

WG10: Strategic Planning Draft

Jordi Duarte-Campderros⁽¹⁾, Carmen Jiménez-Ramos⁽²⁾

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Discussion with contributing groups



- We circulate a second WG10 strategic-planning draft to the contributing groups
 - After feedback received from coordinators
- Goal today: validate the draft collectively before the final delivery (May, 13th)
 - In particular, we need feedback on:
 - whether the WG10 described scope is correctly represented;
 - whether important capabilities, infrastructures, or groups are missing;
 - whether proposed priorities are realistic

- Let's assume not everyone had time to read it in detail...
 - next slides will summarize the logic of the draft

One-slide draft summary

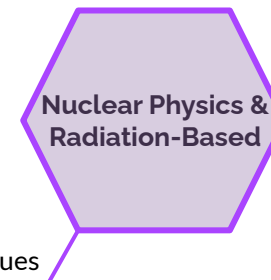
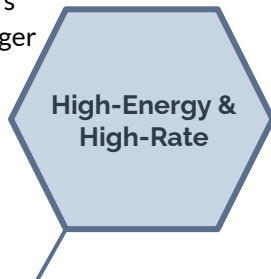


- We identify the WG as a transversal capability supporting detector validation across the whole CNID
 - Therefore, WG10 is not a list of characterization techniques
- The draft is built around the central idea that Spain already has many relevant capabilities, but they are not yet organized as a visible, coordinated characterization infrastructure.
 - **Community:** 20 WG10-related groups.
 - **Scope:** broad set of detector technologies and application domains, but the common element is the characterization and validation role.
 - **Strength:** strong distributed technical expertise and infrastructures.
 - **Main gap:** lack of coordination, visibility and share protocols.
 - **5-year proposal:** move from a capability map to a coordinated WG10 operating model.

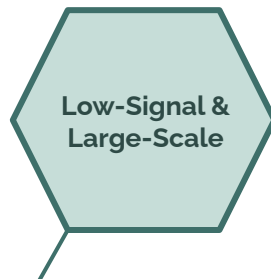
Group / Organization	Contact name	Email
Universitat Politècnica de Catalunya / Department of Physics / Nuclear Engineering Section – ENPAI (Experimental Physics and Instrumentation)	Alfredo de Blas del Hoyo	alfredo.de.blas@upc.edu
Instituto de Nanociencia y Materiales de Aragón (CSIC-UZ) – Quantum Material and Devices	Agustín Camón	acamon@unizar.es
Institut de Física d'Altes Energies (IFAE) – ATLAS	Stefano Terzo	sterzo@ifae.es
Institut de Física d'Altes Energies (IFAE) – Scientific Light Detectors	Cristóbal Padilla	cristobal.padilla@ifae.es
Centro Nacional de Aceleradores / Universidad de Sevilla – Detector and Instrumentation Group at CNA	M. Carmen Jiménez Ramos	mcyjrr@us.es
Instituto de Microelectrónica de Barcelona (IMB-CNM, CSIC) – Radiation Detectors Group (RDG)	Pablo Fernández Martínez	pablo.fernandez@csic.es
Instituto de Física Corpuscular (IFIC, CSIC-UV) – Silicio	Carlos Mariñas	cmarinas@ific.uv.es
Institut de Física d'Altes Energies (IFAE) – Gamma-ray Group	Oscar Blanch Bigas	blanch@ifae.es
Instituto Galego de Física de Altas Enerxías (IGFAE) – SiliconSensors-DAQ	Abraham Antonio Gallas Torreira	abrahamantonio.gallas@usc.es
Instituto de Física Corpuscular (IFIC, CSIC-UV) – IRIS Física Médica	Gabriela Llosá	gabriela.llosa@ific.uv.es
Science and Technology Research Centre / Universidad de Huelva – Estructura de la Materia FQM318	Ismael Martel	imartel@uhu.es
Institut de Física d'Altes Energies (IFAE) – Neutrinos	Thorsten Lux	thorsten.lux@ifae.es
Donostia International Physics Center (DIPC) – Neutrino Group - HK	Helena Almazán	helena.almazan@dipc.org
Instituto Galego de Física de Altas Enerxías (IGFAE) / Universidade de Santiago de Compostela (USC) – Neutrinos	José Ángel Hernando Morata	jose.hernando@usc.es
Instituto de Física de Cantabria (IFCA, CSIC-UC) – Particle Physics and Instrumentation	Iván Vila Álvarez	ivan.vila@csic.es
Instituto Tecnológico de Aragón (ITA) – Tecnologías Eléctricas	Fernando Arteché	fartech@ita.es
Institut de Física d'Altes Energies (IFAE) – Medical Detector Instrumentation and Imaging Physics (MEDIIP)	Gerard Ariño Estrada	garino@ifae.es
CIEMAT – Grupo de Ingeniería de la División de Astrofísica de Partículas	Carlos Díaz Ginzo	carlos.diaz@ciemat.es
Universidad de Salamanca – Grupo de Física y Tecnología en Estructura Nuclear y Aplicaciones (GFTENA)	Begoña Quintana Arnés	quintana@usal.es
Universidad Autónoma de Madrid – Centro de Micro-Análisis de Materiales (CMAM)	Gastón García López	gaston.garcia@uam.es

