First Results from the 20 GHz Pilot Survey

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Introduction

Why to survey the radio sky @ 20 GHz?

- New source populations

-CMB foregrounds

-New ATCA high frequency calibrators

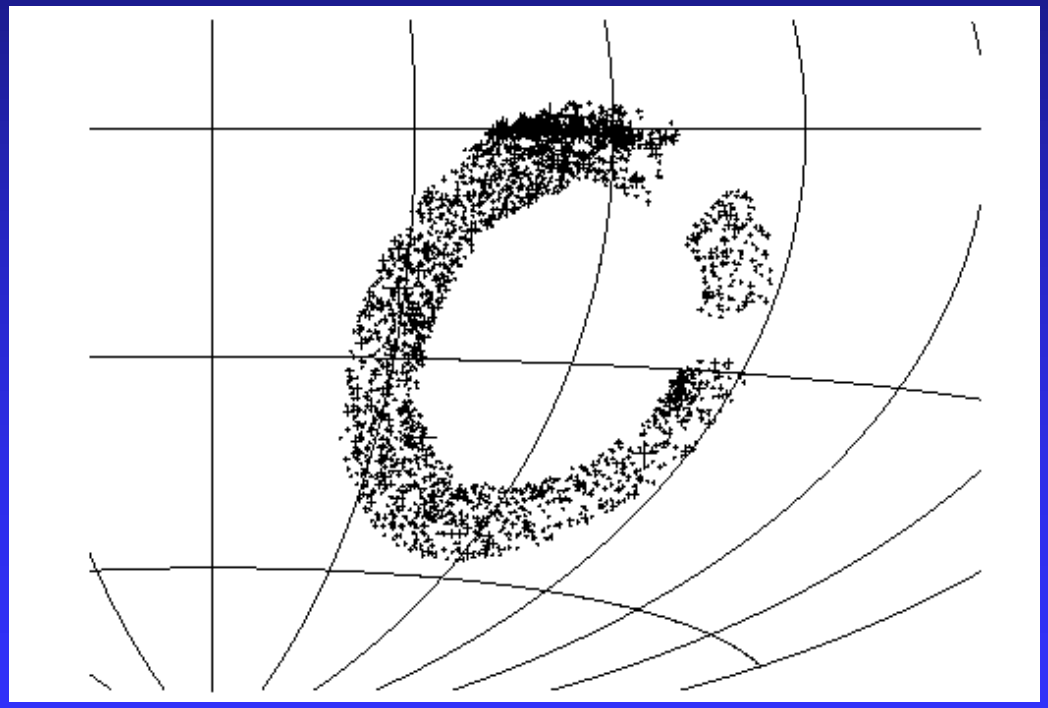
-A. Taylor et al. (2001) → state of the art

Survey Strategy

- 1 ATCA baseline: CA02 –CA03
- WB analogue correlator
  - frequency range: 16-20 GHz
  - BW: 4 GHz (8 frequency channels)
- high scan rate: 10 degrees/min
- No delay correction: scan along meridian

