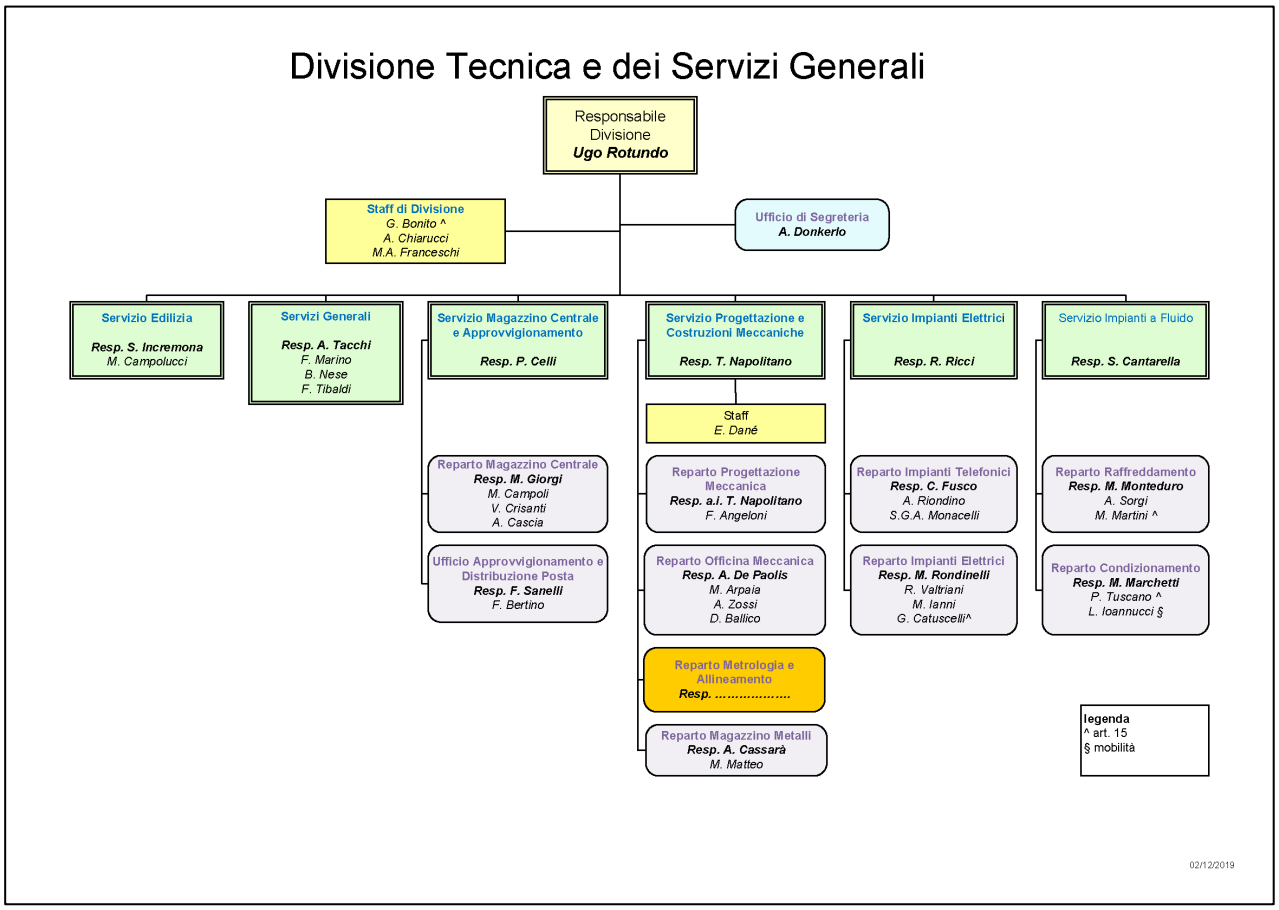
TECHNICAL DIVISION

The facility management of the Frascati Laboratories (and INFN Central Administration) and support to experiments and accelerating machines (mechanics, electric systems, cooling&ventilation systems, civil works and general services) are the main task of the General Services and Technical Division.

