Congresso
del Dipartimento di Fisica

Poster Session

Pisa 27 maggio 2026

AULA MAGNA F.LLI PONTECORVO

Area Pontecorvo, Edificio E

Largo Bruno Pontecorvo, 3 - Pisa

Poster Session

We have a total of 18 posters, spanning many different topics, just to give you an idea:

- Neural network studies and applications: from HEP to environmental data analysis
- Sensors: from polymeric devices to nanostructured photodetectors
- Study of properties of materials, plasma and gas
- Medical physics and biological applications
- Particle experiments: detectors characterization and data analysis
- Astroparticle measurements and cosmological studies
- Light-matter interaction in entanglement and photonics

Poster Session

In the following, you can find one slide for each poster, to have a better insight of the session. We preferred not go through them in detail here.

Enjoy the poster session and the lunch

But first…

Poster Session

Picture Time!

Novel Nanostructured Photodetectors Encompassing Organic Matrices

Syed Ossama Ali Ahmad*, Nicola Puccini, Michele Raucci, Francesca Matino, Luana Persano, Andrea Camposeo, **Dario Pisignano**

This work investigates nanostructured photodetectors based on organic semiconductor heterojunctions. Bulk heterojunction photodiodes fabricated with calibrated blends are analyzed through state-of-art simulations and electrical characterization, in the framework of new research lines activated for the 'Department of Excellence' project. The study focuses on charge transport, optical absorption, transient photocurrent response, and device optimization for broadband and low-intensity photodetection applications.

Light-Cone Approach to Cosmological Observables beyond Linear Order

Pierre Béchaz

Based on JCAP 03 (2026) 075 & arXiv:2604.26690

In collaboration with G. Fanizza, G. Marozzi and M. Medeiros

I show how non-linear relativistic effects on cosmological observables can be computed using a set to light-cone coordinates, specifically adapted to describe light-beam propagation on the past light-cone of an observer.

UNIVERSITÀ DI PISA

Pisa, Congresso di Dipartimento
May 27, 2026

INFN PISA

Temporal Complexity Reveals Criticality in Dense Associative Memory Models

Marco Cafiso[1,2] and Paolo Paradisi[2,3]

[1]Department of Physics 'E. Fermi', University of Pisa, Pisa, Italy

[2]ISTI-CNR, Institute of Information Science and Technologies 'A. Faedo', Pisa, Italy

[3]BCAM-Basque Center for Applied Mathematics, Bilbao, Spain

This poster examines how **temporal complexity reveals critical behavior in bio-inspired learning models**. Using a **Dense Associative Memory** network and the **Temporal Complexity framework** , we analyze **how self-organization and complexity emerge during learning** as the number of stored patterns varies.

Future Artificial Intelligence Research

Consiglio Nazionale delle Ricerche

Istituto di Scienza e Tecnologie dell'Informazione "A. Faedo"

