Covariances for $^{204, 206\text{-}208}$Pb and ^{209}Bi

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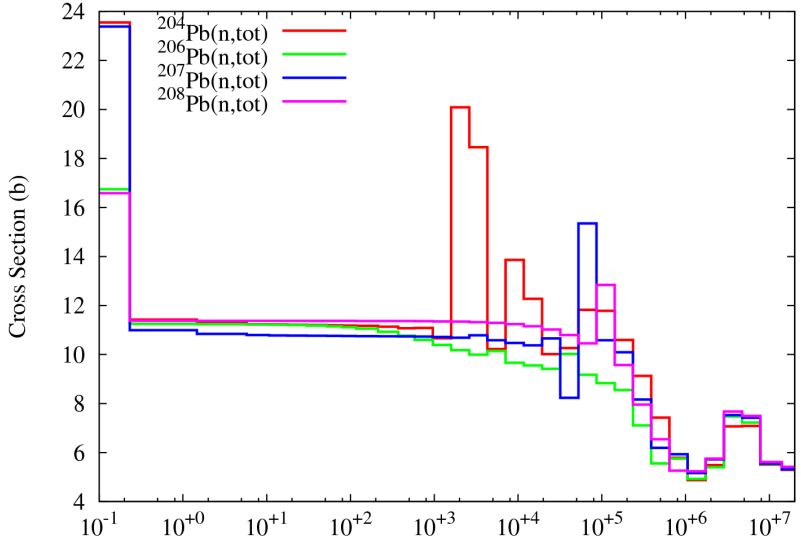
Introduction

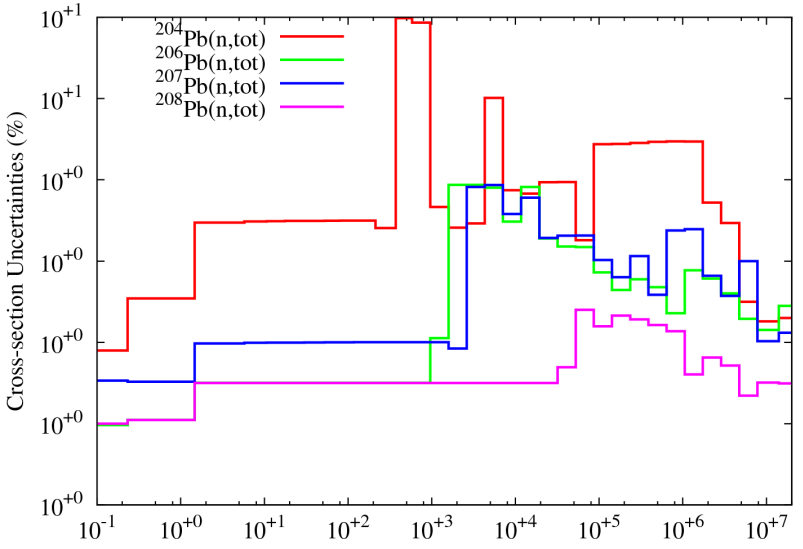
- Neutron cross-section covariances for Leads and ^{209}Bi
  - Thermal Region – ATLAS (S.F. Mughabghab)
  - Resolved Resonance Region - ATLAS + Kercen (P. Oblozinsky)
    - Resonance parameters uncorrelated
    - Assigned correlations
    - Other criteria adopted
  - Fast Neutron Region – EMPIRE + Kalman
    - Model calculations + selected experiments
- Assumptions
  - (co)variances for AFCI-2.0β
  - (co)variances coupled to ENDF/B-VII.0
  - (co)variances possible candidate for ENDF/B-VII.1
- Timeline history
  - Covariances in ENDF/B-VI.8 (for Leads central values differ from ENDF/B-VII.0)
  - Low-fidelity covariances (2008 – estimates from model calculations)
  - AFCI covariances (2010)

