

Plan of activities in 2022

CERN Accelerating science

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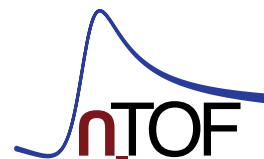
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n_TOF

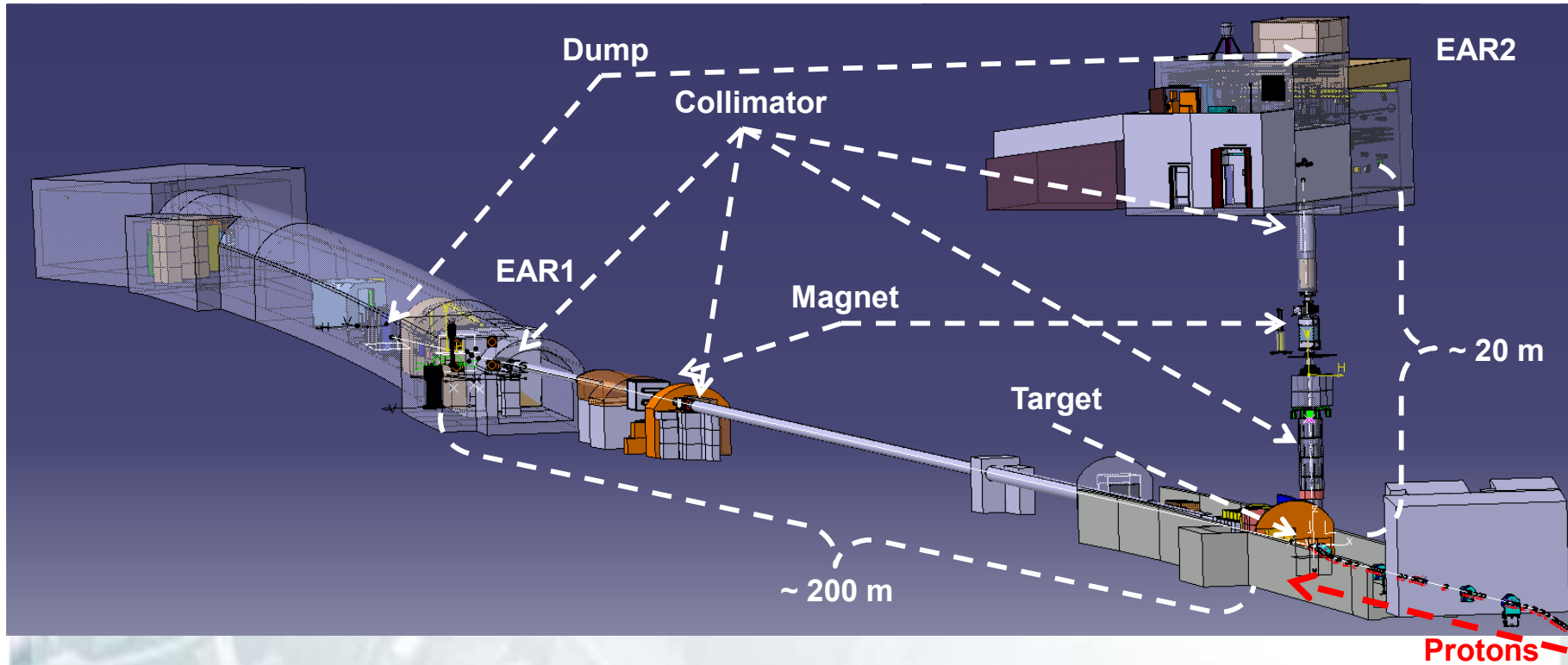
The neutron time-of-flight facility (n_TOF) studies neutron-nucleus interactions for neutron energies ranging from a few meV to several GeV

Alberto Mengoni
on behalf of the n_TOF Collaboration

www.cern.ch/n_TOF



n_TOF @ CERN



20 GeV/c **proton beam**
From the PS accelerator

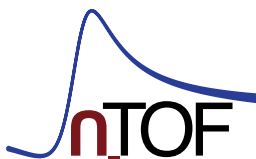
Two experimental areas (EAR)

- Horizontal flight path
EAR1 at 200 m
- Vertical flight-path
EAR2 at 20 m

+ the NEAR Station

Both beam lines with

- 1st collimator
- halo cleaning, initial beam shaping
- Filter station
- Sweeping magnet
- 2nd collimator for beam shaping



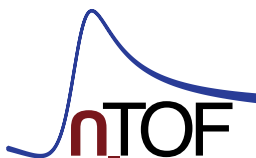
Plan of measurements: 2022 run

reaction	field of interest	note	experimental area	INTC proposal
$^{94}\text{Nb}(n,\gamma)$	<ul style="list-style-type: none"> – anomalies in pre-solar grains – strong contributor to the long-term radiotoxicity amongst FP 	radioactive sample $t_{1/2} = 20 \text{ ka}$	EAR2	<u>INTC-P-577</u>
$^{79}\text{Se}(n,\gamma)$	<ul style="list-style-type: none"> – s-process thermometer – strong contributor to the long-term radiotoxicity among FP 	radioactive sample $t_{1/2} = 300 \text{ ka}$	EAR1 & EAR2	<u>INTC-P-580</u>
$^{94,95,96}\text{Mo}(n,\gamma)$	<ul style="list-style-type: none"> – s-process AGB stars, SiC grains – FP, fuel alloys 	stable samples (*)	EAR1	<u>INTC-P-569</u>
$^{160}\text{Gd}(n,\gamma)$	<ul style="list-style-type: none"> – s-processing in AGB stars – radioisotope (^{161}Tb) production for theranostics 	stable samples	EAR1	<u>INTC-P-437-ADD-1</u>
$^{50,53}\text{Cr}(n,\gamma)$	<ul style="list-style-type: none"> – criticality safety (major element in stainless steel) 	stable samples	EAR1	<u>INTC-P-588</u>



(*) part of a EU H2020 nuclear data project

continue...



