Neutron Cross-Section Measurements Activities at ORNL

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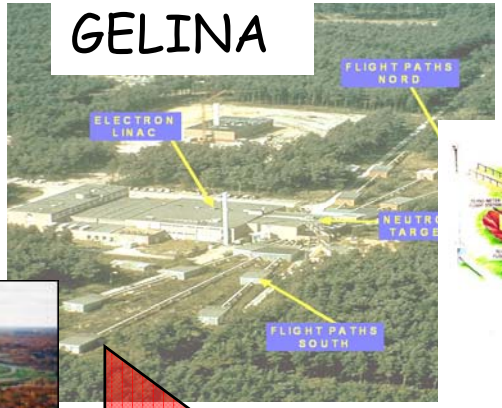
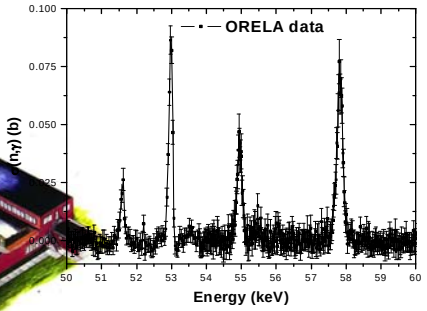
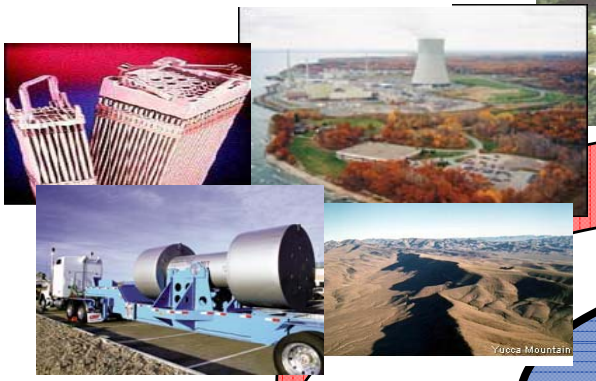
Nuclear Astrophysics



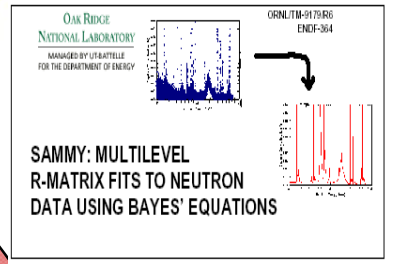
ORELA





Applications

Basic Science

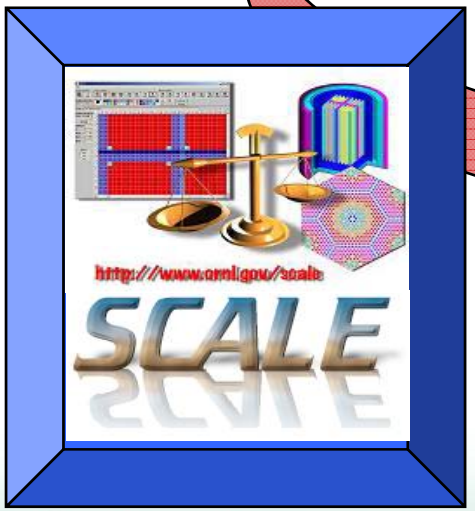


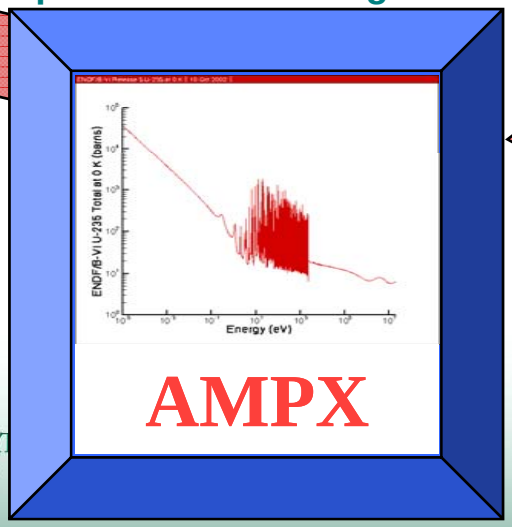
SAMMY

Cross-Section Evaluations

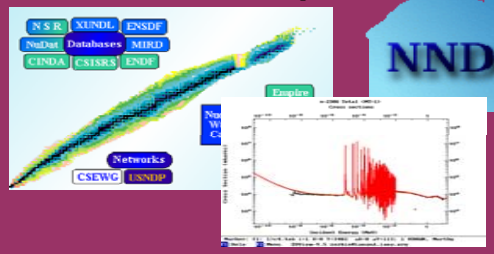
ORNL Data Support for Nuclear Applications

Computational modeling





Evaluated Nuclear Data Files (ENDF/B)

