



micado

WP9 – Digital Waste Platform

**Final Demo Meeting, 25th January 2023
Andrea Peperosa, Daniele Ninci, Andrea Della
Maggiore**

Summary

- Introduction
- Project Objectives
- System's Description
- Work Carried Out
- Results

Digital Waste Platform

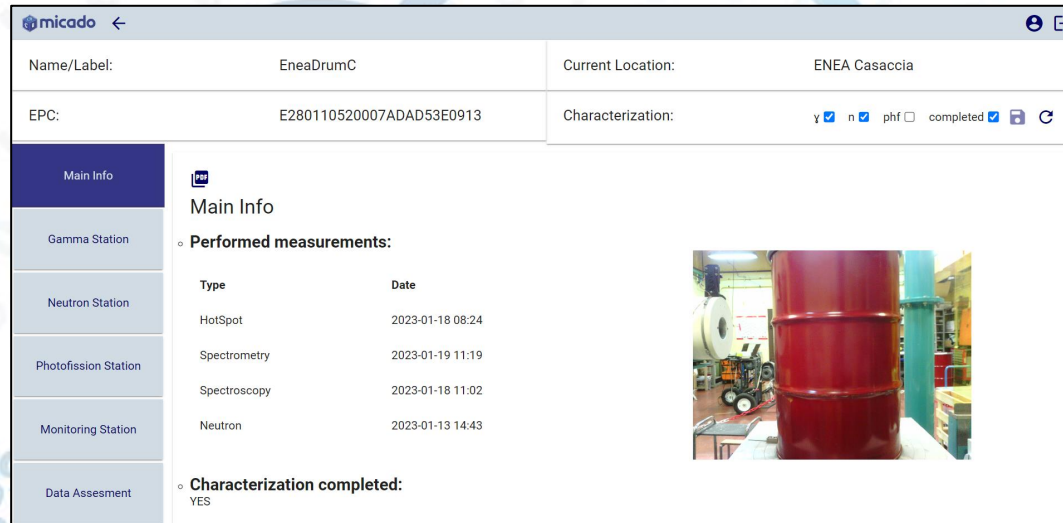
SOFTWARE PLATFORM for the full digitization of the Nuclear Waste data



Gamma Spectroscopy, Imaging and Spectrometry



Neutron measurements

micado

Name/Label: EneaDrumC Current Location: ENEA Casaccia

EPC: E280110520007ADAD53E0913 Characterization: y n phf completed

Main Info

Main Info

Gamma Station

Neutron Station

Photofission Station

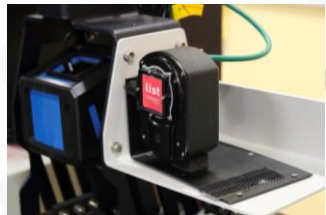
Monitoring Station

Data Assesment

Performed measurements:

Type	Date
HotSpot	2023-01-18 08:24
Spectrometry	2023-01-19 11:19
Spectroscopy	2023-01-18 11:02
Neutron	2023-01-13 14:43

Characterization completed: YES



Long Term Monitoring



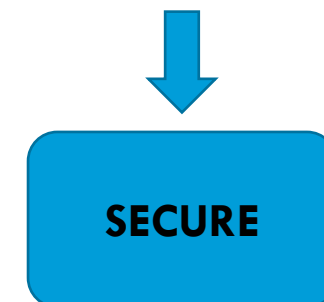
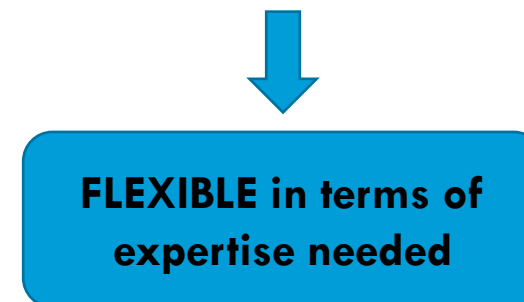
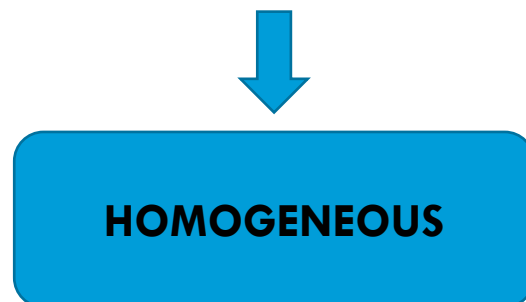
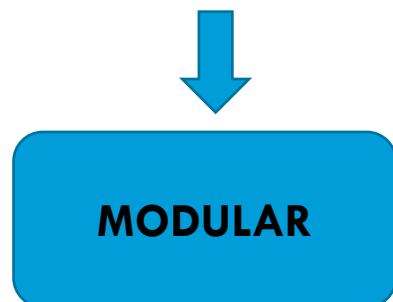
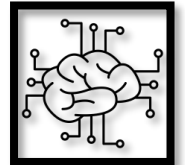
Pipeline Analysis – Reduction of uncertainties



Objectives

The primary objective in the MICADO project has been the development of such a software platform:

- Defining **data transfer protocols** and **software structure**
- Integrating and **securely transferring** external inputs, analyzing and combining them
- **Associating a digital unique ID** of the waste
- Applying computational algorithms to **optimize results** and **workflow**
- Guaranteeing the full **operationalities**



System's Description

The MICADO Database



- **SQL RELATIONAL DATABASE**
- Developed from RadBASE for MICADO requests
- Implemented in **JAVA**
- Data uploaded in single reports. (measurements, spectra, images, files)
- **MONITORING DATA** stored in survey containers
- Accounts with **DIFFERENT PRIVILEGES** on reading/writing
- Accessible through **HTTP REST-API PROTOCOL**

Items List

ID	NAME	RFID	CATEG
50	EneaDrumA	E280110520007B1AD53E0913	
51	EneaDrumB	E28011052000775AD5390913	
52	EneaDrumC	E280110520007ADAD53E0913	
53	NuclecoDrumA	E28011052000771AD5390913	
54	NuclecoDrumB	E28011052000735AD5370913	
55	NuclecoDrumC	E2801105200076DAD5390913	
56	NuclecoDrumD	E280110520007B5AD5310913	
3151	UseCase1	VC1	
3152	UseCase3	VC3	
3153	UseCase1Legacy	VC1Legacy	
3154	UseCase3Legacy	VC3Legacy	
6351	PhotofissionDrum	PhFExDr001	
9552	DrumExample001	E2806D12000000021F472700	

Reports

ID	ITEM ID	# MEASURES	DATE/TIME
118	53	264	13-01-2023 11:03:47 +0100
119	54	264	13-01-2023 11:03:47 +0100
120	55	264	13-01-2023 11:03:47 +0100
121	56	264	13-01-2023 11:03:47 +0100
122	53	384	13-01-2023 11:05:51 +0100
123	54	384	13-01-2023 11:05:51 +0100
124	55	384	13-01-2023 11:05:51 +0100

