

# Review of Nuclear Data of $^{56}\text{Fe}$ in JENDL-4.0

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# Introduction

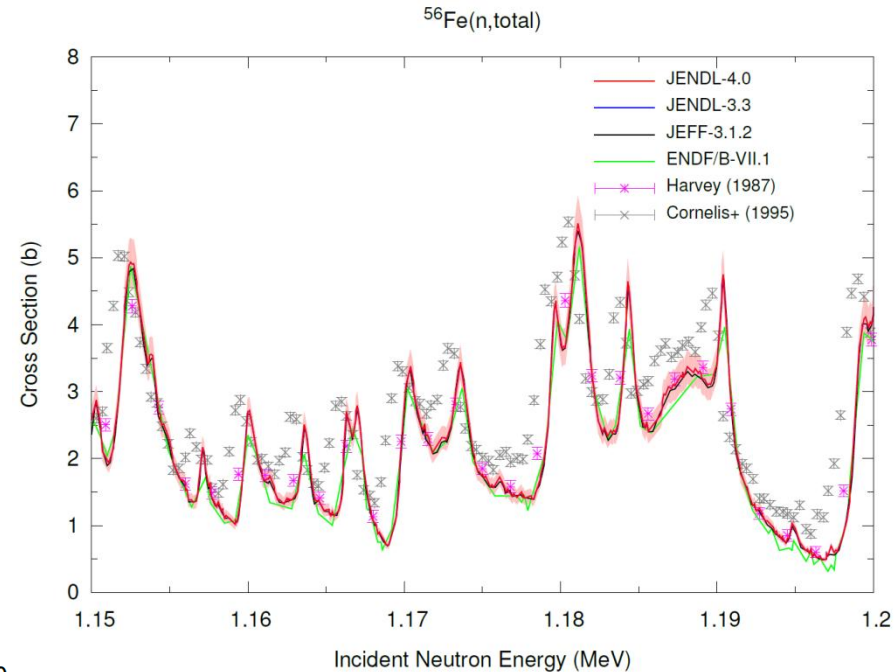
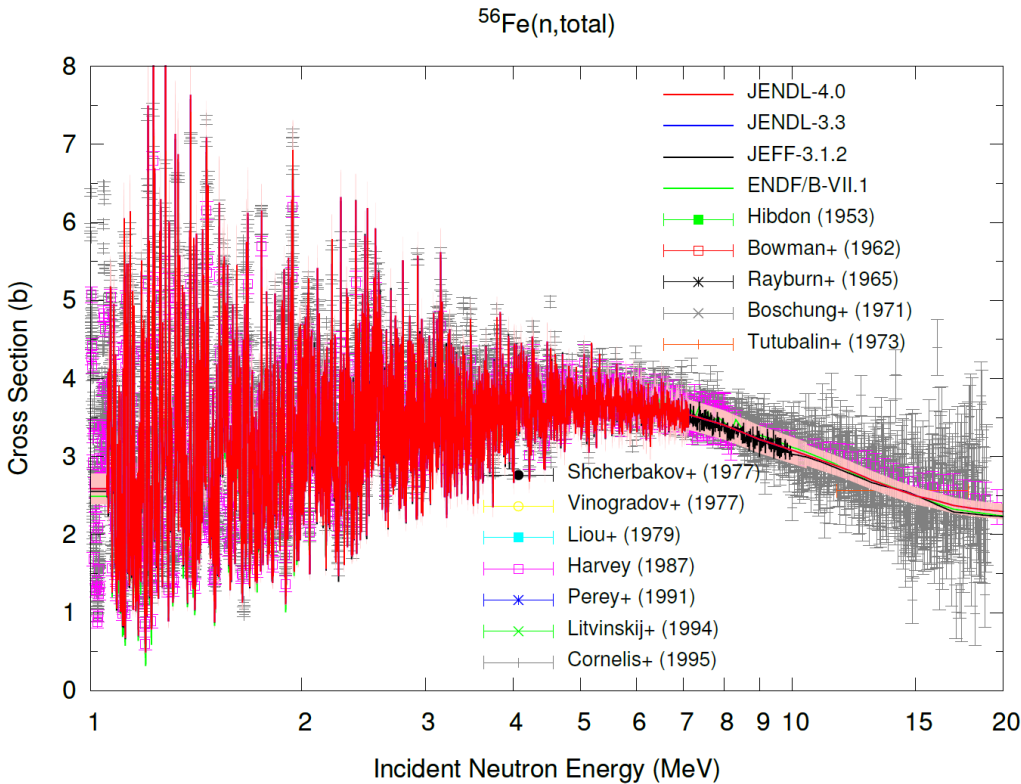
## Nuclear data on $^{56}\text{Fe}$ in JENDL-4.0 (2010)

- A small part of nuclear data on  $^{56}\text{Fe}$  was modified from JENDL-3.3.
- Energy Range:  $10^{-5}\text{eV}\sim 20\text{MeV}$   
(ENDF/B-VII.1:  $10^{-5}\text{eV}\sim 150\text{MeV}$ , JEFF-3.1.2:  $10^{-5}\text{eV}\sim 200\text{MeV}$ )

## Differences between JENDL-3.3 (2002) and JENDL-4.0

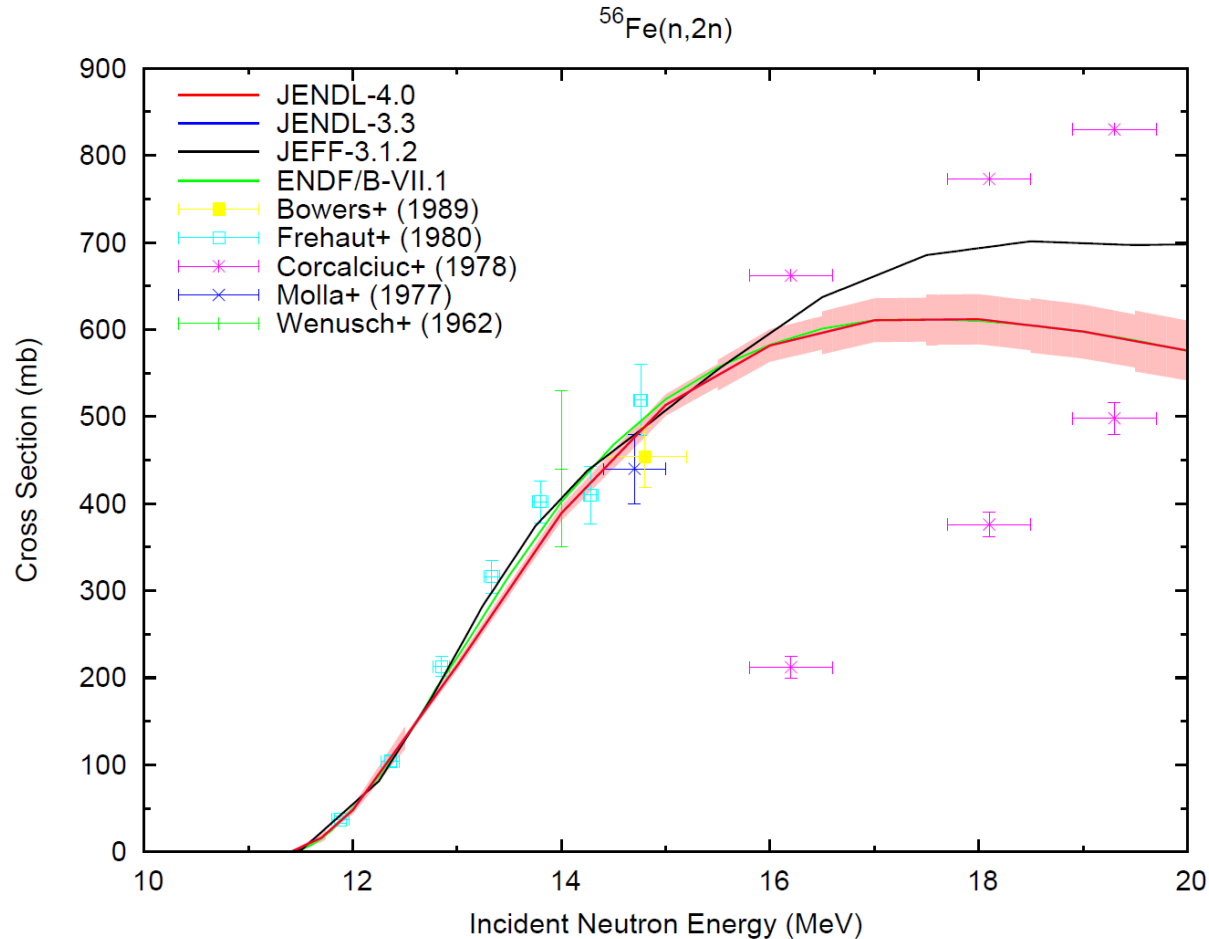
MF	MT	Points of revision
3	1,2,4	Recalculated from partial cross sections.
3	51	Revised by model calculations above 2.1MeV
3	52,53	Revised by model calculations in the whole range.
4	2	Legendre coefficients were revised.
33	1,51,53,54,55,56, 58,61,62,63,64,65, 67,73,75,77,91	Revised by considering the spread of experimental data.