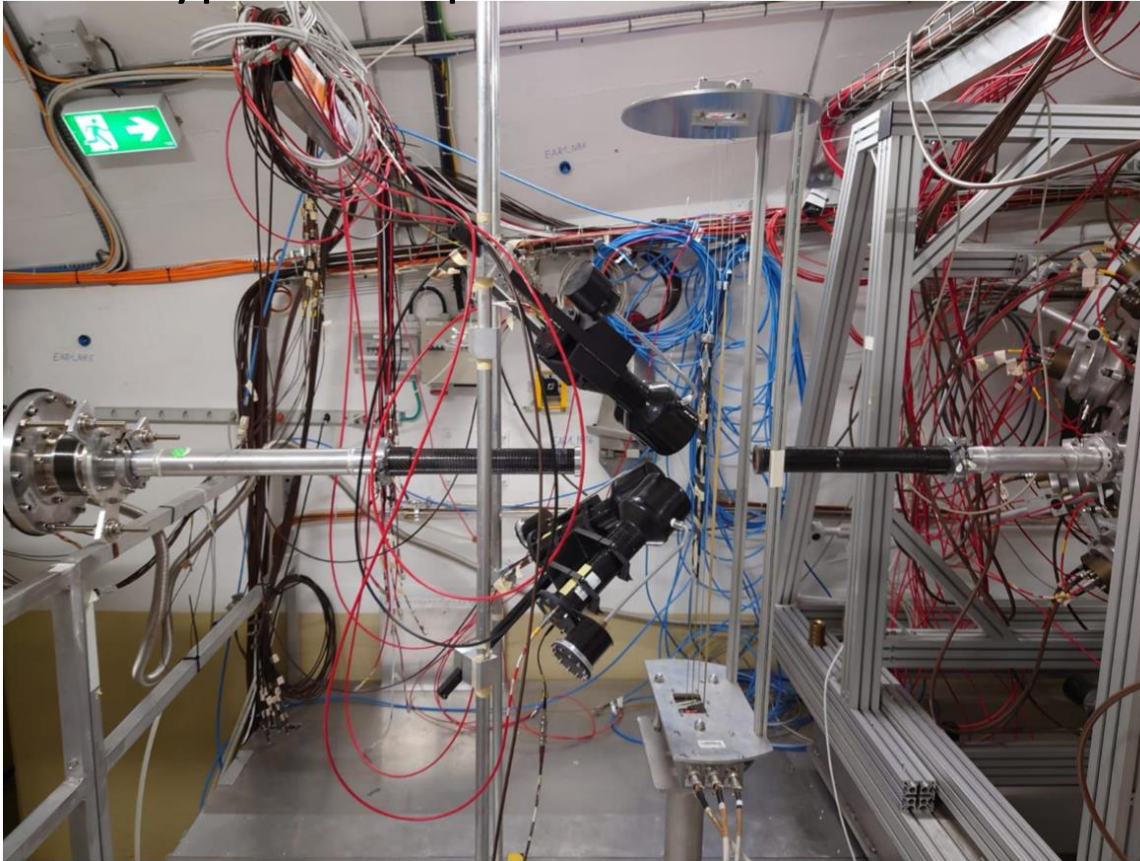
Plan of measurements: 2022 run

reaction	field of interest	note	experimental area	INTC proposal
$^{239}\text{Pu}(n,\gamma)$ and α -ratio	– advanced nuclear technologies	radioactive sample $t_{1/2} = 24.1 \text{ ka} (*)$	EAR1	<u>INTC-P-567</u>
$^{243}\text{Am}(n,f)$	– contributes to production of ^{239}Pu (by $\alpha + \beta^-$ decays)	radioactive sample $t_{1/2} = 7364 \text{ a}$	EAR1 & EAR2	<u>INTC-P-566</u>
NN scattering	– isospin symmetry breaking	detector and setup developments	EAR2	<u>INTC-I-220</u>
$n + ^3\text{He}$	– X17 (dark photon?, fifth force?)	detection tests developments	EAR2	<u>INTC-I-233</u>
(n, lcp)	– DDX measurements	detection tests and developments	EAR1	<u>INTC-I-221</u>
$^{\text{nat}}\text{Fe} + \text{others}$	– HPGe detection system for (n, n') measurements	detection tests developments	EAR1	<u>INTC-I-230</u>

