# Digital technology map: detectors, accelerators, competencies

**Anna Ilina[1,a] et al.**

[a]annailina@jinr.ru

[1]*Meshcheryakov Laboratory of Information Technologies, Joint Institute for Nuclear Research*

# 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

AYSS JINR

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**?

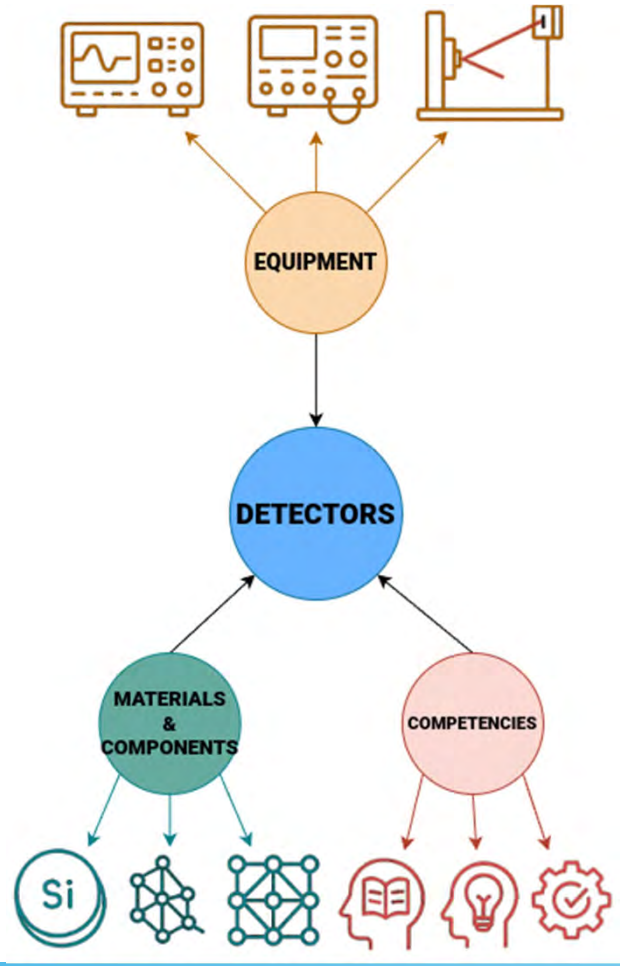
? And what has already been **done in detector and accelerator technology directions in the JINR**?

# First step: a map of detectors technologies

AYSS JINR

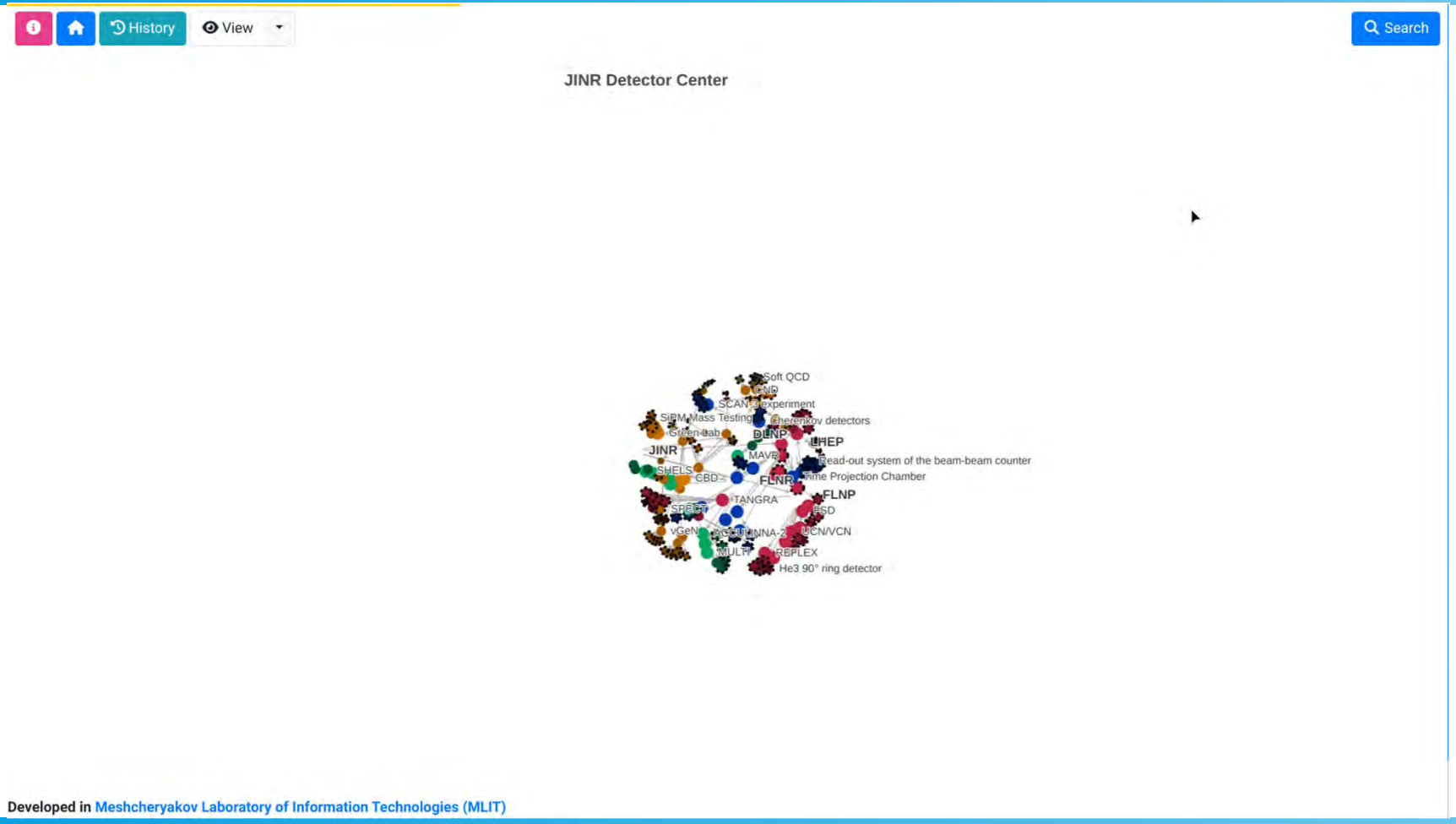
The first step of the project was to collect and organize information about detector technologies.

