



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:

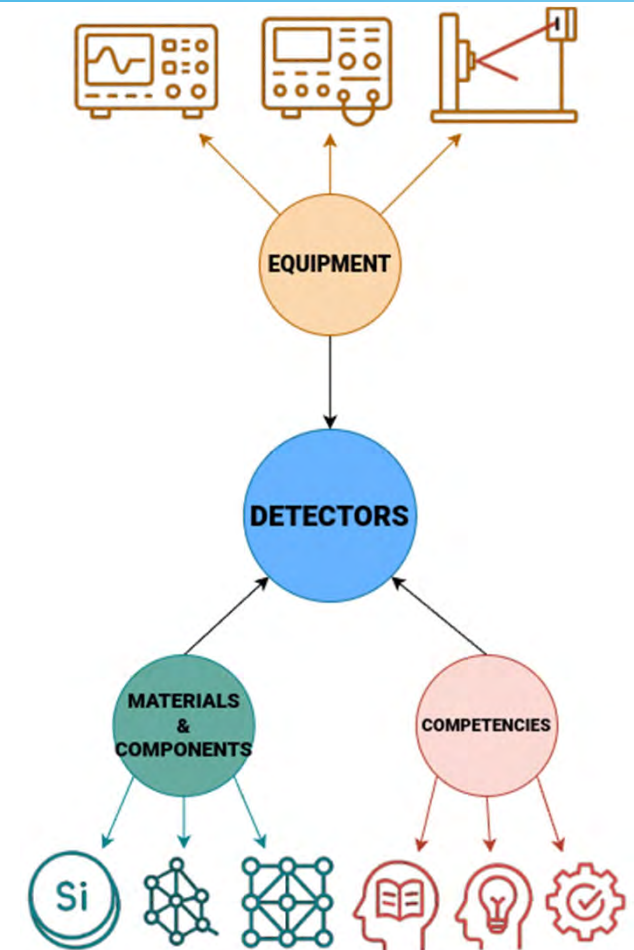
- ? Where to find the **necessary equipment**?
- ? Who has the **necessary competence**
or
Where to get the **necessary people**?
- ? And what has already been **done in detector and accelerator technology directions in the JINR**?

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.



