MINISTERIO DE CIENCIA E INNOVACIÓN

CSIC

IFIC INSTITUT DE FÍSICA CORPUSCULAR

VNIVERSITAT DE VALÈNCIA

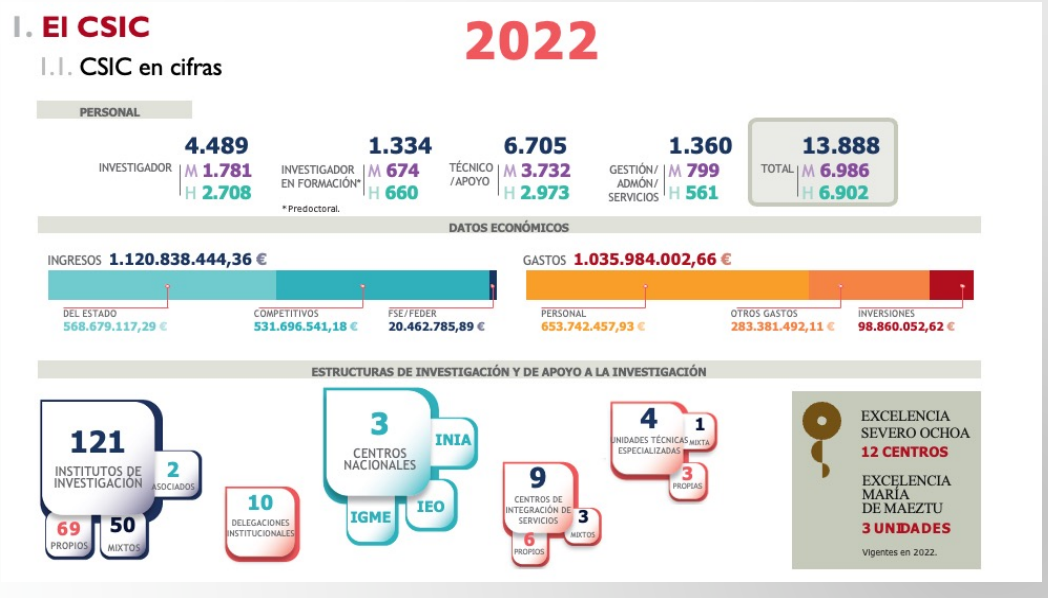
AITANA
MATTER AND TECHNOLOGY
https://aitanatop.ific.uv.es/aitanatop/

