Evaluation of ^{238}U+n in the RRR: issues with n_TOF capture data

S. Kopecky and P. Schillebeeckx

Status evaluated data for ^{238}U+n in RRR

- **Moxon et al. (1990)** : JEF 2, ENDF/B-VI, JENDL 3 (NEA/NDC task force)

  – First evaluation based on resonance shape analysis (REFIT)

  – Experimental data

    Transmission data: ORELA, 42 m and 150 m (Olsen et al.)

    Capture data : ORELA, 40 m (de Saussure et al.) and 150 m (Macklin et al.) with ORELAST detector

    + $\sigma(n_{th},\gamma)$ = **2.718 b**

- **Derrien et al. (2005)** : ENDF/B-VII.1, JEFF-3.2, JENDL- 4.0

  – Starting parameters from Moxon et al. (1990)

  – Experimental data of Olsen et al. , Macklin et al. and de Saussure et al.

    + Transmission data : ORELA, 200 m (Harvey et al.)

    + $\sigma(n_{th},\gamma)$ = **2.683 (12) b** recommended by Trkov et al. **based on microscopic data**
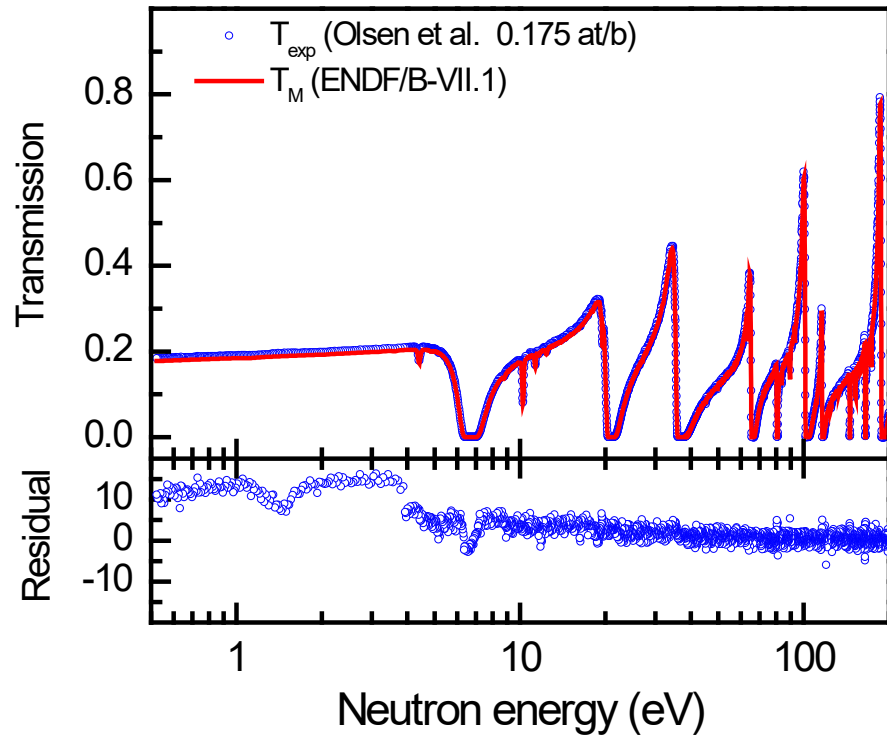
Difference:

$\Rightarrow$ URR starts at 20 keV

$\Rightarrow$ WPEC Subgroup 22: good agreement with integral benchmark measurements with a high sensitivity to thermal region (i.e. LEU-MET-THERM-006) due to $\sigma(n_{th},\gamma)$ = **2.683 (12) b**