Surveys

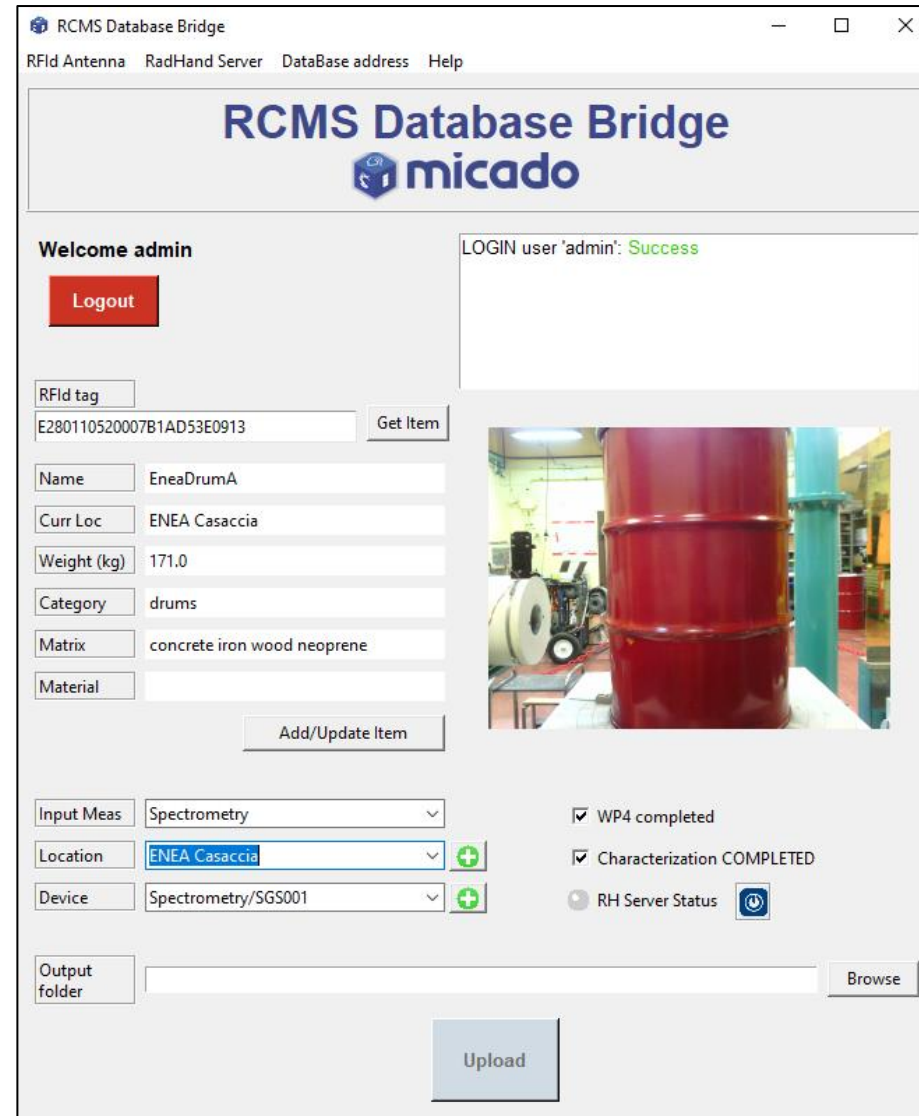
ID	ITEM NAME	ITEM RFID	DATE/TIME
3167	EneaDrumA	E280110520007B1AD53E0913	13-01-2023 14:42:36 +0100
3168	EneaDrumC	E280110520007ADAD53E0913	13-01-2023 14:43:04 +0100
12770	EneaDrumA	E280110520007B1AD53E0913	18-01-2023 11:01:54 +0100
12772	EneaDrumC	E280110520007ADAD53E0913	18-01-2023 11:02:39 +0100
12778	EneaDrumB	E28011052000775AD5390913	19-01-2023 11:18:15 +0100

System's Description

The MICADO Database Bridge

- Graphical Interface tool for MICADO experiments written in PYTHON
- **MULTIPLATFORM**
- Interfaces the with **RFID** antenna device (**ITEM ID**)
- Direct communication with MICADO Database through **HTTP REST-API PROTOCOL**
- Manage the **PARSING** and the **UPLOAD** on Database the output data of each MICADO technologies
- Can be easily **EXTENDED** for new technologies

1/25/2023



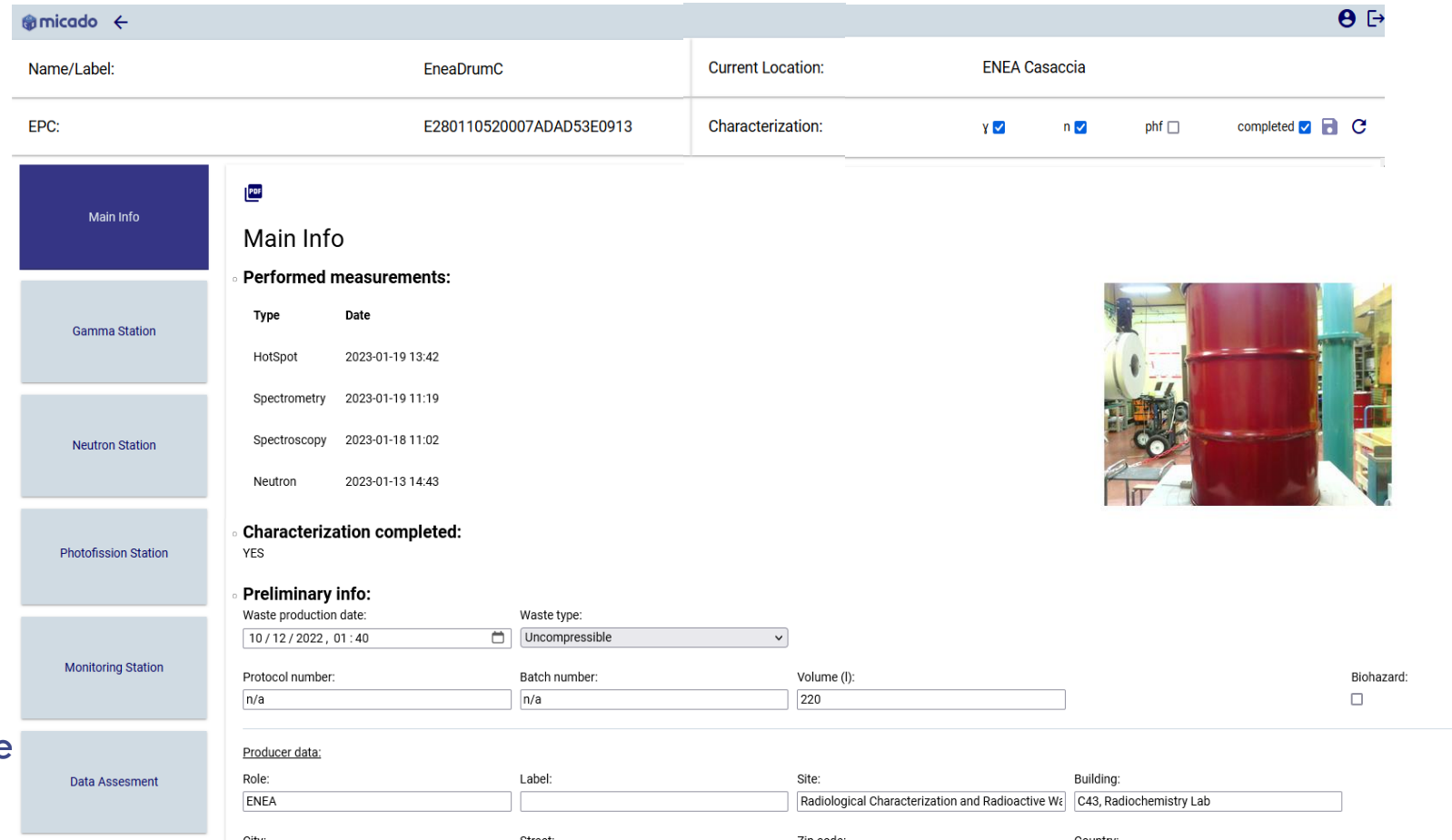
The screenshot shows the RCMS Database Bridge web interface. At the top, there is a navigation bar with links for 'RFId Antenna', 'RadHand Server', 'DataBase address', and 'Help'. The main header displays 'RCMS Database Bridge' and the 'micado' logo. A 'Welcome admin' message is shown on the left, with a red 'Logout' button. On the right, a login status message reads 'LOGIN user 'admin': Success'. Below the login area, there is a form for entering an 'RFId tag' (E280110520007B1AD53E0913) and a 'Get Item' button. A table of item details is displayed, including Name (EneaDrumA), Curr Loc (ENEA Casaccia), Weight (kg) (171.0), Category (drums), Matrix (concrete iron wood neoprene), and Material. An 'Add/Update Item' button is located below the table. To the right of the table is a photograph of a red drum in a laboratory setting. At the bottom, there are dropdown menus for 'Input Meas' (Spectrometry), 'Location' (ENEA Casaccia), and 'Device' (Spectrometry/SGS001), each with a green plus icon. There are also checkboxes for 'WP4 completed' and 'Characterization COMPLETED', and a 'RH Server Status' indicator with a power button icon. An 'Output folder' field with a 'Browse' button and an 'Upload' button are also present.

