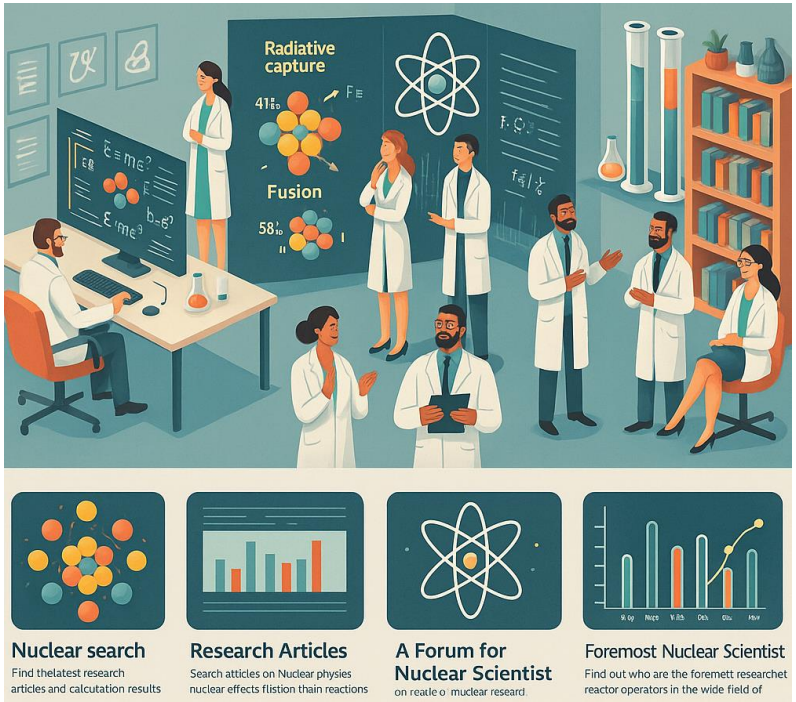
NAPMIX – STATUS OPENDATA4ITCS

NAPMIX Training Workshop 2026 – Metadata, RDM & FAIR Integration

Carla Tatiana Muñoz Chimbo[1], Konstantina Palli[2], [1]Joaquín José Gómez Camacho, [2]Gastón García López, [1]Rafael García-Tenorio García-Balmaseda, Raúl Varela Ferrando

[1]National Centre for Accelerator (CNA) – University of Seville
[2]Centre for Micro Analysis of Materials – Autonomous University of Madrid



Funded by the European Union

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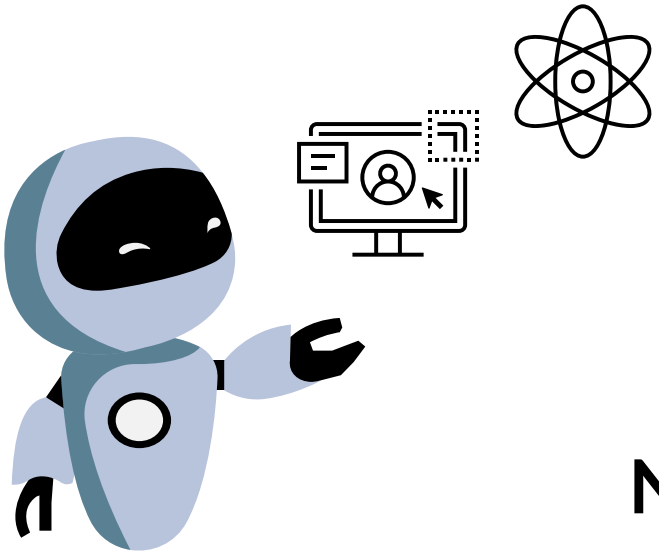

NAPMIX

NAPMIX implementation in OPENDATA4ICTS

Why metadata matters?

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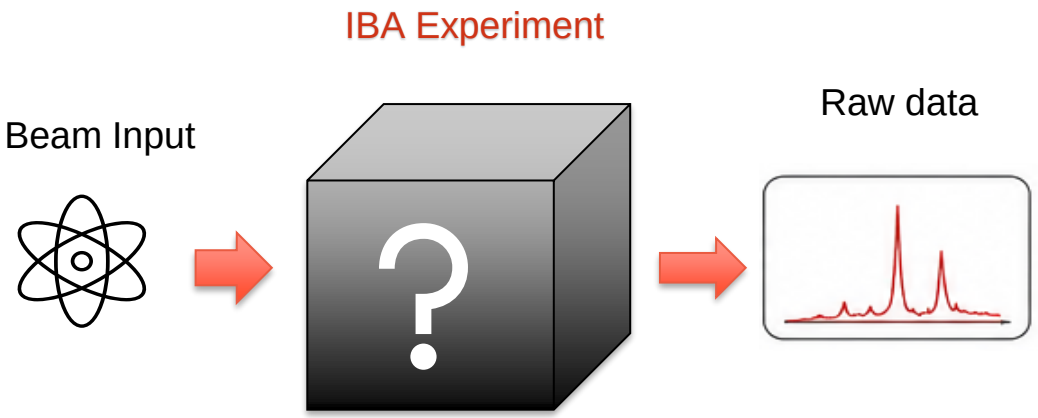
CMAM

Why metadata matter in IBA experiments workflows?



We don't know:

- Experimental conditions
- Sample and setup
- Detector configuration
- Calibrations, angles, etc

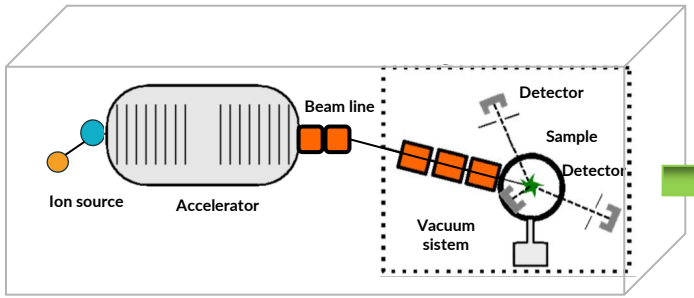
Cannot validate
Cannot trust
Cannot reuse

Without Metadata: The experiment is a black box

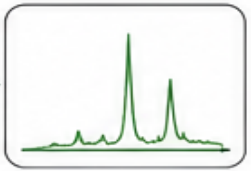
Why metadata matter in IBA experiments workflows?

IBA Experiment

Beam Input



Raw data



Beam parameters

Sample information

Detector configuration

Calibration & setup

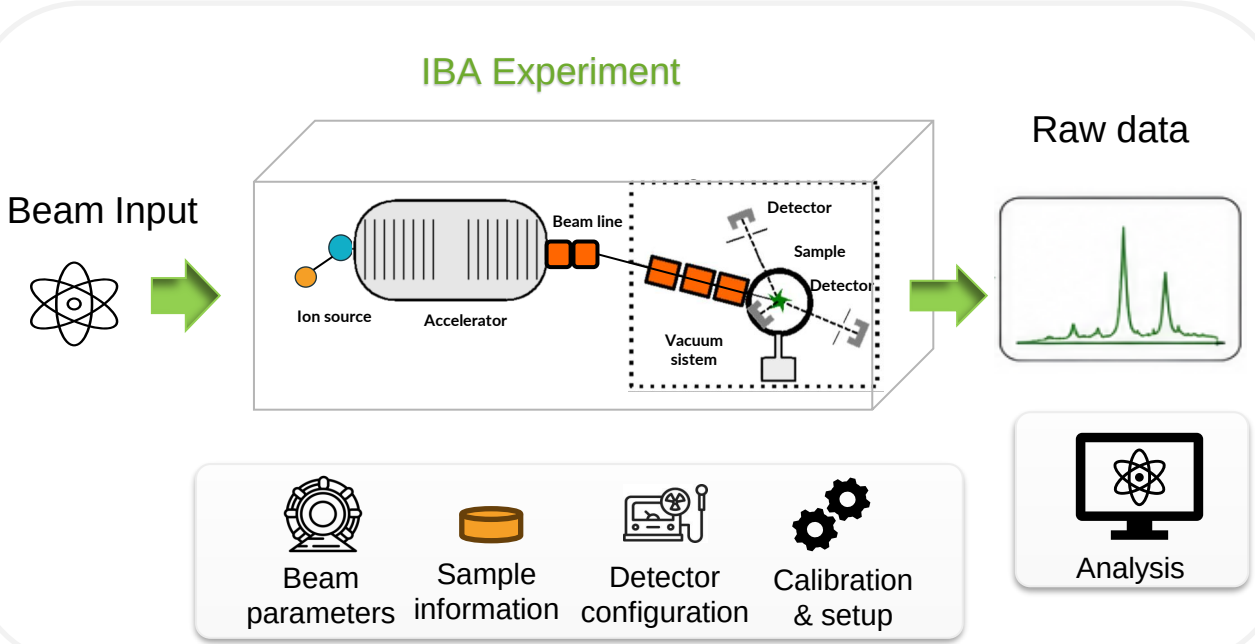
Analysis

FAIR Principles

Findable
Accessible
Interoperable
Reusable

With Metadata: The experiment is transparent and understandable

Why metadata matter in IBA experiments workflows?



Metadata = data about data

Describes:

- how was data generated?
- under which conditions?, by whom and for what purpose?

Metadata often lost after analysis

With Metadata: The experiment is transparent and understandable

OPENDATA4ICTS as a NAPMIX implementation use-case

- Focus on IBA infrastructures
- Adaptation of NAPMIX schemas to local experimental workflows
- Bridge between schema and real workflows

Within OPENDATA4ICTS, CNA and CMAM are implementing and adapting NAPMIX metadata concepts, schemas and workflows to accelerator-based IBA experimental environments.

