N06C4 Calibration at 6cm

This was a 24-hour run in November 2006 using sources selected from VLBA calibrator catalog to be nearly unresolved. The idea was to look at calibration issues. The data was run through EVN pipeline and exported to difmap for display and mapping. An attempt was made to improve the result by successively making changes to the calibration data provided. Some problems noted are given below on a station-per-station basis, as each station has different characteristics.

FLUX SCALE

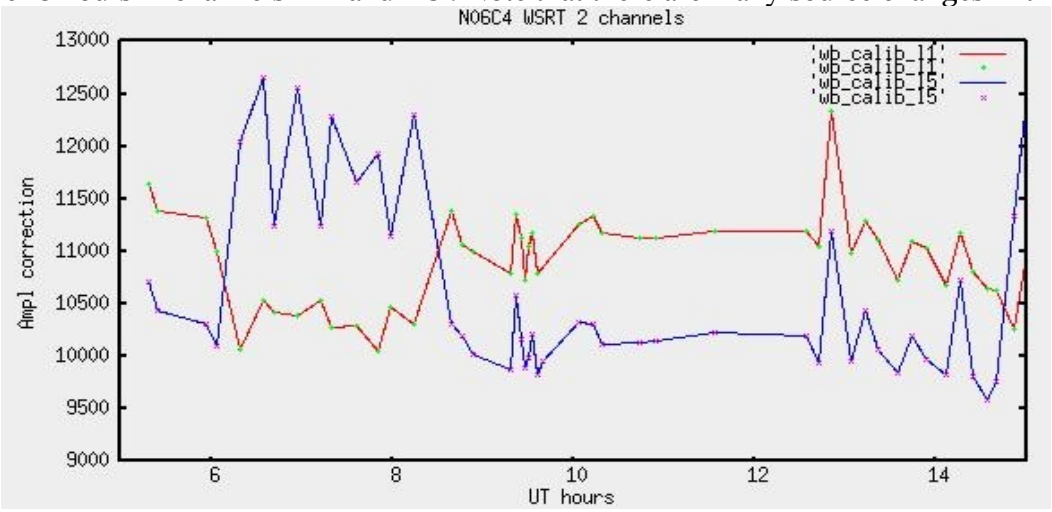
Both Effelsberg and WSRT measured flux densities of the program sources. This was to give an estimate of the degree of resolution of the sources. A plot of the measured fux densities showed however that the measured flux densities at Effelsberg were 5% lower than the WSRT values. This is probably because the flux scale at Effelsberg was set using steep-spectrum sources (3C286, 3C147) using a different centre frequency to the VLBI measurements, so that the flux scale was in error.

MERLIN DATA

Merlin antennas apparently took part in this experiment, but despite several requests I have received no data from Jodrell.

WSRT

The amplitude corrections found by the pipeline show variations over time. The plot below shows changes over 8 hours in channels 'L1' and 'L5'. Note that there are many source changes in this time.



It is apparent that a drop in gain of one channel is accompanied by an increase of gain in another, it is not clear why this happens.

EFFELSBERG Occasional bad pointing with lower amplitude

JODRELL MK2

Antabfs file looks OK, the Tsys values are considerably different between LCP and RCP but it looks like the receivers really are different.

URUMQI

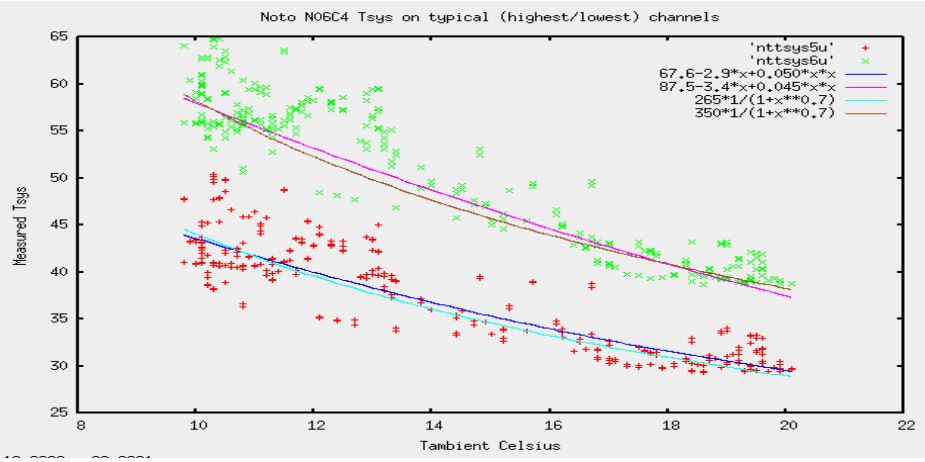
Calibration on long baselines to Urumqi and Hartebeesthoek seemed inconsistent, but self-cal cannot help much on long baselines. Tcal for Urumqi is given as 1.5K. The small value may lead to formatting problems as antabfs formats the value given to one place of decimals. The minimum Tsys of 18K and the Tant of 3C84 seem too low. Therefore for this analysis the temperature scale was

increased by approximately 1.2 to give results consistent with other stations. The station seems to sometimes show lower gain at high elevation. This is probably a pointing problem.