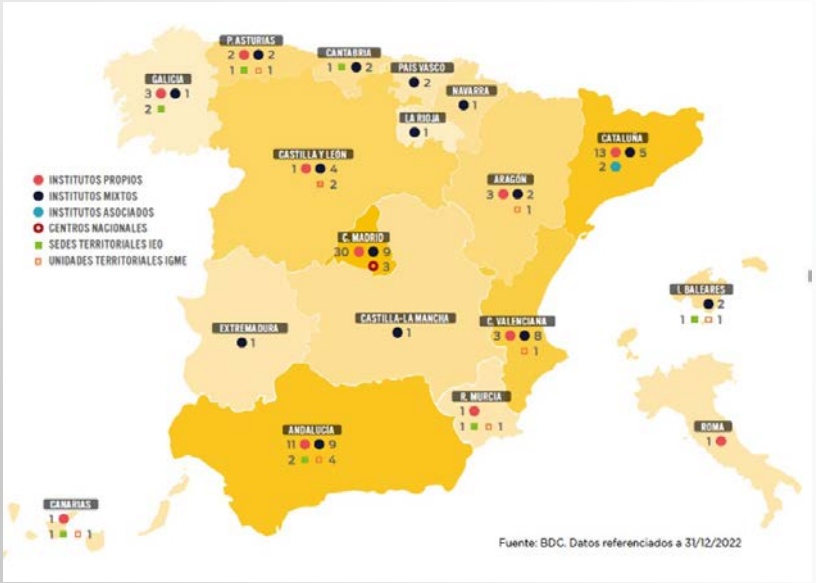
EXCELENCIA SEVERO OCHOA

π^+ p Λ π^- π^- k^0 π^-

CSIC/IFIC role in ELBEX

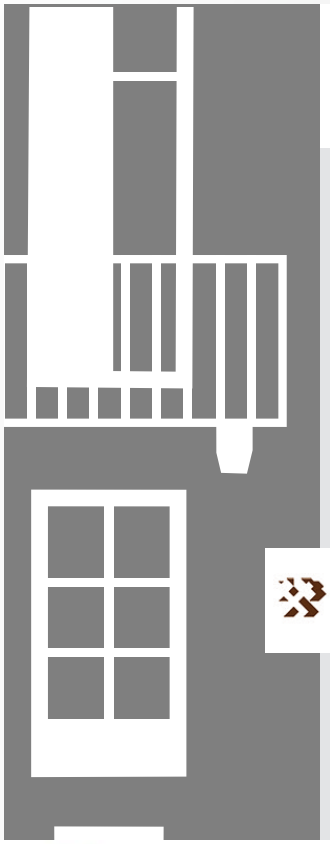
Juan A. Fuster Verdú – IFIC (CSIC-UV), DESY
ELBEX Kickoff Meeting
Hamburg, 27-28 January 2025





CSIC is one the only three Governmental Institutions which is present in all Autonomous Regions in Spain

El CSIC en la Comunidad Valenciana



IATS

CIDE, IFIC, IATA, I2SysBio, IBV, ITQ, IBMCP, I3M, INGENIO

IN

11 institutos de investigación

Casa de la Ciencia

Delegación Institucional

Casa de la Ciència VALÈNCIA

CSIC Consejo Superior de Investigaciones Científicas

PERSONAL*	M	H
INVESTIGADOR	144	230
INVESTIGADOR EN FORMACIÓN	105	109
TÉCNICO /APOYO	303	239
GESTIÓN / ADMÓN. / OTROS	34	26
TOTAL	586	604
TOTAL CSIC	1.190	

*Datos facilitados por SGARH. Fuente: GESPER

EXCELENCIA SEVERO OCHOA

Instituto de Tecnología Química (ITQ)
Instituto de Neurociencias (IN)
Instituto de Agroquímica y Tecnología de Alimentos (IATA)
Instituto de Física Corpuscular (IFIC)


IFIC
INSTITUT DE FÍSICA CORPUSCULAR
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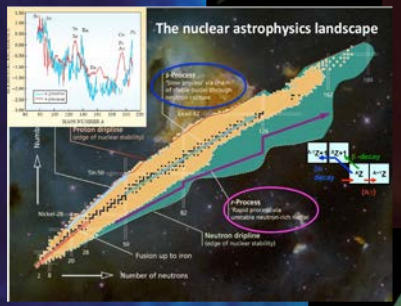
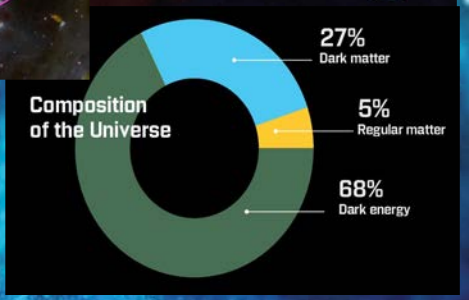
EXCELENCIA SEVERO OCHOA
CSIC
Consejo Superior de Investigaciones Científicas
VNIVERSITAT DE VALÈNCIA

Joint center of the National Research Council (CSIC) and the University of Valencia





Center for Nuclear, Astroparticle and Particle Physics

CSIC
Consejo Superior de Investigaciones Científicas

Universitat de València

INSTITUTO DE FÍSICA CORPUSCULAR: A BIT OF HISTORY

- It was created in the 50's as an appendix to the central CSIC organisation in Madrid
- Spain rejoins CERN in 1984. IFIC in 1985 became a joint Center with the University of Valencia
- For several years IFIC was the only place in Spain with experimental activity in Nuclear and Particle physics
- Today IFIC dedicates its efforts to theoretical and experimental research in Nuclear Physics, Particles and Astroparticles and their applications in both Medical Physics and other fields of Science and Technology.
- IFIC has been awarded with the 'Severo Ochoa' accreditation as center of excellence in 2015 and 2023

