EUROPEAN VLBI NETWORK
www.evlbi.org

www.jive.nl

eVLBI... a Wide-Field Imaging Instrument with milli-arcsecond Resolution and microJy Sensitivity.

Mike Garrett

Joint Institute for VLBI in Europe

- eVLBI – O.K. but what does the "e" stand for ???
  - e = expanded ?

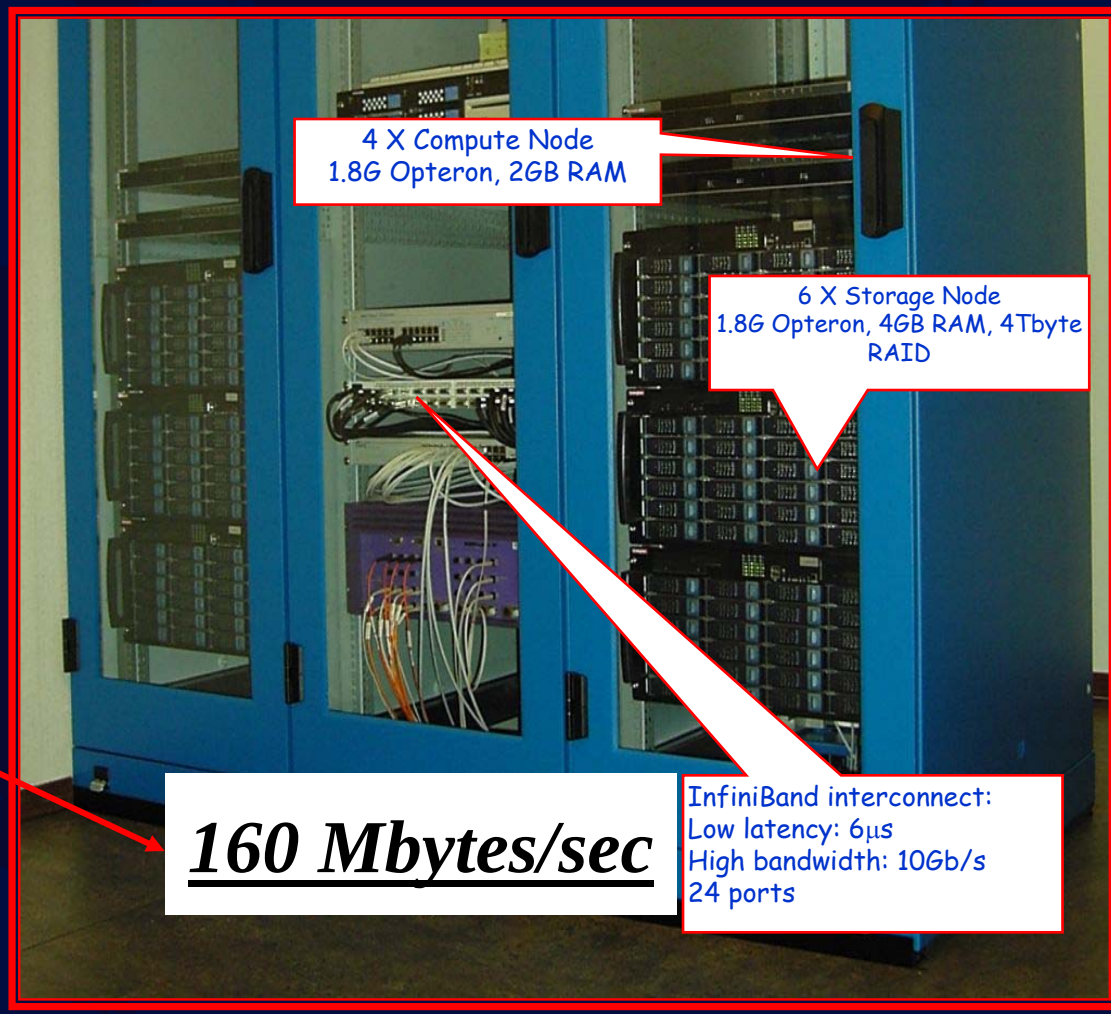
    - Yes, Field-of-View ~ 100 sq. amin at 20 cm.

Field-of-View previously limited by:

(i) Limited correlator data output rates

1 MByte/sec.

(ii) off-line computing resources (the evil of data averaging).