System's Description



The MICADO Database GUI



- **MICADO interface GUI** to the Database
- **WEB APPLICATION** written in TypeScript within Angular framework
- Adopted functional paradigm
- Use of specific purpose functions combined in pipelines to create **more complex functions**
- Item info filtered depending on the **USER PRIVILEGES**
- Direct communication with MICADO Database through **HTTP REST-API PROTOCOL**



The screenshot displays the MICADO Database GUI interface. At the top, there is a breadcrumb trail 'micado <' and a user profile icon. Below this, a summary table shows the following data:

Name/Label:	EneaDrumC	Current Location:	ENECA Casaccia
EPC:	E280110520007ADAD53E0913	Characterization:	y <input checked="" type="checkbox"/> n <input checked="" type="checkbox"/> phf <input type="checkbox"/> completed <input checked="" type="checkbox"/>  

On the left side, there is a vertical sidebar menu with the following items: Main Info (selected), Gamma Station, Neutron Station, Photofission Station, Monitoring Station, and Data Assesment.

The main content area is titled 'Main Info' and contains several sections:

- Performed measurements:** A table with columns 'Type' and 'Date':

Type	Date
HotSpot	2023-01-19 13:42
Spectrometry	2023-01-19 11:19
Spectroscopy	2023-01-18 11:02
Neutron	2023-01-13 14:43
- Characterization completed:** YES
- Preliminary info:**
 - Waste production date: 10 / 12 / 2022 , 01 : 40
 - Waste type: Uncompressible
 - Protocol number: n/a
 - Batch number: n/a
 - Volume (l): 220
 - Biohazard:
- Producer data:**
 - Role: ENEA
 - Label: [empty]
 - Site: Radiological Characterization and Radioactive W
 - Building: C43, Radiochemistry Lab

An image of a red industrial drum is shown on the right side of the main content area.

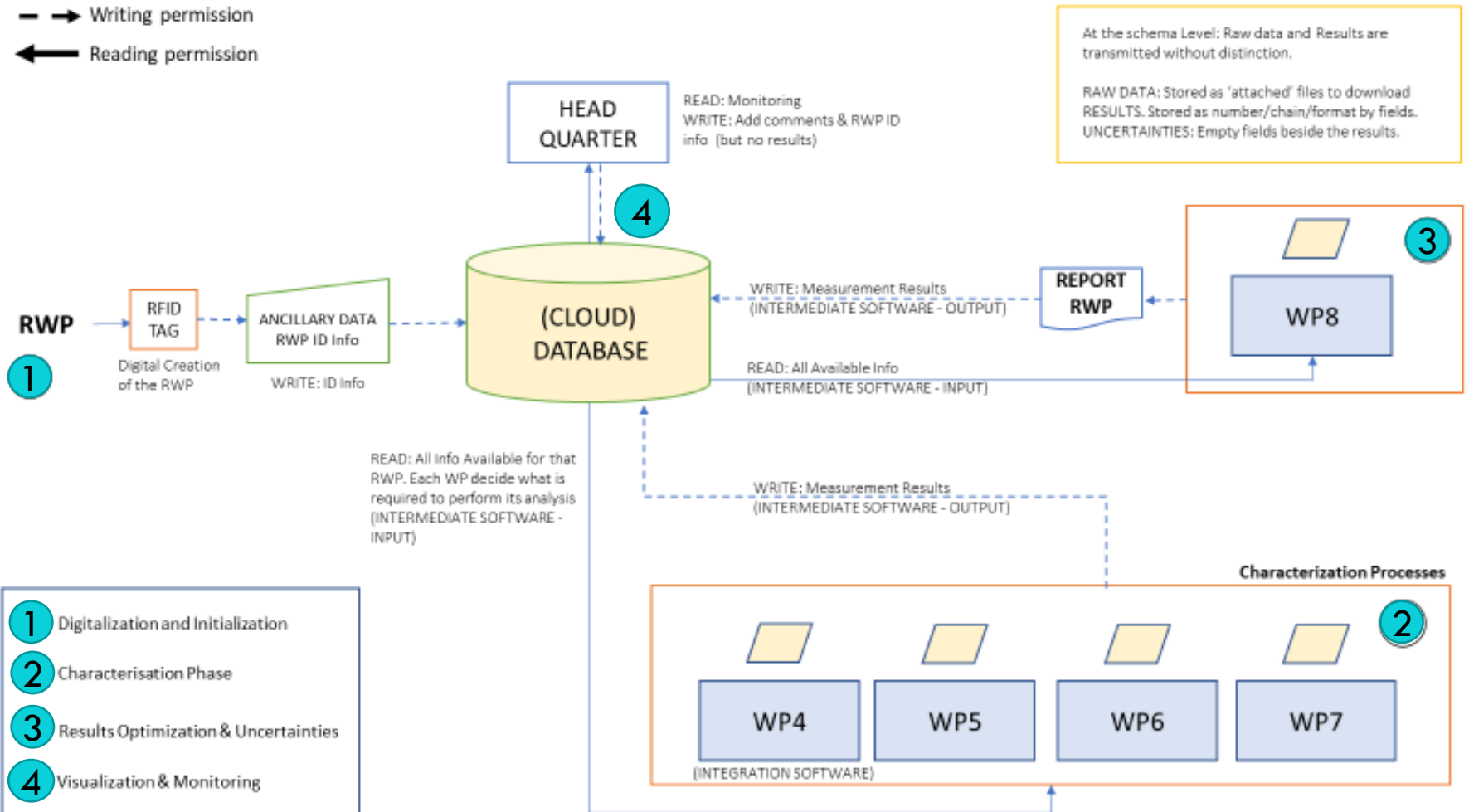
Work Carried Out (I/VII)

- Definition of the communication protocols and data formats: Questionnaire sent to every Partner

