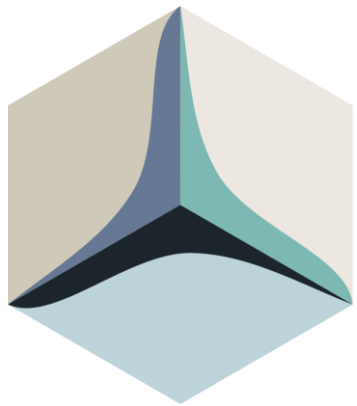


SUPRASYS

Some experiences in technology transfer

25th October 2019



SUPRASYS



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SUPRASYS

- Location
- Technology based
- Business model
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Location

- SUPRASYS is located in the landmark building of Avenue Lehendakari Aguirre 11, in Bilbao, Spain.
- 15 minutes by car from the Airport.



SUPRASYS S.L.

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 admin@suprasys.es

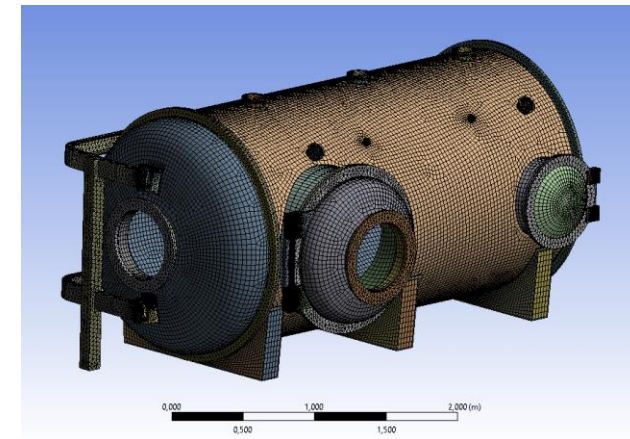
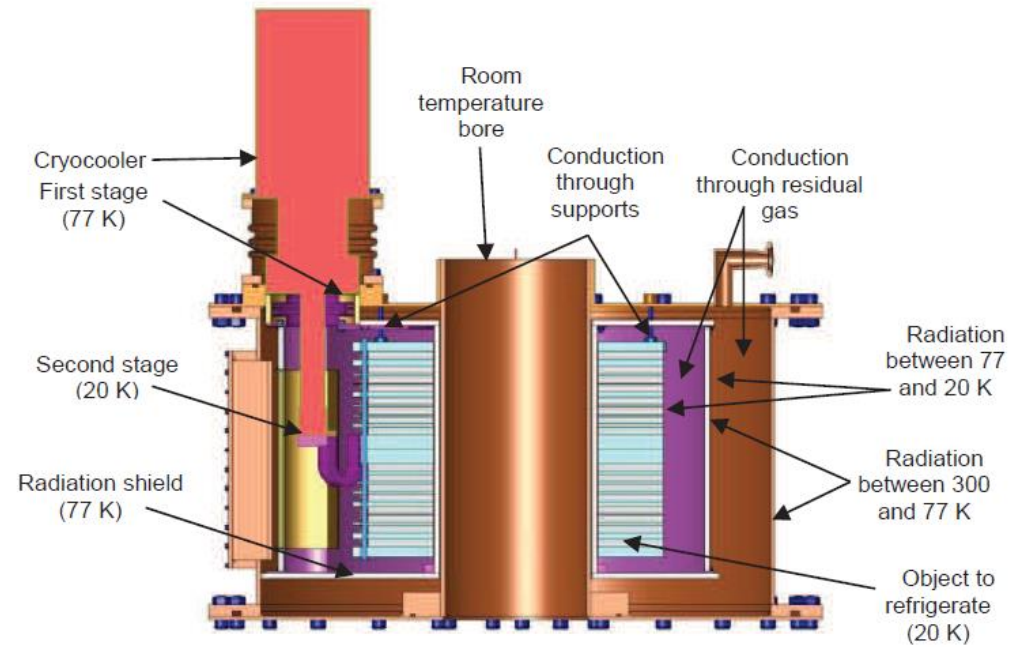
 Av. Lehendakari Aguirre, 11. Planta 7
Dpto.7, E-48014 Bilbao (Spain)