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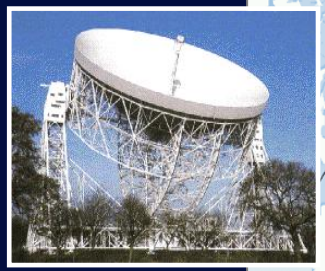
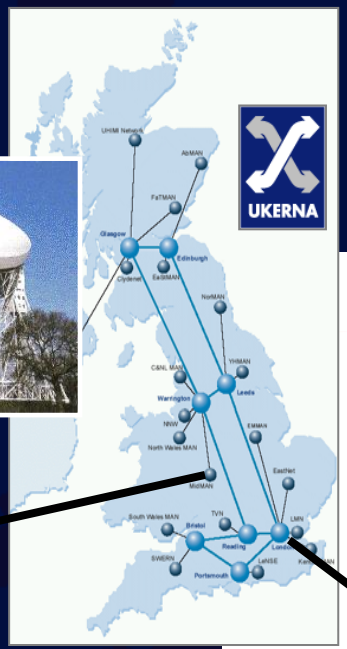
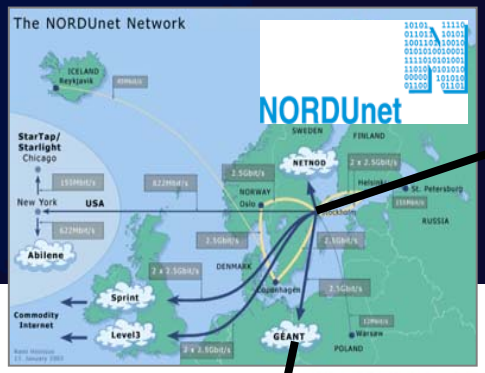
  - e = electronic ?
    - Yes, telescopes connected globally via optical fibres

