



Commission
européenne

APRENDE – WP2

NEW NUCLEAR DATA MEASUREMENTS

Maëlle Kerveno,
IPHC, CNRS, Université de Strasbourg

OUTLINE



OBJECTIVES



PARTNERS & STRUCTURE



DESCRIPTION OF WORK



COMMITMENTS



SUMMARY

OUTLINE



OBJECTIVES



PARTNERS & STRUCTURE



DESCRIPTION OF WORK



COMMITMENTS



SUMMARY

OBJECTIVES



Provide new and accurate experimental nuclear data to be used for improving the accuracy of the evaluated nuclear data relevant to project priorities:

- A. *All aspects of spent nuclear fuel (SNF),*
- B. *Reactor operational characteristics such as reactivity versus burnup, transients, and margins,*
- C. *Advanced reactor and fuel cycle development including small modular reactors (SMR) and GenIV systems based on lead and sodium coolants, molten salts, or an accelerator like MYRRHA,*
- D. *Criticality safety and shielding for safety assessments and safety assessment methodologies,*
- E. *Non-Energy applications, radiation protection.*



Use state-of-the-art detectors and facilities available mainly in Europe **to study various neutron induced reactions** (fission, capture, elastic and inelastic scattering, charged particles emission and decay data)



Tackle challenging measurements listed in HPRL



Enhance exchanges between experimentalists (WP2) and **evaluators** (WP4)

OUTLINE



OBJECTIVES



PARTNERS & STRUCTURE



DESCRIPTION OF WORK



COMMITMENTS



SUMMARY

PARTNERS & STRUCTURE



18 Partners for 186.2 PM & ~1.1 M€

CIEMAT (16.7) , CEA (20.3), ENEA (4), GANIL (2.3), CSIC (11.6), IFIN-HH (8), INFN (10.3), NTUA (7.8), RUG (7.2), UION (5.7), ULODZ (3), UPC (2.8), USE (10), UU (5.6), CNRS (32.5), JRC (26), NPL (AP-3.2), UEDIN (AP-3.2)



WP strongly linked to other WPs

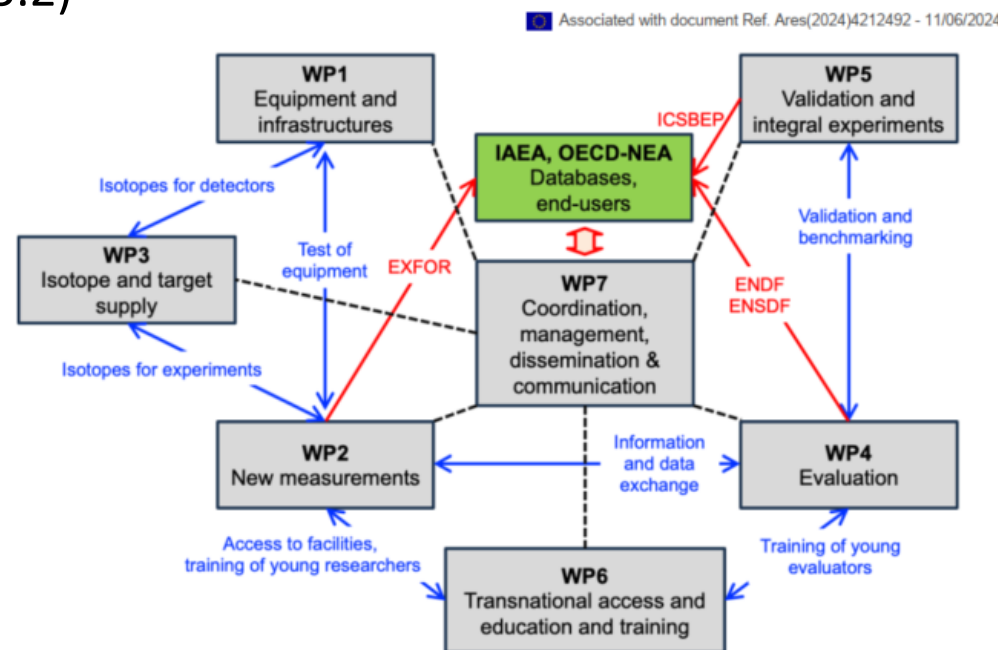


Figure 2: Pert Chart



5 tasks organized around the type of studied reactions

PARTNERS & STRUCTURE



Structure

TASK 2.1 : Decay data,

Task leader : [CSIC](#), Alejandro Algora

Other participants : CNRS

TASK 2.2 : (n, f) cross section measurements and fission yields,

Task leader : [CEA](#), Abdelaziz Chebboubi

Other participants : CIEMAT, CNRS, JRC-Geel, UU, GANIL, NTUA, UION, ULODZ

TASK 2.3 : (n, γ) cross section measurements,

Task leader : [CIEMAT](#), Emilio Mendoza

Other participants : CSIC, INFN, JRC-Geel, ENEA, CEA, USE

TASK 2.4 : Elastic and inelastic scattering cross section measurements,

Task leader : [IFIN-HH](#), Adina Coman

Other participants : JRC-Geel, RUG, CNRS, NTUA

TASK 2.5 : (n, X) and (ch.p., X) reactions,

Task leader : [NPL](#), Michael Bunce

Other participants : UEDIN, USE, CIEMAT, UPC, CSIC, UKAEA, JRC-Geel

PARTNERS & STRUCTURE



Structure

TASK 2.1 : Decay data, CSIC, Alejandro Algora

TASK 2.2 : (n, f) cross section measurements and fission yields, CEA, Abdelaziz Chebboubi