Groups Expertise in Experimental Domain

- Fast and high-resolution detectors
- High-bandwidth readout and trigger
- Radiation tolerant devices



- Spectroscopy and TOF techniques
- Radiation detection and monitoring
- Robust and calibrated detector systems



- Ultra-low noise instrumentation
- Large-area/large-volume detectors
- Radiation tolerant devices



- Medical imaging and dosimetry
- Compact and reliable detector systems
- Transfer of HEP-derived technologies

Proposed WG10 Technical Scope



- Basic detector performance
 - electrical characterization, calibration, stability, metrology.
- Response under beams/radiation/optical excitation.
 - sources, test beams, irradiation, SPA/TPA-TCT, IBIC/TRIBIC.
- Readout and DAQ validation
 - ASIC/readout response and calibration, timing, synchronization, FPGA/SoC DAQ, DQM.
- System-level qualification:
 - Cryogenics, low background, EMC/RF, environmental testing, QA/QC.

Interface with the Electronics WG



Topic	Electronics WG	WG10
ASICs/front-end	Design and development	Characterization, calibration
DAQ/firmware	Architecture and implementation	Validation, stability, benchmarking
Timing/synchronization	System design	Performance measurements
EMC/power	Design compliance	Detector/system qualification

Infrastructure categories identified



2.3.1 Characterization infrastructures

Infrastructure	External access	Description
Electrical and environmental characterization laboratories	Partial / to be defined	Laboratories for detector and module characterization through I-V/C-V measurements, leakage-current studies, gain and noise measurements, calibration, stability tests, and response measurements under controlled temperature, humidity, vacuum, or other laboratory operating conditions.
Optical and laser-based characterization laboratories	Partial / to be defined	Facilities for optical detector characterization, including laser-based transient-response measurements, charge-collection mapping, timing-response studies, detector-uniformity measurements, and SPA-TCT/TPA-TCT developments.
Beam-based, ion-beam, and irradiation characterization facilities	Yes / coordinated access	Facilities and workflows for detector characterization with particle beams, ion beams, microbeams, neutron fields, and irradiation lines. They support charge-collection studies, radiation-damage assessment, radiation-hardness qualification, and pre-/post-irradiation characterization.
DAQ, readout, timing, and control validation setups	Partial / to be defined	Test benches for validating readout-chain performance, ASIC/readout response and calibration, synchronization, clock distribution, data throughput, trigger behavior, digital pulse processing, data quality, and acquisition stability.
EMC/RF validation laboratories	Partial / yes	Facilities for EMC/EMI studies of detector modules, readout chains, power-distribution systems, and integrated detector setups, including validation of detector performance under realistic electromagnetic and system-level operating conditions.
Cryogenic characterization platforms	Partial / to be defined	Low-temperature platforms for detector characterization, cryogenic sensor response, ultra-low-noise measurements, readout validation, and long-term stability studies under cryogenic operating conditions.
Low-background characterization environments	Coordinated access	Underground or shielded environments for rare-event detector validation, low-background operation, radiopurity-related studies, long-duration stability measurements, and detector performance studies under low-background conditions.
Metrology and QA/QC platforms	Partial / to be defined	Facilities for detector inspection, dimensional metrology, quality-control procedures, calibration checks, reproducibility studies, and performance benchmarking of detectors, modules, and readout systems.

Table 1: Main categories of WG10 characterization infrastructures and capabilities.

2.3.2 Open and shared facilities relevant to WG10

Infrastructure / facility	ICTS?	Type of service relevant to WG10
CNA – Centro Nacional de Aceleradores	Yes	Ion and proton irradiation, ion-beam characterization, detector testing, radiation-damage studies, and dosimetry-related measurements.
CMAM-UAM	Yes	Ion-beam irradiation and characterization capabilities relevant for detector response studies, radiation-tolerance qualification, and post-irradiation characterization.
CERN and DESY test-beam facilities	No	Particle-beam characterization of detector prototypes, timing systems, tracking devices, readout chains, and system-level detector demonstrators.
Underground laboratories, including LSC and LSM	Yes / no, depending on facility	Low-background and underground detector characterization, rare-event detector validation, radiopurity-related studies, and long-term operation in shielded environments.
RF/EMC laboratory at ITA	To be defined	EMC/EMI validation of detector modules, power-distribution systems, readout chains, front-end electronics, and integrated instrumentation setups.
Laser characterization laboratories (IFCA, IFIC, LSB-EUH, ...)	No	Optical and laser-based detector characterization, including TCT-type measurements, charge-collection mapping, timing-response studies, and detector-response uniformity measurements.

