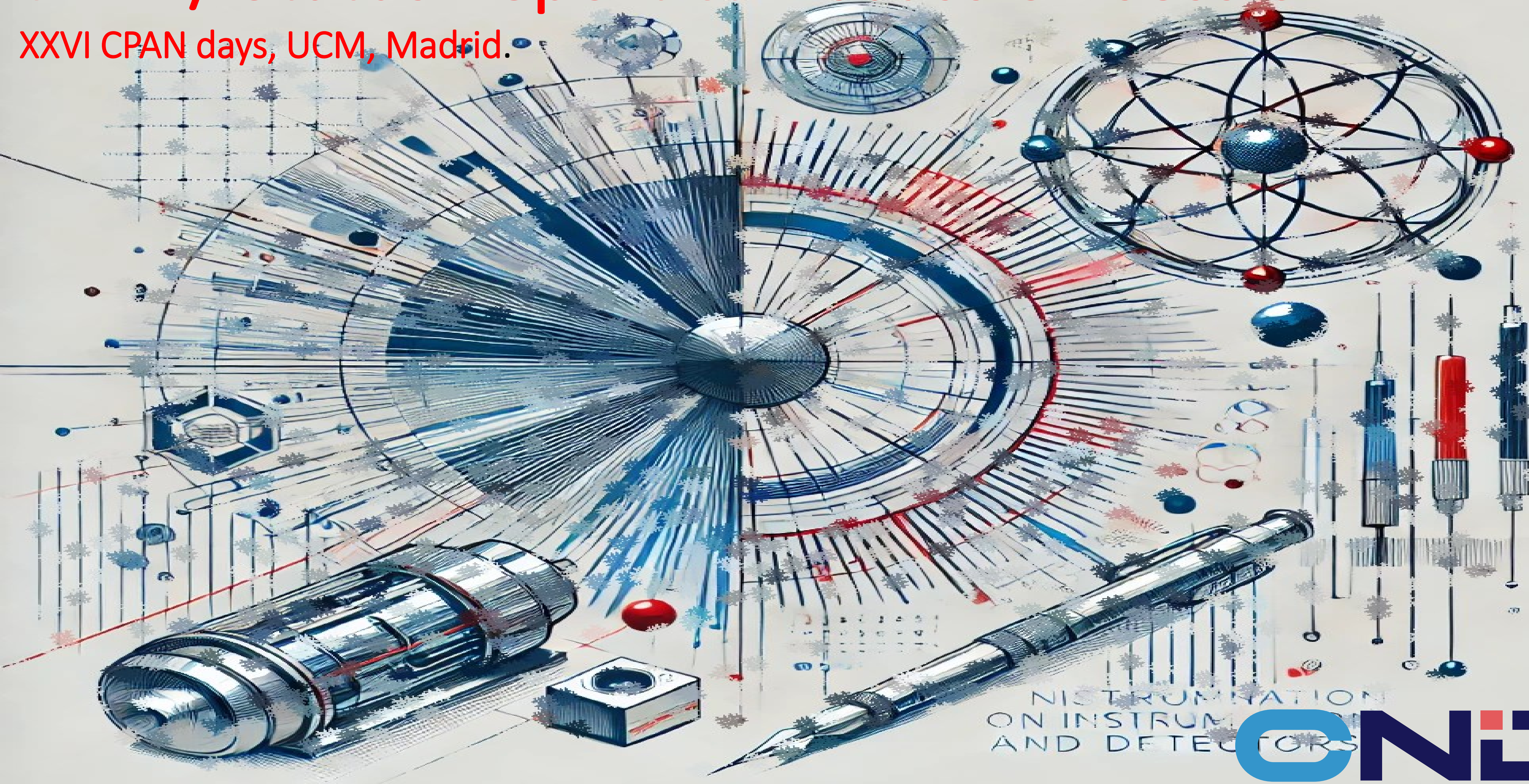
CNID / Status Report & Discussion session

XXVI CPAN days, UCM, Madrid.



