HUN-REN
Hungarian Research Network

Fusion Research in the CENTRE FOR ENERGY RESEARCH & INDUSTRIAL PARTNERS HUNGARY

ATOMIC ENERGY RESEARCH INSTITUTE
CENTRE FOR ENERGY RESEARCH

The aim of the Centre for Energy Research (EK) is to carry out basic, applied and developmental scientific research of international standard in the fields of nuclear energy, functional materials and nanosystems, environmental protection, energy efficiency and energy security.

The Centre for Energy Research was established in January 2012 on the basis of two former independent institutions, the Atomic Energy Research Institute and the Institute of Isotopes. In 2015 Institute of Technical Physics and Materials Science became part of the EK.

The Centre for Energy Research is part of the Eötvös Loránd Research Network.

TARGET AREAS

- Basic, applied and development research in accordance with the provisions of the Atomic Energy Act
- Safety analysis of nuclear power plants
- Basic, applied and development research in the field of renewable energy sources
- Environmental protection systems
- Research on functional materials
- Operation of the Budapest Research Reactor

The Centre for Energy Research is active both in fission and fusion nuclear energy technology development. In fusion the major fields are active beam and optical diagnostics for major fusion experiments, material irradiation studies, cryogenic pellet technology and engineering development for DONES, DEMO and ITER. Several key technological developments are also done by Hungarian fusion industry either through direct contracts with ITER or in collaboration with the Research Centre.

HEADQUARTERS AND ADDRESS

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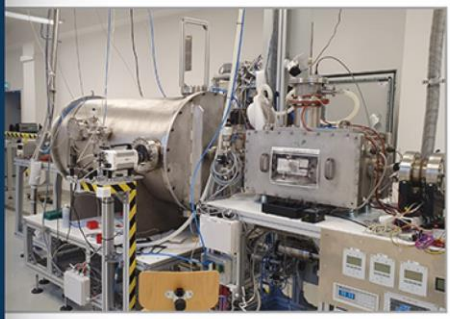
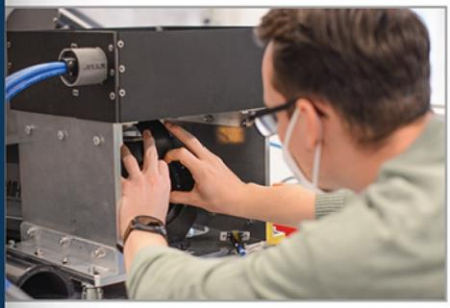
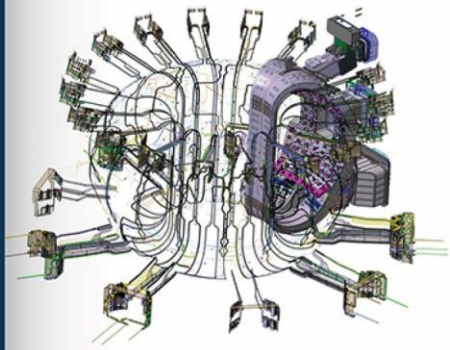
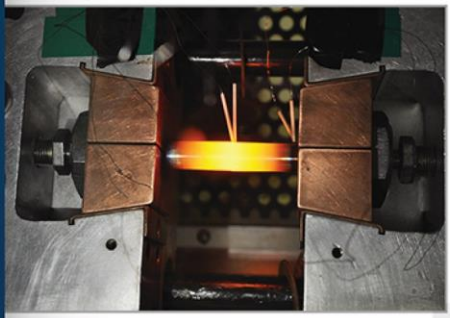
Centre for Energy Research









FUSION PLASMA PHYSICS DEPARTMENT

The research area of the department is the advancement of controlled fusion energy production: develops and builds plasma diagnostic and technology systems, performs and evaluates measurements on the world's largest fusion experiments. Due to the technical-related activities, the staff is composed of physicists and engineers and can perform research and development tasks from physics modeling to engineering design and construction.

