NFRP 2018 - SANDA

SUPPLYING ACCURATE NUCLEAR DATA FOR ENERGY AND NON-ENERGY APPLICATIONS 2019-2023

WORKPACKAGE 1 –

Developments of new innovative detector devices

Maëlle Kerveno, CNRS/IPHC, Strasbourg (France)

SANDA review meeting, 30 November 2022, remotly

OUTLINE

- Introduction : WP 1 description
- At M36 : WP 1 achievements
- WP 1 milestones and deliverables status
- Conclusion

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- **Introduction : WP 1 description**
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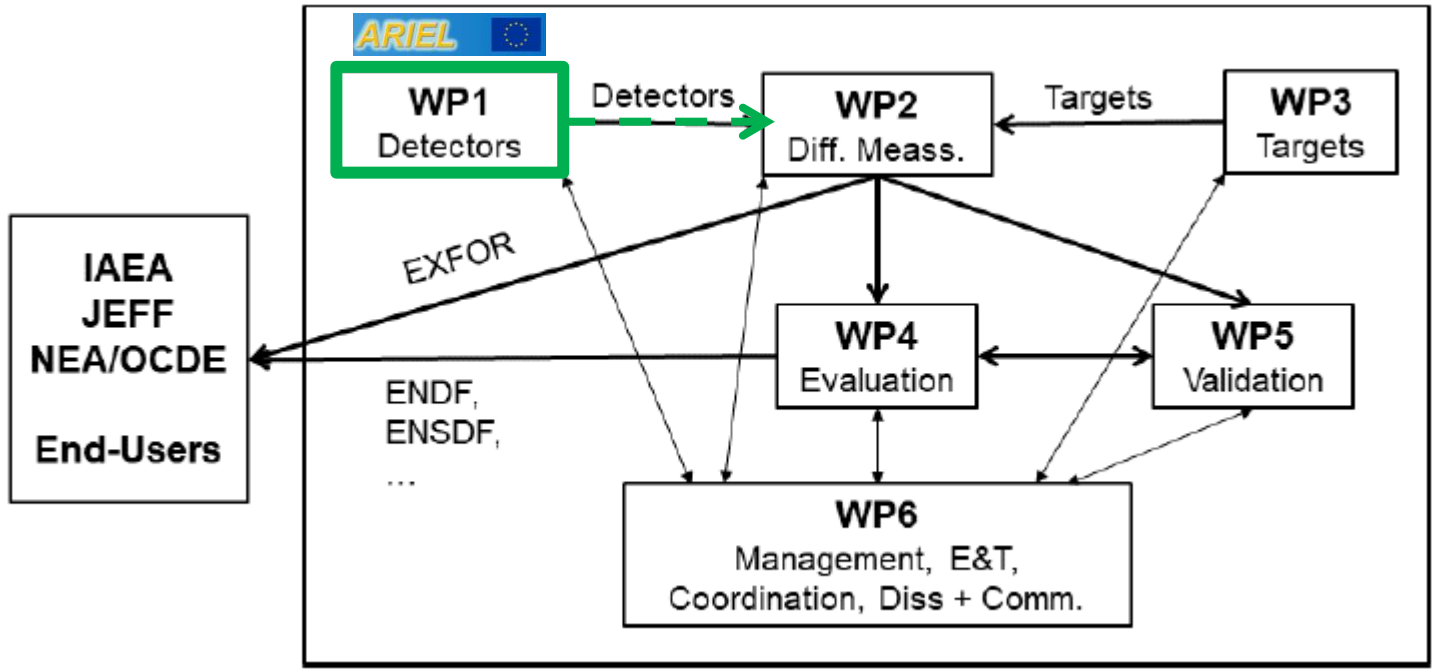
WP 1 in SANDA : Developments of new innovative detector devices

Support the **development of new measurement devices**
which allow **high precision measurements**
for Energy and N.E. applications

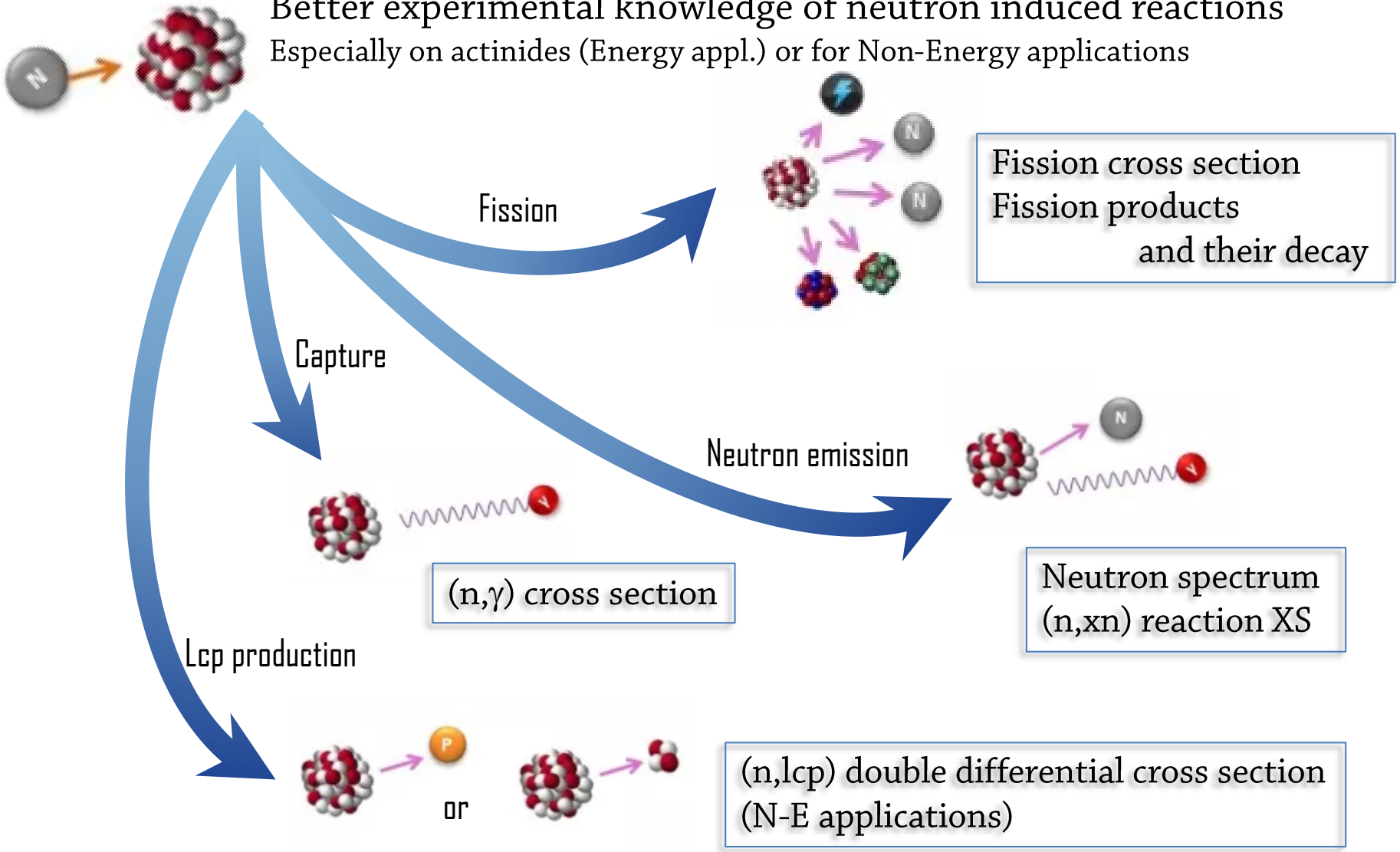
-> for an immediate use in the frame of WP2 (~1/3 of tasks)
-> for more long term experiments which need more R&D



