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Radboud Universiteit Nijmegen

Advanced Instrumentation

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Project Manager BlackGEM

Sr. Business Developer - Science & Technology

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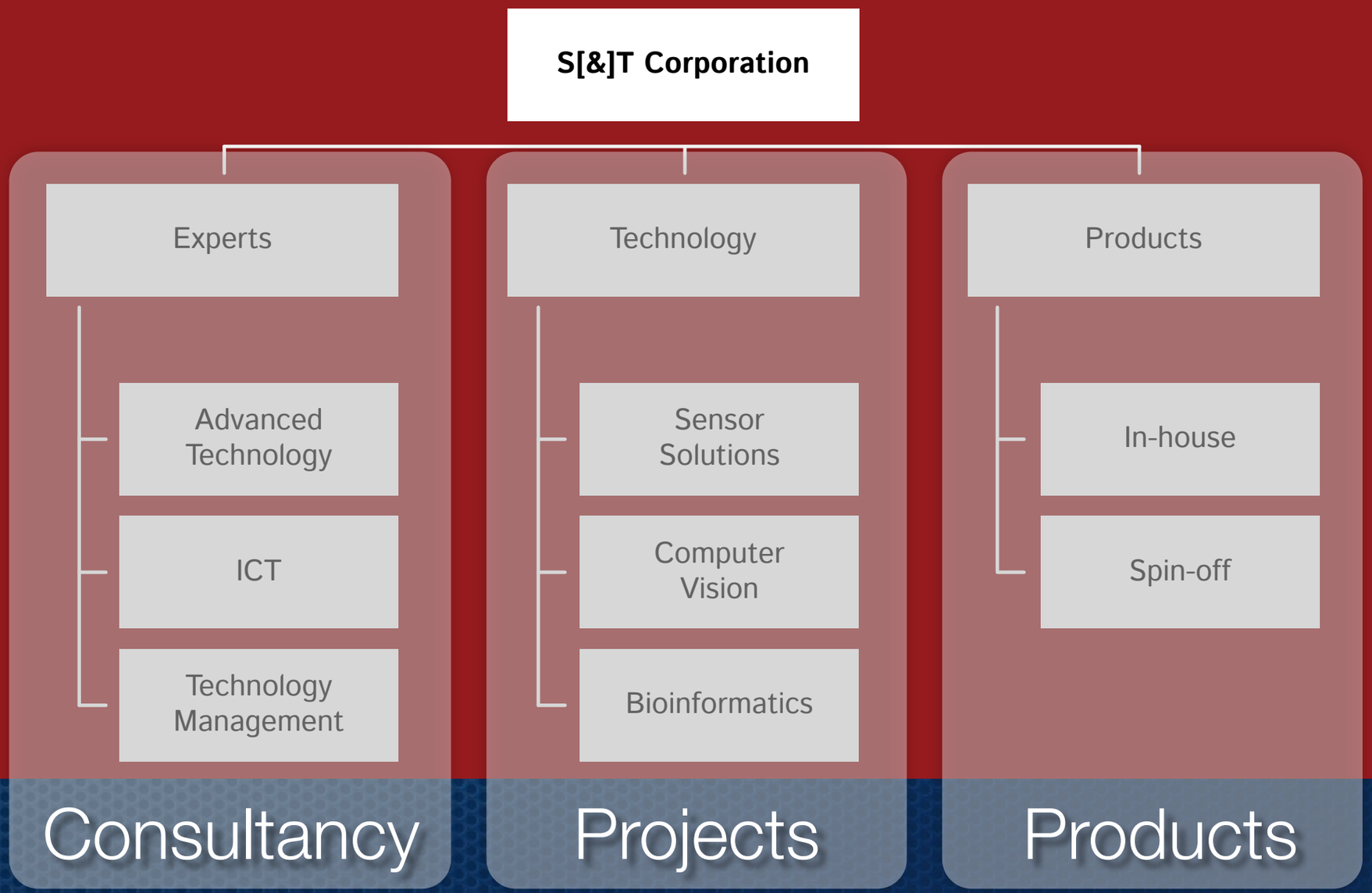
S[&]T & Advanced Instrumentation

The business side of AI, Big Science and Big Data

Science [&] Technology

[our business lines]

- 75 people
- 13 years experience
- Growth through SW engineering
- HW engineering @ HighTech industry
- Bring technology to the market: incubator
- Part of Holland Instrumentation