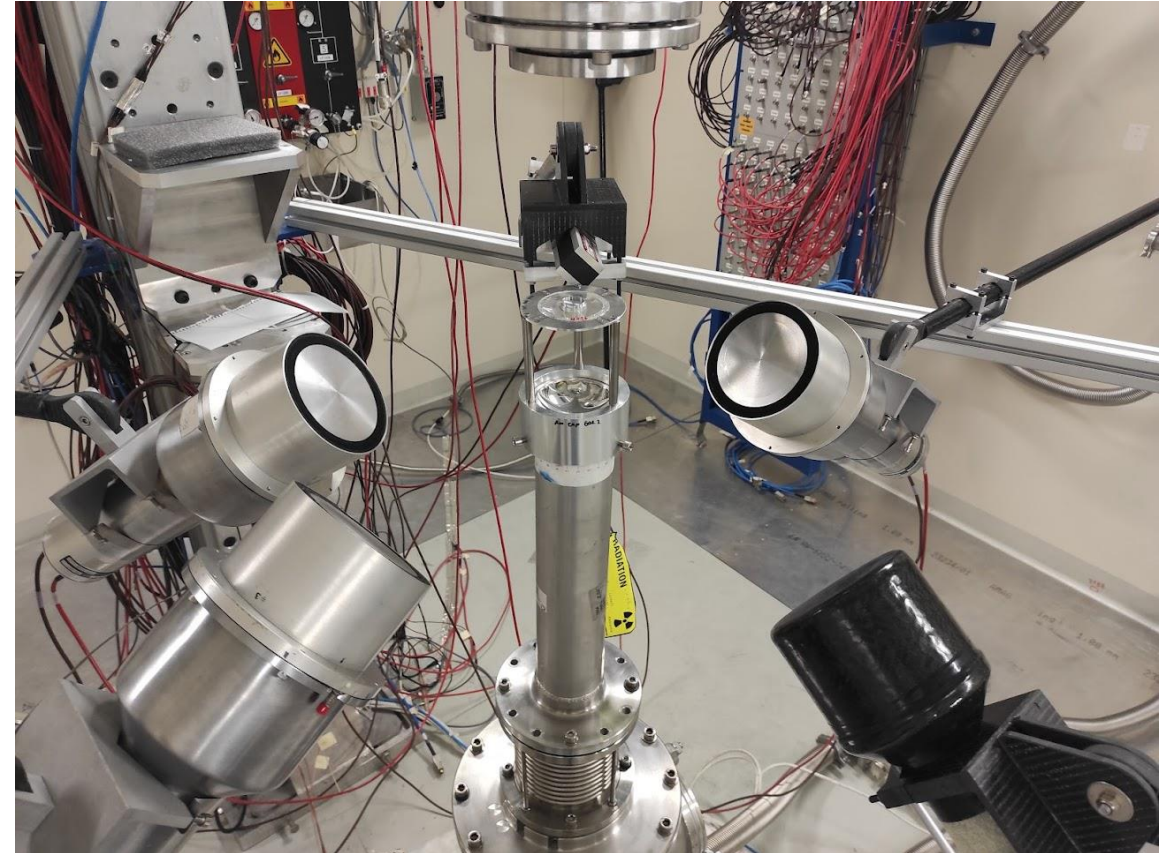
(*) part of a EU H2020 nuclear data project

$^{160}\text{Gd}(n,\gamma)^{161}\text{Gd}$: proposed setup

