Update on recent ^{235}U CIELO evaluation

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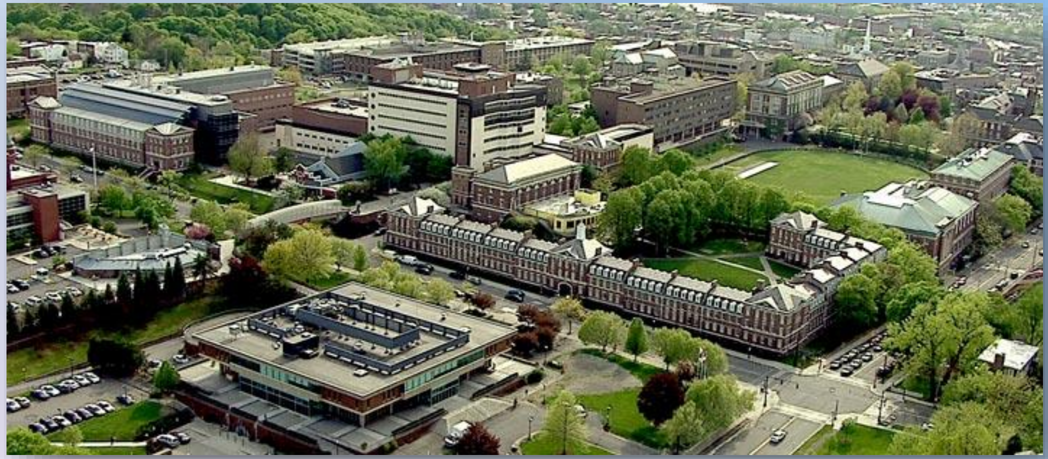

International Nuclear Data Evaluation Network (INDEN), May 8-11, 2018, IAEA Vienna

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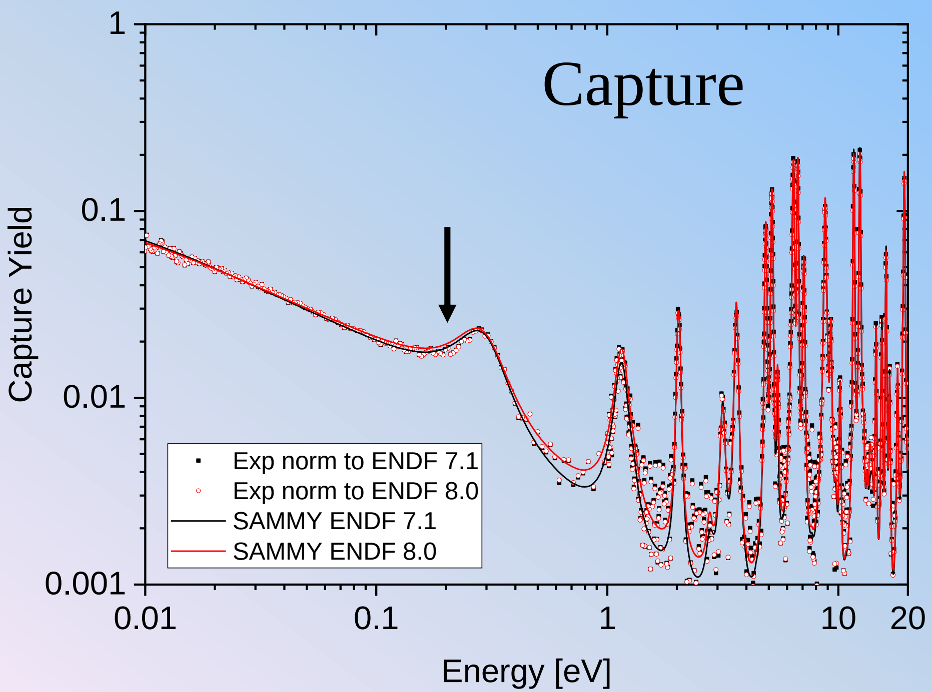
Fission and Capture in ^{235}U

