



MPD software development status

Rogachevsky Oleg
for MPD collaboration

XIII MPD collaboration meeting
24.04.2024
Dubna

Current tasks in the software development

News in the reports:

Slavomir Hnatic

Integration of JupyterLab and ACTS tracker into MPDROOT

Nikita Baldin

The issue of functional division of automated systems in experimental facilities

Sergey Sergeev

Central DCS. Run Control Concept

Alexander Krylov

MPD Event Display - road to the real experiment

Valentin Kuzmin

Misalignment influence on the track reconstruction in MPD TPC

Ivonne Maldonado

Simulation of a mini beam-beam detector for the MPD

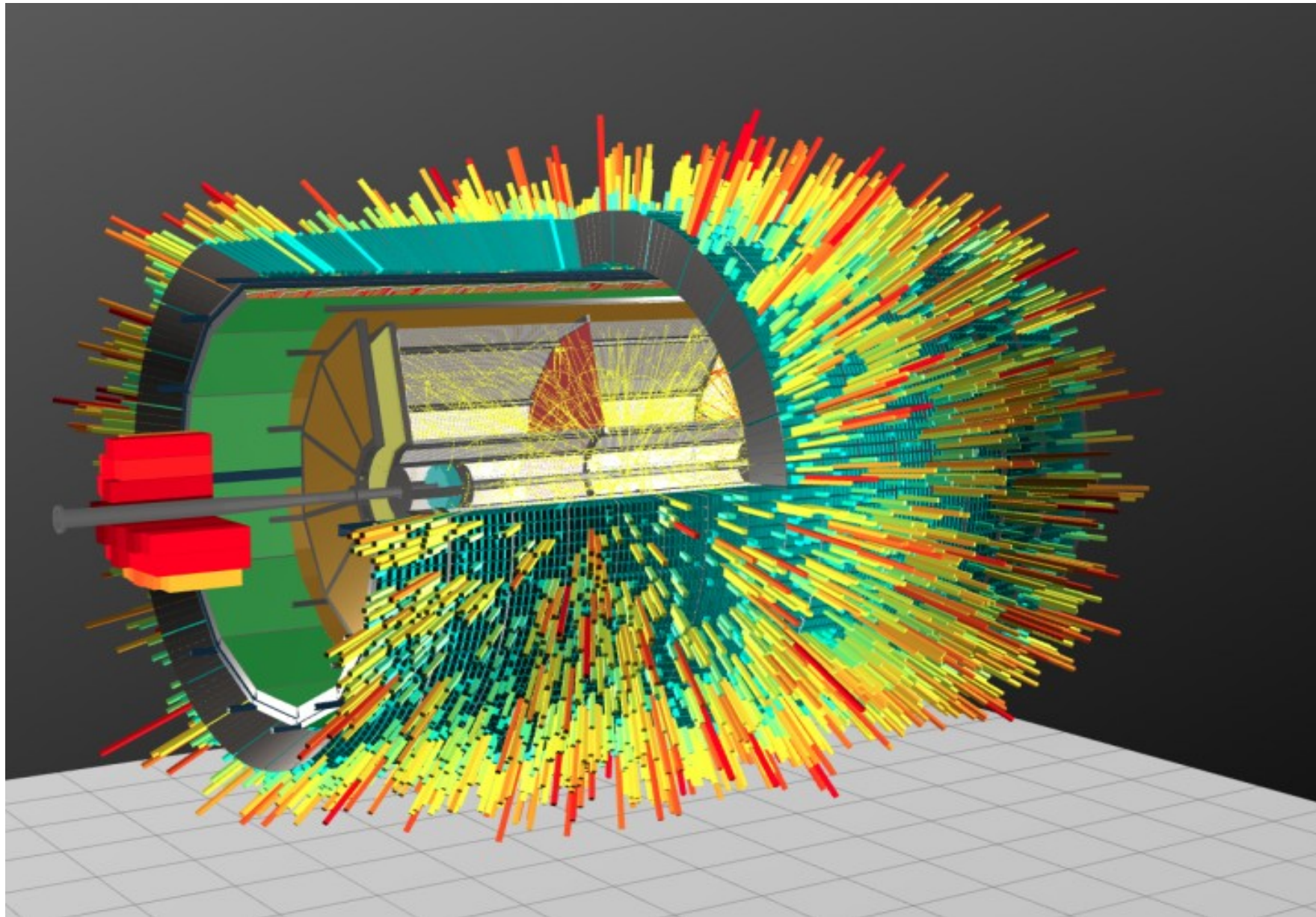
Jamilya Erkenova

Filtering track candidates in TPC track reconstruction

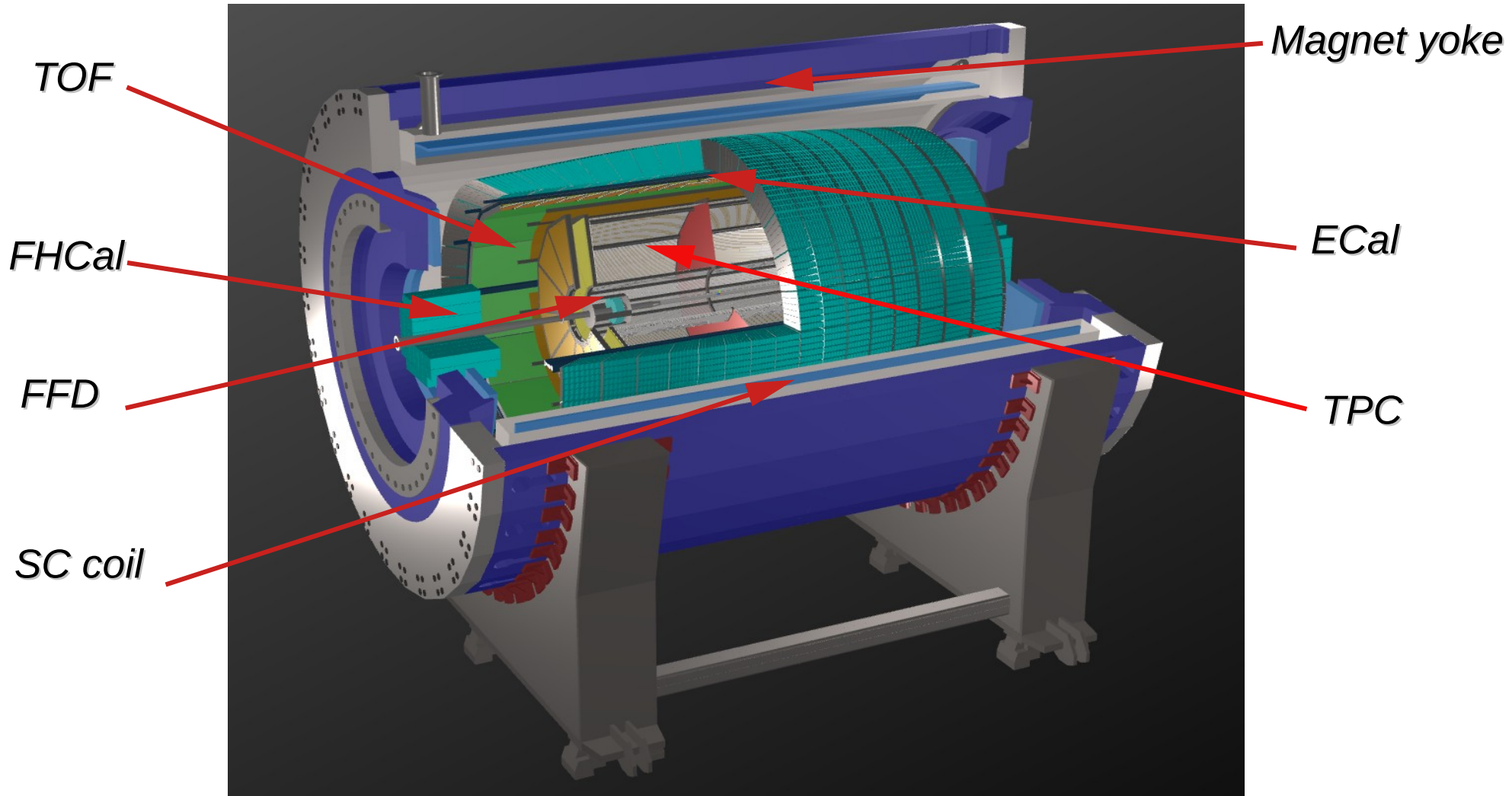
Alexander Bychkov

Simulation and position optimization of real laser emitters for TPC calibration system

MPD eventdisplay (A.Krylov)



Update geometry for eventdisplay (dev. version)

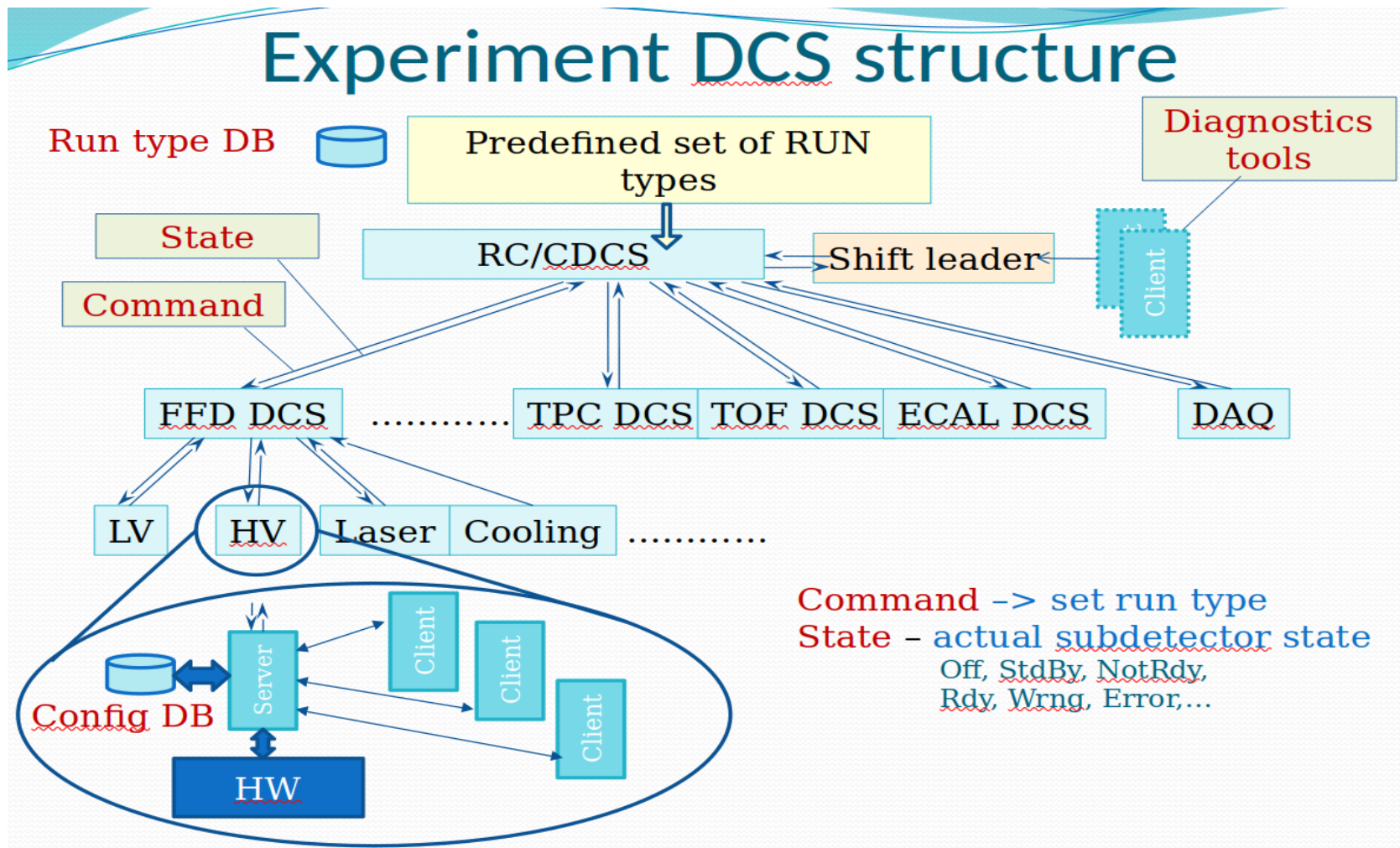


The ALICE Run Control Centre



Online software for MPD

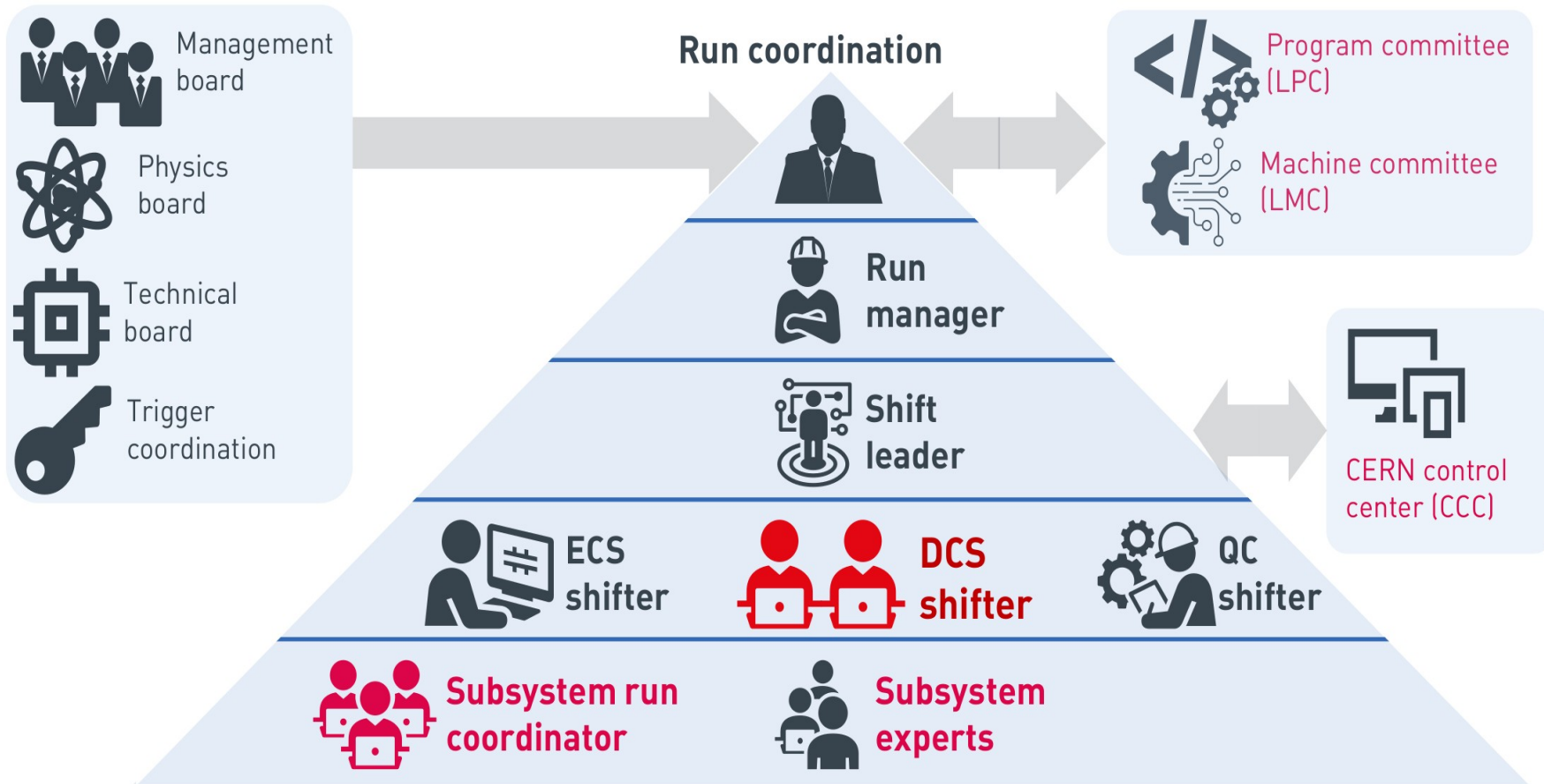
Sergey Sergeev
 Central DCS.
 Run Control Concept