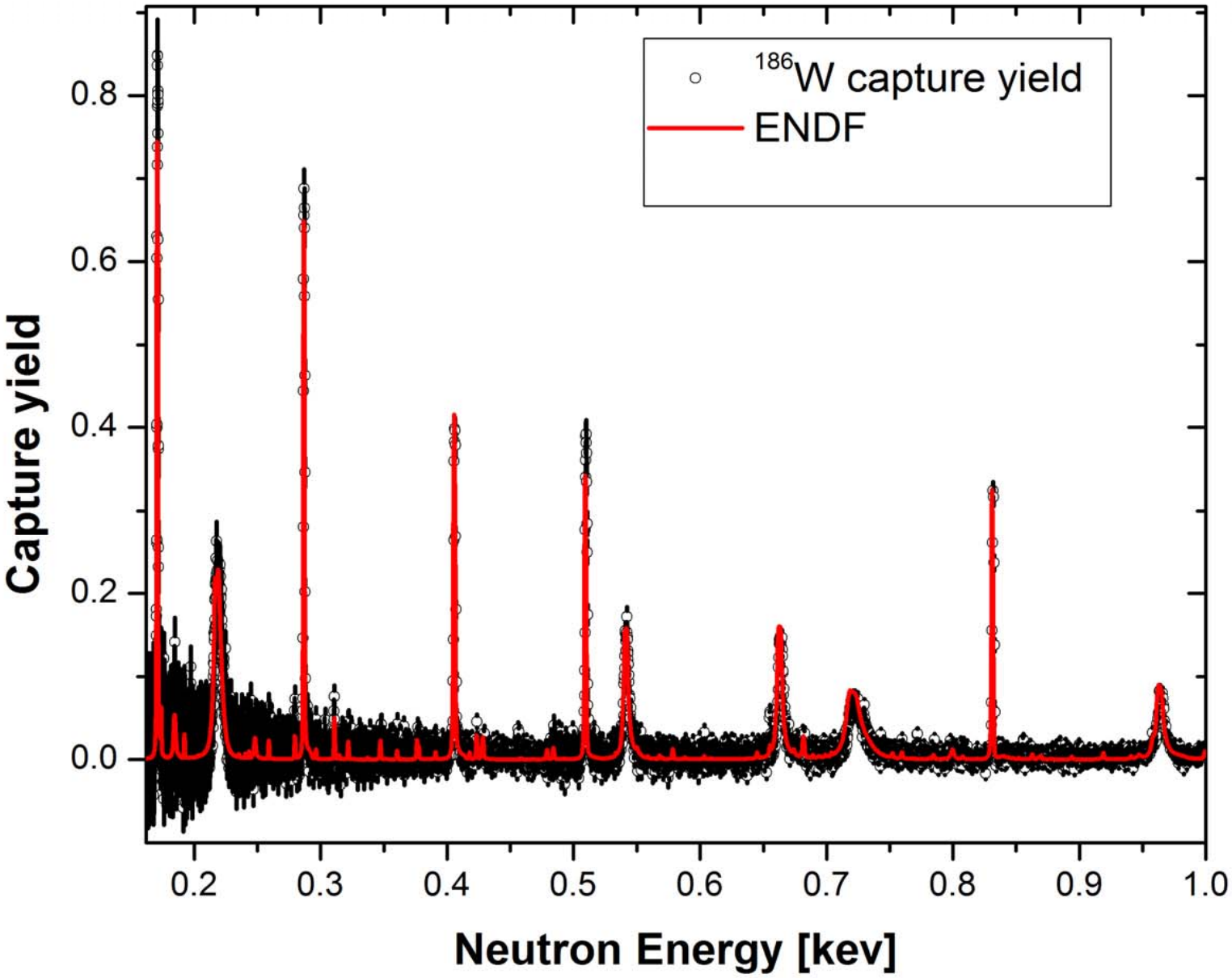


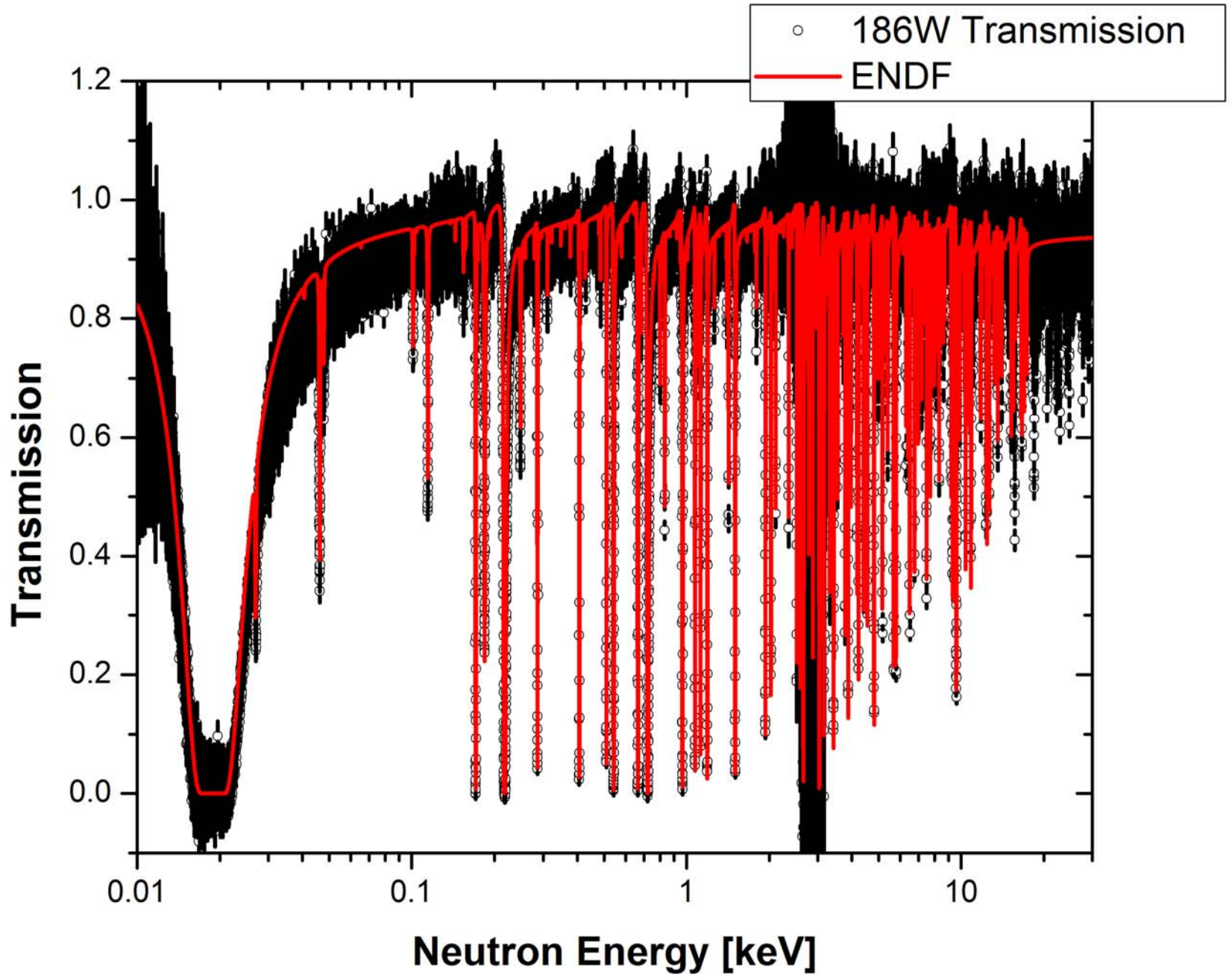
OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