COMPETENCES

- Cryogenic pellet production, acceleration and interaction with the plasma. The laboratory operates the Shattered Pellet Injector (SPI) test laboratory for the ITER experiment where SPI technology is developed for ITER.
- Plasma diagnostics using video cameras and Beam Emission Spectroscopy. The laboratory has original technology for real-time video camera system, alkali beam injectors and observation systems.
- Design of the Demo Oriented Early Neutron Source (DONES). The laboratory develops elements of the test cell, lithium loop and performs system engineering work.
- Conceptual design of the European fusion DEMO reactor: engineering analysis for remote handling of large components, development of optical diagnostics and cryogenic pellet injection technology.
- Modelling activities for beam-plasma interaction, fast particles in fusion plasmas, cryogenics pellet formation.
- 3D printing of fusion device models, technology components.

Sándor Zoletnik, Head of Department
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FUSION PLASMA TECHNOLOGY DEPARTMENT

The Fusion Technology Department seeks solutions to technology related issues that emerge during controlled nuclear fusion research. Our most important activity areas are connected to offering engineering services for large research infrastructures, such as ITER, DEMO and DONES. These include all kinds of services from systems engineering through detailed design to prototype manufacturing and testing, up-to the installation of the final product. Our competences are the engineering design development, finite element analysis, manufacturing, testing, and systems engineering.

REFERENCE WORKS

- Engineering works of the RH (Remote Handling) applications for the RH lower ports of the ITER machine including the engineering calculations, finite element modelling and design work of the remote cutting and welding procedures and pipe manipulation.
- Technology development for thick wall pipe brazing for the DEMO (DEMOnstration power plant) reactor which includes the design work, finite element analysis, manufacturing of full-scale test equipment and brazing trials.
- Research and development of Diffusion Bonding of fusion related materials (Ceramic Dispersion Strengthened (CDS) steels and 316L stainless steel)
- Contribution to the development of the electric infrastructure of the ITER machine.
- Our colleagues take part in the development of optical and mechanical systems of key diagnostic systems of the ITER machine. Works include engineering calculations, design works, system engineering and project management as well.

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András Zsákai, CEO
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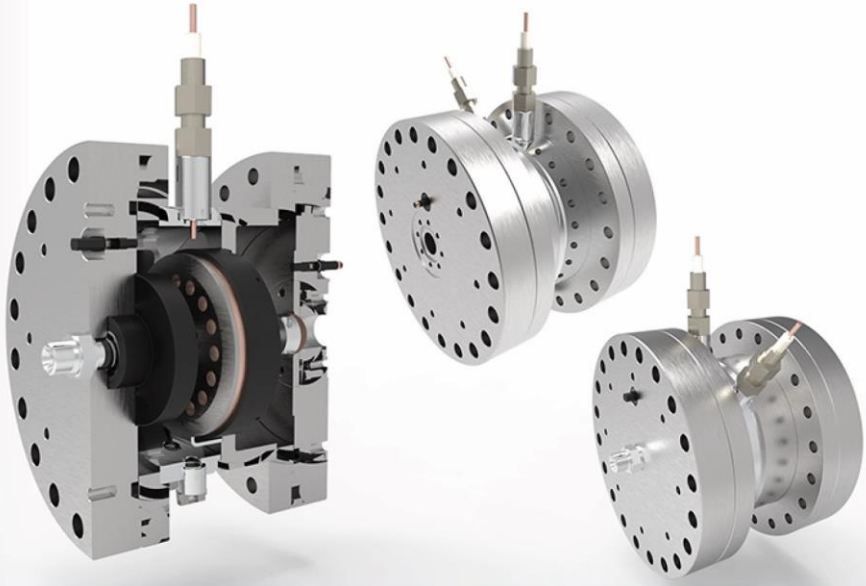
More information about the fast valves at: Dániel Réfy's #184 poster

CEFusion Ltd.

