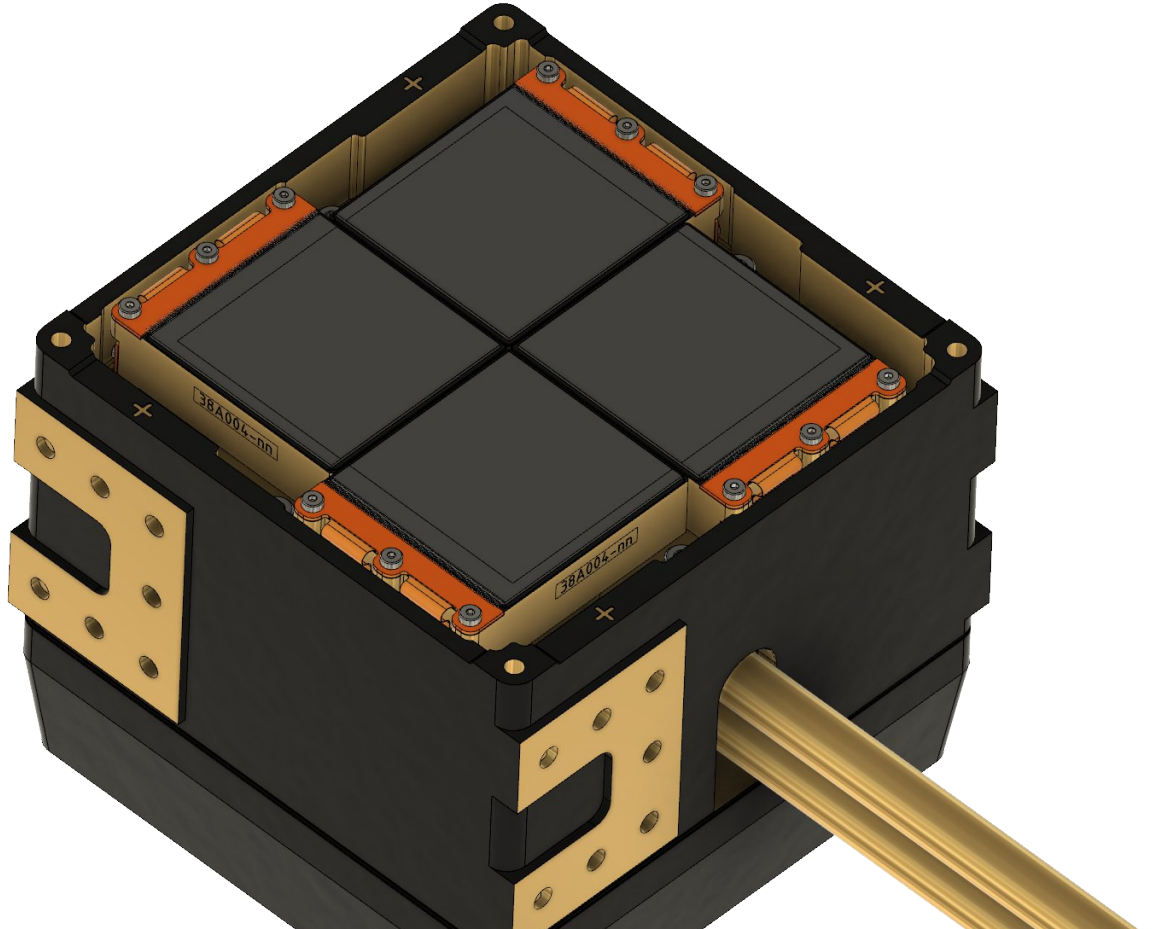
Ultraviolet Transient Astronomy Satellite

