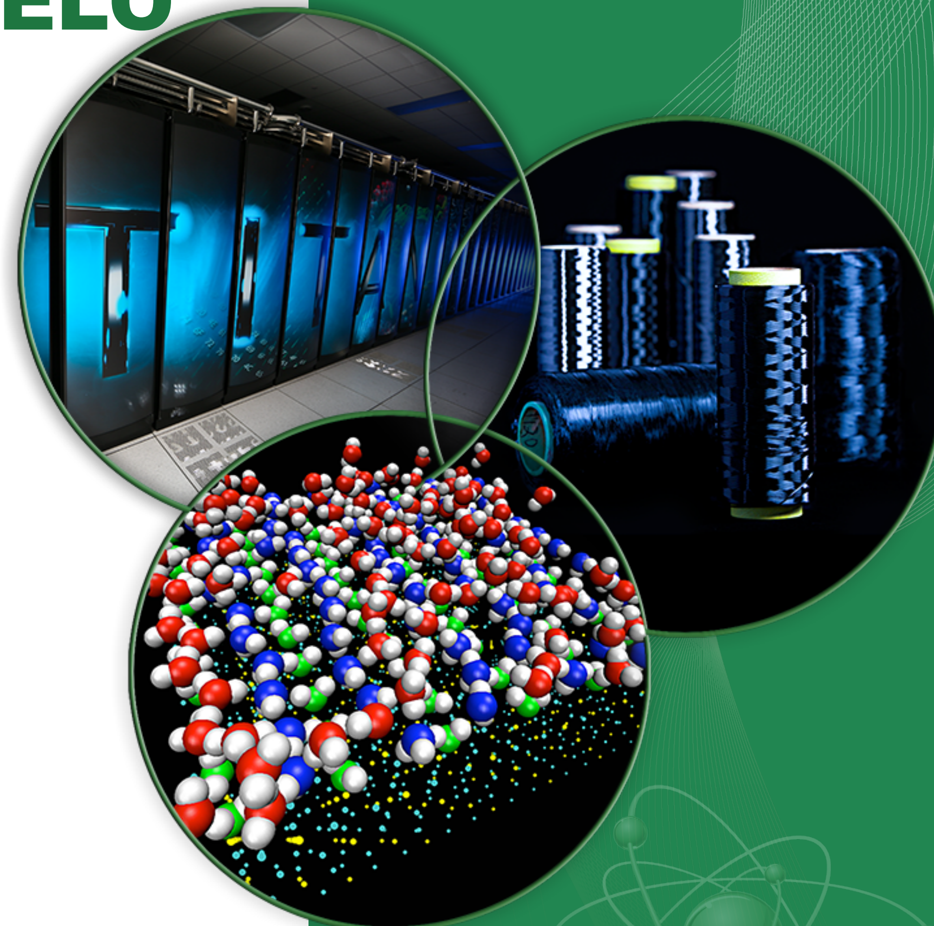
^{235}U Resolved Resonance Evaluation within CIELO Collaboration



