Commissioning surveys with LOFAR

LOFAR

2006 survey plan

Table 2.9: Proposed LOFAR surveys

ν MHz (1)	Flux[†] density mJy (2)	Area	Source density arcmin^{-2} (3)	Number Sources (4)	Main aim[§]
15	4.7	2π sr	0.2	1.3×10^7	New parameter space (4)
30	1.0	2π sr	0.7	5.4×10^7	$z > 6$ radio galaxies (1)
60	1.0	2π sr	0.3	2.2×10^7	Spectral information (1,2)
120	0.043	2π sr	11.6	8.6×10^8	Distant cluster halos(2) $z > 6$ Radio galaxies (1)
200	0.014	250 deg^2	32.2	3.0×10^7	Distant starbursts (3)

Notes:

[†] The specified flux limits given are 3-sigma values.

[‡] The integration time needed using one LOFAR beam of 4 MHz to reach the specified flux limit. The surveys will be carried out in several passes to detect sources that vary on timescales of weeks to years.

[§] The bracketed numbers refer to the list of main drivers as listed in Section 2.4.

Meetings at the LC center
March 2007 + Dec 2008

Proposed modifications

- 60 Mhz
  - 1.0 -> 1.5 mJy: 0.56 yr -> 0.2 yr
- 120 MHz:
  - Half the sensitivity of the 120 MHz survey to bring the 2 years down to 0.5 years
  - Compliment 250 sqrt survey at 200 MHz
- 200 MHz
  - Also 2 Pi over comperable depth as 120 MHz
  - Do 250 sqr at original depth
  - Very deep 10 sqr deg survey

COMMISSIONING SURVEY WITH THE 20 STATION ~ 20 KM LOFAR

great compliment NVSS

Science: nearby galaxies, strange spectrum sources.

Next steps

- Update Sensitivities
- Update plans
  - Next week small meeting with Best, Jarvis and HR in London
- Discuss with survey core team
- Send around to science subgroupsCoordinate with Calibration plans and other KSPs
- Discuss in Hamburg

LOFAR sensitivity

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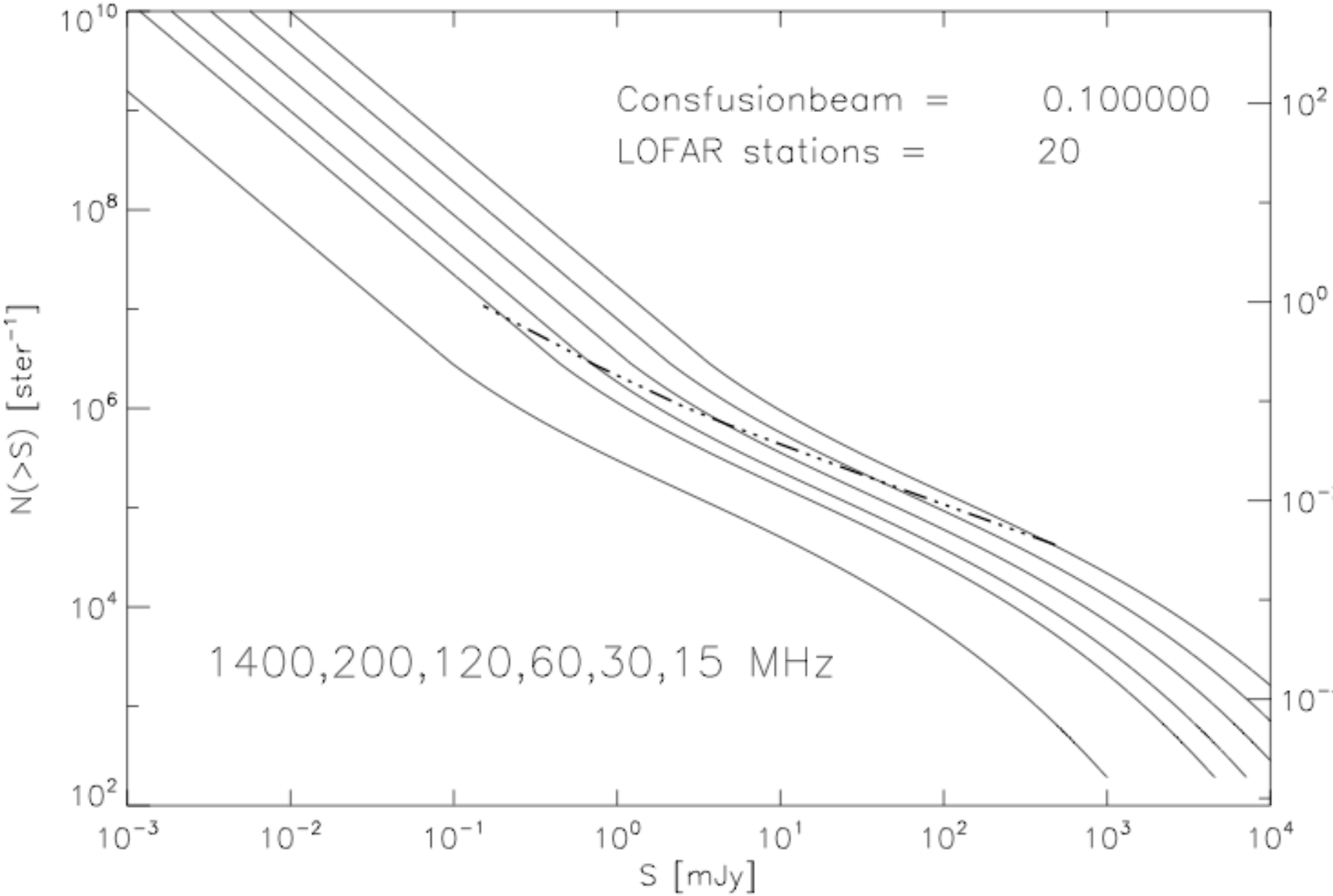
Version 0.4, Mar 16, 2008