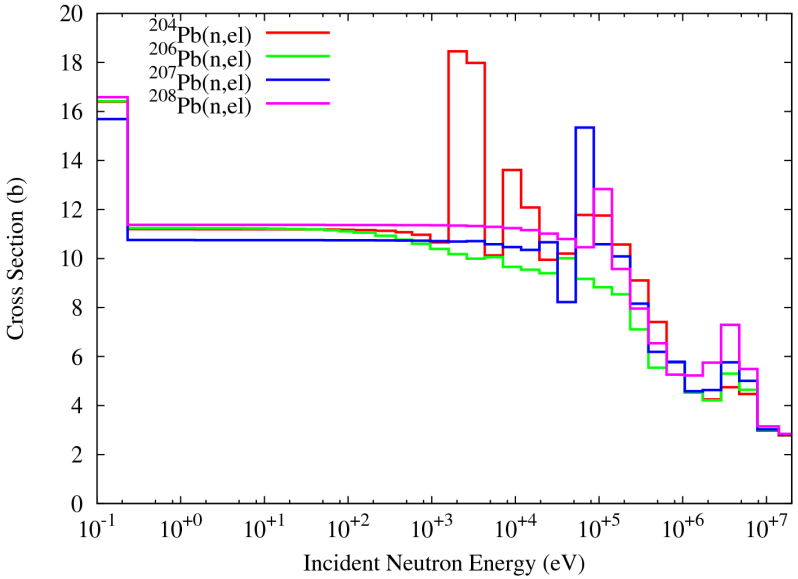
Methodology

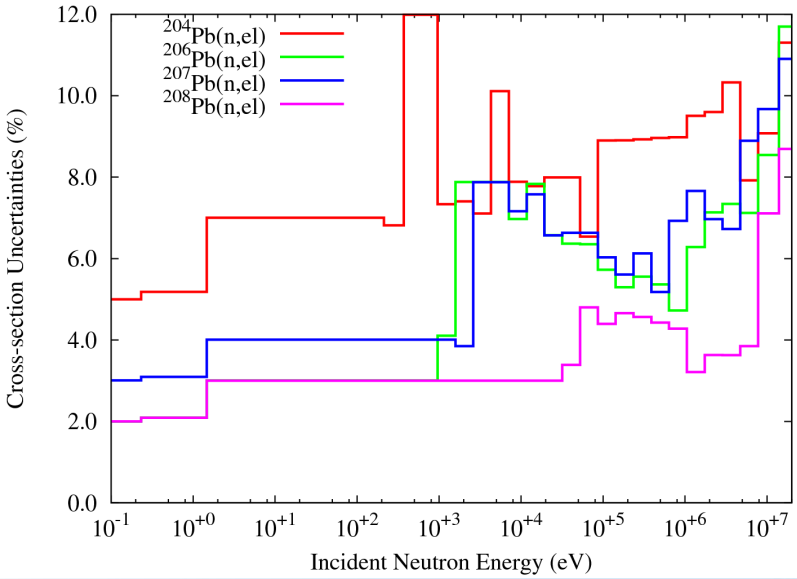
- **Thermal and Resolved Resonance Region**
  - Thermal Region – ATLAS (S.F. Mughabghab)
  - Resolved Resonance Region (RRR) – Different criteria adopted
    - ATLAS + Kernel approx. (P. Oblozinsky)
    - (n,el) dominated by potential scattering ($\Delta R'$ multiplied by 1.5/2.0, P. Oblozinsky/S.F. Mughabghab)
    - For $\sigma < 3$ mb, $\Delta\sigma > 25\%$ (P. Oblozinsky) , mostly for (n,γ)
    - Uncertainty for capture resonance integral (ΔI_γ multiplied by 1.5/2.0, P. Oblozinsky)
    - Cross-section correlations assigned, $\langle \Delta\Gamma \Delta\Gamma \rangle = 50\%$, $\langle \Delta R' \Delta\Gamma_n \rangle = -50\%$ (P. Oblozinsky)
- **Fast Neutron Region**
  - Empire code (sensitivity matrices)
    - Coupled-channel calculations (Spherical pot. plus deform. Parameters)
    - Microscopic level densities (HFB parity dependence)
    - Tuning parameters
  - Kalman (Bayesian)
    - Selected experiments, e.g. (n,tot), (n,2n), (n,γ)
    - Parameter correlations: $P \equiv \langle \Delta p_l^{(1)} \Delta p_m^{(1)} \rangle$
    - Total error matrix: $E \equiv \langle \Delta p_l^{(1)} \Delta p_m^{(1)} \rangle + \langle \Delta p_l^{(2)} \Delta p_m^{(2)} \rangle$
    - Covariance matrix: $C \equiv S^T E S$
    - cov(n,el) computed: cov(n,tot)-cov(n,abs)