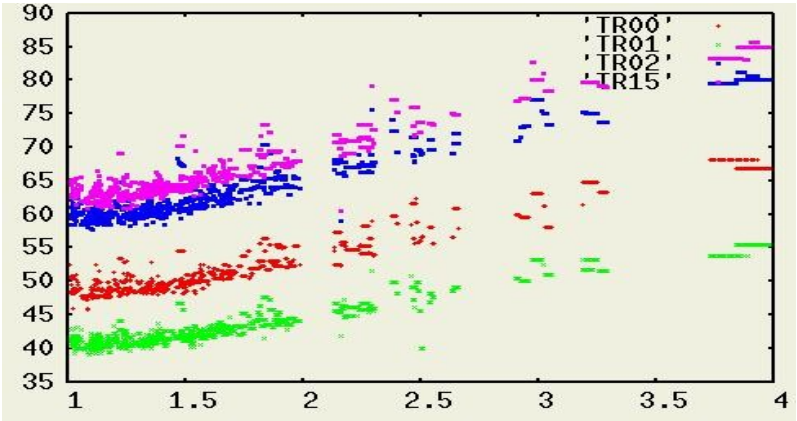
HARTEBEESTHOEK
Posted session calibration results were incomplete. Earlier data from cl06c2 suggested a different Tcal to that in the n06c4 antabfs files. This was because cl06c2 used Virgo A alone. The source size given for Virgo A in the FS files gives beam broadening at 6cm about 15% higher than the true value. However the antabfs values turned out to be accurate, and gave consistent results when the scale of Urumqi was increased.

MEDICINA Looks OK

NOTO
The 'cl06' calibration run seems to have been affected by using broad if channels as well as BBCs, and by a gnplt bug which affects lsb channels. The posted N06C4 antabfs file had been produced with the old version of the analysis script. As a first step the analysis was repeated with the new script. A wide variation of Tsys is seen during the experiment, seemingly independent of elevation. The values of Tsys show a strong anticorrelation with ambient temperature. The plot below shows values for two frequency channels, one from LCP, the other RCP. Analysis suggests that the extra noise is real. The reason for this is unknown. It may be due to rain, but does not show the typical pattern caused by rain showers.



TORUN
The calibration scale is wrong by a factor of about 2.2, individual channels scatter very badly. The plot below shows the slope of measured Tsys against sec(elv), representing airmass, for three extreme cases.



Channels 'TR00' and 'TR01' represent the values from LSB and USB of the same BBC on RCP, while

'TR02' is on LCP. The slopes of these individual channels are very different, demonstrating that in reality the Tsys values for these channels are much more alike than they appear here. Part of this problem may be that, if one allows it to, gnplt will determine different DPFU values for RCP and LCP. The slope of the curves shows that Tsys is actually much lower than the tabulated values. The fact that DPFU and Tsys values do not match each other leads to the overall calibration error of about 2.2. Again, like Noto, the intermediate frequency detectors ia,ic were included in the cl06c3 run, which messes up the gnplt result.

CAMBRIDGE Cambridge does not calibrate. Basta.

DPFU and TSYS

Proper calibration starts with a hot/cold load measurement of Tcal by receiver engineers, as done at VLBA. On that basis DPFU can be estimated. Excellent tools to determine gain/elevation and Tcal against frequency are available in the FS. They deliver excellent results if the antenna control software works properly, and if the tools are used correctly. Realistic estimates of both DPFU and Tsys should be used so that receiver and antenna specialists can check if their equipment is working correctly. Simple consistency checks should be done on calibration results, for example to check Tsys consistency between channels.

SOURCES USED

After calibration it is possible to see which sources give flat visibilities out to about 140 Mλ and may therefore be useful in calibration runs. Of course most of these are rather weak.
The table shows single-dish flux densities and the correlated VLBI flux density.

Source Name	Single-Dish (Jy)	VLBI (Jy)
J0056+1625	1.23	1.2
J0102+5824	3.2	2.9
J0401+2110	0.36	0.36
J0625+4440	0.18	0.16
J0646+4451	3.2	2.9
J1454+1624	0.54	0.48
J1505+0326	0.70	0.70
J2321+3204	0.55	0.48