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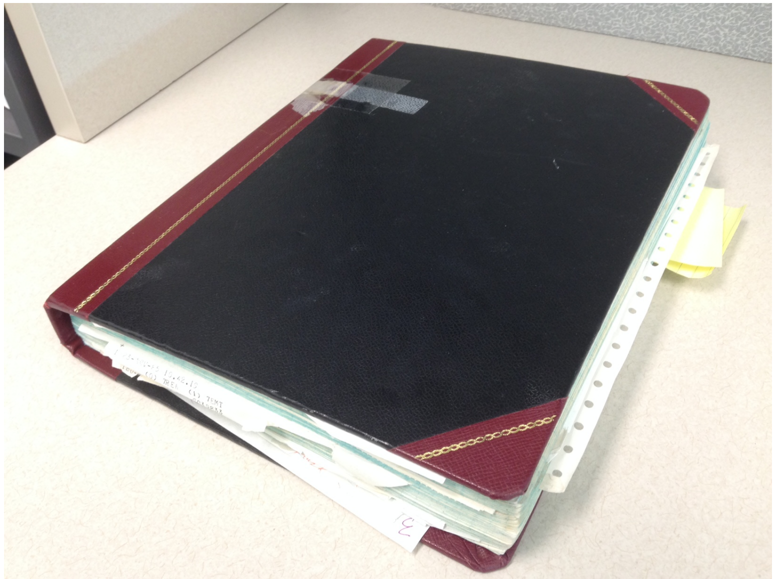
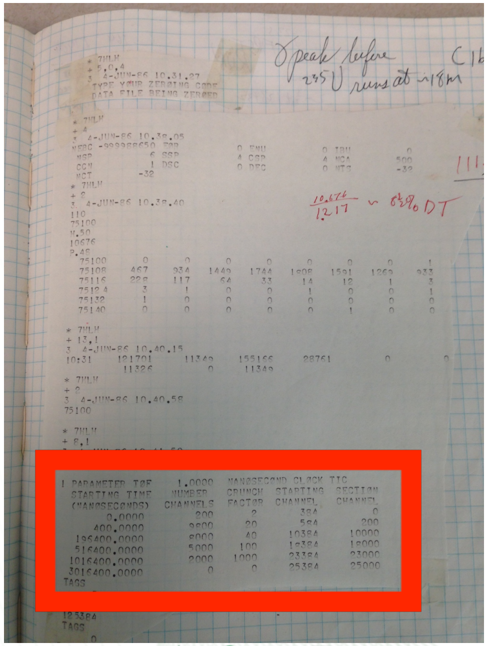
INTRODUCTION (1)

- The current ORNL resonance evaluation **o17** (ORNLv17) is an intermediate step of the evaluation process within CIELO
- The current **o17** resonance evaluation started from a set of resonance parameters merged from **i1** (IRSNv1) and **i2** (IRSNv2)
  - **i2** was documented in the ORNL Report presentation at the CSEWG meeting (November 2015) and released after CSEWG.
- Particular emphasis in producing **o17** was devoted to
  - *sub-thermal* and *thermal* : Thermal Constants (Pronyaev, micro. data)
  - *fission integrals (7.8-11 eV)*
  - *neutron incident energies up to 30 eV* for measurements of $\alpha=\sigma_\gamma/\sigma_f$
- The work to improve the fit of experimental data in the energy region above 100 eV is still in progress

INTRODUCTION (2)