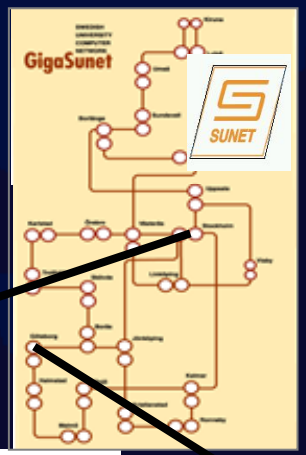
eVLBI Network Topology



Network North-West



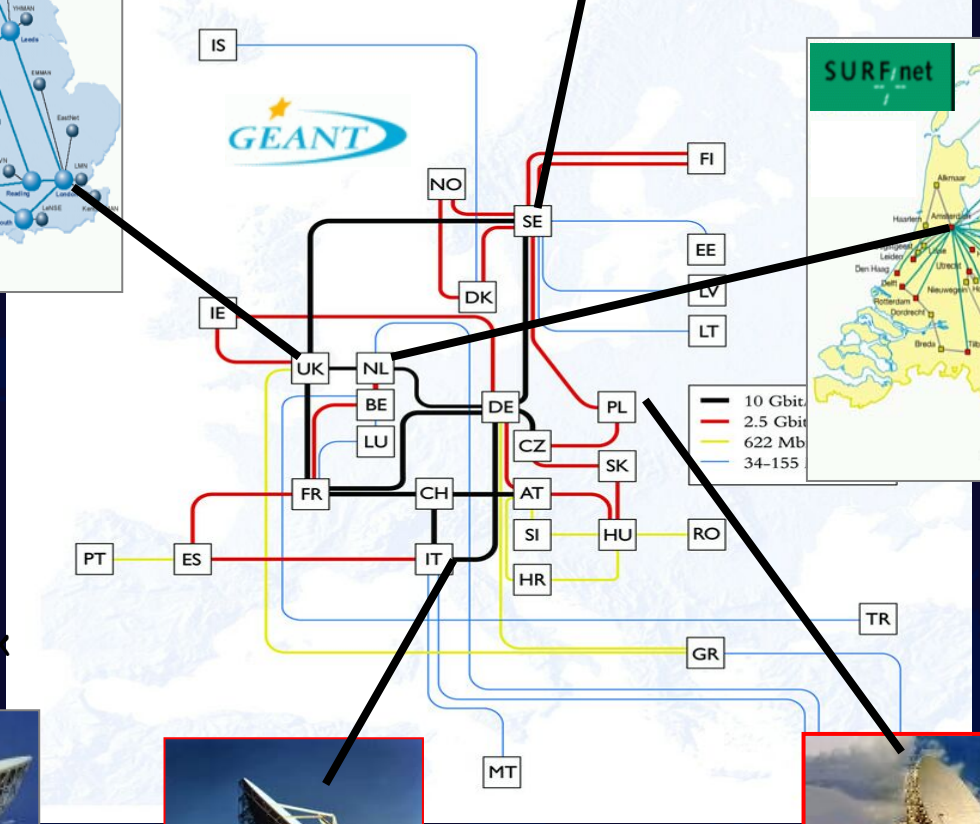




Onsala Sweden

Gbit link

Chalmers University of Technology, Gothenburg



Westerbork Netherlands

150Mbit link

Jodrell Bank

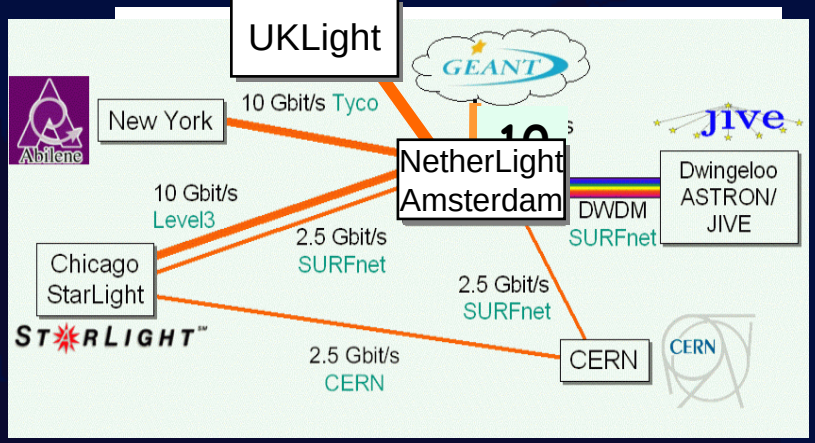
MERLIN Microwave link

Cambridge UK