I. Vila, Instituto de Física de Cantabria (CSIC-UC)

CPAN NETWORK
ON INSTRUMENTATION
AND DETECTORS

Outline…
… after the kick-off meeting in Valencia

- Governance: update on the Steering Group and Collaboration Board composition.
- Application to the "Redes de Investigación 2024"
- Preparation of the "Strategic analysis and resource optimization".
- Instrumentation School.
- Next year workshop venue

Institutional Board

IEM - CSIC	Olof Tengblad
Centro de Astropartículas y Física de Altas Energías (CAPA)-UZ	Gloria Luzón
Centro de Láseres Pulsados (CLPU)	José Manuel Álvarez
Centro Nacional de Aceleradores (US, CSIC, Junta de Andalucía)	Carmen Jiménez Ramos
Centro Nacional de Microelectrónica (IMB-CNM-CSIC)	Pablo Fernandez
CIEMAT	M.Isabel Josa Mutuberría
IGFAE-USC (Instituto Galego de Física de Altas Enerxías)	Abraham Antonio Gallas Torreira
Institut de Física d'Altes Energies (IFAE)	Stefano Terzo
Instituto de Física Corpuscular (CSIC-UV)	Carlos Lacasta
Instituto de Física de Cantabria (CSIC-UC)	Iván Vila Álvarez
Instituto de Instrumentación para la Imagen Molecular (i3M)	Laura Moliner
Instituto Tecnológico de Aragón (ITA)	Fernando Arteche
Universidad de Alcalá	Luis del Peral
Universidad de Cádiz	Inmaculada Ramos Lerate
Universidad de Córdoba	Jorge Berenguer Antequera
Universidad de Oviedo - ICTEA	Santiago Folgueras
Universidad de Salamanca	Begoña Quintana Arnés
Universidade de Vigo	Enrique Casarejos
Universitat Politècnica de València	Miguel Ardid
Instituto de Nanociencia y Materiales de Aragón (CSIC-UZ)	Agustín Camón
DICOM (UC)	Luisa Mª de la Fuente
CAB (INTA-CSIC)	Alicia Gómez
IPARCOS (UCM)	Juan Abel Barrio
Universidad de Barcelona - ICCUB	David Gascón
Universidad Autonoma de Madrid	Luis Labarga
Universidad de Sevilla	Rogelio Pinto
Donostia International Physics Center	Ander simon
IMDEA Nanocienica	Daniel Granados
Universidad Politécnica de Cataluña	Sergio Gómez
Instituto de Ciencas del Espacio (ICE)	aldos@ice.csic.es

Steering group

- **Coordinator:** Iván Vila (IFCA); **Deputies Coordinators:** Cesar Domingo (IFIC) + Inés Gil (Ciemat)
- **WG1 Gaseous detectors:** Yassid Ayyad (IGFAE) + Cristina Fernández (Ciemat)
- **WG2 Liquid detectors:** Clara Cuesta (Ciemat) + Justo Martín (IFIC)
- **WG3 Solid state:** Sebastian Grinstein IFAE) + Carlos Mariñas (IFIC) + Teresa Kurtukian (IEM)
- **WG4 Calorimetry:** Mary-Cruz Fouz (Ciemat) + Héctor Alvarez-Pol (IGFAE)
- **WG5 Quantum/Superconductor sensors:** Gemma Rius (IMB-CNM) + Igor García Irastorza UNIZAR)
- **WG6 Electronics:** Santiago Folgeras (UNIOVI) + Fernando Arteche (ITA) + Diego Real (IFIC)
- **WG7 Mechanics & Integration:** Cristobal Padilla (IFAE) + Enrique Casarejos (UV)
- **WG8 Applications:** Carlos Guerrero (US) + Gabriela Llosá (IFIC)
- **WG9 Scintillators and photodetectors:** Luis Mario Fraile (UCM) + David Gascon (UB)
- **WG10 Characterization Techniques:** Carmen Jiménez (CNA) + Jordi Duarte Campderrós (IFCA)
- **WG11 Training:** from the institution leading the school organization.
- **WG12 Low-Background experiments:** Susana Cebrián (UNIZAR) + Francesc Monrabal (DIPC) + Roberto Santorelli (CIEMAT)

Application to the “Redes de Investigación 2024”

- **Unexpected entropy too early in the process of creation of the network, but welcome**
- **Still under evaluation**

Application to the "Redes de Investigación 2024"

- The management team (César Domingo, Inés Gil and IV) acted as the preparatory team of the proposal.
- For administrative limitation of the call not all of the member of CNID could take part of the "Redes de Investigacion" application.
- Ensuring the that theses groups also enjoy the benefits of the "Red" is a must (If granted, keep in mind)

“Redes de Investigación 2024”: Objectives

- **General Objective:**
  - Optimize research resources and foster complementary detection technology development across particle, astroparticle, and nuclear physics at a national level.

