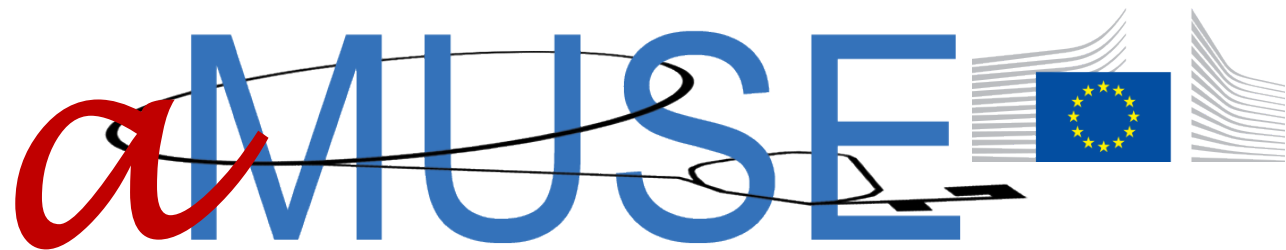


aMUSE



aMUSE overview

S. Giovannella (INFN)

aMUSE Project Coordinator

aMUSE overview

- ✗ H2020 Research and Innovation Staff Exchange program (MSCA-RISE-2020)
- ✗ Extension of a previously funded RISE (MUSE, 2016-2019): **advanced MUSE**
- ✗ EU participants from 6 different countries:
 - 4 research institutes [**HZDR** (DE), **INFN** (IT), **LIP** (PT), **PSI** (CH)]
 - 5 universities [**JGU** (DE), **JU** (PL), **Padova** (IT), **Sapienza** (IT), **TUD** (DE)]
 - 2 companies [**CAEN** (IT), **Luxium** (ex St. Gobain crystals) (FR)]
 - 1 outreach organization [**Frascati Scienza** (IT)]
- ✗ Three US hosting institutes:
 - Fermilab (FNAL), Batavia, Illinois
 - Brookhaven National Laboratory (BNL), Upton, New York
 - Stanford Linac Accelerator Center (SLAC), Menlo Park, California

Project Organization

aMUSE activities are organized in seven Work Packages (WP):

WP1	WP2	WP3	WP4	WP5	WP6	WP7
Muon Campus Experiments	Muon Campus Upgrade	Muon Beams	Software tools	Communication & outreach	Transfer of knowledge	Management
INFN	UniRM	UniPD	LIP	FS	HZDR	INFN

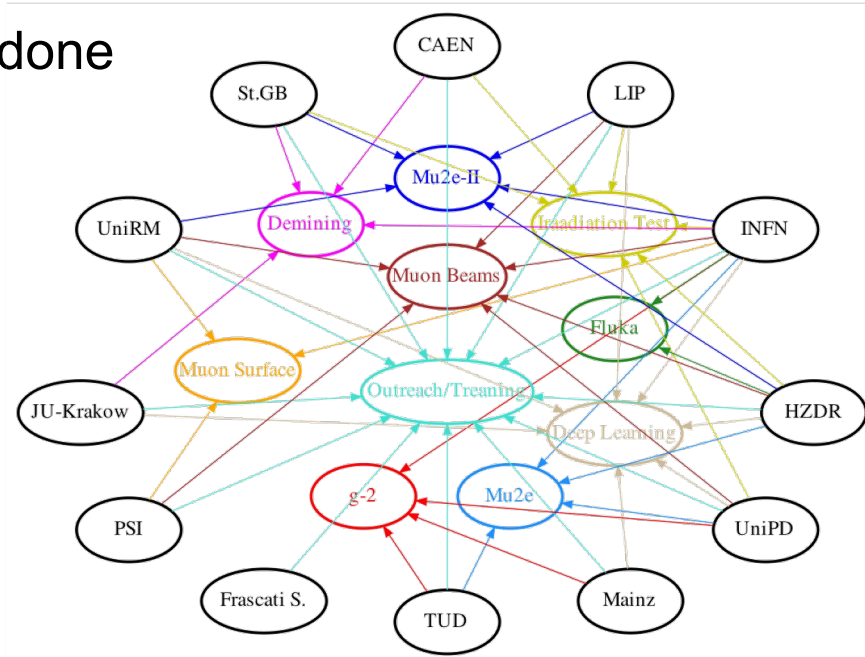
- WP1: Muon (g-2) and Mu2e experiments, theory developments
- WP2: R&D for Mu2e-II and feasibility studies for CLFV from muon decays at PIP-II
- WP3: R&D studies for muon collider and cooling of low energy muon beams
- WP4 connects specific expertise developed in WPs 1-3 into one synergic activity among all network participants
- WP5 coordinates communication & outreach activities of all participating institutes
- WP6: training and application of fundamental research to other fields
- WP7 coordinates and supervises activities across all the WPs