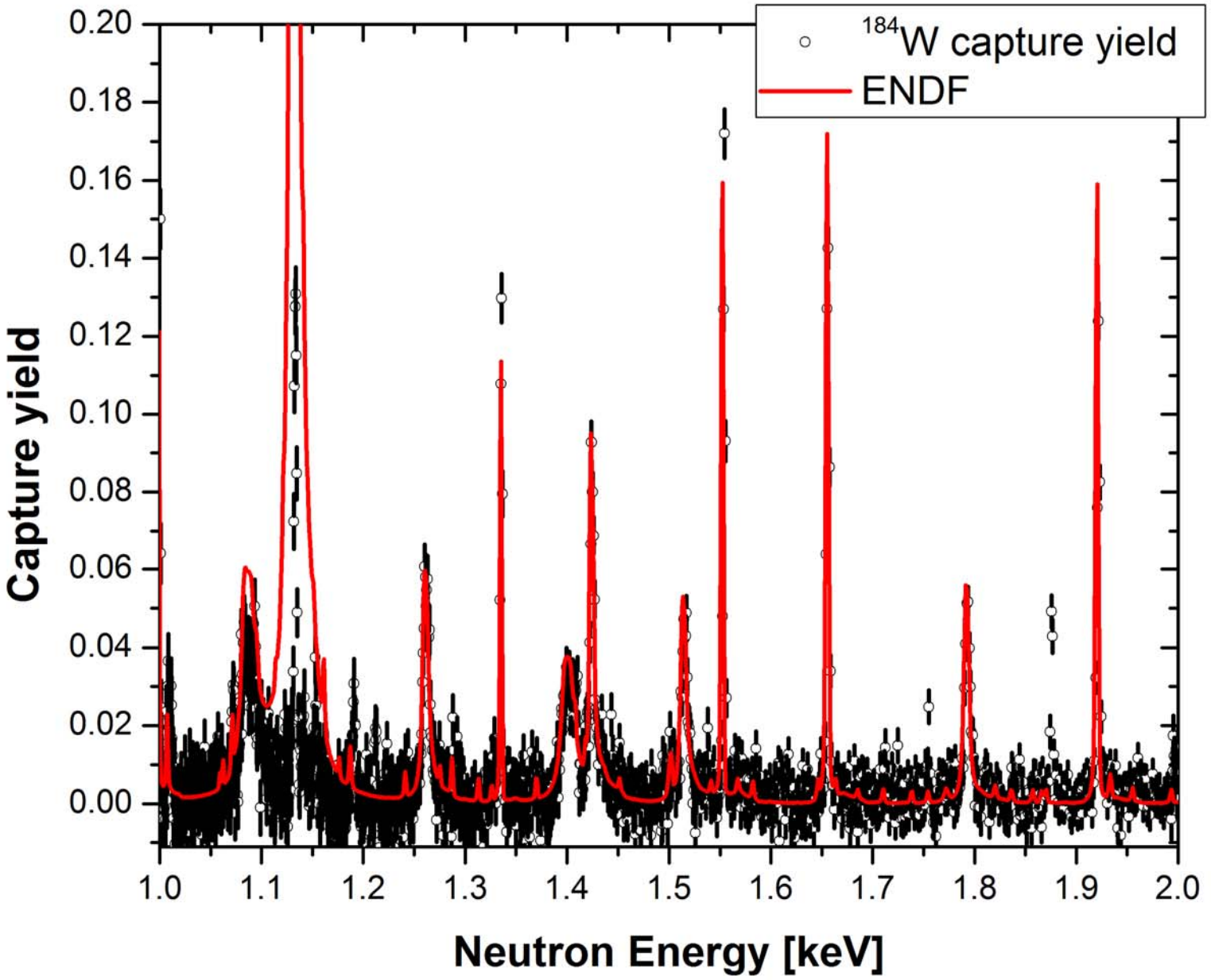
UT-BATTELLE

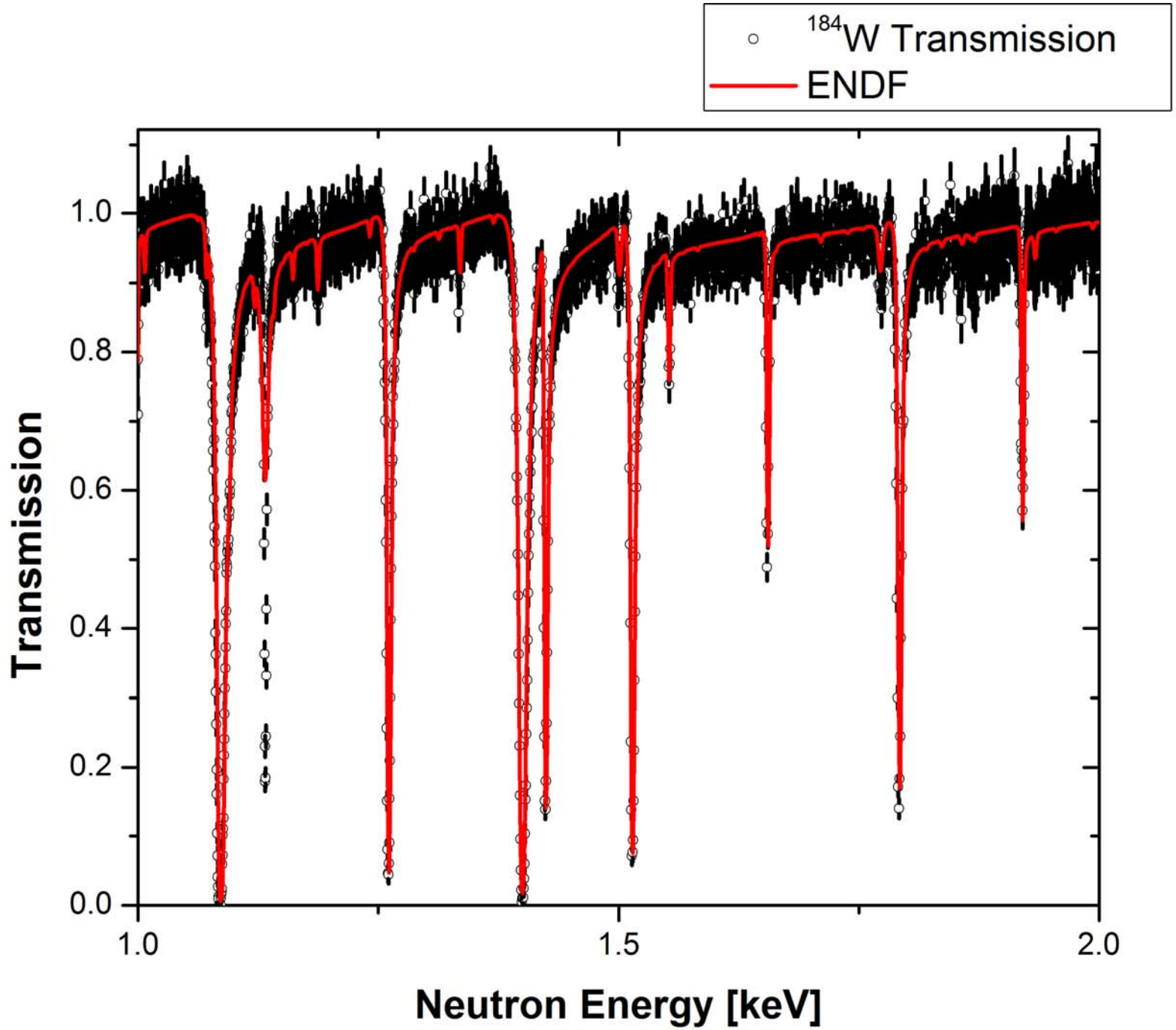
ORNL Measurement Activities in FY10 I

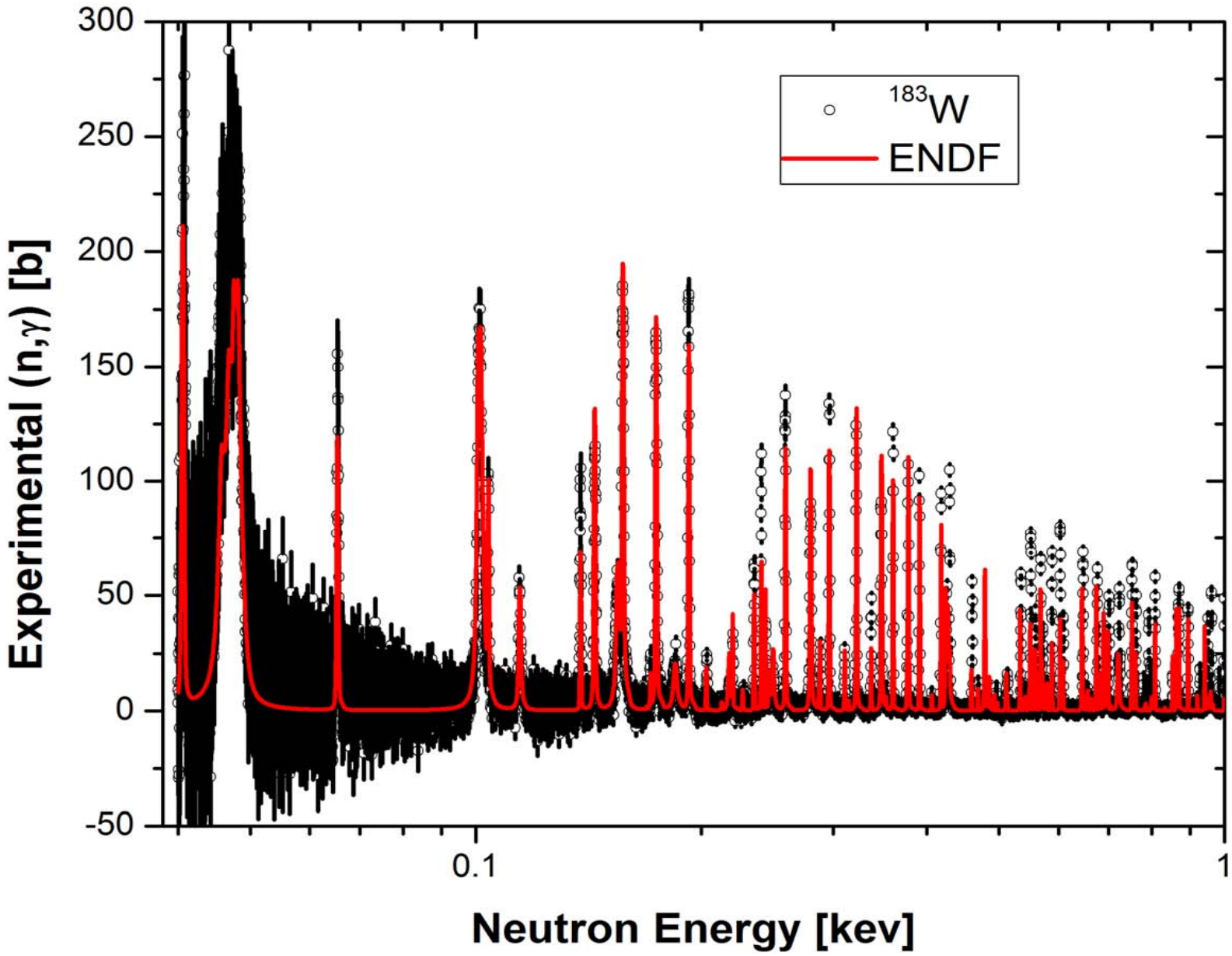
- Measurements completion of the stable W isotopes. Experiments started in FY09 using enriched samples for 4 isotopes.
- Data sets cover now the complete resolved resonance region. As well as part of the unresolved region.
- Normalization of the capture data finalized.
- Capture Data for ^{182,183,184,186}W from the high repetition run available to analyze.
- Transmission data for ^{184,186}W with different sample thickness available.

