GLAST Blazars: DC2-CGRaBS Update

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D. Sowards-Emmerd, S.E. Healey, etc.

CGRaBS = Candidate Gamma-Ray Blazar Survey

Needs a new name….

Fundamentally a radio + optical survey

Strong CLASS heritage, but all- (high latitude) sky

Striving for flux-limited optical follow-up

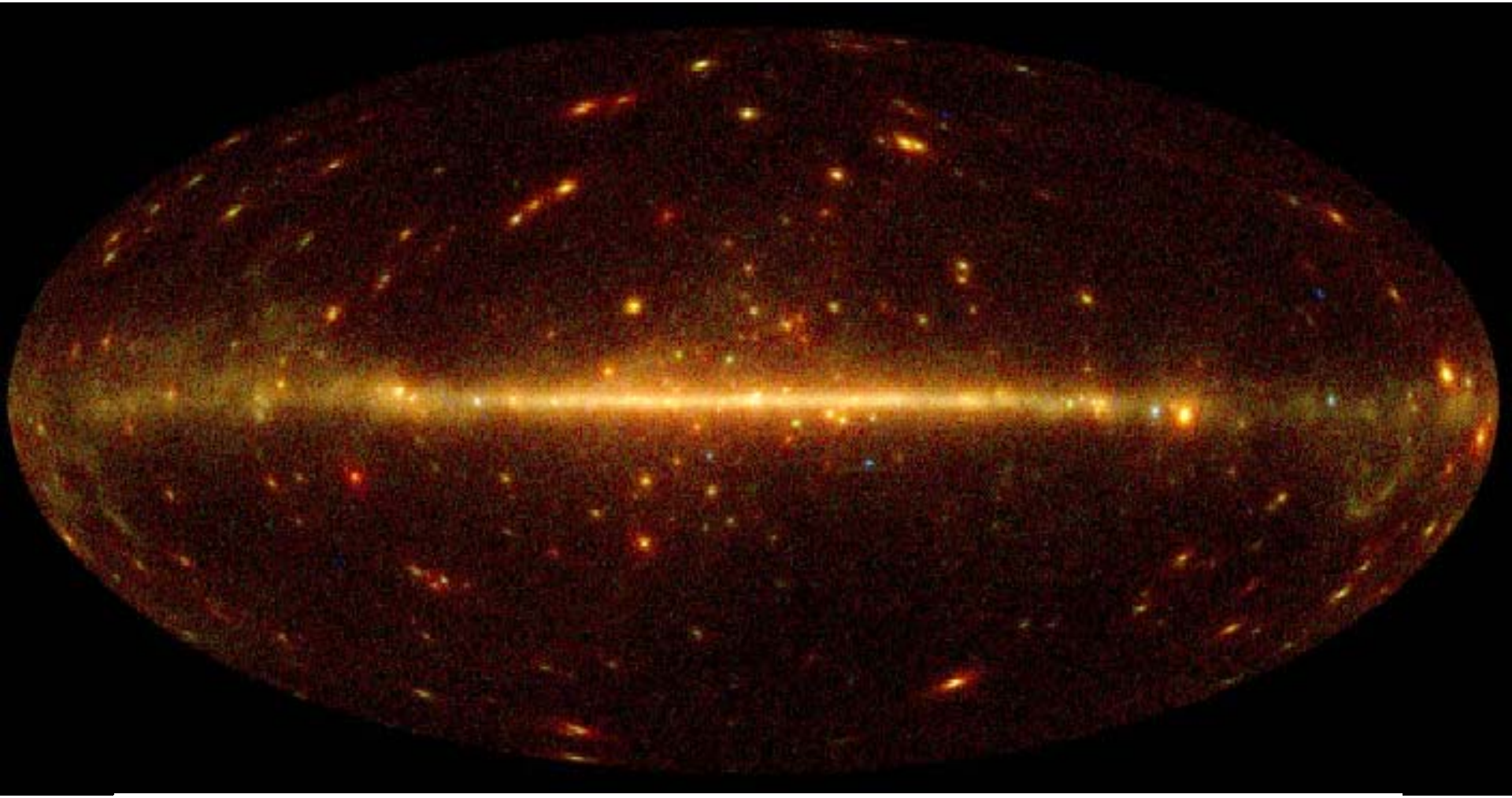
Motivation

The 5Yr GLAST survey will produce 3,000 to >10,000 Blazars

Far fewer are known, need to identify more

- **3EG Blazars are (virtually) all flat spectrum, w/ compact radio-bright cores**
  - **FSRQ**
  - **BL Lacs**
  - **Radio Galaxies**
- **Survey Motivation**
  - **Increase numbers**
  - **Well defined, radio complete sample → populations, evolution**
  - **Push sample to higher z – start on correlative study**
  - **Take care of the 'known unknowns'…**

