Status of Transnational Access Activities

in

EFNUDAT

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EFNUDAT TAA :

Consortium of nuclear data facilities

Nuclear data for waste transmutation systems and innovative reactor design

- dedicated facilities

- non-dedicated facilities
  - strengthen role of nuclear data measurements
  - retain in these institutes a critical level of nuclear data activities
  - maintain the high level of nuclear competence
  - create new research opportunities
  - attract new experimentalists

→ major experimental facilities in Europe involved in nuclear data measurements

AIFIRA	3.5 MV Van de Graaff accelerator	CENBG Bordeaux (France)
BRR	10 MW research reactor	IKI Budapest (Hungary)
LOLITA	3.7 MV Van de Graaff accelerator	FZ Karlsruhe (Germany)
nELBE	40 MeV superconducting electron linac + neutron TOF facility	FZ Dresden (Germany)
PIAF	3.7 MV Van de Graaff accelerator Cyclotron (19 MeV p and d, α)	PTB Braunschweig (Germany)
TSL	Cyclotron (180 MeV p)	UU-TSL Uppsala (Sweden)
CEA	4 MV Van de Graaff accelerator, 7 MV tandem accelerator and 19 MeV electron linac	CEA Bruyéres-le-Chatel (France)
n_TOF	20 GeV proton beam of the PS + spallation neutron source + neutron TOF facility	CERN Geneva (Switzerland/France)
Tandem-ALTO	15 MV tandem and photo-fission source	IPN Orsay (France)
GELINA and VdG	150 MeV electron linac + neutron TOF facility and 7 MV Van de Graaff accelerator	IRMM Geel (Belgium)
NPI	Cyclotron (20 MeV p and d, α)	NPI Řež (Czech Republic)

→ **measurement capabilities :**

quasi-monochromatic neutron beams
high-resolution neutron time-of-flight facilities
thermal neutron beams
charged particle beams
indirect measurements (surrogate reactions)

→ **neutron energy range:**

sub-thermal energies – several hundred MeV

↓

high-quality nuclear data for waste transmutation or GenIV systems

TAA in EFNUDAT

4 015 supplementary data-taking hours in 4 years

20 experiments

TAA budget : 946 k€ ~ 40% of total EFNUDAT budget

TAA scheme: minimum quantity of access offered by each facility

Pool of facilities

- whole budget → Project Coordinator
- common call for proposals
- single PAC → selects best experiments, allocates to best-suited facilities

Contract:

4 015 additional beam hours

20 experiments

6 Calls :

experimental proposals :	41
requested beam time :	6 460 hours
experiments approved :	36
approved beam time :	4 015 hours
experiments cancelled :	2
experiments accomplished :	32 (+ 2 experiments in progress)
beam time delivered :	5 660 hours (98 hours to be delivered)

DoW:

Any type of experiment in the thematic area addressed in the 6th EURATOM Fission Framework programme

Preference will be given to proposals in the areas of
- radioactive waste management
- innovative GenIV nuclear reactor systems

1. Nuclear data for waste transmutation systems and innovative reactor design

- waste transmutation and minimisation, accelerator-driven systems
- improved reactor operation and fuel management
- advanced innovative nuclear energy systems
- nuclear reactor safety

66 %

2. Development of experimental set-ups and techniques needed for these data measurements

- characterisation and calibration of new facilities or set-ups
- validation of innovative measurement methods
- testing and/or calibration of new detector systems
- characterisation of samples

32 %

3. Advanced methods in nuclear technologies, safety and security

- other EURATOM thematic area

2 %

1. Nuclear data for waste transmutation systems and innovative reactor design

First measurements of the neutron capture cross section of ^{231}Pa in the keV region using the activation technique.
A. Plompen (JRC-IRMM) et al. at FZK Van de Graaff

Neutron capture cross sections of ^{235}U in the keV region by activation and detection of ^{236}U by AMS.
A. Wallner (U. Vienna) et al. at Budapest reactor

Measurement of the neutron capture yield of ^{54}Fe, ^{57}Fe, ^{58}Ni, ^{60}Ni and ^{62}Ni.
J. Tain (IFIC, Valencia) et al. at n_TOF

Differential cross sections of elastic and inelastic scattering of 175 MeV neutrons for ADS (^{56}Fe, ^{209}Bi, ^{208}Pb).
F.-R. Lecolley (LPC, Caen) et al. at Uppsala cyclotron