Signals & Images Laboratory

In Supremæ Dignitatis 1343

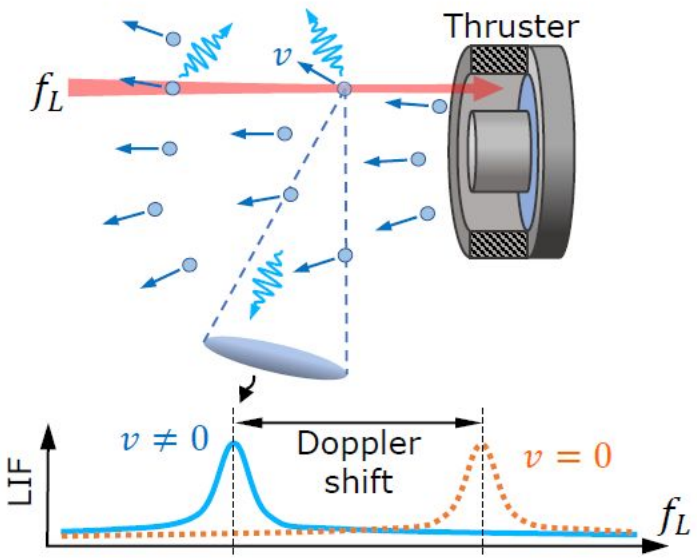
Università di Pisa

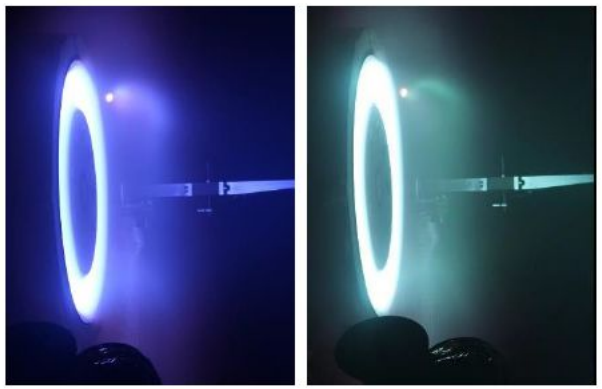
Non-Invasive Plasma Diagnostics of High-Power Hall Thrusters using LIF-Doppler Velocimetry

Michele Cardelli[1], Piergiorgio Laterza[1], Alena Kitaeva[2], Andrea Di Sarli[2], Nicola Giusti[2], Vincenzo Pisano[2], Luca Pieri[2], Massimiliano Cecconi[2], Caterina Binetti[2], Lucio Torre[2], Stefan Gregucci[2], Nicola Puccini[1], Stefano Gennai[1], Enrico Andreoni[1‡], Andrea Camposeo[3], Francesco Califano[1], Francesco Fuso[1], Dario Pisignano[1,3], Ennio Arimondo[1,4], Donatella Ciampini[1,4]

[1] Department di Fascia, Università di Pisa, Largo B. Pontecorvo 3, 56127 Pisa, Italy, [2] SITAEL S.p.A, Via A. Gherardi's 5, 56121 Pisa, Italy, [3] NEST, Istituto Nanoscience CNR, Piazza San Silvestro 12, 56127 Pisa, Italy, 4 INO-CNR, Istituto Nazionale di Ortica, Via G. Moruzzi 1, 56124 Pisa, Italy, ‡ Deceased

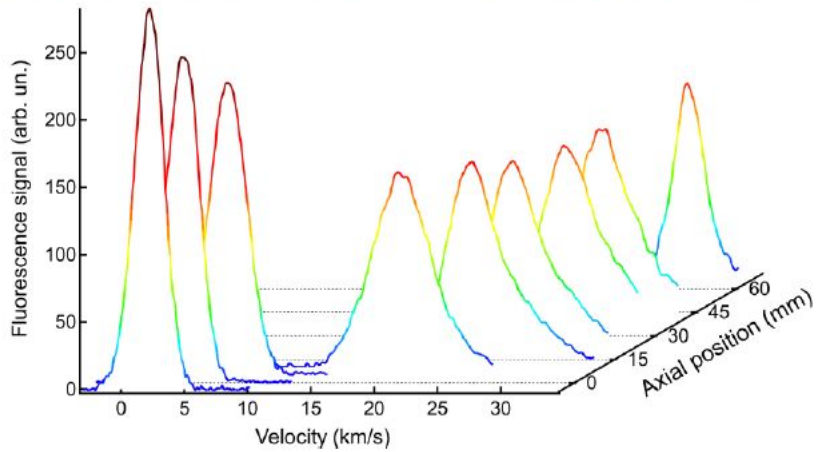
Non-invasive plasma diagnostics are crucial for the development and validation of numerical simulations of Hall-effect thrusters (HETs), especially as interest in high-power (>10 kW) HETs for advanced spacecraft propulsion grows.
Laser-Induced Fluorescence (LIF) Doppler velocimetry is a key spectroscopic technique for this purpose, although its application to high-power HETs remains challenging. We present a novel, compact, and automated LIF setup that drastically reduces the facility footprint in terms of structural modifications, installation time, and associated costs. This system was successfully deployed in a subset campaign on a 20-kW class HET developed by SITAEL S.p.A. within the framework of the European H2020 ASPIRE (GA101004366) project.





SITAEL HT20k (subset of subset campanini) Firing a Pd=25 kW, Vad=400 V, with krypton (lift) and xenon (tight).