Status and overview



Rolf Bühler for the ULTRASAT camera team

APC open session 4th of May 2021

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

ULTRASAT

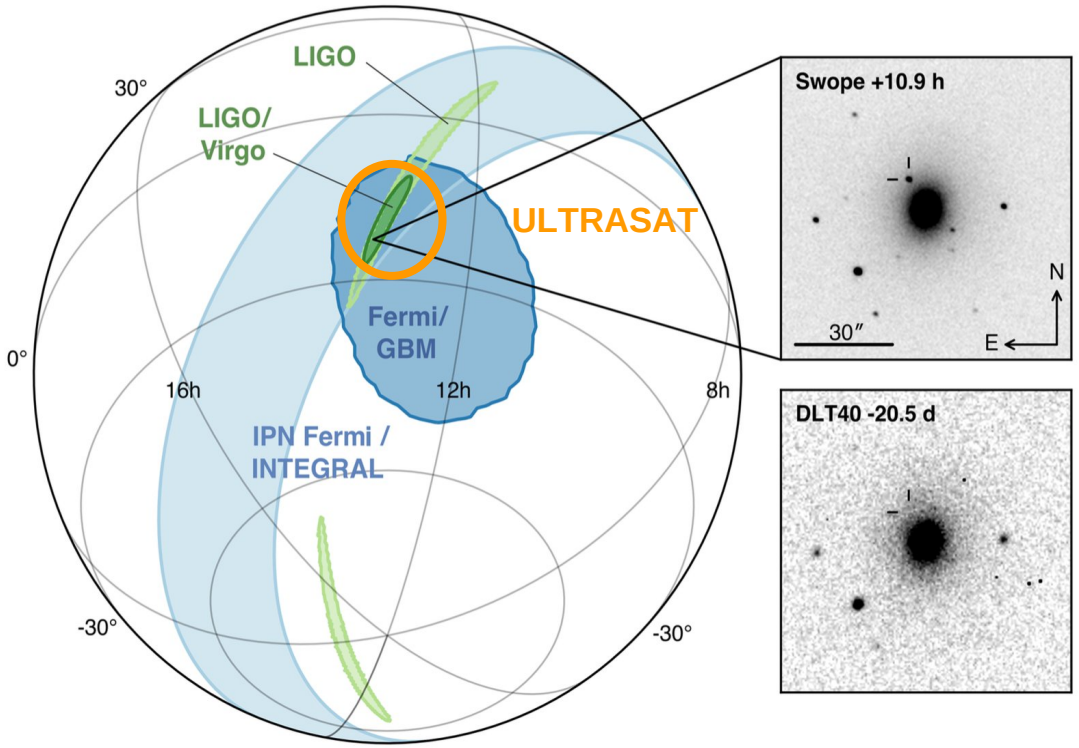
Mission overview

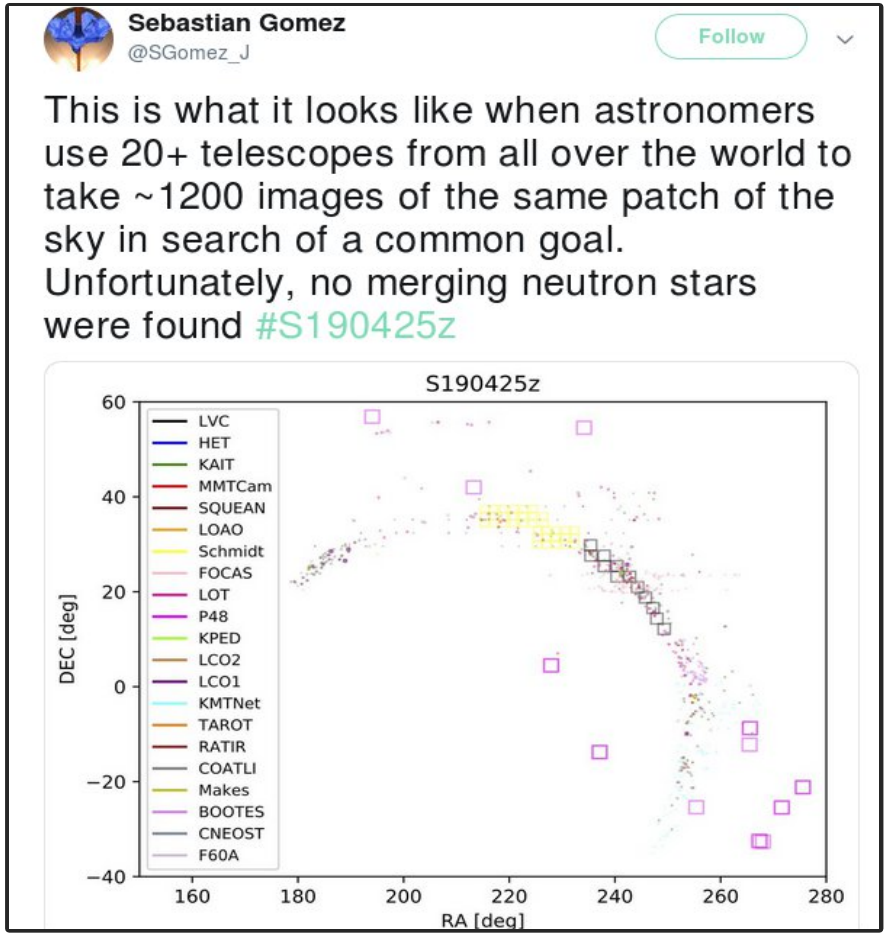
- Astronomy space mission carrying a wide-field UV telescope
- Led by the Weizmann Institute of Science and the Israeli Space Agency
- Spacecraft and telescope are built by Israel based Industry
- DESY will provide the UV camera
- Kick-off on 28th of October, 2019
- Group established beginning of 2020
- Expecting launch in 2024

Observing the UV-sky

Gravitational Wave counterparts

Large field of view (200 deg²) allows rapid transient follow-up (<3 min) and alerts (<30 min) of the astrophysics community.



