"A view of the Fan region with LOFAR"

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FAN team people:

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Checked Strategies

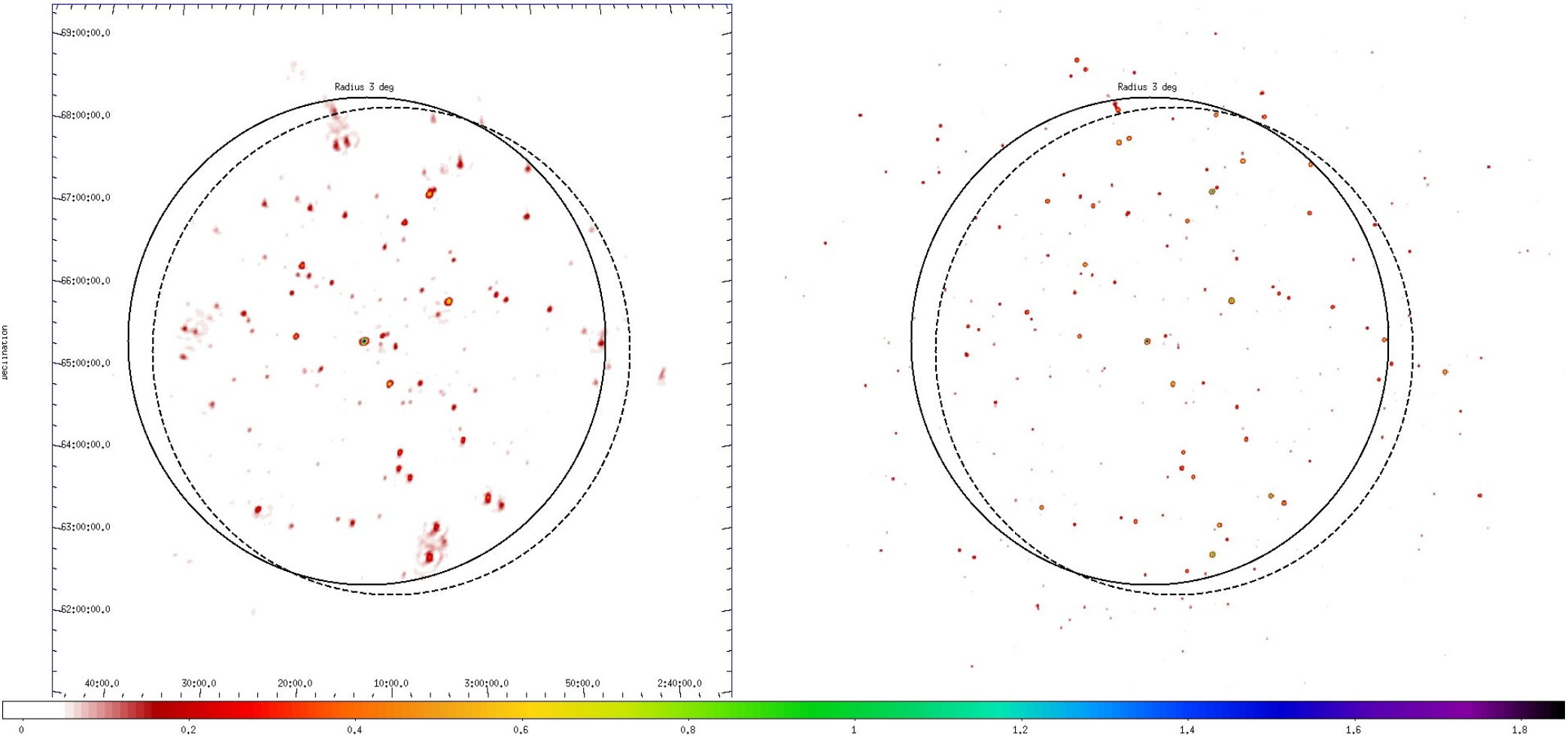
- Cut of dataset > I > without RS
- BBS subtraction > I > with RS
- Cut of dataset > I+RM > without RS
- Cut of dataset > I,Q,U+RM > without RS

  All SB were included (FoV ~8°x8°) and a spatial resolution of 30” for all Stokes parameters was adopted. Cleaning was applied (only) to Stokes I maps.

- WSRT Observations of the Fan Region (FoV ~12°x12°) at 150 MHz (Bernardi et al 2009) used as reference. Spatial resolution adopted is 2' for Stokes I map and 4' for PI map.

AIMS:
- to obtain LOFAR results as close as possible to WSRT ones for all Stokes parameters,
- to investigate how BBS 'works', namely how it manages informations stored in the sky model about Stokes Q,U (and V), as well as RM.