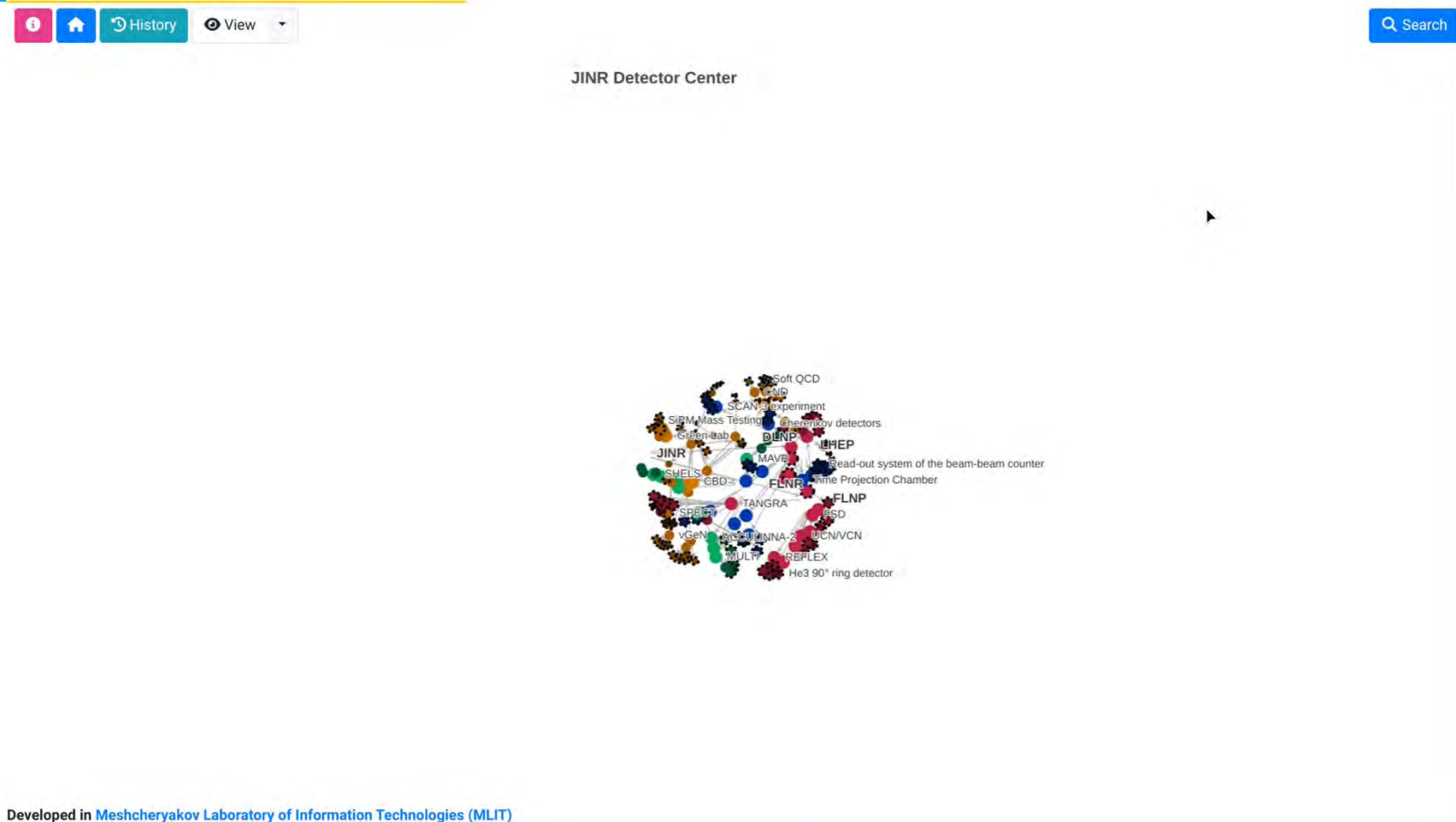
Data storage & Web application

8-15 June, 2025

Alushta-2025