Technology based

Cryogenics, Vacuum & Superconductivity

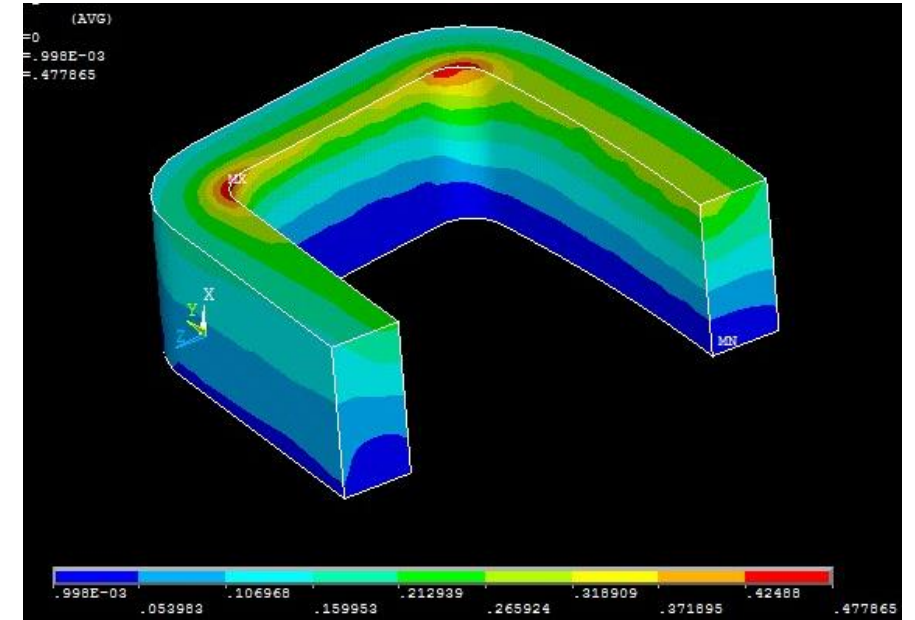
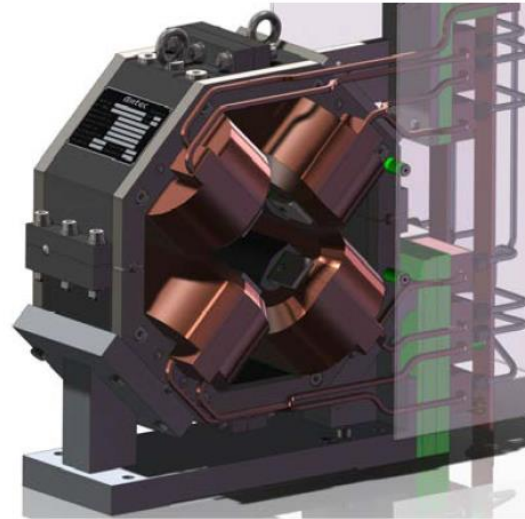
- Cryostat design, configuration and start-up:
 - Cryogen-free cooling system
 - Refrigeration with cryogenic fluids
 - Closed-cycle based system
- Selection and design with specific materials
- Design of superconducting power applications



Technology based

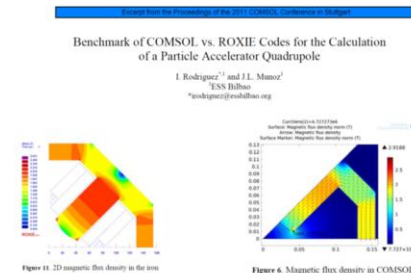
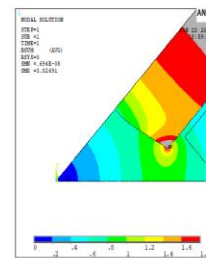
Multiphysics analysis

- Thermal, structural and electromagnetics
- Based on the commercial software ANSYS™ and OPERA™
- Development of own software (Fortran, Python)



Comparison 2D EM codes

- In order to check the harmonics precision calculation, a comparison has been performed over a quadrupole calculated also with COMSOL and ROXIE.
- This is part of an internal SUPRASYS project funded internally



	ANSYS	ROXIE	COMSOL
b6 (units)	31.85	31.92	31.85
b10 (units)	2.2955	2.2912	2.2965
b14 (units)	-0.3639	-0.3639	-0.3641
b18 (units)	-0.0337	-0.0332	-0.333