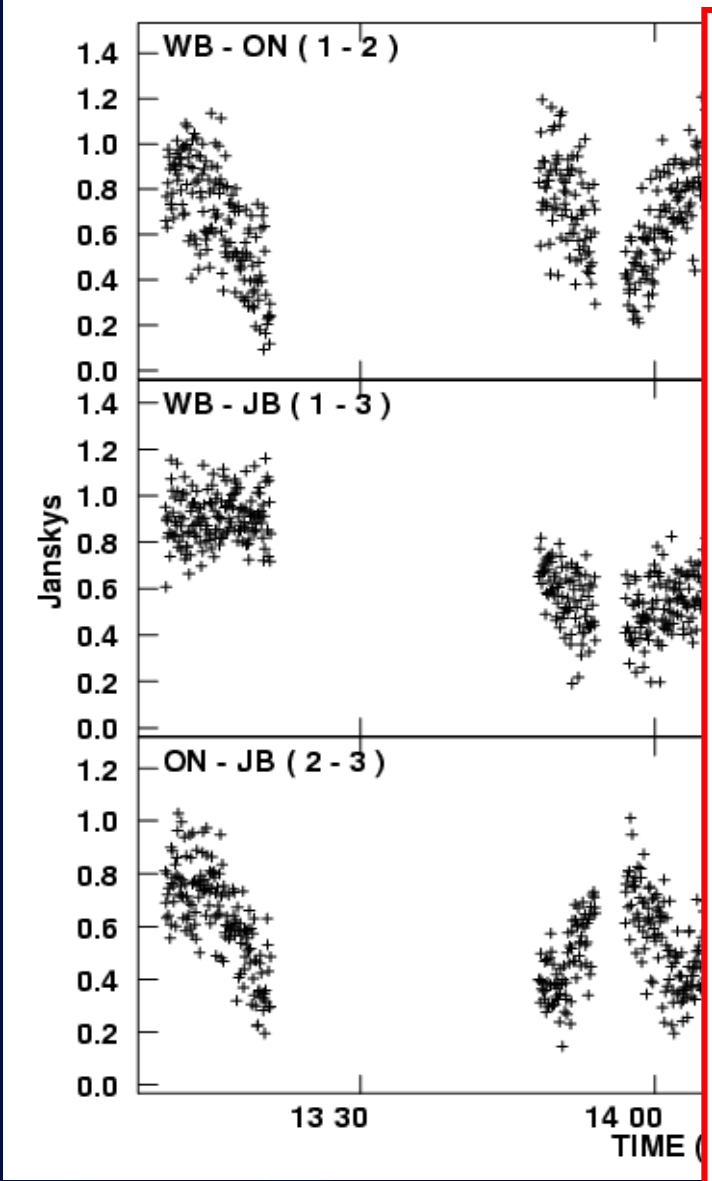
Dwingeloo DWDM link

Gbit link

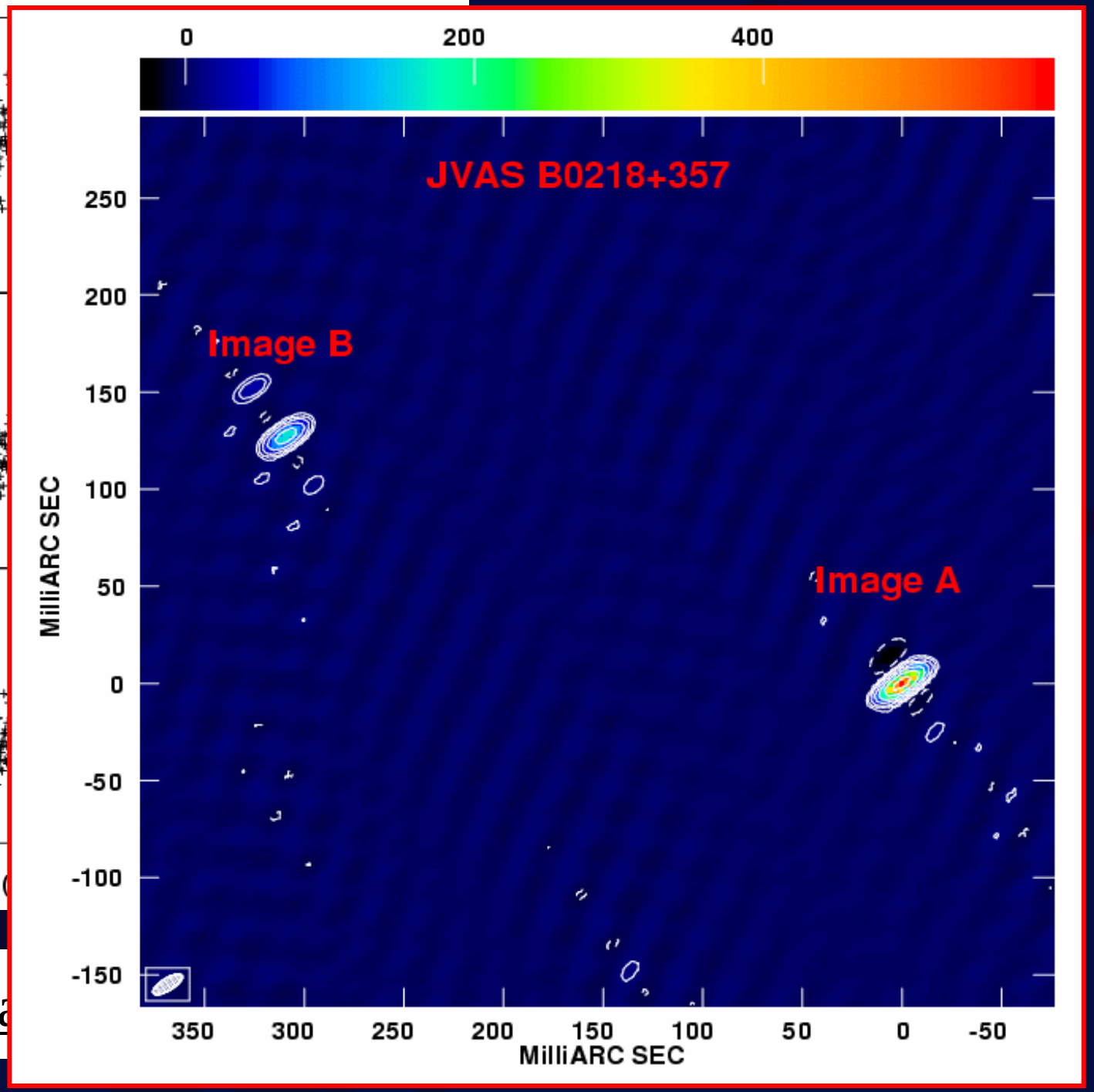
- Global connectivity too…



- Recent eVLBI milestones included…:
  - The first real-time transatlantic VLBI "fringes" (Westford-Onsala → MIT Haystack, USA),
  - The first real-time eEVN image (Westerbork-Onsala-Jodrell → JIVE, NL).