LIF Measurements: Kr II @ Pd=25 kW, Vad=400V



Measurement-induced dynamics of quantum light and matter

G. Citeroni[1,*], M. Polini[1], M. Dapolito[2], D. N. Basov[2], G. Mazza[1]

[1] *Dipartimento di Fisica dell'Università di Pisa, L. Bruno Pontecorvo 3, I-56127, Italy*
[2] *Department of Physics, Columbia University, New York, New York 10027 USA*

Abstract

We study the nonequilibrium dynamics of a collective excitation in a two-dimensional material driven by the signal photon of an entangled pair, while the idler is monitored by a distant photodetector. We show that click and no-click detection events yield, respectively, reduced and enhanced signal photon transmission relative to the ensemble-averaged Lindblad evolution, and that click trajectories exhibit a distribution of transmission coefficients whose width is set by the idler-detector coupling strength. The measurement-induced back-action further gives rise to enhanced light-matter entanglement entropy and transient anti-bunched matter excitations.

* **Presenting author**

Super-Resolution Microscopy: Probing the Cellular Impact of FLASH Radiotherapy.

Martina De Felice, Jacopo Bernardini, Antonella Catanzariti, Vittorio Parenti, Cristina Croia, Alice Usai, Gaia Scabia, Giulia Asero, Margherita Maffei, Francesca Del Debbio, Eleonora Da Pozzo, Fabio Di Martino , Andrea Cavalieri, Francesca Cella Zanacchi, Simone Capaccioli

Among super-resolution microscopy (SR) techniques, single-molecule localization microscopy (SMLM) stands out for its ability to visualise proteins and cellular structures with nanometer-scale precision, far beyond what conventional fluorescence microscopy can achieve. In radiobiology, this approach holds remarkable promise, revealing molecular-level effects that traditional techniques are unable to detect, thus opening new perspectives on the so-called FLASH effect, a phenomenon with recognised clinical potential whose underlying molecular mechanisms remain largely unknown. To address this gap, STORM microscopy was employed to study the effects of FLASH radiotherapy on healthy and cancerous in vitro cell models, with a focus on DNA damage and cytoskeletal rearrangements induced by radiation. This strategy provides nanoscale insights into the complex biological processes triggered by FLASH radiotherapy, contributing to a deeper mechanistic understanding of this emerging treatment modality.

A Magnetic Mystery: Past, Present and Future of the Muon $g-2$ Puzzle

L. Cotrozzi [a], A. Driutti [b,c], E. Hess [b, c], L. Punzi [c, d]

[a] University of Liverpool [b] University of Pisa [c] INFN, Sezione di Pisa [d] Scuola Normale Superiore

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- Introduction to the muon $g-2$ puzzle, with details on the latest experimental results from FNAL. Justification of the importance of the hadronic contribution to the anomalous magnetic moment a_μ^{HLO}.
- Description of KLOE-nxt ongoing analysis, to clarify the tensions in previous determinations of a_μ^{HLO}.
- Introduction of MUonE experiment at CERN and its novel approach to measure a_μ^{HLO}, via precise determination of the muon–electron elastic scattering cross section.
- A new experimental proposal: the J-PARC Muon $g-2$/EDM experiment to independently confirm the results by FNAL.

Congresso Dipartimento di Fisica

Università di Pisa, 27/05/2026

Measurement of the W boson mass at CMS

Ruben Forti *(on behalf of the CMS collaboration)*

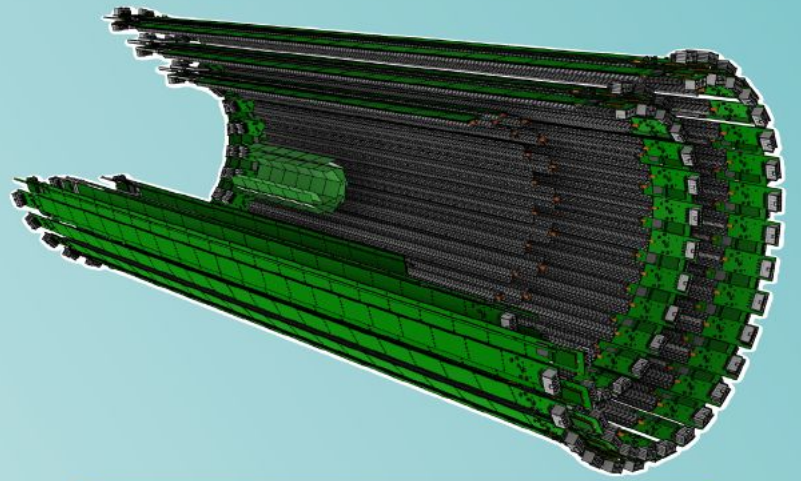
This poster presents the measurement of the W boson mass (m_W) at the CMS experiment, published in 2024 and representing the most precise determination at the LHC, with an uncertainty of 9.9 MeV. The poster covers some of the most important aspects of the analysis, with a particular focus on the detailed measurement of the muon efficiency scale factors, which play a fundamental role in ensuring good agreement between data and simulation before performing the final fit to m_W.