New evaluation

- Transmission data

  - Not consistent with evaluated resonance parameters
  - Data were re-normalised, no details in evaluation report
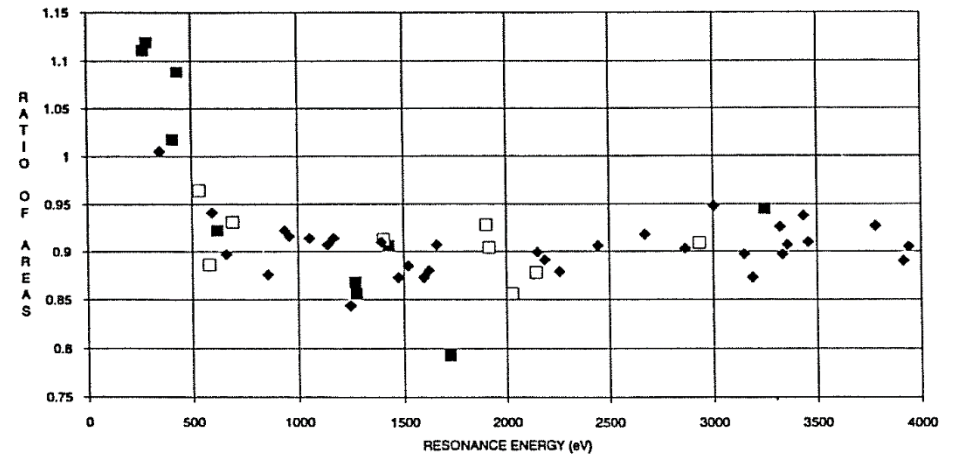
- Capture data

  All data included in evaluation require a substantial renormalisation
  - de Saussure et al.   x 0.85
  - Macklin et al.   x 1.10

  See Moxon et al., PHYSOR 90

New evaluation for ^{238}U+n in RRR

JEFF- 3.3, ENDF/b-VIII.0 (CIELO)

- Resolved resonance region: resonance shape analysis with REFIT
  - Transmission data   : ORELA, 42 m and 150 m   (Olsen et al., NSE 62 (1977) 479, 66 (1978) 141)
  - Capture data   : GELINA, 12.5 m and 60 m   (Kim et al., EPJA 52 (2016) 170)
  - $\sigma(n_{th},\gamma)$ = 2.683 (12) b   (Trkov et al., NSE 150 (2005) 336)
  - b_c = 8.63 (4) fm   (Koester et al., At. Data NDT 49 (1991) 65)

- Evaluation without applying any additional correction to the experimental data

- Integral experiments: only for validation (IAEA, KAERI and NEA)
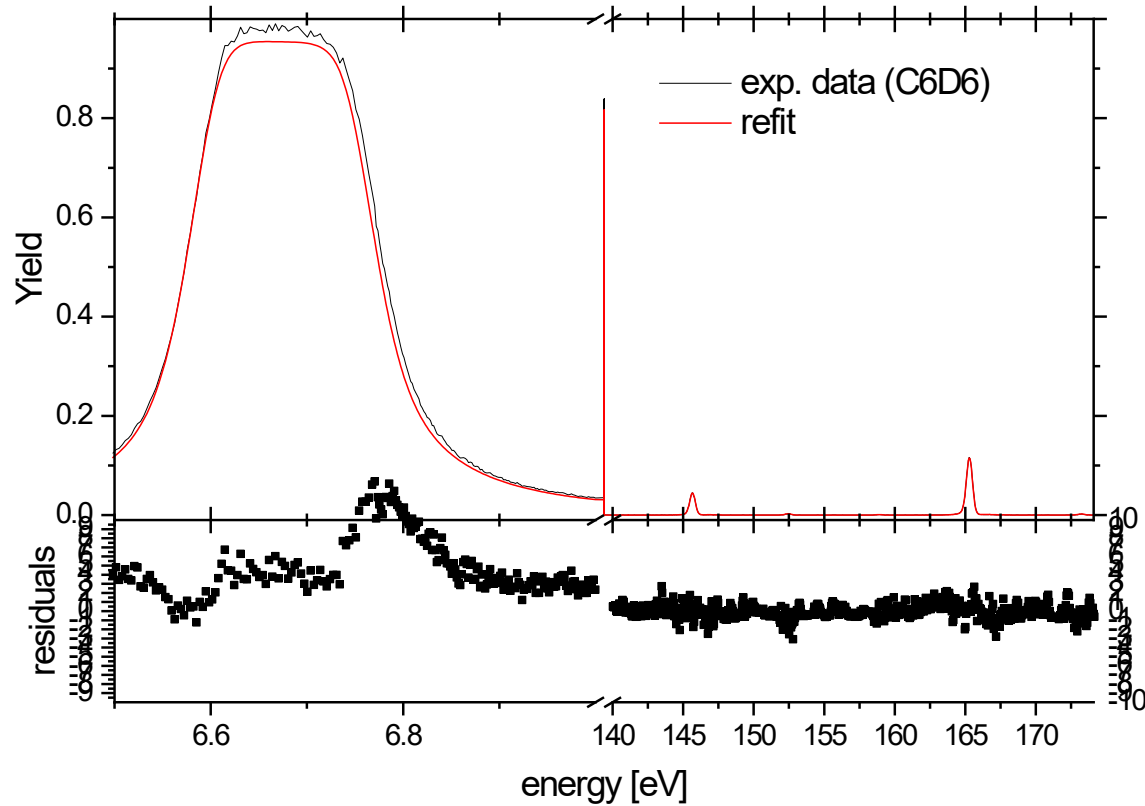
JEFF- 4.0

