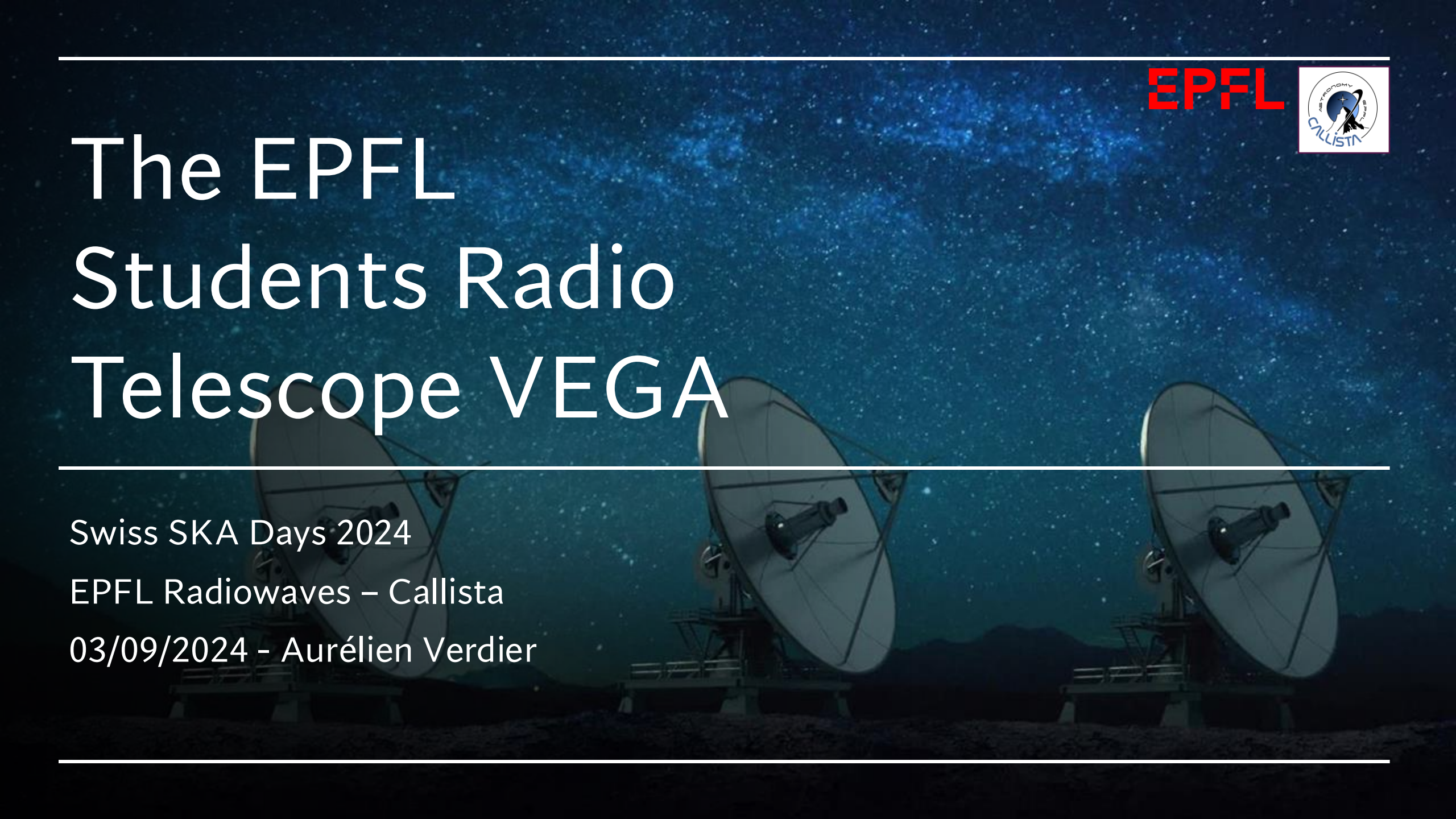


The EPFL Students Radio Telescope VEGA

Swiss SKA Days 2024

EPFL Radiowaves – Callista

03/09/2024 - Aurélien Verdier

VEGA: Very Elegant Galactic Antenna

Goal: Introduce Radio Astronomy to students

Timeline of the project

Timeline of the project

Timeline of the project

Introduction to Radio Astronomy: Building and optimising a low-budget horn radio antenna

Sonali Mayani
Laboratory of Astrophysics (LASTRO)
Swiss Federal Institute of Technology Lausanne (EPFL)

Supervisors: Prof. J-P. Kneib, Aurélien Verdier
Laboratory of Astrophysics (LASTRO)
Swiss Federal Institute of Technology Lausanne (EPFL)

TP IVa Autumn semester 2019-2020

We have developed a low-budget, basic horn radio antenna using cardboard, aluminium foil, and tin cans. The aim of the project is to serve as an introduction to radio engineering and radio astronomy. This field is becoming increasingly important in astrophysics and cosmology due to the amount of astronomical objects that can be seen in radio frequencies, and new objects whose origin is unknown such as FRBs. The target frequency in this case is 1.42 GHz, the neutral hydrogen 21 cm emission line. We conceive an RF front end that after being connected to an SDR USB dongle allows for direct data collection and signal processing via a computer. The antenna waveguide feed is built and is optimised in order to attain the correct thresholds of S-parameters and ensure successful performance of the antenna. This is a jumping point for further radio antenna constructions which improve on this basic model, with the future vision of setting up a radio telescope in Switzerland.

FIG. 6. Photograph of the 1st attempt at a full radio telescope. This was a trial run to see if we could receive signals from various regions in the night sky, such as the Cygnus constellation, which contains Cygnus A, a widely known radio galaxy.

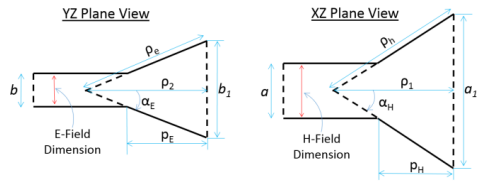
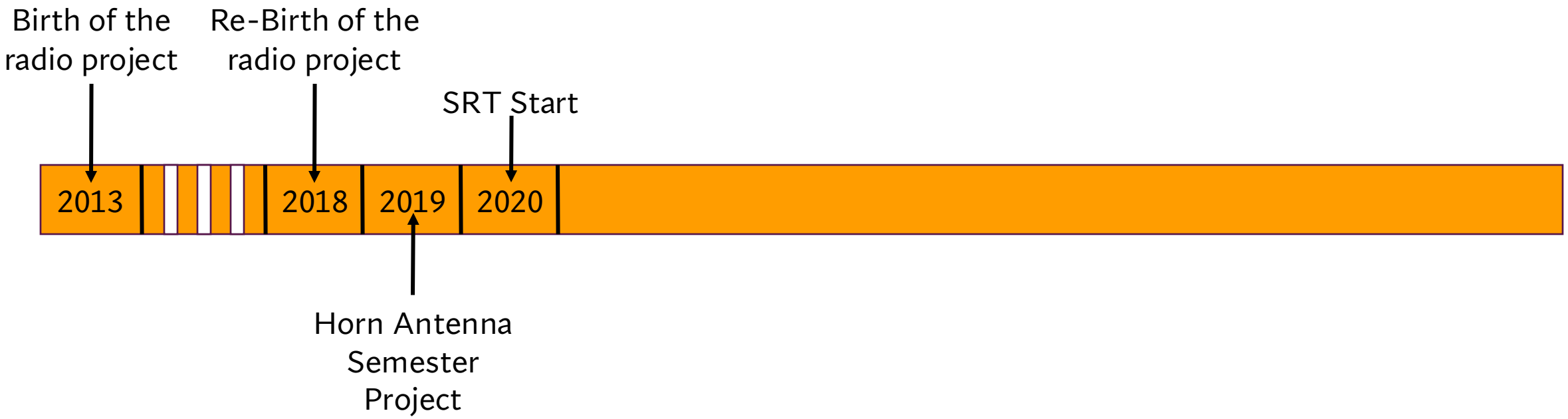


FIG. 1. Aperture fed waveguide horn diagram with all the labeled dimensions [18].