The next Figure shows the Division's OBS.



A summary of the major activities and results attained during 2019 is reported.

NEW BOUNDARIES

During 2019 a new lot of land was acquired by LNF, extending its premises for about 5000 sqm. The next Figure shows the new map layout, with the new land highlighted. The Division cured all the aspects of the trade and of the following management of the new property.

GENERAL SERVICES GROUP

Following the acquisition of the new land, a series of actions was required:

- Realization of a new gate on Via della Perrazzeta, for pedestrian access regulation;
- Realization of a new gate in the existing fence to gain direct access from inside the LNF;
- Green management of the new property;
- Relocation of 30 olive trees from the new property to the LNF premises.

During the year some major porterage activities were required in order to:

- Prepare the set up of the DDG Lab in Bld. N.8;
- Prepare the old liquefier decommissioning and reuse of the space to host a new project (LATINO) in Bld. N.7;

- Dismantling and disposal of the Clean Room hosted in Bld. N.27.


During the year major gardening activities were also required:

- 12 trees felling for illness and new trees reimplantation;
- Green management of pines next to the border with the town road, including traffic management for safety assurance.


In 2019 the Group was also involved in the preparation of some main outreach events:

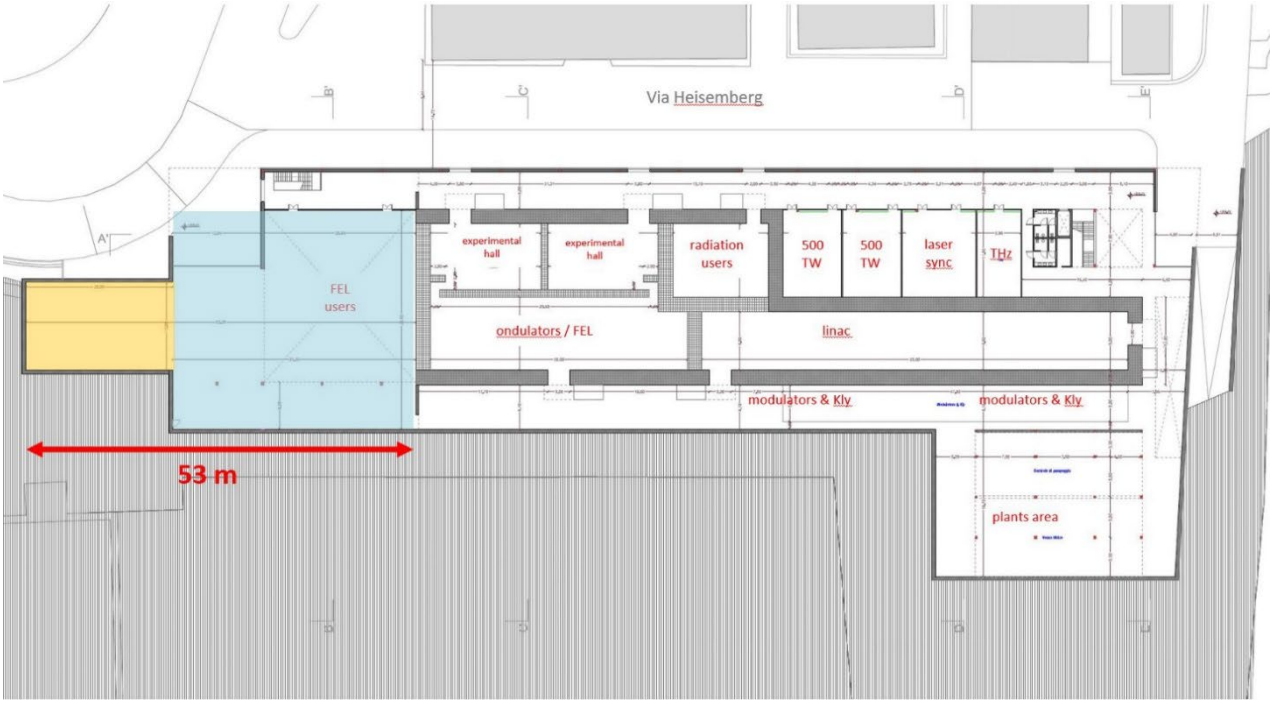
- Set up of the Lab for the opening to the public audience like OpenLabs and The European Researchers' Night;
- Preparation for the Tappa della Scienza, an event related to the passing of the Giro d'Italia, in collaboration and with the participation of the Frascati town Municipality;
- Set up of the external area of the LNF Visitors' Centre, and corresponding Bernardini Hall furnishing;