- 2.2.1 Fission yields measurement
- 2.2.2 Neutron induced fission cross section measurements
- 2.2.3 ^{239}Pu fission studies in the resonance range

TASK 2.3 : (n, γ) cross section measurements, CIEMAT, Emilio Mendoza

- 2.3.1 Capture reaction measurements on structural materials
- 2.3.2 Capture reaction measurements on actinides
- 2.3.3 Capture reaction measurements for neutron metrology

TASK 2.4 : Elastic and inelastic scattering cross section measurements, IFIN-HH, Adina Coman

- 2.4.1 (n, xn γ) cross section measurement
- 2.4.2 Elastic and inelastic scattering measurement

TASK 2.5 : (n, X) and (ch.p., X) reactions, NPL, Michael Bunce

- 2.5.1 $^{35}\text{Cl}(n, \text{lcp})$ cross section measurement for advanced reactor concept
- 2.5.2 Cross section measurements for fusion applications

OUTLINE



OBJECTIVES



PARTNERS & STRUCTURE



DESCRIPTION OF WORK



COMMITMENTS



SUMMARY

DESCRIPTION OF WORK



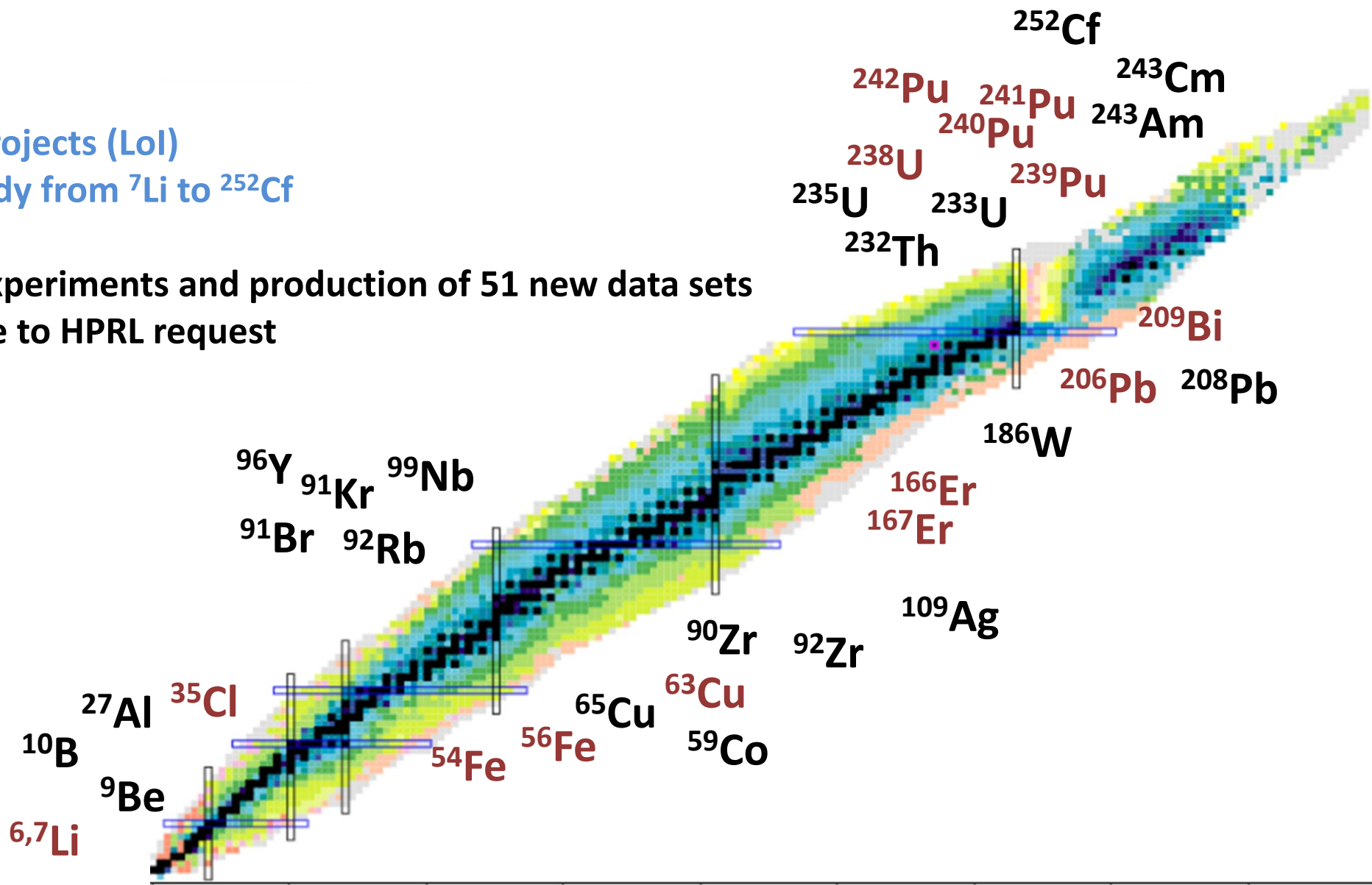
25 measurement projects (LoI)