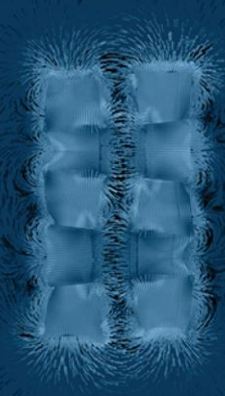
CEFusion
Component Engineering for Fusion

CEFusion is a new spin-off company founded by experienced researchers and engineers of Centre for Energy Research (Budapest, Hungary), aiming at solving high level complexity fusion research related problems. The company is also offering support in the field of systems engineering and component engineering in harsh environment from ground basics up to technical readiness level.



COMPETENCES

- Cryogenics
- Structural and mechanical finite element analysis
- Systems engineering
- Fast high pressure gas valves
- Design and manufacturing of vacuum systems



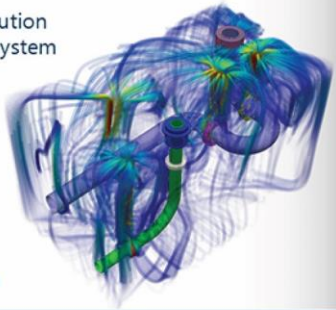
www.cefusion.hu

C3D Engineering Consultant Ltd.

C3D Engineering Consultant Ltd. has been providing engineering services in the field of mechanical engineering, providing expert counselling, organizing trainings, and participating in research and development projects since its establishment in 1999.

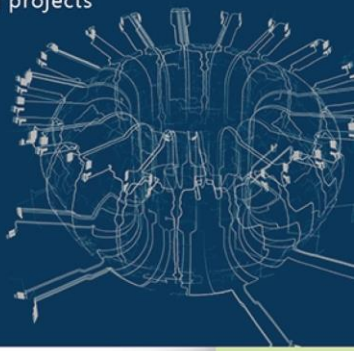
Our Research and Development divisions most highlighted achievements are:

- ITER (2015 -)
  - R&D and detailed design of In-Vessel diagnostics cabling
  - Cooling Design & Structural Assessment of Diagnostic First Walls
  - Development of Erosion Deposition Monitor Diagnostics
- IFMIF-DONES (2015 -)
  - Mechanical design of HFTM and Target System positioning device
  - CFD analysis and various design contribution to Test Cell and Test Cell Liner
  - Design of Secondary and Tertiary Heat Removal System, including piping stress analysis
  - Analysis model of Be7 and ACP generation and distribution in the Main Lithium loop and in the Impurity Control System
  - Remote Handling conceptual design and assessment of Test Systems Lithium Systems Interface Cell
- ESS (2021 -)
  - Technical and Project Management advise to CER in a major BTP procurement (Cask Assembly system)
- ELI-ALPS Szeged
  - Design and Commissioning of Beam Transport System



COMPETENCES

- Comprehensive support for mechanical design and development projects in the field of R&D
- Conducting complete design, manufacture and commissioning projects
- Simulations and analyses (FEA, MBS, CFD, 1D system analysis)
- Structural Integrity assessments (various design codes, e.g. RCC-MR/MRx, ASME BPVC, etc)



Our Quality assurance system in the field of all our engineering and implementation activities is ISO 9001:2015 certified. We manage our clients and our own Intellectual Property and Information according to ISO 27001.

András Korossy-Khayll, Head of Research and Development
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See our work at poster P-1.51 by our colleagues Tamás Dézsi, Dániel Kovács, Viktor Varga and Bálint Dombai

www.c3d.eu

Dániel Dunai, Owner
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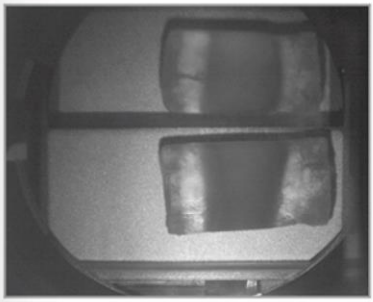
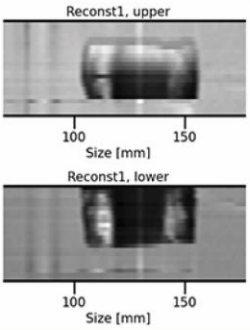
FUSION INSTRUMENTS LTD.