Measurement of differential cross sections of neutron elastic scattering off deuterium using a Time Projection Chamber.
A. Plompen (IRMM, Belgium) et al. at AIFIRA Van de Graaff

(n, xn) cross section measurements on neutron activation detectors used for ADS studies.
V. Wagner (NPI, Řež) et al. at Uppsala cyclotron

Measurements of thermal neutron-induced gamma-ray spectra of stable Fe and Ni isotopes.
F. Gunsing (CEA, Saclay) et al. at Budapest reactor

Neutron prompt gamma ray activation measurements on enriched Hf isotopes.
N. Vasilev (INRNE, Sofia) et al. at Budapest reactor

1. Nuclear data for waste transmutation systems and innovative reactor design (2)

Precise measurements of the fission neutron spectrum for application and fundamental investigation of the neutron emission mechanism.
F.-J. Hambsch (JRC-IRMM) et al. at Budapest reactor

Measurement of the neutron emission spectrum in fission induced by cold neutrons using the neutron activation method.
I. Fabry (IRMM, Belgium) et al. at Budapest reactor

Fission fragment spectrometry by means of the time-of-flight method and fission gamma ray studies.
A. Oberstedt (U Örebro, Sweden) et al. at Budapest reactor

Delayed neutrons measurements for ^{232}Th neutron-induced fission.
D. Doré (CEA, Saclay) et al. at PTB cyclotron

Light-ion production induced by 175 MeV neutrons in uranium.
F.-R. Lecolley (LPC, Caen) et al. at Uppsala cyclotron

Neutron capture and photon strength for $70 < A < 110$.
T. Belgya (II HAS, Budapest) and A. Junghans (FZD, Dresden) et al. at n_ELBE in Dresden and at Budapest reactor

Determination of the photon strength function in ^{196}Pt in joint experiments on photon scattering and on thermal neutron capture.
A. Junghans (FZD, Dresden) and T. Belgya (IKI, Budapest, Hungary) et al. at n_ELBE in Dresden and at Budapest reactor

2. Experimental set-ups and techniques needed for these nuclear data measurements

Spectral distribution of the ANITA white beam facility at TSL.
R. Nolte (PTB, Braunschweig) et al. at Uppsala cyclotron

Characterisation of the neutron beam after installation of the new target station at CERN n_TOF.
R. Nolte (PTB, Braunschweig) and N. Colonna (INFN-Bari) et al. at n_TOF

Definition of a standard field with the ^{7}Li(p,n)^{7}Be reaction at E_p = 1912 keV.
A. Wallner (U Vienna, Austria) et al. at PTB Van de Graaff

Validating the surrogate method applied to capture cross sections.
F.-J. Hambsch (JRC-IRMM, Geel) and M. Aiche (CENBG, Bordeaux) et al. at Orsay Tandem

Test of $LaCl_3$: Ce scintillation detectors for prompt fission γ-ray studies in strong neutron fields.
A. Oberstedt (Örebro University) et al. at Bruyères-le-Chatel Van de Graaff

Efficiency measurements for multigap resistive plate chamber based detectors for high energy neutrons.
D. Bemmerer (FZD, Dresden) et al. at Uppsala cyclotron

Neutron detector efficiency measurement.
X. Ledoux (CEA, Bruyères-le-Châtel) et al. at PTB cyclotron and Van de Graaff

Characterisation of neutron detectors for nuclear technology applications.
D. Cano Ott (CIEMAT, Madrid) et al. at PTB cyclotron and Van de Graaff

Characterisation of an enriched ^{96}Zr sample using PGNAA.
G. Tagliente (INFN-Bari) et al. at Budapest reactor

3. Advanced methods in nuclear technologies, safety and security

RADMON calibration measurements for neutrons of energies between 1 and 20 MeV.
M. Brugger (CERN) et al. at PTB cyclotron and Van de Graaff

Validating the response matrix of the INFN-LNF extended range Bonner sphere spectrometers in quasi mono-energetic high-energy neutron field.
R. Bedogni (INFN-LNF, Frascati) et al. at Uppsala cyclotron

Irradiation for geological thermochronology and application to nuclear data.
L. Tassan-Got (IPNO, France) et al. at Uppsala cyclotron