- Kick off of the national INFN project **“Plastic Free”**.

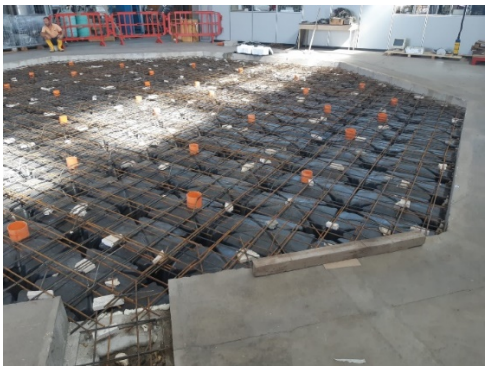
CIVIL ENGINEERING GROUP

During 2019 the Group was involved in some major renovation of several of the 57 Bldgs composing the LNF inventory, the set up for the realization of a new Bldg. to host a new accelerator and infrastructures overhauling, namely:

- Tender procedures for the Detailed Engineering Design award in order to realize a new infrastructure to host the project **EuPRAXIA@SPARCLab**, a new concept PLASMA based acceleration machine. The next pictures show a Photo Manipulation rendering and a layout;



- LNF **access control system** realization. The system is intended to control the presence of people within the LNF premises for safety reasons, but the project includes the realization of the infrastructure to allow for control in specific areas like Radio Protection Controlled or Restricted areas. The work is started and it will continue in 2020;
- Power Supply room floor slab consolidation in Bldg. N.54 for the **BTF2**. This is due to the installation of some heavy component for the construction of the new Beam Test Facility experimental line;
- Slab renovation for the **DDG Lab** in Bld. N.8. This is due to the reuse of the space that hosted the NAUTILUS experiment, a gravitational antenna, which was installed on a huge metallic support engraved under the pavement. The work realigned the floor to host the new Lab;



- **Road surface** renovation. Several areas of LNF internal roads suffered for tree roots outcropping. Also due to heavy rains some part of the roads collapsed for foundation flush. Almost 7000 sqm of road surface were renewed;
- **Central Administration ground floor levelling design**. The activity was made necessary as several years ago the ground floor of Bldg. N.30, hosting the INFN AC, which was designed to be open to the outside, was closed to set up new offices space for new employees. The Group designed and tendered the solution and work will start in early 2020.

- **Tender activities** were carried out for the realization of a new bunker in Bldg. N.7 for the RF Lab of the LATINO project and for the renovation of the external envelope of Bldgs. N.4 – 5 – 5a. The work will start in early 2020.

Other than these, the Group supported the LNF **accreditation at Regione Lazio** for continuous and higher training, interfacing also with Frascati Municipality tech office, and the **construction of a Guest House for the project SESAME** in Amman, Jordan, carrying Project Management responsibilities for this collaboration supported and financed by the Italian Ministry for Research and University.

