

WPEC Subgroup Proposal:  
**U-235 Capture Cross Section**  
in the Energy Region  
from 100 eV to 1 MeV

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# **Justification of the Project**

# Background

- WPEC Subgroup 18
  - epithermal capture cross section of  $^{235}\text{U}$
  - ORNL group: new resonance parameters (Leal 1999)
  - satisfactory for thermal reactors
  - JENDL-3.3, ENDF/B-VII.0, JEFF-3.1

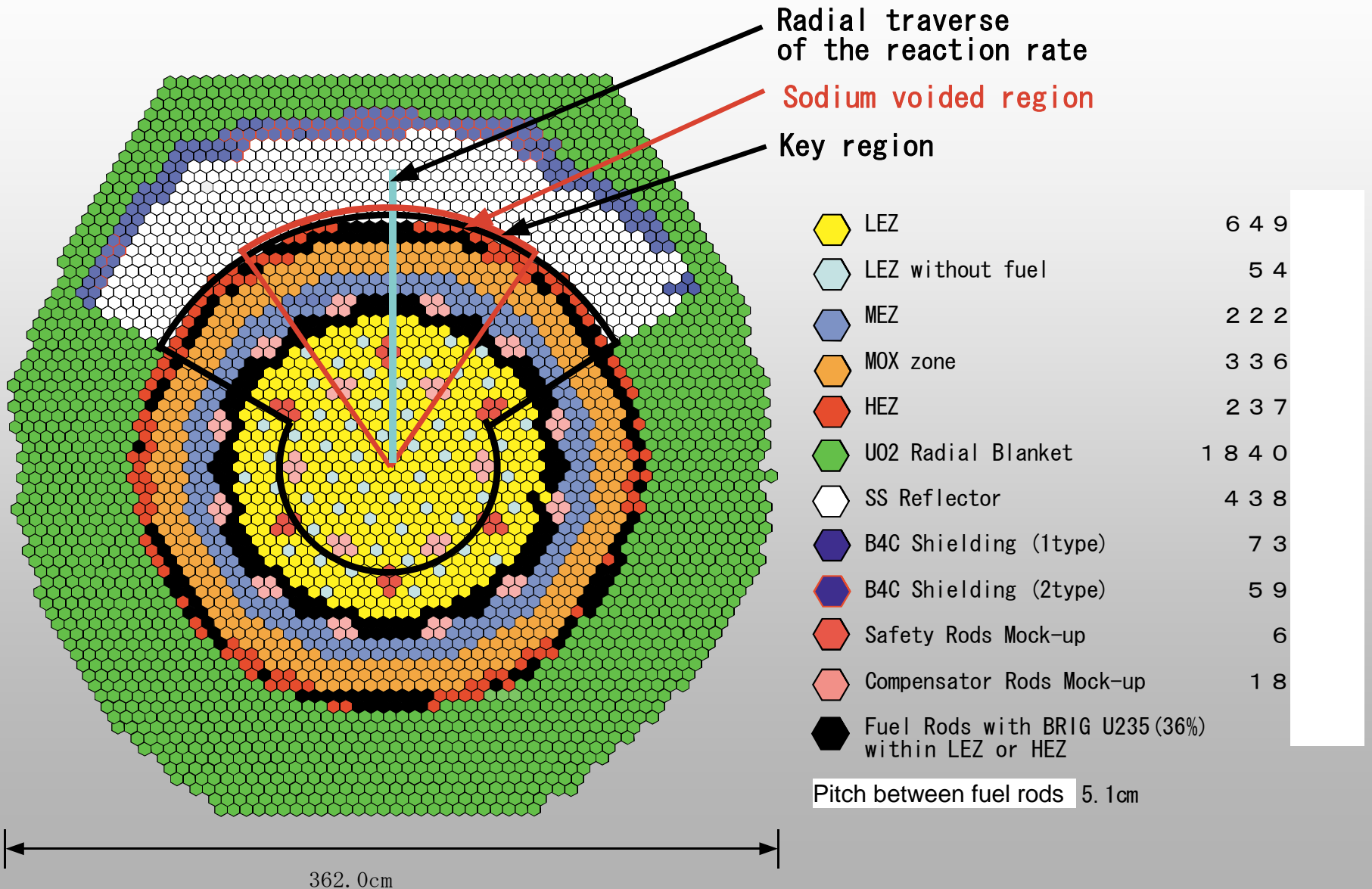
# Problems

- Fast-neutron critical experiments using U fuels
  - BFS (IPPE): underestimation of sodium voided reactivity
  - FCA (JAEA): large dependence of reactivity on neutron spectrum
- Capture cross sections of  $^{235}\text{U}$

