Reactor pulse operation for nuclear instrumentation detector testing – preparation of a dedicated experimental campaign at the JSI TRIGA reactor

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DE LA RECHERCHE À L'INDUSTRIE
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Abstract

JSI TRIGA reactor:

- Very well characterized → suitable for instrumentation testing, but
- Steady state, P=250 kW → max. flux limited to 2×10^{13} n cm^{-2} s^{-1}
- Pulse mode - P_{max}=1 GW (few ms), max. flux = 10^{16} - 10^{17} n cm^{-2} s^{-1}

JSI-CEA collaboration: absolute neutron flux measurements in reactor pulse mode, with:

- Miniature fission chambers
- Neutron dosimetry
- Alternative: Cherenkov light / SIPm

Objective: feasibility of pulse mode for instrumentation testing

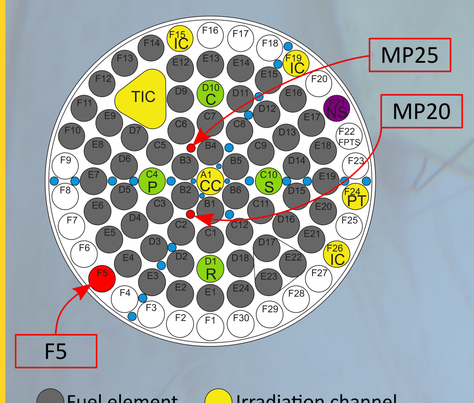
This work: first results of test measurements, as preparation for a dedicated experimental campaign

Miniature fission chambers (MPs in core)

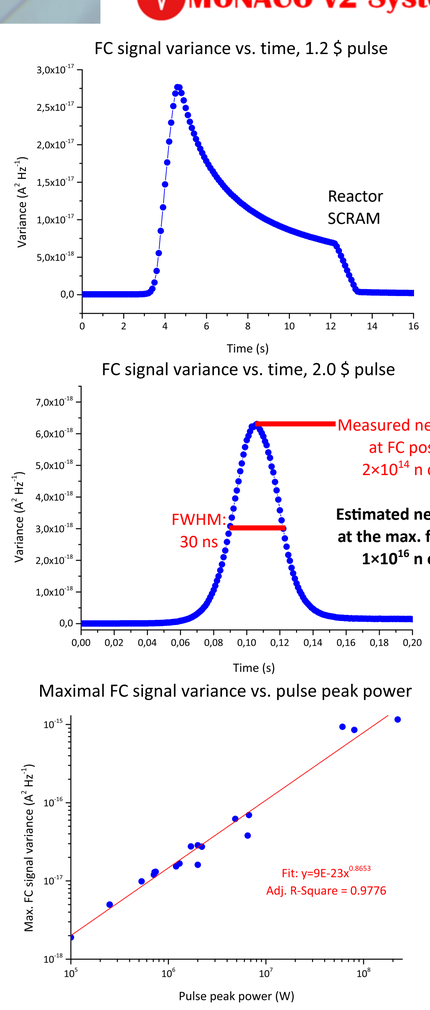
- Developed & manufactured by CEA/LDCI
- Outer diameter: 3 mm, ^{235}U deposit (10 ug)
- Calibration - absolute neutron flux measurements

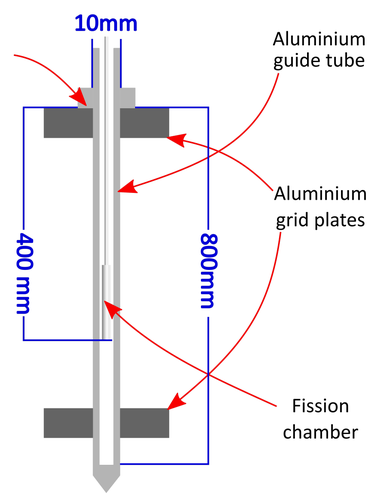
MONACO acquisition system - 3 operation modes:

- Pulse (low flux)
- Campbell (intermediate flux)
- Current (high flux)



Core configuration (top view)





