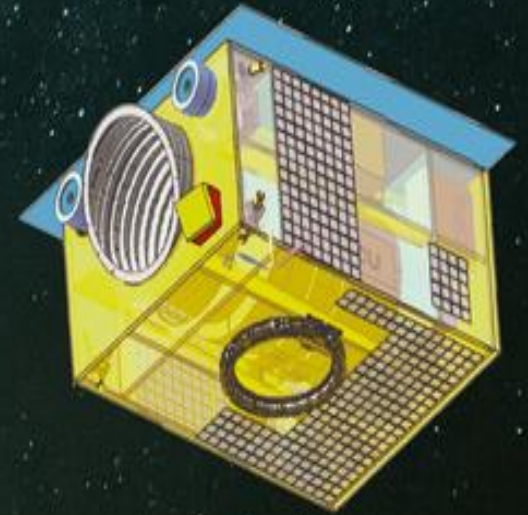


ULTRASAT camera

development

Status update and next steps

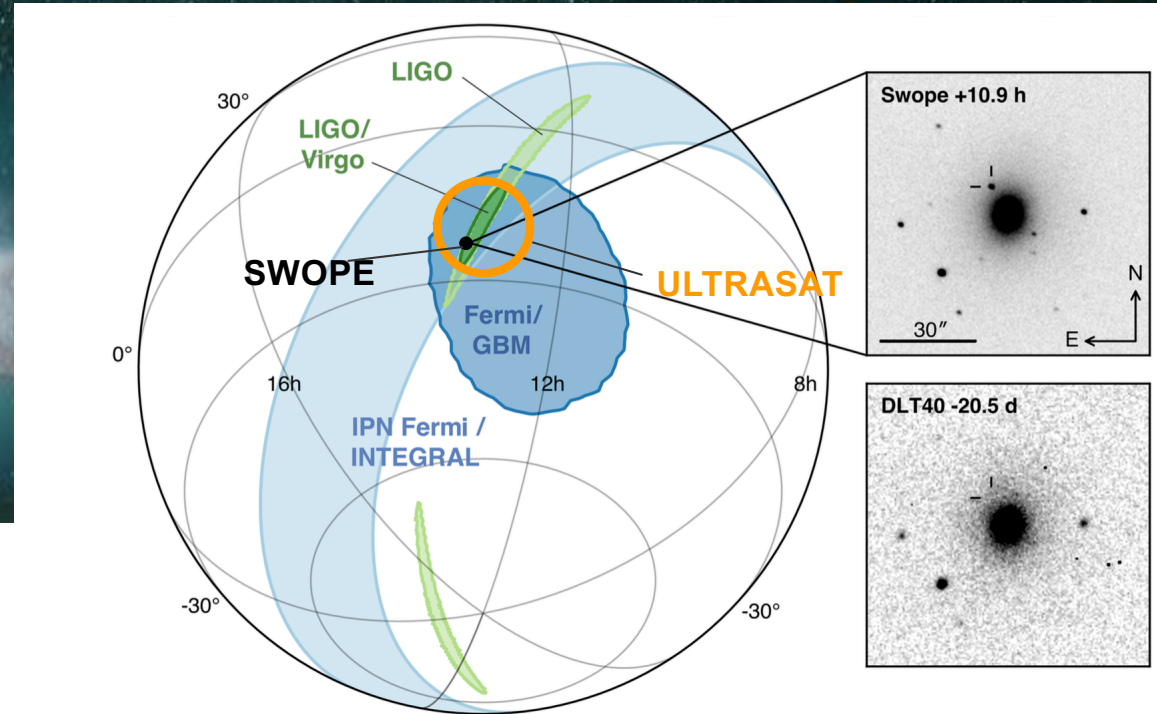


APC meeting, 11th November 2020
The ULTRASAT camera team

UC-1200-PT022-01

ULTRASAT camera development

Status update and next steps



APC meeting, 11th November 2020
The ULTRASAT camera team

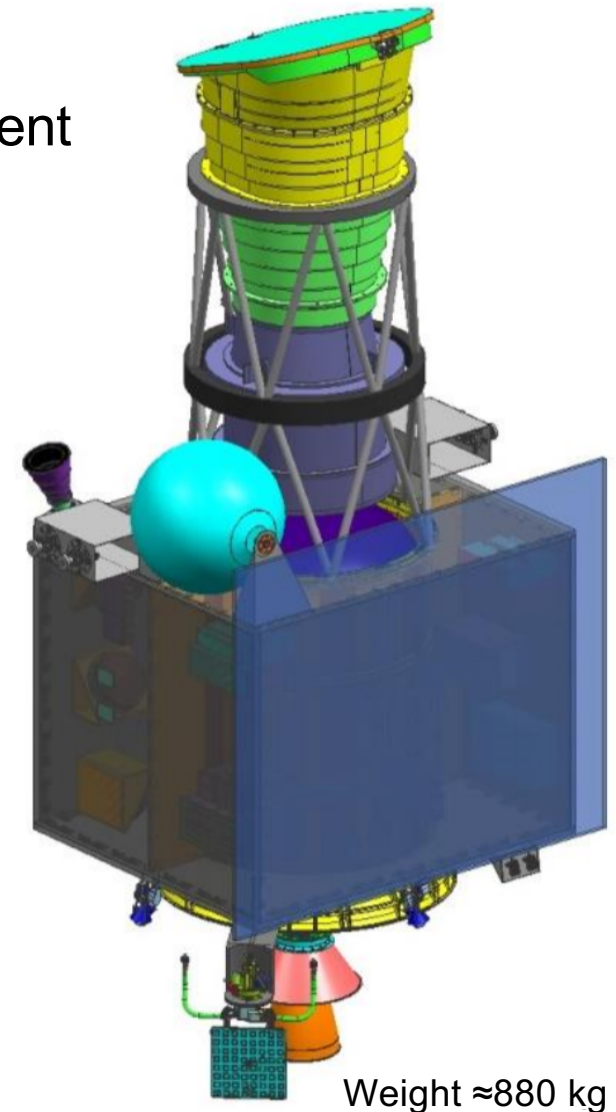
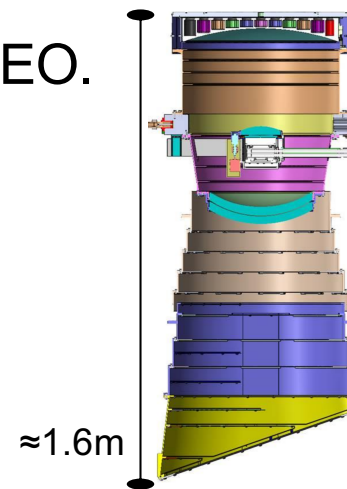
UC-1200-PT022-01