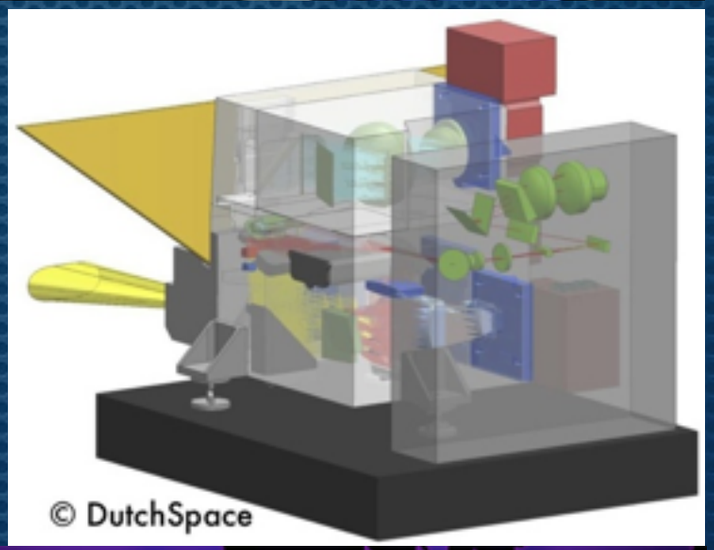


S[&]T AI/Big Data projects

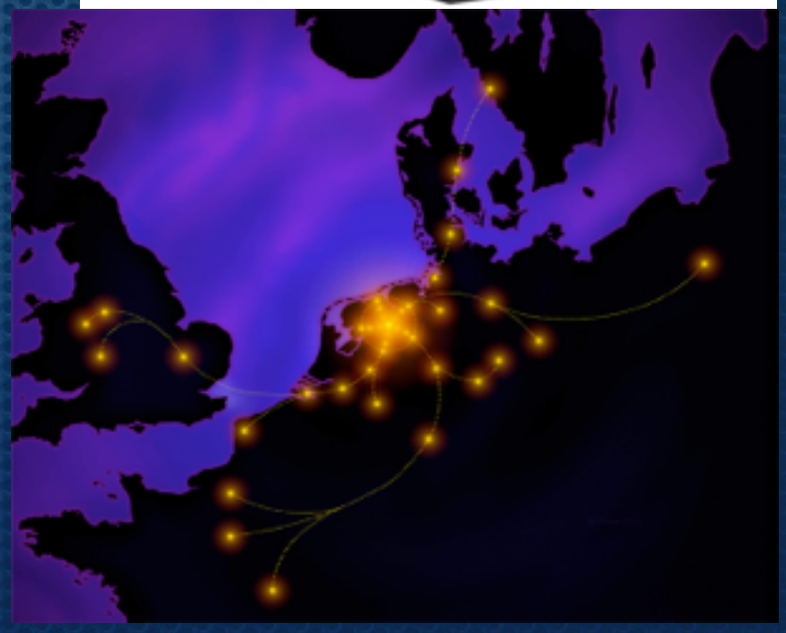
- Calibration & Data analysis for Earth observation / remote sensing missions / Astronomy
- System health management (housekeeping data)
- Semantic Technology: Big Data mining

Calibration and data Analysis

- **[Projects]**: OMI, GOME-2, MERIS (ENVISAT), SCIAMACHY, LOFAR, SKA, DOME, Raman-Libs spectrograph for Exomars, TROPOMI, Sentinel-4

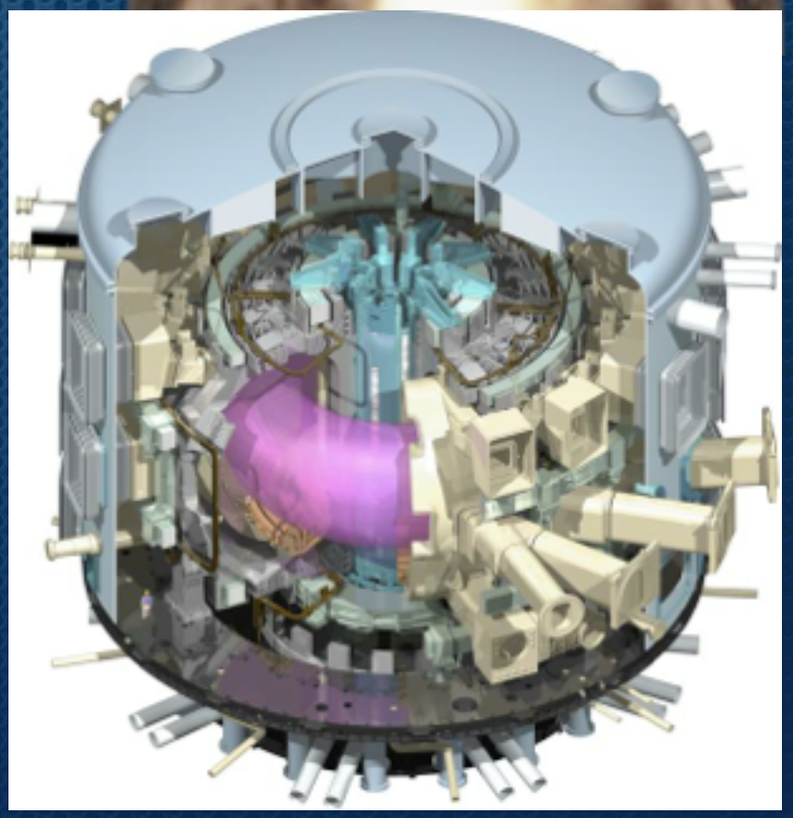


- **[Activities]**: (on-ground) calibration, algorithm and data-pipeline development, Development of Calibration and test facilities, Management and conducting test campaigns, data simulators, pre-processing and visualization of raw data, generation of calibration key-data for level 0-1 and 1-2 data processors

