

Additional analysis of FLATTOP-Pu using SUS3D/PARTISN, SUS3D/ANISN with different P_N orders

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Cross Section Sensitivity Coefficients

Forward / Adjoint Flux Approach

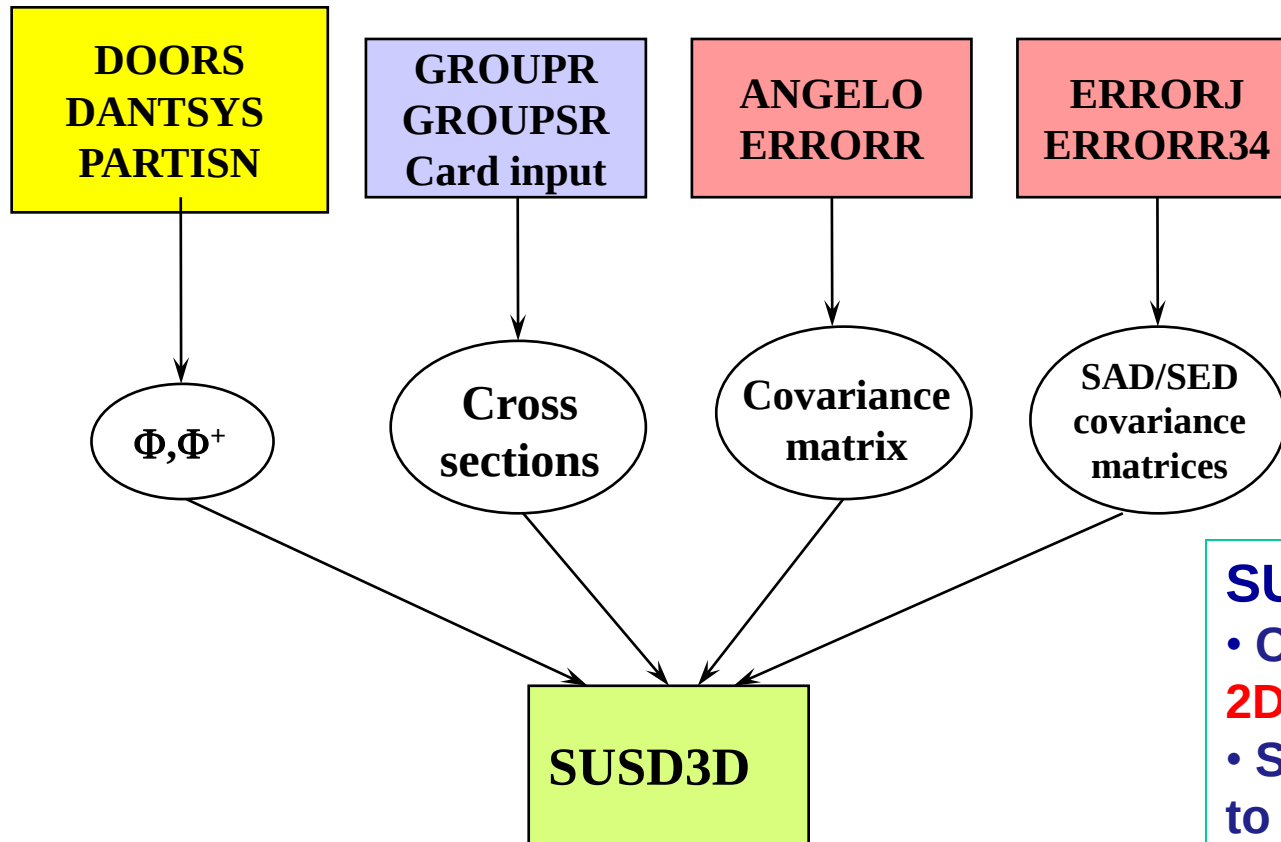
$$\begin{aligned}
 P_g^x &= \frac{\delta R / R}{\delta \sigma_g^x / \sigma_g^x} \\
 &= \frac{1}{R} \sum_i \Delta V_i \left(\begin{aligned}
 & - \rho_i^x \sigma_{T,g}^x \sum_m \Phi_{g,i,m} \Phi_{g,i,m}^* \Delta \Omega_m && \textbf{Loss term} \\
 & + \rho_i^x \sum_{g'} \sum_{l=0}^L (2l+1) \sigma_{l,g \rightarrow g'}^x \sum_{n=-l}^l M_{g,i}^{l,n} M_{g',i}^{*l,n} && \textbf{Gain term} \\
 & + \sigma_g^{Dx} \sum_m \Phi_{g,i,m} \Delta \Omega_m && \textbf{Direct term}
 \end{aligned} \right)
 \end{aligned}$$