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Metadata in IBA experiments

General and scientific metadata

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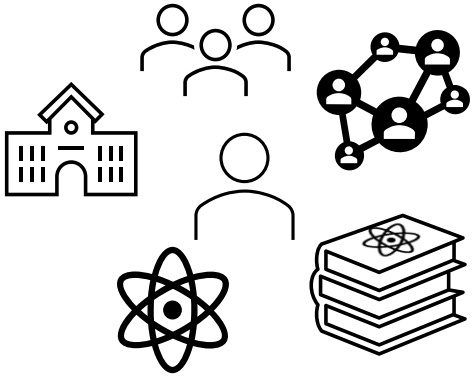
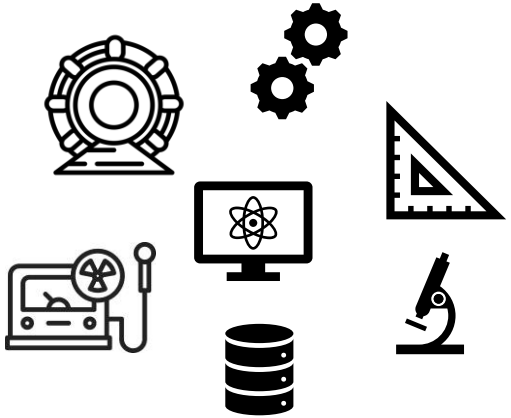
Metadata categories





General metadata

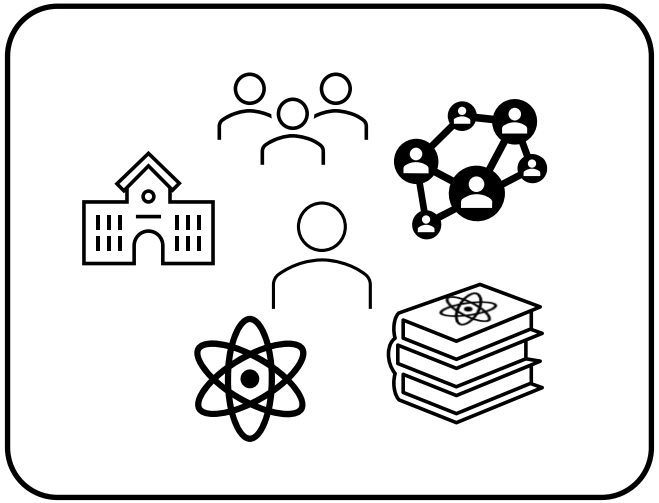
Proposal details
Researchers, institutions, beamlines, techniques, experiment main information

Scientific metadata

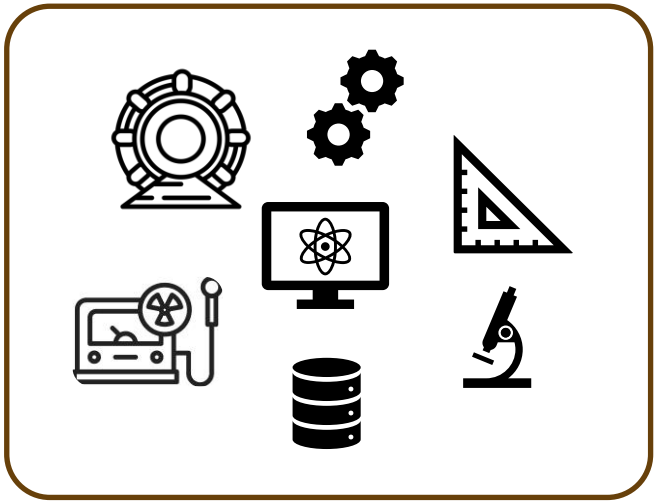
Experimental set up
Beam settings (geometry, angles, filters), electronic chain, detectors, technique-specific models.

Metadata categories

General metadata



Scientific metadata



General metadata improve discoverability, while technical metadata ensure reusability

3 MV Tandem

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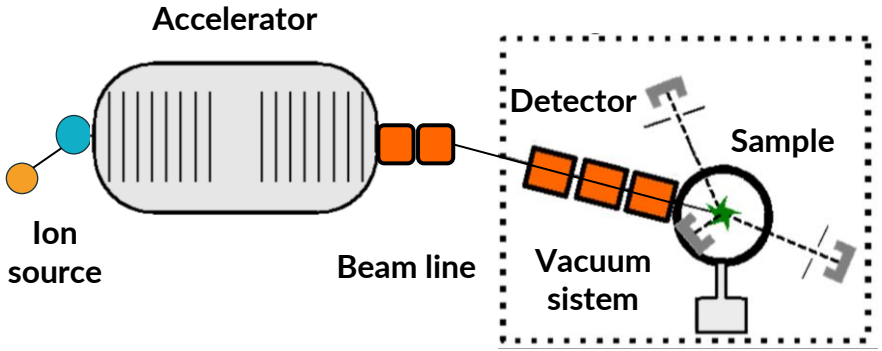
5 MV Tandem



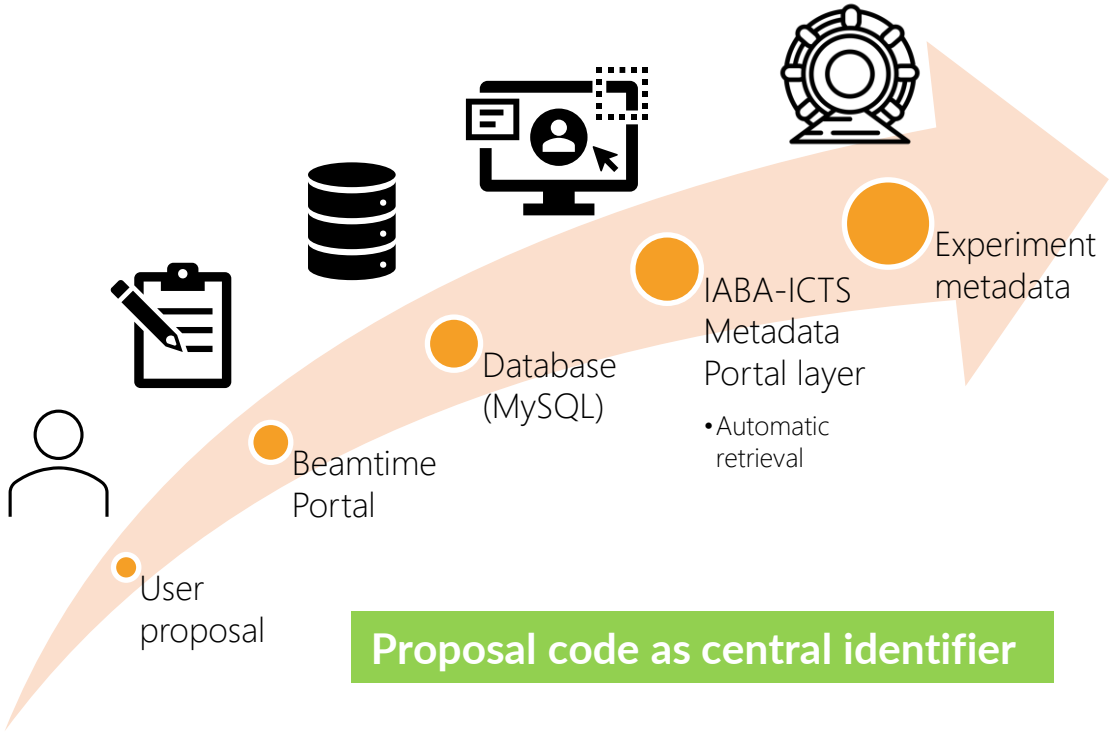
Proposal
- Beamtime Portal
- Manually Entry
- CLEAR

General metadata
- Proposal ID
- Users
- Affiliations
- Dates
- keywords

Scientific metadata
- Beam
- Sample
- Detectors
- Logbook

General Metadata: Integration with the IABA Beamtime Portal

- General metadata are automatically retrieved from the CNA/CMAM proposal management system.
- Automatic linking of users and experiments
- Unified access across CNA and CMAM



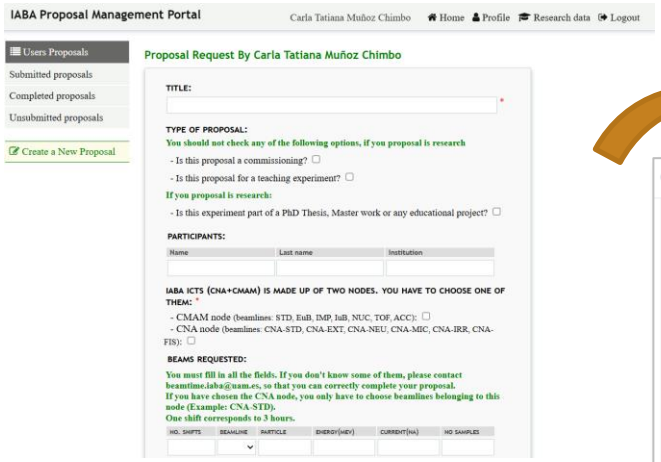
Proposal code as central identifier

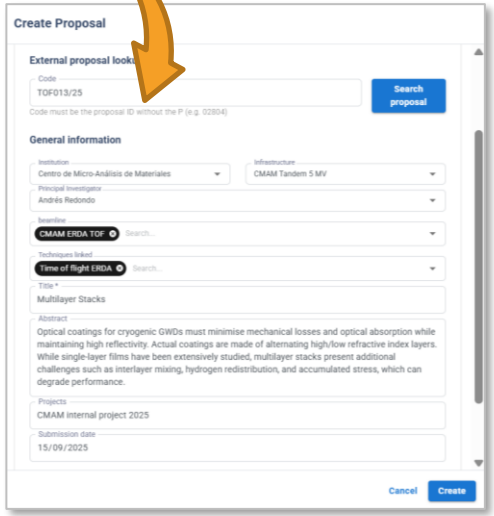
General Metadata: Integration with the IABA Beamtime Portal

Proposals (Beamtime Portal)

- Institutions
- Infrastructures
- Beamlines
- Projects
- Researchers
- Techniques

Proposal Submission portal for CMAM and CNA
https://beamtime.cmam.uam.es/





Proposal code as central identifier: TOF013/25

Scientific Metadata File Developed

We follow a modular approach where a common core is extended by technique-specific metadata models.