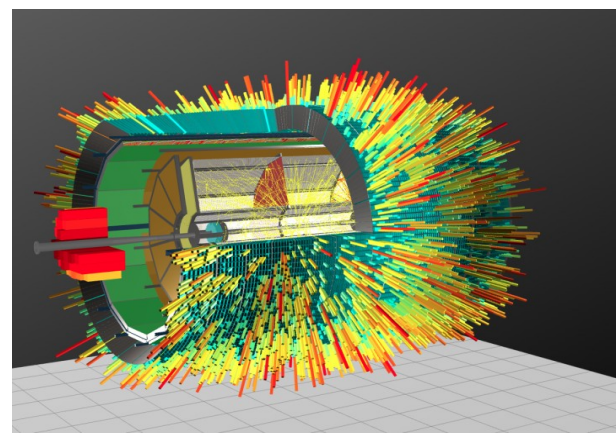
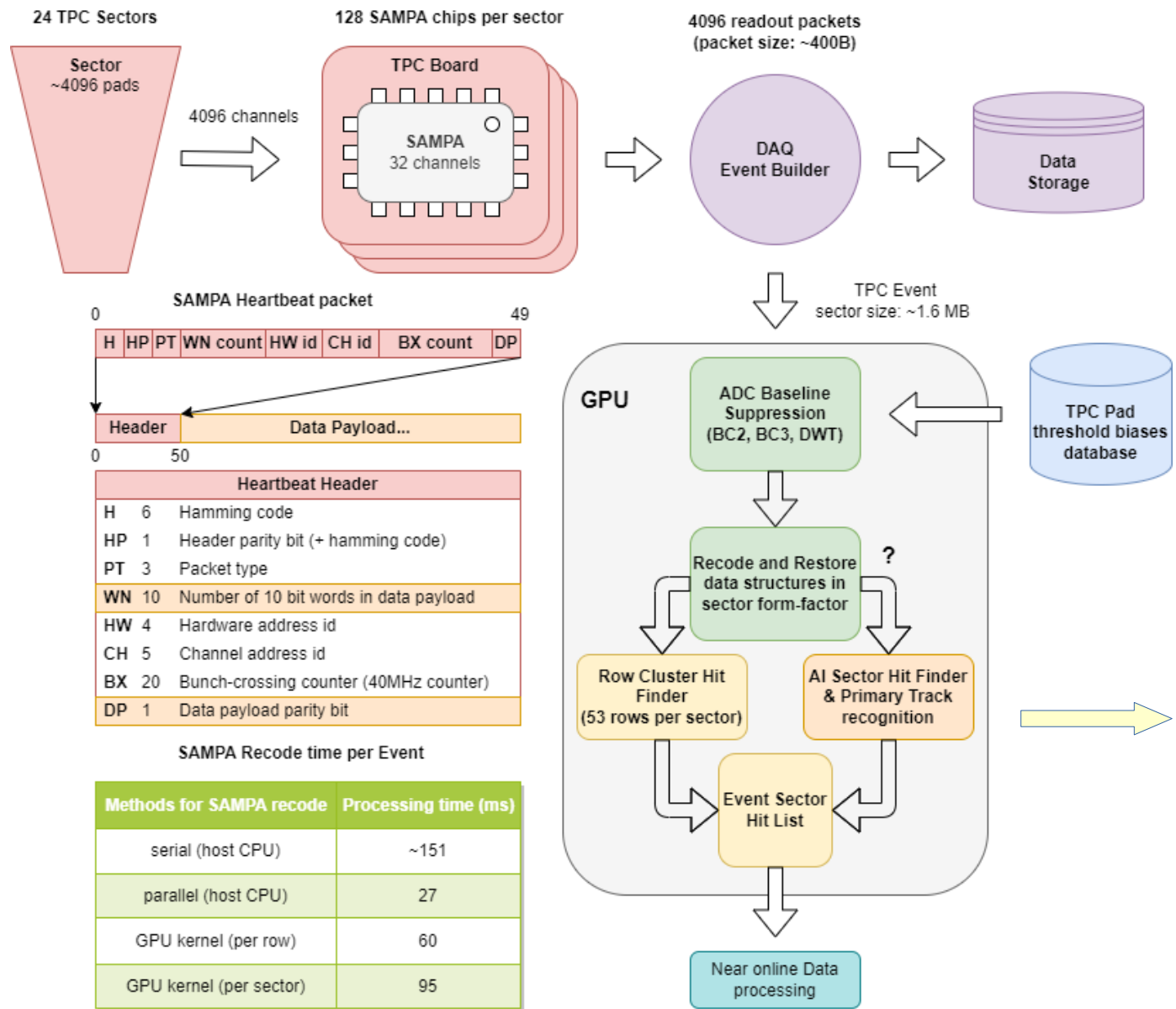
Online software for MPD

Nikita Baldin

The issue of functional division of automated systems in experimental facilities



TPC data for eventdisplay



MPDroot release v24.03.2024

(J.Busa & S.Hnatic)

Installation:

<https://mpdroot.jinr.ru/running-mpdroot-on-local-machine-using-cvmfs/>

Release:

<https://git.jinr.ru/nica/mpdroot/-/releases/v24.03.24>

FOR USERS

- v33.0.0 ACTS tracker integration: [#234](#) [#243](#)
- ROOT 6.28/12
- GEANT4 11.1.3
- Fairroot 18.6.10
- Analysis update: [#235](#)
- Nuclei analysis: [!516](#) [!504](#)
- Hyperons update: [!517](#) [!518](#) [!519](#)
- evPid update: [#240](#) [#236](#)
- Magnet geometry update: [!512](#)

