



# A VLBI survey of weak extragalactic radio sources for the link with the future GAIA frame

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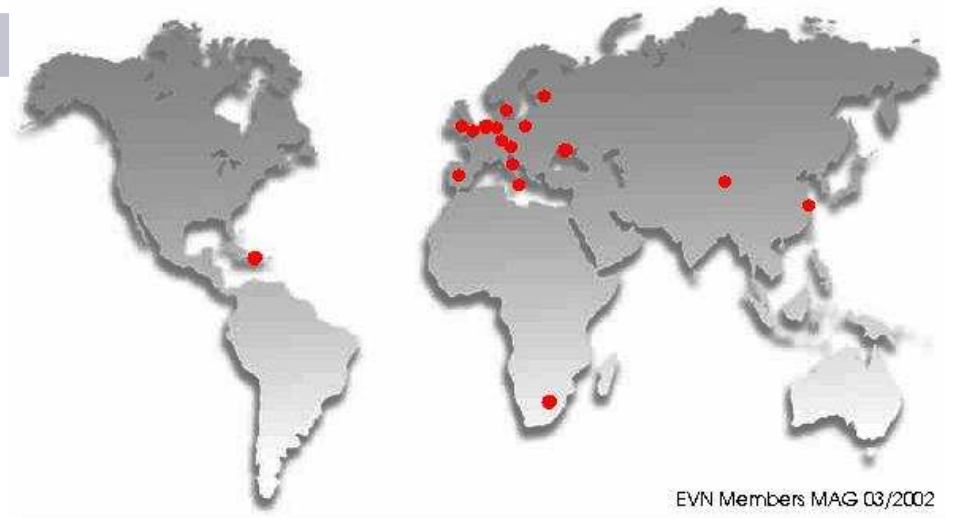
# Overview

- Context for this survey
- Presentation of the project
- First experiment

Initial Results

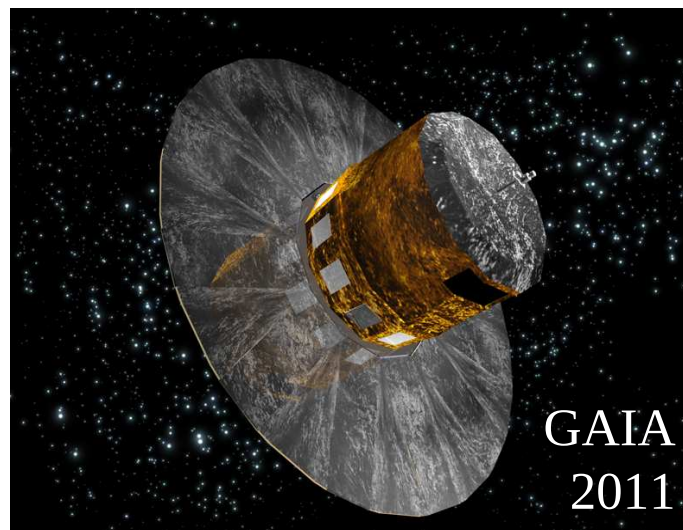
Analyses

- Conclusions and Prospects



# I. Context

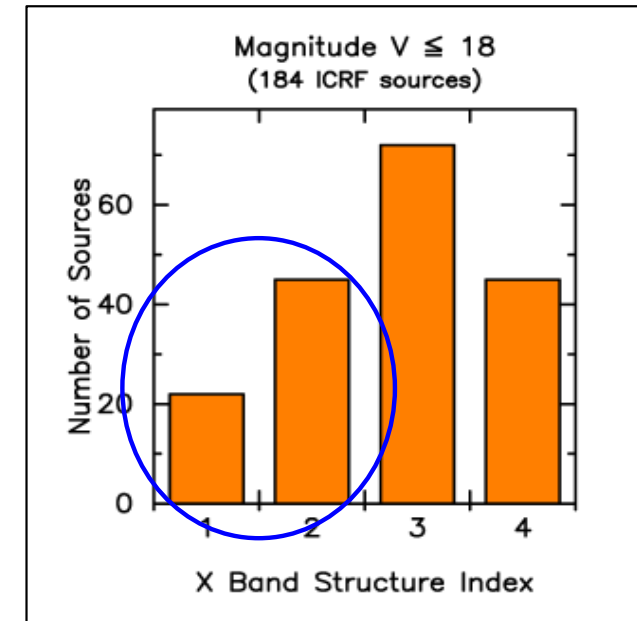
- Space astrometric mission **GAIA** (ESA) launch —————→ 2011
- **Optical** positions of objects with  $V \leq 20$
- QSOs based celestial reference frame —————→ 2015–2019
- **Establish an accurate ICRF-GAIA link:**
  - ✓ Several hundreds of common sources,
  - ✓ Accurate ICRF & GAIA positions (i.e. compact VLBI structure &  $V \leq 18$ ).



