

Status of ENDF/B-VIII.0/ β 4 for Light-Element Evaluations

Mini-CSEWG

4-5 May 2017

Los Alamos National Laboratory



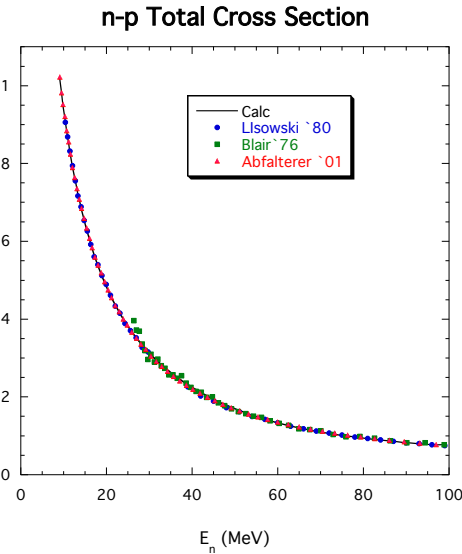
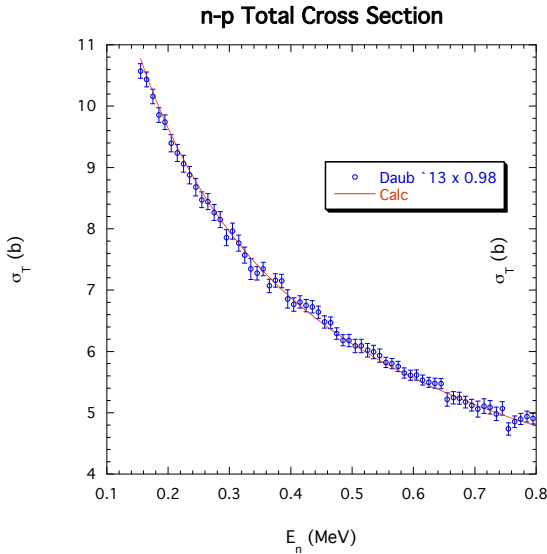
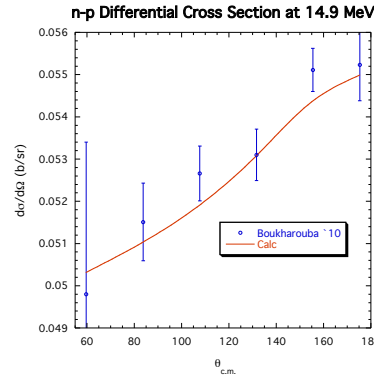
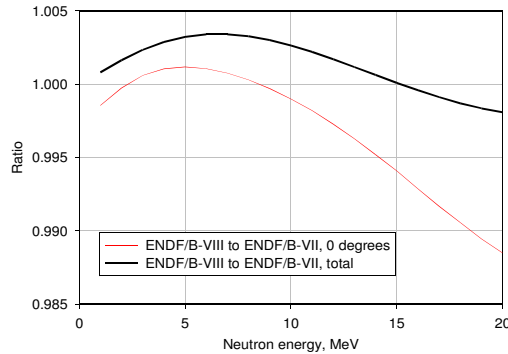
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May 4, 2017



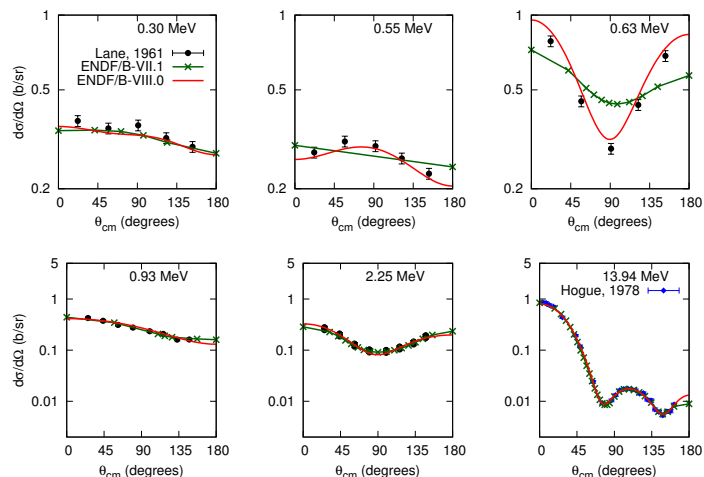
Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA

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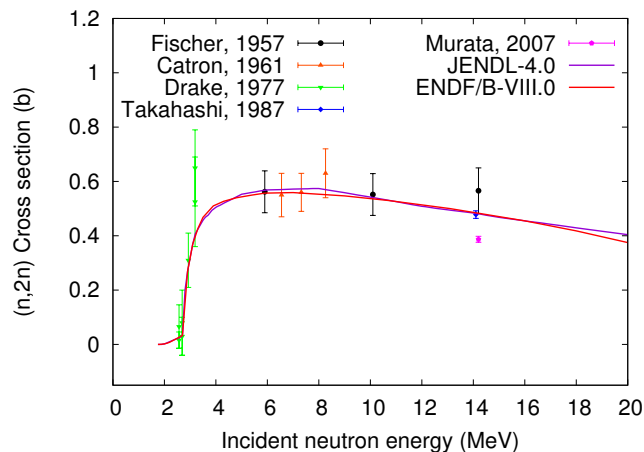
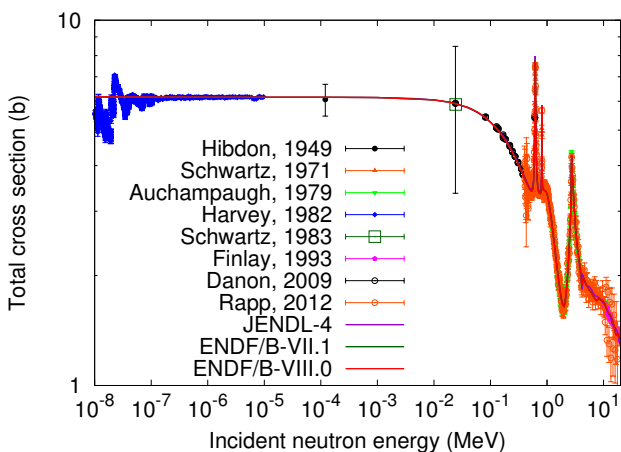
- Changes from VII.1 for $0 \leq E_n \leq 20$ MeV are within uncertainties
- New data are fit well
- Small change in thermal capture cross section had large effect on solution criticals
- R-matrix analysis presently goes to 100 MeV
- Still to do: Covariances on differential cross sections (c.m. and lab); Extend analysis to at least 200 MeV

$n+{}^9\text{Be}$:

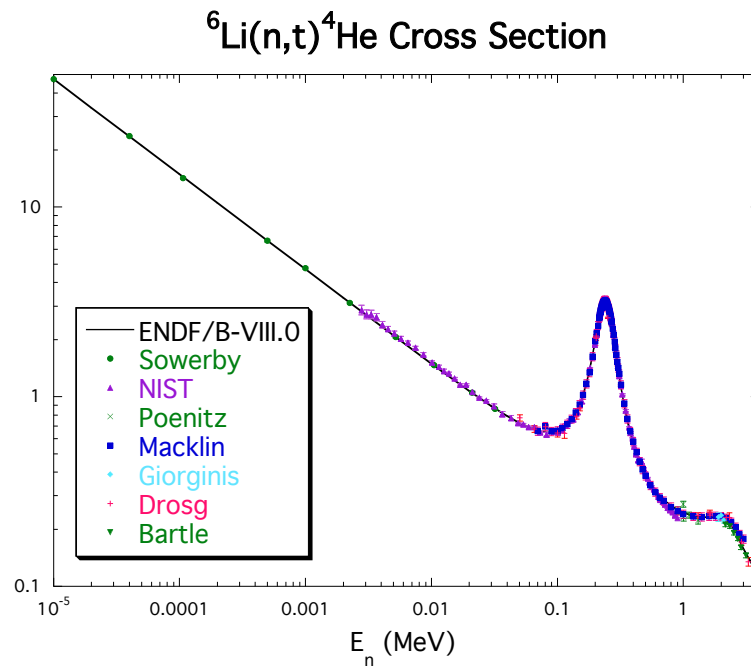
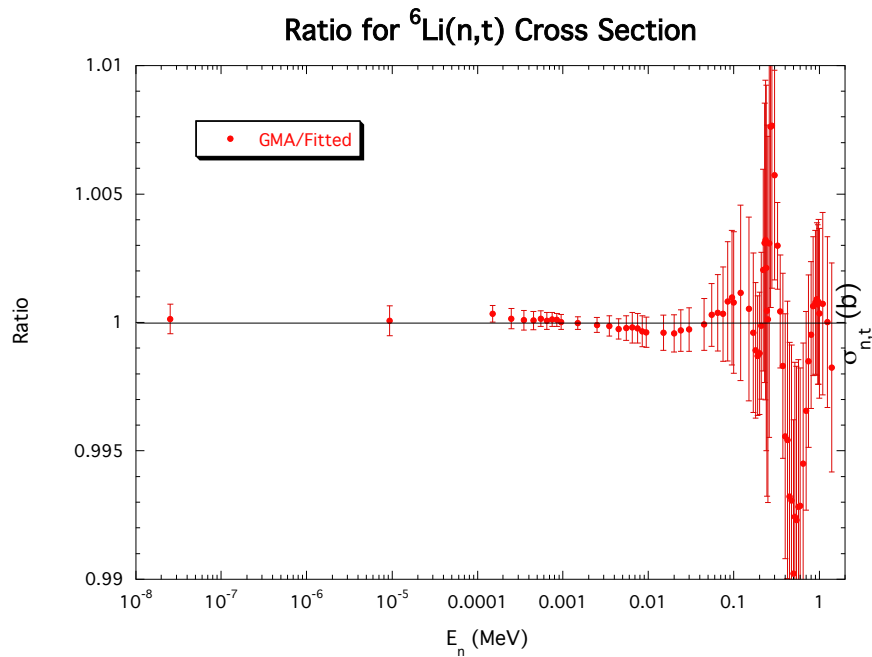


Still to do:

- Improve description of $(n,2n)2\alpha$ breakup cross section in R-matrix analysis using hyper-spherical coordinates
- Covariances

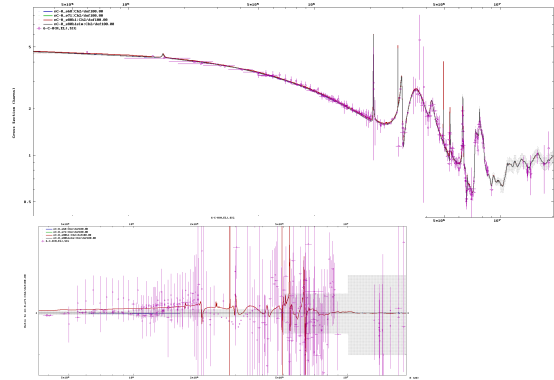
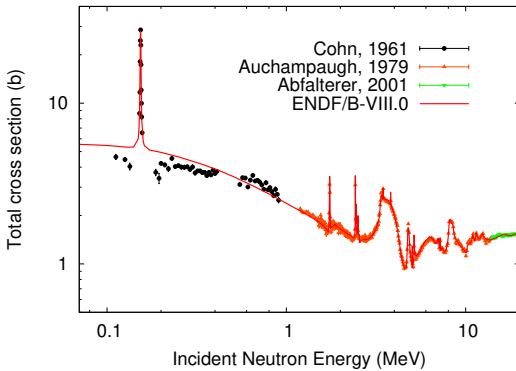
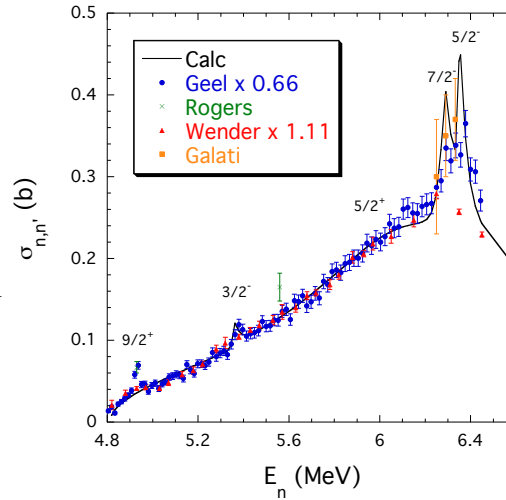
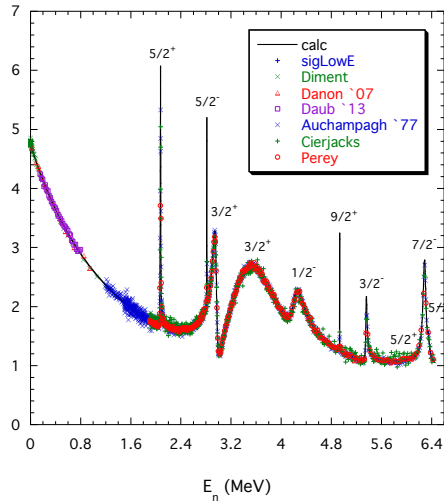