37 nuclei under study from ${}^7\text{Li}$ to ${}^{252}\text{Cf}$

Expected results :

completion of 40 experiments and production of 51 new data sets

19 data sets relative to HPRL request



DESCRIPTION OF WORK



25 measurement projects (LoI) : 37 nuclei under study from ${}^7\text{Li}$ to ${}^{252}\text{Cf}$

nucleus	reaction
6Li	6Li(d,n)7Be
7Li	7Li(d,2n)7Be
9Be	9Be(α ,n)
10B	10B(α ,n)13N
27Al	27Al(α ,n)
35Cl	35Cl(n,p)
35Cl	35Cl(n,a)
54Fe	54Fe(n,α)51Cr
54Fe	54Fe(n,2n)53Fe
54Fe	54Fe(n,n)
54Fe	54Fe(n,n')
56Fe	56Fe(n,n)
56Fe	56Fe(n,n')

nucleus	reaction
59Co	59Co(n, γ)
63Cu	63Cu(n,g)
65Cu	65Cu(n, γ)
91Br	decay data
91Kr	decay data
92Rb	decay data
96Y	decay data
90Zr	90Zr(n,n' γ)
92Zr	92Zr(n,n' γ)
99Nb	decay data
109Ag	109Ag(n, γ)
167Er	167Er(n,γ)
166Er	166Er(n,γ)
186W	186W(n, γ)

nucleus	reaction
206Pb	206Pb(n,n)
206Pb	206Pb(n,n')
208Pb	208Pb(n,n)
208Pb	208Pb(n,n')
209Bi	209Bi(n,γ)
232Th	232Th(n, γ)
235U	FY
238U	238U(n,γ)
238U	238U(n,2n γ)
238U	238U(n,3n γ)
233U	FY

nucleus	reaction
239Pu	239pu(n,f)
239Pu	FY
239Pu	Pn
239Pu	239pu(n,tot)
240Pu	240pu(n,f)
241Pu	241Pu(n,f)
241Pu	241Pu(n, γ)
242Pu	242Pu(n,f)
243Am	243Am(n,f)
243Cm	FY
252Cf	FY
252Cf	Pn

DESCRIPTION OF WORK



51 new data sets for APRENDE priorities

	A. SNF	B. Burnup, Transients, Margins	C. Advanced reactors and fuel cycles	D. Criticality safety and shielding	E. Non-energy and radioprotection
WP2 new measurements	TAS of 91Kr , 91Br and 99Nb	166,167Er (n, γ)	Fast fission yields of 239Pu , 243Cm , 233U , 235U	63Cu , 65Cu (n, γ) cross sections	59Co , 109Ag , 186W and 232Th (n, γ) MACS
	beta-shape of 92Rb and 96Y decays		240Pu and 242Pu (n,f) cross section		
	231Am (n,f) cross section		209Bi (n, γ) cross section		27Al , 9Be (α ,n)
	241Pu (n,f) and (n, γ)		231Am (n,f) cross section		
	239Pu (n,tot) and 238U (n, γ)		35Cl (n,p) (n, α) cross section		10B (α ,n) 13N
	239Pu (n,f), nu_bar and spectrum		90,92Zr (n,n' γ) and 238U (n,2-3n γ) cross section		
	Thermal fission yields of 235U			206,208Pb and 54,56Fe (n,n) and (n,inel) cross section	6,7Li (d,x) 7Be
				54Fe activation in 252Cf spectrum	

DESCRIPTION OF WORK



TASK 2.1 : Decay data

Lol : e-shape

Measurement of the shape of beta transitions relevant for reactor applications (priority A)

Submitters :

CNRS/SUBATECH : Magali Estienne
CSIC : Alejandro Algora

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
β -Decay of fission product : ^{92}Rb , ^{96}Y	-	Shape of e^- spectrum with e-shape detector	JYFLTRAP @Jyväskylä	NO	-	TAGS (WP2)	D2.14 M45

Lol : TAGS

Total absorption measurements for reactor applications (priority A)

Submitters :

CNRS/SUBATECH : Muriel Fallot
CSIC : Alejandro Algora

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
β -Decay of fission product : ^{91}Kr , ^{99}Nb , ^{91}Br	-	β -decay with DTAS or ROCINANTES TAS detector	JYFLTRAP @Jyväskylä	NO	To be submitted	(NA)2STARS (WP1)	D2.14 M45

DESCRIPTION OF WORK



TASK 2.2 : (n, f) cross section measurements and fission yields

2.2.1 Fission yields measurement (4)

LoI : AFFY
Actinide Fission Fragments Yields
 (priority C)

Sample JRC Geel

Submitters :
CEA/DRF: Diane Doré
GANIL : Jean Eric Ducret
CEA/DES : Olivier Litaize

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{235}\text{U}(n,f)$	0.5 - 40 MeV	FY (mass) & neutron mult., kinetic en. distr. with FALSTAFF (2-arms)	NFS@SPIRAL2	NO	MS5 M18 PAC GANIL	-	D2.6 M45

LoI : LOHENGRIN
Fission mass yield measurement with the LOHENGRIN spectrometer
 (priority A & B)

Submitters :
CNRS/LPSC : Christophe Sage
CEA/DES : Abdelaziz Chebboubi

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{235}\text{U}(n_{th},f)$	thermal	LOHENGRIN + ToF	ILL	NO	Accepted	COREL (WP4)	D2.6 M45

DESCRIPTION OF WORK



TASK 2.2 : (n, f) cross section measurements and fission yields

2.2.1 Fission yields measurement (4)

LoI : VERDI

The 2E-2v fragment spectrometer VERDI - High precision experiments on fission yields and nubar (priority A)

Submitters :

UUppsala: Ali Al-Adili

JRC-Geel : Stephan Oberstedt

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{235}\text{U}(n_{\text{th}},f)$ $^{252}\text{Cf}(sf)$	thermal	mass and energy FY (pre-post neutron), nubar as a function of mass and total kinetic energy with VERDI spectrometer	ILL	NO	To be submitted	-	D2.6 M45

LoI : SENFY

Fission Yields measurements (priority C)