FIG. 7. Photograph of the 2nd attempt at a full radio telescope. This is a rectangular waveguide with a pyramidal horn.

Timeline of the project

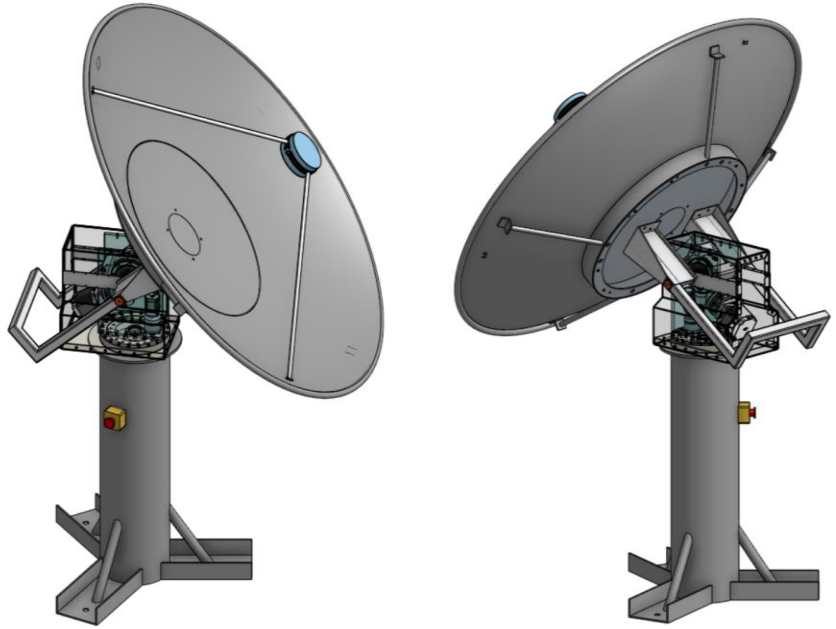


SRT: Small Radio Telescope

Model developed by MIT Haystack Observatory

Complete Wiki about how to build it

EPFL Small Radio Telscope



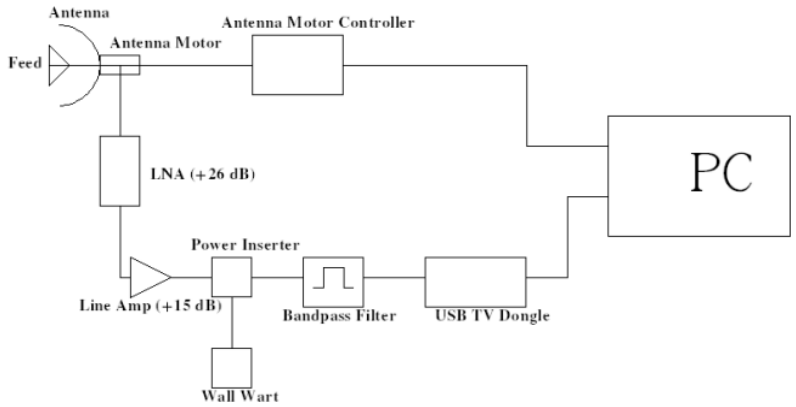
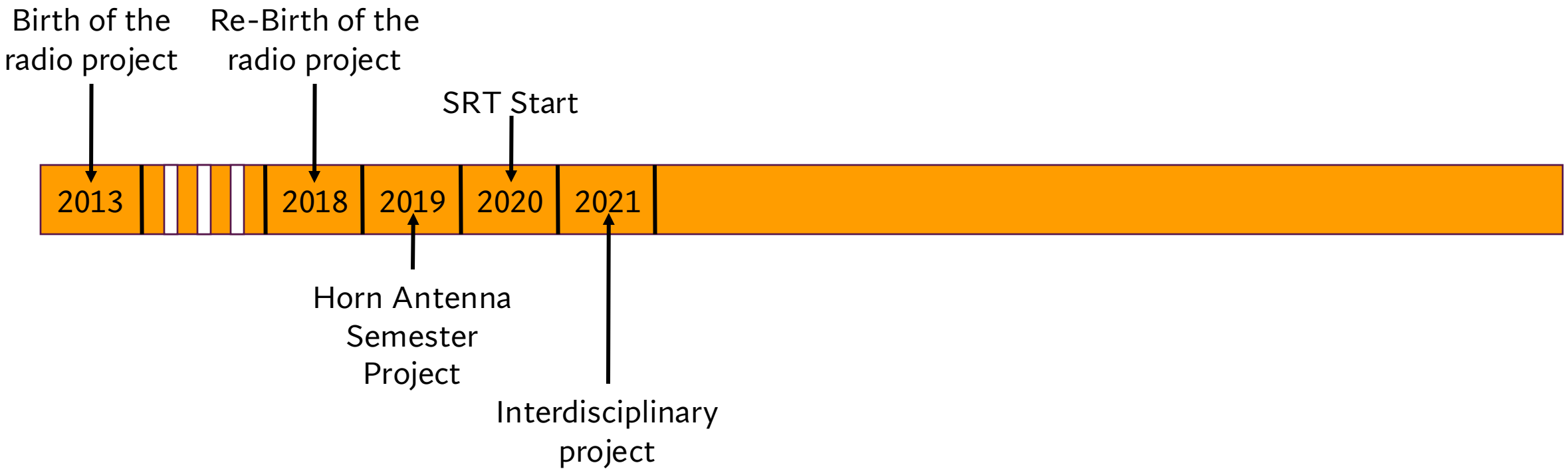


***Figure 11**: Dongle based SRT schematic.*

Goal: Detect the 21cm Hydrogen line and measure galactic rotation curve

Timeline of the project



Interdisciplinary Project

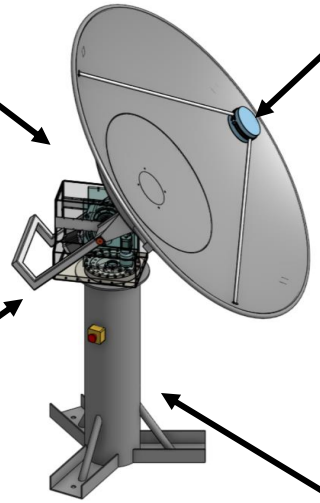
Interdisciplinary Project: Small Radio Telescope Antenna

Dominic Dahinden, Oriane Robin, Joséphine Potdevin
dominic.dahinden@epfl.ch oriane.robin@epfl.ch josephine.potdevin@epfl.ch

February 22, 2022

System Engineering of a Small Radio Telescope

Space Technologies Minor Project



Mechanical Design and Motorisation of a Radio Telescope

Radio Waves Small Radio Telescope Project
Callista, astronomy association of EPFL

Master Project - Mechanical Engineering

Radio Waves

Structure of a Small Radio Telescope

Interdisciplinary Project

System Engineering of a Small Radio Telescope

Space Technologies Minor Project

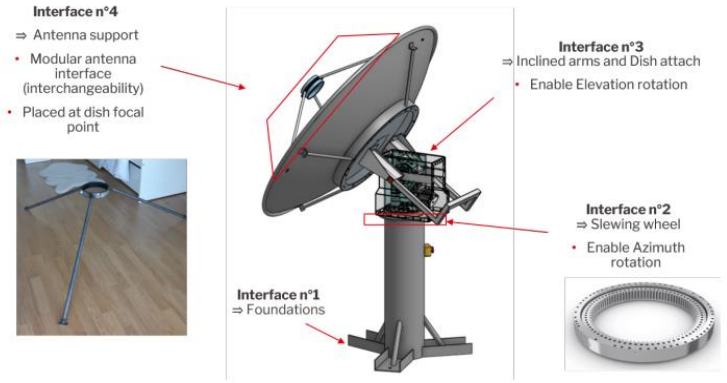
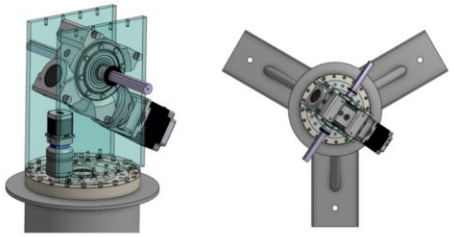


