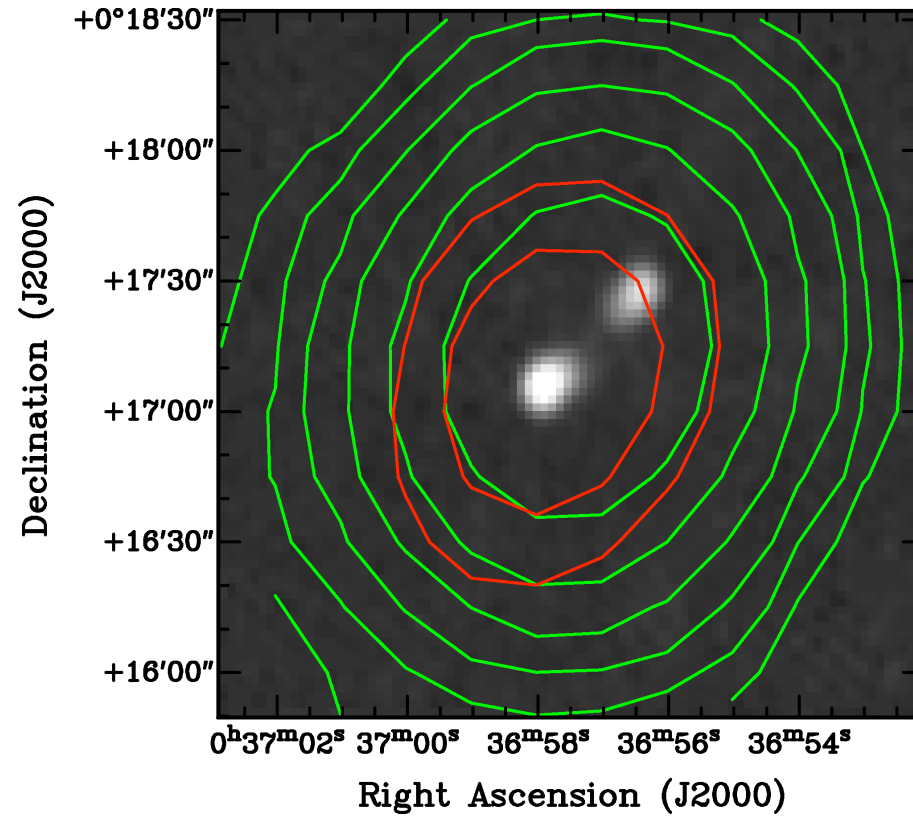


POSSUM Source Finding



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Source Finding in Polarization

