

AntArr Project: a DBBC3 synthesis array

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The Project

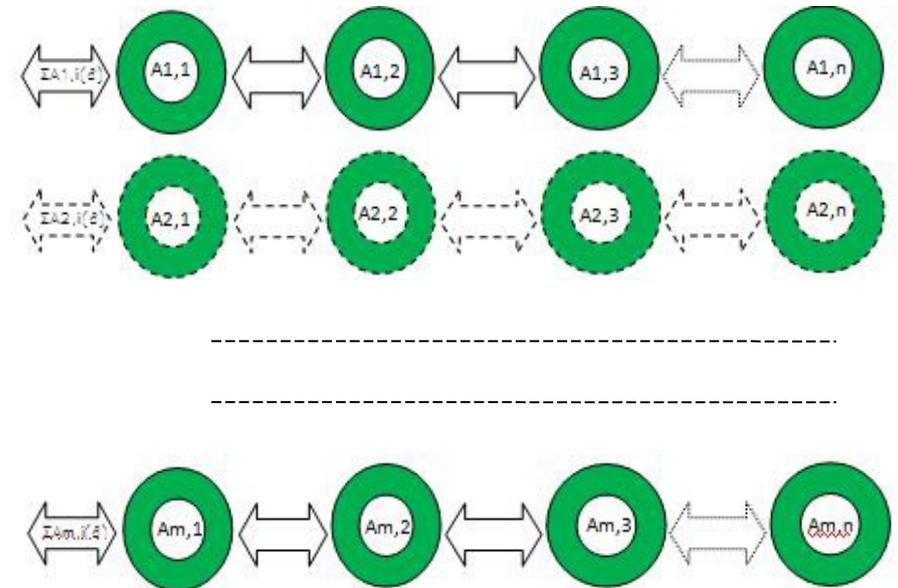
- **alternative application of the DBBC3**
- **set of antennas combined into an array**
- **broadband range from 10 MHz to 1000 MHz**
- **synthesize a beam with an innovative approach**
- **final product of the array is a single station standard VLBI data set**

ARRAY AND BEAM SYNTHESIS

GENERAL FEATURES

- **Antenna Prototype frequency range: 10 - 1000 MHz**
- **Max. number of antennas in a single arm: 32**
- **Max. number of arms in a single DBBC3L: 32**
- ***Max. observation bandwidth at each arm: 128 MHz***
- ***Analogue delay compensation digitally controlled at every antenna***
- ***Analogue summation for each arm at every antenna***
- ***Digital correlation between any element of the array***
- ***Digital correlation between any element of the array and the synthesized beam***

SCHEMATIC INSTRUMENT ARCHITECTURE

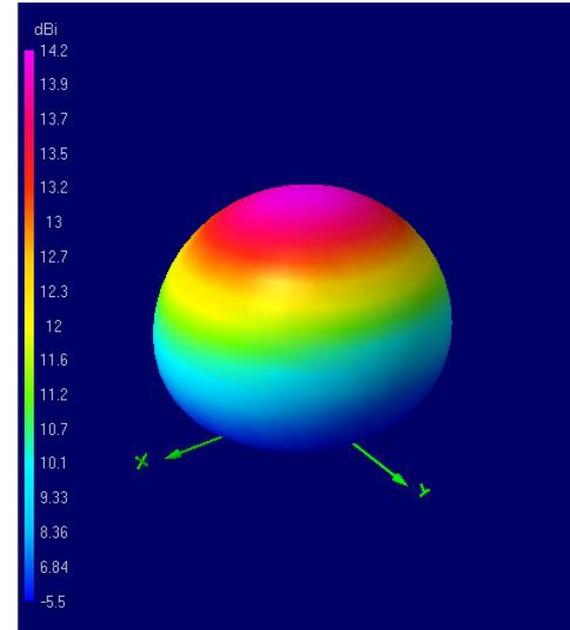
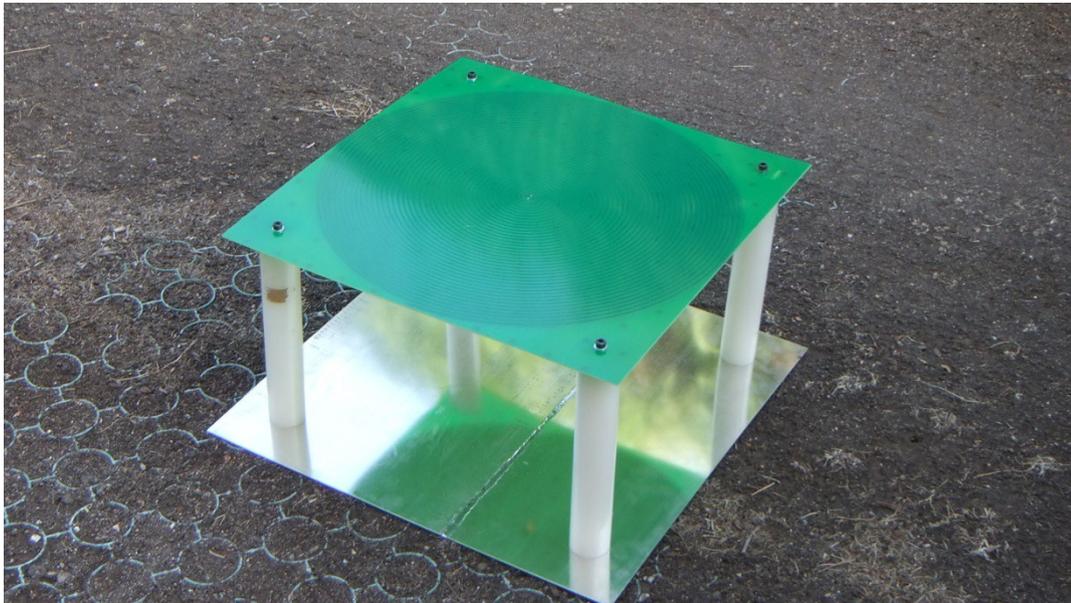