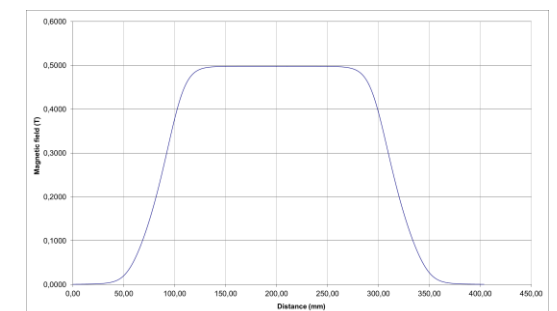
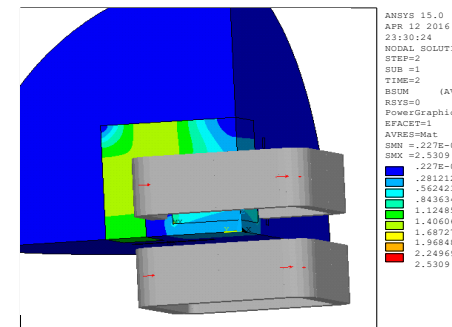
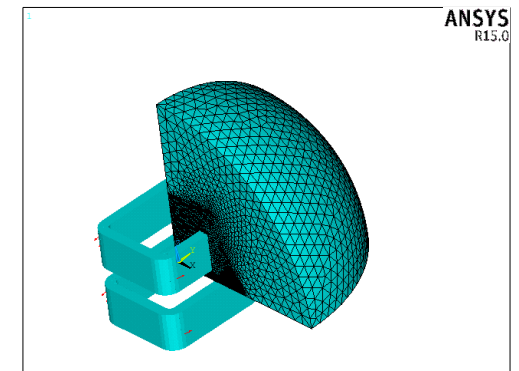
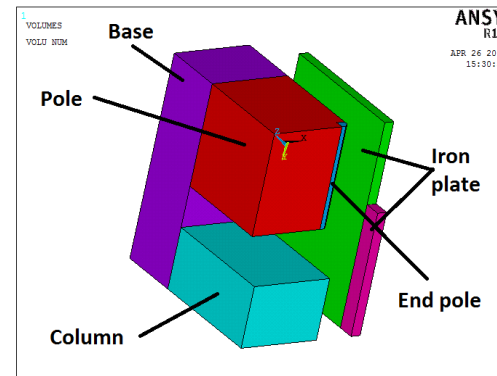
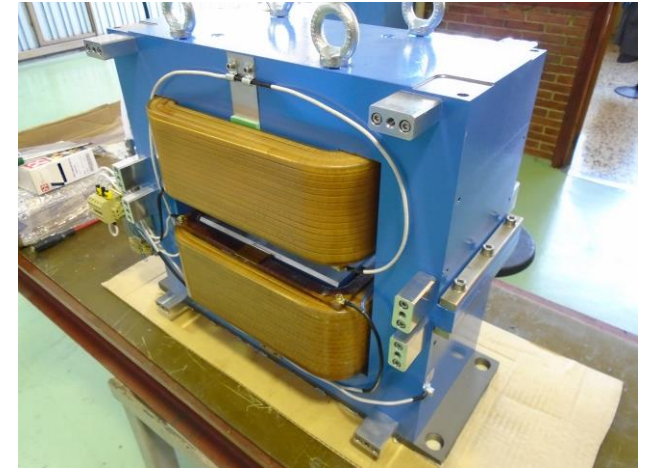


Technology based

Electromagnetic systems

- Superconducting, resistive and permanent magnets
- Industrial electromagnetic systems: motors, actuators, ...
- Experimental test bench conceptual design
- Characterization and analysis of superconducting wires and coils
- Current leads design and fabrication
- Quench calculation