- Why do it?
- Challenges
- Options
- The Plan

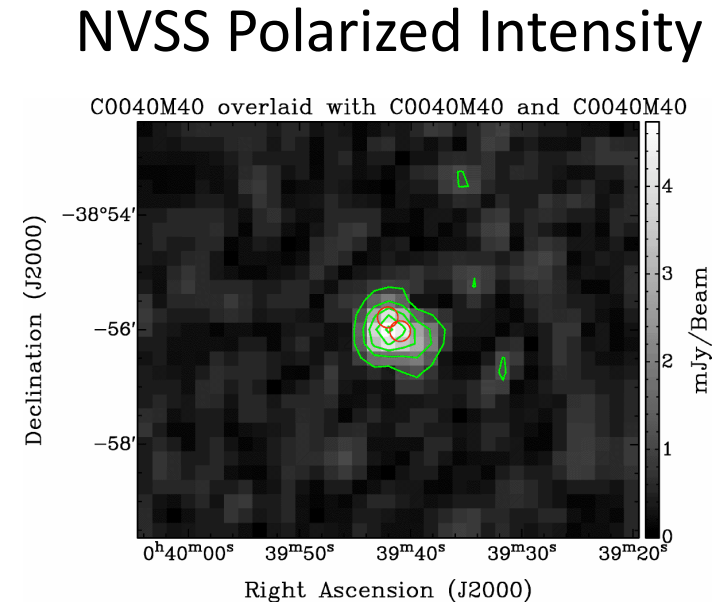
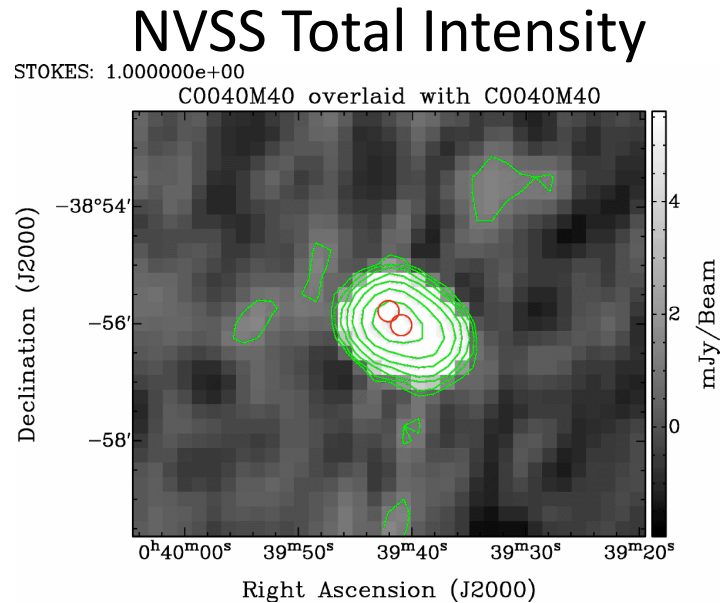
Look for Polarized Intensity at the Location of Each Stokes I Source

- Look for Polarized Intensity at the Location of Each Stokes I Source
- Works well for unresolved sources, but not for (slightly) resolved sources
- Integrate Stokes Q and U over aperture defined by low Stokes I contour? (Subrahmanyan et al. 2010)

Approximately one third of sources in FIRST (5" FWHM) is resolved

Need to tabulate meaningful parameters for polarization of all sources in catalog!