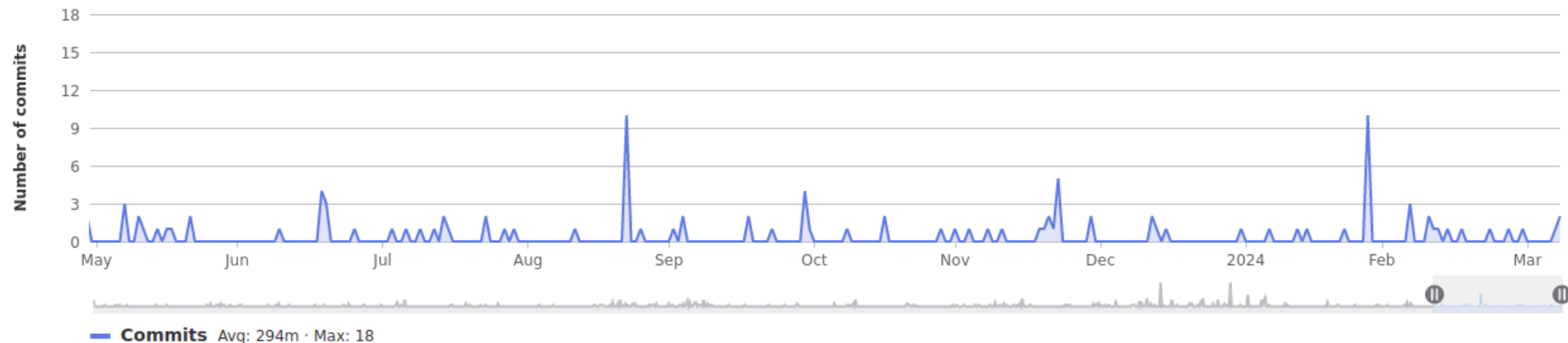
FOR Developers

- MpdKalmanFilter no longer a FairTask: [#227](#)
- Clang-format 18.1.1
- PostgreSQL 16.2
- warnings fixed: [#237](#)
- fix FhCal mapping file not loaded: [#244](#)








MPD GIT software repository

Commits to dev

Excluding merge commits. Limited to 6,000 commits.



Apr 08, 2024

- 
Fix clang-format in CI pipeline
 Slavomir Hnatic authored 2 weeks ago ✔ da92eadf  
- 
Fixes of MPDROOT towards ROOT 6.30.06 and Pythia 8.3.11
 Jan Busa authored 2 weeks ago and  Slavomir Hnatic committed 2 weeks ago 5d4739ee  

Apr 07, 2024

- 
Acts Tracker: remove clutter
 Slavomir Hnatic authored 2 weeks ago ✔ 42cfcebc  

Mar 31, 2024

- 
Analysis update: KK, PK, PIK, PiLambda, PIPi (Victor Riabov's request)
 Slavomir Hnatic authored 3 weeks ago ✔ b0de6b05  

Mar 28, 2024

- 
Added evFlowEP wagon
 Пётр Парфёнов authored 3 weeks ago ✔ 4f9e1d4b  

Mar 24, 2024

- 
Fix for MCStack for GEANT4.
 Alexander Zinchenko authored 4 weeks ago ✔ 9f84583f  

MPDroot deployment

Running MPDRoot locally using CVMFS

Questions? [Click here](#)

INSTALL CVMFS AND TOOLBOX (Users and Developers)

Supported OS: Fedora, CentOS, AlmaLinux, Ubuntu 22.04, 20.04, Debian 11, 12, Manjaro 21

NOTE: If your OS is based on any of those, then pass it to nica-init script, for example
`./nica-init.sh -d Ubuntu -v 20.04`

```
[user@fedora ~]$ wget -N https://git.jinr.ru/nica/nicadist/-/raw/master/scripts/nica-init.sh --no-check-certificate
--2021-12-02 00:00:00-- https://git.jinr.ru/nica/nicadist/-/raw/master/scripts/nica-init.sh
.....
2021-12-02 00:00:02 (87.9 MB/s) - 'nica-init.sh' saved [10794/10794]

[user@fedora ~]$ chmod +x nica-init.sh && ./nica-init.sh
Installing toolbox on Fedora 39
[sudo] password for user:
.....
Creating container a9-nica-dev ...
.....
Installing cvmfs service as container ...
.....
=====
INSTALLATION SUCCESSFUL

How to use:

1. Enter toolbox container by:
   toolbox enter a9-nica-dev

2. Load MPDroot environment as a user by:
   [user@toolbox]$ module add mpdroot

   or MPDroot environment as a developer by:
   [user@toolbox]$ module add mpddev

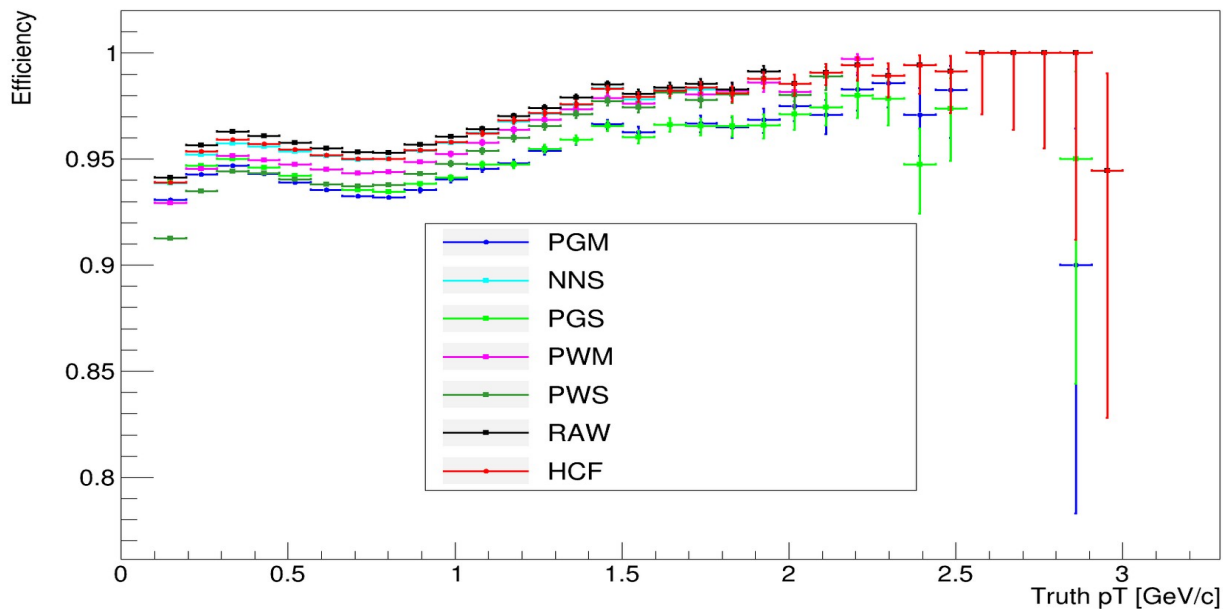
=====
[user@fedora ~]$
```