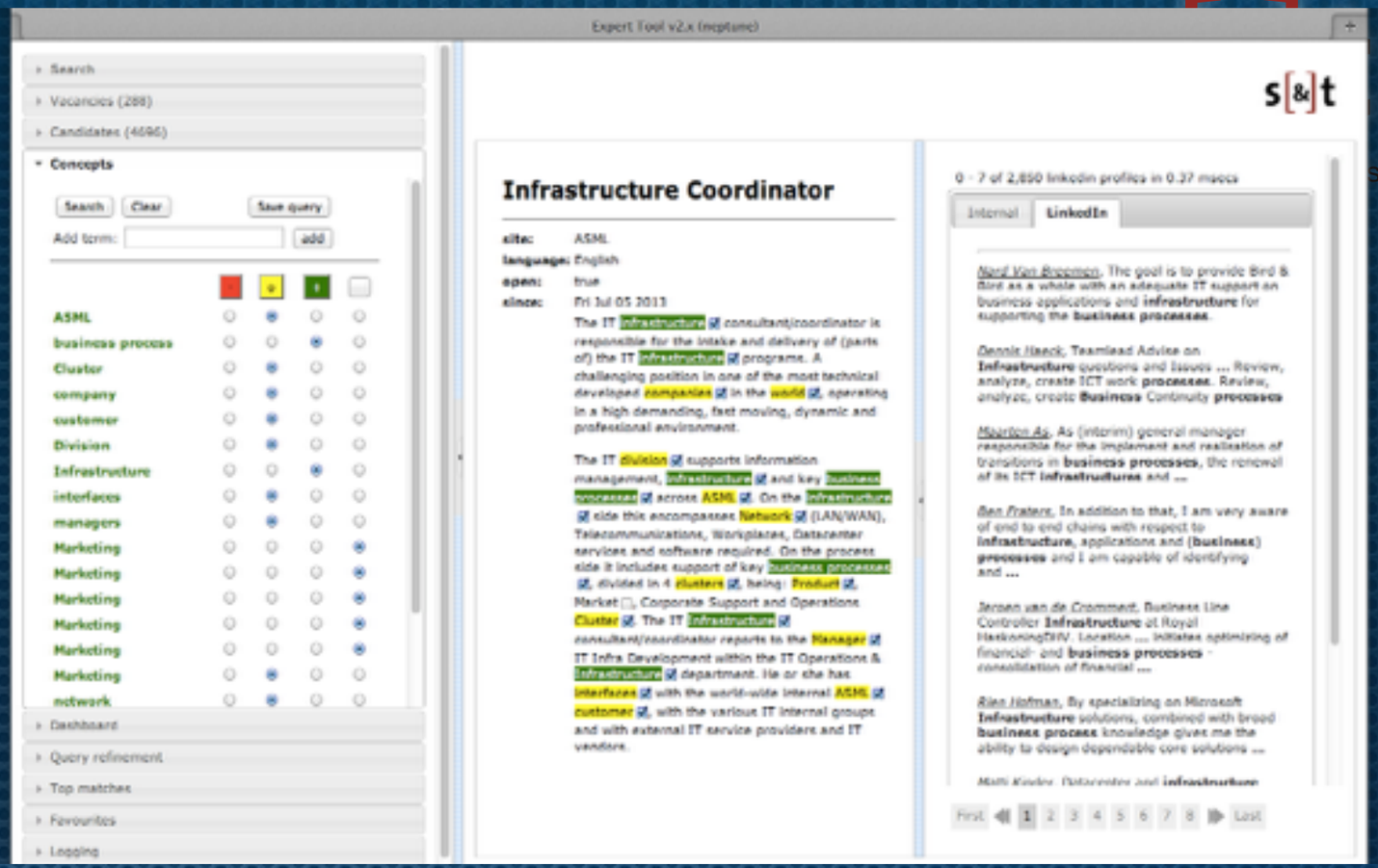


System Health Management & Quality control

- [**Projects**]: LOFAR, SKA, ITER-NL, VULCAIN Thust-chamber, High-Thrust Engines (Snecma), Semiconductor equipment (ASML),
- [**Activities**]: Fault, leak detection and isolation, diagnostic and prognostic software, data health and quality management
- [**Products**]: Quadas toolbox: inspects the data products for possible failures in both the space segment (e.g., sensor failures) and the ground segments (e.g., incorrect application of calibration data), used for Aeolus, SWARM, CryoSat-2, Galileo, Sentinel-1, SCIAMACHY



Semantic Technology & Big Data



- production > processing, unstructured data
- Concept-based search tool for databases (discoveries)
- Integration of data sources: link between different data bases
- identification of relations between data elements
- Smart algorithm development and spin-off to other domains
- Prototype for business and medical application
- also for sensor data: pattern searches

LOFAR & SKA: Big Data

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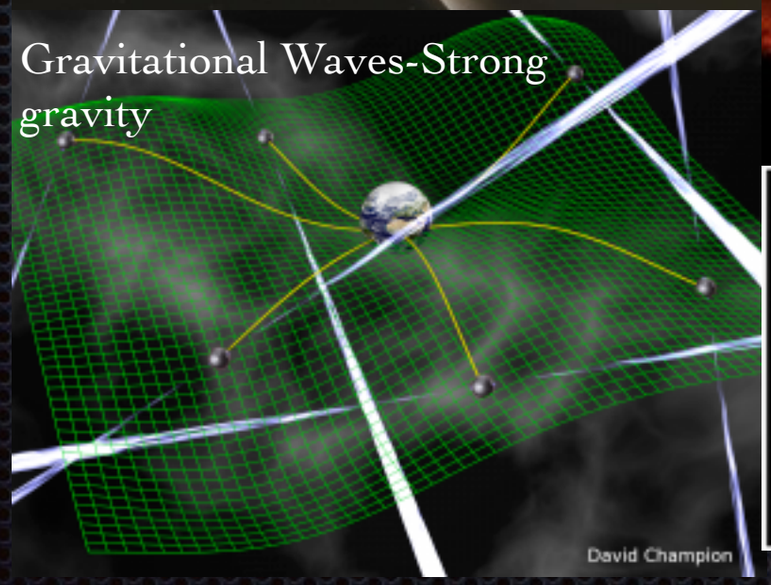
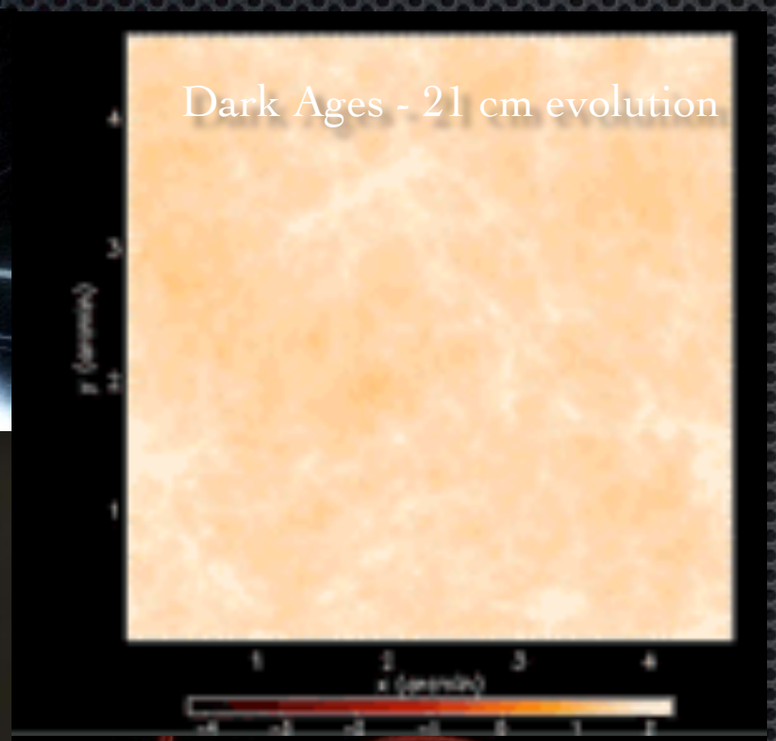
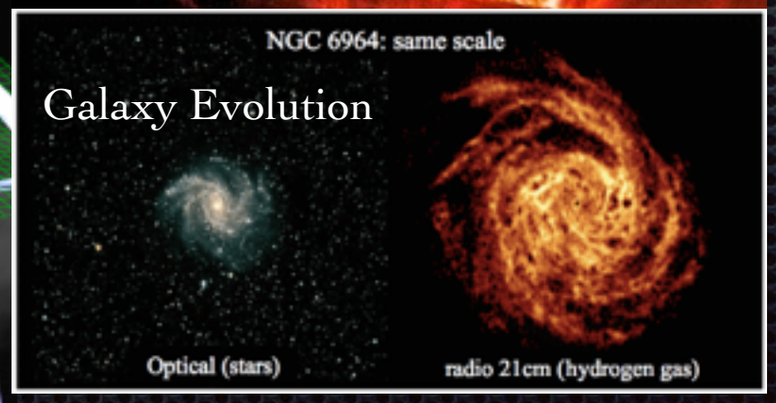
SKA - Science and Data





