HNPS2021

EUROfusion

NCSRD activities at JET in support to ITER nuclear analyses

T. Vasilopoulou, M.I. Savva, P. Tsavalas, A. Lagoyannis
V. Ioannou-Sougleridis, K. Mergia, I.E. Stamatelatos
& JET contributors

NCSR "Demokritos", Greece

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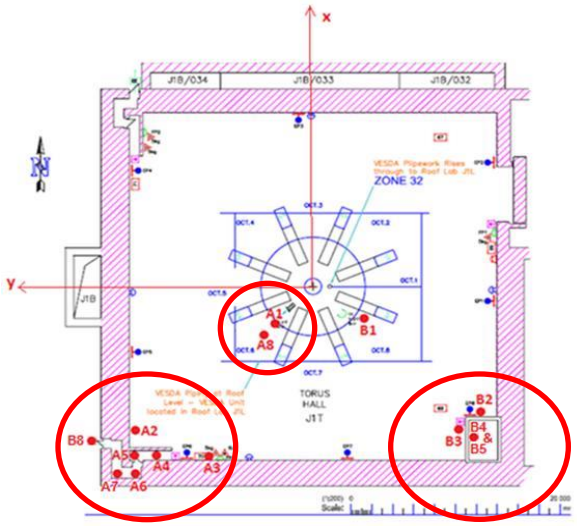
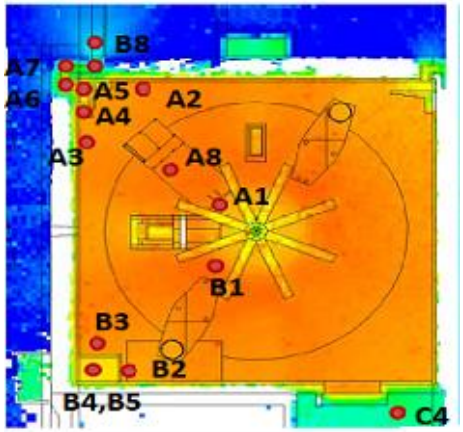
Neutron streaming experiments

Validation of numerical tools and data to accurately predict neutron fluence through ducts and labyrinths in the JET biological shielding

- Neutron fluence measurements in the JET Hall using activation foils within PE moderators
- Irradiations during JET 2015-2021 D-D, T-T & D-T campaigns
- SW entrance labyrinth, SE chimney, Octant 6
- Comparison against TLD measurements & MCNP calculations

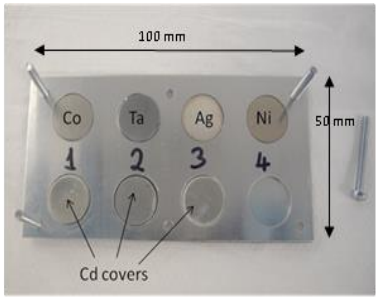


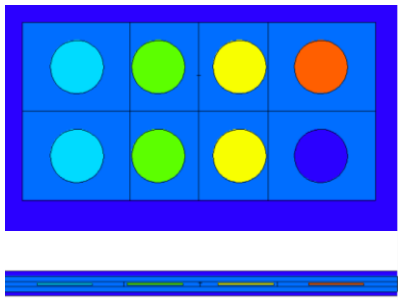


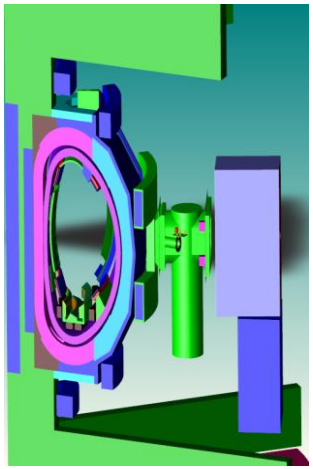
Shutdown dose rate experiments

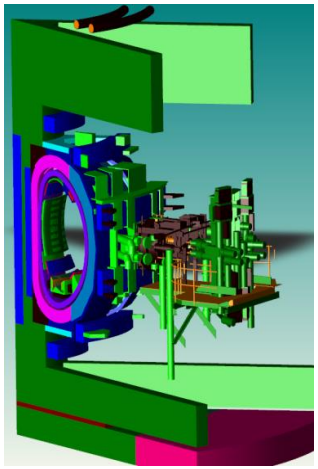
Estimation of neutron fluence and spectra to complement shutdown dose rate measurements

- Neutron fluence measurements in Octants 1 & 2 using activation foils in Aluminum holders
- Irradiations during JET 2015-2021 D-D, T-T & D-T campaigns
- Comparison against Ionization Chamber measurements & MCNP calculations