aMUSE status

Last General Meeting was in June 2023. In the meanwhile:

- ✗ The outcome of the Mid-Term Meeting was positive on the scientific side, while the PO was concerned on the small number of travels (36%)
 - ✗ We closed the First Progress Report on the 2022-2023 activities
 - ✗ aMUSE activities and tasks are progressing steadily
 - ✗ Governing boards meetings regularly done
 - ✗ Dissemination
 - ✗ Outreach
- Several events organized

The aMUSE website is the right place where to find documentation for all of this: <http://amuse.lnf.infn.it>



Muon Campus in US and Europe contribution

Public section for the general public to maximize the visibility of the project:

- General information on the project and its organization
- Dissemination and outreach events being kept updated on the web site
As of today: 83 talks/posters/seminars, 32 publications, 22 outreach events

ABOUT MUSE PROJECT

The MUSE project coordinates the activities of about 70 researchers from various European research institutes and industries for the participation to the experiments at the Muon Campus of the Fermi National Laboratory, USA. It promotes international and intersectoral collaboration by means of secondments of personnel, thus enhancing European contribution and visibility in this activity.

The duration of the MUSE project is of four years, thus well adapting to the Muon Campus schedule that will host in the same period two world class experiments dedicated to the search of new physics: Muon $g-2$, for a ten-fold improvement on the measurement of the muon magnetic anomaly, and Mu2e, for the search of the yet unobserved conversion of a muon to an electron.

Web site: <http://muse.inf.infn.it>

PROJECT DISSEMINATION OUTREACH PARTNERS ORGANIZATION CONTACTS



Muon Campus in US and Europe contribution

Private section to share documents and information among participants:

- ↯ Grant Agreement
- ↯ Status of deliverables and milestones
- ↯ Meetings with presentations and minutes
- ↯ Mailing lists
- ↯ Biannual reports
- ↯ Useful tools

INTERNAL MENU

- Grant Agreement
- Deliverables
- Milestones
- Meetings
 - Internal
 - Management Board
 - Scientific Board
- Mailing lists
- Reports
- MUSE logo
- Acknowledgements
- Templates
- Logout

aMUSE extension

- ✘ aMUSE started in the middle of a pandemic period, while the Covid-19 Omicron variant was hitting Europe and US :
 - 6-month delay in the start of travels, limited mobility for the whole 2022
 - delays in several activities of the aMUSE program
 - three of the 2022-2023 milestones not achieved
 - expected delays for few 2024-2025 deliverables

- ✘ In March, the Consortium started a discussion with the Project Officer to request an extension of the project

- ✘ EU granted a 6-month extension of Reporting Period 1
 - New aMUSE timeline: **1 January 2022** ⇔ **30 June 2026**
 - RP1: extended to June 30th, 2024 (new submission with updated information)
 - RP2 covers the last two years of the project
 - Updated scheme for the milestones/deliverables
 - Updated secondment plan