Overview

- Wide-field UV telescope (220-280 nm, FOV~200 deg²) for transient astronomy (GW, SN, etc.).
- Mission led by Weizmann Institute of Science and Israeli Space Agency; DESY provides camera. Mission costs O(100M€), ≈ 5% for DESY.
- Kick off Sep. 2019, launch agreement NASA for 2024 far advanced.
- Launcher to GTO orbit, satellite will fly to GEO.

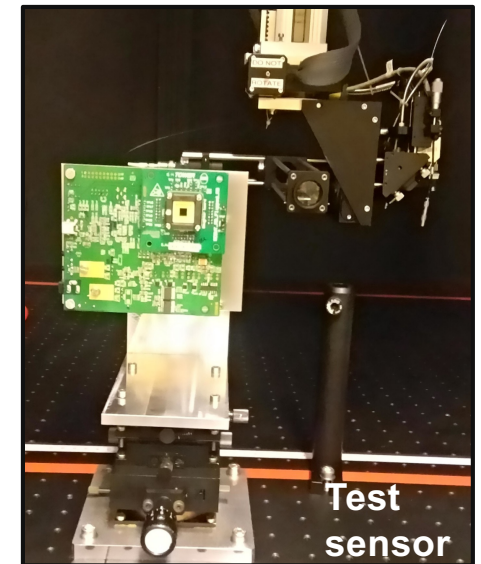
Current phase:

- Telescope (ELOP) PDR in Oct. 20.
- Satellite (IAI) ΔSDR Nov. 20.
- Camera (DESY) PDR 14 & 15 Dec. 20.



Main advances since last meeting

- Group build-up (QA, Firmware).
- Significant gain in expertise and understanding (DLR cooperation).
- Sensor contracted, designed and taped in imminent.
- Test sensors characterized (lead to important design changes).
- Electronics and structure design advanced for PDR.
- Sensor package contracted and ongoing design.
- Heat pipe design contracted and ongoing.
- Laboratories and TVAC approved (but not yet contracted).
- Small TVAC procured and on site.



Group and facilities

Group

One year ago

Photon Science
DESY Hamburg

*Cornelia Wunderer
Alessandro Marras*

Electronic
workshop

Mechanics
workshop

Administration
purchasing / legal



Francesco
Zappon
Electronics



Rolf Bühler
Project Manager



David Berge
Project PI
Gamma group



Marek
Kowalski
Ice-cube group



Gianluca
Giavitto
System engineer

Group

Photon Science
DESY Hamburg

*Cornelia Wunderer
Alessandro Marras*

Electronic
workshop

Mechanics
workshop

Administration
purchasing / legal

Full-time



Nirmal
Kaipachery
AIV



Merlin Barschke
System engineer



Juan Crespo
Mechanical
and thermal



Shrinivasrao
R. Kulkarni
QA



Francesco
Zappon
Electronics



Rolf Bühler
Project Manager



Julian
Schliwinski
Testing & science



Arooj Asif
Firmware



David Berge
Project PI
Gamma group



Marek
Kowalski
Ice-cube group



Steve Worm
Detector lab.