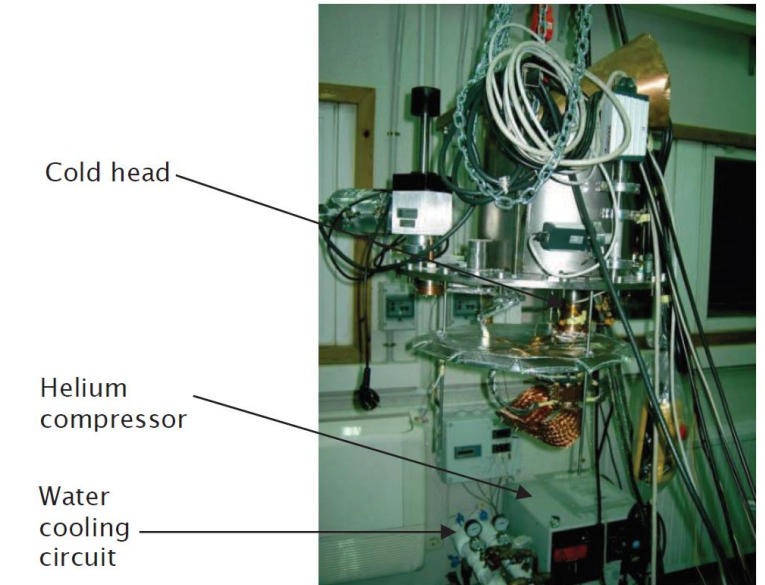
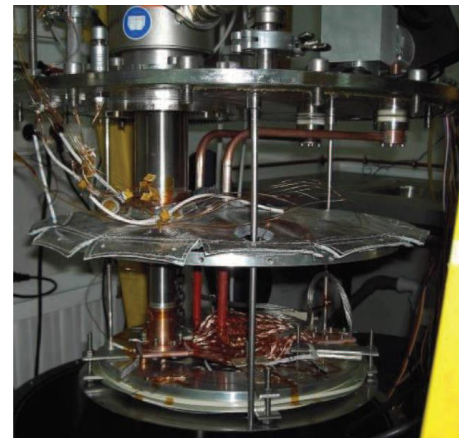
CLARA dipole at Daresbury. Picture courtesy of Antec.



Technology based

Laboratory instrumentation and testing

- Thermometry
- Magnetic measurements
- Strain gauges measurements
- Control and acquisition systems
- Quench detection and protection
- System global analysis



Business model

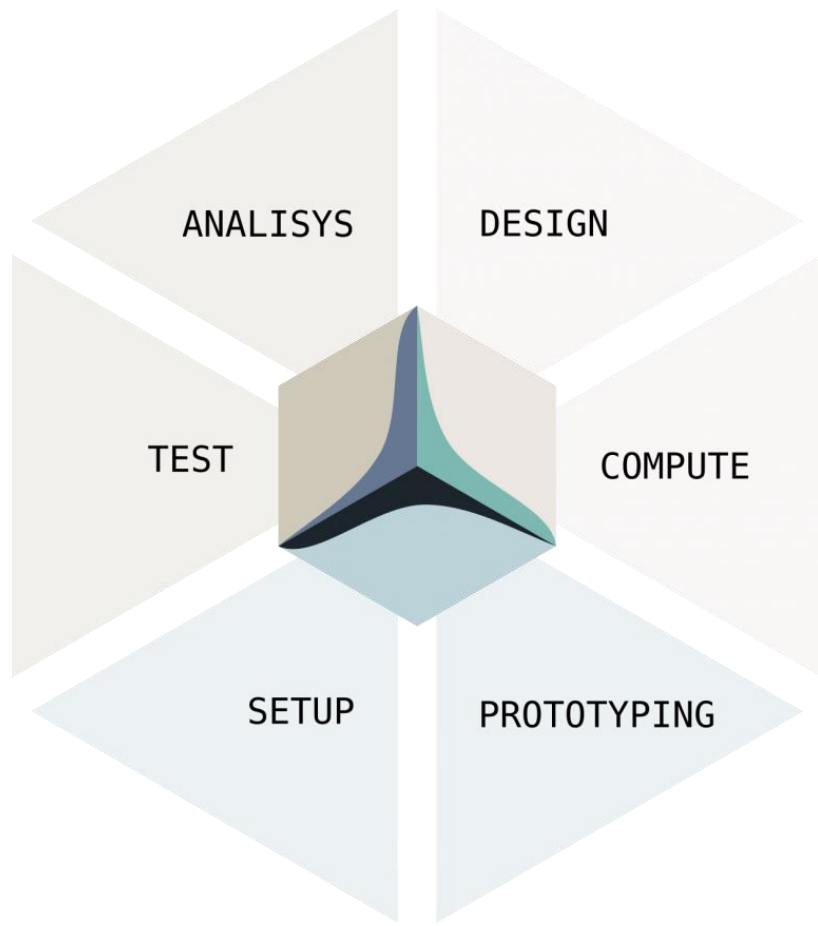
Advanced Calculation technical
Studies and Services in the fields of
Electromagnetics and Multiphysics
analysis