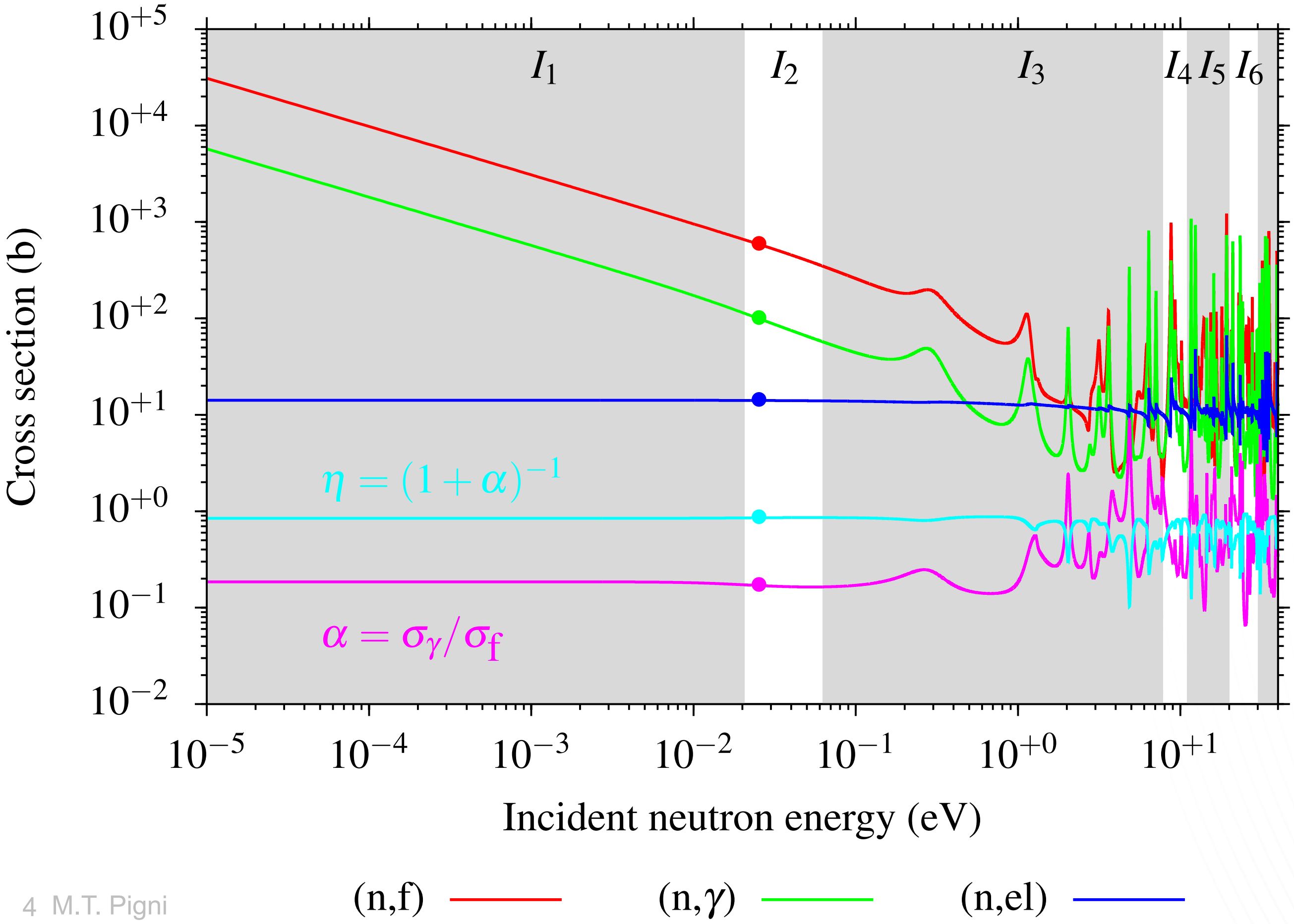
- The current ORNL resonance evaluation **o17** is generated by the SAMMY code using the Reich-Moore approximation
  - All SAMMY inputs included in the current evaluation procedure are written using the most recent key-word for particle-pair definitions.
  - Isotopic impurities included
  - Parameters for the resolution functions (crunch data, γ-peak) of transmission experimental data (J. A. Harvey) retrieved from ORELA logbook (special thanks to K. Guber).
- Residuals and chi-squared of all exper. data





Thermal Cross Sections and Integrals

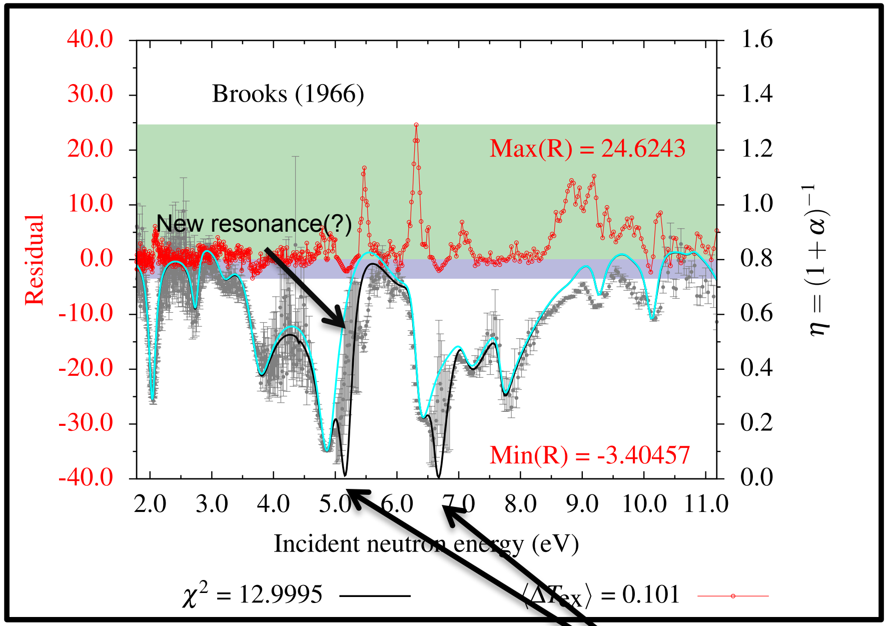
- **O17** values for fission and capture thermal cross sections are based on ^{235}U(n,f) thermal constants obtained on the basis of *microscopic* data (i.e., only considering Wallner thermal capture measurements)
- Fission integral (I_4 in the Figure below) between 7.8 and 11 eV based on recommendation of Neutron Standards