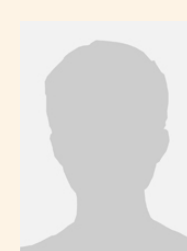


Gianluca
Giavitto
System engineer

Part-time



Mikhail
Vasilev
Electronics



Sebastian
Philipp
Mechanical
and thermal



Nicola de
Simone
Firmware



Jason
Watson
EGSE



Benjamin
Bastian
Testing



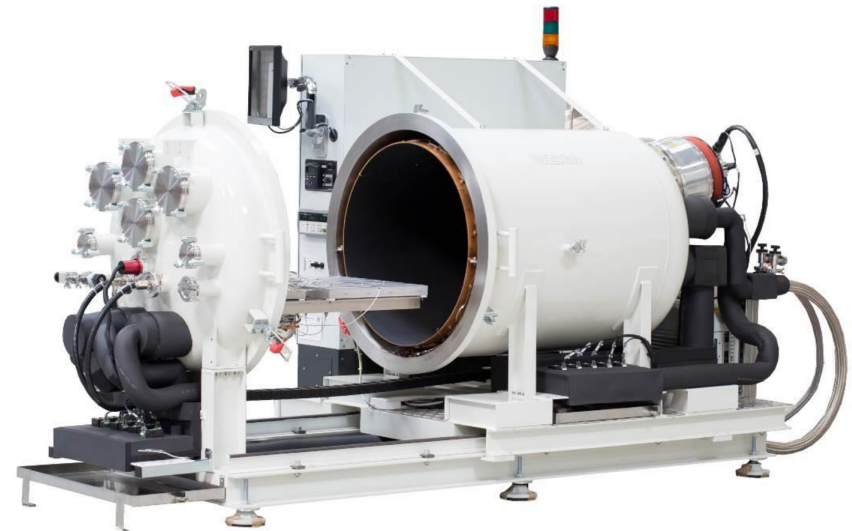
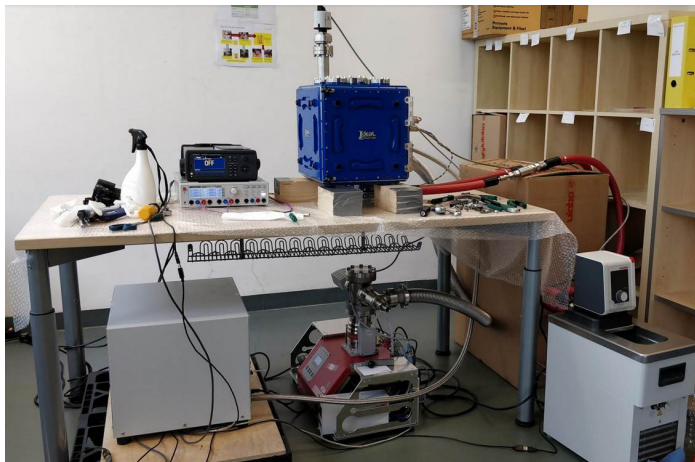
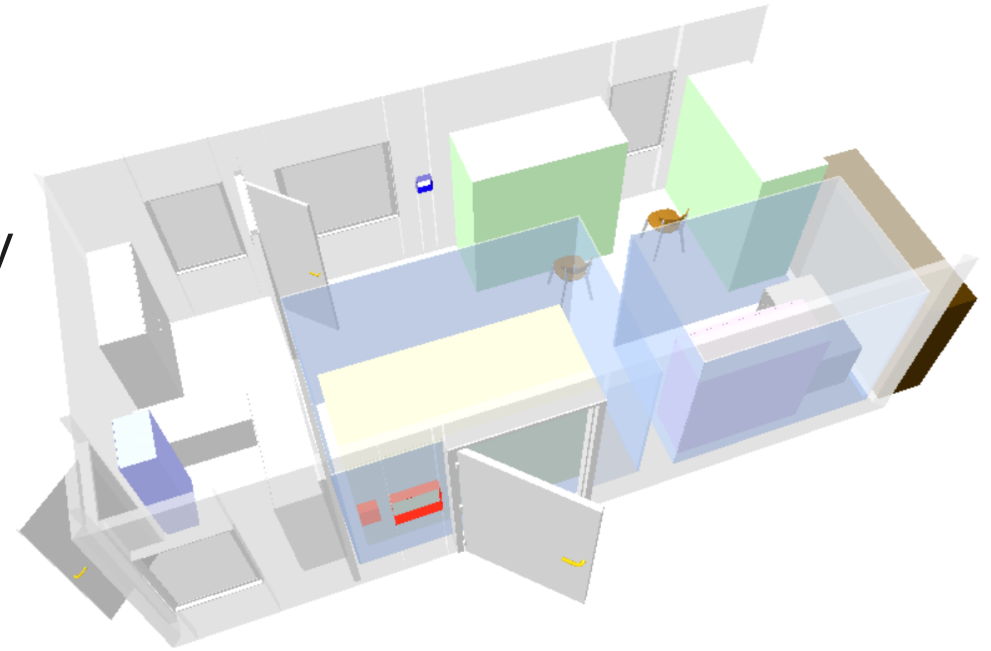
Daniel
Küsters
Testing

Laboratory setup

Obtained directorate approval for laboratory investment, tender being prepared.

- One ISO 7 laboratory with ISO 5 areas of 35m².
- Large 170 L TVAC.

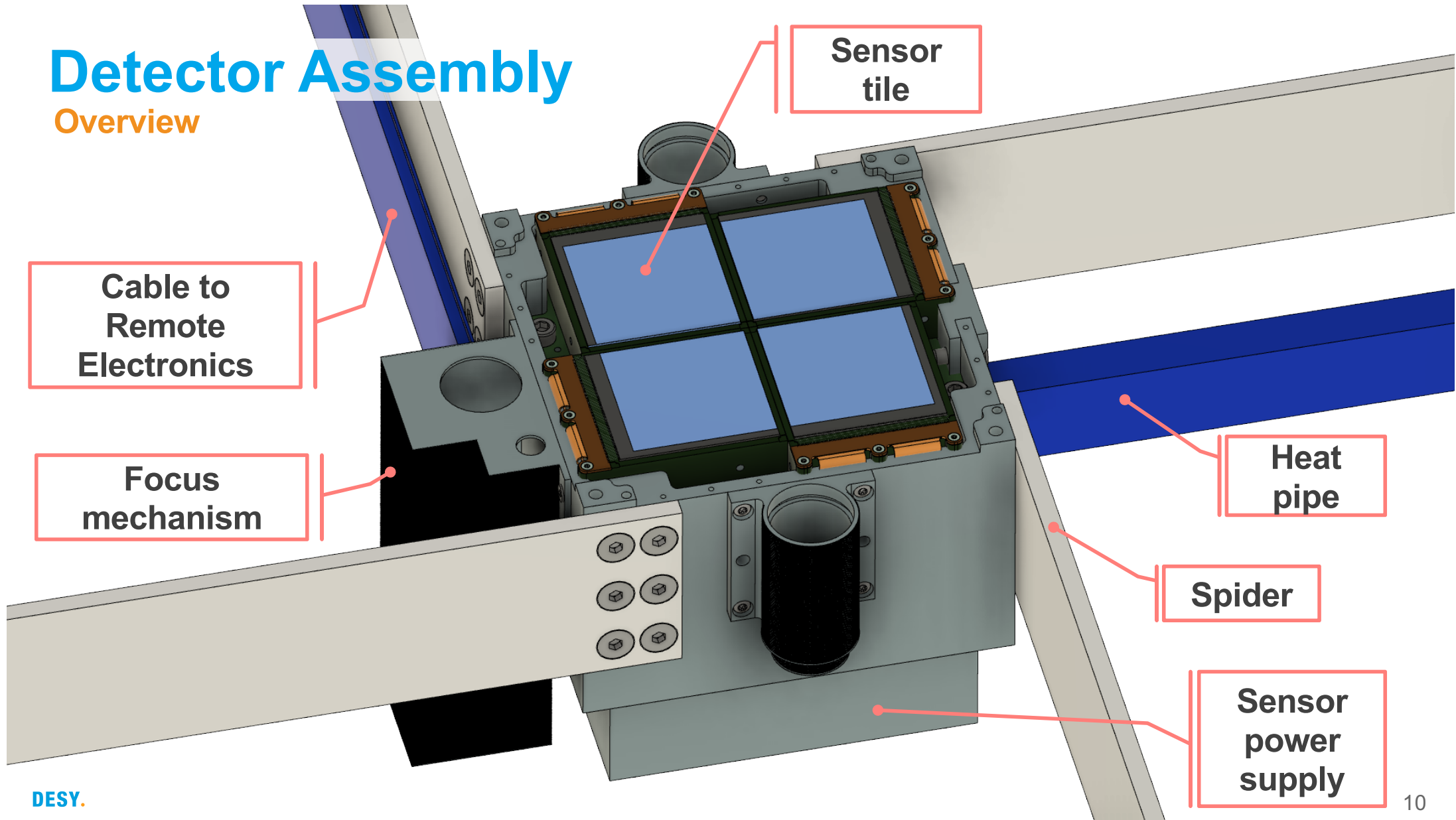
Small 27L TVAC procured and working.