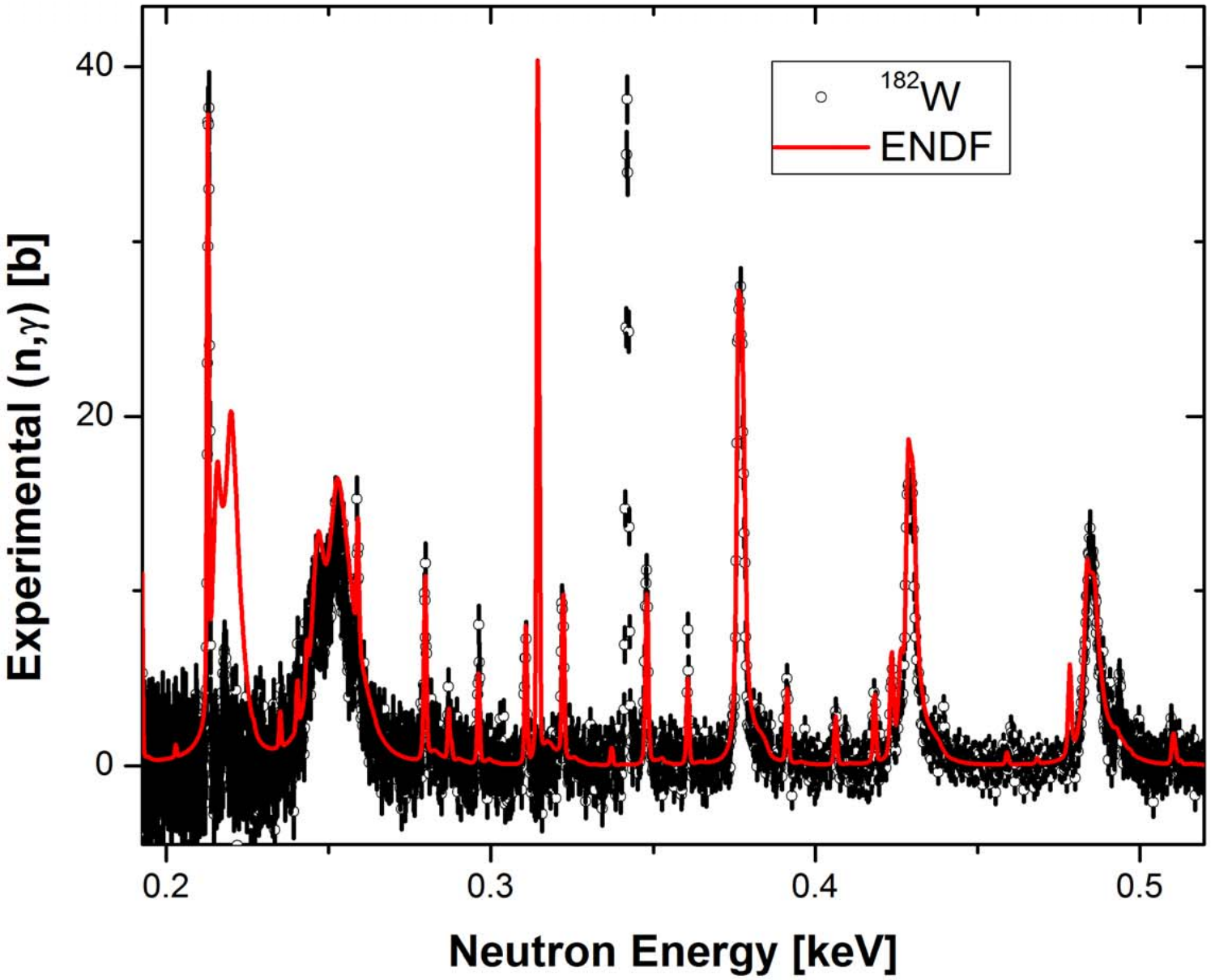

^{186}W capture yield
ENDF
Capture yield
0.0
0.2
0.4
0.6
0.8
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Neutron Energy [kev]


186W Transmission
ENDF
Transmission
Neutron Energy [keV]
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.01
0.1
1
10


^{184}W capture yield
ENDF
Capture yield
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
Neutron Energy [keV]


^{184}W Transmission
ENDF
Transmission
1.0
0.8
0.6
0.4
0.2
0.0
1.0
1.5
2.0
Neutron Energy [keV]

