


Research Data Management Practices at GANIL

NAPMIX Training Workshop 2026
19th May 2026

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- GANIL overview
- Metadata usage at GANIL
 - Unfolding of an experiment
 - Data Management Plan
 - DOI submission strategy
 - DataCite mapping
- openNP catalog
 - Overview
 - Next step

GANIL overview

- First experiment in 1983
- SPIRAL1 exotic beams in 2001
- SPIRAL2 start construction in 2011

EXO GAM



ACTAR TPC

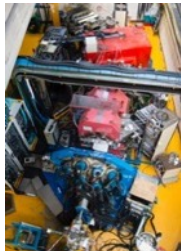


Irradiation sample holder



MUGAST

AGATA



VAMOS



LISE Spectrometer



INDRA-FAZIA

Cyclotron

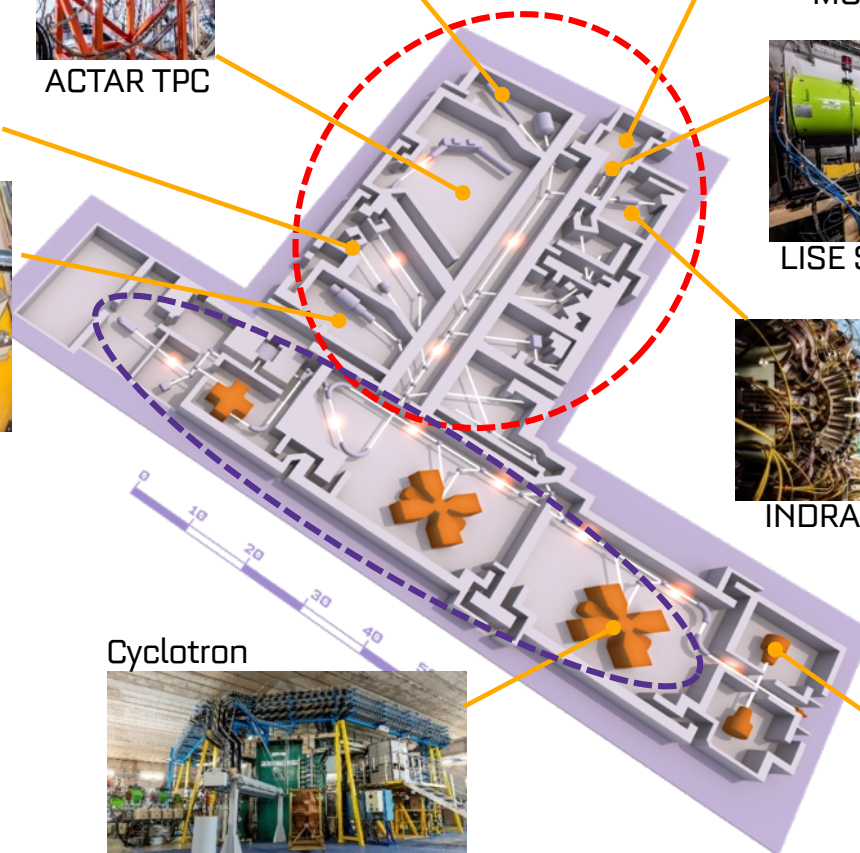


Ion sources



- ~240 permanent staff
→ CNRS and CEA
- ~70 temporary staff
- International scientific community of
~1000 people

- 5 cyclotrons
- Stable beams : from ^{12}C to ^{238}U
- From <1 MeV up to 95 MeV/nuc
- Radioactive beams (SPIRAL1)
- Up to 4 experiments in parallel



GANIL overview – SPIRAL 2

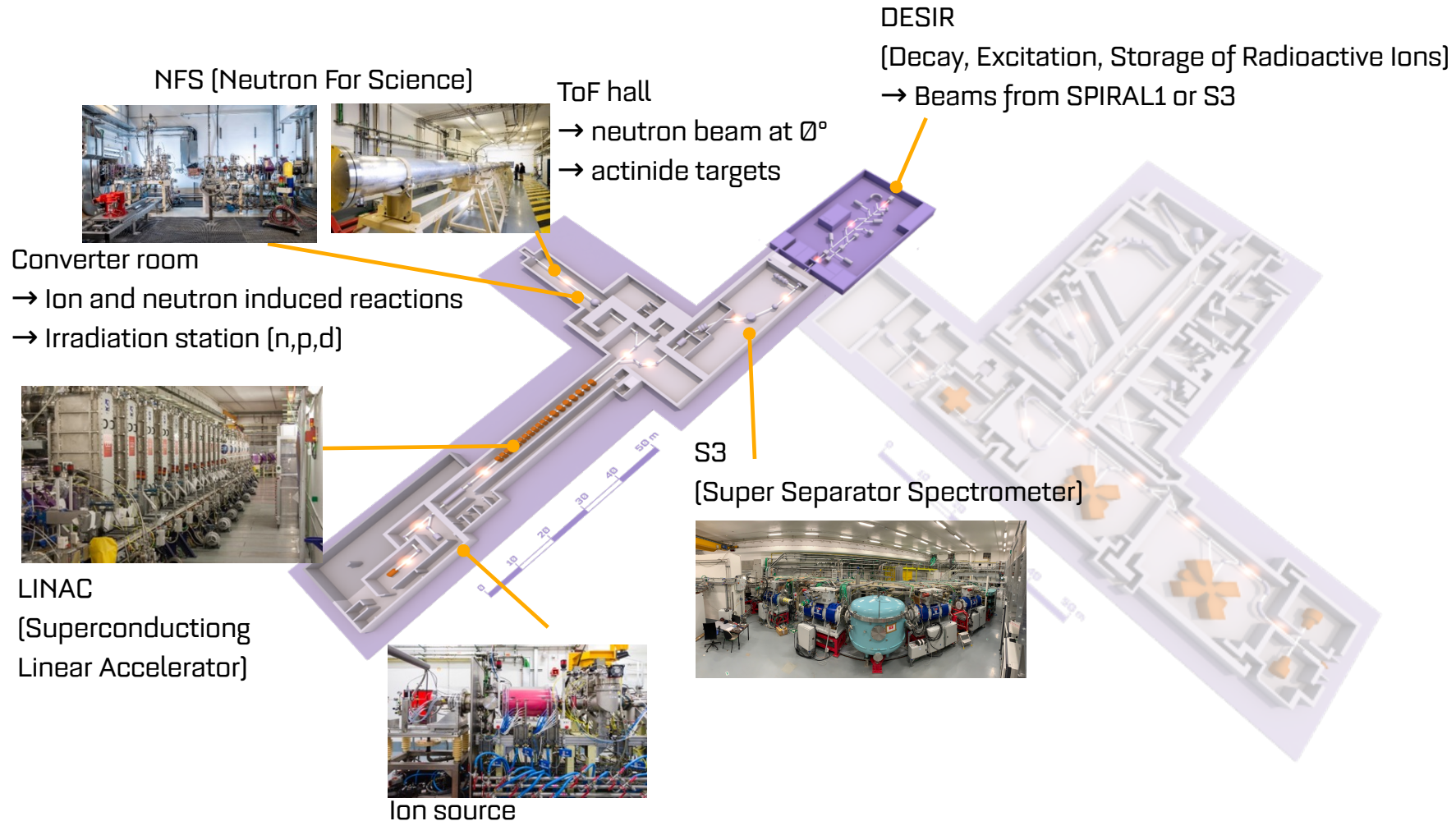


Table of contents

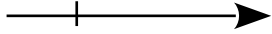
- GANIL overview
- Metadata usage at GANIL
 - Unfolding of an experiment
 - Data Management Plan
 - DOI submission strategy
 - DataCite mapping

Unfolding of a GANIL experiment

Typical timeline for a GANIL experiment :



$t_0 - 1^{\text{st}}$ Oct.



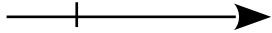
- First contact with scientific coordinators
- Online submission ([XpGan platform](#))

Unfolding of a GANIL experiment

Typical timeline for a GANIL experiment :



$t_0 - 1^{\text{st}}$ Oct.



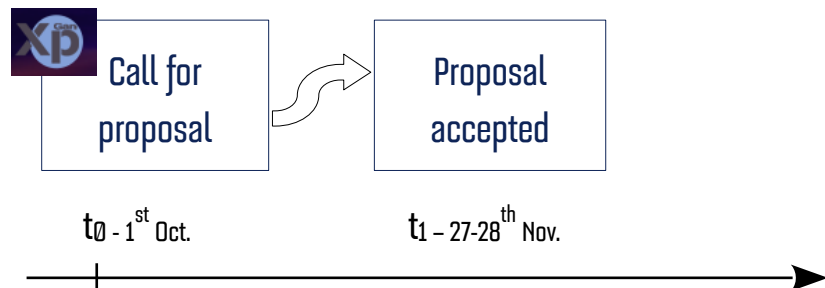
- First contact with scientific coordinators
- Online submission ([XpGan platform](#))

In terms of metadata:

- **Spokeperson(s)** details (firstname, surname, affiliation(s))
- **Title & abstract** of the experiment
- List of **collaborators** (ORCIDs, RORs)
- List of similar experiments performed at GANIL
- List of related **scientific productions**
- **Detection system**
- **Beam** and **target** request(s),
- Data manager, **embargo** period, data preservation period

Unfolding of a GANIL experiment

Typical timeline for a GANIL experiment :



- Online submission (XpGan platform)

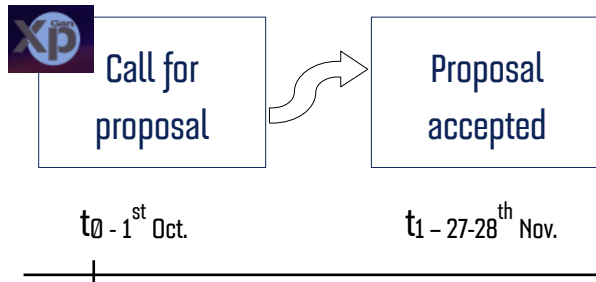
- GANIL TAC/PAC
- Some **metadata** already available
- Initial **DOI** submission (*draft*)
- Experiment scheduled