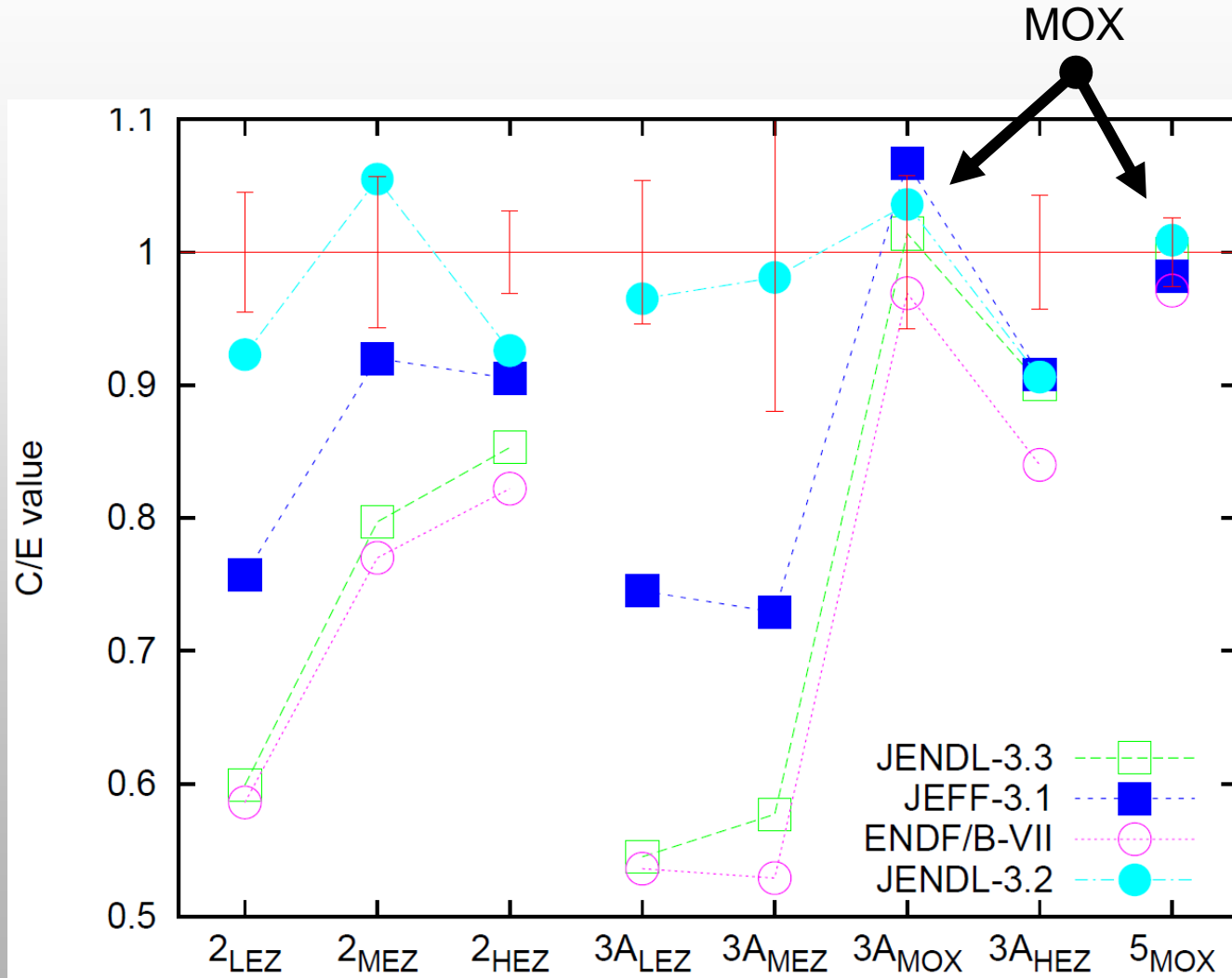
# BFS experiment

- $\text{UO}_2$  (3 zone) + MOX
  - HEZ (High Enriched U Zone)
  - MEZ (Medium Enriched U Zone)
  - LEZ (Low Enriched U Zone)
  - MOX