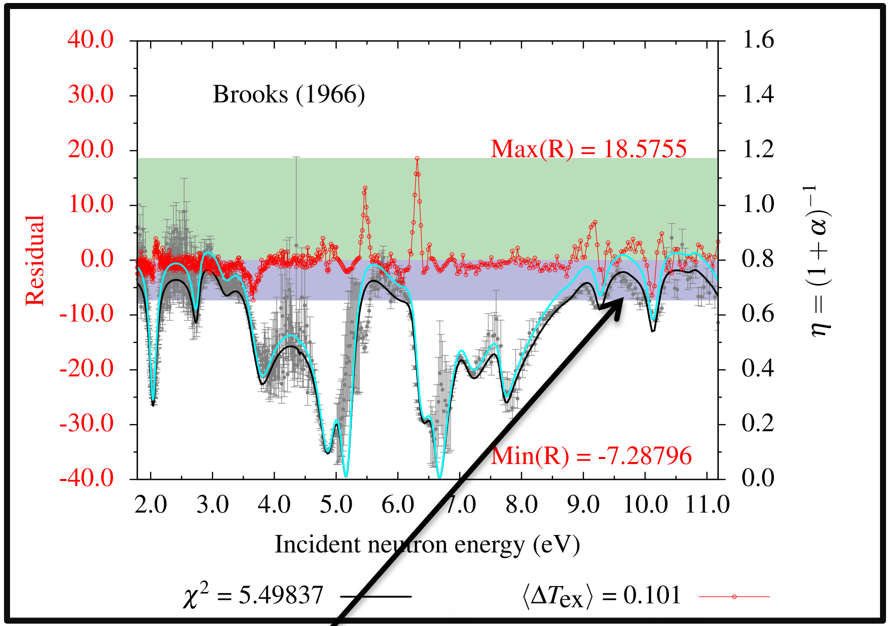


Standards	o17 (T=0°K)
586.7 +/- 1.4	586.5
100.2 +/- 1.3	99.4
14.07 +/- 0.22	14.08
0.8541	0.855
0.1707	0.1695

Brooks (1966) experimental data sets

- Comments on the fit of Brooks' α measurements
  - converted to η





Impact of impurities, i.e., ^{234}U

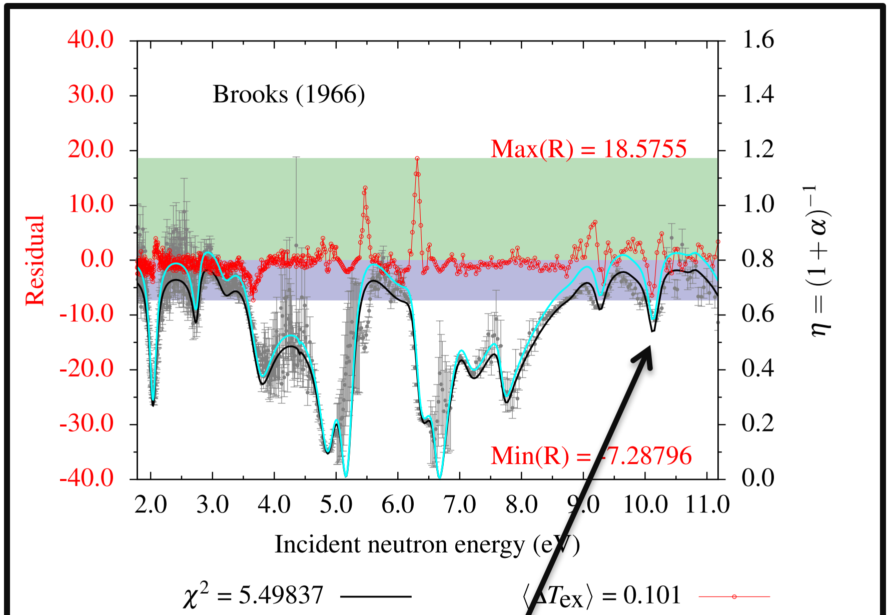
Impact of normalization on η (black curve)