Figure 3.8: Main SRT Interfaces



Mechanical Design and Motorisation of a Radio Telescope

Radio Waves Small Radio Telescope Project
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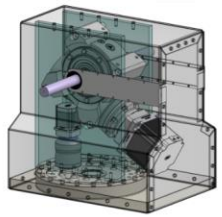
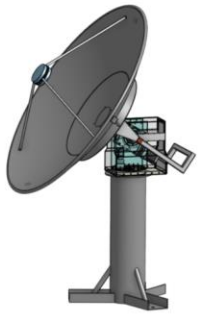


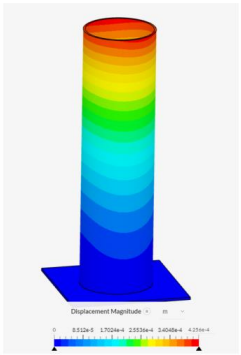


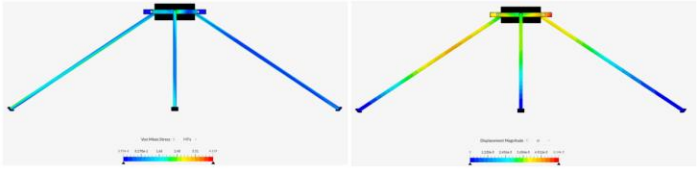
Interdisciplinary Project: Small Radio Telescope Antenna

Dominic Dahinden, Oriane Robin, Joséphine Potdevin
dominic.dahinden@epfl.ch oriane.robin@epfl.ch josephine.potdevin@epfl.ch

February 22, 2022

(a) The detector (b) Final assembly of the antenna on the parabolic dish





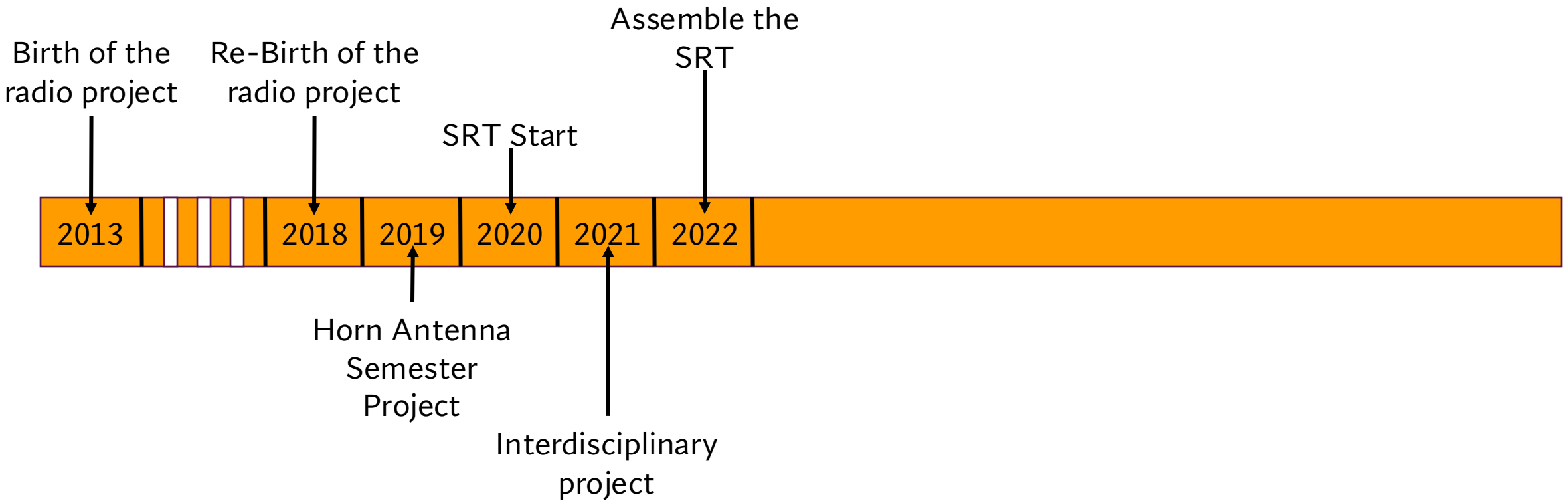
(a) Simulation results in terms of stresses (b) Simulation results in terms of displacement