EAR1 typical setup



EAR2 typical setup

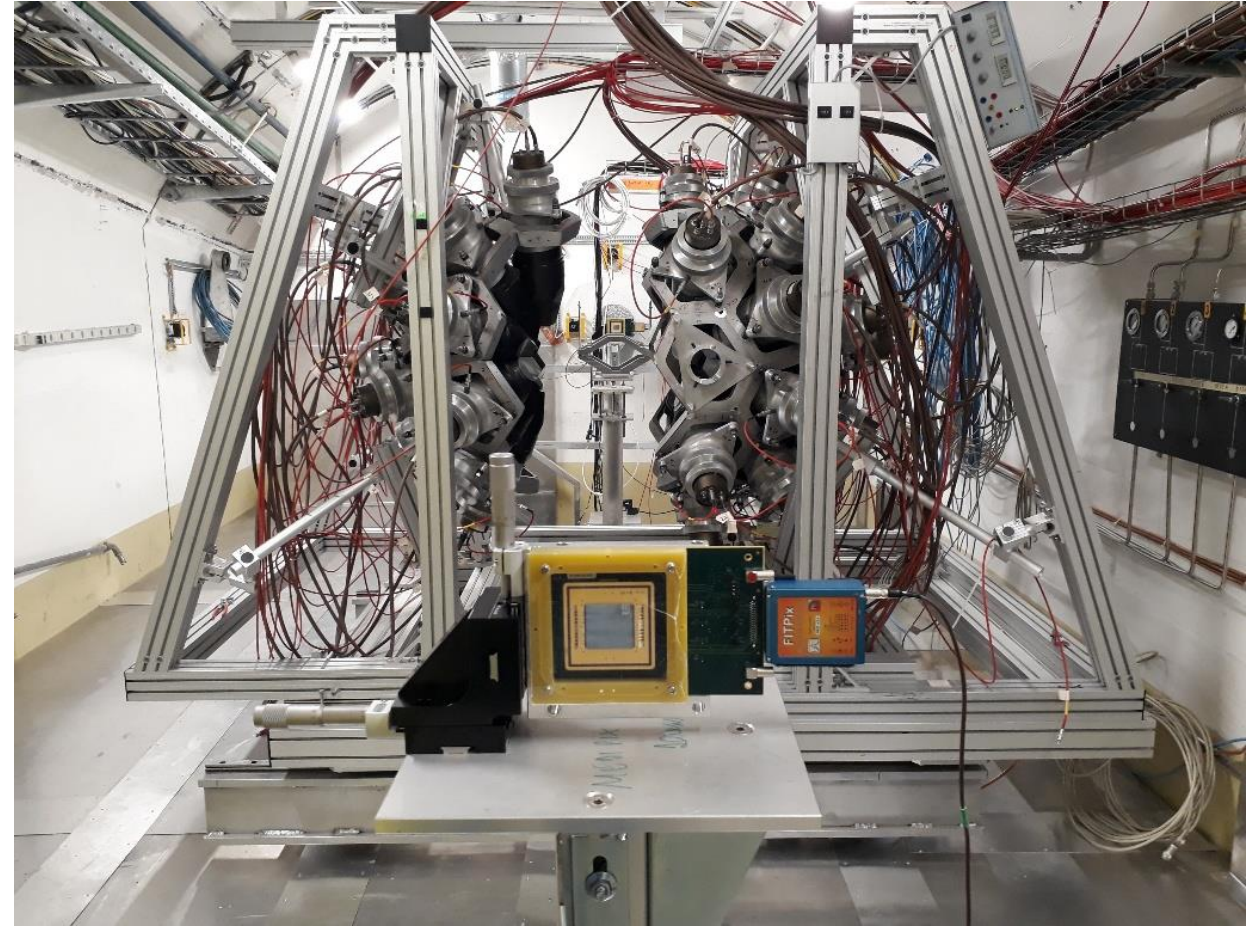
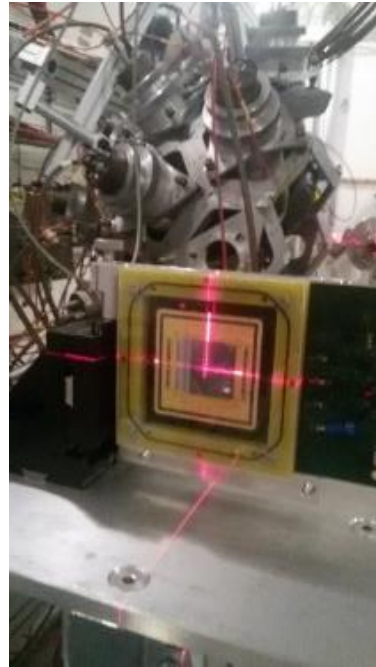
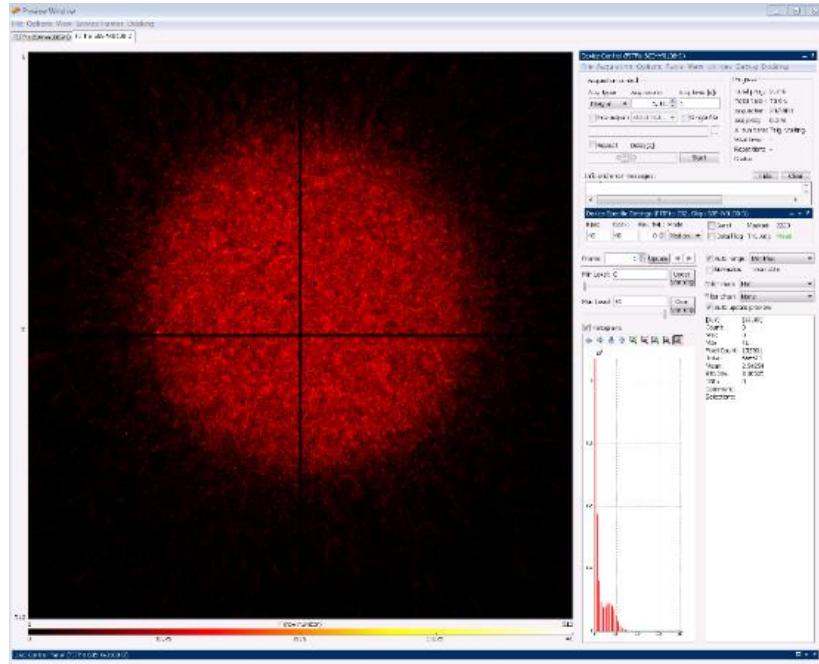