Submitters :

GANIL : Diego Ramos

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{233}\text{U}, ^{239}\text{Pu},$ $^{243}\text{Cm}(n,f)$	fast & epithermal neutron	isotopic FY in inverse kinematics with VAMOS PISTA	GANIL	NO	-	SENFY (WP4)	D2.7 M45

DESCRIPTION OF WORK



TASK 2.2 : (n, f) cross section measurements and fission yields

2.2.2 Neutron induced fission cross section measurements (3)

LoI : EPIC <i>Fission cross section measurements of $^{242,240}\text{Pu}(n,f)$</i> (priority C)					Submitters : CEA/DAM : Audrey Chatillon JRC-Geel : Goedele Sibbens		
Sample JRC Geel							
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{240,242}\text{Pu}(n,f)$	0.7- 100 MeV	XS meas. (rel. to ^{235}U & ^{238}U) with Fission chamber	WNR @LANL	YES	To be submitted	-	D2.8 M45

LoI : PuF <i>^{240}Pu Fission cross section</i> (priority C)					Submitters : CNRS/LP2i : Ludovic Mathieu		
Sample JRC Geel							
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{240}\text{Pu}(n,f)$	1 – 3 MeV	XS meas. (rel. to H(n,p)) with Solar cells	MONNET @JRC-Geel	YES	To be submitted	-	D2.8 M45

DESCRIPTION OF WORK



TASK 2.2 : (n, f) cross section measurements and fission yields

2.2.2 Neutron induced fission cross section measurements (3)

LoI : SOFIA

Study Of Fission cross section on ^{243}Am (SOFIA)
(priority C)

Sample JRC Geel

Submitters :

NTUAthens : Roza Vlastou

Uioannina : Nikolaos Patronis

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{243}\text{Am}(n,f)$	thermal -hundred of MeV	XS meas. (rel. to $^{235}\text{U}(n,f)$, $^{238}\text{U}(n,f)$ and $^{10}\text{B}(n,\alpha)$) with micromegas det.	EAR1 & EAR2 @n_TOF	YES	-	-	D2.10 M45

DESCRIPTION OF WORK



TASK 2.2 : (n, f) cross section measurements and fission yields

2.2.3 ^{239}Pu fission studies in the resonance range (2)

LoI : Pu239 <i>Toward new measurements and evaluation of the Pu239 resonance parameters</i> (priority A & B)					Submitters : CIEMAT : Emilio Mendoza Ulodz : Jaroslaw Perkowski		
					Sample JRC Geel		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{239}\text{Pu}(n,f)$	low energy region resonance range	XS meas. with Fission chamber (used at n-TOF in the TAC)	GELINA @JRC-Geel	YES	To be submitted MS6 M24	Pu239 (WP4)	D2.9 M45

LoI : REMUS <i>Resonance Prompt Neutron Multiplicity in Pu239 Fission</i> (priority A & B)					Submitters : Uppsala : Andreas Solders JRC-Geel : Stephan Oberstedt CEA/DES : Olivier Litaize		
					Sample JRC Geel		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{239}\text{Pu}(n,f)$	0.3 - 100 eV (RRR)	nubar % $^{252}\text{Cf}(sf)$ nubar & PNS with SCINTIA, LaBr3 and IC	GELINA @JRC-Geel	YES	To be submitted MS6 M24		D2.9 M45

DESCRIPTION OF WORK



TASK 2.3 : (n, γ) cross section measurements

2.3.1 Capture reaction measurements on structural materials (3)

Lol : BINGO <i>$^{209}\text{Bi}(n,\gamma)$ cross section measurement at n_TOF (priority C)</i>					Submitters : IFIC : Javier Balibrea Correa		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
$^{209}\text{Bi}(n,\gamma)$ $^{209}\text{Bi}(n,\gamma)/^{209\text{m}}\text{Bi}(n,\gamma)$ BR	thermal - 300 keV neutron resonance	TOF & Pulse height weighting method, Activation (XS & BR)	EAR2@n_TOF HISPANOS@CNA	YES	Accepted @n-TOF	-	D2.11 M45

Lol : ErCapture <i>Measurement and analysis of the capture cross section of Er-166 and Er-167 (priority B)</i>					Submitters : CIEMAT : Victor Alcayne Aicu INFN : Cristian Massimi		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
$^{166,167}\text{Er}(n,\gamma)$	0,02 - 100 keV	TAC & C6D6	EAR1 & EAR2@n_TOF	YES	-	-	D2.11 M45

DESCRIPTION OF WORK



TASK 2.3 : (n, γ) cross section measurements

2.3.1 Capture reaction measurements on structural materials (3)

LoI : RAMEN <i>Neutron cross sections for ^{63}Cu and ^{65}Cu</i> (priority D)						Submitters : INFN : Cristian Massimi ENEA : Donato Maurizio Castelluccio	
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{63,65}\text{Cu}(n,\gamma)$	thermal - 300 keV	XS with C6D6	EAR @n_TOF	YES/NO	To be submitted ? MS7 M24	-	D2.11 M45

DESCRIPTION OF WORK



TASK 2.3 : (n, γ) cross section measurements

2.3.2 Capture reaction measurements on actinides (3)

Lol : Cap-Fiss-Pu241 <i>Measurements of the ^{241}Pu fission and capture cross sections at GELINA and n_TOF (priority A)</i> Sample JRC Geel					Submitters : CEA/DRF : Emmeric DUPONT CEA/DES : Olivier Serot		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
$^{241}\text{Pu}(n,f)$ $^{241}\text{Pu}(n,\gamma)$	En < 1 MeV En < 100 keV	Fission XS and fission to capture ratio with TAC & FC	GELINA@JRC-Geel EAR1@n_TOF	YES	Accepted	-	D2.12 M45