- Include n_TOF capture data

- Problems….

n_TOF: C$_6$D$_6$

- TOF-response function (Gunsing)

- 5% difference in normalisation between resonances

- Background correction not complete

$\Rightarrow$ Difficult to include in evaluation process

$\Rightarrow$ Prepare capture yields that are as much as possible free from background contributions

European Commission

n_TOF: total absorption detector
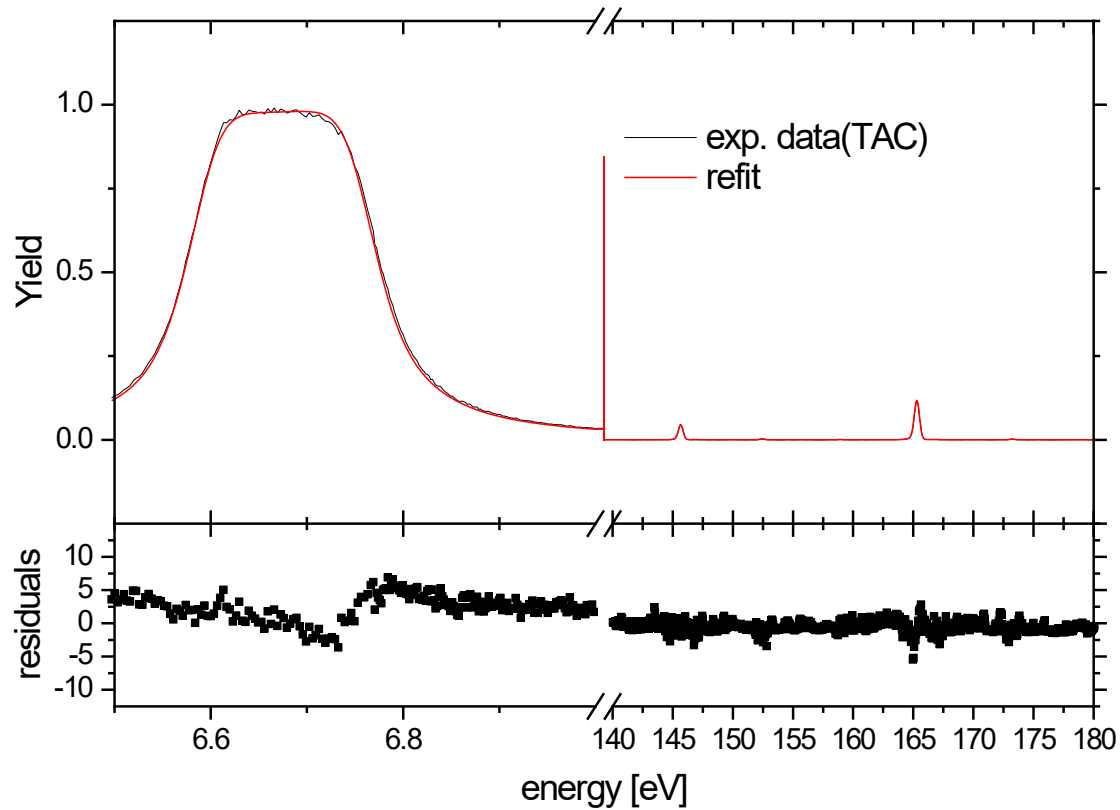
- TOF-response function (Gunsing)

- Consistency checks of normalisation at three resonances!