Measurements with the Total Absorption Calorimeter

EAR1

Beam profile and position

2-Quad Timepix has been used for beam alignment and for flux measurement in Phase-2021

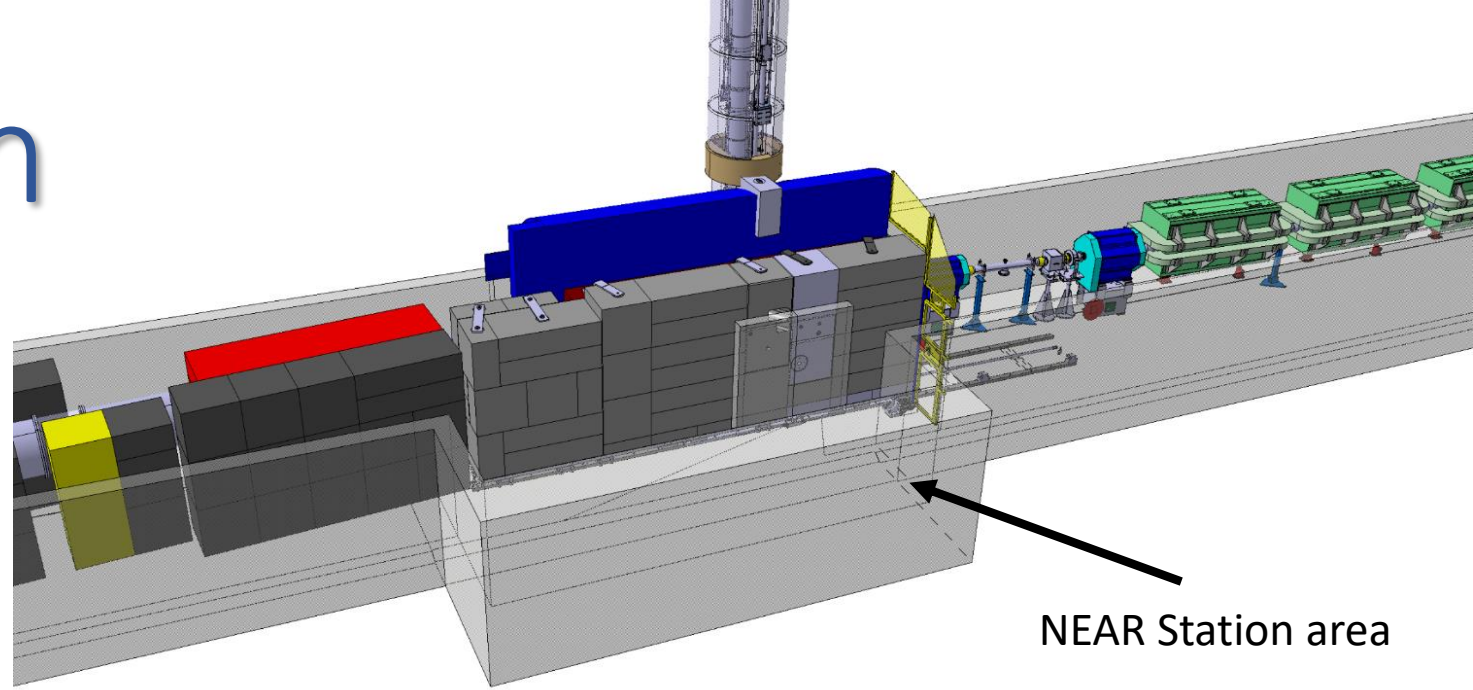


Plan of measurements: 2022 run

09/02/2022																						
2022 week number	date	days	NoP [1E+17]	EAR1		EAR2		NEAR	NoP requests [1E+17]				PhD/post-doc involved	EC funding	sample availability [week #]	other						
				proposal	NoP	proposal	NoP		EAR1	EAR2												
11	14-Mar-22	0		test		test			INTC-P-566	243Am(n,f)	30	30	Elisso Stamati		tbd							
12	21-Mar-22	7		test		test			INTC-P-567	239Pu(n,f)	50		Adrian Sanchez	yes	38							
13	28-Mar-22	14	0	Se-79	35	Nb-94	35		INPC-P-569	94-96Mo(n,g)	60	20	Riccardo Mucciola/Alice Manna	yes	9							
14	04-Apr-22	21	7									INTC-P-577	94Nb(n,g)		30	Javier Balibrea	yes	1	ERC funding only until end of May'22			
15	11-Apr-22	28	14									INTC-P-587	79Se(n,g)	35	25	Jorge Lereendegui	yes	1	ERC funding only until end of May'22			
16	18-Apr-22	35	21									INTC-P-588	50,53Cr(n,g)	40		Pablo Perez Maroto		30				
17	25-Apr-22	42	28									INTC-P-607	176Yb(n,g)	15		Francisco Infantes		(done in 2021)				
18	02-May-22	49	35	Gd-160 + DDX	10 + 4	Se-79	28		INTC-P-607	160Gd(n,g)	10	0,5	Mario Mastromarco		tbd							
19	09-May-22	56	42									LOI	NN scatterling		5							
20	16-May-22	63	49	Mo-94,95,96	63	Gd-160	7		LOI	X17		6										
21	23-May-22	70	56									LOI	HPGe	6								
22	30-May-22	77	63									LOI	DDX	10		Mirco Dietz	yes					
23	06-Jun-22	84	70									Totals		256,0	116,5							
24	13-Jun-22	91	77																			
25	20-Jun-22	98	84			X17	7															
26	27-Jun-22	105	91			NN scattering	14															
27	04-Jul-22	112	98	Cr-50,53	42	commissioning (borated H2O, large collimator)																
28	11-Jul-22	119	105																			
29	18-Jul-22	126	112																			
30	25-Jul-22	133	119																			
31	01-Aug-22	140	126																			
32	08-Aug-22	147	133																			
33	15-Aug-22	154	140																			
34	22-Aug-22	161	147																			
35	29-Aug-22	168	154																			
36	05-Sep-22	175	161																			
37	12-Sep-22	182	168	HPGe	7																	
38	19-Sep-22	189	175	Pu-239	56	Am-243	35															
39	26-Sep-22	196	182																			
40	03-Oct-22	203	189																			
41	10-Oct-22	210	196																			
42	17-Oct-22	217	203																			
43	24-Oct-22	224	210																			
44	31-Oct-22	231	217																			
45	07-Nov-22	238	224	DDX	7																	
46	14-Nov-22	245	231																			
47	21-Nov-22	252	238	Am-243	35																	
48	28-Nov-22	259	245																			
49	05-Dec-22	266	252																			
50	12-Dec-22	273	259																			
51	19-Dec-22																					
52	26-Dec-22																					
53	02-Jan-23																					
54	09-Jan-23																					

The NEAR Station

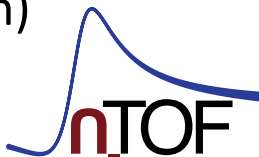
during the design studies of the new shielding around the target station the opportunity for a new near-target experimental area appeared (NEAR station)



Measurements for technical and engineering developments

- Irradiation of non-metallic materials + SEE (R2M & R2E projects)

1. Measurements of MACS by activation for nuclear astrophysics
2. Fusion-related measurements (cross sections, not irradiation)
3. Measurements of decay rates of long-lived isotopes



NEAR Station (inner area)

irradiation positions
inside the shielding

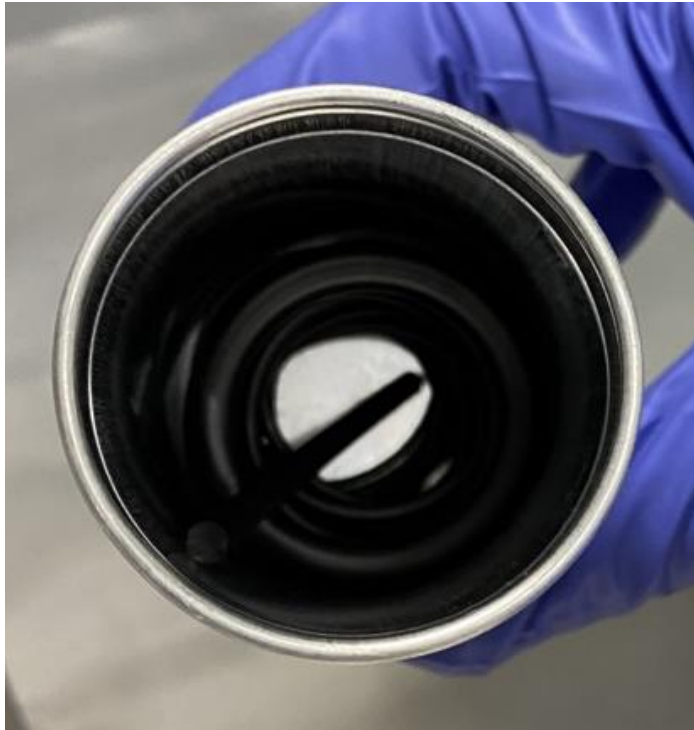
n_TOF target area
shielding **OPEN**



n_TOF target (pool)