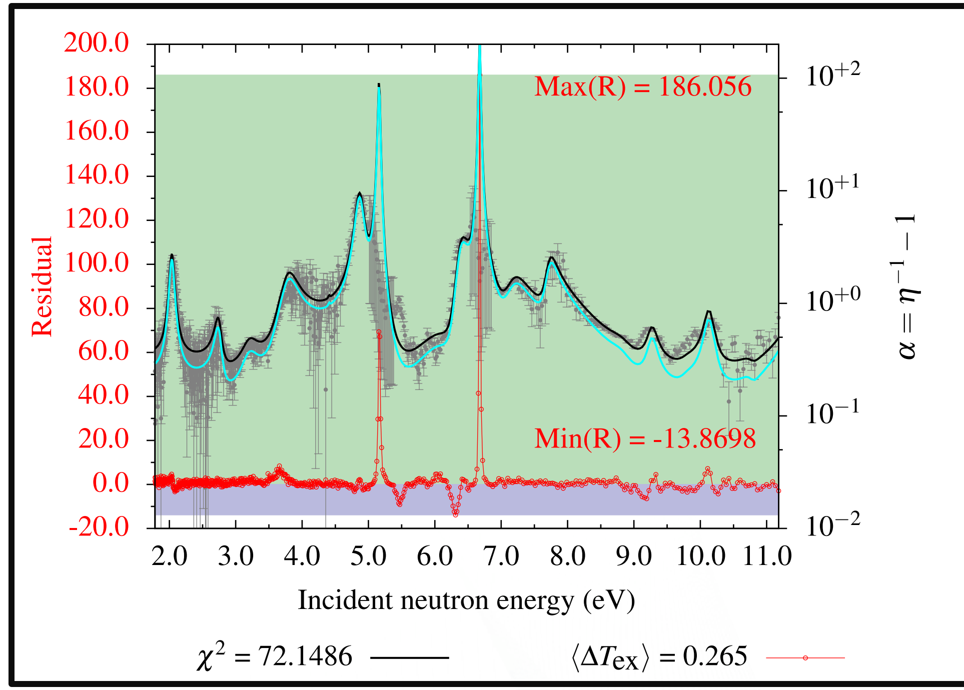
- Brooks data might reveal
  1. new resonance at E=5.46 eV (?)
  2. poor resonance parameters for ^{234}U

- N=0.92379 (extreme case!?)
  - Values obtained by SAMMY fit with large uncertainty on N

Brooks (1966) experimental data sets

- Comments on the fit of Brooks' *α* measurements
  - Relation of normalization parameter between *α* and *η*





Impact of normalization on *η*

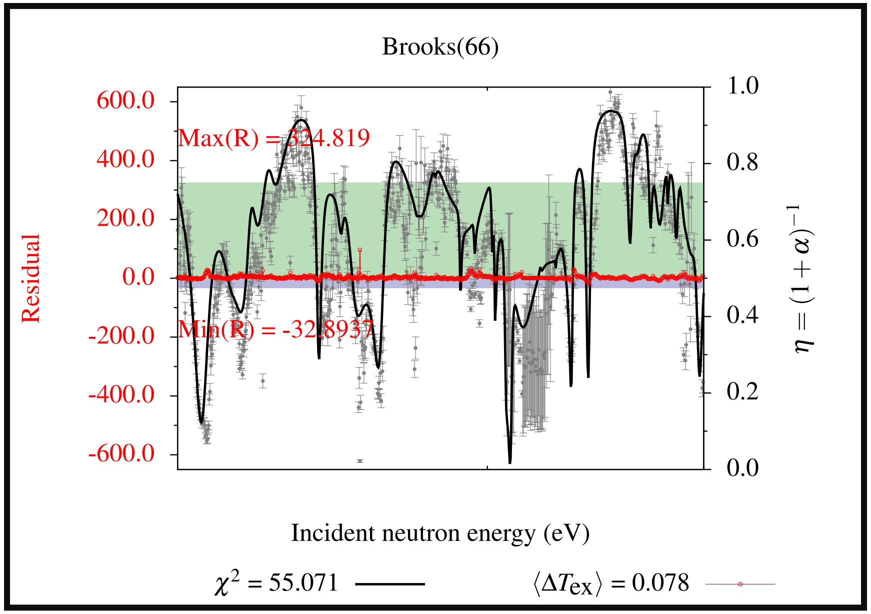
- N=0.92379 (extreme case!?)
- N is driven by the fact η too high above 8 eV