Beam Synthesis Method

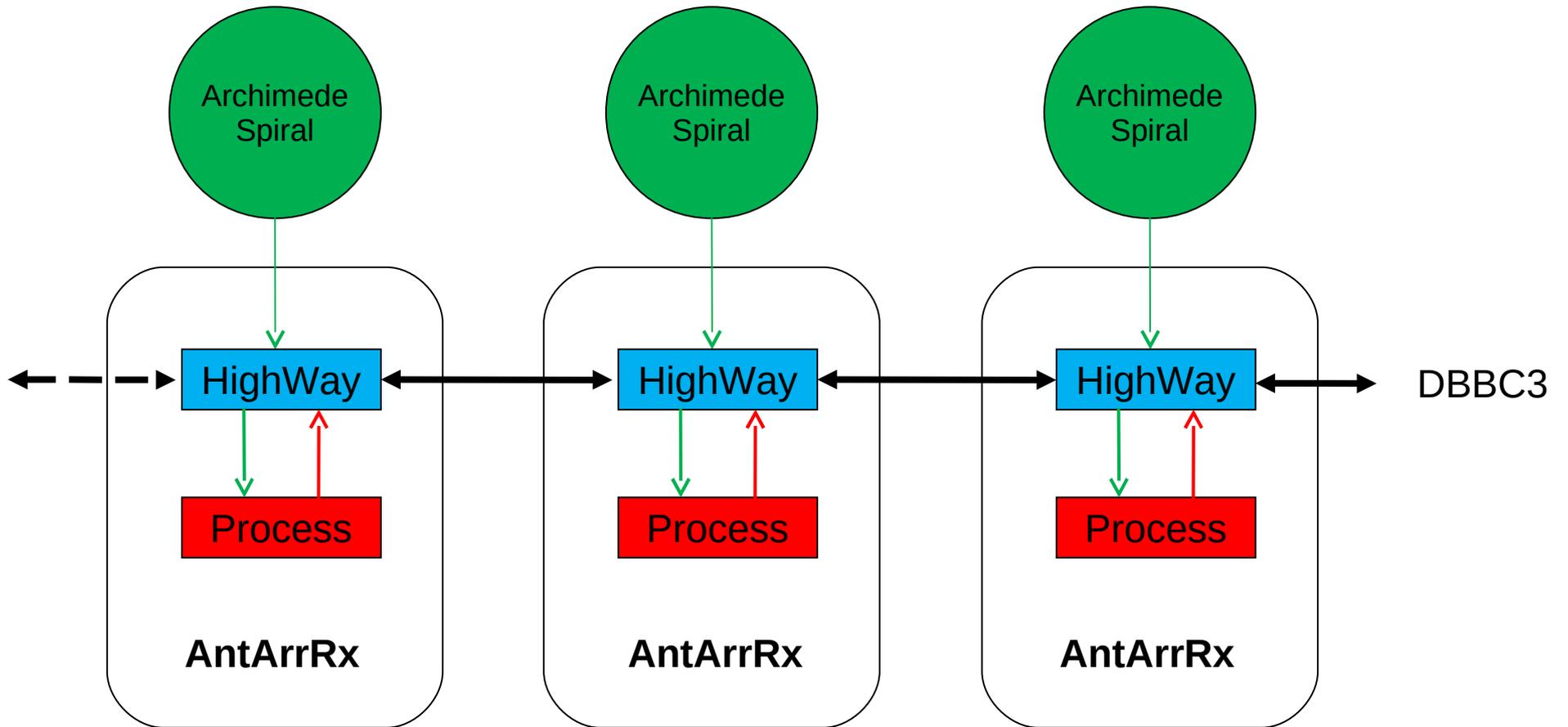
- signals will be processed by the VLBI back-end DBBC3L
- antennas are organized in arms
- groups of four arms managed by a single ADB3L-CORE3L
- signal from each antenna has the model delay applied
- delayed signal is summed to this next neighbor
- single beam correlated with either the synthesized beam or with any other element in the array
- signal of the source is tracked with a mix of theoretical geometric model plus measured correction