Sample inspection (preliminary)



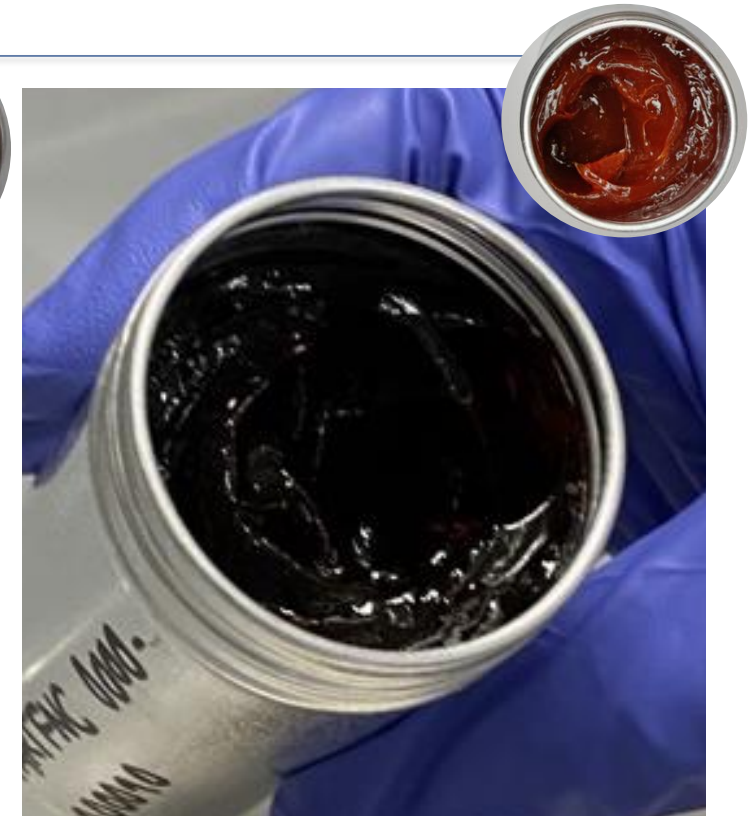
ELASTOMER

- No changes detectable
- **Keep the same configuration in 2022**



PPE GREASE

- Change of colour
- No displacement visible



MIN. OIL-BASED GREASE

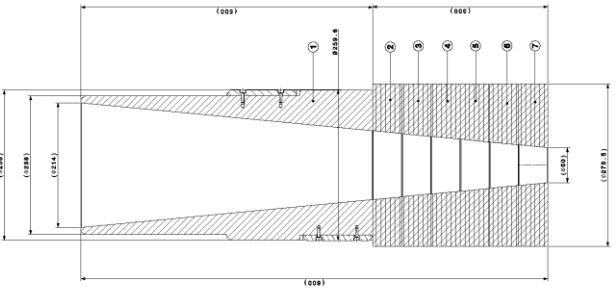
- Change of colour
- No displacement visible

R2M samples at NEAR in 2022

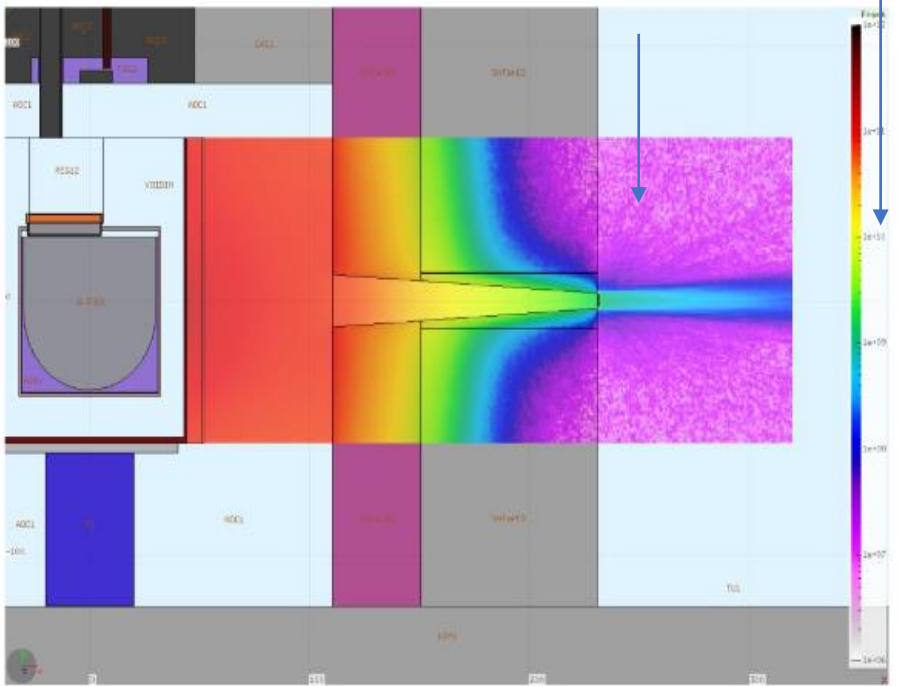
#	PRODUCT	PRODUCER	TYPE	GENERAL COMPOSITION	POSITION	TOTAL AMOUNT
1	RP-42R	M O RESCO	oil	PPE (polyphenyl ether)	Shelf	160 mL
2	RG-42R-1	M O RESCO	grease	PPE + bentonite	Shelf	200 g
3	RG-42R-2	M O RESCO	grease	PPE + bentonite	Shelf	200 g
4	LY PPE 360	Lubrilog	oil	PPE	Shelf	160 mL
5	LX AGFA 00	Lubrilog	grease	PPE + silica	Shelf	200 g
6	LX AGFA 2	Lubrilog	grease	PPE + silica	Shelf	200 g
7	PETAMO GHY 133N	Kluberlub	grease	Minera oil + polyurea	Shelf	200 g
8	GRIZZLYGREASE N.1	Lubcon	grease	Minera oil + Li/ Ca	Shelf	200 g
9	SANTOVAC 5GB	SANTOLUBES	grease	PPE + unknown additives	Shelf	200 g
10	NUCLEOL G121	Castrol	grease	Mineral oil + inorganic thickener	Shelf	200 g
11	EPDM 70.10-02	Angst + Pfister	elastomer	EPDM-based, various additives	Shelf	20 grams
12	Shieldseal 663	James Walker	elastomer	EPDM-based, various additives	Shelf +R2	40 grams
13	Shieldseal 664	James Walker	elastomer	EPDM-based, various additives	Shelf + R2	40 grams
14	Aeroshell grease 22	Shell	grease	Mineral oil + silica	Shelf + R2	260 g