In terms of metadata:

- Various metadata **already available from the proposal**
→ Provided by the Spokeperson
- The experiment is assigned a **unique number**
→ ex: e793s_19
- Initial DOI submission through **DataCite Fabrica**
→ At this step, only **Draft** DOI state
- DOI prefix for GANIL (publisher) : **10.26143**
→ ex: 10.26143/ganil-2021-e793s_19

Unfolding of a GANIL experiment

Typical timeline for a GANIL experiment :



In terms of metadata:

- Various metadata **already available from the proposal**
→ Provided by the Spokeperson
- The experiment is assigned a **unique number**

10.26143/ganil-2021-e793s_19

Update DOI (Form)

Update DOI (File Upload)

Draft

Metadata Export

DataCite XML

DataCite JSON

Schema.org JSON-LD

BibTeX

DOI created

August 11, 2022 at 08:49:33 UTC

DOI registered

August 12, 2022 at 07:56:02 UTC

DOI last updated

November 28, 2025 at 09:25:31 UTC

Metadata version

27

Schema

DataCite Metadata Schema 4

URL

https://data.ganil-spiral2.eu/record/10.26143/ganil-2021-e793s_19

Metadata

Summary View

Proton-neutron interactions across the N = 28 shell closure via 47K(d,p) 48K, and implications for the most neutron-rich phosphorus Dataset

Wilton Catford, Adrien Matta,

Dataset published 2021 via GANIL, Large Heavy Ion National Accelerator, Caen, France

The experiment consisted in the measurement of one neutron transfer (d,p) and (d,t) from a 47K beam at 7A MeV. Measurement of the light p or t particle was carried out by the MUGAST silicon array, in coincidence with gamma-ray detected using the AGATA HPGe tracking array. In addition, detection of the fast heavy product of reaction is performed with VAMOS, allowing rejection of the non-direct reaction channel, e.g. fusion-evaporation on Carbon.



https://doi.org/10.26143/ganil-2021-e793s_19

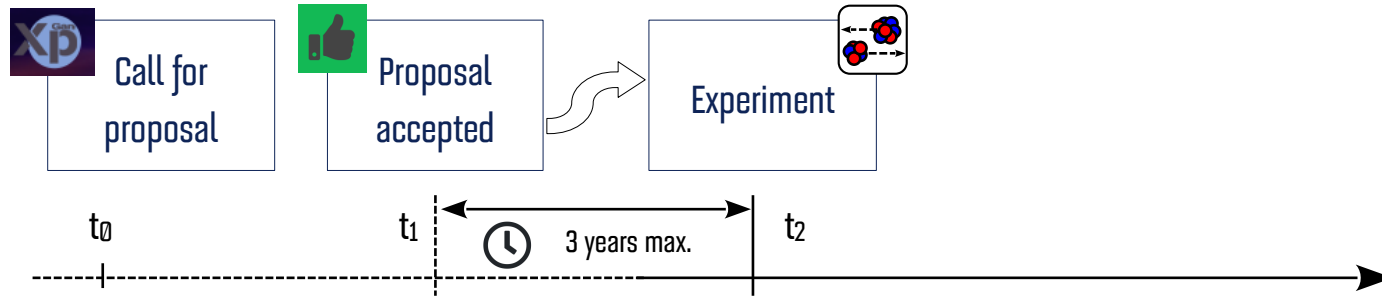
Citation

APA

Catford, W., & Matta, A. (2021). *Proton-neutron interactions across the N = 28 shell closure via 47K(d,p) 48K, and implications for the most neutron-rich phosphorus* [Data set]. GANIL, Large Heavy Ion National Accelerator, Caen, France. https://doi.org/10.26143/GANIL-2021-E793S_19

Unfolding of a GANIL experiment

Typical timeline for a GANIL experiment :



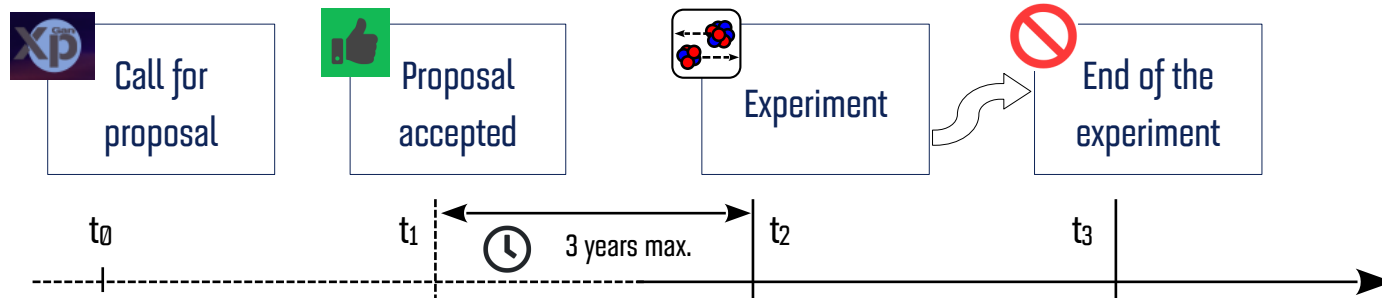
- Online submission (XpGan platform)

- GANIL TAC/PAC
- Some **metadata** already available
- Initial **DOI** submission (*Draft*)
- Experiment scheduled

- Local storage of the data (GANIL infrastructure)
- Preliminary analysis
- GANIL **Data Management Plan** and data policy

Unfolding of a GANIL experiment

Typical timeline for a GANIL experiment :



Updated metadata:

- Metadata updated from the experiment report
 - date of the end of experiment
 - actual target/beam info
 - exp. periods
 - collaborators, etc.

- Online submission (XpGan platform)

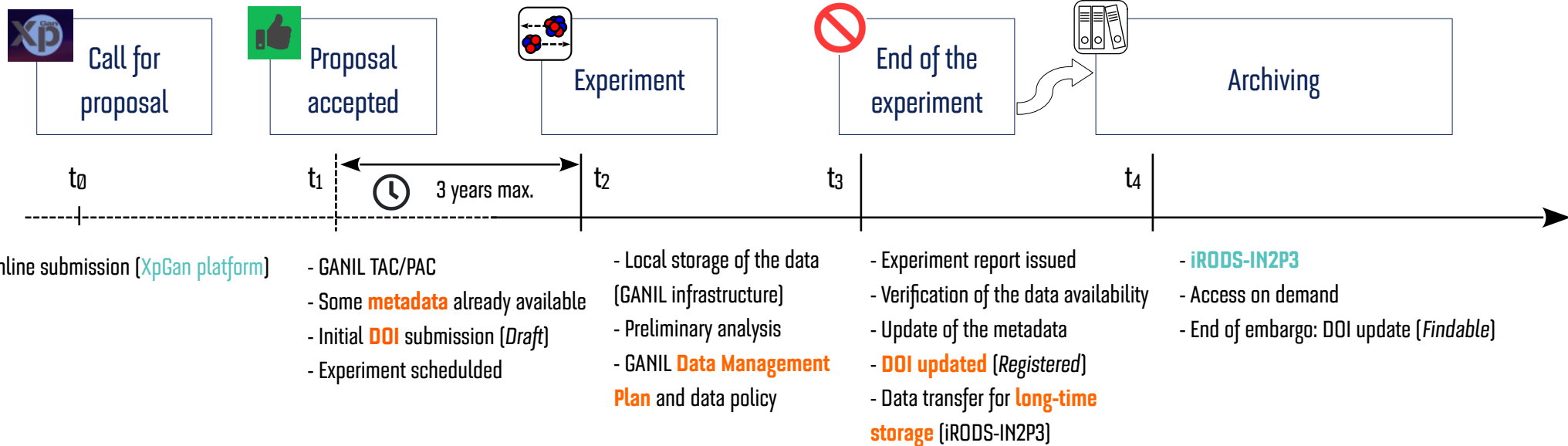
- GANIL TAC/PAC
- Some **metadata** already available
- Initial **DOI** submission (*Draft*)
- Experiment scheduled

- Local storage of the data (GANIL infrastructure)
- Preliminary analysis
- GANIL **Data Management Plan** and data policy

- Experiment report issued
- Verification of the data availability
- Update of the metadata
- **DOI updated** (*Registered*)
- Data transfer for **long-time storage** (iRODS-IN2P3)

Unfolding of a GANIL experiment

Typical timeline for a GANIL experiment :



Data Management Plan

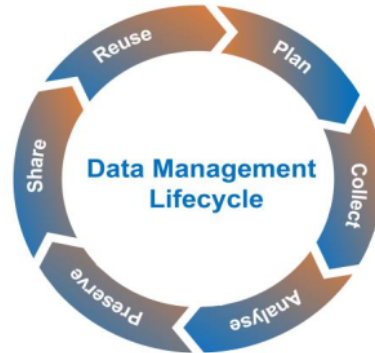
- The **Data Management Plan** (DMP) is a tool allowing to define the process of :
 - **Creation** and **use** of the data
 - **Structuring** of the data
 - **Backup**, conservation and protection of the data
- It is essential for a structured planning, implementation and administration of the data in any scientific project
- Needed for **FAIR-compliance**
- Living document → **continuously updated**

Data Management Plan

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Data management plans aid:

- Communication tool for researchers
- RDM project internal management
- Future reuse and project planning
- Useful for IT/Resource Cost estimates
- Funding body requirements



→ See also Marjolaine Bodin's talk !

Contents can include:

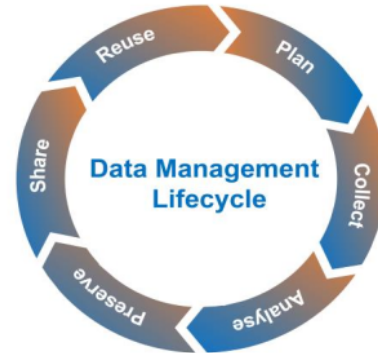
- General info (Project name/PI)
- Data info (Data type, size, generation method)
- Overhead (Data protection, personnel costs...)