Results for Leads (33 energy-grp 1/E)

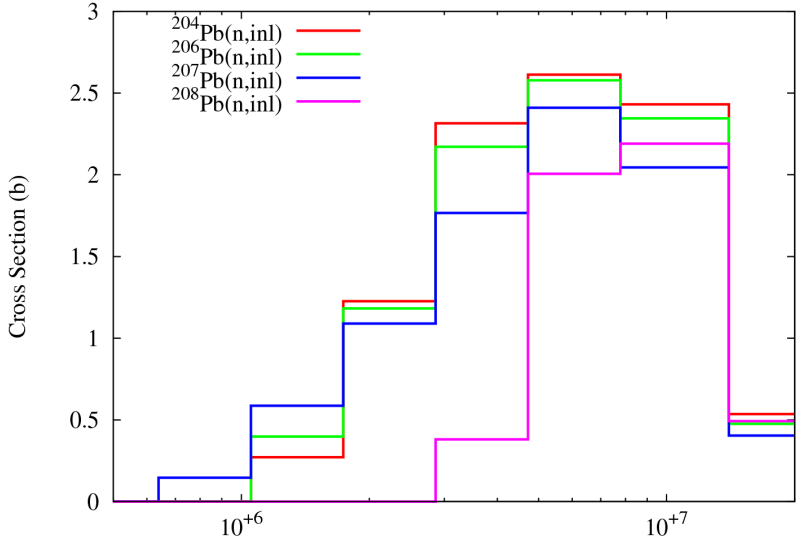


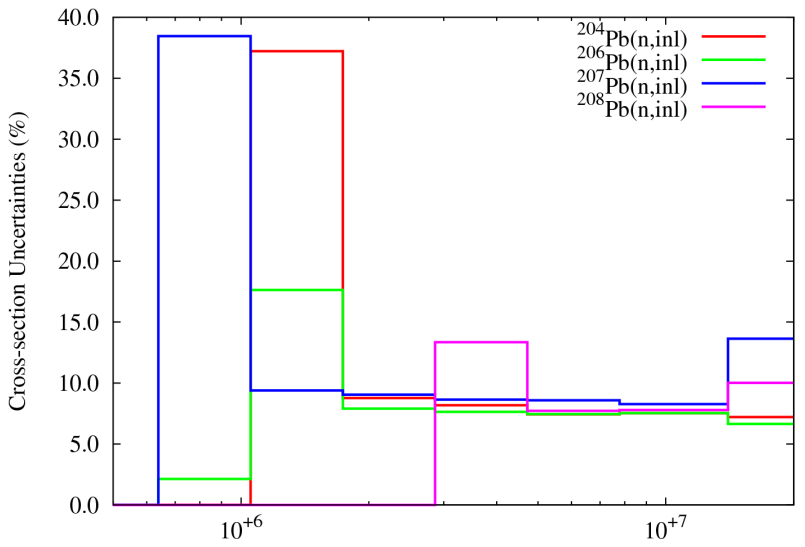


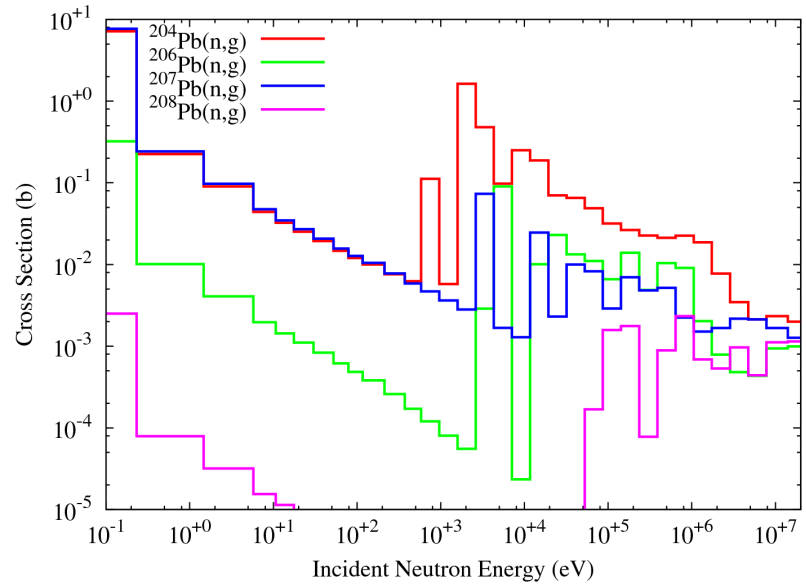


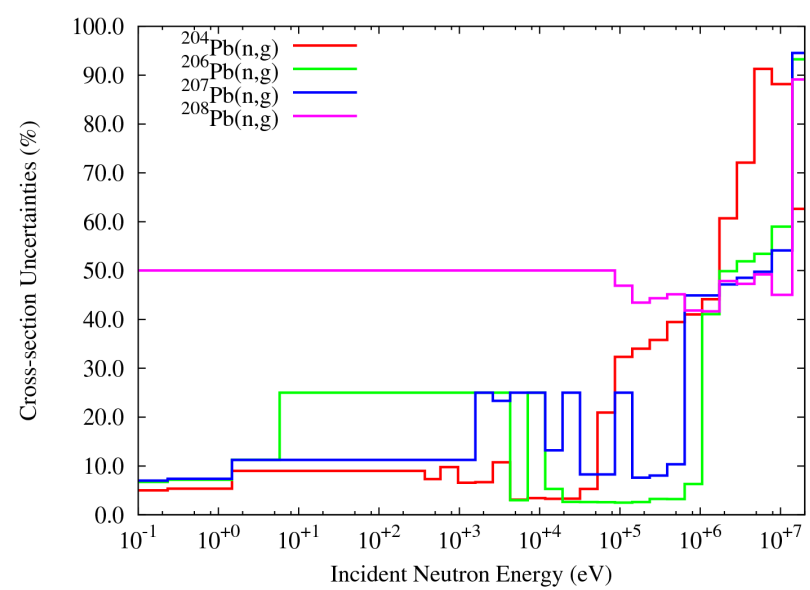


Results for Leads (33 energy-grp 1/E)