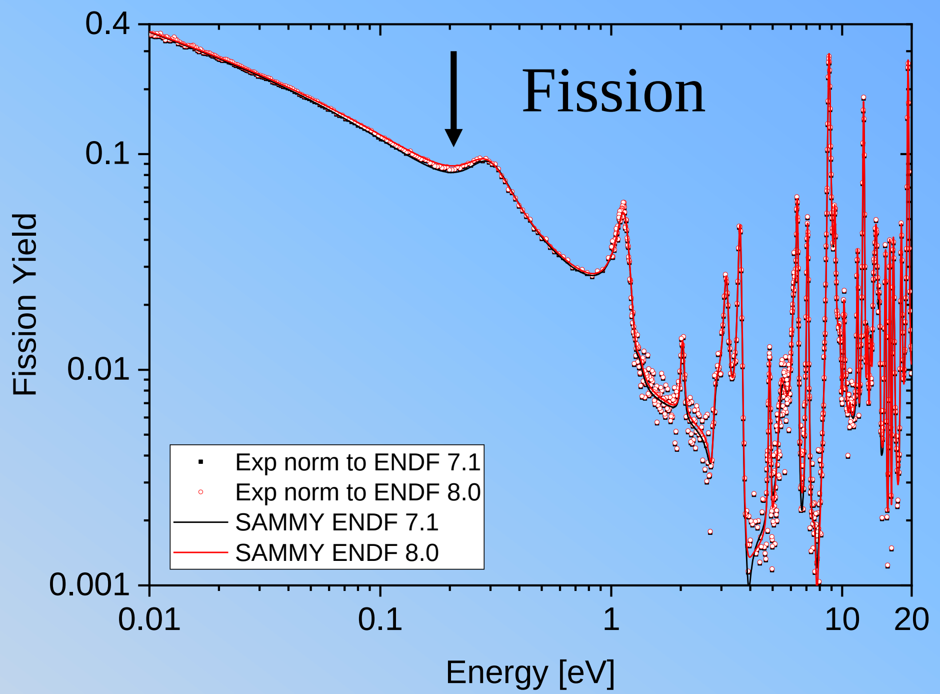
- Two measurements were done that together cover the energy range from 0.01 eV to 2.5 keV
- The measurements recorded gammas from ^{235}U reactions using the RPI multiplicity detectors
- Fission and capture events were separated by event multiplicity and total energy deposition
- The experimental data was renormalized to ENDF 8.0 to facilitate comparison with ENDF 7.1 that was published
- The details including ENDF 7.1 normalization were described in the reference below

Y. Danon, D. Williams, R. Bahran, E. Blain, B. McDermott, D. Barry, G. Leinweber, R. Block and M. Rapp, "Simultaneous Measurement of ^{235}U Fission and Capture Cross Sections From 0.01 eV to 3 keV Using a Gamma Multiplicity Detector", *Nuclear Science and Engineering*, vol. 187, no. 3, pp. 291-301, 2017.

Thermal Region

- Compare the Capture Yield with SAMMY calculations using ENDF 7.1 and 8.0 resonance parameters
- Turned off experimental error bars to declutter the plot
- Some differences are highlighted, a closer look is needed

