Amplitude Calibration Methods of the Karoo Array Telescope

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Introduction

Amplitude calibration is a vital step in Radio Astronomy.

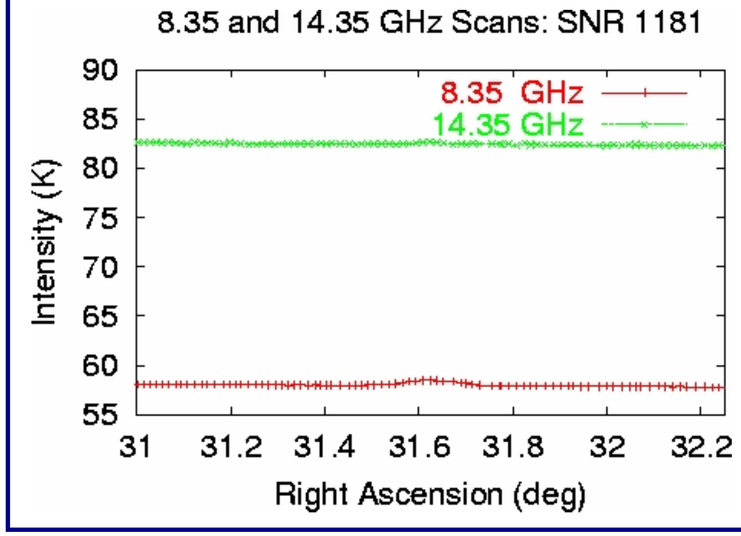
Calibration compensates for imperfections and unknowns in the instrument used, including:

- Antenna defects (surface quality, focus),
- Pointing errors,
- Atmospheric transmission and fluctuations,
- Receiver and backend gain and instabilities.

Parameters affecting Calibration

Some of the parameters affecting accurate flux calibration are:

- Changes in the receiver temperature
- Electronic gain drift
- Variable atmospheric optical depth and emission
- Variable ground pickup

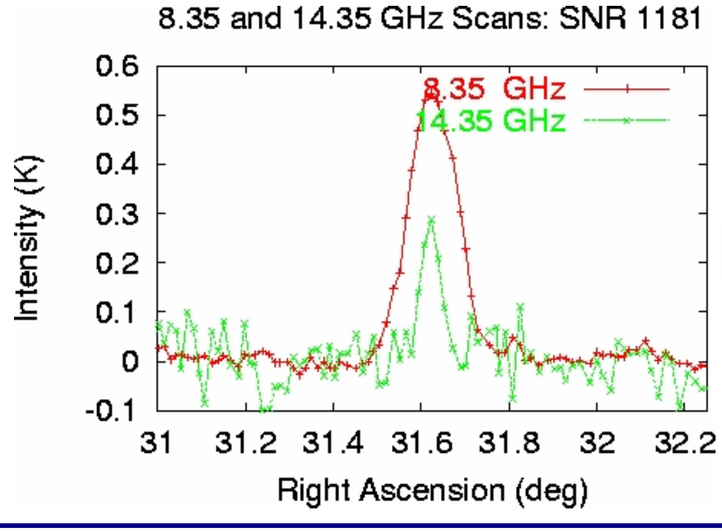


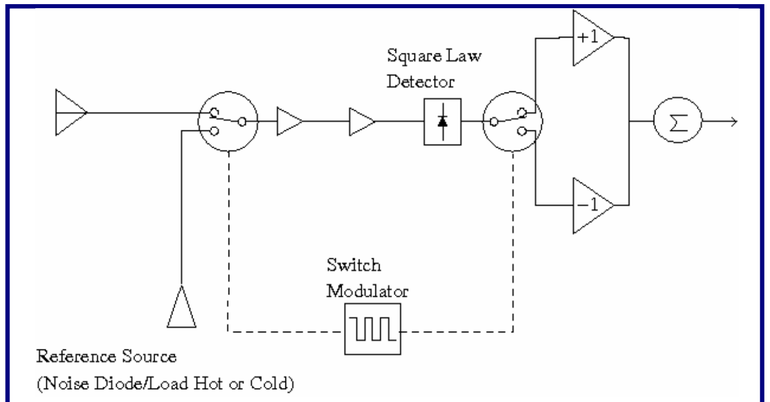
Testing

On the receiver side, necessary tests have to be carried to ascertain the gain and receiver temperature are maintained within a certain designed band such that high fidelity imaging can subsequently be performed.

Amplitude stability

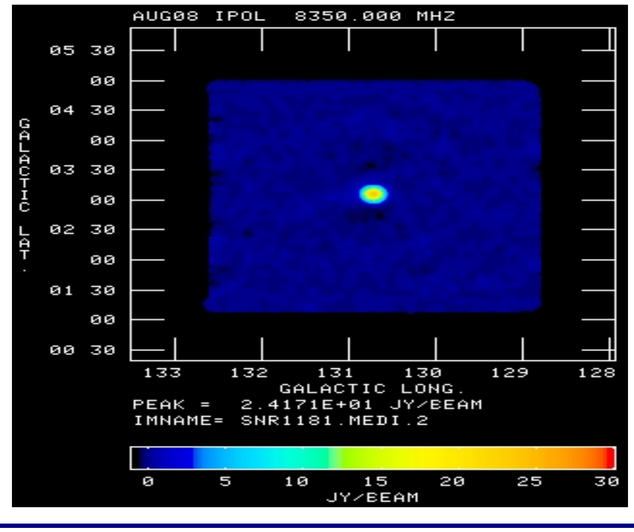
The capability to measure and maintain amplitude stability of the receiver at the level of 1% is needed to combine imaging information from one array configuration to another reliably and to permit accurate comparison of line strengths to determine such physical parameters as the excitation temperature of interstellar clouds or material in galactic nuclei.





Problems

The astronomical source power to be measured by the radio telescope is in most cases incoherent and behave in a similar way to noise originating from the receiver itself. The received signals are of exceedingly low power and receivers have to provide high gains. Techniques will have to be employed to calibrate, measure and compare purity of signal in comparison to thermal and 1/f noise.



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