Survey Characteristics

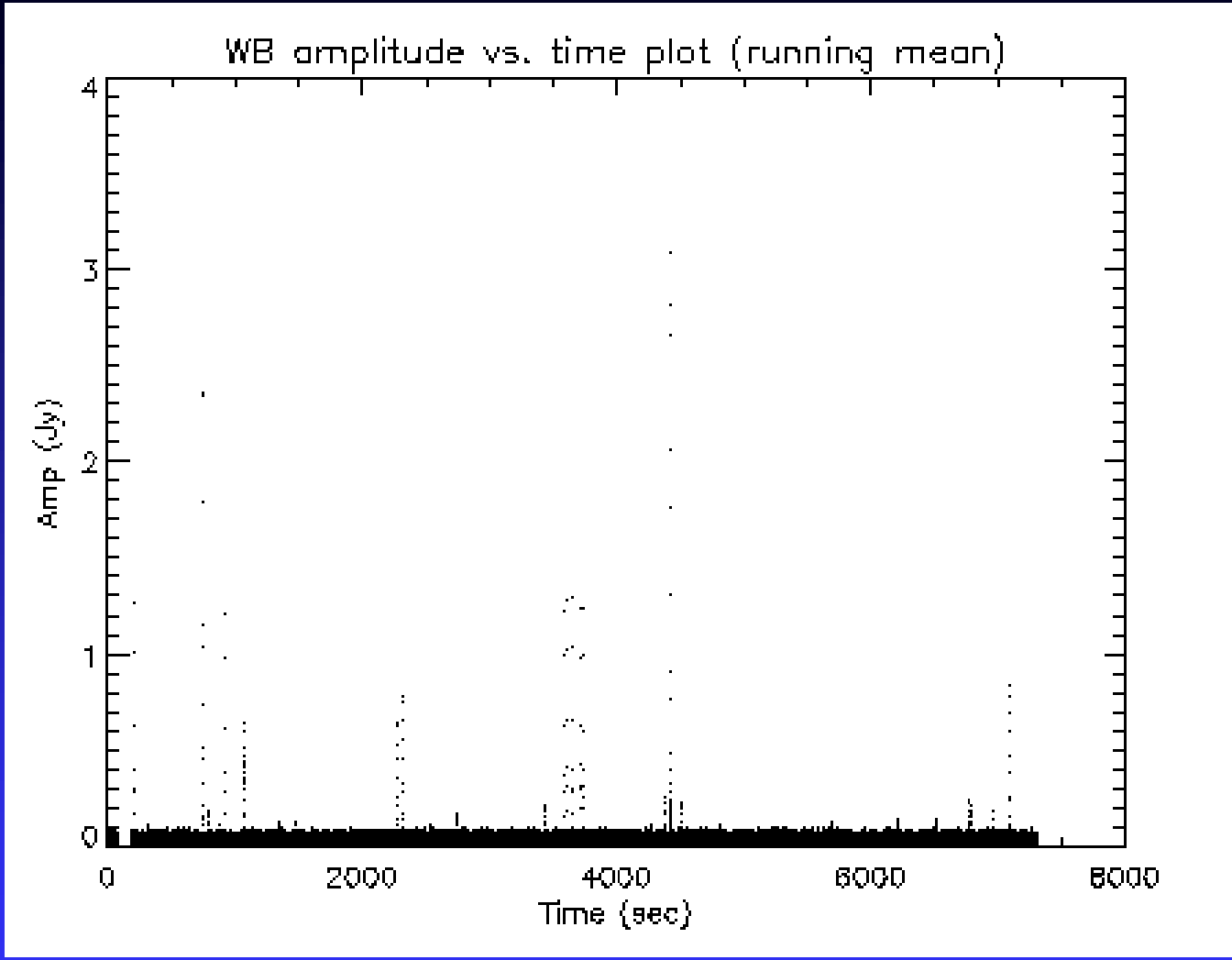
- Surveyed area: ~1200 sq. deg.
- S_{lim} = 60 mJy (4 σ)
- Sky strip covered: δ = -70° to –60°



PMNS sources present in 20 GHz Survey area

Survey Observations

- Date: Sep 13-17, 2002
- Observing time scheduled: 96 hrs
- Surveyed time: 65 hrs
- Survey samplings no.= 2700000



