ASTRON

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On MSSS

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ASTRON is part of the Netherlands Organisation for Scientific Research (NWO)

LOFAR

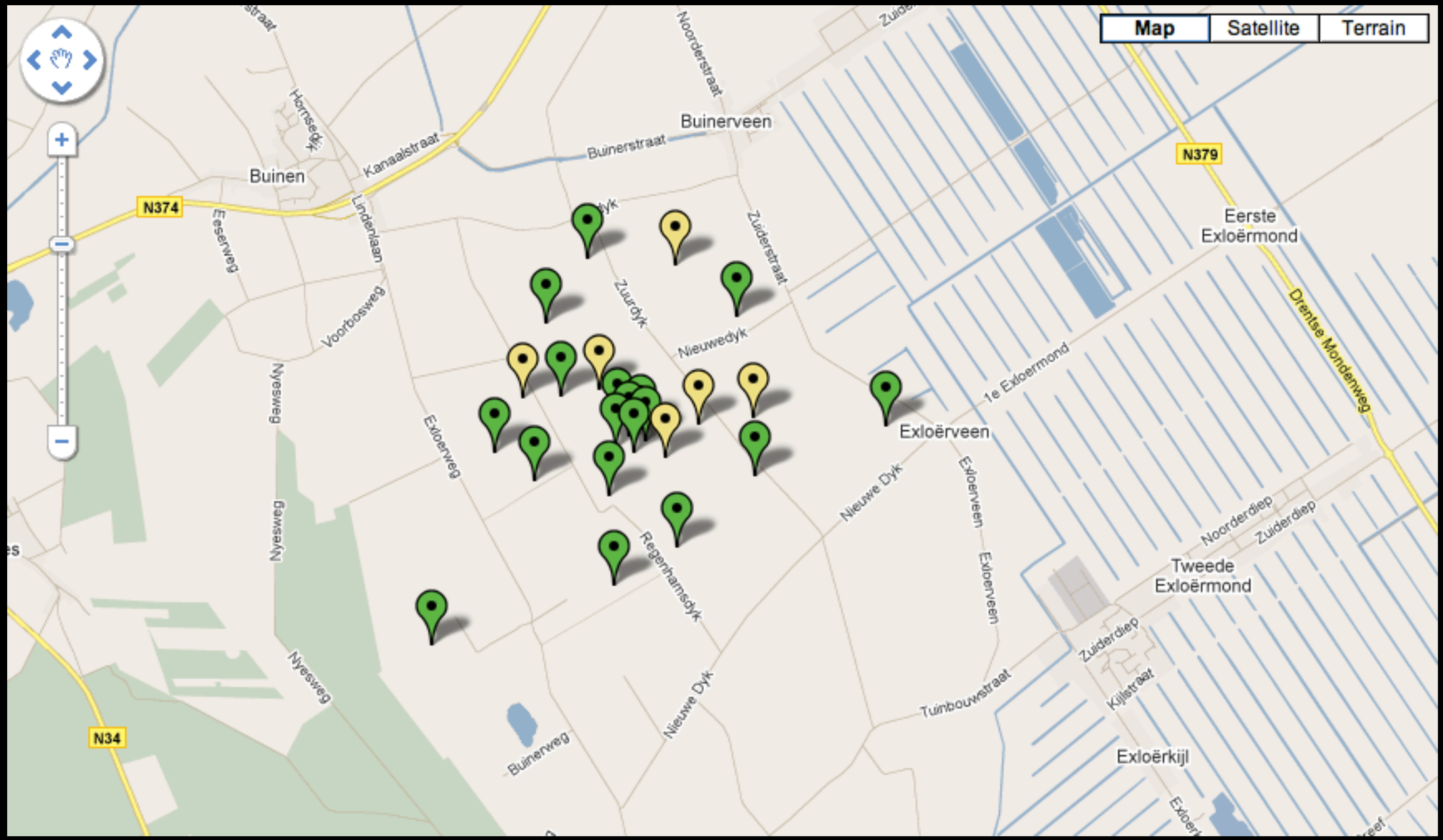
MSSS, originally

- Conceived as **a survey to fill the initial GSM** database
  - Side benefits: shakedown of observatory operations; testing of pipeline software; piggybacking
- Intended to be performed with a 13CS+7RS(+3Eu) array
  - Limited uv coverage ⇒ multiple snapshots per field
  - two narrow bands: 60 MHz and 150 MHz
  - 4 x 8 MHz beams
  - tapered to 10 km baselines: ~ same resolution as VLSS
  - thermal noise ~ 5 mJy @ both 60 MHz and 150 MHz (based on 30 MHz net bandwidth)

