# Hydrogen Observations using Software Defined Radio and the IAR1 Antenna

G. Gancio, M. Salibe M. Tueros M. Fernández-López
Instituto Argentino de Radioastronomía – CCT La Plata - CONICET.

## Introduction

A new digital receiver was implemented during 2014 for 1.4GHz-1.6GHz (⍀=21cm) radioastronomy observations in the IAR antenna. This allows for neutral hydrogen and continuum measurements.

**Previous Back-End**

- ***Digital AutoCorrelator 1008 channels from Arecibo.***
- ***High Power consumption.***
- ***Three Racks Cabinets.***

Previous Back-End

New USB-SDR.

## Software Defined Radio

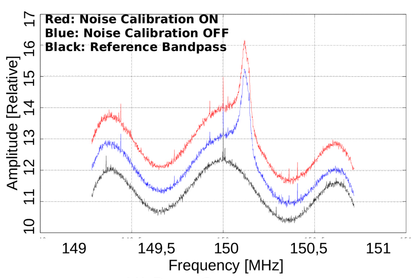
An SDR system is a radio device in which mixers, filters and amplifiers are implemented by software, programmable with a Computer.

- ***FFT channels implemented in Software.***
- ***Low Power.***
- ***Reduced Size, ∽3x2cm up to ∽10x30cm boards.***
- ***Low Cost devices, from 20USD up to 5000USD.***

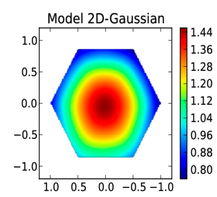
## Resulting Observations

To validate the system performance several trial were accomplished. We tested the pointing using known calibrators. We compared cataloged and observed HI profiles. Also, a 2-days spectra acquisition was made.

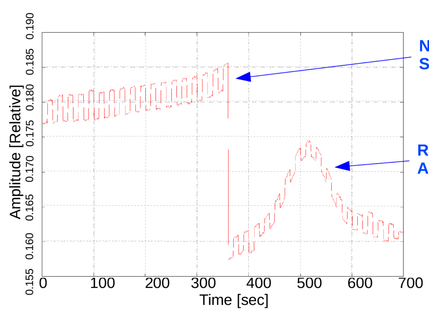
- ***Used bandwidth: 2 MHz***
- ***Spectral resolution: 1024 points (FFT)***
- ***Observation time: 5 minutes***
- ***No Amplitude Calibration***




HI Raw Observation




Gaussian fit for a seven point measurement of Hydra A.

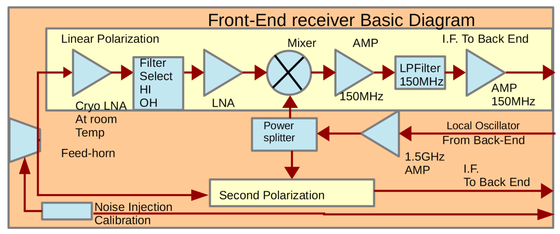



Continuum source sweep in right ascension

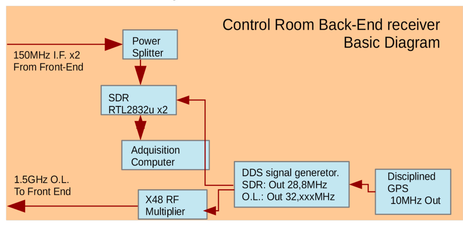
## Project Description

To acquire signals from the radio telescope, the SDR receivers were installed in the control room of the radio telescope.

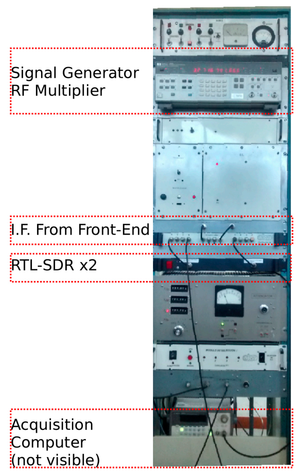
- ***Two SDR for each Linear Polarization.***
- ***150MHz Intermediate Frequency.***
- ***Personal Computer for control and Acquisition.***




Front-End Block Diagram




Back-End Block Diagram

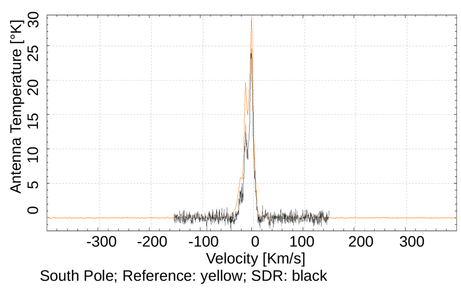



Back-End Rack

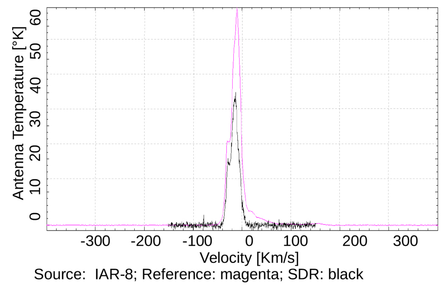
## Software Description

The software used was developed at the IAR with the aim of optimize observation times. It is written in "C" and it is executed on a Linux platform.

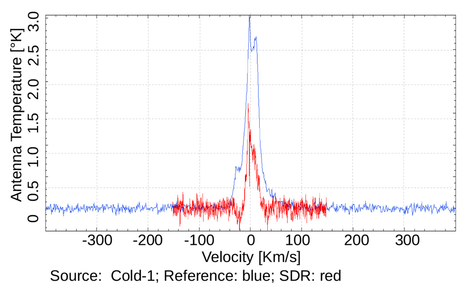
- ***1024 FFT points, thread process.***
- ***Simultaneous Acquisition and FFT.***
- ***Noise Diode Control for Calibration.***
- ***Spectral Line / Continuum Observations.***



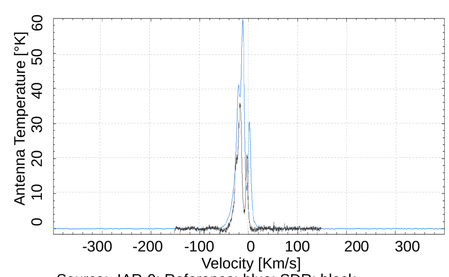

South Pole; Reference: yellow; SDR: black



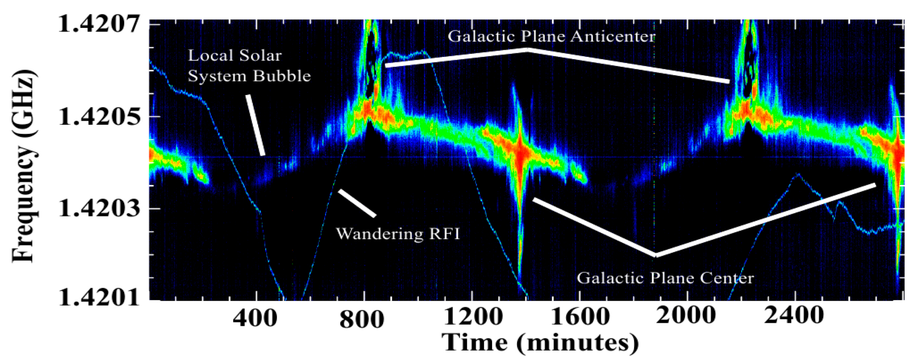

Source: IAR-8; Reference: magenta; SDR: black




Source: Cold-1; Reference: blue; SDR: red




Source: IAR-9; Reference: blue; SDR: black




HI Spectral Line observations of two consecutive days.