GANIL Data Management Plan

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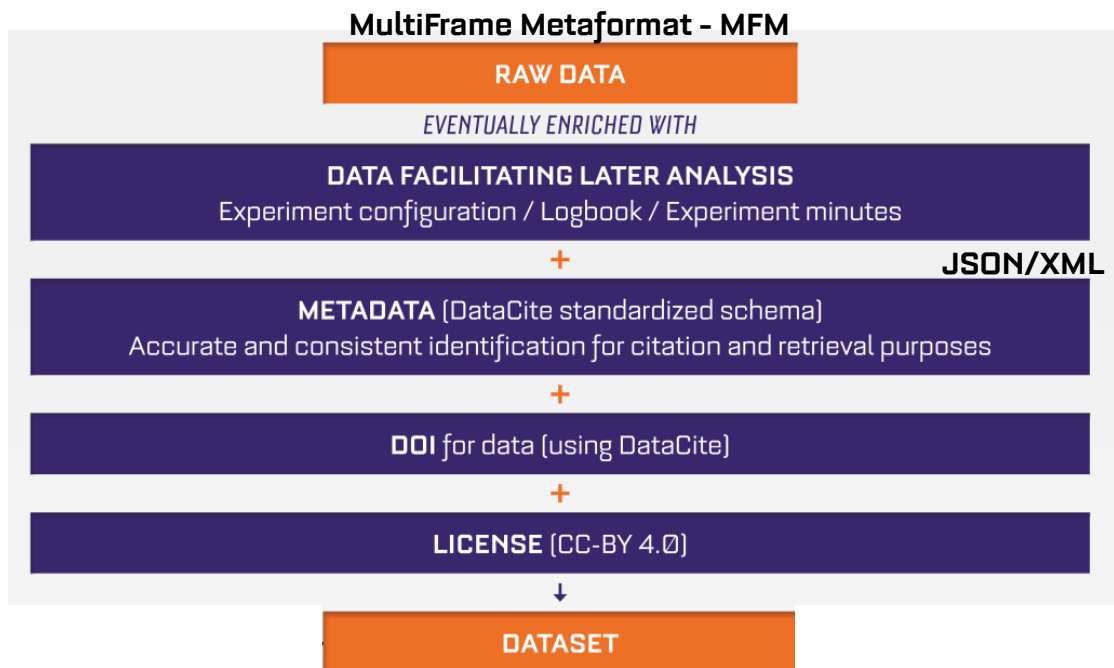


- Concerning **GANIL DMP** :
 - First version issued in 2020
 - New version on the way !
 - Focused on **raw data**
 - Defines :
 - Data collection
 - Data storage and curation
 - Data access
 - Associated **metadata**

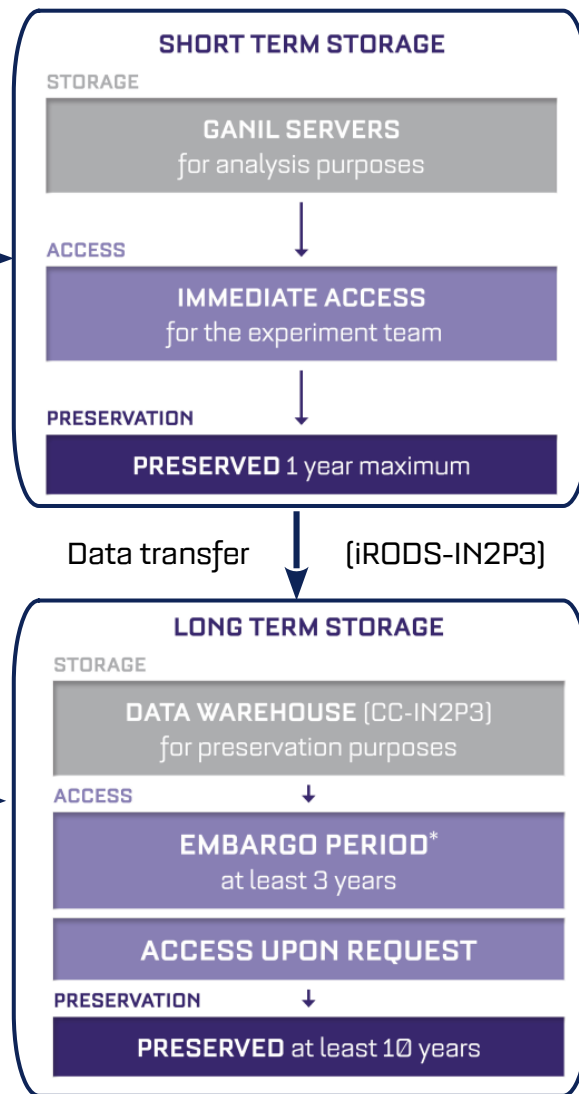
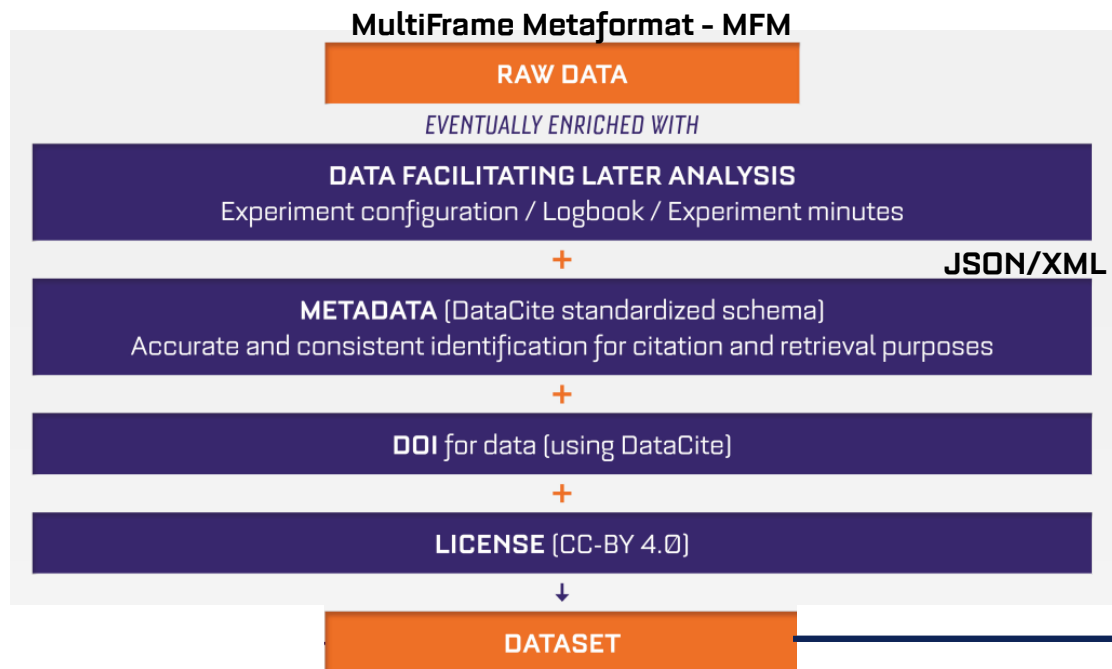
Contents can include:

- General info (Project name/PI)
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- Overhead (Data protection, personnel costs...)

GANIL Data Management Strategy



GANIL Data Management Strategy



- **GANIL Data Manager** :
→ Data **curation** and **storage** (max. ~700 TB/year), data **indexing** and **referencing**, DOI submission, **assist** spokespersons and researchers, ...
- **Data Policy** : https://www.ganil-spiral2.eu/wp-content/uploads/2023/05/GANIL-0560-DataPolicy-EN-B_final.pdf
- **Data Management Plan** : <https://www.ganil-spiral2.eu/scientists/running-an-experiment-in-ganil/data-management-plan/>

GANIL DOI submission - DataCite

DOI submission for a GANIL experiment:

- Create a DOI for **each dataset** record (raw data)
- Responsibility of the **GANIL Data Manager**
- Through **DataCite Fabrica**:
 - GANIL is member of DataCite through INIST OPIDoR
 - GANIL DOI prefix: **10.26143**
- Using **DataCite REST API**
 - DOI mint, update and verification

Create DOI	▶
Export DOI Metadata	
State	
<input type="checkbox"/> Findable	25
<input type="checkbox"/> Draft	13
<input type="checkbox"/> Registered	12
Resource Type	
<input type="checkbox"/> Dataset	50
Year created	
<input type="checkbox"/> 2025	13
<input type="checkbox"/> 2024	10
<input type="checkbox"/> 2023	4
<input type="checkbox"/> 2022	5
<input type="checkbox"/> 2021	8
<input type="checkbox"/> 2020	10
Repository	
<input checked="" type="checkbox"/> Grand Accélérateur National d'Ions Lourds	50
Prefix	
<input type="checkbox"/> 10.26143	50
Schema Version	
<input type="checkbox"/> Schema 4	47

DataCite Fabrica - <https://doi.datacite.org/>


Type to search. For example 10.4121/17185607.v1 [Search](#)

[Reset All](#)

50 DOIs [Sort by Date Updated](#)

Proton-neutron interactions across the N = 28 shell closure via 47K(d,p) 48K, and implications for the most neutron-rich phosphorus Dataset