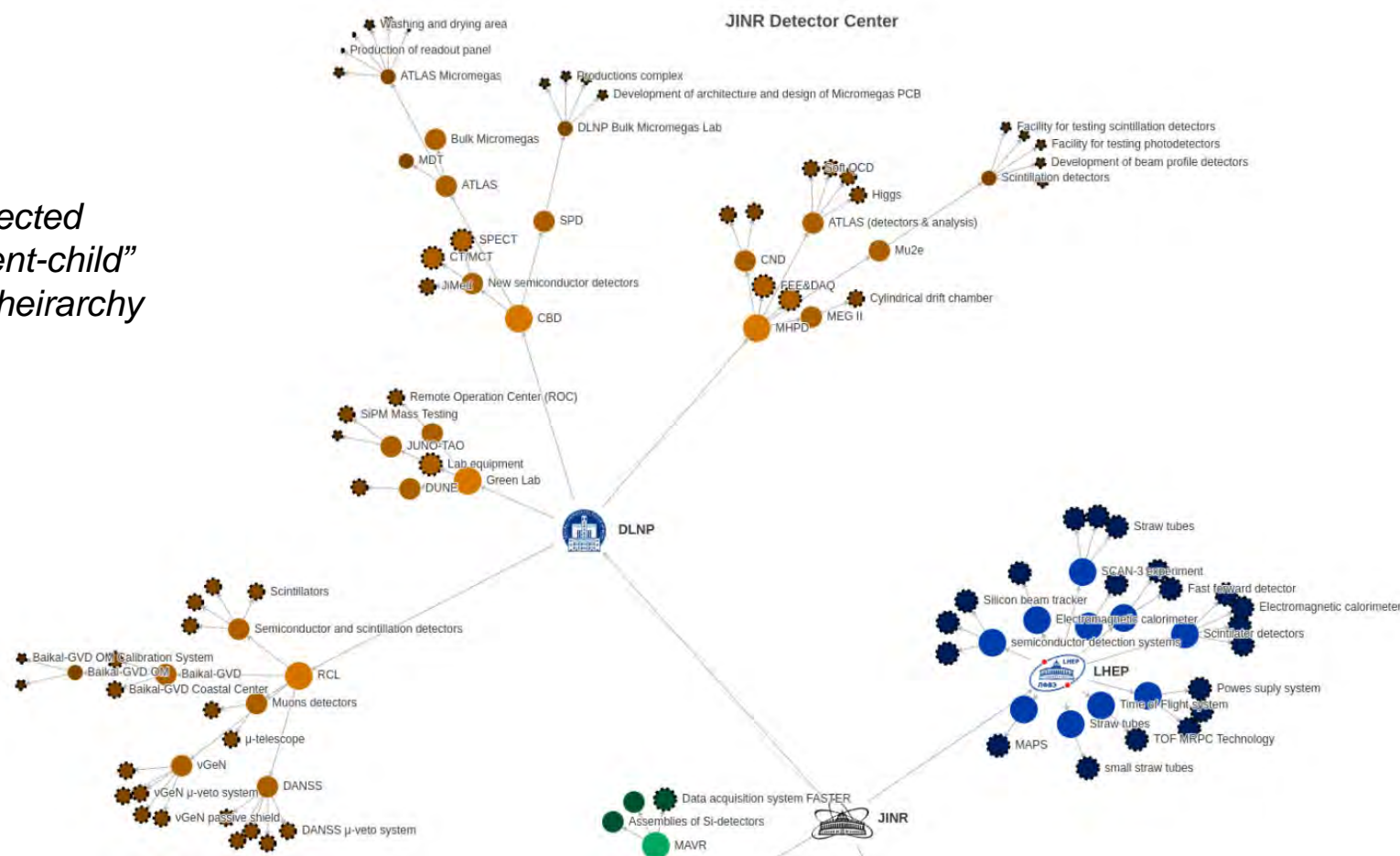
Digital technology map: detectors, accelerators,
competencies (speaker: A. Ilina)