GLAST Gamma-Ray Sky



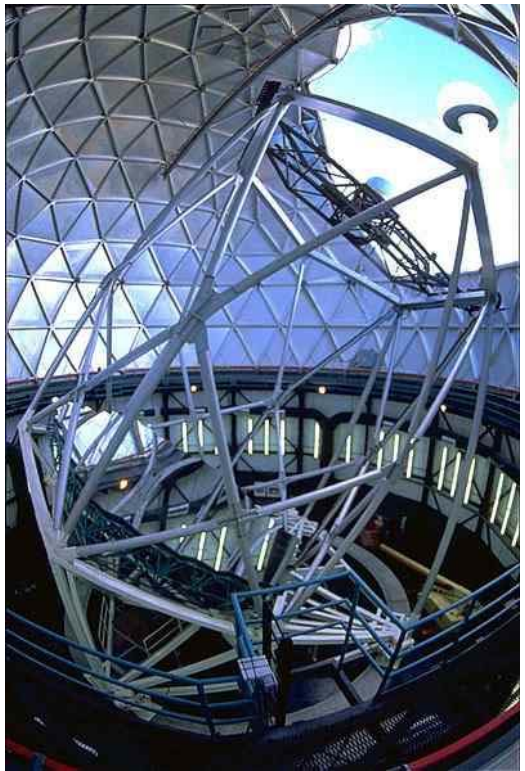
- DC2 partway there….

Evaluating Blazar counterparts

- **Need deep all-sky samples.**
- **Train SED FoM against clear EGRET counterparts**
- **Radio: flux, spectrum, compactness**
- **X-ray: (RASS) weak selection for detection**
- **Position w/in 3EG uncertainty contour**
- **Issues:**
  - **False Positives**
  - **Confusion**
  - **Variability**

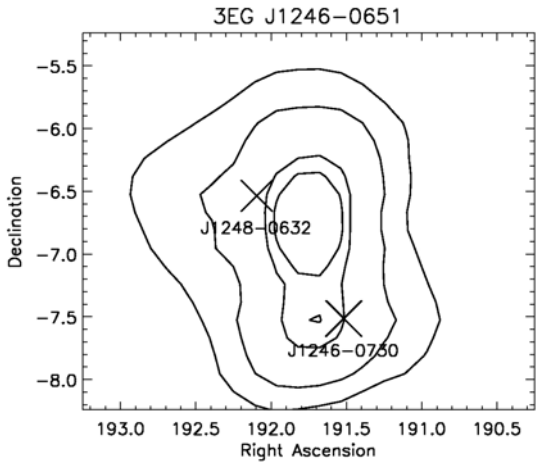
3EG Blazar Follow-up Survey

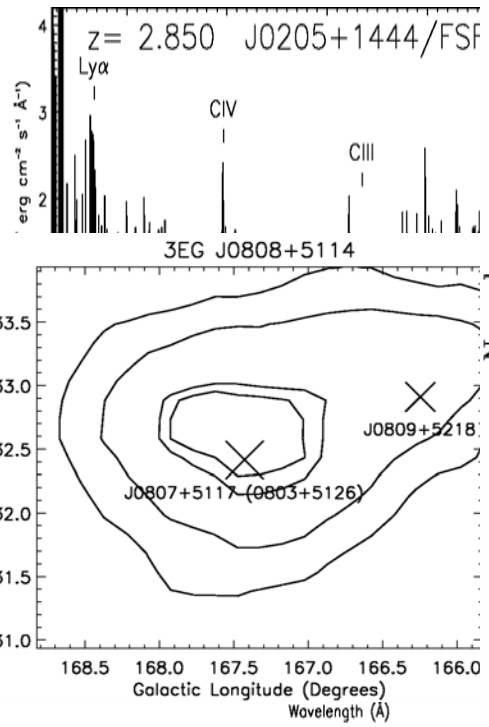
- EGRET sources -- start from 3EG (some are spurious!!)
  - **Select flat spectrum**
    - **(NVSS/SUMSS+CLASS/new VLA/ATCA 8GHz <1" resol.)**
    - **FoM approach: increasing weight with large S_ν, small α**
  - **Including X-ray, γ-ray position:**
    - **Total FoM has weak X-ray weight, uses 3EG TS maps**
  - **Optical ID of high FoM, R<23 w/ Hobby*Eberly Telescope**
    - **Optical Arecibo → DEC>-10**