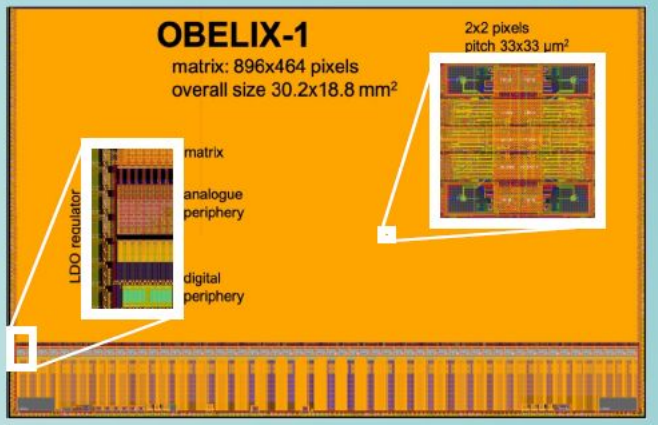
Upgrade of the Belle II Vertex Detector with depleted monolithic CMOS active pixel sensors

Alice Gabrielli on behalf of Belle II VTX collaboration

- Belle II at SuperKEKB aims to operate at an instantaneous luminosity of $6 \times 10^{35} \mathrm{cm}^{-2}\mathrm{s}^{-1}$. The current Belle II Vertex Detector (VXD) has limited safety margin at future luminosities due to increased occupancies and radiation levels, as well as possible modifications of the interaction region design.
- A new fully pixelated vertex detector (VTX), based on Depleted Monolithic Active Pixel Sensors (DMAPS), is proposed to provide higher granularity, faster timing capability, lower material budget, and improved radiation tolerance.
- The upgrade is based on the new OBELIX DMAPS sensor, derived from the TJ-Monopix2 architecture and optimized for Belle II requirements.
- The poster presents the VTX detector concept, the OBELIX sensor design, and the results of extensive laboratory characterization and DESY test beam campaigns performed with TJ-Monopix2 sensors to validate the technology and define safe operating conditions after irradiation. Preliminary results show excellent efficiency after irradiation, with a strong dependence on operating temperature and frontend design.
- The first full-scale OBELIX-1 prototype was submitted in May 2026.

VTX layout with 5 straight layers





Matrix inherited from TJ-Monopix2, size adjusted

Machine learning clustering of Tyre Rolling Noise for noise map modelling improvement

Simon Kanka[1], Antonino Moro[2], Domenico Profumo[2], Laura Fiorella[3]
Francesco Fidecaro[1], Massimiliano Razzano[1], Gaetano Licitra[3,4]

1 Department of Physics, University of Pisa, Italy
2 iPOOL S.r.l., via Antonio Cocchi 3, Pisa, Italy
3 Environmental Protection Agency of Tuscany Region (ARPAT), Pisa, Italy
4 Institute of Chemical and Physical Processes of National Research Council (CNR-IPCF), Pisa, Italy

Input parameters for road surface corrections of distressed roads are not present inside the CNOSSOS-EU method. This inclusion is required to correctly monitor the influence of traffic noise in the environmental noise pollution. Preliminary research on acoustic classification of Tyre Rolling Noise based on the standardized Close ProXimity experimental setup method are here presented. Clustering of the sound pressure levels are shown as a way to identify new road segment types.