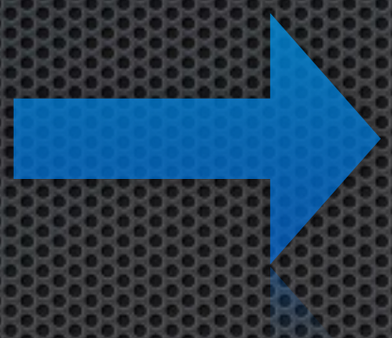


- 20 Gb/s per dish
- **14 exabyte/day** of which **one petabyte** (10^{15}) is stored
- 100 petaflops/s processing power
- Data processing and calibration
- Requires new technologies for processing and storage

See: presentation Ronald Halfwerk

Innovation @ S[&]T

Science:
Concept/Model/
Algorithm



Application in
Industry

Requires:

- Scientifically trained & entrepreneurial personnel
- The right partners
- Structured process (incubator)
- Investments
- Time
- Iterative development process (test bed)
- Solid business plan: application with market demand

Innovation @ S[&]T

An Example: System Health Management

Model-Based Diagnostics: fault prediction

Too complex for real time fault detection

Application to LOFAR: more pragmatic approach for fault detection

Developed towards know indicators for faults (from user experience)

Applications in Oil & Gas and ITER: fault and leak detection system

Oil & Gas application is now on the market in spin-off

THE RADBOUD UNIVERSITY & ADVANCED INSTRUMENTATION

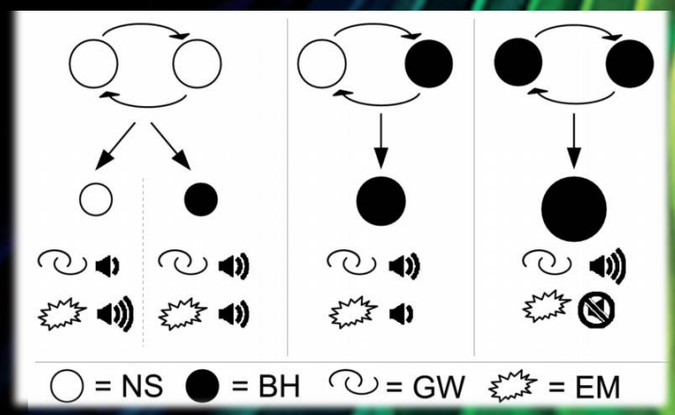
An example of a big-ish science project: BlackGEM array of optical telescopes in Chili