Common core metadata
↓
Technique-specific extensions
↓
Instrument-specific parameters

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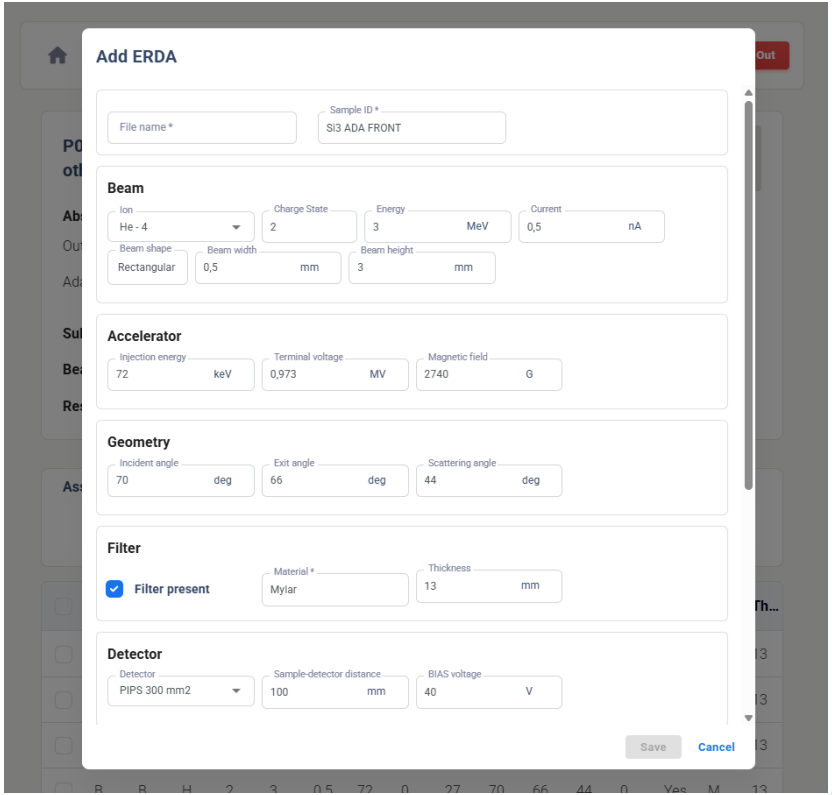
Implemented	In development	Implemented	In development
Standard beamline ERDA/RBS/PIGE/ PIXE	Microbeam chamber IBIC/PIXE/TRIIBIC **Nuclear physics** • HISPANOS • FNB	• TOF-ERDA	**Nuclear physics** • NUC30 • NUC45

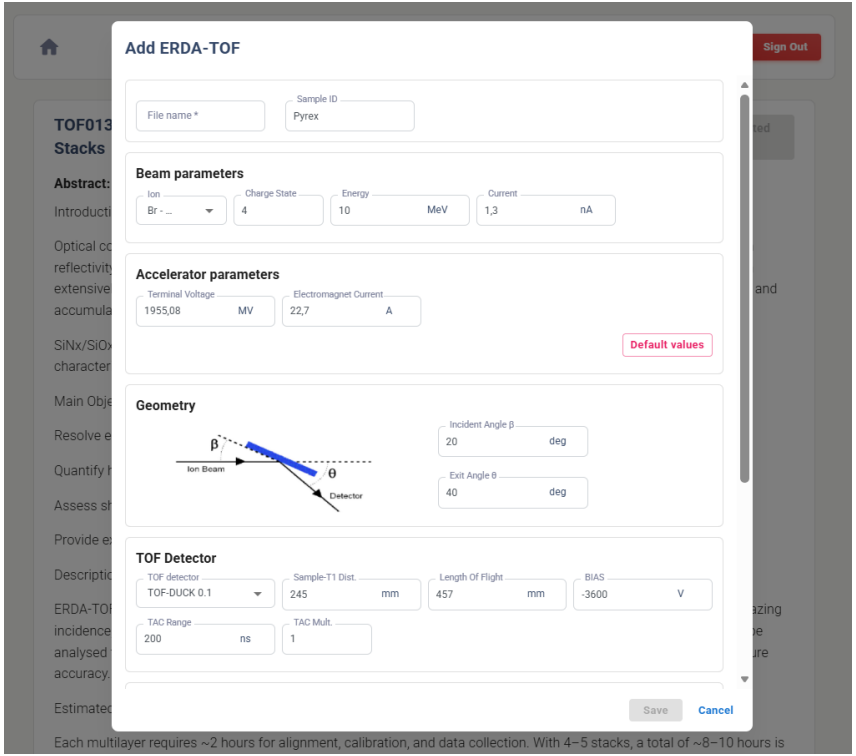
Scientific Metadata file for CNA STD ERDA / RBS / PIGE / PIXE

	• File name • Sample ID
Beam	• Ion and charge state • Energy • Current • Beam shape and width/height/diameter
Accelerator	• Injection and Terminal energy • Magnetic field
Geometry	• Incident, exit and scattering angle
Filter	• Material and thickness
Detector	• Model • Sample-detector distance • BIAS voltage
Electronics	• Shaping / Peaking time • Coarse / Fine / ADC gain • ADC range
Measurement	• Accumulated charge • Inverse current
	• Notes



Scientific Metadata file for CMAM STD ERDA-TOF

	• File name • Sample ID
Beam	• Ion and charge state • Energy and Current
Accelerator	• Injection and Terminal energy • Electromagnetic current
Geometry	• Incident and exit angle
TOF Detector	• TOF detector model • Sample-T1distance • Length of flight • BIAS • TAC range and multiplier • ADC gain and range
Energy Detector	• Energy detector model • Sample-detector distance • BIAS voltaje and shaping time • Coarse / Fine / ADC gain • ADC range
Coincidence	• Coincidence window
	• Notes



03

IABA-ICTS Metadata Portal

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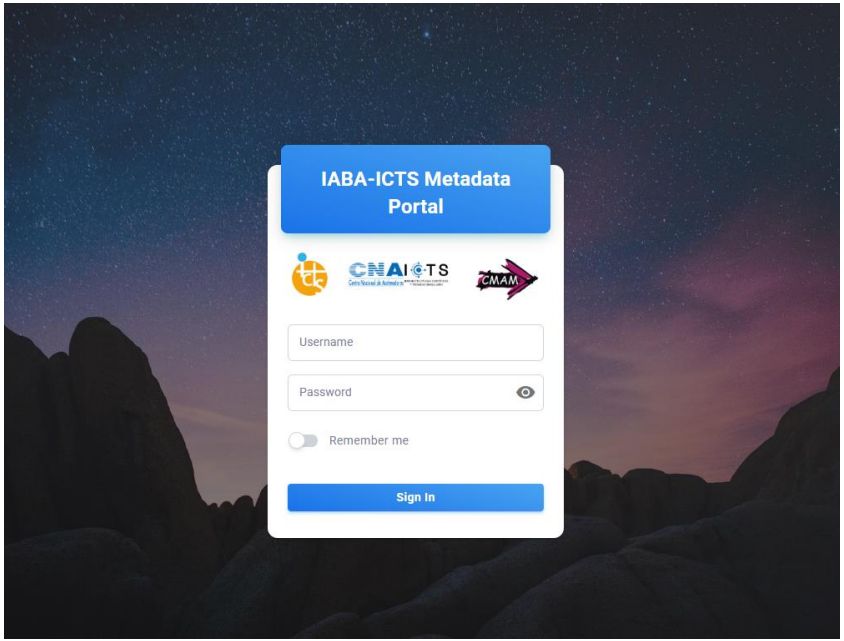
IABA-ICTS Metadata Portal

The IBA-ICTS Metadata Portal is a central hub for experimental metadata management in accelerator-based IBA infrastructures, built on NAPMIX concepts and schemas.

- Bridges experimental planning, execution and data archiving
- Provides guided metadata capture with validation
- Generates exportable, reusable JSON metadata
- Reduces complexity for researchers through structures form(User-friendly interface).

