

Neutron transmission measurements at nELBE

A. EXPERIMENT DESCRIPTION

1. Main Reference	A.R. Junghans et al., EPJ Web of Conferences 239, 01006 (2020)	[A]
2. Facility	nELBE time of flight facility	
3. Neutron production Neutron production beam Nominal average beam energy Nominal average current Repetition rate (pulses per second) Pulse width Primary neutron production target Target nominal neutron production intensity	Electron 30 MeV 0.5 μ A 101.562 5 ps Liquid Pb-target 10^{11} n/s at 1 mA	
4. Moderator Primary neutron source position in moderator Moderator material Moderator dimensions (internal) (thickness, height $\times$ width $\times$ depth,...) Density (moderator material) Temperature (K) Moderator-room decoupler (Cd, B, ...)	No moderation of neutrons No moderator. The source volume is a 11 mm * 11 mm Mo tube with liquid Pb flowing through No moderator Liquid Lead temperature 420 C No available	
5. Other experimental details Measurement type Method (total energy, total absorption, ...) Flight path length (m) (moderator –detector) Flight path direction Neutron beam dimensions at sample position (mm $\times$ mm, diameter in mm, ...) Neutron beam profile Overlap suppression (Filter material and thickness, chopper, ...) Other fixed beam filters	Neutron transmission Time-of-flight Target-detector 918,0(3) cm Single flight path only Sample in open field in front of 2.5 m long collimator uniform beam profile, see R. Beyer et al., NIM A723(2013)151–162 No beam overlap, detection threshold is ca. 10 keV 5 cm Pb filter between neutron production target and transmission sample	[B]
6. Detector Type Material Surface Dimensions (mm $\times$ mm, diameter in mm, ...)	plastic scintillator EJ 228 200 * 20 mm ²	

Thickness (mm) Distance from sample (m) Detector(s) position relative to neutron beam Detector(s) solid angle	5 mm Sample-detector 818 cm detector in beam 0 deg Neutron beam larger than detector cross section	
7. Sample Type (metal, powder, liquid, crystal) Chemical composition Sample composition (at/b) Temperature Sample mass (g) Geometrical shape (cylinder, sphere, ...) Surface dimension (mm × mm, diameter in mm, ...) Nominal thickness (mm) Containment description Additional comment	gas xenon, 99.998% 0.07762(50) 293 K abs. pressure: 49.9 bar right cylinder 30 mm * 400 mm 393 mm High pressure gas cell stainless steel flat end caps 3 mm thickness	
8. Data Reduction Procedure Dead time correction Back ground subtraction Flux determination (reference reaction, ...) Normalization Detector efficiency Self-shielding Time-of-flight binning	Dead time measured per event, time of flight dependent correction, see R. Beyer et al., NIM A723(2013)151–162 Live time factor 0.88-0.93 Constant background subtracted ca. 80% of which is beam off background Relative measurement no flux determination See Main ref. [A], 3 % uncertainty due to beam fluctuations Cancels in relative measurement URR self shielding correction not applied $20/40.96 = 0.488$ ns bin size from TDC	[B]
9. Response function Initial pulse Target / moderator assembly	Gaussian response function Initial pulse length negligible (5ps) $\Delta L = 0.35$ cm (1 sigma) from detector thickness and beam spot size on neutron production target	

Detector	$\Delta t = 0.30 \text{ ns}$ (1 sigma) time resolution measured from width of bremsstrahlung peak in ToF spectra
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B. DATA FORMAT

Column	Content	Unit	Comment
1	Index Number		Count of data points
2	t	ns	absolute time-of-flight
3	E_u	MeV	Upper limit of kinetic energy of tof bin
4	E_l	MeV	Lower limit of kinetic energy of tof bin
5	E	MeV	Kinetic energy of tof bin (arithmetic mean of E_u, E_l)
6	Transmission		Transmission per time of flight bin
7	Uncorrelated uncertainty		Uncertainty from counting statistics and background subtraction
8	Total cross section	b	Effective total cross section per time of flight bi
9	Uncorrelated uncertainty	b	Uncertainty from counting statistics and background subtraction
10	Time of flight spectrum (Target IN)		Target IN summed over full experiment, rebinned to 20 TDC channels (0.488 ns) dead time corrected before background subtraction
11	Time of flight spectrum (Target OUT)		Target OUT summed over full experiment, rebinned to 20 TDC channels (0.488 ns) dead time before background subtraction
12	Relative background level		Target IN ratio of constant background to ToF spectrum
13	Relative background level		Target OUT ratio of constant background to ToF spectrum

REFERENCES

[A] A.R. Junghans et al., EPJ Web of Conferences 239, 01006 (2020)

<https://doi.org/10.1051/epjconf/202023901006>

[B] R. Beyer et al., NIM A723(2013)151–162

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