- **Specific Objectives:**
  - **Foster Synergies:** Promote collaboration among groups in particle, astroparticle, and nuclear disciplines, encouraging new partnerships.
  - **Coordinate Research:** Enhance detector development, innovation, and societal applications of Spanish research groups.
  - **Train Young Researchers:** Establish schools and workshops to develop technological skills.
  - **Define National Strategy:** Develop a medium- to long-term national plan for instrumentation aligned with European and international initiatives.

"Redes de Investigación 2024": Coordination

- **Task 1.1: Governance Structure**
  - Establish governance framework, roles, responsibilities, and decision-making processes.
  - Deliverable: Network Framework Agreement for governance and decision-making.
- **Task 1.2: Internal Communication**
  - Promote collaboration via tools like intranet, videoconferencing, agenda management, and messaging systems.
  - Deliverable: Setup of communication tools for network activities.
- **Task 1.3: Annual Workshop**
  - Facilitate knowledge exchange, collaboration, and strategic planning through yearly workshops.
  - Deliverable: Organize one workshop annually.
- **Task 1.4: Thematic Mini-Workshops**
  - Focused events on R&D topics with review talks, discussions, and training.
  - Deliverable: One or two mini-workshops per year.
- **Task 1.5: Strategic Analysis and Resource Optimization**
  - Analyze R&D capabilities, infrastructure, and collaboration opportunities for strategic alignment.
  - Deliverable: Reports on R&D priorities, methodologies, and challenges.

"Redes de Investigación 2024": Training, Diffusion & Outreach

- Training
  - Task 2.1 School Organization:
    - Organize a two-week annual school for early-career researchers in detector and instrumentation.
    - Provide structured education and hands-on training to stay updated on advancements in the field.
    - Deliverable: Two-week school annually.

- Diffusion and Outreach
  - Task 3.1 Diffusion:
    - Disseminate research outcomes through websites, publications, seminars, and social media.
    - Target stakeholders like researchers, industry partners, and policymakers.
    - Deliverable: Website and social network presence.
  - Task 3.2 Outreach:
    - Engage the community through educational events, workshops, and public seminars.
    - Promote awareness of instrumentation's importance in science and society.
    - Deliverable: University-level seminars on frontier physics technologies.

"Redes de Investigación 2024": Industry Partnership & Community Representation

- Partnership with Industry
  - Task 4.1: Public-private connections
    - Facilitate collaborations with industries (especially SMEs) to address societal challenges using detector technologies. Promote advancements in science and industrial applications. Assist industries in accessing scientific experiments and infrastructure.
    - Collaboration: INEUSTAR (Spanish Science Industry Association).
    - Deliverable: Annual joint meetings with INEUSTAR.
- Community Representation
  - Task 5.1: Engage with Spanish social agents and administration (Coordinated with CPAN)
    - Foster collaboration with policymakers (e.g., Ministries of Science & Industry, CDTI).
    - Support policy initiatives, funding opportunities, and regulatory matters in detector R&D.
    - Deliverable: Joint meetings with CDTI and relevant stakeholders.
  - Task 5.2: Interface with international R&D collaborations
    - Maintain active communication with CERN DRDs, NUPECC, APPEC, etc.
    - Enhance the network's visibility and contributions in global R&D communities.
    - Deliverable: Reports on international collaborations during the annual network workshop.

Current Implementation Status: Coordination

- **Task 1.1: Governance Structure**
  - Establish governance framework, roles, responsibilities, and decision-making processes.
  - Deliverable: Network Framework Agreement for governance and decision-making.
- **Task 1.2: Internal Communication**
  - Provide collaboration: dedicated web, indico, and Mattermost.
  - Deliverable: Setup of communication tools for network activities.
- **Task 1.3: Annual Workshop**
  - Facilitate knowledge exchange, collaboration, and strategic planning through yearly workshops.
  - Deliverable: Organize one workshop annually.

Current Implementation Status: WG conveners charge

- Implement coordination TASK 1.5: Strategic analysis and resource optimization:
  - Requires mostly time (a very precious resource though).
  - It is a critical task in order to foster synergies and fund hunting.