Master Project - Mechanical Engineering

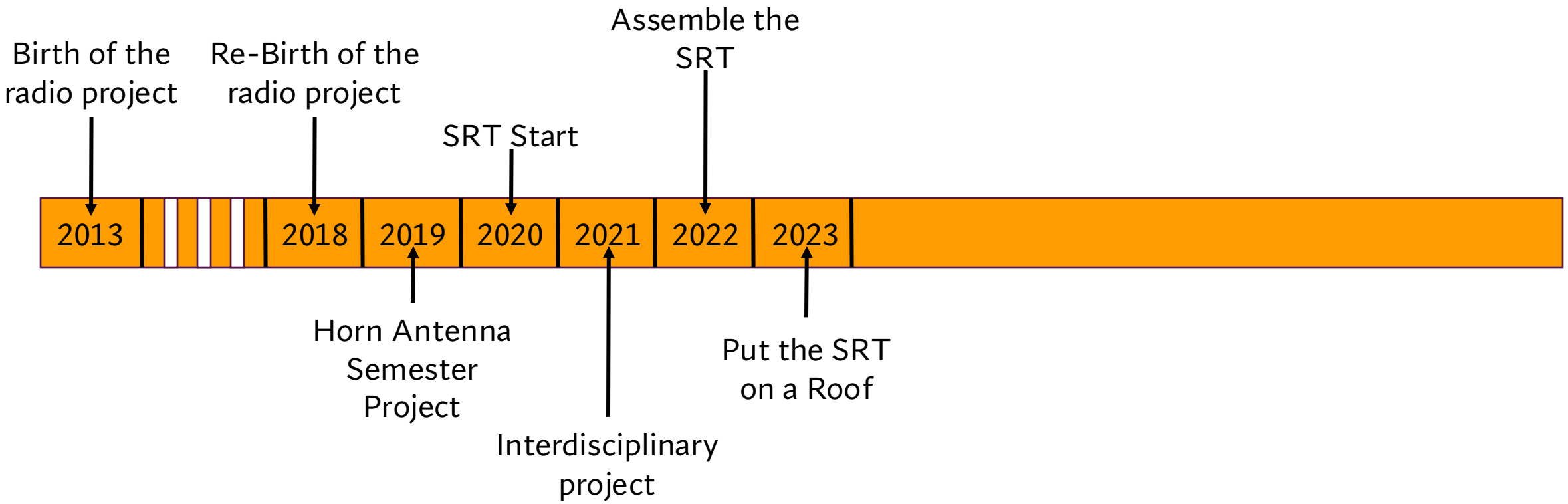
Radio Waves

Structure of a Small Radio Telescope

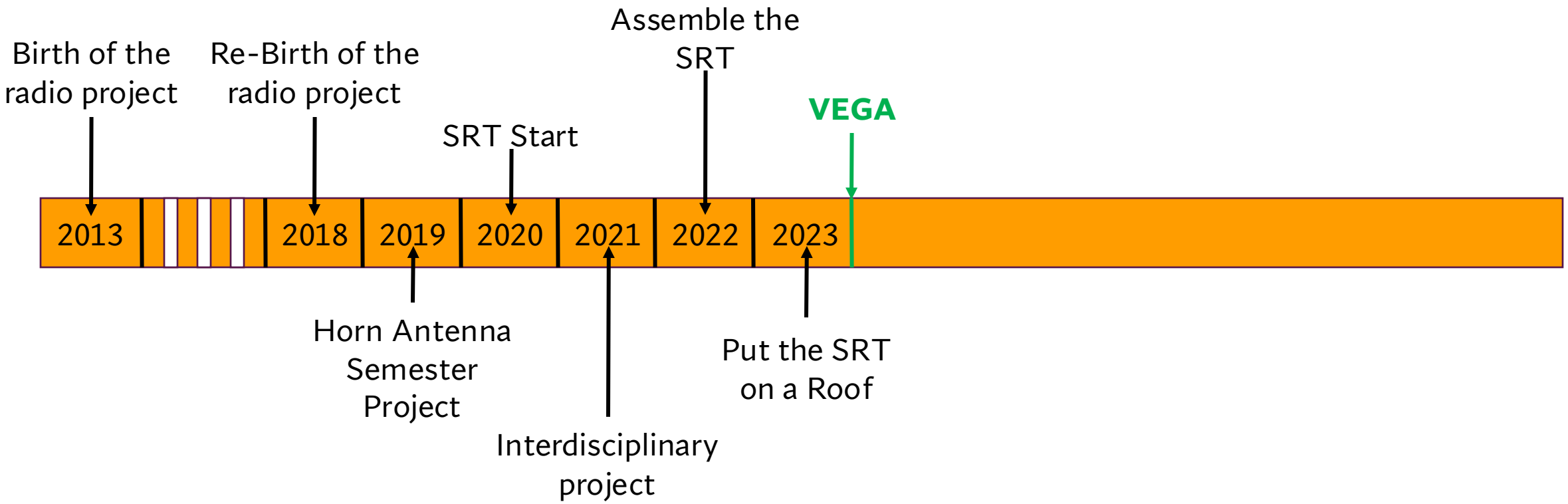
Timeline of the project



Timeline of the project



Timeline of the project

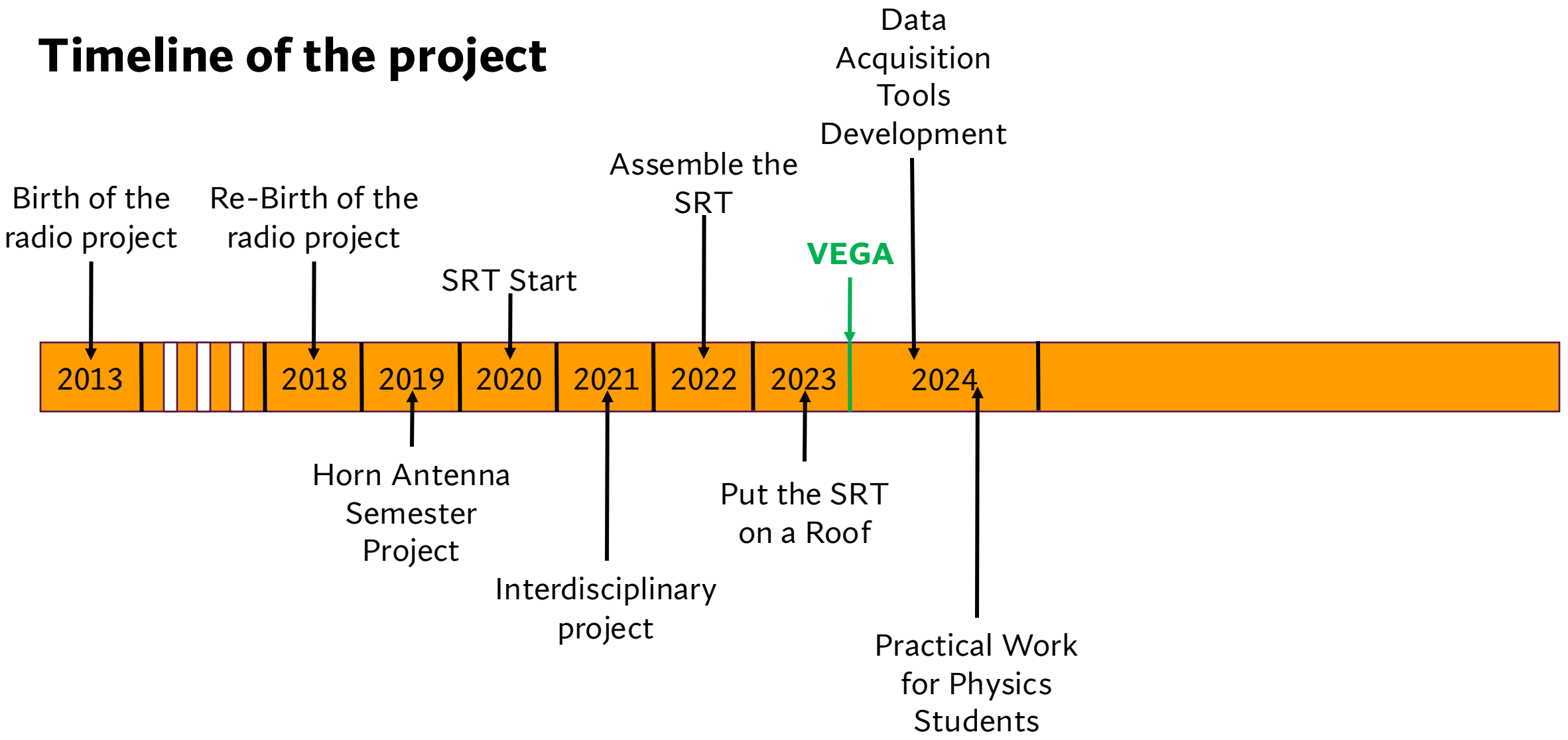


Birth of VEGA !