Presentations at EFNUDAT progress meetings and scientific workshops

- Dresden
- Uppsala
- Budapest
- Geel
- Bruyéres-le-Chatel
- Geneva

Users

external users :	119
supported users :	62
first-time users :	72 %
students :	24 %
user institutes:	36

CEA (Bruyères-le-Châtel), University of Vienna, CIEMAT (Madrid), IFIC (Valencia), LNL-INFN (Legnaro), PTB (Braunschweig), EC-JRC-IRMM (Geel), Technische Universität (Munchen), CEA (Cadarache), CEA (Saclay), NPI (Řež), CENBG (Bordeaux), University of Örebrö, INFN (Bari), ITN (Lisbon), FZD (Dresden), IPNP(Prague), IKI (Budapest), LPC (Caen), KTH (Stockholm), Kyushu University, Chiang Mai University, ESRF (Grenoble), GSI (Darmstadt), ATOMKI (Debrecen), University of Cologne (Köln), FZK (Karlsruhe), ENSICAEN (Caen), IPNO (Orsay), Université Paris-Sud, Technische Universität (Darmstadt), CNRS (Caen), CERN (Geneva), University of Bergen, IFIN-HH (Bucharest), University of Thessaloniki

Facility	In proposal (hours)	PAC decisions (hours)	Delivered (hours)	Hours for free	Delivered/ Supported (%)
AIFIRA	770	258	408	150	158
BRR	800	1246	1442	196	116
LOLITA	375	444	590	146	133
nELBE	250	267	267	0	100
PIAF	240	370	486	116	131
TSL	200	428	690	262	161
CEA	300	100	100	0	100
n_TOF	550	550	1350	800	245
Tandem-ALTO	530	352	425	73	121
Total	**4015**	**4015**	**5758**	**1743**	**143**

Spent TAA budget : 99 %

Pool of TAA

for the interested **external users**:

- a unique entry point for requesting access
- users are directed towards the best suited facility

for the **nuclear data community**:

- experiments are prioritised
- duplications are avoided
- more flexibility when new demands emerge
- efficiency and effectiveness of research programmes

for the **project management**:

- allows reshuffling of beam time ~ priorities
- minimises risks related with cancelling of experiments
- efficient and timely expenditure of the whole TAA budget
- facilitates incorporation of new facilities

Assessment by the PAC

- a consortium which is a solid and structured network of the major nuclear data facilities and their stakeholders,

- scientific quality of the experiments that were proposed was in general very high,

- a number of measurements are of high importance and/or have a high priority in the research fields of interest,

- good response from the nuclear data community to the TAA calls is a clear indication for the usefulness of such a programme,

- it is important that Transnational Access opportunities to the European nuclear data facilities remain possible also beyond 2010.

ERINDA: **European Research Infrastructure for Nuclear Data Applications**

Conclusions in view of ERINDA

- keep pooling system
- extend consortium with new partners
- consolidate participation of young researchers
- increase end-user involvement
- good coordination and delimitation with ANDES and EUFRAT
- education and training

Conclusions

- EFNUDAT TAA fulfilled **all requirements**
  (quality of measurements, beam hours, experiments and budget)

- **sustainable network** of the major neutron data facilities

- contributed to the **effective use** for data for nuclear technology.

- replaced a rather informal approach of beam-time applications
  by **a coherent and systematic approach**, based on high scientific standards.

- **avoided duplications** of experiments.

- focus on scientific **priorities.**

- attracted a large quantity of **first-time users** and **young researchers**.

- contributed to the **visibility** of the activities in the field of nuclear data measurements.