Acknowledgements: M. Ferrari

NEAR Station (outer area)



5E8 n/cm2/pulse
(outside the shielding)

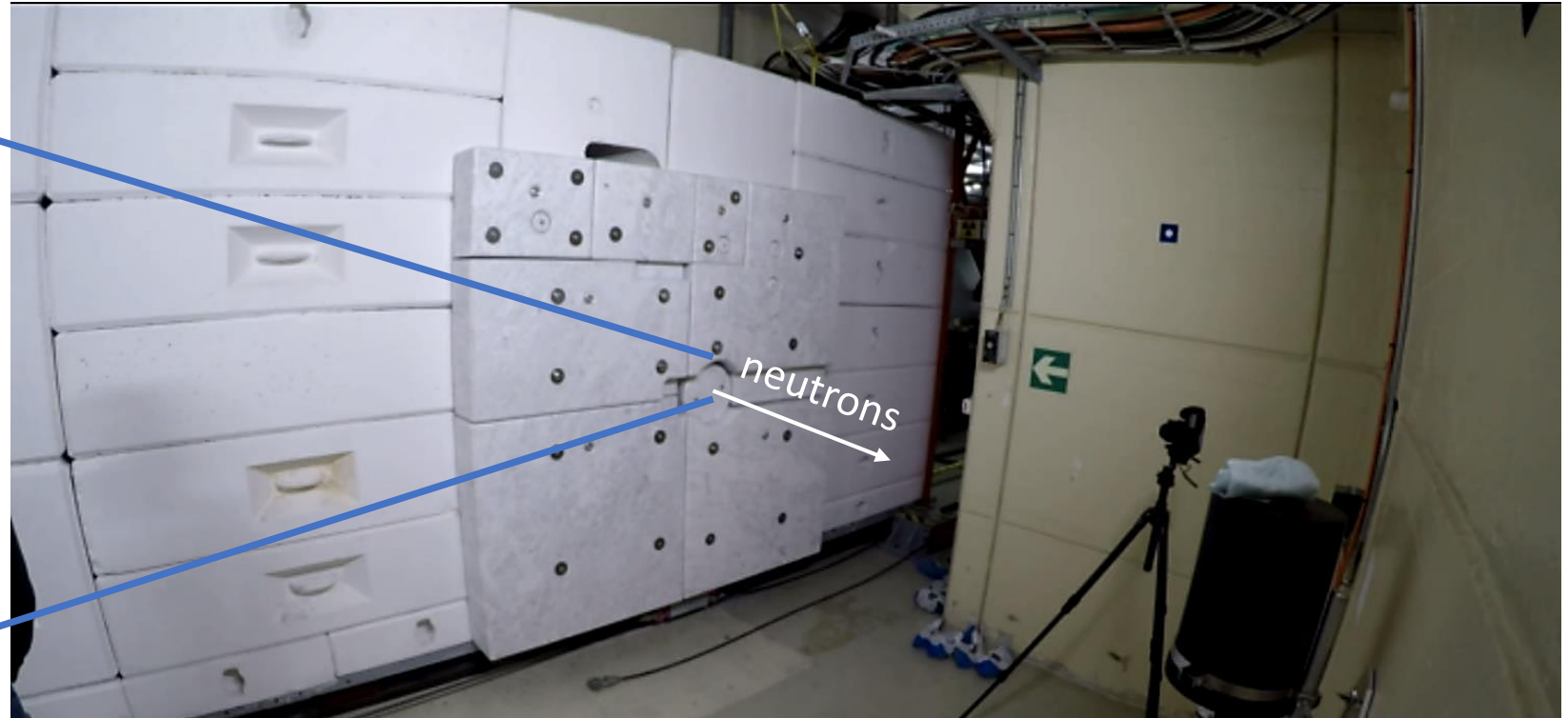


NEAR Station (outer area)

n_TOF target area
shielding **CLOSED**



Sample + filter assembly support



See INTC proposal P-623

Neutron capture cross section measurements by the activation method
at the n_TOF NEAR Station