Fusion Instruments specializes in complete optical diagnostic solutions where high sensitivity and speed is needed. The APDCAM family of detector cameras are used worldwide in fusion and laboratory experiments. These devices combine Avalanche Photodiode or Solid State Silicon Photomultiplier arrays with 10 Gbit Ethernet data acquisition systems. The configurations are highly customizable to meet requirements of special systems.
APDCAM cameras are being used in Beam Emission Spectroscopy (BES), Fast Ion Loss Detector (FIELD) and Gas Puff Imaging (GPI) diagnostics. The company also develops sensitive custom electronics for neutron detectors and optical diagnostics.

Fusion Instruments develops the concept of the Optical Pellet Diagnostic for the ITER Shattered Pellet Injectors. The setup uses rows of sight lines which "scan" the passing-by pellet from two directions, and cameras are taking single images of the pellet triggered by the APD signals of these sight lines. The light from the interspace is imaged by a complex relay optics to the port cell, thus avoiding radiation sensitive components in the interspace. The concept has been successfully tested in the SPI laboratory of the Centre for Energy Research.

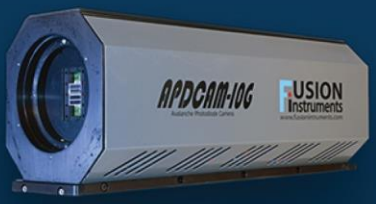




Camera image of a 28.5 mm diameter Hydrogen pellet and image reconstructed from 20 sight lines in the ITER Optical Pellet Diagnostic.

COMPETENCES

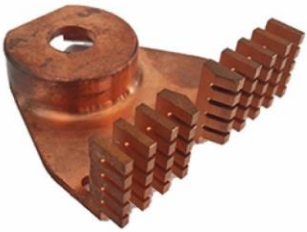
- APD and SiPM (MPPC) detector systems
- Custom design optics
- Complete system optimization
- Custom electronics design and manufacturing
- Data acquisition solutions
- Systems for nuclear and magnetic environment

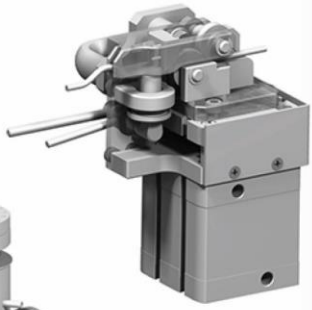


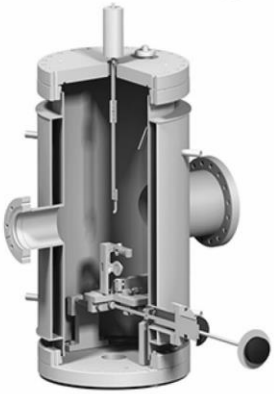
The quality management system of ISO 9001:2015 is certified by CERTOP Ltd.

GEMS Engineering Ltd.

GEMS Engineering Ltd. is an engineering SME specialized for the R&D market and offering innovative engineering and manufacturing solutions for projects involving substantial amounts of human expertise. We are supplying solutions covering the whole development process: from conceptual through final design up-to prototype manufacturing, testing and installation of the final product.







COMPETENCES

- 3D design
- Finite Element Modelling
- Prototype testing
- Design optimization for manufacturing
- Manufacturing of UHV components
- Design and manufacturing of ITER in-vessel components
- Project management

OUR OFFERS

- Complete solutions for R&D projects
- Feasibility studies
- Prototype manufacturing and testing
- Quality assurance system (ISO 9001:2015)
- Onsite services
- Employees with broad range of expertise gained in large research centres/companies all over Europe

The quality management system of ISO 9001:2015 is certified by MARTON Ltd.