Design status and timeline

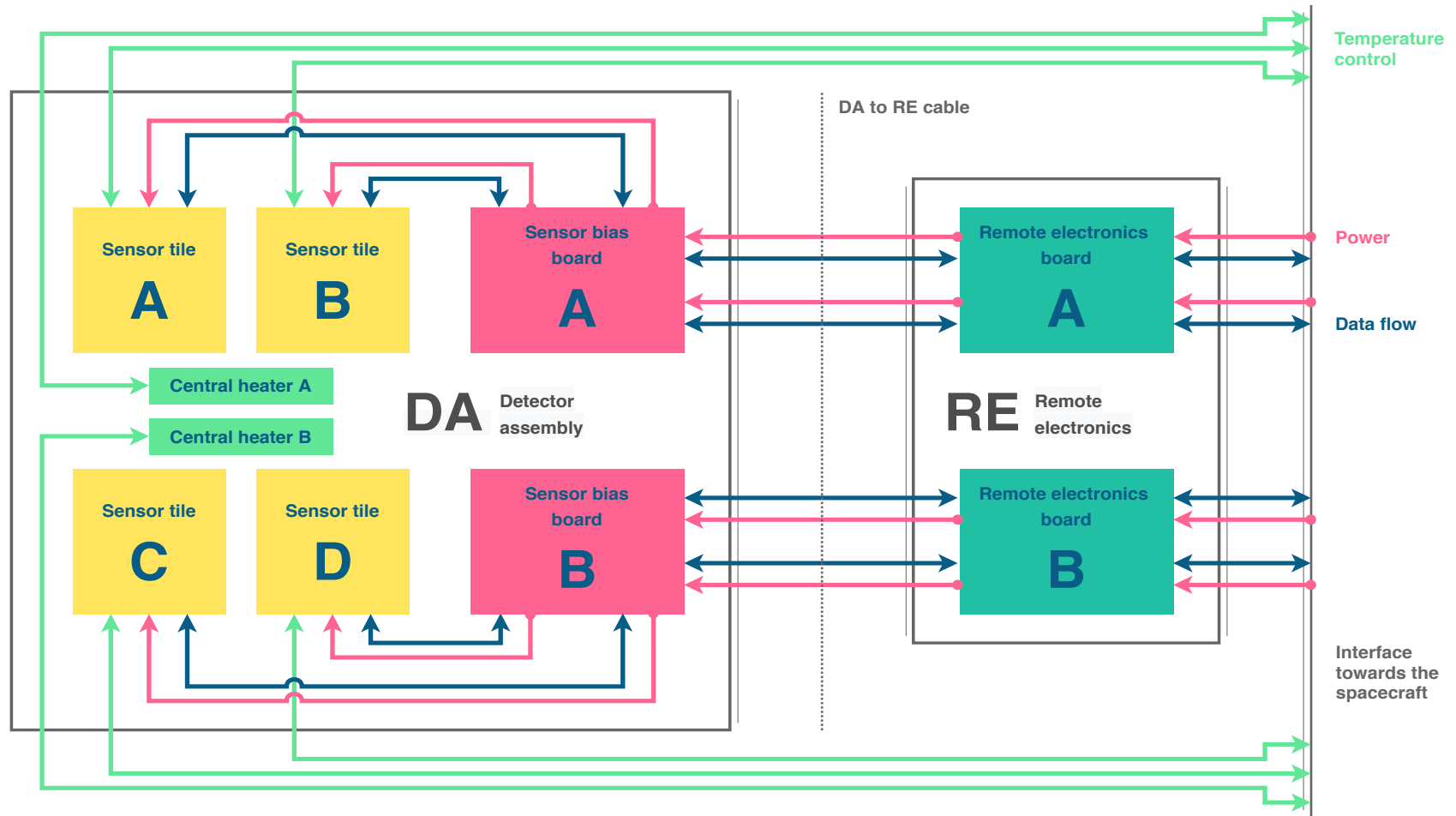
Detector Assembly

Overview



Camera layout

Remote Electronics and Detector Assembly

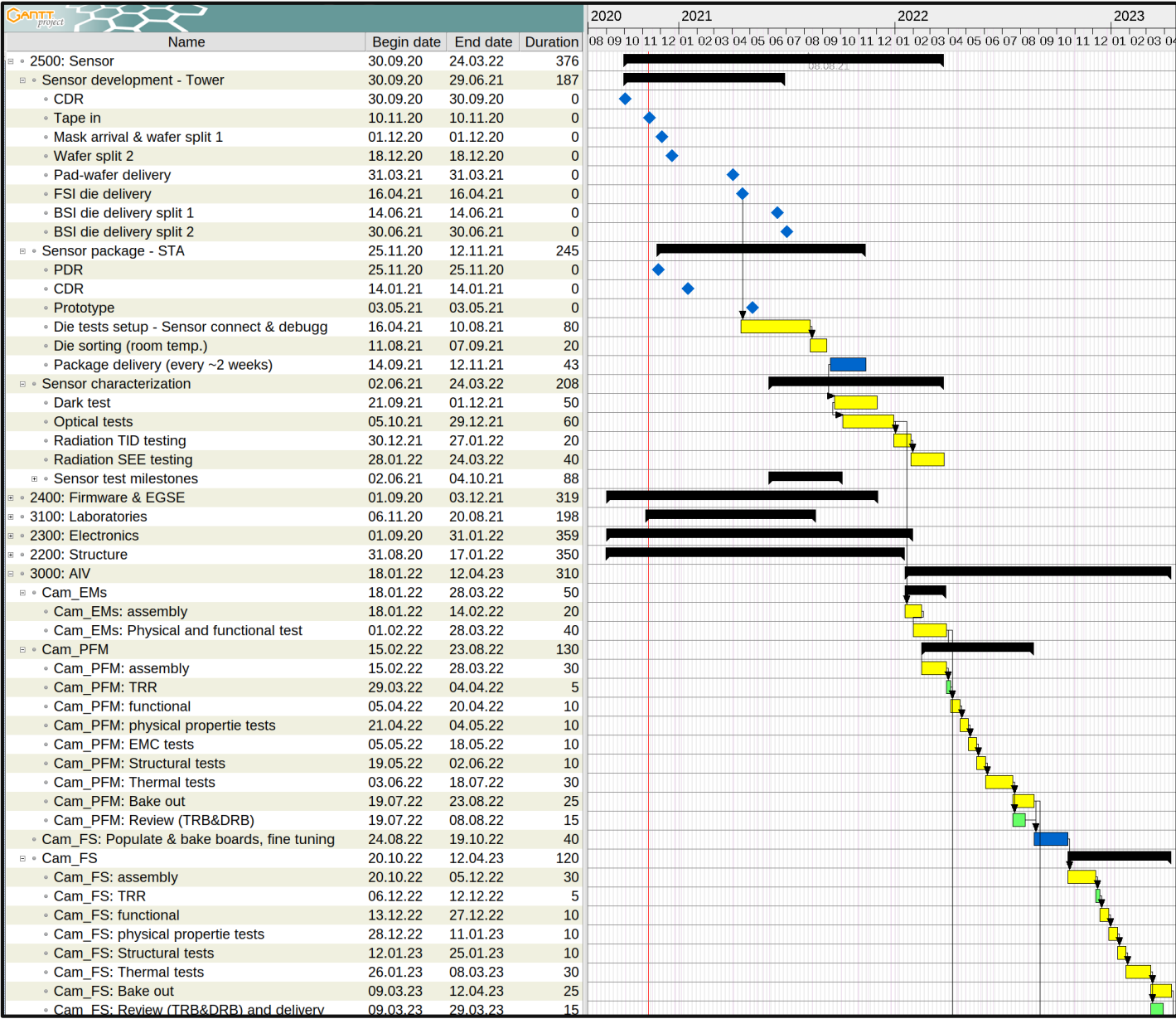


Time line

Delivery of EMs 30 months and PFM 35 months after kick off.

Time line “close to best case”, communicated from the start. Electronics, structure, sensor and laboratories all in parallel, no buffers.

However, delay could endanger the mission. Risk mitigation focus of advisory board next week.



Risks

High-level risks

Despite great support from DESY so far, delays compared to the ambitious time line are likely. The main risks are (concrete example):

A) Sensor:

- Performance below specifications (dark current).
- Connecting Readout Electronics (voltages or interface debugging).

B) Readout electronics design delay (too high workload).

C) Structure design delay (problems in DM tests, too high workload).

D) Procurement delays (electronic components and boards).

E) Laboratory availability delayed (no vendor builds in time).

F) Large TVAC delayed (TVAC not working “out of the box”).

Risk mitigation

For A, B, C)

- 1) Additional experienced DESY engineers for structural and thermal design would significantly reduce risks; will also lead to better 'DESY integration'.
- 2) Additional experienced postdoc for sensor testing.

For D, E, F)

- 1) More support on infrastructures: Typical DESY process times too slow for ULTRASAT. Laboratory, TVAC and components procurement work intensive. Infrastructure group already overloaded, consider external support company
- 2) Laboratory alternative as backup in case of **E**) (~25 m² ISO-5 area within ISO 7 room).
- 3) Dedicated ULTRASAT laboratory in Zeuthen DM/EM work (room with clean benches sufficient, currently using desk in particle physics lab.).
- 4) TVAC alternative through DLR (already contacted, application required, which needs our time).

Summary and outlook

Summary and outlook

ULTRASAT group built up and achieved great progress:

- PDR on December 14th, design almost ready.
- Key long-lead items procured (sensor and package).

No surprise that the project is more complex than expected (2 years ago). The schedule remains the single major challenge, despite great support from DESY so far.

The risk can be significantly reduced (but not eliminated) with:

- Additional manpower support, particularly from experienced DESY engineers.
- Support on laboratories and procurement.