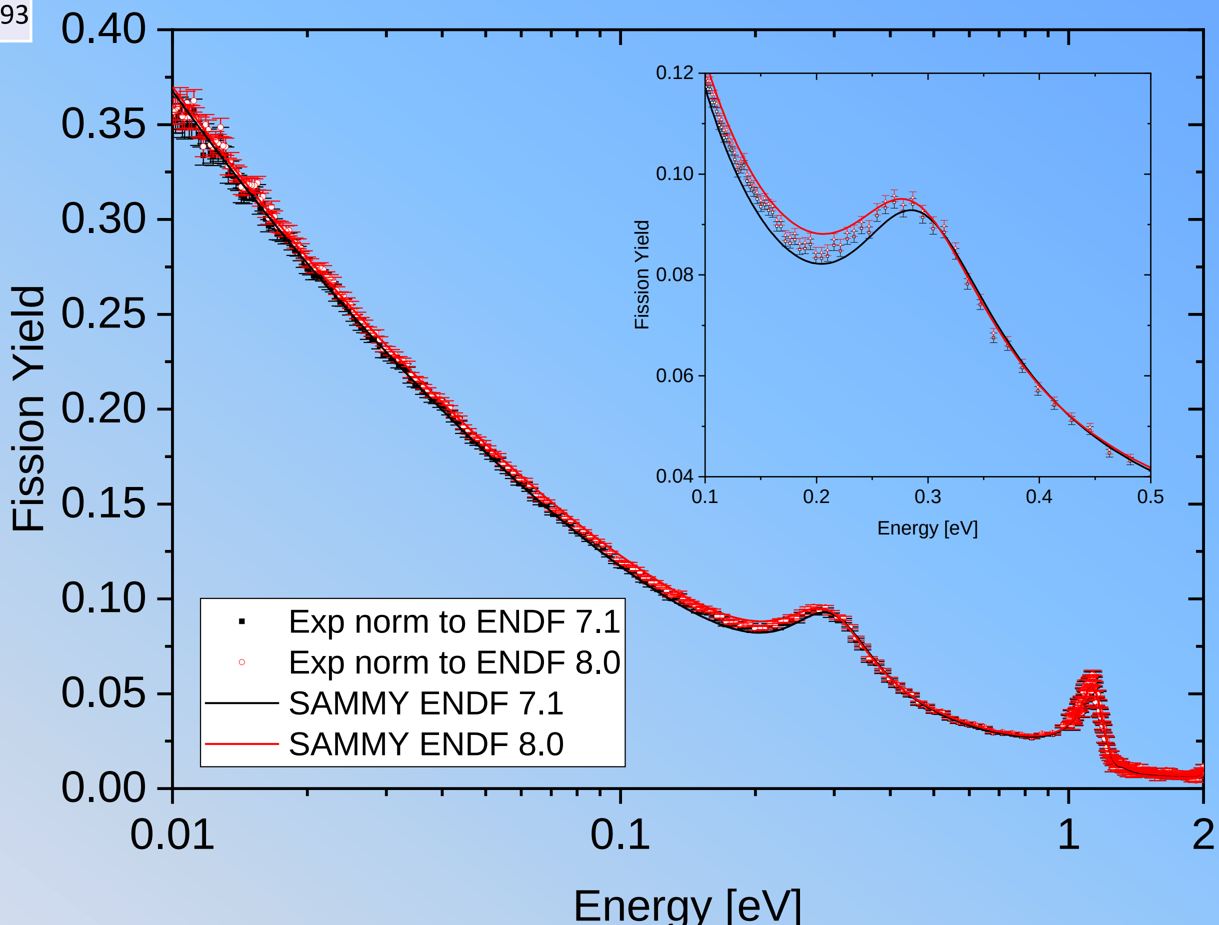




Thermal Fission

Evaluation	E_0 [eV]	Γ_n [eV]	Γ_γ [eV]	Γ_f [eV]
ENDF 7.1	0.2738	4.249E-06	0.0462	0.1181
ENDF 8.0	0.2684	4.271E-06	0.0473	0.1193