(absorption, scattering)

(scattering, fission, nu-bar)

(detector response function)

SUSD3D : sensitivity and uncertainty code system



SUSD3D uses

- **flux moment files** produced by **SN codes**: DORT-TORT, ONE-, TWO-, THREEDANT and **PARTISN**
- **angular flux files** from ANISN and DOT-III

SUSD3D

- Complex geometries **1D, 2D, 3D**
- Sensitivity-uncertainty to **distributions in (E, θ)** of emitted neutrons
- Shielding, criticality (**fusion, fission**)
- PC DOS, LINUX
- written **Fortran 95**

FLATTOP-Pu calculations

- ENDF/B-VII.0, 33 groups, P1, P3 and P5
- PARTISN & DANTSYS: flux moments
- ANISN: angular fluxes converted internally to moments; in principle P_N order in transport can be different from P_N in sensitivity calculation.

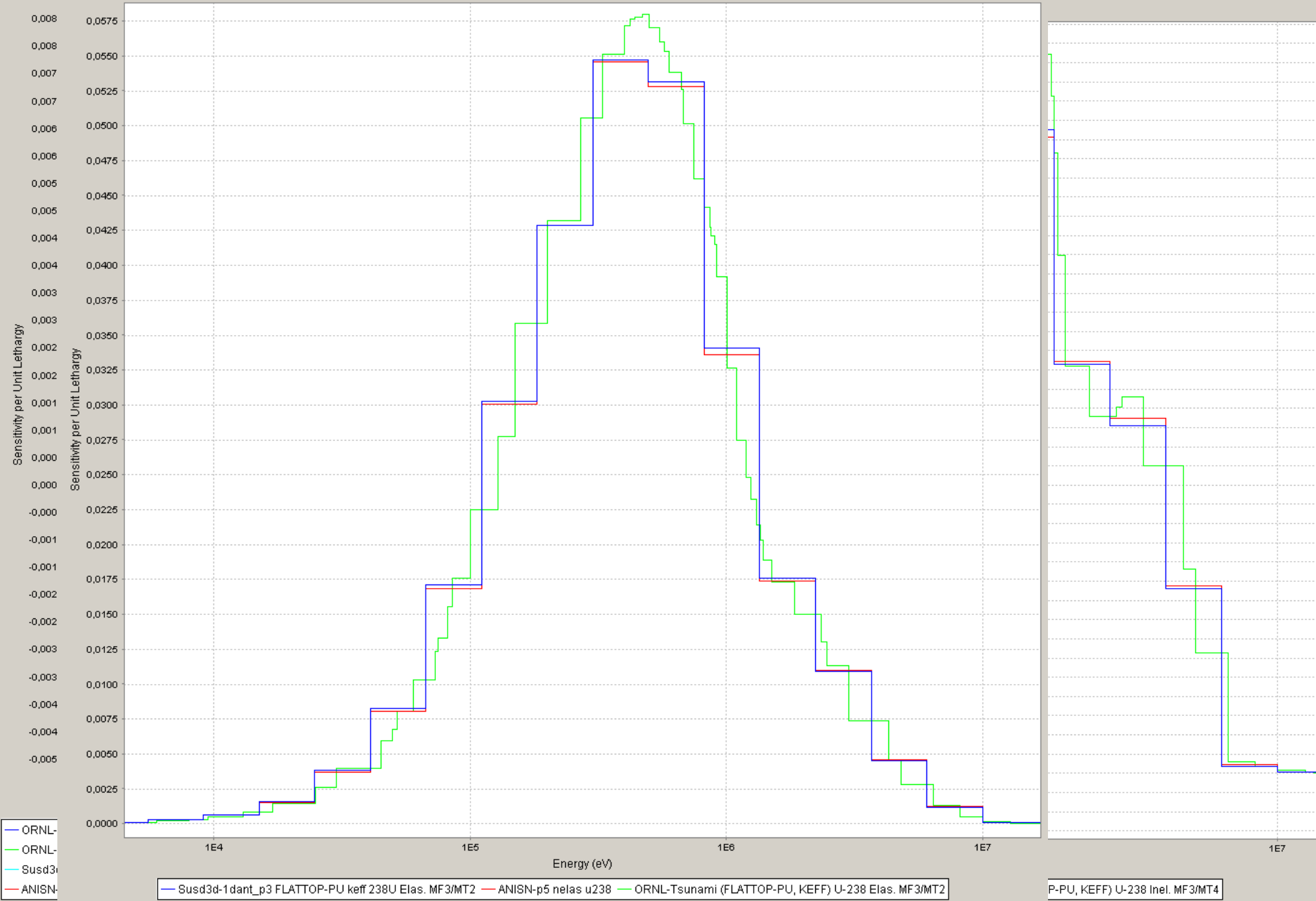
Results

- P5: excellent agreement between SUS3D/PARTISN, SUS3D/ANISN (& SUS3D/ONEDANT) and TSUNAMI 238-group P5 results;
- P1: good agreement between SUS3D with PARTISN P1 and ANISN P1/P1, but not with ERANOS/PSI P1;
- P1: consistent trends between SUS3D/ANISN P1/P5 and ERANOS/PSI P1.

TSUNAMI: pnm=... transport P_N order,
pn=... sensitivity P_N order

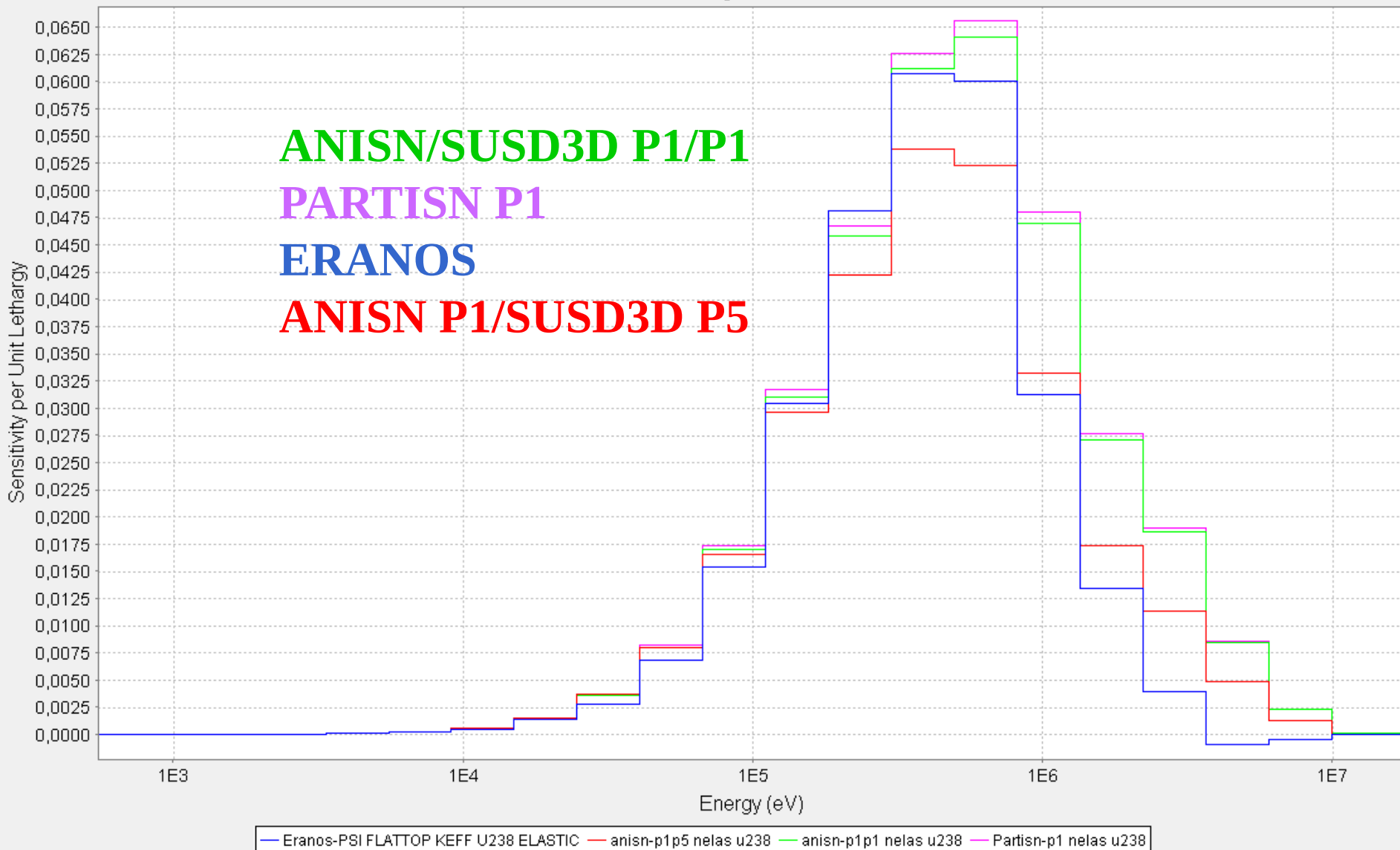
FLATTOP-Pu (P₅)

