



Financiado por
la Unión Europea
NextGenerationEU



Junta de Andalucía
Consejería de Universidad,
Investigación e Innovación

Neutrino Physics and Detector Instrumentation at UGR



UNIVERSIDAD
DE GRANADA



Unidades de
Excelencia
UGR

Strong involvement in the international DUNE and SBN programmes
(Neutrino line started in 2018)

The Experimental Particle Physics Group of the Theoretical Physics and Cosmology Department at
the University of Granada

A Cohesive and Internationally Integrated Group

- **4 Senior** researchers: stable core
- **5 PhD students:** active and growing group
 - 2 students will defend their PhD theses this summer
 - 1 student halfway through her thesis project
 - 2 new students recently transitioned from MSc
- Technical staff: **1 dedicated electronics technician**
- **Close collaboration with Fermilab** (continuous participation in SBND/DUNE)

<https://neutrino.ugr.es/index.php>



A well-balanced group combining strong **expertise in hardware, software, and data analysis.**

Competitive Funding and National Coordination

- Project: “**UGR Contribution to the DUNE Neutrino Physics Program with LAr**”
 - The second highest-funded project awarded to UGR in this call
- **Coordinated** project across Spain:
 - CIEMAT, IFIC, University of Santiago de Compostela, University of Vigo
- **International framework** (Fermilab experiments):
 - LBNF / DUNE
 - SBND experiment

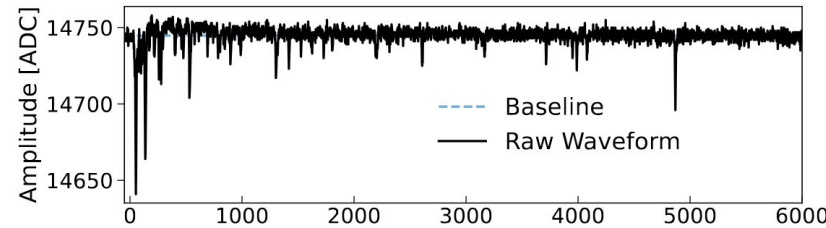
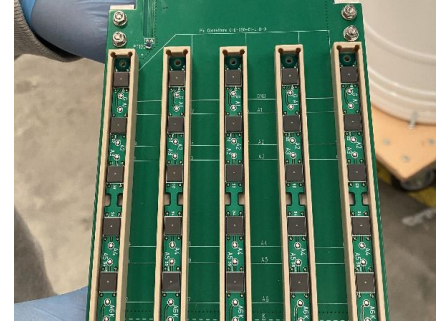


Strong **national leadership** combined with deep involvement in major **international** neutrino programmes

Additional funding through regional strategic programmes (Junta de Andalucía), supporting multiple research lines within the group

From Detector Construction to Physics Results

- **Detector and data calibration (Photon Detection System):**
 - **SiPM characterization for the DUNE FD (in-house laboratory)**
 - One of the five nodes in Europe
 - End-to-end **calibration of the PDS in SBND**
- **Reconstruction and Analysis:**
 - **LArSoft + Deep Learning** for event reconstruction
 - Development of **full PMT reconstruction chain**
- **Physics output:**
 - **Cross-section measurements** in LAr
 - **Early SBND publications** (EPJC, PRD in preparation)



A unique combination of hardware, software, and physics expertise enabling **full-chain contributions** to DUNE and SBND.

Strong International Visibility



- **Active roles in DUNE and SBND collaborations**

- **Current**

- Chair of the **Executive Committee** in SBND
- Convener of the **Photosensor WG** in DUNE
- **Shift Coordinator** in SBND
- **Speakers Committee** member in DUNE and SBND

- **Previous**

- (2021 - 2025) **Reconstruction** Convener in SBND
- (2021 - 2023) **Simulation and Calibration** Convener of the PDS system in SBN

- **Participation in:**

- Commissioning and data-taking (**Fermilab**)
- Detector construction (**SURF**)



The group plays a **leading and visible role** across the full lifecycle of large-scale neutrino experiments

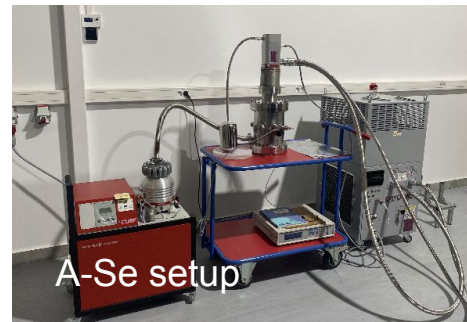
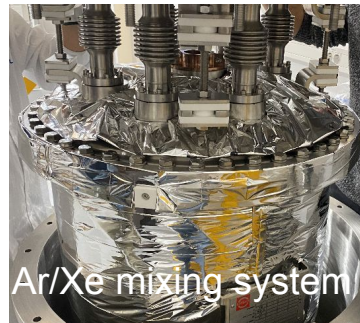
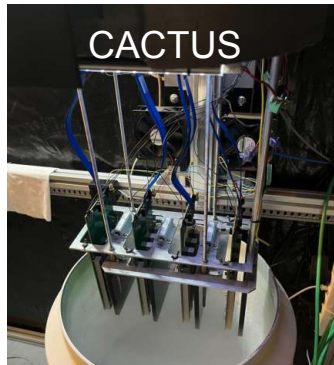
Laboratory Infrastructure and Experimental Capabilities

- **CACTUS**: large-scale SiPM testing for DUNE FD
- **Cryogenic setups**: sensor testing and stability
- **Optical systems**: UV-VUV calibration (monochromator)
- **Ar/Xe mixing system**: precision scintillation studies
- **Amorphous Se**: in-house sensor fabrication

What this enables:

- Large-scale sensor validation for DUNE
- Electronics integration and signal processing
- Detector testing and physics measurements in LAr
- Development of novel detector technologies

Provides a versatile infrastructure enabling **large-scale detector validation, precision scintillation studies, and in-house sensor development.**



Strategic Value and Outlook

Current:

- Characterization and validation of SiPMs for the DUNE Photon Detection System
- Development and optimization of photon detection performance

Near-term:

- Participation in the installation of the DUNE Photon Detection System at SURF
- Transition from laboratory validation to full detector deployment

Ongoing:

- SBND data exploitation and physics program

Key contributions to the Unit:

- Leading role in DUNE and SBND
- Strong international presence (Fermilab, SURF)
- End-to-end expertise (instrumentation → physics)
- Proven ability to deliver high-impact results

A strategic asset for the Unit, combining international leadership, technical expertise, and sustained scientific output in neutrino physics.