Wilton Catford, Adrien Matta,
Dataset published 2021 via GANIL, Large Heavy Ion National Accelerator, Caen, France
The experiment consisted in the measurement of one neutron transfer (d,p) and (d,t) from a 47K beam at 7A MeV. Measurement of the light p or t particle was carried out by the MUGAST silicon array, in coincidence with gamma-ray detected using the AGATA HPGe tracking array. In addition, detection of the fast heavy product of reaction is performed with VAMOS, allowing rejection of the non-direct reaction channel, e.g. fusion-evaporation on Carbon.
Created August 11, 2022 at 08:49:33 UTC. [Findable](#)



https://doi.org/10.26143/ganil-2021-e793s_19

Origin and competition between fission modes in pre-actinides Dataset

Antoine Lemasson, Christelle Schmitt, Igor Tsekhanovich, Andrei Andreyev,
Dataset published 2024 via GANIL, Large Heavy Ion National Accelerator, Caen, France
The goal of this experiment is to take advantage of the assets of the GANIL facility to obtain further insight into low-energy fission of pre-actinides. Fission of ^{184}Pb was induced by fusion in inverse kinematics. The reaction $^{124}\text{Xe}+^{60}\text{Ni}$ was used at near-barrier energy (ELab=4.07–4.29 MeV/u) leading to a compound-nucleus excitation energy of $E^*=24\text{--}32$ MeV. The different beam energies were obtained starting from 4.38 MeV/u beam thanks to variable stripper foils thicknesses placed after CSS1. A moderate E^* is required to be able to evidence shell effects. The coincident measurement of the two fission products was achieved with the heavy-ion spectrometer VAMOS+ coupled to a second detection arm (SDA). The fragment entering VAMOS++ were uniquely identified in post-neutron mass A1 (after its cooling by neutron evaporation after scission), in nuclear charge Z1, and its velocity vector (v_1 , θ_1 , ϕ_1) at the target position and kinetic energy E1 was measured. The SDA arm will provide
Created November 20, 2025 at 16:20:18 UTC. [Registered](#)



https://doi.org/10.26143/ganil-2024-e851_21

GANIL DOI submission - DataCite

DOI submission for a GANIL experiment:

- Create a DOI for **each dataset** record (raw data)
- Responsibility of the **GANIL Data Manager**
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- Using **DataCite REST API**
 - DOI mint, update and verification

Grand Accélérateur National d'Ions Lourds / DOIs

[10.26143/ganil-2019-e789_18](https://doi.org/10.26143/ganil-2019-e789_18)

[Update DOI \(Form\)](#)

[Update DOI \(File Upload\)](#)

Findable

Metadata Export

[DataCite XML](#)

[DataCite JSON](#)

[Schema.org JSON-LD](#)

[BibTeX](#)

DOI created

January 24, 2025 at 12:36:07 UTC

DOI registered

January 24, 2025 at 13:18:23 UTC

DOI last updated

January 24, 2025 at 15:19:27 UTC

Metadata version 

5

Schema 

[DataCite Metadata Schema 4](#)

