Calculated Response of RADFET Dosimeters in 6 MeV and 7 MeV γ Field near KATANA Facility

D. Govekar[1,2], J. Peric[1,2], D. Kotnik[1,2], V. Radulović[1,2]

[1]*Reactor Physics Department, Jožef Stefan Institute, Ljubljana, Slovenia*

[2]*Faculty of Mathematics and Physics, University of Ljubjana*

domen.govekar@ijs.si

Motivation

- High-energy γ (6–7 MeV) from activated water ^{16}N → shielding challenge
- Need for reliable dosimetry in fusion-relevant fields

Method

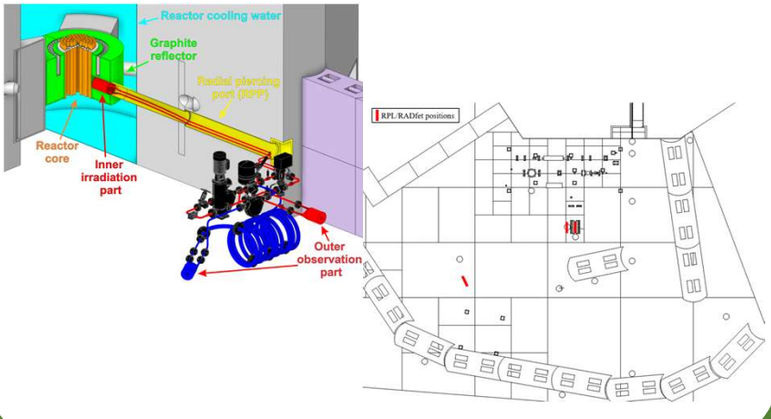
- Simulations at 3 distances: center of snail, 10 cm and 200 cm
- Pb thicknesses: 0–10 mm
- Two dosimeter types: RADFET & RPL

Conclusion

- 2–6 mm Pb provides optimal attenuation
- RADFET and RPL results in good agreement

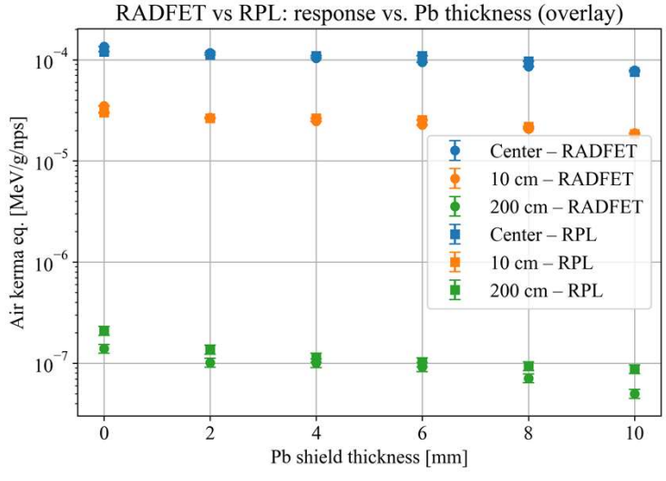
KATANA Facility & Methodology

- Closed water-activation loop installed at JSI TRIGA reactor.
- Produces 6–7 MeV γ-rays and ~1 MeV neutrons from short-lived isotopes.
- Dosimetry with RADFET (MOSFET-based) and RPL (radiophotoluminescence) detectors.
- Monte Carlo simulations with Pb shielding (0–10 mm) at three positions: center, 10 cm, and 200 cm.



Results

- Pb shielding reduces dose consistently at all detector positions.
- Strongest attenuation observed at short distances (center and 10 cm).
- RADFET and RPL responses show good agreement, typically within ~10%.
- Practical shielding range is 2–6 mm Pb; thicker layers give diminishing returns.
- Non-monotonic RPL at 200 cm likely due to scattering & statistics



Simulated RADFET and RPL responses (MeV/g/nps)

Pb [mm]	Center RADFET	Center RPL	10 cm RADFET	10 cm RPL	200 cm RADFET	200 cm RPL
0	1.36e-04	1.21e-04	3.49e-05	3.02e-05	1.41e-07	2.14e-07
2	1.17e-04	1.12e-04	2.69e-05	2.64e-05	1.02e-07	2.08e-07
4	1.04e-04	1.10e-04	2.47e-05	2.64e-05	1.01e-07	1.80e-07
6	9.46e-05	1.10e-04	2.26e-05	2.54e-05	9.22e-08	6.66e-08
8	8.56e-05	9.67e-05	2.08e-05	2.18e-05	7.13e-08	1.05e-07
10	7.90e-05	7.60e-05	1.89e-05	1.85e-05	5.00e-08	1.06e-07

Conclusion

- Pb layers are effective in reducing high-energy γ dose rates.
- Thin shields (2–4 mm) provide substantial protection; thicker layers give diminishing returns.
- Dual-dosimetry with RADFET and RPL offers reliable assessment of shielding effectiveness.

Acknowledgement

This work has been carried out within the framework of the EUROfusion Consortium.