Radboud Universiteit Nijmegen

SCIENCE -1

Merging Black Holes

Prediction:
1-1700 gravitational wave events per year

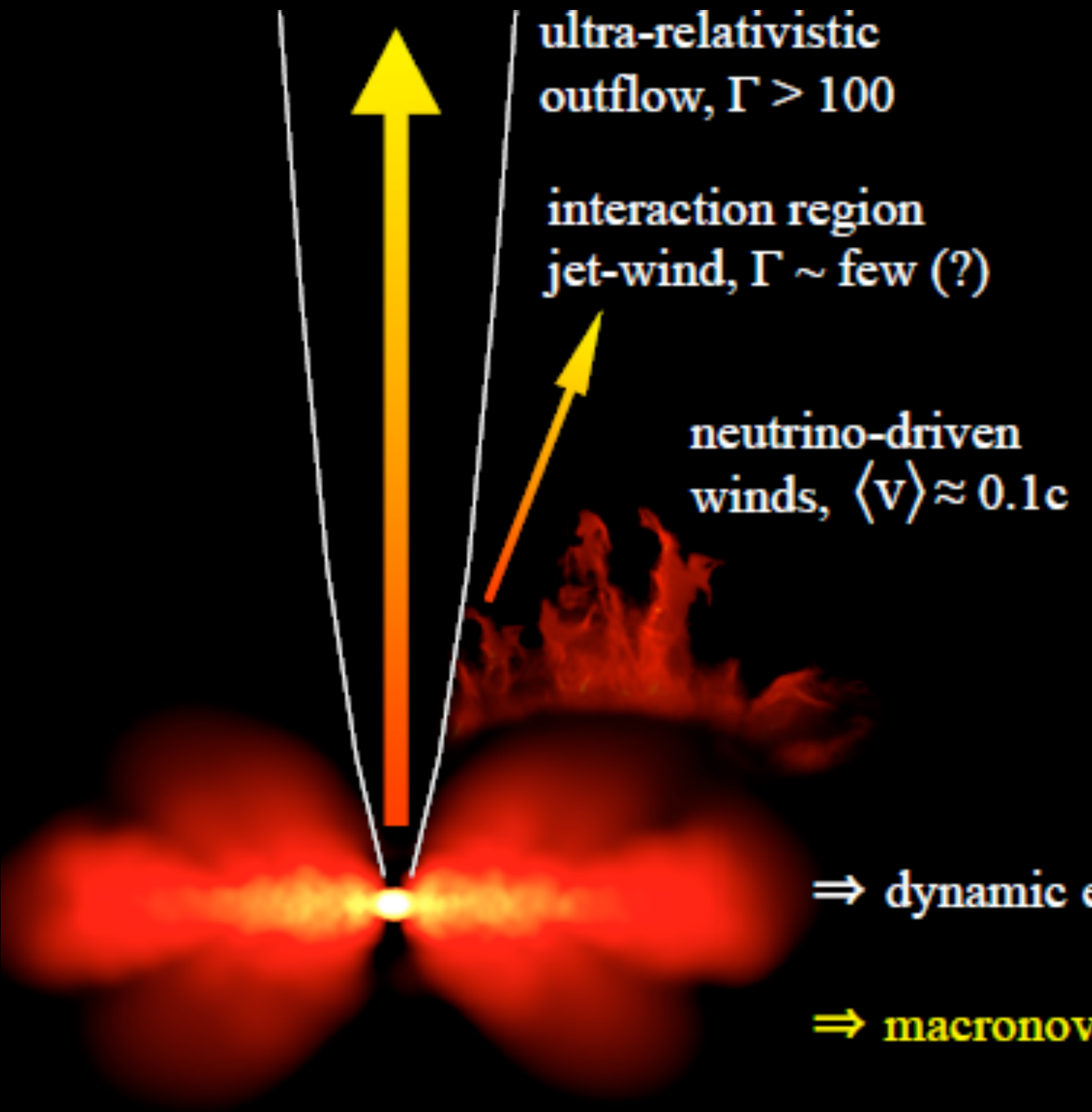


Virgo interferometer (Italy)

Detections up to 400 Mpc (local Universe): once per week (range is 10's per day-few per year)

SCIENCE - II

Sensitivity to detect optical counterparts up to 400 Mpc: magnitude 22.5 (10^{-15} times fainter than the full moon)



Requirements:

- large fov: 100 square degrees
- sensitive: good site!
- Dedicated facility
- Robotically Operated: KISS Design