TASK 1.5 Strategic analysis and resource optimization: Conduct a comprehensive analysis of R&D activities related to particle, astroparticle, and nuclear physics instrumentation in Spain. Assessing the expertise available, identifying existing infrastructures, evaluating current technological capabilities, and mapping out potential areas for collaboration and resource optimization. Insights gained from this analysis inform strategic planning, ensuring alignment with national and international research priorities. **Deliverable:** Comprehensive intermediate and final reports on R&D topics outlining priorities, propose new methodologies or technologies, highlight challenges, and recommend strategies.

Strategic analysis: Implementation

- WG conveners should conduct inside their group a thorough analysis of R&D activities in Spain related to instrumentation for particle, astroparticle, and nuclear physics:
  - Assess the expertise available across institutions.
  - Identify existing infrastructures and their capabilities
  - opportunities of improvement with impact.
  - Evaluate current technological capabilities.
  - Map out potential areas for collaboration (possible focused joint projects) and resource optimization.
  - SWOT analysis both at WG level and all network.
- A Form for collecting these information in a uniform way is current under discussion inside the Steering Group.

Strategic analysis: Expected Outcome

- Use insights from this analysis to inform strategic planning, ensuring alignment with both national and international research priorities.
- A detailed report including:
  - Outline key R&D priorities.
  - Propose/indentify new methodologies or technologies.
  - Highlight challenges faced by the WG.
  - Recommend strategies for addressing challenges and advancing technological development
- Prepare an executive version of the report as a tool for supporting the requests of **dedicated funds** for instrumentation R&D
- Requesting funds **complementary** to the current Spanish R&D program:
  - Some type of funding mechanism as the "Plan Complementario"

Strategic analysis: Tentative Timeline

- Conveners request information to the groups and organize dedicated meetings with the interested parties (by January 27).
- Conveners prepare an initial draft of the strategic analysis for each WP (by February 24).
- Management team integrates the input from the different WG into a single draft to be review by the conveners, including an executive summary(by March 17).
- Final draft for full network review by March 31
- Strategic analysis completed by April 12

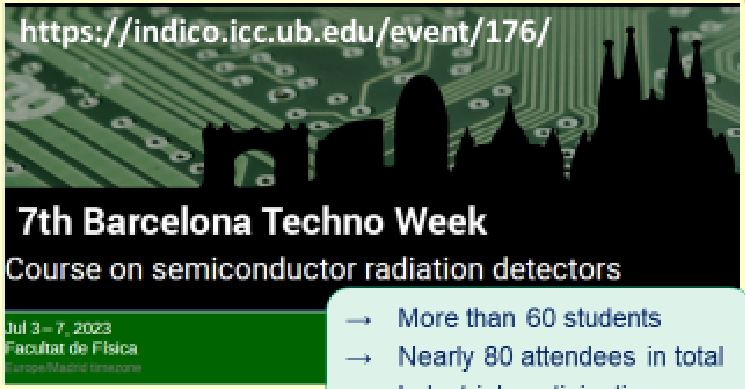
Training: Instrumentation School

- **Funding Requirement**: These activities cannot be conducted without financial support; funding is essential.
- **Interest from Groups:** Several groups have already expressed interest as of today (see next slides): CIEMAT, IFCA, IFIC, IMB-CNM, ITA, UCCUB
- **Planning Meeting:** Schedule an open meeting within the next 2–3 weeks to decide on the venue, followed by selecting a suitable date.
- **Local Leadership:** A local representative from the selected venue, working closely with the CNID management team, should lead the organization of the school.

Training: Interested groups - ICCUB

ICCUB training on instrumentation and detectors

1) **Barcelona Techno Week:** Comprehensive course on solid state radiation detection between academia and industry
   - physics of interaction of radiation with matter
   - signal formation in detectors
   - solid state radiation and photon detection technologies
   - detector analog and digital pulse processing readout circuits
   - detector packaging and advanced interconnect technologies
   - radiation and photon detectors in scientific and industrial applications



→ More than 60 students
→ Nearly 80 attendees in total
→ Industrial participation

2) **Subject *Integrated Sensors and Circuits for Imagers and Radiation Detectors*** in the Master's Degree in Semiconductor Engineering and Microelectronic Design
   - Introduction to solid state radiation detection in light sensing (imagers) and radiation detection (X-ray, gamma-ray, charged particles).

