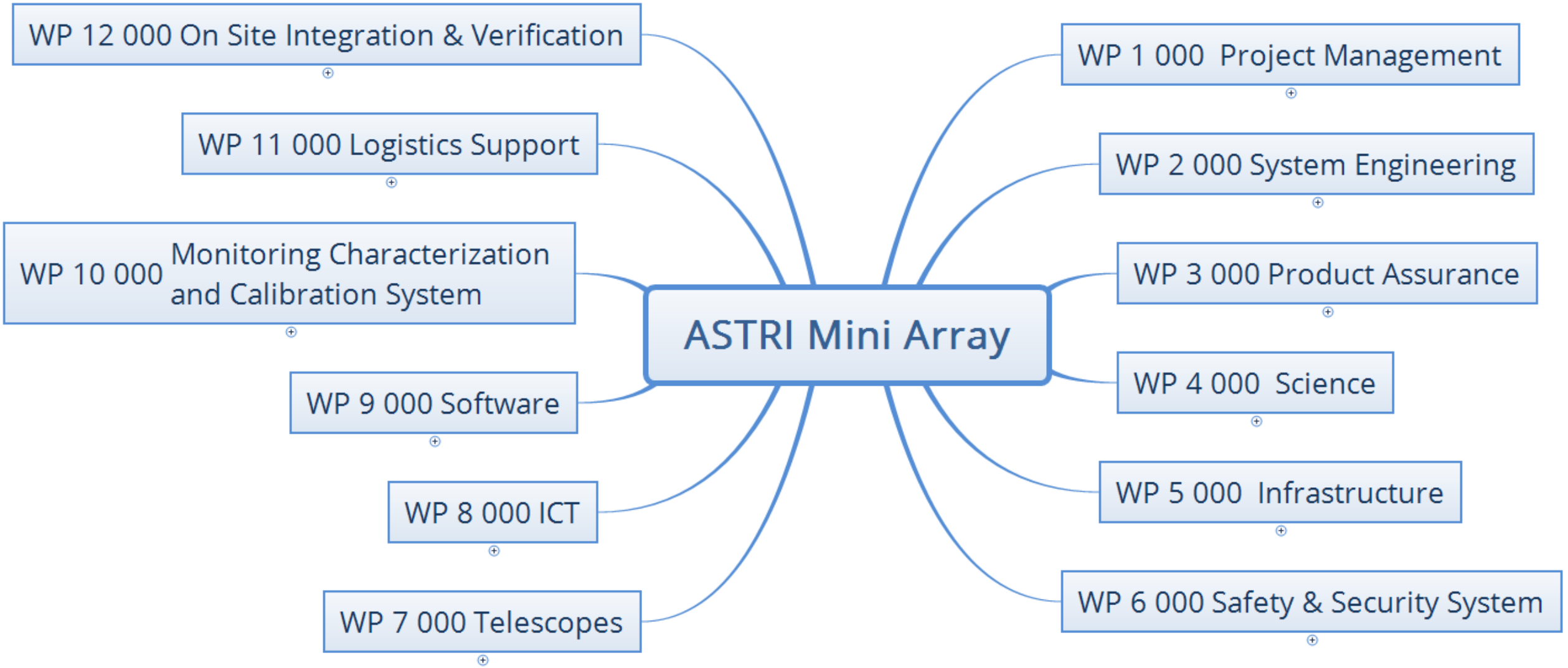
ASTRI Mini-Array Status & Implementation

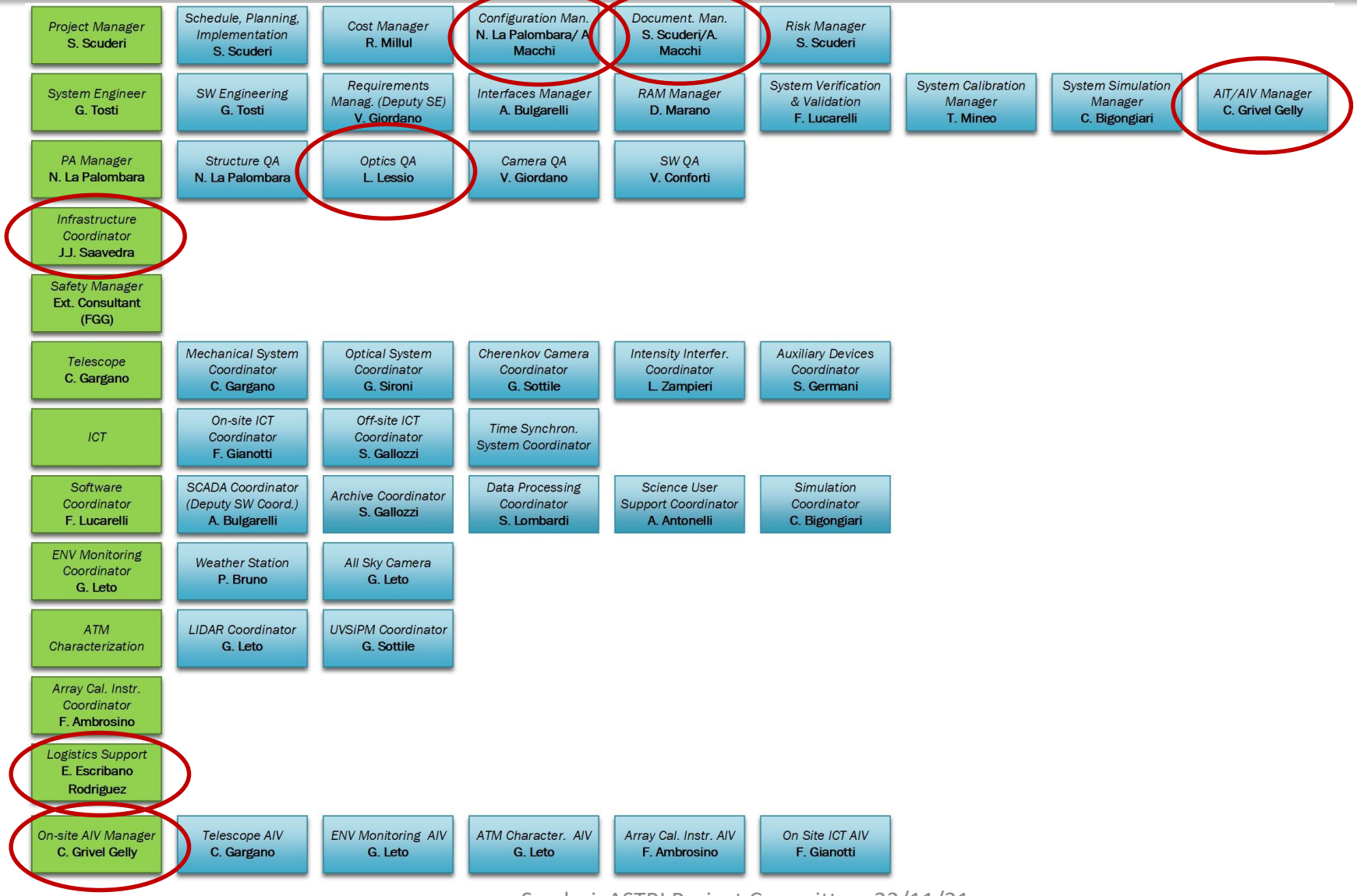
Salvo Scuderi – INAF/IASF Milano

ASTRI Project Committee 22/11/2021

WBS


ASTRI Mini Array
WP 12 000 On Site Integration & Verification
WP 11 000 Logistics Support
WP 10 000 Monitoring Characterization and Calibration System
WP 9 000 Software
WP 8 000 ICT
WP 7 000 Telescopes
WP 1 000 Project Management
WP 2 000 System Engineering
WP 3 000 Product Assurance
WP 4 000 Science
WP 5 000 Infrastructure
WP 6 000 Safety & Security System

Organization Breakdown Structure



WP5000 – Infrastructure

Mini-Array

ACTA DE REPLANTEO Y COMIENZO DE OBRA

Tipo de obra: Infraestructuras para los telescopios Astri Mini-Array

Emplazamiento: Observatorio del Teide. Izaña. Tenerife

Nº de licencia de obra: Decreto 2021-2752 (Excmo. Ayuntamiento de Güímar)

Redactor del Proyecto: Juan José Saavedra Gallo

En Observatorio del Teide, Izaña (Tenerife), a 4 de octubre de 2021

REUNIDOS

D. Ennio Poretti, con NIE Y6058191M, gerente y representante de la Fundación Galileo Galilei-INAF, Fundación Canaria (CIF ES G-38783312) como promotor

D. David Aguilar Casanova, con DNI 78608264Z, gerente y representante de VVO Construcciones y Proyectos SA (CIF: A-35091057) como empresa constructora

D. Juan José Saavedra Gallo, con DNI 42.933.155K, como director de obra y coordinador de seguridad y salud

MANIFIESTAN

1.- Que todos los agentes que lo firman, disponen del proyecto de ejecución redactado para la construcción de la obra y en base a la cual se ha otorgado la licencia municipal de obra.

2.- Que habiendo procedido el constructor al replanteo de la obra proyectada, el director de la obra a la comprobación de dicho replanteo y a su verificación con relación a la documentación incluida en el proyecto, no aprecian ningún impedimento que impida el comienzo y desarrollo de la obra.

3.- Que el plan de seguridad y salud en el trabajo ha sido aprobado por el coordinador de seguridad y salud durante la ejecución de la obra.

4.- Que el constructor declara encontrarse en condiciones de iniciar los trabajos contratados.

5.- Que todos los agentes acuerdan el comienzo de la obra con fecha **4 de octubre de 2021**.

Y para que conste y sirva como justificante del inicio de la obra en los términos establecidos en la Ley de Ordenación de la Edificación, todos ellos firman de común acuerdo el presente acta, por triplicado ejemplar, en el lugar y fecha indicados.

El promotor

Ennio Poretti

Firmato digitalmente da Ennio Poretti
Data: 2021.10.04 16:31:30 +02'00'

Ennio Poretti

El constructor

AGUILAR CASANOVA DAVID - 78608264Z

Firmado digitalmente por AGUILAR CASANOVA DAVID - 78608264Z

David Aguilar Casanova

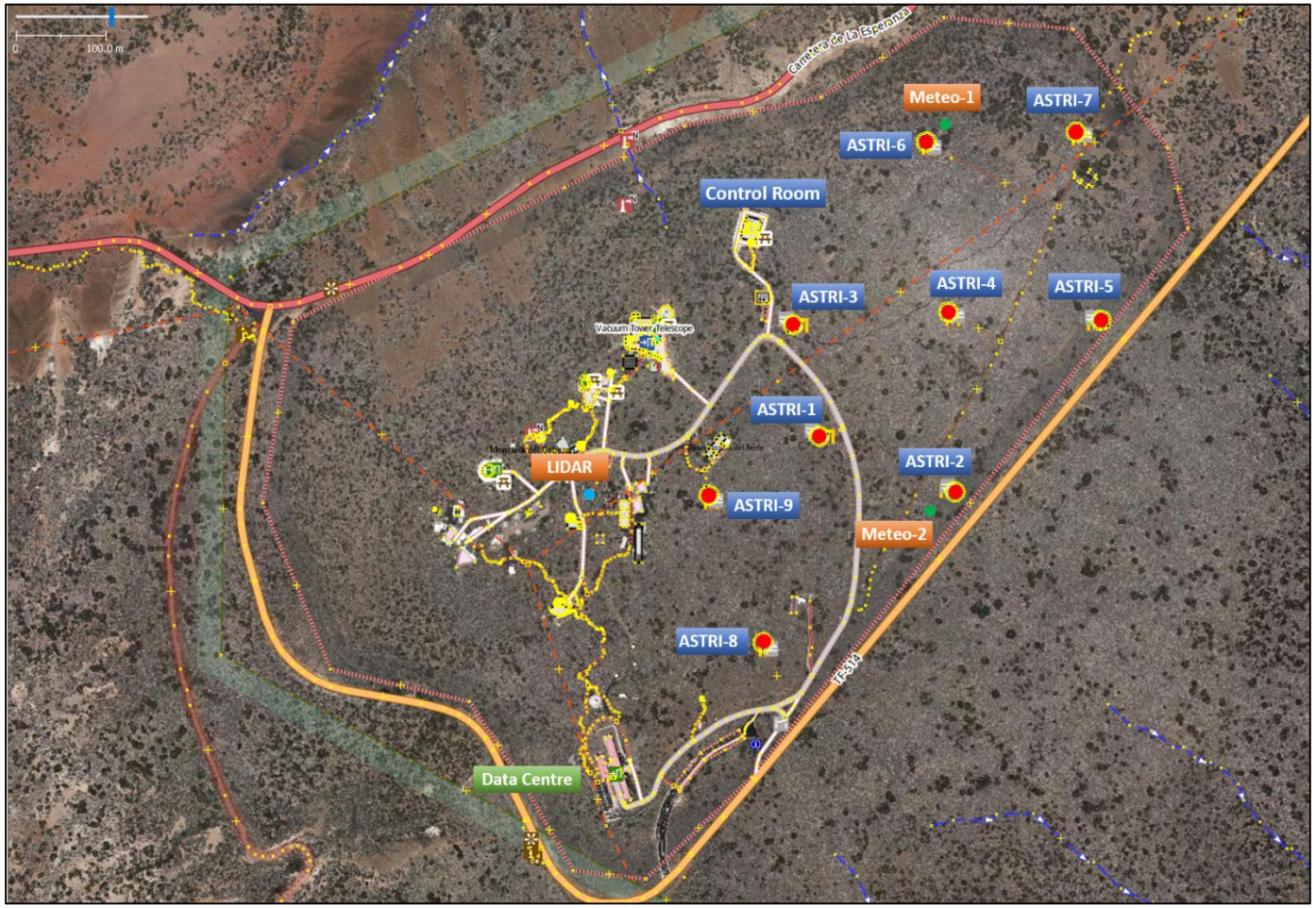
El director de obra y coordinador de seguridad y salud