Work on the app started over 2 years ago.



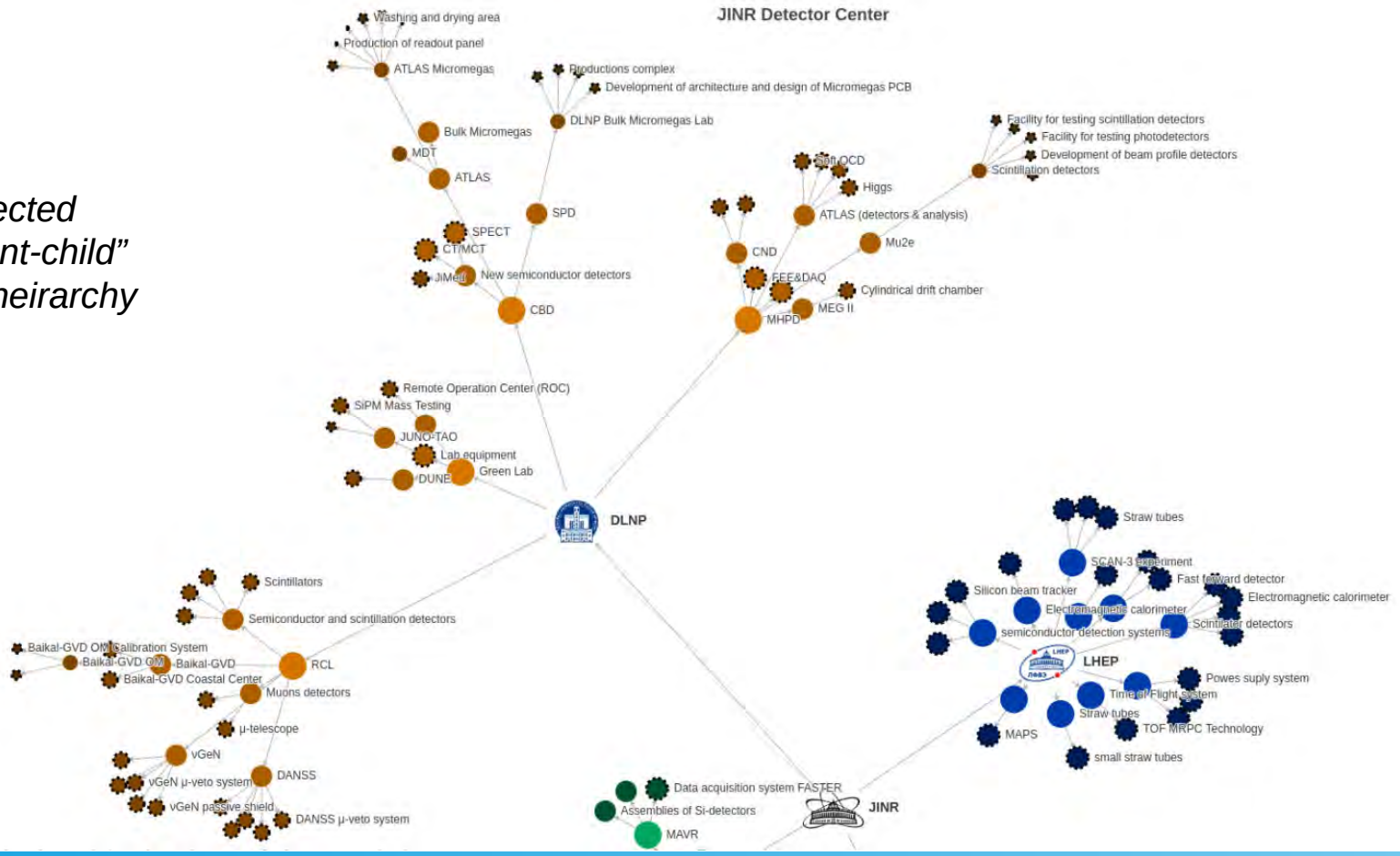
# Data storage & Web application

# Storing the information as a graph

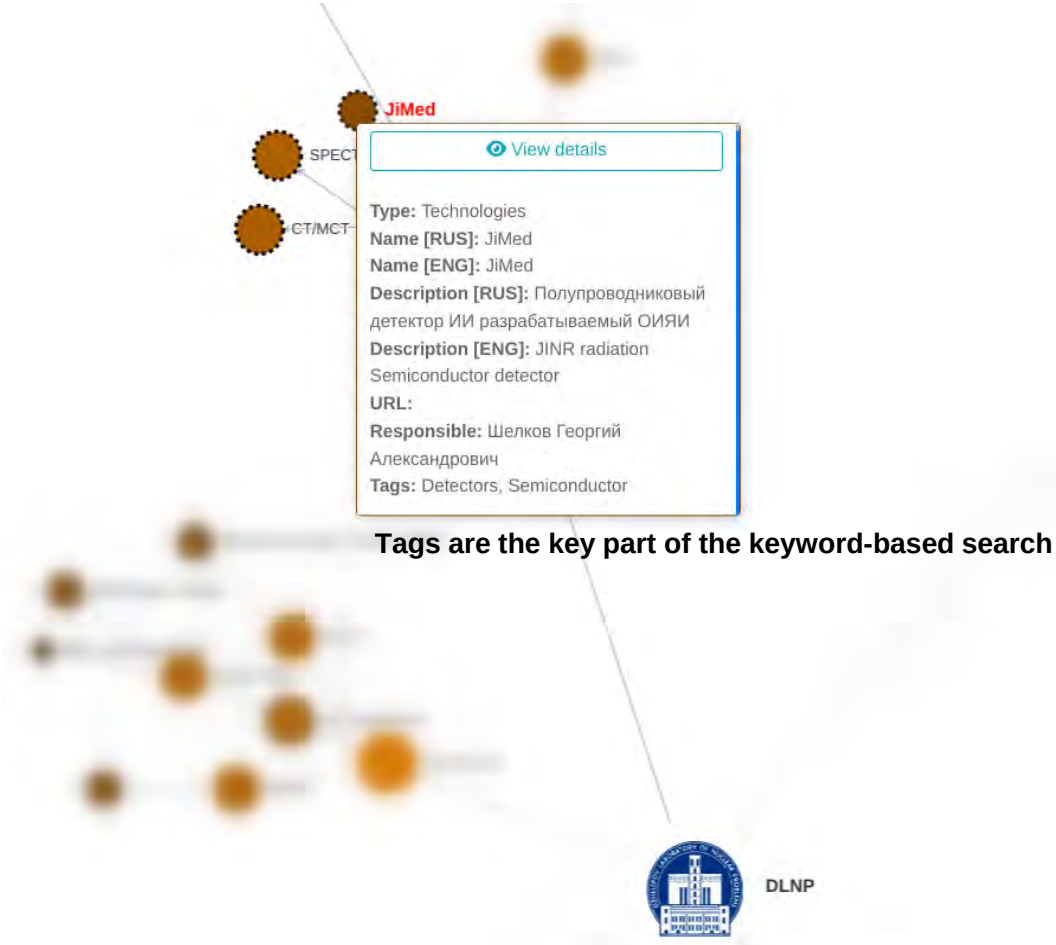


# Nodes & Edges

*The nodes are connected by edges showing "parent-child" relationships, forming a heirarchy*

