

Digital technology map: detectors, accelerators, competencies

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Motivation

The JINR has significant experience in:

- The development and application of **detector and accelerator systems, data handling and processing,**
- Co-operation with **manufacturers** of components, materials and non-standard equipment,
- Co-operation with scientific and technological **partners.**

Sharing this knowledge, especially on equipment for detector and accelerator R&D, is crucial.



The eight-layer module of the TRT ATLAS transient radiation detector is being tested before being sent to CERN (photo.jinr.ru)



During the installation of the DC-60 cyclotron, developed for the Republic of Kazakhstan (2006) (photo.jinr.ru)



The picture shows the calibration of charged particle telescopes at the ACCULINNA-2 facility. In the photo A.A.Bezbakh (photo.jinr.ru)

Motivation



The need for a shared knowledge base has been raised repeatedly.

With the sharing of such information, it seems possible to get quick answers to questions such as:

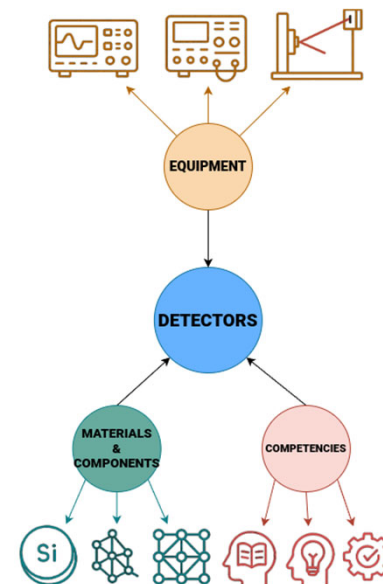
- Where to find the **necessary equipment**?
- Who has the **necessary competence**
or
Where to get the **necessary people**?
- And what has already been **done in detector and accelerator technology directions in the JINR**?

First step: a map of detectors technologies

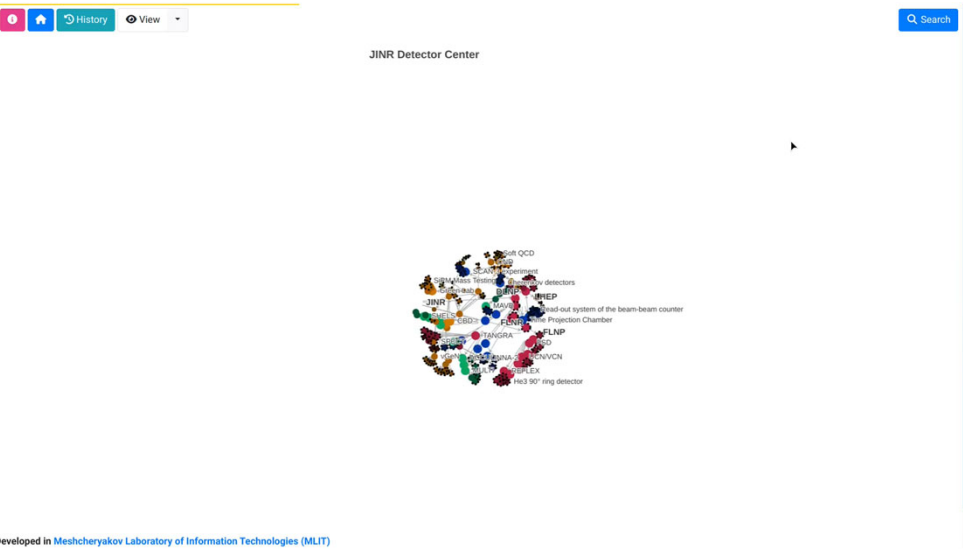


The first step of the project was to collect and organize information about detector technologies.

Work on the app started over 2 years ago.