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ARPAT
Agenzia regionale per la protezione ambientale della Toscana

TECHNOLOGY COMPANY iPOOL DESIGN MATERIAL

Optical Control of Energy Transfer in Strongly Coupled Organic Microcavities

Author names: Lorenzo Lavista, A. Cargioli, M. Lednev, A. Camposeo, A. Sassella, D. Pisignano, A. Tredicucci, F. J. Garcia-Vidal, J. Feist, L. Persano

The poster reports on experimental and theoretical results on light–matter interaction in organic microcavities [1], exploring how strong coupling can mediate energy transfer between in donor-acceptor systems. The devices consist of polymeric bilayers and metal mirrors, with photochromic compounds as donors. UV illumination provides direct control over the light–matter coupling strength and polariton formation, and photoluminescence analysis reveals a relevant enhancement in the acceptor's contribution to the total emission when the system is embedded within a resonant cavity.
[1] A. Cargioli et al., Nanophotonics 13 (14), 2541-2551.

Polymeric Piezoelectrics for Energy Harvesting and Implants

Sujoy Kumar Ghosh[1], Francesca Matino[1], Fabio Lineu Favrin[5], Ilaria Tonazzini[1], Rosarita D'Orsi[2], Jose Gustavo de la Ossa[1], Andrea Camposeo[1], Jun Li[3], Wenjian Liu[3], Timothy A. Hacker [4], Dario Pisignano[1],[5], Alessandra Operamolla[2], Xudong Wang[3], Luana Persano[1]

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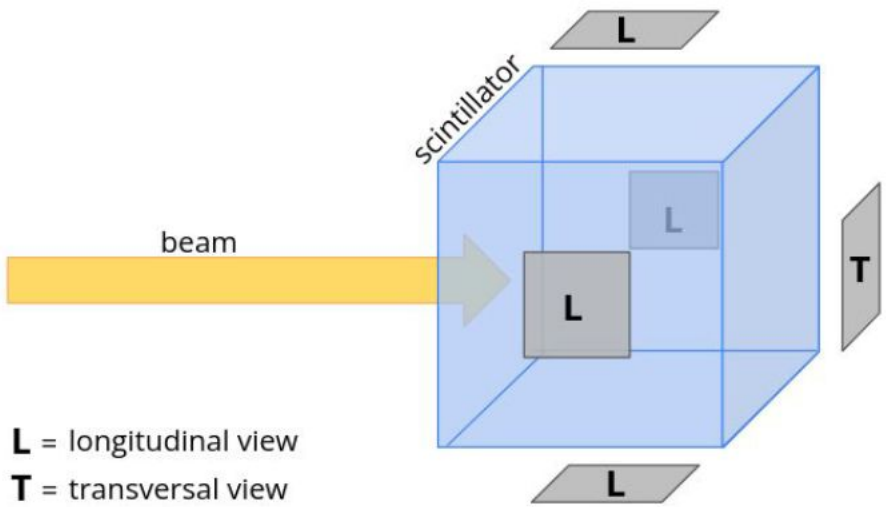
[2] Dipartimento di Chimica e Chimica Industriale Università di Pisa via Giuseppe Moruzzi, 13, 56124 Pisa, Italy
[3] Department of Materials Science and Engineering, University of Wisconsin-Madison
[4] Cellular and Molecular Arrhythmia Research Program, Department of Medicine, University of Wisconsin, Madison, Wisconsin 53706
[5] Dipartimento di Fisica "E. Fermi", Università di Pisa, Largo B. Pontecorvo 3, I-56127 Pisa, Italy