Example of survey raster scan time sequence

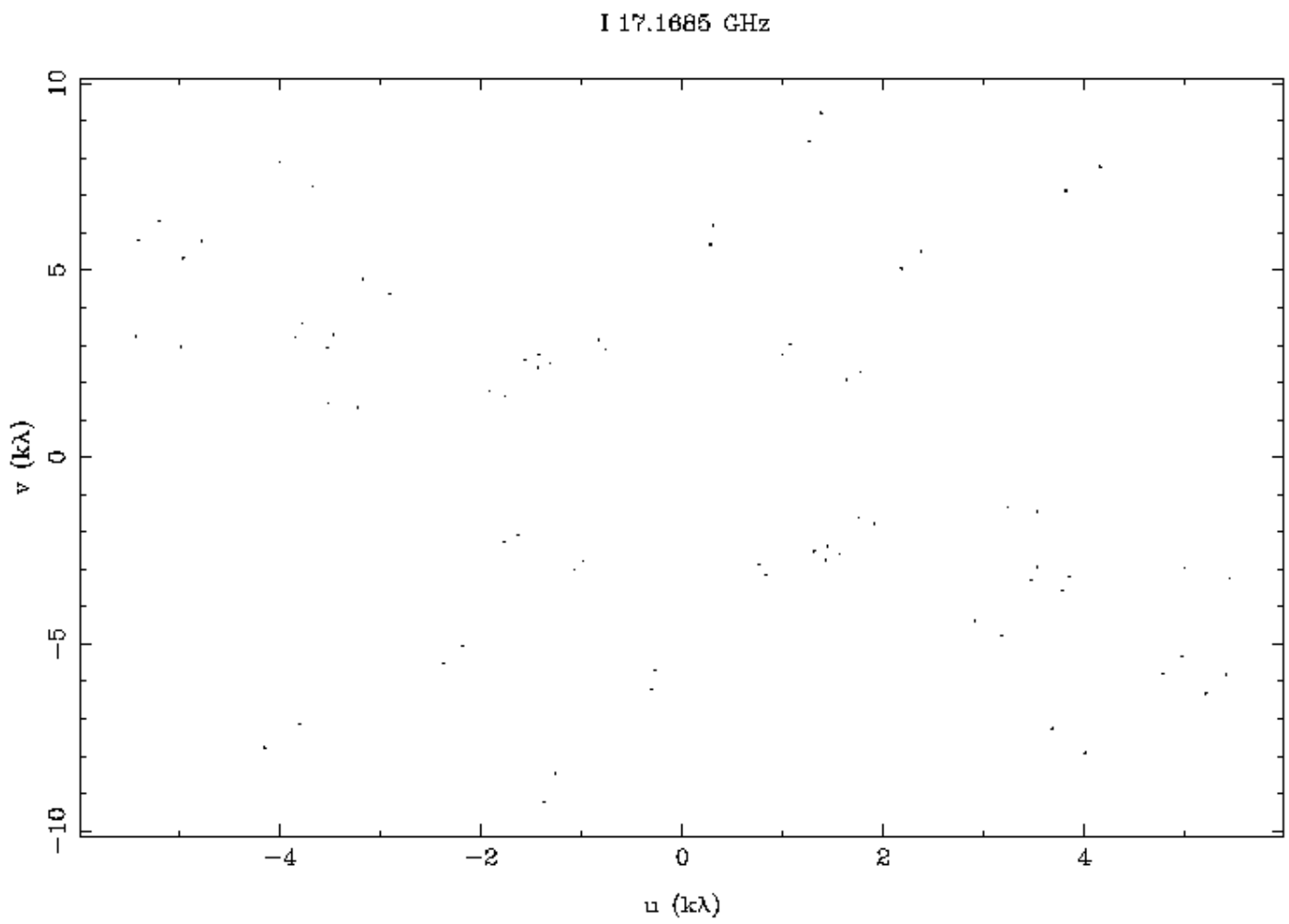
Raster scan data reduction

- Antenna encoders → sampling position
- WB correlator → fringe visibilities
- Frequency channel averaging
- Denoising → Boxcar smoothing
- Search for amplitude peaks
- Candidate source → peak position & amp
- 574 candidates found at S/N = 4