CSIC
Consejo Superior de Investigaciones Científicas

Vniversitat de València

368 members in total (280 scientists)

Experimental and theoretical departments

Coordination of Master in Advanced Physics and PhD in Physics program of Valencia University

Permanent staff: 80

44 experimentalists (12 University of Valencia, 32 CSIC)

36 theoreticians (25 University of Valencia, 11 CSIC)

Technical Support Units:

Computing

Electronics and Microelectronics

Mechanical Workshop

Maintenance and Safety

UCIE (since 2018)

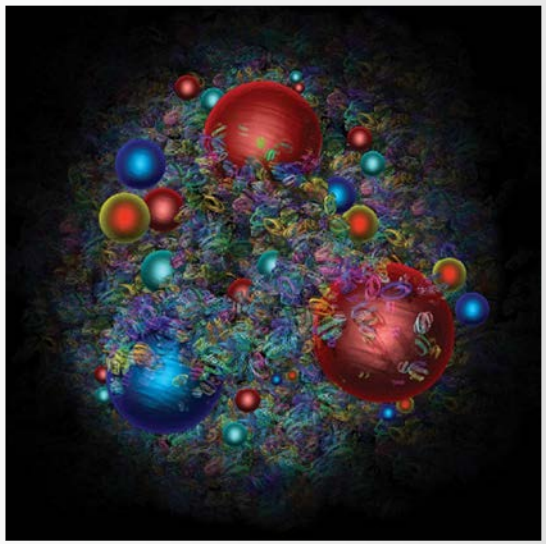
Scientific Unit of Entrepreneurial Innovation, funded by the Valencian Agency of Innovation (AVI)

Support to Medical Physics, nuclear power radioactive waste, other applications

CSIC
Consejo Superior de Investigaciones Científicas

Vniversitat de València

IFIC RESEARCH LINES



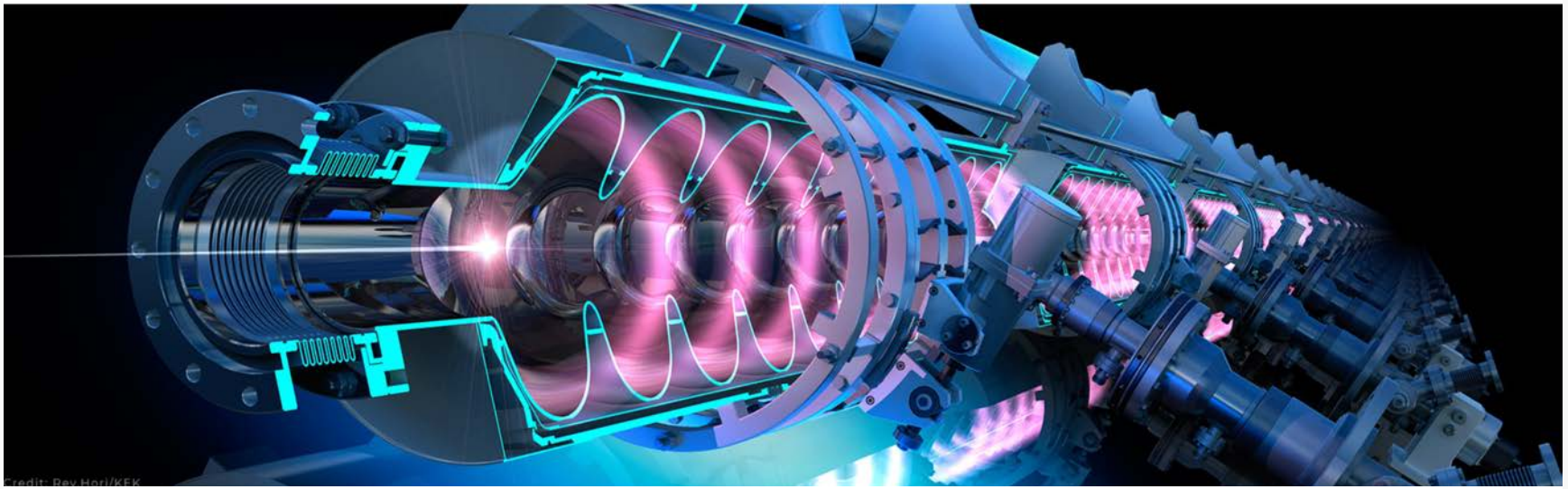
Origin of mass: understanding the fundamental laws of physics