Sensitivity table for de-scoped LOFAR LBA and HBA for 1h integration time taking into account the instrumental noise

Freq (MHz)	wavelength (m)	Dipole Eff. Area (m^2)	Station Eff. Area (m^2)	Gain (K/Jy)	T_{sys} (K)	ΔS_{20} (mJy)	ΔS_{18+18} (mJy)	ΔS_{25+25} (mJy)
15**	20.0	27.0	1296.0	0.47	623373	559.21	329.07	235.98
15*	20.0	118.2	5674.5	2.05	623373	136.85	75.15	53.90
30**	10.0	27.0	1296.0	0.47	47309	45.48	24.97	17.91
30	10.0	33.3	1599.8	0.58	47309	36.84	20.22	14.51
45	6.7	14.8	710.8	0.26	9706	17.01	9.34	6.70
60	5.0	8.3	399.8	0.14	4277	13.32	7.32	5.25
75	4.0	5.3	255.8	0.09	4573	22.27	12.22	8.77
120	2.5	1.6	1198.0	0.43	776	0.80	0.441	0.31
150	2.0	1.3	1021.4	0.37	525	0.64	0.350	0.25
180	1.7	0.9	714.2	0.26	417	0.72	0.397	0.28
210	1.4	0.7	522.2	0.19	347	0.82	0.452	0.32
240	1.3	0.5	399.4	0.14	106	0.91	0.505	0.35

[1] No weighting factor applied
[2] with an effective BW of 3.57 MHz (89.25% of 4 MHz)