- No background problems!

n_TOF: total absorption detector
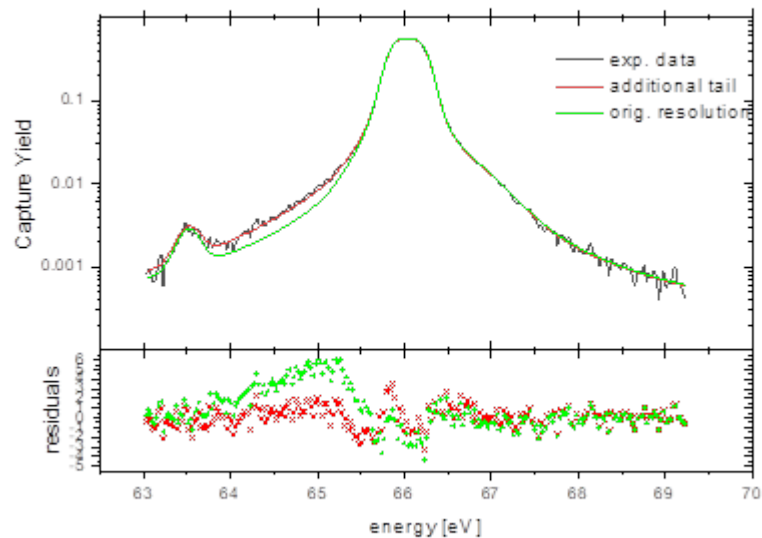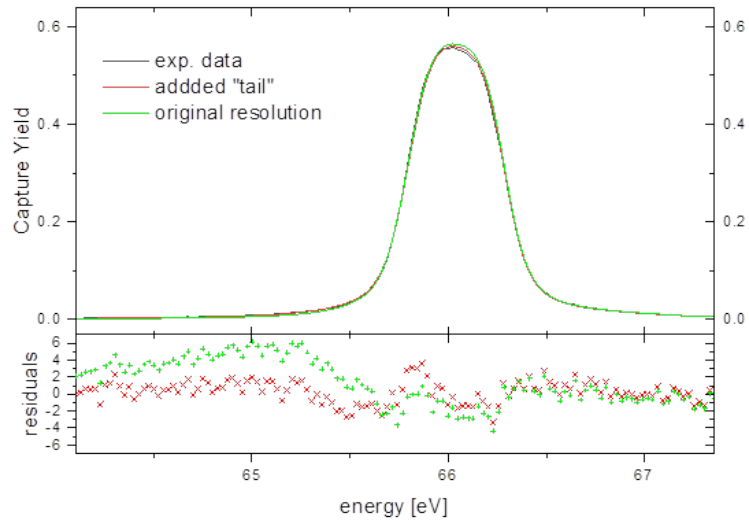
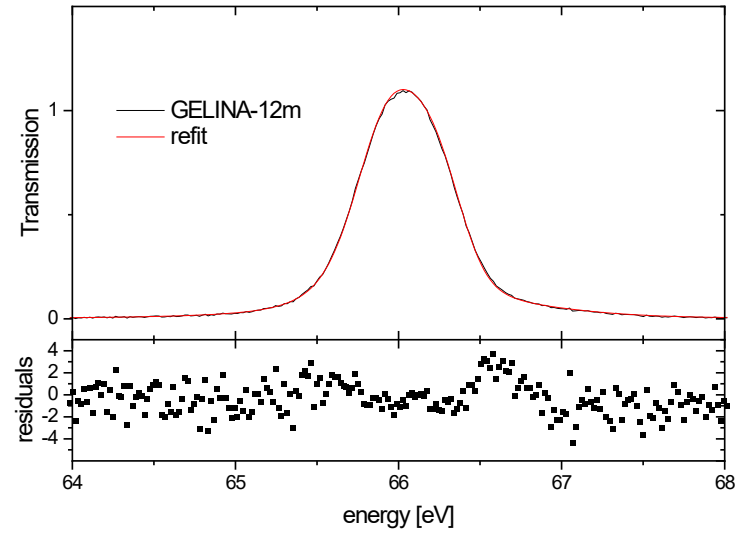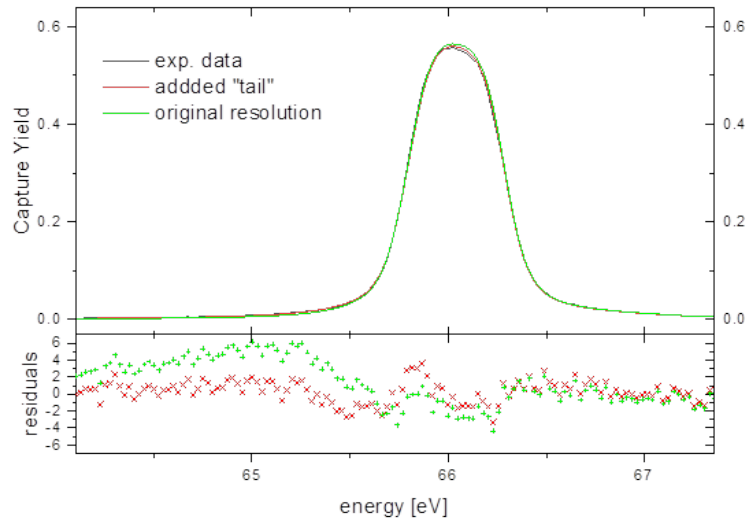Need an additional "tail" in TOF- response function