WP 1 Physics case

Better experimental knowledge of neutron induced reactions

Especially on actinides (Energy appl.) or for Non-Energy applications



Fission cross section
Fission products
and their decay

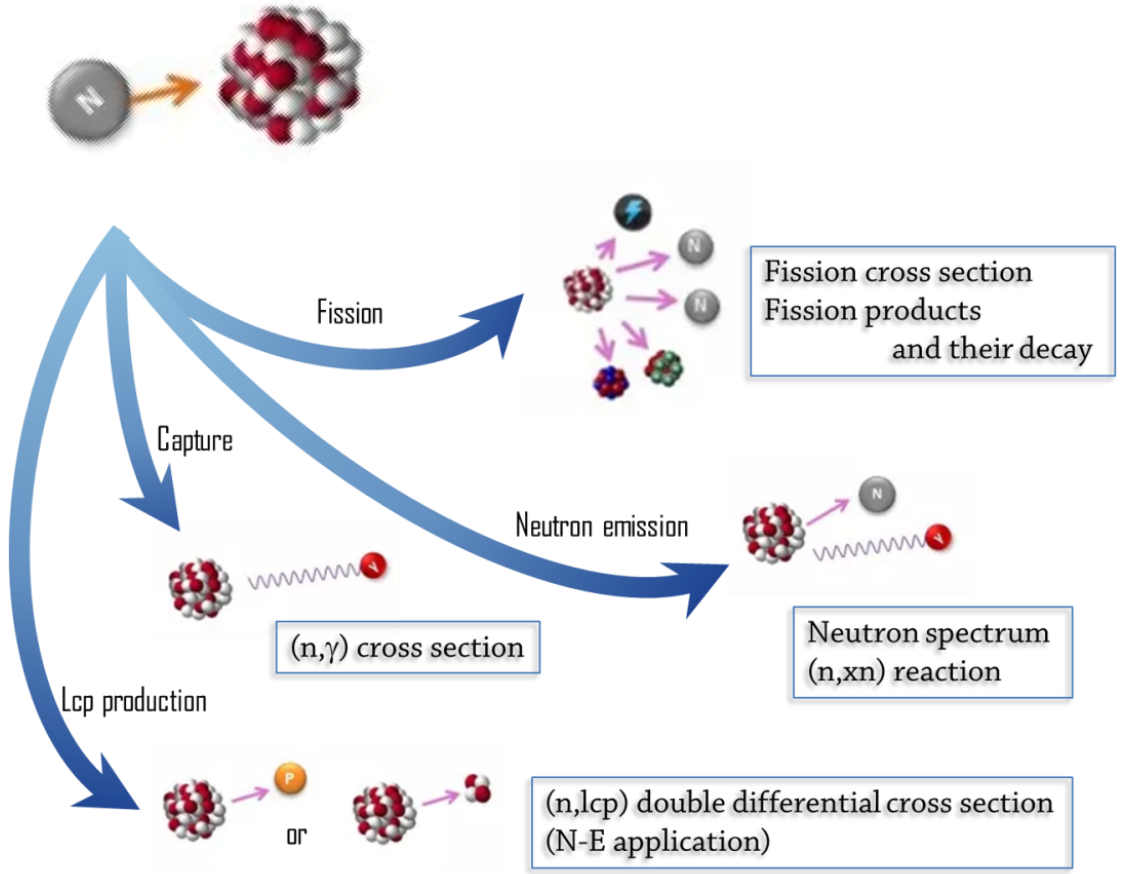
(n,γ) cross section

Neutron spectrum
(n,xn) reaction XS

(n,lcp) double differential cross section
(N-E applications)

WP 1 Physics case

Better experimental knowledge of neutron induced reactions
Especially on actinides (Energy appl.) or for Non-Energy applications



Experimental challenges

For new evaluations

-> new measurements
with reduced uncertainties (even on already studied isotopes)
-> new experiments more discriminating and binding for theoretical models

Actinide samples

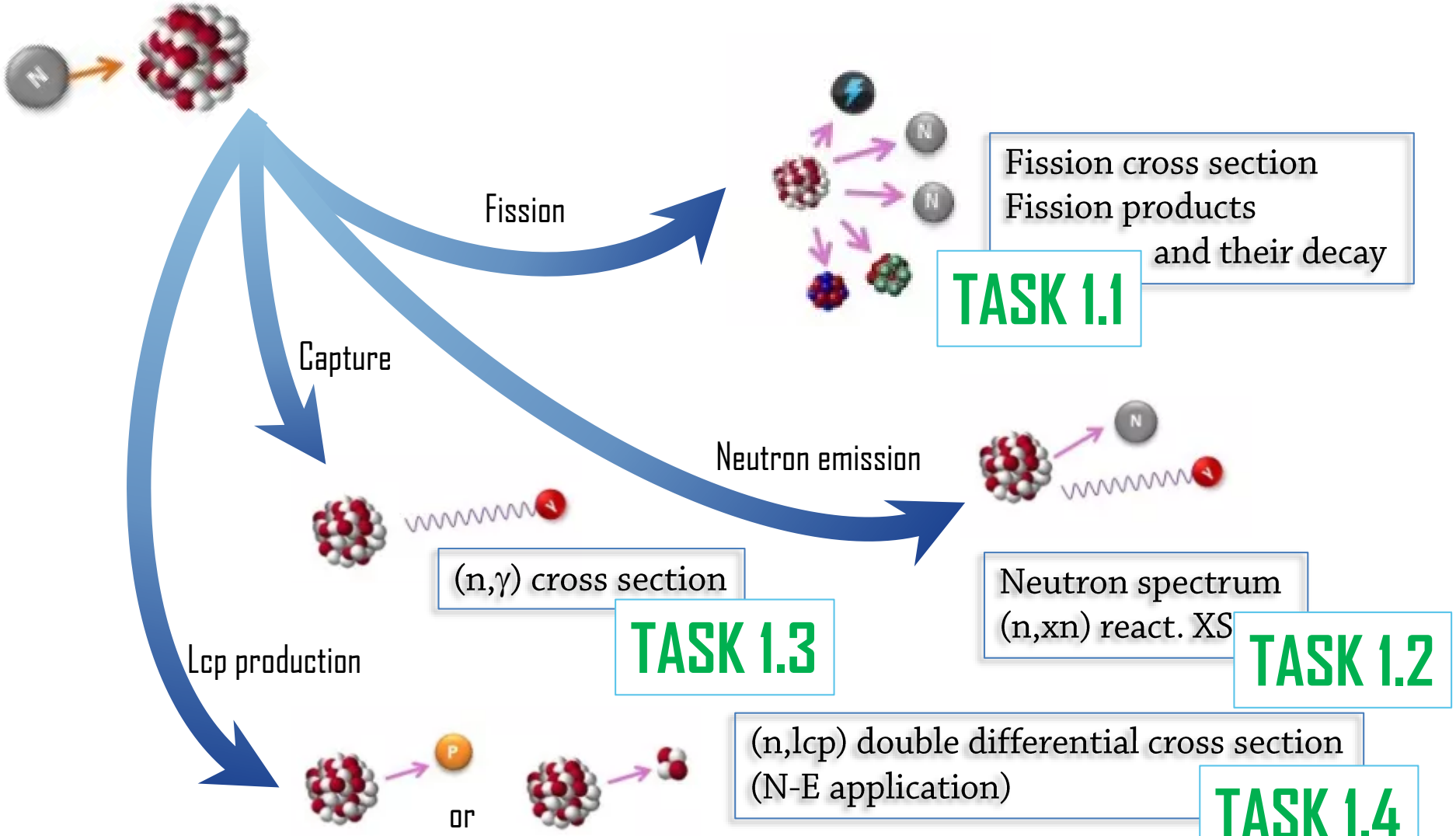
-> low mass samples :
very efficient detector devices needed
-> high resolution for particle discrimination

New facilities

-> n_TOF EAR2, SPIRAL2/NFS

Instrumental work is needed!