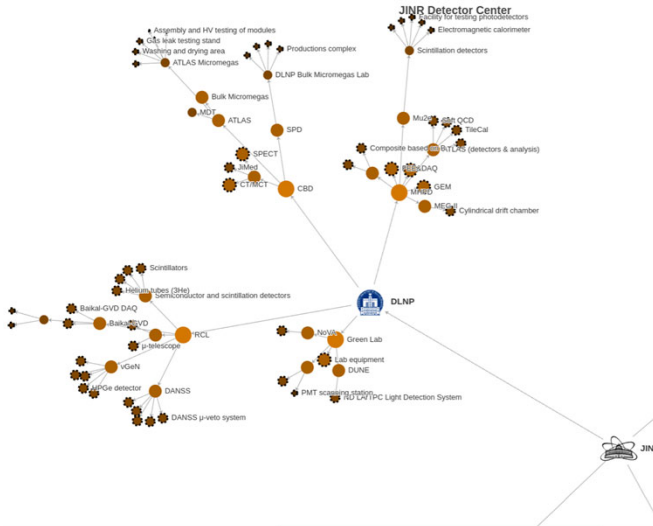


Storing the data as a graph

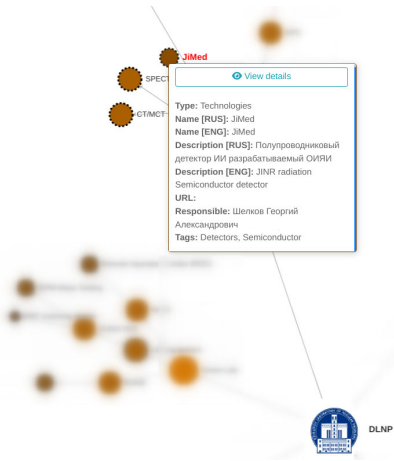


Nodes and edges

The nodes are connected by edges showing “parent-child” relationships, forming a heirarchy



Nodes with «Technologies» type



JiMed

Components and materials

Name	Tags	
GaAs	GaAs,Sensor	
CdTe	CdTe,Sensor	
CZT	Sensor,Si	

Showing 1 to 3 of 3 entries

Competencies

Name	Accessibility	Tags
FPGA development	inner	FPGA
FPGA development	outer	FPGA
FPGA testing	inner	FPGA
FPGA testing	outer	FPGA
Bonding	outer	Bonding
Readout development	inner	Electronics
Readout development	outer	Electronics
Sensor testing	inner	CZT,CdTe,GaAs,Sensor

Showing 1 to 8 of 8 entries

Equipment

Name	Accessibility	Tags
Zond station for measurements of sensor parameters	inner	Zond station,measurement of sensor parameters
Set-up for measurement charge collection efficiency	inner	Measurement of charge collecting efficiency

Showing 1 to 2 of 2 entries

Information

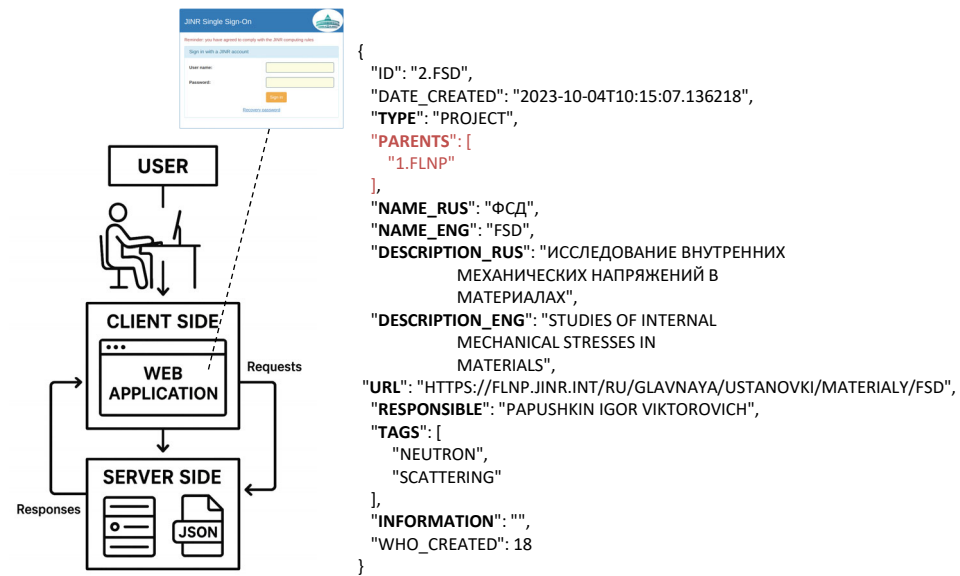
Enter ...

Powered by [Knowledgebased laboratories of Information Technology \(KIL\)](#)

Developed in Meshcheryakov Laboratory of Information Technologies (MLIT)

Tags are the key part of the keyword-based search

Web application workflow & Data storage



Search system: the key feature

The interface allows user to apply multiple filters, use semantic search and export results.

- All accumulated data is shown in the main data table on a special search page
- The search is performed on the main data table
- The search results are also displayed in the main data table

The screenshot displays a search system interface with the following components:

- Filters by conditions:** A section on the left with multiple filter groups (Type, Parameters, Components, Equipment) each containing a list of items with expand/collapse icons.
- Semantic search:** A search bar at the top right with a dropdown menu showing suggestions.
- Main data table:** A table with columns: Type, Name in English, Name in Russian, Parameters, Responses, Tags, Components, Competencies, Equipment, URL, and Actions. It lists various scientific projects and equipment.
- Footer:** Information about the system being developed in the Moscow Center for Advanced Research and Education (MIREA) and the date June 19, 2025.