SAAVEDRA GALLO JUAN JOSE - 42933155K

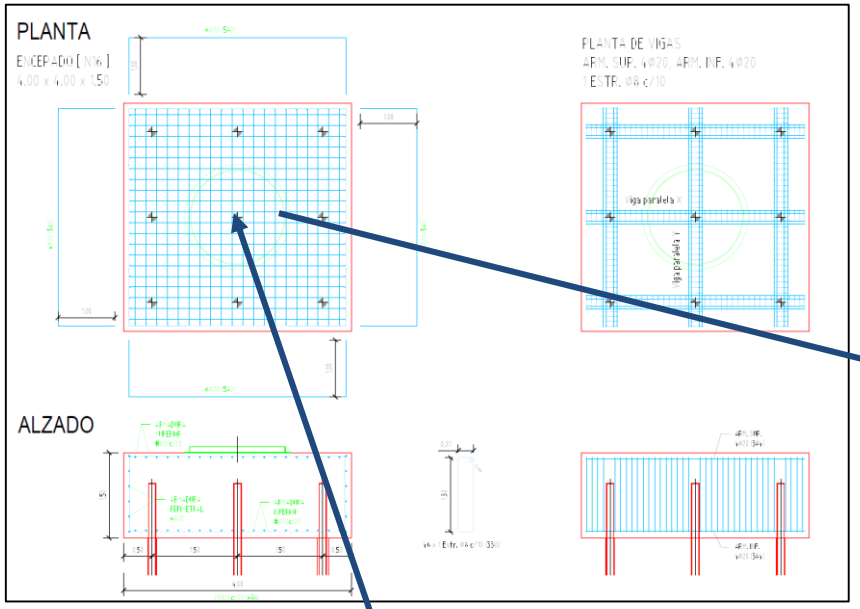
Juan José Saavedra Gallo

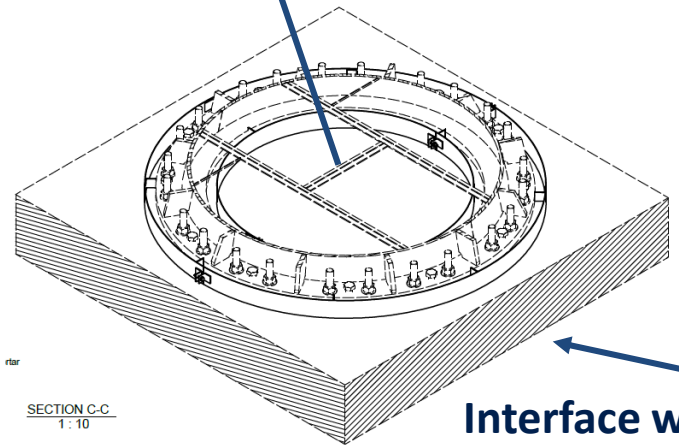
WP5000 – Infrastructure

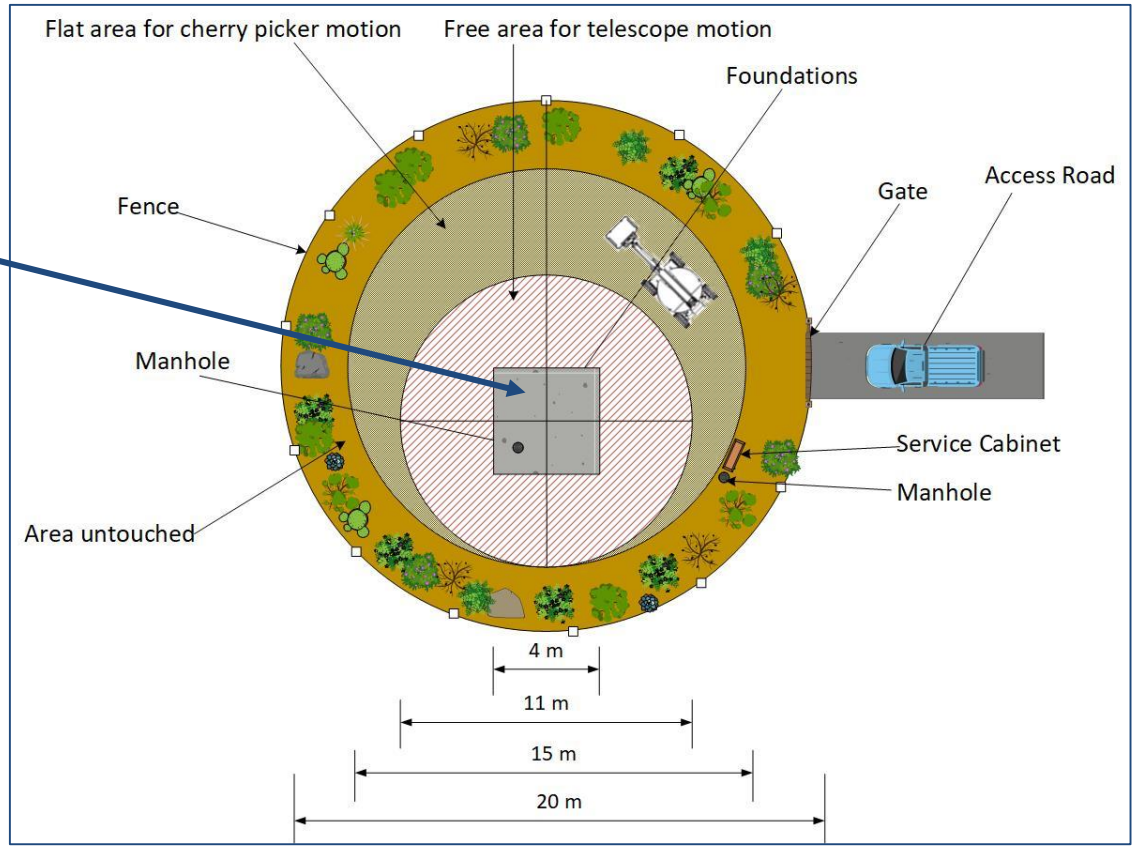
- 5 Infrastructure
  - 5. 1 Civil Infrastructures
  - 5. 2 Power Supply Network
  - 5. 3 Data Networks
  - 5. 4 Control Room @ THEMIS
  - 5. 5 Data Centre @ Residencia OT
  - 5. 6 Service Cabinets
  - 5. 7 Facilities @ IAC La Laguna