Revised milestones & deliverables

Deliverable	Del. Submitted
Milestone	Mil. Achieved

TODAY

Del/Month	Jun-22 M6	Dec-22 M12	Jun-23 M18	Dec-23 M24	Jun-24 M30	Dec-24 M36	Jun-25 M42	Dec-25 M48	Jun-26 M54	Deliverable description
D1.1			INFN (18)							Measurement of a_mu
D1.2				MS1 (20)				Mainz (48)		Muon (g-2) systematics
D1.3						MS2 (36)	INFN (38)			Mu2e commissioning
D1.4									HZDR (52)	Mu2e performance & beam normal.
D1.5				MS3 (24)				TUD (44)		Theory interpretations
D2.1			MS4/MS5 (18)			MS7 (36)		INFN (48)		Mu2e-II detector design
D2.2						MS6 (36)			UniRM (50)	Muon decay experiment concept
D3.1			MS8 (20)			PSI (36)				Muon cooling
D3.2				INFN (22)						Beam induced background
D3.3					MS9 (29)		UniPD (42)			Detector simulation for muon collider
D4.1			INFN (18)							FLUKA interface with IR lattice
D4.2		MS10 (12)								ILC software update
D4.3				MS11 (22)				LIP (46)		Application of ML tools to aMUSE activities
D5.1-D5.2				FS (24)					FS (54)	Report on Communication/Outreach
D6.1		MS12 (12)								Report on irradiation tests
D6.2										Report on calorimetry for Laser-Plasma
D6.3				MS13 (20)				Krakow (44)		Report on HPCry
D7.1-4	INFN (1)		INFN (18)			INFN (34)		INFN (46)		aMUSE General Meeting
D7.5-D7.6	MS14 (1)		INFN (13)					INFN (43)		aMUSE Progress Reports
D7.7	INFN (5)									Web site
D7.8	HZDR (6)									Data Management Plan

Shifted because of delays in the scientific activities

Shifted because of the 6-month extension

Updated secondment plan

Institute	Original	Current
	# secondments (p.m.)	# secondments (p.m.)
INFN Mu2e	115	115
INFN g-2	52	52
INFN Muon Collider	14	14
UniRM	27	17
HZDR	70	56
UniPD	31	20
LIP	25	25
PSI	20	10
TU Dresden	15	5
Mainz	23	13
Krakow	11	8
Frascati Scienza	4	4
CAEN	4	4
St.Gobain	2	2
Total	413	345

RP1: status of secondments

Beneficiary	Number of secondments due in RP1	Fraction of secondments completed in RP1
INFN	96	87.3%
HZDR	10	64.0%
Univ. of Padova	5	80.0%
LIP	10	78.0%
JGU - Mainz	5	84.0%
Univ. of Rome, Sapienza	2	55.0%
PSI	0	--
TUD	0	--
JU – Krakow	0	--
Frascati Scienza	0	--
CAEN	1	30.0%
LUXIUM	1	0.0%
Total	130	82.7%

First Progress Report

Technical Part:

- ✗ Summary for publication for non-experts
- ✗ Risk assessment
- ✗ Deliverables/Milestones (all due completed)
- ✗ Dissemination/Communication/Publications
- ✗ Gender information
- ✗ Technical Report
 - ↪ description/impact of the work carried on
 - ↪ deviations from the GA planning

Financial Part:

- ✗ Derived from the list of secondments for RP1

First Progress Report

Technical Part:

✗ Summary for publication for non-experts

➔ Risk assessment

✗ Deliverables/Milestones (all due completed)

➔ Dissemination/Communication/Publications

✗ Gender information

✗ Technical Report

↪ description/impact of the work carried on

➔ ↪ deviations from the GA planning

Financial Part:

✗ Derived from the list of secondments for RP1

aMUSE risk register (I)

#	Description	WP
1	Delays in achieving 100 ppb systematic error for a_μ	1
2	Delay in the Mu2e start-up phase	1
3	Problems to operate in vacuum CAPHRI detector	2
4	Delay in the availability of high energy centre of mass IR lattice	3
5	Impossibility to fully simulate physics bckg for 3-Higgs analysis due to high CPU consumption	3
6	Delays in planned secondments	ALL
7	Loss of key personnel	ALL
8	Unavailability of the SLAC laser-plasma source	6
9	COVID consequence: travels towards US laboratories allowed for essential activities only for the first 10 months of the project	ALL