Storing the information as a graph



Nodes & Edges

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



Nodes with “Technologies” type

The diagram shows a network of nodes represented by orange circles of varying sizes. A callout box points to a specific node labeled 'JiMed'. The callout box contains the following information:

- Type:** Technologies
- Name [RUS]:** JiMed
- Name [ENG]:** JiMed
- Description [RUS]:** Полупроводниковый детектор ИИ разрабатываемый ОИЯИ
- Description [ENG]:** JINR radiation Semiconductor detector
- URL:**
- Responsible:** Шелков Георгий Александрович
- Tags:** Detectors, Semiconductor

Below the callout box, there is a logo for DLNP (Department for Laboratory Nuclear Physics) and the text 'DLNP'.

Tags are the key part of the keyword-based search

The screenshot shows the 'JiMed' web application interface. It has a blue header with the 'JiMed' logo. The main content area is divided into three sections: 'Components and materials', 'Competencies', and 'Equipment'. Each section contains a table of data.

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

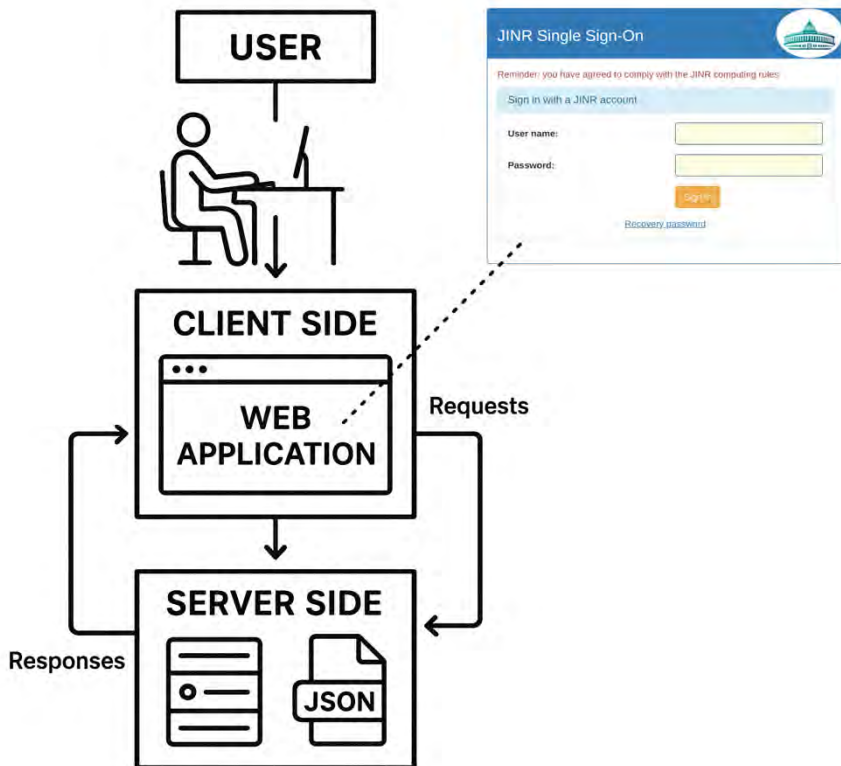
Showing 1 to 2 of 2 entries

Information

Enter ...

Developed in Meshcheryakov Laboratory of Information Technologies (MLIT)

Web application workflow & Data storage



```
{  
  "ID": "2.FSD",  
  "DATE_CREATED": "2023-10-04T10:15:07.136218",  
  "TYPE": "PROJECT",  
  "PARENTS": [  
    "1.FLNP"  
  ],  
  "NAME_RUS": "ФСД",  
  "NAME_ENG": "FSD",  
  "DESCRIPTION_RUS": "ИССЛЕДОВАНИЕ ВНУТРЕННИХ  
    МЕХАНИЧЕСКИХ НАПРЯЖЕНИЙ В  
    МАТЕРИАЛАХ",  
  "DESCRIPTION_ENG": "STUDIES OF INTERNAL  
    MECHANICAL STRESSES IN  
    MATERIALS",  
  "URL": "HTTPS://FLNP.JINR.INT/RU/GLAVNAYA/USTANOVKI/MATERIALY/FSD",  
  "RESPONSIBLE": "PAPUSHKIN IGOR VIKTOROVICH",  
  "TAGS": [  
    "NEUTRON",  
    "SCATTERING"  
  ],  
  "INFORMATION": "",  
  "WHO_CREATED": 18  
}
```

Search system: the key feature

8-15 June, 2025

Alushta-2025

Digital technology map: detectors, accelerators,
competencies (speaker: A. Ilina)

10

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

All accumulated data in the database is presented on the search page in a table

The main table with all accumulated data in the database is located under the filter panels at the bottom of the page

The search is performed on the main data table
The search results are also displayed in the main data table

Filters

The main data table

Filter by conditions

Semantic search

Filters Active - 0

Type

Name in English

Name in Russian

Parent(s)

Responsible

Tags

Components

Competencies

Equipment

URL

Actions

Copy

CSV

Excel

PDF

Print

Column visibility

Highlight selected nodes

Show 10 entries

Search:

Type	Name in English	Name in Russian	Parent(s)	Responsible	Tags	Components	Competencies	Equipment	URL	Actions
root	JINR	ОИЯИ							http://jinr.ru	
laboratory	DLNP	ЛДП	JINR	Якушев Евгений Александрович	Atrophytic, Basal, DarkMatter, Detectors, Linear, Tomography, neutrino				https://ldnp.jinr.ru	
laboratory	FLNP	ЛФН	JINR							
laboratory	FLNR	ЛФР	JINR							
laboratory	LHEP	ЛФБЗ	JINR							
project	ACCULINNA-2	АКУЛИНА-2	FLNR	Сергей Крупо	exotic, nuclei, radioactive, beams, cryogenic, targets, beam, diagnostic				http://aculina.jinr.ru	
sublaboratory	CBD	НЗОВП	DLNP	Гусakov Алексей Вячеславович, avg@jint.ru	Linear, Mirap, Microtarget, SPD, Timepix				https://ldnp.jinr.ru/nzovp/home	
detector	Cherenkov detectors	ЧРЕНОВСКИЕ ДЕТЕКТОРЫ	LHEP	Юренин Владимир Иванович	Cherenkov light					
project	CORSET	КОРСЕТ	FLNR							
project	GRAND	ГНС-3	FLNR	Утенков Владимир Климентьевич						

Showing 1 to 10 of 189 entries

Previous

1

2

3

4

5

...