# Total Cross Sections



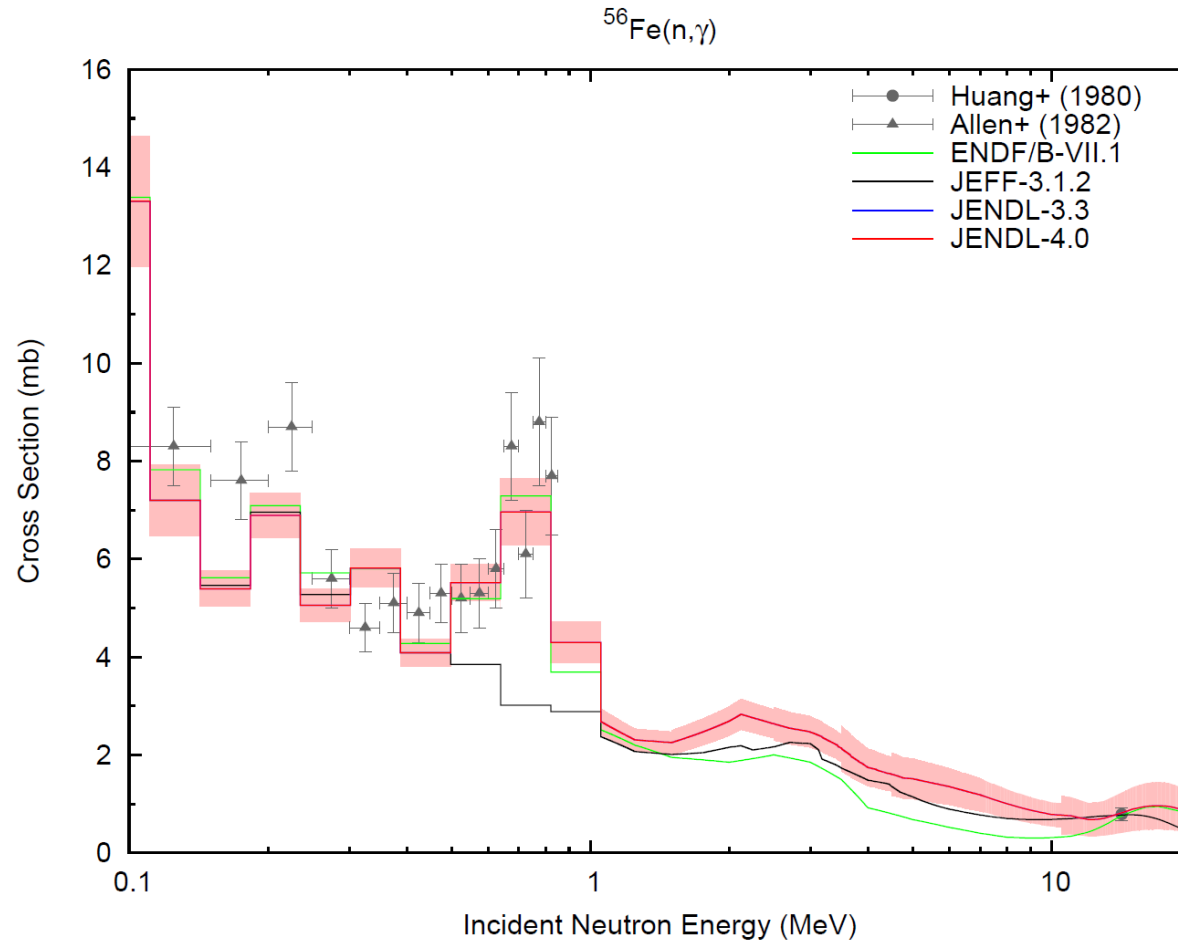
Between 850keV and 7MeV, fine structure measured by Berthold+ (1995) on  $^{\text{nat}}\text{Fe}$  was followed. The contributions from Fe-54,57,58 were subtracted.

# (n,2n) Reaction Cross Sections



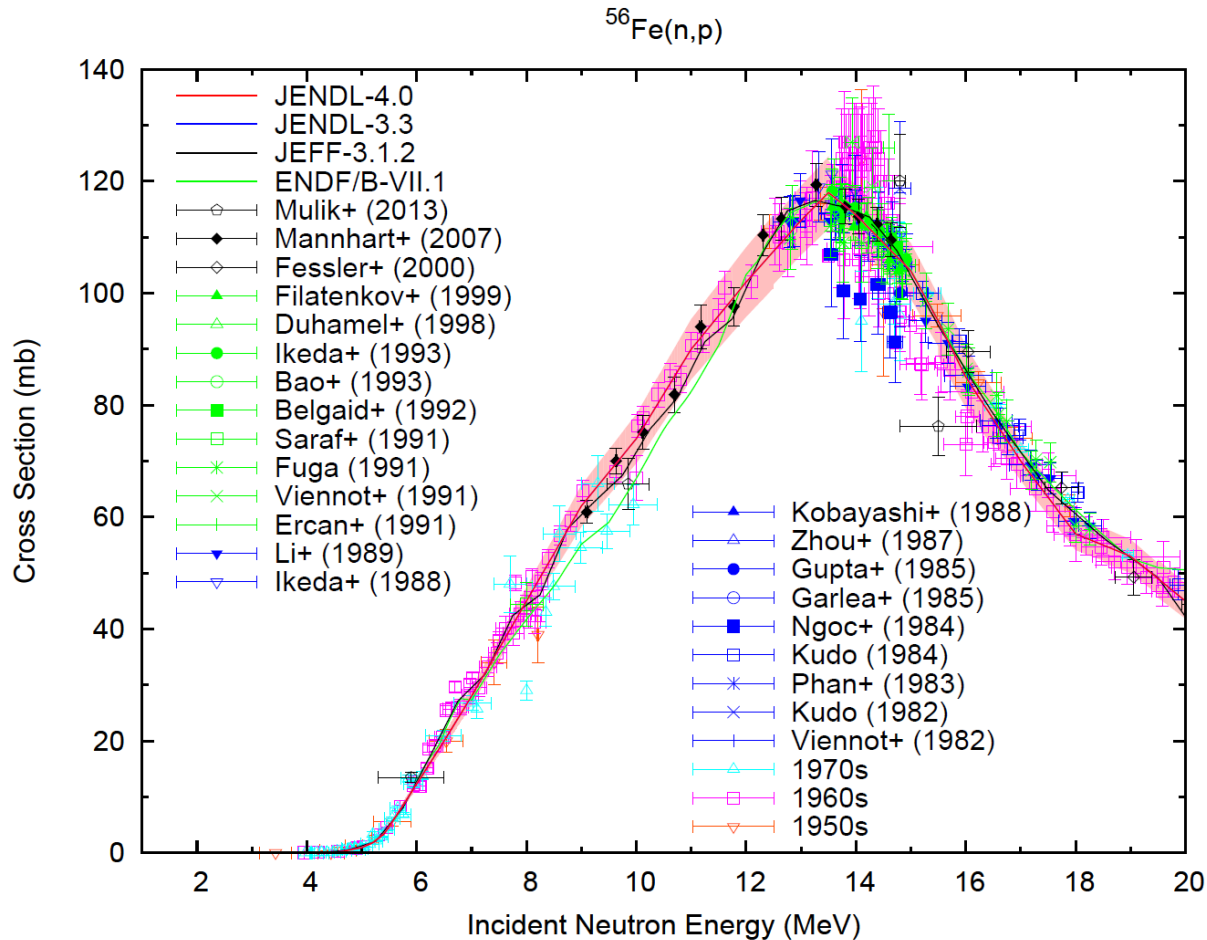
JENDL-4.0 is almost same as ENDF/B-VII.1 due to the use of same input parameters for model calculation.  
KALMAN was used to evaluate the covariances.