Where we are today

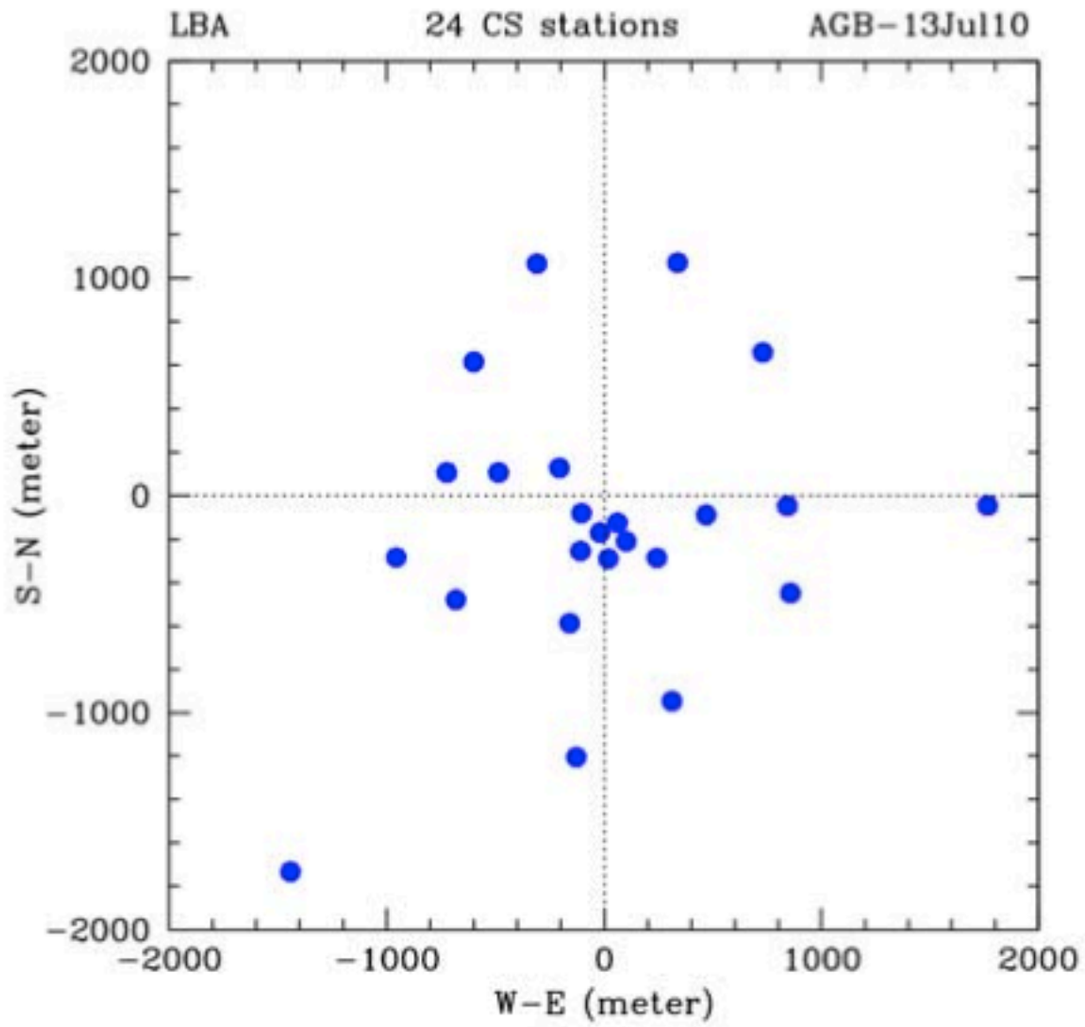
- The original MSSS (& rollout etc) schedule has slipped...
- We now have a significantly different array than planned for: 18CS+6RS+2Eu validated stations
- Expect to have 24CS+8RS+3Eu validated ~October
  - Significantly better instantaneous uv coverage!
- Now have 48 MHz instead of 32 MHz bandwidth
- ITRF Beam server (required for station calibration) is now in early rollout stage
- Pipeline software still under heavy development
  - Observatory operations still being worked on
  - Some functionality still missing (DD corrections, ...)
- Offline cluster capacity still limited with respect to final plans