NEW

NEW

Risk 1: delays in releasing the result from the Muon (g-2) Collaboration

➡ **4 months of delay in completing Deliverable D1.1** (“Measurement of a_μ ”, M18)

Risk 2: delay in the assembling of the calorimeter in the Mu2e hall as a consequence of Covid-19

➡ **MS2** (“Mu2e calibration tools”) **and D1.3** (“Mu2e commissioning”) **delayed with the amendment** (+18 months and +12 months, respectively)

Risk 6: risk related to a delay on specific tasks/activities

➡ **Covid-19 delays** more extended, **only partially recovered** by applying mitigation measurements

aMUSE risk register (II)

#	Description	WP
1	Delays in achieving 100 ppb systematic error for a_μ	1
2	Delay in the Mu2e start-up phase	1
3	Problems to operate in vacuum CAPHRI detector	2
4	Delay in the availability of high energy centre of mass IR lattice	3
5	Impossibility to fully simulate physics bckg for 3-Higgs analysis due to high CPU consumption	3
6	Delays in planned secondments	ALL
7	Loss of key personnel	ALL
8	Unavailability of the SLAC laser-plasma source	6
9	COVID consequence: travels towards US laboratories allowed for essential activities only for the first 10 months of the project	ALL

NEW

NEW

Risk 7: realized for **Task 6.3 “Design of an alternative Mu2e-II tracking system”**

➔ SB actively engaged in identifying researchers w/ equivalent profile and experience potentially, it could result in a descoping of D2.1 “Mu2e-II detector design” (M30)

Risk 8: consequence of a large upgrade of the Matter Under Extreme Conditions (MEC) end station

➔ deliverable **D6.2 moved to the last months of the project** with the amendment

Risk 9: technically added to motivate the amendment

Dissemination and Outreach

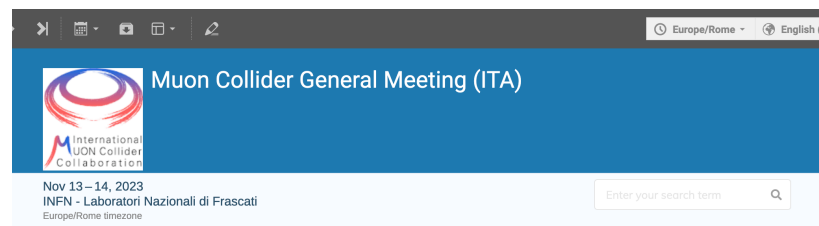
- X Lot of effort in dissemination and outreach activities
- X List of public events on the aMUSE web site
- X aMUSE results disseminated to the international scientific community through the participation to physics and instrumentation international conferences and the publication in professional journals:
 - ↪ **83 talks** delivered
 - ↪ **32 publications** produced (all gold/green open access)
 - ↪ **3 public datasets** according to our Data Management Plan
<https://doi.org/10.5281/zenodo.7117705>
- X Outreach events, promoting communication between aMUSE scientific community and general public to increase science awareness and to inspire the next generations of scientists:
 - ↪ aMUSE General Meeting: Outreach event for University students
 - ↪ Open Day and European Researchers' Night
 - ↪ Other specific events in different aMUSE institutions
 - ↪ Twitter and LinkedIn accounts
 - ↪ News, newsletters

Dissemination and Outreach

- X Lot of effort in dissemination and outreach activities
- X List of public events on the aMUSE web site
- X aMUSE results disseminated to the international scientific community through the participation to physics and instrumentation international conferences and the publication in professional journals
 - ~ **83 talks** delivered
 - ~ **32 publications** produced (all gold)
 - ~ **3 public datasets** according to FAIR principles
- X Outreach events and activities:
 - aMUSE scientific awareness and to inspire young people to pursue a career in science
 - **Open Access required**
 - **aMUSE acknowledgements mandatory**
- X Outreach event for University students
- X Open Access European Researchers' Night
- X Other specific events in different aMUSE institutions
- X Twitter and LinkedIn accounts
- X News, newsletters