Backup

Camera models

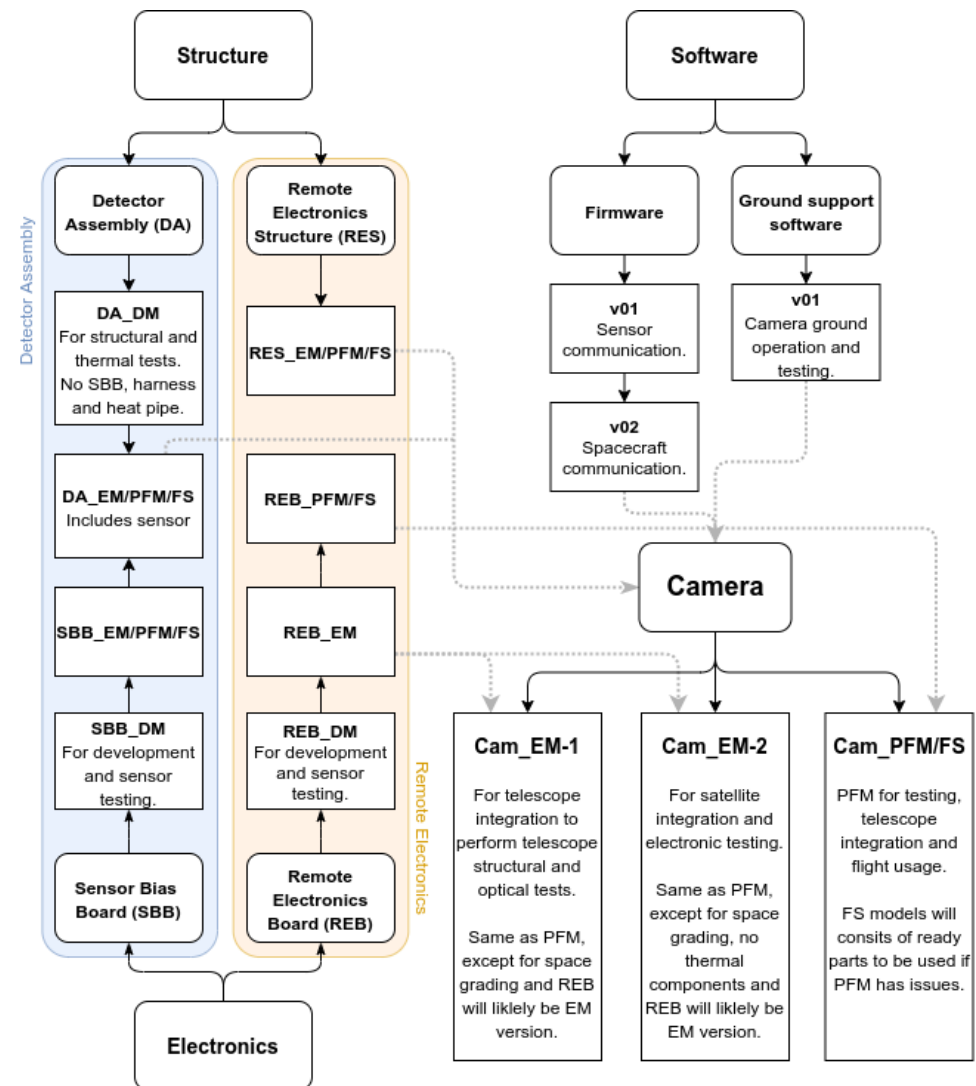
We will build 3 full cameras:

- Two engineering models (EM).
- One Proto-Flight Model (PFM).

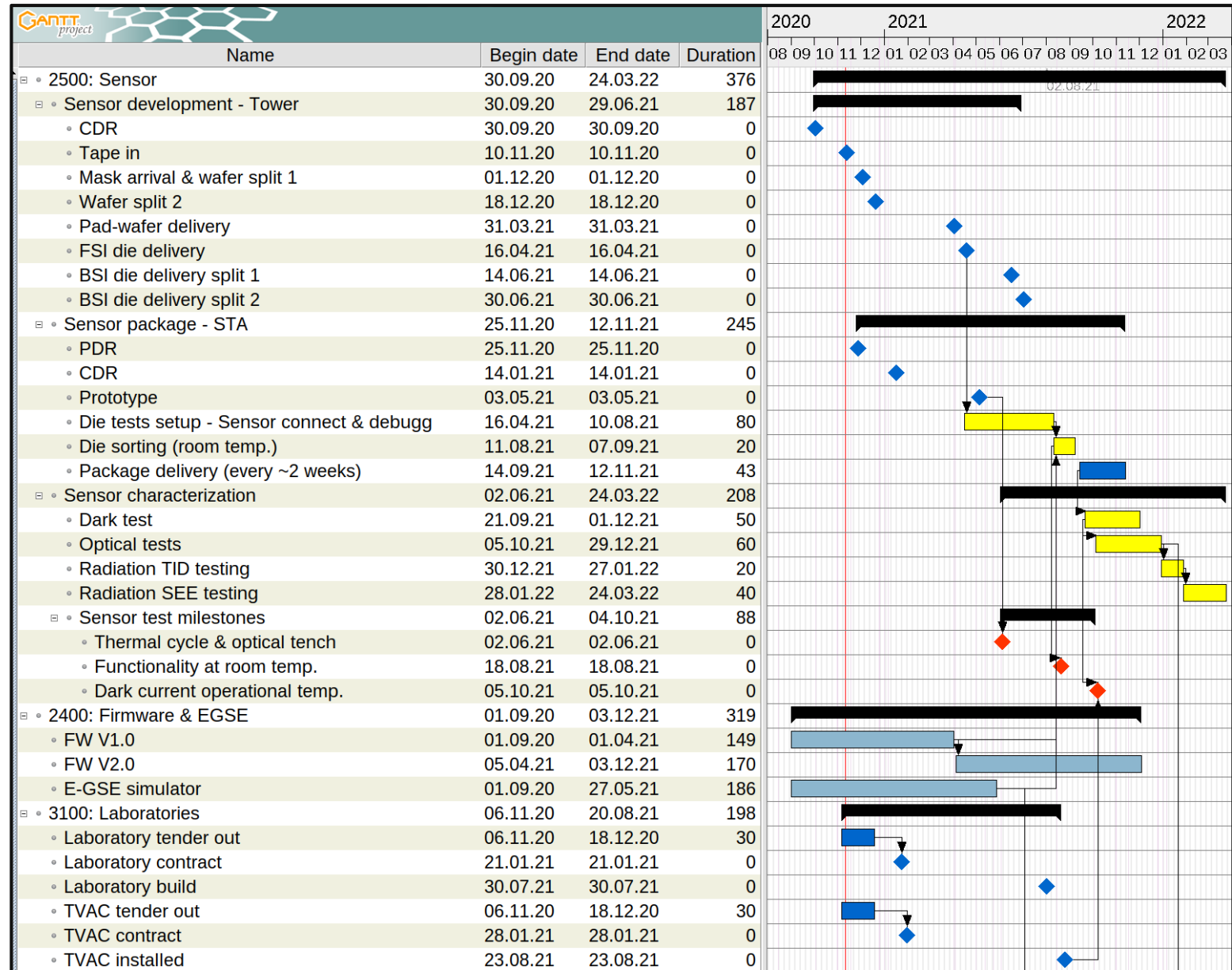
One Flight Spare (FS).