URL

https://u.ganil-spiral2.eu/10.26143/GANIL-2019-E789_18.html

Metadata

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{
  "id": "https://doi.org/10.26143/ganil-2019-e789_18",
  "doi": "10.26143/GANIL-2019-E789_18",
  "url": "https://u.ganil-spiral2.eu/10.26143/GANIL-2019-E789_18.html",
  "types": {
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    "bibtext": "misc",
    "citeproc": "dataset",
    "schemaOrg": "Dataset",
    "resourceTypeGeneral": "Dataset"
  },
  "creators": [
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      "name": "Lopez, Olivier",
      "nameType": "Personal",
      "givenName": "Olivier",
      "familyName": "Lopez",
      "affiliation": [
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          "name": "LPC CAEN, Caen, France",
          "schemeUri": "https://ror.org",
          "affiliationIdentifier": "https://ror.org/022txr781",
          "affiliationIdentifierScheme": "ROR"
        }
      ]
    }
  ],
}
```

DataCite JSON

Summary View

DataCite XML

DataCite JSON

Schema.org JSON-LD

Citeproc JSON

Codemeta JSON

BibTeX

RIS

JATS XML

GANIL DOI submission – GANIL repository

GANIL dataset repository: <https://data.ganil-spiral2.eu>

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Landing pages are managed by GANIL

- **GANIL data repository**

Exp.	DOI	Title	Year	Spokesperson	Size	State
e851_21	10.26143/ganil-2024-e851_21	Origin and competition between fission modes in pre-actinides	2024	Lemasson, Antoine	8.0 TB	registered
e859_22	10.26143/ganil-2024-e859_22	238U(n,2ng) and (n,3ng) reaction cross sections measurements	2024	Henning, Greg	2.9 TB	findable
e849_21	10.26143/ganil-2024-e849_21	Complete isotopic fission yields in the thorium region from inverse-kinematics transfer-induced fission	2024	Ramos, Diego	8.6 TB	registered
e845_21	10.26143/ganil-2024-e845_21	Nuclear moment studies of short-lived excited states using TDRIV on H-like ions. Resolving the 22Ne puzzle on the way of a study of 42Ar and 44Ar	2024	Georgiev, Georgi	6.4 TB	registered
e870_22	10.26143/ganil-2024-e870_22	Cluster structure of the ground state of light exotic nuclei beyond alpha-clustering	2024	Alcindor, Valérian	0.243 TB	registered
e872_22	10.26143/ganil-2024-e872_22	Developments and performance assessment of high-intensity thin targets for SHE production	2024	Renisch, Dennis	2.11 TB	registered
e878_23	10.26143/ganil-2024-e878_23	237Np fission fragment study with FALSTAFF at NFS	2024	Ducret, Jean-Eric	0.505 TB	registered
e847_21	10.26143/ganil-2024-e847_21	Study of the effects of high energy 8Li beam on biomolecules	2024	Traykov, Emil	0 TB	registered
e831_21	10.26143/ganil-2023-e831_21	Impact of neutron excess on near-barrier fusion in 19,20O + 12C	2023	DeSouza, Romualdo	0.57 TB	registered
em130	10.26143/ganil-2023-em130	Test S3 Target	2023	Stodel, Christelle	0.64 TB	findable
tat_at-211	10.26143/ganil-2022-tat_at-211	TAT_At-211	2022	de France, Gilles	0 TB	findable
e798_19	10.26143/ganil-2022-e798_19	Study of deformed and spherical 2+ states via Coulomb excitation and first time measurement of PDR in 34Si	2022	Lica, Razvan	3.1 TB	findable
e823_21	10.26143/ganil-2022-e823_21	Coulomb excitation and inelastic proton scattering of neutron-rich Si isotopes between N=20 and N=28	2022	Grévy, Stéphane	3.07 TB	registered

GANIL DOI submission – Landing page

Landing page for a GANIL experiment - <https://data.ganil-spiral2.eu>







DOI submission for a GANIL experiment:

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- Using **DataCite REST API**
 - DOI mint, update and verification

Landing pages are managed by GANIL:

- **GANIL data repository**
- Generic metadata

General Info

Field	Value
Experiment Number	e793s_19
Title	Proton-neutron interactions across the N = 28 shell closure via 47K(d,p) 48K, and implications for the most neutron-rich phosphorus
Spokeperson(s)	Wilton, Catford  Adrien, Matta 
Data Manager(s)	Adrien, Matta 
GANIL Scientific Coordinator	Diego, Ramos 
Collection Dates (dd-mm-yy)	Start: 10-03-2021 End: 17-03-2021
End of Embargo	17-03-2024
DOI	10.26143/ganil-2021-e793s_19
DOI State	findable
Publication Year	2021
Publisher	GANIL, Large Heavy Ion National Accelerator, Caen, France
Data Curator	GANIL, Large Heavy Ion National Accelerator, Caen, France 
Hosting Institution	CC-IN2P3, IN2P3's Computing Centre, Villeurbanne, France 
Size	0.3 TB

GANIL DOI submission – Landing page

DOI submission for a GANIL experiment:

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Landing pages are managed by GANIL:

- [GANIL data repository](#)
- Generic metadata
- Enriched metadata
 - towards **domain-specific metadata**

Abstract

The experiment consisted in the measurement of one neutron transfert (d,p) and (d,t) from a 47K beam at 7A MeV. Measurement of the light p or t particle was carried out by the MUGAST silicon array, in coincidence with gamma-ray detected using the AGATA HPGe tracking array. In addition, detection of the fast heavy product of reaction is performed with VAMOS, allowing rejection of the non-direct reaction channel, e.g. fusion-evaporation on Carbon.

Technical Info

Setup	MUGAST + VAMOS + AGATA
-------	------------------------

Beam(s)

Ion(s)	Charge state	Energy	Energy unit	Av. intensity	Intensity unit	Purity (%)	Accelerator	Production
47K	19+	7	MeV/u	1.e+5	pps	90	Radioactive	SPIRAL1







Target(s)

Material	Thickness	Thickness unit	Sample phase	Type
CD2	0.34	mg/cm2	Solid	Compound

Studied reaction(s)

Name	Projectile	Target
47K (7 MeV/u) + CD2 (0.34 mg/cm2)	47K(19+) @ 7 MeV/u	CD2 (0.34 mg/cm2)

Contributors

Given Name	Family Name	Id.	Affiliation(s)
Wilton	Catford		University of Surrey, Guildford, United Kingdom 
Adrien	Matta		LPC Caen, Caen, France 
Marlene	Assié		IJCLab, Orsay, France 

GANIL DOI submission – DataCite mapping

GANIL metadata schema is defined in GANIL DMP:

- Based on DataCite [Metadata Schema standard \[v4.5\]](#)
- ... Work in progress: **enriched metadata (domain-specific)** → **NAPMIX metadata**

Attribute [DataCite]	ID	Definition	Oc.	Ob. lvl [M/R/O]	Example
Identifier	1	DOI id.	1	M	10.26143/ganil-yyyy-exxx-yy
Creator	2	Spokeperson info	1-n	M	
givenName, familyName	2.2, 2.3	Full name of the Spokeperson	1,1	M	Bob, Kelso
nameIdentifier	2.4	ORCID or ISNI id.	0-n	R	https://orcid.org/0000-0001-6498-0552
nameIdentifierScheme	2.4.a	nameIdentifier scheme	1	R	ORCID
schemeURI	2.4.b	namedentifier scheme URI	0-1	R	https://orcid.org/
affiliation	2.5	Institutional affiliation(s)	1-n	M	GANIL, GSI, ...
affiliationIdentifier	2.5.a	Aff. id.	0-1	R	https://ror.org/042dc0x18
affiliationIdentifierScheme	2.5.b	affiliationIdentifier scheme	1	R	ROR
schemeURI	2.5.c	affiliationIdentifier scheme URI	0-n	R	https://ror.org
Title	3	Experiment title	1-n	M	Study of nuclei at GANIL
PublicationYear	5	Year the data was/will be made publicly released	1	M	2027 (YYYY)
Subject	6	Subject(s) of the exp.	1-n	M	FOS: Physical sciences
subjectScheme	6.a	Classification code	0-1	R	Fields of Science and Technology (FOS)
schemeURI	6.b	subject scheme URI	0-1	R	http://www.oecd.org/science/inno
valueURI	6.c	subject term URI	0-1	R	http://www.oecd.org/science/inno/123.pdf
Contributor	7	Organizational and Personnal contributors to the exp.	0-n	R	
contributorType	7.a	Type of contributor (CVL)	1	M	ResearchGroup or Researcher

DataCite mapping in practice - GANIL metadata form

User-friendly UI for the Spokepersons:

- [GANIL repository metadata form](#)
- Aligned with [DataCite metadata schema](#)

The screenshot shows the GANIL Experiment Metadata Form. The header includes the GANIL logo, navigation links for Home and Metadata, a 'New draft' button, and a Logout link. The form title is 'GANIL Experiment Metadata Form'. The 'General Information' section contains the following fields:

- Experiment Number ***: e793s_19 (3.a titleType="Subtitle")
- Publication Year ***: 2021 (5. PublicationYear)
- Resource Type ***: Dataset (10. ResourceType)
- DOI**: 10.26143/ganil-2021-e793s_19 (1. Identifier). A note indicates 'This DOI already exists on DataCite'.
- URL**: https://data.ganil-spiral2.eu/record/10.26143/ganil-2021-e793s_19 (Landing page). A 'DOI state' button labeled 'findable' is present.
- Experiment Title ***: Proton-neutron interactions across the N = 28 shell closure via 47K(d,p) 48K, and implications for the most neutron-rich phosphorus (3. Title)