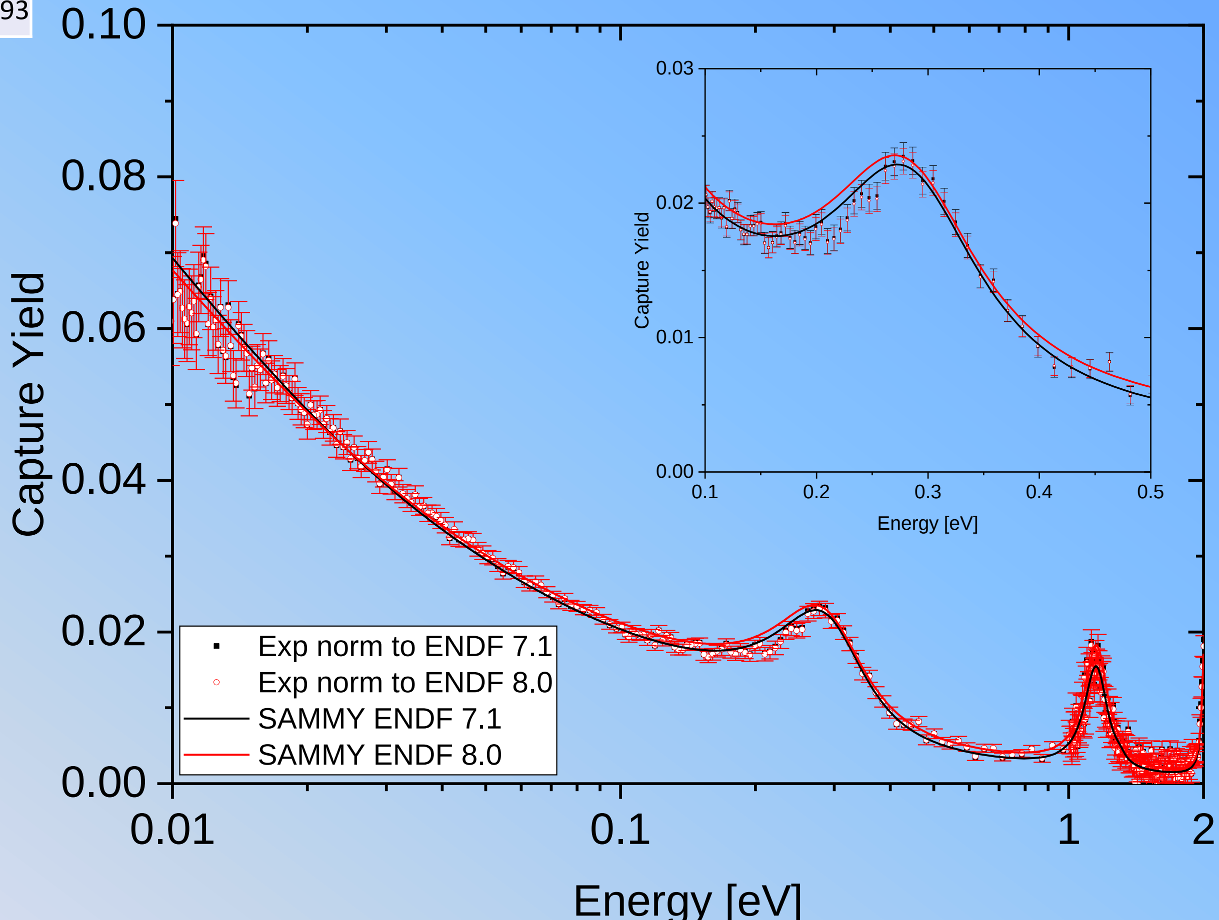
- The fission yield was normalized at the thermal point
- Between 0.15 to 0.3 eV, ENDF 8.0 is slightly higher then the measured yield
- Suggest to carefully compare with other fission cross section experiments



Thermal Capture

Evaluation	E_0 [eV]	Γ_n [eV]	Γ_γ [eV]	Γ_f [eV]
ENDF 7.1	0.2738	4.249E-06	0.0462	0.1181
ENDF 8.0	0.2684	4.271E-06	0.0473	0.1193

- The experiment was normalized using the thermal value and the 11.7 eV resonance
- In the energy range from 0.15 to 0.3 eV the evaluations are higher than the data. ENDF 8.0 is not an improvement here.
- Might need to adjust bound levels instead of the 0.27 eV resonance
  - Suggest to compare with other experimental data