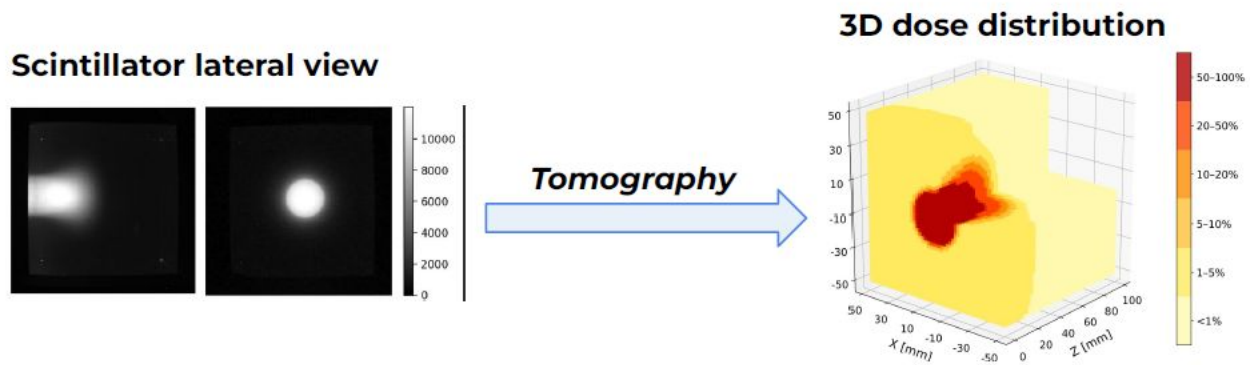
The poster discusses the main steps for the realization of new piezoelectric, sensing, biodegradable devices [1] with energy harvesting capacity. It includes:
-The development of pillar arrays made of piezoelectric bio-polymers, e.g. cellulose nanocrystals in polymers;
- The design of self-powered energy harvester as power generator;
- The realization of self-powered bio-resorbable implantable medical devices for battery-less sensing, pacemaker operation, and other flexible biomedical applications
[1] S.K. Ghosh et al., Science Advances 11 (3), eads0778 (2025).

Full-3D dosimetry with plastic scintillators for QA in e- FLASH-RT

Presenter: Eleonora Ravera

This contribution presents a feasibility study of a real-time full-3D dosimetric system for electron FLASH radiotherapy based on multi-view imaging of a plastic scintillator block and tomographic reconstruction.





Another piece in the scrambled puzzle of polarimetric analyses of Supernova Remnants: RCW 86 through the eyes of IXPE

Stefano Silvestri

Supernova remnants (SNRs) are among the main sources of cosmic ray acceleration up to the knee.

The mechanism of acceleration is that of diffusive shock, that crucially relies on the details of the physical state of the plasma at the shock fronts, such as turbulence and magnetic field strength.

The pre-existing magnetic field is amplified by shock waves, but the observation of SNRs in radio waves shows a significant difference between what is expected from a shock-compressed magnetic field, only evident on old SNRs, and what is seen in young ones. Radio waves, however, sample plasma that has already cooled down and is far from the shock front where compression happens.

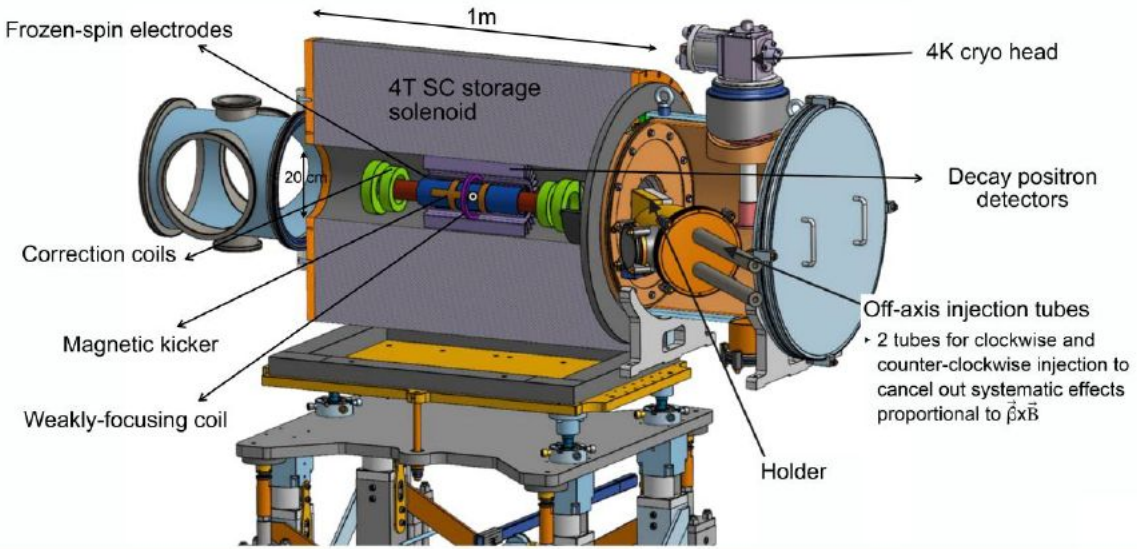
Being an X-ray instrument, IXPE samples a population of particles whose emission is short lived, and freshly accelerated plasma that is supposed to reveal what happens right at the shock front.