Development of own **R&D**
product-oriented projects

Support in technical challenging projects for Universities, Institutes and
Enterprises
Promotion and execution of business R&D



Business model



SUPRASYS covers part or the whole process of technological solutions development



Resources

- Highly qualified staff
- Advanced Software:
 - ANSYS 19.2 Mechanical Maxwell 3D, Ansys Mechanical Enterprise and Emag.
 - OPERA 19 Simulation Software
 - SolidWorks Professional 2018
 - Draftsight 2018
- Hardware:
 - High performance Workstation for calculations
 - Access to the supercomputing Cluster “Ariña” (University of the Basque Country)

NEXT-GENERATION
PERVASIVE ENGINEERING SIMULATION

19.2

Opera
Simulation Software
joins 



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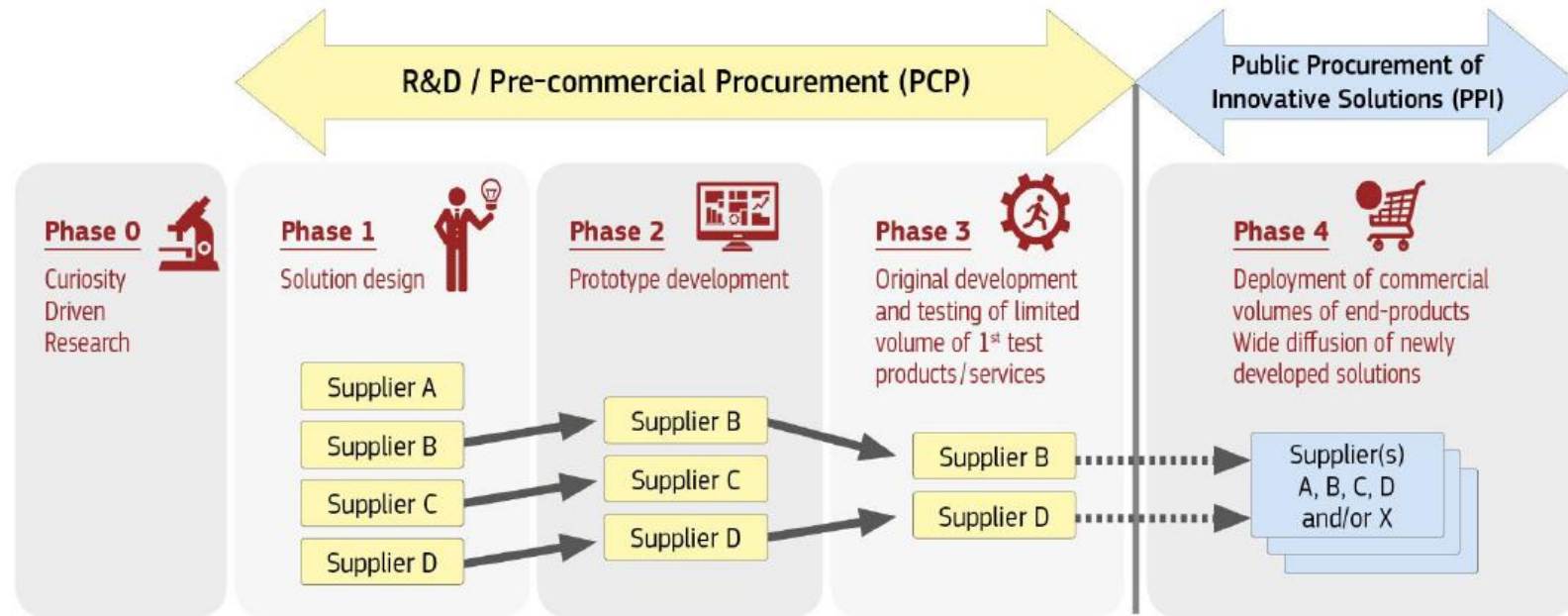


Relevant contributions (particle accelerators):

❑ Technical support for QUACO PCP Phase II

- Development of a first-of-a-kind double aperture quadrupole magnet for High-Lumi LHC