WP 1 Structure



WP 1 description

Summary

WP 1

- **8 partners** (CEA, CERN, CIEMAT, CNRS, HZDR, JYU, PTB , UPC)
- **80.8 pm, 476 k€**
- **4 tasks**

TASK 1.1 2 subtasks, 4 partners (CEA, JYU, CNRS, UPC)

TASK 1.2 3 subtasks, 2 partners (CEA, CERN)

TASK 1.3 0 subtask, 2 partners (CIEMAT, UPC)

TASK 1.4 0 subtask, 2 partners (PTB, HZDR)

SANDA

WP 1 organizational work

- One WP1 summary excel file with all important information, budget allowed and dead line (MS, D) has been send, at the beginning of SANDA, to all task and subtask leaders to follow up the WP1 activities.
- The file is updated along the project to take into account encountered delays…

Workpackage 1 : Developments of new innovative detector devices

Status of Milestones and Deliverables at M36 : actual and foreseen delays

milestone due date / deliverable due date — milestone delay / deliverable delay — maj 09-2022

Task 1.1: innovative devices from fission cross section to Fission products decay

subtask	Partners	Milestone Deliverable	Sep-19 M1	Aug-20 M12	Feb-21 M18	Aug-21 M24	Feb-22 M30	Aug-22 M36	Feb-23 M42	Aug-23 M48
1.1.1	CEA	MS.6					ACHIEVED			
		D 1.1								
	CNRS	MS.5					ACHIEVED			
		D 1.1						!!!! DELAY FORESEEEN		
1.1.2	JYU	MS.2						DELAYED M43		
		D 1.2						DELAYED M46		
	CEA	MS.1		ACHIEVED						
		D 1.3				ACHIEVED		CONTINUED in WP2		
	UPC	MS.7			ACHIEVED					
		D 1.3					ACHIEVED	CONTINUED in WP2		
	CEA	MS.3					ACHIEVED			
		D 1.3					ACHIEVED	CONTINUED in WP2		

Workpackage 1 : Developments of new innovative detector devices
WP leader: CNRS/IPHC Maëlle Kerveno

Task 1.1: innovative devices from fission cross section to Fission products decay
task leader : CEA/DRF/IRFU Frank Gunsing

n°	subtask	Partners	Lead and financed institut	collaboration	project leader	Subject	deliverables	deliverable date & responsible	Milestones	Milestones date & responsible	EC allocated budget	WP 2 meas. allocated budget
1	1.1.1	CEA	CEA/DRF/IRFU	TUW, JRC-Geel,…	F. Gunsing	development of a micromegas Time projection Chamber	D.1.1 "Report on the study and construction of new devices for precise fission cross section measurements"	M48 CNRS	M.1.5 Completion of simulations for a MicroMegas-based time projection chamber at CEA/DRF/IRFU, CEA, M24	M24 CNRS/CENBG	50 000 €	-
2		CNRS	CENBG	CEA/DEN, LPSC	L.Mathieu	development of a new gaseous proton recoil detector			M.1.6 Completion of GRPD - gaz recoil proton detector at CNRS/CENBG, CNRS, M24	M24 CEA/DRF/IRFU,	32 000 €	-
3	1.1.2	JYU	JYU	U.U.	H. Penttilä	development of a new large gas cell with electric field guidance for IGISOL	D.1.2 "Report on the design of the large gas cell for IGISOL"	M24 JYU	M.1.2 Completion of simulations for new gas cell with electric field guidance at IGISOL, JYU, M18	M18 JYU	50 000 €	-
4		CEA	CEA/DRF/IRFU	GANIL, ILL…	D. Doré	coupling of FALSTAFF with FIPPS @ ILL	D.1.3 "Report on the performances of new devices for precise study of fission products and their decay in view of measurements"	M24 CEA	M.1.1 Completion of the simulation for the coupling of FALSTAFF and FIPPS at ILL,	M12 CEA/DRF/IRFU	50 000 €	15 000 €
5		UPC	UPC	IFIC	F. Calvino	build a new version of BELEN optimized for maximum total efficiency and spectrometric response			M.1.7 Completion of the design of the new version of the BELEN detector at UPC,	UPC M24	20 000 €	10 000 €
6		CEA	CEA/LNE-LNHB	SUBATECH, IFIC	M. Kellet	new measurement facility dedicated to the measurement of half-lives			M.1.3 Completion of a new measurement facility by CEA/LNE-LNHB,	M18 CEA/LNE-LNHB	36 000 €	10 000 €

Task 1.2: innovative devices for neutron emission studies
task leader : CERN Massimo Barbagallo

n°	subtask	Partners	Lead and financed institut	collaboration	project leader	Subject	deliverables	deliverable date & responsible	Milestones	Milestones date & responsible	EC allocated budget	WP 2 meas. allocated budget
6	1.2.1	CEA	CEA/DEN/TAD		R. Jacqmin	build of a compact fast neutron spectrometer based on a single organic crystal	D.1.4 "Report on the commissioning of a compact broad-band fast neutron spectrometer"	M36 CEA	M.1.4 Completion of the design of the fast neutron spectrometer at CEA/DEN	M24 CEA	40 000 €	-
7	1.2.2	CERN	CERN	Univ. March., NTUA, Univ. Ion., IFIN-HH	M. Barbagallo	development of Germanium detectors for (n,xn) measurements at n-TOF	D.1.6 "Report on the performance of the HPGe equipped with newly developed electronics"	M48 CERN	M.1.8 Completion of the commissioning of the HPGe equipped with newly developed electronics at CERN	M24 CERN	55 000 €	-
8	1.2.3	CEA	CEA/DAM		G.Belier	development of the SCONE detector	D.1.5 "Report on the performance of the SCONE setup at NFS"	M48 CEA	M.1.9 Completion of the installation of the SCONE setup at NFS	M24 CEA	40 000 €	-

Task 1.3: innovative devices for capture cross section measurement on actinides
task leader : CIEMAT Emilio Mendoza

n°	subtask	Partners	Lead and financed institut	collaboration	project leader	Subject	deliverables	deliverable date & responsible	Milestones	Milestones date & responsible	EC allocated budget	WP 2 meas. allocated budget
9	-	CIEMAT	CIEMAT	Univ. Sevilla	E. Mendoza	development of CLYC detector for (n,g) XS measurements @EAR2 n_TOF	D.1.7 "Report on the development and performances of the new detectors for capture cross section measurements at n-TOF"	M48 CIEMAT	M.1.10 Completion of the new detectors for capture measurements at n-TOF, CIEMAT, M36	M36 CIEMAT	60 000 €	-
10		UPC	UPC		F. Calvino	extend the i-TED technique for measurement on actinides @EAR2 n_TOF					15 000 €	-