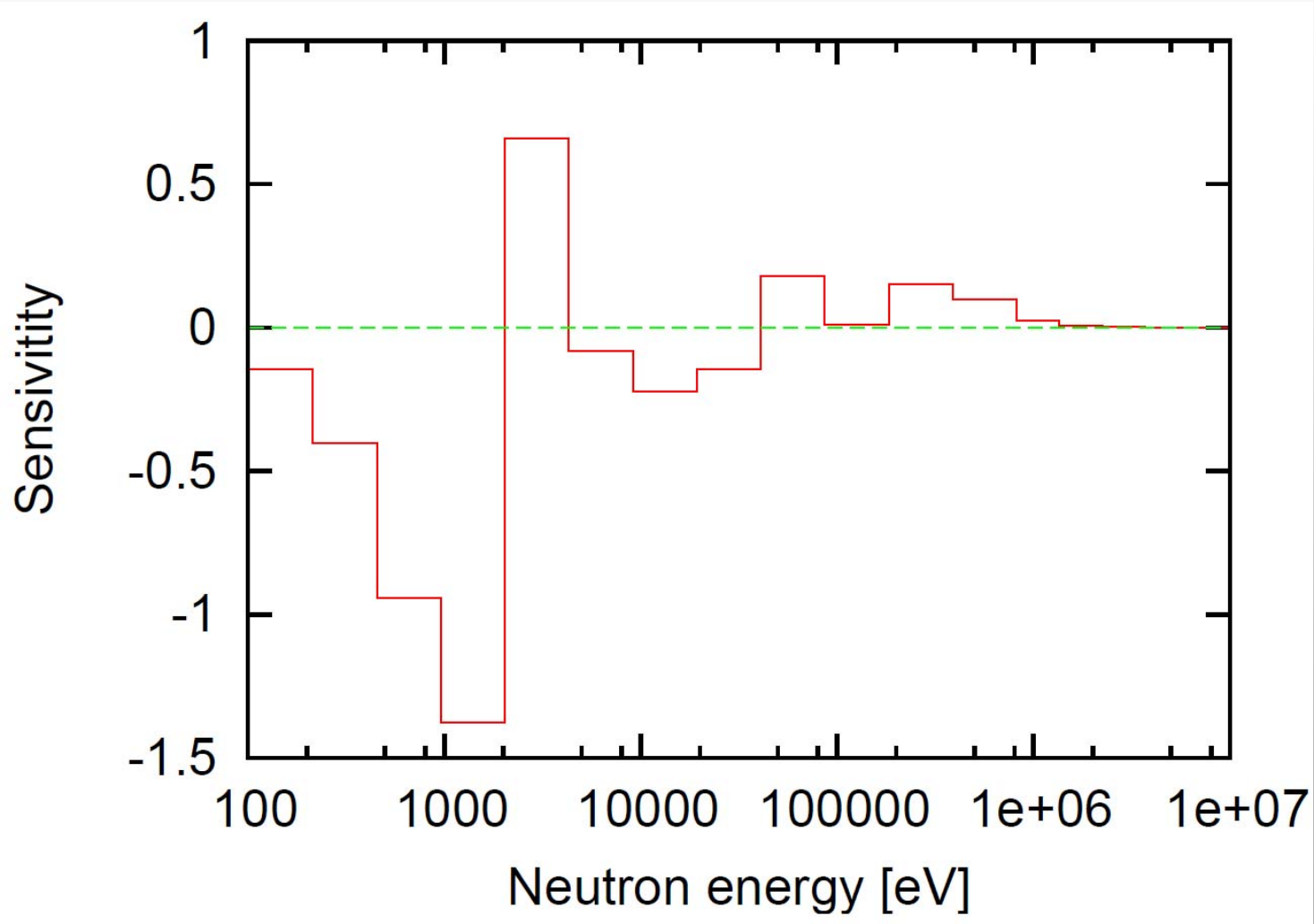
# Layout of BFS-62-3A Core



# sodium voided reactivity in BFS



# Sensitivity of capture cross section of $^{235}\text{U}$ to sodium-voided reactivity

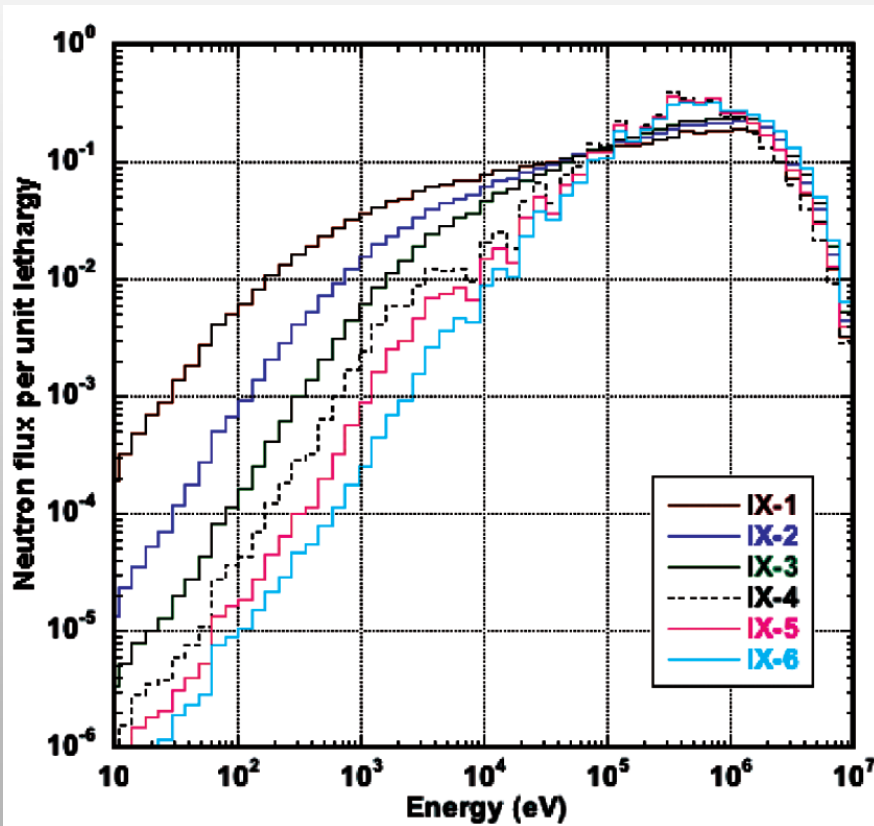




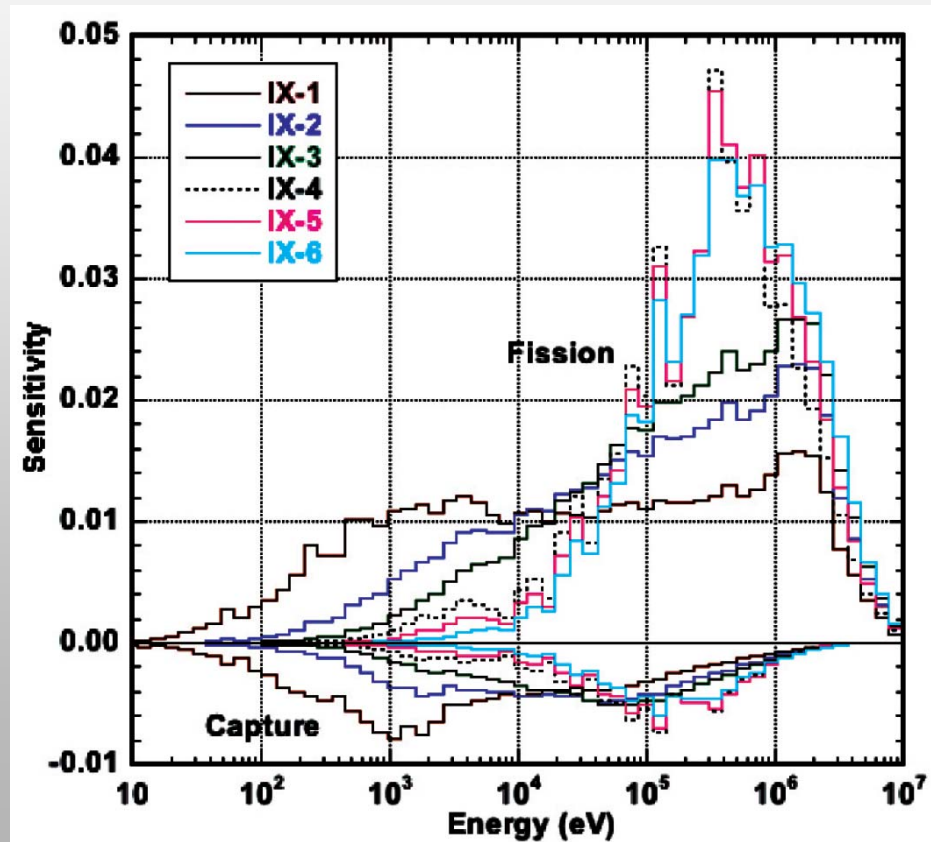
# FCA experiments

# FCA experiment (enriched U + C)

## Neutron spectra

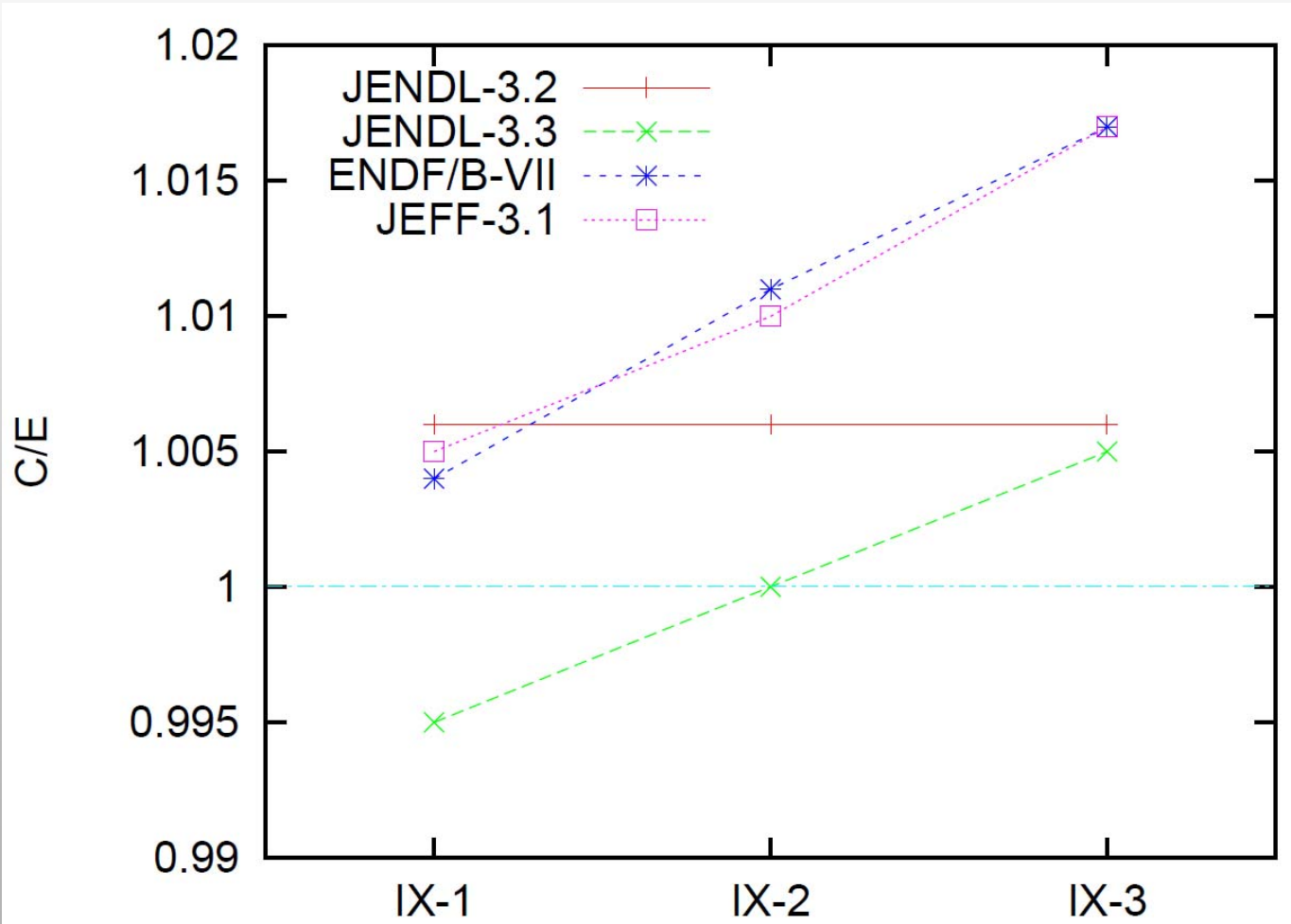