USERS

NOTE: If you are using CentOS 7 instead of "toolbox enter a9-nica-dev" command, type:
`"source /cvmfs/nica.jinr.ru/sw/os/login.sh"`

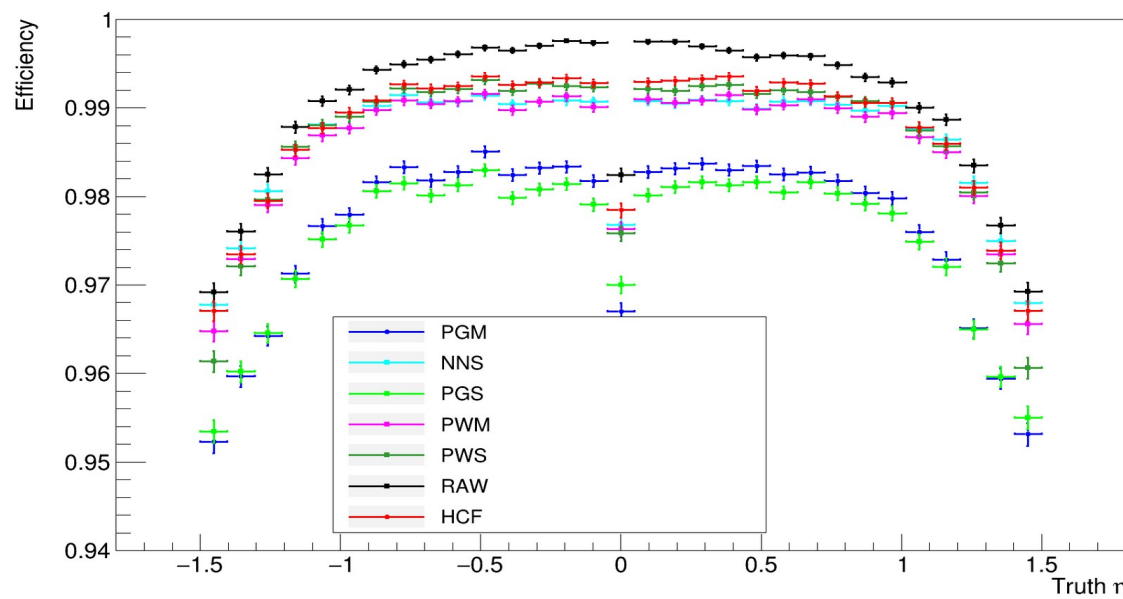
TPC tracking with ACTS

Jamilya Erkenova



UrQMD v 3.4
AuAu @ $\sqrt{s} = 7.7$ GeV

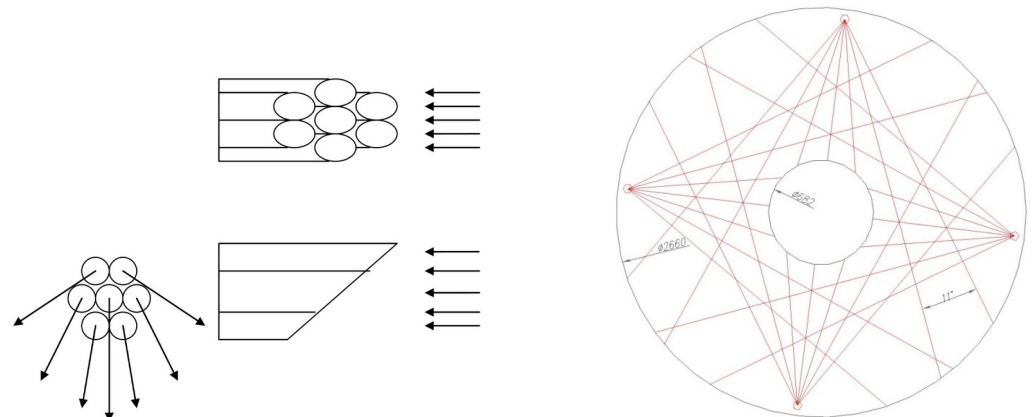
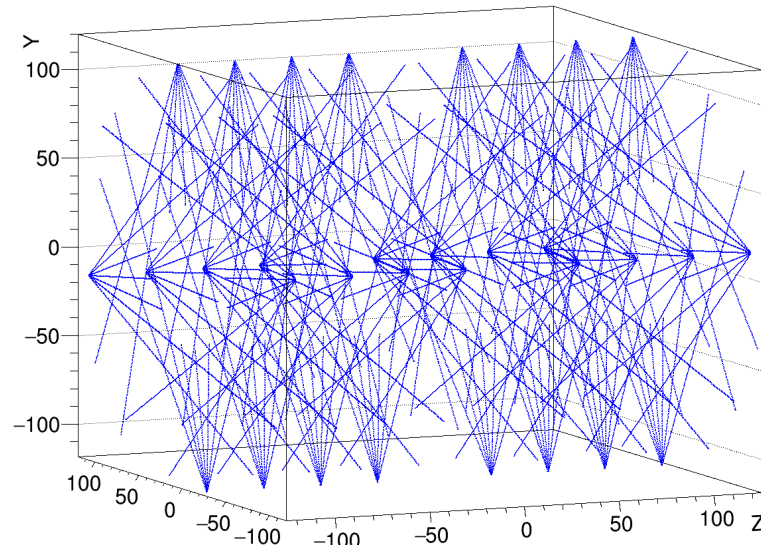
1. Hit-coverage-based track filtering (HCF)
2. Pairwise track matching and selection (PWS)
3. Pairwise track matching and merging (PWM)
4. Track proximity graph selection (PGS)
5. Track proximity graph merging (PGM)
6. Neural network-based selection (NNS)*