3) **Single-photon detectors introduction** in the *Photonics Laboratory* subject of the Photonics Master (UAB, UB, UPC and ICFO)
   - Single-photon detection for fast-timing applications

→ *We would like to participate in the CNID Instrumentation school in these lines*

ICCUB Institute of Cosmos Sciences

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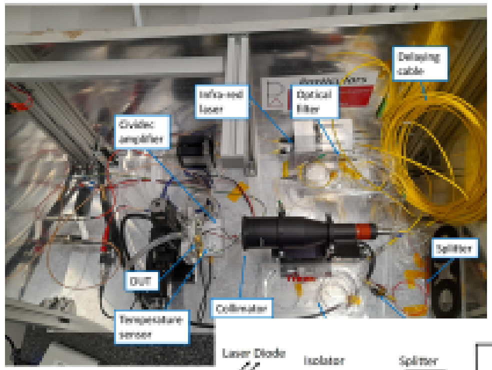
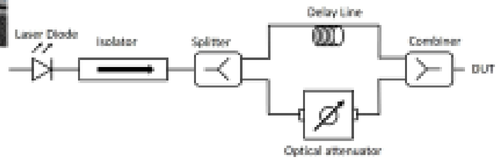
Training: Interested groups – IMB-CNM

Experimental Setups

Transient Current Technique:
Measurements
- CCE measurements with IR and Blue laser
- 2D Electric field maps
- Timing Measurements

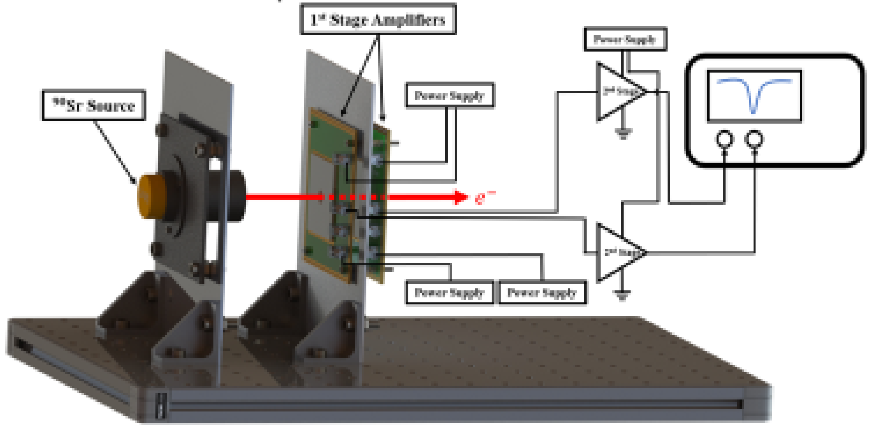
Advantages
- Very hands on
- Lots of different types of measurements
- Flexible





MIP Setup:
Measurements:
- CCE measurements with Sr90 source
- Coincident measurements for timing measurements

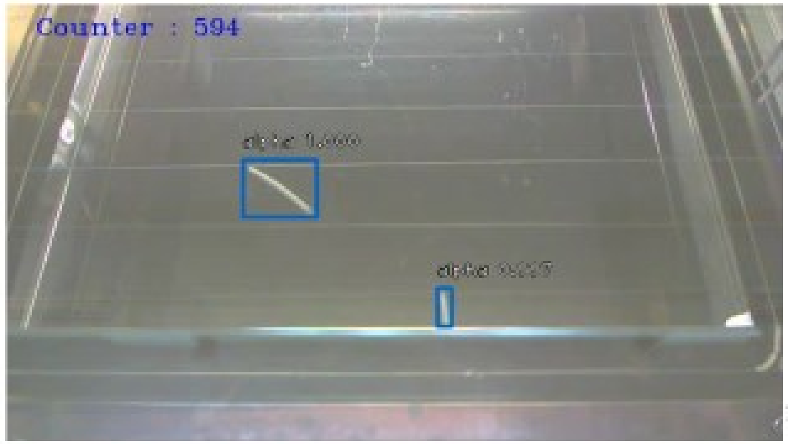
Advantages:
- Simple and fast DAQ
- Small setup