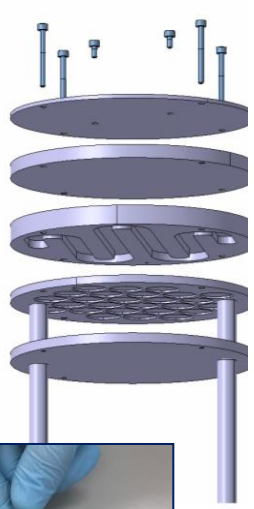


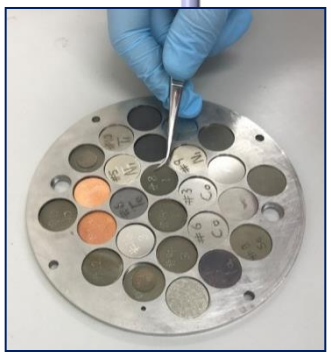
Octant 1 Octant 2

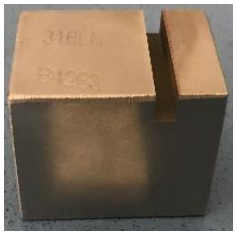
ITER materials activation studies

Validation of ITER materials nuclear analysis

- Characterization of activation properties of materials that will be used in ITER as structural or functional components
- ITER material samples and dosimetry foils irradiated at JET during JET 2015-2021 D-D, T-T & D-T campaigns
- Comparison against FISPACT calculations



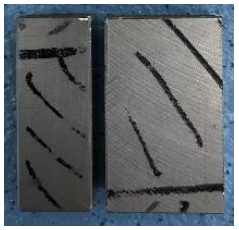




Austenitic steel for blankets

CuCrZr divertor pipes

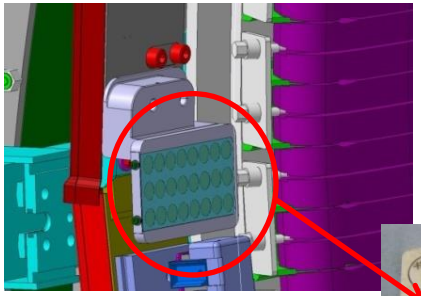
Divertor W Monoblock



Eurofer 97-3

Inconel 718

In-wall shielding

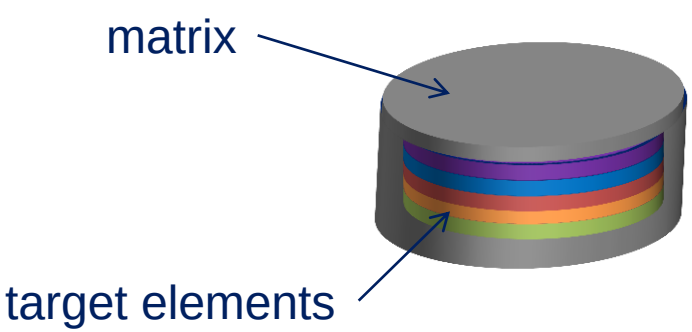


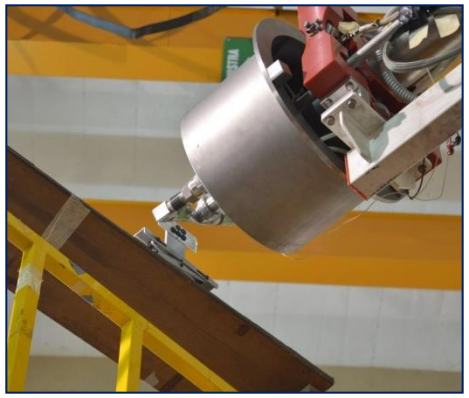
Irradiation position on ITER-like wall

Novel neutron detector for fusion

Development of a detector capable to accurately monitor neutrons surviving the harsh conditions of the fusion environment

- Low activation matrix capsule able to withstand the fusion environment (high temperature, high and variable neutron fluences / magnetic fields)
- Core of selected metallic elements of defined concentration
- Neutron fluence and spectrum inferred by the analysis of the activation products γ-lines





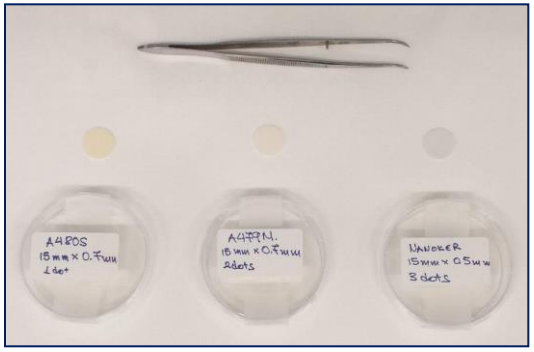
Irradiations of VERDI detectors

- at the Frascati Neutron Generator 14MeV reference neutron field
- at JET during the 2019-2021 D-D, T-T & D-T campaigns

Radiation damage studies of ITER materials

Assessment of neutron effects on mechanical and structural properties of ITER functional materials (sapphire, alumina, diamond, nitrides etc)

- Dielectric and optical characterization of materials before and after neutron irradiation
  - Optical methods
    - Raman spectroscopy
    - FT-IR transmittance and reflectance
    - UV-Vis transmittance, diffuse reflectance
    - Photoluminescence and photoluminescence excitation
  - Electrical degradation probed by
    - Dielectric spectroscopy
    - Thermally stimulated currents



- Irradiations of ITER functional materials at JET during the 2019-2021 D-D, T-T & D-T campaigns

Concluding remarks

The results of the ITER oriented NCSRD experiments at JET

- provide important information and significant experience to be applied on ITER analyses
- enable the validation of codes, models, assumptions, procedures and data currently used in ITER nuclear analyses
  - reducing the related uncertainties and associated risks in ITER operation
  - maximizing the scientific and technological preparedness
  - ensuring a successful launch of ITER
- contribute to the validation of the numerical tools employed for the design and safety of future fusion power plants