An Example From The NVSS

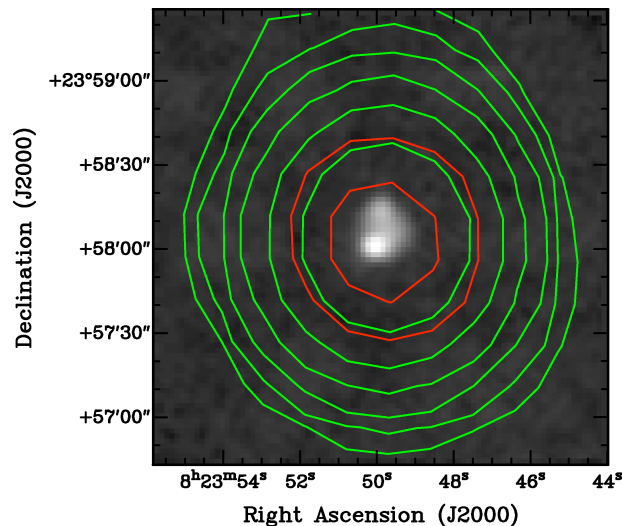
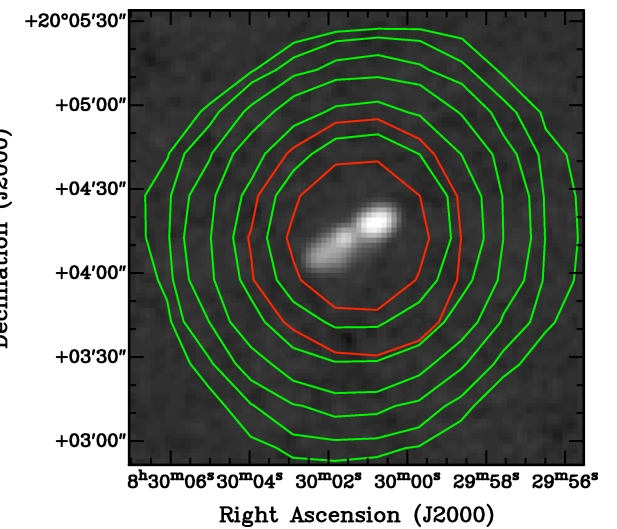
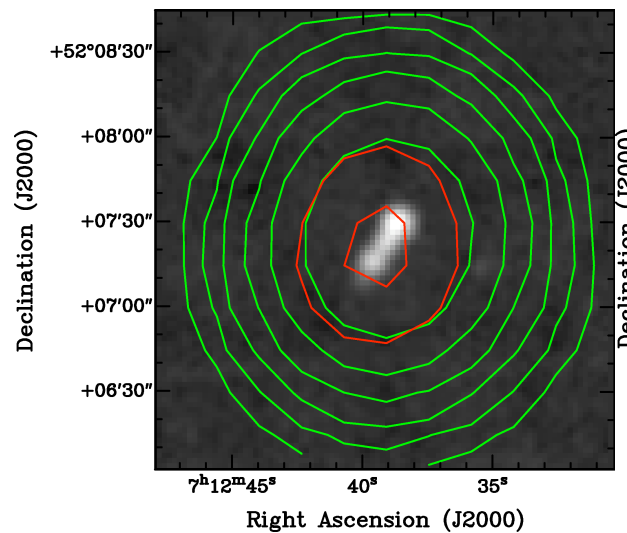
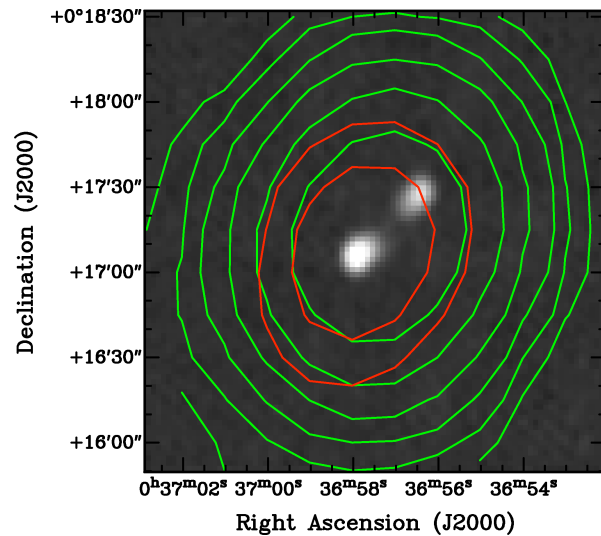


Red circles: Entries in the NVSS catalog (“Gaussian components”, not “sources”)

Name	Peak I (mJy)	Maj x Min size	% Polarization
NVSS J003940-385601	98.7	67.8'' x 47.7''	4.7 %
NVSS J003942-385547	10.7	45.0'' x 45.0''	40.2%

Total flux is sum of all Gaussian components in I, but not in PI!

Why Source Finding in Polarization?



NVSS total intensity contours (green) and Polarized intensity contours (red) on FIRST total intensity.

Polarization structure in source (e.g. core-lobe) or **Laing-Garrington effect** may cause a significant displacement of the source in polarized intensity.

