Tutorial: Drift Scan with HartRAO

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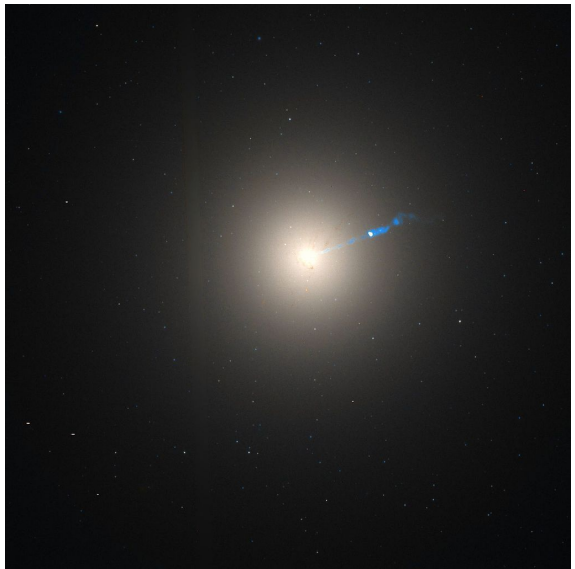
Main Purpose - Calibration

We want to look at a source with a **known** flux density (measured in Jy) to calculate how our telescope responds to sources with an **unknown** flux density.

This is called **flux calibration**.

Known Source

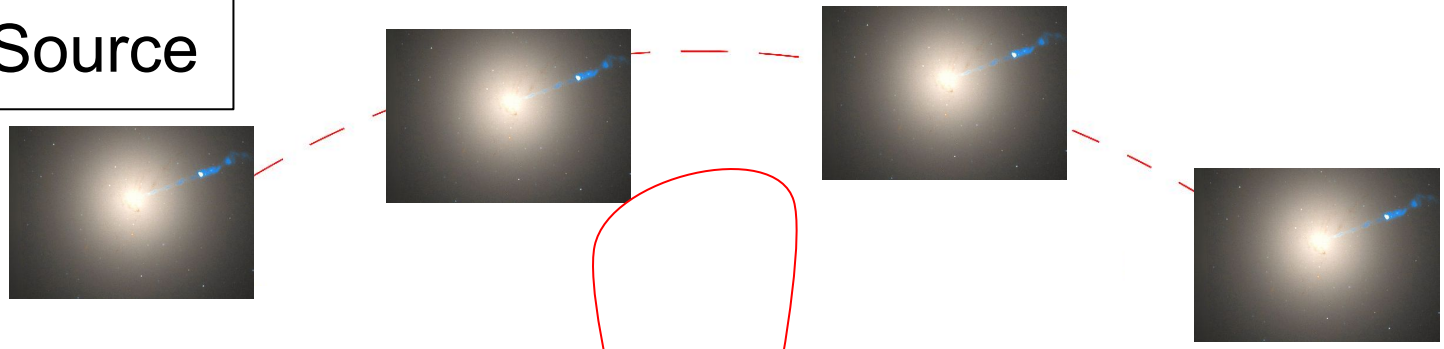


PSS

Unknown Source

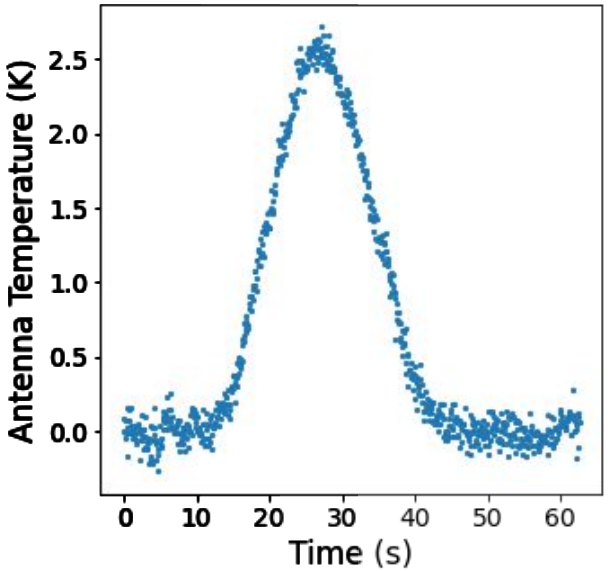
How do we do this?