Lol : Pu239 <i>Toward new measurements and evaluation of the Pu239 resonance parameters (priority A & B)</i> Sample JRC Geel					Submitters : CEA/DES : Gilles Noguere JRC-Geel : Carlos Paradela		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
$^{239}\text{Pu}(n,tot)$	Resonance range	Transmission	GELINA @JRC-Geel	YES	To be submitted MS6 M24	Pu239 (WP4)	D2.9 M45

DESCRIPTION OF WORK



TASK 2.3 : (n, γ) cross section measurements

2.3.2 Capture reaction measurements on actinides (3)

LoI : U238_NG_Meas

Measurement of the U-238 neutron capture cross section at the n_TOF facility (priority A)

Submitters :

CIEMAT : Emilio Mendoza

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{238}\text{U}(n,\gamma)$	thermal - 20 keV	C6D6	EAR1@n_TOF	YES	Accepted	-	D2.12 M45

DESCRIPTION OF WORK



TASK 2.3 : (n, γ) cross section measurements

2.3.3 Capture reaction measurements for neutron metrology

Lol : M2nM

MACS Measurements for Neutron Metrology
(priority E)

Submitters :

Usevilla/CNA : Carlos Guerrero

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
$^{59}\text{Co}(n,\gamma)$, $^{109}\text{Ag}(n,\gamma)$, $^{186}\text{W}(n,\gamma)$, $^{232}\text{Th}(n,\gamma)$	kt=30 keV	SACS _{30keV} with activation	HISPANOS@CNA	NO	accepted	-	D2.2 M36

DESCRIPTION OF WORK



TASK 2.4 : Elastic and inelastic scattering cross section measurements

2.4.1 $(n, xn\gamma)$ cross section measurement

LoI : NNNXNXS <i>(n,n) and $(n,xn\gamma)$ cross section measurements</i> (priority C & D)					Submitters : IFIN-HH : Adina Coman CNRS/IPHC : Maëlle Kerveno JRC-Geel : Carlos Paradela		
Reaction	Energy range	Method /detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{92}\text{Zr}(n,n'\gamma)$,	<20 MeV	GAINS	GELINA@JRC-Geel	NO	to be submitted MS6 M24	ZEN (WP4)	D2.13
$^{90}\text{Zr}(n,n'\gamma)$,	<20 MeV	GRAPhEME	GELINA@JRC-Geel		-	ZEN (WP4)	M45
$^{238}\text{U}(n,2-3n\gamma)$	6-40 MeV	MAELS	NFS@SPIRAL2		In progress		

DESCRIPTION OF WORK



TASK 2.4 : Elastic and inelastic scattering cross section measurements

2.4.2 Elastic and inelastic scattering measurement

LoI : NNNXNXS

(n,n) and (n,xn γ) cross section measurements
(priority C & D)

Submitters :

Ugrogenen : Myroslav Kavatsyu
NTUAthens : Maria Diakaki
JRC-Geel : Carlos Paradela

Reaction	Energy range	Method /detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{54,56}\text{Fe}(n,n'), (n,n)$	<20 MeV	ELISA	GELINA@JRC-Geel	NO/YES	-	NNNXNXS (WP4)	D2.13
$^{206,208}\text{Pb}(n,n'), (n,n)$	<20 MeV			YES/NO	To be sub. MS6 M24	NDELISA (WP1)	M45

DESCRIPTION OF WORK



TASK 2.5 : (n, X) and (ch.p., X) reactions

2.5.1 $^{35}\text{Cl}(n, lcp)$ cross section measurement for advanced reactor concept (2)

Lol : 35clxs $^{35}\text{Cl}(n,p;\alpha)^{35}\text{S}$ cross section measurement in the energy range $E_n=0.5-5$ MeV (priority C)						Submitters : NPL : Giuseppe Lorusso	
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
$^{35}\text{Cl}(n,p)$ $^{35}\text{Cl}(n,\alpha)$	0.1-5 MeV	XS by activation	NPL	YES NO	To be submitted	-	D2.1 M36
Lol : More Measurement of the $^{35}\text{Cl}(n,p)^{35}\text{S}$ cross section relevant for fast chloride molten salt reactor design (priority C)					Submitters : Uedinburgh : Claudia Lederer-Woods JRC-Geel : Cristiano Fontana		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other Lol	Deliverable
$^{35}\text{Cl}(n,p)$	1.4 MeV - 3 MeV	XS with double sided silicon strip detectors	MONNET@JRC-Geel	YES	To be submitted	-	D2.1 M45

DESCRIPTION OF WORK



TASK 2.5 : (n, X) and (ch.p., X) reactions

2.5.2 Cross section measurements for fusion applications (3)

LoI : He3Be7@DONES <i>Assessing the NEA-HPRL request for measuring the deuteron-induced production of ^3H and ^7Be in $^6,7\text{Li}$ up to 40 MeV (priority E)</i>					Submitters : Usevilla/CNA : Carlos Guerrero		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^6\text{Li}(d,n)^7\text{Be}$ $^7\text{Li}(d,2n)^7\text{Be}$	5 - 40 MeV	differential cross sections for ^7Be production via activation	HISPANOS@CNA NFS@SPIRAL2	YES YES	To be submitted MS5 M24	-	D2.5 M45