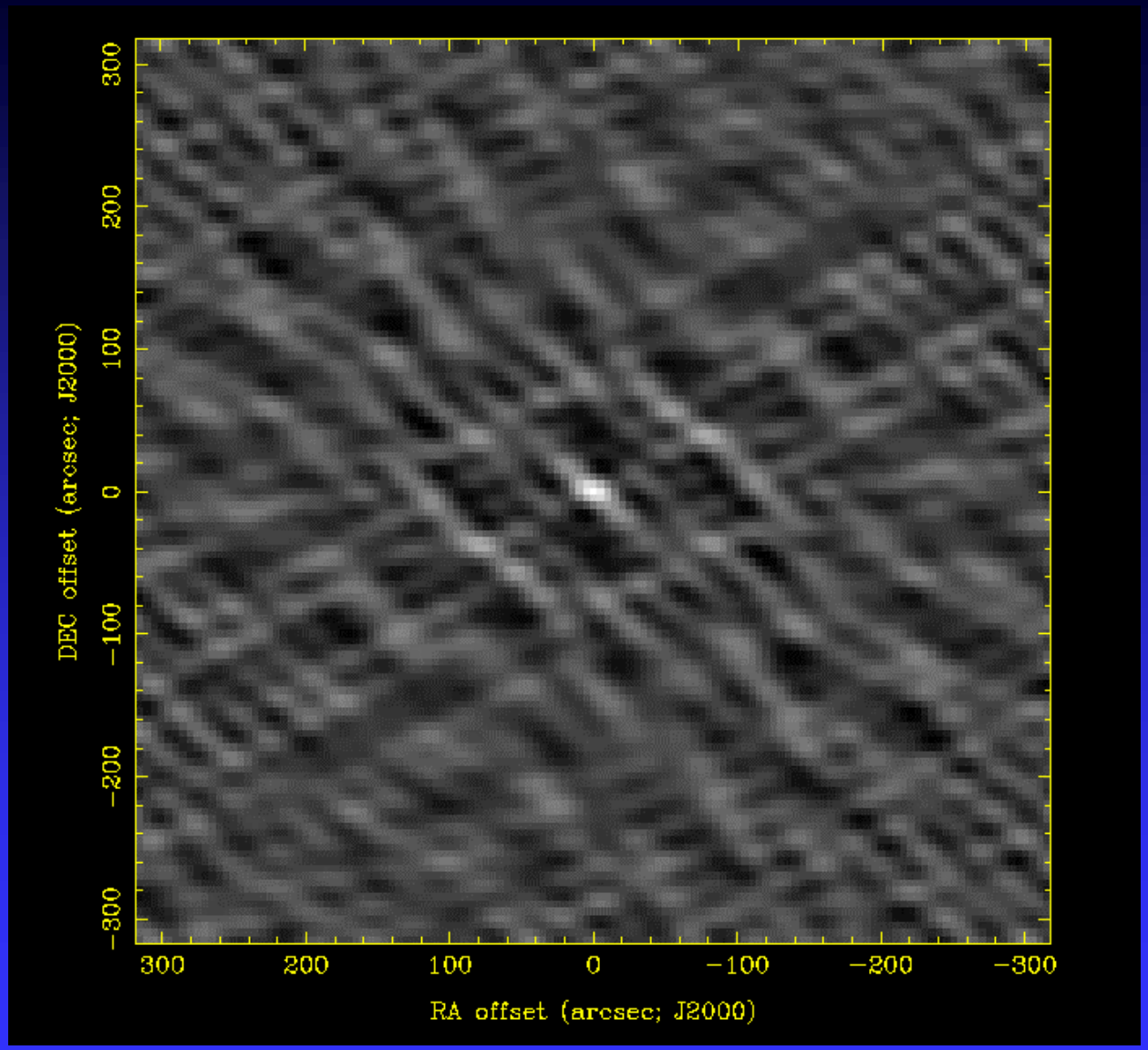
Follow-up observations

- Date: Oct 8-12, 2002 (96 hrs)
- Obs type:
  - double band (17-19 GHz)
  - BW = 128 MHz
  - snapshots (1 min each)
  - 4 Stokes
- ATCA config: H168B (3 antennas)
- 574 candidates & 22 calibrators observed
- Primary calibrator: Mars (0.4 Jy)
- 5 - 7 cuts per source

uv plane of J0025-6028 (candidate source)