Contribution to topical workshops

- ✗ aMUSE contributed to the organization of two workshops on topics related to the project
 - ⚡ MuCol General Meeting, 13-14 Nov 2023
 - ~ 50 participants
 - Status of Italian Muon Collider activities
 - ⚡ SATIF-16, 28-31 May 2024
 - ~ 140 participants
 - Radiation physics experts
 - Modelling and tools for radiation shielding



- Overview
- Timetable
- Registration
- Participant List
- How to get here
- Accommodation
- Internet access
- Safety Rules
- INFN Privacy Policy
- Contact

The meeting si svolgerà presso l'Auditorium "Bruno Touschek" (Ed. 36). I partecipanti potranno accedere dall'ingresso secondario di Via E. Fermi, 60 (vedi mappa).

I partecipanti in possesso di un badge della propria struttura INFN, in corso di validità, potranno utilizzare tale badge per accedere dal tornello.

Il cancello secondario sarà aperto dalle ore 8:00 alle ore 16:00 (anche per le autovetture). Oltre questo orario - a meno che non si sia dotati del proprio badge INFN per l'uso del tornello - bisognerà passare dall'ingresso principale di Via E. Fermi, 54.

I Coffee breaks ed il pranzo a buffet del 13 Novembre si svolgeranno nella hall dell'Auditorium e saranno offerti dall'organizzazione.

Il pranzo del 14 Novembre si terrà presso la mensa dei LNF alle h. 13:30 (costo per un pasto completo 7,00 €).

Si prega di indicare la partecipazione ai pranzi nel modulo di registrazione.

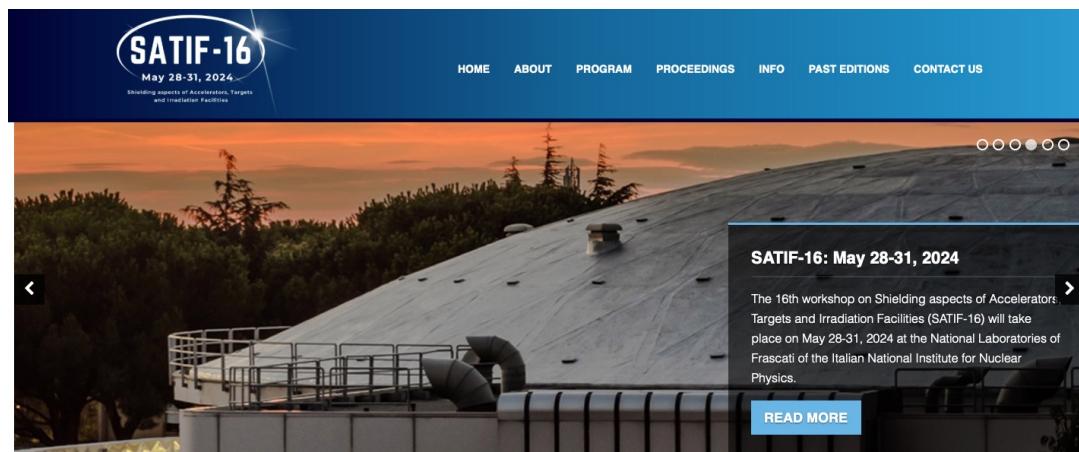
La cena sociale del 13 Novembre si svolgerà presso l'Osteria San Rocco Piacente di Frascati (Via Luigi Cadorna, 1) al costo di circa 50,00€.

Il 13 Novembre un autobus verrà messo a disposizione dei partecipanti al termine della riunione per il viaggio dal LNF a Villa Mercedes e Frascati centro.

Il 14 Novembre Villa Mercedes metterà a disposizione 3 navette (due alle ore 8:20 e una alle ore 8:35) per raggiungere i LNF.