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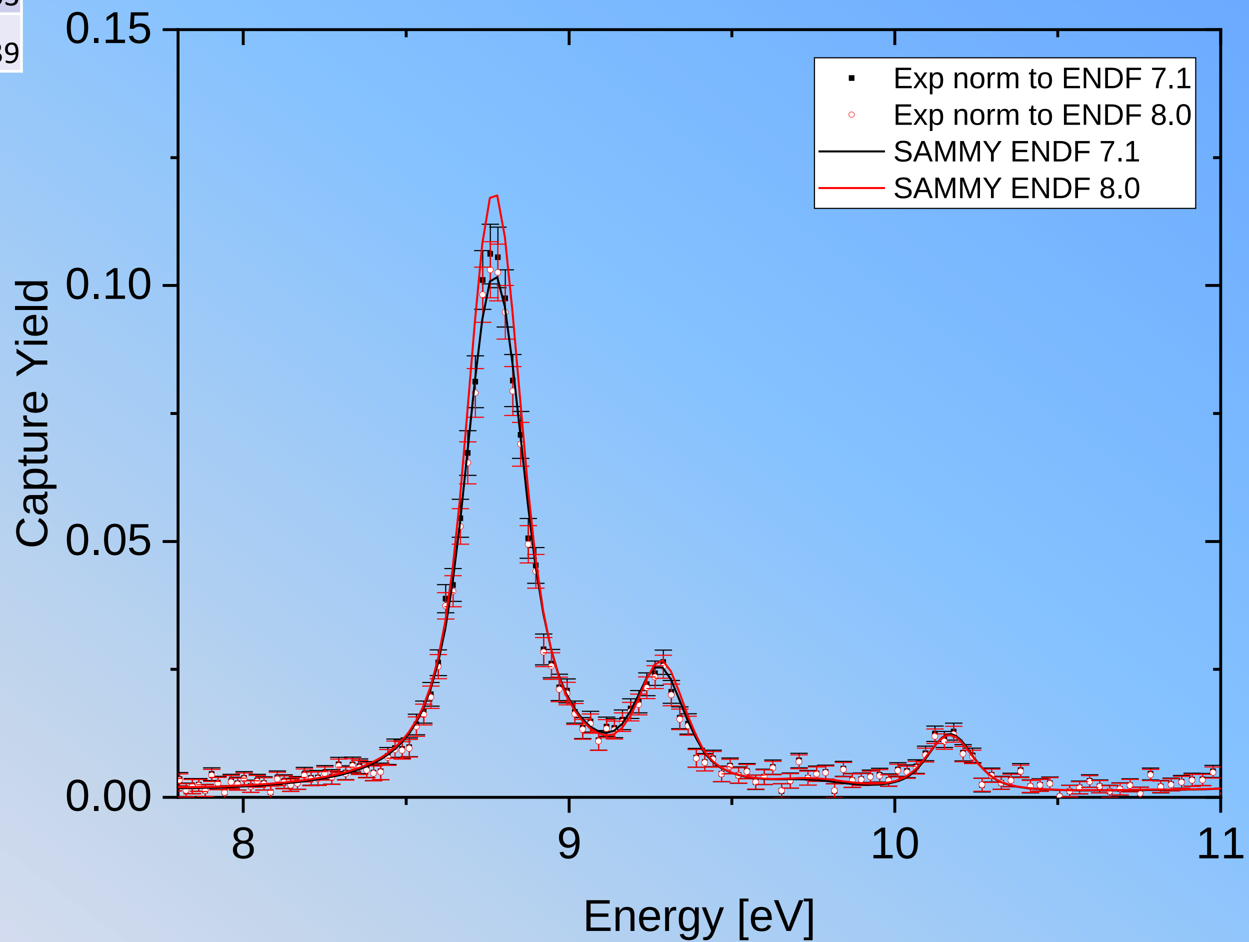
Capture Yield for the 8.76 eV Resonance

Evaluation	Γ_n/Γ	Γ_γ/Γ	Γ_f/Γ
ENDF 7.1	0.0072	**0.2825**	0.7103
ENDF 8.0	0.0083	**0.3078**	0.6839

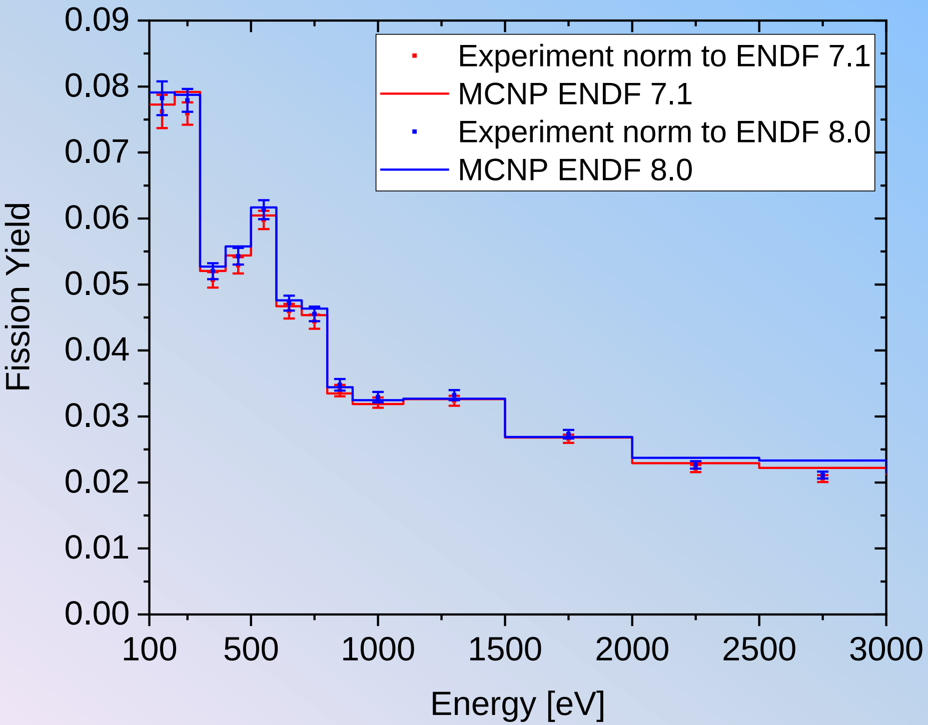
- The range from 7.8 to 11 eV is used for the fission standard and was adjusted in ENDF 8.0 to match the standard cross section