LOFAR HBA vs WSRT: Stokes I

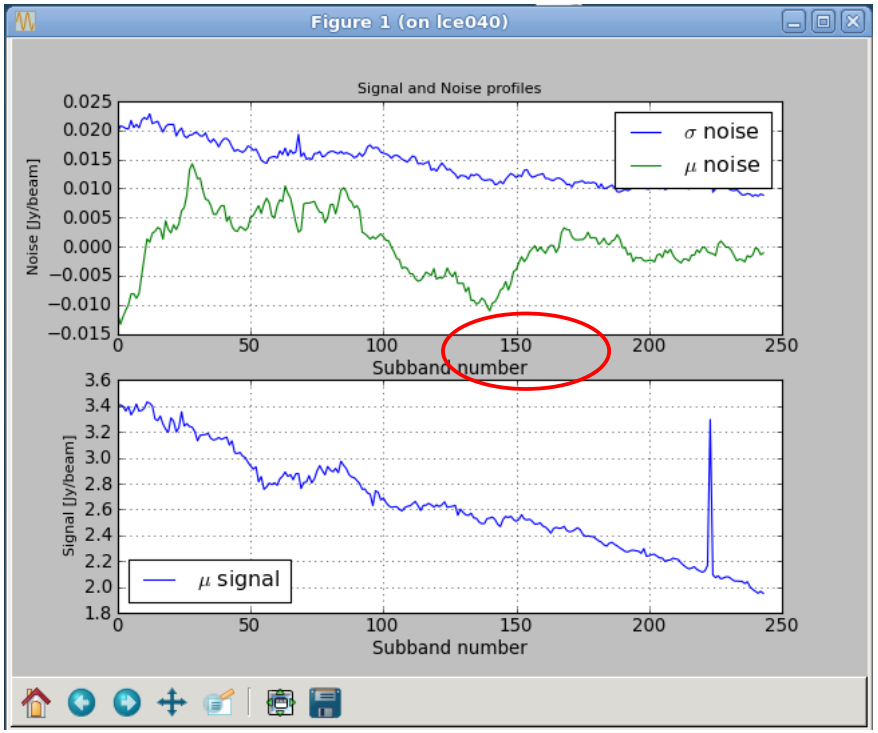


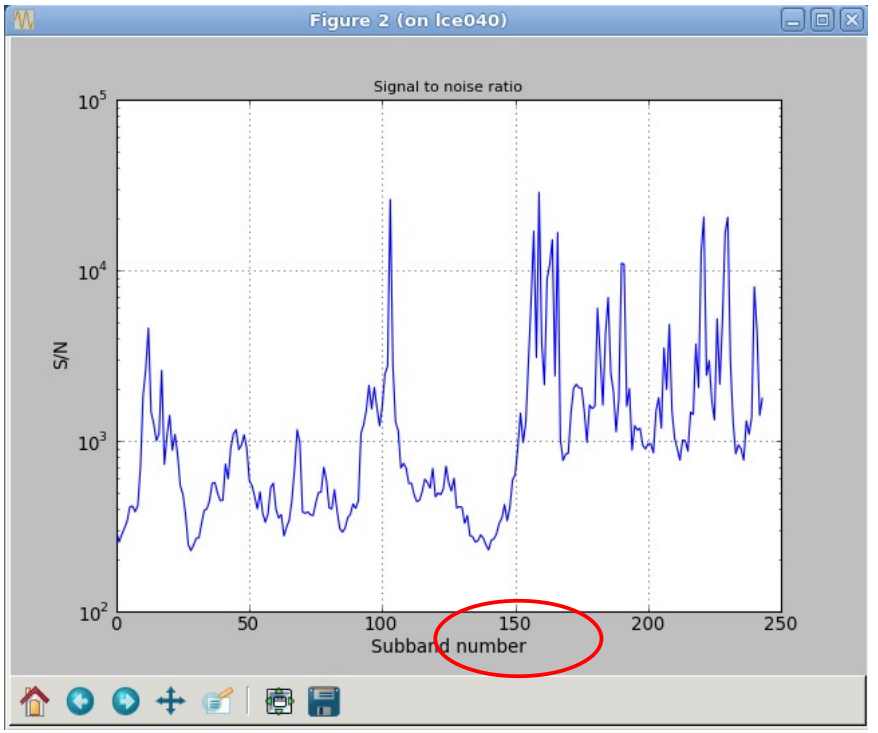
The dynamic range of the maps is similar ...

LOFAR vs WSRT frequency averaged map! Intensity is showed in the full range:
LOFAR, I~[-0.070,2.542] Jy/beam <=> WSRT, I~[-0.024,1.853] Jy/beam

LOFAR HBA vs WSRT: Stokes I

The (mean) noise level is not constant OVER ALL 244 SB !





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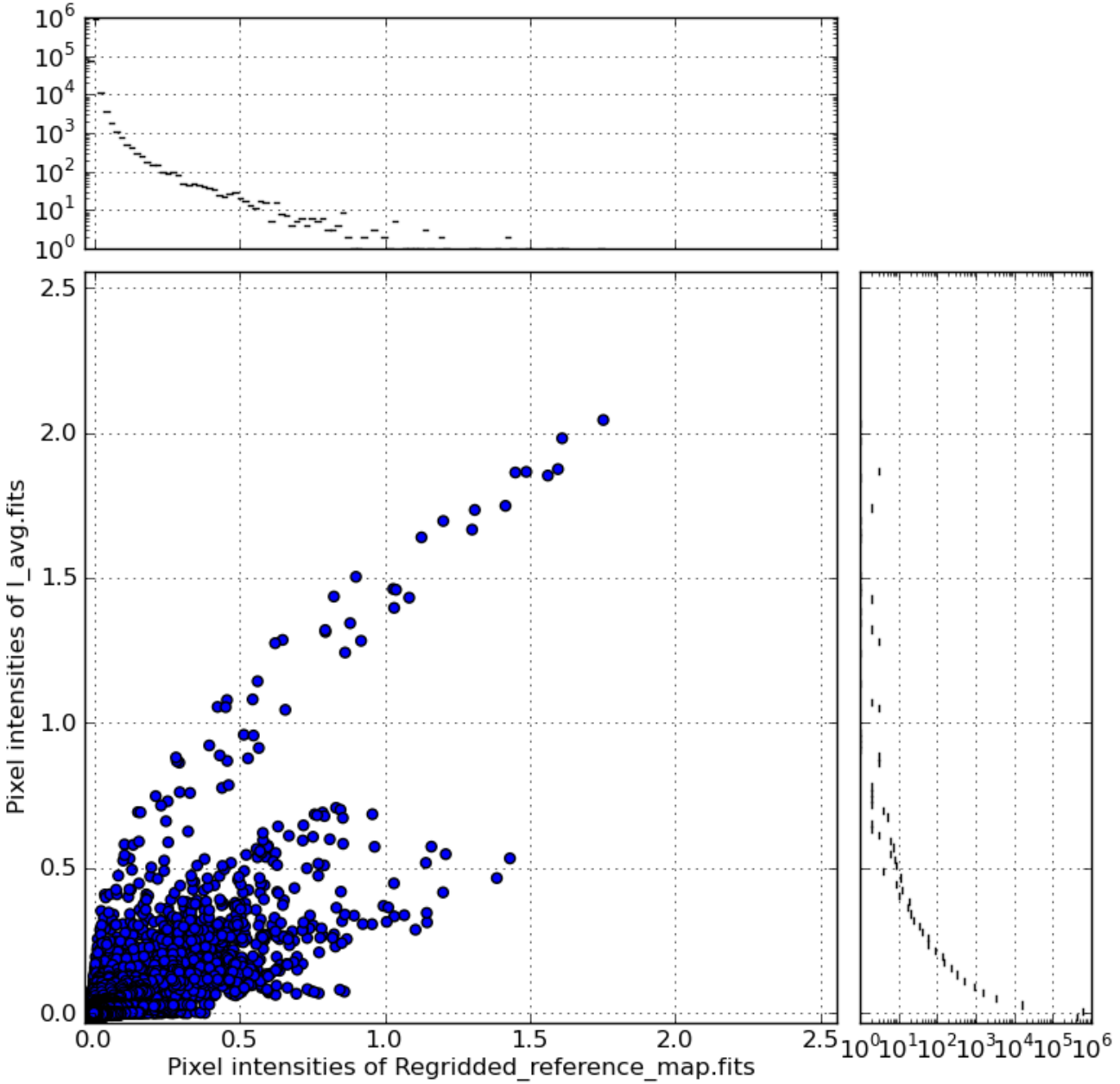
LOFAR HBA vs WSRT: Stokes I