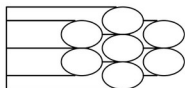

TPC laser calibration system

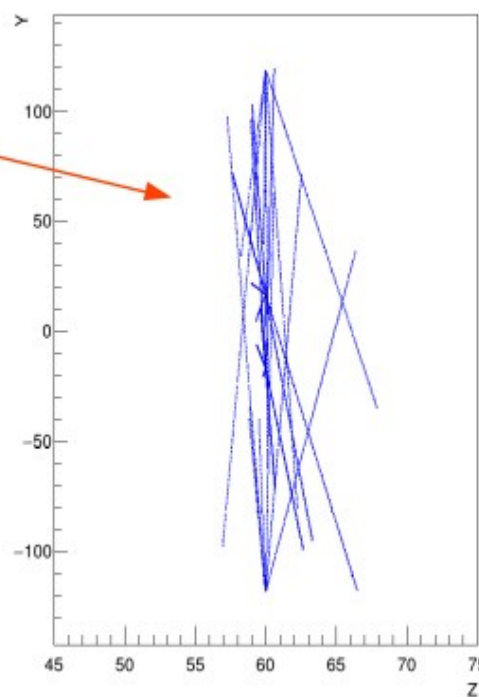
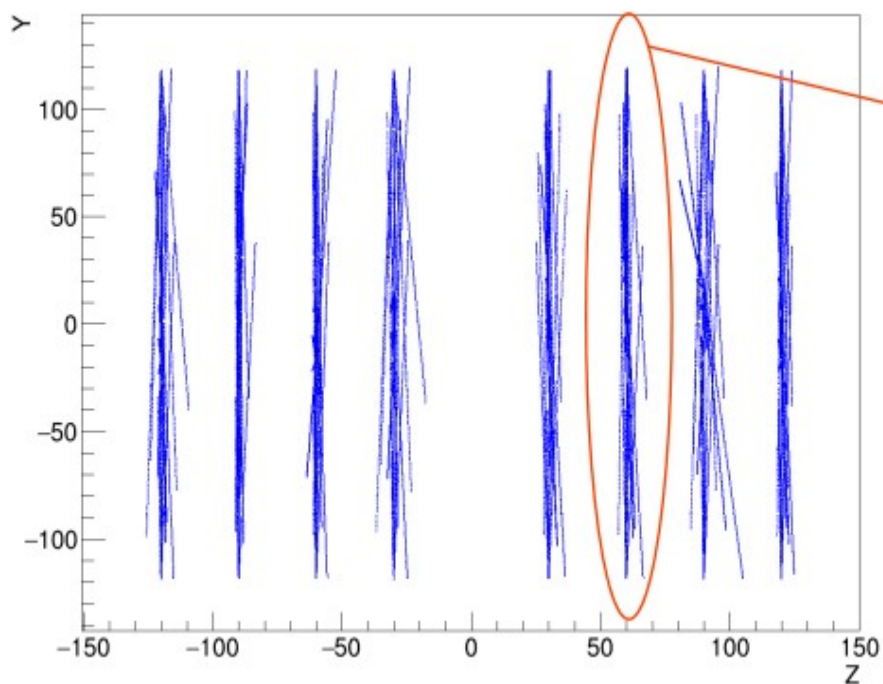
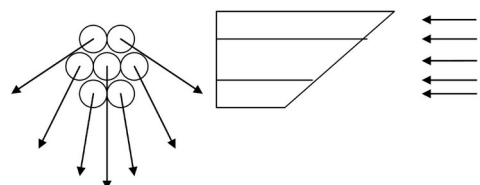
- UV laser system
 - Two pulsed 130 mJ 5-7 ns Nd:YAG lasers
 - ~1mm diameter
 - 224 laser beams in total
 - 112 “tracks” in each half of the TPC
 - **4 planes of laser beams**
 - **30cm between planes**
 - **16 bundle with 7 mirrors each**
 - 4 tubes with 4 bundles
 - 10 Hz impulses

A.Bychkov



Real laser beam

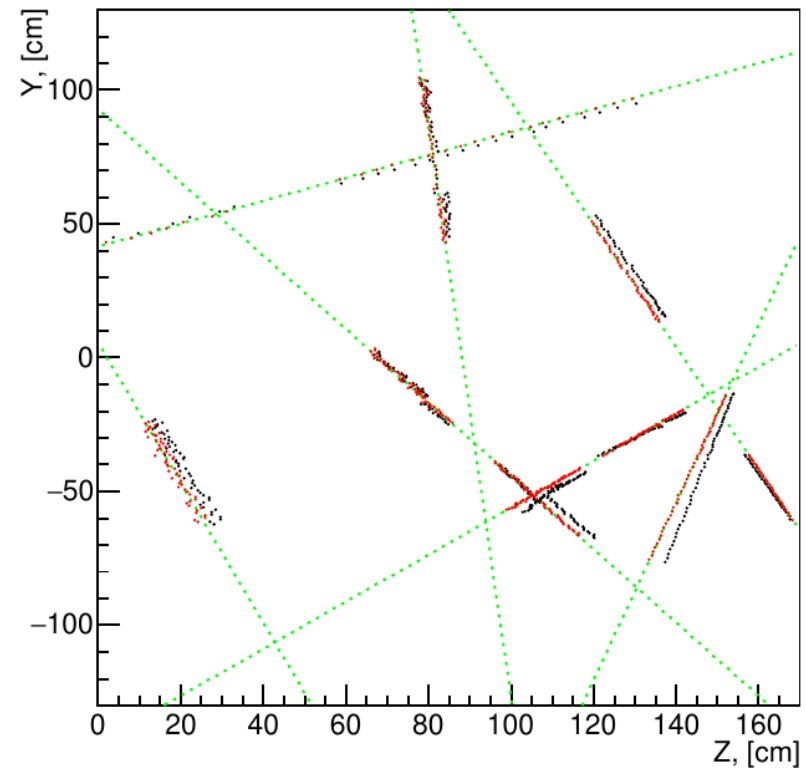
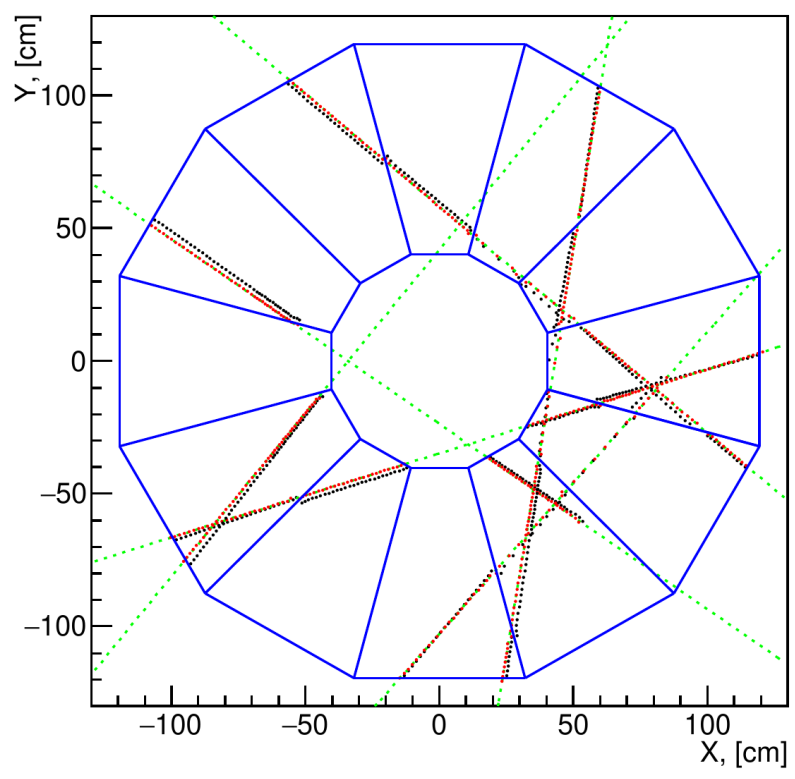
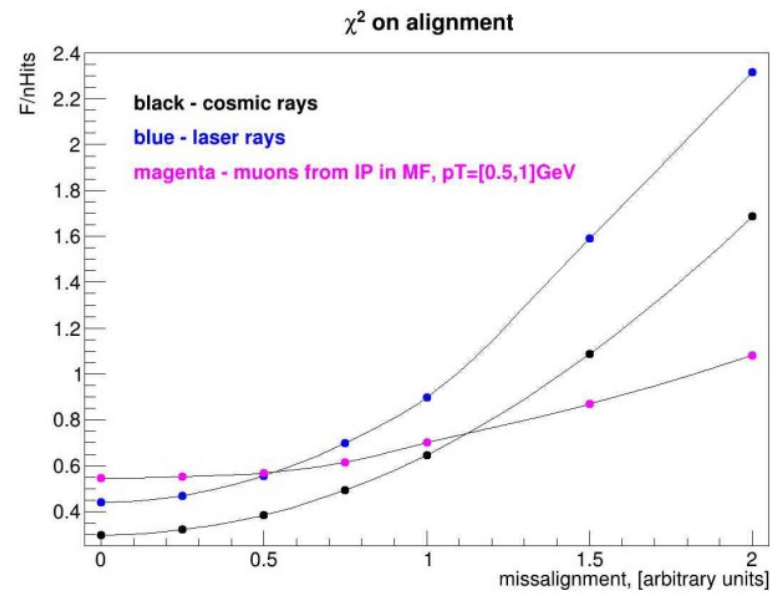
bundle of micro mirrors   the initial wide beam (18 mm)