LoI : XS10BAN <i>$^{10}\text{B}(\alpha,n)^{13}\text{N}$ cross section measurement and evaluation for plasma diagnostics applications (priority E)</i>					Submitters : UKAEA : Ivan Kodeli NPL : Giuseppe Lorusso		
Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{10}\text{B}(\alpha,n)^{13}\text{N}$	1 – 6 MeV	XS with moderated ^3He detector ELIGANT-TN	IFIN-HH	NO	To be submitted	-	D2.4 M45

DESCRIPTION OF WORK



TASK 2.5 : (n, X) and (ch.p., X) reactions

2.5.2 Cross section measurements for fusion applications (3)

LoI : MANY

**Measurement of (α, xn) reactions yields
(priority E)**

Submitters :

CIEMAT : Trino Martinez Perez

UPC : Guillem Cortes Rossell

CSIC : Ariel Tarifeño

Usevilla/CNA : Carlos Guerrero

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{27}\text{Al}(\alpha, n)$	up to 9 MeV	activation & MONSTER detector (time of flight) miniBELEN	HISPANOS@CNA CMAM	NO	To be submitted	-	D2.4 M45
$^{27}\text{Al}(\alpha, n)$	2 - 10 MeV						
$^9\text{Be}(\alpha, n)$	2 - 10 MeV						
$^9\text{Be}(\alpha, n)$	up to 9 MeV						

DESCRIPTION OF WORK



TASK 2.5 : (n, X) and (ch.p., X) reactions

2.5.3 Cross section measurements for dosimetry

LoI : NPL_D

Iron reaction cross-section measurements for dosimetry at the National Physical Laboratory (priority E)

Submitters :

NPL : Michael Bunce

Reaction	Energy range	Method/detector	Facility	HPRL	Exp. status	Link with other LoI	Deliverable
$^{54}\text{Fe}(n,\alpha)^{51}\text{Cr}$ $^{54}\text{Fe}(n,2n)^{53}\text{Fe}$	15,5 - 19 MeV & ^{252}Cf	activation	NPL	YES	-	-	D2.3 M36

OUTLINE



OBJECTIVES



PARTNERS & STRUCTURE



DESCRIPTION OF WORK



COMMITMENTS



SUMMARY

COMMITMENTS



Milestones

Only 3 milestones to verify that the experiments performed at neutron facility with competitive beam time request have been accepted before the half of the project

MS5	Experiments accepted at NFS	WP2	3 - CEA	Report to the WP lead	M18
MS6	Experiments accepted at JRC-Geel	WP2	35 - CNRS	Report to the WP lead	M24
MS7	Experiments accepted at n_TOF	WP2	6 - ENEA	Report to the WP lead	M24

COMMITMENTS



Deliverables

14 reports have to be prepared.

If possible (ready) produced data have to be send to EXFOR before the end of the project.

(NB: the last deliverable date is M45 and not M48!)

#	Deliverable Title	Lead	name	Type	Diss. level	due date in Months	tasks	LoI involved	institutions
D2.1	Report on measurement results for $^{35}\text{Cl}(n, \text{lcp})$ reaction Cross section	UEdinburg	C. Lederer-Woods	Report	public	M36	5 : (n,X) & (lcp, X) reaction studies	35CIXS, More	NPL, UEdinburgh
D2.2	report on measurements for SACS measurements on ^{59}Co, ^{109}Ag, ^{186}W, ^{232}Th	USevilla	C. Guerrero	Report	public	M36	3 : (n,g) cross section measurements	M2NM	USevilla
D2.3	Report on the alpha and neutron yield in neutron induced reactions on ^{54}Fe	NPL	M. Bunce	Report	public	M36	5 : (n,X) & (lcp, X) reaction studies	NPL-D	NPL
D2.4	Report on measurement results for ^{27}Al, ^9Be, $^{10}\text{B}(\alpha, n)$ cross section	UPC	G. Cortes Rossell	Report	public	M45	5 : (n,X) & (lcp, X) reaction studies	MANY, XS10BAN	CIEMAT, UPC, IFIC, USevilla, NPL, UKAEA
D2.5	Report on the Be production in deuteron induced reaction on Li	USevilla	C. Guerrero	Report	public	M45	5 : (n,X) & (lcp, X) reaction studies	H3Be7@D ONES	USevilla

COMMITMENTS



Deliverables

14 reports have to be prepared.

If possible (ready) produced data have to be send to EXFOR before the end of the project.

(NB: the last deliverable date is M45 and not M48!)

#	Deliverable Title	Lead	name	Type	Diss. level	due date in Months	tasks	LoI involved	institutions
D2.6	Report on thermal and fast fission yields and nu-bar in 235U(n,f)	CEA	A. Chebboubi	Report	public	M45	2: (n,f) cross section measurements and fission yields	AFFY, LOHENGRIN, VERDI	CEA, CNRS, UUppsala
D2.7	Report on measurement results for fission yields of 239Pu, 243Cm, 233U	GANIL	D. Ramos	Report	public	M45	2: (n,f) cross section measurements and fission yields	SENFY	GANIL
D2.8	Report on measurements for 242Pu and 240Pu(n,f) cross section	CNRS	L. Mathieu	Report	public	M45	2: (n,f) cross section measurements and fission yields	EPIC, PuF	CEA,CNRS
D2.9	Report on 239Pu(n,f) and (n,tot) measurements	CEA	G. Noguere	Report	public	M45	2: (n,f) cross section measurements and fission yields	Pu239, REMUS	CEA, CIEMAT, Ulodz, UUppsala
D2.10	Report on measurements for 243Am(n,f) cross section	NTUAthens	R. Vlastou	Report	public	M45	2: (n,f) cross section measurements and fission yields	SOFIA	NTUAthens, Uioannina

COMMITMENTS



Deliverables

14 reports have to be prepared.