WRITE HERE THE NAME OF THE TECHNOLOGY the questions are referred to	INFN		INFN		ENEA		CAEN		SCK-CEN		CEA DEN		CEA LIST		CTU		CEA-LIST		CEA-LIST						
	SiLiF		SciFi		SRWGA: Segmented Radioactive Waste gamma Analysis		RadHsd (No Database)		WPS Data analysis pipeline		Passive and active neutron measurement system		Photofission		Timepix		Expressif		Gamma Camera						
Is it a detector technology?	YES		YES		YES		YES	embeds a Nb(Ti) 2"x2"	NO		YES		YES		YES		NO		YES						
If not, go to 6.0									N.R.									n.a.							
Is there a calibration procedure?	NO	Calibration when the detector is first assembled with its electronics, not in the field, only at the factory level, only once	NO	Calibration when the detector is first assembled with its electronics, not in the field, only at the factory level, only once	YES		YES	The calibration is performed at the company before the shipment	N.R.		YES		YES		YES			n.a.		YES					
Is there a background measurement procedure?	NO	not needed	NO	Probably so SiLiF	YES		peak	There is only a stabilisation (40k peak) and no background	N.R.		YES		YES		YES			n.a.		NO(?)					
If yes to questions 2.0 and 3.0, are the calibration and background results required to perform a measurement?		Calibration only once, background whenever one is curious to know	NO		YES		YES	Calibration, - without calibration, the instrument is not able to perform radioisotope identification	N.R.		YES	Both	YES	The measurement protocol will be composed of two steps. Step 1: background measurement. Step 2: irradiation of the suspect area.	YES			n.a.		YES	Calibration (only once)				
If yes to questions 2.0 and 3.0, Are the calibration and background results required to perform the analysis and obtain the final result?		But optionally one can choose to check every now and then	YES	yes in the sense that it is done at the factory and not on the site. "è poco da calibrare, dovrebbe bastare regolare lo scintillatore. Poi può essere utile fare una misura di fondo in loco ma prima di installare i sensori sui fusti, giusto in caso che il fondo naturale sia diverso da quello del mio laboratorio"	YES		YES	Yes for calibration, but unknown to the user	N.R.		YES		YES		YES			n.a.		YES	Calibration (only once)				
Besides background measurement and calibration procedures, is there a specific pre-measurement procedure?	NO		NO		YES		NO		N.R.		YES		NO	Not necessarily. But it will depend on the measurement protocols which will be defined later on in the project.	NO			n.a.		NO(?)					
Is your system performing different measurement types with the same instrument?	NO	Actually same measurements with different meaning, depending on the neutron moderator employed	NO		YES		YES		N.R.		YES		NO	Not planned at the moment	YES			n.a.		YES	Image, count rate, spectroscopy, dose rate estimation				
If yes, which ones?					Open Geometry - Segmented Gamma Scanning - Angular Scanning - Transmission/Emission Tomography			- Dose Rate (µSv/h o mrem/h) - Radioisotopes Identification	N.R.		Passive (calibration source) AND active measurement (with neutron generator)			no answer				n.a.							
Is it possible to accept logical inputs (ex. To define a start/stop or a popup)	YES	not needed(?) It is a long term monitor, do we need these input, probably not	YES	not needed(?) It is a long term monitor, do we need these input, probably not	YES		NO		?	Unclear at present if this is applicable to our case. The data analysis pipeline would be initiated by an API or system call.	NO		No answer	YES	external trigger				YES	all - sz input to the control software					
If yes, which ones?					Start/stop/control parameters															It is a service so it starts when it is called					
Is the hardware remotely controllable?	YES	probably not needed	YES	probably not needed	YES		YES		YES	We don't really have specific hardware. The data analysis pipeline is software. In principle it should be possible to run it on the DigWaste server/platform itself, where the code can be launched by a system call for instance, and data exchange can go via direct access to the database. If an external server is required, we are thinking of an HTTP/REST API. If WPS would in any case prefer such an API, whether the data analysis pipeline would be hosted on the DigWaste server itself, or an external one, we can also foresee it of course. It would be nice to have some feedback on that early on, so we now if the API has to be foreseen. Also, if direct access to the database would be the way to go, it would be nice to know which type of SQL database is being considered (e.g. MySQL, SQLite, PostgreSQL...)	NO		YES		NO		YES					NO		YES	
If No, go to 12.0 Which type of remote connection do you have?					Ethernet, USB, RS232, WiFi		USB		Ethernet	If it would be an external server			Ethernet		Ethernet			n.a.			Ethernet, USB, WiFi (to be implemented)				

Work Carried Out (II/VII)

- Dataflow & Software structure



Work Carried Out (III/VII)

- Software dvpt and technologies integration




RCMS Database Bridge

RCMS Database

RCMS Database Bridge

RFid Antenna RadHand Server DataBase address Help

RCMS Database Bridge



Welcome admin

Logout

LOGIN user 'admin': Success


RFid tag
E280110520007B1AD53E0913

Name: EneaDrumA
Curr Loc: ENEA Casaccia
Weight (kg): 171.0
Category: drums
Matrix: concrete iron wood neoprene
Material:

Input Meas: Spectrometry
Location: ENEA Casaccia
Device: Spectrometry/SGS001

WP4 completed
 Characterization COMPLETED
 RH Server Status

Output folder:



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micado

Name/Label: EneaDrumC Current Location: ENEA Casaccia

EPC: E280110520007ADAD53E0913 Characterization: y n phf completed

Main Info

Performed measurements:

Type	Date
HotSpot	2023-01-19 13:42
Spectrometry	2023-01-19 11:19
Spectroscopy	2023-01-18 11:02
Neutron	2023-01-13 14:43

Characterization completed: YES


Preliminary info:

Waste production date: 10 / 12 / 2022 , 01 : 40 Waste type: Uncompressible

Protocol number: n/a Batch number: n/a Volume (l): 220 Biohazard:

Producer data:

Role: ENEA Label: Site: Radiological Characterization and Radioactive W Building: C43, Radiochemistry Lab



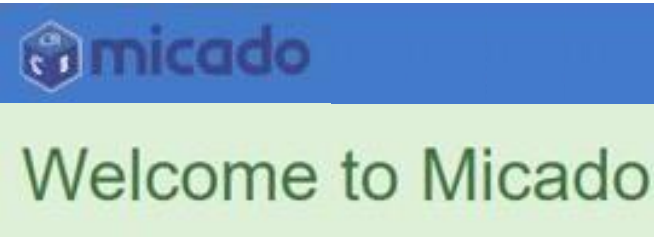
Work Carried Out (IV/VII)



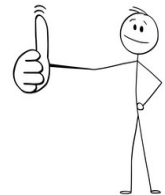
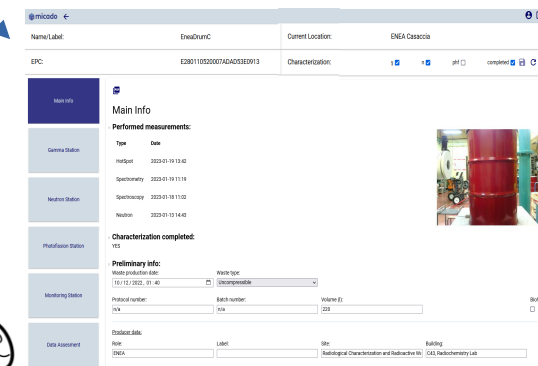
- Software development and technologies integration