First tests will be done on a Development Models (DMs).

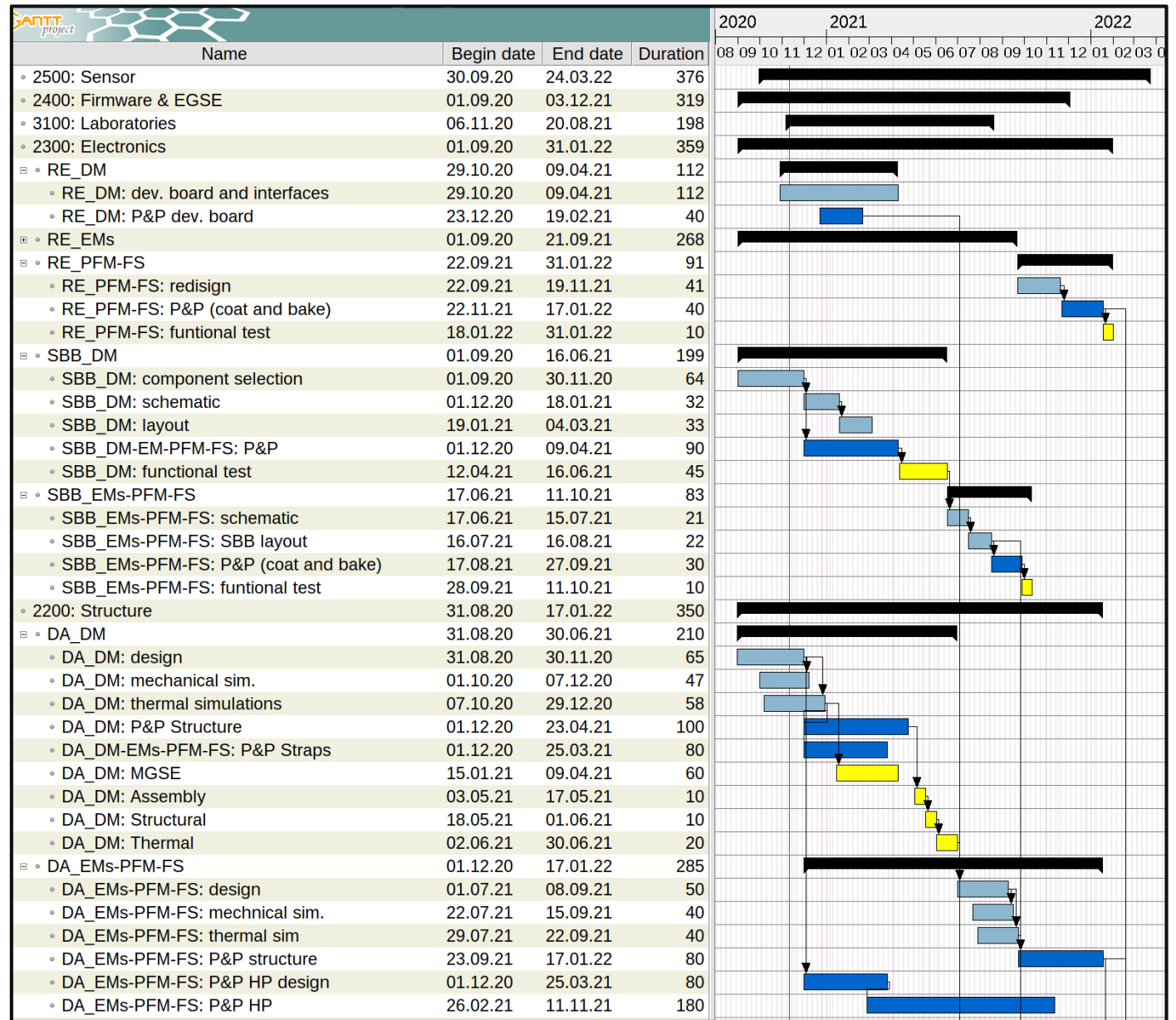
Environmental tests on the PFM, in line with the “fast but riskier approach” ULTRASAT philosophy.