Task 1.4: detectors for non-energy application
task leader : PTB Ralf Nolte

n°	subtask	Partners	Lead and financed institut	collaboration	project leader	Subject	deliverables	deliverable date & responsible	Milestones	Milestones date & responsible	EC allocated budget	WP 2 meas. allocated budget
12	-	HZDR	HZDR	PTB	A. Junghans	DDX (n,lcp) meas @ n-tof ff on 20 to 200 MeV	D.1.8 "Report on the development and performances of the new detectors for non-energy applications";	M24 PTB	-	-	26 000 €	0 €
13		PTB	PTB	HZDR	R. Nolte	DDX (n,lcp) meas @ n-tof ff on 20 to 200 MeV					23 000 €	30 000 €

OUTLINE

Introduction : WP 1 description

At M36 : WP 1 achievements

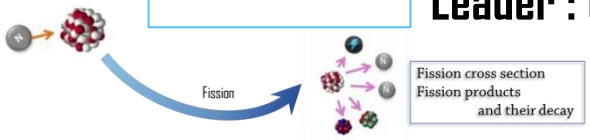
WP 1 milestones and deliverables status

Conclusion

WP 1 Structure and tasks

TASK 1.1 Innovative devices from fission cross section to Fission products decay

Leader : CEA/DRF/IRFU – Frank Gunsing



SUBTASK 1.1.1 new devices for fission cross section measurements

- development of a **micromegas Time Projection Chamber**
  Partner : **CEA/DRF/IRFU** ; project leader : F. Gunsing; collab. TUW, JRC-Geel
- development of a **new Gaseous Proton Recoil Telescope**
  Partner : **CNRS/CENBG** ; project leader : L. Mathieu; collab. CEA/DEN, CEA/DRF/IRFU, JRC-Geel

SUBTASK 1.1.2 new devices for fission products studies

- development of a **new large gas cell** with electric field guidance **for IGISOL**
  Partner : **JYU** ; project leader : H. Penttilä; collab. UU
- coupling of **FALSTAFF with FIPPS @ ILL**
  Partner : **CEA/DRF/IRFU** ; project leader : D. Doré; collab. GANIL, ILL
- build a **new version of BELEN**
  Partner : **UPC** ; project leader : F. Calvino; collab. IFIC
- **new measurement facility** dedicated to the **measurement of half-lives**
  Partner : **CEA/LNE-LNHB** ; project leader : M. Kellet; collab. CNRS/SUBATECH, IFIC

Measurements planned in WP2

SUBTASK 1.1.1

Deliverable 1.1 (CNRS) M48

"Report on the study and construction of new devices for precise fission cross section measurements"

¤ Development of a micromegas Time Projection Chamber for cross section measurements

COVID impact

COMMITMENTS :

Use of micromegas as "Transparent" XY beam detector exploiting strip timing (**TPC** mode)

- to perform neutron beam imaging and neutron flux measurements
- to measure **neutron-induced (n,f)** and **(n,lcp) reaction cross sections** & **angular distributions**

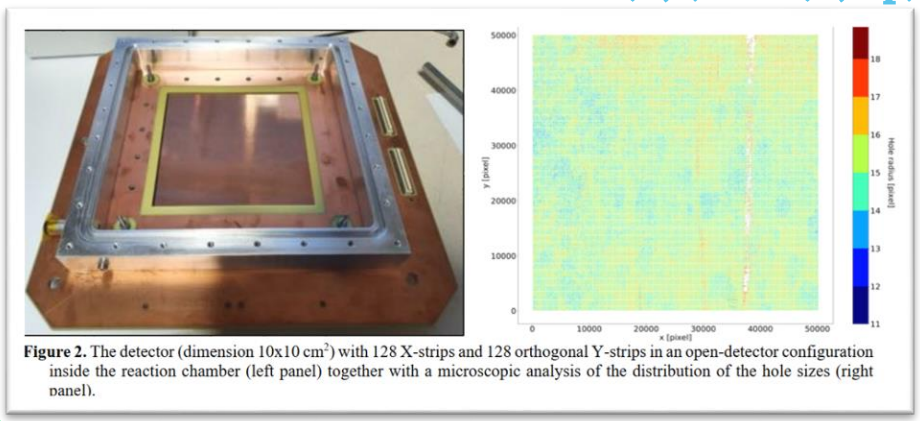


Figure 2. The detector (dimension 10x10 cm^2) with 128 X-strips and 128 orthogonal Y-strips in an open-detector configuration inside the reaction chamber (left panel) together with a microscopic analysis of the distribution of the hole sizes (right panel).

MS6 Milestone objectives (simulations) have been adapted to mitigate problem of post doc recruitment

=> Delayed but report submitted

Workstatus :

- **First prototype** of segmented mesh and anode microbulk detector has been **produced** and was scanned using a Mitutoyo microscope in order to analyze and quantify the geometrical parameters of the detector.

- A **development board** with a VMM3 chip was made **available**.

for some components, in particular FPGA chips, long ordering times are still encountered.

- The **simulation part is postponed** to a time slot near the end of the project.

Deliverable is due for M48, no delay has been announced during the M36 reporting.

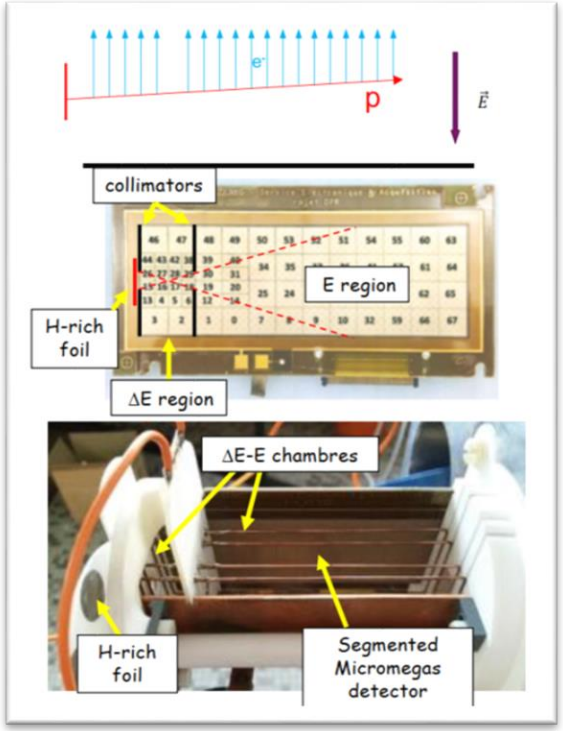
SUBTASK 1.1.1

Deliverable 1.1 (CNRS) M48
"Report on the study and construction
of new devices for precise fission cross section measurements"

¤ Development of a new Gaseous Proton Recoil Telescope (GRPT)

COVID impact

COMMITMENTS :
Completion of the GRPT (in view of measurement with 5% accuracy below 1 MeV for the ^{242}Pu(n, f) XS)



Work status :
- **One year delay** due to several lockdowns in 2020, mechanical issues and accelerator breakdown for the **tests at AIFIRA**, finally **performed in 2021**.
- **Problems with acquisition system** raised in the treatment of high counting rates. 2022 was devoted to solve this issue.
- **New tests at AIFIRA are planned in 12/2022** to confirm the requested 100% efficiency of the detector.