Table 2: Open or shared facilities of direct relevance to WG10 activities.

Critical gaps proposed



- No national searchable catalogue of facilities, techniques and contacts.
- Lack of common characterization protocols.
- Lack of common metadata and data-format conventions (à la [FAIR](#) principles).
- Limited technical continuity in DAQ and firmware in characterization setups.
- Need for structured training in specialized techniques.
- Access to some facilities is still informal or poorly visible.
- Cryogenic and low-background characterization workflows need stronger consolidation.

WG10-specific SWOT

2.2.2 WG10-specific SWOT

Strengths	Weaknesses
<ul style="list-style-type: none">• Strong expertise in detector characterization, including electrical, optical, laser-based, ion-beam, irradiation, beam-test, EMC/RF, cryogenic, and low-background techniques.• Access to complementary national and international characterization infrastructures.• Experience in detector and readout validation for HEP, nuclear physics, neutrino, astroparticle, medical, and industrial applications.• Clear alignment with European detector R&D activities, especially DRD3, with additional links to DRD7, DRD5, and DRD1.• Existing activity in application-oriented validation, including medical imaging, dosimetry, tomography, and radiation-monitoring systems.	<ul style="list-style-type: none">• Lack of harmonized characterization protocols and data-format conventions across laboratories.• Uneven level of automation, documentation, and reproducibility in characterization workflows.• Limited availability of firmware and DAQ expertise in some groups for maintaining advanced characterization setups.• Limited consolidated expertise in cryogenic and low-background characterization workflows, including low-noise and multiplexed readout validation where relevant.• Access conditions to some specialized infrastructures are not yet sufficiently visible or standardized.
Opportunities	Threats
<ul style="list-style-type: none">• Define WG10-wide characterization protocols, meta-data standards, and reference workflows.• Create a searchable national portfolio of characterization facilities, techniques, contacts, access conditions, and typical use cases.• Develop coordinated irradiation and post-irradiation characterization campaigns.• Launch cross-WG demonstrators where characterization is a central deliverable.• Use WG10 as a platform for training and mobility in advanced detector characterization methods.	<ul style="list-style-type: none">• Characterization capabilities may remain fragmented if no common operating model is established.• Dependence on external test-beam and irradiation schedules may limit strategic autonomy.• Loss of expertise in specialized techniques such as TCT, IBIC/TRIBIC, cryogenic testing, EMC/RF validation, or low-background operation.• Characterization may be perceived as a support activity rather than as a strategic R&D capability.• Lack of sustained funding for operation, maintenance, and upgrade of shared characterization infrastructures.

Proposed national collaboration lines



- Semiconductor detector characterization: IMB-CNM, IFAE, IFCA, IFIC, IGFAE, CNA, ITA.
- Laser, beam and ion-beam characterization: IFCA, IFIC, CNA, CERN/DESY access CMAM/UAM?
- Readout, DAQ, timing and EMC/RF validation: IFCA, IGFAE, IFAE, IFIC, UPC, ITA.
- Cryogenic, low-background, neutrino and astroparticle instrumentation: INMA, IFAE, DIPC, IGFAE, CIEMAT, IFCA.
- Nuclear, medical and industrial applications: USAL, UHU, CNA, UPC, IFIC-IRIS, IFAE-MEDIIP, IFAE-Gamma, ITA.

Proposed WG10 actions



- Build a national WG10 portfolio
 - Characterization techniques, infrastructures and facilities, expert groups, ...
- Define minimal common protocols and metadata.
- Create mission-oriented task forces.
- Select a few (2-3) cross-WG demonstrators.
- Launch training and mobility actions.
- Coordinate instrumentation-specific funding request

Examples of task-forces and demonstrators



- Task forces
 - Common TCT / IBIC / beam-test measurement framework.
 - Irradiation and post-irradiation characterization workflow.
 - Detector/readout validation task force with the Electronics WG.
 - Cryogenic and low-background characterization.
- Possible demonstrators.
 - Shared timing/spatial-resolution telescope.
 - Pilot coordinated irradiation + post-irradiation campaign.
 - Medical / industrial validation demonstrator.

What we need from WG10 groups



- What should be corrected in the draft?
- Are any groups, infrastructures or capabilities missing?
- Are the identified critical gaps the right ones?
- Which proposed actions, task forces or demonstrators are realistic?
- Any other feedback for the final version.

Please send comments by **11 May** so that they can be incorporated before the WG10 submission deadline on 13 May.