Access & Deployment Model



- Installed directly on Tandem accelerator workstations (data acquisition environment)
- Next step: beamline-specific user accounts
- Future evolution: individual researcher accounts
- Scalable structure aligned with experimental facility organization

Role-based Access Model

Admin User

- Full access across CNA and CMAM
- Manage users and permissions
- Configure: researchers, beamlines, techniques, projects, institutions
- Maintain internal metadata database structure

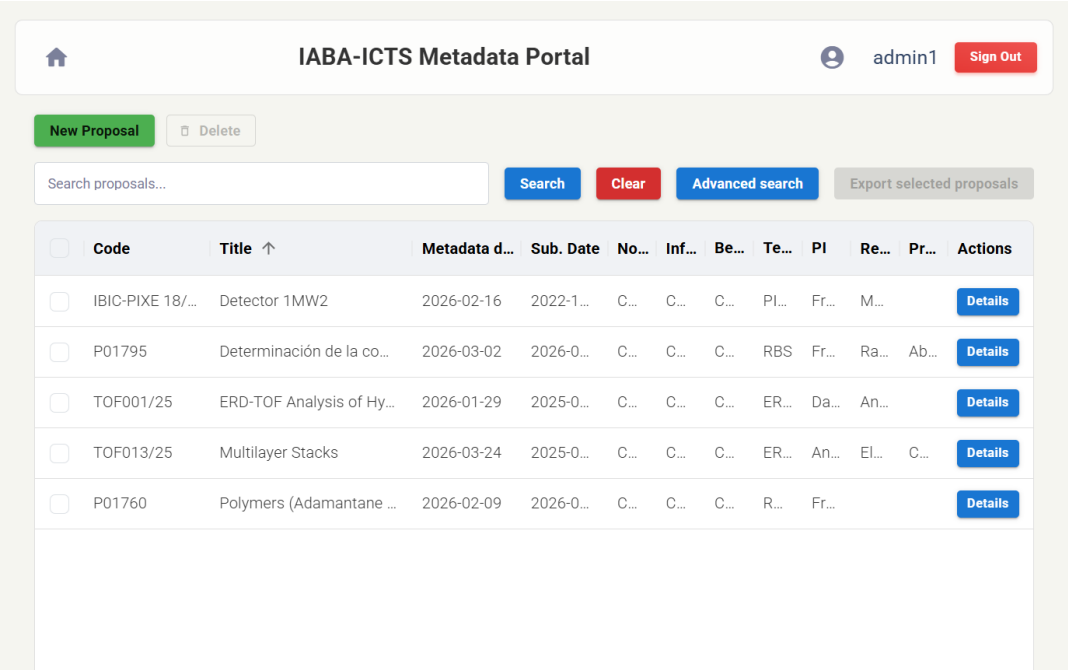
CNA user

- Access to CNA proposals only
- Create and manage CNA proposals
- Register, edit, delete and export metadata
- Remove proposals without metadata

CMAM user

- Same capabilities scoped to CMAM environment
- Full lifecycle management of CMAM proposals and metadata

Proposal Dashboard (Main View)

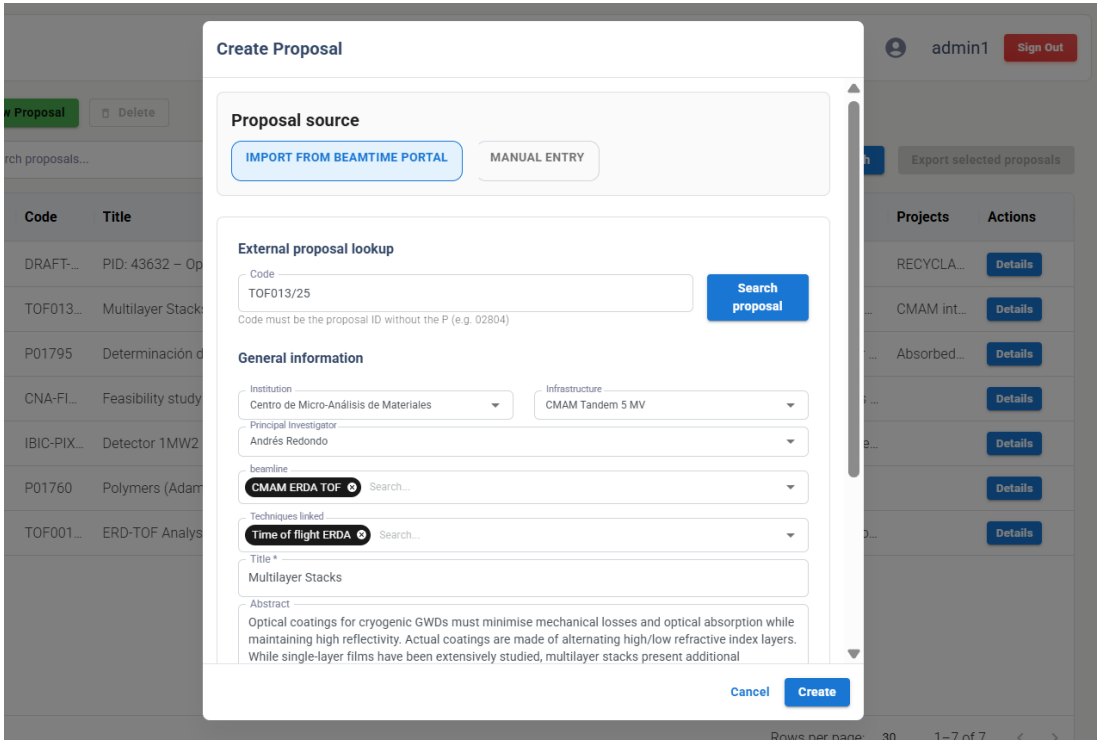


Overview of experimental proposals

Table of all registered experimental proposals Each entry includes:

- Proposal ID / code
- Experiment title
- Registration date
- Submission date
- Node & infrastructure
- Beamline & technique
- Researchers & project

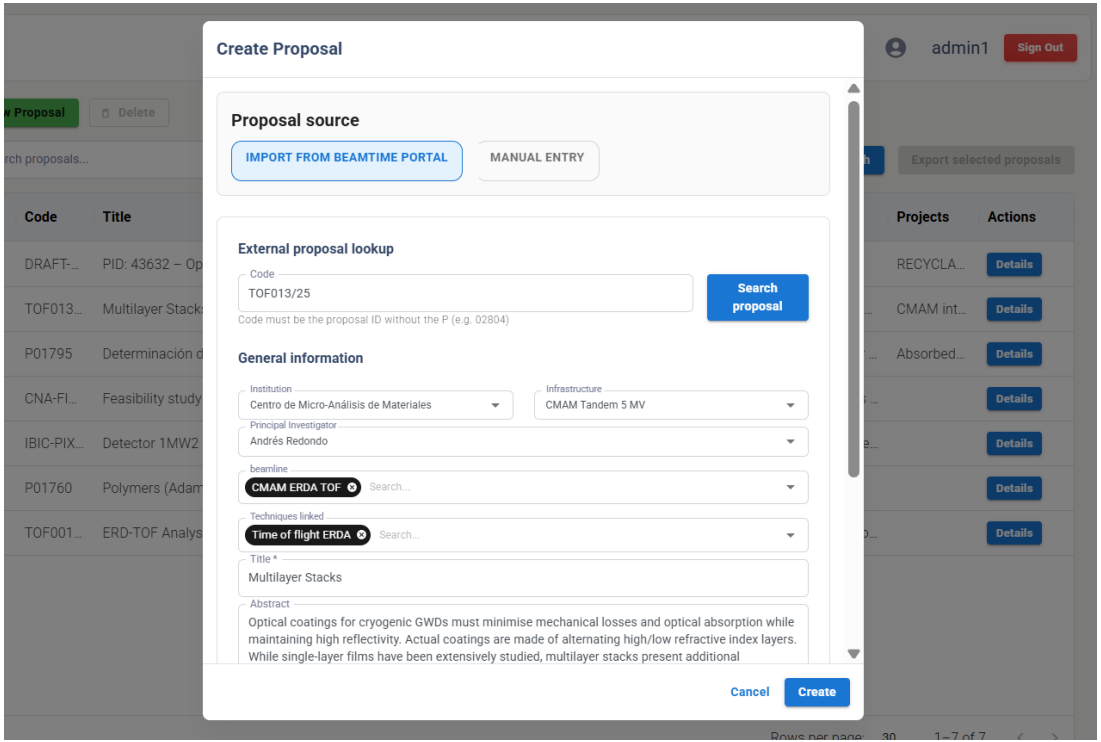
Creating a new Proposal



General metadata registration options

1. Beamtime Portal import (recommended)
2. Manual Entry
3. CLEAR database (in development)

Creating a new Proposal

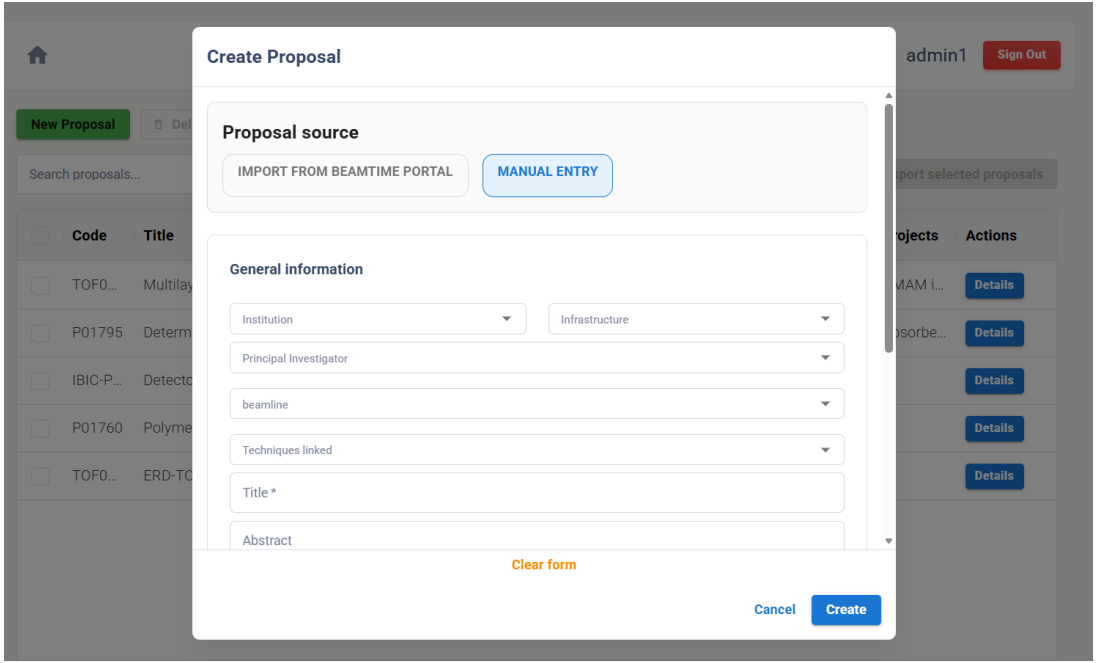


Beamtime Portal Import (recommended)