Source

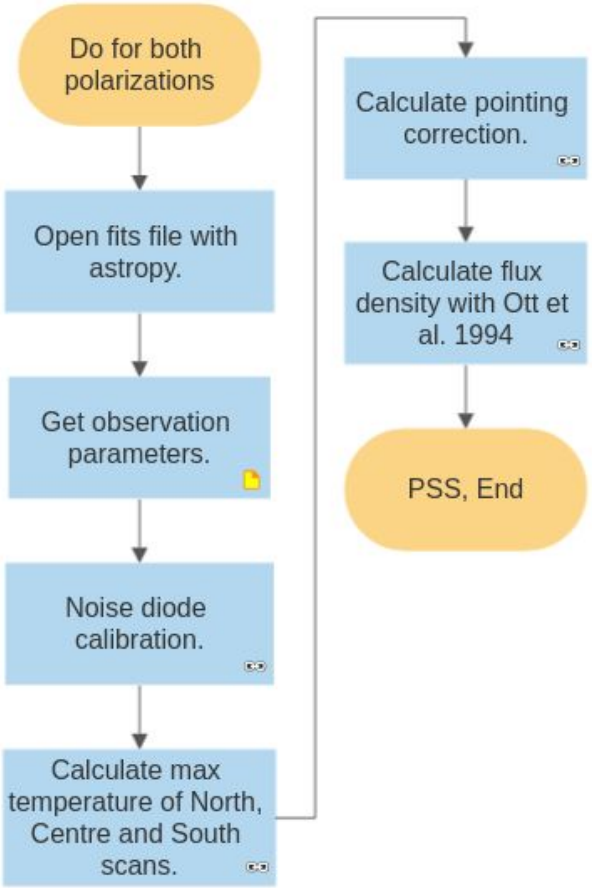


Beam pattern

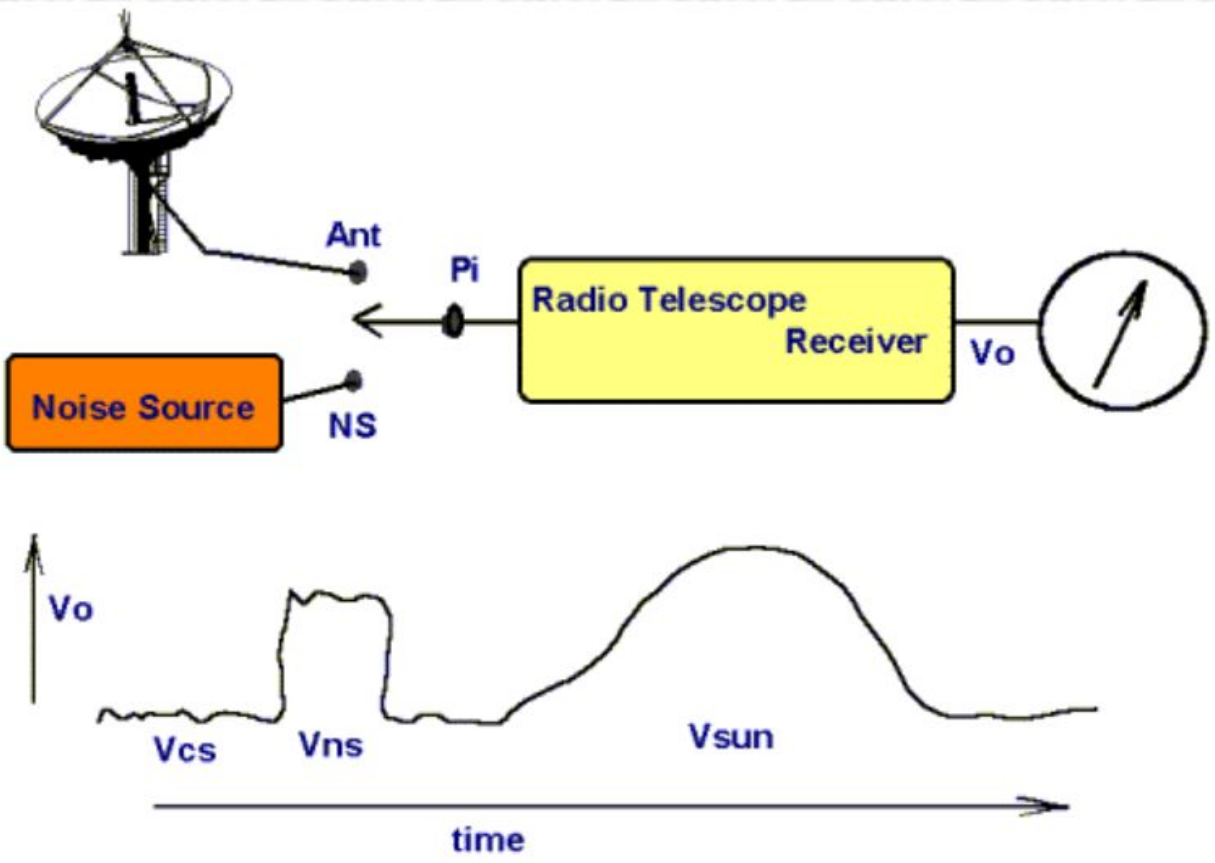
Radio Telescope



We have to make a few corrections.