Buyer's group



Suppliers

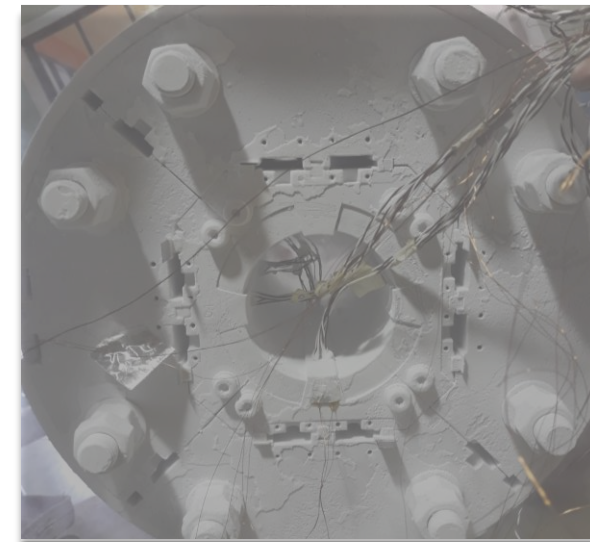
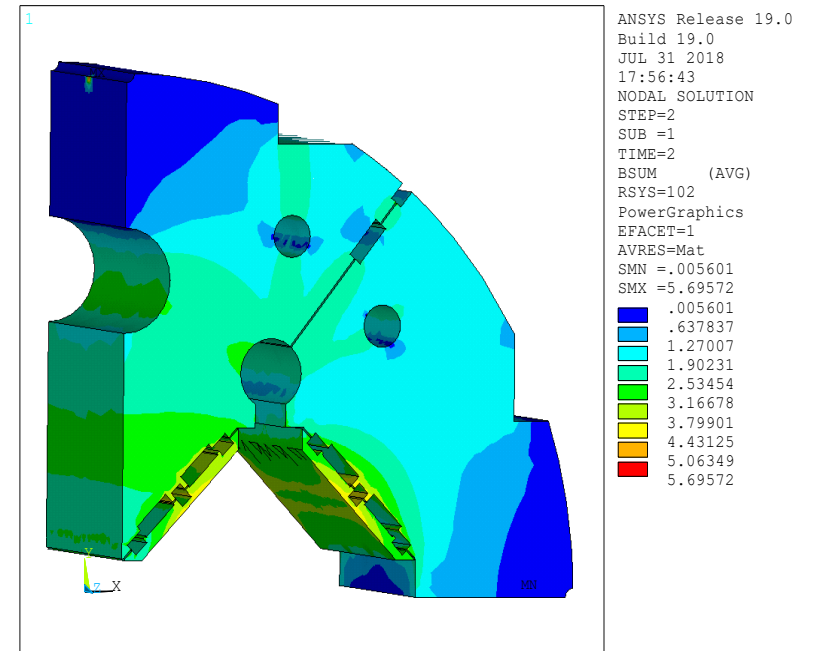


Relevant contributions:

□ Technical support for QUACO Phase II

- This PCP Project has been developing in three phases: conceptual design, detailed design and prototype manufacturing. This project corresponds to the technical support given by SUPRASYS to the company ANTEC during the phase II development including:
 - Magnet conceptual and detailed design
 - Multiphysics FEM simulations including structural and EM FEM analysis
 - Mock-up design and testing
- The 2D and 3D static non- linear EM simulations were conducted by ANSYS APDL. The EM forces were calculated and coupled to the structural analysis, including ferromagnetic parts.

□ Bi-directional technology transfer: from institutes to industry and from the industry to the institutes (co-creation)