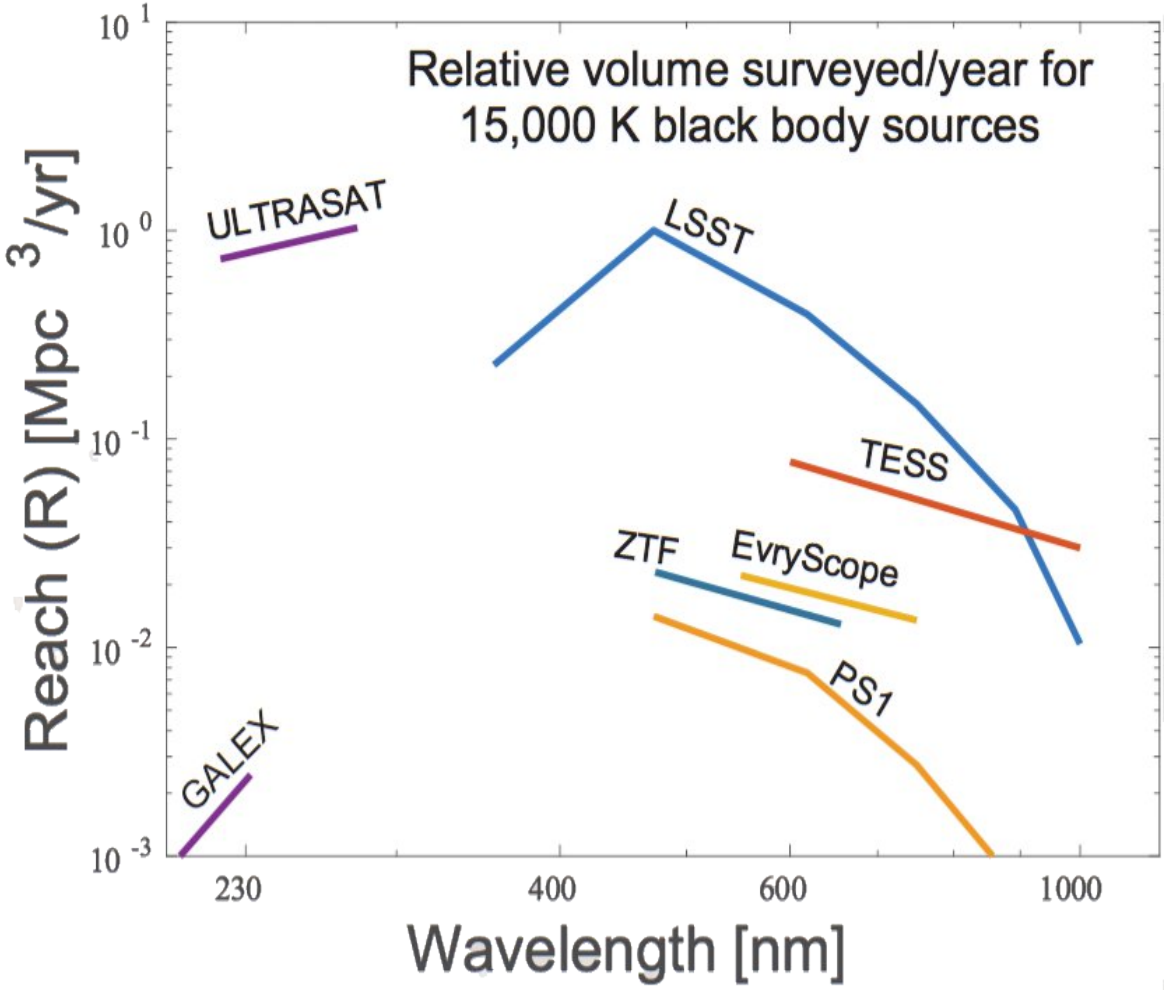


Observing the UV-sky

Deep surveys and serendipitous discoveries.

1. Stellar collisions
   - How are heavy elements formed?
   - How do black holes form?
   - What is the expansion rate of the Universe?
2. Supernovae
   - How do stars explode?
   - How do they affect their environment?
3. Active Galactic Nuclei
   - How is mass accreted on black holes?
   - How is the accretion disk connected to jet emission?

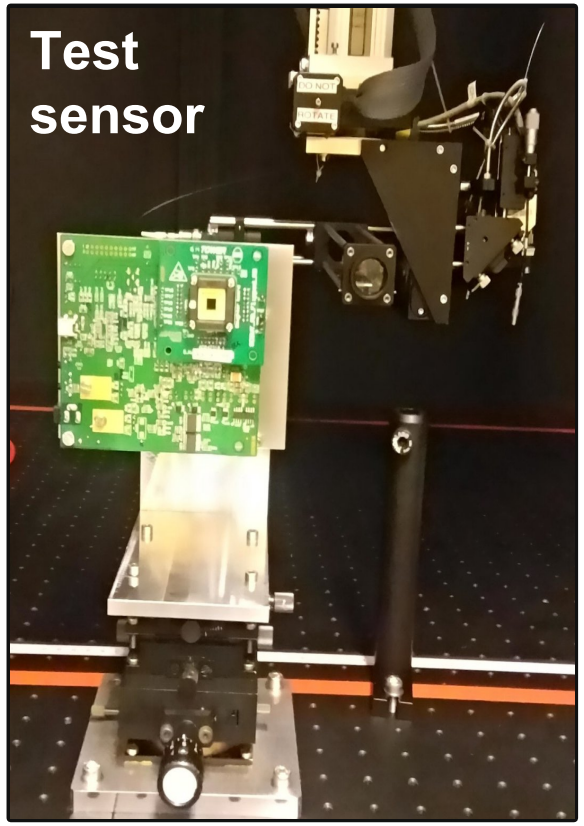
... and many more ..