## Sensitivity of U-235



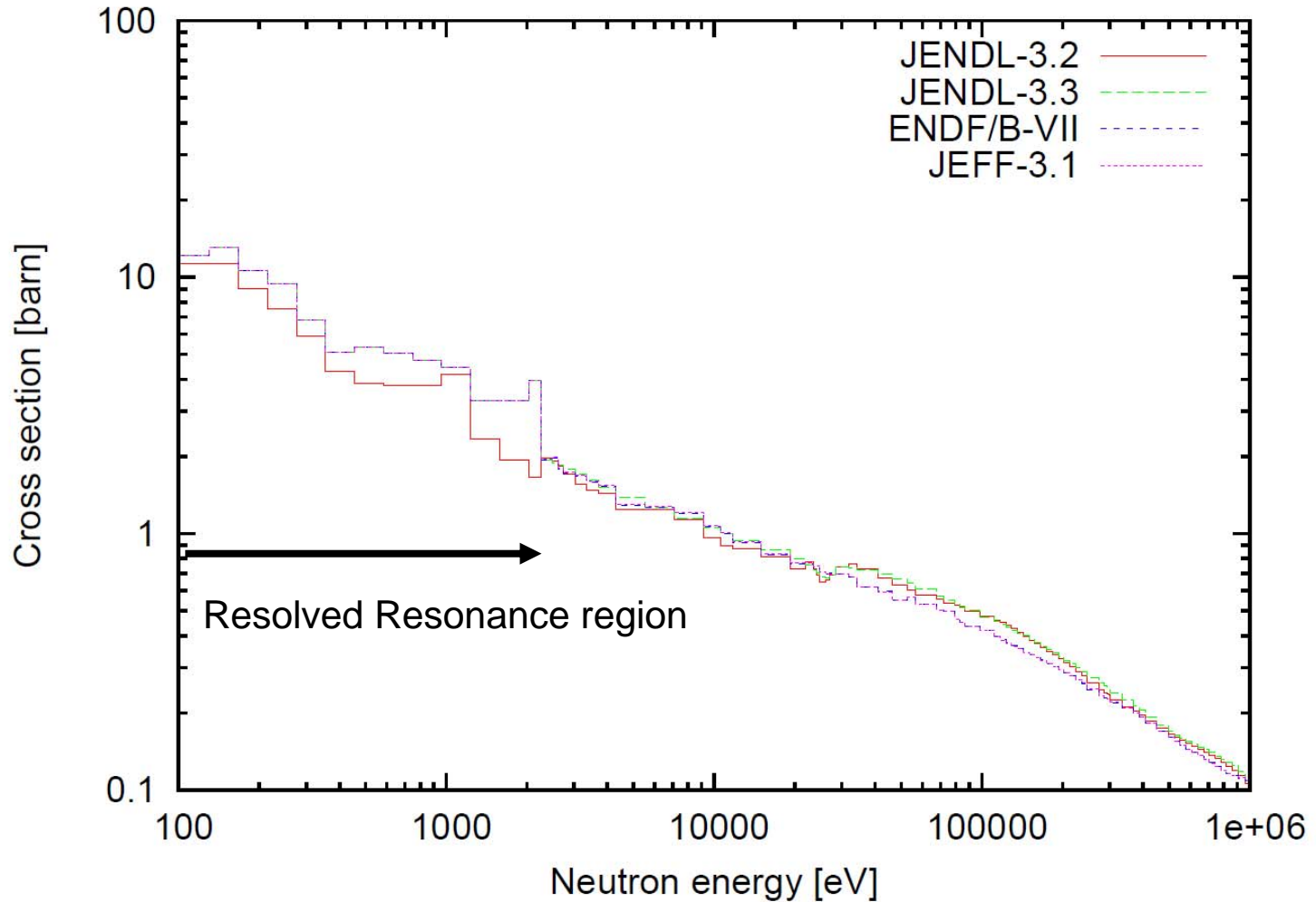
# criticality of FCA IX assemblies

Soft  Hard



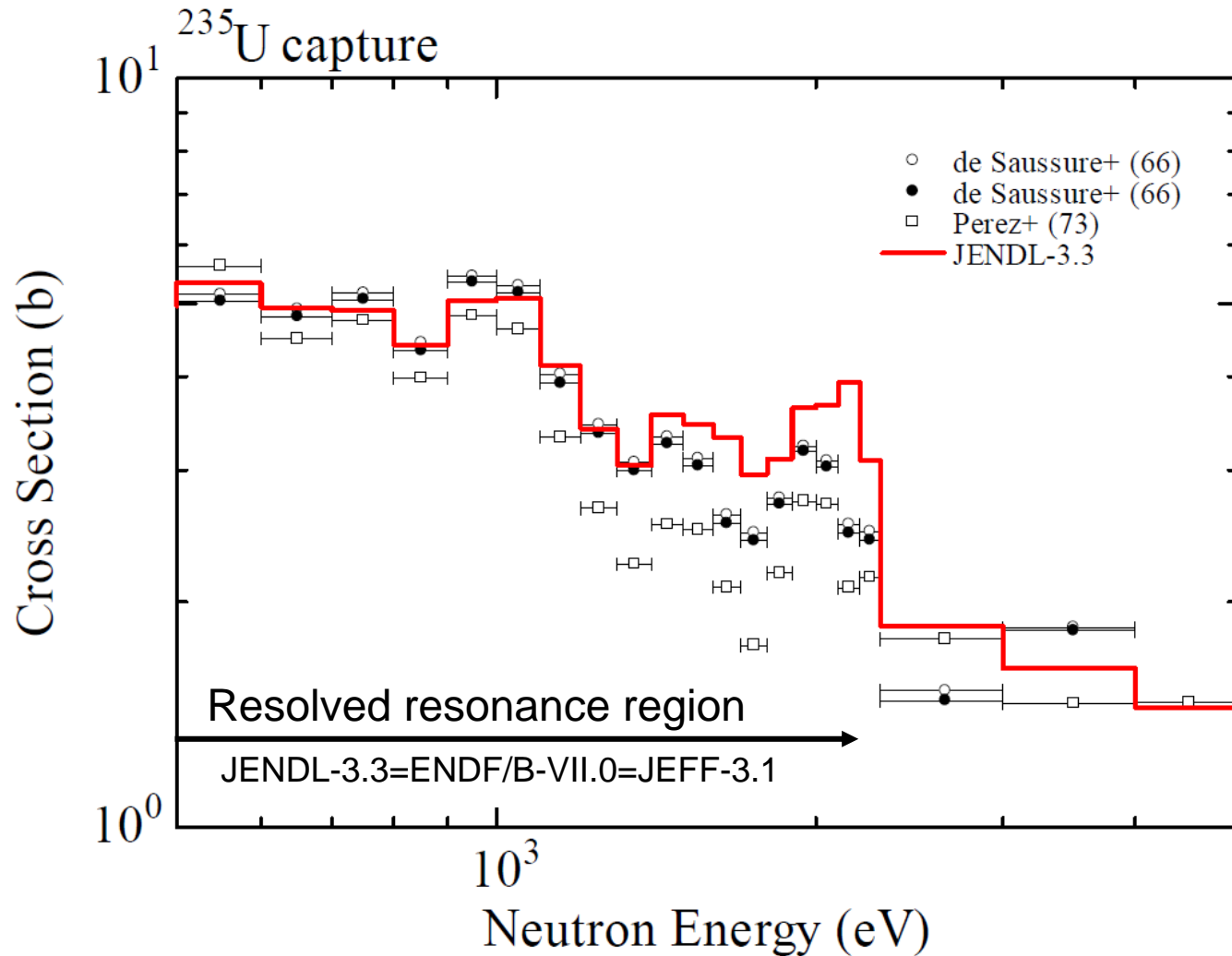
# Cross Section

# Comparison of capture cross sections of U-235

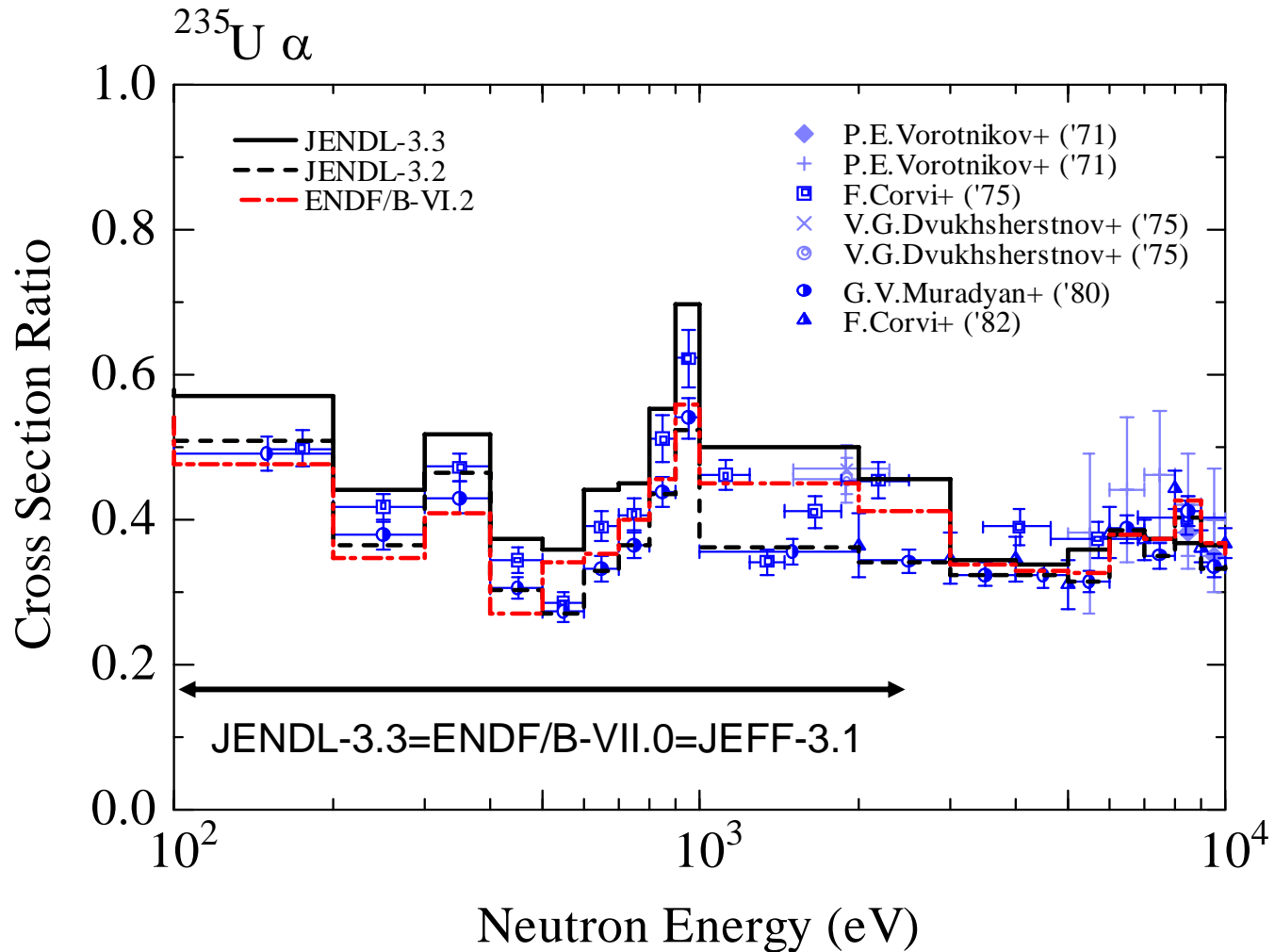