- Retrieve proposal using identifier code
- Metadata automatically imported from external database
- Extra field required: experimental techniques
- Ensures consistency and reduces manual input

Code: TOF013/25

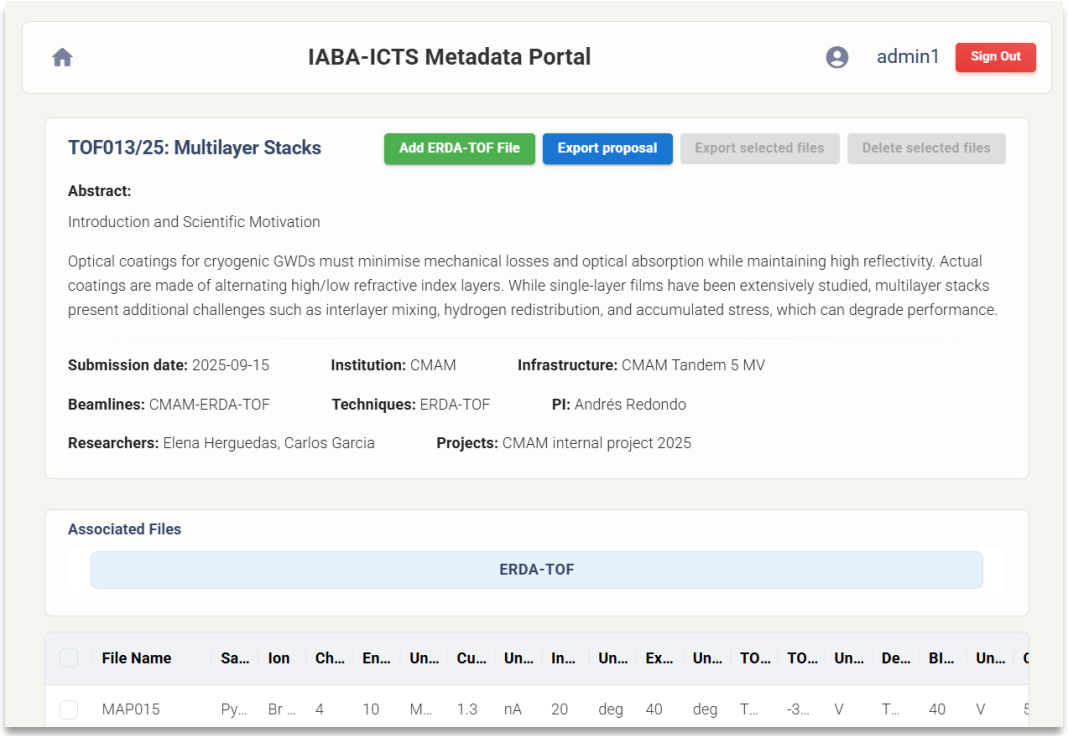
Creating a new Proposal



Manual Entry

- Used when no Beamtime Portal record exists
- Requires administrative approval
- User can work normally but internal dataset creation is restricted until validation

Proposal Detail View



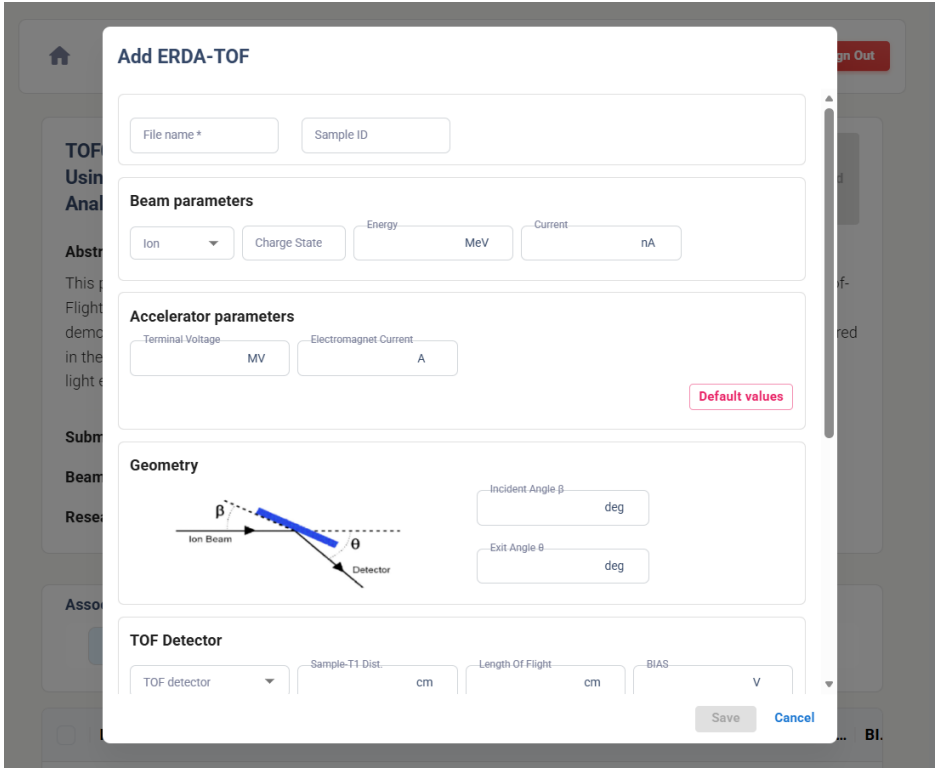
Full metadata management environment

- General and scientific metadata overview
- File-level management per experiment
- Actions:
  - Add file
  - Export proposal (JSON)
  - Export selected files (JSON)
  - Delete selected files

Scientific Metadata per File

Experiment-level data registration

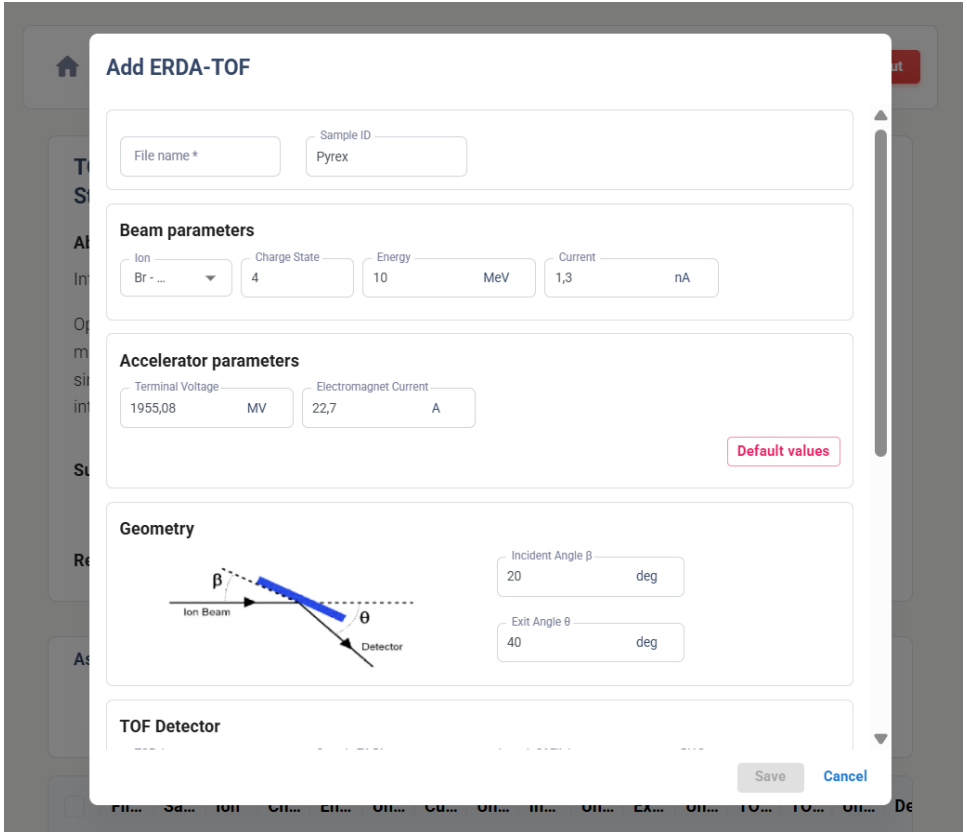
- Each file = one experimental dataset (spectrum/run/setup change)
- Dedicated form per dataset
- Pre-filled default values when available
- Users only adjust relevant parameters
- Ensures consistency across experiments