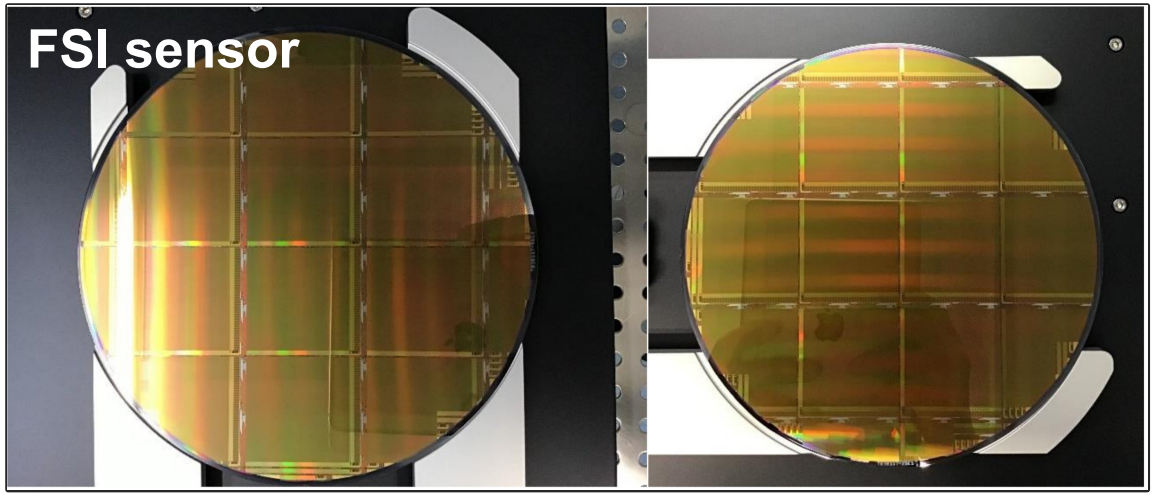


Time line

Collection of milestones

- **09/2019**: Kick off
- **01/2020**: System Requirements Review
- **03/2020**: System Design Review
- **12/2020**: Preliminary Design Review
- **01/2020**: Sensor designed and in production
- **08/2021**: Critical Design Review
- **10/2022**: Flight model delivery
- **2024**: Launch ready





The ULTRASAT satellite

And payload parameters

- Operated in **GEO** (35,800 km)
- Satellite mass: **900 kg**
- Mission duration: **3.5 years**
- **Schmitt design** telescope
- Field of view: **15 degrees** diameter
- Wavelength: **220 to 280 nm**
- Exposure time: 3 x **300 s**

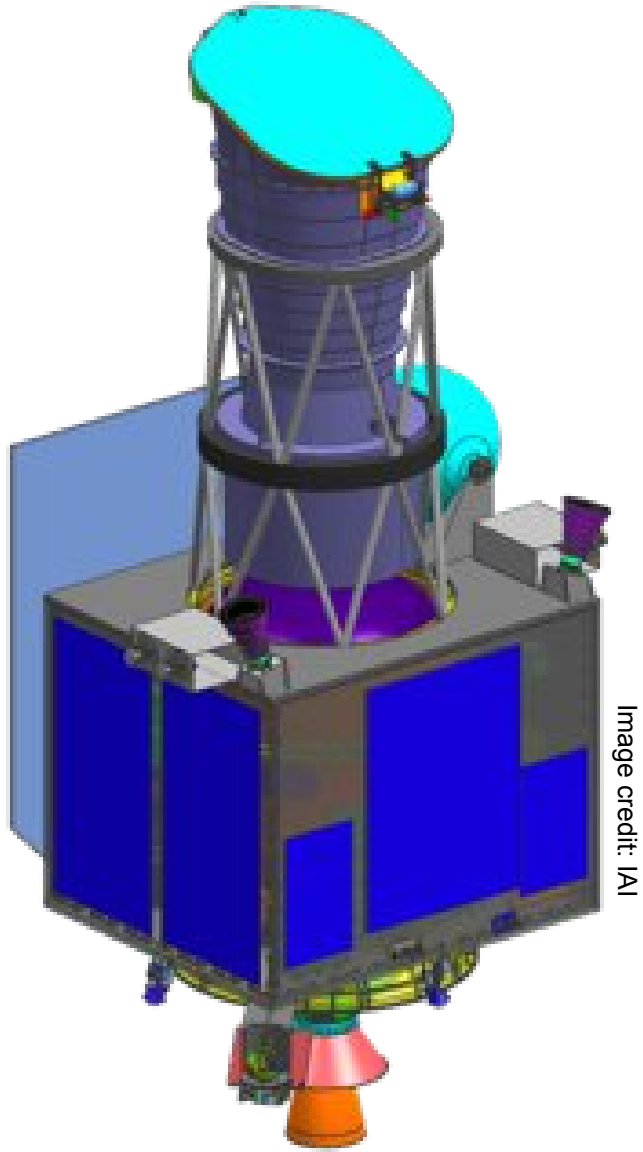


Image credit: IAI

Camera overview

Basic parameters

Detector assembly (DA)

- **90M pixel UV** sensor
- Cooled to **200 ± 5 K** by two heat pipes
- Heated to **75°C** for decontamination
- **Position accuracy** along optical axis **< 20 µm**
- FF lens **400 µm** above **sensors‘ surface**
- Very **stringent cleanliness requirements**
- Power conditioning for the sensor

Remote electronics (RE)