Conditions & Quick filters

Type

Equals

technologies

>

x

Name in English

Equals

Baikal-GVD

<

>

x

Name in English

Equals

Baikal-GVD OM Calibration System

<

>

x

Filter by conditions

Responsible

Equals

Сиренко Анна Эркиновна

>

x

Filter by conditions

And

Or

x

Filters Active - 3

Collapse All

Show All

Clear All

Type

technologies

Name in English

Baikal-GVD OM Calibration System

Name in Russian

Байкал-ГВД Система калибровки ОМ

Parent(s)

Baikal-GVD OM

Responsible

Сиренко Анна Эркиновна

Tags

detector

gel

glass

Hamamatsu

mesh

OM

Components

Controller OM

Glass spheres VITROVEX 17"

Permited mesh for shielding

PMT Hamamatsu R7081-100

Silicone two-component gel

SubComp LPH1955 Deep-Dive Receptacle

Competencies

Registration of Vavlov-Cherenkov radiation

Equipment

No data

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Digital technology map

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Semantic search (basic version)

 Semantic search — ×

Input text

Result

detection of neutrons with a low level of sensitivity to gamma-rays

Search

Clear

most similar

least similar

 Semantic search — ×

Input text

Result

Found similar texts in:

- Node Name[ENG]: **CND**
Text: *Development of composite scintillation materials intended for neutron detection with a low level of sensitivity to gamma quanta.Simulation of detector.* description_eng 0.875
- Node Name[ENG]: **Composite based on 6Li glass**
Text: *Heterogeneous (composite) scintillator for detecting thermal neutrons based on lithium glass with low gamma-sensitivity* description_eng 0.874
- Node Name[ENG]: **NRCA**
Text: *reduce sensitivity to neutrons* components_and_materials.tags 0.843

Conclusion

The service allows to store and **search data by categories and key parameters**:

- Filter equipment by type (e.g. detectors, detector systems, technologies etc.).
- Specify technical specifications (beam energy, resolution, sensitivity, application area etc.).
- Identify which laboratories or departments have the required equipment/competencies.

For nodes may be specified:

- Responsible staff (to find their contacts in PIN),
- History of use (examples of experiments, publications),
- Conditions of access (internal/external).

In 2025 the service became part of the JINR Digital EcoSystem services (*Science* → *Technologies and Expertise* → *Map of detector technologies*).

✓ **For researchers:** to quickly find an available component or people with the right competences for a new experiment

✓ **To find industrial partners:** to clarify which technologies can be used in a joint project

✓ **For administration:** to analyse equipment utilisation and plan infrastructure development

Links



<https://detectors.jinr.ru/>
(access via JINR SSO)



<https://digital.jinr.ru/e?sid=178>
(access via JINR SSO)

A certificate of state registration of a computer program

In 2024 a certificate of state registration of a computer program was received.

РОССИЙСКАЯ ФЕДЕРАЦИЯ  ФЕДЕРАЛЬНАЯ СЛУЖБА ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ ГОСУДАРСТВЕННАЯ РЕГИСТРАЦИЯ ПРОГРАММЫ ДЛЯ ЭВМ		RU2024690973
Номер регистрации (свидетельства): 2024690973	Датa регистрации: 18.12.2024	Авторы: Ильина Анна Владимировна (RU), Пелеванко Игорь Станиславович (RU) Промообладатель: Объединенный Институт Ядерных Исследований (RU)
Номер и дата поступления заявки: 2024687896 18.11.2024	Датa публикации и номер бюллетеня: 18.12.2024 Бюл. № 12	
Название программы для ЭВМ: Программа визуализации и учёта технологий и компетенций организации		
Реферат: Программа позволяет вносить информацию о выполняемых деятельности, проектах и конкретных установках с учётом их связей друг с другом. Программа строит граф связей от организации к конкретной технологии. Визуализированный граф позволяет увидеть общую картину технологий, которыми владеет организация. Каждая технология имеет отдельное окно визуализации связанных с ней материалов, компонентов, компетенций и оборудования. Каждый узел или технологии имеют связанные с ними ключевые слова. Программа позволяет осуществлять поиск, по ключевым словам, названию узлов или технологий, а также по словам в описании. Тип ЭВМ: ПК на базе процессора Intel, AMD, x32, x64, ARM. ОС: Windows 7 и более новые версии Windows, Ubuntu 20.04 и более новые версии, MacOS 10.15 Catalina.		
Язык программирования:		Python 3.10 с использованием библиотеки Django
Объём программы для ЭВМ:		18 МБ

Future plans

1. Collect users feedback.
2. Update the service design and functions to meet users needs.
3. Improve the semantic search algorithms.
4. Continue to develop a similar base for the accelerator technology area.

Acknowledgements



We warmly thank all colleagues who take an active part in the development of the service and filling the databases and look forward to further co-operation:

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Vladislav Sharov (DLNP)
Iliia Zimin (DLNP)

Special thanks go to those who first highlighted the need for a technological map and helped design its structure and features.