# Resonance Region

# $^{235}\text{U}$ capture cross section

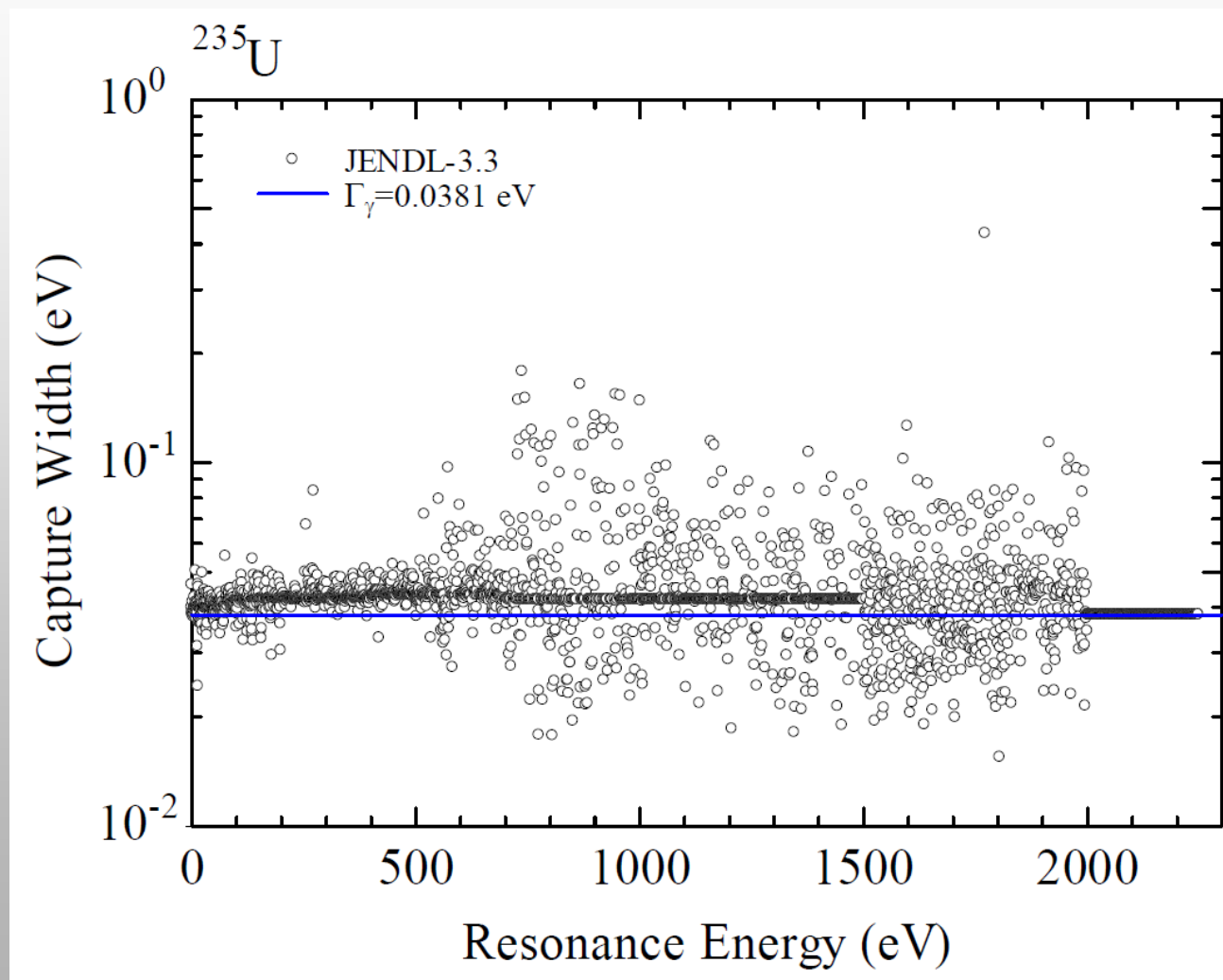


# $^{235}\text{U}$ capture to fission ratio ( $\alpha$ )



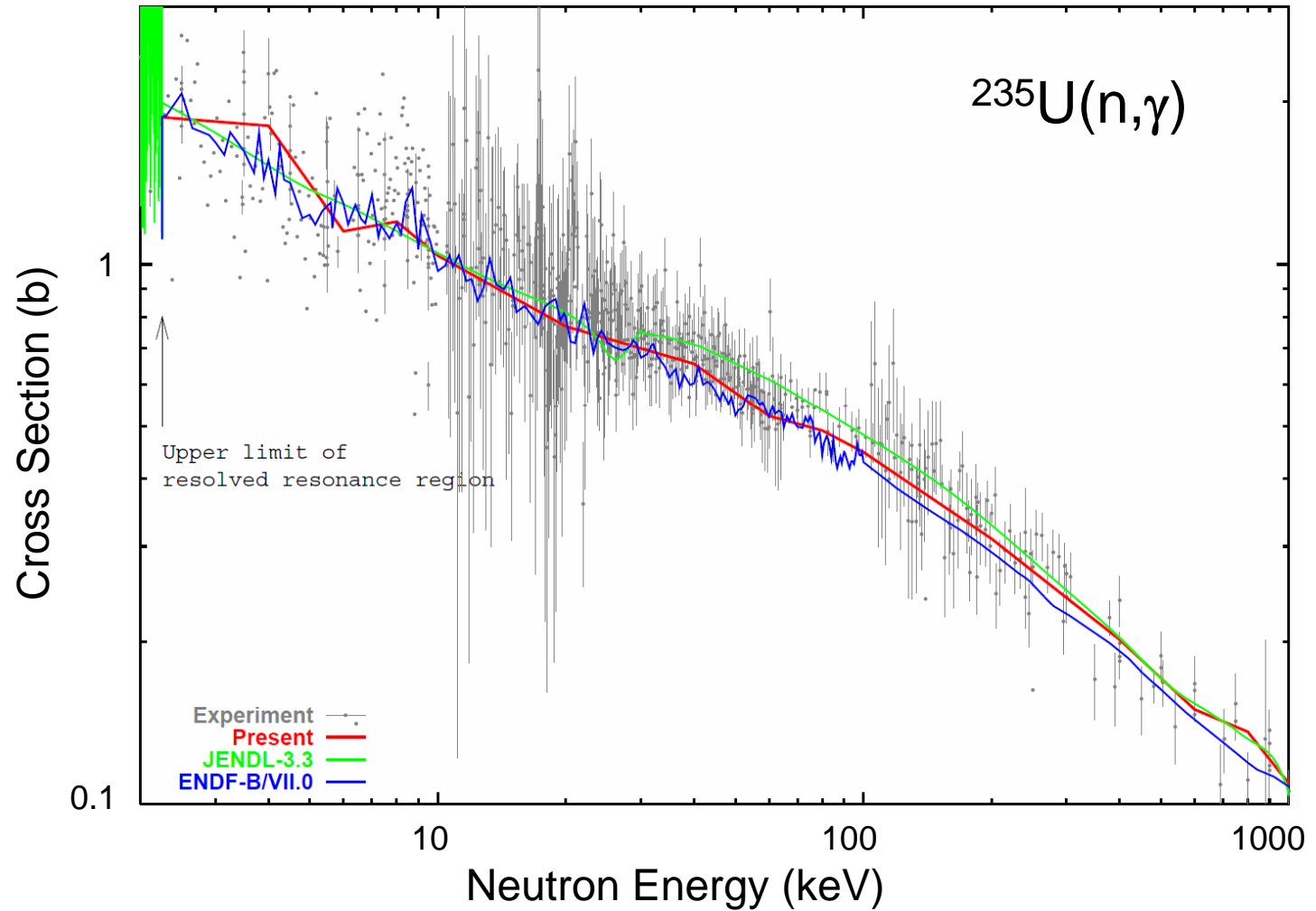


# Capture widths of $^{235}\text{U}$ resonances



Smooth Region

# $^{235}\text{U}$ capture cross section (above 2 keV)



# Definition of the Project

- Investigate the problems seen for the BFS and FCA-IX critical experiments