MS5 Milestone objectives have been reached
=> Delayed but report submitted

The 1 y delay will not be totaly absorbed before the end of SANDA, the D1.1 (val. of the GRPT) will not be reached in M48,
proposed date is M54.

SUBTASK 1.1.2

Deliverable 1.2 (JYU) M24

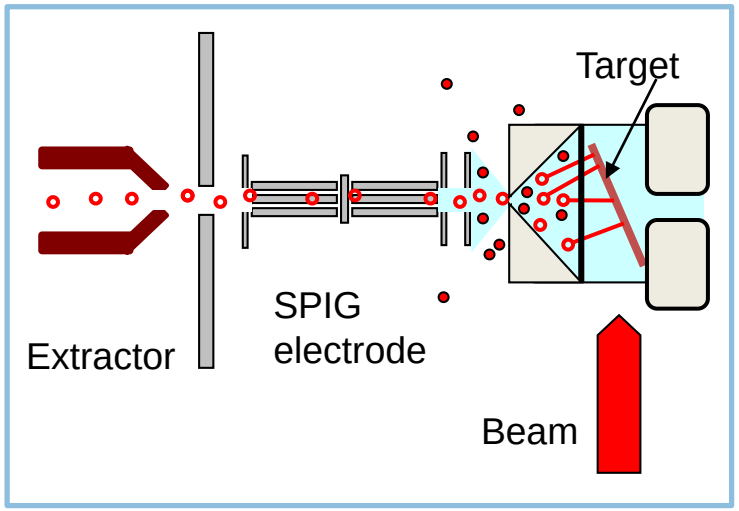
"Report on the design of the large gas cell for IGISOL"

¤ development of a new large gas cell with electric field guidance for IGISOL

COVID impact

COMMITMENTS :

Study of a new stopping gas cell with better ions stopping efficiency and faster transport.
(expected overall improvement of efficiency of the order of 100)



Work status

- **COVID crisis and internal difficulties** to hire a **dedicated person for doing the simulation work** delay the start of the work.
- The work has just started in July 2022 with the recruitment of a post doctoral researcher.

MS2 Milestone originally planned for M18 is postponed to M42

A new date for D1.2 has been proposed at M46

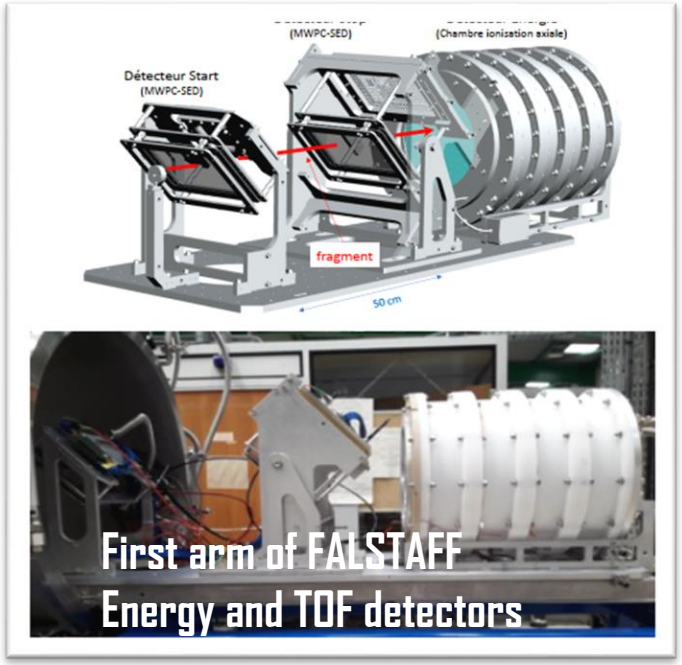
SUBTASK 1.1.2

Deliverable 1.3 (CEA) M24
"Report on the performances of new devices for precise study of fission products and their decay in view of measurements"

⌑ coupling of FALSTAFF with FIPPS @ ILL

COMMITMENTS :

Prepare a new setup by coupling FALSTAFF ~~and FIPPS @ ILL~~ to provide new nuclear data for fission modeling improvements (fission and deexcitation models, prompt γ-ray spectra with FF A & M, FF angular momentum)



Work status :

- Several upgrades on the different detectors and the DAQ system have been made
- A new ^{252}Cf source was bought, reducing the time needed for the tests.
- An **experiment has been performed at Lohengrin** (ILL reactor, Grenoble) and results have been included in simulations and experimental data analysis codes.
- Due to problem for implementation of FALSTAFF at ILL, **the project has been refocused on experiment at SPIRAL2/NFS**
- FALSTAFF was moved to GANIL in 09/2021 and an experiment was planned with the VAMOS spectrometer which has confirmed the possibility of nuclear charge identification.
- The project is now continuing in WP2 (since M24) for measurements at NFS.

MS1 Milestone has been submitted on time (M12)

Deliverable submitted on time M24

SUBTASK 1.1.2

Deliverable 1.3 (CEA) M24

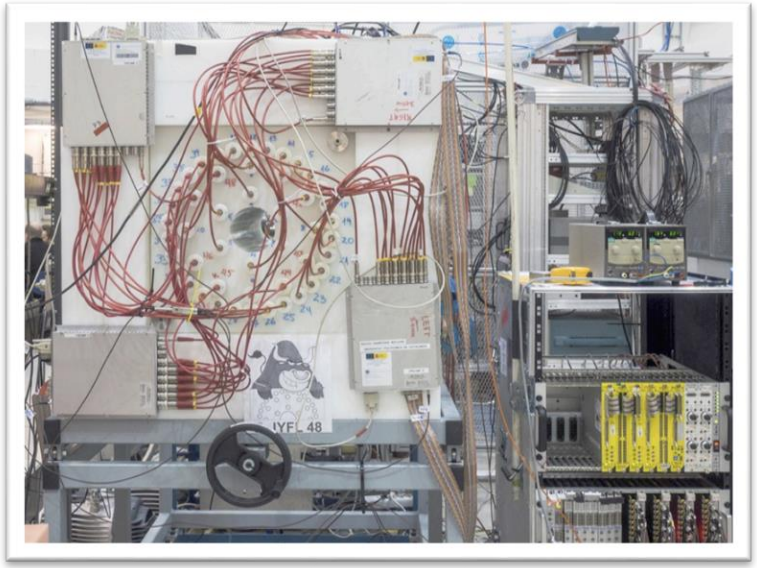
"Report on the performances of new devices for precise study of fission products and their decay in view of measurements"

COVID impact

⌑ build a new version of BELEN

COMMITMENTS :

Optimize the BELEN detector to obtain a device with very high efficiency capability for Pn and low resolution energy spectra measurements



Work status :

- A new version of BELEN – BELEN-62- has been designed.
- **Neutron detection efficiency is in average 51%** for neutron energies up to 5 MeV, and presents a rather flat behavior up to 2.5 MeV.
- The new design presents a **good energy sensitivity per ring**
- A new Bayesian unfolding method has been developed to reconstruct the "measured" spectra.
- The work is continuing in WP2 since M30

MS7 Milestone has been submitted on time (M12)

Deliverable submitted on time M24

SUBTASK 1.1.2

Deliverable 1.3 (CEA) M24

"Report on the performances of new devices for precise study of fission products and their decay in view of measurements"

⌑ new measurement facility dedicated to the measurement of half-lives

COVID impact

COMMITMENTS :

Prepare and commission a new meas. facility dedicated to the meas. of half-lives for a range of radionuclides on a routine basis.