WP5000 – Foundations

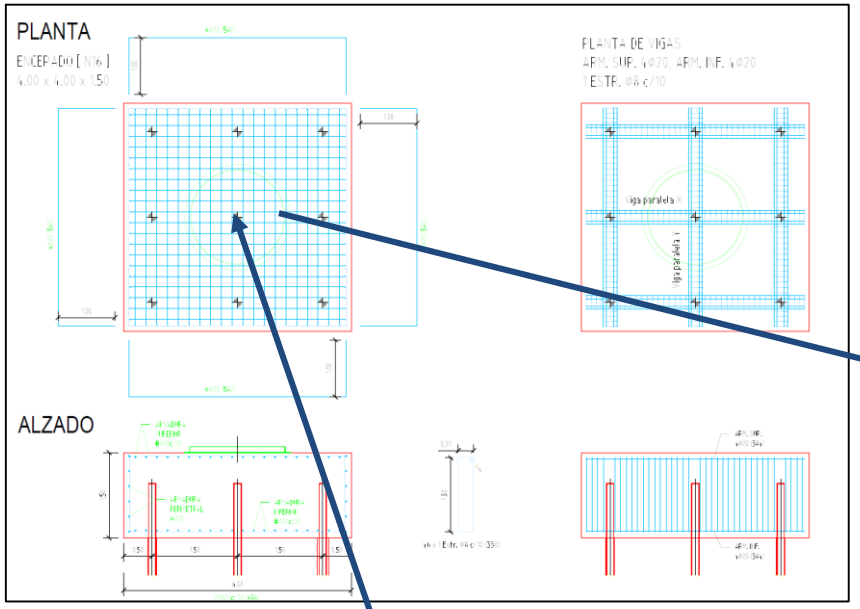


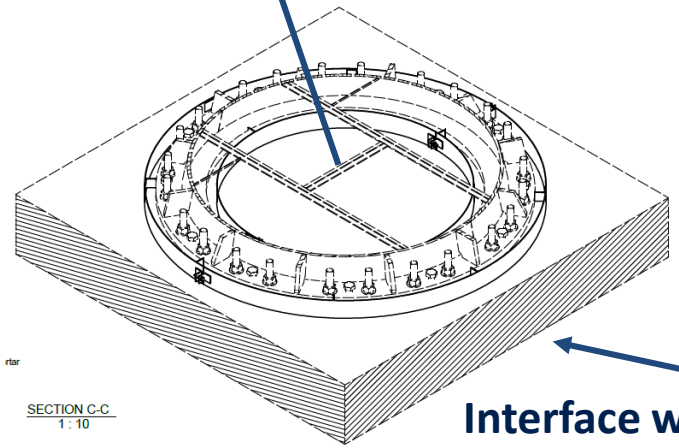


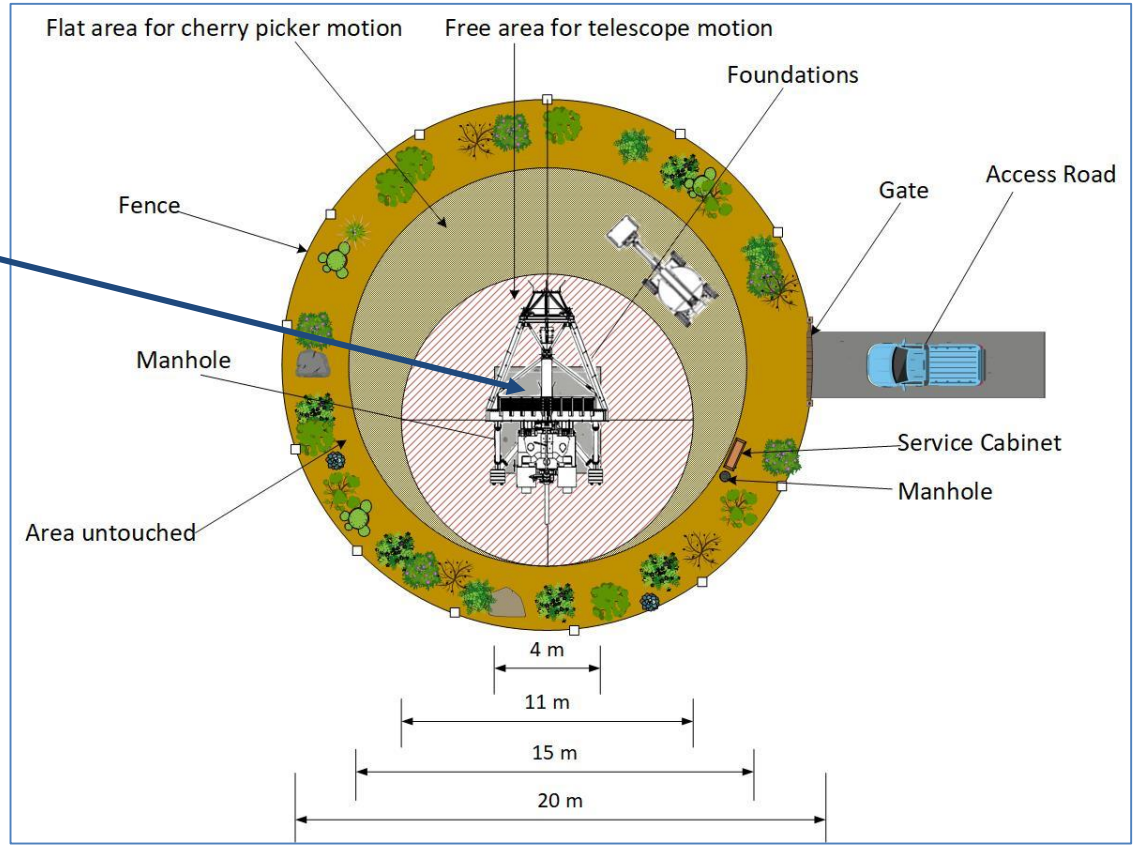


Interface with telescopes

WP5000 – Foundations

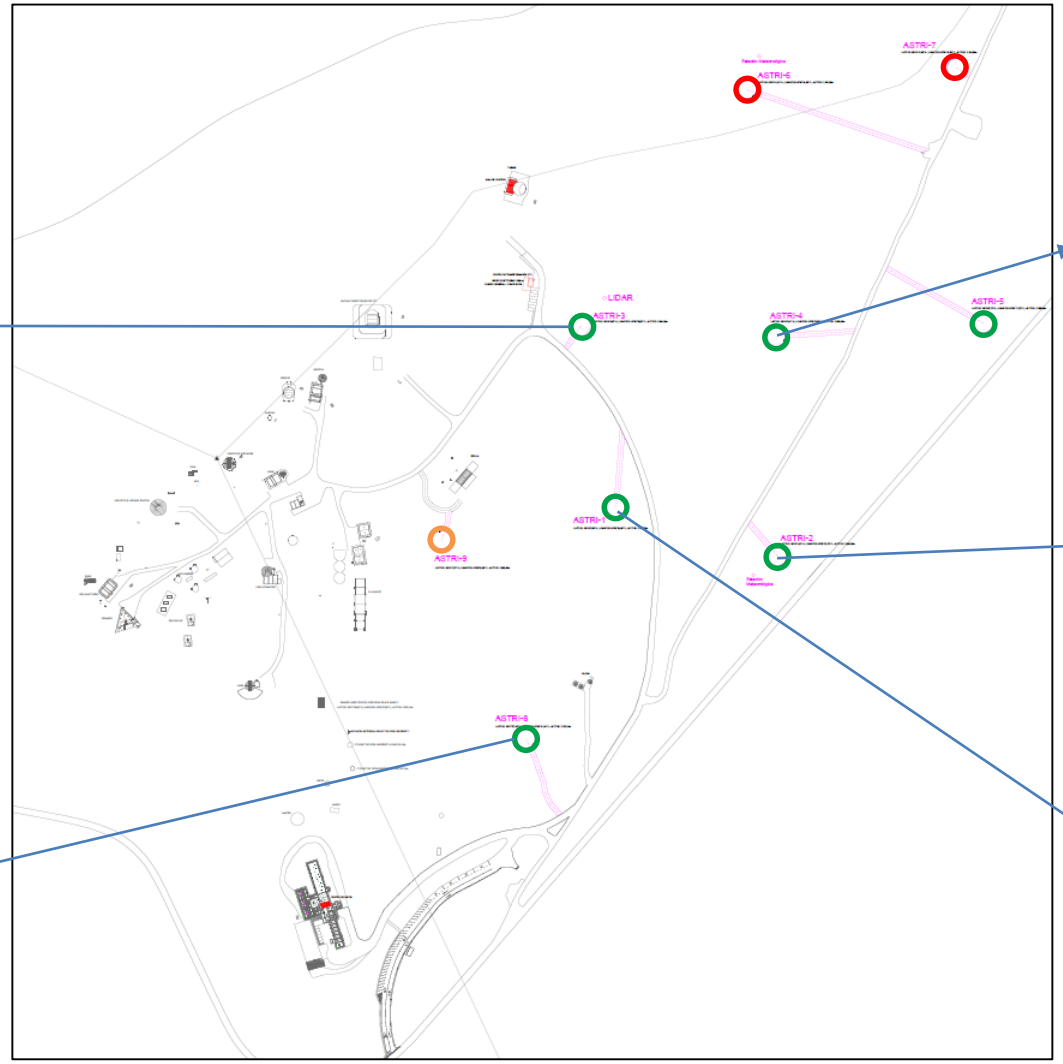




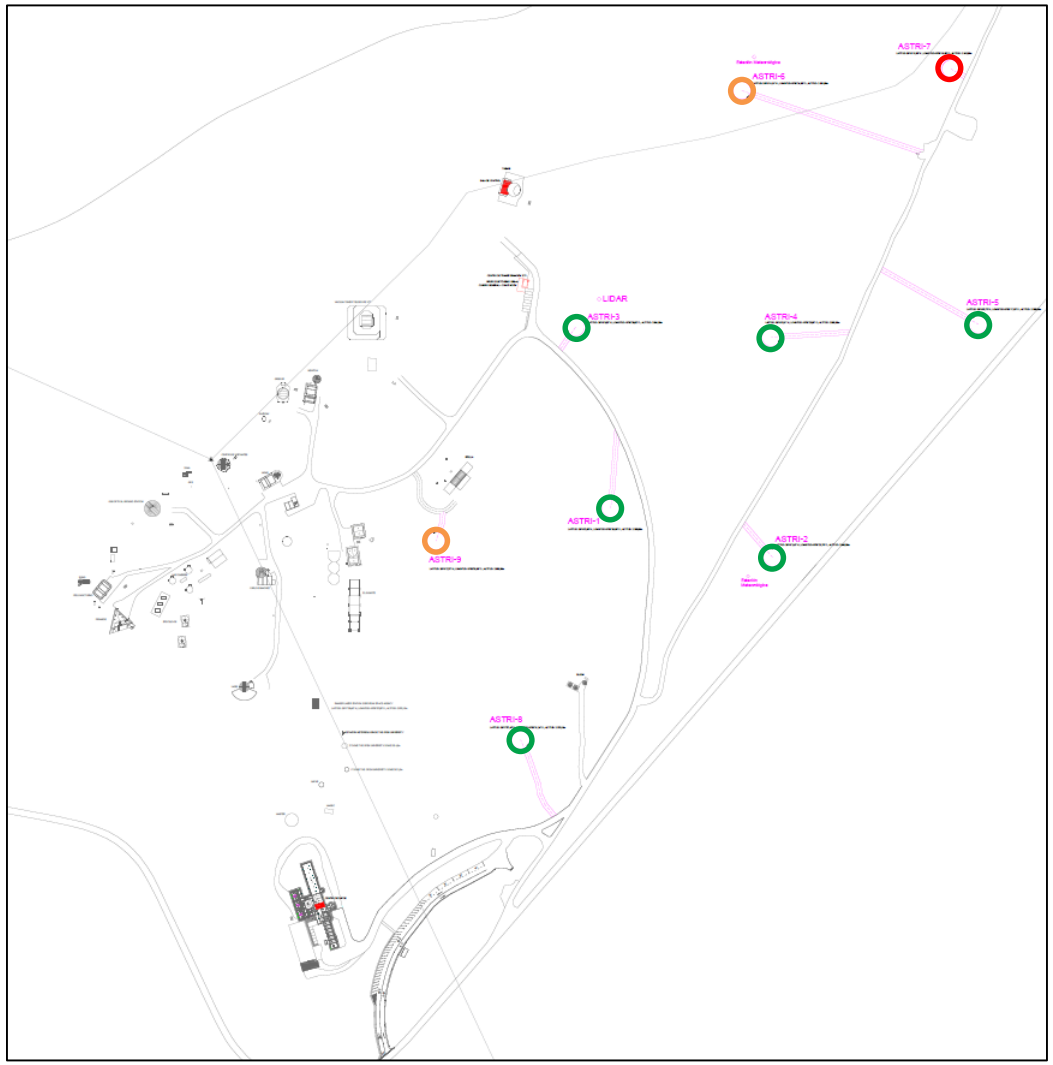


Interface with telescopes

WP5000 – Foundations

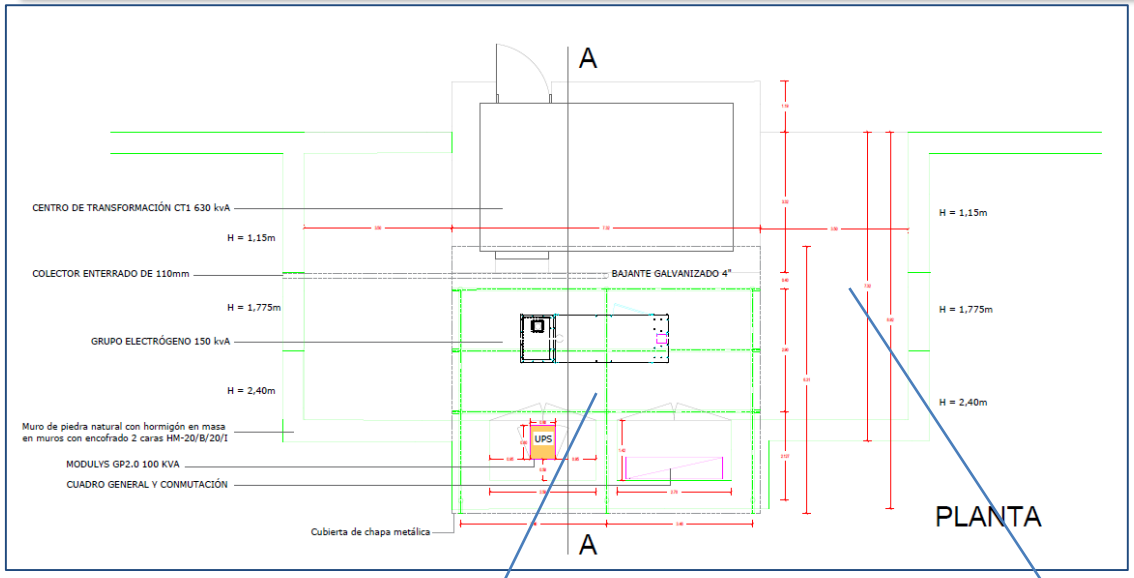


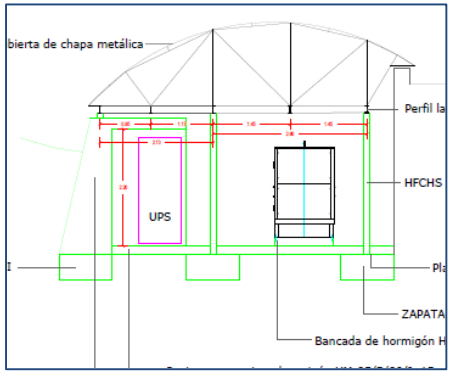
WP5000 – Foundations



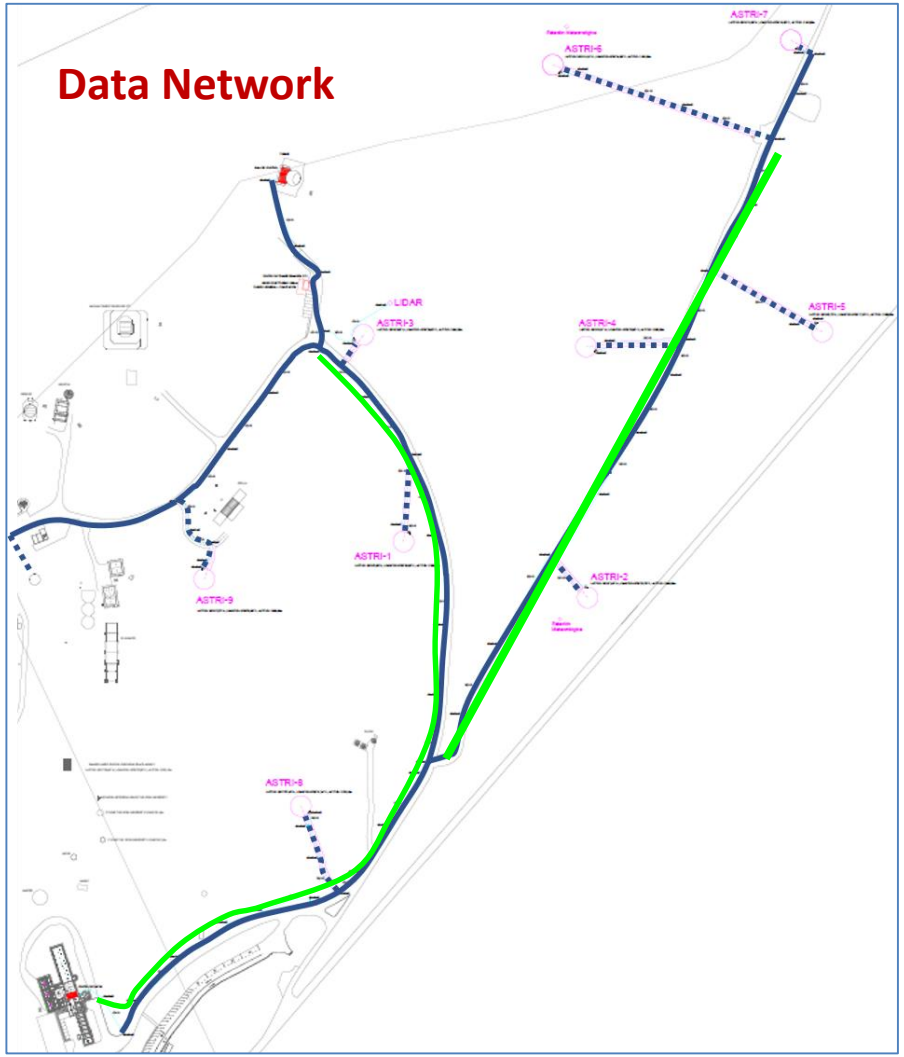
- ASTRI-1 → ready for micropiles
- ASTRI-2 → consolidate ground to host micropiles
- ASTRI-3 → consolidate ground to host micropiles
- ASTRI-4 → ready for micropiles
- ASTRI-5 → consolidate ground to host micropiles
- ASTRI-6 → works will start after OK for change design in power network layout
- ASTRI-7 → waiting for IAC topographical survey
- ASTRI-8 → consolidate ground to host micropiles
- ASTRI-9 → new foundation design due to characteristics of underground soil (no rocks down to 15 metres)