RadBASE for MICADO

Managed by CAEN



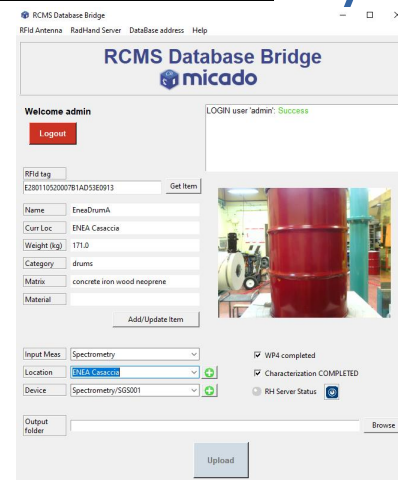
RCMS Database GUI



All Micado Users



RCMS Bridge

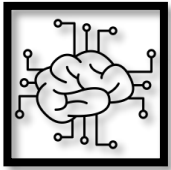


Tech and supervisors of WPs

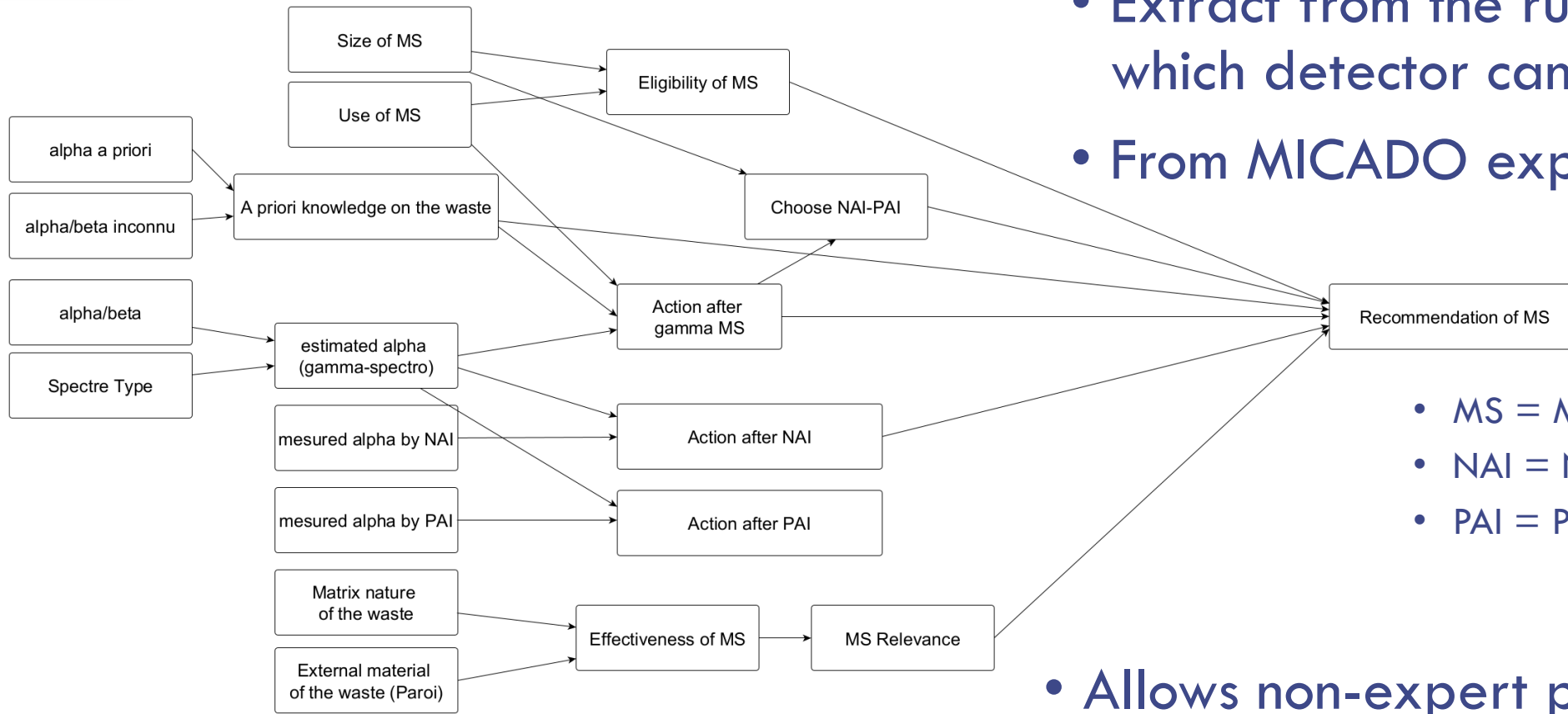
Drums Measurement Site



Work Carried Out (V/VII)



AI algorithm implementation

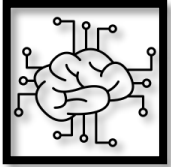


- Workflow recommendation
- Extract from the rule base that allows which detector can be used next
- From MICADO experts' interview

- MS = Measurement System
- NAI = Neutron Active Interrogation
- PAI = Photonic Active Interrogation

- Allows non-expert people to conduct waste characterization

Work Carried Out (VI/VII)



- Same AI algorithm applied in conjunction with gamma camera improvement
- Control:
 - Mask/antimask procedure is now automatic
 - Json format for the results (image, spectrum, etc.)
- Embedding AI and treatments
 - Embedded software have been rethought for more robustness (restful apis)
 - Noisy pixels automatic cancellation
 - Implementation of the Bayesian algorithms developed in WP4
- Automatic exposure time
 - Regarding the number of events and the quality of data, ExpressIF[®] advices if the acquisition must continue or stop

Work Carried Out (VII/VII)



- Data Security Assessment and Implementation
 - **Public/private key protocol** implemented
 - Evaluation test of the **blockchain technology** : software form to test the data encryption and access based on different user configurations
 - For the test only ancillary and already available drum data/info will be used. No direct connection to the different technologies to minimize the impact.

User dependent

Form to be manually filled

Par1

Par2

Par3

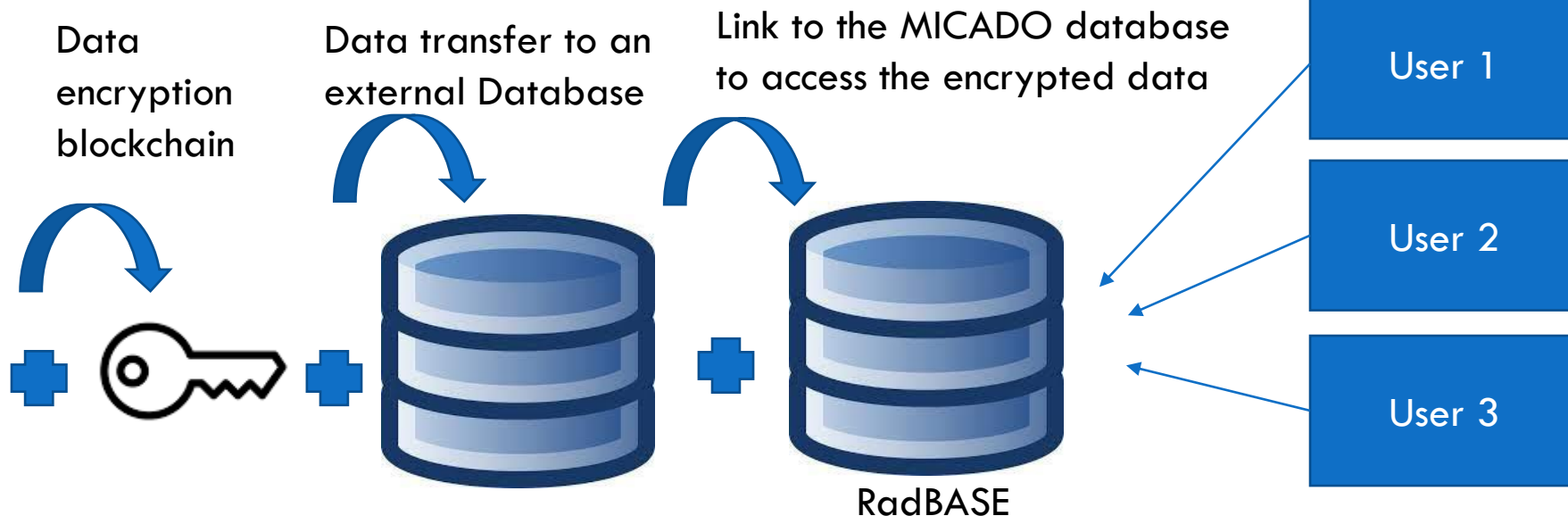
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•

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Web form

1/25/2023




Results

RCMS Database Bridge

RFid Antenna RadHand Server DataBase address Help

RCMS Database Bridge



Welcome admin LOGIN user 'admin': Success

[Logout](#)

RFid tag: E280110520007B1AD53E0913 [Get Item](#)