# Capture Cross Sections



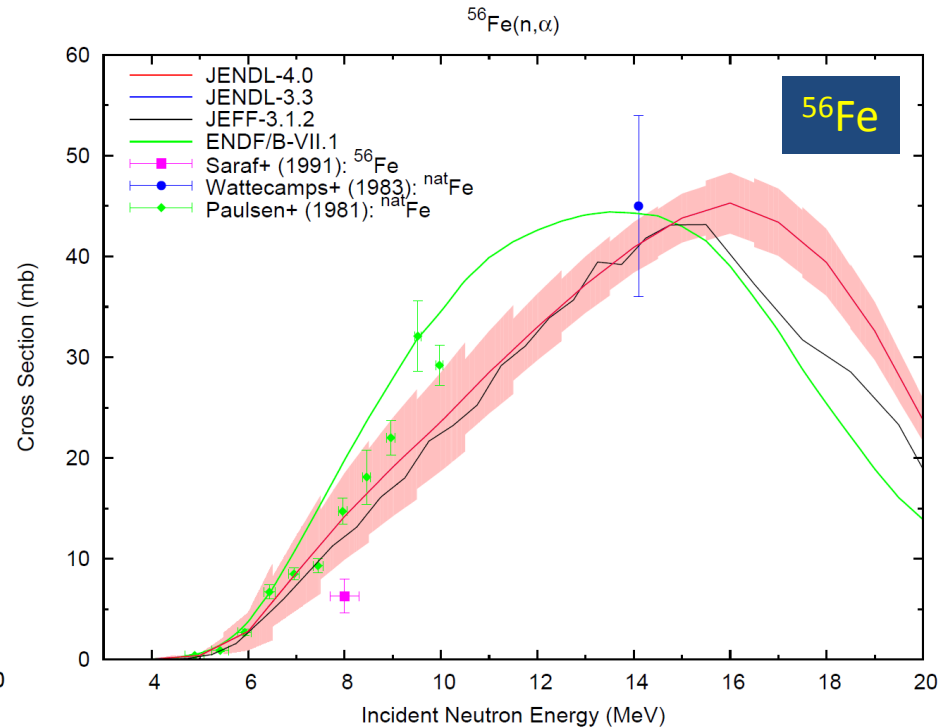
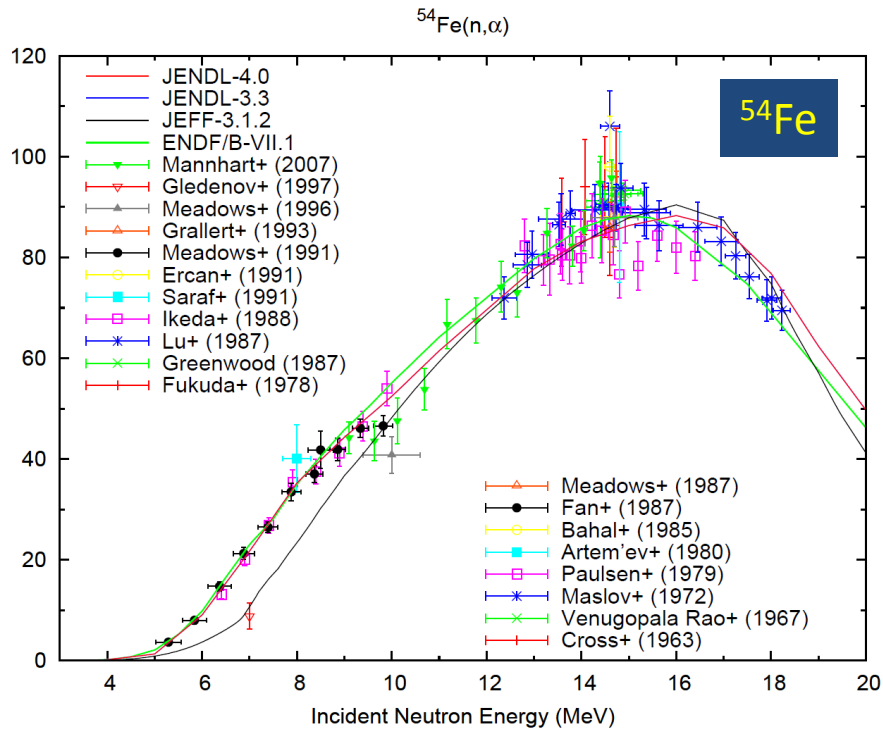
Experimental efforts for capture cross section above resolved resonance region are expected (2 sets of exp. data for  $^{\text{nat}}\text{Fe}$ , 1 for  $^{56}\text{Fe}$ , and 1 for  $^{58}\text{Fe}$ ).

# (n,p) Reaction Cross Sections



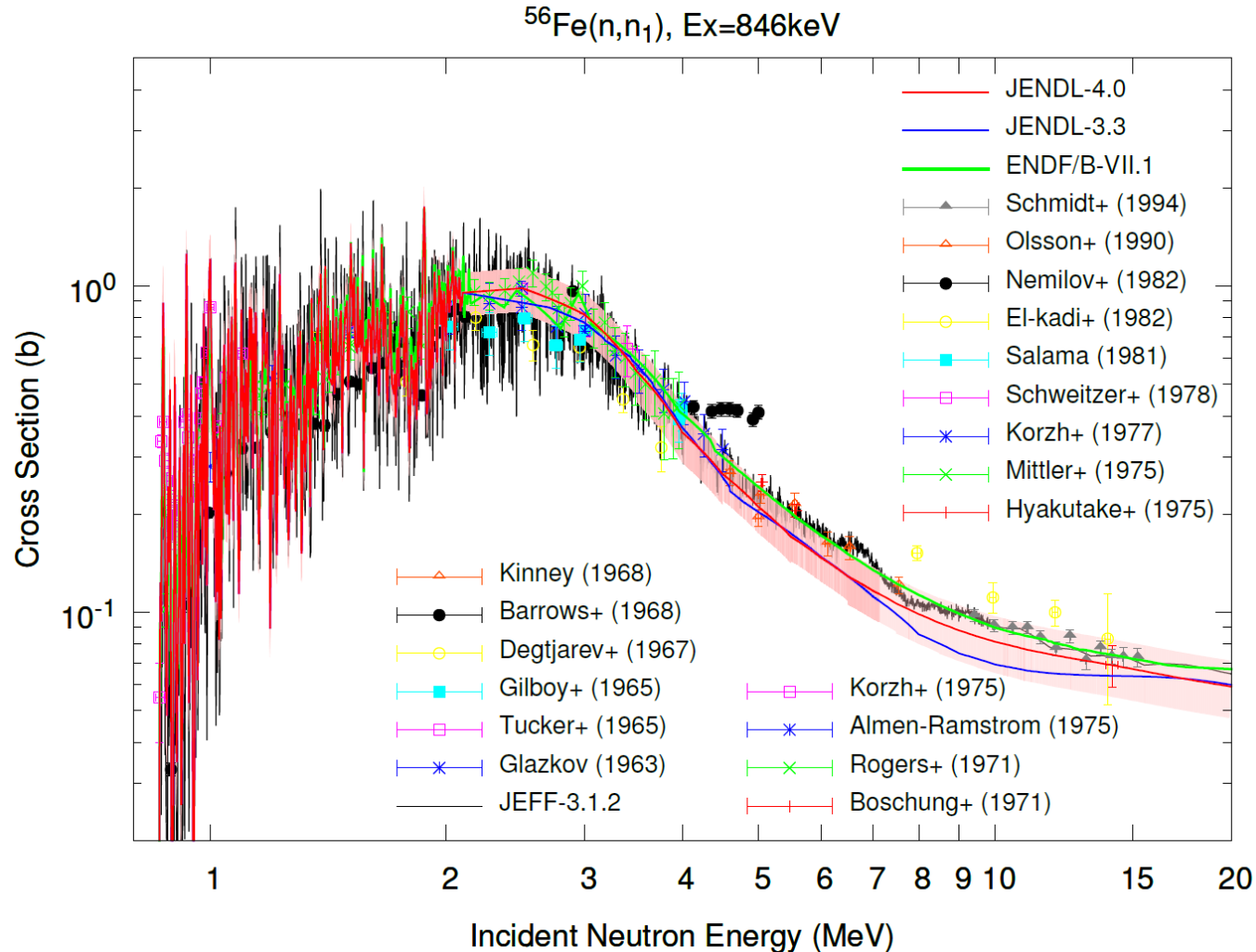
Data were basically taken from JENDL-2, but they were evaluated by considering Smith+ (1975) below 7MeV and Ikeda+ (1988) between 13-16MeV. Covariance was based on the experimental data.

# (n, $\alpha$ ) Reaction Cross Sections



Evaluation based on experimental data of  $^{54}\text{Fe}$  reasonably explains the data of  $^{nat,56}\text{Fe}$ .