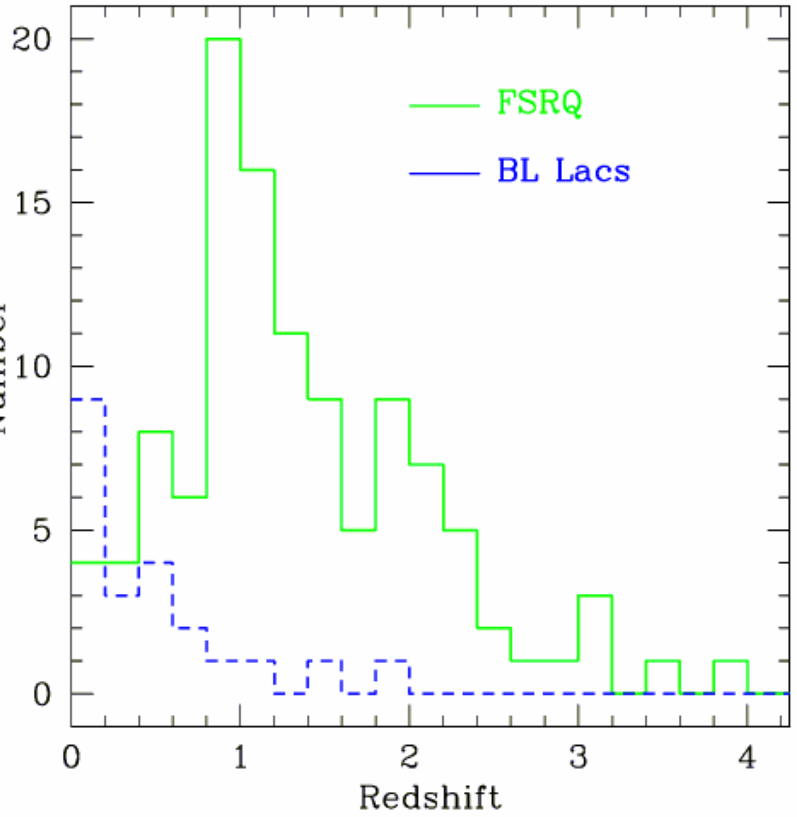


HET 3EG Blazar Survey

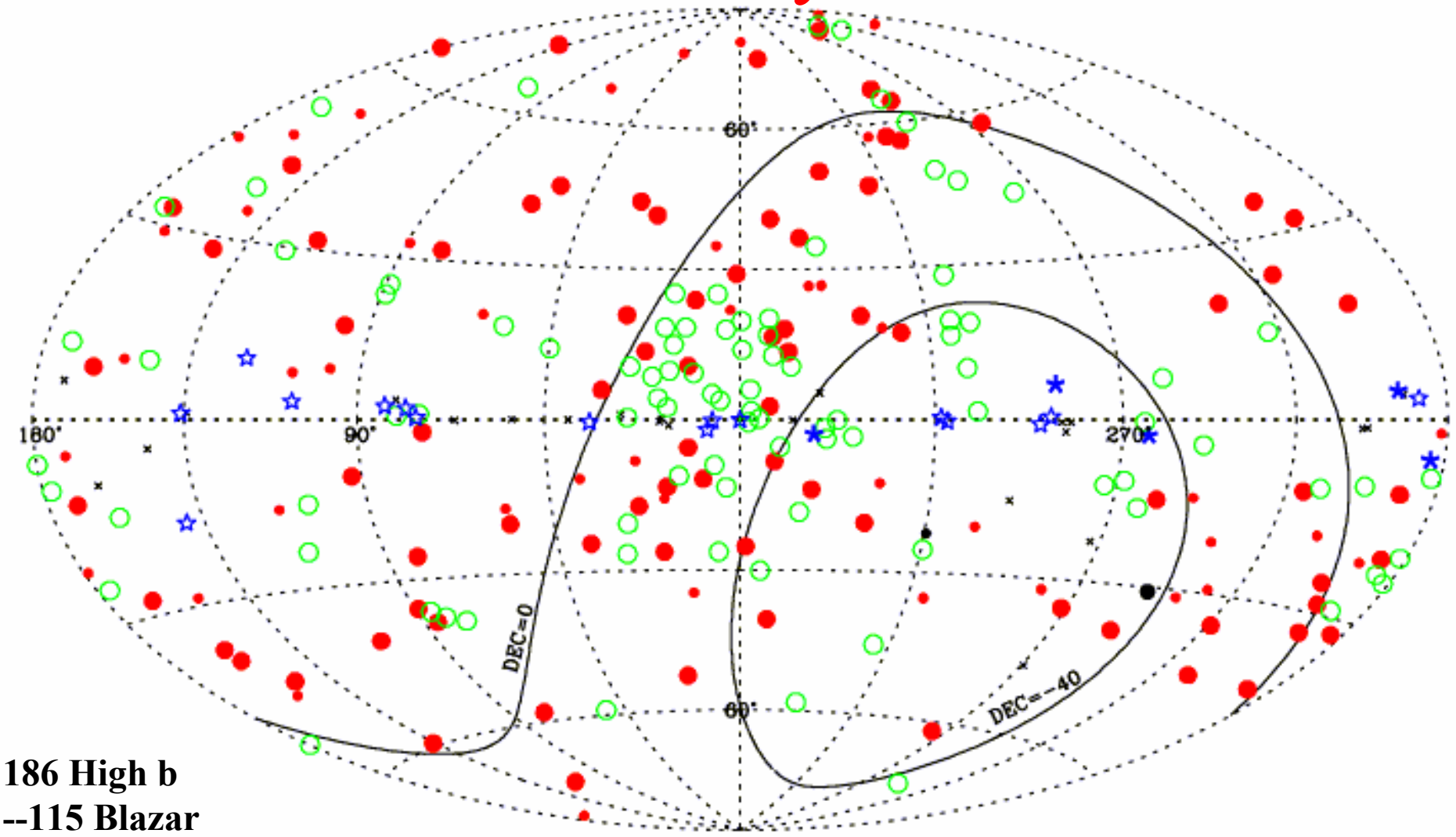
- Results
  - **>64% IDs at high b**
  - **20% are BL Lac, almost all of rest are FSRQ**
  - **Multiple IDs (composite γ-ray sources)**
  - **~Doubled maximum z**
  - **radio faint (non-blazar) populations**
    - **Isotropic, bulge?**