Thank you for your attention!

Slides reserve

Editor's functional

Lab equipment

Edit

Delete

View details

Type: Technologies

Name [RUS]: Лабораторное оборудование

Name [ENG]: Lab equipment

Description [RUS]: Оборудование и помещения, которые мы используем в нашей лаборатории

Description [ENG]: The equipment and facilities which we use in our laboratory

URL:

ND LA-TPC Light Detection System

Components and materials

Name	ID from EDMIS	Who added	Tags	Actions
Polycarbonate backplane, bundle, a...		Vladislav Igorevich Sharov	polycarbonate	x
WLS fibers Kuraray Y-11		Vladislav Igorevich Sharov	Kuraray fiber	x
SPM Hamamatsu S13340		Vladislav Igorevich Sharov	Hamamatsu SPM	x

Showing 1 to 3 of 3 entries

add new

Competencies

Name	Accessibility	Who added	Tags	Actions
Prototyping and production of ...	inner	Vladislav Igorevich Sharov	3D design Autodesk prototyping	x

Showing 1 to 1 of 1 entries

add new

Equipment

Name	Accessibility	ID from EDMIS	Who added	Tags	Actions
Light Collection Module (LCM)	inner		Vladislav Igorevich Sharov	LCM fiber polycarbonate	x
SPM power supply	inner		Vladislav Igorevich Sharov	SPM power supply	x
Cold preamplifiers	inner		Vladislav Igorevich Sharov	preampifiers	x
ATI 64-ch ADC	inner		Vladislav Igorevich Sharov	ADC ATI	x
Micro coaxial cable	inner		Vladislav Igorevich Sharov	cable coaxial micro	x
Variable Gain Amplifier (VGA)	inner		Vladislav Igorevich Sharov	VGA	x

Showing 1 to 6 of 6 entries

add new

Find by text

Copy CSV Excel PDF Print Column visibility Highlight selected nodes

Show 10 entries

Search: 3d

Type	Name in English	Name in Russian	Parent(s)	Responsible	Tags	Components	Competencies	Equipment	URL	Actions
technologies	CT/MCT	КТ/ЭКТ	New semiconductor detectors	Шелков Георгий Александрович chelkov@jinr.ru	Medipix PixelDetectors Timepix Tomography Detector Semiconductor Prodis scintillator Mechanics Standa Hamamatsu Source Ray 3mexMesa ElectMed Cooling system Geant4 c++ python ImageJ ASTRA Toolbox Tiger 3dSlicer X-Ray	Timepix Widepix Prodis MARK Galapad Stepper motors Motor controllers X-ray source Cooling system 308kg	Pixel detector simulation Processing and analysis of data received from the detector Tomographic reconstruction 3d visualization of gamma sources and radiopharmacy	"Kalan" X-ray protected box	https://dlnp.jinr.ru/neovp/	☐
technologies	Lab equipment	Лабораторное оборудование	Green Lab		design protomat climate chamber Earth's magnetic field compensation Faraday cage Light-proof room clean room dark 3D printer CNC Milling scanning			LEIF ProtoMat 5103 Climate chamber Dark room Photopolymer 3D printer Formlabs Form 2 CNC machine 3D axis table		☐
technologies	MWPC	Многопроволочные пропорциональные камеры	ACCULINNA -2	Безбах Андрей	chambers proportional tracking Positronic xavac 3D design soldering	Разъем вакуумный электротехнический	Разработка и изготовление корпуса Разработка и изготовление сеток и катодов детектора		http://aculina.jinr.ru/a-2.html	☐

Nodes highlighting

The screenshot shows the 'Nodes' application interface. At the top, there is a toolbar with buttons for Copy, CSV, Excel, PDF, Print, and Column visibility. A red arrow points from the 'Highlight selected nodes' button in the toolbar to the 'Action' column of the last row in the table. The table has columns: Type, Name in English, Name in Russian, Parent(s), Responsible, Tags, Components, Competencies, Equipment, URL, and Action. The last row is highlighted in blue, and its 'Action' column contains a blue square icon.

Type	Name in English	Name in Russian	Parent(s)	Responsible	Tags	Components	Competencies	Equipment	URL	Action
root	JINR	ОИЯИ							http://jinr.ru/	☐
laboratory	DLNP	ДНП	JINR	Рыкова Елевна Александровна	Accelerator Beamline Electronics Experiments Lenses Particle Services				https://dlnp.jinr.ru	☐
laboratory	FLNP	ФНП	JINR							☐
laboratory	FLNR	ФНР	JINR							☐
laboratory	LHEP	ЛФБЗ	JINR							☐
project	ACCU LIN NA-2	АКЦ/ИИИ А-2	FLNR	Сепиш Криво	Accelerator Beamline Electronics Experiments Lenses Particle Services				http://accu lin.jinr.ru/	☒