EUFRAT European facility for innovative reactor and transmutation neutron data

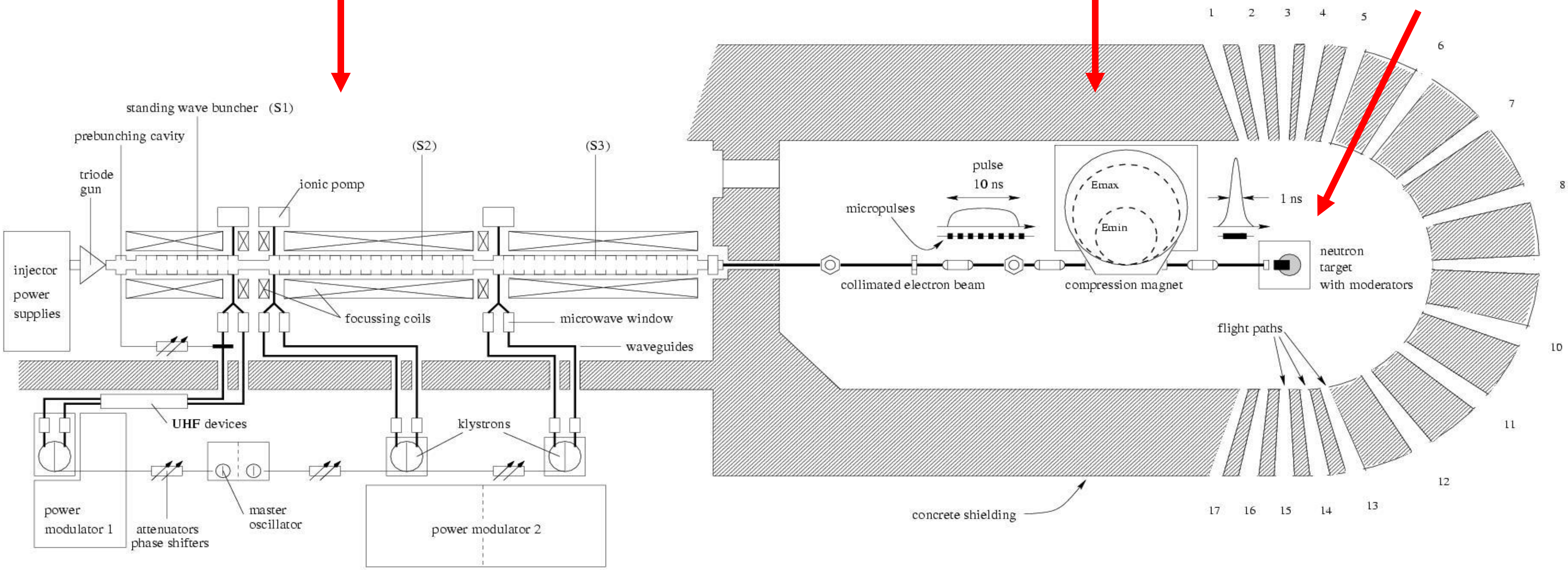
- duration : 4 years (2008 – 2012)
- 4 500 supplementary data-taking hours for external users
  - 3 600 hours at GELINA
  - 900 hours at the VdG