3EG Survey Status

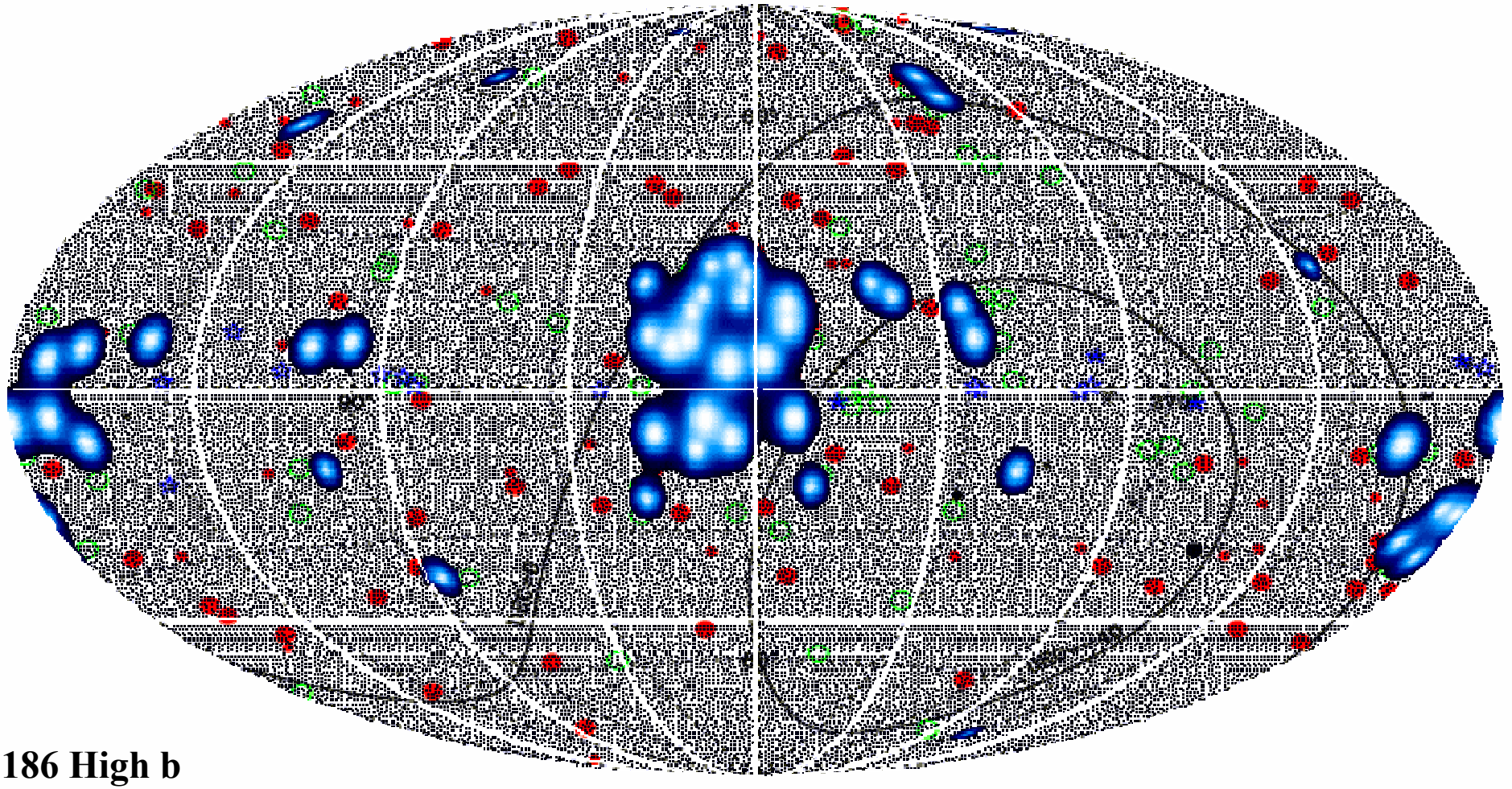


186 High b
--115 Blazar
-- 2PSR/PWN
--66 Non-Blazar (many questionable SRCs)
-- 3 TBD

N.B.

115 3EG Blazars → 135 Blazars (multiples)
>64% High b sources IDed

3EG Survey Status



186 High b
--115 Blazar
-- 2PSR/PWN