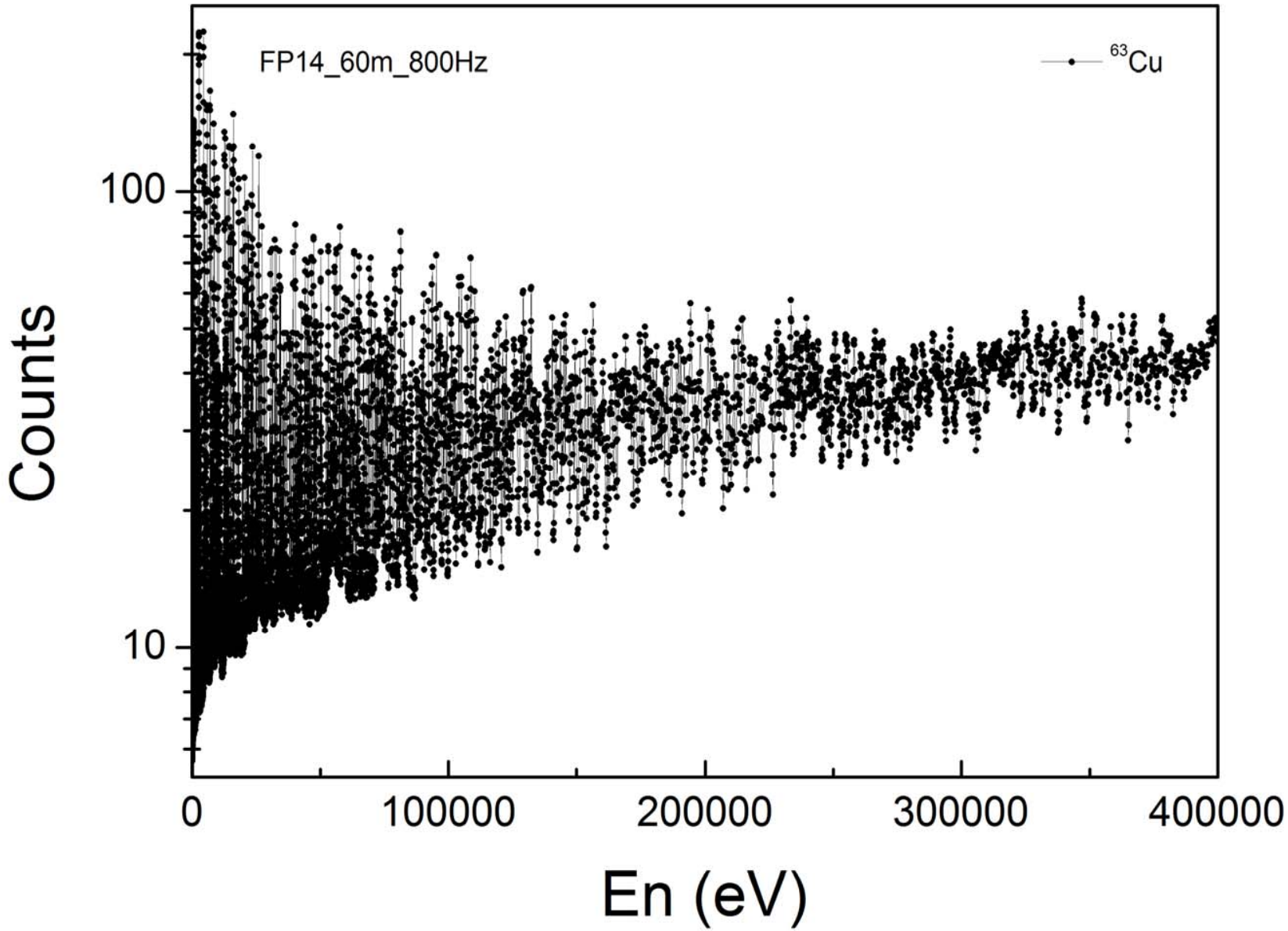

300
250
200
150
100
50
0
-50
0.1
1
Experimental (n,γ) [b]
Neutron Energy [kev]
183W
ENDF


40
20
0
0.2
0.3
0.4
0.5
Experimental (n,γ) [b]
Neutron Energy [keV]
182W
ENDF

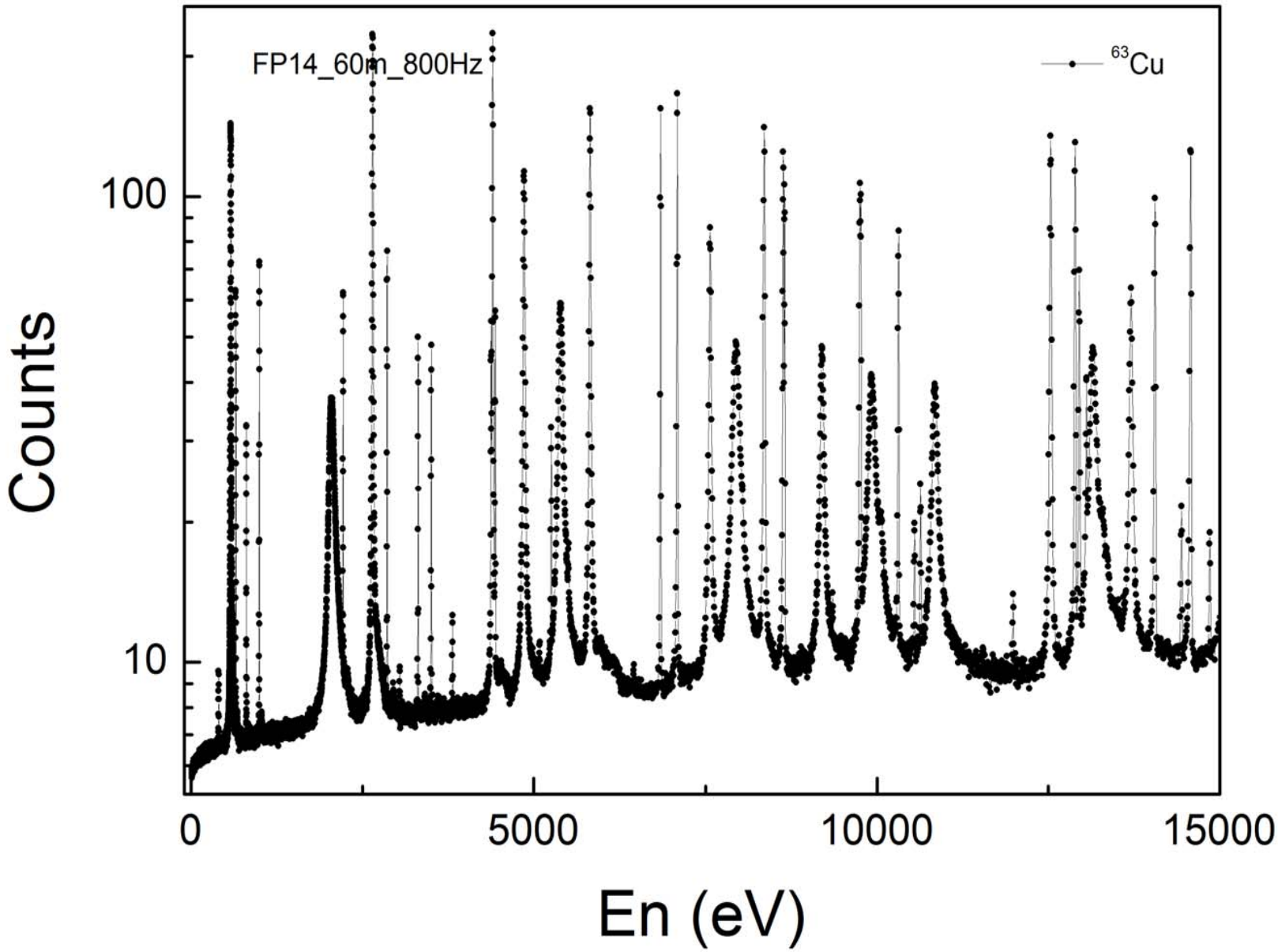
ORNL Measurement Activities in FY10 II

- Neutron Capture measurements for ^{63,65}Cu at GELINA using set up at FP14, 60m station.
- Neutron transmission on natural Cu using GELINA FP4, 50m station.
- Use of metallic samples, >99% isotopic enrichments. 8cm diameter disks with 1mm thickness.
- Include old ORELA transmission data in evaluation.