## ■ Current status of the astrometric ICRF/GAIA link?

➡ 30% of ICRF sources a priori suitable  
(i.e. optical counterpart with  $V \leq 18$ )

➡ Only 10% of ICRF sources sufficiently  
compact  
(i.e. Structure Index = 1 or 2)



## ■ Necessity to find new radio sources suitable for this link !!

➡ Go to weaker radio sources

➡ Possibly more compact (i.e. higher astrometric quality)?

## II. Project: VLBI observations of weak radio sources at EVN (European VLBI Network)

- Weak radio sources observations possible with EVN:

Big antennas (e.g. Effelsberg, 100 m Ø - Germany),

Recent increase in network sensitivity (i.e. recording at 1 Gb/s).

- Criteria for the sample: ~ **400 sources**

From NVSS dense radio catalogue (excluding ICRF & VCS)

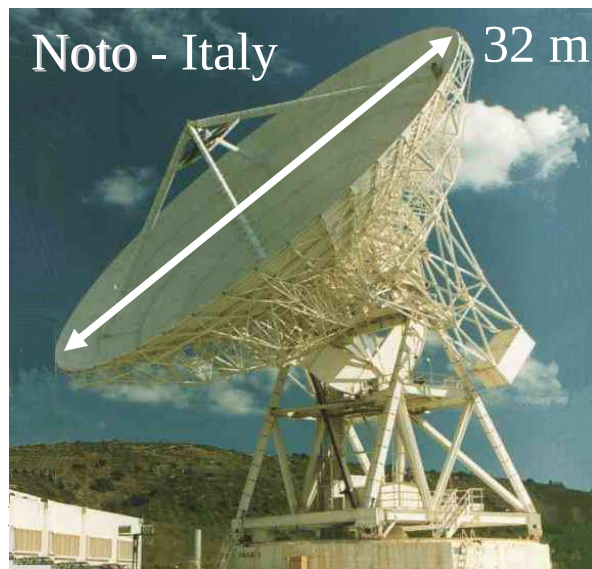
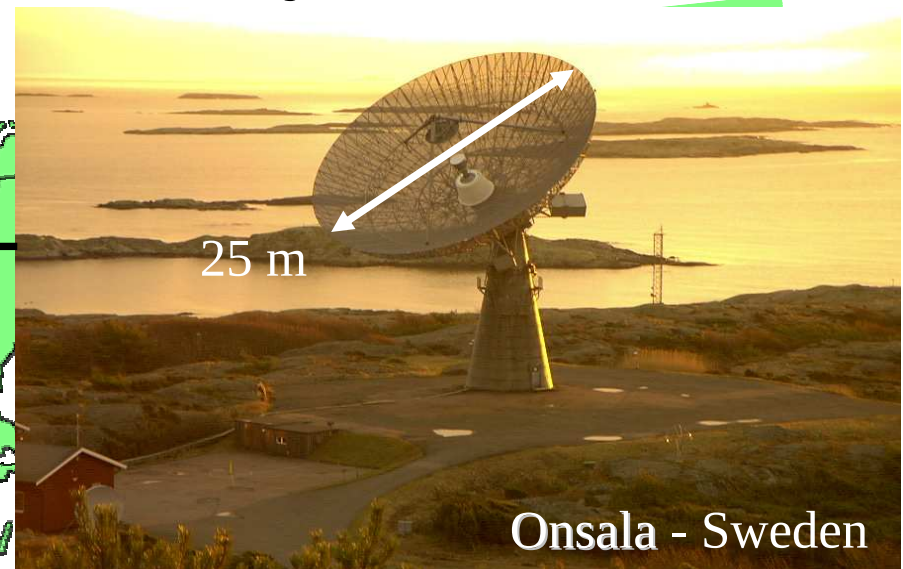
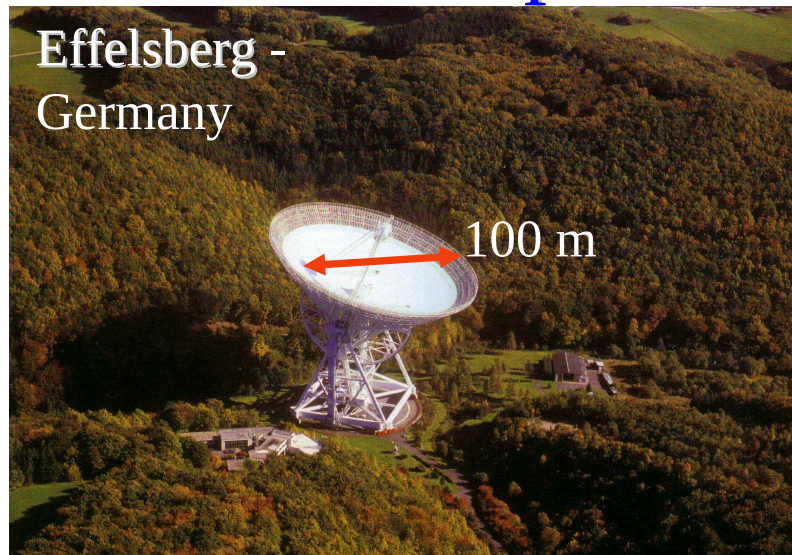
Flux density  $\geq 20$  mJy,