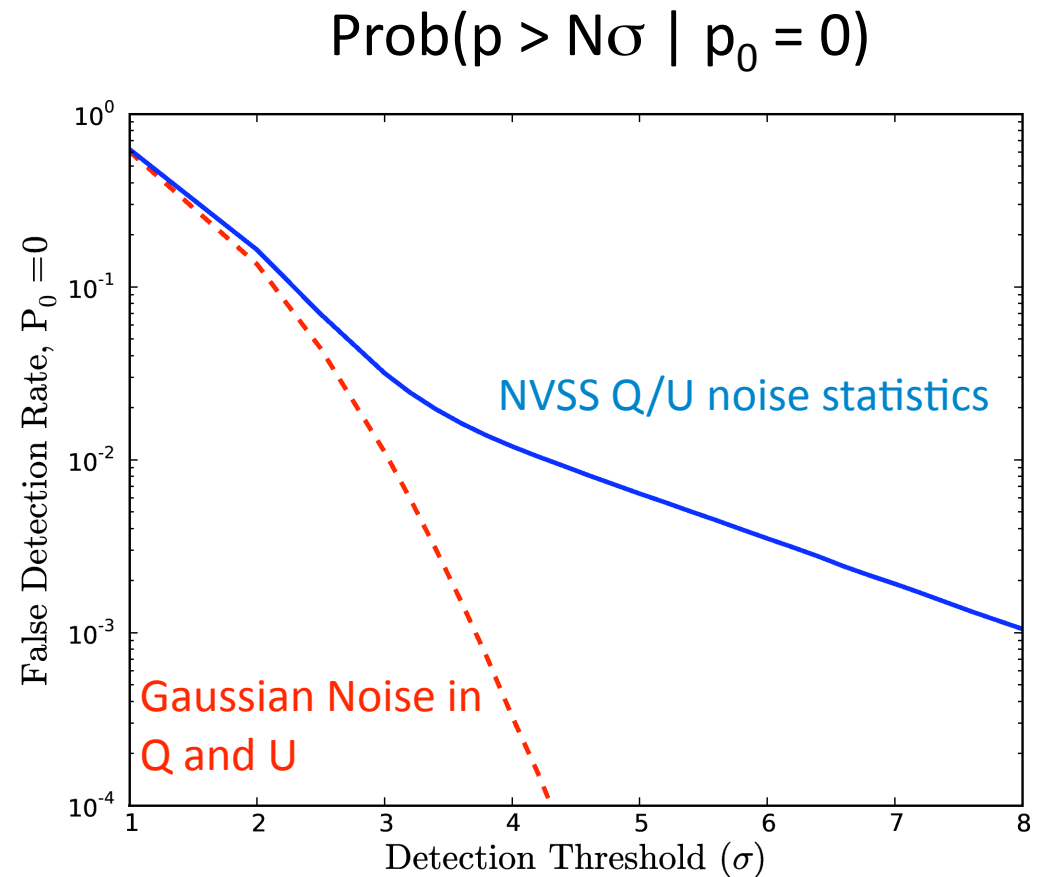
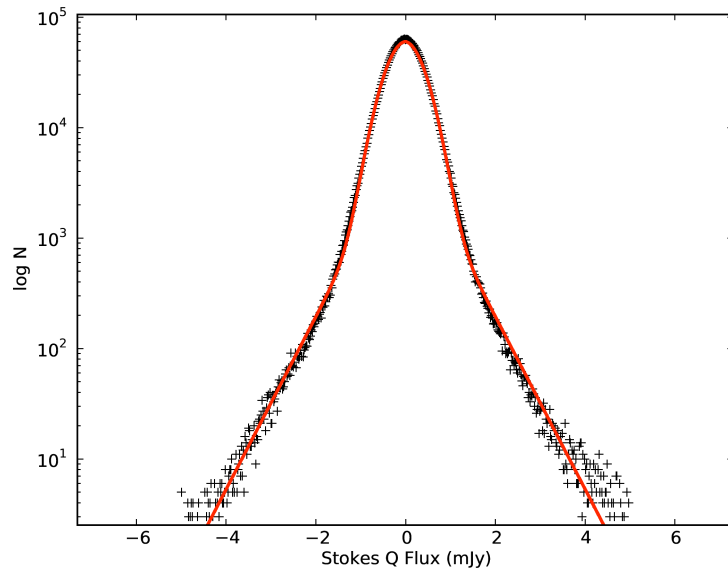
Source Finding in Polarization Challenges

- How to use the sensitivity of broad-band observations?
 - RM synthesis
 - Average PI per channel across the band
- What to Fit?
 - Polarized Intensity or Q and U
 - Stokes V (up to 100% circularly polarized sources)
- Fitting biases under skewed noise statistics
- False detection rate (simulations/noise statistics/correlation with total intensity)
- Polarization bias correction (local noise statistics)
- Small-scale Galactic emission: Baseline subtraction in Q and U?
- Integrated polarized flux from Q and U