Origin of matter: understanding the Universe

Advanced instrumentation and computing: from fundamental physics to society

AITANA

RESEARCH ACTIVITIES AITANA AT WORK MEMBERS OUTREACH FUNDING THESES AND JOB OFFERS BLOG



AITANA

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Advanced instrumentation and data analysis in accelerators

MATTER AND TECHNOLOGY

CSIC/IFIC: AITANA

AITANA

MATTER AND TECHNOLOGY

The AITANA – matter & technology - group from IFIC is a multidisciplinar team that encompasses experimental particle physics and accelerator physics researchers.

With 31 members the topics covered are:

- **Large Hadron Collider (LHC):** the ATLAS experiment and the MoEDAL experiment.
- **Higgs/EW/Top-quark factories,** as the International Linear Collider (ILC) or the Compact Linear Collider (CLIC).
- **Detector R&D programs**: Calorimetry, Si-detectors, LUXE and RADES-IAXO
- **Accelerator R&D for collider facilities and medical applications:** ELBEX, ILC, High Gradient Tech (VBOX), LINAC6+ (IFIC's ion accelerator in construction)

CSIC/IFIC: AITANA Accelerator Development Group

Members of the Accelerator Development Team of AITANA:

- Juan Fuster Verdú: juan.fuster@ific.uv.es
- Benito Gimeno Martínez: benito.gimeno@uv.es
- Daniel Esperante Pereira: daniel.esperante@ific.uv.es