$n+{}^6\text{Li}$:



- Fitted (unsmoothed) GMA standard cross section in place of (n,t) data
- Still to do: Covariances, capture cross section

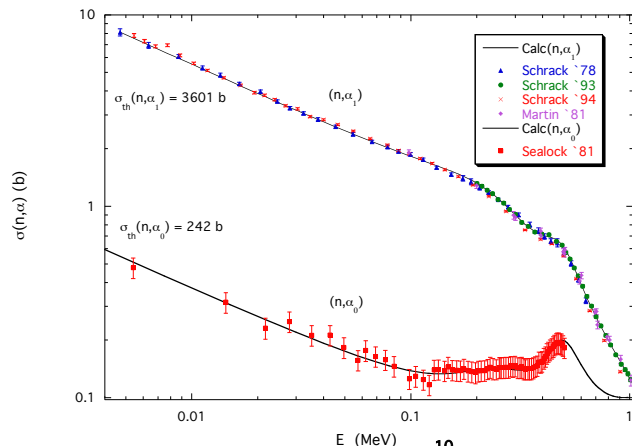
$n+^{12,13}\text{C}$:



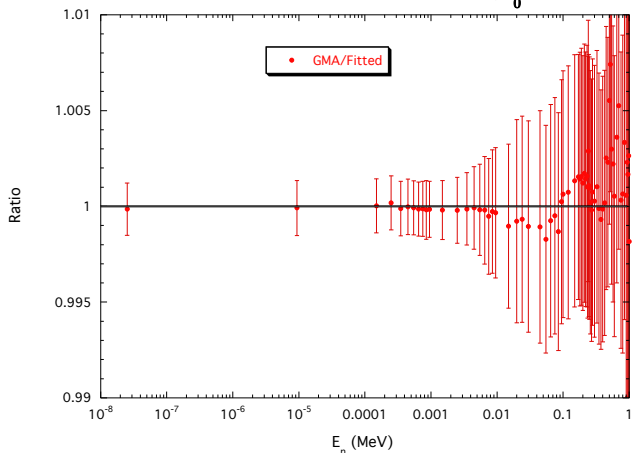
- $n+\text{C}$ elastic cross section about 2% higher than VII.1 near 2 MeV
- Seems to have little effect on benchmarks
- Still to do:
 - Covariances
 - Improve $^{13}\text{C}(n,\gamma)$ xs
 - Add $^{13}\text{C}(n,n'\gamma)$ files

$n+^{10}\text{B}$:

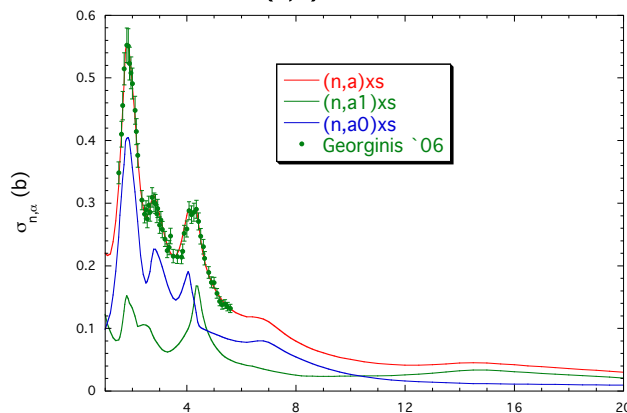
$^{10}\text{B}(n,\alpha)$ Cross Sections