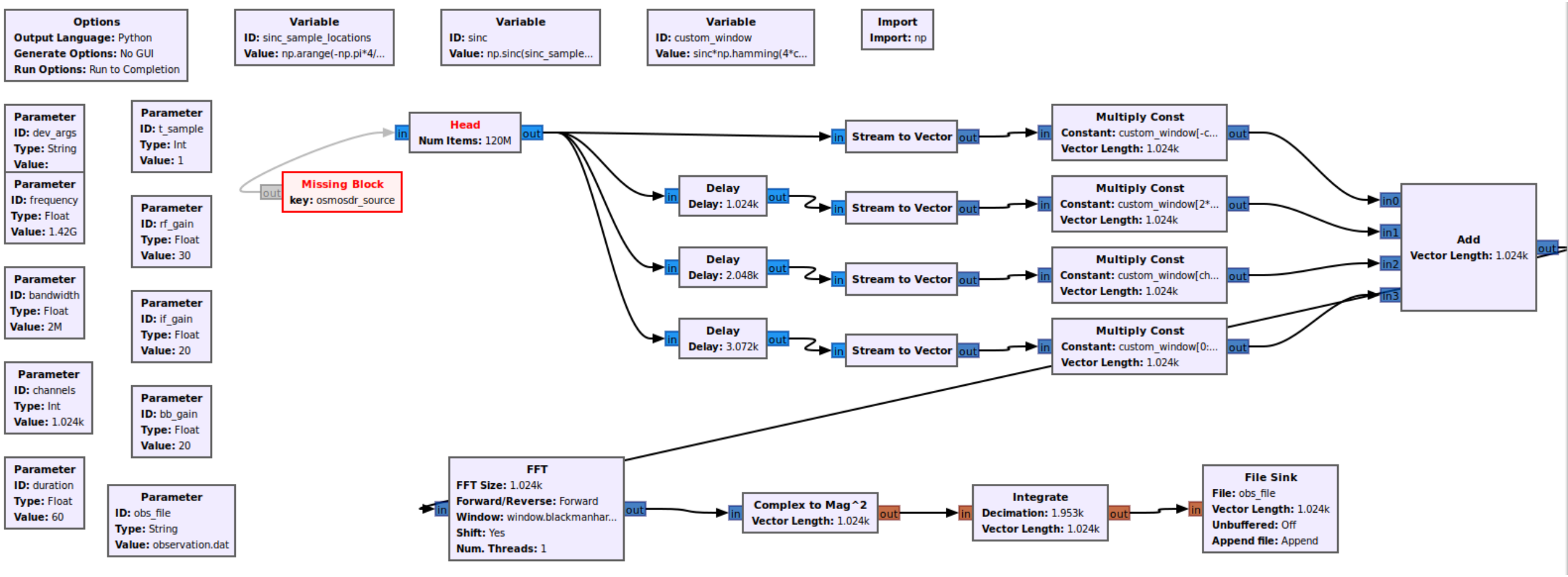
Very
Elegant
Galactic
Antenna

Dimitri Hollosi

Timeline of the project



Data Acquisition



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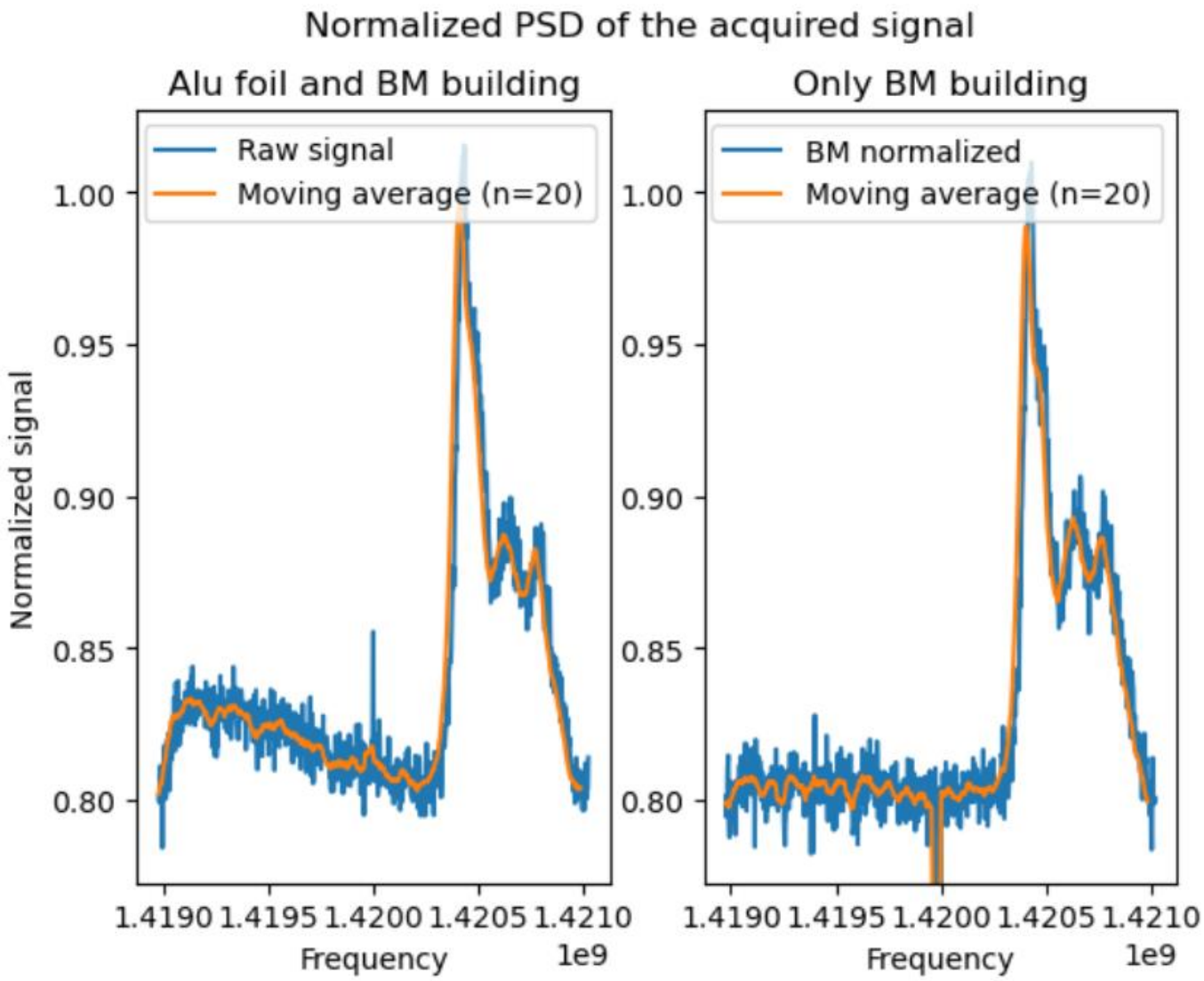