--66 Non-Blazar (many questionable SRCs)
-- 3 TBD

If we delete the 49 Cassandjian >5^0 3EGs
Get ~140src: 104 blazar, 31 Non-Blazar
>81% High b sources IDed

GLAST-sized samples

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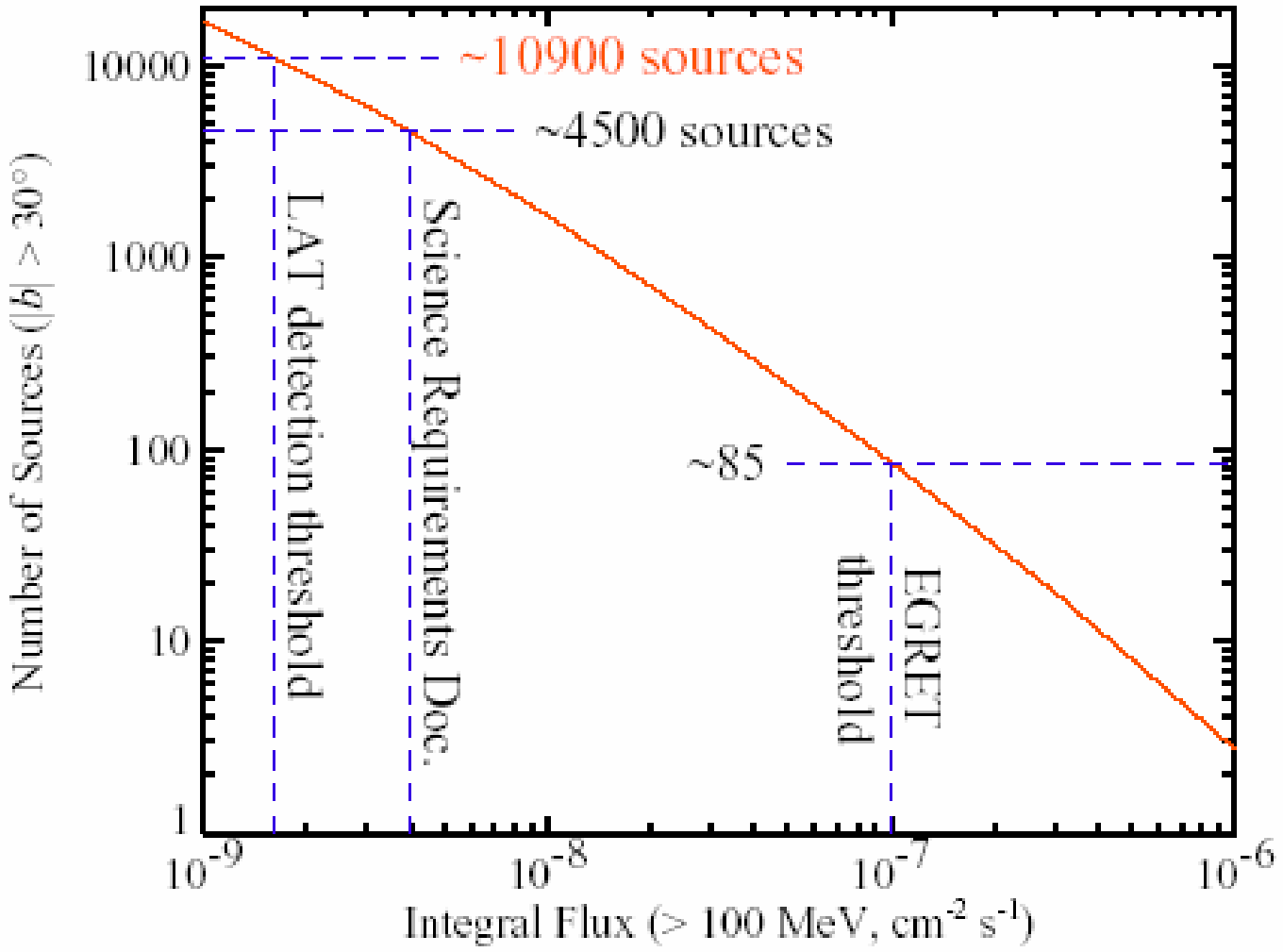