Surprisingly, some young SNRs analyzed by IXPE still exhibit a radial magnetic field, and the upper limits on RCW 86 further complicate the scenario.

The muEDM experiment

Maria Elisa Tegano on behalf of the muEDM collaboration

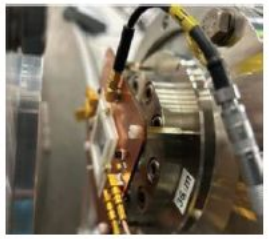
- A permanent EDM violates T and, under CPT theorem, also CP.
- Current direct limit: $d_\mu < 1.5 \cdot 10^{-19}$ e cm
- muEDM experiment goal: $d_\mu < 6 \cdot 10^{-23}$ e cm
- Frozen spin technique: cancels the magnetic contribution of spin precession, so any observed precession comes from the EDM part
- EDM signature: time evolution of the up-down asymmetry of the positron from the muon decay

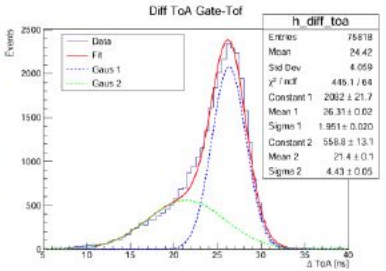


- Positron tracker composed by six concentric stereo-layers cylinders of 500 µm squared scintillating fibers connected to SiPMs
- Resolutions estimated via Geant4 simulations:

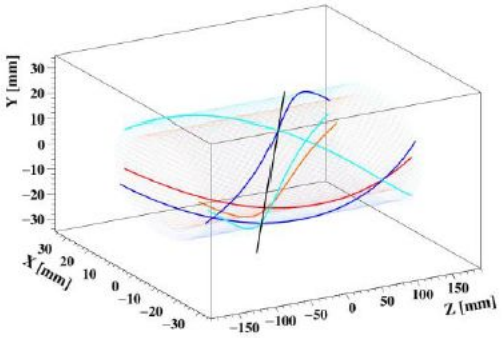
$\sigma_p / p = 0.1$ $\quad \sigma_\phi = 100$ mrad $\quad \sigma_\theta = 50$ mrad

- ToF detector to measure injected muon momentum ($\sigma_p < 1\%$)
- 50 µm foil coupled to SiPMs
- Time resolution of 473 ps



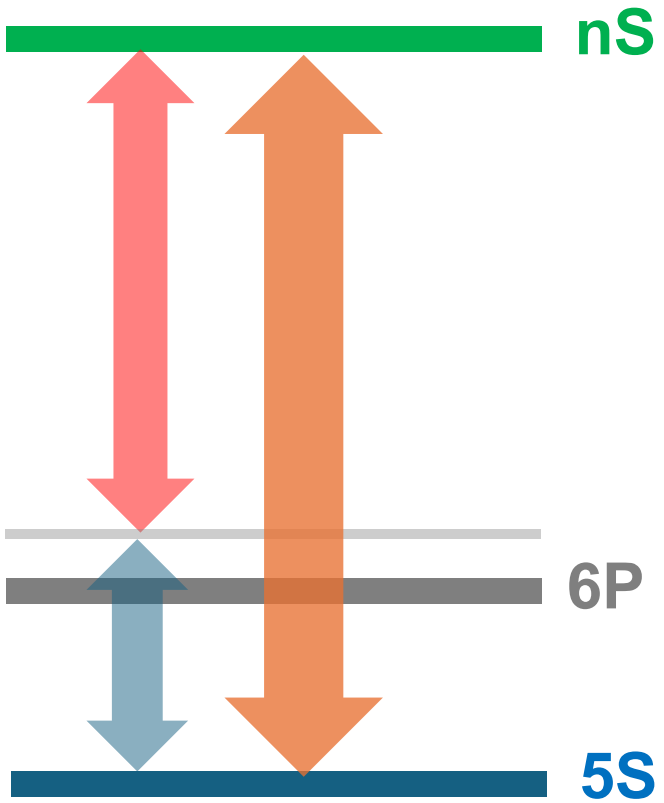


- DAQ based on FERS boards, MIDAS slow control.
- Cosmic rays reconstruction from FERS output (ToA and ToT)