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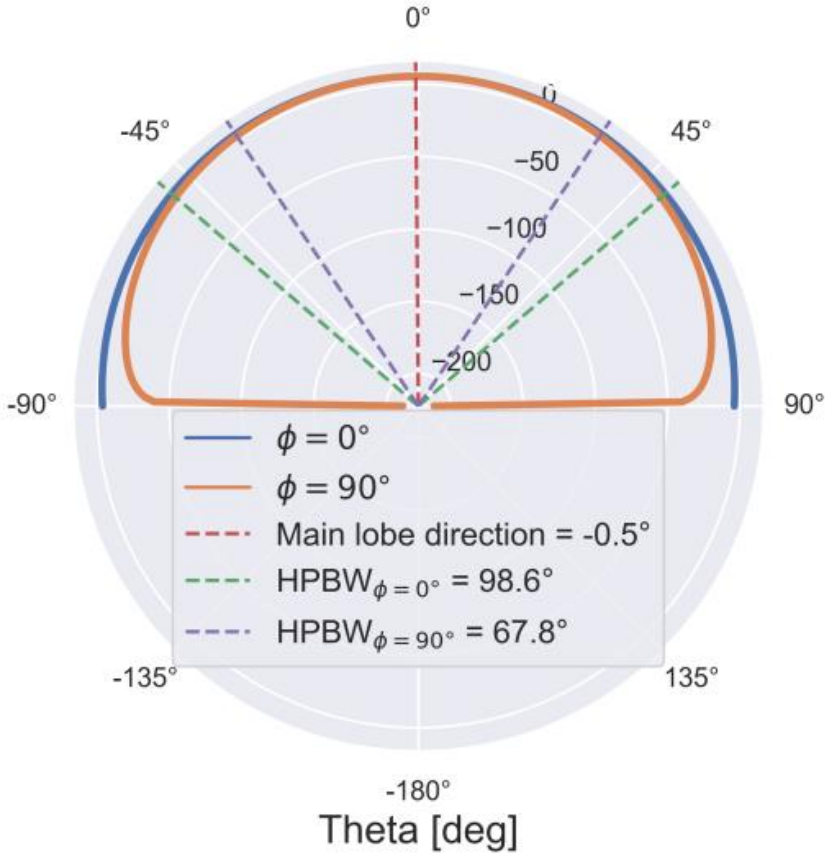
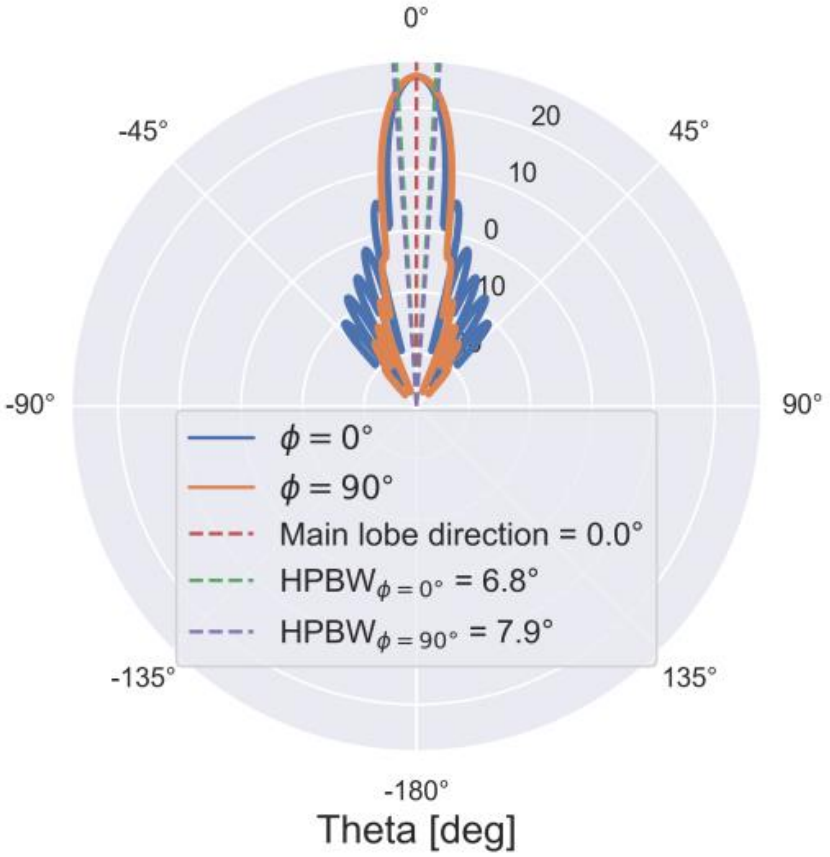
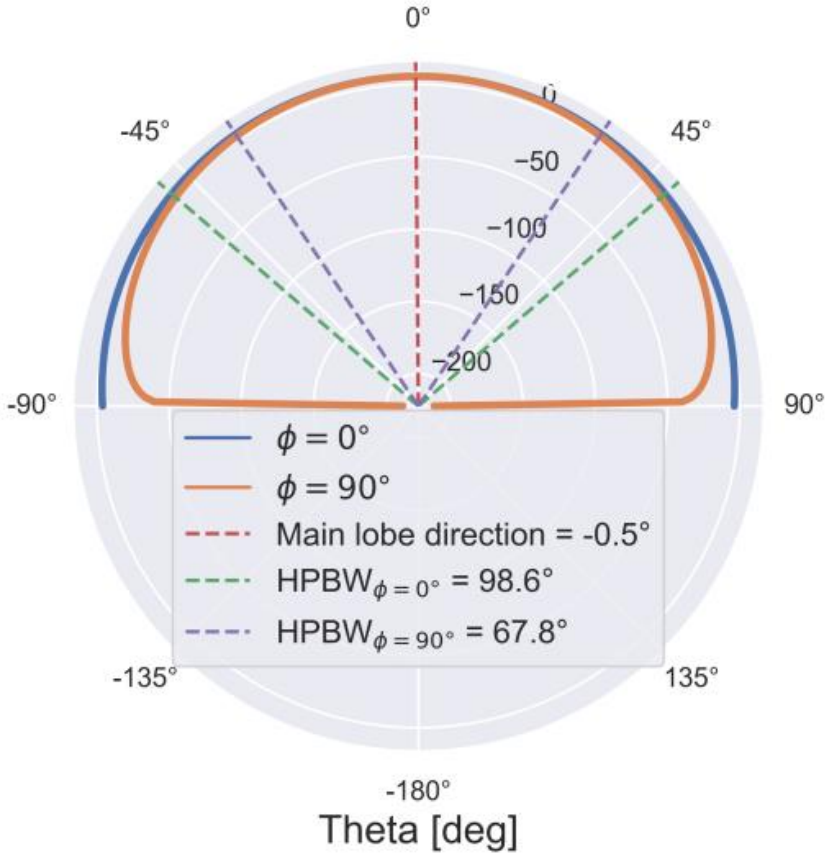