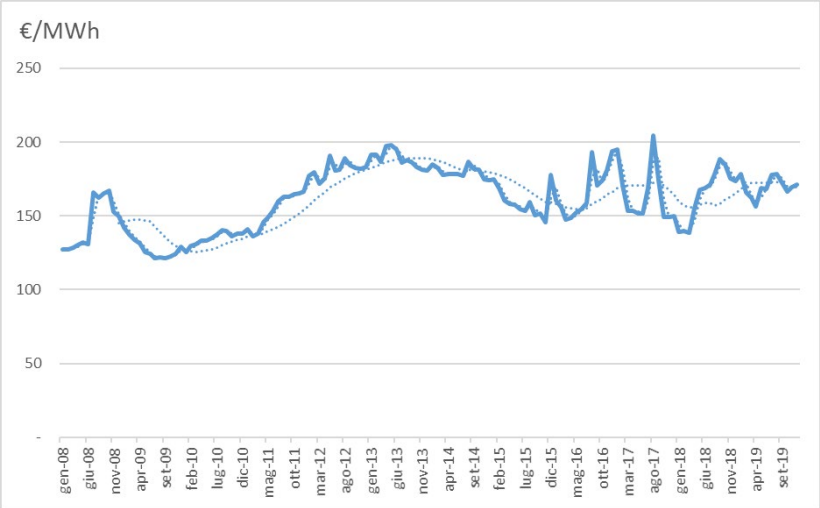
ELECTRICAL INSTALLATIONS GROUP

Among the relevant activities performed by the Group in this year:

- Dafne auxiliaries' automation and control system has been updated in order to include the new BTF2 infrastructure, and all the Linac magnet interlock system has been renewed;
- A video surveillance system has been internally designed and tendered, installation foreseen for early 2020;
- **EuPRAXIA@SPARCLab** electrical installation preliminary design has been performed;
- **CNAF** maintenance review and the new **Tecnopolo** project have been supported;
- The Group supports other INFN sites through participation in the **CCR** (Computing and Network Board of INFN) as member of the Installation group, devoted to cooling, power and energy saving issues related to Data Centres. In this frame a course on data centre infrastructures for INFN operators has been given.

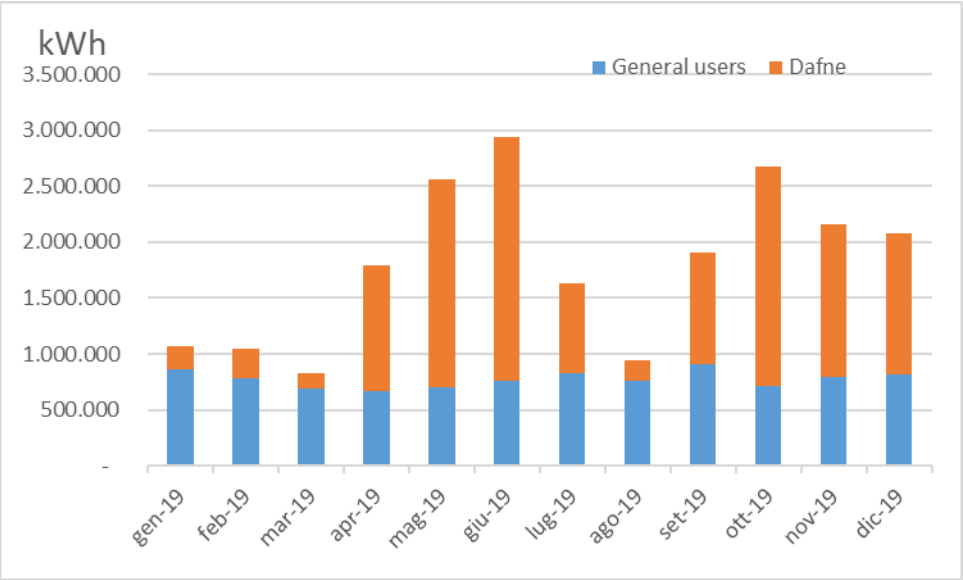
Energy management

The technical direction of the electrical power supply contract involves continuous contact with public utility and ever more accurate load and budget forecasts. 21,6 GWh were used in the 2019, with a bill of 3,66 M€. The consolidated medium cost of the electric power in the year was 169 € /MWh.