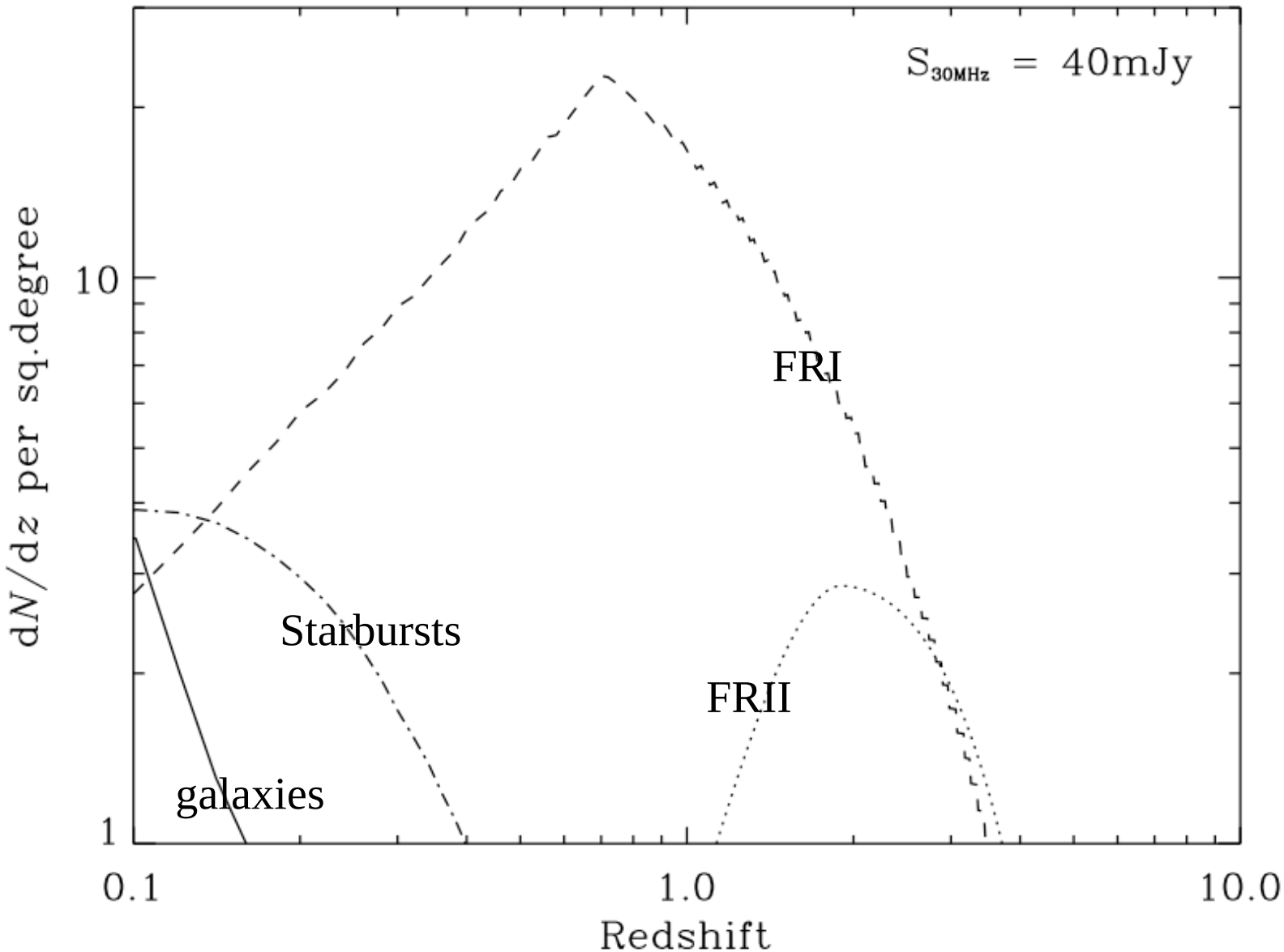

Consfusionbeam = 0.100000
LOFAR stations = 20
1400,200,120,60,30,15 MHz
N(>S) [ster^{-1}]
S [mJy]
10^{10}
10^{8}
10^{6}
10^{4}
10^{2}
10^{2}
10^{0}
10^{-1}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}

LOFAR 20 - 15 km

4 MHz

Confusion parameters
Conf. sigma = 3
Conf. beam = 0.100000

f(MHz)	flux(mJy)	#/min2	#/beam	#/sky	time(h)	allsky(week)
15	481.11	0.0036	3114	2.7e+05	23.59	12.01
30	46.76	0.0143	3114	1.1e+06	14.39	29.29
60	4.85	0.0574	11111	4.3e+06	114.87	262.17
75	2.50	0.0896	11111	6.7e+06	1208.68	4310.31
120	0.74	0.2295	9000	1.7e+07	17.75	200.03
150	0.45	0.3586	9000	2.7e+07	30.08	529.76
210	0.20	0.7028	9000	5.2e+07	246.69	8514.93
240	0.15	0.9180	9000	6.8e+07	556.67	25096.60


S_{30MHz} = 40mJy
dN/dz per sq.degree
10
1
FRI
Starbursts
FRII
galaxies
0.1
1.0
10.0
Redshift

Jarvis et al.

What commissioning surveys?

- We need to
  - Commission the entire wavelength range
  - Obtain global sky models
  - Go deep to understand limitations
    - ionospheric
    - beam calibration
    - RFI
  - Enable first science

Strawman

- A Combination of Large sky and shallow plus small areas deep at the key frequencies
- For 16 weeks
  - 15 MHz: all sky and selected regions, use good ionospheric weather conditions (2 weeks) (prio 4: very new, but difficult)
  - 30 MHz: all sky (3 weeks, prio 1: new grounds)
  - 60 MHz: selected regions deep (1 weeks, prio 5)
  - 120 MHz all skfly (4w) and selected region (1w) (prio 2: efficient)
  - 200 MHz all sky (4w) and selected regions (1w) (prio 3: very deep, high angular resolution)
- Note
  - Flexible in exact choice of BW, frequency