Per la sistemazione alberghiera si veda 'Accommodation'. N.B.: opzione di prenotazione all'hotel Villa Mercedes fino al 30 Ottobre 2023.

La scadenza per la registrazione è posticipata al 5 Novembre p.v.



IMPORTANT DATES

ABSTRACT SUBMISSION

OCTOBER 16, 2023 MARCH 27TH, 2024

ABSTRACT ACCEPTANCE NOTIFICATION

APRIL 15, 2024



ORGANIZATION

INFN - Laboratori Nazionali di Frascati



indico v3.3.3

Training for aMUSE participants

Secondments give a unique opportunity to aMUSE participants in improving their individual skills and career perspectives

aMUSE provided also the opportunity to:

- ↪ increase attendance of schools for PhD students and postdocs
- ↪ attend training courses (management, science communication, language...)

We have also organized specific training courses during General Meetings on specific advanced topics from research development in HEP or industry

**2024 GM Training session
18 September 2024**

Nuclear Fusion: The Energy of the Sun on Earth	<i>lidia piron</i>
<i>Aula Vigna</i>	09:00 - 09:45
Quantum simulation: overview and perspectives	<i>Marco Di Liberto</i>
<i>Aula Vigna</i>	09:45 - 10:30
Radionuclide production technologies at INFN-LNL	<i>Aurora Leso</i>
<i>Aula Vigna</i>	11:00 - 11:45

aMUSE irradiation network

- ✗ Existing European (and US) infrastructures used to carry on an irradiation program among aMUSE participants (HZDR, INFN, CAEN, LUXIUM), aiming to test radiation hardness and characterize detector components of the Mu2e, Mu2e-II detectors

- ✗ Already exploited in the previous RISE project, MUSE

- ✗ The ELBE accelerator complex at HZDR provides both high dose neutron flux (pELBE) and high-intensity Bremsstrahlung radiation (gELBE)

- ↗ Several irradiation campaigns (neutrons, protons, photons) already performed @ ENEA/CNAO (Italy) and Fermilab, UCDavis (US) for the characterization of digital electronics for Mu2e

- ↗ Two irradiation beam tests @ ELBE in 2023:
 - Radiation hardness of scintillating crystals @ gELBE for the technology choice of the Mu2e-II calorimeter
 - Precise characterization of the neutron source for next round of irradiation campaigns

Deviations from GA

Two specific tasks are not progressing as planned:

X Task 2.3 “Design of an alternative Mu2e-II tracking system” (INFN, UniRM)

↻ Mu2e-II baseline technology: 8 μm straw tracker

↻ Proposed R&D: innovative detector adapting & improving MEG/II tracker option

↻ Key researchers left the project, not easy to identify a researcher with similar profile and equivalent professional experience

↻ Deliverable D2.1, “Mu2e-II Detector Design” will be provided with a reduced scope.

X Task 6.3 “Laser plasma detectors” (HZDR, INFN)

↻ R&D for a sampling SiPM calorimeter to characterize photon radiation ultra-high intensity laser plasma experiments

↻ Test beams planned @ SLAC to characterize detector response

↻ SLAC experimental hall not available for users after Covid reopening because of a large upgrade of the Matter Under Extreme Conditions end station

↻ Currently ongoing activities: R&D on electronics design, development of radiation transport codes to simulate the radiation from the target

Conclusions

- ✗ First 2.5 years of the project completed
- ✗ 6-month extension granted from EU to complete the scientific scope of the project
- ✗ A revised and solid plan for the completion of deliverables is available
- ✗ Despite some delays in few specific items, aMUSE activities are progressing well
 - ↪ several achievements on the scientific side
 - ↪ despite the slow start-up due to pandemic, a good fraction of planned secondments started
 - ↪ milestones on track, no showstoppers to complete deliverables
 - ↪ very active networking and transfer of knowledge among different institutions
 - ↪ a lot of dissemination and outreach events