LITHUANIAN ENERGY INSTITUTE
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NATIONAL OPEN ACCESS SCIENTIFIC CENTRE FOR FUTURE ENERGY TECHNOLOGIES

OPEN R & D LITHUANIA

Lithuanian Energy Institute activities with CERN

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LEI in brief

245 Employees

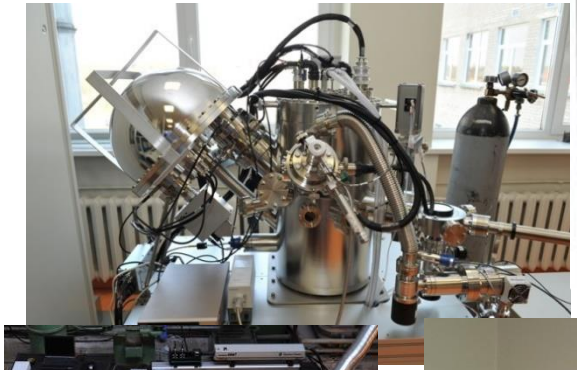
130 Scientists & researchers

20 PhD students

11 scientific laboratories

12.700 sqm of lab facilities

10 MEUR R&D infrastructure



R&D competencies

RESEARCH ON ENERGY TECHNOLOGIES

- **Nuclear and thermonuclear**
- RES (wind, biomass)
- H2 energy (fuel cells, storage)
- Combustion and Plasma technologies

THERMAL ENGINEERING & METROLOGY

- Thermal physics
- Gas & Fluid dynamics
- Metrology

ENVIRONMENTAL ENGINEERING

- Hydrology
- Combustion and Plasma technologies
- Environmental impact assessment

MATERIALS SCIENCE

- Materials synthesis
- Materials analysis (surface, bulk)

ENERGY SYSTEMS AND ECONOMY

- Energy economy
- Energy systems modeling, smart grids

Topics for cooperation of the Lithuanian Energy Institute with CERN

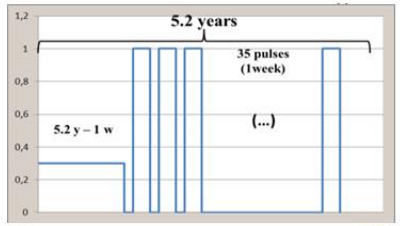
- Monte Carlo neutron/proton/gama **particle and radiation transport** (ongoing activities)

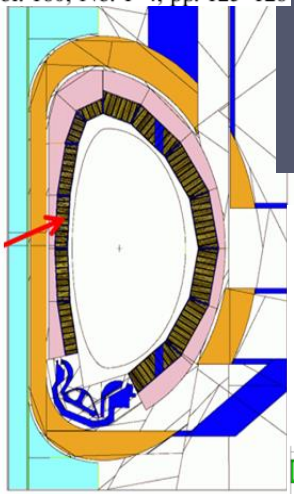
- Hydrogen Technologies
- Materials Research and Testing
- Studies of flow dynamics using µPIV system
- Plasma processing research

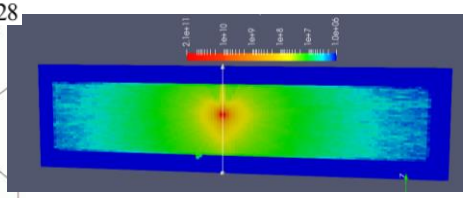
Nuclear Installation Safety lab. activities - MCNP:

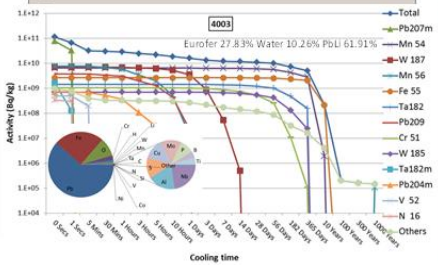
- 3-D, all-particle, all energy Monte Carlo transport code

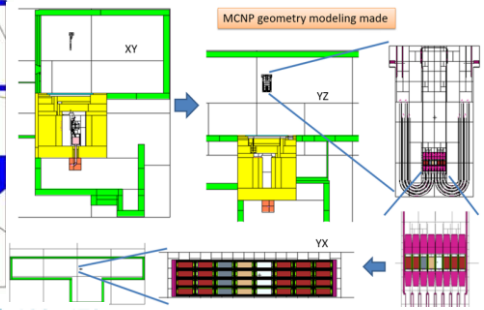
Radiation Protection Dosimetry (2018), Vol. 180, No. 1–4, pp. 125–128