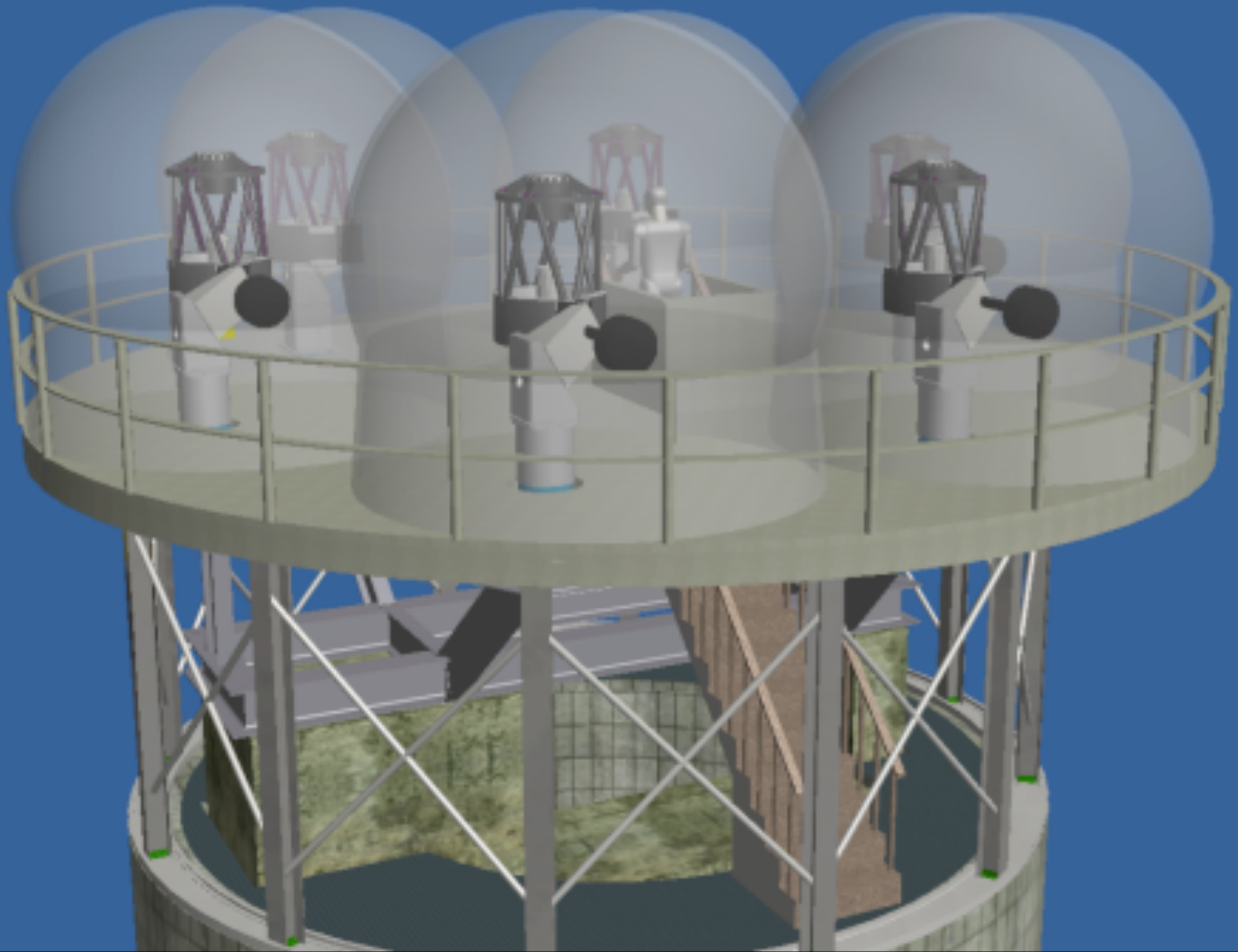
ESO - LA SILLA

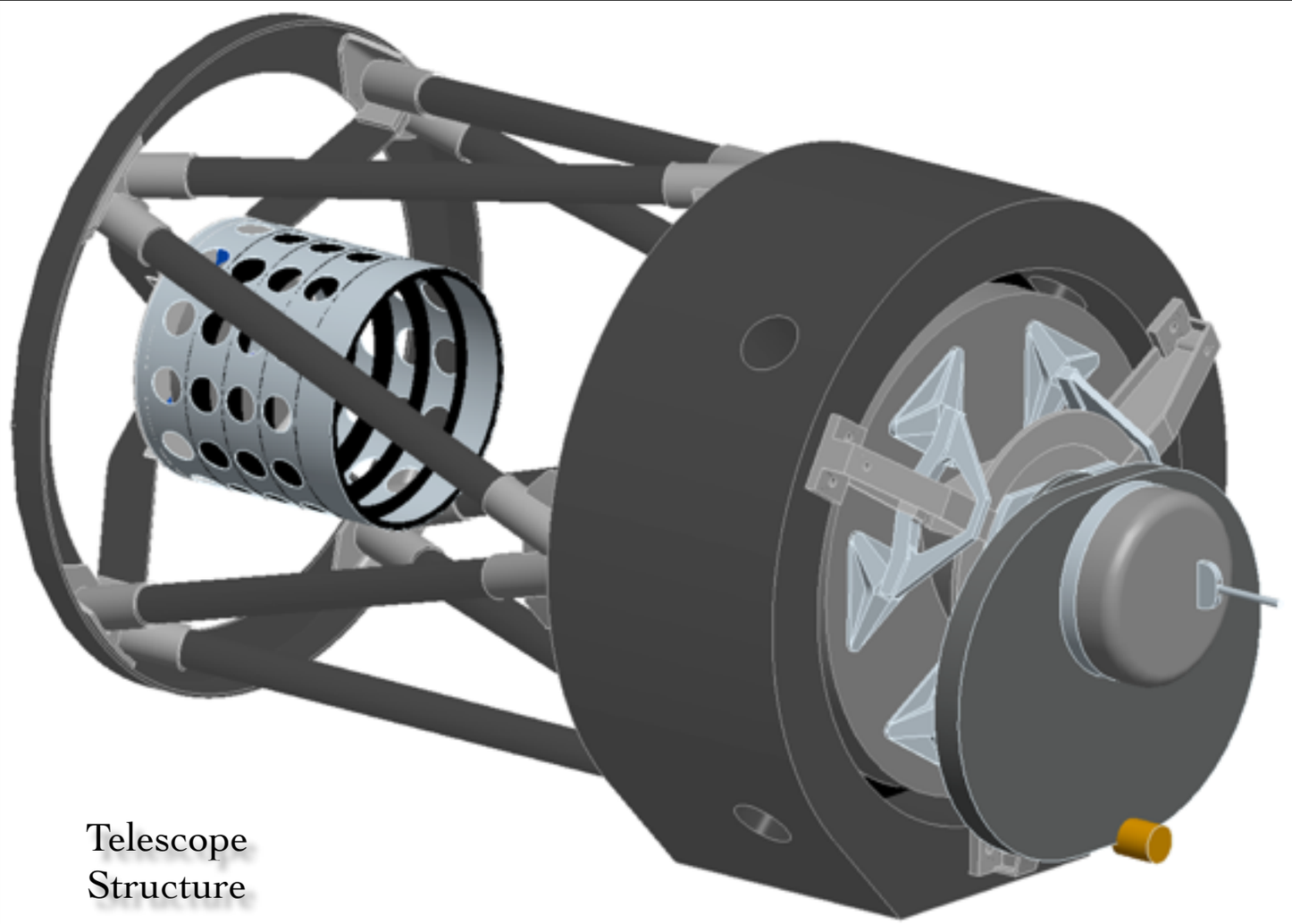
GPO/Marly Building

TEAMS

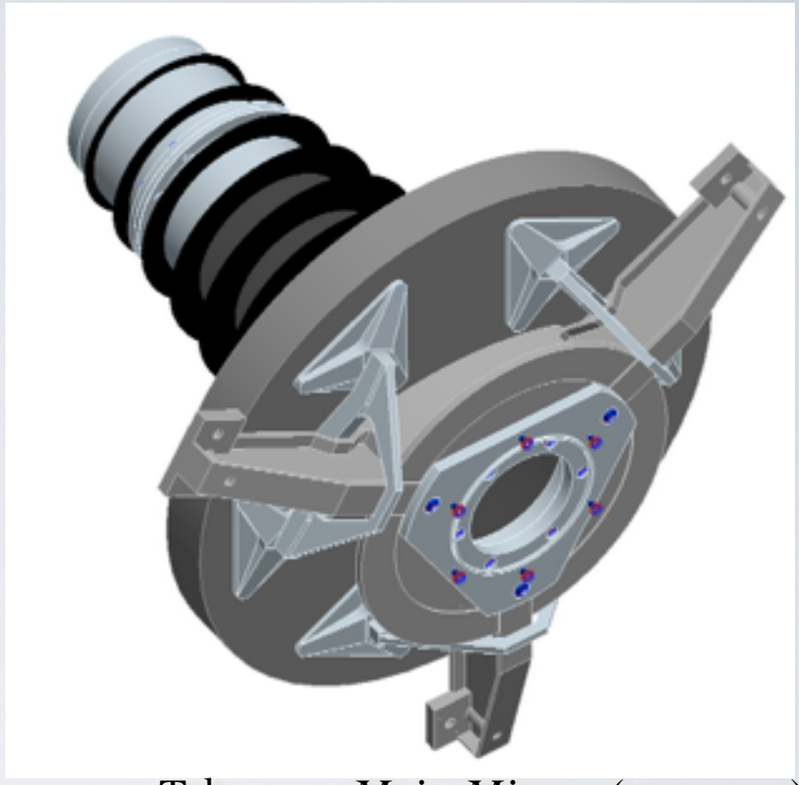
Optical Team	**Castor**, NOVA Optical-Infrared Group
Telescope Team	NOVA Optical-Infrared Group, **Airborne**
Housing Team	TechnoCenter Radboud University, **Fornax**
Camera Team	**Mecon** (Design)
Software Team	Radboud University