$\delta \geq -10^\circ$ ,  $V \leq 18$  (i.e. accurate position with GAIA).

- Project with 3 steps over several years:

1. Detectable in VLBI? **Never observed before!!**
2. Mapping and accurate astrometric positions.
3. Refine astrometry for the most compact sources.

### III. First experiment: preliminary results



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- Sources observed:

First step, half of the sample ...

→ 224 sources observed during 48h-experiment (+ 4 calibrators)

- Sources detected:

✓ X-band: 222 sources detected → 99%

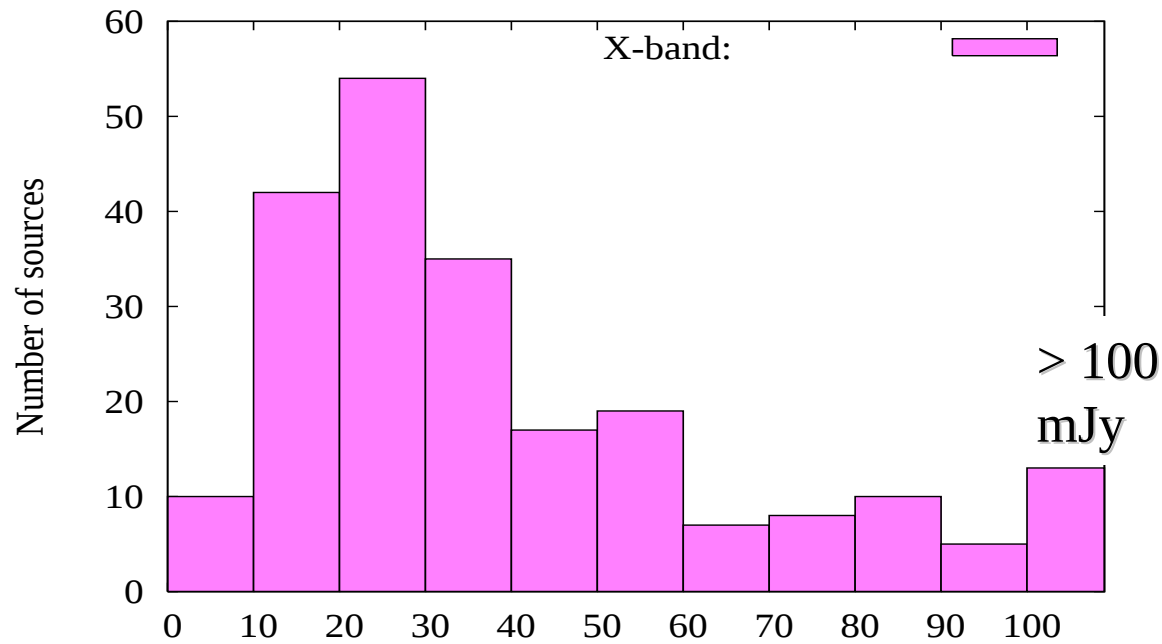