Visibility Data Correla

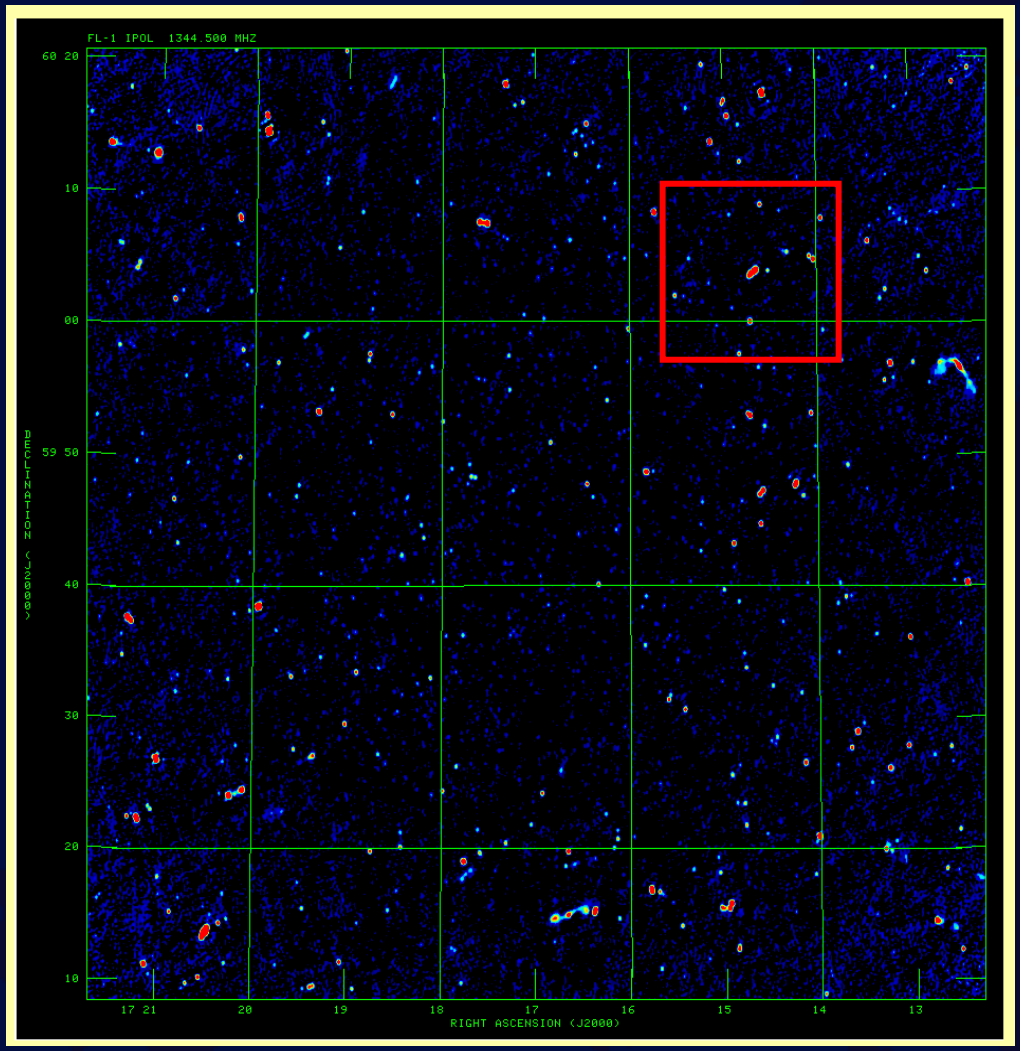


First real-time eVLBI Image

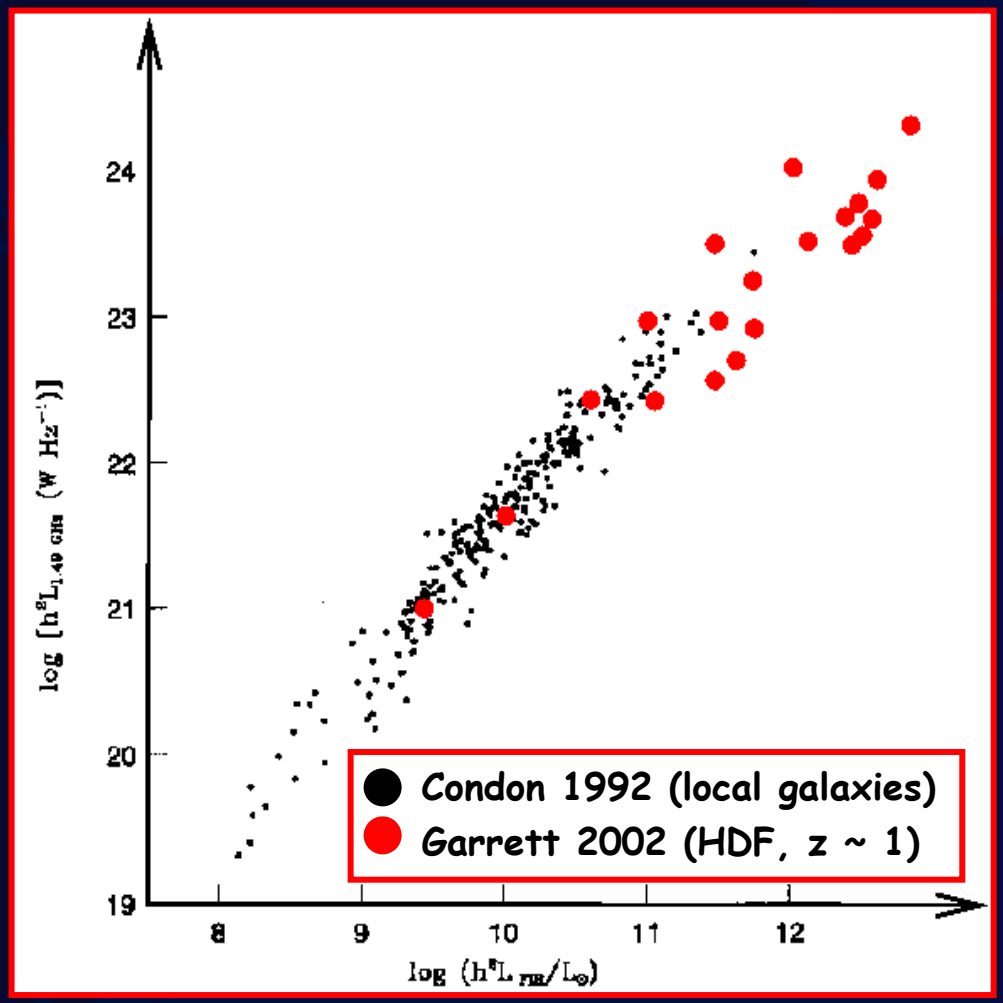
- eVLBI – O.K. but what does the "e" stand for ???
  - e = expanded ?
    - Yes, Field-of-View ~ 100 sq. arcminutes at 20 cm
  - e = electronic ?
    - Yes, telescopes connected globally via optical fibres/PC-Disks.
  - e = embarrassingly sensitive ?
    - Yes, ~ 5% of the Square Km Array
      (& several new telescopes under construction…)
    - *Global VLBI → ~ 2 MicroJy (1-sigma) rms noise.*

NOW !

· eVLBI will permit *milliarcsecond resolution* (astrometric) surveys to be conducted of faint *microJy* radio sources (AGN) across (relatively) *large areas of sky* …