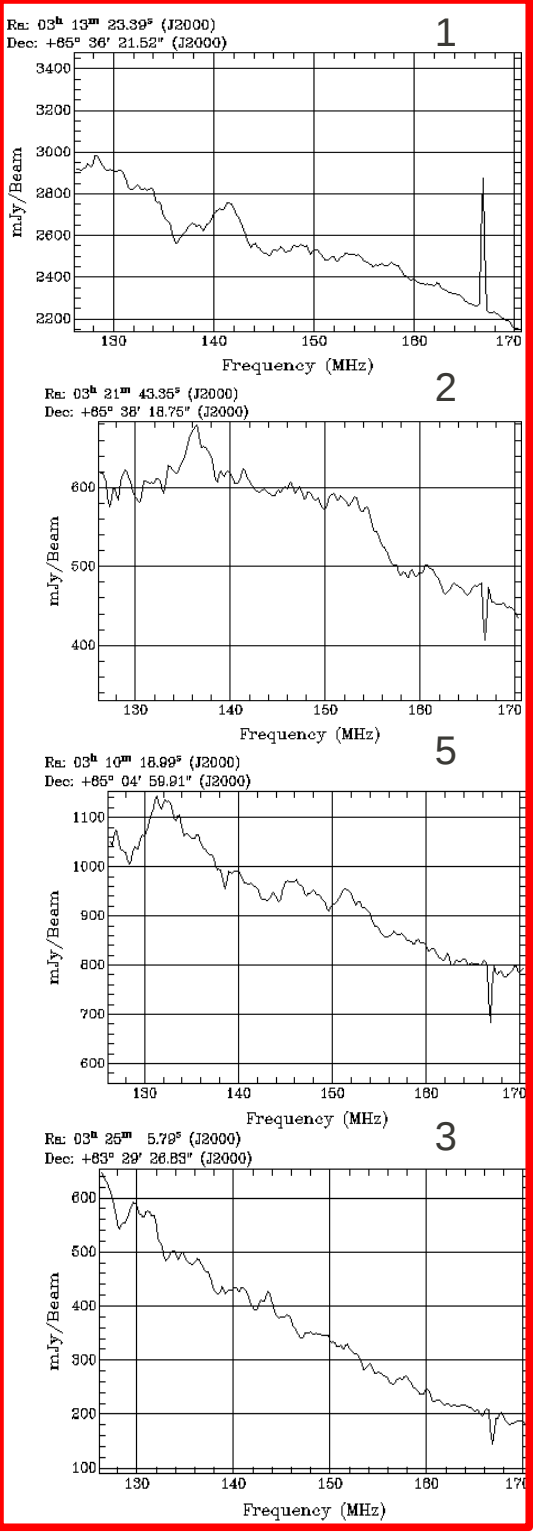
Such a pattern is seen for maps derived without RS.
Differences arise when considering RS.