- Abstract ***: The experiment consisted in the measurement of one neutron transfert (d,p) and (d,t) from a 47K beam at 7A MeV. Measurement of the light p or t particle was carried out by the MUGAST silicon array, in coincidence with gamma-ray detected using the AGATA HPGc tracking array. In addition, detection of the fast heavy product of reaction is performed with VAMOS, allowing rejection of the non-direct reaction channel, e.g. fusion-evaporation on Carbon. (17. Description - 17.a descriptionType="Abstract")
- Size (TB) ***: 0.3 (13. Size)

... + Other properties: 4. Publisher, 16. Rights, etc.

DataCite mapping in practice - GANIL metadata form

User-friendly UI for the Spokepersons:

- GANIL repository metadata form
- Aligned with DataCite metadata schema
- Import/export (JSON format)

GANIL Home Metadata

New draft

GANIL Experiment Metadata Form

General Information

Experiment Number * 3.a titleType="Subtitle" 2021 5. PublicationYear Dataset 10. ResourceType

exists on DataCite URL Landing page DOI state
:793s_19 1. Identifier https://data.ganil-spiral2.eu/record/10.26143/ganil-2021-e793s_19 findable

itions across the N = 28 shell closure via 47K(d,p) 48K, and implications for the most neutron-rich phosphorus 3. Title

sisted in the measurement of one neutron transfert (d,p) and (d,t) from a 47K beam at 7A MeV. Measurement of the light p or t particle was carried out by array, in coincidence with gamma-ray detected using the AGATA HPGe tracking array. In addition, detection of the fast heavy product of reaction is IOS, allowing rejection of the non-direct reaction channel, e.g. fusion-evaporation on Carbon.

n - 17.a descriptionType="Abstract"

Size

ies: 4. Publisher, 16. Rights, etc.

DataCite mapping in practice

Contributors

Organizational Contributors

Organization Name	Type	Actions
GANIL, Large Heavy Ion National Accelerator, Caen, France	Producer	
GANIL, Large Heavy Ion National Accelerator, Caen, France	DataCurator	
CC-IN2P3, IN2P3's Computing Centre, Villeurbanne, France	HostingInstitution	
GANIL, CEA/DRF-CNRS/IN2P3, Caen, France	ResearchGroup	
University of Surrey, Guildford, United Kingdom	ResearchGroup	

Personal Contributors

Name	Type	Affiliation(s)	Actions
Catford, Wilton	ProjectLeader	University of Surrey, Guildford, United Kingdom	
Matta, Adrien	ProjectLeader	LPC Caen, Caen, France	
Catford, Wilton	ContactPerson	University of Surrey, Guildford, United Kingdom	
Matta, Adrien	ContactPerson	LPC Caen, Caen, France	
Matta, Adrien	DataManager	LPC Caen, Caen, France	
Ramos, Diego	Other	GANIL, Caen, France	
Catford, Wilton	Researcher	University of Surrey, Guildford, United Kingdom	
Matta, Adrien	Researcher	LPC Caen, Caen, France	
Assié, Marlene	Researcher	IJCLab, Orsay, France	

Add Contributor

Institutes

Search for existing contributor

GANIL

Auto-completion from contributor's database

Contributor Type 7.1.a nameType

Person Organization

Name

GANIL, Large Heavy Ion National Accelerator, Caen, France

7.1 contributorName

Role *

Research group

7.a contributorType

Affiliation(s) * 7.5 affiliation

Grand Accélérateur National d'Ions Lourds

7.5.a affiliationIdentifier

https://ror.org/042dc0x18

ROR fetching

Save

Cancel

Add Contributor

Personal

Search for existing contributor

Quentin Fable

Auto-completion from contributor's database

Contributor Type 7.1.a nameType

Person Organization

Given names *

Quentin

7.2 givenName

Family name *

Fable

7.3 familyName

ORCID

https://orcid.org/0000-0001-6498-0552

7.4 nameIdentifier

Role *

Researcher

7.a contributorType

Affiliation(s) * 7.5 affiliation

Grand Accélérateur National d'Ions Lourds

7.5.a affiliationIdentifier

https://ror.org/042dc0x18

+ Add another affiliation

Save

Cancel

Enriched metadata mapping in practice

GANIL metadata schema is defined in GANIL DMP :

- Based on DataCite [Metadata Schema standard \[v4.5\]](#)
- Enriched metadata (tailored to a GANIL experiment)
 - Inspired by NAPMIX current schema proposed [here](#)
 - Mapping between GANIL properties and NAPMIX schema



FAIR-compliance for enriched metadata:

- Need for **persistent**, **citable** and externally **resolvable** metadata
 - **Versioning** [schema] + **unique ID** [core properties]
- NAPMIX DOI integration strategy?
 - Hybrid strategy [“Live Metadata Layer”]
 - See Ivan’s talks

Projectile	0+	<i>Projectile Metadata For Beam Dataset</i>						
Projectile	0/1	Percentage of Given Projectile	100		Percentage of a particle projectile (in the case of mixed/cocktail beams)	Float	Spin box	projectilePercentage
Projectile	0/1	Beam Energy (Projectile)	32.1		Energy (average) of the beam	Float	Spin box	projectileBeamEnergy
Projectile	0/1	Unit of Beam Energy	MeV/nucleon		Unit of beam energy	String	Key table	projectileBeamEnergyUnit
Projectile	0/1	Beam Frequency	100		Frequency of beam	Float	Spin box	projectileFrequency
Projectile	0/1	Beam Frequency Unit	Hz		Units of beam frequency	String	Key table	projectileFrequencyUnit
Projectile	0/1	Operation Mode of the Beam	Pulsed		Can be pulsed, CW etc	String	Key table	projectileBeamOperation
Projectile	0/1	Average Beam Intensity	3		Beam intensity during measurement	Float	Spin box	projectileAverageBeamIntensity
Projectile	0/1	Beam Intensity Unit	nA		particle nA, particles per spill etc.	String	Key table	projectileBeamIntensityUnit
Projectile	0/1	Projectile Charge State	20+		Ionisation state of the projectiles	Int	Spin box	projectileChargeState
Projectile	0/1	Beam Destination	D5		GANIL experimental room	String	Text Box	projectileBeamDestination
Projectile	0/1	Beam Energy Spread	-		Spread of the beam (could be secondary beam for example)	Float	Spin box	projectileEnergySpread
Projectile	0/1	Beam Spread Units	cm		Units of beam spread	String	Key Table	projectileBeamSpreadUnit
Projectile	0/1	Beam Spot Size	-		Beam spot size	Float	Spin box	projectileBeamSpotSize
Projectile	0/1	Beam Dose	-		Over course of experiment	Float	Spin box	projectileBeamDose
Projectile	0/1	Beam Spot Size Unit	cm		Beam spot size units	String	Key Table	projectileBeamSpotSizeUnit
Projectile	0/1	Reaction Name	48Ca+181Ta		Linked to reaction table	String	Text Box	projectileReaction
Projectile	0/1	Projectile Isotope	64Ni		Isotope symbol (natC, 48Ca, 64Ni, etc...)	String	Key Table	projectileIsotope
Projectile	0/1	Projectile Particle	Ion		Ion, Photon	String	Key Table	projectileParticle
Projectile	1	Beam Type	Stable		Stable, Radioactive (see https://u.ganil-spiral2.eu/chartbeams/) - Suggestion: Calibration/Physics beam ?	String	Key Table	projectileBeamType

Cardinality

Field type

NAPMIX property



NAPMIX mapping in practice

Experiment Details

Detector(s) *



MUGAST + VAMOS + AGATA

Beam(s)

Ion(s)	Charge state	Energy (MeV/u)	Intensity	Intensity unit	Purity (%)	Accelerator	Production	Actions
47K	19+	7	1.e+5	pps	90	SPIRAL1	Radioactive	 

+ Add Beam

Target(s)

Material	Thickness	Thickness unit	State	Type	Actions
CD2	0.34	mg/cm2	Solid	Compound	 

+ Add Target

Reaction System(s)

Reaction name	Beam	Beam energy	Beam intensity	Target	Target thickness	Actions
47K (7 MeV/u, q=19+, I=1.e+5 pps) + CD2 (0.34 mg/cm2)	47K (q=19+)	7 [MeV/u]	1.e+5 [pps]	CD2	0.34 [mg/cm2]	 

+ Add Reaction

+ Add Beam

Nuclei

Ca

Mass (A)

48

Charge State (Q) projectileChargeState

20+

Isotope projectileIsotope

48Ca

Purity (%) * projectilePercentage

100

Production Type * projectileBeamType

Stable

Accelerator * projectileAcceleratorType

Cyclotrons

projectileEnergy - projectileEnergyUnit="MeV/u"

Beam energy (MeV/u)

34.98

Total beam energy (MeV) 

1679.04

projectileAverageBeamIntensity

Beam intensity (pps)

1.e+8

Unit

Particle per second (pps)

Converted (nA) 

3.204e-1

Save Beam

Cancel

projectileBeamIntensityUnit="pps"



NAPMIX mapping in practice

Experiment Details

Detector(s) *



MUGAST + VAMOS + AGATA

Beam(s)

Ion(s)	Charge state	Energy (MeV/u)	Intensity	Intensity unit	Purity (%)	Accelerator	Production	Actions
47K	19+	7	1.e+5	pps	90	SPIRAL1	Radioactive	 



+ Add Beam

Target(s)

Material	Thickness	Thickness unit	State	Type	Actions
CD2	0.34	mg/cm2	Solid	Compound	 

+ Add Target

Reaction System(s)

Reaction name	Beam	Beam energy	Beam intensity	Target	Target thickness	Actions
47K (7 MeV/u, q=19+, I=1.e+5 pps) + CD2 (0.34 mg/cm2)	47K (q=19+)	7 [MeV/u]	1.e+5 [pps]	CD2	0.34 [mg/cm2]	 