- Survey available experiments on fast-neutron cores with U fuels other than BFS and FCA-IX
- Re-evaluate cross sections and resonance parameters
- Re-analyze BFS and FCA-IX experiments
- New sodium-voided reactivity experiments with U fuels at FCA (planned on 2008)

# Candidate for Subgroup Participants

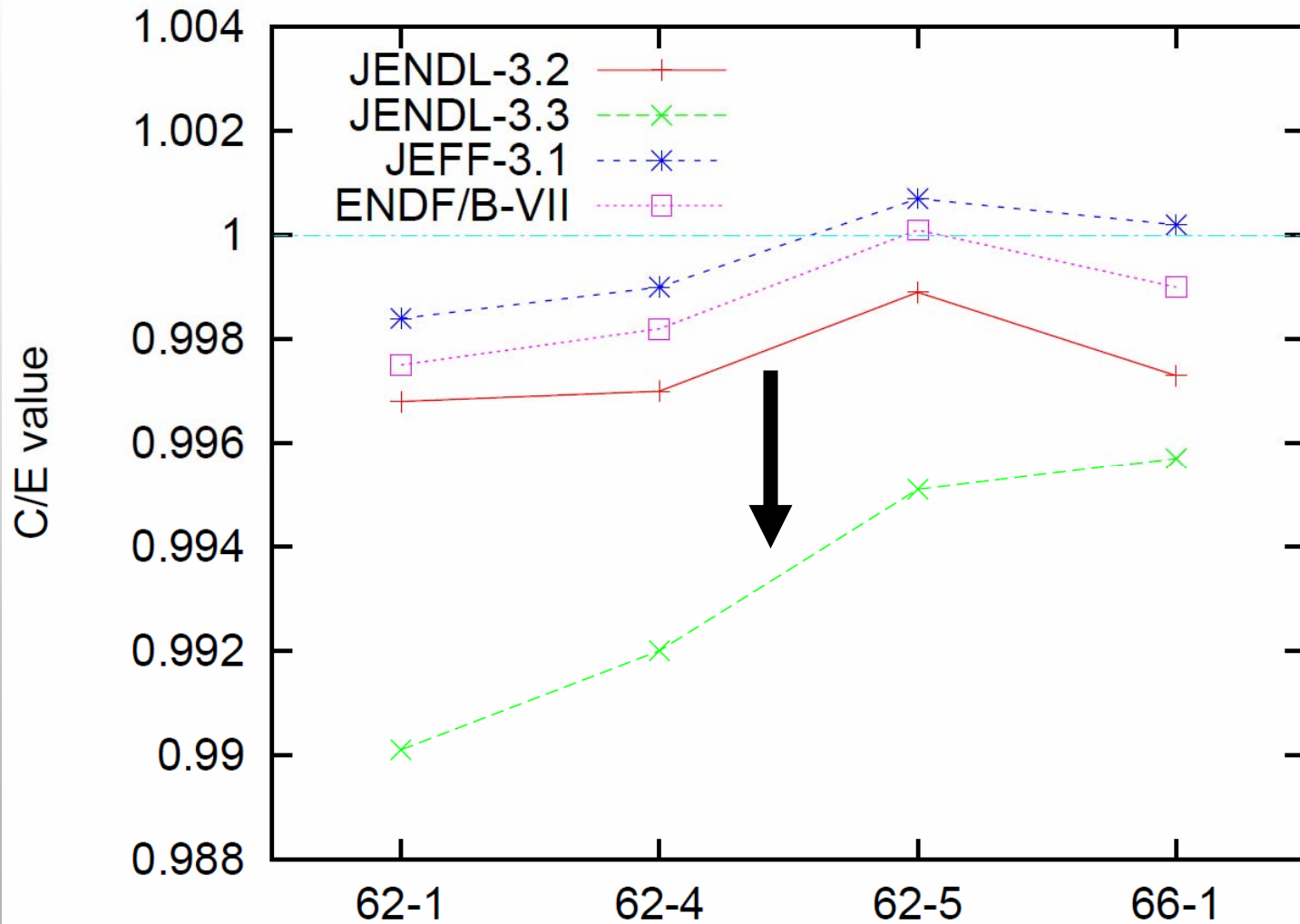
- **JENDL:**
  - O. Iwamoto, T. Nakagawa, G. Chiba, S. Okajima, M. Ishikawa (JAEA)
- **JEFF:**
  - R. Jacqmin (CEA), .....
- **ENDF:**
  - R. McKnight (ANL), L.C. Leal (ORNL), T. Kawano (LANL), C. Lubitz (KAPL) ....

# Time-Schedule and Milestones

- 1st year: Re-evaluation of  $^{235}\text{U}$  capture cross sections, re-analysis of resonance parameters and survey of available benchmarks.
- 2nd year: Start up of sodium-voided reactivity experiments at FCA. Benchmark calculations and feedback to evaluations.
- 3rd year: Recommendation and preparing a final report.

Thank you for your attention.

# criticality of BFS





# sodium voided reactivity on BFS U-core