- Santiago Noguera Puchol: Santiago.noguera@ific.uv.es
- Cesar Blanch Gutiérrez: cesar.blanch@ific.uv.es
- Daniel González-Iglesias: daniel.gonzalez-iglesias@uv.es
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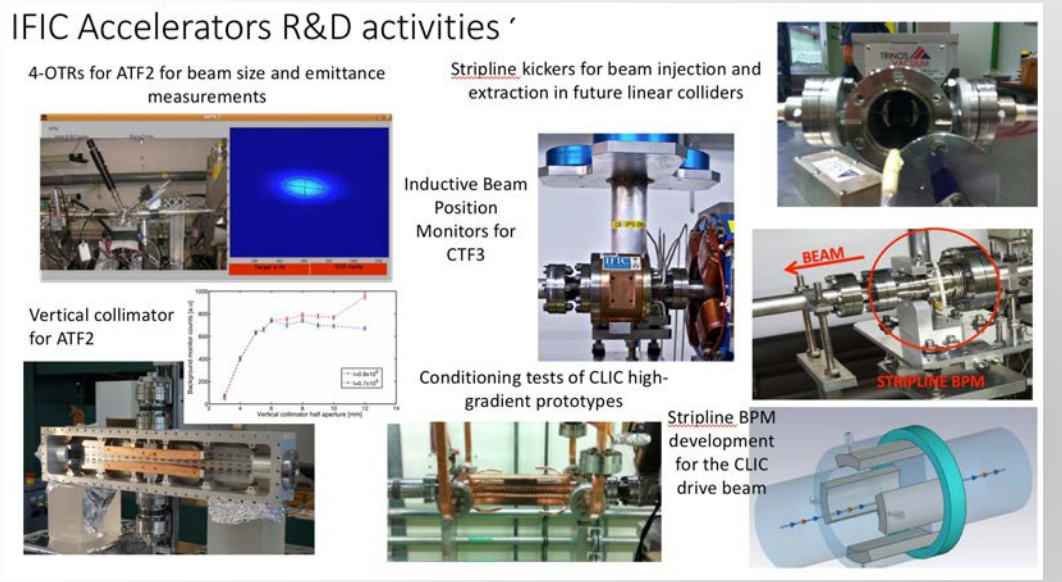
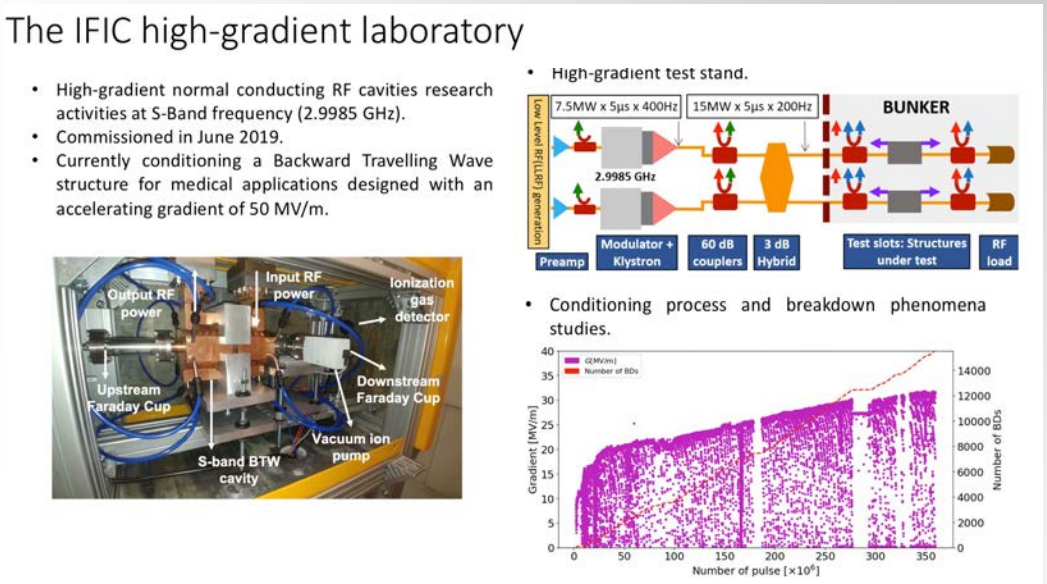
- Laura Karina Pedrazo: pedraza.laurakarina@gmail.com
- Jose reina: Jose.Reina@ific.uv.es
- Juan Carlos: Juan.Carlos@ific.uv.es

Within the AITANA group (https://aitanatop.ific.uv.es/aitanatop/)

Members of the ATF Collaboration

Past accelerator R&D activities





Bean instrumentation:

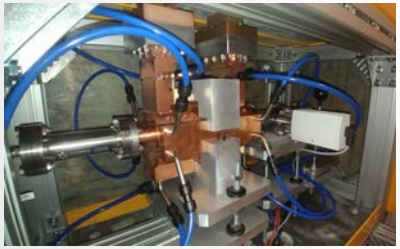
- 4 optical tranOptics Design and Beam Instrumentation studies for the Beam Delivery System of Future Linear Colliders.
- Collimation system studies for Future Linear Colliders (CLIC).
- Beam halo collimation and wakefield studies at ATF2. Design, construction and installation of a vertical collimator in ATF2.
- Beam Dynamic studies for the EXT line of ATF-ATF2.
- High-gradient RF structures studies.
- Design and construction of Beam instrumentation for radiation monitors at ATF-ATF2.
  - ✓ Inductive Beam Position Monitors for CTF3.
  - ✓ Stripline BPM development for the CLIC drive beam.
  - ✓ Stripline kickers for beam injection and extraction for a future Linear Collider.