+ Add Reaction

+ Add Target

(Gaseous target)

State * targetSamplePhase

Gaseous

Type * targetType (not NAPMIX property)

Compound

Material * targetIsotopes

H2

Composition (%) * targetIsotopePercentage

90

Material *

iCH4

Composition (%) *

10

+ Add material

Pressure

950

targetTargetThicknessValue

Pressure unit

mbar

targetTargetThicknessUnit

Current gaseous target composition

H2(90%) + iCH4(10%)

Save Target

Cancel

Edit Target

(Solid target)

State *

Solid

targetSamplePhase

Type * targetType (not NAPMIX property)

Isotope

Material *

natAu

targetIsotopes

Thickness *

416

targetTargetThicknessValue

Thickness unit * targetTargetThicknessUnit

Areal thickness (mg/cm2)

Areal thickness (mg/cm2)

Thickness (µm)

Save Changes

Cancel



NAPMIX mapping in practice

Experiment Details

Detector(s) *



MUGAST + VAMOS + AGATA

Beam(s)

Ion(s)	Charge state	Energy (MeV/u)	Intensity	Intensity unit	Purity (%)	Accelerator	Production	Actions
47K	19+	7	1.e+5	pps	90	SPIRAL1	Radioactive	 



+ Add Beam

Target(s)

Material	Thickness	Thickness unit	State	Type	Actions
CD2	0.34	mg/cm2	Solid	Compound	 

+ Add Target

Reaction System(s)

Reaction name	Beam	Beam energy	Beam intensity	Target	Target thickness	Actions
47K (7 MeV/u, q=19+, I=1.e+5 pps) + CD2 (0.34 mg/cm2)	47K (q=19+)	7 [MeV/u]	1.e+5 [pps]	CD2	0.34 [mg/cm2]	 

+ Add Reaction

+ Add Reaction

Beam *

47K (7 MeV/u) projectileReaction (not a NAPMIX property) ▾

Target *

CD2 (0.34 mg/cm2) targetReaction ▾

Reaction name

47K (7 MeV/u, q=19+, I=1.e+5 pps) + CD2 (0.34 mg/cm2) reactionName

Save changes

Cancel

Table of contents

- GANIL overview
- Metadata usage at GANIL
 - Unfolding of an experiment
 - Data Management Plan
 - DOI submission strategy
 - DataCite mapping
- **openNP catalog** – <https://opennp.in2p3.fr>
 - Overview
 - Use-case
 - Next step

Purposes :

- A platform to **centralize metadata** :
 - For **nuclear physics** datasets
 - Experimental, processed, simulated data
 - For EURO-LABS RIs
- A trusted **entry point** for **authenticated** users
- Standardizing :
 - Submission of metadata
 - Cross-domain search
- **Metadata-only** catalogue :
 - Data stored at producer level (RIs)
 - According to their own DMP, institutional policies
- To go forward :
 - An interface for future services of data lakes and high performance computing/analysis platforms


Architecture :

DOI 10.5281/zenodo.17020290

- [InvenioRDM](#) (v13 LTS)
 - [Flask Python](#) framework (same than Zenodo)
 - Records versioning, preview and embargo
 - **Custom vocabularies**
 - Standard metadata schema ([DataCite](#))
 - REST API
 - OAI-PMH protocol support
- **Support from CC-IN2P3** : OpenShift Kubernetes infrastructure (**OKD**)



<https://opennp.in2p3.fr>

Search 



Laboratories



Data Sets



Softwares



Upload

openNP - Use case

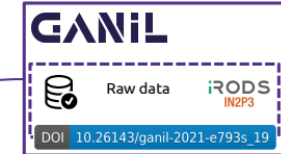
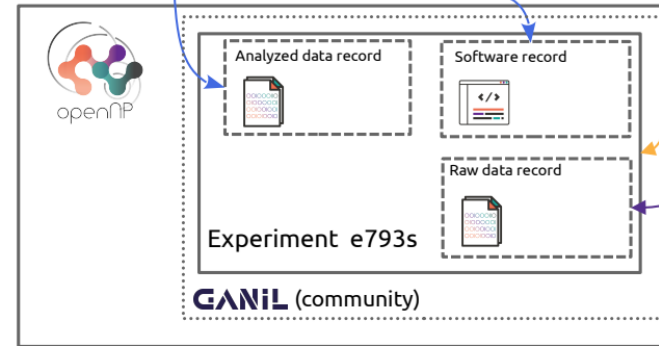
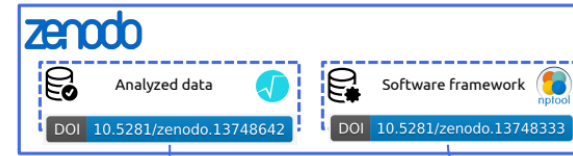


The GANIL e793s Dataset :

- Experiment performed at GANIL in 2021
- Multi-instruments (VAMOS++ - AGATA – MUGAST detection systems)
- Multiple data and software layers

This dataset led to the publication of :

- A journal article
- Processed data in open-access
- Software analysis codes in open-access



Key interest :

Use DataCite standard to link records together (**RelatedIdentifier** property)

Related works

Relation	Identifier	Scheme	Resource type
Is derived from	6143/GANIL-2021-E7935_19	DOI	Dataset
Is compiled by	10.5281/zenodo.13748333	DOI	Software
Is referenced by	03/PhysRevLett.134.162504	DOI	Publication / Journal article

zenodo

Probing Exotic Cross-Shell Interactions at $N = 28$ with Single-Neutron Transfer on ^{47}K

C. J. Paxman, A. Matta, W. N. Catford, G. Lotay, M. Assié, E. Clément, A. Lemasson, D. Ramos, N. A. Orr et al.

Published September 11, 2024 | Version v1

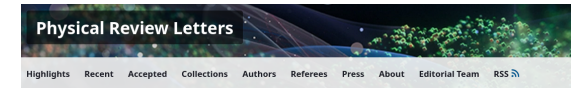
Single-neutron transfer on $^{47}\text{K}(d,p)$: Processed data of experiment

zenodo

Single-neutron transfer on $^{47}\text{K}(d,p)$: nptool framework for the analysis of e793s

Matta, Adrien, Catford, Wilton, Lotay, Gavin, nt, Emmanuel, LEMASSON, Antoine, Ramos, Diego, ranco, Girard-Alcindor, Valérian, Dudouet, Jérémie, nm, Dieter, Barrientos, D., Beaumel, D., Bednarczyk, P., Canete, Laetitia, Cedronwall, B., Ciemala, M., I. T., Domingo-Pardo, C., Fernández-Domínguez, B., FLAVIGNY, Freddy, Fougères, Chloé, de France, Gilles, s, Andres, GIBELIN, Julien, González, V., ayal, Nishu, Kortén, W., Labiche, M., Lalanne, L., Ljungvall, J., Lois-Fuentes, J., Lokotko, T., A., Marqués, F., Martel, I., Menegazzo, R., Nyberg, J., Pérez-Vidal, R., Piagnol, L., Quintana, B., Ragueira-Castro, D., Reiter, P., s, K., Sanchis, E., Shenqit, M., de Sérville, N., Stozowski, O., Thomas, J.-C., Utegov, A., smey, D., Zielirska, M.

Published September 11, 2024 | Version v1



Highlights Recent Accepted Collections Authors Referees Press About Editorial Team RSS

Single-neutron transfer on $^{47}\text{K}(d,p)$: nptool framework for the analysis of e793s

Matta, Adrien, Paxman, Charlie James, Girard-Alcindor, Valérian, Morfouace, Pierre, de Sérville, Nicolas, FLAVIGNY, Freddy, Labiche, Marc, Shearman, Rob

This is a snapshot of the nptool framework used for the analysis of the experiment e793s (10.26143/ganil-2021-E793s_19), wherein the single-neutron transfer reaction $^{47}\text{K}(d,p)$ was performed in inverse kinematics using a radioactive isotope beam.

For the most recent version of nptool, and to find the complete version history and author contribution, please see the repository: <https://gitlab.in2p3.fr/nptool>

Towards custom vocabulary :

- Facility
 - Experiment unique ID
 - Beam(s) and Target(s)
 - Setup, etc.
-
- Can be used for :
 - Advanced queries within the catalog
 - Linked datasets *e.g.* based on experiment ID

Experiments

Experiments



Specify an experiment and associated facility, setups, beams and targets.

General Information

Facility * Experiment ID *



GANIL e793s_19

Beam(s)

Accelerator	Type	Isotope	Energy	Intensity	Actions
LISE	radioactive	ca-48	39.05 MeV/u	1.20e+7 pps	 

+ Add beam

Target(s)

State	Type	Material	Thickness	Density	Actions
Solid target	Isotopic target	48Ca (100%)	250 mg/cm ²	200 mg/cm ³	 

+ Add target

Call to contribution (Nov. 2025):

- **Contact persons** among EURO-LABS RIs, providing :
 - Initial inputs about **data management** and **metadata practices**
 - Identify **data curators**
 - Feedbacks on openNP **features and improvements**
- More than **10 RIs identified** (CNA, INFN, IFIN-HH, IRFU, etc.)

Governance Board & Policy Framework:

- Ensure strategic oversight of the catalogue
- Define priorities for development, integration and service extension
- Ensure **alignment with FAIR data principles**
 - including domain-specific metadata

Ongoing developments:

- Upgrade to **InvenioRDM v.13**
 - **Sub-community** and **Collection** integration
- Extend default metadata of the catalogue to include:
 - **Enriched metadata**
 - **PIDINST metadata schema**
(persistent identifier for instruments)
- Automatic import of datasets:
 - commonmeta CLI tool
 - Need of a **versioned schema**
 - Need of **properties with unique ID**



Front Matter

Thanks for your attention

Backup slides

Backup slide – Open Science statements and policies

Numerous example of Open Science **policies** and **statements**...

→ See also : Sh. Moradi and S. Abdi,
 “Open science-related policies in Europe”
<https://doi.org/10.1093/scipol/scad011>



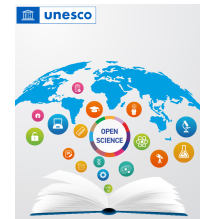
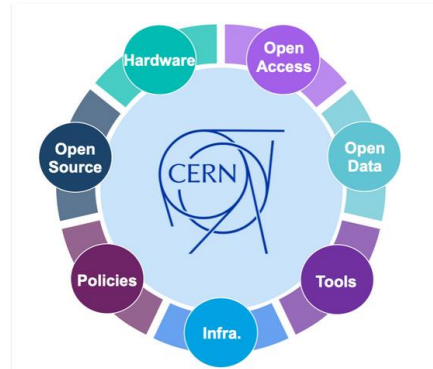
Chapters on Open Science included in **strategic plans**

→ [NuPECC Long Range Plan \[2024\]](#)

CERN publishes comprehensive open science policy

CERN's core values include making research open and accessible for everyone. A new policy now brings together existing open science initiatives to ensure a bright future based on transparency and collaboration at CERN.

3 OCTOBER, 2022 | By Naomi Dinmore



National Strategy for Open Science [2023]



Based on :

- [European Strategy for Particle Physics \[2020\]](#)
- [UNESCO recommendation on Open Science \[2021\]](#)

FAIR principles



Findable

- Use of **persistent Identifiers** (PID) : ensures unique and persistent identification of a dataset on the web.