19

Next

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Selected Filters in SearchPanels

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8-15 June, 2025

Filter by conditions

The screenshot shows a search filter interface. On the left is a blue sidebar with the word "And" and a vertical list of "x" icons. The main area contains several filter conditions, each with a red-bordered field, a green-bordered operator, and a blue-bordered value field. The conditions are: 1. Type Equals technologies. 2. An "Or" group containing: Name in English Equals Baikal-GVD, and Name in English Equals Baikal-GVD OM Calibration System. 3. Responsible Equals Сиренко Анна Эркиновна. Each condition has a blue "Filter by conditions" button below it. To the right of the filter area is a control panel with a 3x3 grid of blue buttons: the top row has ">" and "x"; the middle row has "<", ">", and "x"; the bottom row has "<", ">", and "x". Below this grid is a "Reset" button.

And	Type	Equals	technologies	>	x		
	Or	Name in English	Equals	Baikal-GVD	<	>	x
		Name in English	Equals	Baikal-GVD OM Calibration System	<	>	x
	x	Filter by conditions					
	Responsible	Equals	Сиренко Анна Эркиновна	>	x		
x	Filter by conditions						

Type	
detector	11
detector system	12
laboratory	4
project	41
root	1
sublaboratory	4

Parent(s)	
ACCULINNA-2	3
ATLAS	3
ATLAS (detectors & analysis)	4
ATLAS Micromegas	6
Baikal-GVD	3
Baikal-GVD OM	2

Components	
No data	111
0.1 mm проволока из W (Au)	1
10 um wires	6
10B4C	1
12-ти канальная плата АЦП	1
12-ти канальный разветвитель сигналов	1

Name in English	
10B-RPC	1
10B-straw detector	1
3He-PSD	1
3He-MWC	1
ACCULINNA-2	1
Assemblies of Si-detectors	1

Responsible	
No data	33
Дряблов Дмитрий	2
Еник Темур	1
Сергей Кичанов	1
Сухов Евгений	1
Тишевский Алексей	1

Competencies	
No data	114
"Отжи" нейтронной трубки	1
10B-RPC producing	1
10B4C magnetron sputtering (<350C)	1
3D modeling (Autodesk Inventor)	1
3d modeling of passive shield	2

Name in Russian	
No data	25
10B-ППРК	1
12-детекторный CsI(Tl) сцинтилляционный спектрометр полной геометрии	1
3He-МПК	1
ATLAS	1
ATLAS (детекторы и анализ данных)	1

Tags	
No data	46
#CAEN	1
#laboratory neutron source	2
#magnetron sputtering thin film	1
#pulse reactor	2
0.01 mbar	1

Equipment	
No data	128
"Kalan" X-ray protected box	1
137Cs	1
22Na	1
3D axis table	1
3D-принтеры для создания элементов воздушной системы охлаждения	1

Filters Active - 4

[Collapse All](#) [Show All](#) [Clear All](#)

Type

detector 1

Parent(s)

Baikal-GVD 1

Name in English

Baikal-GVD OM 1

Cherenkov detectors 0

Responsible

Круглов Максим Викторович 1

Юревич Владимир Иванович 1

Name in Russian

Байкал-ГВД OM 1

Tags

Atrophysic 1

Baikal 1

Detectors 1

Hamamatsu 1

neutrino 1

детектор 1


Selected Filters in SearchPanels

Type: detector

Name in English: Baikal-GVD OM Cherenkov detectors

Responsible: Круглов Максим Викторович

Semantic search

 Semantic search — ×


Input text

Result

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

Search

Clear

 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

most similar

least similar

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)

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:

Alexey Aparin (LHEP)
Andrey Bezbakh (FLNR)
Karen Bunyatov (DLNP)
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Polina Filonchik (FLNP)
Kirill Gikal (FLNR)
Semen Gursky (DLNP)
Alexey Kuznetsov (DLNP)

Igor Lensky (Department of
Innovation And Intellectual Property)
Alexandr Nezvanov (FLNP)
Maria Patsyuk (LHEP)
Igor Pelevanyuk (MLIT)
Maria Petrova (FLNP)
Vladislav Rozhkov (DLNP)
Vladislav Sharov (DLNP)
Rostislav Sotenskii (DLNP)
Sergei Stukalov (FLNR)
Ilia 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

8-15 June, 2025

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ion

NO-

4D

NoVA

+ Child

Edit

Delete

Type: Project

Name [RUS]:

Name [ENG]: NoVA

Description [RUS]: Эксперимент NOvA (Фермилаб, США) – нейтринный ускорительный эксперимент, основными целями которого являются изучение иерархии масс нейтрино и нарушения CP инвариантности в лептонном секторе. Для регистрации и измерения потоков нейтрино и

ND LArTPC Light Detection System

Components and materials

Name	ID from EDMS	Who added	Tags	Actions
Polycarbonate backplane, bundler, s...		Vladislav Igorevich Sharov	polycarbonate	x
WLS fibers Kuraray Y-11		Vladislav Igorevich Sharov	Kuraray fiber	x
SiPM Hamamatsu S13360		Vladislav Igorevich Sharov	Hamamatsu SiPM	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 EDMS	Who added	Tags	Actions
Light Collection Module (LCM)	inner		Vladislav Igorevich Sharov	LCM fiber polycarbonate	x
SiPM power supply	inner		Vladislav Igorevich Sharov	SiPM power supply	x
Cold preamplifiers	inner		Vladislav Igorevich Sharov	preamplifiers	x
AFI 64-ch ADC	inner		Vladislav Igorevich Sharov	ADC AFI	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

8-15 June, 2025

Alushta-2025
Digital technology map: detectors, accelerators,
competencies (speaker: A. Ilina)