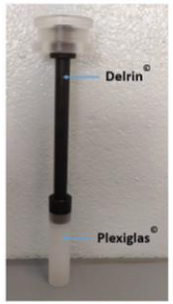


Fig. 3.1 The source holder for the Centronics IG11 ionisation chamber.

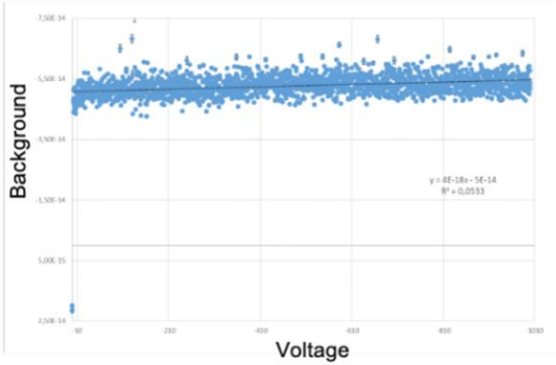


Fig. 3.2 Background measurement as the high voltage is varied.

Work status :

- A **new IG11 ionization chamber and ass. electronics is functioning**
- The **COVID crisis impact this project by delaying the receipt** of the ordered materials and finally it actually started in 09/2020
- **Performances about the repeatability** of the system **has been evaluated**
- Preliminary half-life measurement – ^{99m}Tc, has been done
- Simulations have been performed in order to calculate the shielding requirements for the source stocker
- The work is continuing in **WP2** since M30

MS3 Milestone originally planned for M18 was postponed and finally D1.3 was submitted

Deliverable submitted with a small delay M30 (instead M24)

WP 1 Structure and tasks

TASK 1.2 Innovative devices for neutron emission studies

Leader : CERN – Massimo Barbagallo -> Mickael Bacak (01/2022)

SUBTASK 1.2.1 Build of a compact fast neutron spectrometer

Partner : **CEA/DEN/CAD** ; project leader : R. Jacqmin; collab. -

SUBTASK 1.2.2 Development of the SCONE detector

Partner : **CEA/DAM** ; project leader : G. Belier; collab. -

SUBTASK 1.2.3 Development of Germanium detectors for (n,xn) measurements at n-TOF

Partner : **CERN** ; project leader : M. Barbagallo -> Mickael Bacak; collab. UMANCH., NTUA, UOI., IFIN-HH

SUBTASK 1.2.1

Deliverable 1.4 (CEA) M36

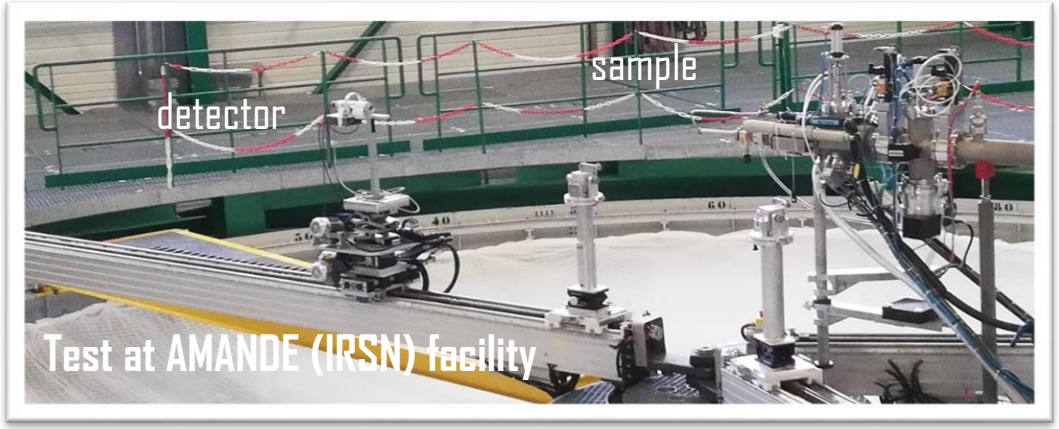
"Report on the commissioning of a compact broad-band fast neutron spectrometer"

¤ development of a compact broad-band fast neutron spectrometer

COVID impact

COMMITMENTS :

Construction of a compact broad-band fast neutron (10 keV – 10 MeV) spectrometer based on a solid organic scintillator (stilbene detector) with its associated electronics



From Augusto Di Chicco, proceedings of ANIMMA 2019 conference

Work status :

- γ & neutron response functions have been obtained with different measurement campaign at IRSN/AMANDE and at PTB. ARIEL
- The **COVID crisis impact the experimental part** of the project, but the realization of the PTB experiment done in **a semi remote mode.**
- Validation of the GEANT4 and experimental response matrices were done.

MS4 Milestone originally planned for M24 was postponed by 1 year and finally D1.4 was submitted

Deliverable submitted with a small delay M38 (instead M36)

SUBTASK 1.2.2

Deliverable 1.5 (CEA) M48

"Report on the performance of the SCONE setup at NFS"

¤ development of the SCONE setup for (n,xn) reaction studies at NFS

COVID impact

COMMITMENTS :

Development of a **new neutron counter based on plastic scintillator** bars wrapped with Gd loaded material (SCONE) for measurements at **NFS facility**

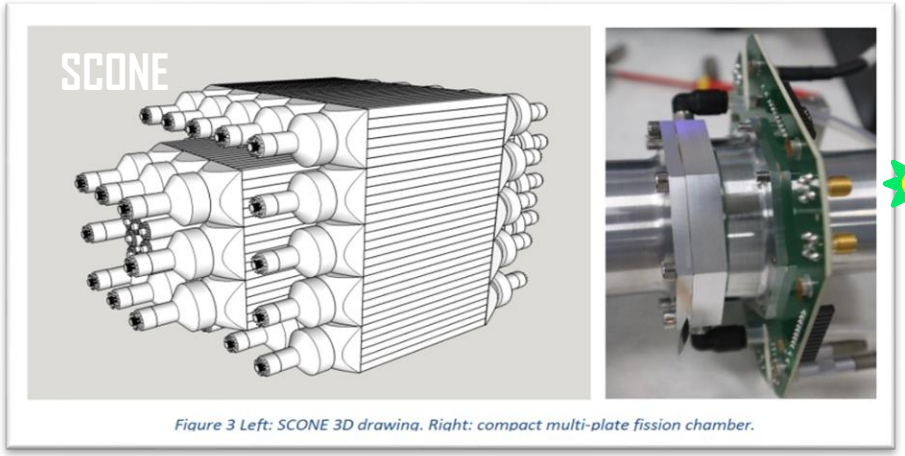


Figure 3 Left: SCONE 3D drawing. Right: compact multi-plate fission chamber.

Work status :

- **Final assembly of SCONE** (~900 EJ200 plastic scintillator bars) coupled to the compact **multi plate fission chamber has been done**.
- The installation at NFS was done (**with delay due to COVID crisis**) and a first exp. took place in fall 2021 with a ^{238}U sample.
- First preliminary results are very encouraging and demonstrate that the setup can study the fission process in its whole complexity, the work is pursued to extract the (n, xn) response .