- **FPGAs** for camera readout
- Control of the **focus mechanism (FME)**

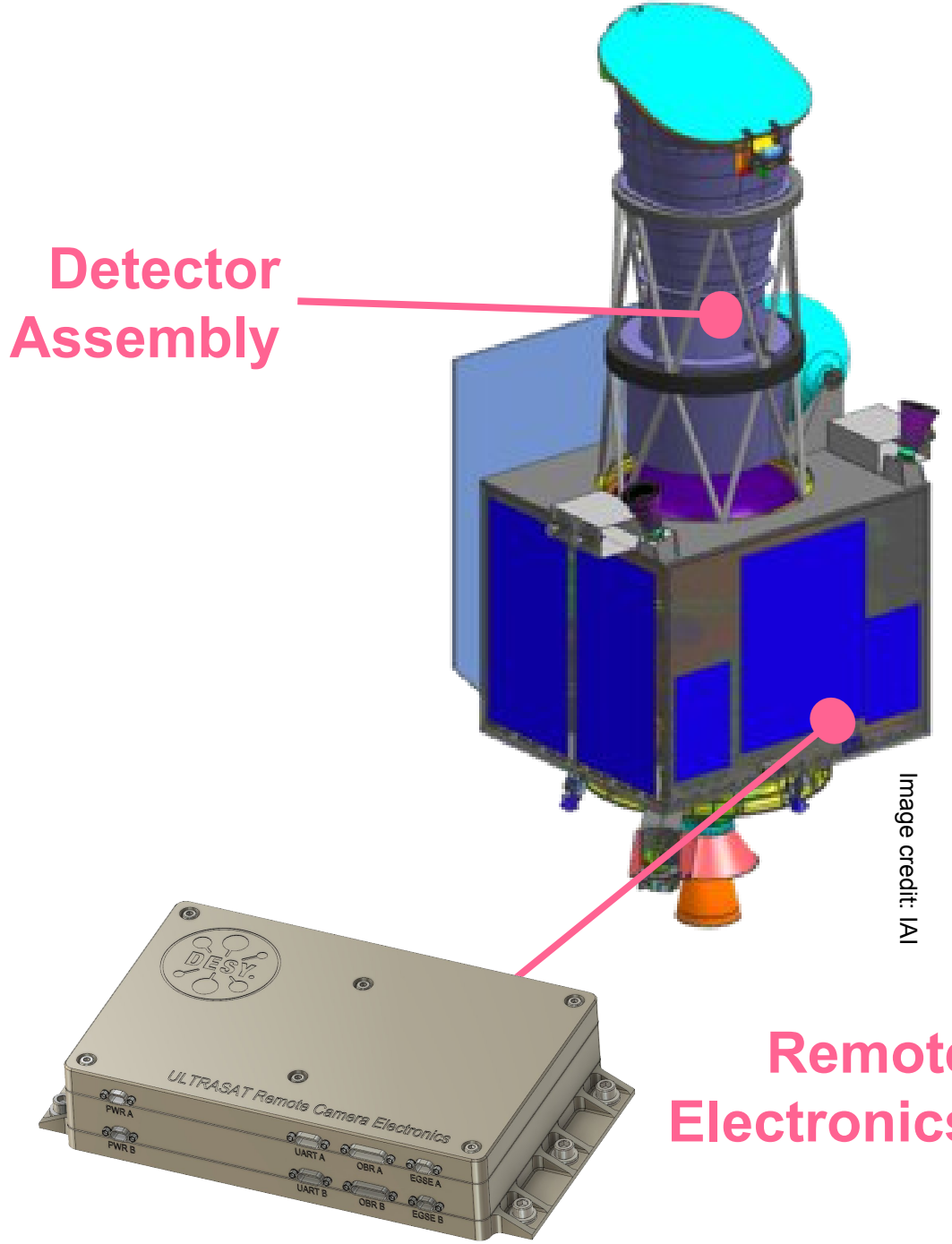


Image credit: IAI