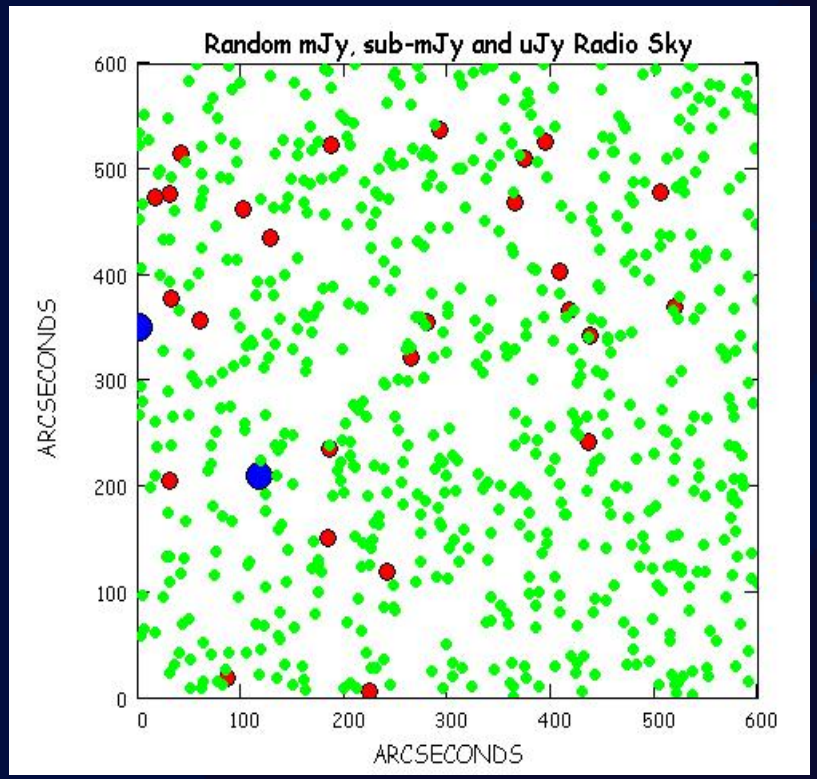


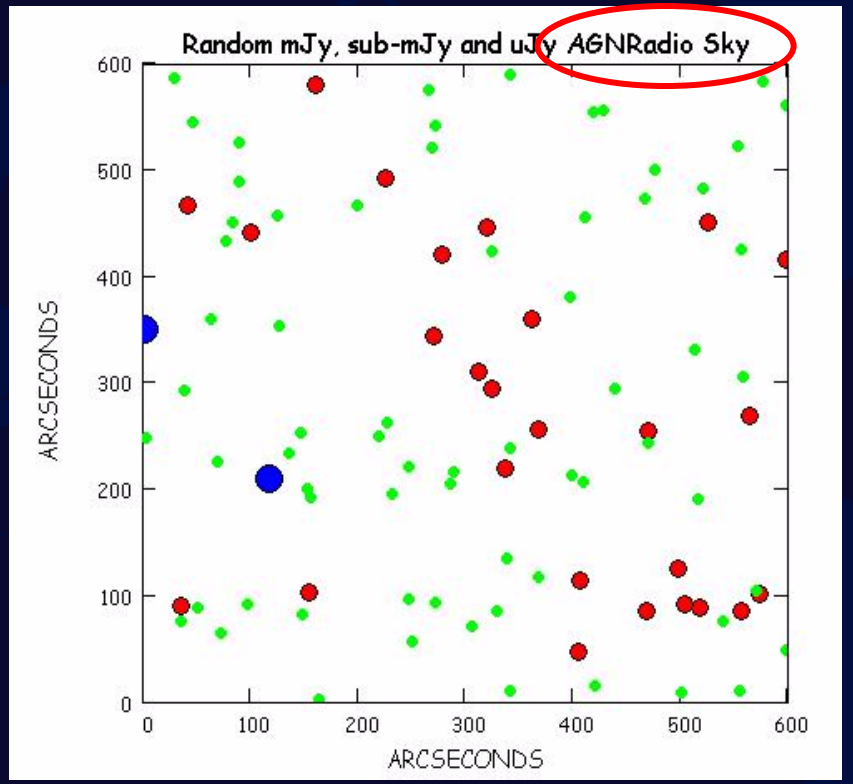
R. Morganti et al. 2004 - WSRT FLSv



See also Elbaz et al. 2002, Spitzer FLSv

eVLBI as an AGN Survey machine: Potential Target Sky 20cm…

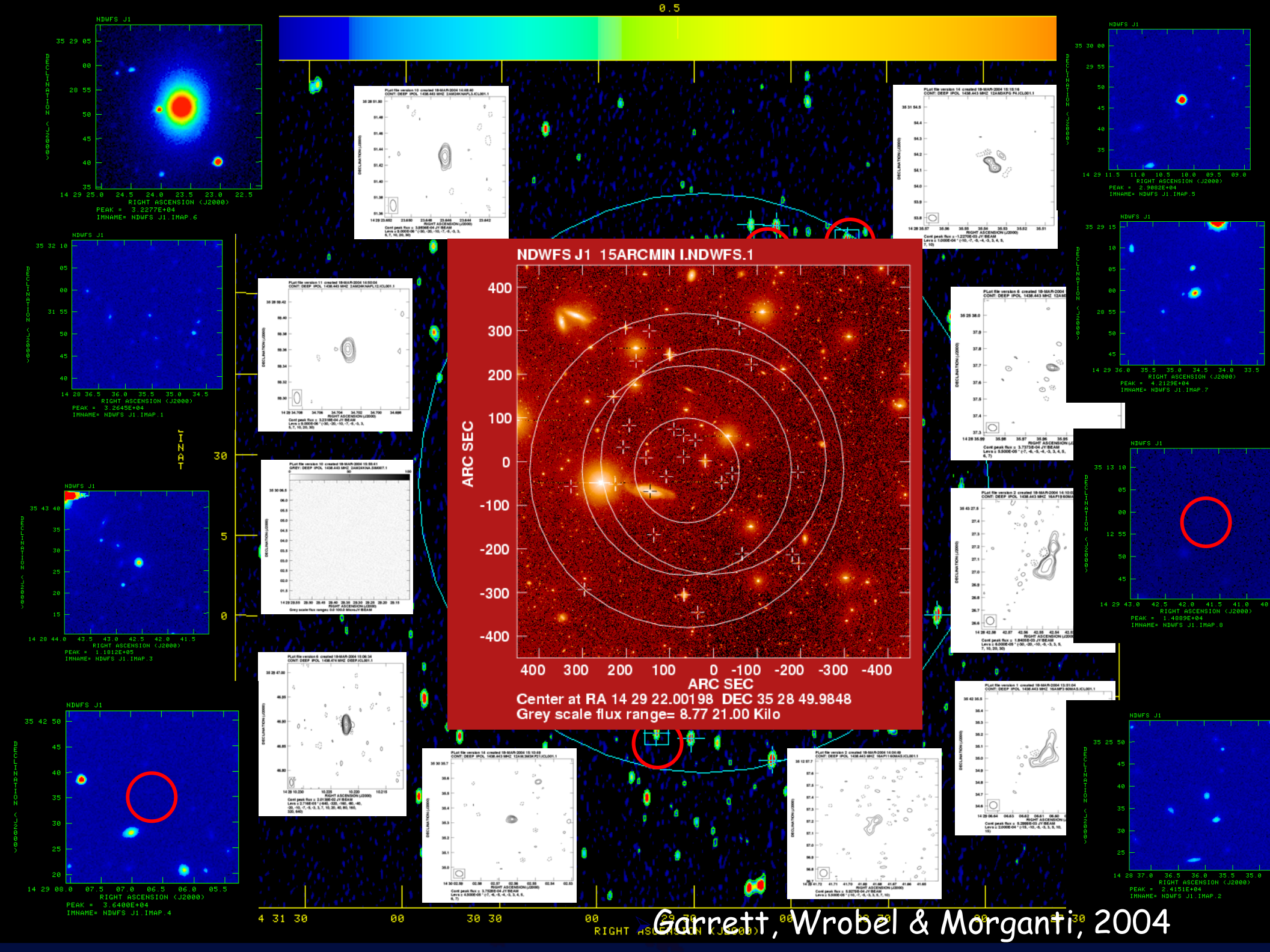




- > 1 mJy
- 0.1 – 1 mJy
- 10-100 uJy

VLBI resolves the radio emission associated with synchrotron and HII regions…

- VERY DIRECT AGN DETECTOR !



Garrett, Wrobel & Morganti, 2004

Results from NOAO-N: (Garrett, Wrobel, Morganti et al. 2004):

Total of ~ 62 potential target sources in the NOAO-N Field (rms noise level of 9 uJy/beam):

- Detected about 29 % of the mJy targets (> 1 mJy)
- Detected about 8 % of the sub-mJy (> 45-1000 uJy) targets...

➔ ~ 2500 AGN VLBI per sq degree (1 uJy Global VLBI 1-sigma noise level)

