Performance of the C-Band Feed

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Goals

- Goals the same as for L-Band – determination of:
  - Efficiency
  - Zenith system temperature
  - Spillover characteristics
  - Beamwidth and sidelobe structure
  - Focus position
- All of these characteristics are to be measured as a function of frequency across the band.

Method

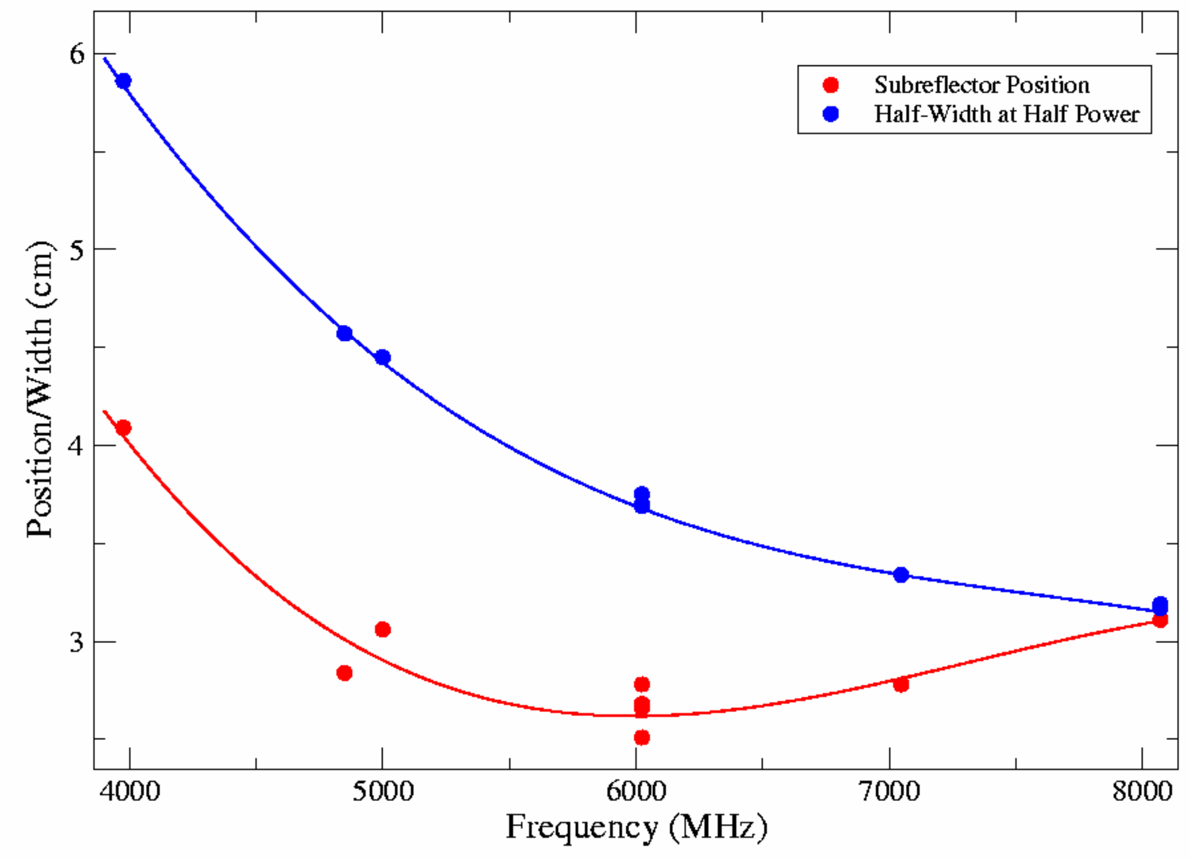
- Same total-power method as used for the L-Band tests.
- Important improvement: the LSC converter was available, allowing us to test performance at a wide range of frequencies from 3976 to 8072 MHz.
- The tests were done in Nov/Dec. 2004, and in early Feb, 2005.
- Most important new problems were in correcting for Cygnus A size and antenna pointing errors.

Calibration

- The same ‘hot load, cold sky’ calibration technique for L-Band was employed.
- Calibration assumed the cold load temperature as Tr + 10 K
- A 5 K variation in this (i.e., 5 K or 15 K) results in an error of <1% in the efficiency and about 1.5% in the spillover contribution.
- Linearity assured to <1% by measurement of internal noise diode contribution.