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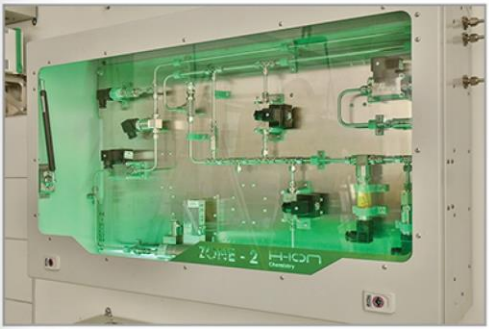
H-ION Ltd.

H-ION consists of experienced, young researchers and engineers from wide range of fields of sciences who examine the problems in an innovative way from system approach perspective.

H-ION's team has more than 10 years of expertise of R&D at the field of fine chemical syntheses applying novel, innovative flow technologies, design and development of unique laboratory equipment from basic research scale up to pilot.

Our team has experienced skills on the field of precise and high-pressure dosage of liquids and gases. We have many collaborations in development of high-pressure hydrogenation reactor systems with our pharmaceutical and academic partners.
On the other hand, we cover development activities in the field of chemical and mechanical engineering. Participation in research and development tenders is also essentially linked to our activities.



COMPETENCES

- Design and development of unique and single-purpose equipment
- Condition assessment, maintenance and modernization of laboratory and pilot equipment
- Development of chemical syntheses and technologies and optimization of reaction parameters
- Support and professional project management in R&D fields
- Education, professional lectures, trainings, etc

Since 2015 an ISO 9001:2015 quality assurance system has been introduced for the "Research and development in the field of engineering and natural science" and "Manufacturing of custom built machinery" activities.

OMI OPTIKA Engineering Ltd.

Dr. István G. SZABÓ
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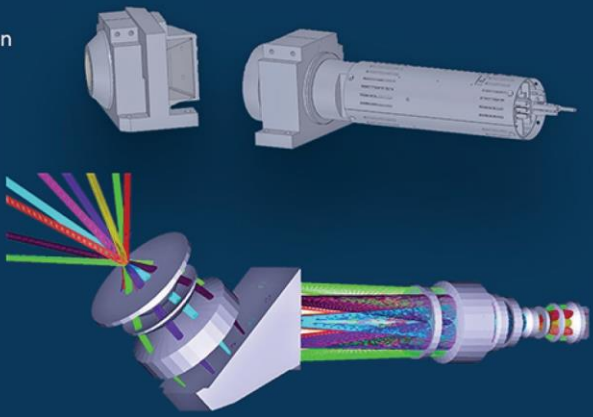
OMI OPTIKA Mérnökiroda kft/Engineering Ltd offers applied optical solutions for industrial and scientific customers since 2004. Products of Industrial Division includes LED lights (for high speed imaging as well) and optical components for Machine Vision while Scientific Division provides unique optical systems and components for Plasma Diagnostics and Neutron Imaging, including: camera and APD optics for TEXTOR TOKAMAK (2006-2008); design and production of objectives for theW7-X video diagnostics (2012); optical design of EAST system (2013); design and manufacturing of JT-60SA optical system (2019), fiber optic assemblies for ITER SPI, OPD and W7-X (2021).