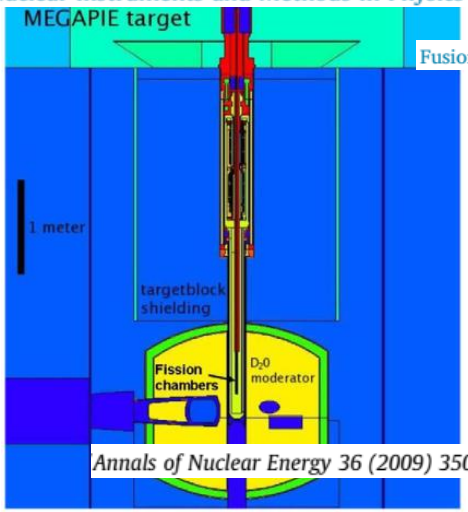






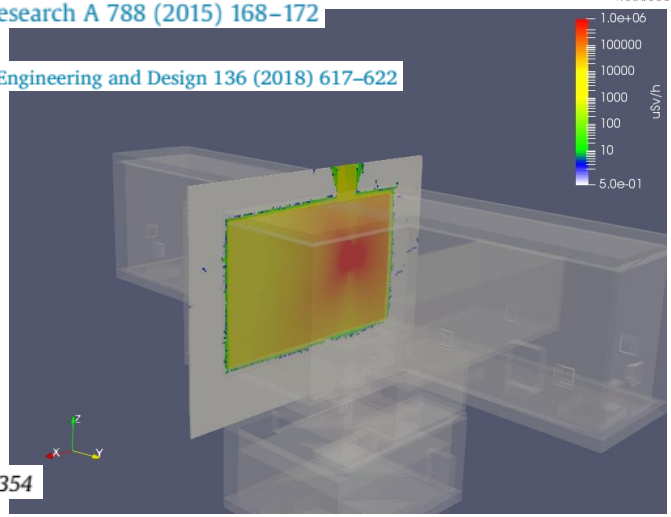


Nuclear Instruments and Methods in Physics Research A 788 (2015) 168–172



Annals of Nuclear Energy 36 (2009) 350–354

Fusion Engineering and Design 136 (2018) 617–622



- **Monte Carlo radiation transport code:**

✓ Simulation of particle interactions, radiation protection and dosimetry, radiation shielding, detector design and analysis, accelerator target design, etc.

✓ Particle transport of 34 different particle types + 2205 heavy ions — Neutrons, photons, electrons, protons, pions, muons, light-ions, etc.

✓ Results of 7 tally types: particle flux, energy spectrum, dose rates, cross-sections, etc., SDDR maps (R2S).

✓ **LEI experience in MCNP/MCNPX:**

- ✓ MEGAPIE
- ✓ JET
- ✓ DEMO
- ✓ IFMIF-DONES

(see LEI contribution in references on this slide)

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Nuclear analysis of high power molten targets at MEDICIS and ISOLDE for the production of radioisotopes

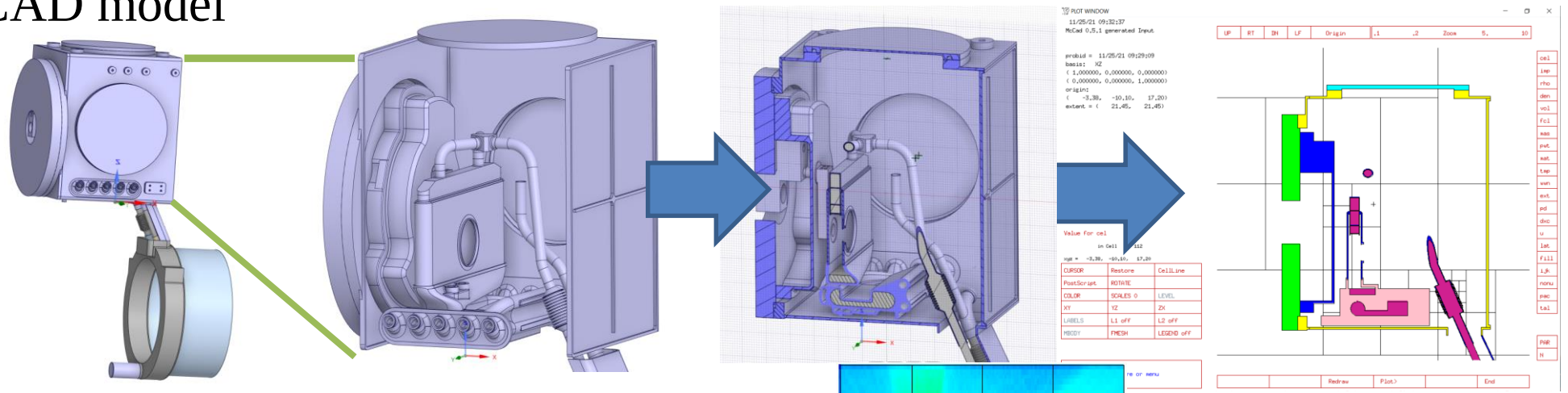
- In order to increase the primary beam intensity in the next generation of Radioactive Ion Beam installations, the production of targets capable of dissipating high beam power, especially for molten targets, is a major challenge.
  - A concept in the ISOLDE operational environment, a target prototype, named LIEBE (LIquid Eutectic Lead Bismuth for EURISOL), has been designed and assembled.
    - This project‘s results can lead to new beams that are of great interest in nuclear structure and studies of physics
    - The project takes into account the primary beam upgrade scenarios at ISOLDE, ranging from a pulsed proton beam of 1.4 GeV-2 µA to 2.0 GeV-4 µA
    - In order to obtain additional data and perform a nuclear analysis in this project using the MCNP (Monte Carlo particle transport code) package, it is planned to perform more accurate estimates of radiation processes (material activation, heat of decay or dose rate) by modeling LIEBE target and thick lanthanum targets at high nuclear spallation energies.