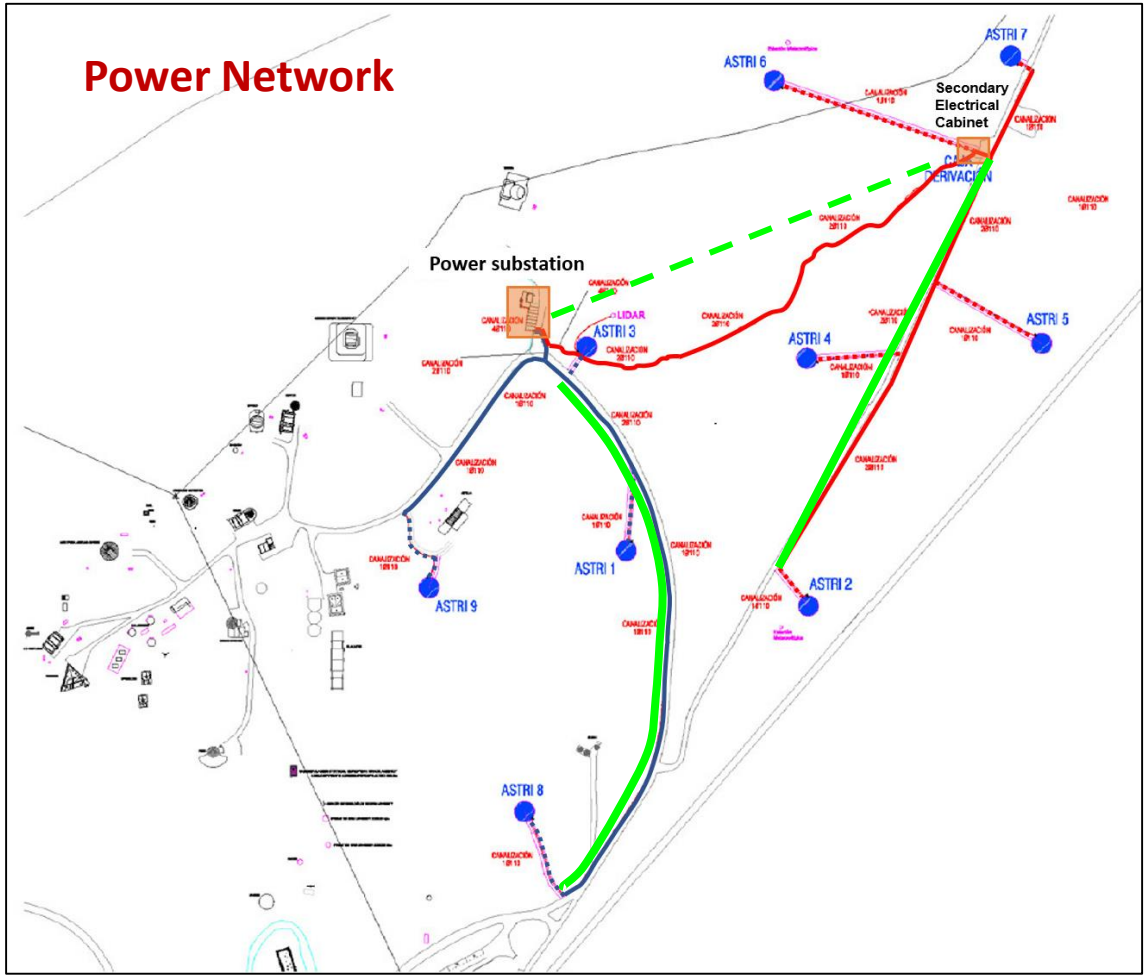
WP5000 – Power station





WP5000 – Power & Data networks



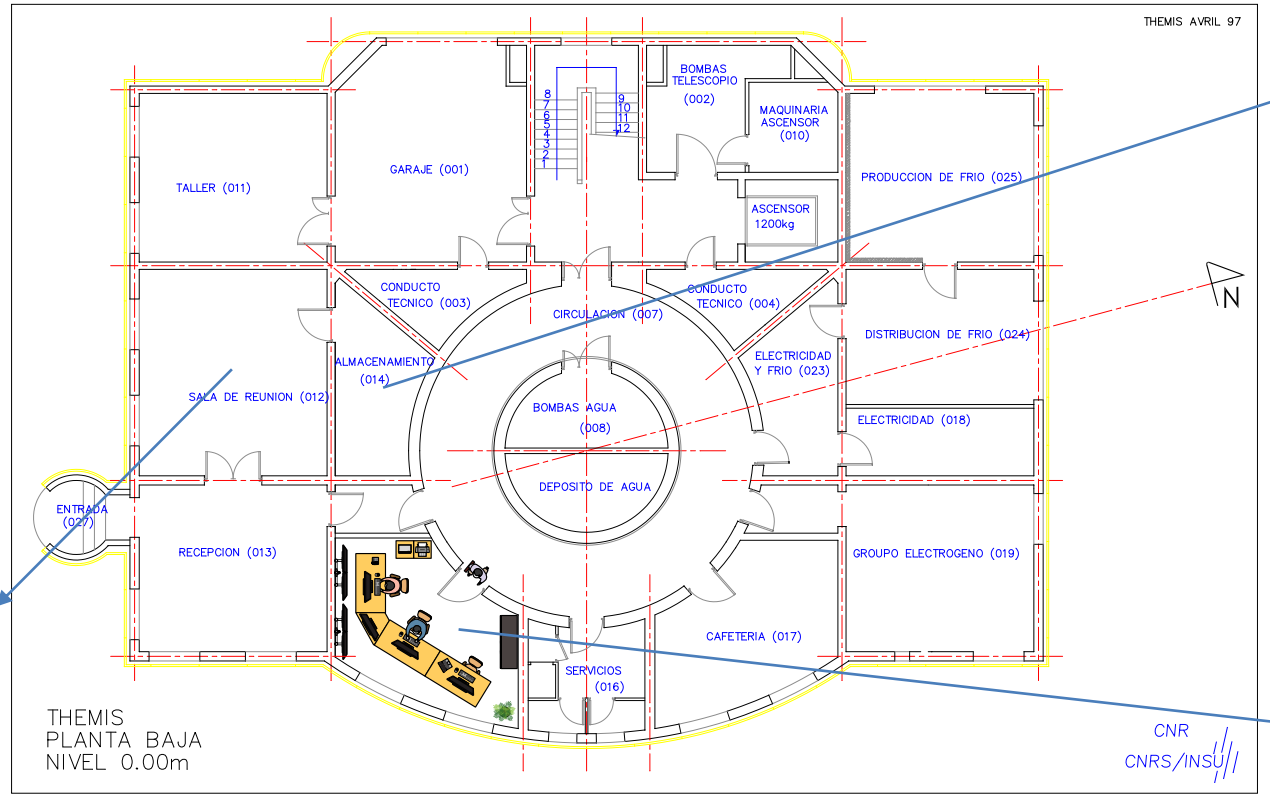


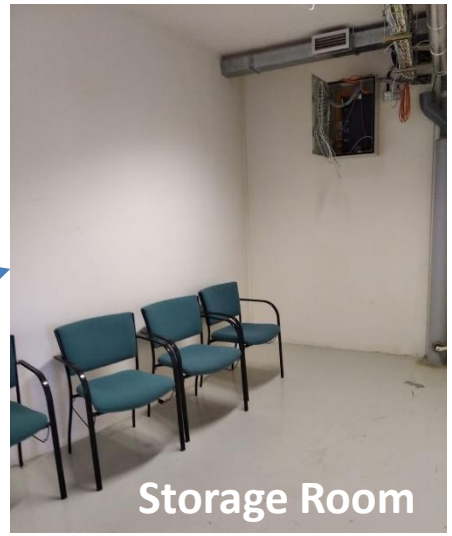
WP5000 – Power & Data networks

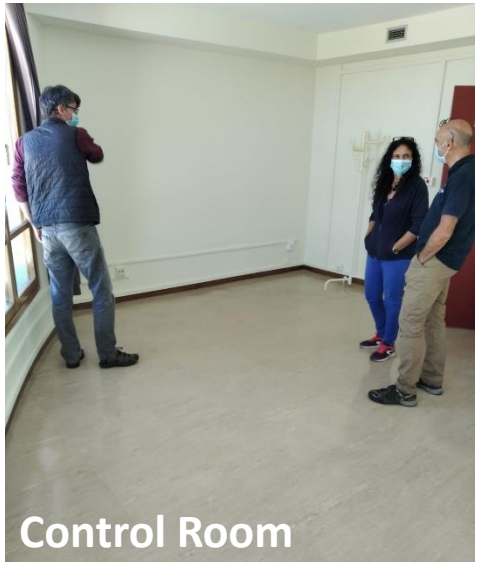
From data centre to ASTRI-1

From ASTRI-2 to ASTRI-6

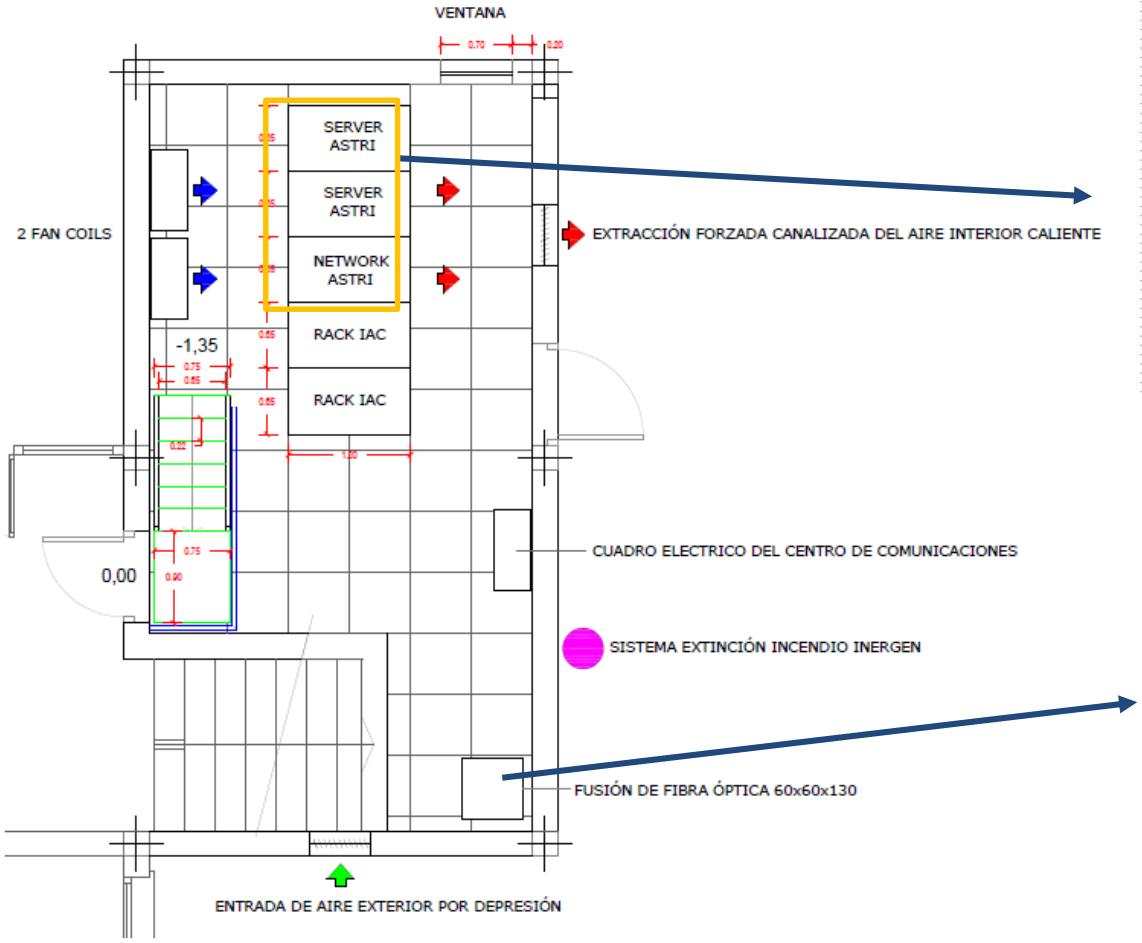
WP5000 – Control room @ THEMIS

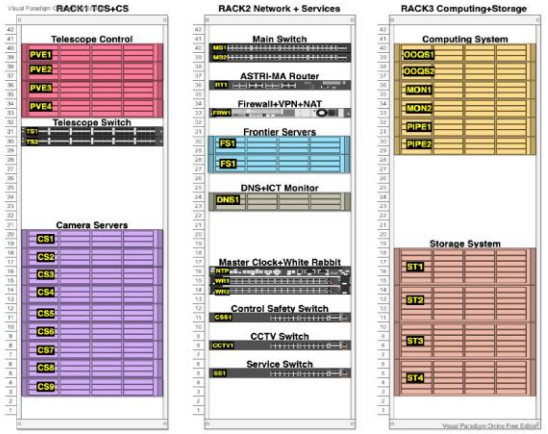


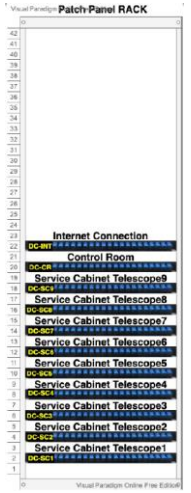




WP5000 – Data Centre







WP5000 – Care of Environment

Continuous contact with botanist (C. Amarin) *Medio Ambiente* to address and resolve any issue related to protected species of plants (*Retama*) in the areas of construction.