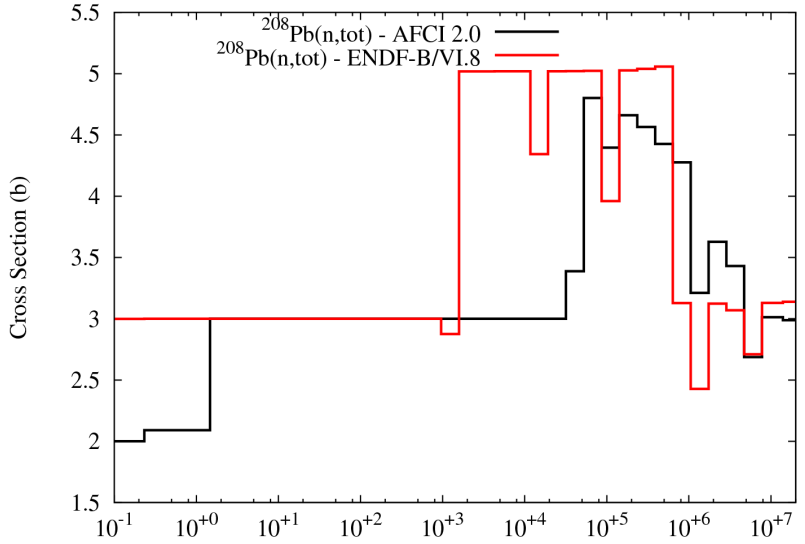


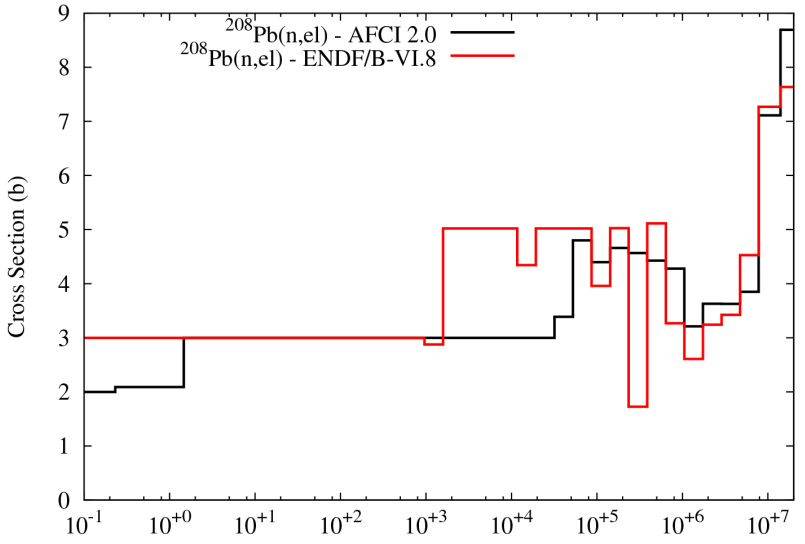


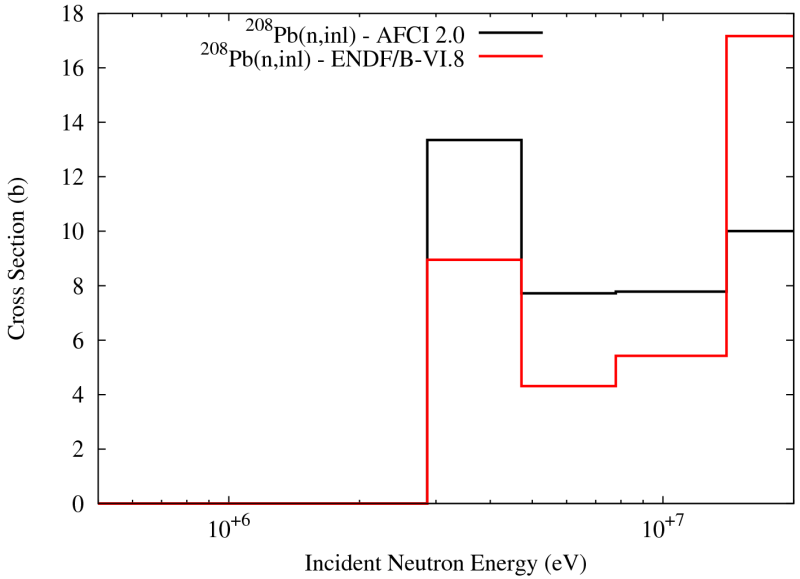


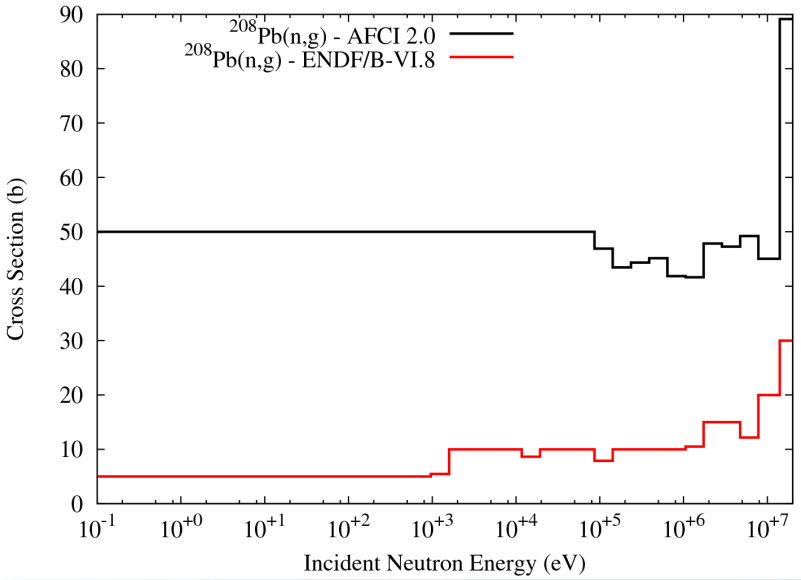


Results for Leads (comparison)









Conclusions

- Neutron cross-section covariances for Leads and ^{209}Bi
  - Thermal Region – ATLAS (S.F. Mughabghab)
  - Resolved Resonance Region - ATLAS + Kercen + other criteria
  - Fast Neutron Region – EMPIRE + Kalman
    - Model calculations + selected experiments

Covariances were generated for AFCI-2.0β

- (co)variances possible candidate for ENDF/B-VII.1

- Possible improvements
  - Cross-reaction correlations
  - Inclusions of other reaction channels