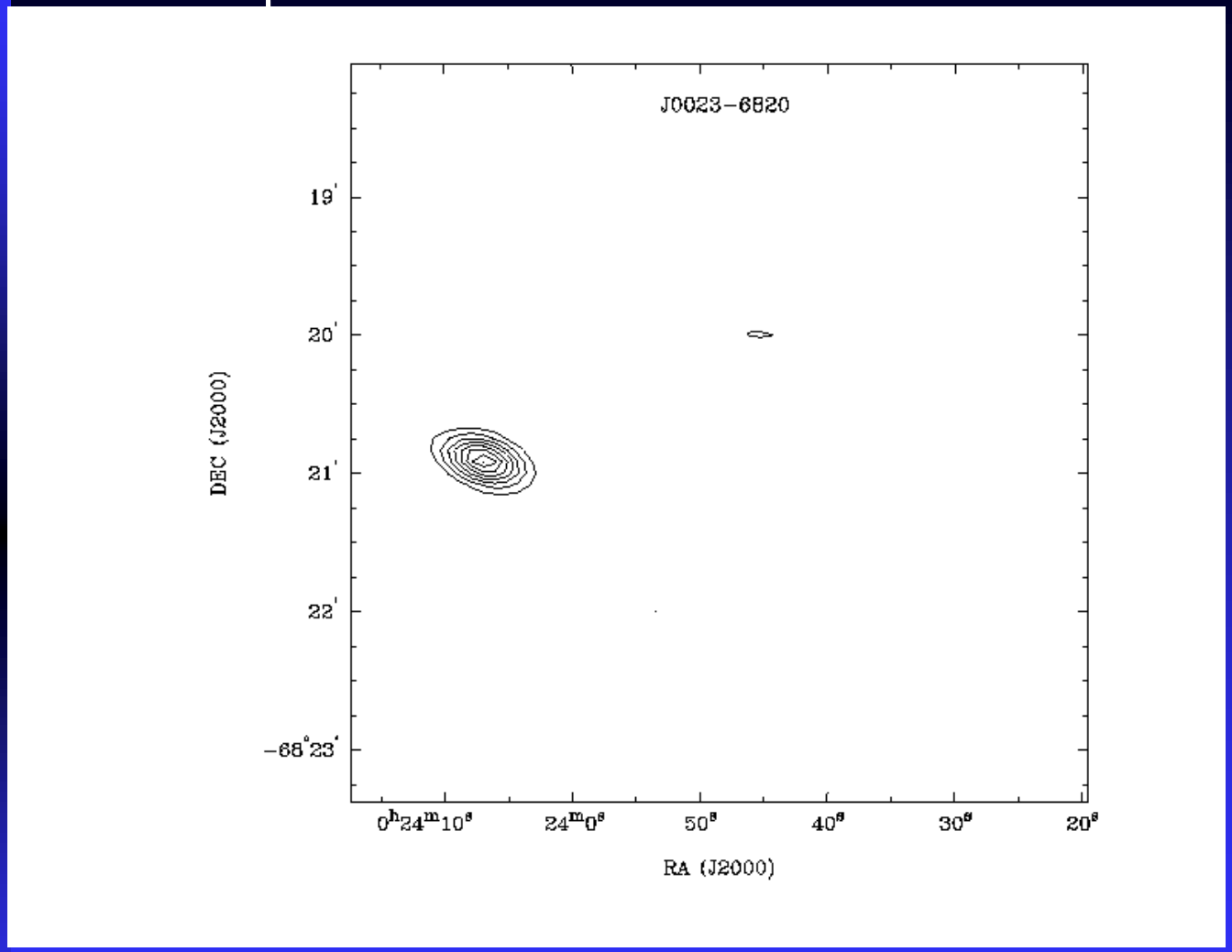
Beam pattern of J0025-6028



Follow-up preliminary results

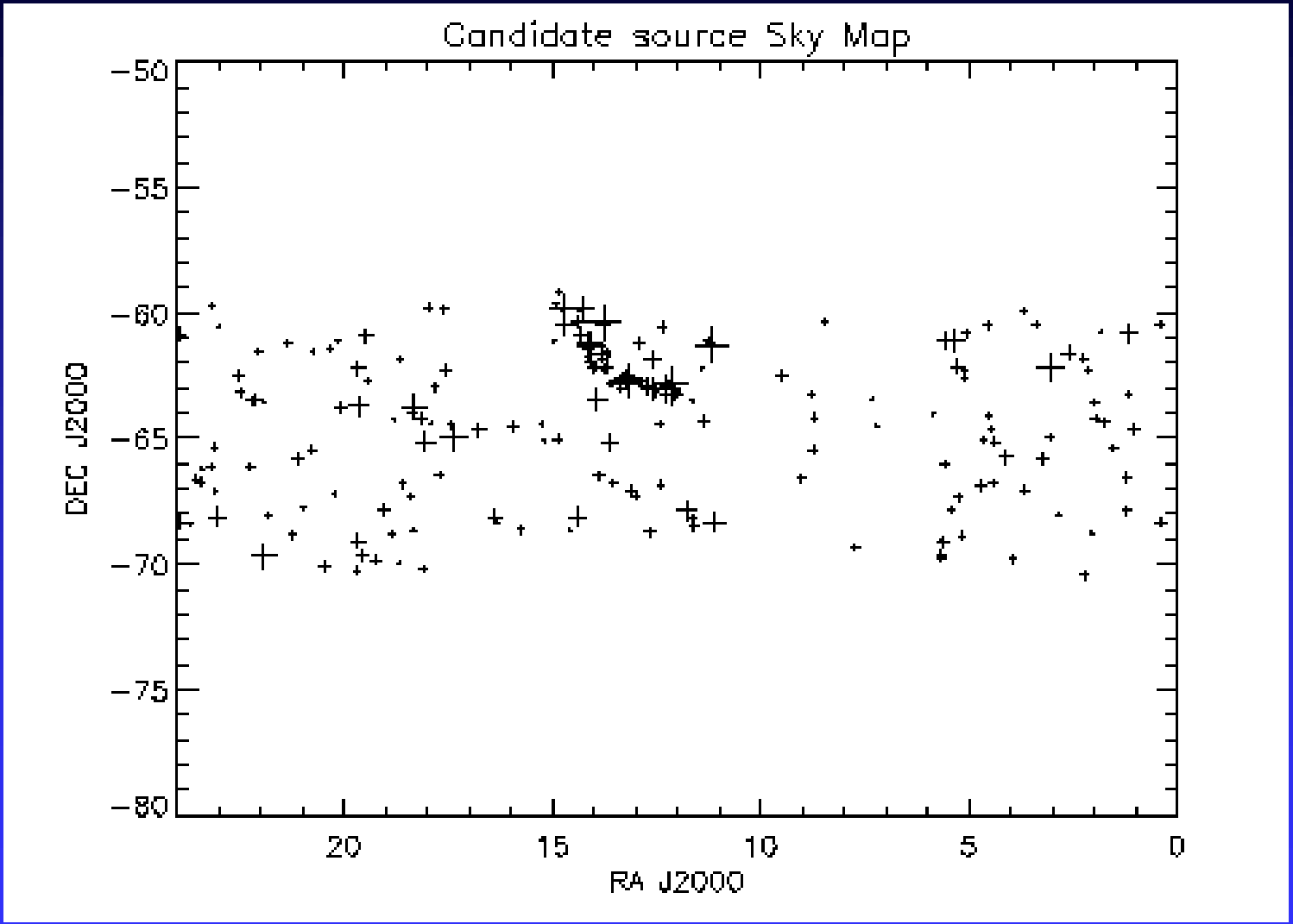
- All 574 candidates calibrated and imaged in all the Stokes parameters
- 286/574 sources confirmed (S/N > 5)
- Some of them are multiple detections
  → final source number = 226
- On primary beam corrected restored maps:
  - accurate position & flux density
  - IMFITted source size
    → deconvolution for resolved sources