Iterative Metadata & Versioning

Incremental metadata capture

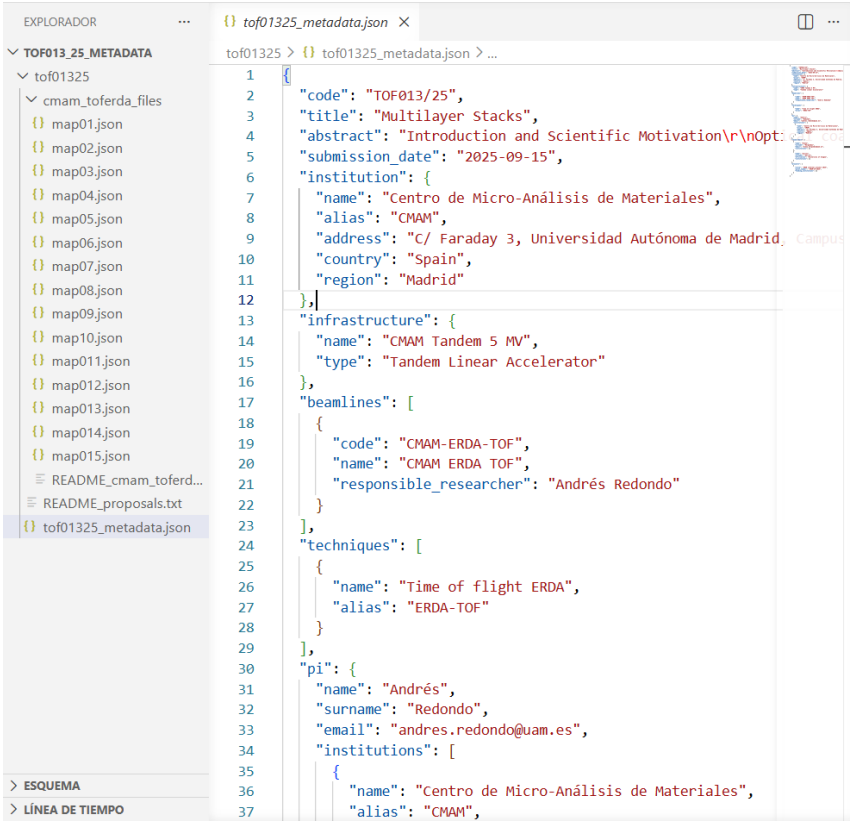
- Each new file inherits previous metadata
- Only modified parameters are updated
- Each entry requires a unique file name
- Enables fast and consistent experimental logging
- Logbook



Export & FAIR integration

Incremental metadata capture

- Export full proposal as JSON
- Compatible with external repositories
- Researchers choose destination repository
- Future integration:
  - Direct Zenodo upload button



Scientific metadata models validated in real experiments

Technique	Facility/ Beamline	Experiment description	Principal Investigator
ERDA	CNA/STD	P01760: Polymers (Adamantane and others) thin films charac.	Javier Ferrer
RBS	CNA/STD	P017: Determination of the chemical composition of AlOx coatings with different stoichiometries	Javier Ferrer
TOF-ERDA	CMAM/STD	Characterization of Si_3N_4 films (upcoming 24/03/2026).	Andrés Redondo Cubero

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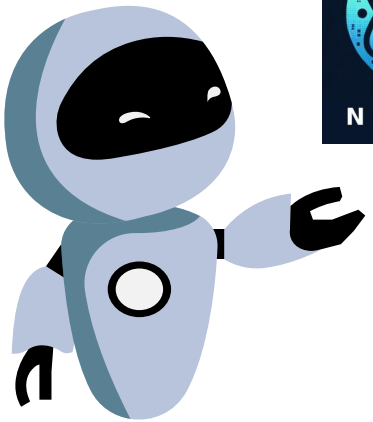

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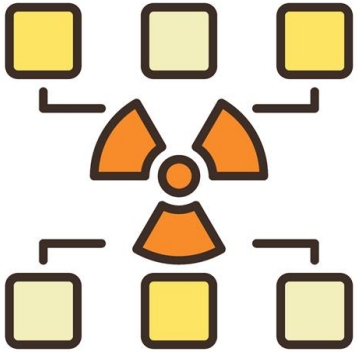

Implementation of Nuclear Physics beamlines

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The Challenge: Nuclear Experiment Metadata

IBA Techniques:

- Separate metadata file per technique/beamline
- Standardized setups, electronic, acquisition systems
- Fixed detector geometries
- Similar type of detector between measurements

→ Technique-Specific Metadata

Nuclear Physics:

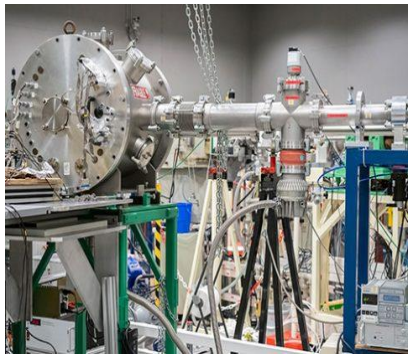
- Highly variable setups and geometries
- Custom detector combinations
- Complex trigger and data acquisition systems
- Increased number of parameters

→ Experiment-Specific Metadata

Nuclear Physics in ICTS facilities

CMAM

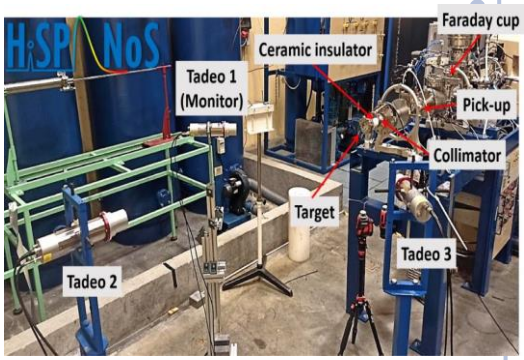
- **NUC-30:**



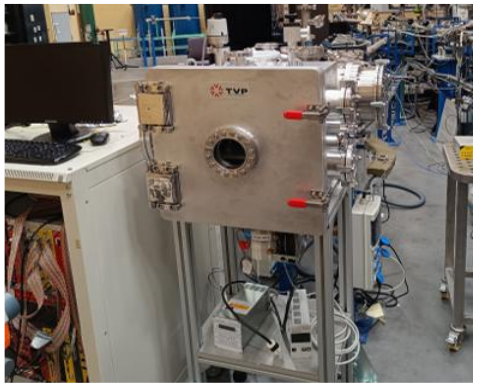
- **NUC-45:**

CNA

- **HiSPANoS:**



- **FNB:**



Proposed Implementations

Metadata file for each NP beamline:

- Dedicated metadata structure, dependent on the beamline
- Relation between beamline and experiment type (HiSPANoS → Neutron activation)

Additional fields:

- Target details
- Geometrical configuration

etc...

Parameter Lists:

- Possibility of creating a single file for several samples

Separation between static and dynamic metadata:

- Static: Default values can be stored in databases and reused (e.g. bias and dimensions of specific detector)
- Dynamic: Experiment-dependent parameters given by the user (e.g. angular range, distance from target)

Proposed Implementations

Detector / electronics databases:

- Predefined default parameters

- Reusable detector arrays and saved configurations

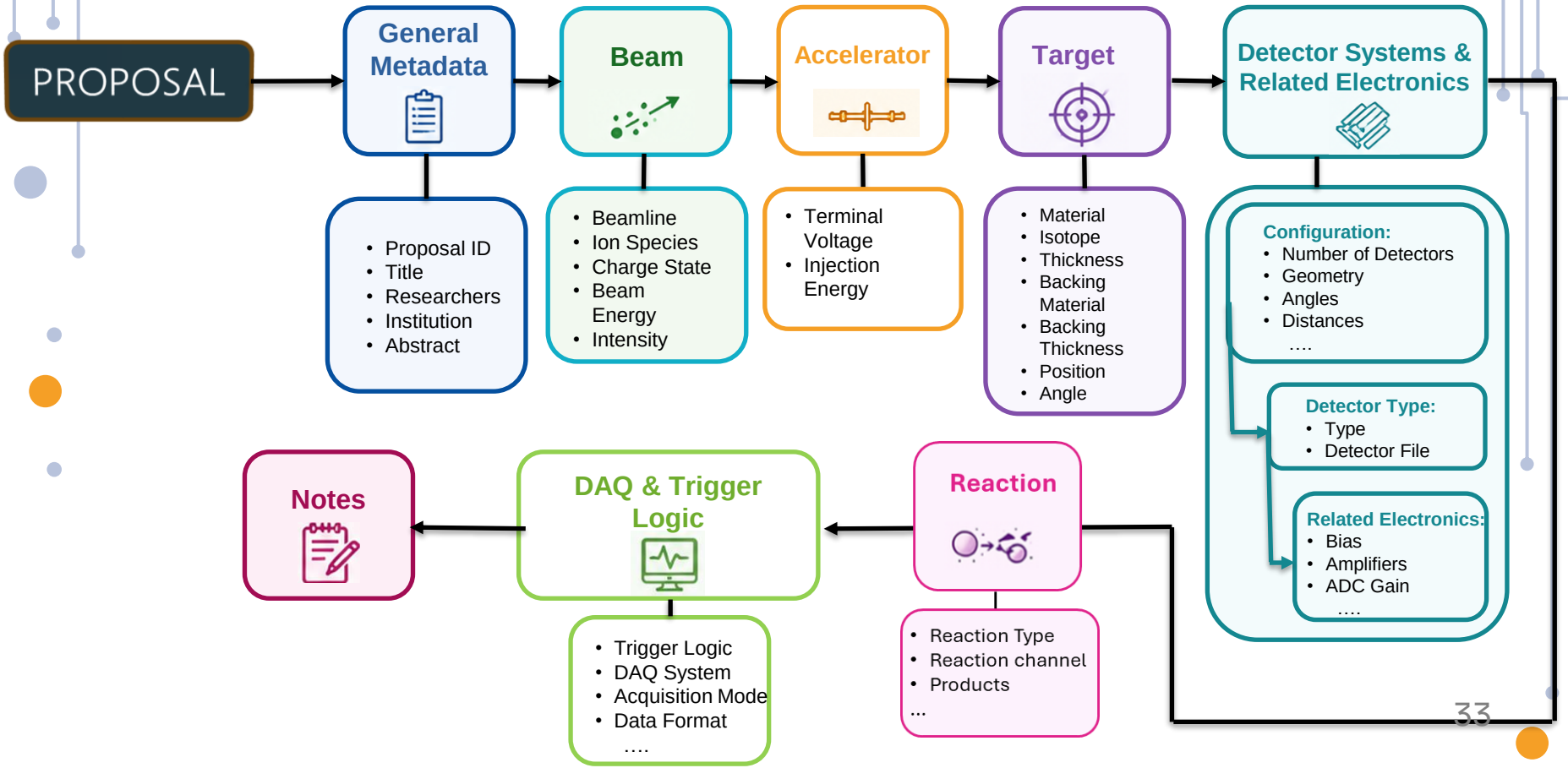
 - Faster and more user-friendly metadata submission