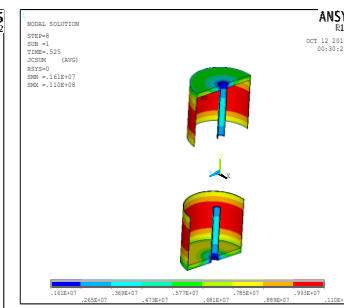
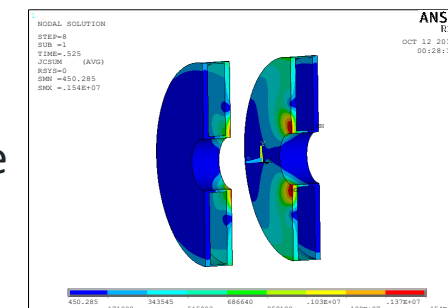
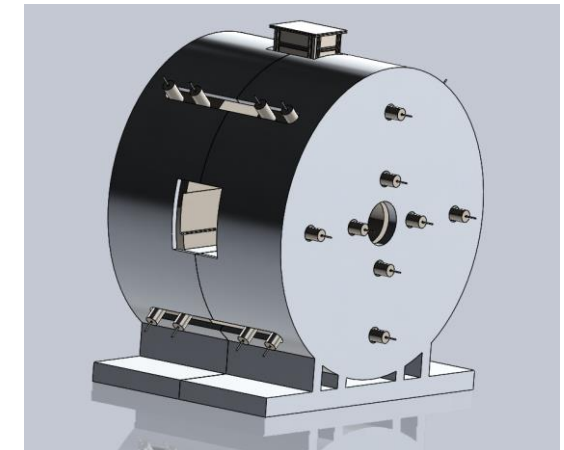
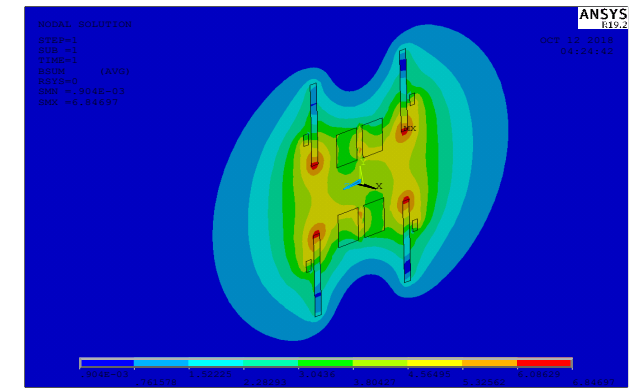
Relevant contributions (fusion):

❑ Superconducting magnet feasibility study for UKAEA

- The objective of this study was to analyze the viability of a large-scale fusion component test bed, where simultaneously a static magnetic field of 4 T is applied together with an orthogonal collapsing field of 0.5 T in a large volume ($\sim 600 \times 600 \times 1600 \text{ mm}^3$) corresponding to the sample part exposed to high magnetic field. The following aspects were afforded:

- **Magnetic design.** The coil dimensions are established, for both the resistive and superconducting solenoid. 2D and 3D static and transient FEM studies were afforded with ANSYS APDL.
- **Mechanical design.** A conceptual design of the support structure is performed, as well as the internal mechanical parts of the cryostat.
- **Quench analysis.** The superconducting coils can transit to the resistive state. In that case, it is mandatory to guarantee that the magnet will survive this transitory process. Current, voltage and temperature evolution are simulated and analyzed to determine the required quench protection system. 3D transient thermal FEM model was made with OPERA.
- **Transitory analysis.** Effects of the orthogonal field while collapsing were analyzed in SC magnet and cryostat.