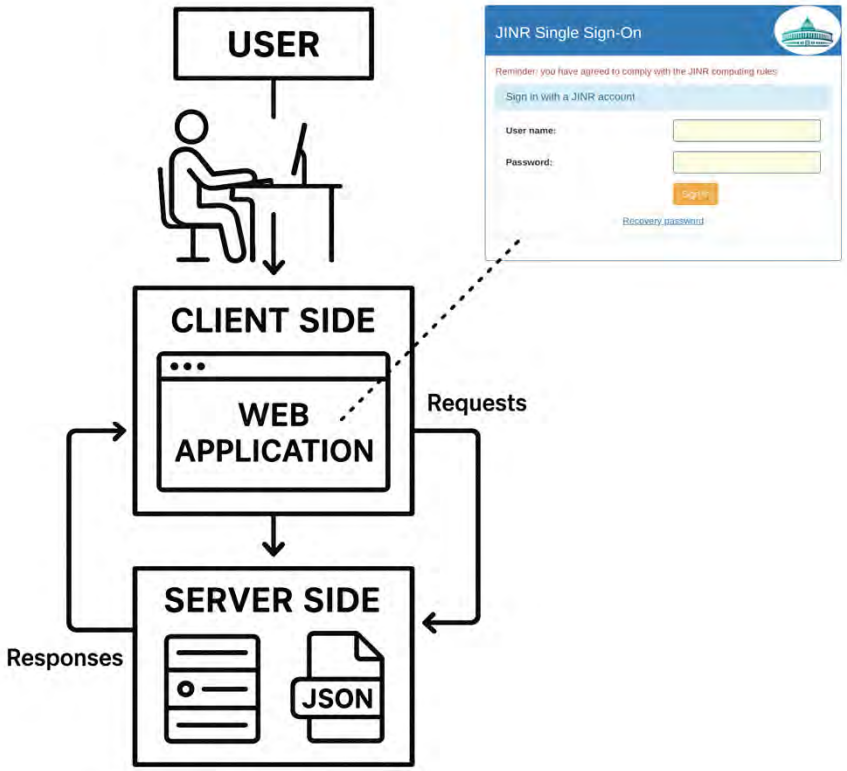


# Nodes with “Technologies” type




**Tags are the key part of the keyword-based search**

# Web application workflow & Data storage





```
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    "TYPE": "PROJECT",
    "PARENTS": [
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    ],
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    "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

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

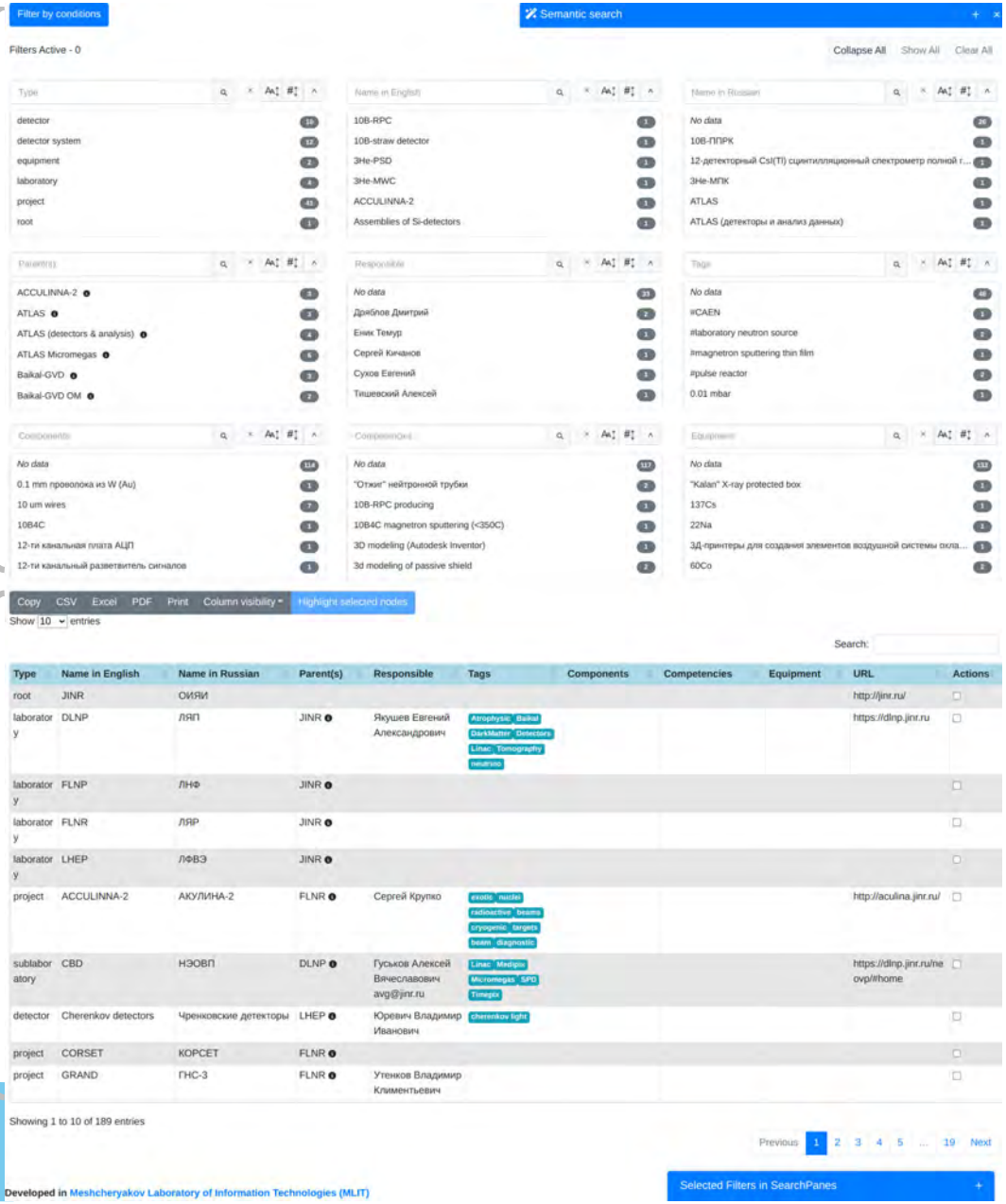
All accumulated data in the database is presented on the search page in a table

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

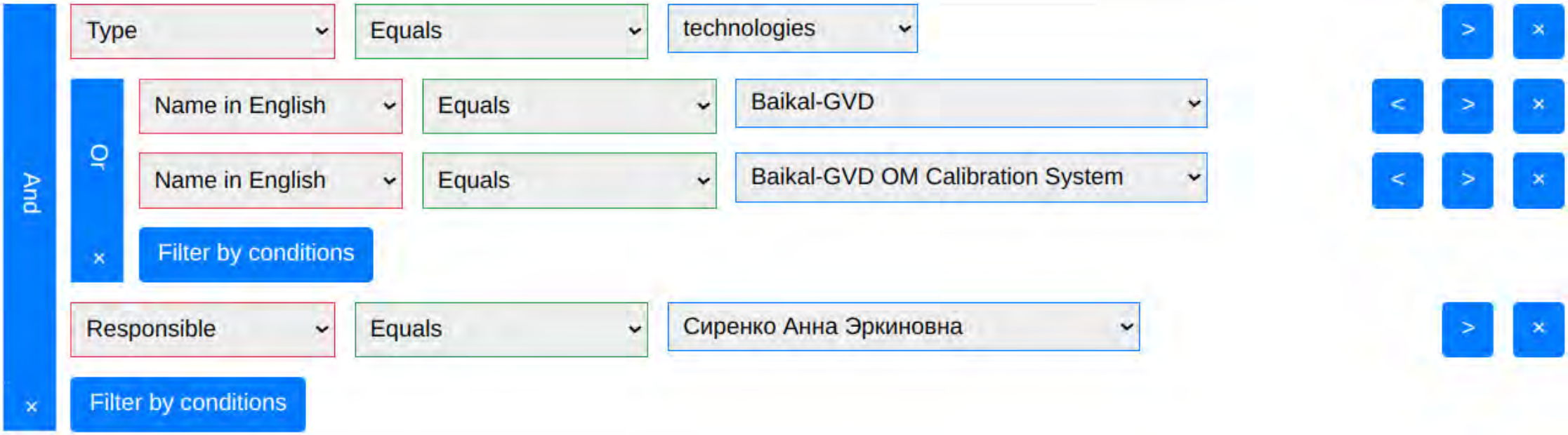
The search is performed on the main data table
The search results are also displayed in the main data table

Filters

The main data table



# Filter by conditions



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

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