Object-specific dynamic fields:

- Metadata file structure and fields generated according to the setup (e.g. detector number, type)

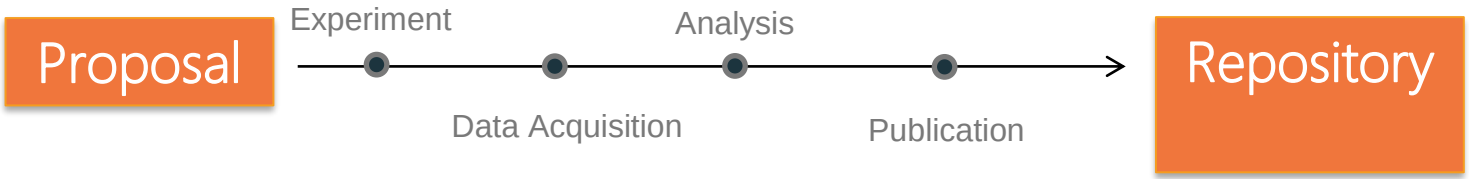
- Flexibility in metadata form generation, relevant to the experiment

Metadata Schema for Nuclear Physics



Future Tests @ CMAM

- STD Beamline: Testing metadata file generation for a simple case.
- Nuclear Beamline: Test End-to-End workflow



5

End to End Workflow

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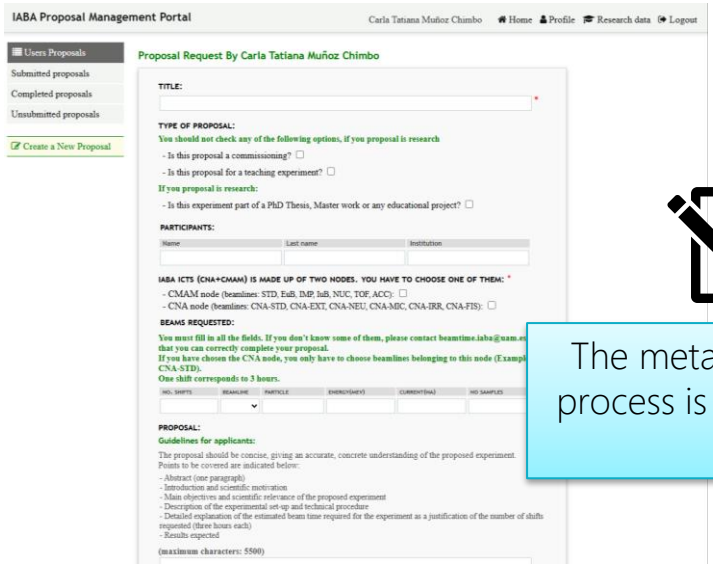
Proposal

- Proposal creation (Beamtime Portal)
- Experiment execution
- Metadata Registration (during acquisition)
- Data and metadata collection
- Repository

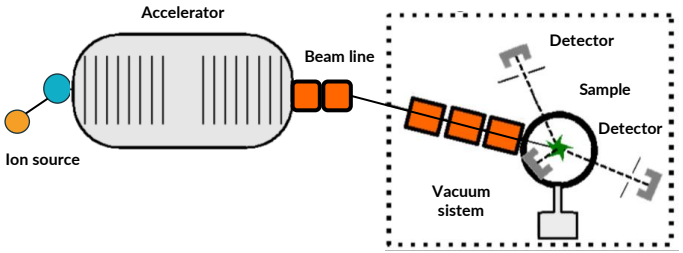
Proposal Submission portal for CMAM and CNA
https://beamtime.cmam.uam.es/



The metadata registration process is proposal - driven

IBA Experiment

- Proposal creation (Beamtime Portal)
- Experiment execution
- Metadata Registration (during acquisition)
- Data and metadata collection
- Repository



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CMAM

Registration general metadata

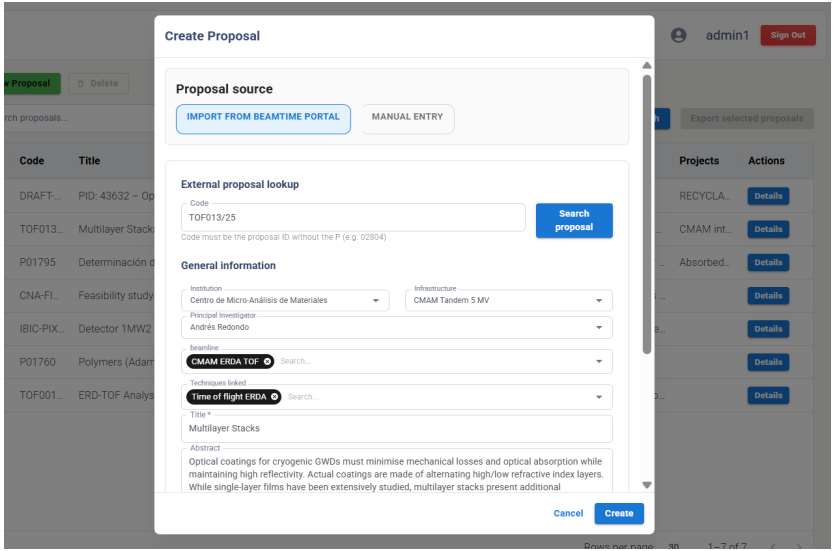
Proposal creation (Beamtime Portal)

Experiment execution

Metadata Registration (during acquisition)

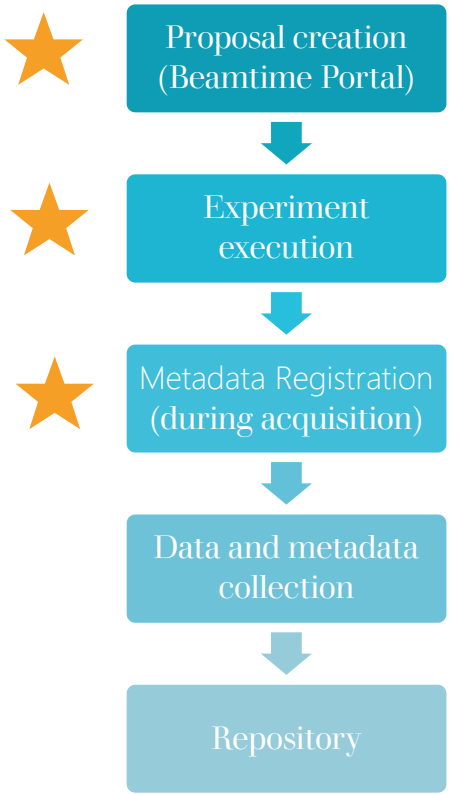
Data and metadata collection

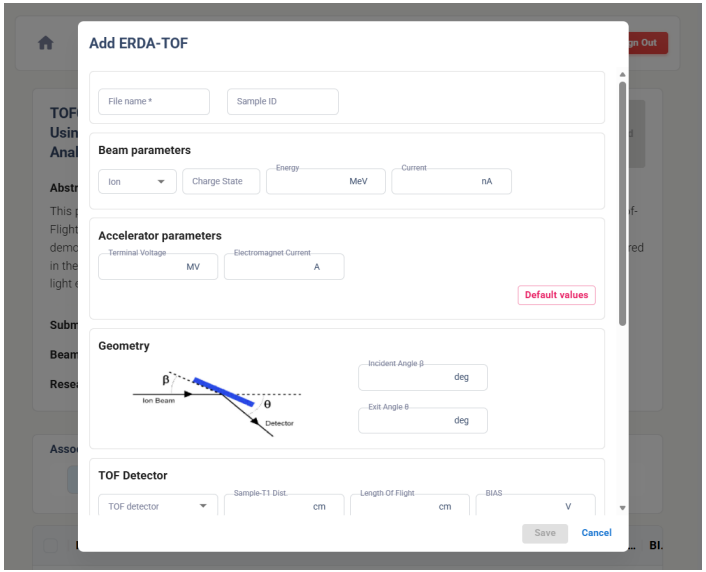
Repository



- General metadata (proposal-level)
- Scientific metadata (setup, beam)
- Logbook (experimental tracking