Antenna Prototype

- Several types of antennas tested
- An ad-hoc modified Archimede-Spiral candidate under test in array
- Dual polarization in the same location possible
- Add-on elements to cover frequencies $< 10\text{MHz}$ down to KHz range



AntArrRx

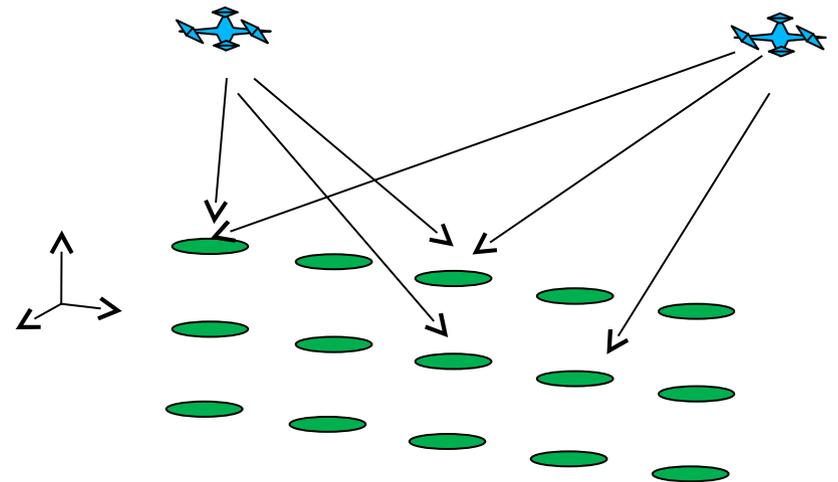


AntArrRx

- Single board with low noise receiver and array element processor
- Apply digital controlled delay
- Process one of the the neighbor antenna signals
- Select and forward single un-modelled antenna signal
- Bidirectional data flow
- 1 GHz Highway allows to carry one channel with the 128 MHz sythesized beam and additional other 7 virtual data channels
- Up-down conversion for the 7 data channels
- Bandwidth further selection in the DBBC3

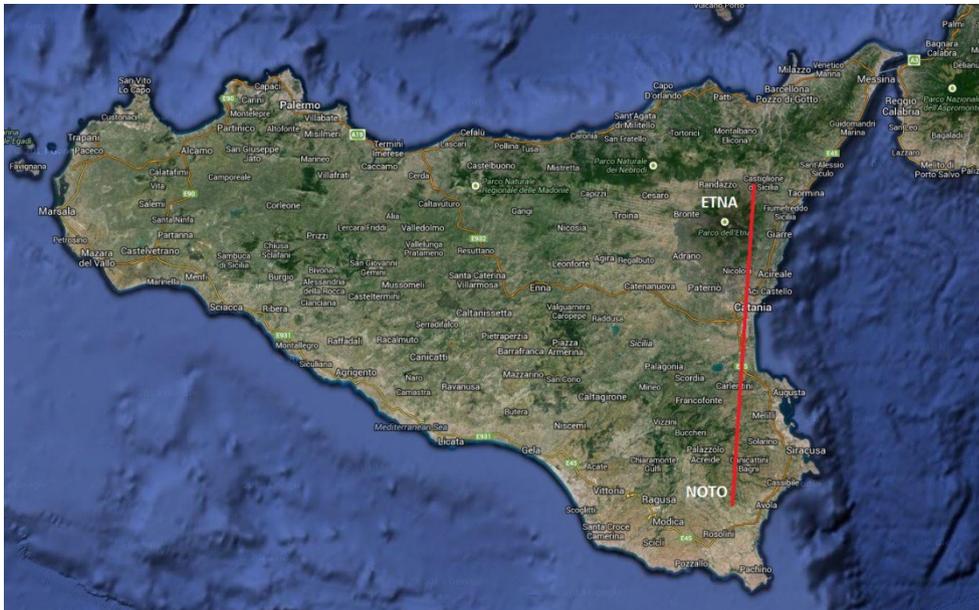
CHARACTERIZATION

- Single antenna and antenna groups characterized using a GPS/altimeter controlled drone in far field regime
- Drone equipped with 327-654-981 MHz transmitter



STATIONS

- More stations are planned with ≥ 128 antennas ea.
- Two stations have been started to be equipped
- **Noto:** radiotelescope area
- **Etna:** northern side at low altitude (600 mt.)
- Etna station equipped with Rubidium atomic clock
- Noto-Etna stations baseline 114 Km



TEST AND OBSERVATIONS under way now and in 2015

- **weekly tests in Noto and Etna while the arrays are growing up**
- **as soon as the Noto array will be completed with 128 antennas:
interferometry with 327 MHz VLBI parabola receiver**
- **as soon as the Etna array will be completed with 128 antennas:
interferometry at 327 MHz with Noto AntArr and VLBI parabola**

COST

- **for a 128-256 antennas array: in the range of a standard radioastronomy cooled receiver (150-300 K€)**

THANKS!
QUESTIONS?



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