Contour plot of J0023-6820

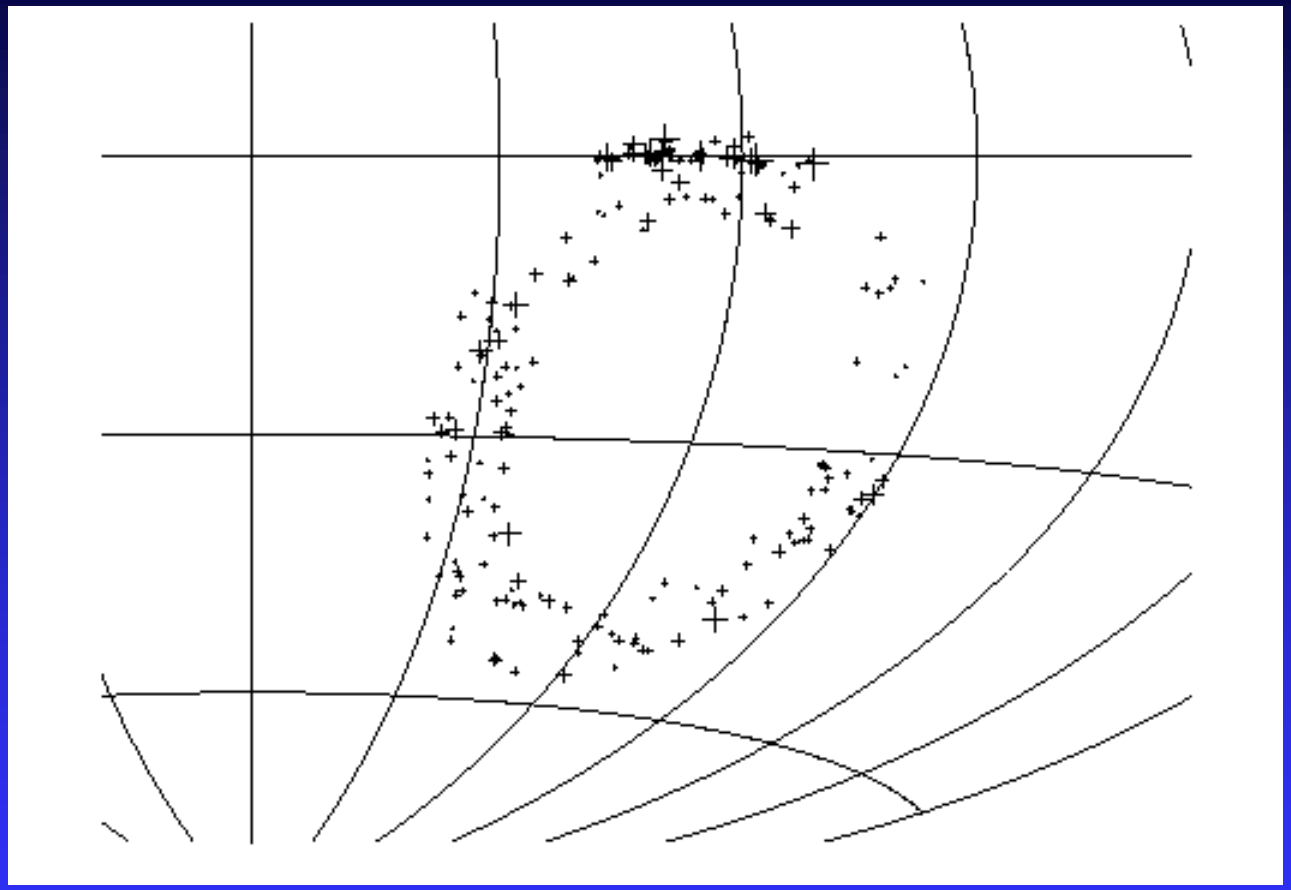


Contour levs at –1%, 1%, 2%, 4%, 8%, 16%, 32% of the peak flux = 312 mJy/beam

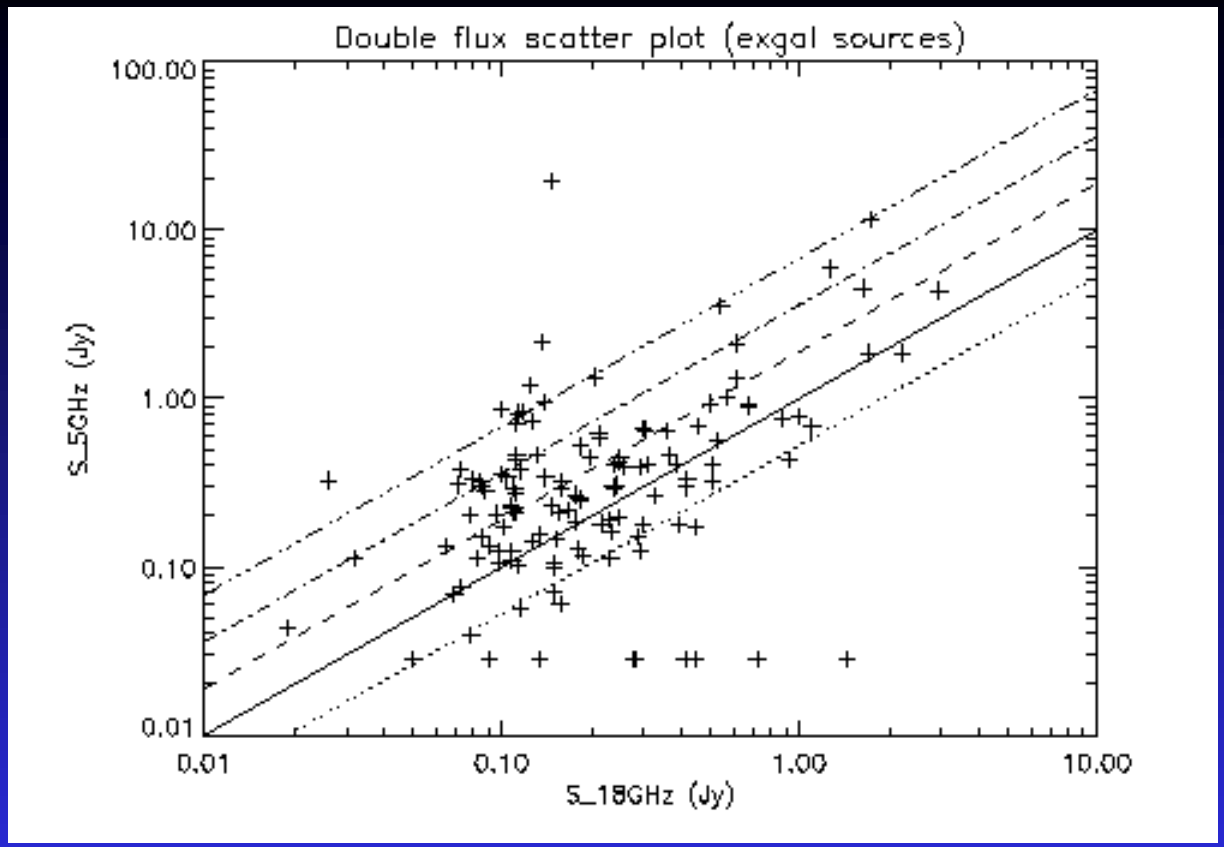
Follow-up sources sky maps



Aitoff equal area projection of the Follow-up sources sky map in galactic coordinates