8.4 GHz - 3.6 cm

Good detection rate

✓ S-band: 211 sources detected → 95%

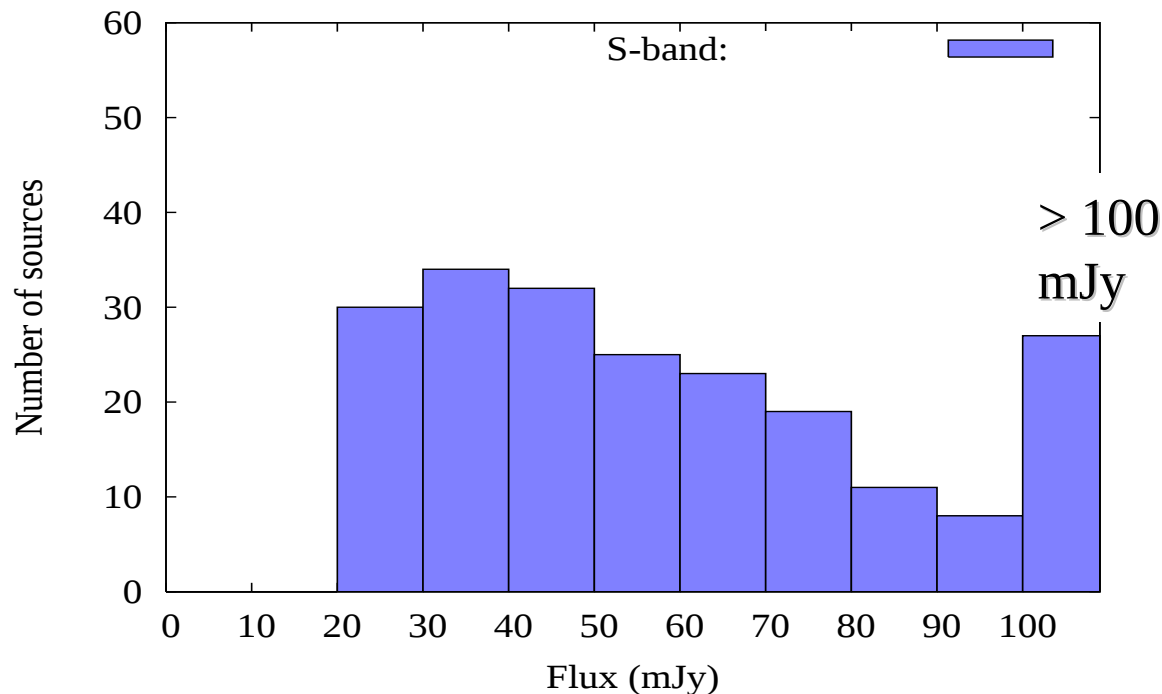
2.3 GHz - 13 cm

# EVN sample: Flux Density Histograms



**X-band:** 222 sources

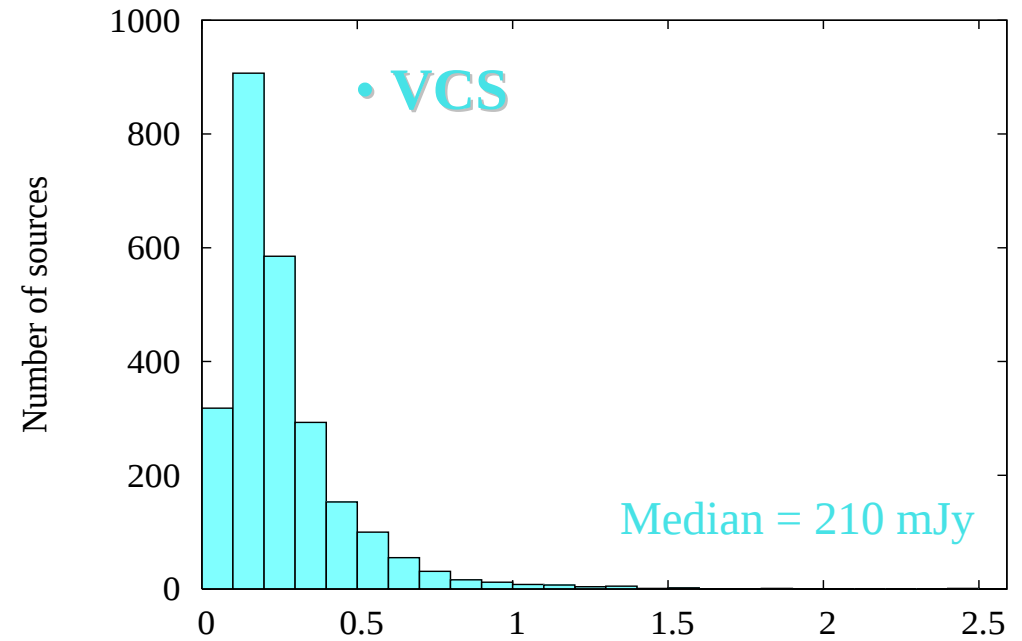
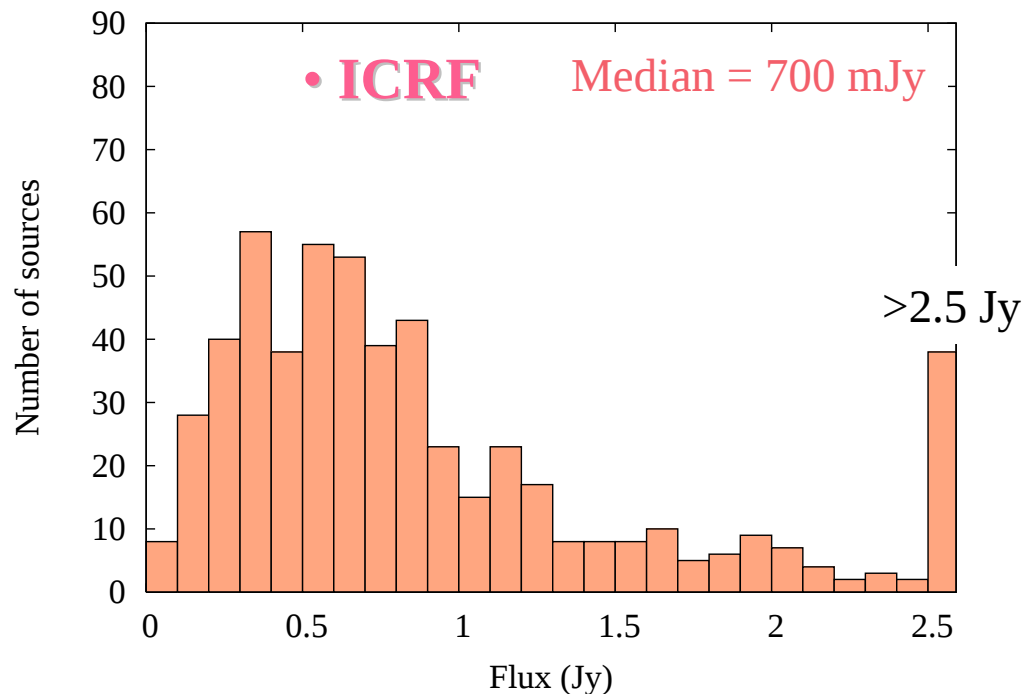
Median value = 32 mJy