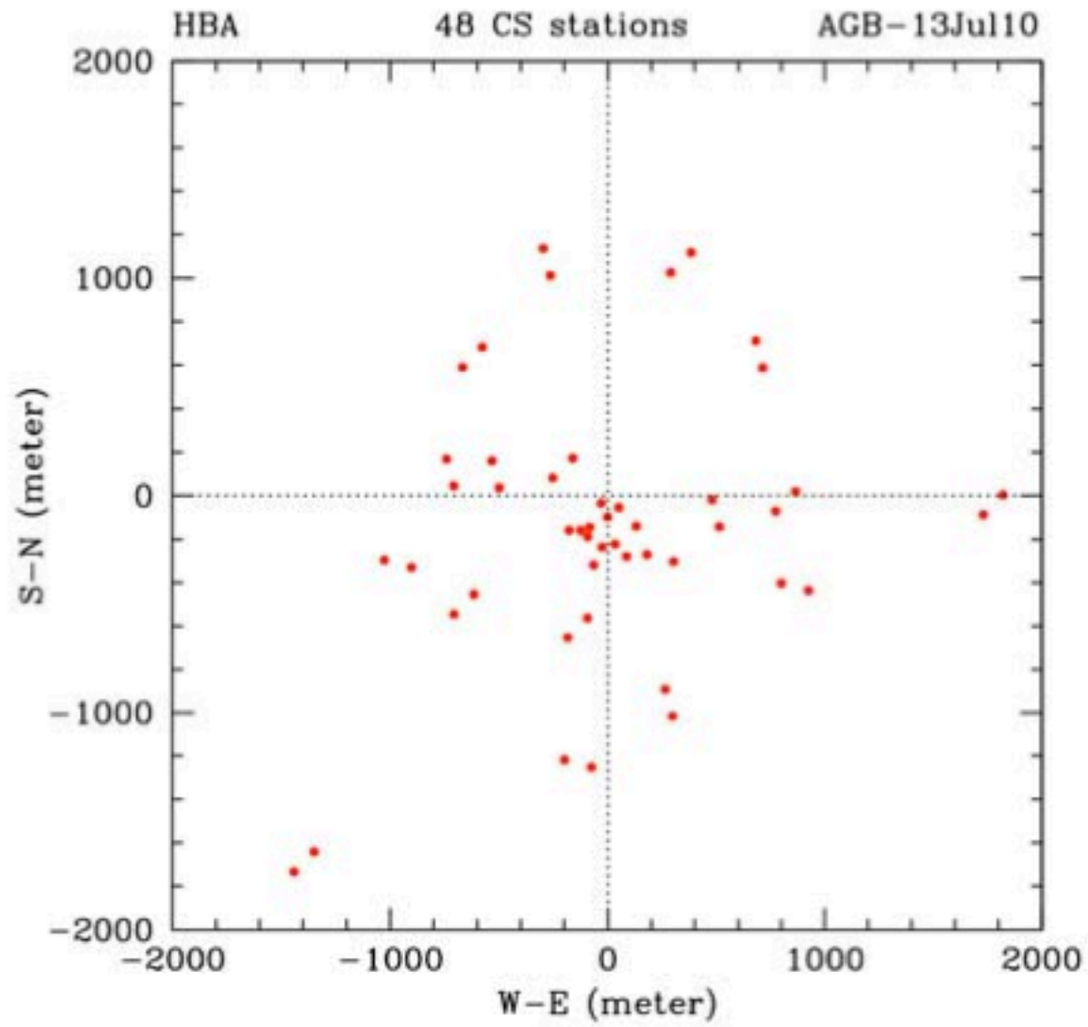
uv coverage



24 core stations (18 validated), on LOFAR status map

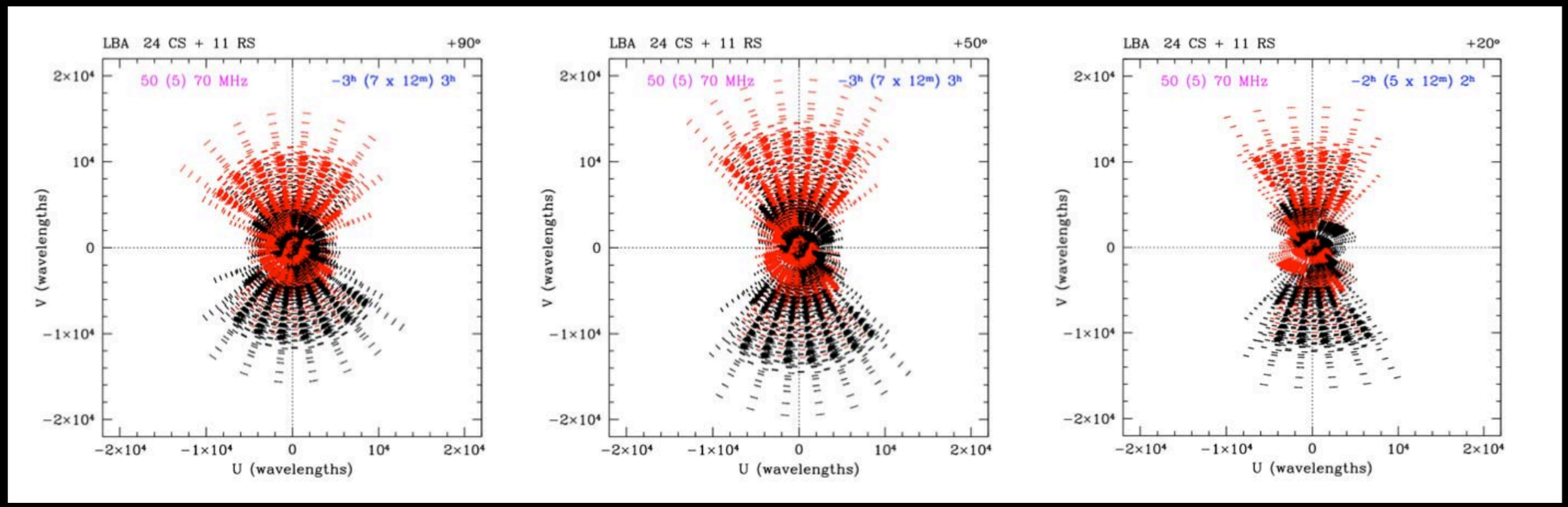
uv coverage





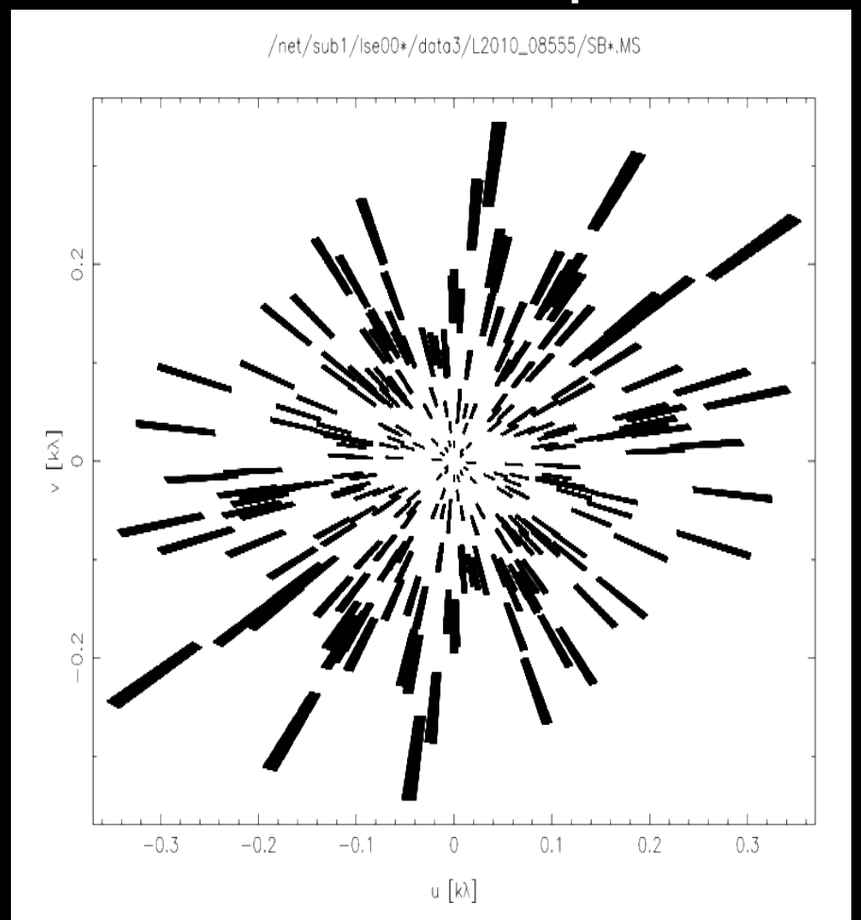
GdB

uv coverage



GdB

- With existing array, CS+RS synthesized beam shape is not ideal, even with multiple snapshots
- Core-only situation far better (shown: 17 CS, 10 min, bandwidth 30-40 MHz)



Reconsidering the MSSS setup

- We have recently been considering a revamped MSSS strategy

Core only **Wideband** **Tiered approach**

- **Benefits** of core only MSSS:
  - ✓ uv coverage [only need one epoch, not case for N-S RS]
  - ✓ station beams [HBA stations equal size within core]
  - ✓ temporal stability [minimal source movement]