Long-time trend of the cost of electricity @LNF

The Dafne power demand for Siddharta experiment is reduced to 2,9 MW thanks to Kloe experiment's electronic, magnet and cryogenic system turn off.



Monthly record of electrical energy usage

Energy saving activities have been carried out both in the civil and in the particle accelerator installations. Led lighting system substitution is gradually going on.

Massive retrofit of fluorescent bulbs with led started and the Dafne hall new lighting system has been completed.

The thermal energy recovery system, implemented in the year 2015, that reuses thermal waste of the chilled water station and supply about 32 % of the heated building volume, has been upgraded. Additional heat now can be recovered also from Dafne cooling system to compensate for the amount of thermal power from Kloe experiment no more available.

During 2019 the system delivered 760 MWht, avoiding about 96.000 cubic meters of natural gas consumption. The economical saving, compensating the additional cost of electric power required, is about 65 k€ per year. In terms of environmental parameters this means a saving of 163 CO2 Ton or 59 TeP/year.

The project for the installation of a 1,1 MW of photovoltaic system over 22 LNF Bldgs. roofs, involving also the thermal insulation and the renovation of 50% of the buildings is under way, through a project financing proposal. This activity is expected to supply 1,3 GWh/year. Tender will take place in 2020.

FLUID PLANTS (CV) GROUP

In 2019 the Group provided support to DAFNE, SIDDHARTA, BTF, SPARC_LAB, FLAME, ATLAS and the LNF Data Centre.

During the year, the Group supported activities for:

- **HVAC for new BTF hall (det. 19/2018)**

  With the new 2nd experimental hall of BTF and the revamping of the old hall 1, two new HVAC plant were designed. The plants were installed in the first part of the year and now the halls have thermal conditions stable in all seasons with a temperature variation within 1 °C.

- **Cooling plant for new BTF beam lines (det. 88/2018)**

  The upgrade of the BTF with new 2nd beam-line and the modification of the old one has required a total redesign of magnets' cooling system. 90 % of the new plant was installed in 2019 and in the first part of 2020 it will be completed in order to assure perfect conditions to run new experiments.

- **Latino – new cooling plant for magnet test plant in building n.38 (det.147/2018)**

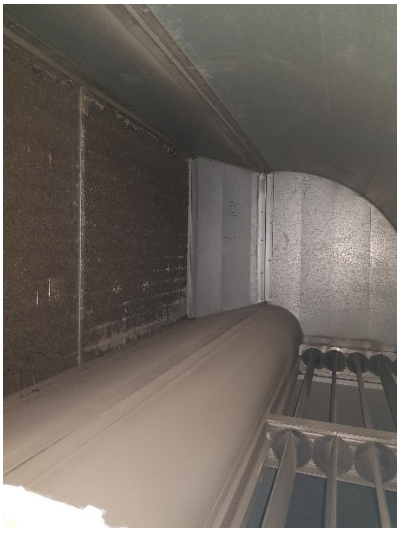
  For the tests and measurements of the new magnets foreseen for the laboratories it was necessary to redesign and install a new stainless-steel cooling system. The new cooling plant is equipped with new regulation system for a wide range of magnets.

- **Design and procurement for new clean room in building n.7B for collaboration ASI-INFN.**
- **Design support, in charge of building service, for HVAC of Bldg N. 7 and cooling system for X band modulator and RF structure test.**
- **Magnets and RF Cooling System, HVAC plants and compressed air distribution system for Eupraxia@SPARCLab project**
- **Wiggler Hoses Replacement**

  In order to assure lower number of failures during the run of DAFNE about 200 wiggler hoses were replaced in the first part of the 2019.

- **Extraordinary maintenance of building n. 36**

  After 20 years of operation, an extraordinary cleaning of offices heating system and a sanitation of conference hall's (Bruno Touschek auditorium) AHU and its duct was necessary.