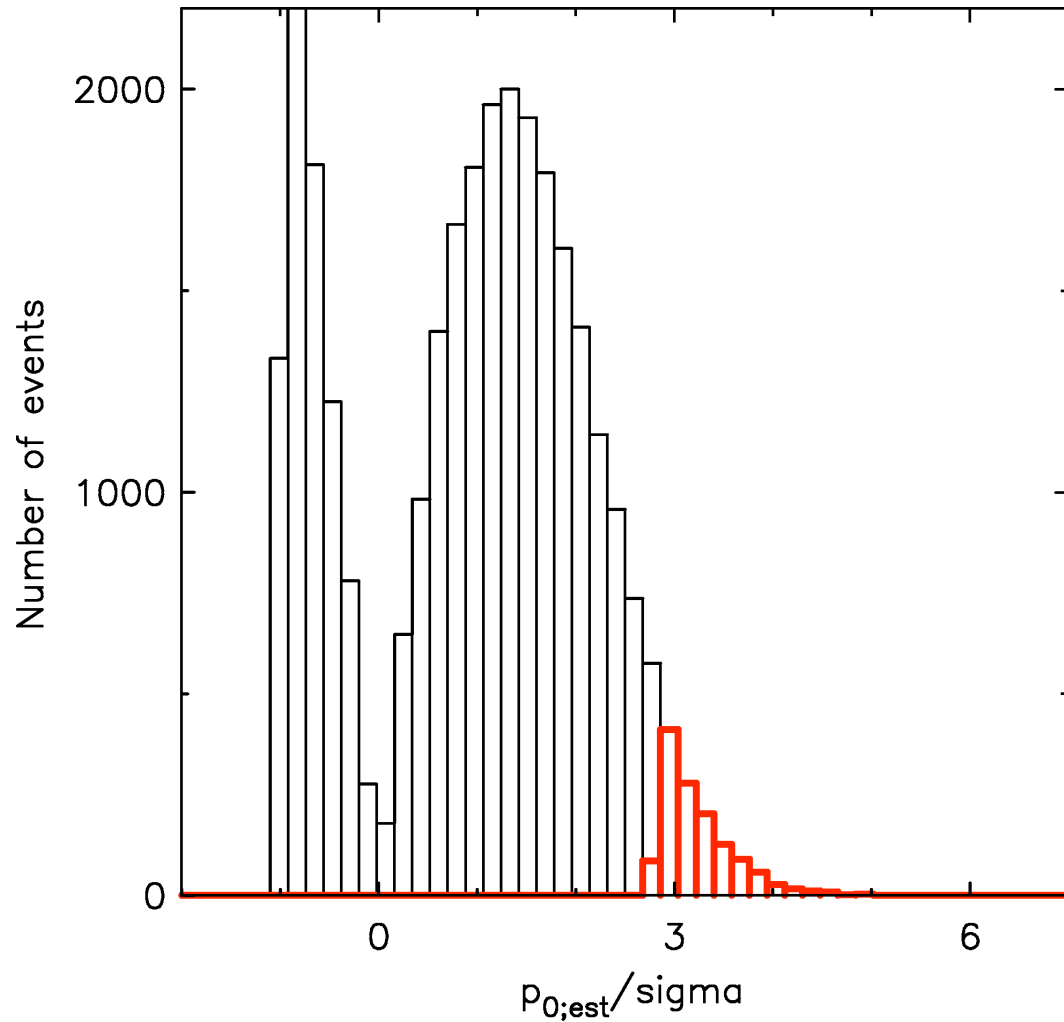
False Detection Rate

Effect of Non-Gaussian Noise in Q and U

NVSS Q/U pixel values