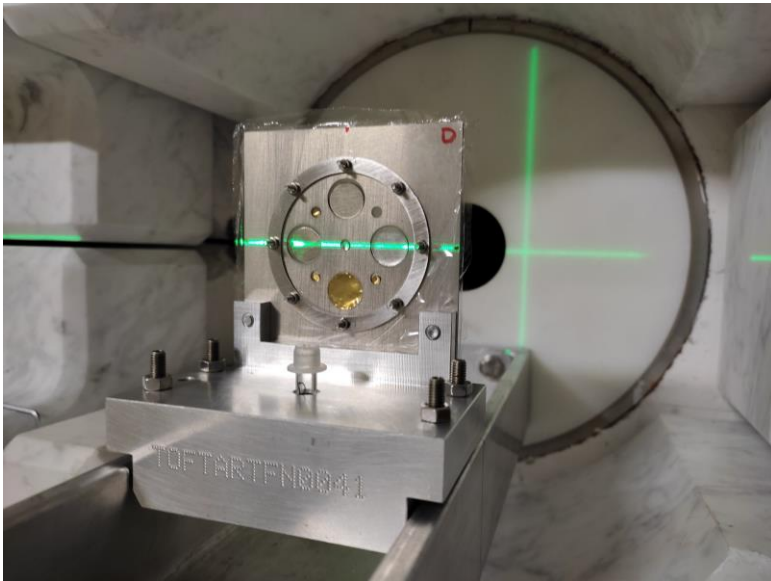
Alice Manna (Universita e INFN, Bologna, IT),

Elisso Stamati (University of Ioannina, GR),

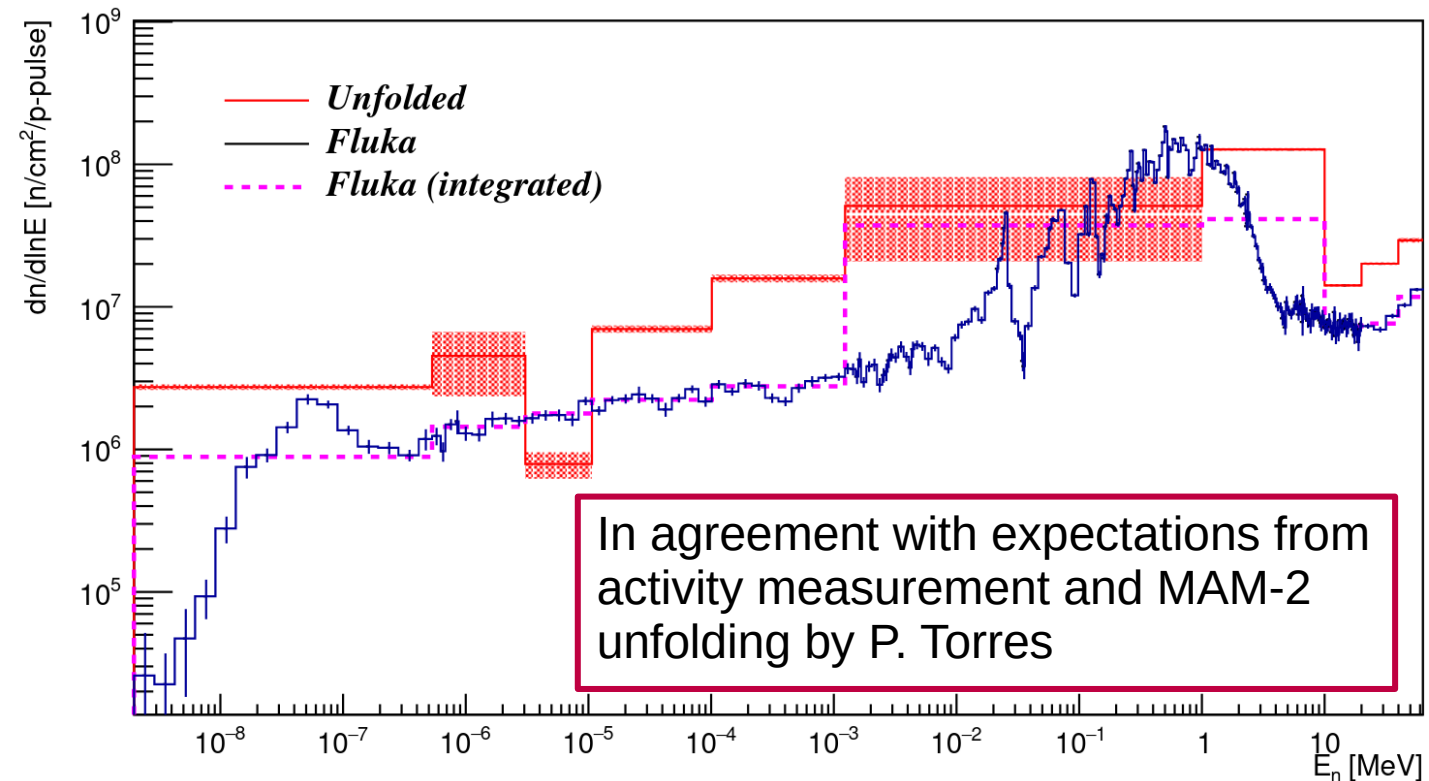
Gianpiero Gervino (INFN, Torino, IT)

NEAR Station (outer area)

Multi-foil activation analysis (MAM)
Measurements performed during commissioning
(CERN-INTC-2020-073, [INTC-I-222](#))



Reminder: Preliminary (almost final) results



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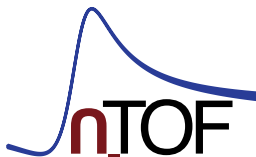
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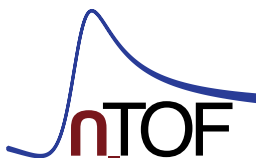
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The n_TOF Collaboration



The End