TPC alignment

Kuzmin V. MSU INP

Green points simulated muon tracks
Black points misalignment hits
Red points - hits with alignment

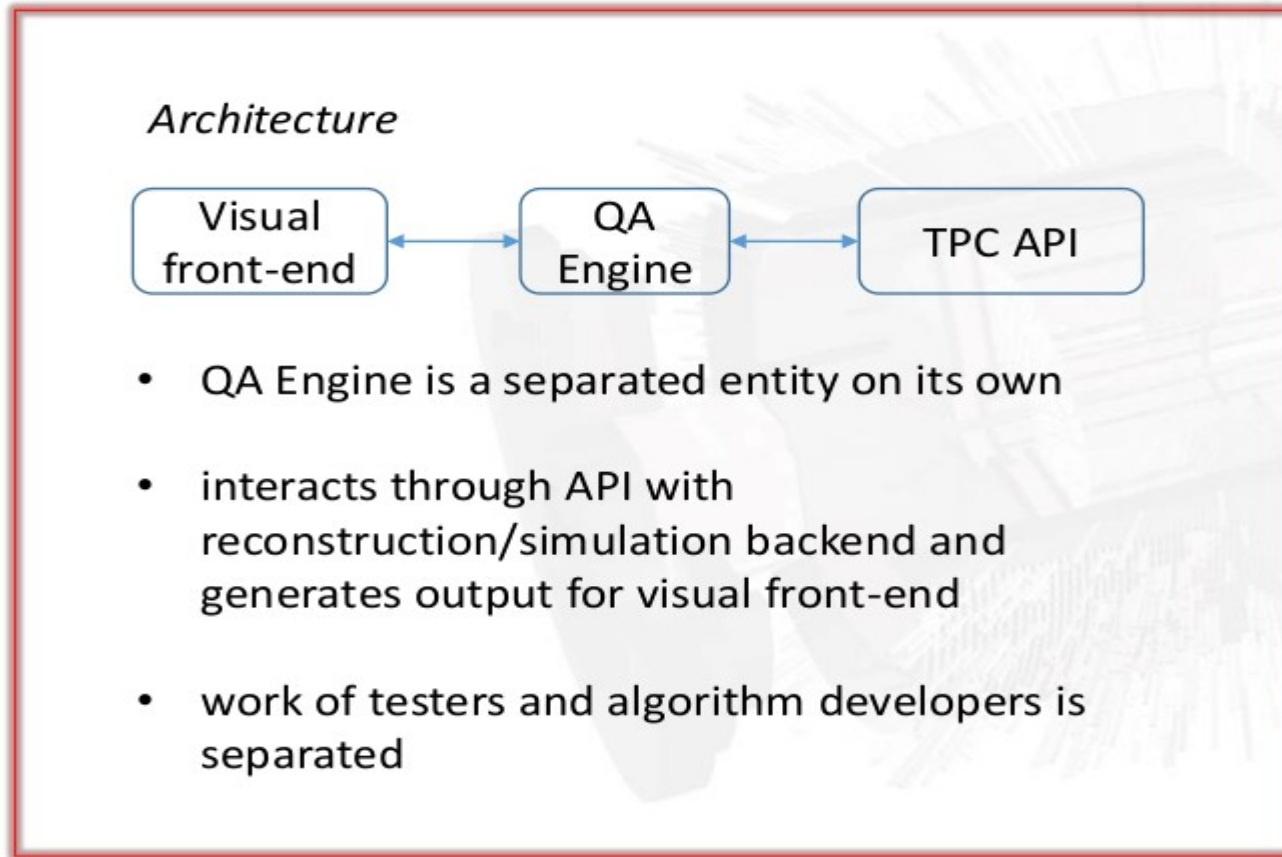


MC dataset for MPD physics

Generator	PWG	Coll.		# of events (10 ⁶)	Reconstruction	
UrQMD	PWG4	AuAu	11	15	+	
		BiBi	9	10	+	
			9.46	10	+	
				9.2	95	+
	PWG2	AuAu	11	10	+	
	PWG3	AuAu	7.7	10	+	
		BiBi	7.7	10	+	
				9	15	+
			pp	9	10	+
			BiBi fix target	2.5	12	+
			BiBi fix target	3.0	12	+
			BiBi fix target	3.5	12	+
		PWG1	BiBi	9.2	61	+
DCM-SMM	PWG1	BiBi	9.2	1	+	
PHQMD	PWG2	BiBi	8.8	15	+	
			9.2	61	+	
			2.4/3.0/4.5	10/10/2	-	
vHLE-UrQMD	PWG3	BiBi	11.5	15	+	
		AuAu	11.5	15	+	
		AuAu	7.7	20	+	
		BiBi	9.2	48	+	
Smash	PWG1	BiBi	9.46	10	+	
		ArAr	4/7/9/11	20/20/20/20	-	
		AuAu	4/7/9/11	20/20/20/22	-	
		XeXe	4/7/9/11	20/20/20/20	-	
		CC	4/7/9/11	20/20/20/20	-	
		pp	4/7/9/11	50/50/50/50	-	
		JAM	PWG3	AuAu	3/3.3/3.5/3.8/4.0/4.2/4.5/5	40/40/40/40/40/40/40/40
DCM-QGSM-SMM	PWG3	AuAu	4/9.2	5/5	+	
		AgAg	4/9.2	5/5	+	
		BiBi	4/9.2	5/6	+	
PHSD		BiBi	9/9.2	25	+	
Total				1367	523	

Quality Assurance engine

(S.Hnatic)