If possible (ready) produced data have to be send to EXFOR before the end of the project.

(NB: the last deliverable date is M45 and not M48!)

#	Deliverable Title	Lead	name	Type	Diss. level	due date in Months	tasks	LoI involved	institutions
D2.11	Report on (n, γ) cross section on ^{209}Bi , $^{166,167}\text{Er}$ and $^{63,65}\text{Cu}$	INFN	C. Massimi	Report	public	M45	3 : (n, g) cross section measurements	BINGO, ERCapture, RAMEN	IFIC, CIEMAT, INFN
D2.12	Report on (n, g) measurements on actinides (^{238}U , ^{241}Pu)	CIEMAT	E. Mendoza	Report	public	M45	3 : (n, g) cross section measurements	CAP-FISS-Pu241, U238_NG_Meas,	CEA, CIEMAT, Ulodz, Uppsala
D2.13	Report on (n, el) and $(n, inel)$ data of $^{54,56}\text{Fe}$, $^{90,92}\text{Zr}$, $^{206,208}\text{Pb}$, ^{238}U	IFIN-HH	A. Olacel	Report	public	M45	4 : elastic and inelastic scattering cross section measurements	NNNXNXS	IFIN-HH, CNRS, Ugroningen, NTUAthens
D2.14	report on β -decay studies : ^{92}Rb , ^{96}Y , ^{91}Br , ^{91}Kr , ^{99}Nb	IFIC	A. Algora	Report	public	M45	1 : Decay data	e-shape, TAGS	IFIC, CNRS

OUTLINE



OBJECTIVES



PARTNERS & STRUCTURE



DESCRIPTION OF WORK



COMMITMENTS



SUMMARY

SUMMARY



Very ambitious WP which must produce a significant amount of accurate new experimental data



WP management

Tables with all the information (WP structure, milestones, deliverables, contacts) have been already sent to all Lol's submitters. Consider it as a "summary map" of all WP2 works. KEEP IT! (also on indico)

APRENDE WP2 : New nuclear data measurements											
WP leader : CNRS - Maëlle Kerveno											
TASK leader											
UET	TASK 1: Decay data	TASK 1: Decay data	Lol Acronym	Country	Submitter	Institute	DELIVERABLE	DELIVERABLE	DELIVERABLE	MILESTONE	MILESTONE
β-decay measurements	β-decay measurements	Measurement of the shape of the fission cross-section for reactor applications	IRAP	Spain	Rafael Barrera	CSIC	D2.14 - Report on the experimental results of the β-decay measurements	CSIC	M45	-	-
		Total absorption measurements for reactor applications	TACR	Spain	Rafael Barrera	CSIC					
TASK leader											
UET	TASK 2.2 : (n, f) cross section measurements and fission yields	TASK 2 : (n, f) cross section measurements and fission yields	Lol Acronym	Country	Submitter	Institute	DELIVERABLE	DELIVERABLE	DELIVERABLE	MILESTONE	MILESTONE
fission yields measurement	fission yields measurement	Multiple Fission Products Yields	IPPY	France	Eric Bell	CEA	D2.6 - Report on the experimental results of the fission yields measurements	CEA	M45	M55 - Experimental results of the fission yields measurements	M18
		Fission cross-sections measured with the ILL-ENGIN experiment	ENGIN	France	Mathieu Gheeraert	CEA					
		The IFMIF-DEMO experiment (IFMIF) - High resolution experiments on fission yields and yields	IFMIF	Spain	Jose Garcia	IFMIF					
		Fission yields measurements	IFMIF	France	Eric Bell	CEA					
neutron induced fission cross section measurements	neutron induced fission cross section measurements	Fission cross-section measurements of ²³⁵ U(n,f)	ENFC	France	André GHEYSSER	CEA	D2.8 - Report on the experimental results of the fission cross-section measurements	CNRS	M45	-	-
		238Pu fission cross-section	238Pu	France	Lucien FAHREND	ORNL					
		Study of fission cross-sections of ²³⁸ U(n,f)	238U	Spain	Rafael Barrera	CSIC					
239Pu fission studies in the resonance range	239Pu fission studies in the resonance range	Fission cross-sections and yields of the ²³⁹ Pu resonance structure	FR239	France	Eric Bell	CEA	D2.9 - Report on the experimental results of the ²³⁹ Pu fission cross-sections and yields	CEA	M45	M56 - Experimental results of the ²³⁹ Pu fission cross-sections and yields	M24
		Resonance Fission Products Yields for ²³⁹ Pu	FR239	Spain	Rafael Barrera	IFMIF					
TASK leader											
UET	TASK 2.3 : (n, γ) cross section measurements	TASK 3 : (n, γ) cross section measurements	Lol Acronym	Country	Submitter	Institute	DELIVERABLE	DELIVERABLE	DELIVERABLE	MILESTONE	MILESTONE
Capture reaction measurements on structural materials	Capture reaction measurements on structural materials	²³⁸ U(n,γ) cross-section measurement of ²³⁸ U	IR238	Spain	José Barrera	CSIC	D2.11 - Report on the experimental results of the capture reaction measurements on structural materials	INFN	M45	M57 - Experimental results of the ²³⁸ U(n,γ) cross-section measurement	M24
		Measurement of the capture cross-sections of ²³⁸ U and ²³⁵ U	IR238	Spain	Mathieu Gheeraert	ORNL					
		Neutron cross-sections for ²³⁸ U and ²³⁵ U	IR238	Spain	Mathieu Gheeraert	ORNL					
Capture reaction measurements on actinides	Capture reaction measurements on actinides	Measurement of the ²³⁸ U(n,γ) fission cross-section of ²³⁸ U and ²³⁵ U	IR238	France	Eric Bell	CEA	D2.12 - Report on the experimental results of the capture reaction measurements on actinides	CIEMAT	M45	M57 - Experimental results of the ²³⁸ U(n,γ) fission cross-section measurement	M24
		Measurement of the ²³⁸ U(n,γ) fission cross-section of ²³⁸ U and ²³⁵ U	IR238	Spain	Mathieu Gheeraert	ORNL					
Capture reaction measurements on actinides	Capture reaction measurements on actinides	Measurement of the ²³⁸ U(n,γ) fission cross-section of ²³⁸ U and ²³⁵ U	IR238	France	Eric Bell	CEA	D2.13 - Report on the experimental results of the capture reaction measurements on actinides	CEA	M45	M58 - Experimental results of the ²³⁸ U(n,γ) fission cross-section measurement	M24
		Measurement of the ²³⁸ U(n,γ) fission cross-section of ²³⁸ U and ²³⁵ U	IR238	Spain	Mathieu Gheeraert	ORNL					