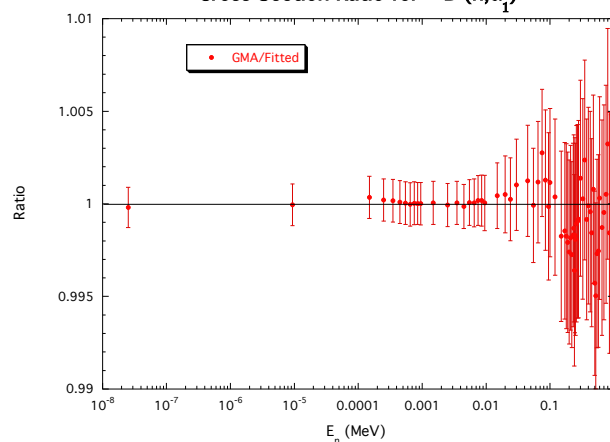
Cross Section Ratio for $^{10}\text{B}(n,\alpha_0)$



$^{10}\text{B}(n,\alpha)$ Cross Sections



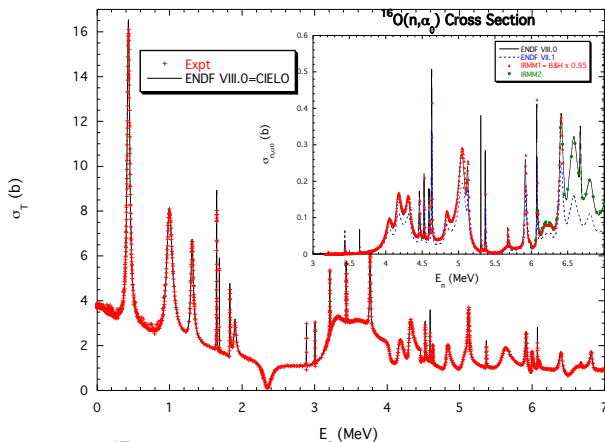
Cross Section Ratio for $^{10}\text{B}(n,\alpha_1)$



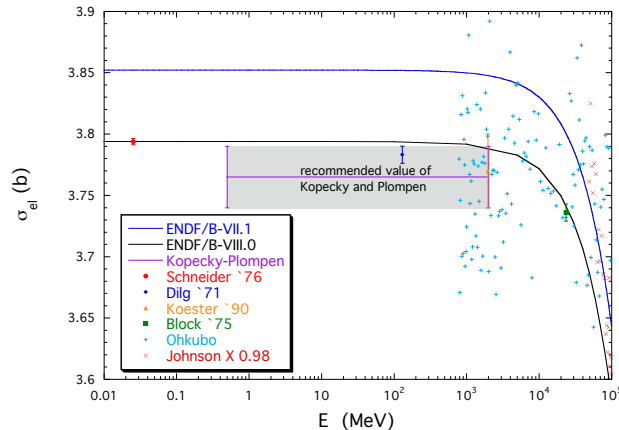
- Fitted (unsmoothed) GMA (n,α) cross sections in place of data up to 1 MeV
- Made extensive changes in (n,α) and total cross sections above 1 MeV
- Still to do: Covariances

$n+^{16}\text{O}$:

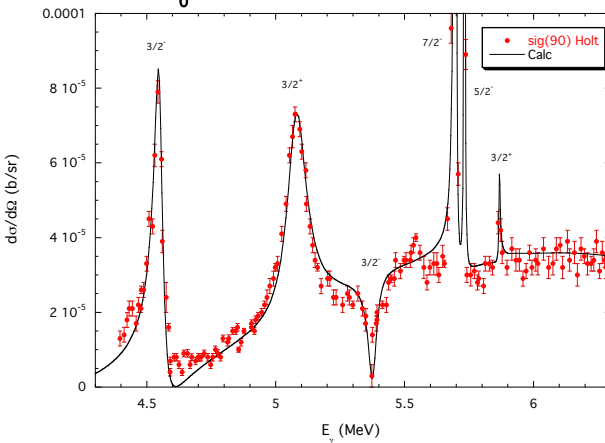
$n+^{16}\text{O}$ Total Cross Section



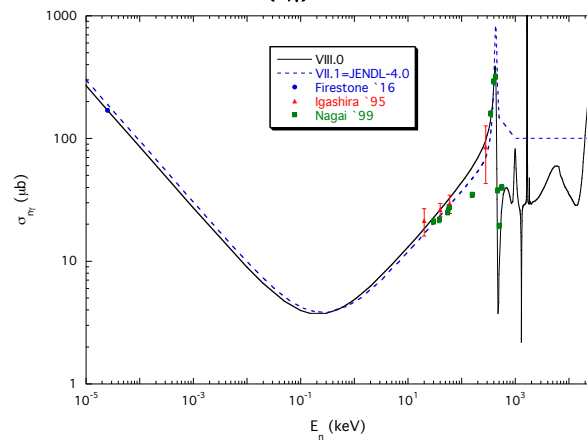
$n+^{16}\text{O}$ Elastic Scattering Cross Section



$^{16}\text{O}(\gamma, n_0)$ Differential Cross Section at 90 Degrees



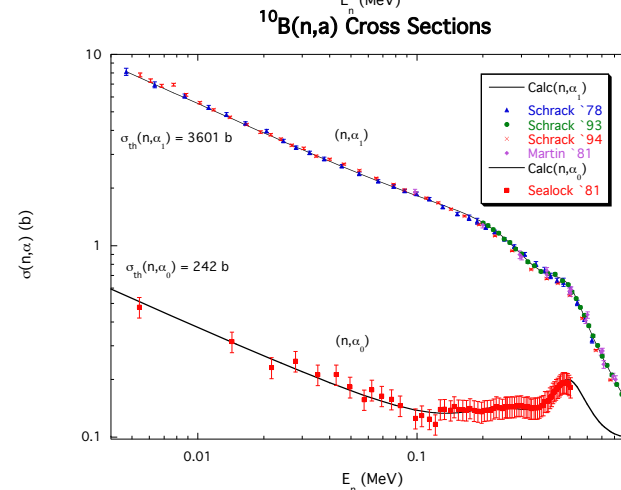
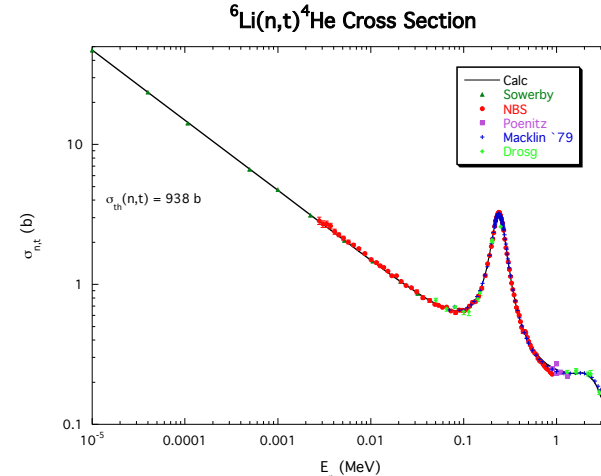
$^{16}\text{O}(n, \gamma)$ Cross Section



- All data well represented
- Little change in critical benchmarks
- Capture cross section improved (? need astrophysics feedback)
- Still to do: covariances (calculated up to 7 MeV, but not formatted)

Analyses for the Light-Element Standards

- n-p scattering: N-N analysis goes up to 100 MeV; plan to extend it to 200 MeV.
- ${}^6\text{Li}(n,t)$: ${}^7\text{Li}$ analysis gives excellent fits ($\chi^2/\nu=1.36$) to data up to 4 MeV.
- ${}^{10}\text{B}(n,\alpha)$: ${}^{11}\text{B}$ analysis gives excellent fits ($\chi^2/\nu=1.14$) to data up to 1 MeV.
- Natural carbon: σ_{el} increased $\sim 2\%$ at 2 MeV, as already shown.



$n+^{16}\text{O}$ Total Cross Section