COMPETENCES

- Optical and optomechanical design
- Manufacturing
- Assembling
- Testing



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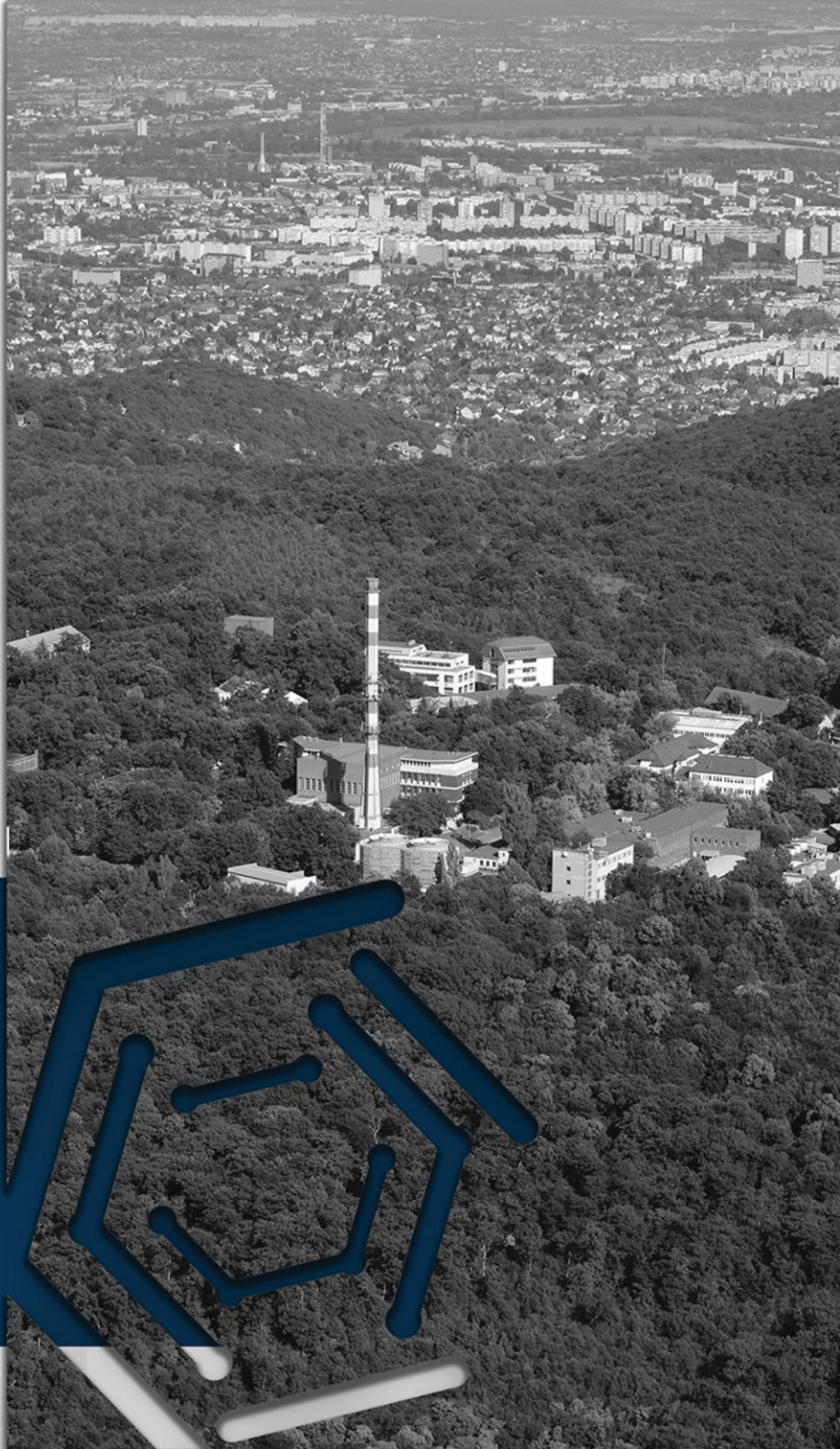
Optimal Optik Ltd.

Optimal Optik Ltd operates in the fields of OPTICS, PRECISION MECHANICS, OPTOELECTRONICS. Our primary activity is to provide design, research, and development services to our customers. We also manufacture custom optical devices from prototype to medium and high volume production. We also participate in domestic and EU-funded research projects where there is a great demand for our world-leading optical expertise.

COMPETENCES

- ITER: Design of In-Vessel and Ex-Vessel optics for CXRS system
- Observation optics for the alkali beam diagnostic on the Wendelstein 7-X stellarator
- Observation system of the Beam Emission Spetcroscopy diagnostic on the EAST tokamak
- Fast Ion Loss Detector (FILD4) optics for the ASDEX Upgrade tokamak
- Optical system design for Erosion Deposition Monitor ("55.G8-EDM PDR Design")
- Optical system design for ITER SPI diagnostic

Our company places great emphasis on quality, our operation is regulated by a certified ISO 9001 quality assurance system.



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