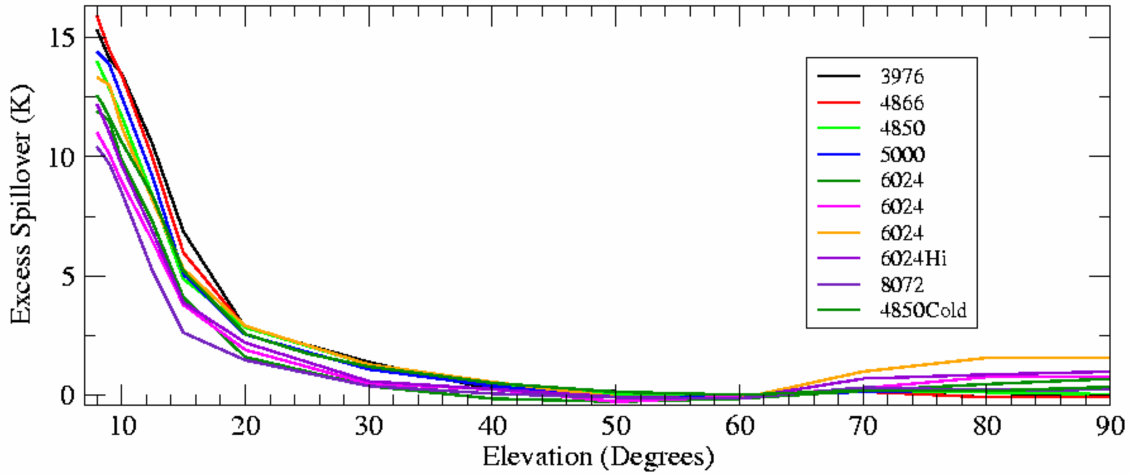
Results -- Focus

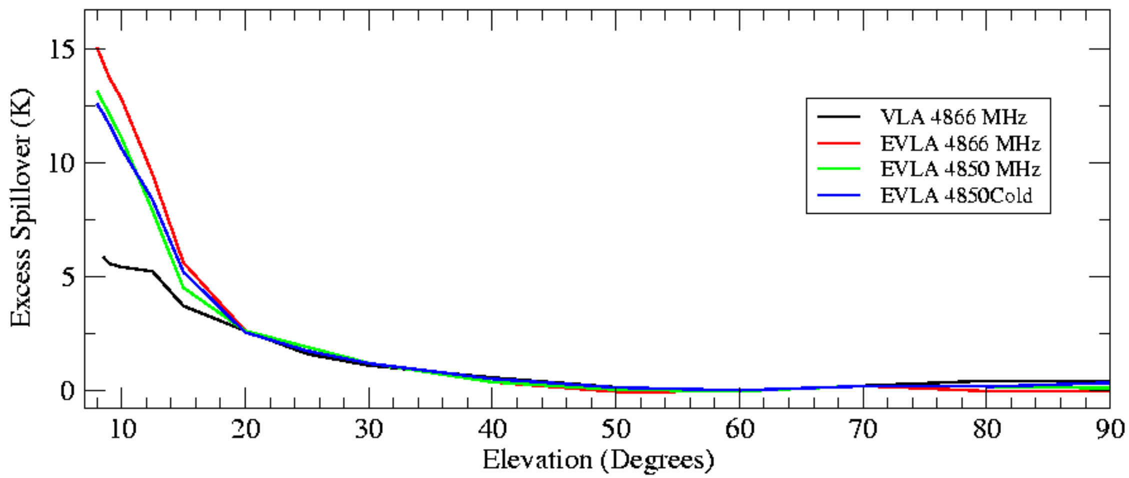
- Focus curve very beneficial to wide-band astronomy!
- When in median position, focus loss less than 10% at low frequency end and negligible elsewhere.



C-Band: Spillover

- Differential spillover is higher than VLA system by ~8 K
- But it is only a problem below 15 deg elevation.
- Spillover is greater at low frequencies, by ~5 K.
- Optimize sensitivity by scheduling!





C-Band: Efficiency

- Efficiency measured by Cygnus A observations.
- Corrections for pointing error and resolution were required.
- Pointing errors determined with each observation.
- Error in efficiency about 2% for low end, to perhaps 5% at high end.
- Also used 3C295 at 4850 MHz – gave ε = 56%.