MS9 Milestone originally planned for M24 was postponed by 1 year and was submitted in M36

Deliverable is due for M48, no delay has been announced during the M36 reporting.

SUBTASK 1.2.3

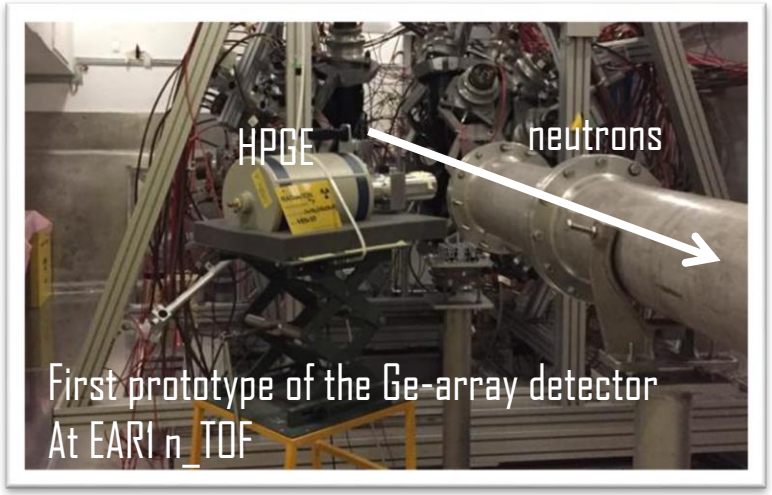
Deliverable 1.6 (CERN) M48
"Report on the performance of the HPGe equipped with newly developed electronics"

⌑ development of Germanium detectors for (n,xn) measurements at n-TOF

COVID impact

COMMITMENTS :

Development of a new 4 HPGE setup with newly developed electronics to overcome the huge γ-flash preceding the neutron beam



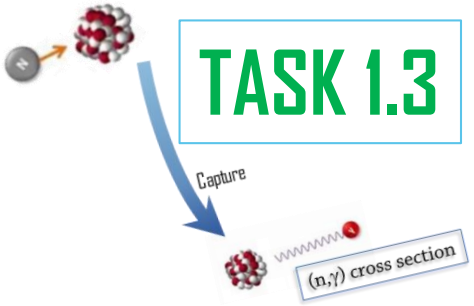
Work status :

- The **definition, characterization of the efficiency and resolution** of the prototype HPGe detector has been performed.
- The delay (COVID) of the restart of CERN accelerator delayed the realization of the tests.
- A letter of Intend for benchmarked measurements at n_TOF EAR 1 has been submitted to INTC and approved. ARIEL
- Extensive simulations with GEANT4 have been carried out to estimate the response to the mixed-field environment at EAR1

MS8 Milestone originally planned for M24 was postponed by 1 year and was submitted in M36

Deliverable is due for M48, no delay has been announced during the M36 reporting.

WP 1 Structure and tasks



Innovative devices for capture cross section measurement on actinides

Leader : CIEMAT – Emilio Mendoza

- Development of **segmented total energy detector for (n,γ) XS** measurements **@EAR2 n_TOF**
  Partner : **CIEMAT** ; project leader : E. Mendoza; collab. USE
- Extend the **i-TED technique** for measurement on **actinides @EAR2 n_TOF**
  Partner : **UPC** ; project leader : F. Calviño; collab. - IFIC

TASK 1.3

Deliverable 1.7 (CIEMAT) M48
"Report on the development and performances of the new detectors for capture cross section measurements at n-TOF"

¤ development of s-TED detector for (n,γ) XS measurements @ EAR2 n_TOF

COMMITMENTS :

Design and test a total energy detector prototype based on segmented inorganic scintillator adapted to the very demanding characteristics (high counting rates) of the n_TOF EAR2 experimental area and for meas. with actinide samples

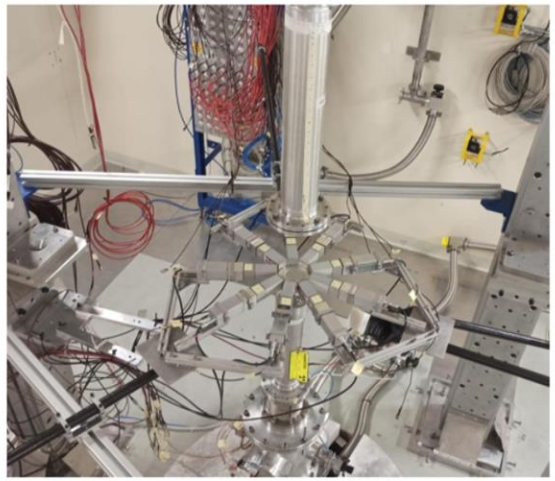


Figure 2: Picture of the sTED detector, made of 9 individual modules, in the configuration used in the ^{79}Se(n,γ), ^{94}Nb(n,γ), ^{160}Gd(n,γ) and ^{94,95,96}Mo(n,γ) cross section measurements performed in 2022

Work status :

- Construction of the segmented Total Energy Detector (sTED) is completed.
- Test experiment at CIEMAT allowed the choice of PM and the characterization of the modules. Tests at n_TOF with a ^{197}Au sample have been also performed.
- Finally, capture experiments on Se, Nb, Gd & Mo isotopes have been already performed in 2022 at n_TOF EAR2 from thermal energies up to hundred of keV.

This action is completed, only the deliverable remains to be written (due in M48)

MS10 Milestone has been submitted on time (M36)

TASK 1.3

Deliverable 1.7 (CIEMAT) M48
"Report on the development and performances of the new detectors for capture cross section measurements at n-TOF"

¤ extend the i-TED technique for measurement on actinides @ EAR2 n_TOF

COMMITMENTS :

Developed an i-TED (imaging total energy detector) for radiative capture measurement with highly radioactive sample at EAR2 n_TOF


i-TED detector at an angle of about 125°.

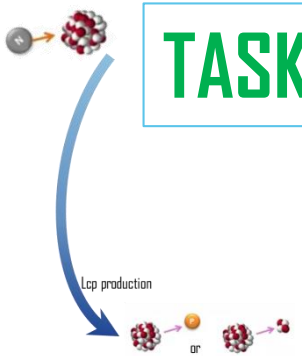
Work status :

- measurements and analysis have been carried out with an i-TED module at n_TOF EAR2 in order to characterize its response to very high count rates.
- Maximum counting rate capabilities have been determined, techniques have been developed to reduce the intrinsic neutron sensitivity.
- Solutions are investigated to mitigate the limitations raised during the characterization phase.

MS10 Milestone has been submitted on time (M36)

Deliverable is due for M48, no delay has been announced during the M36 reporting.