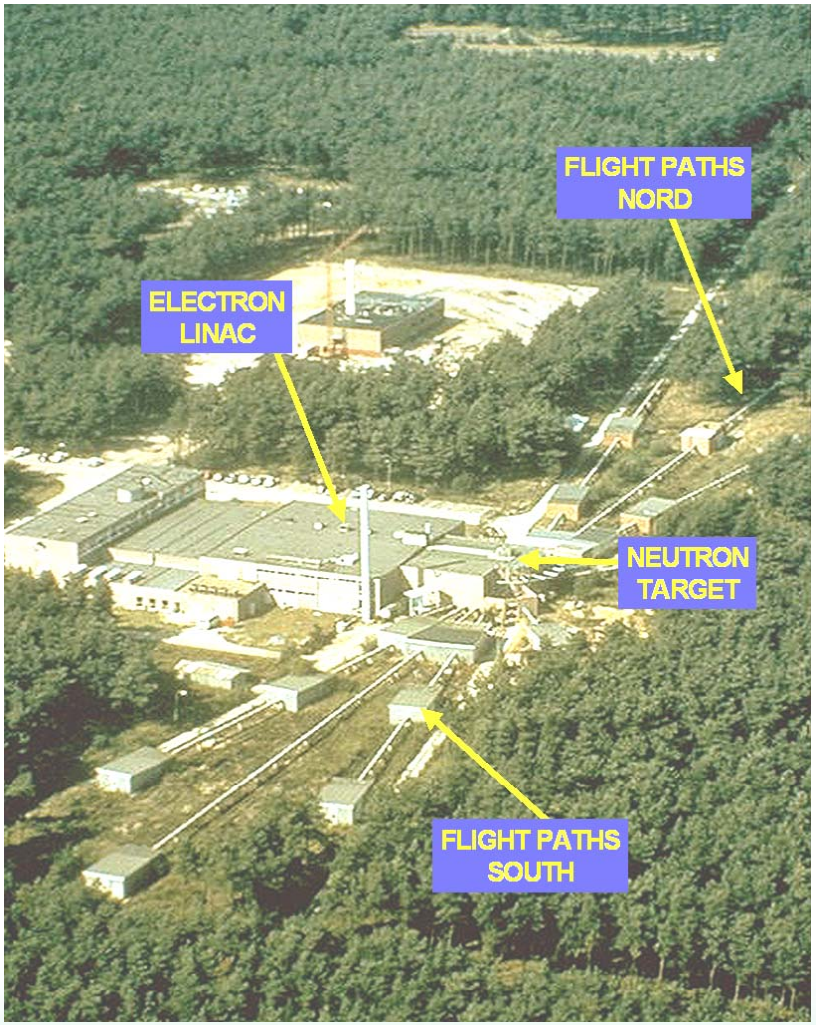
^{63}Cu (n,γ) Data


FP14_60m_800Hz
63Cu
Counts
100
10
0
100000
200000
300000
400000
En (eV)

^{63}Cu (n,γ) Data Details



GELINA

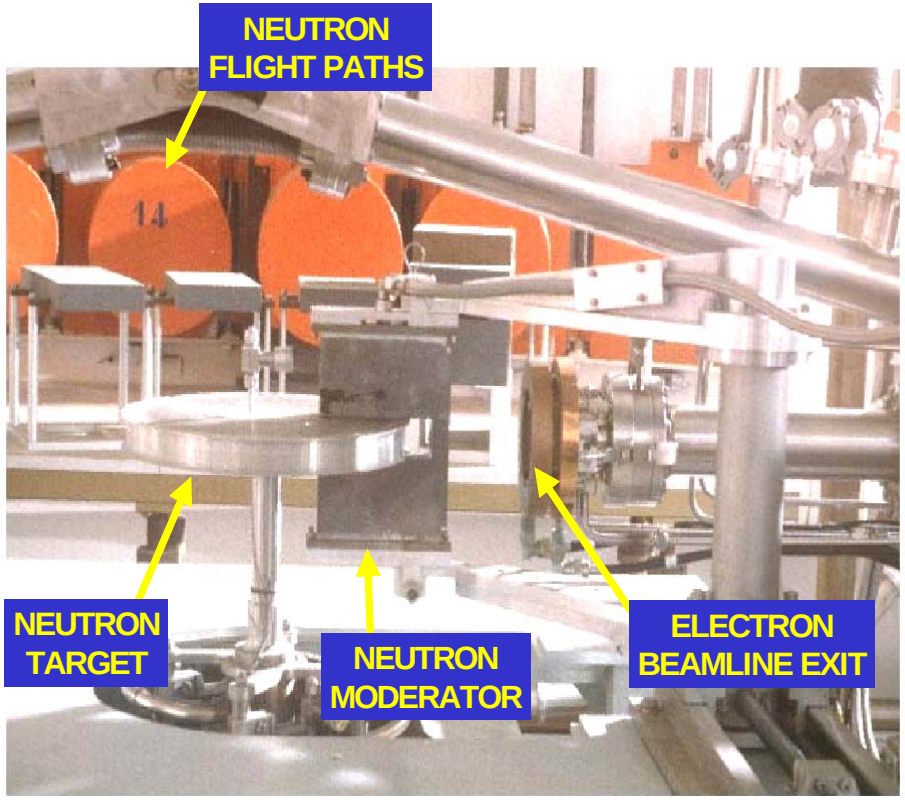


- Time-of-flight facility
- Pulsed white neutron source

  (10 meV < E_n < 20 MeV)
- Multi-user facility with 10 flight paths (10 m - 400 m)
- The measurement stations have special equipment to perform:
  - Total cross section measurements
  - Partial cross section measurements