- The 8.76 eV capture yield is too high in ENDF 8.0 and needs to be lowered to match the experimental data



Epi Thermal Energy Range

- ENDF 8.0 is a great improvement from ENDF 7.1



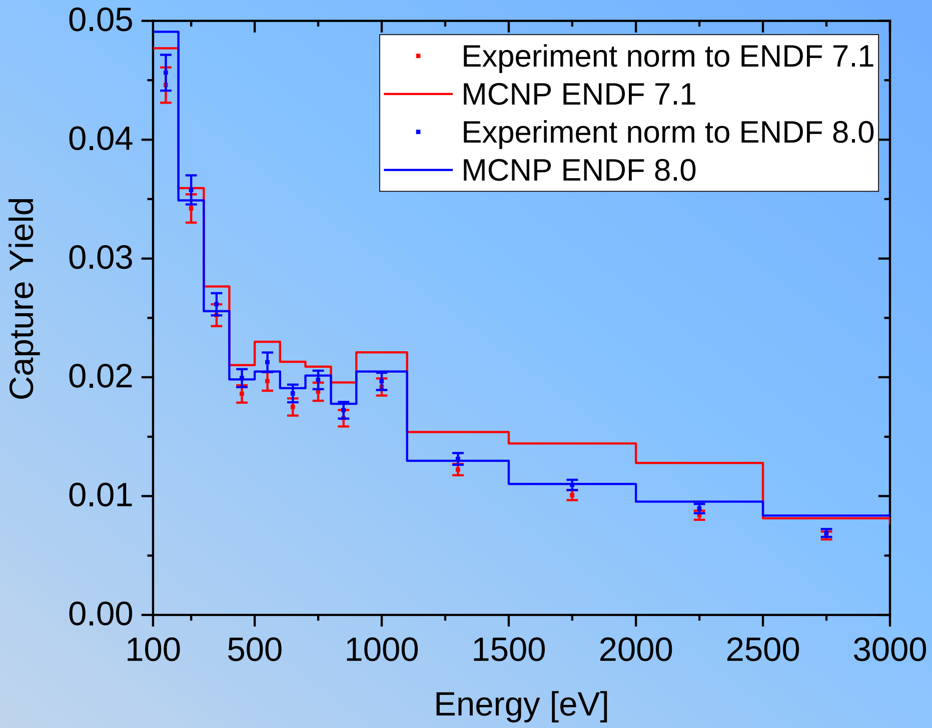


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Table of C/E

- The C/E are ratios of grouped yields which are approximately ratios of grouped cross sections (more accurate for small yields)
- Highlighted in red are areas where ENDF 8.0 needs improvement
  - The low energy groups included the 8.76 eV resonance that has a problem in capture.
- Systematic uncertainty on fission is 2% and 3% for capture

Energy [eV]		Fission C/E		Capture C/E	
From	To	ENDF 7.1	ENDF 8.0	ENDF 7.1	ENDF 8.0
0.0253	9.4	0.98	0.99	0.99	1.06
7.8	11	0.97	0.97	0.97	1.07
9.4	150	1.02	1.01	1.04	1.03
150	250	1.01	0.99	1.06	1.03
250	350	1.02	1.01	1.04	0.95
350	450	1.02	1.03	1.11	0.99
450	550	1.02	1.02	1.17	0.99
550	650	1.01	1.00	1.16	0.99
650	750	1.01	1.01	1.15	1.01
750	850	1.02	1.02	1.16	1.03
850	950	0.98	0.99	1.15	1.05
950	1500	1.01	0.98	1.23	1.00
1500	2500	1.02	1.01	1.47	1.03