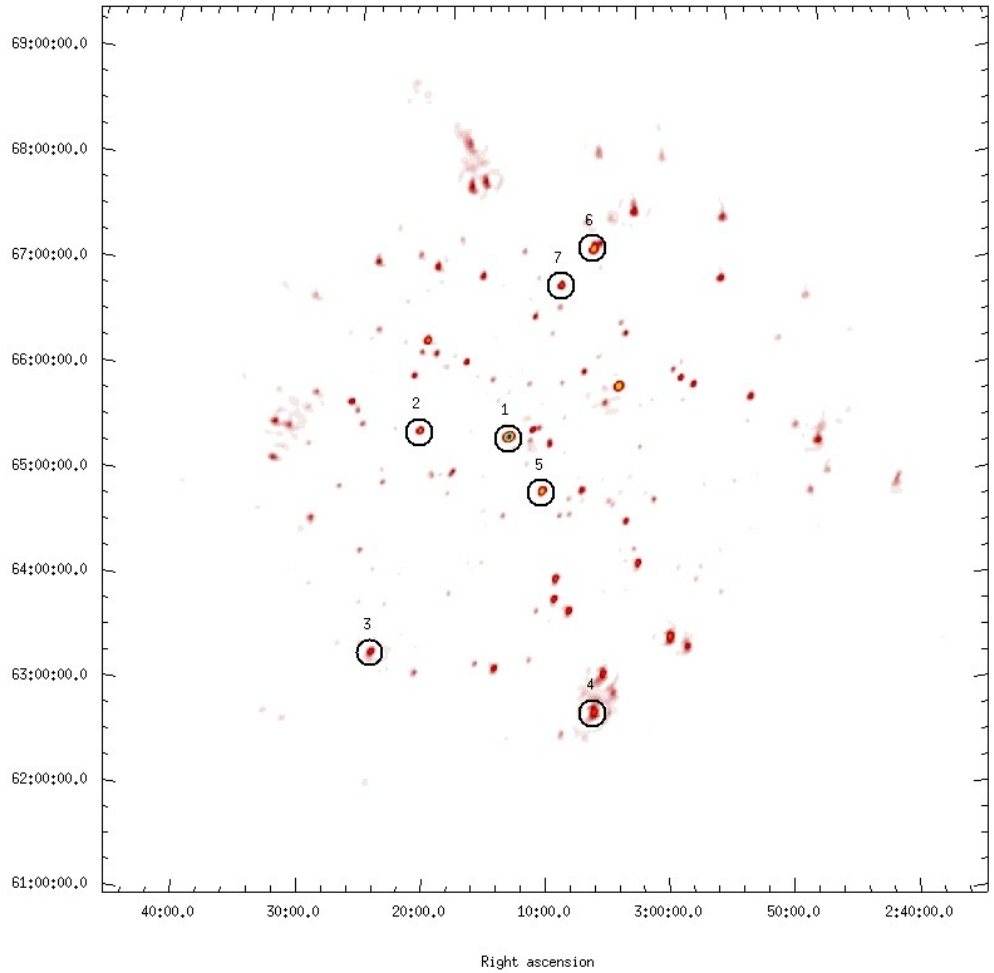


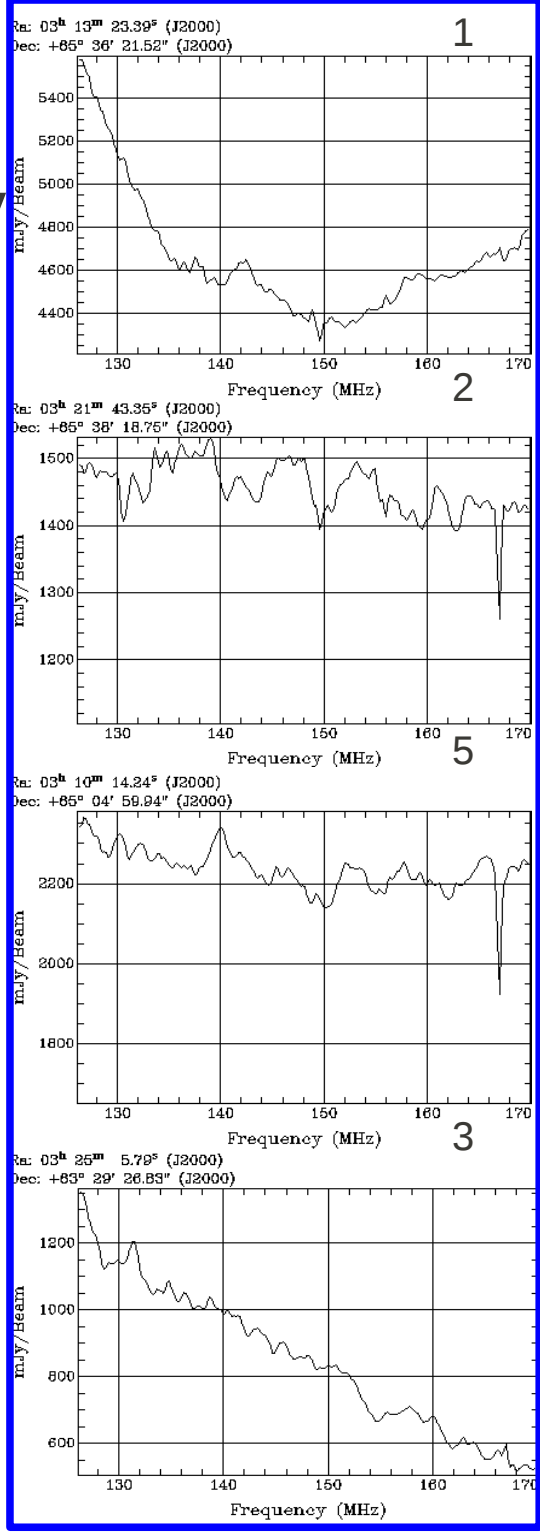
LOFAR HBA:
Stokes I vs frequency

Without RS | With RS

To be or not to be point-like ...