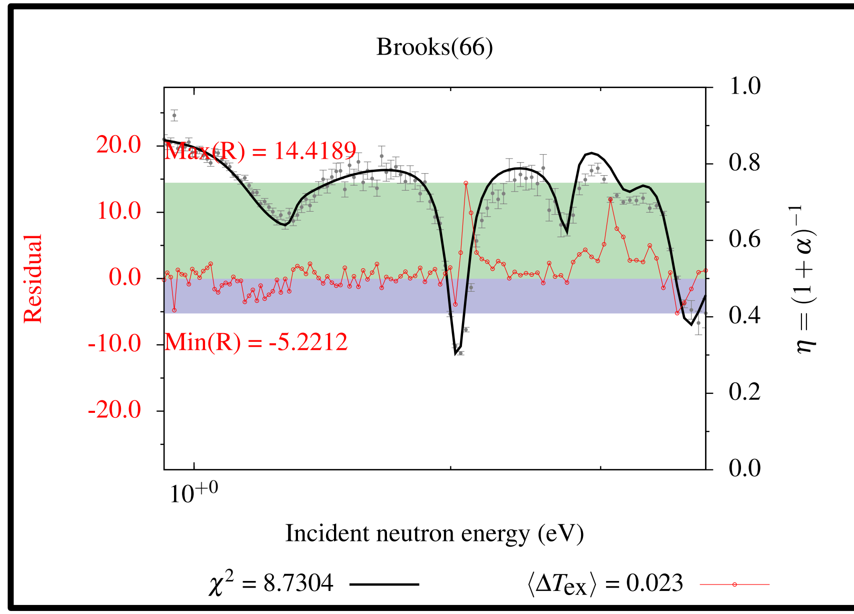
Conversion from *η* to *α*

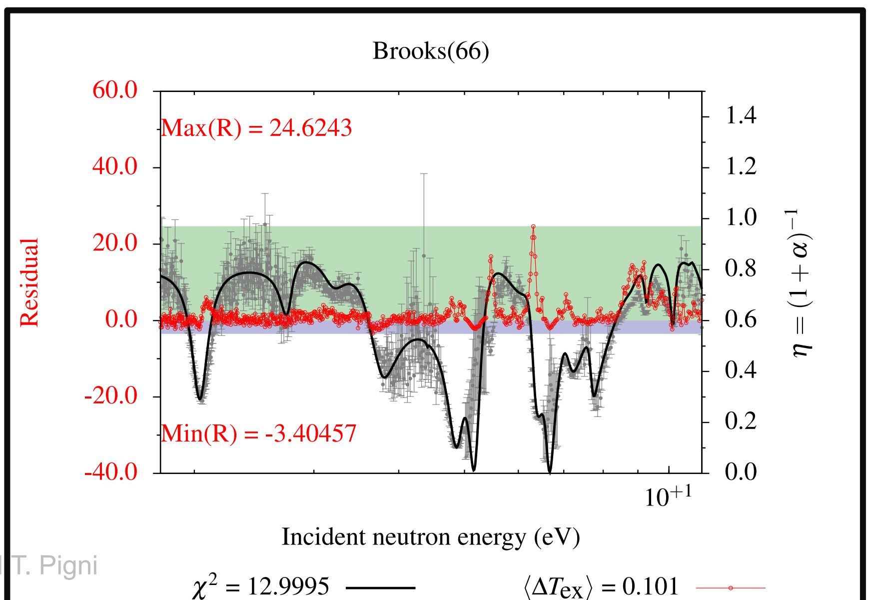
- Impact of the N on α is even more extreme
- Impurities effect more evident