❑ Technology transfer from industry to research institute



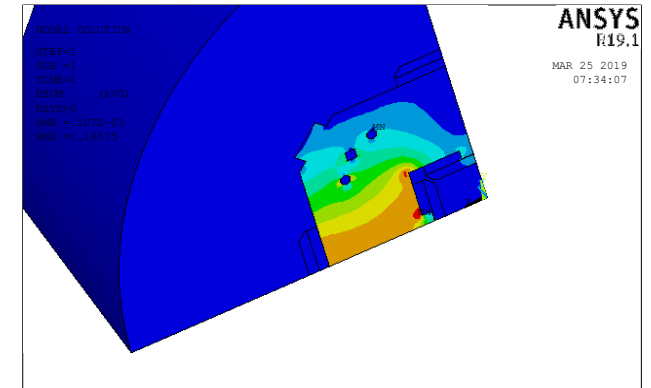
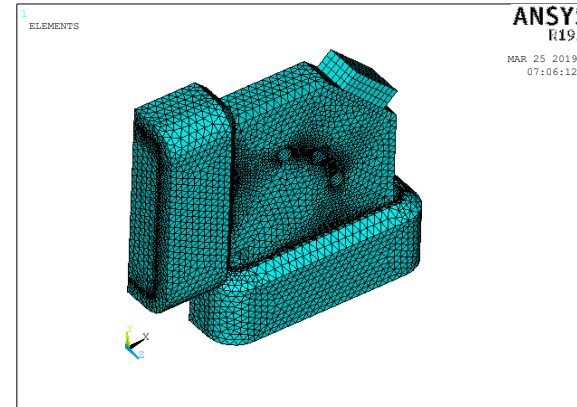
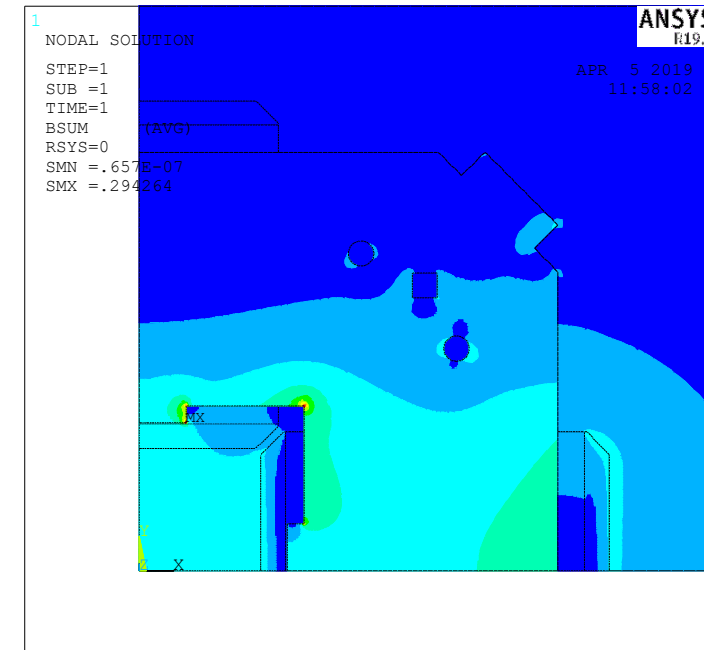
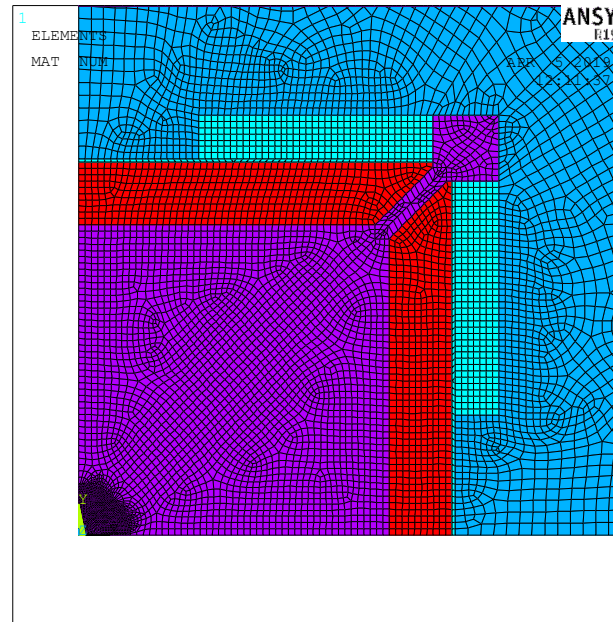
Relevant contributions (medical systems):

❑ Orbit Corrector: Steerer for Proton Therapy

- The objective of this study was to analyze the magnetic performance of a steerer for orbit correction in a High Energy Beam facility for Proton Therapy
 - 2D Magnetic design.
 - 3D Magnetic design and optimization

❑ International technology transfer

- Development made in collaboration between accelerator developer and magnet designer/manufacturer (open specs)



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References



References: Our Clients



Antec Magnets



The Vacuum Projects



Ciemat



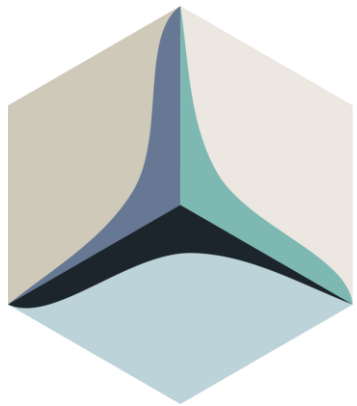
UKAEA



International and Spanish references



Thank you very much
for your attention!



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