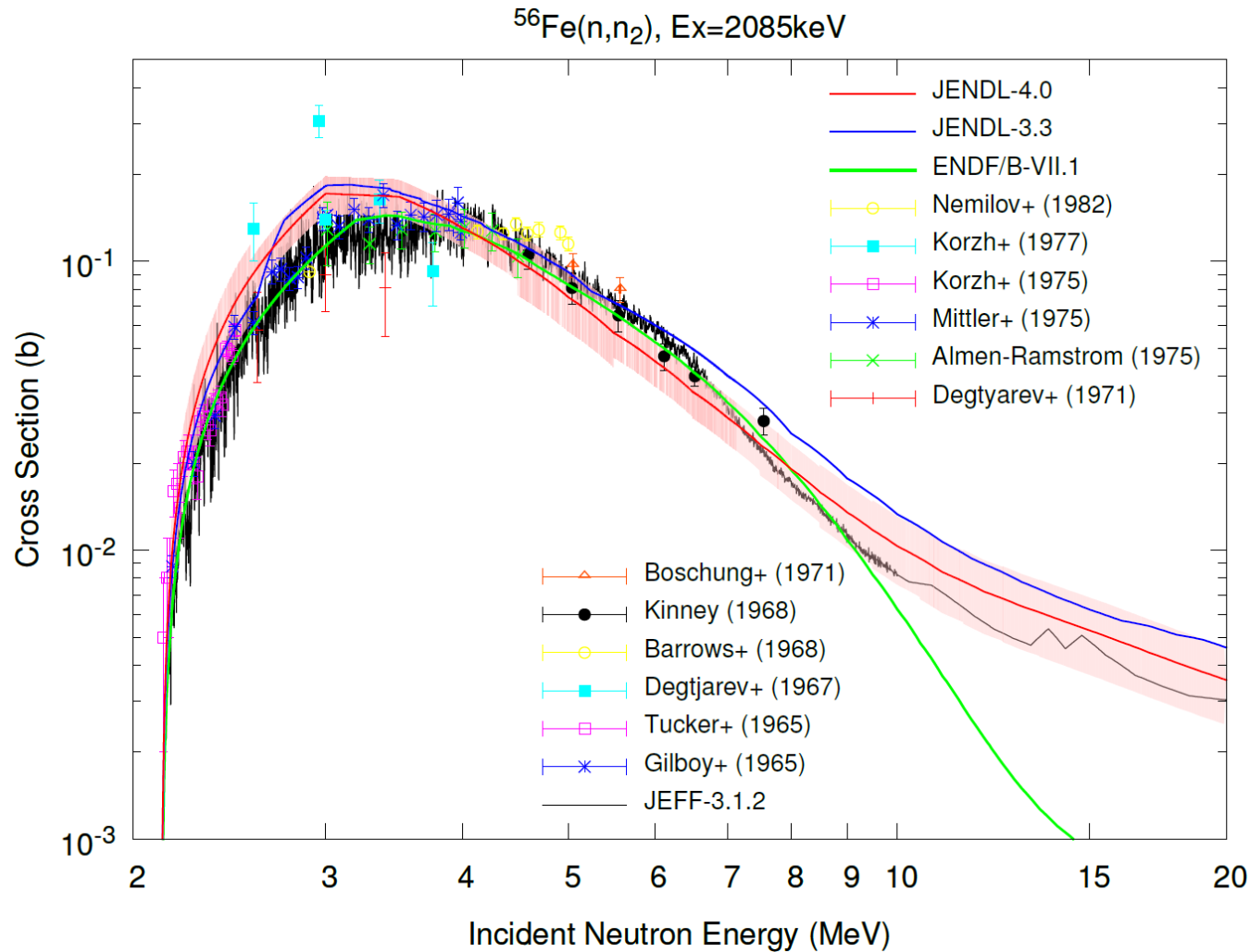
# Inelastic Scattering Cross Sections to 1st<sup>E</sup>xcited Level



JENDL-3.3 (and JENDL-4.0) evaluation was based on experimental data below 2.1MeV. New evaluation was performed above 2.1MeV.