- Amplitude a few percent

- Exponential decay with time constant equivalent to approx. 60 cm equivalent distance

- Simultaneous fit of TAC and GELINA/ORELA data not possible
    - Γ_γ : TAC 5-6 % higher than ORELA data
    - Γ_γ : higher than JEFF-3.2 and JEFF-3.3

- TOF-response function or neutron sensitivity/multiple interaction?

European Commission

n_TOF: total absorption detector – C$_6$D$_6$
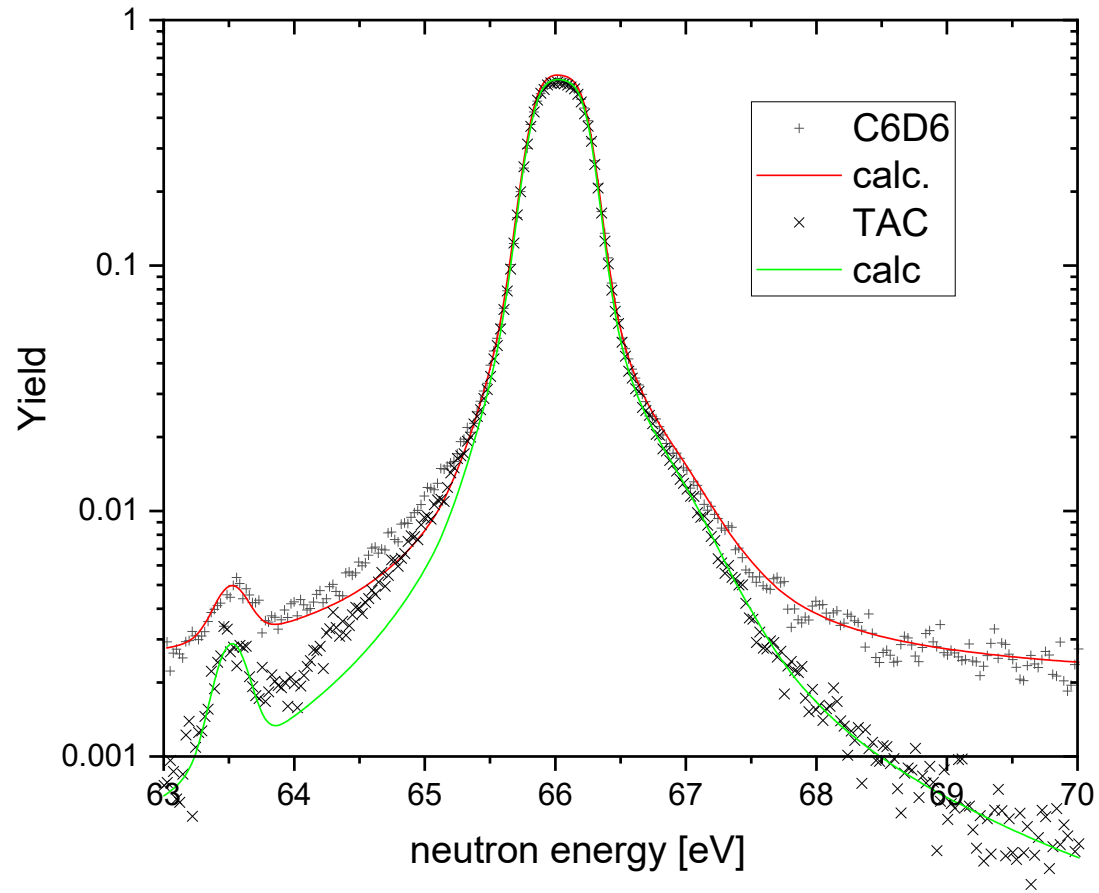
n_TOF (total absorption) – GELINA (C_6D_6 – 12m)

9