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

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

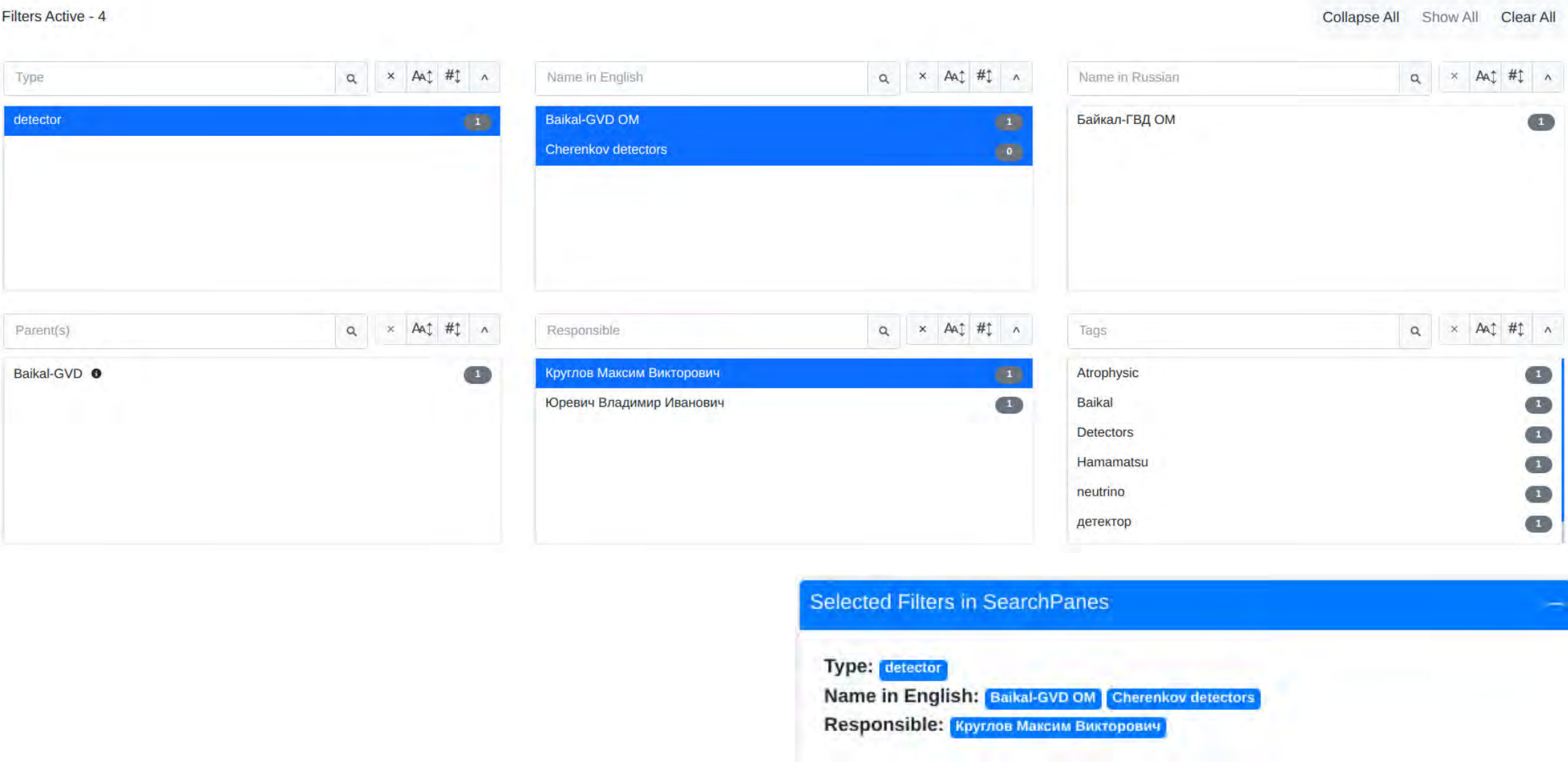
| Responsible | |
|---|---|
| *No data* | 33 |
| Дряблов Дмитрий | 2 |
| Еник Темур | 1 |
| Сергей Кичанов | 1 |
| Сухов Евгений | 1 |
| Тишевский Алексей | 1 |

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

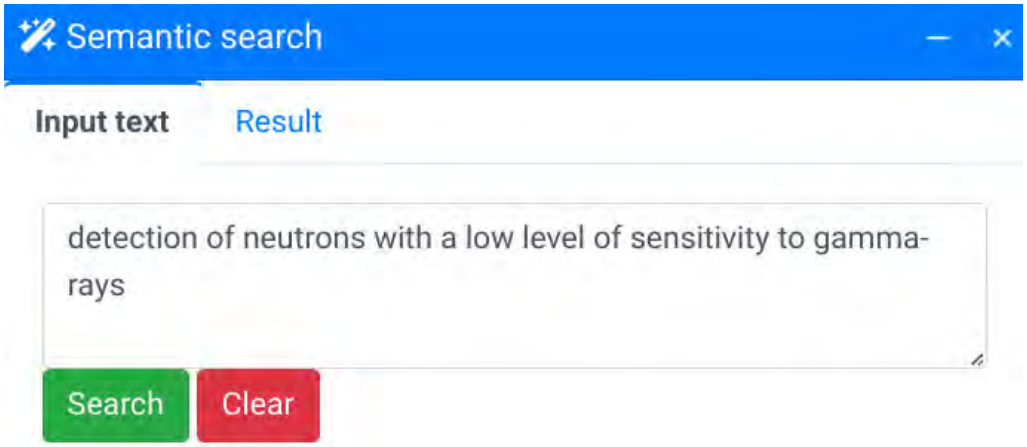
| Components | |
|---|---|
| *No data* | 111 |
| 0.1 mm проволока из W (Au) | 1 |
| 10 um wires | 6 |
| 10B4C | 1 |
| 12-ти канальная плата АЦП | 1 |
| 12-ти канальный разветвитель сигналов | 1 |

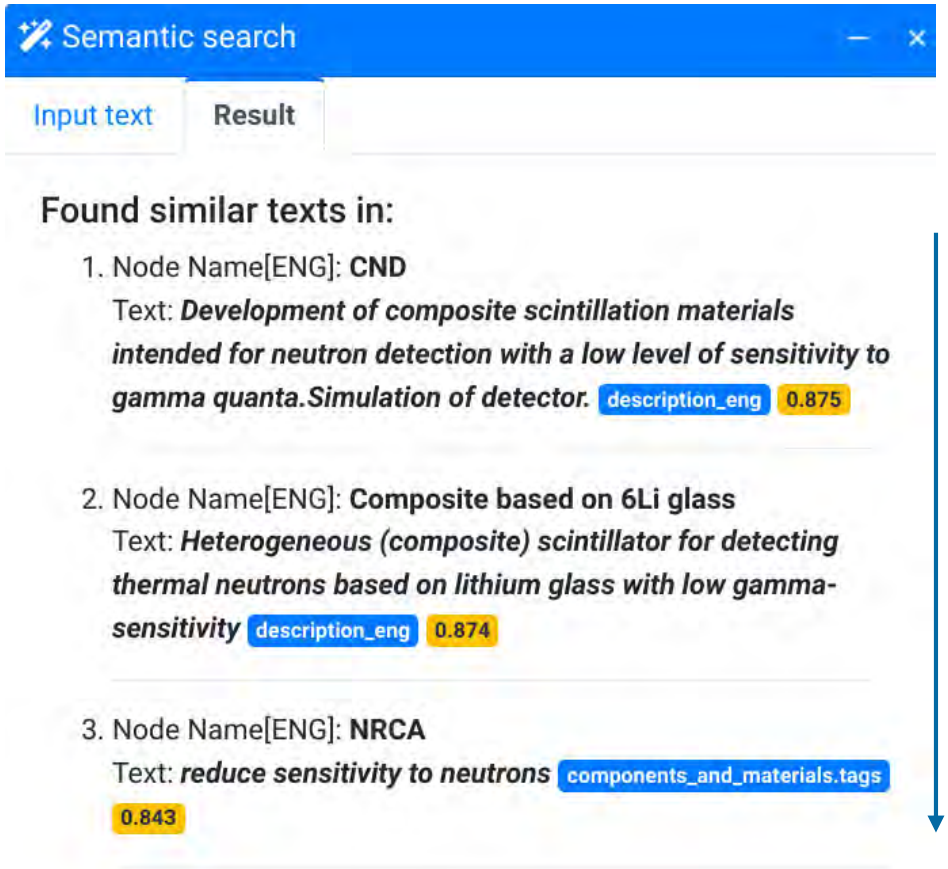
| Competencies | |
|---|---|
| *No data* | 114 |
| "Отжиг" нейтронной трубки | 1 |
| 10B-RPC producing | 1 |
| 10B4C magnetron sputtering (<350C) | 1 |
| 3D modeling (Autodesk Inventor) | 1 |
| 3d modeling of passive shield | 2 |

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


Filters Active - 4