- ***Replanting (young plants)***
- ***Keeping in place (treat affected roots and branches)***
- ***Removing (old plants > 4 years)***
- ***Planting new specimen***

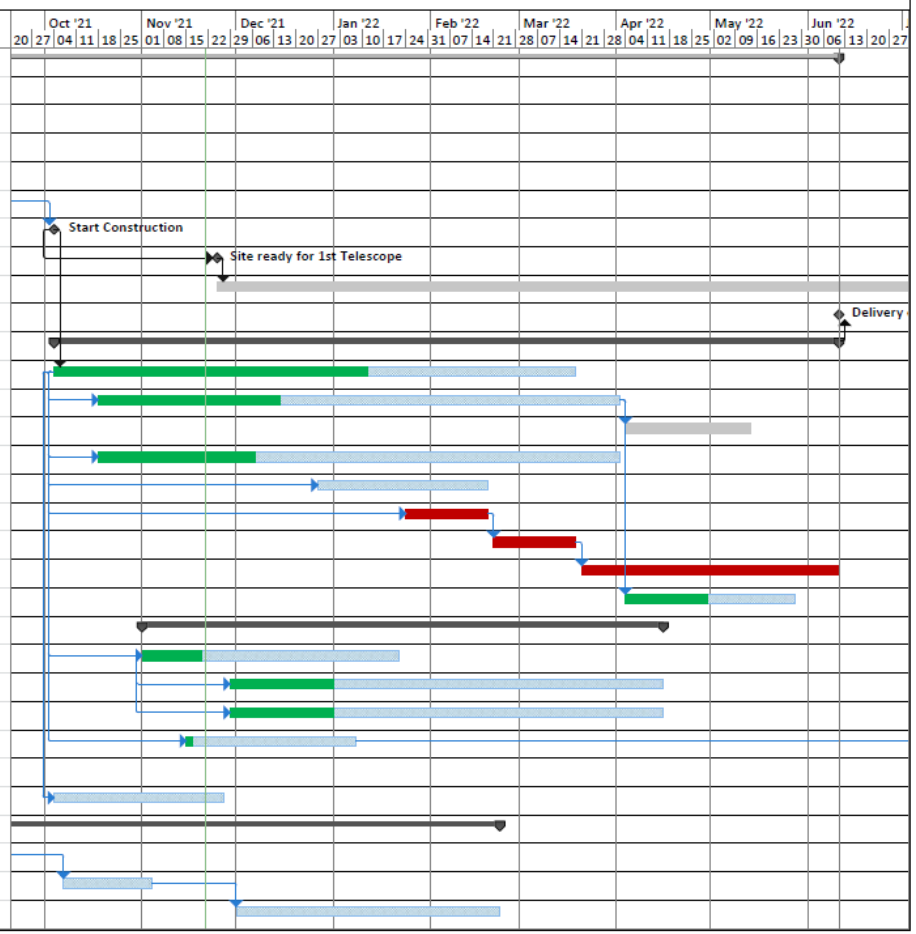
WP5000 – Infrastructure

Title: ASTRI mini-array schedule
Date: Sun 21/11/21
Page 1 of 2

ASTRI Mini-Array Construction Project

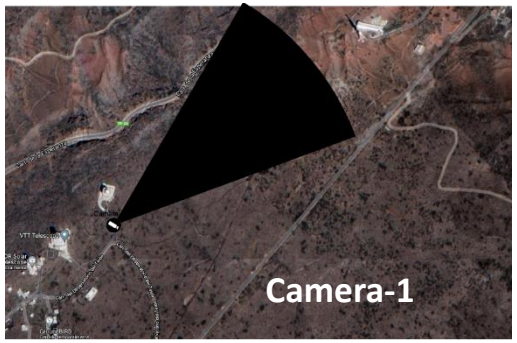
INAF ISTITUTO NAZIONALE DI ASTROFISICA NATIONAL INSTITUTE FOR ASTROPHYSICS

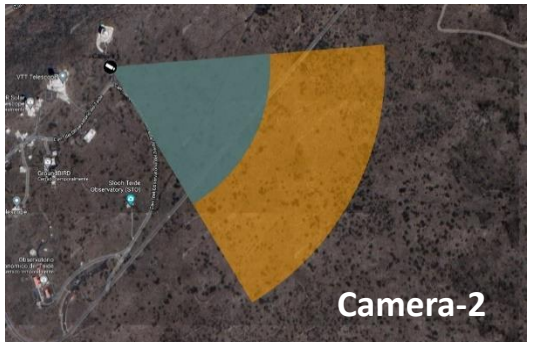
ID	Task Name	Start	Finish	Duration
0	**Infrastructure**	**Mon 16/03/20**	**Fri 10/06/22**	**585 days**
1	General design	Mon 16/03/20	Thu 10/09/20	6,45 mons
2	Tenerife Cabildo Approval	Fri 11/09/20	Wed 28/10/20	1,7 mons
3	INAF approval of general de:	Fri 11/09/20	Mon 12/04/21	7,6 mons
4	Permissions to build	Tue 13/04/21	Thu 22/07/21	3,65 mons
5	Tender Process	Fri 23/07/21	Wed 11/08/21	14 days
6	Start Construction	Mon 04/10/21	Mon 04/10/21	0 days
7	Site ready for 1st Telescope	Wed 24/11/21	Wed 24/11/21	0 days
8	SAF Implementation	Thu 25/11/21	Wed 06/07/22	8 mons
9	Delivery of the Infrastructur	Fri 10/06/22	Fri 10/06/22	0 days
10	**Civil Works**	**Mon 04/10/21**	**Fri 10/06/22**	**180 days**
11	Earthmoving work	Mon 04/10/21	Fri 18/03/22	6 mons
12	Foundations	Mon 18/10/21	Fri 01/04/22	6 mons
13	Weather Stations AIT	Mon 04/04/22	Fri 13/05/22	1,5 mons
14	Trenches, pit, manholes	Mon 18/10/21	Fri 01/04/22	6 mons
15	Structures	Mon 27/12/21	Fri 18/02/22	2 mons
16	Bricklaying	Mon 24/01/22	Fri 18/02/22	1 mon
17	Floors	Mon 21/02/22	Fri 18/03/22	1 mon
18	Hardware	Mon 21/03/22	Fri 10/06/22	3 mons
19	Access Roads	Mon 04/04/22	Fri 27/05/22	2 mons
20	**Power supply network**	**Mon 01/11/21**	**Fri 15/04/22**	**120 days**
21	Medium voltage network	Mon 01/11/21	Fri 21/01/22	3 mons
22	Low voltage network	Mon 29/11/21	Fri 15/04/22	5 mons
23	**Data networks**	Mon 29/11/21	Fri 15/04/22	5 mons
24	**Data centre @ Residencia O**	Mon 15/11/21	Fri 07/01/22	2 mons
25	Onsite ICT AIT/AIV	Wed 13/07/22	Tue 09/08/22	1 mon
26	**Control Room @ THEMIS**	Mon 04/10/21	Fri 26/11/21	2 mons
27	**Service cabinets**	**Mon 04/01/21**	**Tue 22/02/22**	**297 days**
28	Design	Mon 04/01/21	Fri 16/07/21	7 mons
29	Tender	Thu 07/10/21	Wed 03/11/21	1 mon
30	Production & Shipment	Wed 01/12/21	Tue 22/02/22	3 mons

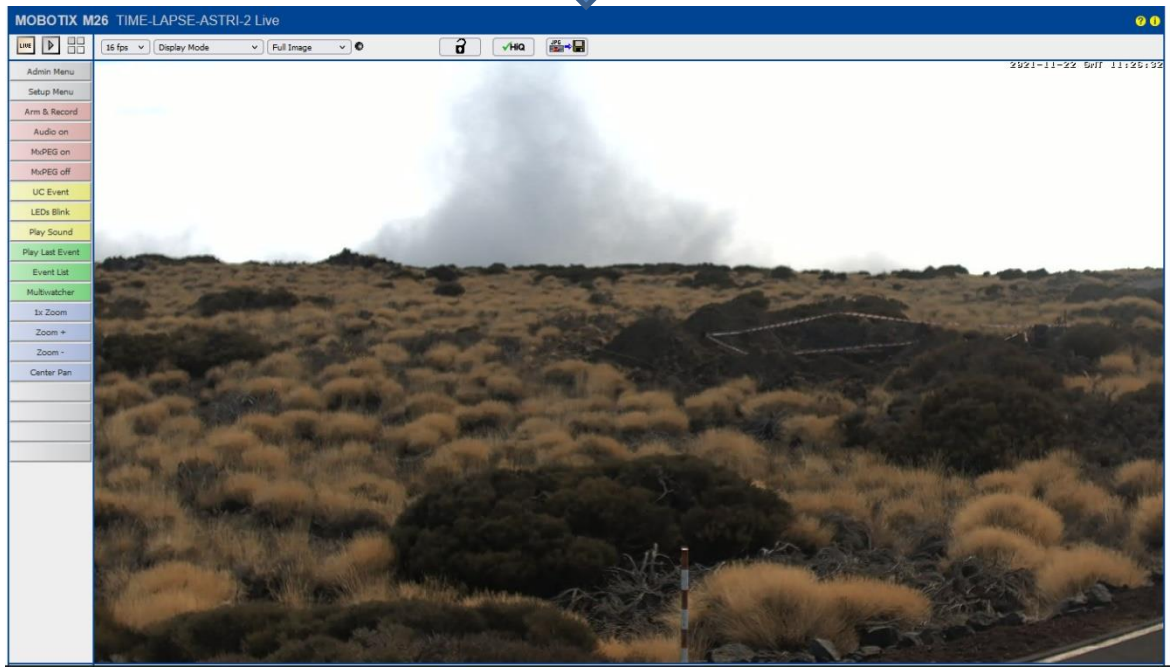


- 4th October start of the works
- ASTRI-1 foundation ready beginning of February 2022
- Infrastructure ready for ASTRI-1 beginning of March 2022
- Infrastructure delivery June 2022