Registration scientific metadata





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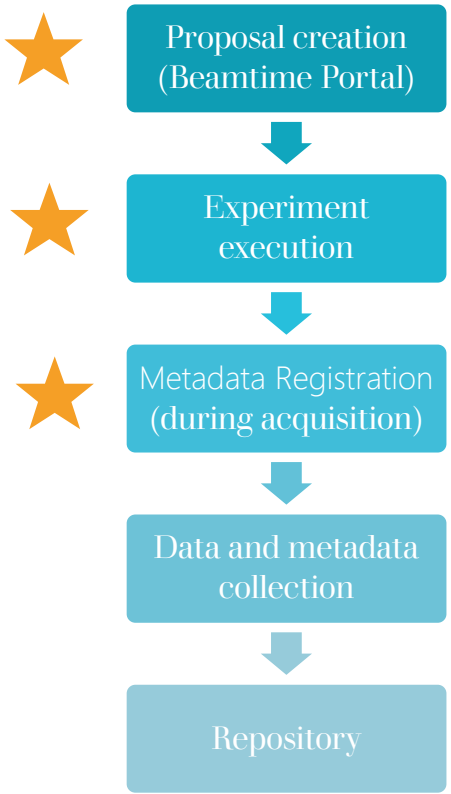
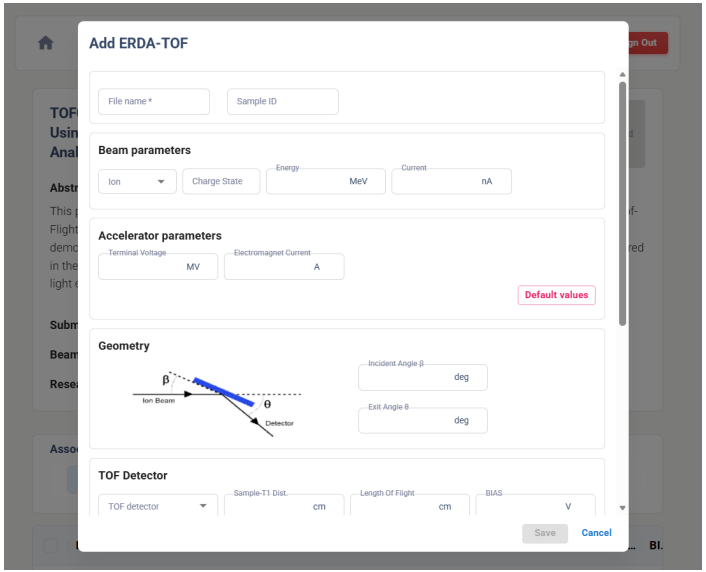
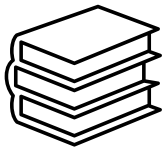
Logbook



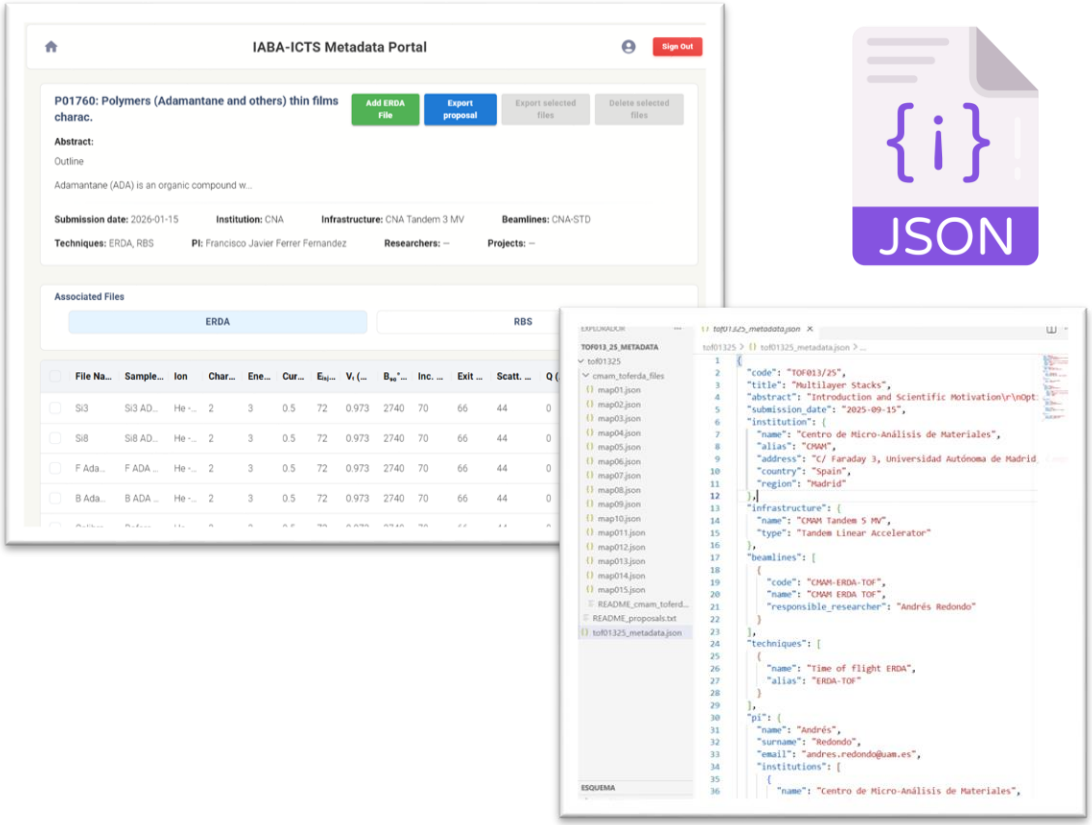


- General metadata (proposal-level)
- Scientific metadata (setup, beam)
- Logbook (experimental tracking

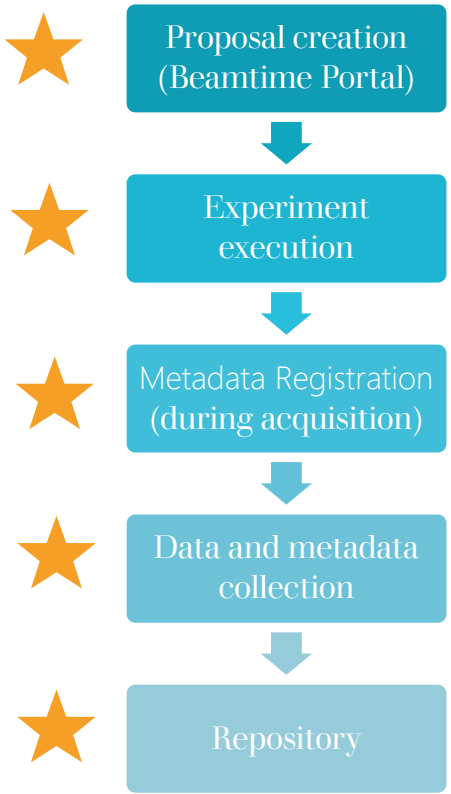


Metadata in format JSON

- Proposal creation (Beamtime Portal)
- Experiment execution
- Metadata Registration (during acquisition)
- Data and metadata collection
- Repository



Next step



This workflow integrates metadata generation directly into experimental routines.

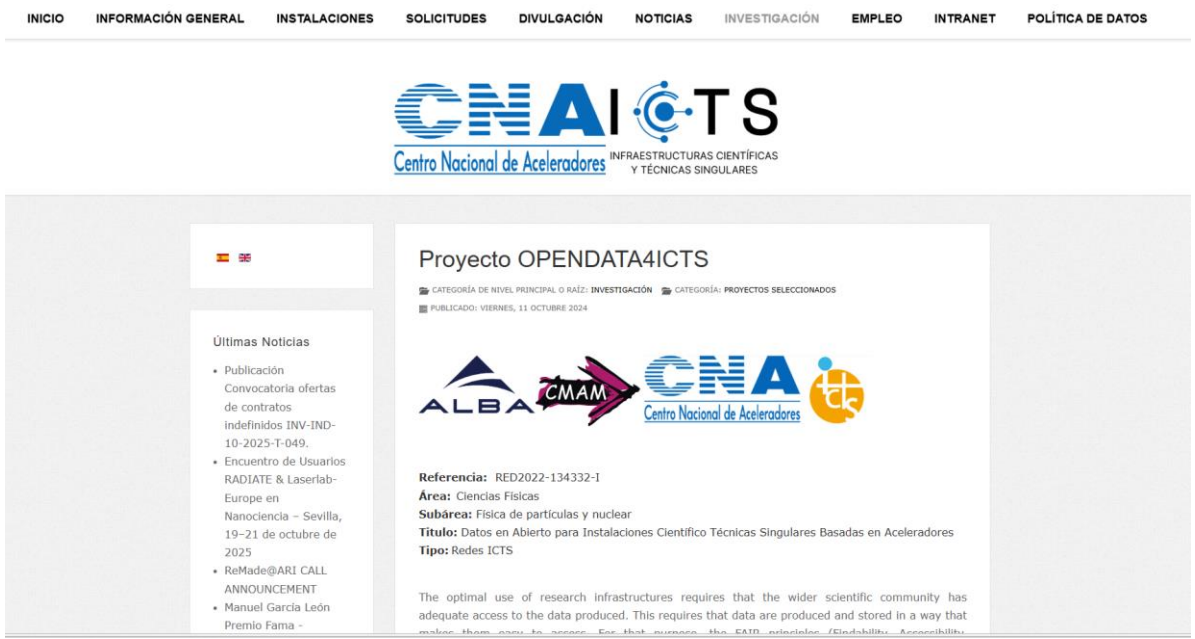
NAPMIX implemented in real IBA infrastructures:

- Modular and interoperability metadata architecture
- Integrated end-to-end experimental workflows.

OPENDATA4ICTS demonstrates how NAPMIX can be operationalized in real Accelerator-based environments

You can find ICTS-IABA PORTAL

https://cna.us.es/index.php/es/investigacion/proyectos-seleccionados/1254-proyecto-opendata



Thank you!

The IABA-ICTS Metadata Portal supports your experimental workflow from start to finish.

Centro Nacional de Aceleradores
INFRAESTRUCTURAS CIENTÍFICAS Y TÉCNICAS SINGULARES
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