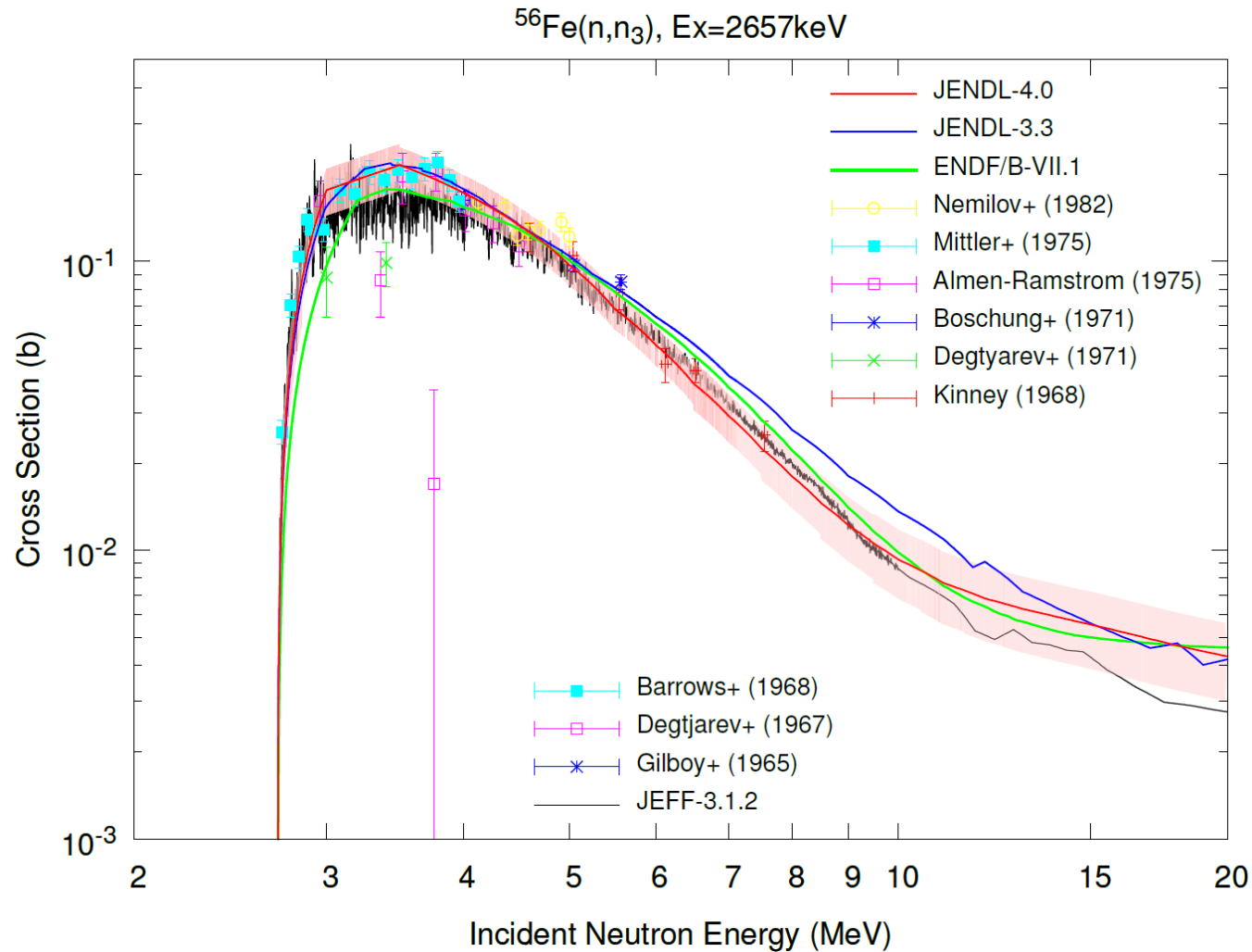


# Inelastic Scattering Cross Sections to 2<sup>nd</sup> Excited Level



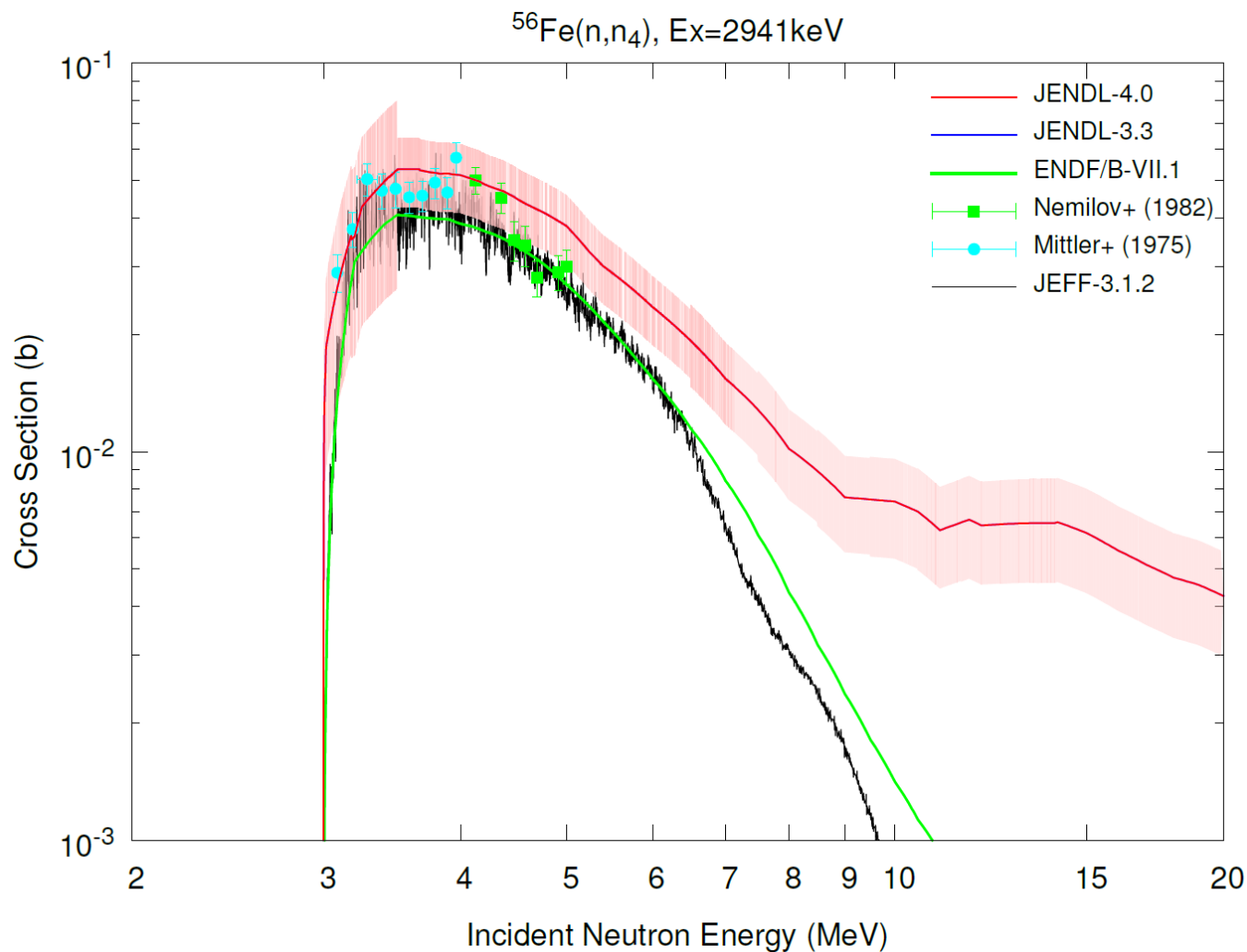
New evaluation was performed in the whole energy range.

# Inelastic Scattering Cross Sections to 3<sup>rd</sup> Excited Level

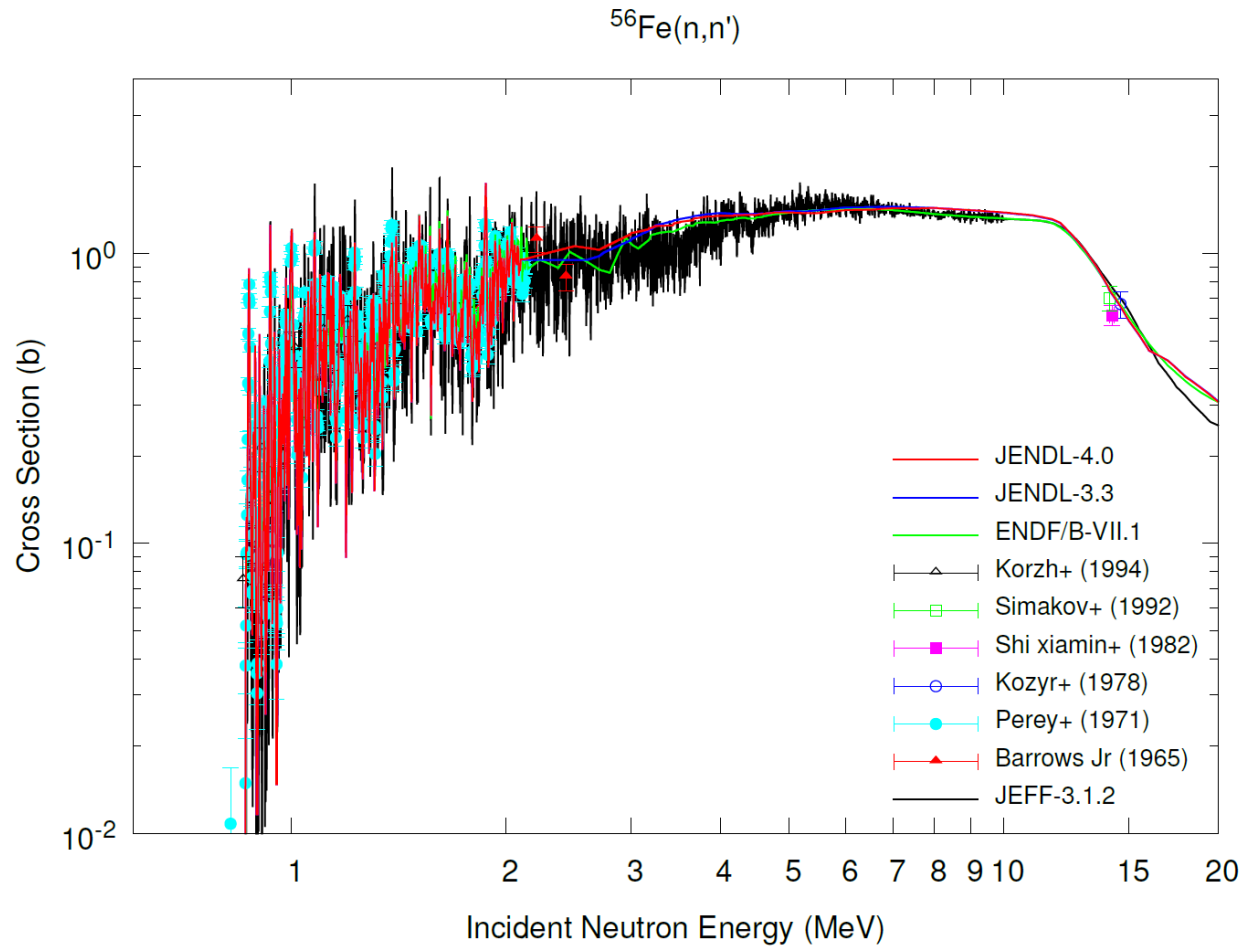


New evaluation was performed in the whole energy range.

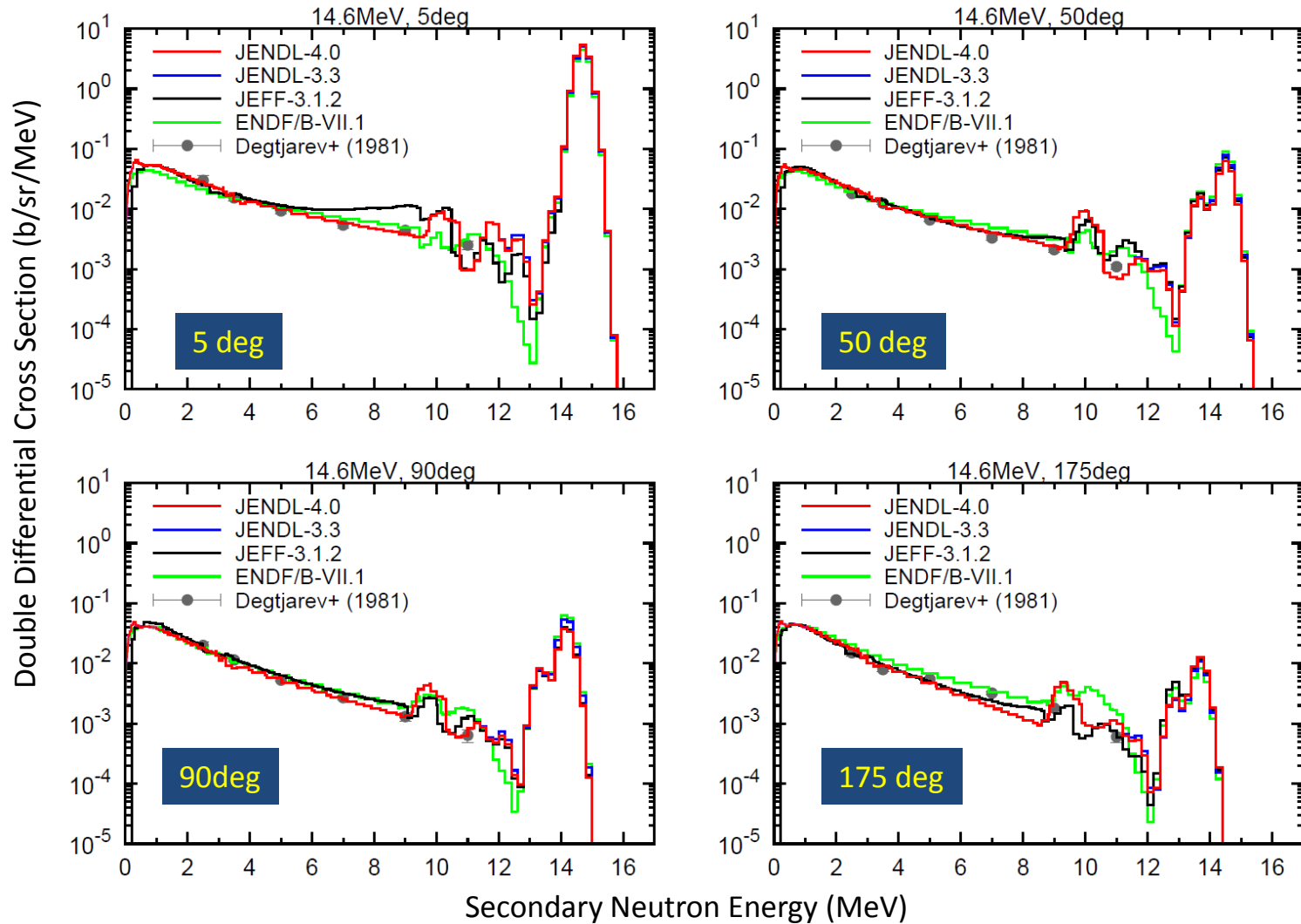
# Inelastic Scattering Cross Sections to 4<sup>th</sup> Excited Level