WP6000 – Safety & Security







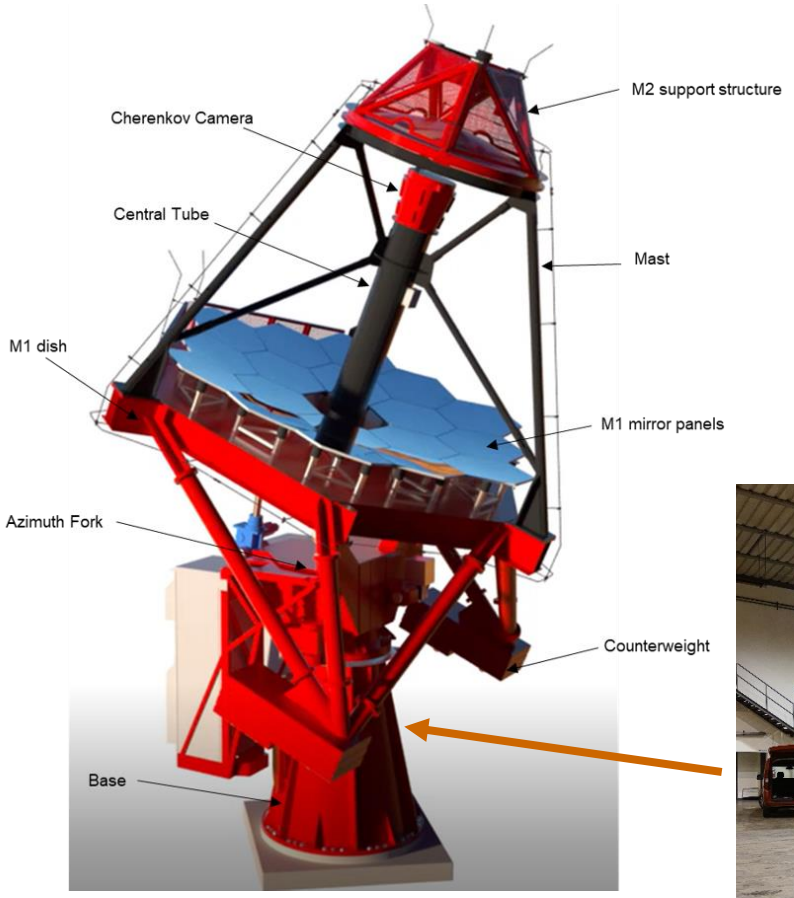
WP7000 – Telescopes

- 7 Telescopes
  - 7. 1 Mechanical Structure Assembly
  - 7. 2 Optical Assembly
    - 7. 2.1 Primary Mirror (M1)
    - 7. 2.2 Secondary Mirror (M2)
  - 7. 3 Cherenkov Camera
    - 7. 3.1 Thermo-mechanical subassembly
    - 7. 3.2 SiPM subassembly
    - 7. 3.3 Electronics subassembly
    - 7. 3.4 Calibration System
  - 7. 4 Stellar Intensity Interferometry Instrument
  - 7. 5 Auxiliaries assemblies
    - 7. 5.1 Pointing Monitoring Camera
    - 7. 5.2 Mirror Alignment System
    - 7. 5.3 Telescope Condition Monitoring System
  - 7. 6 Telescope Protection System

- **Mechanical structures**
  - **Production of first three structures**
  - **Tender for remaining six to be issued**
- **Mirrors**
  - **Production of M1 ended**
  - **Recoating of part of M2 mirrors ongoing**
- **Cherenkov Cameras**
  - **Desing phase in progress**