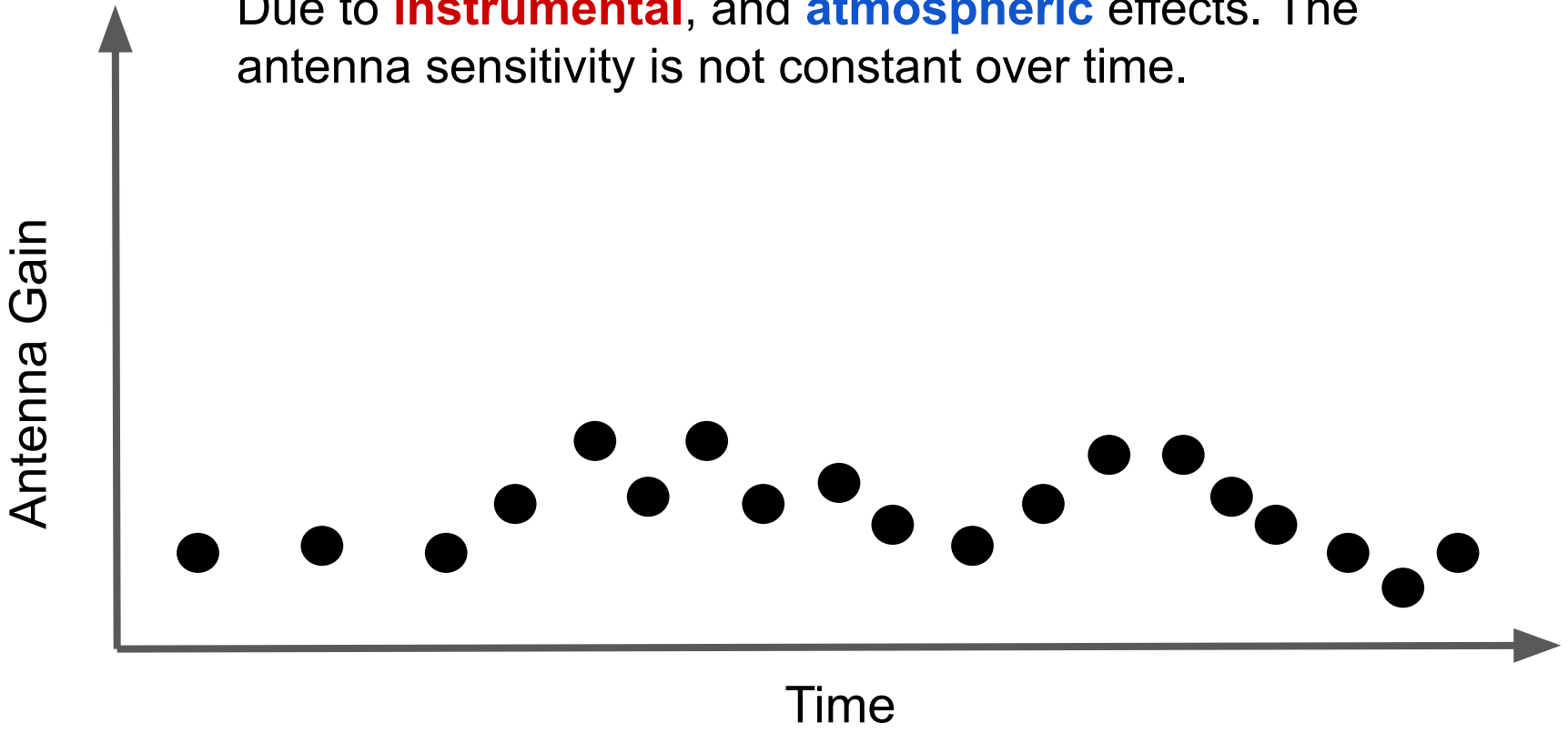


1. Conversion to Antenna Temperature

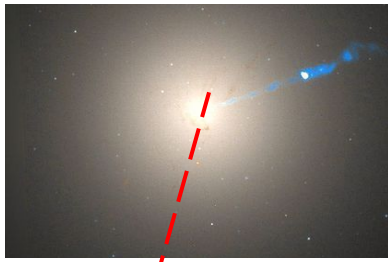


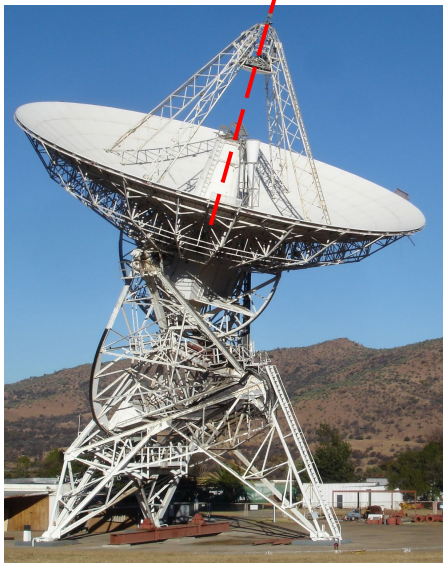
2. Correction of time dependant gain effects.

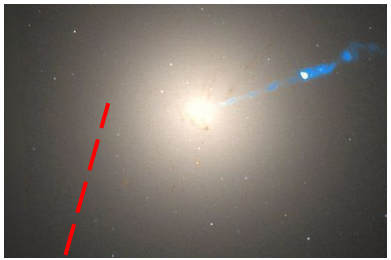
Due to **instrumental**, and **atmospheric** effects. The antenna sensitivity is not constant over time.

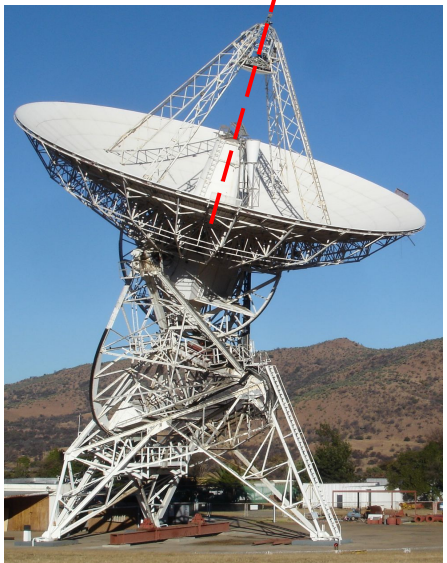


3. Pointing Correction.









4. Point Source Sensitivity Calculation

Table 5. New spectral fits for calibrator sources

$$\log S\,[\mathrm{Jy}] = a + b * \log \nu\,[\mathrm{MHz}] + c * \log^2 \nu\,[\mathrm{MHz}]$$