- Data described by rich and explicit **metadata**.
- (Meta)data registered and indexed in a **searchable resource** : essential to enable data to be **discoverable**.

Accessible

- Datasets are **retrievable** by their **identifier** using **open and standard protocols**.
- Metadata remain accessible, even when data is not available.

Interoperable

- Data are described by a documented model of controlled vocabulary.
- This vocabulary is also described by FAIR-compliant metadata with a globally unique PID.
- Data should be machine-readable.
- Data include qualified reference to each other.

Reusable

- Data are well-described so easily **usable** and **replicable**.
- Data are released with a clear and accessible data usage **licence**.
- (Meta)data meet **domain-relevant** community standards (common data type, template, vocabulary, ...).



Image: ARDC licensed under a [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) License

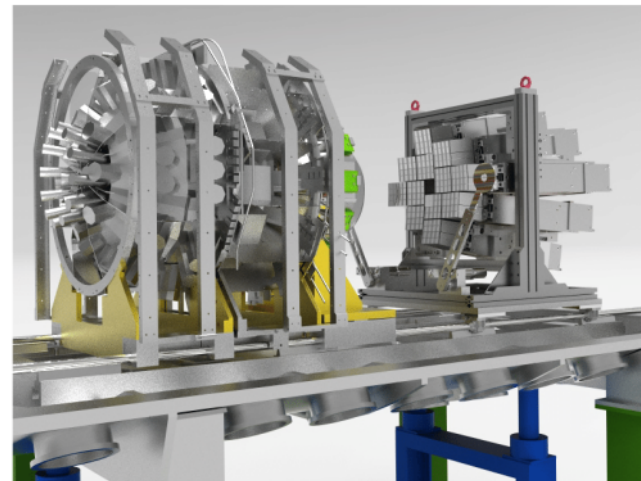
Another use-case : INDRA-FAZIA data

Experiments at GANIL:

• e789 experiment (2019)

- Title: “Isospin transport and the Density Dependence of the Symmetry Energy”
- Setup: INDRA-FAZIA
- Systems: $^{58,64}\text{Ni} + ^{58,64}\text{Ni}$ at 32 and 52 MeV/nuc
- Publications:
 - <https://doi.org/10.1103/PhysRevC.106.024603> (2022)
 - <https://doi.org/10.1103/PhysRevC.108.054611> (2023)

Isospin equilibration



Physical Review C

First results from the INDRA-FAZIA apparatus on isospin diffusion in $^{58,64}\text{Ni} + ^{58,64}\text{Ni}$ systems at Fermi energies

[C. Ciampi](#)^{1,2,*}, [S. Piantelli](#)¹, [G. Casini](#)¹, [G. Pasquali](#)^{1,2}, [J. Quicray](#)³, [L. Baldesi](#)¹, [S. Barlini](#)^{1,2}, [B. Borderie](#)⁴, [R. Bougault](#)³ *et al.* (INDRA-FAZIA Collaboration)

<https://doi.org/10.1103/PhysRevC.106.024603> (2022)

Quasiprojectile breakup and isospin equilibration at Fermi energies: Potential indication of longer projectile-target contact times

[C. Ciampi](#)^{1,*}, [S. Piantelli](#)², [G. Casini](#)², [A. Ono](#)³, [J. D. Frankland](#)¹, [L. Baldesi](#)^{2,4}, [S. Barlini](#)^{2,4}, [B. Borderie](#)⁵, [R. Bougault](#)⁶ *et al.* (INDRA-FAZIA Collaboration)

<https://doi.org/10.1103/PhysRevC.111.044601> (2023)

Another use-case : INDRA-FAZIA data

Experiments at GANIL:

• e789 experiment (2019)

→ Title: "Isospin transport and the Density Dependence of the Symmetry Energy"

→ Setup: INDRA-FAZIA

→ Systems: $^{58,64}\text{Ni}+^{58,64}\text{Ni}$ @ 32 and 52 MeV/nuc

→ Publications:

• <https://doi.org/10.1103/PhysRevC.106.024603> (2022)

• <https://doi.org/10.1103/PhysRevC.108.054611> (2023)

• $^{58}\text{Ni}+^{58}\text{Ni}$ at 32 MeV/nuc also studied in a former INDRA campaign !!!

• INDRA 2nd campaign (1994)

→ Title: "Multifragmentation process for different mass asymmetry"

→ Setup: INDRA (solo)

→ Systems:

• $^{181}\text{Ta}+^{238}\text{U}$, ^{197}Au @ 33 MeV/nuc

• $^{238}\text{U}+^{238}\text{U}$ @ 23 MeV/nuc

• $^{58}\text{Ni}+^{58}\text{Ni}$ @ 32-90 MeV/nuc

• $^{58}\text{Ni}+^{197}\text{Au}$ @ 10-90 MeV/nuc

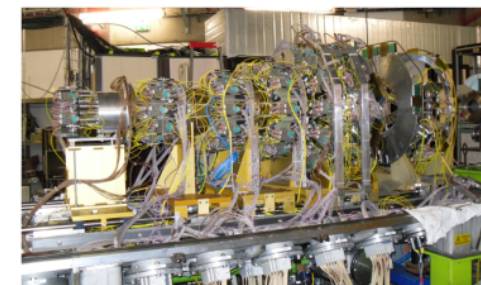
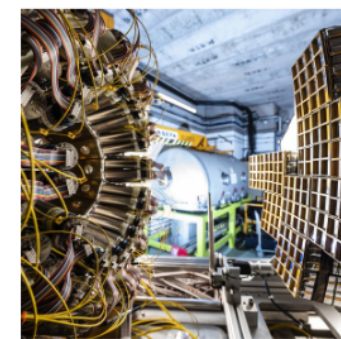
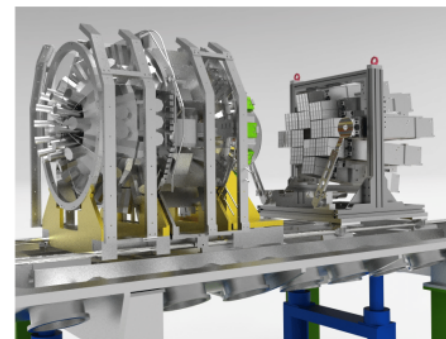
→ Publications:

• <https://doi.org/10.1103/PhysRevC.65.044604> (2002)

• <https://doi.org/10.1103/PhysRevC.67.064603> (2002)

• [https://doi.org/10.1016/S0375-9474\(02\)00988-0](https://doi.org/10.1016/S0375-9474(02)00988-0) (2003)

• <https://doi.org/10.1103/PhysRevC.79.064614> (2009)



Physical Review C

Measurements of sideward flow around the balance energy

[D. Cussol¹](#), [T. Lefort¹](#), [J. Péter¹](#), [G. Auger²](#), [Ch. O. Bacri³](#), [F. Bocage¹](#), [B. Borderie³](#), [R. Bougault¹](#), [R. Brou¹](#) et al. (INDRA Collaboration)

<https://doi.org/10.1103/PhysRevC.65.044604> (2002)

Dynamical effects in multifragmentation at intermediate energies

[J. Colin¹](#), [D. Cussol¹](#), [J. Normand¹](#), [N. Bellaïze¹](#), [R. Bougault¹](#), [A. M. Buta¹](#), [D. Durand¹](#), [O. Lopez¹](#), [L. Manduci¹](#) et al. (INDRA Collaboration)

<https://doi.org/10.1103/PhysRevC.67.064603> (2002)

Isospin diffusion in ^{58}Ni -induced reactions at intermediate energies. I. Experimental results

[E. Galichet^{1,2*}](#), [M. F. Rivet¹](#), [B. Borderie¹](#), [M. Colonna³](#), [R. Bougault⁴](#), [A. Chhibi⁵](#), [R. Dayras⁶](#), [D. Durand⁴](#), [J. D. Frankland⁵](#) et al. (INDRA Collaboration)

<https://doi.org/10.1103/PhysRevC.79.064614> (2009)

Nuclear Physics A

Multifragmentation process for different mass asymmetry in the entrance channel around the Fermi energy

[N. Bellaïze^a](#), [O. Lopez^a](#), [J.P. Wieleccko^b](#), [D. Cussol^a](#), [G. Auger^b](#), [Ch.O. Bacri^c](#), [F. Bocage^a](#), [B. Borderie^c](#), [R. Bougault^a](#), [B. Bouriquet^b](#), [R. Brou^a](#), [P. Buchet^d](#), [A.M. Buta^a](#), [J.L. Charvet^e](#), [A. Chhibi^b](#), [J. Colin^a](#), [R. Dayras^d](#), [N. De Cesare^a](#), [A. Demeyer^f](#), [D. Doré^d](#), [C. Volant^d](#)

[https://doi.org/10.1016/S0375-9474\(02\)00988-0](https://doi.org/10.1016/S0375-9474(02)00988-0) (2003)

Sideward Flow

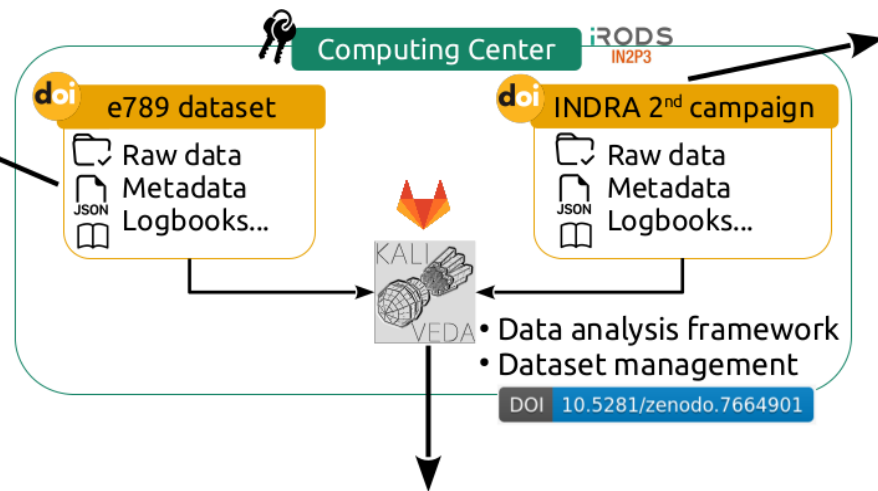
Multifragmentation

Isospin equilibration

Another use-case : INDRA-FAZIA data

e789 (2019)

- “Isospin transport and the Density Dependence of the Symmetry Energy”
- Setup: INDRA-FAZIA
- Systems: $^{58,64}\text{Ni}+^{58,64}\text{Ni}$ @ 32 and 52 MeV/nuc



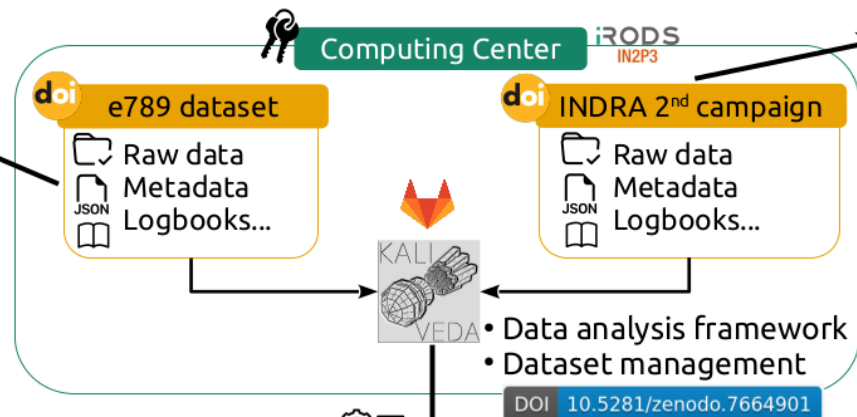
INDRA 2nd campaign (1994)

- “Multifragmentation process for different mass asymmetry”
- Setup: INDRA (solo)
- Systems:
 - $^{181}\text{Ta}+^{238}\text{U}$, ^{197}Au @ 33 MeV/nuc
 - $^{238}\text{U}+^{238}\text{U}$ @ 23 MeV/nuc
 - $^{58}\text{Ni}+^{58}\text{Ni}$ @ 32-90 MeV/nuc
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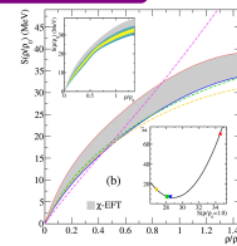
Pre-processed data

The physics analysis

- $^{58,64}\text{Ni}+^{58,64}\text{Ni}$ @ 32 MeV/nuc
- Observable = Isospin transport ratio
- [e789] → **exp. isospin diffusion**
- [e789 + 2nd camp.] → **model-independent impact parameter reconstruction**
- [e789 + 2nd camp. + simulations] → **Symmetry energy constraints**

Simulations

- Transport calculations
- BUU@VECC-McGill
- 5 ≠ Equation of State (EoS) parametrizations

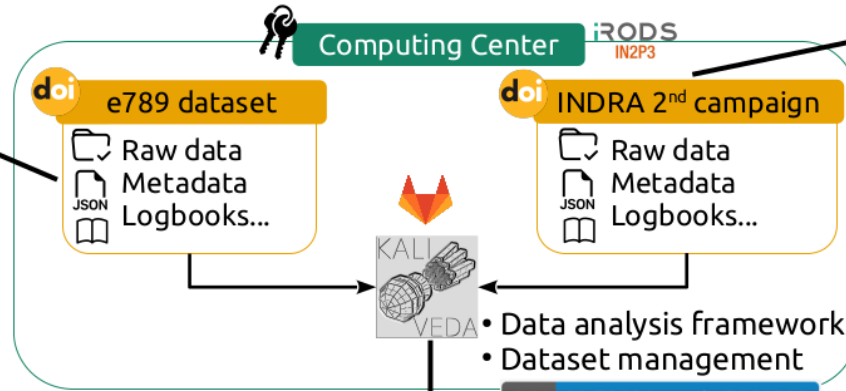


Simulated data

Another use-case : INDRA-FAZIA data

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Publication

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Letter
Constraining the nuclear symmetry energy with Fermi-energy heavy ion collisions

C. Ciampi ^a, S. Malik ^{b,c}, F. Gulminelli ^d, D. Gruyer ^d, J.D. Frankland ^a, N. Le Neindre ^d, R. Bougault ^d, A. Chbihi ^a, L. Baldesi ^{e,f}, S. Barlini ^{e,f}, B. Borderie ^g, A. Camaiani ^{e,f}, G. Casini ^e, I. Dekhissi ^d, J.A. Dueñas ^h, Q. Fable ^a, F. Gramegna ⁱ, M. Henri ^j, B. Hong ^k, S. Kim ^m, E. Vient ^d

Pre-processed data

The physics analysis

- $^{58,64}\text{Ni}+^{58,64}\text{Ni}$ @ 32 MeV/nuc
- Observable = Isospin transport ratio
- [e789] → **exp. isospin diffusion**
- [e789 + 2nd camp.] → **model-independent impact parameter reconstruction**
- [e789 + 2nd camp. + simulations] → **Symmetry energy constraints**

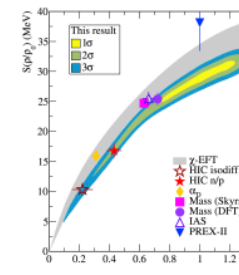
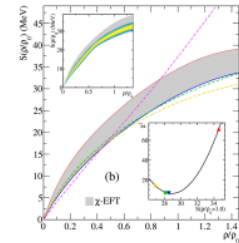
Simulated data

HEPData

ρ/ρ_0	S [MeV]	$\Omega(1-)$ [MeV]	$\Omega(2-)$ [MeV]	$\Omega(3-)$ [MeV]
0.75	25.00	[24.88,25.20]	[24.88,26.00]	[25.42,26.71]
0.80	25.93	[25.49,26.38]	[24.80,27.04]	[24.18,27.09]
0.85	26.73	[26.27,27.18]	[25.54,27.91]	[24.88,28.57]
0.90	27.49	[27.03,27.97]	[26.24,28.73]	[25.58,29.42]
0.95	28.20	[27.65,28.76]	[26.89,29.51]	[26.10,30.22]
1.00	28.87	[28.20,29.55]	[27.48,30.27]	[26.76,30.98]
1.05	29.51	[28.84,30.17]	[28.08,30.93]	[27.35,31.67]
1.10	30.10	[29.49,30.71]	[28.68,31.52]	[27.91,32.29]
1.15	30.65	[30.05,31.26]	[29.22,32.09]	[28.44,32.87]
1.20	31.17	[30.55,31.79]	[29.71,32.63]	[28.93,33.41]

Simulations

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- BUU@VECC-McGill
- 5 ≠ Equation of State (EoS) parametrizations



"Our analysis [...] produces more stringent constraints on the density dependence of the symmetry energy term of the nuclear equation of state, with a posterior distribution which can be directly used for the inference of the EoS of astrophysical objects like neutron stars."