Copy CSV Excel PDF Print Column visibility Highlight selected nodes

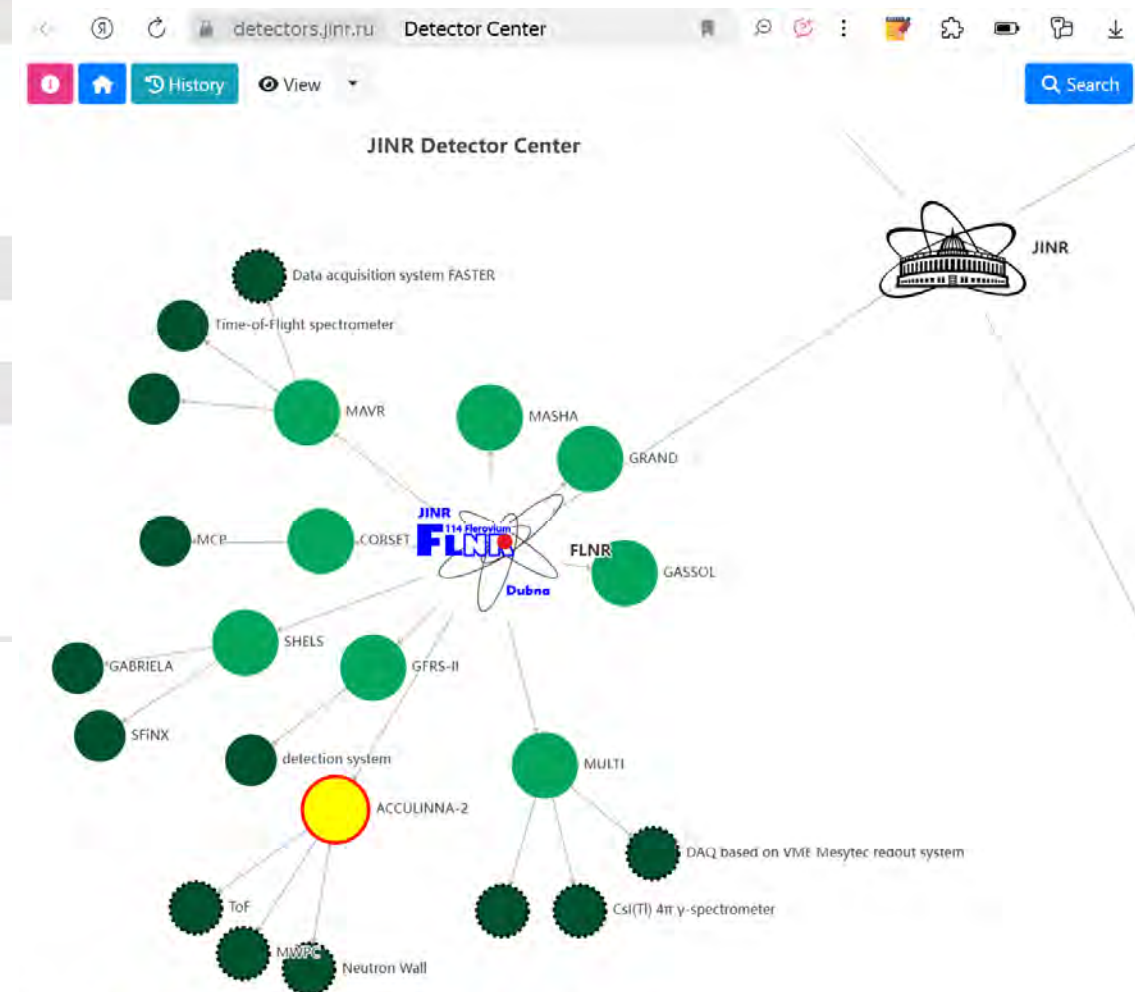
Show 10 entries

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 ЭлтехМед EltechMed Cooling system Geant4 c++ python ImageJ ASTRA Toolbox Tiger 3dSlicer X-Ray	Timepix Widepix Prodis MARK Galapad Steper motors Motor controllers X-ray source Cooling system JIMed	Pixel detector simulation Processing and analysis of data received from the detector Tomographic reconstruction 3d visualisation of gamma sources and radiopharmacy	"Kalan" X-ray protected box	https://dlnp.jinr.ru/neovp/	<input type="checkbox"/>
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			LPKF ProtoMat S103 Climate chamber Dark room Photopolymer 3D printer Formlabs Form 2 CNC machine 3D axis table		<input type="checkbox"/>
technologies	MWPC	Многопроводочные пропорциональные камеры	ACCULINNA-2	Безбах Андрей	chambers proportional tracking Positronic xavac 3D design soldering	Разъем вакуумный многостырьковый	Разработка и изготовление корпуса Разработка и изготовление сеток и катодов детектора		http://aculina.jinr.ru/a-2.html	<input type="checkbox"/>

2025

Copy CSV Excel PDF Print Column visibility Highlight selected nodes										
Show 10 entries										
Type	Name in English	Name in Russian	Parent(s)	Responsible	Tags	Components	Competencies	Equipment	URL	Actions
root	JINR	ОИЯИ							http://jinr.ru/	<input type="checkbox"/>
laboratory	DLNP	ЛЯП	JINR	Якушев Евгений Александрович	Atrophysic Baikal DarkMatter Detectors Linac Tomography neutrino				https://dlnp.jinr.ru	<input type="checkbox"/>
laboratory	FLNP	ЛНФ	JINR							<input type="checkbox"/>
laboratory	FLNR	ЛЯР	JINR							<input type="checkbox"/>
laboratory	LHEP	ЛФБЭ	JINR							<input type="checkbox"/>
project	ACCULINNA-2	АКУЛИНА-2	FLNR	Сергей Крупко	exotic nuclei radioactive beams cryogenic targets beam diagnostic				http://aculina.jinr.ru/	<input checked="" type="checkbox"/>



Developed in Meshcheryakov Laboratory of Information Technologies (MLIT)

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

<p>РОССИЙСКАЯ ФЕДЕРАЦИЯ</p> 		<p>RU2024690973</p>
<p>ФЕДЕРАЛЬНАЯ СЛУЖБА ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ ГОСУДАРСТВЕННАЯ РЕГИСТРАЦИЯ ПРОГРАММЫ ДЛЯ ЭВМ</p>		
<p>Номер регистрации (свидетельства): 2024690973 Дата регистрации: 18.12.2024 Номер и дата поступления заявки: 2024687896 18.11.2024 Дата публикации и номер бюллетеня: 18.12.2024 Бюл. № 12</p>		<p>Автор(ы): Ильина Анна Владимировна (RU), Пелеванюк Игорь Станиславович (RU) Правообладатель(и): Объединенный Институт Ядерных Исследований (RU)</p>
<p>Название программы для ЭВМ: Программа визуализации и учёта технологий и компетенций организации</p> <p>Реферат: Программа позволяет вносить информацию о направлениях 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 технология 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.</p> <p>Язык программирования: Python 3.10 с использованием библиотеки Django</p> <p>Объем программы для ЭВМ: 18 МБ</p>		

8-15 June, 2025

Alushta-2025

Digital technology map: detectors, accelerators,
competencies (speaker: A. Ilina)