Pulse Width	: 1ns		
Frequency Hz	: 40 Hz	-	800
Average Current	: 4.7 μA	-	75 μA
Neutron intensity n/s	: 1.6 10^{12} n/s	-	2.5 10^{13}

Neutron Production



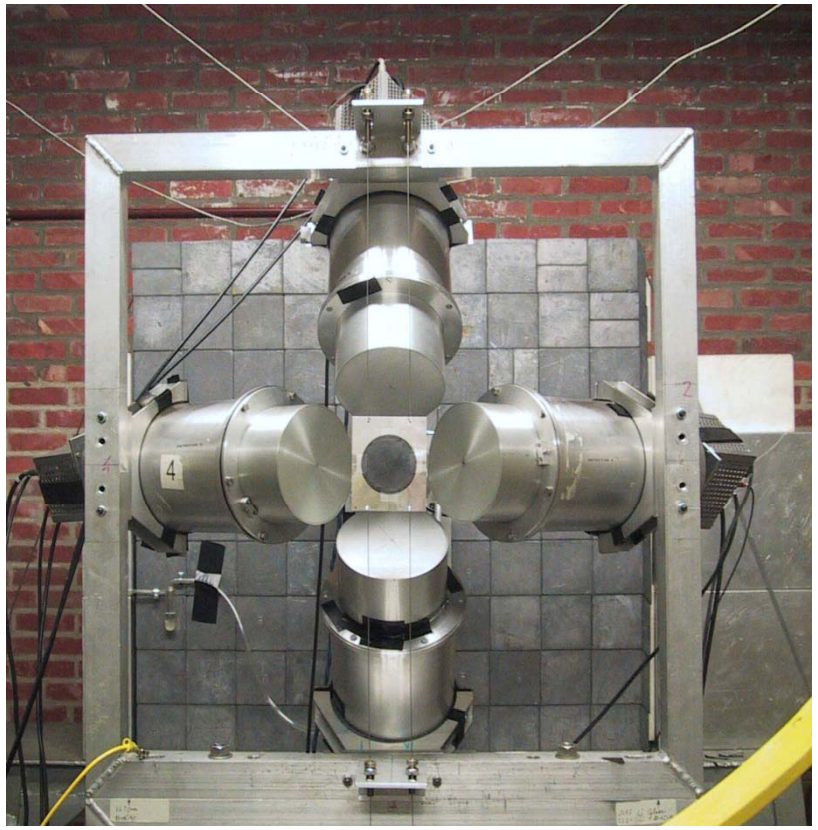
- e^- accelerated to $E_{e-,max} \approx$ 140 MeV
- (e^-, γ) Bremsstrahlung in U-target (rotating & cooled with liquied Hg)
- (γ,n) , (γ ,f) in U-target
- Low energy neutrons by water moderator in Be-canning

Capture cross section measurements at GELINA

Total energy detection

- C_6D_6 liquid scintillators
  - 125°
  - PHWT
- Flux measurements (IC)
  - $^{10}B(n,\alpha)$
  - $^{235}U(n,f)$

L = 10 m, 30 m and 60 m

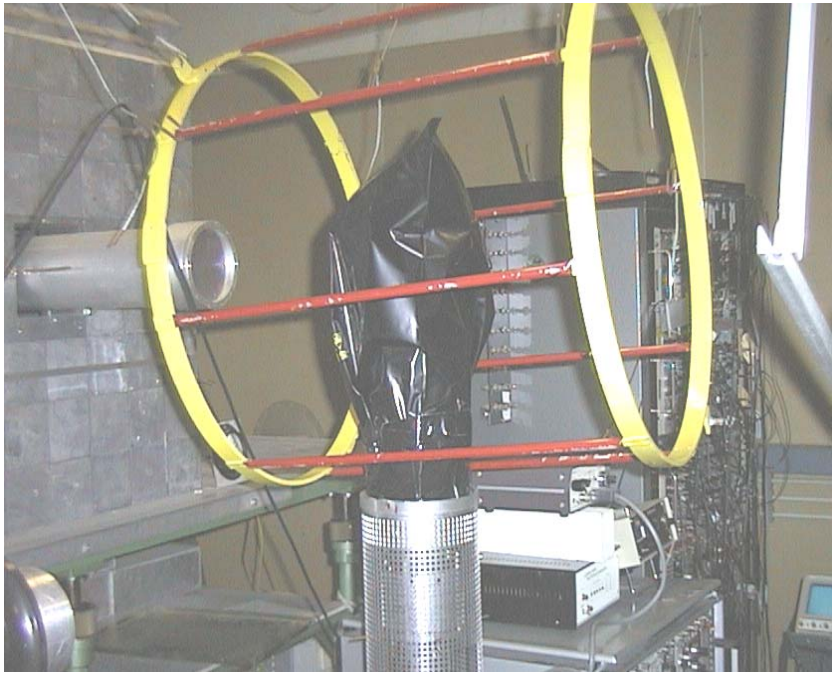


$$Y_{exp} = N\sigma_{\varphi}\frac{C_W - B_W}{C_{\varphi} - B_{\varphi}}$$

Transmission Measurements

Sample & Background Filters

Detector



Detector stations
Moderated: L= 30 m,50 m,(100 m,200 m)
Fast : L= 400 m

Low energy : $^{6}Li(n,t)\alpha$ Li-glass

High energy : H(n,n)H Plastic scintillator

$$T = \frac{C_{in}}{C_{out}} \cong e^{-n\sigma_{tot}}$$

People involved in the Experiments

- Christos Lampoudis, IRMM
- Peter Schillebeeckx, IRMM
- Stefan Kopecky. IRMM
- Peter Siegler, IRMM
- Clint Ausmus, ORNL