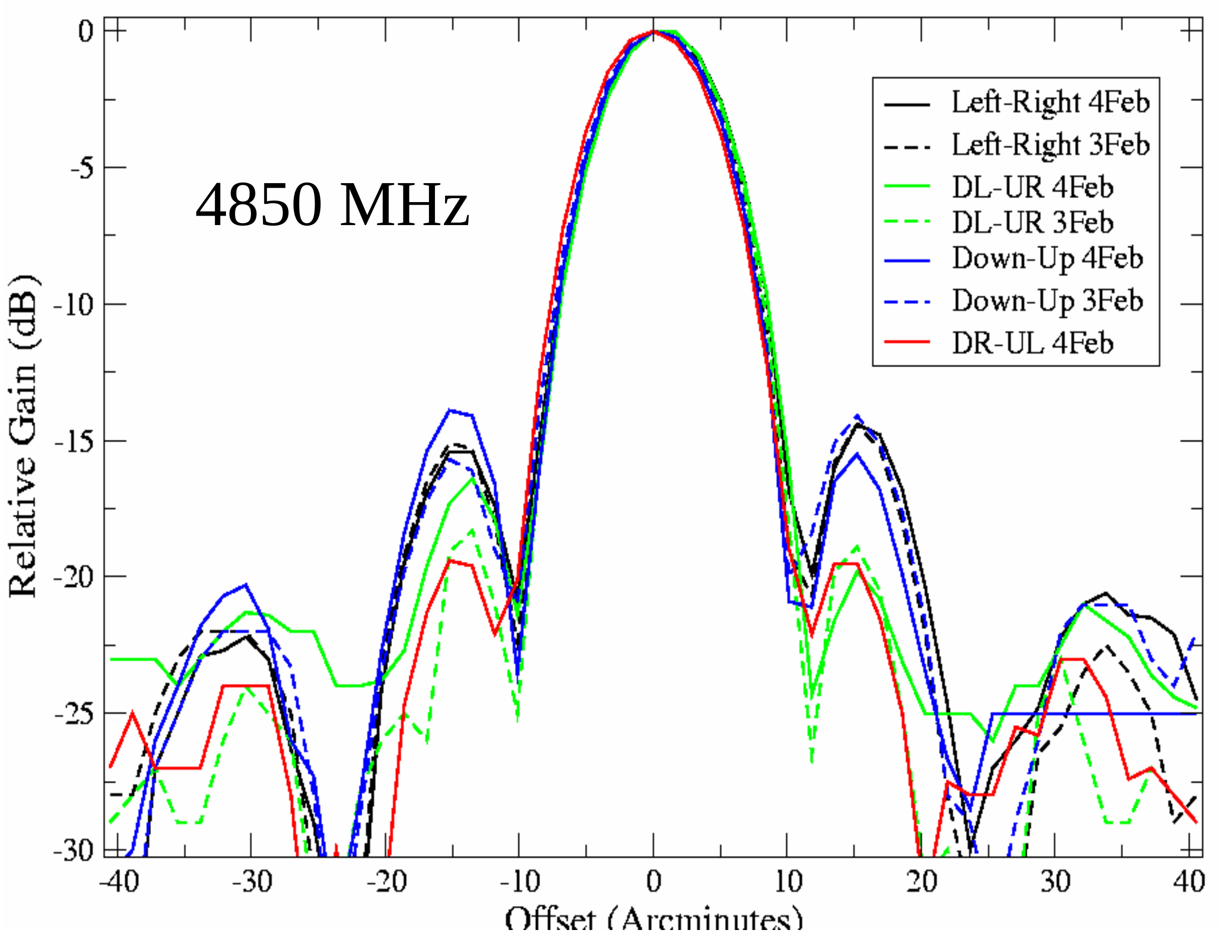
Frequency	T_{Cyg}	S_{Cyg}	ε
3976 MHz	49 K	495 Jy	.55
4850	37	389	.56
5000	36	375	.54
6024	34	297	.65
7048	27	243	.62
8072	24	204	.64

Sensitivity

- As the EVLA OMT is not ready yet for testing, we used a cooled VLBA system to measure system sensitivity at 4850 MHz.
- Should be a good predictor of final EVLA sensitivity performance.
- We measured a zenith Tsys = 23.5 K, far better than the current VLA value of 50 K.
- Presuming 1.5 K atmosphere, 2.75 K CMB, and 5 K spillover, T_{rec} ~ 14 K.
- Lab measurement of T_{rec} = 18 K, but this includes a small unaccounted contribution from the cold load cable.

C-Band: Beamshape

- Measurements at 4850 and 6024 MHz
- Sidelobes are slightly lower than VLA.
- Some asymmetry is seen – likely due to horn alignment.
- Beam is circular to 1%.
- Beamsize is slightly greater than VLA.



C-Band: Bottom Line

- This is a superb feed!
- The SEFD is ~235 Jy – half the current VLA value, and ~10% less than the project book requirements.
- The only negative is the increased spillover – this is only relevant at very low elevations, (where nobody should be observing unless they really have to).
- We'll take it!