Name: EneaDrumA
 Curr Loc: ENEA Casaccia
 Weight (kg): 171.0
 Category: drums
 Matrix: concrete iron wood neoprene
 Material:

[Add/Update Item](#)

Input Meas: Spectrometry
 Location: Spectroscopy
 Device: Spectrometry
 Output folder:

WP4 completed
 Characterization COMPLETED
 RH Server Status

[Upload](#)



GOAL ACHIEVED



100%

Flexibility
Modularity

Homogeneity
Security

micado

Name/Label: EneaDrumC Current Location: ENEA Casaccia

EPC: E280110520007ADAD53E0913 Characterization: y n phf completed

Main Info


Performed measurements:

Type	Date
HotSpot	2023-01-19 13:42
Spectrometry	2023-01-19 11:19
Spectroscopy	2023-01-18 11:02
Neutron	2023-01-13 14:43

Characterization completed:
YES

Preliminary info:
 Waste production date: 10/12/2022, 01:40 Waste type: Uncompressible
 Protocol number: n/a Batch number: n/a Volume (l): 220
 Biohazard:

Producer data:
 Role: ENEA Label: Site: Radiological Characterization and Radioactive Waste Building: C43, Radiochemistry Lab



Results

Main Info

Characterization completed:
YES

Preliminary info:
Waste production date: Waste type:

Protocol number: Batch number: Volume (l):

Producer data:
Role: Label: Site:
City: Street: Zip code:

Weight (g):
Gross: Tare: Net:

Container type: Matrix materials: Heavy metals:

Main Info

Max dose rate measurements:

Label	Max dose rate	Meas unit	Date
Contact	12.26	uSv/h	2023-01-18 11:02
Distant	0.78	uSv/h	2023-01-18 11:02

Radio nuclides gamma station:

Label	Activity	Uncertainty	MDA	Meas unit	Position
Cs-137	338000	8160	241	Bq	Y1037_R64_T71
Cs-137	634000	65000	8020	Bq	Y277_R103_T78
Cs-137	102000	9970	1540	Bq	Y317_R143_T81
Cs-137	326000	7800	271	Bq	Y877_R103_T101
Cs-137	359000	11200	467	Bq	Y917_R64_T71
Cs-137	412000	108000	413	Bq	Y957_R103_T101
Cs-137	488000	9120	384	Bq	Y997_R64_T108

Radio nuclides Pu & U measurements:

Label	Value	Uncertainty	MDA	Meas unit	Station
Pu240_mass	4.55	0.2	0.56	g	Neutron

Let's have a look!



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847641. This text reflects only the author's views and the Commission is not liable for any use that may be made of the information contained therein.



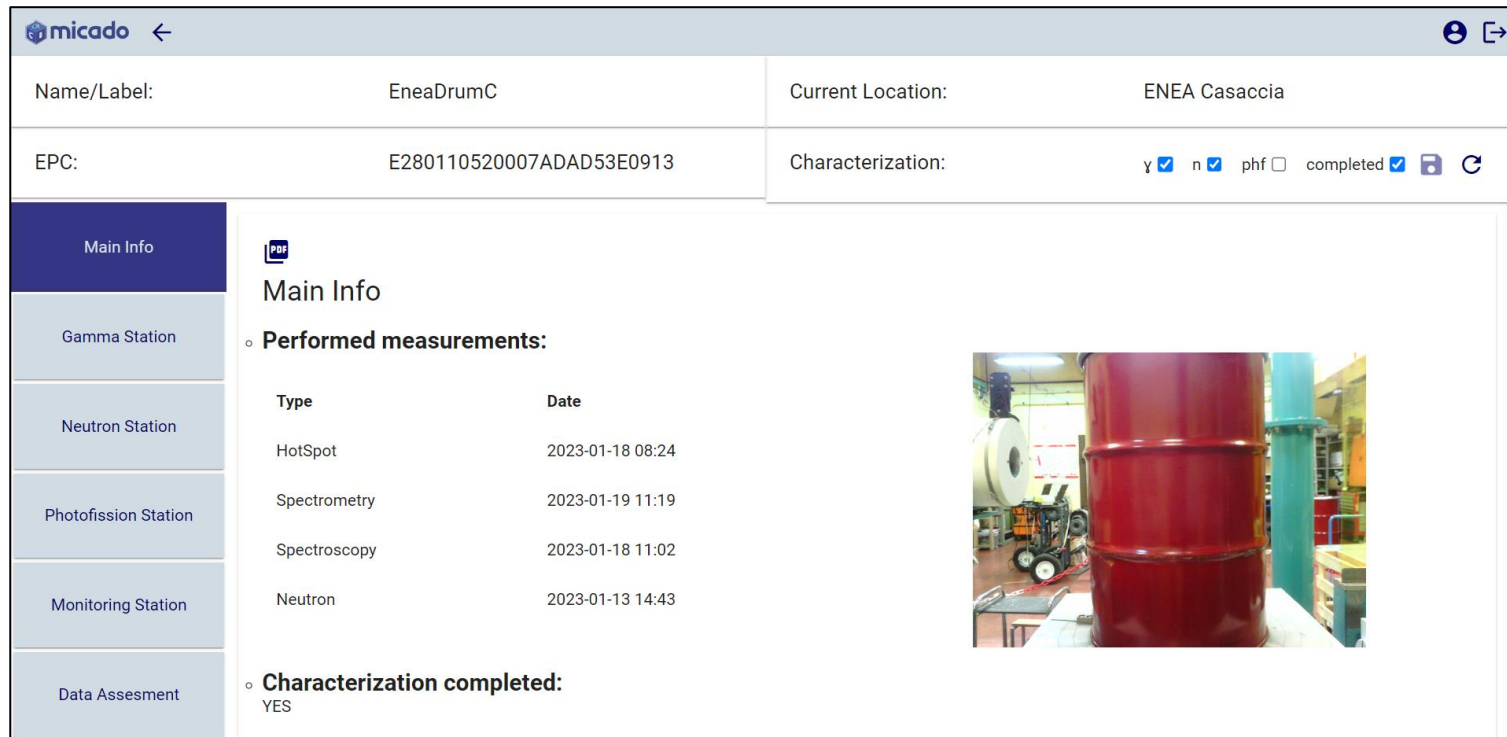
micado

Thanks for your attention





Back up slides

RCMS Database GUI



The screenshot shows the micado application interface. At the top, there is a header with the micado logo and a back arrow. Below the header, there are two rows of information:

- Name/Label: EneaDrumC
- Current Location: ENEA Casaccia
- EPC: E280110520007ADAD53E0913
- Characterization: y n phf completed  

On the left side, there is a navigation menu with the following items:

- Main Info (selected)
- Gamma Station
- Neutron Station
- Photofission Station
- Monitoring Station
- Data Assesment

The main content area displays the 'Main Info' section. It includes a PDF icon and the title 'Main Info'. Below this, there is a section for 'Performed measurements' with a table:

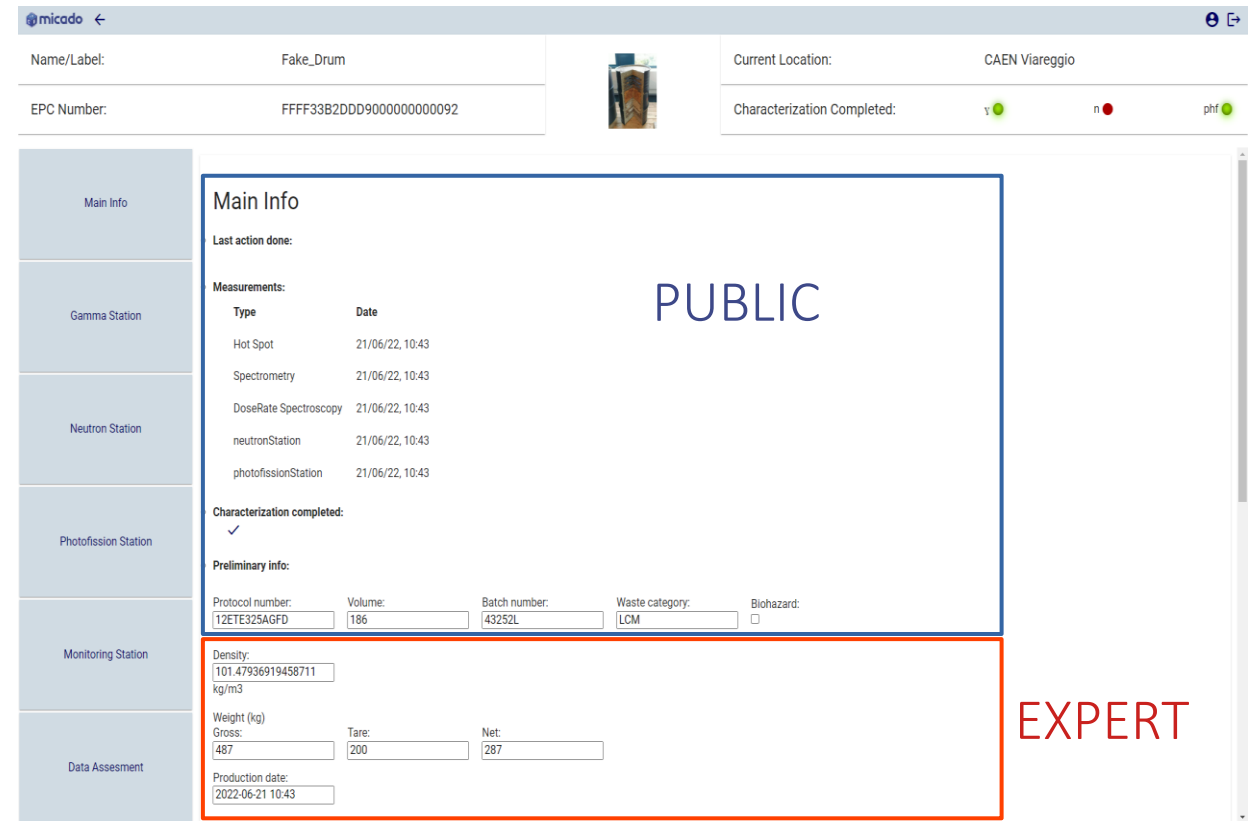
Type	Date
HotSpot	2023-01-18 08:24
Spectrometry	2023-01-19 11:19
Spectroscopy	2023-01-18 11:02
Neutron	2023-01-13 14:43

Below the table, there is a section for 'Characterization completed:' with the value 'YES'. To the right of the table, there is an image of a red drum in a laboratory setting.

- JavaScript/TypeScript application developed through Angular
- Visualization and functionality depend on the user permission
- It interfaces with the RMCS DB, but it is decoupled from specific API types
- It includes the possibility to download all the information as a document report

Data Classification

- The information reported in the GUI are tagged as 'PUBLIC' or 'EXPERT'
- Each quantity characterizing the Drum in term of waste properties are public (i.e. dose rate, radionuclides identified) and each MICADO user has access to them.
- All the information related to the technology involved in the characterization or measurement details are classified as 'EXPERT' and thus, visible by a restricted group of item.



The screenshot shows the MICADO interface for a 'Fake_Drum' with EPC Number FFFF33B2DDD9000000000092. The 'Main Info' section is highlighted with a blue border and labeled 'PUBLIC'. The 'Preliminary info' section is highlighted with a red border and labeled 'EXPERT'.

Name/Label:		Current Location:	
Fake_Drum		CAEN Viareggio	
EPC Number:		Characterization Completed:	
FFFF33B2DDD9000000000092		v ● n ● phf ●	

Main Info				
Last action done:				
Measurements:				
Type	Date			
Hot Spot	21/06/22, 10:43			
Spectrometry	21/06/22, 10:43			
DoseRate Spectroscopy	21/06/22, 10:43			
neutronStation	21/06/22, 10:43			
photofissionStation	21/06/22, 10:43			
Characterization completed: ✓				
Preliminary info:				
Protocol number: 12ETE325AGFD	Volume: 186	Batch number: 43252L	Waste category: LCM	Biohazard: <input type="checkbox"/>
Density: 101.47936919458711 kg/m3				
Weight (kg): Gross: 487	Tare: 200	Net: 287		
Production date: 2022-06-21 10:43				

RCMS user classification

- The Bridge and GUI interaction depends on the type of permission the user has:

	RCMS Database Bridge		RCMS Database GUI		
	Data upload	Create/update item, device, location	PUBLIC info visualization	PUBLIC report download	EXPERT info visualization
Administrator	✓	✓	✓	✓	✓
WP technician	✓	✗	✓	✓	only the own WP
WP Supervisor	✓	✓	✓	✓	only the own WP*
External Authority	✗	✗	✓	✓	✗

- *Supervisor can modify the item info and check if the measurement stored lead to a complete characterization of the Drum

Ex1: RadHAND

Gamma Station

PUBLIC

Summary Spectroscopy Hotspot Spectrometry

Contact measurements:

Pos	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Dose rate (uSv/h)	201.17	199.92	132.45	196.67	55.77	169.99	166.49	213.86	143.42	186.35	126.31	185.96

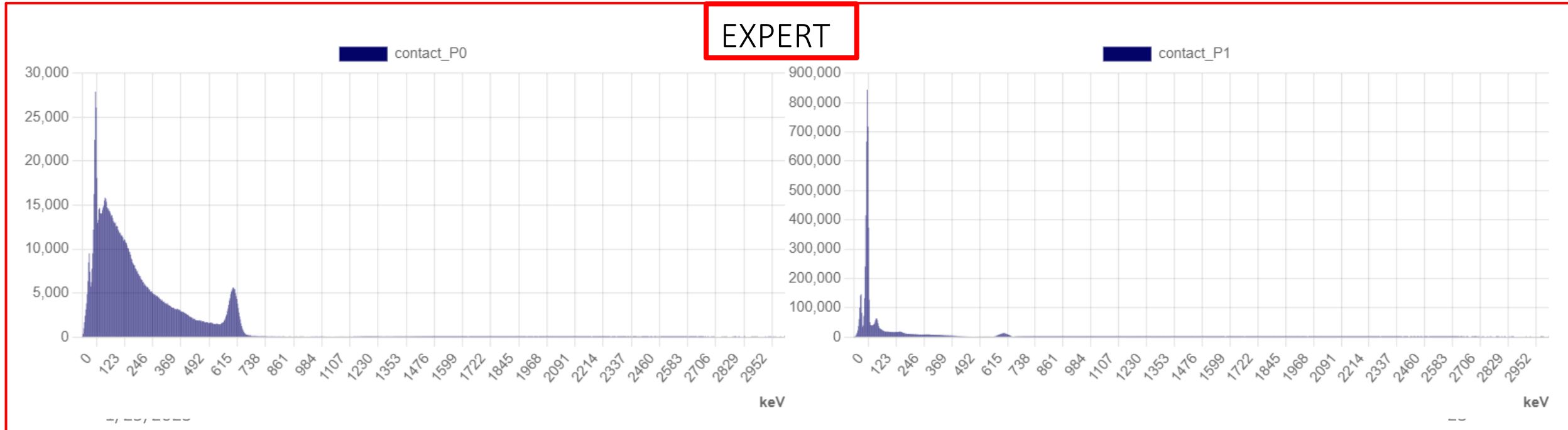
Dose rate @1m:

Front: 237.86 ± 5.42 uSv/h
Back: 72.33 ± 2.77 uSv/h

Radio nuclides measured:

Label	Front	Back
Plutonium240	✓	✗
Europium152	✓	✗
Thorium232	✓	✗
Americium241	✗	✓

Software dvpt and technologies integration



Software dvpt and technologies integration

Ex1: Photofission Station

◦ **Pu-240 mass:**
234.97 ± 9.86 g 24/06/22, 16:30

PUBLIC

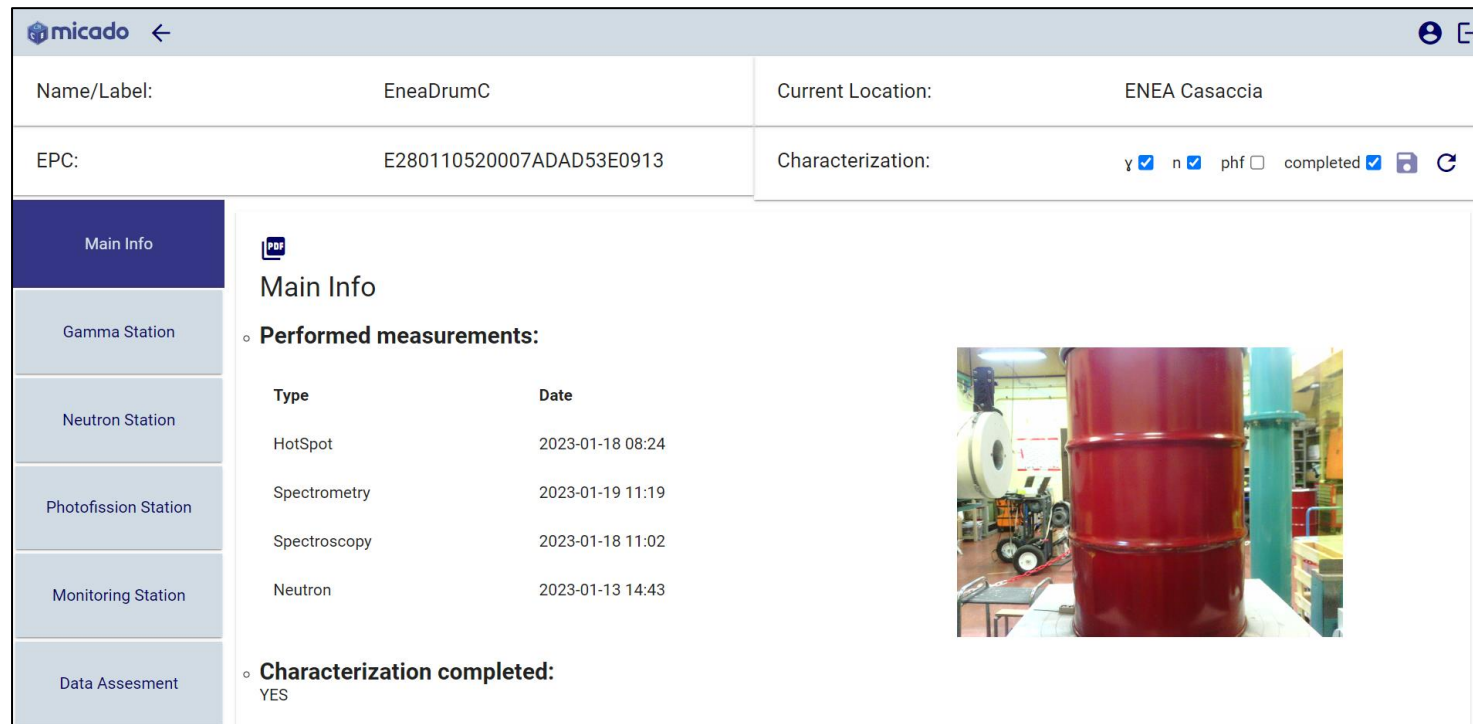
◦ **Measurements:**

Type	Value	Error	Measure unit	Meas time (sec)
Pu240_mass	234.9725031935558	9.857089219719866	g	800.21
Real_cps	178.4946435620364	0.8166618856642971	cps	800.21
Bkg_cps	188.72097392232806	8.41999523032386	cps	800.21
Sens A	54.4383675690447	3.2417373966881535		800.21
Sens B	147.43117955607318	0.8391058482123159		800.21
Linac Energy	206.81068697623934	7.605421704643343	MeV	800.21

EXPERT

RCMS Database GUI

- Each technology as a Device Category:
- Measurements of each technology are uploaded as a single report
- Following the data categorization:
- MAIN data section: visualized by every people. Contains results
- EXPERT data section: visualized by specific WP user (e.g. WP technician, Supervisor). Contains raw data




The screenshot shows the micado interface with the following details:

- Header:** micado logo and navigation icons.
- Form Fields:**
 - Name/Label: EneaDrumC
 - Current Location: ENEA Casaccia
 - EPC: E280110520007ADAD53E0913
 - Characterization: y n phf completed [save icon] [refresh icon]
- Left Sidebar:**
 - Main Info (selected)
 - Gamma Station
 - Neutron Station
 - Photofission Station
 - Monitoring Station
 - Data Assesment
- Main Content Area:**
 - Main Info** (with a PDF icon)
 - Performed measurements:**


Type	Date
HotSpot	2023-01-18 08:24
Spectrometry	2023-01-19 11:19
Spectroscopy	2023-01-18 11:02
Neutron	2023-01-13 14:43
 - Characterization completed:** YES
 - Image:** A photograph of a large red industrial drum in a laboratory setting.


Data security assessment - Blockchain



Tools for Discovery
Powered By: 

SEARCH








HELP


LOG OUT

Documents < TestM1









TESTM1

GENERAL INFORMATION

Drum Name : Drum 101

Data : asdfas

Location of the action : Viareggio

EPC (Tag ID) *Required : 0000000000101

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HISTORICAL INFORMATION

Template test to check the use of the Blockchain template

Owner : Erica | Fanchini

Production date (DD-MM-YYYYHR:MIN:SEC): 12/ 11 / 2022

Location : Viareggio

Address (GPS not required) :

Category (Package geometry) : Drum

Status:

TESTM1 Edit

Description:

Date Created: 08/02/2022

Last updated: 08/02/2022

Document Type: Other


Document Sub Type:

State: In Progress

Owner: Erika Fanchini

Role of Creator:

ATTACHMENTS:



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.pdf, .doc, .docx, .png, .jpg, .xls, .xlsx, .ppt, .pptx

Users



Erika Fanchini
(Owner)



Francesco Rogo
(Manager, Software dev)

Edit Remove



Add User

Messages

Message Francesco Rogo

Data security assessment - Blockchain

Category (Package geometry) : Drum

Status:

Validation Pending Not Validated Validated

Attribute (Matrix Element) Light mixed material Glass Plastic Concrete Metal Soil Resin Other

Content (Filling Material) : Concrete

Comments/Notes : Notes that can be inserted

Remarks / Specific Requirements : No remarks

ATTACHMENTS

(Attachments can be included upon creating a new document using this template)

a. Previous Tests (for example like the MIC example chart attachment)

b. Other Files (Doc, XL, PPT, PDF or image file - any other file uploads that are not necessarily test specific)

Role of Creator:

ATTACHMENTS:

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Users

Erika Fanchini (Owner)

Francesco Rogo (Manager, Software dev) [Edit](#) [Remove](#)

[Add User](#)

Messages

Message Francesco Rogo 0/300

[SEND](#)

person

User based notification system