Helix alone

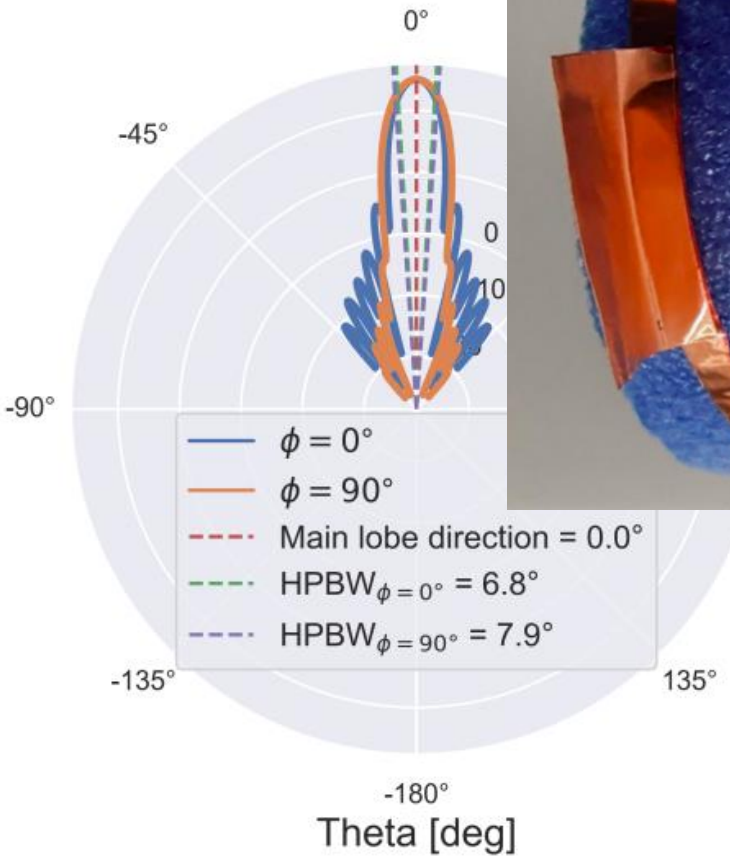


Helix + Dish

Data Acquisition

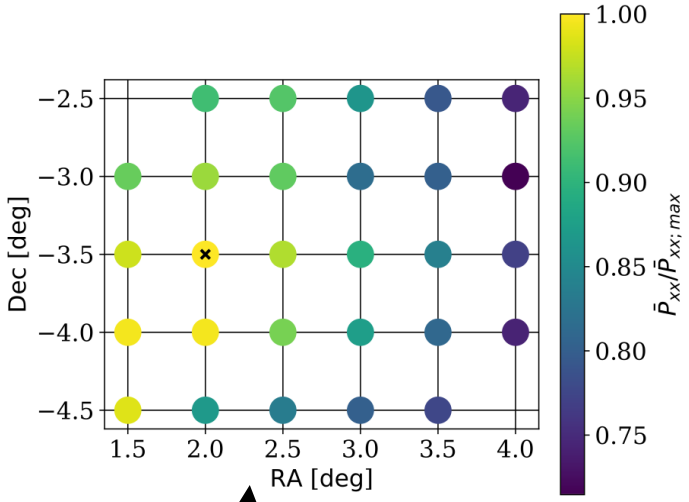


Helix alone



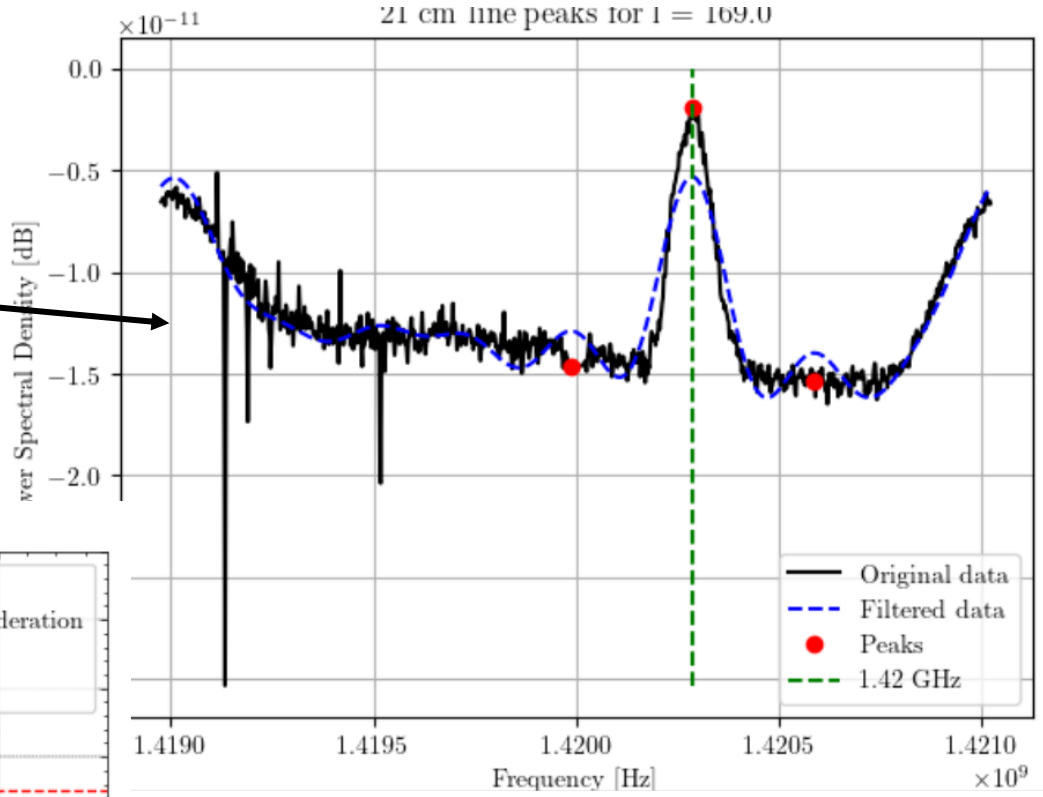
Helix + Dish

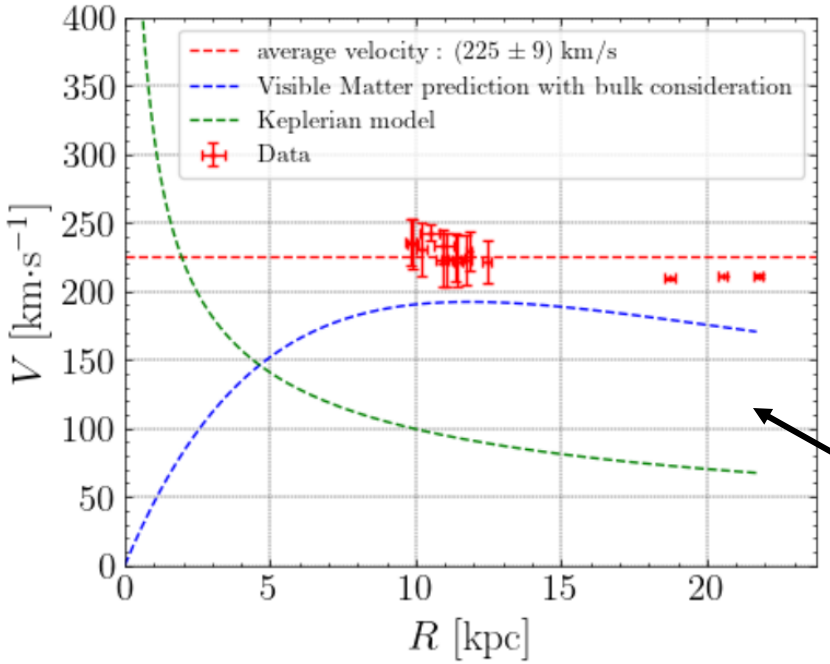
Practical Work for Physics Students



Pointing Calibration with the Sun

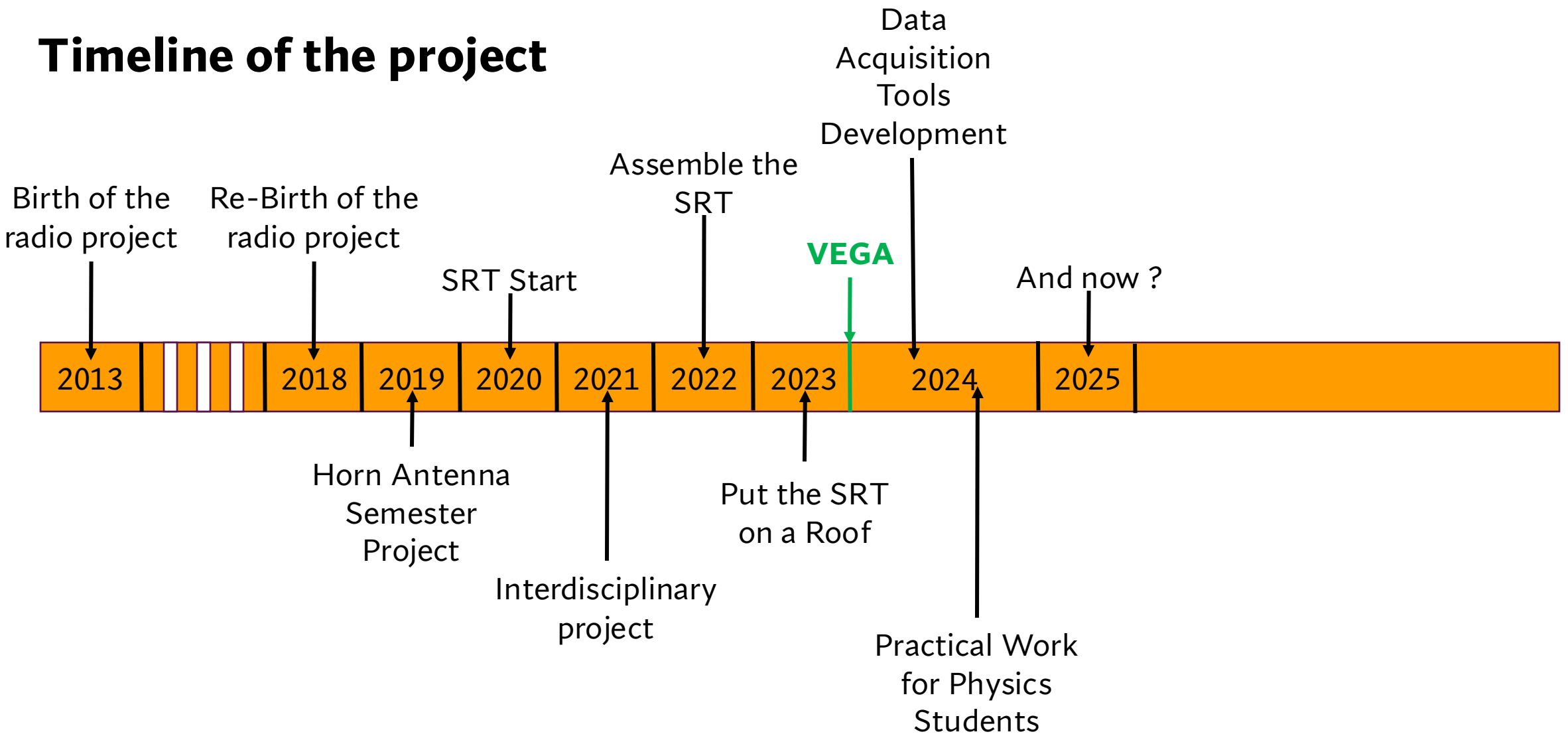
Signal Cleaning and H21cm Detection





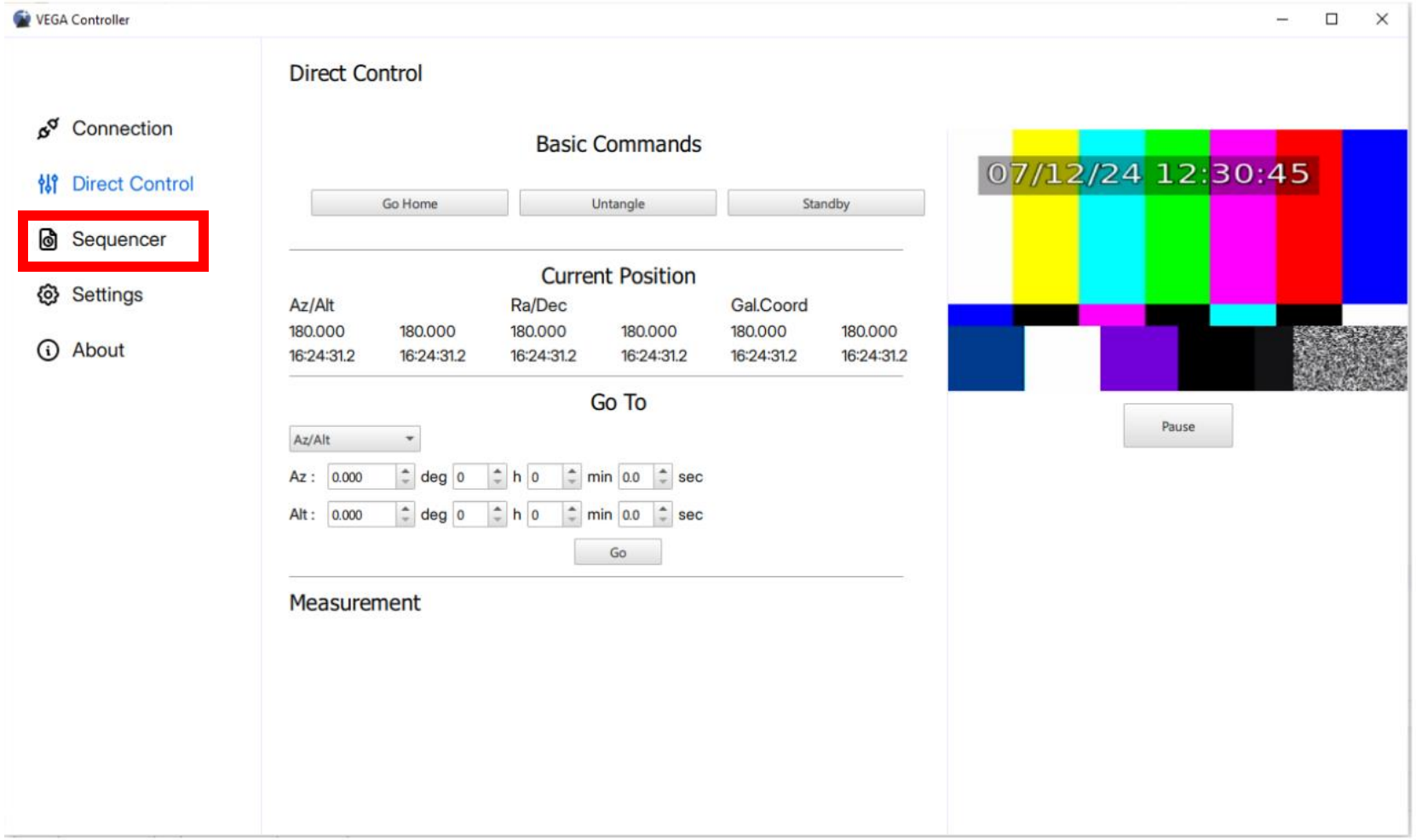
Velocity Curve of the Milky Way

Timeline of the project