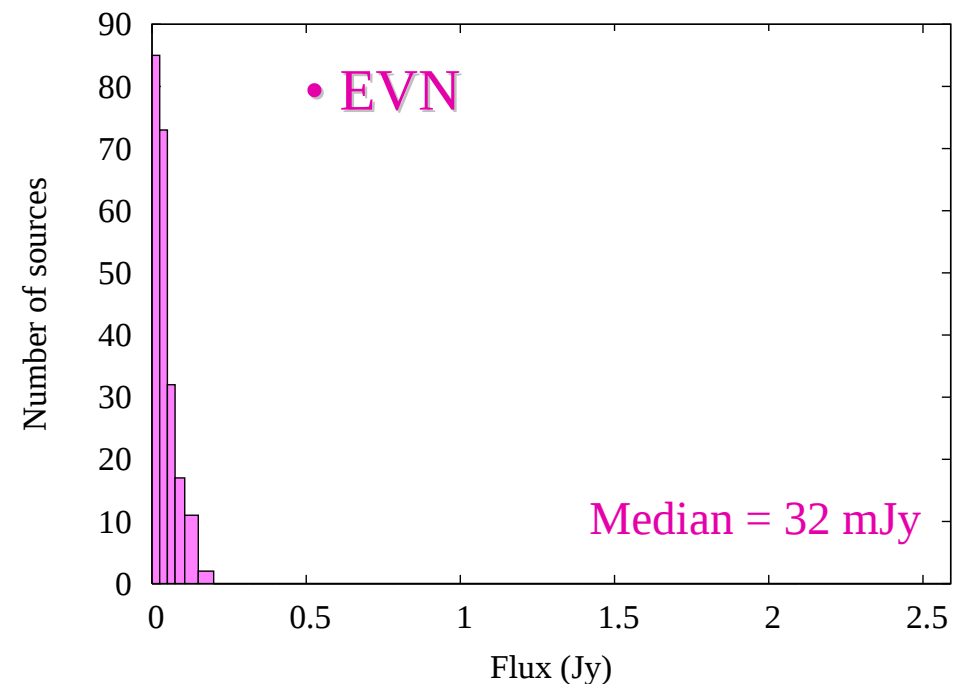
**S-band:** 211 sources

Median value = 55 mJy

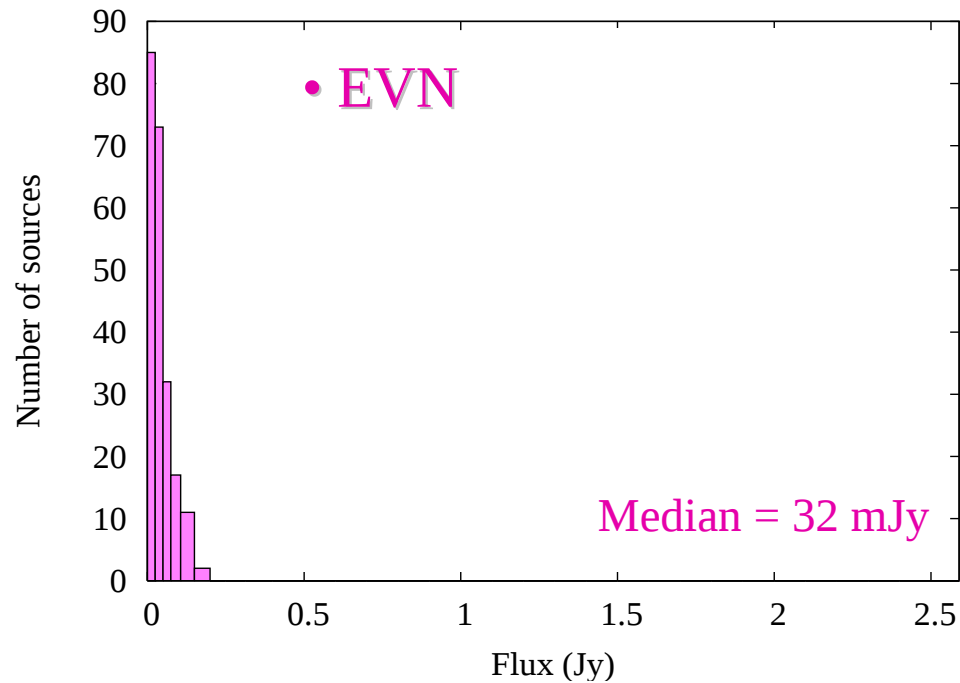