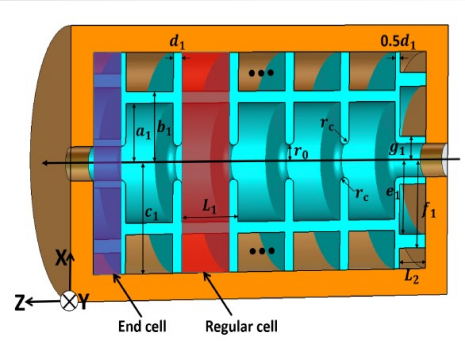
RF - lab

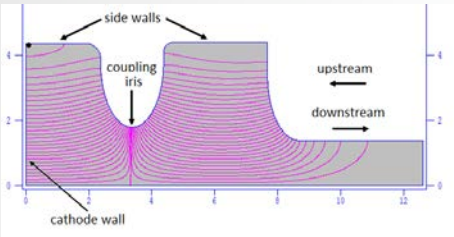
- Construction and commissioning of the IFIC high-gradient RF laboratory.
- High-gradient RF accelerating structure theoretical and experimental studies.

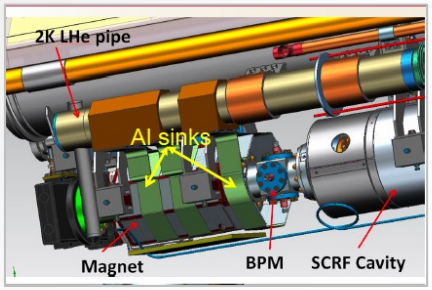
Current accelerator R&D activities

- **R&D on accelerating technologies**
  - High power RF test-stands construction, commissioning and operation
  - High-gradient RF cavities R&D
  - Dielectric Assist Accelerating (DAA) cavities design
  - R&D on diagnostics and online system for a linear injector for ion-theraphy
  - Beam-driven Wakefield in carbon nanotubes (CNT)
- **Beam dynamics studies**
  - Analytical and numerical modelling of non-linear EM phenomena
- **Accelerator applications**
  - High-frequency technologies and beam dynamic R&D for ion linacs
  - Use of accelerators and nanoparticles for hadrontherapy optimization
  - Ion radiobiology
- **Instrumentation:**
  - R&D on cold cavity BPMs for the main linac cryomodules of ILC
  - BPM construction for ELBEX project









Current accelerator funding

Projects/Contrats/Agreements:

- ✓ CIPROM/2021/073 PROMETEO-Grups of Excelence, Generalitat Valenciana, (2022-2025)
- ✓ PID202-1122134NB-C21. Spanish Science Agency (AEI) (2023-2025)
- ✓ ASFAE/2022/013, Generalitat Valenciana (2022) & AEI (Next Generation EU, 2023-2025)
- ✓ EAJADE, Europe America Japan Accelerator Development Exchange Programme, HORIZON-MSCA-2021-SE-01, 101086276 (2023-2026)
- ✓ ELBEX, AN ELECTRON BEAMLINE AT THE European-XFEL, HORIZON-INFRA-2023-DEV-01,, 101130174, (2025-2029)
- ✓ CPP-hadronterapia, Innovative Public Procurement CDTI program (2024-2028), CSIC-CDTI agreement (2023), 21,8 M€
- ✓ CIEMAT-IFIC (CSIC-UV) cooperation agreement to develop infrastructure and radiobiology studies at the future IFIC Ion facility (in process, 2025-2028)

CSIC/IFIC: AITANA – New Accelerator C^{6+} facility at IFIC

Objective:

- The proposal considers the development of a linear accelerator-injector for carbon ions of at least 10 MeV/n as a first stage of a full Carbon Ion Facility
- At an operational level, this equipment will be the basis of a facility that will remain functional at IFIC for its scientific exploitation in pre-clinical biomedicine and radiobiology
- This installation will be used to acquire the necessary knowledge about the effects of the deposition of this type of radiation in the organism
- It also could be used in order to perform studies on adequate clinical knowledge for treatment planning
- It will be coordinated with a network of similar facilities in Europe and Japan

Main strategic lines:

- ***Scientific:*** advance in radiobiological, biomedical and clinical aspects essential for an adequate knowledge of ion radiotherapy
- ***Innovation:*** the equipment will be built by industry. It will be framed in the funding line of CDTI Innovative Public Procurement (*Compra Pública Innovadora*)