Telescope

Design and camera position

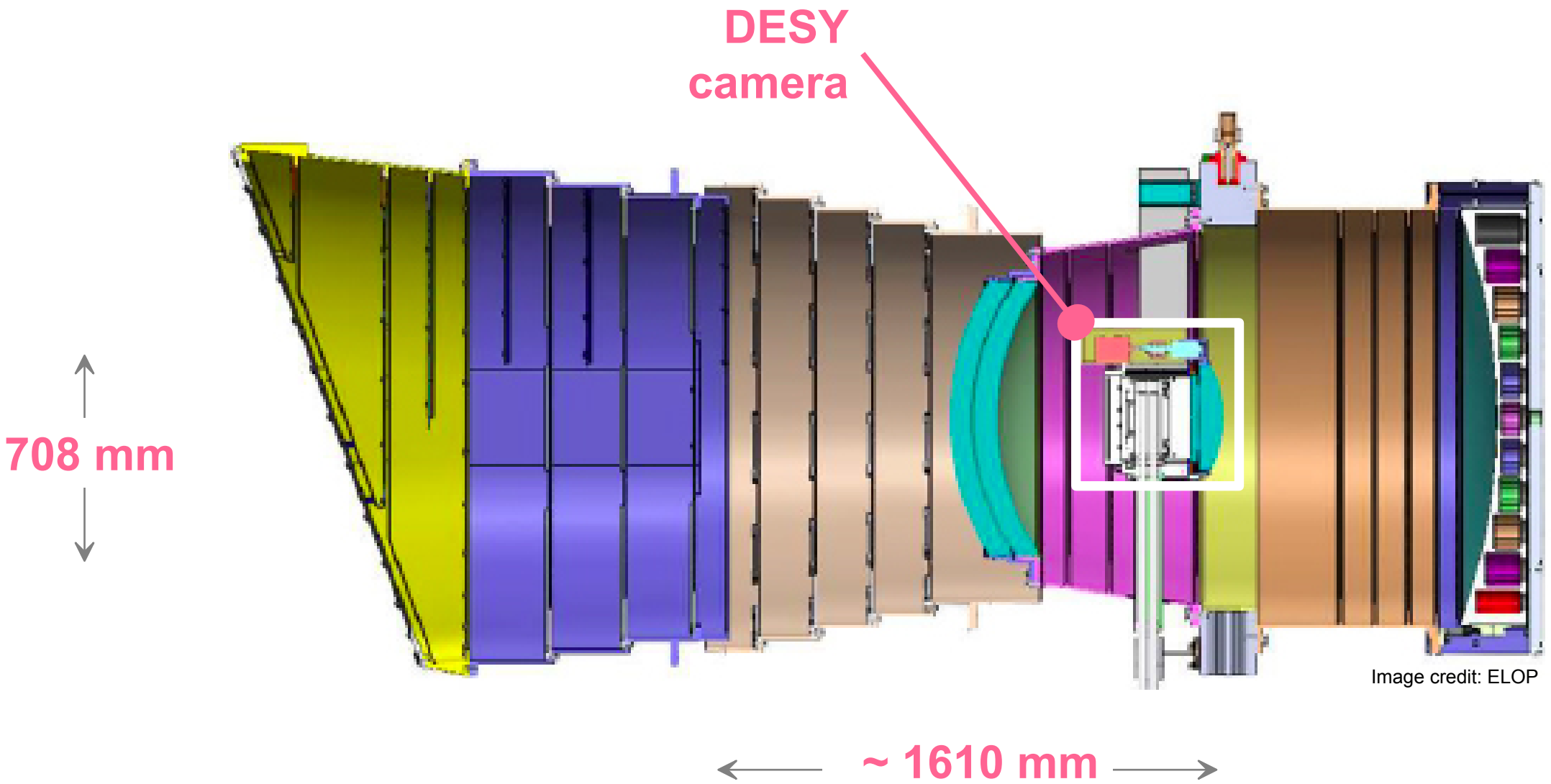
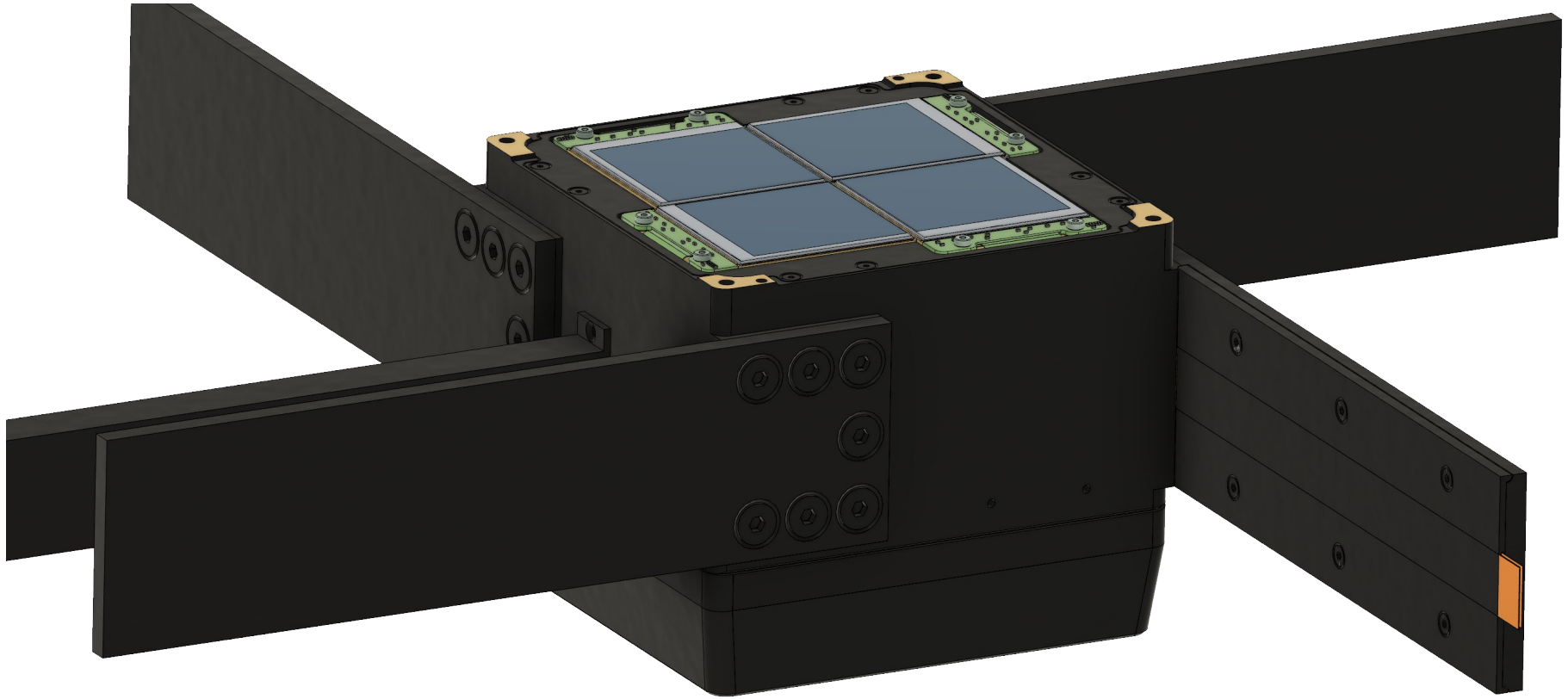