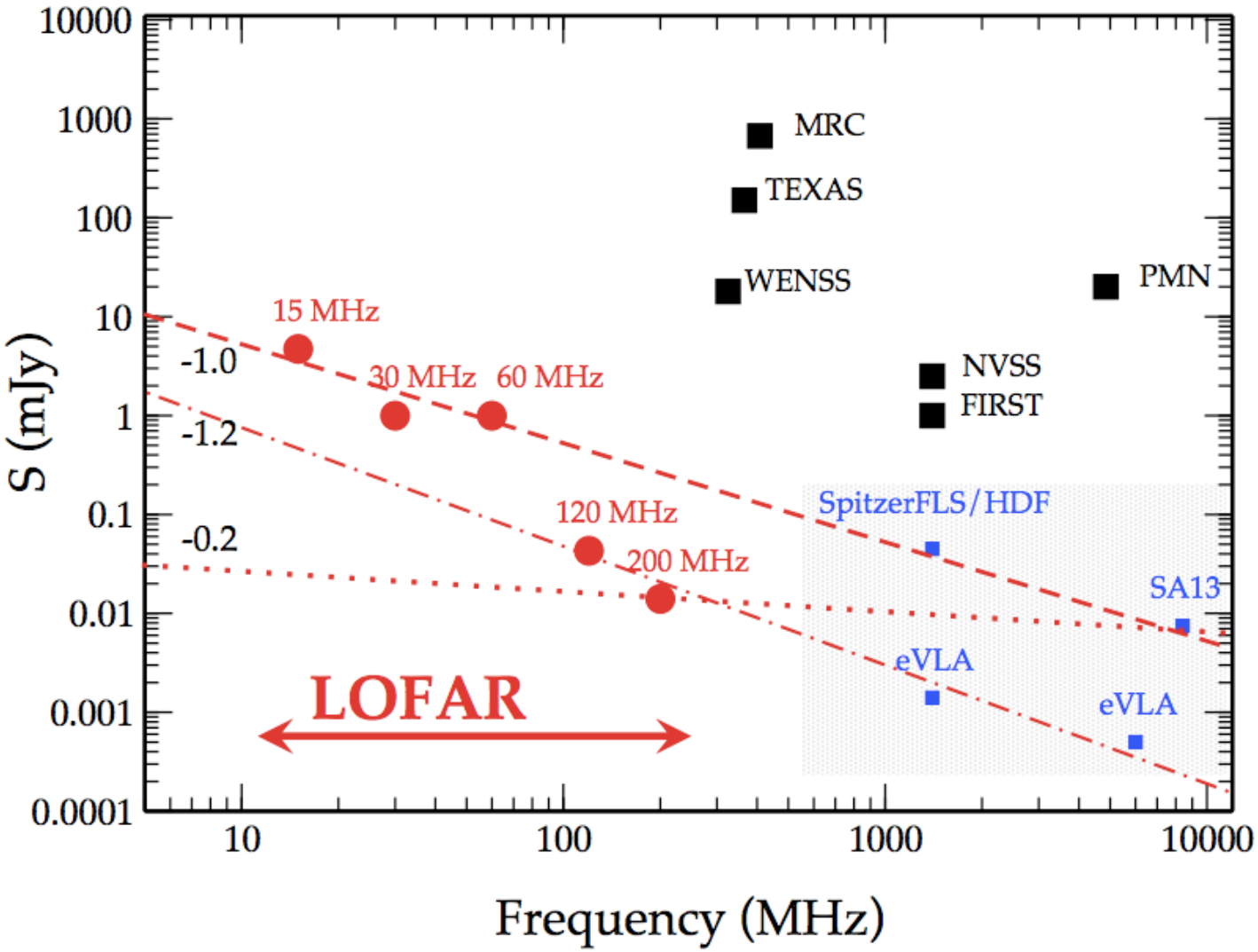
Next steps

- Detailed observing plan for survey commissioning
  - Frequencies, taking into account RFI situation
  - Detailed pointing grid
  - Field selection
- Small workgroup to come up with an integrated plan taking into account wishes of transients and EoR?

Phasing

- One pointing moderate deep
  - (Bootes field?)
- Mosaic of 16 pointing
- All sky
- A number of deep pointings

End


10000
1000
100
10
1
0.1
0.01
0.001
0.0001
S (mJy)
10
100
1000
10000
Frequency (MHz)
MRC
TEXAS
WENSS
PMN
NVSS
FIRST
15 MHz
30 MHz
60 MHz
120 MHz
200 MHz
-1.0
-1.2
-0.2
SpitzerFLS/HDF
SA13
eVLA
eVLA
LOFAR