Institution receiving the equipment:

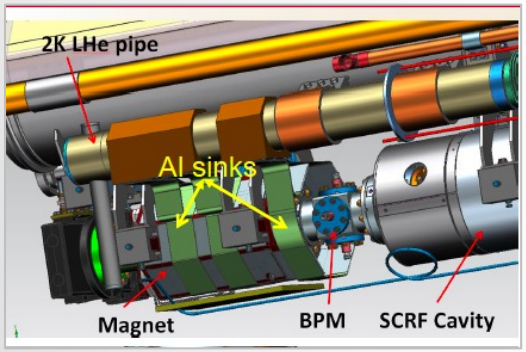
- The facility will be received by CSIC and installed at IFIC

Contribution to ILC Technological Network

In 2021 the Spanish network for Future Colliders identified as a promising contribution from CIEMAT and IFIC groups to the ILC the development of the splitable quadrupole magnet (CIEMAT) and its associated Beam Position Monitor (IFIC) of the Main Linac.

So IFIC is now interested in contributing to the European ITN Activity 1 on the task on R&D of Main Linac elements in particular on the development of a cold cavity Beam Position Monitor (BPM).

In 2023, we have started the collaboration with CIEMAT (L. García, F. Toral, O. Durán) and KEK (A. Yamamoto, H. Hayano) on this development.



Fabricated L-band BPM prototype. S. Jang, H. Hayano et al., Development of L-band cavity BPM for STF, IPAC19

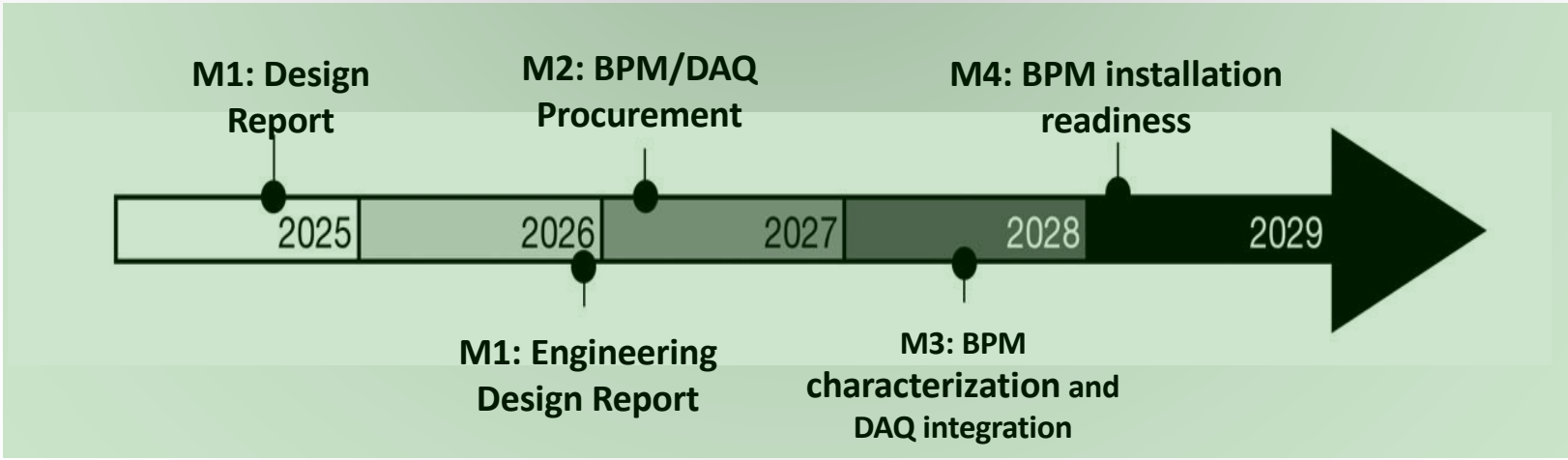
❑ **General requirements for the BPM performance:**