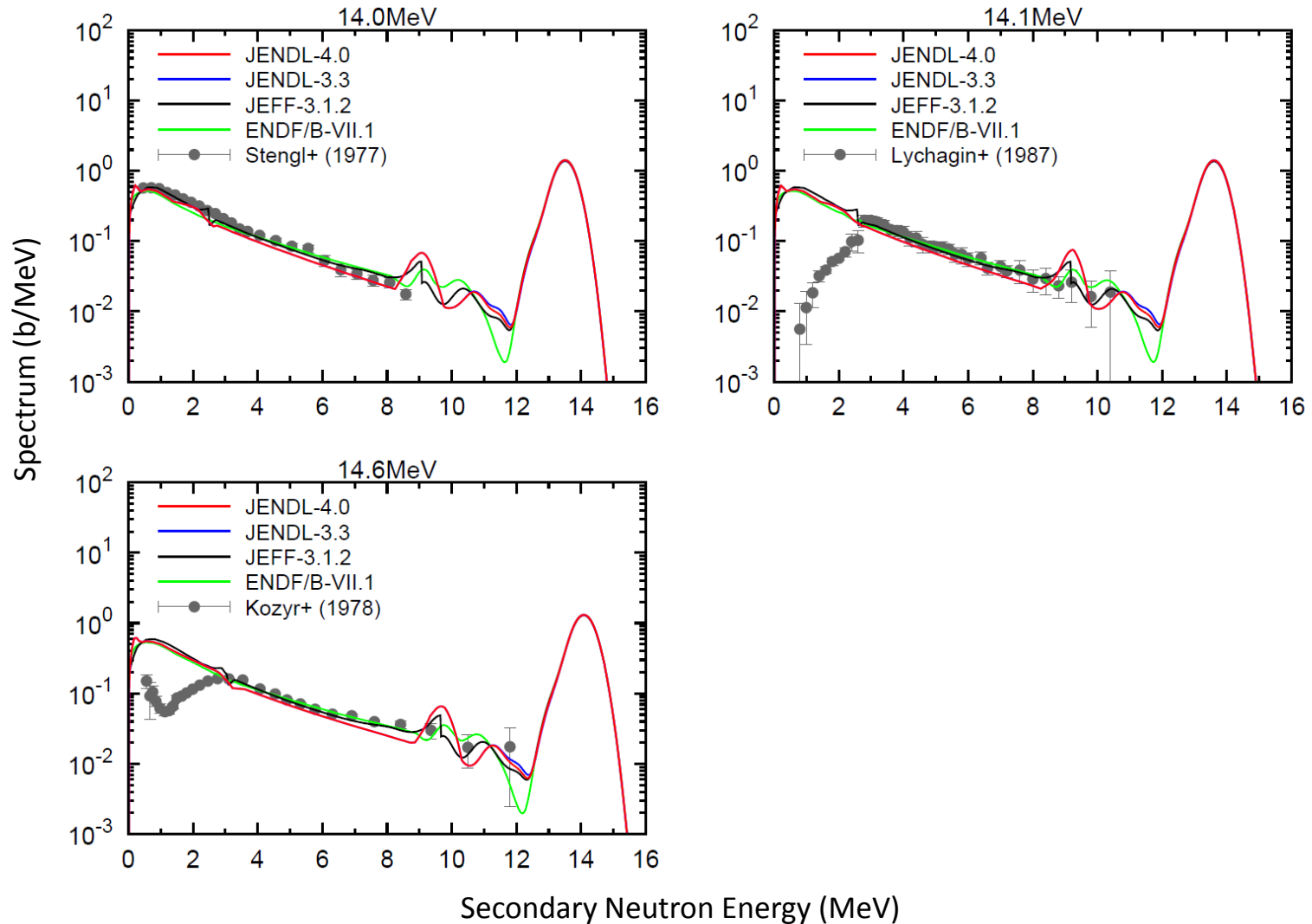
# Inelastic Scattering Cross Sections



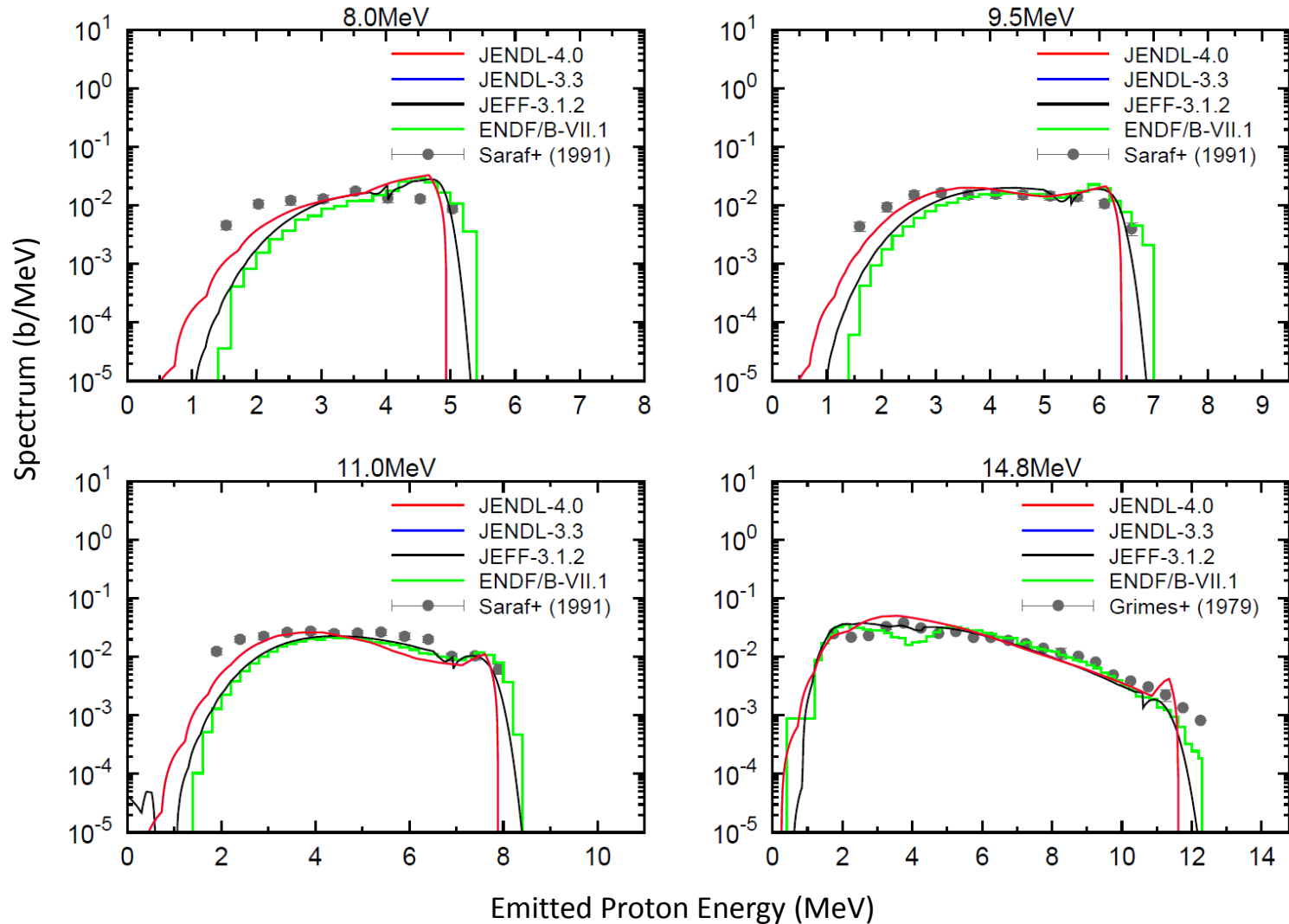
# Neutron Emission DDX



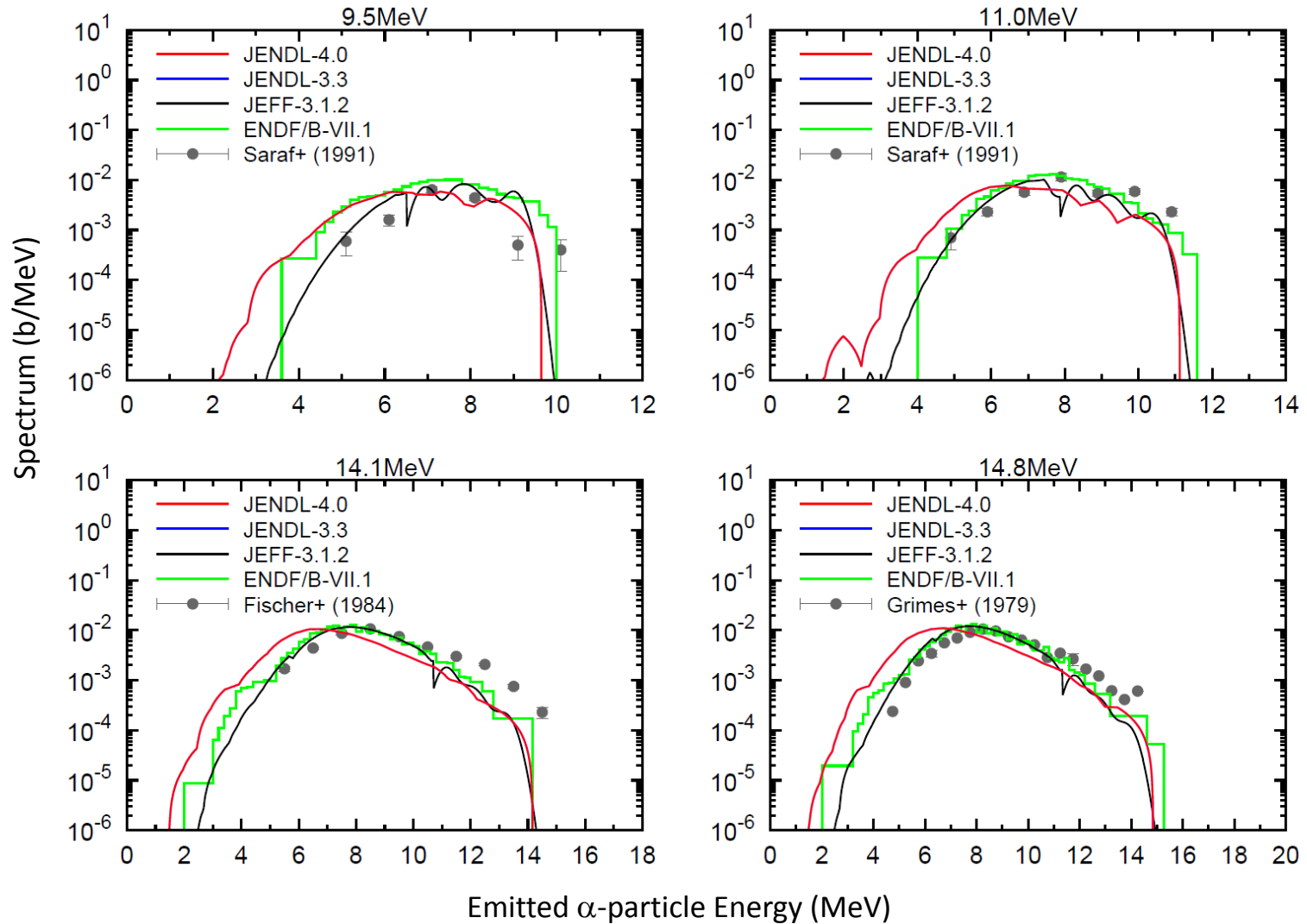
# Neutron Emission Spectra



# Proton Emission Spectra



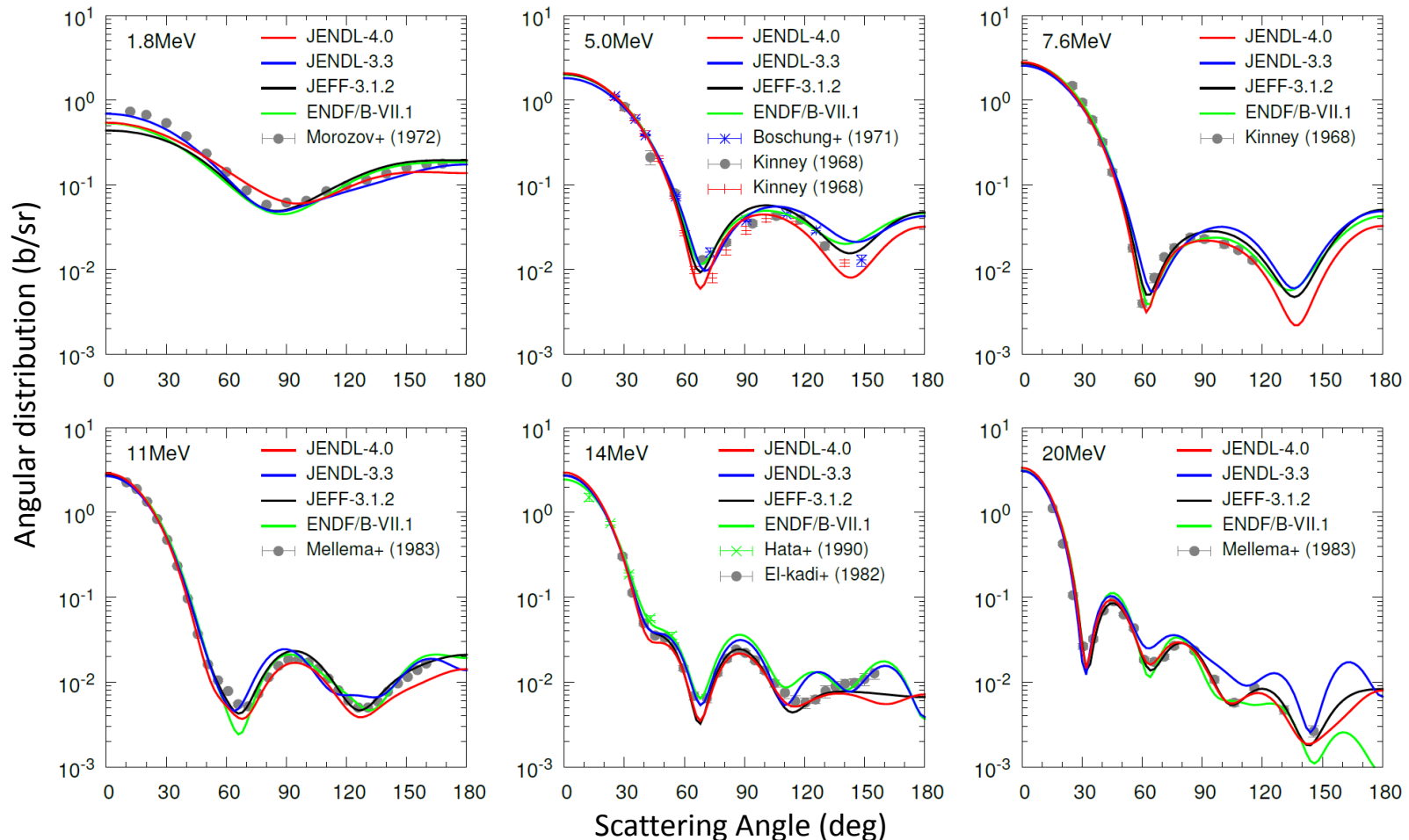
# $\alpha$ -particle Emission Spectra





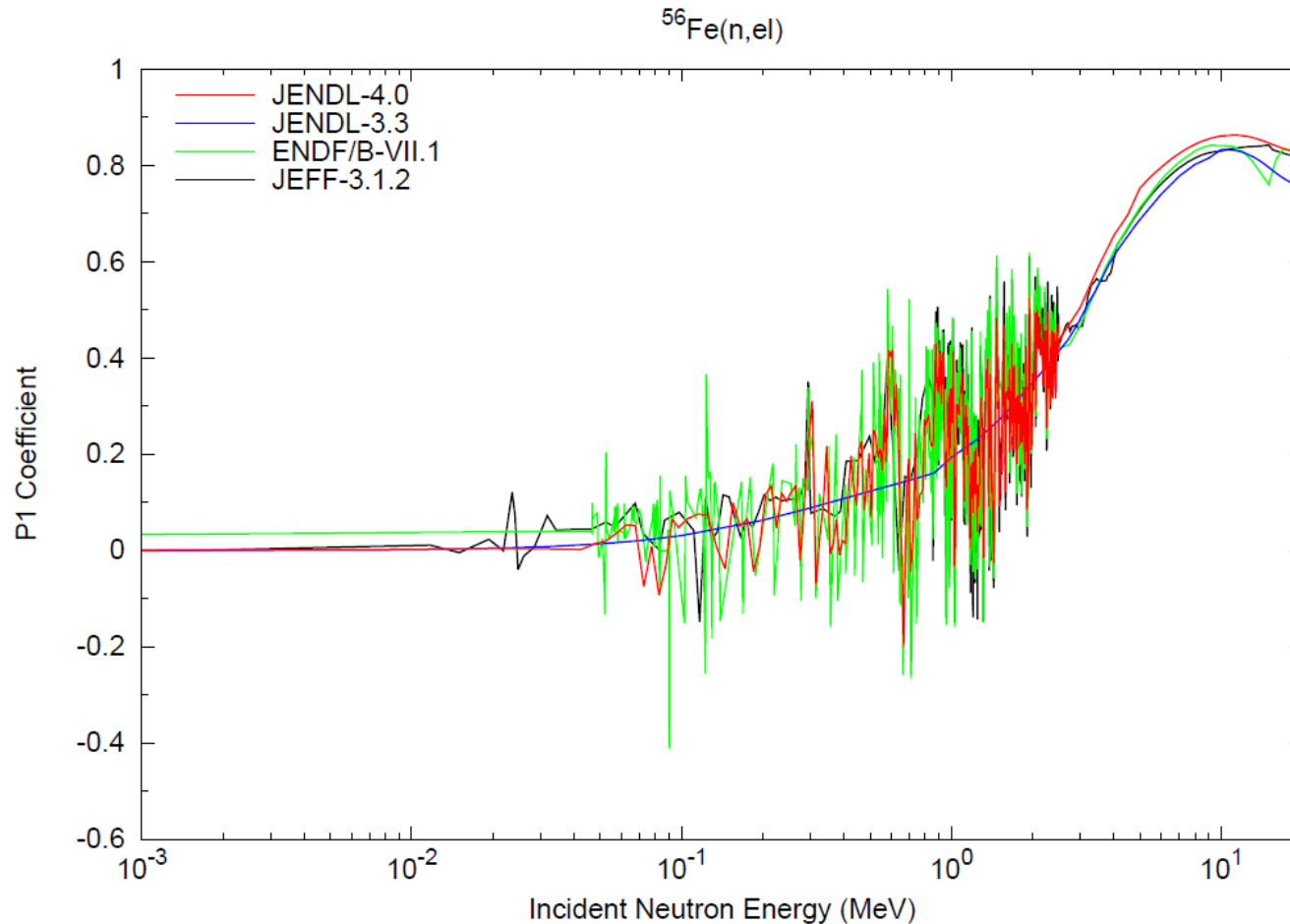
# Elastic Scattering Angular Distributions

Angular distributions are important for the criticalities of fast reactors with iron reflectors