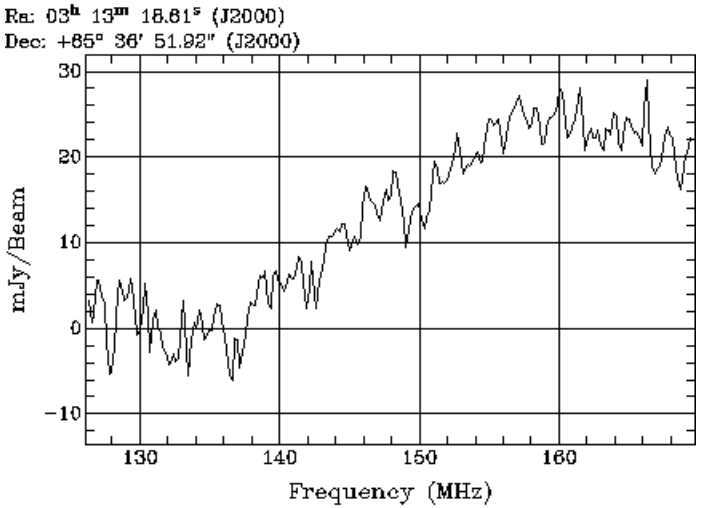




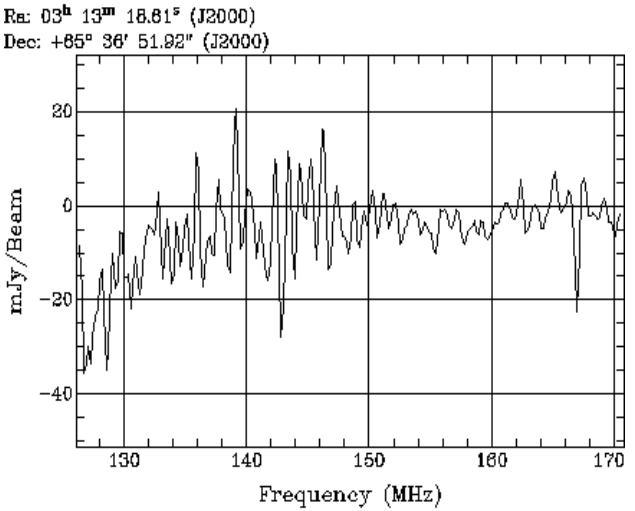


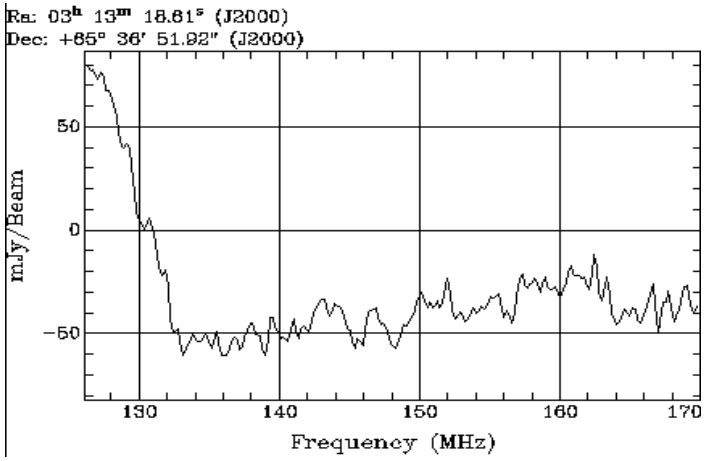
LOFAR HBA: Stokes V vs frequency

I without RS

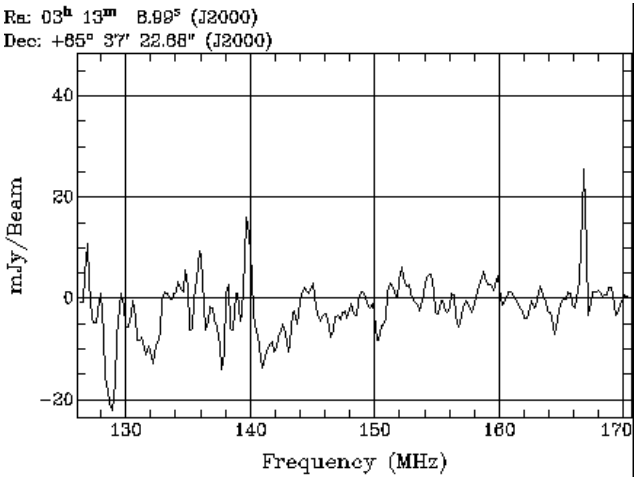


I Q,U+RM without RS





I with RS



I+RM without RS

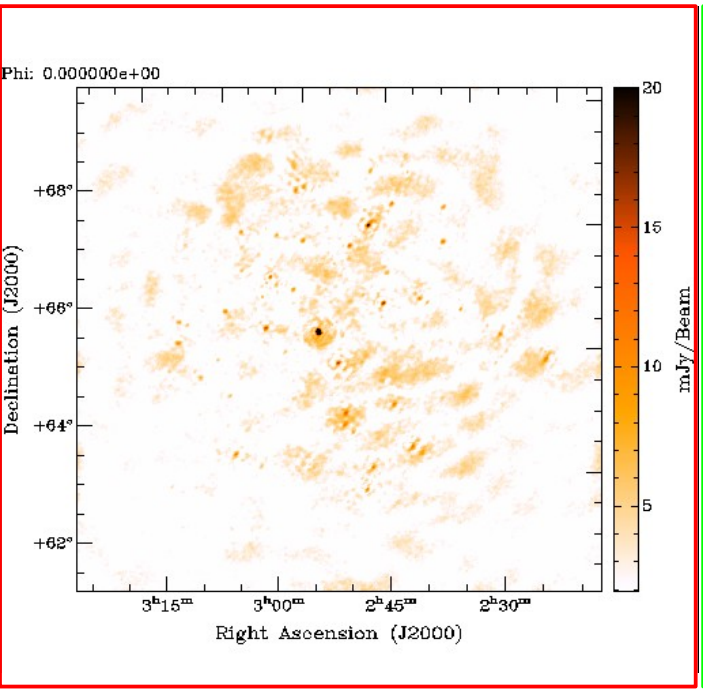
In all cases no extended emission or features are seen in the maps; however discrete sources exhibits a different frequency behaviour.

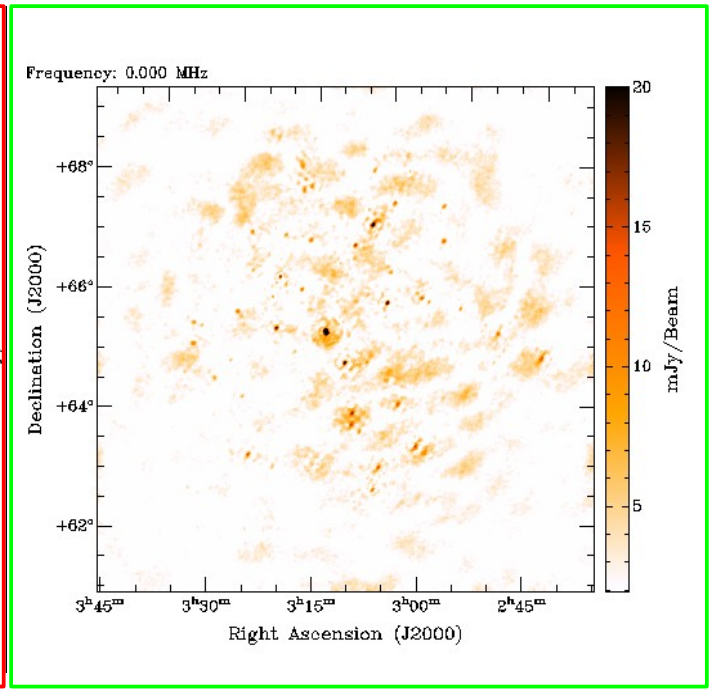
RM-synthesis software

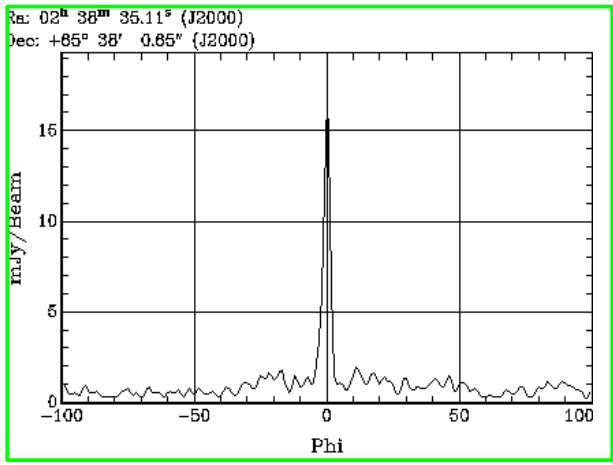
- Essentially the same results but :