Training: Interested groups – IFIC

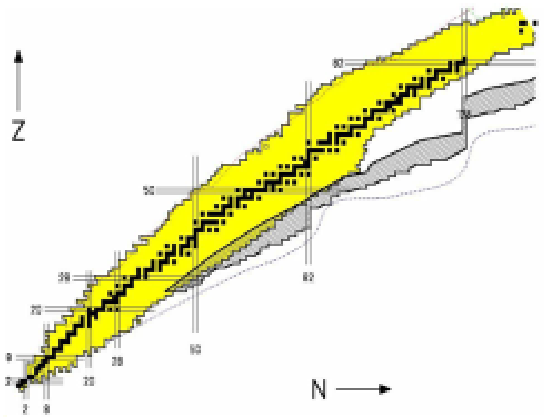
Cloud Chamber particle ID with AI

- The goal is to teach particle ID with AI.
- The students will learn:
  - The physics principles that allow cloud chambers to work.
  - To qualitatively distinguish different type of radiations and particles (a, b, protons, muons, …).
  - To train AI to identify and count particles starting from recorded videos.
  - To use the AI particle ID to measure Radon concentration.
- To train the AI, students could use either Artemisa or Google Colab facilities.
- If the school takes place in Valencia, the students could visit and use the Cloud Chamber, enhancing their learning experience.



Training: Interested groups – IFIC

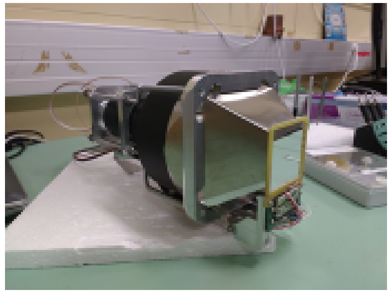
Challenges in beta decay studies

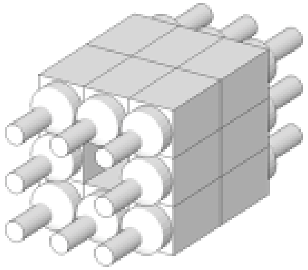


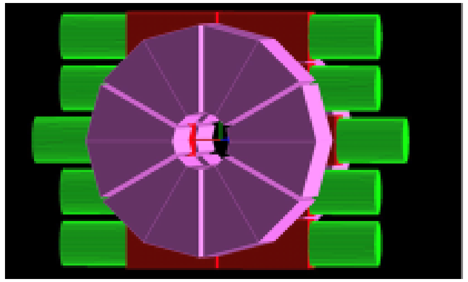
Beta decay is the most extended form of element transmutation in the nuclide chart. As such it can provide relevant information for nuclear structure, fundamental physics and practical applications

IFIC has pioneered the development of instrumentation and methods related to the study of exotic beta decays. The talks (and hands on practices) will cover these developments and provide the necessary background in modern applications.

These will cover: application of total absorption spectroscopy, measurement of the shape of beta spectrum, beta delayed neutrons, Monte Carlo simulations, beta decay data and reactor applications, etc.







Contact:
algora@ific.uv.es

Training: Interested groups – Ciemat/IFIC/IFCA

- Ciemat could contribute with personel, equipment and resources.
- IFCA is currently organizing a hand-on training on TCT techniques under the umbrella of the DRD3 and AIDAInnova project, also interested in ML analisis training .
- IFIC is interested also in training on semiconductor sensors using the Alivaba system

Training: Interested groups – ITA

ita 1

1. ITA - Electronics Integration (EMC) & RF and signal processing

- Mod1: RF and Signal Processing
  - Provide participants with a fundamental and practical understanding of radiofrequency (RF) principles and their implementation through digital systems and signal processing techniques. The module aims to equip students with the necessary skills to design, analyze, and optimize RF systems using digital tools.
- Main Points:
  - Introduction to basic RF concepts and digital electronics.
  - Fundamental principles of signal processing applied to RF systems.
  - Techniques for modulation, demodulation, and signal filtering in RF systems.
  - Simulation/analysis of RF circuits using software tools.
  - Identification and resolution of common issues in digital RF systems.

- Mod 2: Electronics Integration (EMC)
  - Provide theoretical and practical training on the integration of electronics into physics detectors, emphasizing the limitation of EMC standards. This module will train students in grounding strategies, noise measurements, and EMC based electronics design.
- Main Points
  - Understand the fundamental principles of EMC
  - .Grounding strategies for electronic systems in detectors.
  - Measurement of conducted and radiated noise in electronic systems.
  - Methods to characterize electromagnetic susceptibility in systems.
  - EMC-based electronic designs.

Final remarks

- Need to fix the venue and the date of next year workshop, please, volunteer!
- Need to rethink the format of the CNID session inside the CPAN days, to many overlaps with other sessions; your input on this is very valuable.
- Next 1h 15’ joint session with F.A. on DRDs status (45 min) and ESPP update (30 min) with LHC network.