Collapse All
Show All
Clear All
Type
detector 1
Name in English
Baikal-GVD OM 1
Cherenkov detectors 0
Name in Russian
Байкал-ГВД ОМ 1
Parent(s)
Baikal-GVD 1
Responsible
Круглов Максим Викторович 1
Юревич Владимир Иванович 1
Tags
Atrophysic 1
Baikal 1
Detectors 1
Hamamatsu 1
neutrino 1
детектор 1
Selected Filters in SearchPanes
Type: detector
Name in English: Baikal-GVD OM Cherenkov detectors
Responsible: Круглов Максим Викторович

# Semantic search



# 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

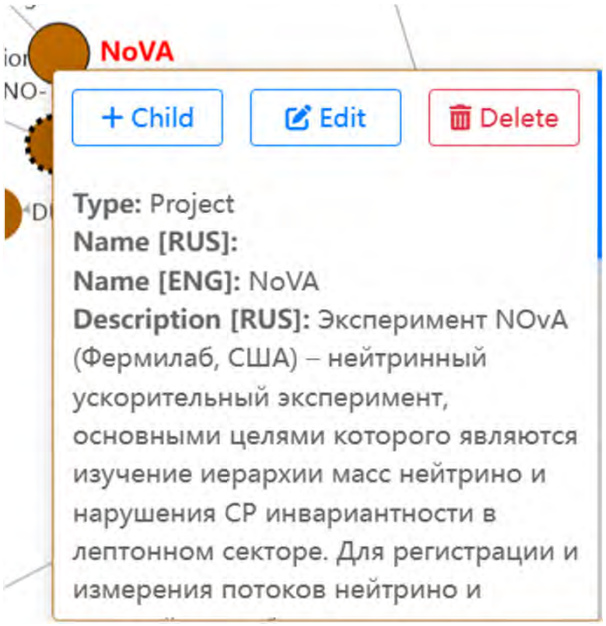
**We warmly thank all colleagues who take an active part in the development of the service and filling the databases and look forward to further co-operation:**

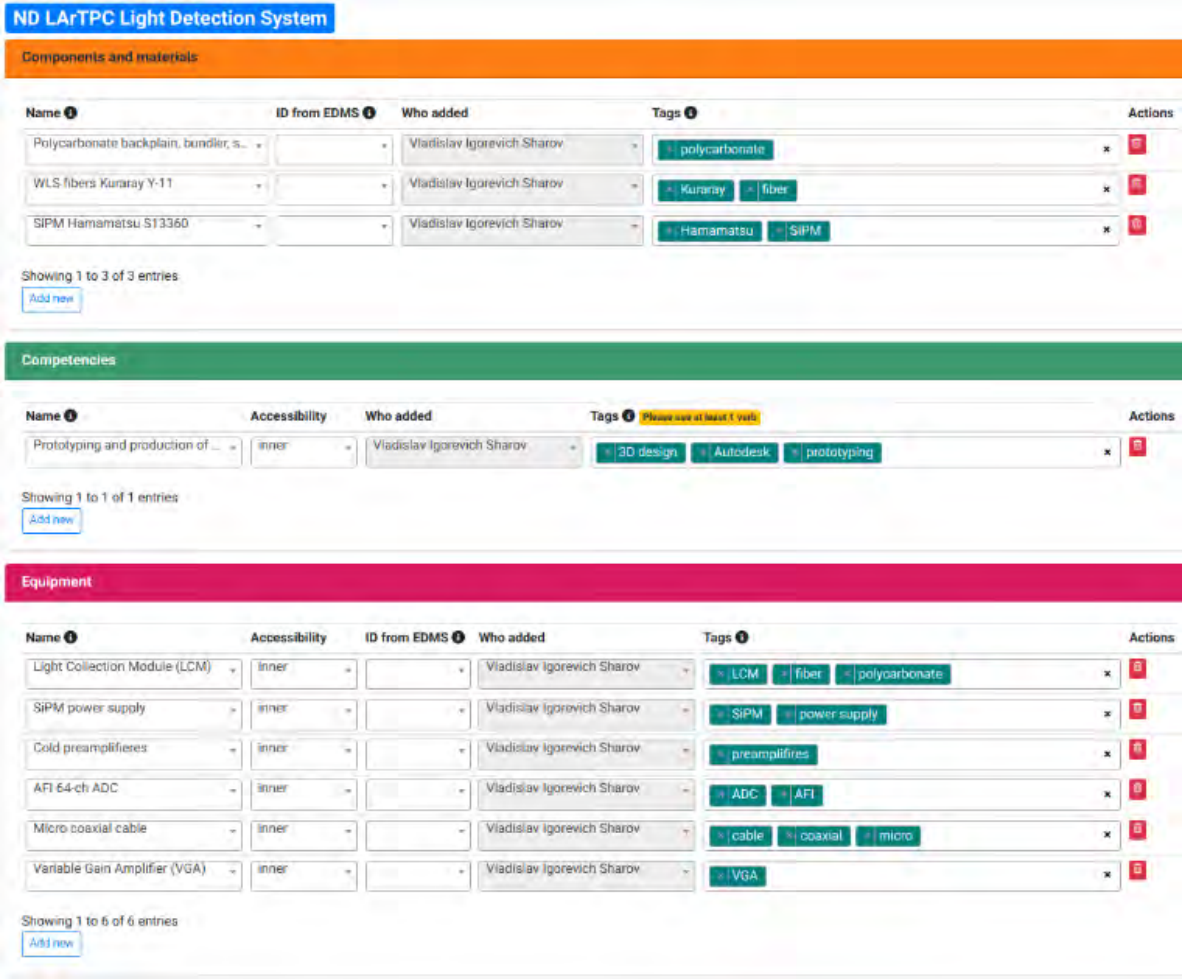
Alexey Aparin (LHEP)
Andrey Bezbakh (FLNR)
Karen Bunyatov (DLNP)
Artem Bystryakov (DLNP)
Sergei Fateev (DLNP)
Nikita Fedorov (FLNP)
Polina Filonchik (FLNP)
Kirill Gikal (FLNR)
Semen Gursky (DLNP)
Alexey Kuznetsov (DLNP)