Image credit: ELOP

ULTRASAT camera

Build by DESY

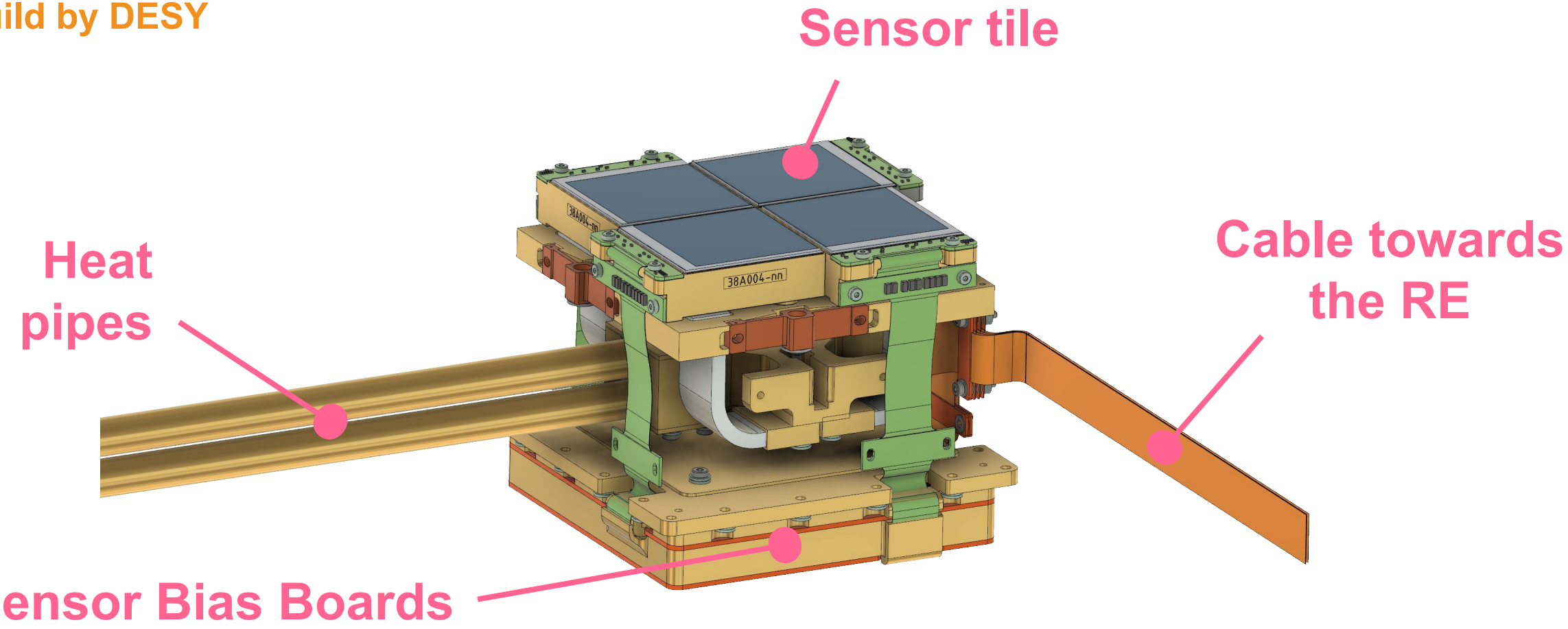


The ULTRASAT camera will be the most sensitive UV instrument so far.

The 135 x 135 x 115 mm^3 camera operated at 200°K.

ULTRASAT camera

Build by DESY



The ULTRASAT camera will be the most sensitive UV instrument so far.

The 135 x 135 x 115 mm^3 camera operated at 200°K.

Sensor Performance

Designed for ULTRASAT

Property	Specification (one sensor tile)
Pixel size	9.5 µm × 9.5 µm
Pixels	4738 × 4738
Sensitive area	45011 µm × 45011 µm
Wavelength	220 to 280 nm
Quantum Efficiency	> 55%
Readout time	< 14 s
Peak power	< 1.25 W
Dark current (@200K)	< 0.026 e-/sec
Full well depth	>140 ke-
Readout noise	< 4.5 e-

Group
Spring of 2021

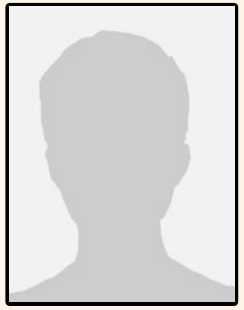
David Berge
Project PI

Marek Kowalski

Steve Worm

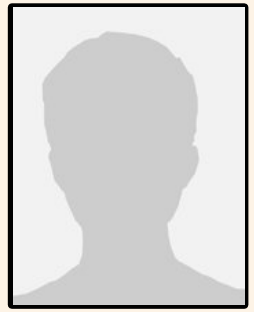
Management

Arooj Asif



Nicola de Simone

Jason Watson



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Firmware and Software

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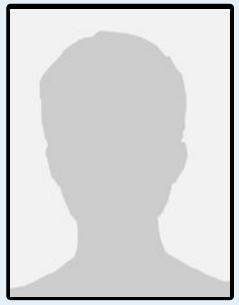
Louise Dittmar

Sebastian Philipp

Mechanical and thermal

Mikhail Vasilev

Francesco Zappon



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Merlin Barschke
System engineer

Rolf Bühler
Project manager

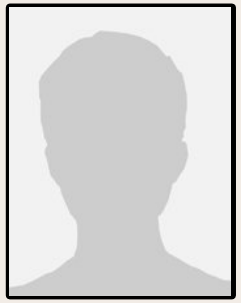
Shrinivasrao R. Kulkarni
Quality assurance

Benjamin Bastian-Querner

Gianluca Giavitto

Nirmal Kaipachery

Julian Schliwinski



Daniel Küsters

Verification

Rapid group build-up.
Majority joined last year, during the pandemic.