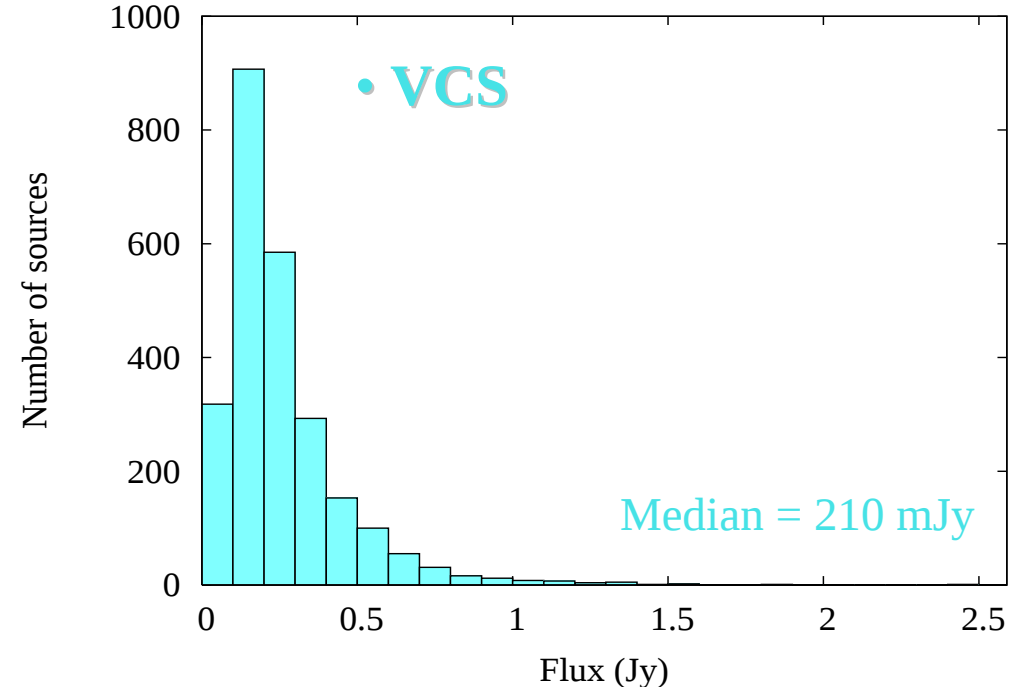
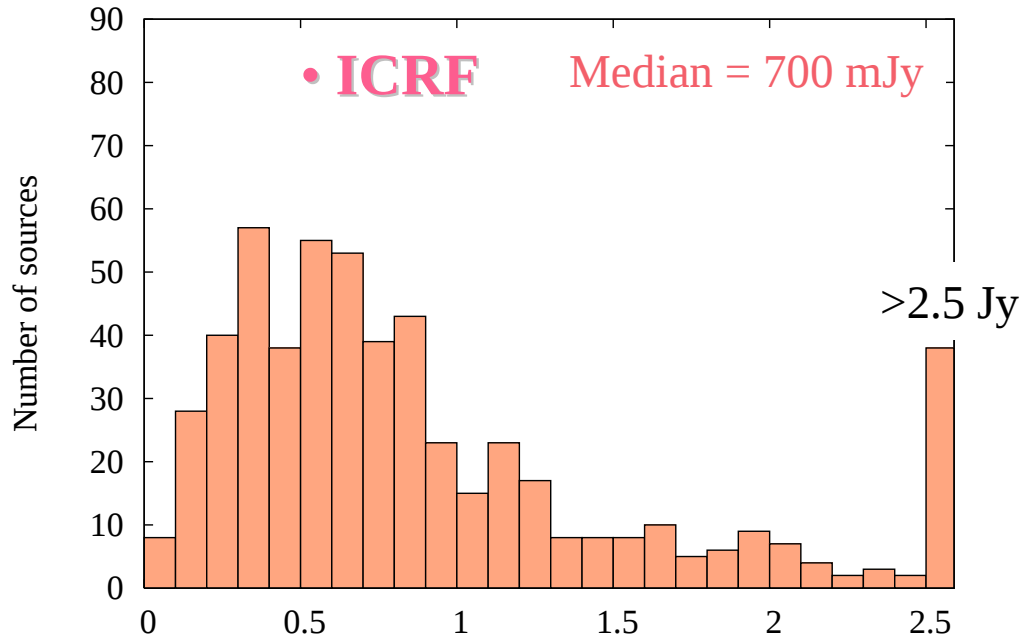
# EVN sample: sources really weak?