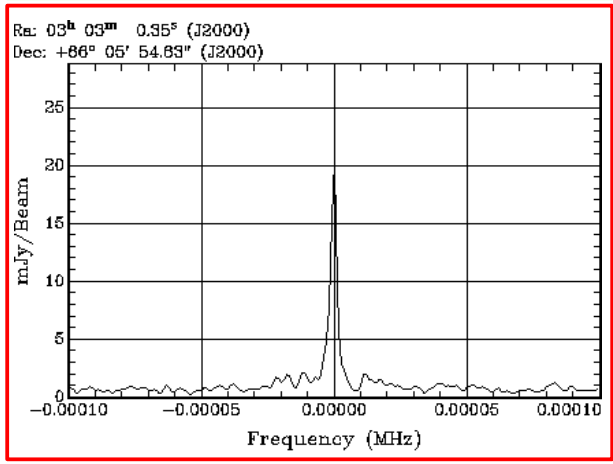
  M. Bell > slower, bad RA but correct Φ keywords

  M. Brentjens > faster, good RA but wrong Φ keywords

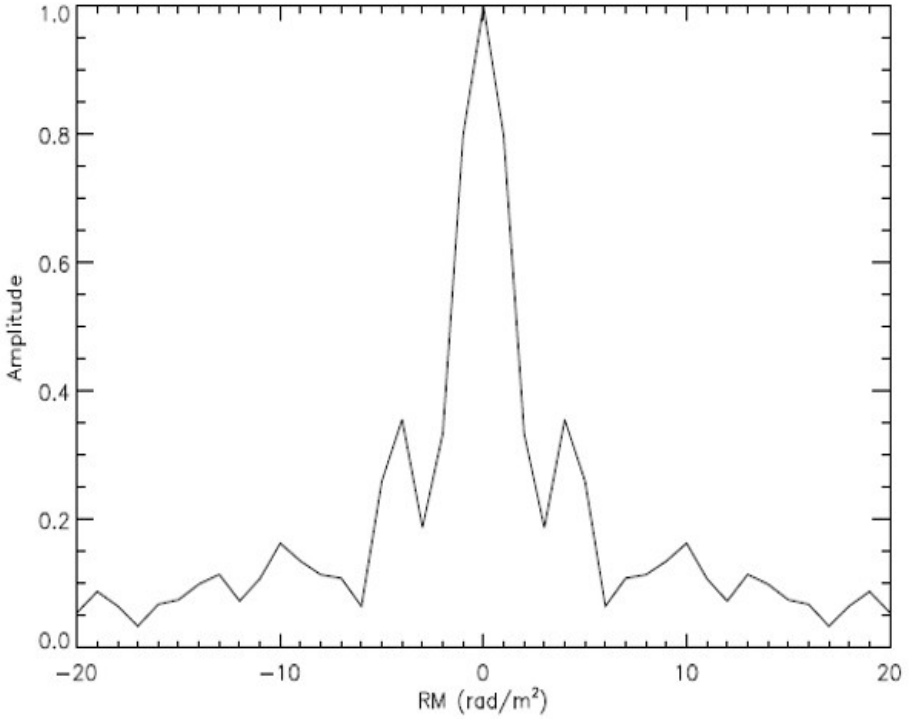


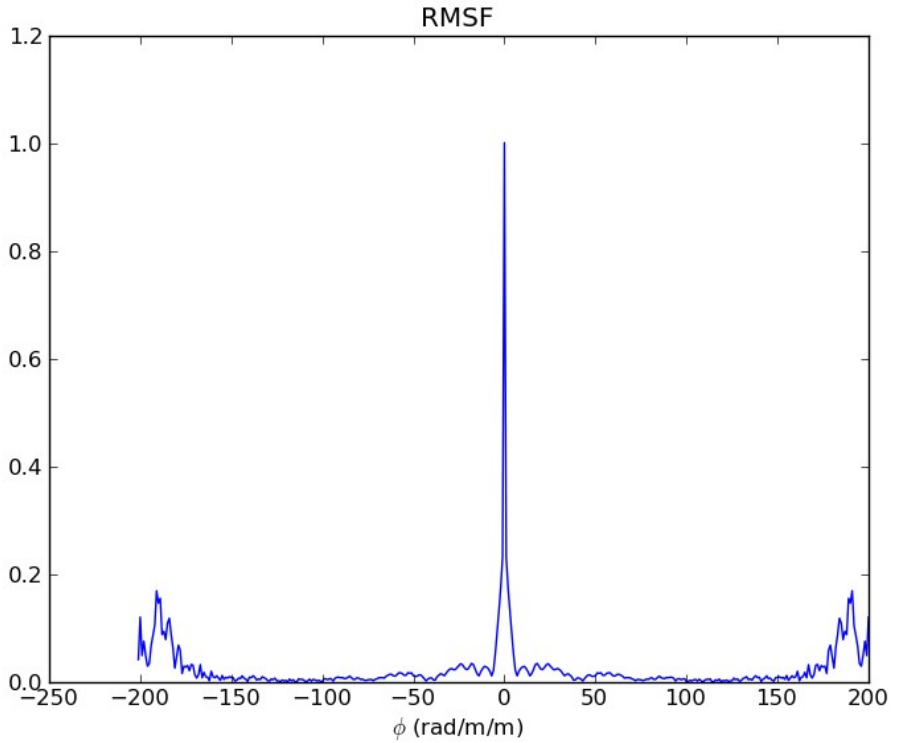






LOFAR polarized intensity cubes





- Cut of dataset > I > without RS
- BBS subtraction > I > with RS
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Please remember the sign inversion of Φ !

LOFAR polarized intensity cubes

- Cut of dataset > I > without RS

  Extended emission (<PI> ≤ 5.5 mJy/beam) in Φ~[-3,+8] rad/m^2; no features from discrete sources. Instrumental polarization (~0.5%) only from Stokes I brightest sources. Mean noise level is 0.68±0.36 mJy/beam.

- BBS subtraction > I > with RS

  Extended emission (<PI> < 6.0 mJy/beam) in Φ~[-5,+7] rad/m^2; evident artefacts around discrete sources at Φ=0 rad/m^2. Instrumental polarization (~1.5%) from many I sources. Mean noise level is 0.63±0.31 mJy/beam.

- Cut of dataset > I+RM > without RS

  Extended emission (<PI> ≤ 2.5 mJy/beam) in Φ~[-3,+8] rad/m^2. Instrumental polarization (~0.6%) only from Stokes I brightest sources. Mean noise level is 0.32±0.15 mJy/beam.