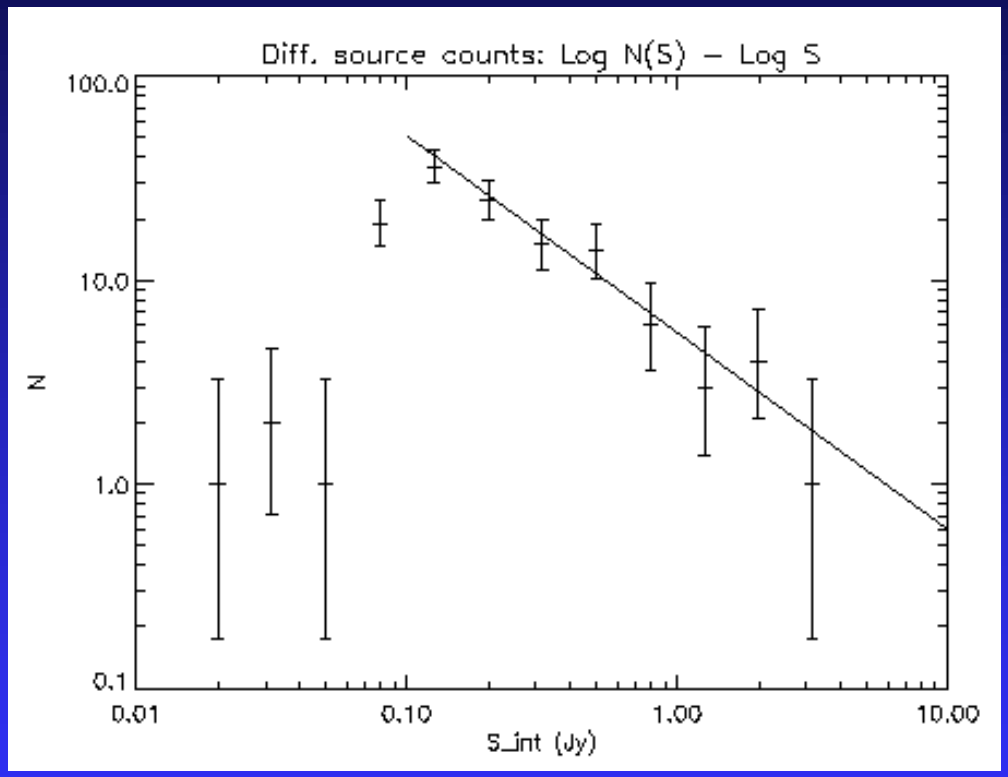


- two populations (galactic & extragalactic)



- Extragalactic population ($b^{(II)} < -10^{o}$)
- 20 GHz Survey extragalactic source no. = 127
- PMN source no. = 118/127

Differential Source Counts of survey extragalactic sources



Surveyed area = 925 sq. deg.

Incompletess:

$S_{18\ GHz} < 100$ mJy

Linear Fit:

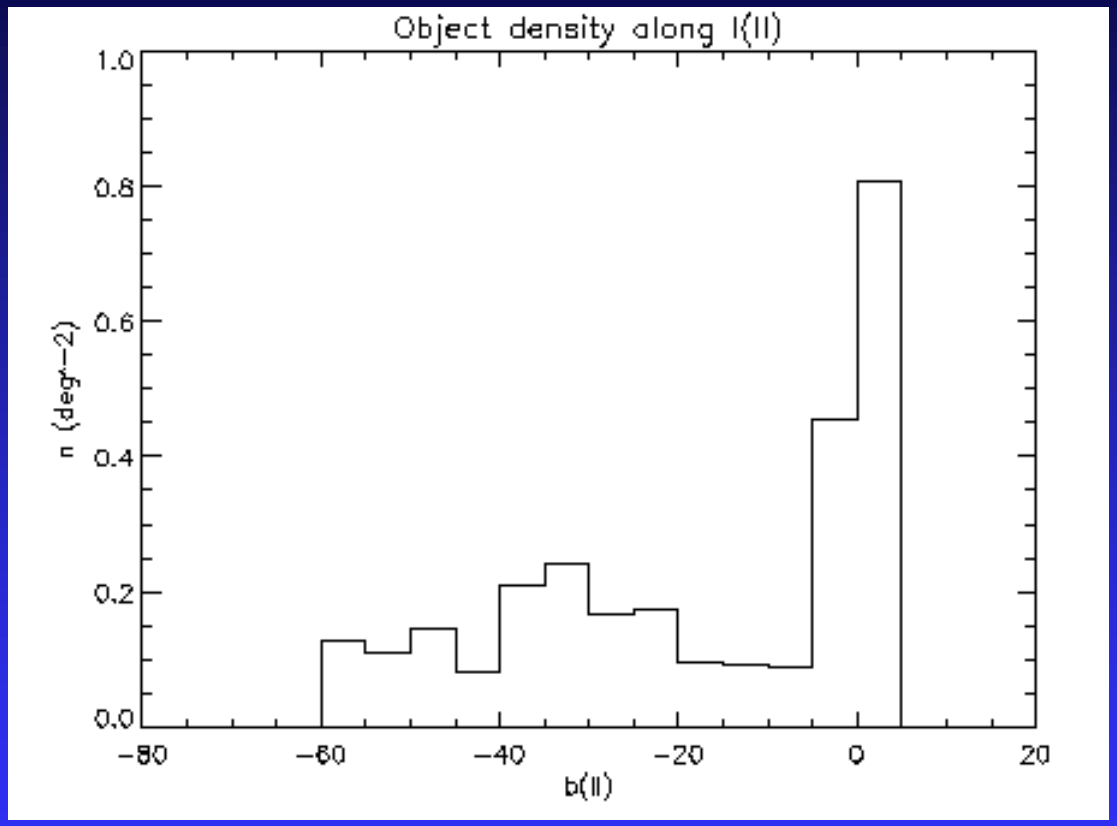
$N(S) \alpha S^{-1.97+/-0.24}$

Taylor *et al.* 2001

$N(S) \alpha S^{-2.0+/-0.5}$

$S_{lim,\ 15\ GHz} \sim 30$ mJy over 63 sq. deg.

Survey Source Density



- Steep source density increase toward the galactic centre

Future Work

- Radio spectra of confirmed source sample
- Redshift determination
- Better constraints to models of radio source confusion noise contaminating CMB anisotropies
- Plans for a 20 GHz all southern sky survey in 2003

  - 3 ATCA baselines

  -WB correlator (8 GHz BW)

  - simultaneous follow-up capabilities