JENDL-4.0 well reproduces the experimental data in a wide energy region, except for the most backward distribution in higher energies.

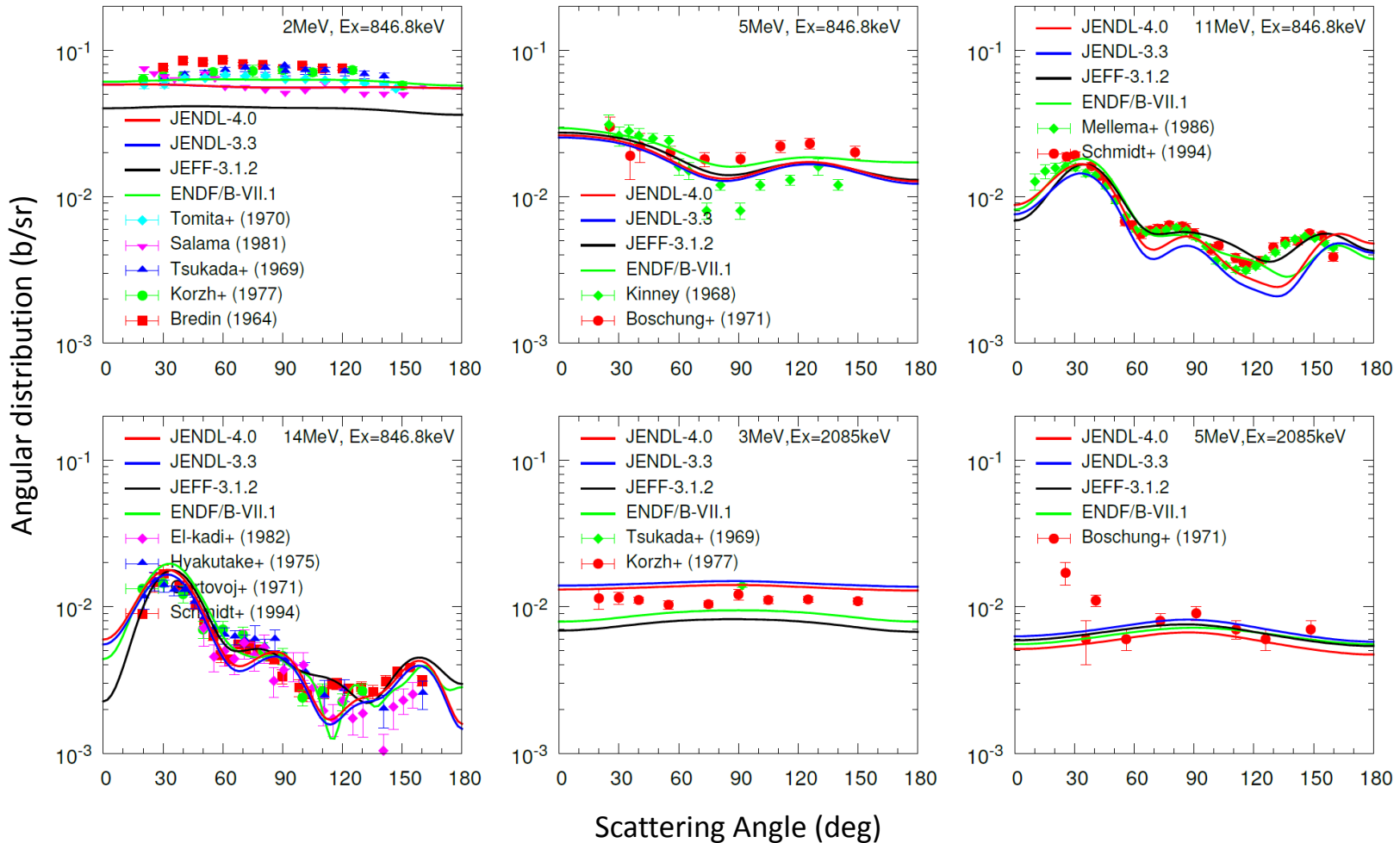
# 1<sup>st</sup> Order Legendre Coefficient for Elastic Scattering



Below 2.5MeV evaluation was made using Kinney+ (1976) and Perey+ (1992).  
JENDL-4.0 has forward peak distribution above 2.5MeV.

# Inelastic Scattering Angular Distributions

Comparison with experimental data of inelastic scattering to 1<sup>st</sup> (846keV) and 2<sup>nd</sup> (2085keV) excited levels.



# Summary

- In JENDL-4.0 (2010) nuclear data on  $^{56}\text{Fe}$  and the other Fe isotopes were partly reevaluated.
- New evaluation for  $^{56}\text{Fe}$  above the resolved resonance region will be performed in collaboration with CIELO.
- The evaluations for the other Fe isotopes are important to subtract their contributions from data of natural Fe and to constrain cross sections with lack of experimental data for  $^{56}\text{Fe}$ . They are planned to be evaluated.

Fe	54	56	57	58
Abundance (%)	5.845	91.754	2.119	0.282