Spatially resolved Rydberg Doppler thermometry of a cold gas

Description: In this work, we present a method to measure the spatially resolved temperature of atomic cloud using Rydberg Doppler broadening thermometry. In this method we excite the atom from ground state to a Rydberg state via two photon absorption process, allowing us to extract the atomic velocity distribution. Temperature information is extract from the width of the velocity distribution. In addition, we demonstrate the capability to measure position–velocity correlations of atoms, which is not accessible using traditional techniques such as absorption or fluorescence imaging. We also explored the regime of a blue-detuned MOT and observed interesting features, including a bimodal velocity distribution under certain conditions. These findings suggest that Rydberg Doppler-broadening thermometry is a powerful tool for characterizing cold atomic systems.



Two-photon Rydberg excitation

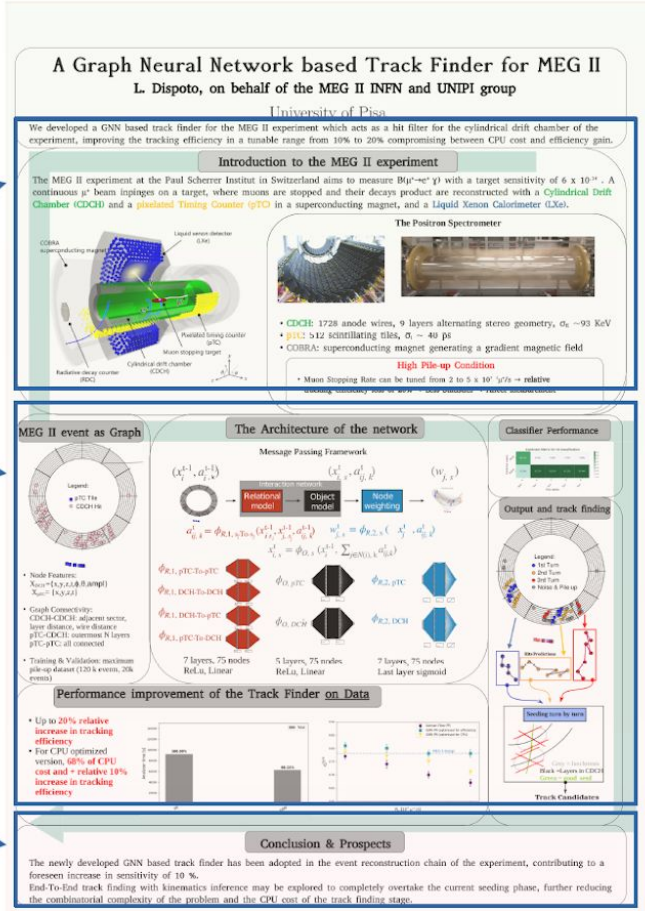
Presented by: Krishna Nand Trivedi
Team: K. N. Trivedi , E. Solé Cardona, B. Bégoc, M. Carminati,

A Graph Neural Network based Track Finder for MEG II

We illustrate in this poster a novel track finder for MEG II based on Graph Neural Networks which mitigates pile-up and improves the tracking efficiency of the experiment on data, by acting as a hit filter for the cylindrical drift chamber of the experiment.

Poster Organization:

- MEG II introduction and pile-up
- The Novel Track Finder
  1) Input to the model, Architecture
  2) Performance of the model
- Conclusions & Prospect



Thermal Stability of Organic Semiconductor Thin Film Glasses by Local Changes in Spontaneous Orientation Polarization

Marta Ruiz-Ruiz[1,2], Arnau Villalobos-Martin[2], Tapas Bar[2], Cristian Rodríguez-Tinoco[1,2], Jordi Fraxedas[2], **Simone Capaccioli[3]**, **Massimiliano Labardi[4]**, Marta González-Silveira[1,2] & Javier Rodríguez-Viejo[1,2]

[1] Universitat Autònoma de Barcelona, [2] Catalan Institute of Nanoscience and Nanotech, [3] Department of Physics UNIPI, [4] IPCF-CNR; **M.R.R. has been visiting PhD student at Physics Department UNIPI for 4 months**