source	range [MHz] from	to	a	b	c
3C48	1408	23780	2.465	−0.004	−0.1251
3C123	1408	23780	2.525	+0.246	−0.1638
3C147	1408	23780	2.806	-0.140	−0.1031
3C161	1408	10550	1.250	+0.726	−0.2286
3C218	1408	10550	4.729	−1.025	+0.0130
3C227	1408	4750	6.757	−2.801	+0.2969
3C249.1	1408	4750	2.537	−0.565	−0.0404
VirA	1408	10550	4.484	−0.603	−0.0280
3C286	1408	43200	0.956	+0.584	−0.1644
3C295	1408	32000	1.490	+0.756	−0.2545
3C309.1	1408	32000	2.617	−0.437	−0.0373
3C348	1408	10550	3.852	−0.361	−0.1053
3C353	1408	10550	3.148	−0.157	−0.0911
CygA	4750	10550	8.360	−1.565	—
NGC7027	10550	43200	1.322	−0.134	—

NGC7027 flux densities reduced to epoch JD = 2448171.
Fit to points at 2.8, 1.3 and 0.7 cm.
DR21 Complexity of spectrum allows no overall fit.

We can calculate the “real” flux density of the source.

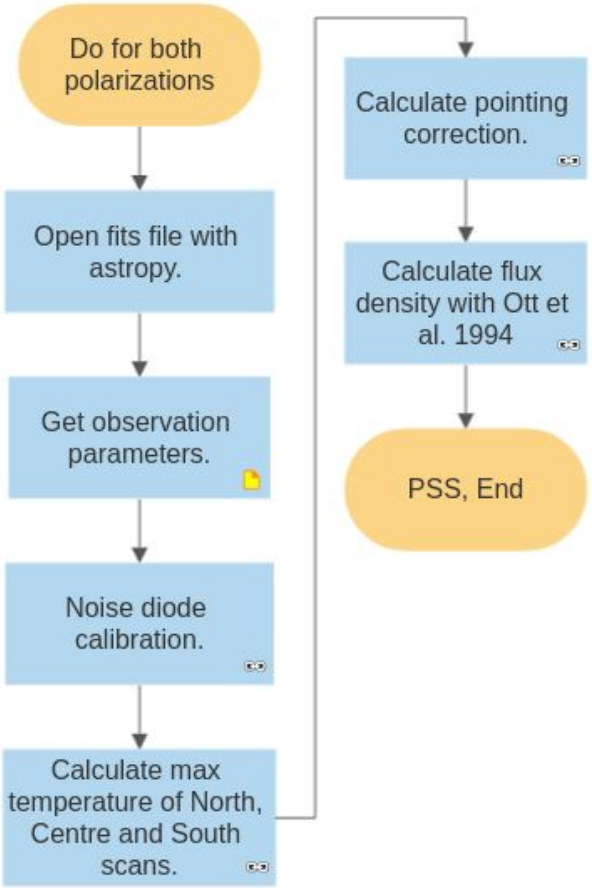
Divide by the corrected peak antenna temperature we get.

And we have the **point source sensitivity.**

Calibration completed!

Ott. et al., 1994.

In summary.


Do for both polarizations
Open fits file with astropy.
Get observation parameters.
Noise diode calibration.
Calculate max temperature of North, Centre and South scans.
Calculate pointing correction.
Calculate flux density with Ott et al. 1994
PSS, End

Now we are ready for the practical.

Any questions?