Igor Lensky (Department of Innovation And Intellectual Property)
Alexandr Nezvanov (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


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 backplain, bundler, s...
Vladislav Igorevich Sharov
polycarbonate
WLS fibers Kuraray Y-11
Kuraray
fiber
SiPM Hamamatsu S13360
Hamamatsu
SiPM
Showing 1 to 3 of 3 entries
Add new
Competencies
Accessibility
Prototyping and production of ...
inner
3D design
Autodesk
prototyping
Showing 1 to 1 of 1 entries
Equipment
Light Collection Module (LCM)
LCM
SiPM power supply
power supply
Cold preamplifieres
preamplifires
AFI 64-ch ADC
ADC
AFI
Micro coaxial cable
cable
coaxial
micro
Variable Gain Amplifier (VGA)
VGA
Showing 1 to 6 of 6 entries

Copy CSV Excel PDF Print Column visibility Highlight selected nodes

Show 10 entries

Search: 3d

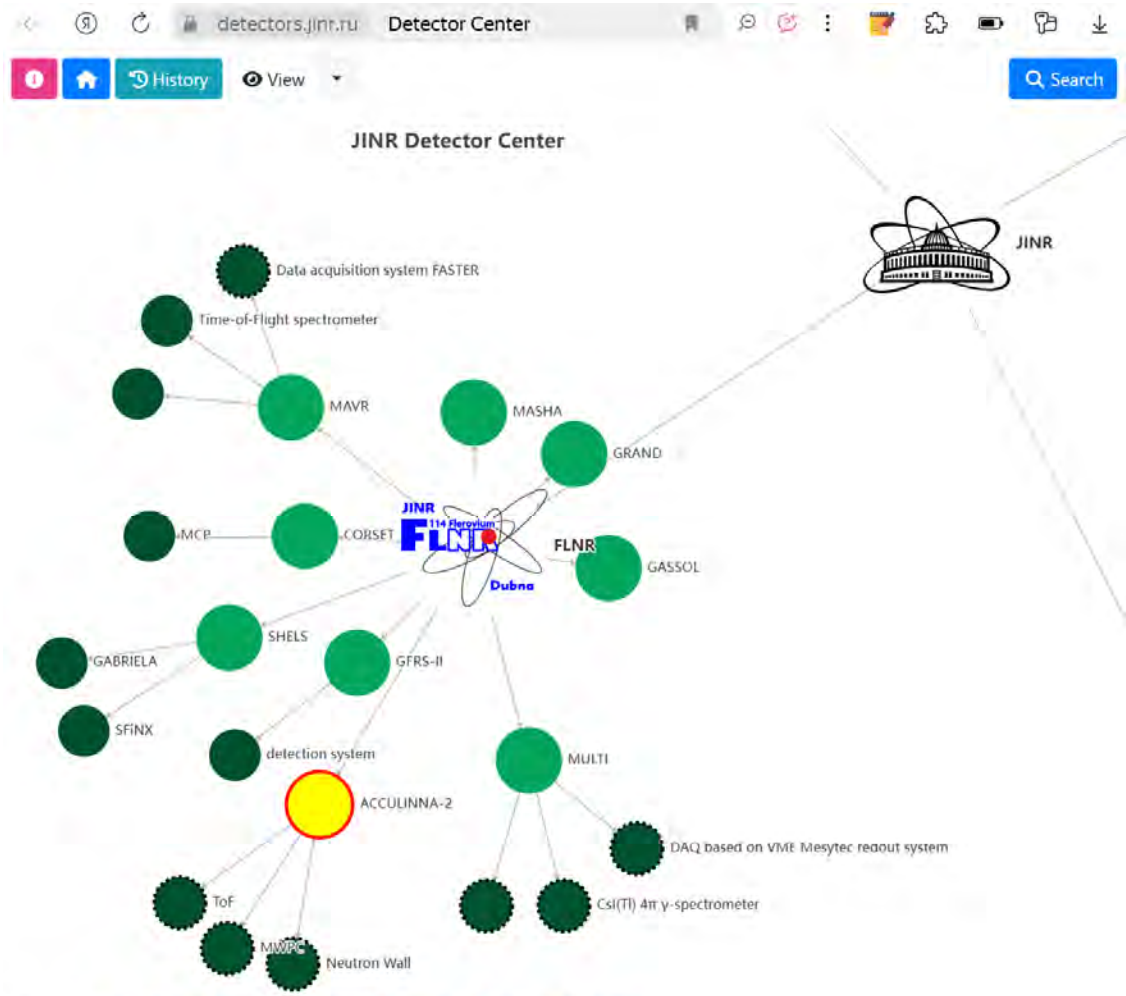
| Type | Name in English | Name in Russian | Parent(s) | Responsible | Tags | Components | Competencies | Equipment | URL | Actions |