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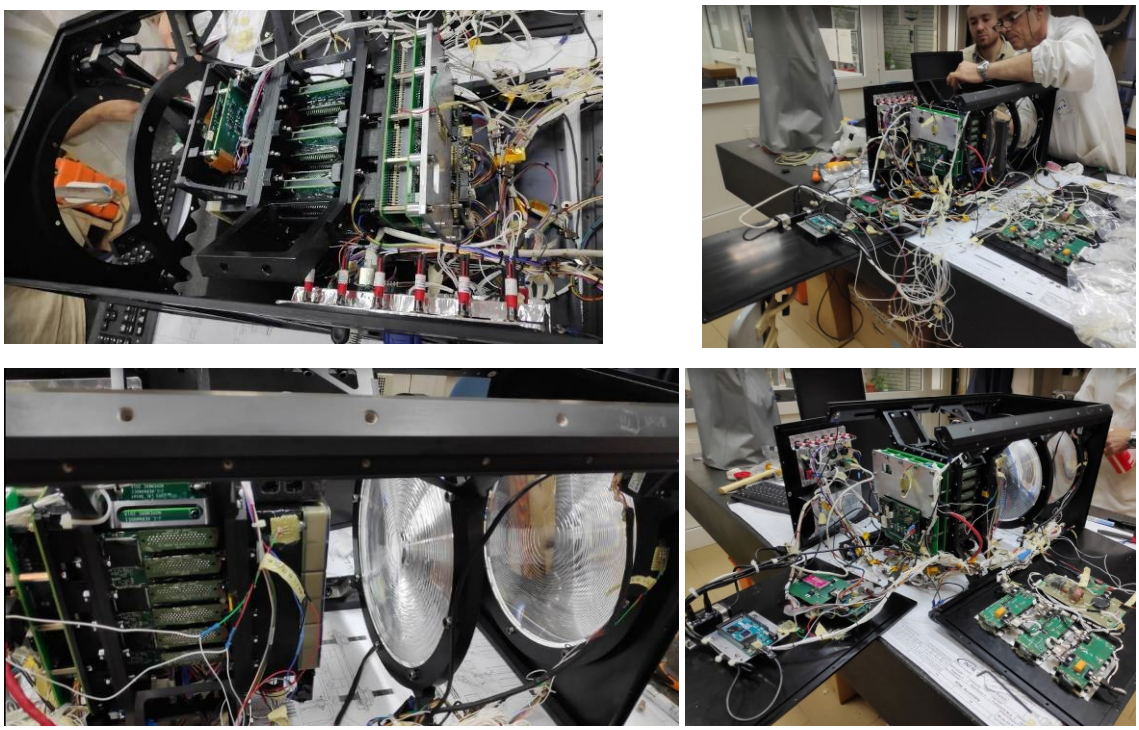
MECHANICAL DESIGN AND CONSTRUCTION GROUP

The Mechanical Design and Construction Group (SPCM) is composed of four Units: *Mechanical Design, Machine Shop, Metrology and Alignment, Metals Store*.

During 2019, SPCM supported some experimental activities, playing a role of direct responsibility in the design, production, construction or installation:

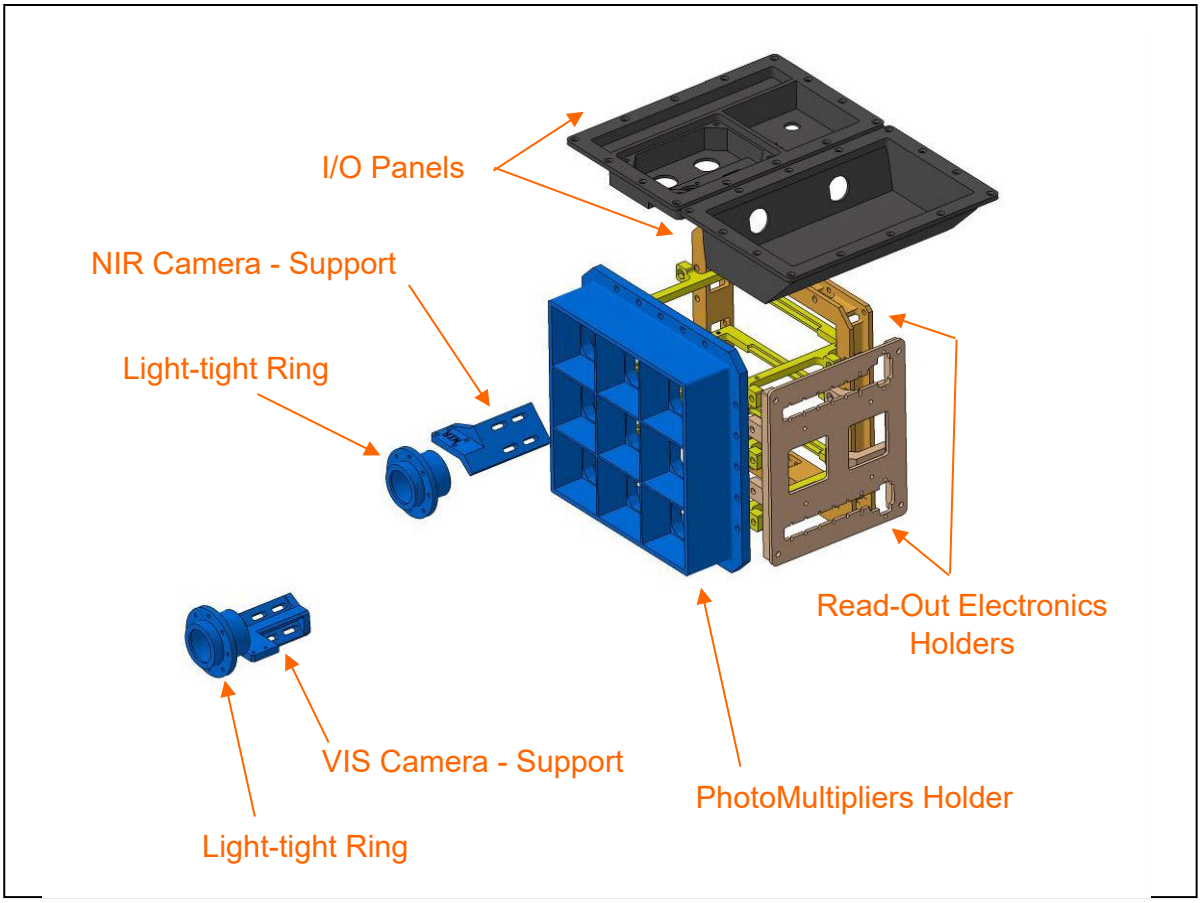
- DARKSIDE-20K, double phase Argon detector with an active volume of 50 tons of liquid Argon (LAr). It will be installed in Room "C" of the LNGS and will be able to reveal dark matter in the form of WIMP. The SPCM dealt with the integration of TPC and VETO into the Cryostat of the Experiment and contributed to the design of the VETO itself.

- Mini-EUSO/UV (Extreme Universe Space Observatory), a new generation telescope for the study of night-time earth emissions in ultraviolet (UV) band. The telescope is now operational on board the ISS (International Space Station). The launch (Soyuz Mission: MS-14) took place on August 22, 2019 while the docking was successful on August 27, 2019. The telescope mechanics was entirely designed and built by the SPCM. The Group' staff also took care of assembling the telescope (two models, Engineering Model and Flight Model) and following the vibration test necessary to validate its correct design and integration. Many components of the telescope were made in ULTEM with additive technique using one of the 3D printers available for the Group.



Mini-EUSO: Construction phases @SPCM-LNF

Mini-EUSO: Flight Model @Baikonur Cosmodrome



Mini-EUSO: ULTEM 3D-printed parts