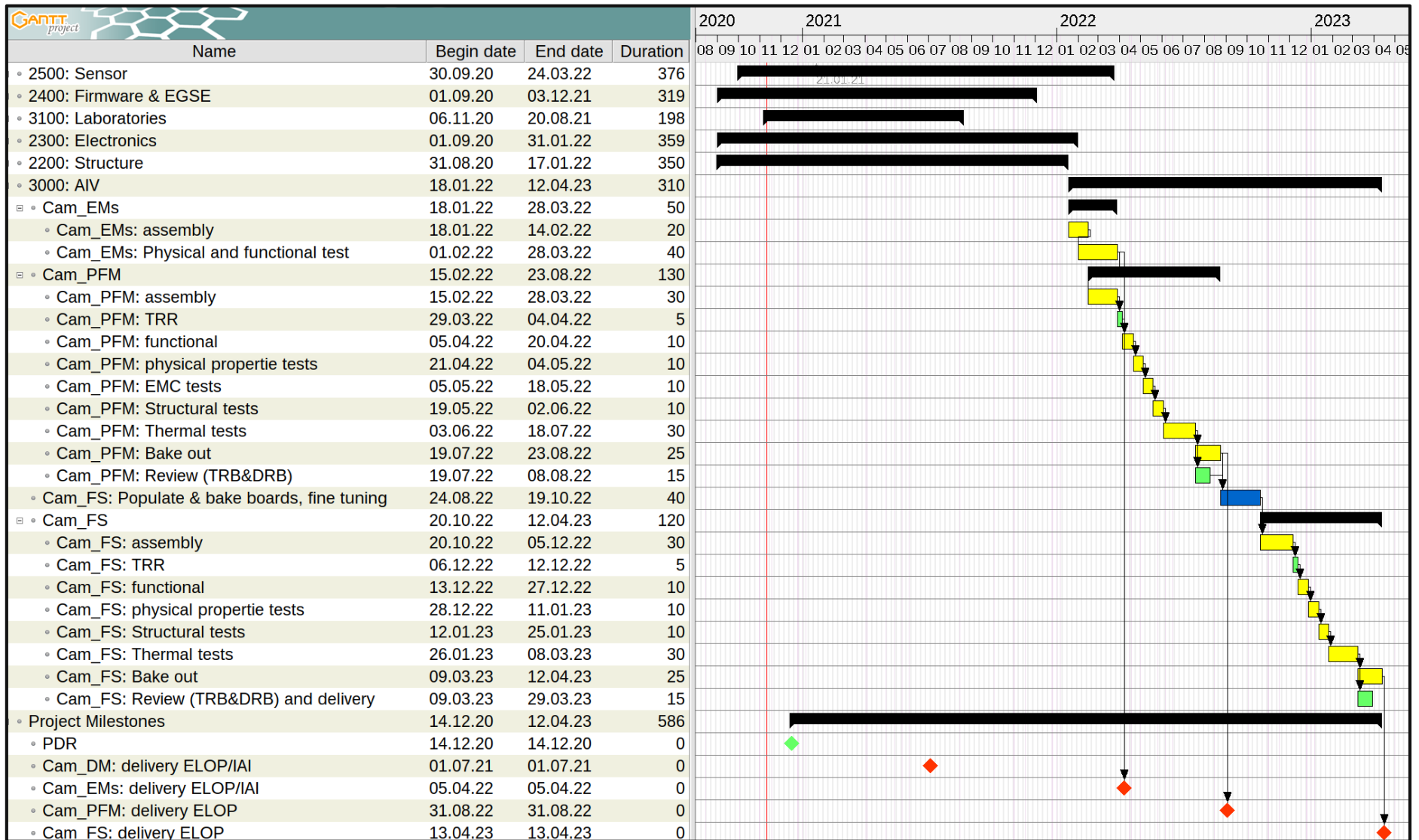
Time line - sensor, package, laboratories and firmware



Time line - electronics and structure



Time line - AIV



Advisory board schedule

Topic	Duration	Speaker
Introduction, group, model plan	8+2 min	@ Rolf Buehler
Camera system overview	8+2 min	@ Merlin Barschke
Mechanical & thermal design	8+2 min	@ Juan Maria Haces Crespo
Electronic design	8+2 min	@ Francesco Zappon
Scouts	5+2 min	@ Nirmal Kaipachery @ Julian Schliwinski
Firmware and EGSE	5+2 min	@ Arooj Asif
QA, cleanliness, V&V, laboratories	8+2 min	@ Shrinivasrao Ramarao Kulkarni
Time line and risk management	20 min	@ Rolf Buehler
Discussion	~45 min	
Closed session	~45 min	

Advisory board



Norbert Kappelmann
Uni-Tübingen,
UV astronomy
and detectors.



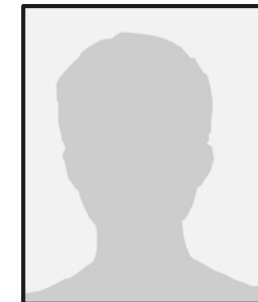
Maria Fürmetz
OHB thermal
and
mechanical.



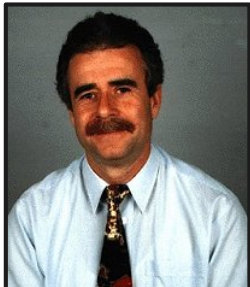
Olivier Limousin
CEA,
sensors and
electronics.



Chris Tenzer
Uni-Tübingen,
management,
electronics.



Simone Del Tegno
DLR
Adlershof,
thermal and
mechanical



Harald Michaelis
DLR
Adlershof,
management
and sensors.



Nick Waltham
RAL space,
management
electronics,
sensors.



Achim Peters
HU-Berlin
electronics,
lasers.



Jörn Wilms
Uni Erlangen
Adlershof
X-ray
missions
APC member