X-band flux  
density  
histograms



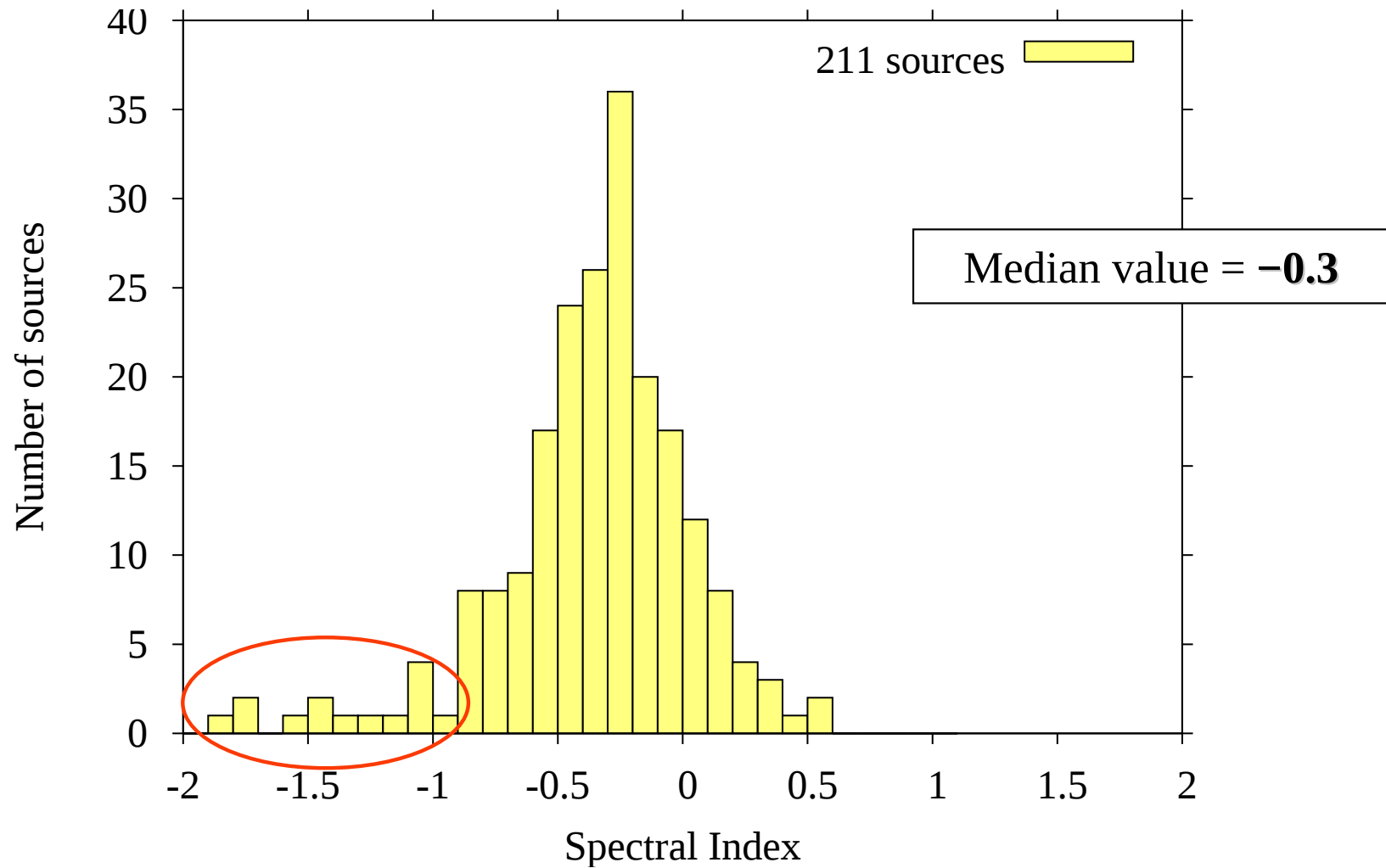
# EVN sample: sources really weak?



X-band flux  
density  
histograms

## EVN sample: S/X Spectral Index Histogram

S/X Spectral Index  $\alpha$ :  $\text{Flux (S-band)} / \text{Flux (X-band)} = (2.3/8.4)^\alpha$



## IV. Conclusion & Prospects

- What's new? 211 new extragalactic radio sources detected in VLBI,  
Median Flux Density  $20 \times$  smaller than ICRF flux densities.
- First step very promising (~200 other sources observed in October 2007).
- Next step: VLBI imaging & astrometric positions of the sources detected.
- Goals:
  1. Good prospects for an **accurate astrometric ICRF/GAIA link**.
  2. Densification of ICRF,  
Weaker sources really more compact? (i.e. Different population of sources?)