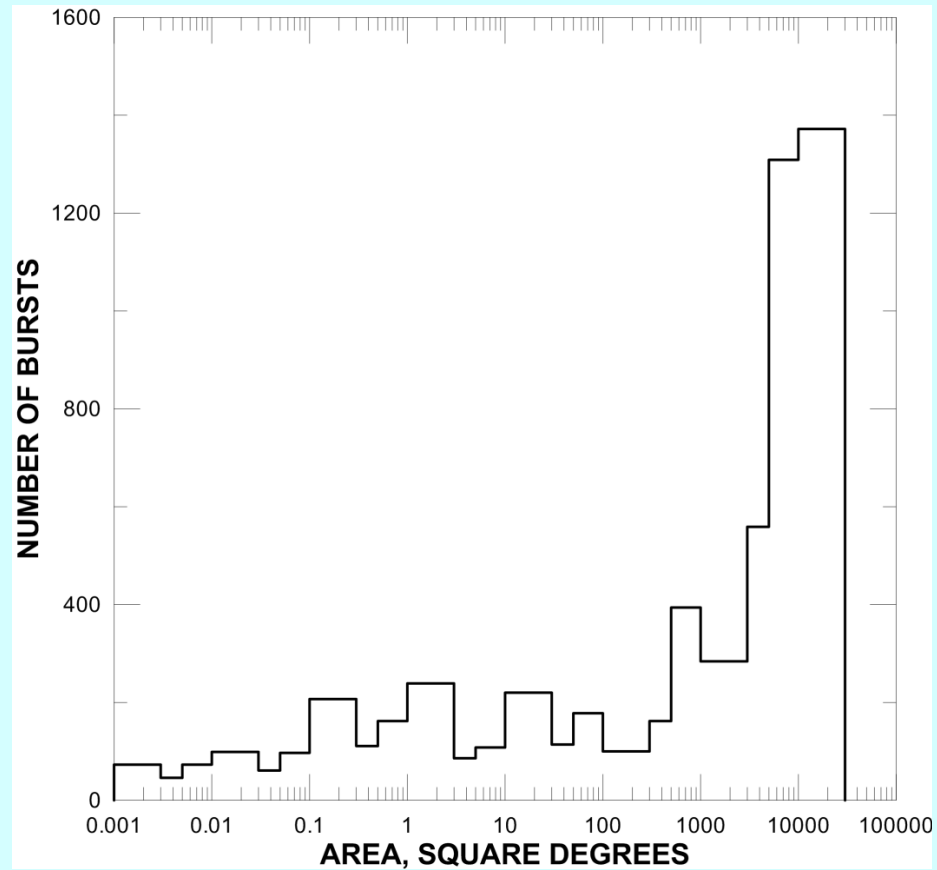
**IPN LOCALIZATIONS ARE GIVEN AS INTERSECTIONS OF  
SMALL CIRCLES – SOMETIMES THEY FORM NEAT, SMALL  
POLYGONS**



# OTHER TIMES, THEY ARE A NIGHTMARE



# IPN ERROR BOX AREA DISTRIBUTION



## SOME USES OF IPN LOCALIZATION DATA

- Refining Fermi GBM and LAT positions by up to 4 orders of magnitude (poster P.II.8)
- Searching for GRBs consistent with optically detected Ib/c SNe, or other transients (2010ah, 2010ay, PTF10qts, 2011dh, 2011fe,...)
- Searching for gravitational radiation using LIGO/Virgo data
- Searching for neutrino emission using AMANDA & IceCube
- Programs are available to determine whether bursts in the database are consistent with any given RA and Dec, within a given time window

## **KEEP IN MIND...**

- The localization database is not completely populated (we're working on it)
- Very few IPN localizations are announced in GCN Circulars
- Contact me for information about specific GRBs, or time periods of interest: [khurley@ssl.berkeley.edu](mailto:khurley@ssl.berkeley.edu)
- [ssl.berkeley.edu/ipn3/index.html](http://ssl.berkeley.edu/ipn3/index.html)