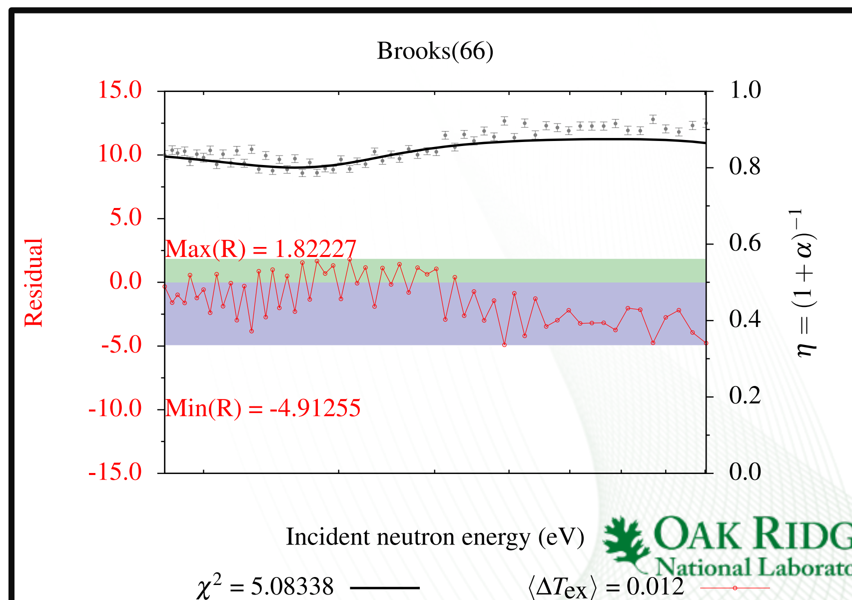
Summary of Brooks' α measurements

(converted to η and not normalized)