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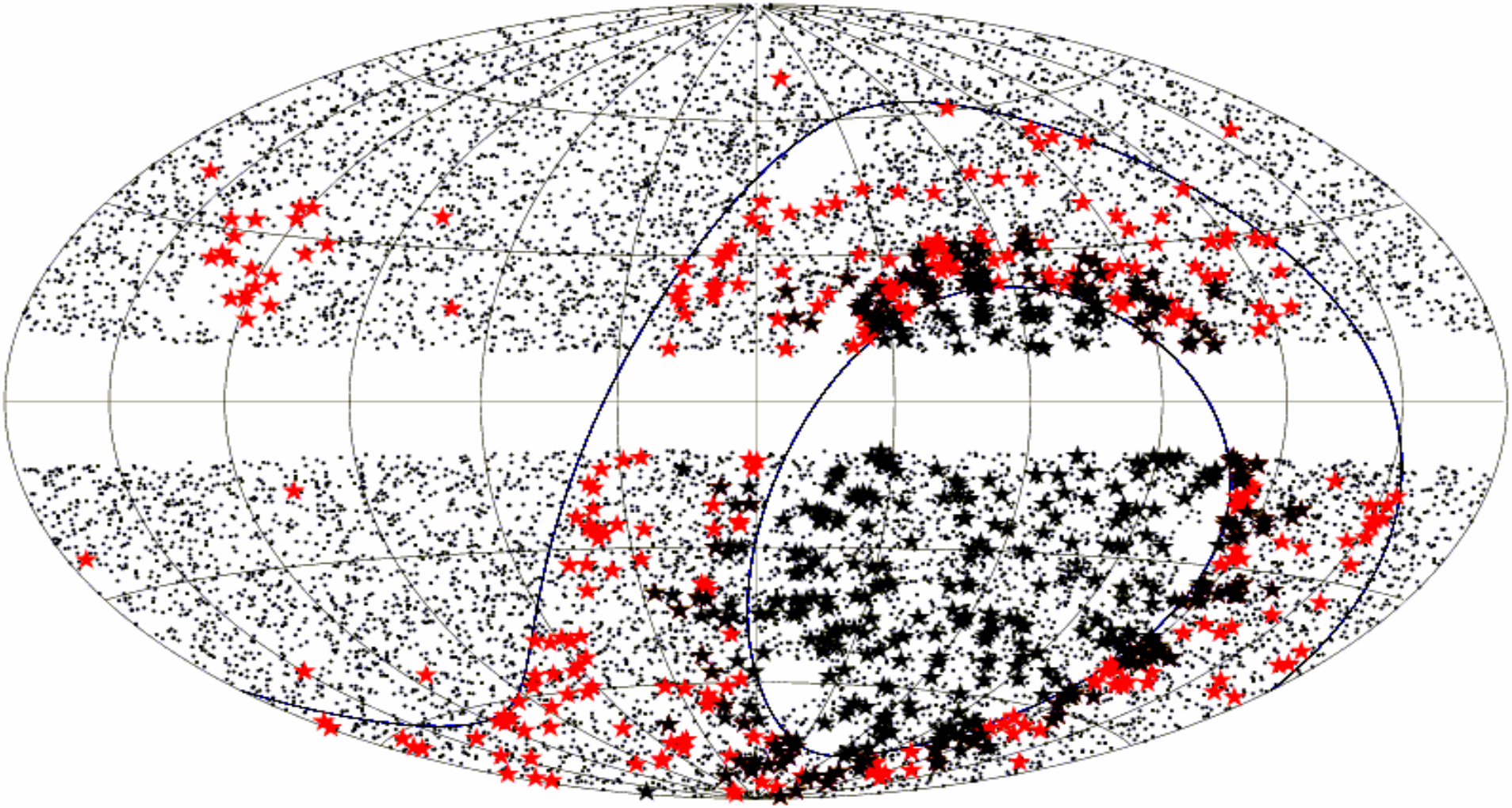
Radio Target List