- High precision BPM with a time nanometer resolution (< 369 ns) and a spatial resolution < 1 µm
- ILC beam bunch by bunch measurements (fast readout electronics)
- Low beam dynamics impact (wakefields studies)
- Ultra high-vacuum and cryogenic temperatures performance
- Special mechanical design for ease cleaning

Contribution to ELBEX

BPM System for the ELBEX extraction line:

- M1: Design of the BPM system by optimizing the location of the different BPMs
  - Optics and beam dynamics simulation
- M2: Manufacturing of the BPMs
  - Evaluation of BPM manufacturing options: AVS (Added Value Solutions) or TVP (Thermal Vacuum Projects).
  - Selection of readout electronics: Bergoz or in-house development (uTCA)
- M3: BPMs calibration in the laboratory and a pre-installation study
- M4: Installation on the Beam Line and control integration



Contribution to ELBEX

Working Team:

- Juan Fuster Verdú: juan.fuster@ific.uv.es
- Daniel Esperante Pereira: daniel.Esperante@ific.uv.es
- Marçà Boronat Arevalo: boronat.arevalo@ific.uv.es
- Daniel González-Iglesias: daniel.gonzalez-iglesias@uv.es
- Abraham Menéndez: Abraham.menendez@uv.es



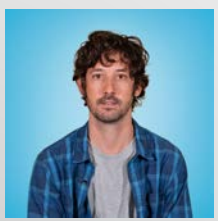
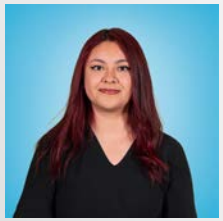


Contribution to LUXE

Adrián Irles Quiles, adrian.irles@ific.uv.es

Melissa Almansa Soto, melissa.almanza@ific.uv.es

Carles Orero Canet, carlos.orero@ific.uv.es

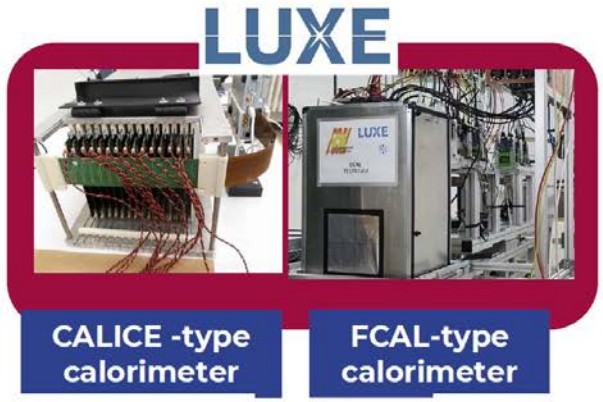




Barrel ECAL:
Similar design in:

(linear collider)
CLICdetector, ILD, SiD

(circular collider)
CLD, ILD, CepC

Electron Calo for LUXE

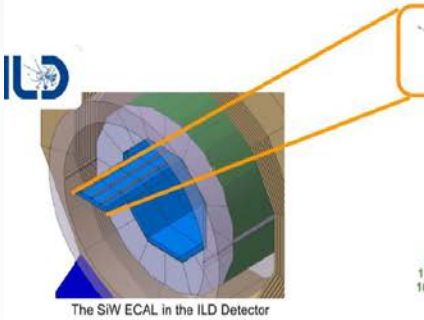


Froward LumiCAL:
Similar design in:

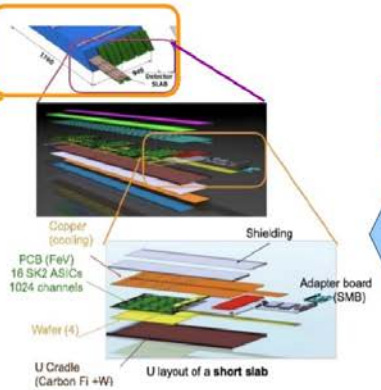
(linear collider)
CLICdetector, ILD, SiD

(circular collider – with adaptations)
ILD, CEPC,..

Positron Calo for LUXE



SiW Ecal



R&D on sensor hybridization

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