WP 1 Structure and tasks



TASK 1.4

Detectors for non-energy application

Leader : PTB – Ralf Nolte -> E. Pirovano (06/2022)

- **Doub. Diff. XS (n,lcp)** measurements @ **n_TOF from 20 to 200 MeV**
  Partner : **HZDR** ; project leader : A. Junghans; collab. PTB
- **Doub. Diff. XS (n,lcp)** measurements @ **n_TOF from 20 to 200 MeV**
  Partner : **PTB** ; project leader : R. Nolte -> E. Pirovano; collab. HZDR

Measurement planned in WP2

TASK 1.4

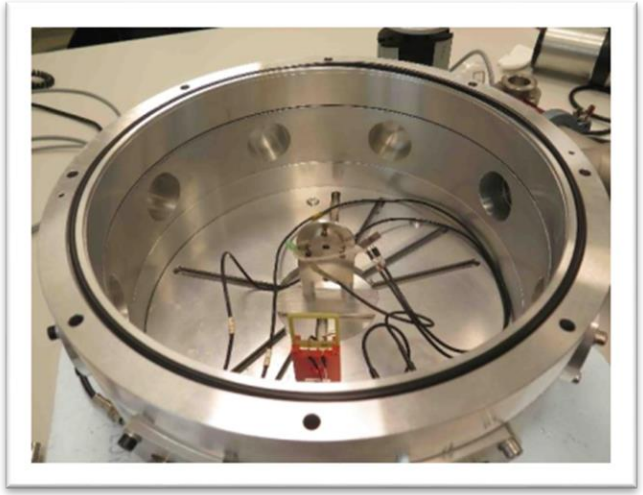
Deliverable 1.8 (PTB) M24
"Report on the development and performances of the new detectors for non-energy applications"

¤ Double Diff. XS (n,lcp) measurement @ EAR1 n_TOF from 20 to 200 MeV

COVID impact

COMMITMENTS :

Development of a scattering chamber and detector telescopes for H and He ions detection useable at EAR1 n_TOF (good resol., low thresholds, high max. neut. Energy)



tests using the 241Am/244Cm/239Pu alpha source

Work status :

- **Scattering chamber and telescopes**, after designed, **have been setup**.
- The **COVID crisis impact** the project by limiting the coll. between HZDR and PTB
- A first **experiment** at **n_TOF EAR1 has been performed** in May 2022. A second one, has been done in November 2022.
- It was found that EM noise disturbs the measurement. Investigations are ongoing to mitigate this issue.
- The work is continuing in WP2

Deliverable submitted with a small delay M31 (instead M24)

PUBLICATIONS

¤ C. Chatel, L. Mathieu et al., "Towards the experimental validation of a small Time-Projection-Chamber for the quasi-absolute measurement of the fission cross section" , Eur. Phys. J. Web of Conferences 253, 11013 (2021)

¤ D. Attié et al., "Current Status and Future Developments of Micromegas Detectors for Physics and Applications", Appl. Sci. 11 (2021) 5362

¤ Augusto Di Chicco et al. "Gamma-response characterization of a solution-grown stilbene based detector assembly in the 59 keV–4.44 MeV energy range; an alternative low-resolution gamma spectrometer,"
Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, Volume 1034, 1 July 2022, 166740

¤ V. Babiano-Suarez et al., "Imaging neutron capture cross sections: i-TED proof-of concept and future prospects based on Machine-Learning techniques, The European Physical Journal A, Volume 57, Issue 6, article id.197 (2021).

To be added in the participant portal

OUTLINE

Introduction : WP 1 description

At M36 : WP 1 achievements

WP 1 milestones and deliverables status

Conclusion

WP 1 milestones and deliverables status

¤ Only one Milestone is pending (expected at M42).
¤ 3 deliverables achieved.
¤ One deliverable delayed (expected at M46).
¤ 4 deliverables expected at the end of SANDA (M48 as scheduled) but one for which an action foresees 6 months delay.

Workpackage 1 : Developments of new innovative detector devices

Status of Milestones and Deliverables at M36 : actual and foreseen delays

1/2

milestone due date
deliverable due date
milestone delay
deliverable delay
maj 09-2022

Task 1.1: innovative devices from fission cross section to Fission products decay

subtask	Partners	Milestone Deliverable	Sep-19 M1	Aug-20 M12	Feb-21 M18	Aug-21 M24	Feb-22 M30	Aug-22 M36	Feb-23 M42	Aug-23 M48
1.1.1	CEA	MS.6					ACHIEVED			
		D 1.1								
	CNRS	MS.5					ACHIEVED			
		D 1.1							!!!! DELAY FORESEEEN	
1.1.2	JYU	MS.2						DELAYED M42		
		D 1.2							DELAYED M46	
	CEA	MS.1		ACHIEVED						
		D 1.3				ACHIEVED			CONTINUED in WP2	
	UPC	MS.7			ACHIEVED					
		D 1.3					ACHIEVED		CONTINUED in WP2	
	CEA	MS.3					ACHIEVED			
		D 1.3					ACHIEVED		CONTINUED in WP2	

regular monitoring is planned

WP 1 milestones and deliverables status

Workpackage 1 : Developments of new innovative detector devices

2/2

Status of Milestones and Deliverables at M36 : actual and foreseen delays

milestone due date
deliverable due date
milestone delay
deliverable delay

maj 09-2022

Task 1.2: innovative devices for neutron emission studies

change of task leader

subtask	Partners	Milestone Deliverable	Sep-19 M1	Aug-20 M12	Feb-21 M18	Aug-21 M24	Feb-22 M30	Aug-22 M36	Feb-23 M42	Aug-23 M48
1.2.1	CEA	MS.4					DELAY FORESEEN			
		D 1.4						ACHIEVED		
1.2.2	CEA	MS.9						ACHIEVED		
		D 1.5								
1.2.3	CERN	MS.8						ACHIEVED		
		D 1.6								

Task 1.3: innovative devices for capture cross section measurement on actinides

subtask	Partners	Milestone Deliverable	Sep-19 M1	Aug-20 M12	Feb-21 M18	Aug-21 M24	Feb-22 M30	Aug-22 M36	Feb-23 M42	Aug-23 M48
-	CIEMAT UPC	MS.10						ACHIEVED		
		D 1.7								

Task 1.4: detectors for non-energy application

subtask	Partners	Milestone Deliverable	Sep-19 M1	Aug-20 M12	Feb-21 M18	Aug-21 M24	Feb-22 M30	Aug-22 M36	Feb-23 M42	Aug-23 M48
-	HZDR PTB	-								
		D 1.8					ACHIEVED	CONTINUED in WP2		

OUTLINE

Introduction : WP 1 description

At M36 : WP 1 achievements

WP 1 milestones and deliverables status

Conclusion

CONCLUSION

¤ **Except for 2 actions, the work in WP1 is progressing well.**

¤ **Despite the COVID crisis, and all the associated restrictions (access to laboratory, to nuclear facilities, reduction of travels, difficulties to order some materials, to organize recruitment, …) not to much delay is observed (a lot of adaptability and alternative solutions when possible to make progress).**

¤ **All teams have worked to fulfill the objectives despite difficulties.**

¤ **Publication rate is not yet so high in this WP but certainly due to the nature of the work (take time to develop detector).**

Thank you for your attention …

Partners

partners	budget	pm
CEA	195 000 €	36.1
CNRS	32 000 €	4.5
CERN	55 000 €	1.2
CIEMAT	60 000 €	13.3
UPC	35 000 €	6.5
JYU	50 000 €	9
PTB	23 000 €	5.7
HZDR	26 000 €	4.5
TOTAL	**476 000 €**	**80,8**

Deliverables

D.1.1	D.1.2	D.1.3	D.1.4	D.1.5	D.1.6	D.1.7	D.1.8
14.6 pm	9 pm	16.1 m	5 pm	1.2 pm	9 pm	15.8 pm	10.2 pm