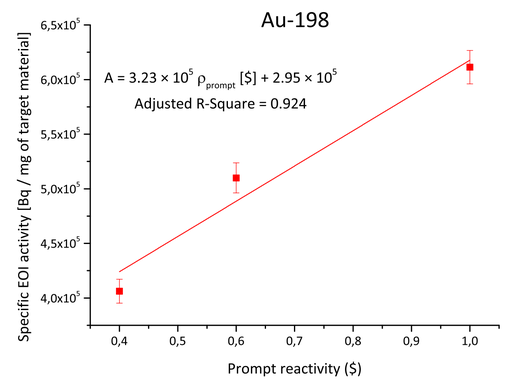
Guide tube and FC (side view)

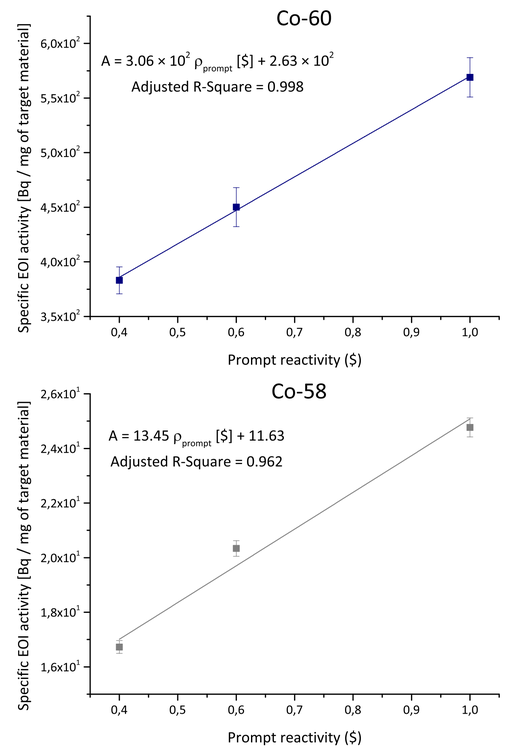
Activation dosimetry (Central Channel)

- Reference for neutron flux measurement
- Purpose: integral fluence in pulse mode

Reactions

- ^{197}Au(n,g) - thermal & epithermal
- ^{59}Co(n,g) - thermal
- ^{58}Ni(n,p) - fast



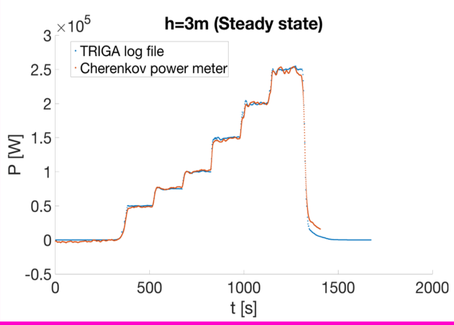


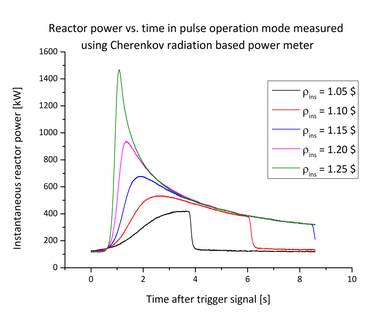
Cherenkov light measurements (F5)

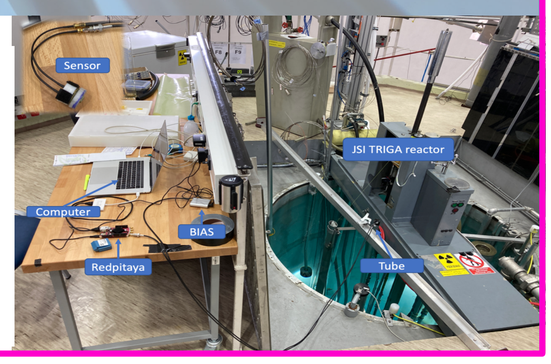
- Alternative technique for pulse shape measurement
- Simple and inexpensive

Setup:

- Dry tube (platform to core), 1 L of water
- SIPm in tube, approx 3 m from water level
- Voltage amp (10 x), RedPitaya board, PC







Conclusions

- Feasibility of proposed techniques for measurements in pulse mode
- Development of Cherenkov light measurement system, promising results
- Useful experimental data for dedicated experimental campaign
- Increased experimental capability of the JSI TRIGA reactor