  - ✓ less compute power needed
    - less data, more compression, simpler widefield effects
    - less ionospheric DD effects (and wideband helps here)
    - many sources unresolved (easily modeled)
  - ✓ ~ same sensitivity as original MSSS plan can be achieved

Reconsidering the MSSS setup

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Core only **Wideband** **Tiered approach**

- **Drawbacks** of core only MSSS:
  - x 3 km baselines ⇒ lower resolution than VLSS by ~x3
  - x (note however that we would get crucial spectral information from the wide frequency span per field)
  - x effect on piggybacked observations?

➡ Note that RS & Eu would also be perhaps included in the observations, but not processed for MSSS itself.

Tiered approach

- Not tiers of depth as in survey KSP plans:
  - begin with targeted observations of the “easy” fields in the sky - bright compact dominant sources - and then move on to widefield observations of the rest of the sky
  - begin with LBA [station calibration will be available first] and then move on to HBA afterward

Final words

- This is an idea that we're thinking of as we work towards starting **a** version of MSSS (this autumn?), many details still open and **input is appreciated**
- There are still *many* issues that must be resolved before full survey operations begin
- First test observations (12x10 minutes) obtained very recently:
  - 3C380 (~simple bright point source)
  - 3C465 (complicated source)
- Pipeline tests now beginning ...

~12 arcmin