- Selection $S_{4.8}$>65mJy, |b|>10^0, α<0.5 -- CLASS+
  - 10,931 srcs [97.3% obs, will finish w/ VLA run in 3wks (orange)]
  - Call it `CLASSIER'? CLASS Including Extra Regions

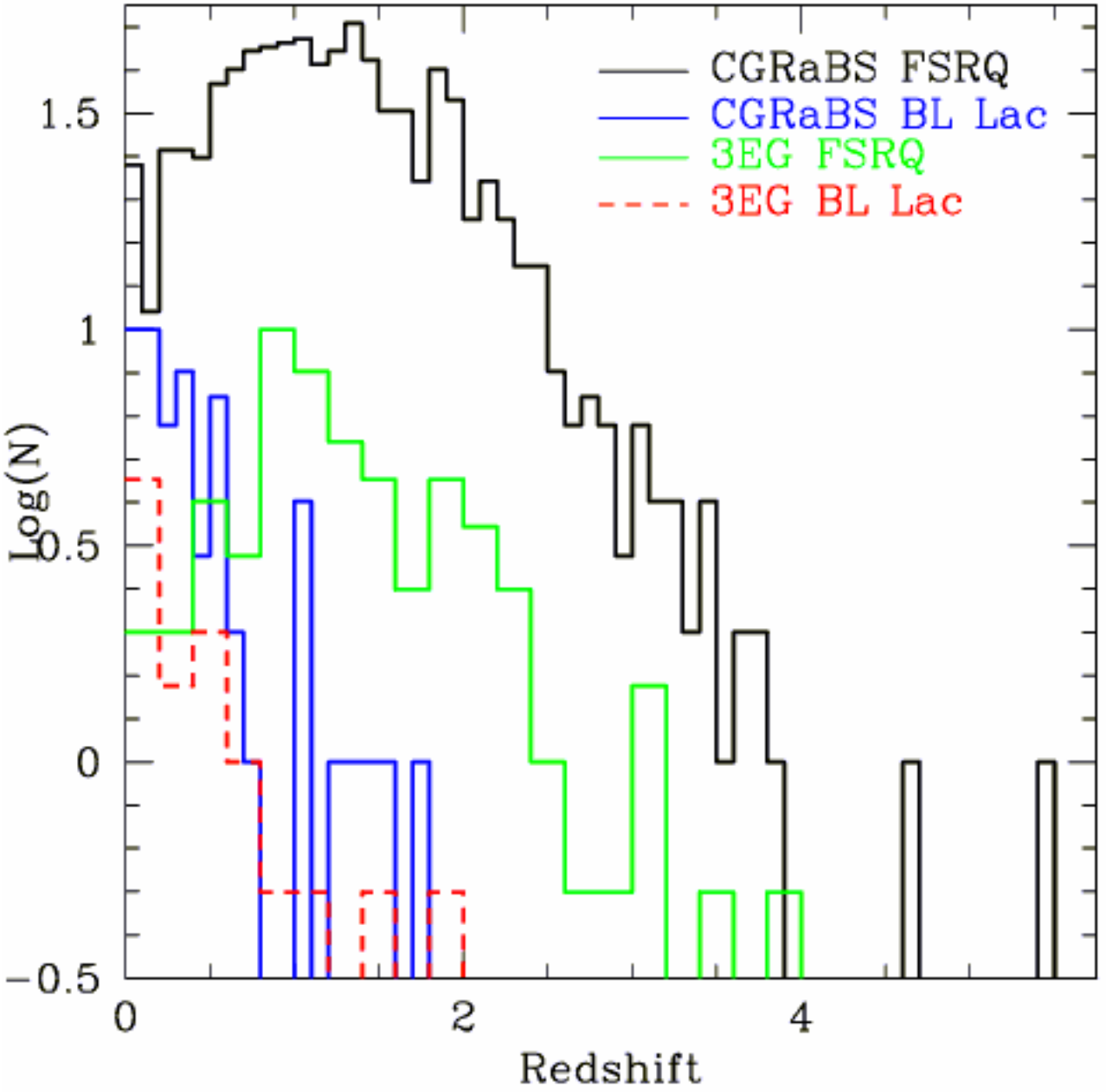


Downselect to CGRaBS

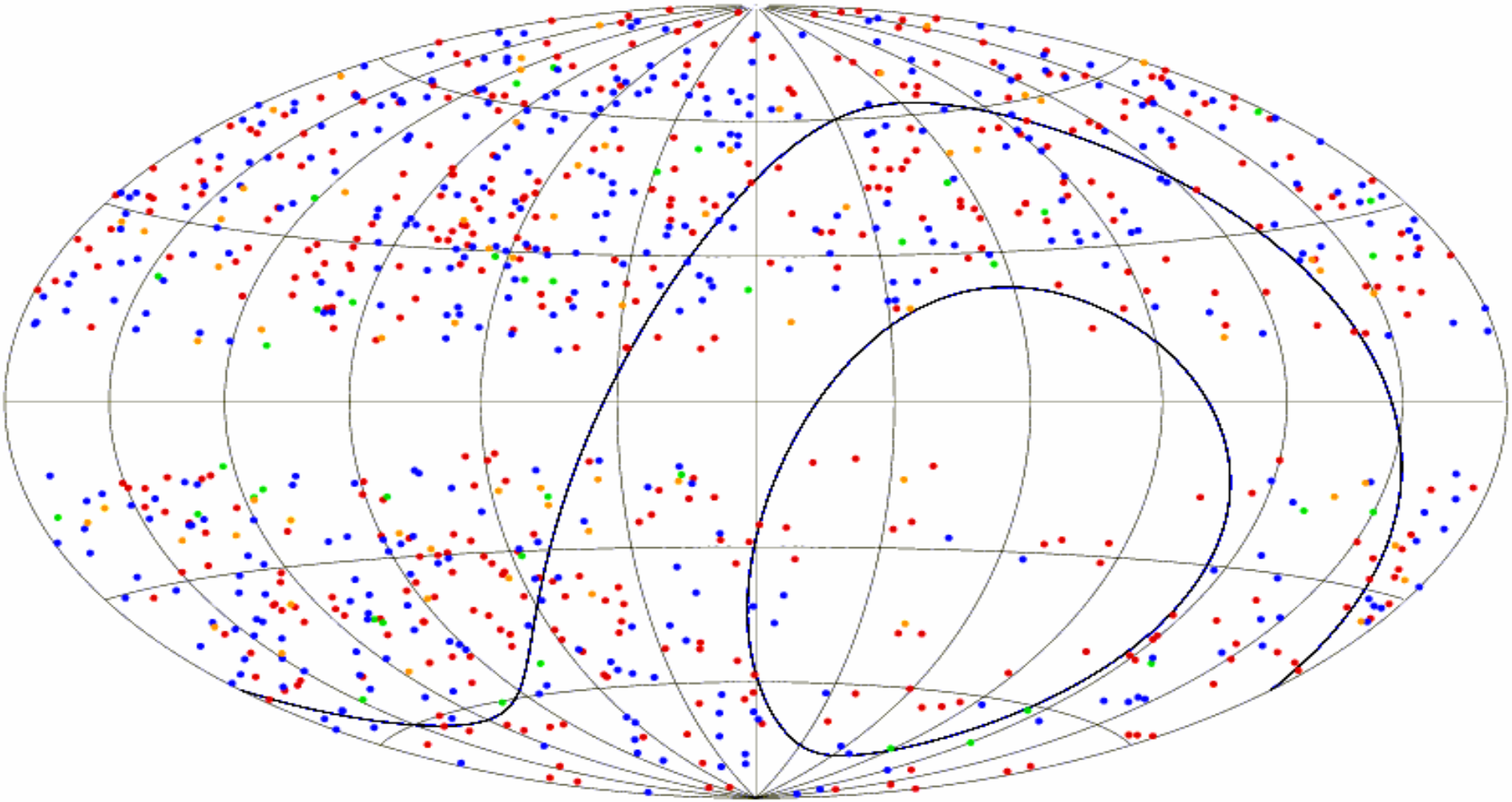
- Use FoM ($S_{8.4}$, α, S_X) trained against 3EG
- Candidate Gamma-Ray Blazar Survey
  - 1496 sources (should grow to > 1500 w/ radio completion)
  - These are the best and brightest of the EGRET-like Blazars
- Optical Follow-up – Hard work!
  - Archival
  - Most at McDonald Observatory (HET/2.7m)
  - Starting w/ CTIO, NTT time to come
  - Handful w/ 5m, trying for some 10m time

Redshift Distribution – FSRQ/BLL

- High-z tail…
- 3EG
  - 9 z>2.5
  - 5 z>3
- CGRaBS
  - 86 z>2.5
  - 30 z>3



CGRaBS optical



Done **Still Need Redshifts**

To finish off CGRaBS

- Finalizing ATCA fluxes, structures. Getting last VLA chunk
  - Note AT20G survey (E. Sadler & co) provides high ν info
  - Some in WMAP set…
- HET continues to plug away at r<23
- w/ Readhead and colleagues proposed for 5m, Keck
- In South, w/ European GLAST colleagues: ESO NTT, VLT proposals, some CTIO time
- Should be done to R~23 by launch