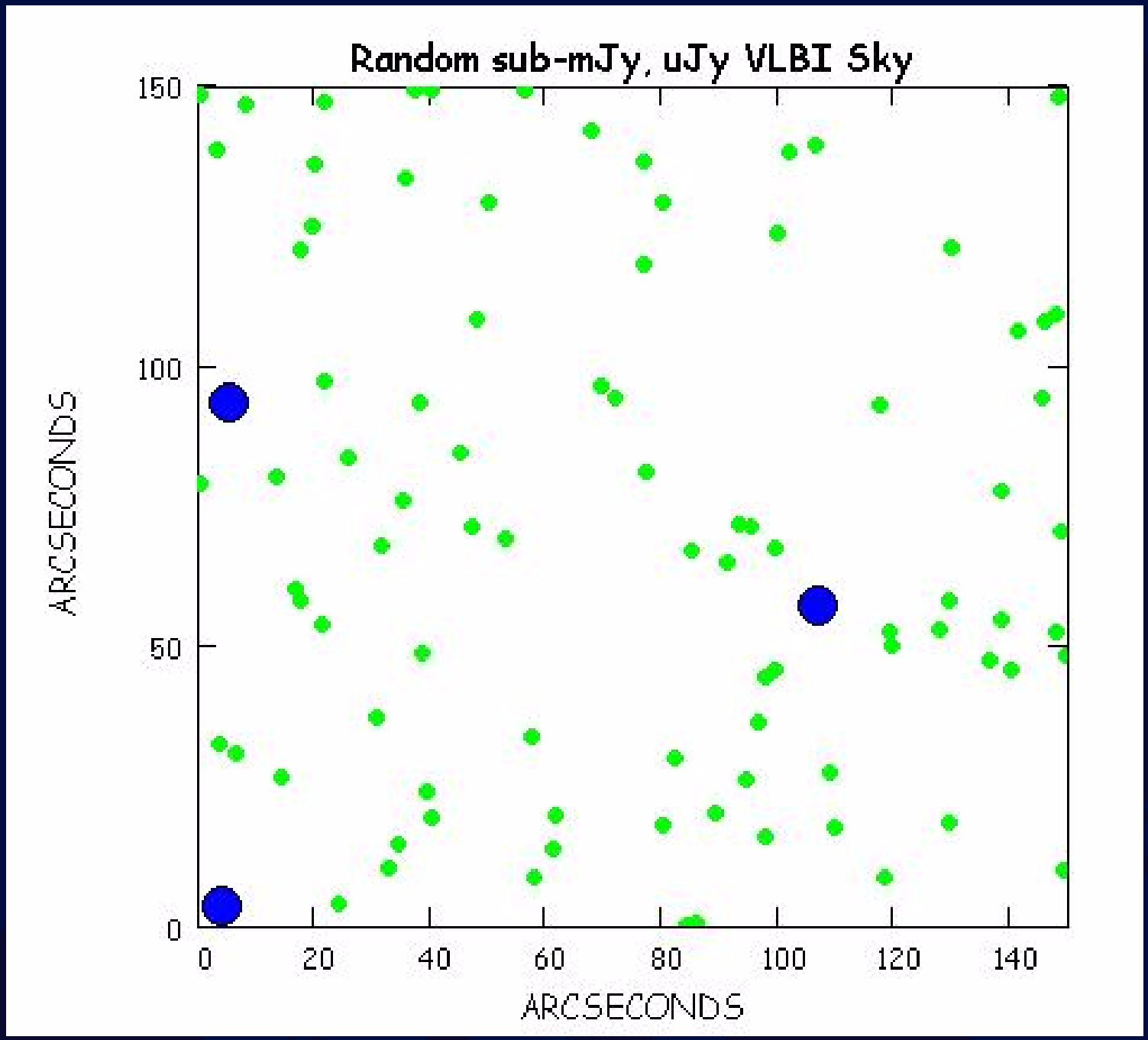
For Chandra... ~ 3000 AGN per sq degree in HDF-N,

➔ but Chandra HDF-N integration time 2 Million seconds !

➔ <u>23 DAYS (& counting) !</u>

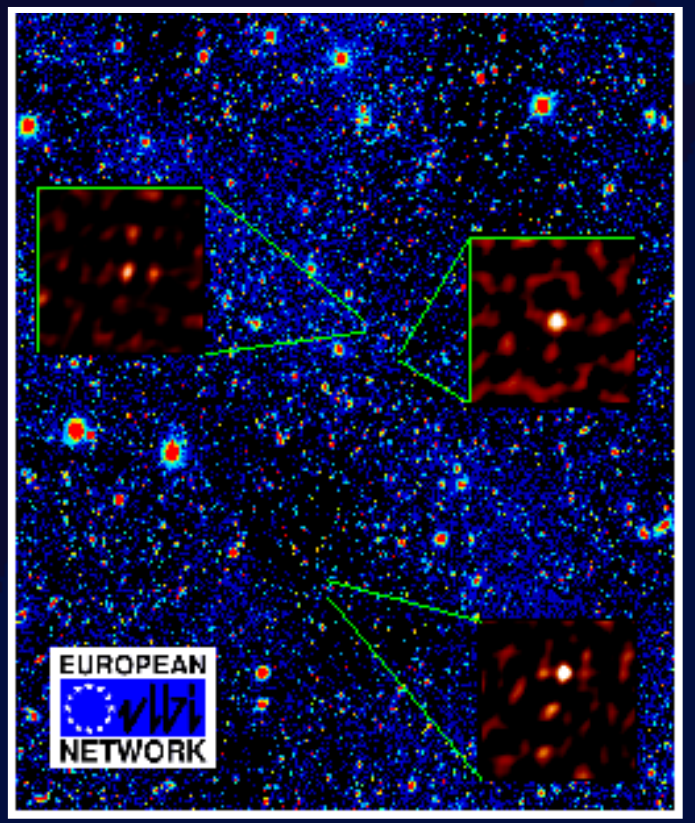
For VLBI ➔ 0.2 uJy rms noise levels:

➔ 400000 AGN per square deg !



- (See Prandoni et al. Poster 37).

- New opportunity to use compact Radio emission as an AGN indicator at sub-mJy flux density levels.
- Deep Global can reveal AGN that are missing from other surveys:
  - Radio AGN associated with Optically faint (obscured) systems (10%)
  - Radio AGN associated with Compton-thick AGN, missed by X-ray
  - VLBI can reveal Low-luminosity Radio AGN, embedded in "Starburst Galaxies" (e.g. SCUBA samples)
  - In principle can detect even low-luminosity AGN (10^21 W/Hz) to z ~ 5…



Summary, Conclusions, Sanity checks etc.

- Global VLBI is embarrassingly sensitive – untapped potential…
- eVLBI improves reliability and permits sustained high-data rate (Gbps) observations.
  - *Implications* for *Telescopes* and *Correlators.*
- The development of a wide-field of view VLBI capability is natural – practical today.
- Deep & Efficient AGN surveys is just one area eVLBI can contribute…
- Long baselines are *essential* for the SKA – they are not an "optional extra" !

Compact SKA AGN Radio Sky… ?