with no Stokes I source



Polarization Bias and Detection Threshold



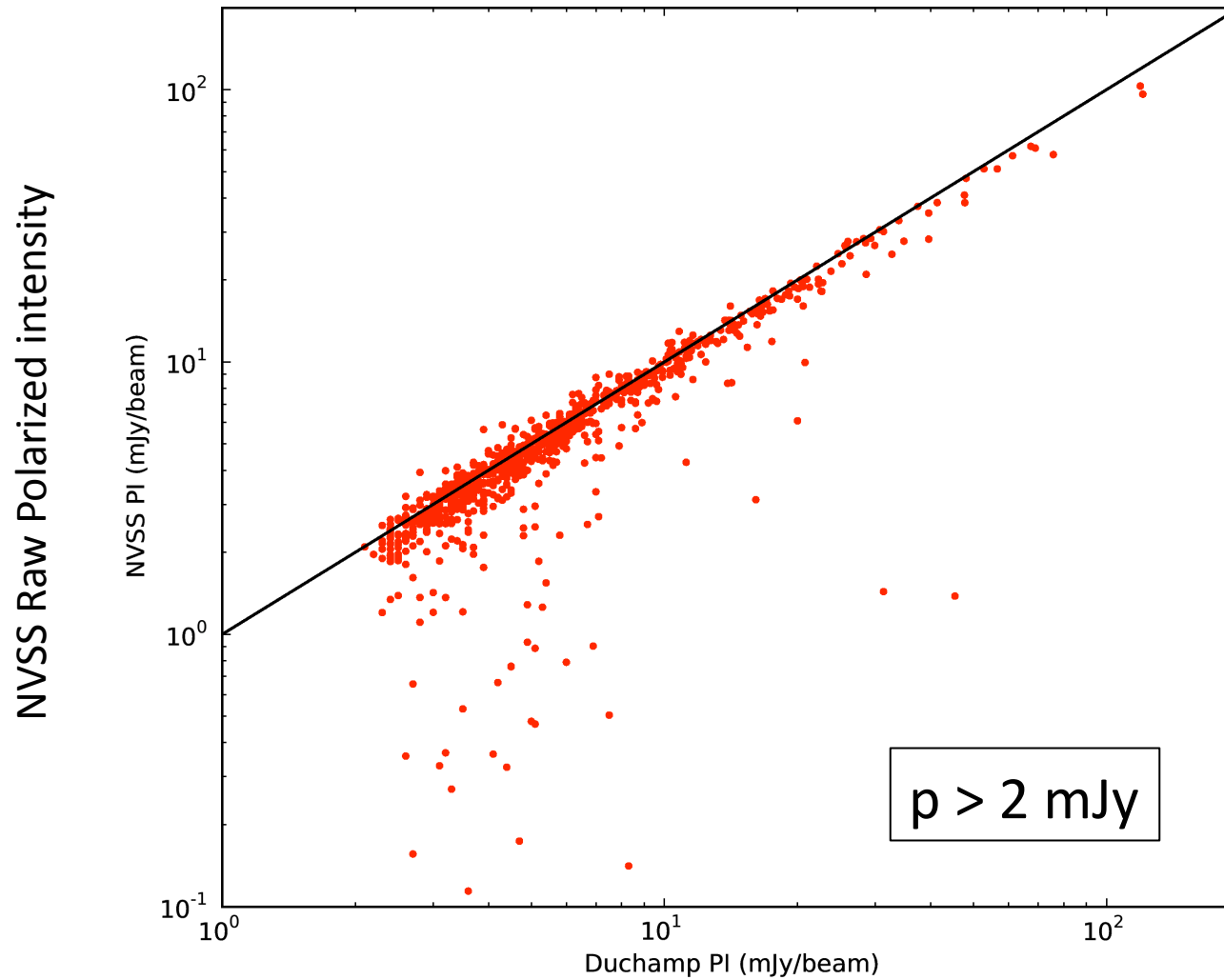
Example:

All sources with $p_0 = 1 \sigma$

$$p_{0;est} = \sqrt{Q^2 + U^2 - \sigma^2}$$

~4% exceed 3σ after polarization bias correction

Duchamp on 100 NVSS Polarized Intensity Images



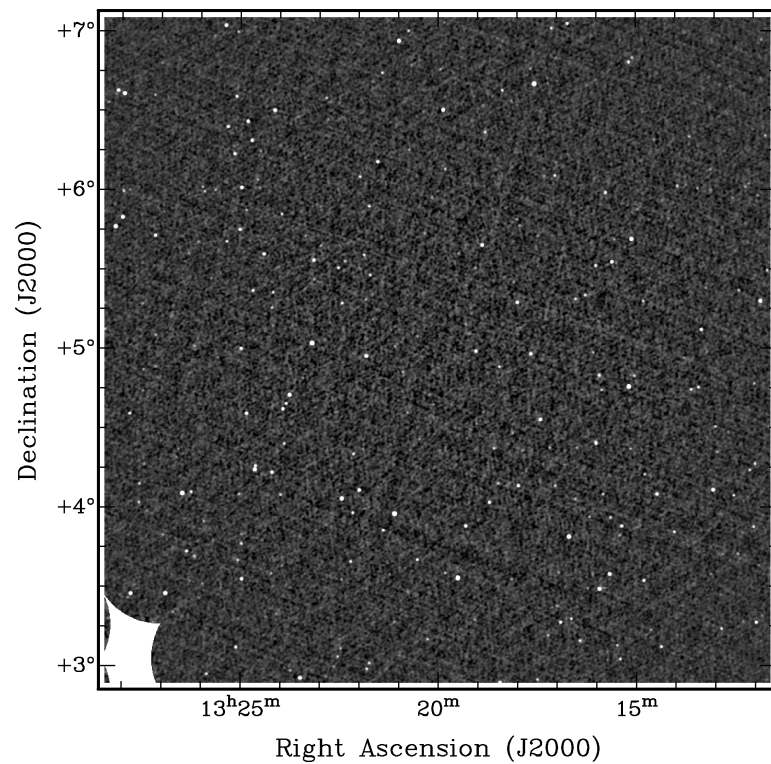
Duchamp Fitted Peak Polarized intensity

Performance Testing

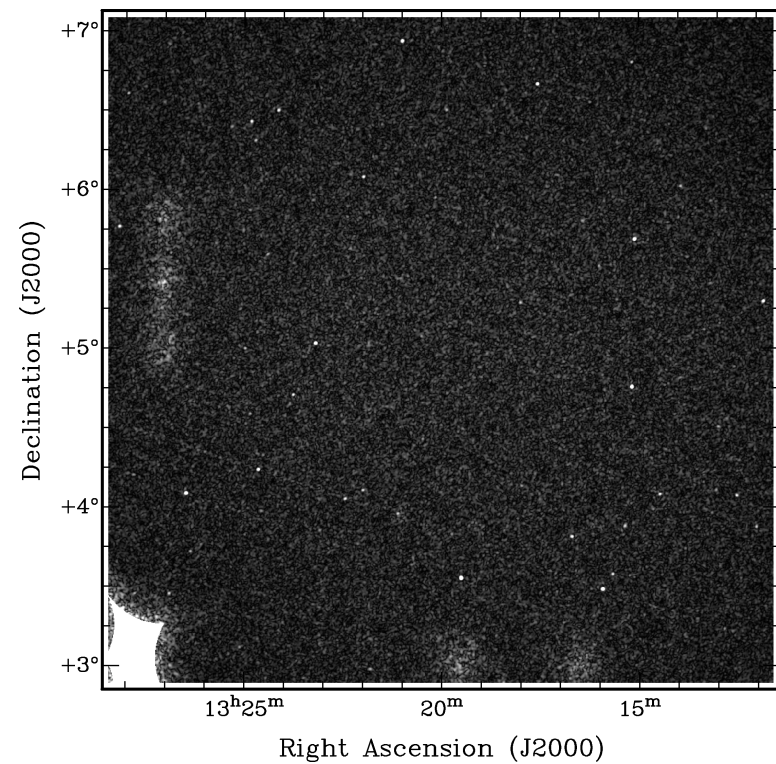
ASKAP Imaging simulations

400 **simulated** NVSS Stokes I,Q,U images already available

Real data (NVSS, GALFACTS) seeding sources



Simulated NVSS 4°x4° Stokes I



Simulated NVSS 4°x4° PI

Conclusions

- Source Finding in polarization is necessary to make an effective end-user source catalogue (more than one catalogue may be necessary)
- POSSUM WG2 focuses on specific challenges of source finding in polarization
- Summer 2010: Testing and optimization of source finding applied to PI images and RM cubes on simulated data and real data (NVSS and GALFACTS)