Group
Spring of 2021

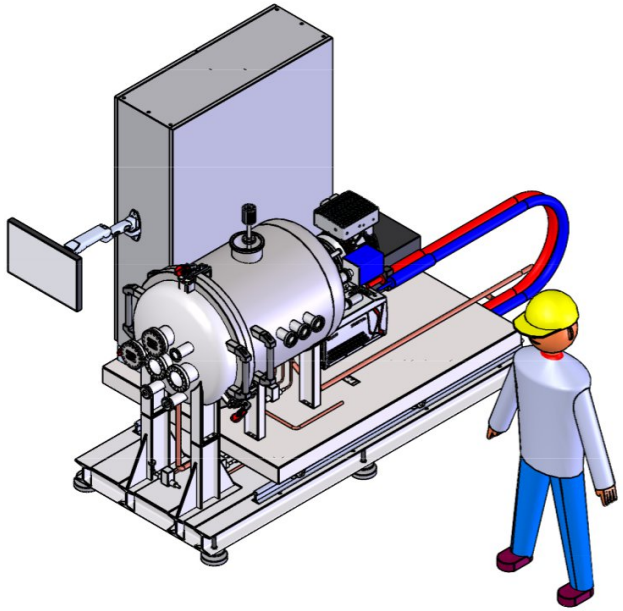
Laboratory

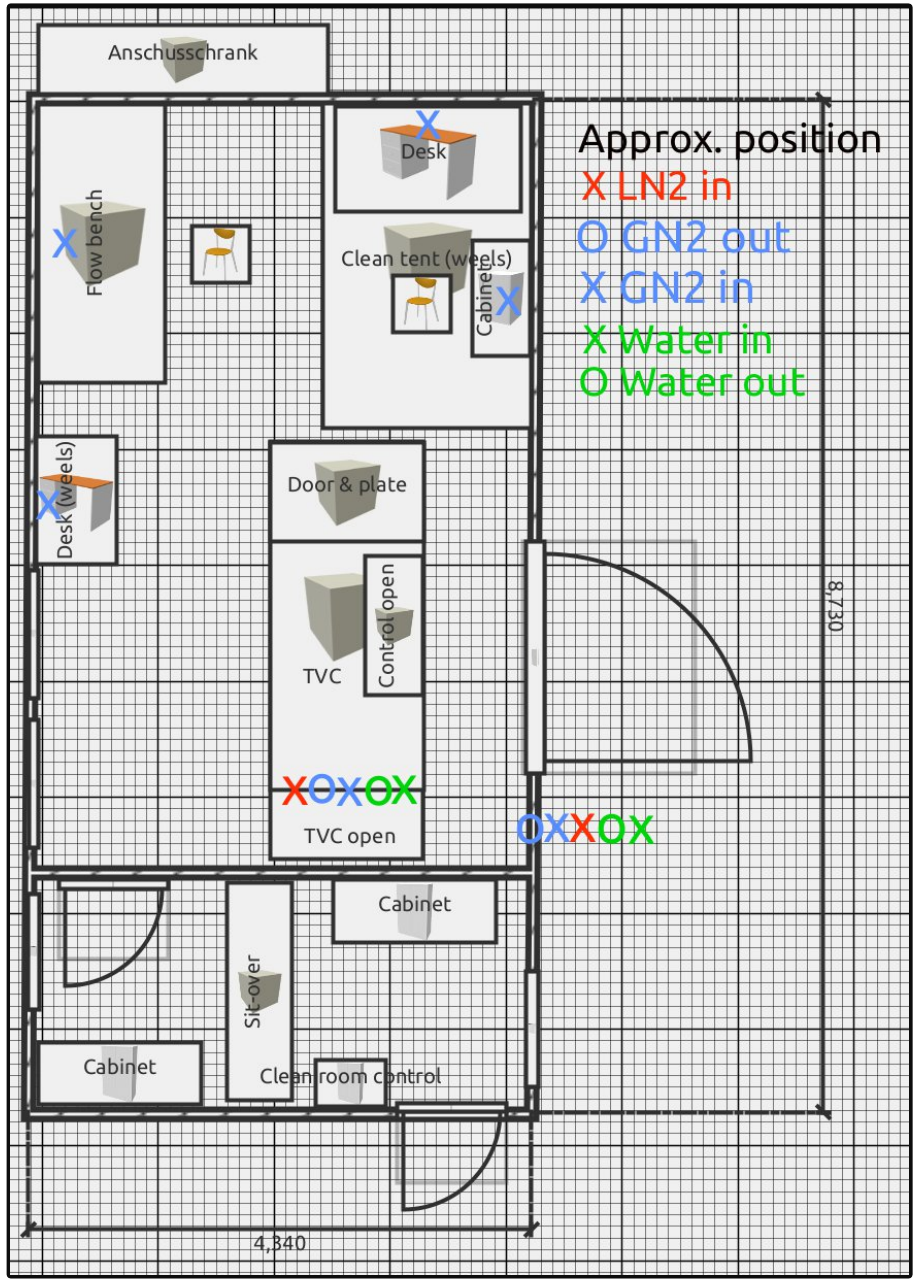
In the "Zeuthen hall"

Contracts made for:

- ISO 7 laboratory with ISO 5 areas of 35m² .
- Large 250 L TVAC.

Building ongoing finish in July (Laboratory)
November (TVC) 2021.





Summary and Outlook

Towards construction

Main achievements of the last 6 months:

- Advanced electronic and structural design, passed Preliminary Design Review
- Sensor is designed and in production, package (“carrier”) follows this month
- Major equipment and lab infrastructure ordered
- Team established, work in full swing

Next steps:

- Start building prototypes in the coming months
- First camera model towards the end of the year

Backups.