- Cut of dataset > I,Q,U+RM > without RS

  Extended faint emission (<PI> ≤ 3.0 mJy/beam) at Φ~-50 and 0 rad/m^2; discrete emission is seen at Φ~-50 and ~-10 rad/m^2. Evident artefacts around discrete sources. Instrumental pol. (~1%) from many I sources. Mean noise level is 0.35±0.18 mJy/beam.

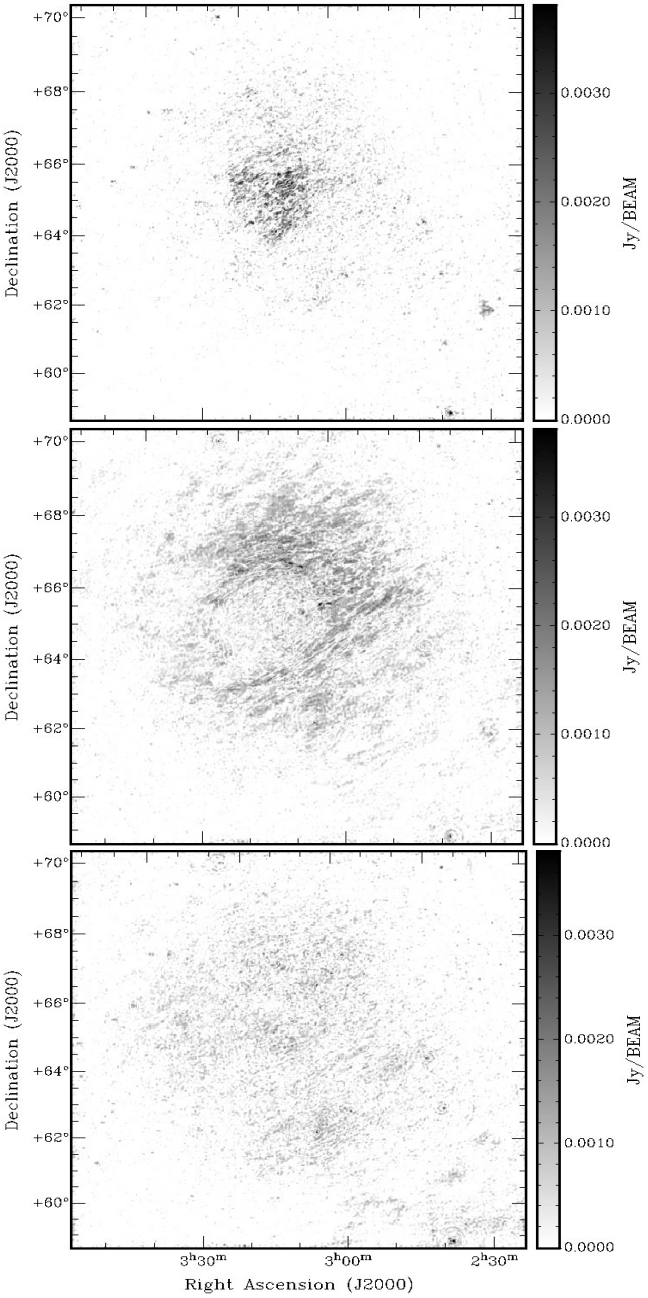
Polarized intensity in [-15,+15] rad/m^2

WSRT

Φ~[-13,-5] rad/m^2

Φ~[-4,-1] rad/m^2

Φ~[0,+5] rad/m^2



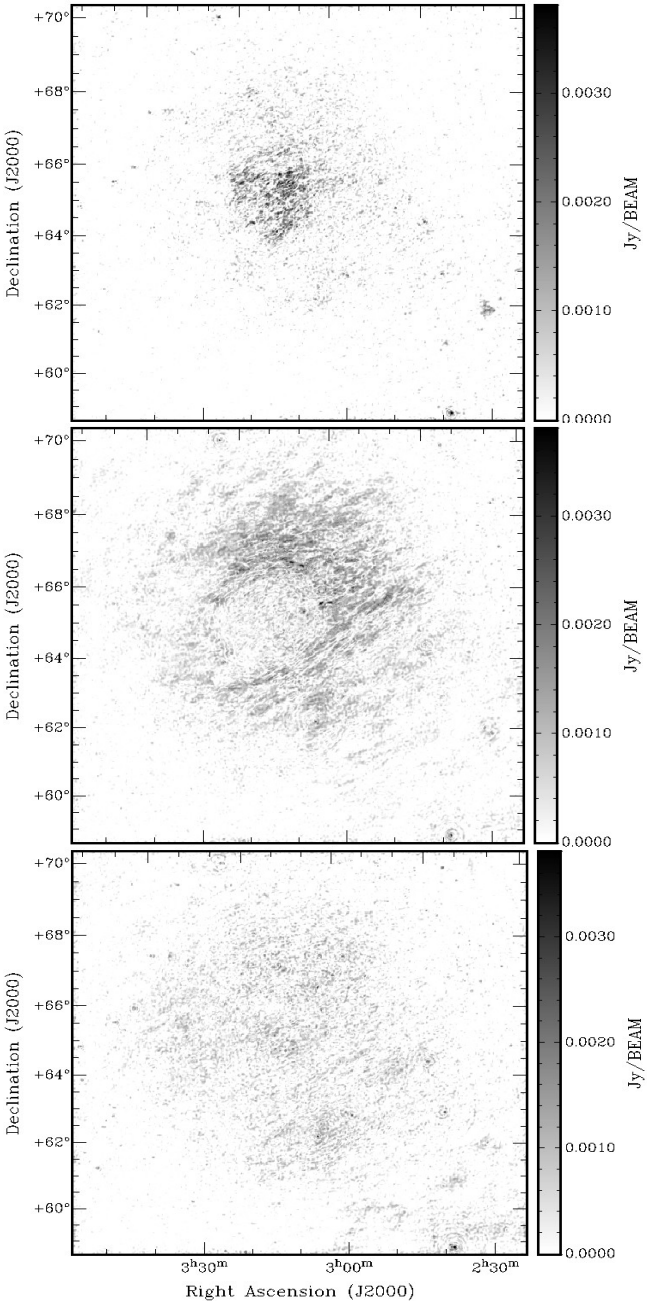
Polarized intensity in [-15,+15] rad/m^2