SUMMARY



Very ambitious WP which must produce a significant amount of **accurate new experimental data**



WP management

- Tables with all the information (WP structure, milestones, deliverables, contacts) have been already sent to all Lol's submitters. Consider it as a “summary map” of all WP2 works. KEEP IT! (also on indico)
- Task leaders will be key people for efficient management.**

SUMMARY



Very ambitious WP which must produce a significant amount of **accurate new experimental data**



WP management

- Tables with all the information (WP structure, milestones, deliverables, contacts) have been already sent to all Lol's submitters. Consider it as a "summary map" of all WP2 works. KEEP IT! (also on indico)
- Task leaders will be key people for efficient management.
- Remote meetings**, between **WP leader and task leaders (and/or Lol's submitters)** will be organized **every 6 months** to follow and monitor the progress of each task. **First in January 2025!**

SUMMARY



Very ambitious WP which must produce a significant amount of **accurate new experimental data**



WP management

- Tables with all the information (WP structure, milestones, deliverables, contacts) have been already sent to all Lol's submitters. Consider it as a "summary map" of all WP2 works. KEEP IT! (also on indico)
- Task leaders will be key people for efficient management.
- Remote meetings, between WP leader and task leaders (and/or Lol's submitters) will be organized every 6 months to follow and monitor the progress of each task. First in January 2025!
- In case of major difficulties** during the execution of the project, **inform as soon as possible**.

SUMMARY



Very ambitious WP which must produce a significant amount of **accurate new experimental data**



WP management

- Tables with all the information (WP structure, milestones, deliverables, contacts) have been already sent to all Lol's submitters. Consider it as a "summary map" of all WP2 works. KEEP IT! (also on indico)
- Task leaders will be key people for efficient management.
- Remote meetings, between WP leader and task leaders (and/or Lol's submitters) will be organized every 6 months to follow and monitor the progress of each task.
- In case of major difficulties during the execution of the project, inform as soon as possible.



A desire to **strengthen exchanges between experimentalists** and **evaluators** to streamline and **improve the overall evaluation process**

- Organization of common WP2-WP4 workshops during the APRENDE project :
exchanges on "good practices", on common studied (meas. & eval.) nuclei, ...

SUMMARY



SUMMARY per PARTNERS

L = Lead beneficiary

Partner	CNRS	JRC	CEA	CIEMAT	CSIC	INFN	USE	IFIN-HH
PM	32.5	26	20.3	16.7	11.6	10.3	10	8
Task/sub-task	2.1- 2.2.1- 2.2.2- 2.4.1	2.2.2- 2.2.3- 2.3.2- 2.4.1- 2.4.2	2.2.1- 2.2.2- 2.2.3- 2.3.2	2.2.3- 2.3.1- 2.3.2- 2.5.2	2.1- 2.3.1- 2.5.2	2.3.1	2.3.3- 2.5.2	2.4.1
Responsibilities	WP Leader; D2.8 L; MS6 L		T leader 2.2; D2.9 & D2.6 L; MS5 L	T leader 2.3; D2.12 L;	T leader 2.1; D2.14 L	D2.11 L;	D2.2 & D2.5 L;	T leader 2.4; D2.13 L
Contribution to Deliverable	D2.6 D2.8 D2.13	D2.8 D2.9 D2.13	D2.6 D2.8 D2.9 D2.12	D2.4 D2.9 D2.11 D2.12	D2.4 D2.11 D2.14	D2.11	D2.2 D2.4 D2.5	D2.13

SUMMARY



SUMMARY per PARTNERS

L = Lead beneficiary

Partner	NTUA	RUG	UION	UU	ENEA	NPL	UEDIN	ULODZ	UPC	GANIL
PM	7.8	7.2	5.7	5.6	4	3.2	3.2	3	2.8	2.3
Task/sub-task	2.2.2- 2.4.2	2.4.2	2.2.2	2.2.1 2.2.3	2.3.1	2.5.1- 2.5.3	2.5.1	2.2.3	2.5.2	2.2.1
Responsibilities	D2.10 L				MS7 L	T Leader 2.5; D2.3 L	D2.1 L		D2.4 L	D2.7 L
Contribution to Deliverable	D2.10 D2.13	D2.13	D2.10	D2.6 D2.9	D2.11	D2.1 D2.3	D2.1	D2.9	D2.4	D.7

THANK YOU



WISH list

- A fruitful collaboration,
- Efficient cooperation for reporting,
- Nice and significant results !!!

Merci