DOME - HOUSING



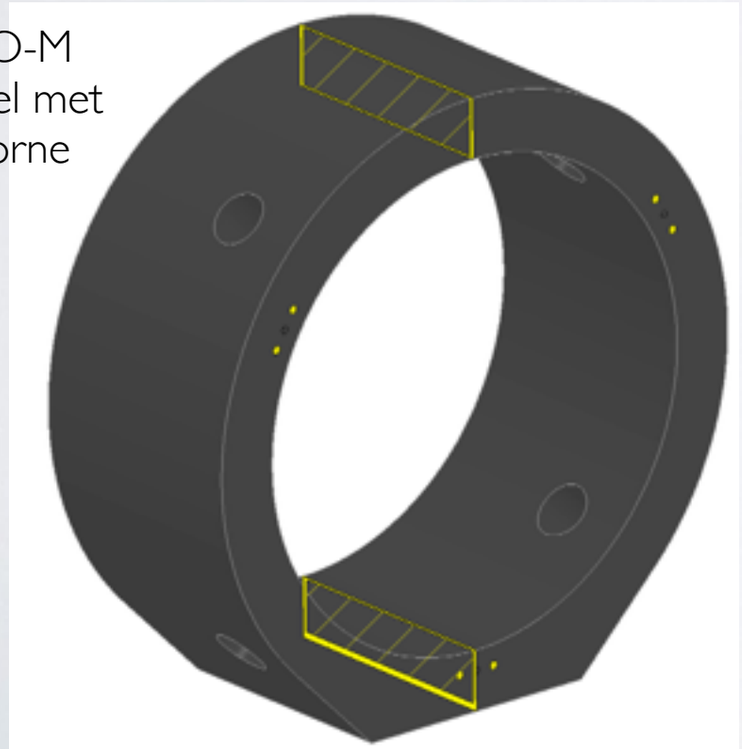


Telescope
Structure

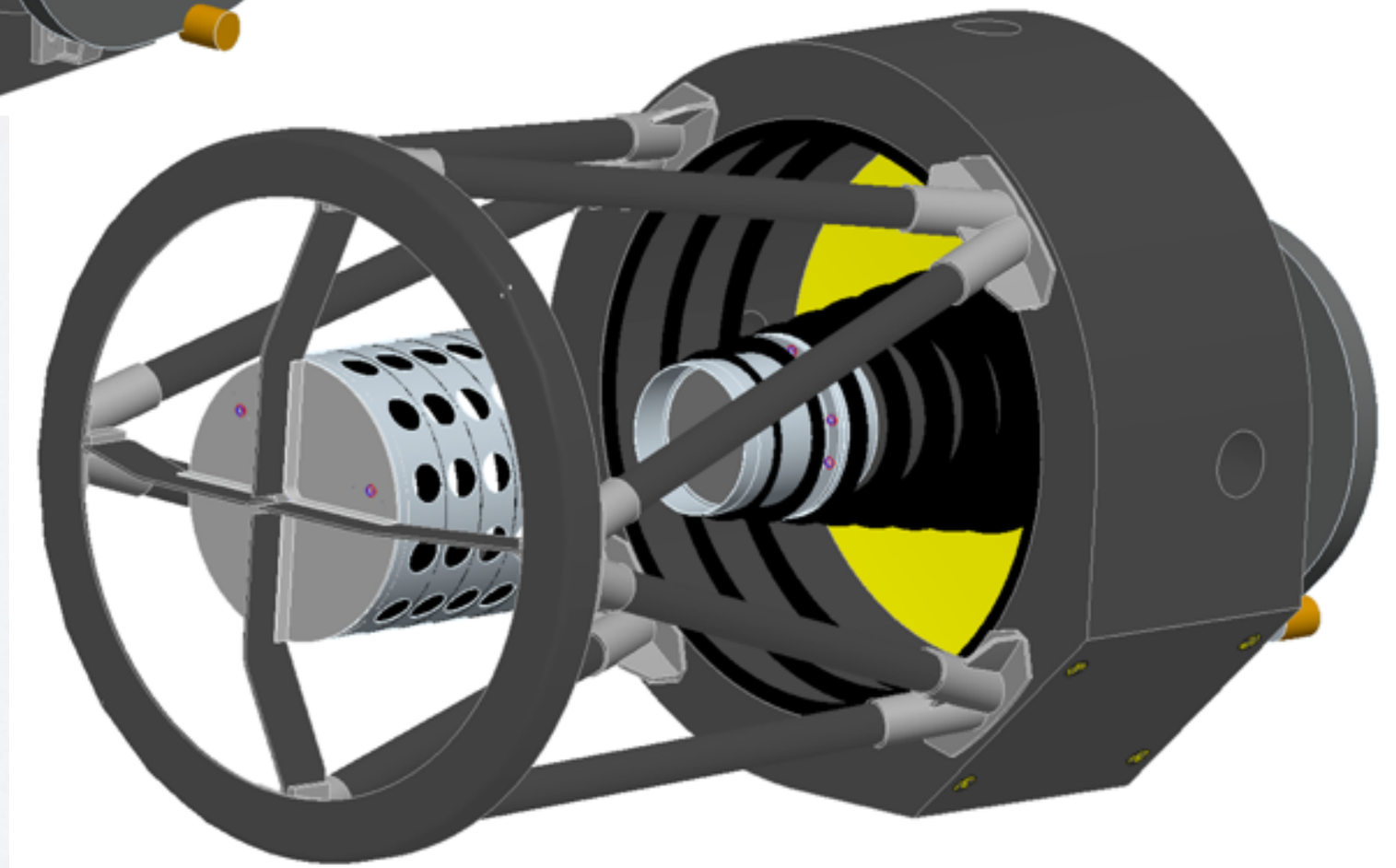


Telescope Main Mirror (+support)
and Lens barrel with baffles

NWO-M
voorstel met
Airborne



Telescope Main Ring



BLACKGEM TIMELINE

KO: May 2013

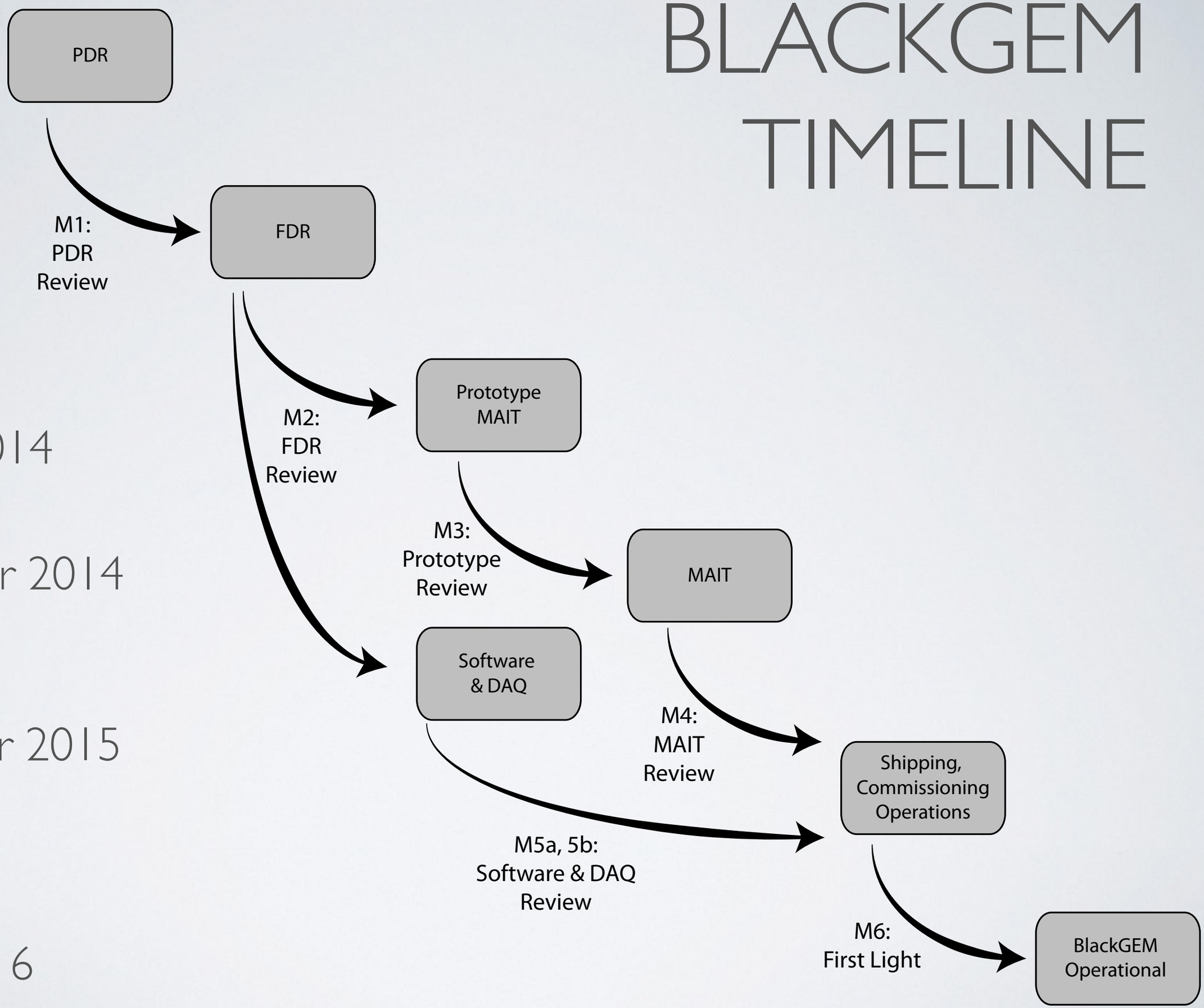
October 2013

January 2014

September 2014

November 2015

March 2016



INDUSTRY INVOLVEMENT

- NOVA Funded project
- Part of Roadmap advanced instrumentation (Optical Instrumentation): specific knowledge obtained from industry, e.g. carbon components (NWO call) & Opto-mechanical Design.
- significant fraction of the total budget to industry: ~30 % budget
- Partners involved: Mecon (camera design), Airborne (telescope structure), ...?

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Thanks...

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