Integration site in Italy

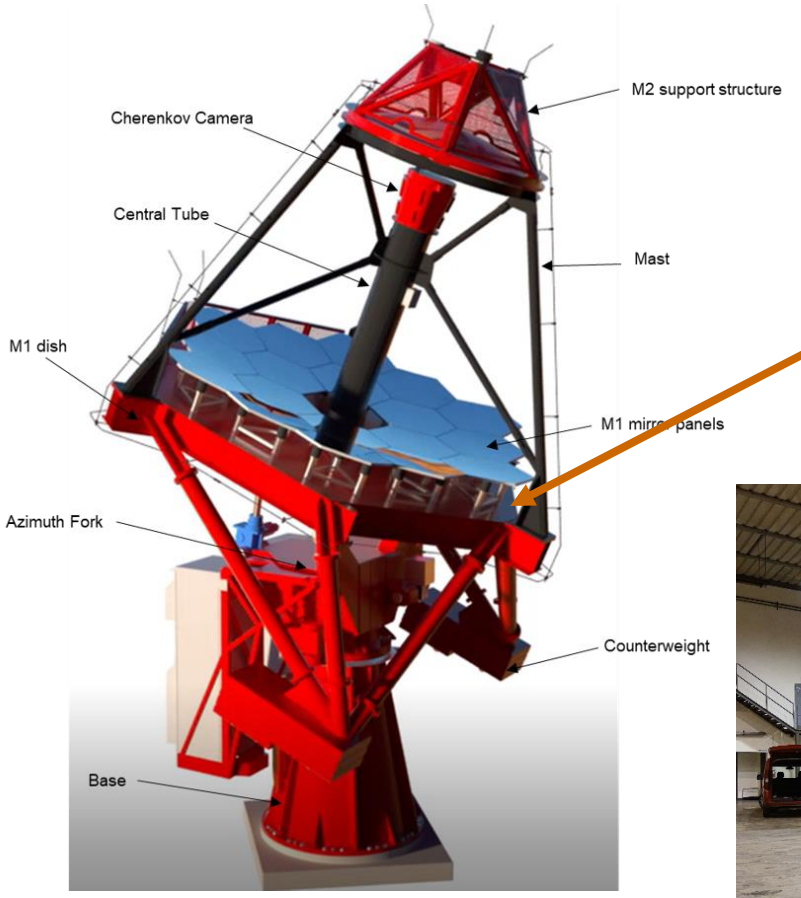
WP7100 – Mechanical structures



Base and Azimuth fork

WP7100 – Mechanical structures

EIE GROUP



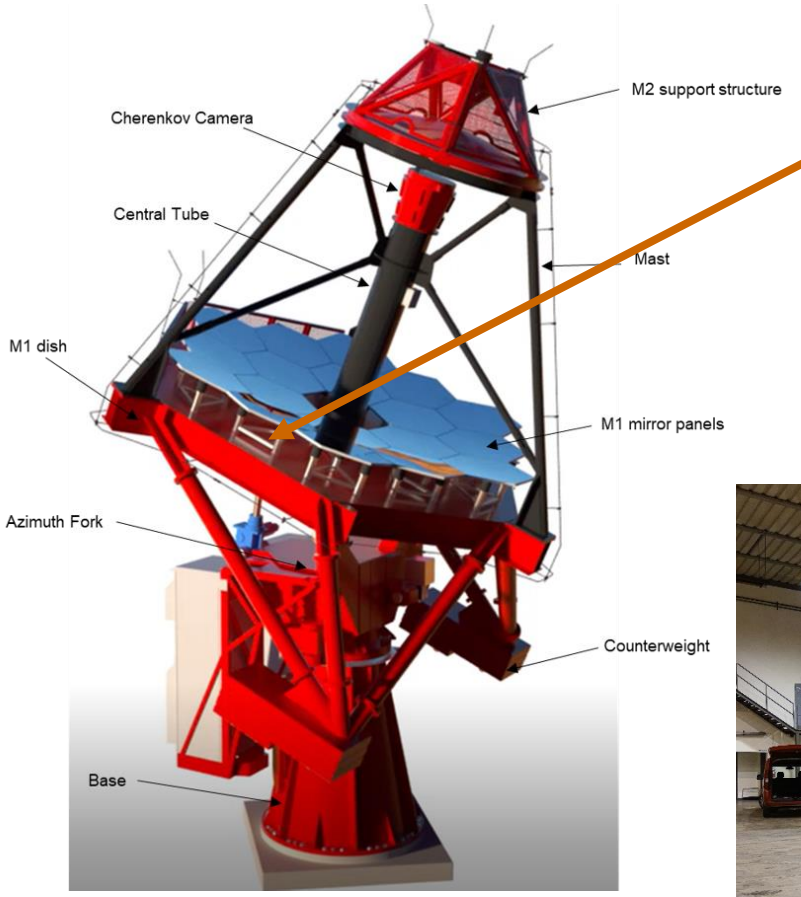
M1 dish

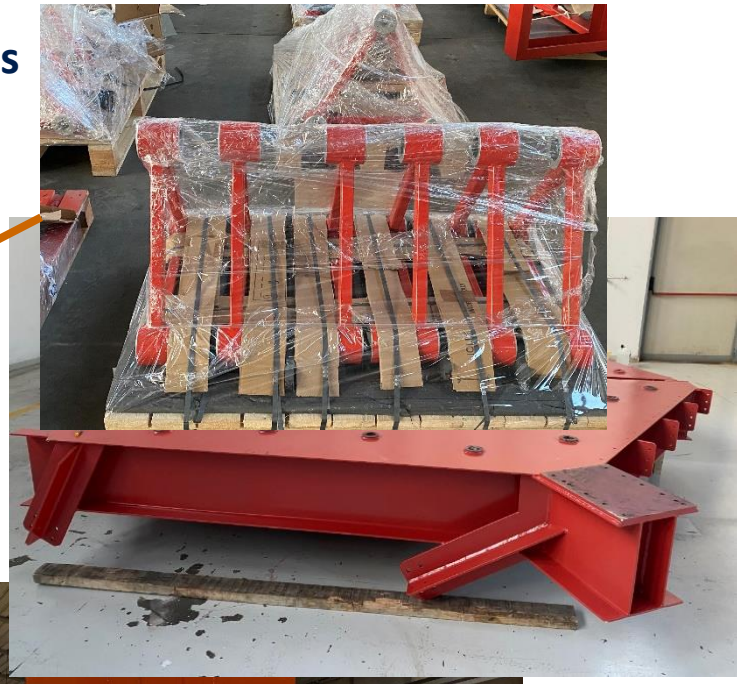
WP7100 – Mechanical structures

EIE GROUP

ASTRI Mini-Array

M1 mirrors supports



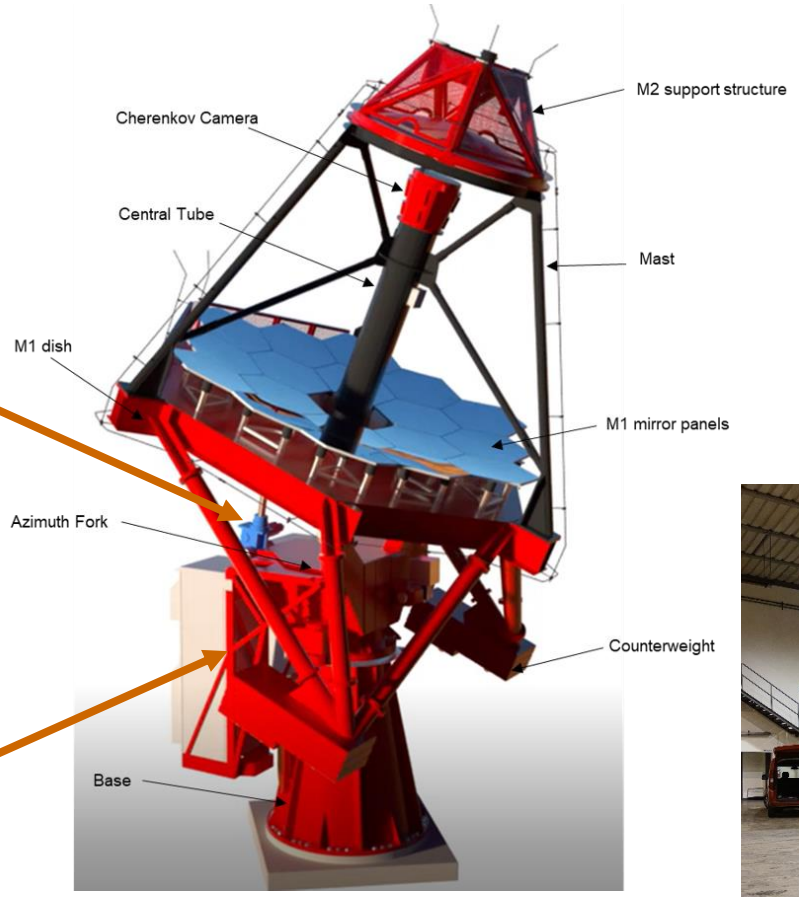


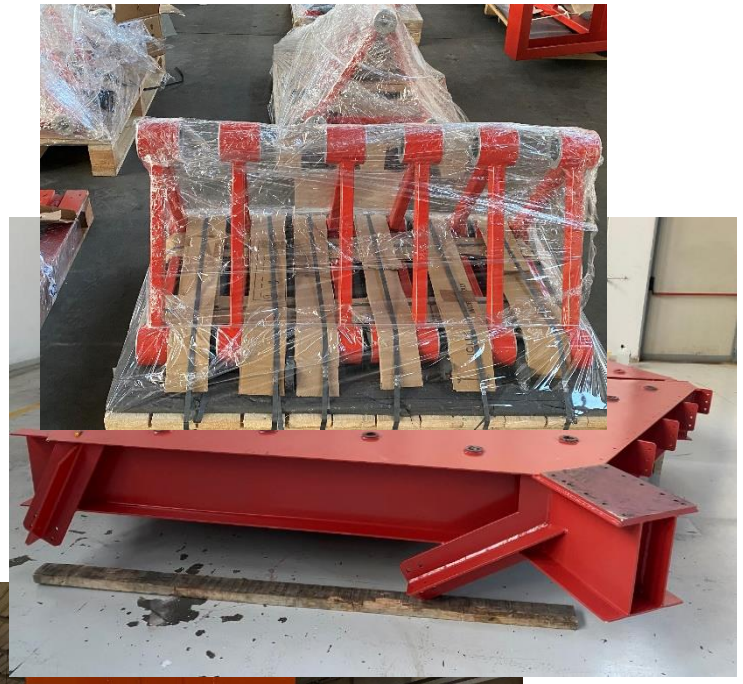
WP7100 – Mechanical structures

EIE GROUP

ASTRI Mini-Array

Elevation jack





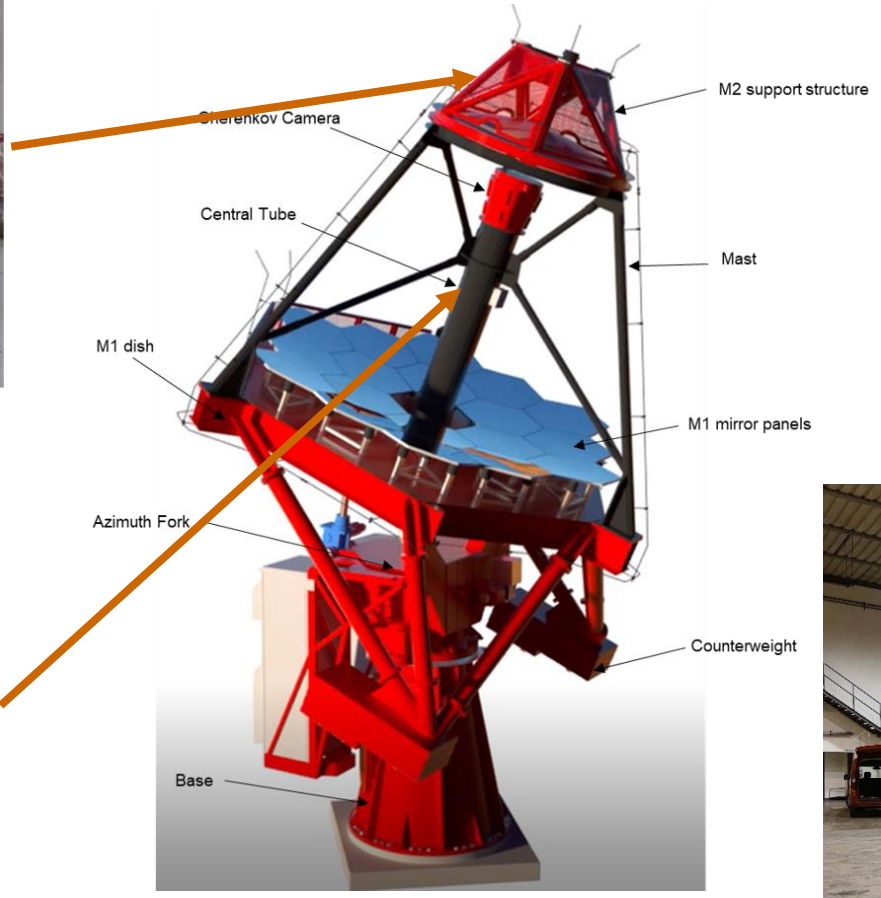
Electrical cabinet supports

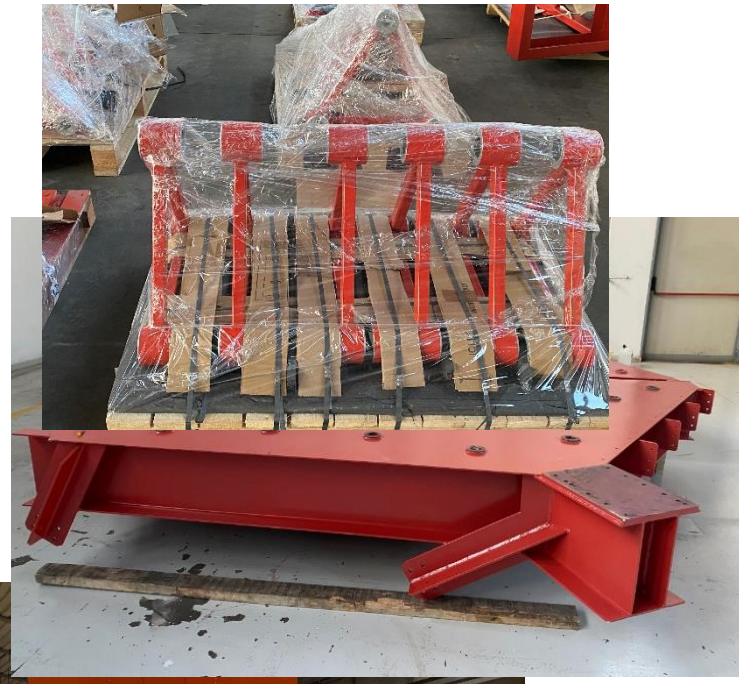
WP7100 – Mechanical structures

EIE GROUP

ASTRI Mini-Array

M2 support structure





Central tube and mast

WP7200 – Mirrors

ASTRI Mini-Array

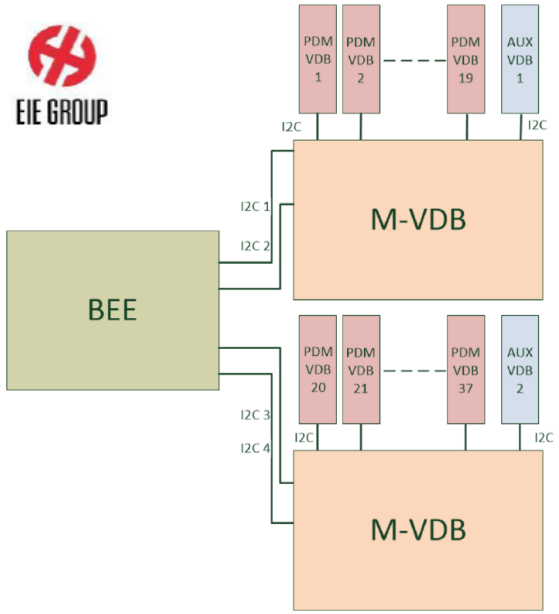
Gluing M2 tangential pads @ telescope integration site

M1 panels ready for integration

WP7300 – Cherenkov Cameras

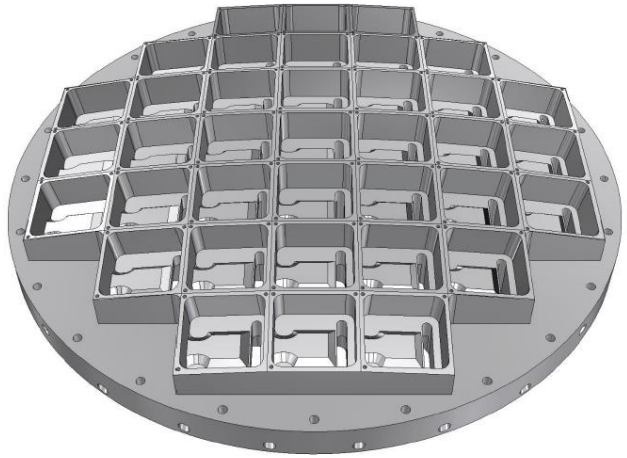
CAEN Tools for Discovery

EIE GROUP



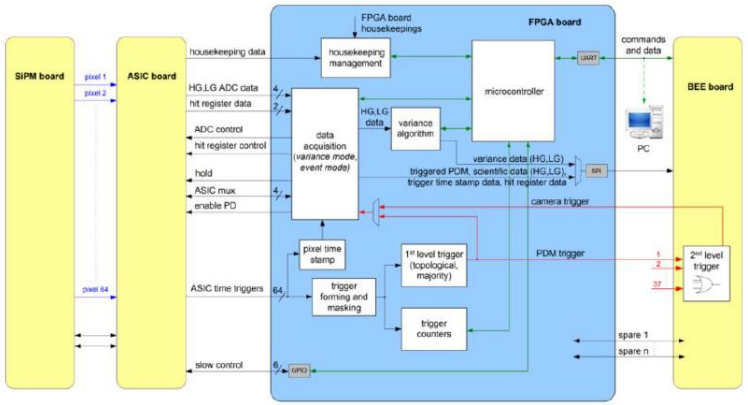
On going activities

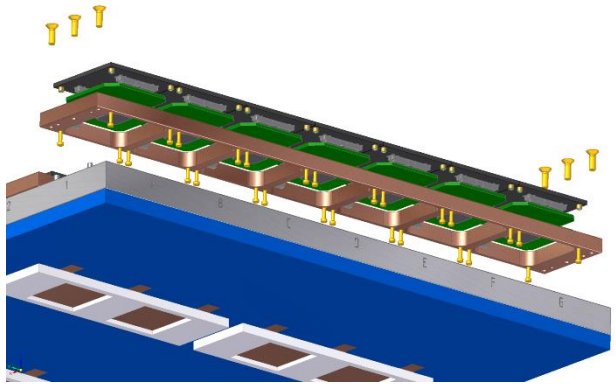
- Prototype activities on going on FPGA and VDB boards
- Analysis and test of thermal control system
- Redesign of focal plane support structure
- Firmware optimization
- Early procurement of critical components for Cameras 0,1,2

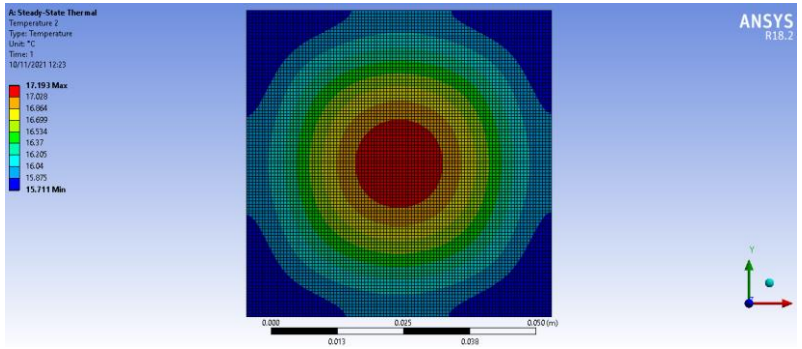


Milestones

- KoM on 7th of July
- Camera Requirement Review 11th of October
- Preliminary design review in January



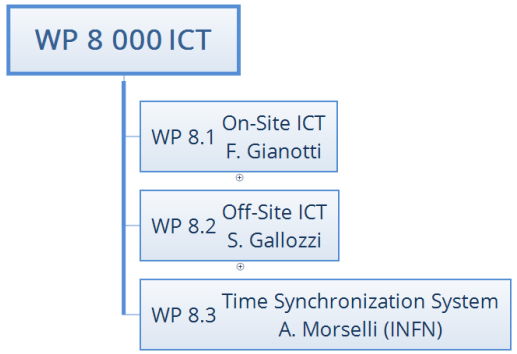


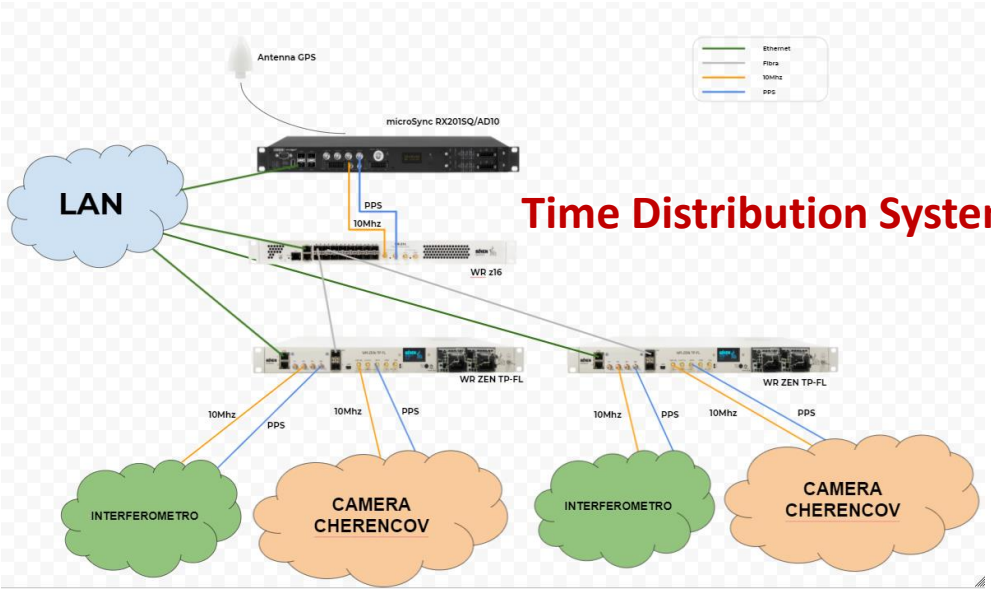


WP7000 – Schedule

- ASTRI-1 completion of integration in Italy → end of 2021
- ASTRI-1 completion of industry tests → middle of February 2022
- ASTRI-1 shipping to Tenerife → after successful completion of tests
- ASTRI-1 @ Teide → beginning of March
- ASTRI-1 on site acceptance → Half of April 2022
- ASTRI-8 and ASTRI-9 production start → beginning of 2022
- ASTRI-1, ASTRI-8 and ASTRI-9 ready at the site → beginning of October 2022
- Production of Camera#0 (engineering camera) → May 2022
- Camera #0 at the site → November 2022
- Camera #1 and Camera #2 at the site → Spring 2023