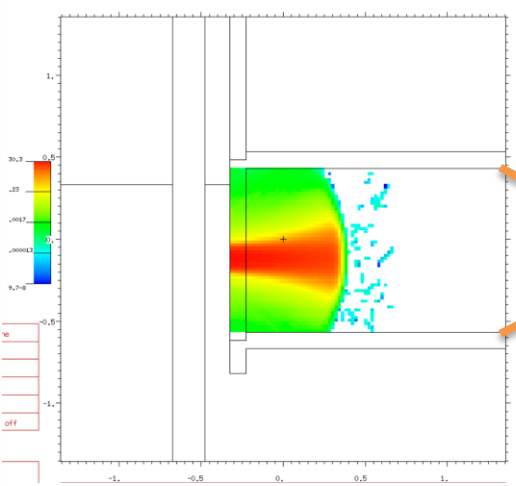
Model preparation and calculations

- CAD to MCNP conversion using McCAD code of LIEBE target.
- Nuclear analysis (proton/neutron/gama) flux, dose, activation etc.

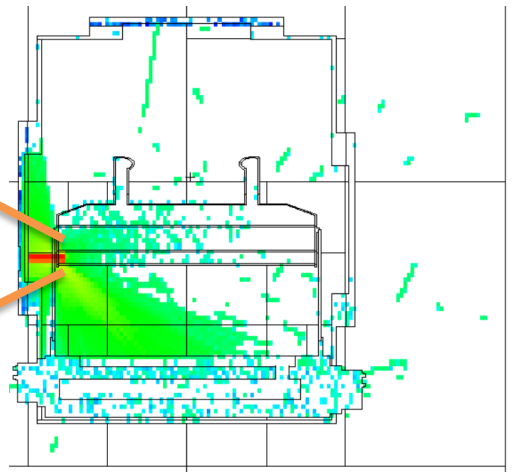
CAD model

MCNP model

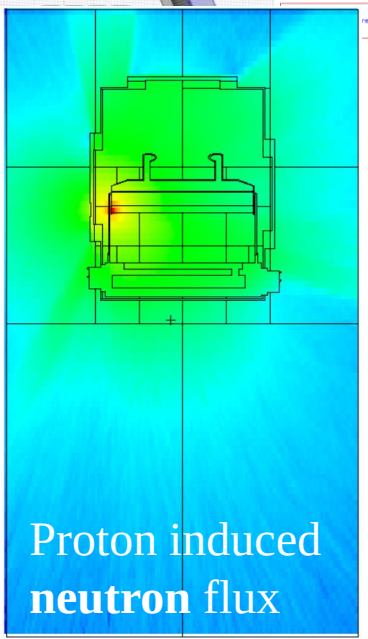


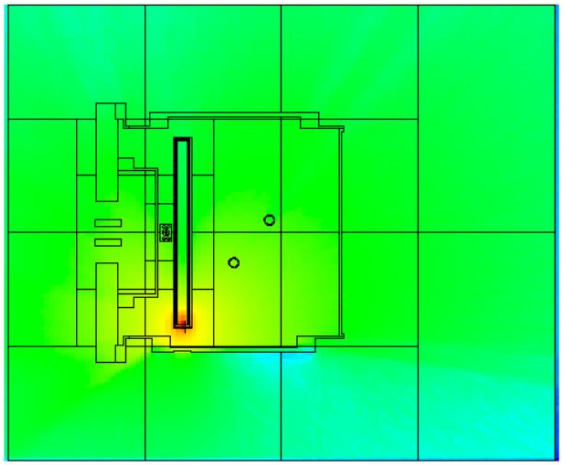


proton (70MeV) flux
inside the LBE



proton (70MeV) flux
inside the LIEBE target





Proton induced **gamma** flux

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Thank You for the attention

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