|---|---|---|---|---|---|---|---|---|---|---|
| technologies | CT/MCT | КТ/ЭКТ | New semiconductor detectors | Шелков Георгий Александрович chelkov@jinr.ru | Medipix, 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/ | |
| 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 scaning | | | LPKF ProtoMat S103, 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 вакуумны многоштырьковый | Разработка и изготовление корпуса, Разработка и изготовление сеток и катодов детектора | | http://aculina.jinr.ru/a-2.html | |

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 | ЛЯП | JINR | Якушев Евгений Александрович | Atrophysic, Baikal, DarkMatter, Detectors, Linac, Tomography, neutrino | | | | https://dlnp.jinr.ru | |
| laboratory | FLNP | ЛНФ | JINR | | | | | | | |
| laboratory | FLNR | ЛЯР | JINR | | | | | | | |
| laboratory | LHEP | ЛФВЭ | JINR | | | | | | | |
| project | ACCULINNA-2 | АКУЛИНА-2 | FLNR | Сергей Крупко | exotic, nuclei, radioactive, beams, cryogenic, targets, beam, diagnostic | | | | http://acculinna.jinr.ru/ | |




Developed in Meshcheryakov Laboratory of Information Technologies (MLIT)

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

РОССИЙСКАЯ ФЕДЕРАЦИЯ

RU2024690973

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

**ГОСУДАРСТВЕННАЯ РЕГИСТРАЦИЯ ПРОГРАММЫ ДЛЯ ЭВМ**

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**

Автор(ы):
**Ильина Анна Владимировна (RU),**
**Пелеванюк Игорь Станиславович (RU)**
Правообладатель(и):
**Объединенный Институт Ядерных Исследований (RU)**

Название программы для ЭВМ:
**Программа визуализации и учёта технологий и компетенций организации**

**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 материатов, компонентов, компетенций и оборудования. Каждый узел или технология имеют связанные с ними ключевые слова. Программа позволяет осу ществлять 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

**Объем программы для ЭВМ:** 18 МБ