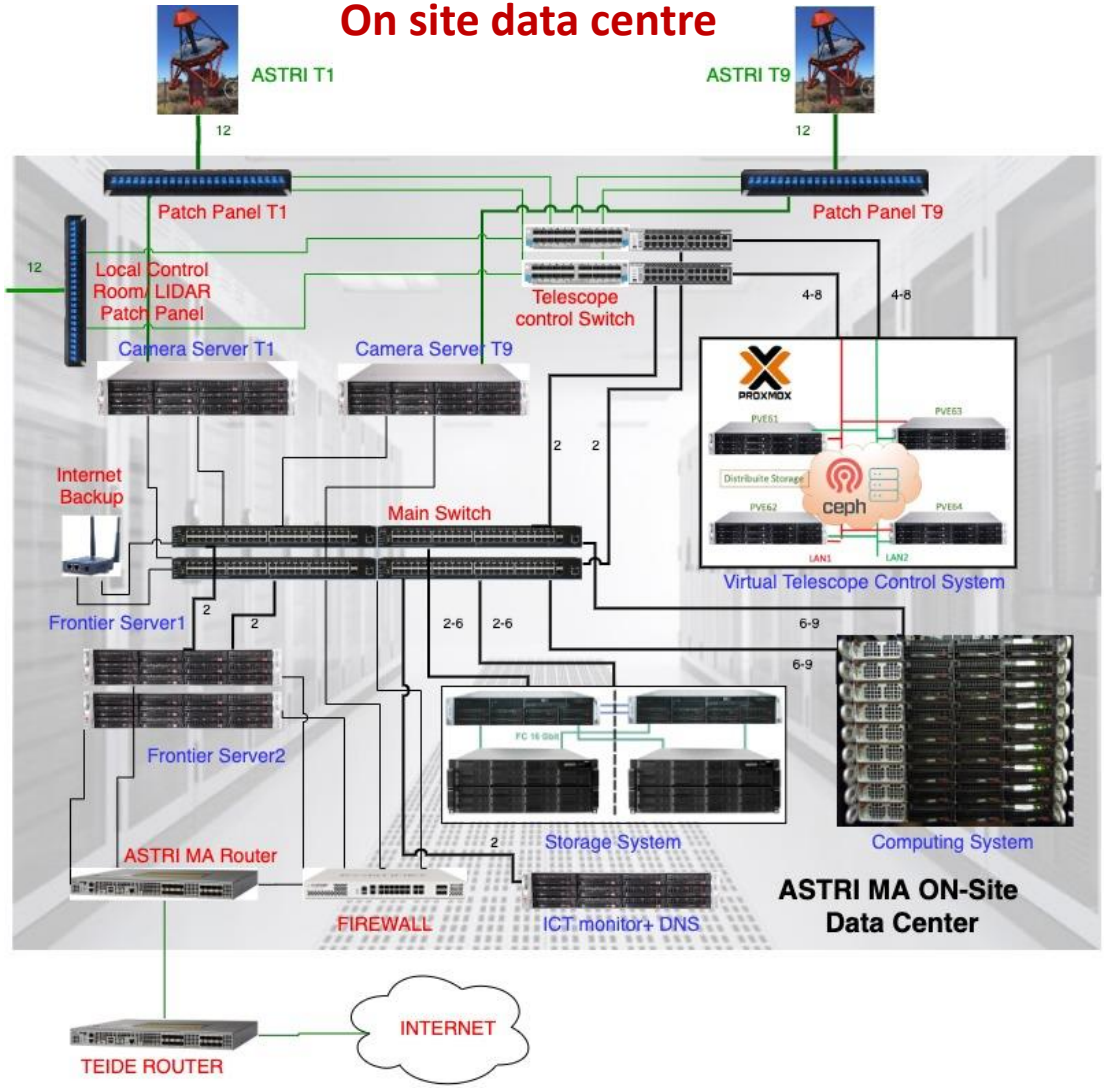
WP8000 – ICT



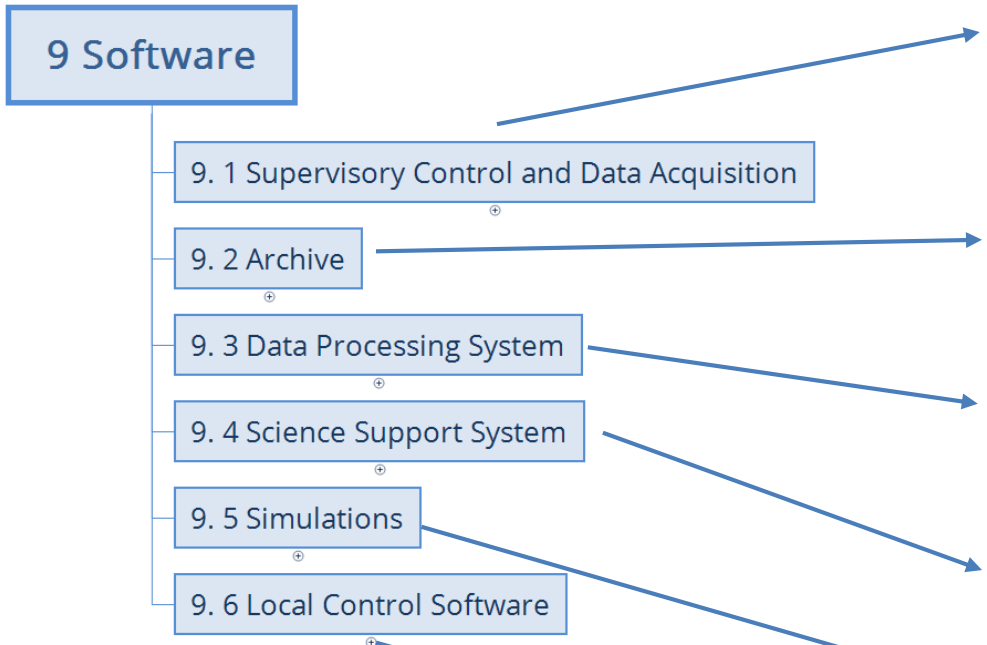


Time Distribution System

On site data centre



WP9000 – Software



- **SCADA** INAF will deliver Online Observation Quality System, Alarm, Monitoring, Logging and Array Data Acquisition Systems WP and parts of Central Control System
- Central Control by Universidad Tecnica Federico Santa Maria
- Operator Human Machine Interface by University of Geneve
- SW integration by external company

- **Archive** development mainly by INAF
- Support by external companies on specific aspects
- Important heritage from ASTRI-Horn

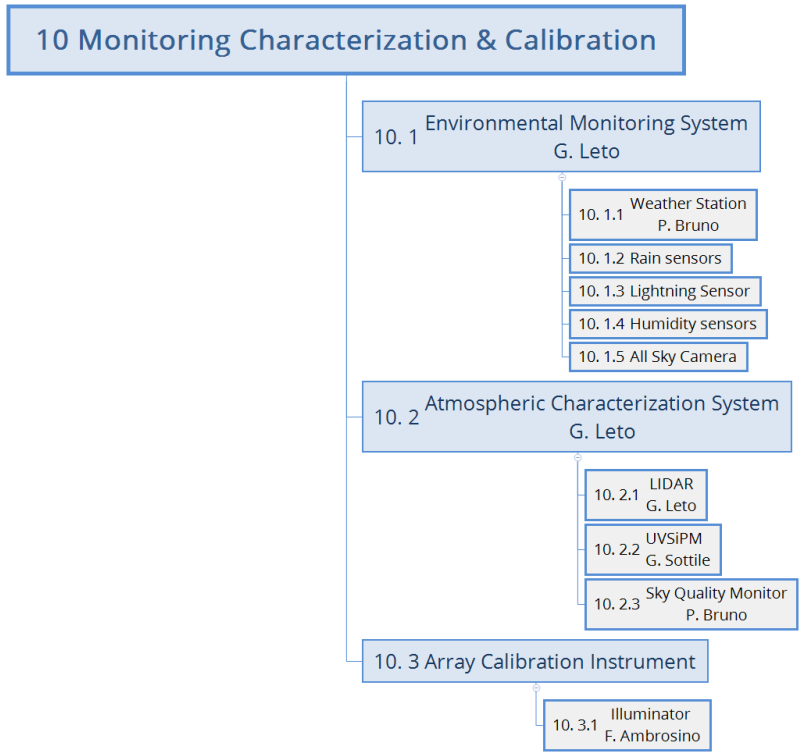
- **Data Processing system** development mainly by INAF
- Support by external companies on specific aspects
- Important heritage from ASTRI-Horn

- **Science Support System** development entirely by INAF
- Important heritage from ASTRI-Horn

- **Simulations** development entirely by INAF
- Important heritage from ASTRI-Horn

- **Local Control Software** developed by hardware provider
- Integration into SCADA by INAF and SCADA provider

WP10000 – Monitoring, Characterization & Calibration System



- **Envirnomental Monitoring System**
  - **Meteo Station → Shipping to Tenerife**
  - **All Sky Camera → Under test in Catania**
- **Atmospheric Calibration System**
  - **UVSiPM → Design to be started**
  - **LIDAR**
    - **Hosted in a dedicated dome**
    - **Design in progress**
    - **Investigating possibility to share its use with other institutions (IAC, AEMet)**
  - **Sky Quality Monitor → Intregrating in Pointing Monitoring Cameras @ UniPG**
- **Array Calibration System**
  - **Illuminator**
    - **Design in progress**
    - **Installation site @ VTT (Vacuum Tower Telescope)**

WP11000 – Logistics

Criticalities

- All technical issues are under control so far

- Programmatic issues exists
  - COVID-19 related → delays related to full scale resumption of activities
  - Shortage of raw material → delays in production of processed parts
  - Shortage of semiconductor components → delays form months to years

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Increase in costs

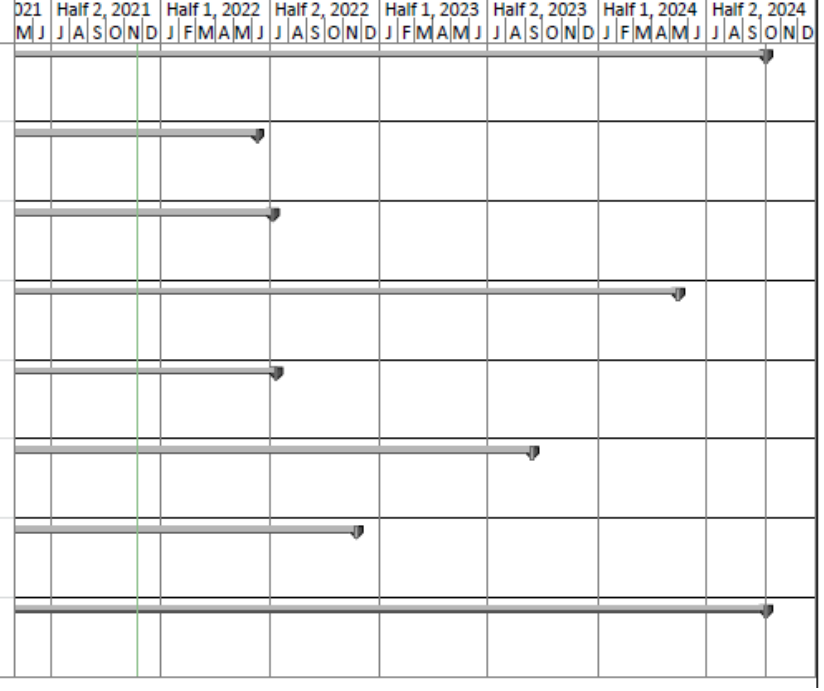
Current Master Schedule

ASTRI Mini-Array ready for operation beginning of Fall 2024

Title: ASTRI mini-array schedule
Date: Mon 22/11/21
Page 1 of 1

ASTRI Mini-Array Construction Project

ID	Task Name	Start	Finish
0	**ASTRI Mini-Array**	Wed 22/06/16	Tue 08/10/24
1	Infrastructure	Mon 16/03/20	Fri 10/06/22
2	Safety and Security System	Mon 15/02/21	Wed 06/07/22
3	Telescope	Wed 22/06/16	Tue 14/05/24
4	ICT	Wed 04/12/19	Tue 12/07/22
5	Software	Thu 04/07/19	Wed 13/09/23
6	MCCS	Thu 20/02/20	Wed 23/11/22
7	On Site Integration & Verification	Fri 09/04/21	Tue 08/10/24



ASTRI Mini-Array