LOFAR

Φ~[-13,-5] rad/m^2

Φ~[-4,-1] rad/m^2

Φ~[0,+5] rad/m^2



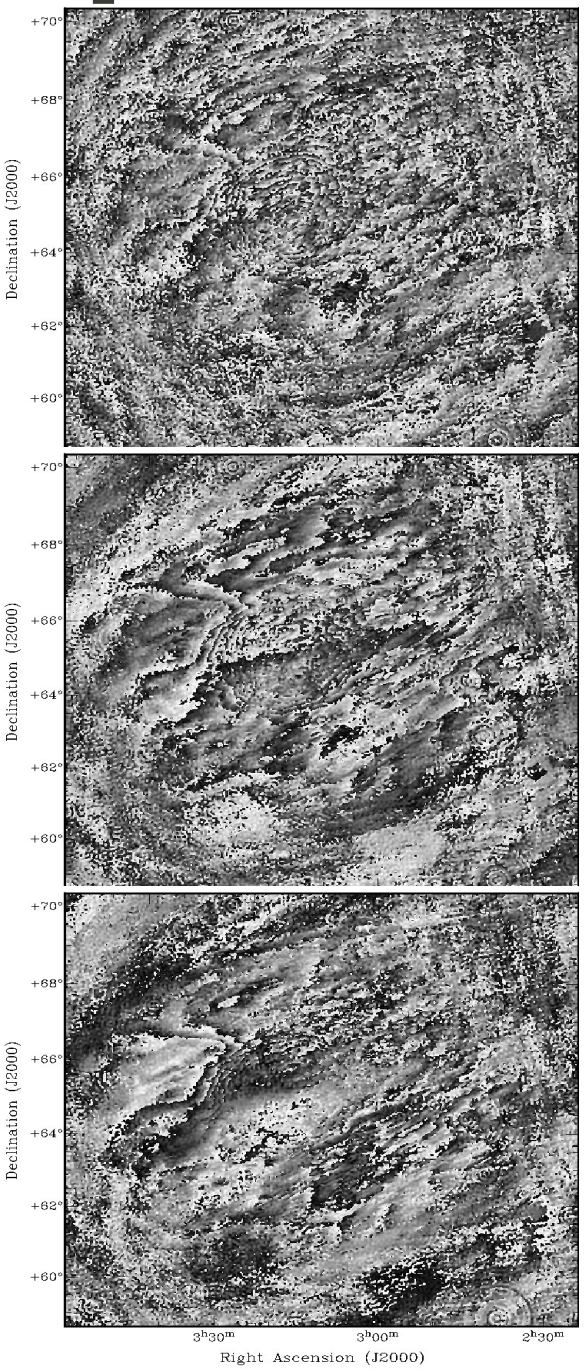
Polarization angles in [-15,+15] rad/m^2

WSRT

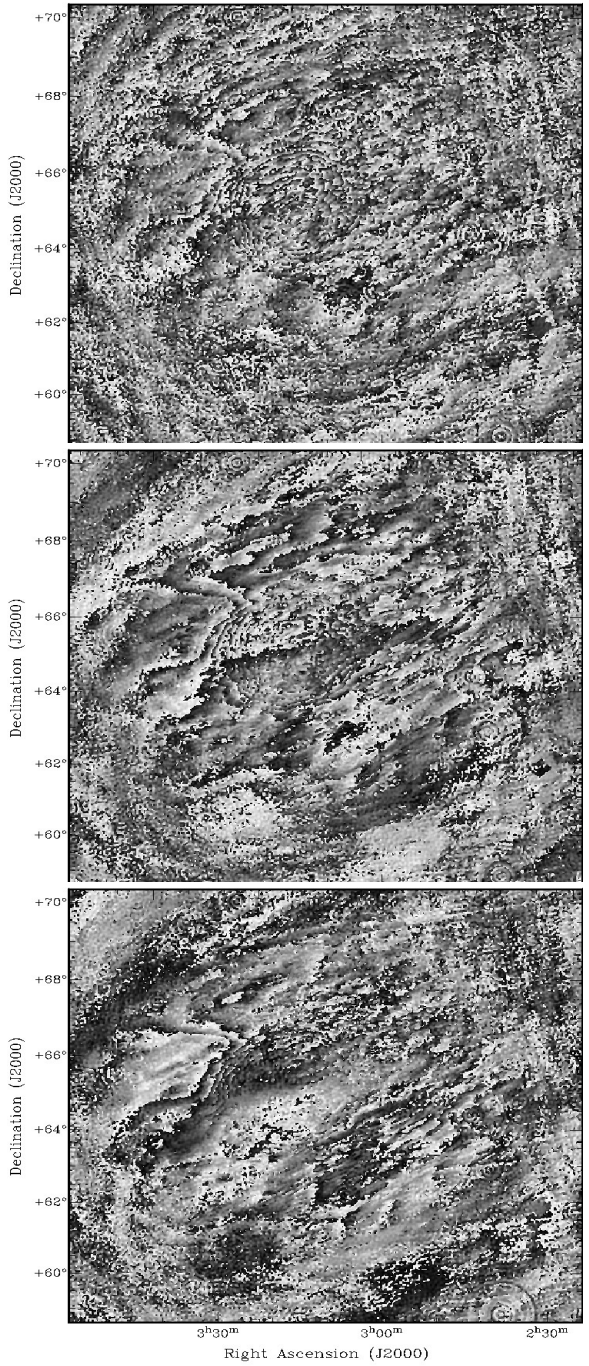
Φ~-6 rad/m^2

Φ~-4 rad/m^2

Φ~-1 rad/m^2



Polarization angles in [-15,+15] rad/m^2



Φ~-6 rad/m^2

Φ~-4 rad/m^2

Φ~-1 rad/m^2

LOFAR

Conclusions

- Several “views” of the Fan field were obtained
- Changes in all Stokes parameters along with frequency dependence were pointed out
- The early basic approach (i.e. sky model with only Stokes I, no RS) seems to be the closest to the WSRT results
- M.Bell & M. Brentjens RM-synthesis software provide matchable outputs

Future work:

- interpretation and open questions ...

- ionospheric corrections, improved sky model ...

- a new observation > demixing ...