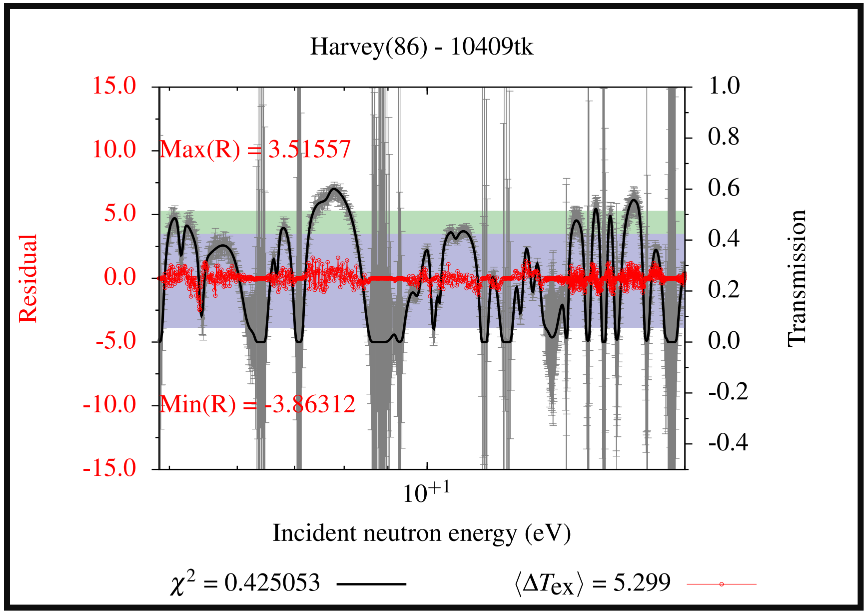


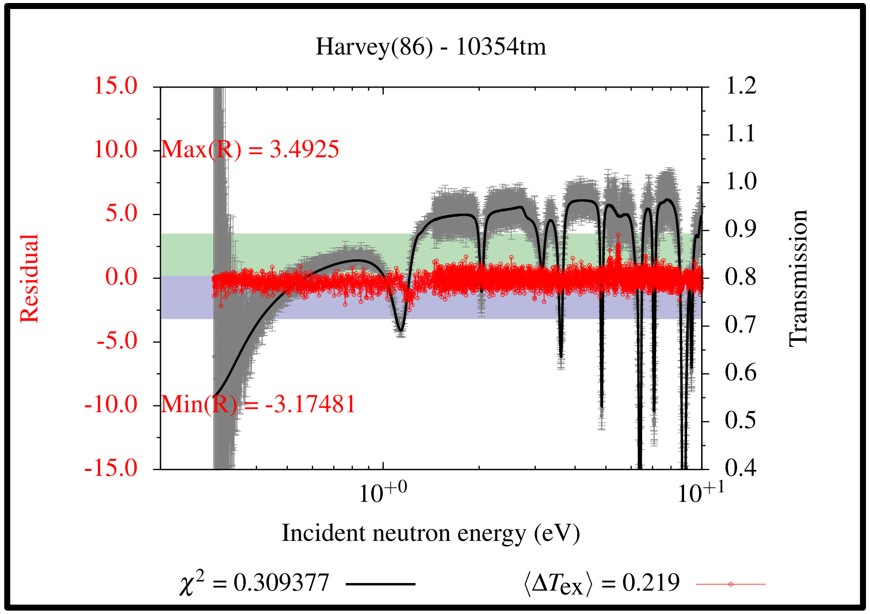






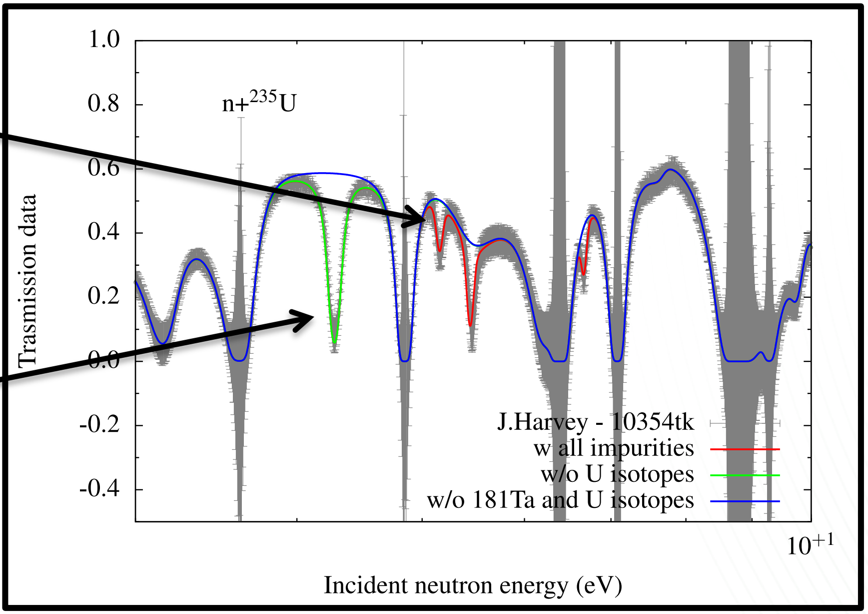
Transmission data (Harvey)
with updated resolution function and impurities





U isotopes

Tantalum



Summary and Conclusions

- We applied the R-matrix SAMMY method using the Reich-Moore approximation to determine a consistent set of neutron resonance parameters for ^{235}U
- In the analyzed energy range up to 2.25 keV, the evaluation o17 is based on a previous release within the CIELO collaboration, namely i2a, merged version of i1 and i2. o17 (ORNLv17) did not try to improve experimental data above 100 eV.
- Updated inputs for SAMMY (particularly for resolution function parameters for Harvey transmission data)
  - Original ORELA data
  - Inclusion of impurities (parameters taken from ENDF/B-VII.1)
- Analysis of Brooks' α experimental data (four sets) converted to η in order to be fitted with SAMMY
  - Analysis on the impurities and normalization of Brooks data is still in progress
  - Very likely a new resonance at E=5.46 eV
- Constraint of the o17 evaluation are the standard thermal cross sections and the fission integral between 7.8-11 eV.
- The validation analysis on the thermal benchmarks showed good agreement with the experimental response and that the o17 resonance parameters are compatible with the current values of nubar (from thermal constants) and thermal PFNS (average energy 2.00+/- 0.01)

ACKNOWLEDGMENTS

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Thank you!