Sensitivity Plot



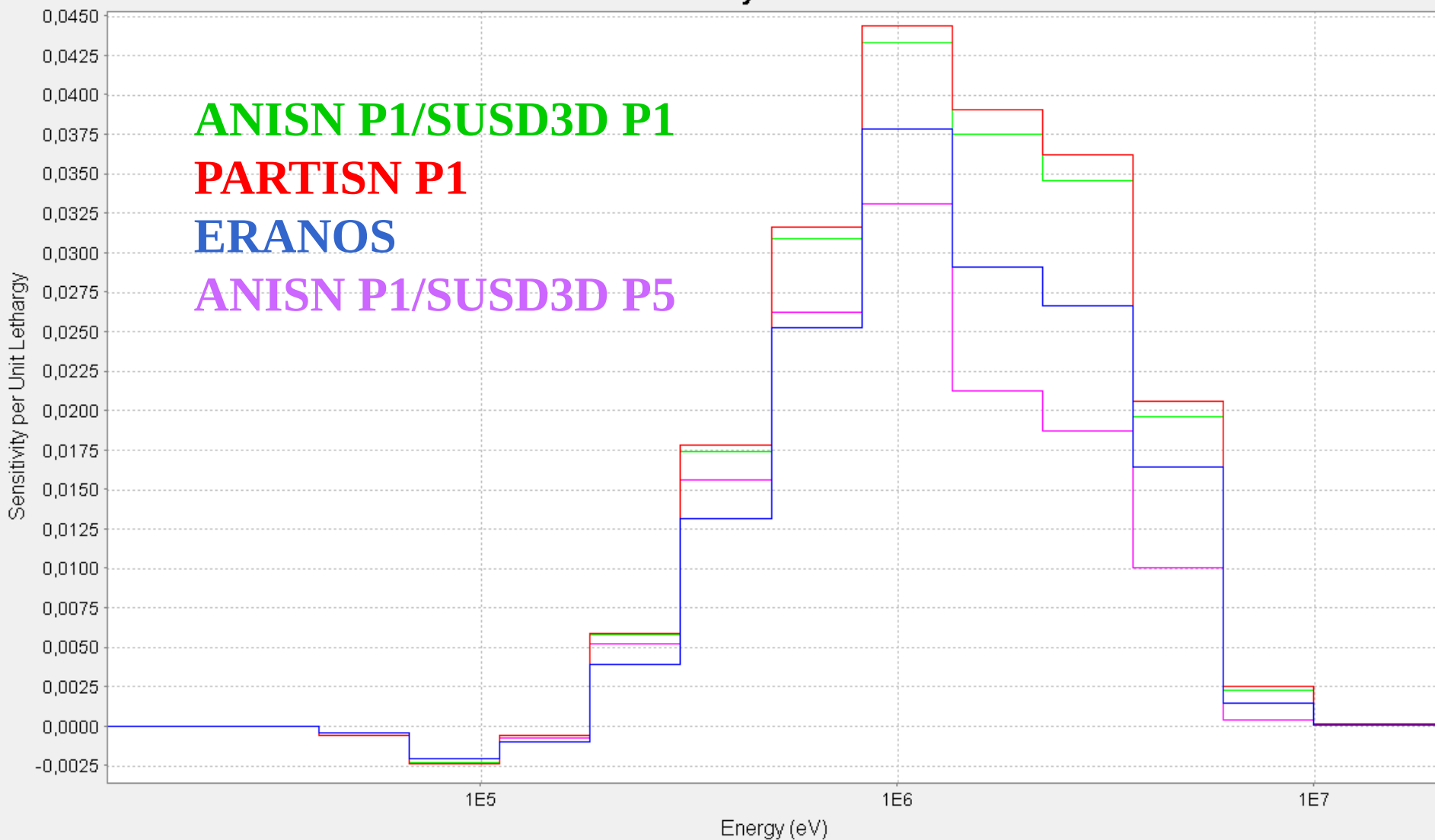
FLATTOP-Pu (P_1) ^{238}U elastic

Sensitivity Plot



FLATTOP-Pu (P_1) ^{238}U inelastic

Sensitivity Plot



— Eranos-PSI FLATTOP KEFF U238 INELASTIC — Partisn-p1 ninel u238 — anisn-p1p1 ninel u238 — anisn-p1p5 ninel u238

CONCLUSIONS

- Good consistency for higher P_N orders P_3 , P_5 ...
- For P_1 ???.