GELINA

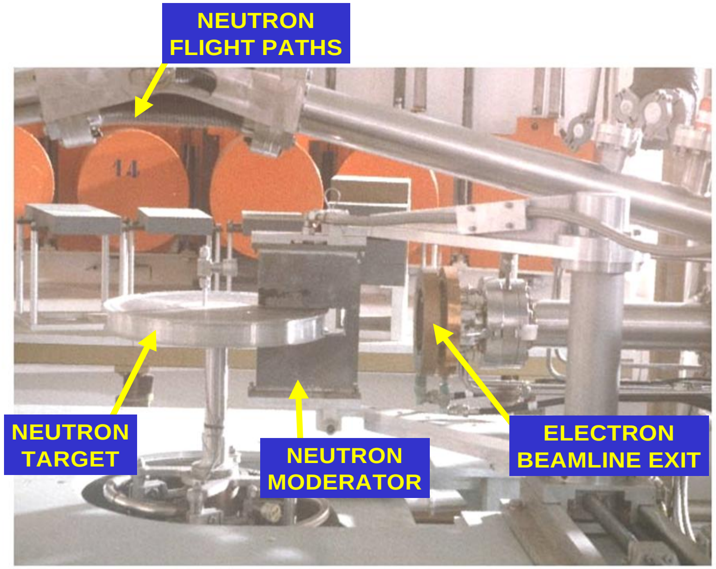
Accelerator Sections

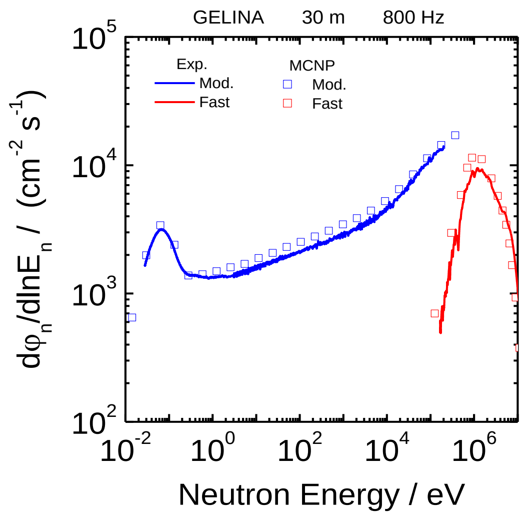
Compression Magnet

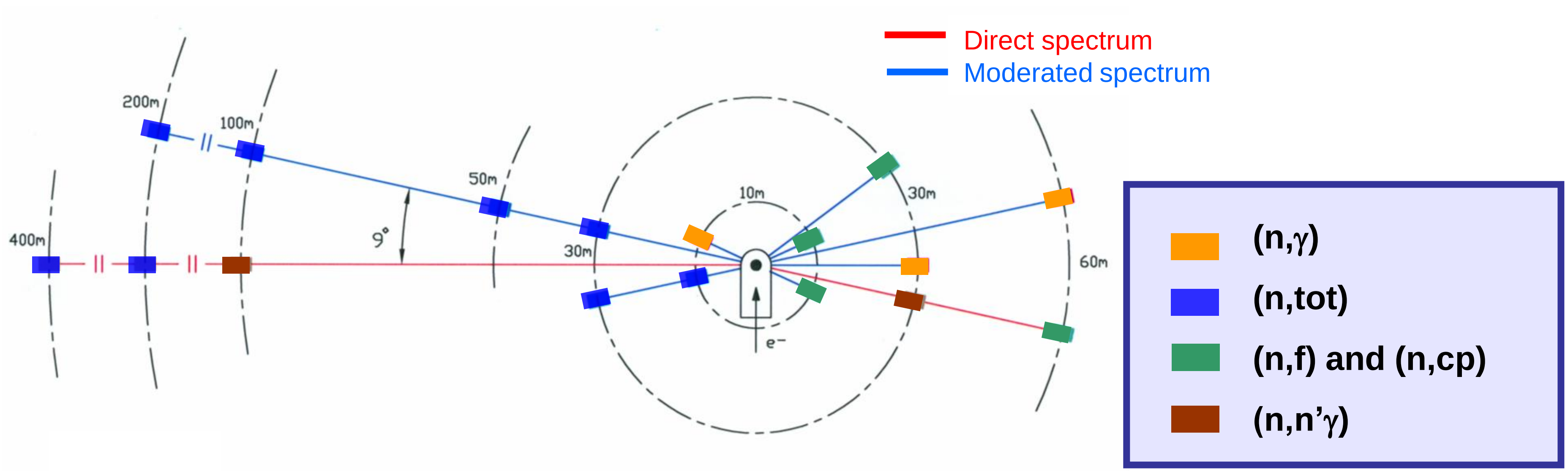
Target



Average current :	75 μA	Repetition frequency :	800 Hz
Max. electron energy :	140 MeV	Pulse width :	1 ns
Mean beam power :	7.5 kW	Neutron intensity :	2.5 x 10^{13} n/s


NEUTRON FLIGHT PATHS
NEUTRON TARGET
NEUTRON MODERATOR
ELECTRON BEAMLINE EXIT


GELINA 30 m 800 Hz
Exp.
Mod.
Fast
MCNP
Mod.
Fast
$d\varphi_n/d\ln E_n$ / (cm^{-2} s^{-1})
Neutron Energy / eV


Direct spectrum
Moderated spectrum
400m
200m
100m
50m
30m
10m
30m
60m
9°
e⁻
(n,γ)
(n,tot)
(n,f) and (n,cp)
(n,n'γ)

Van de Graaff

Continuous and pulsed proton-, deuteron- and helium ion beams

High-voltage : 7 MV
Average ion current : 60 μA
Neutron intensity : 10^8 n/s

Repetition frequency : 2,5 MHz
Pulse width : 2,5 – 1,5 ns

Lithium, deuterium or tritium targets

Continuous and autonomous operation

ONE CALL for PROPOSALS / YEAR

NEXT DEADLINE

SEPTEMBER 30, 2010

http://irmm.jrc.ec.europa/eufrat