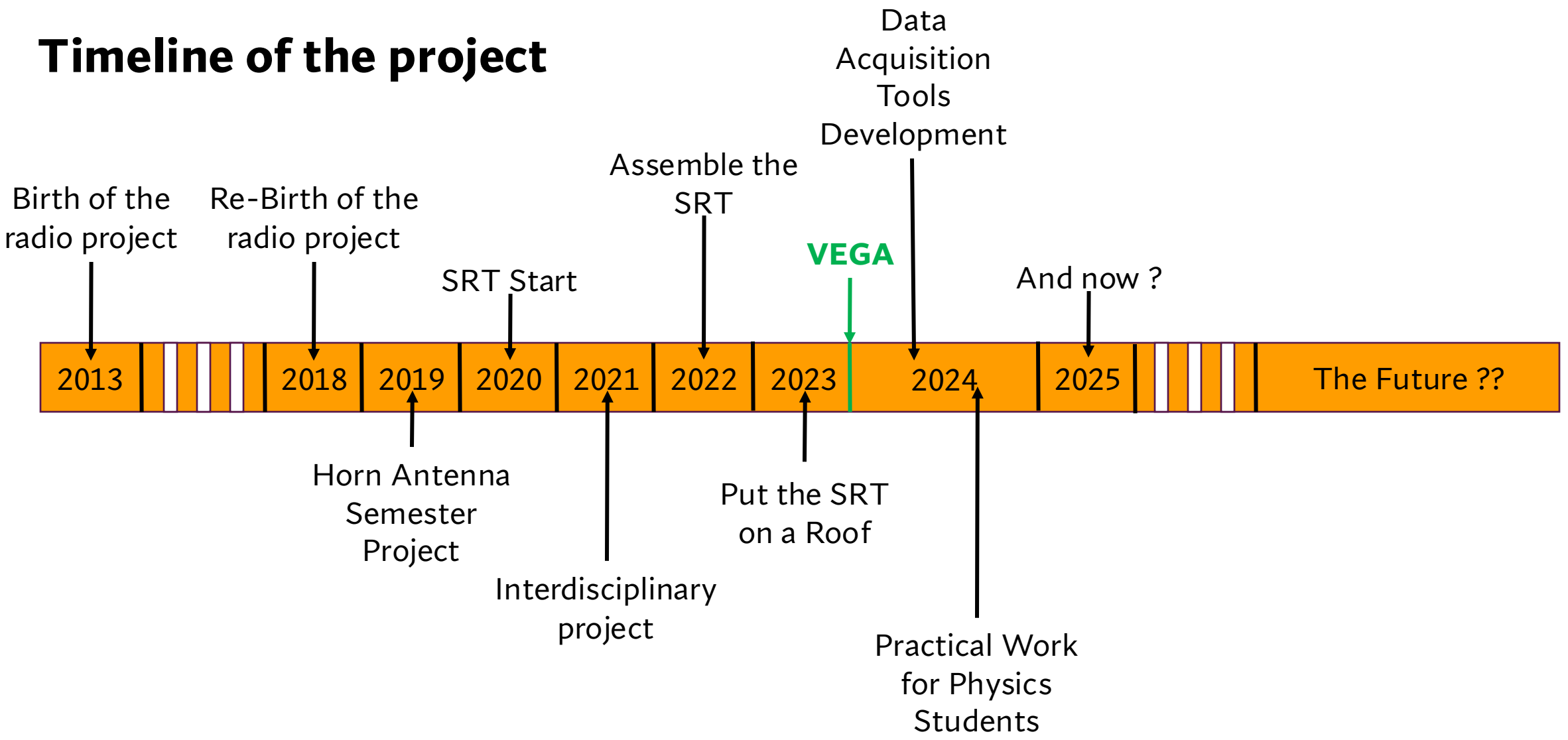


End of 2024

- Still doing Practical work
- Updating Tools



Timeline of the project

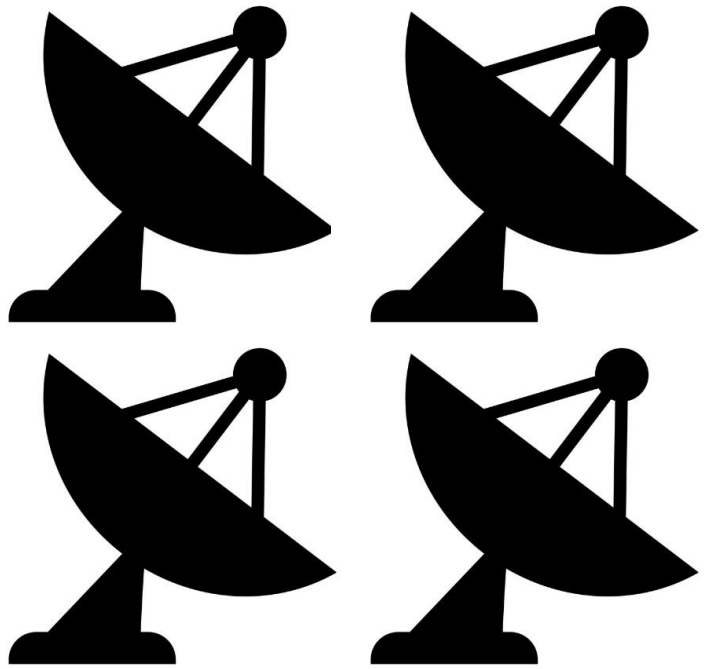


Future Projects

- **Update Feed**
  - Collab with EPFL Spacecraft Team
  - L-band + X-band feed

- **New Dish**
  - Sponsored by EPFL Physics Section

- **New project: SRI**
  - Small Radio Interferometer
  - Collab with: SKACH ?
  - Goal: Introduce students to radio interferometry



Thank you for your Attention