dev ▾ mpdroot / tools / tdd / + ▾

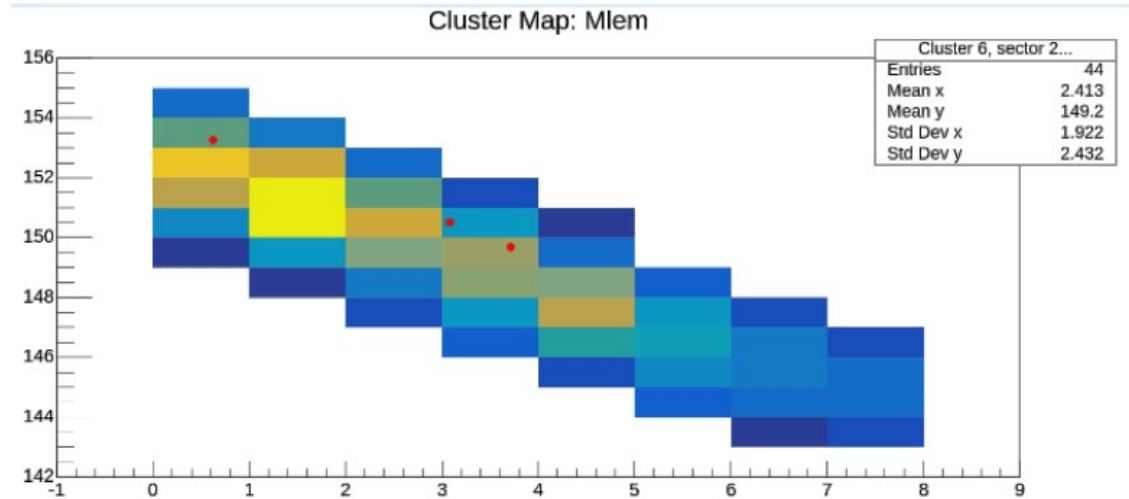
History Find file Web IDE ⬇ ▾ Clone ▾

Name	Last commit	Last update
..		
📁 QA	QA Engine: directory placeholders, build, initial Abstract Base Class	1 month ago
📁 scripts	QA Engine: directory placeholders, build, initial Abstract Base Class	1 month ago
📄 CMakeLists.txt	QA Engine: directory placeholders, build, initial Abstract Base Class	1 month ago

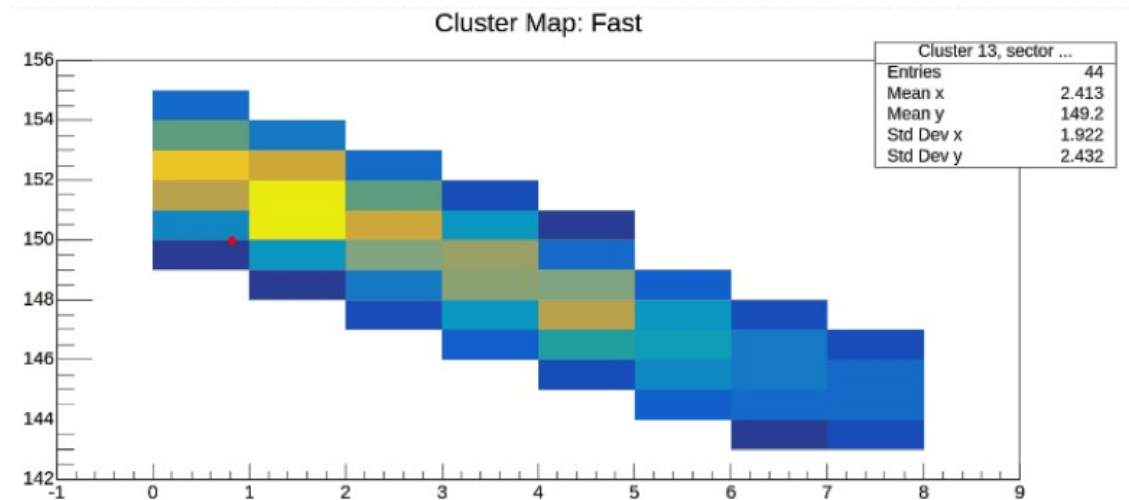
Cluster finders comparison with QA engine

Most illustrative with JSROOT

Mlem clusterfinder



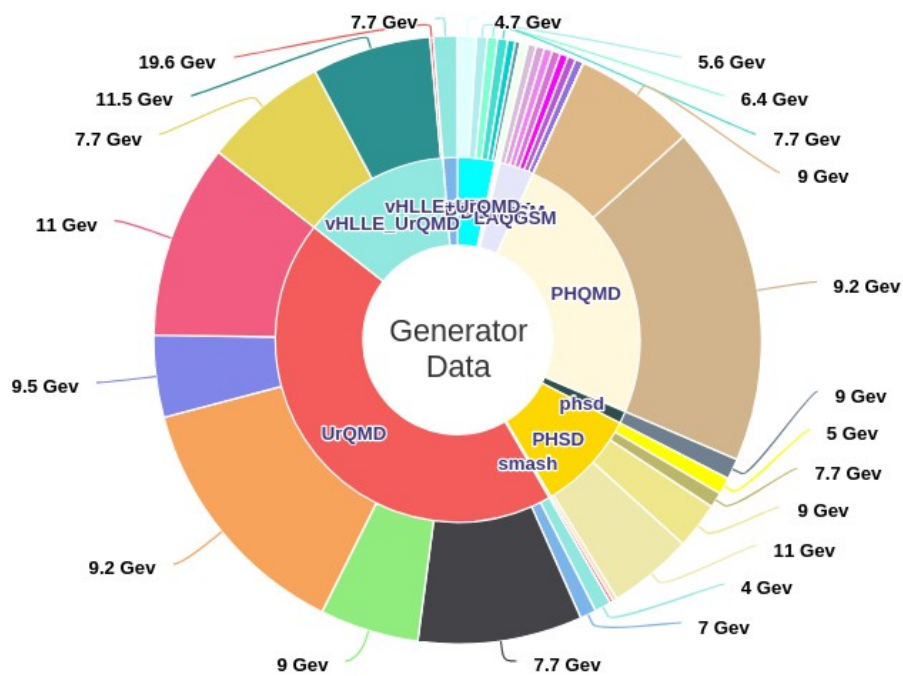
Fast clusterfinder



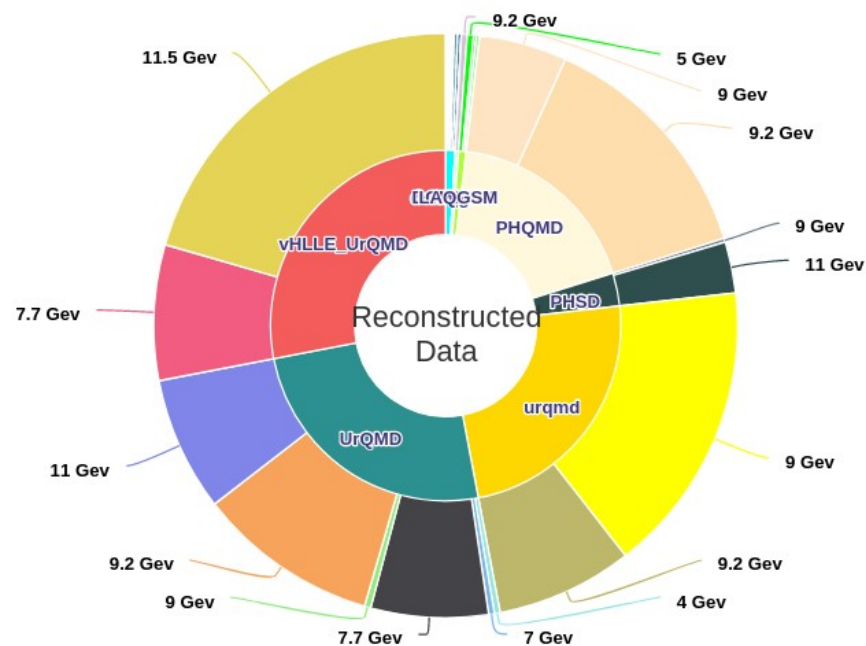
MPD mass production database

<http://db-nica.jinr.ru/mpdmc/stat.php>

all mass production requests done in acceptable time



1170



All production data stored in Dirac File Catalog

MPD databases

- ✓ List of MPD members & authors
- ✓ MC events mass productions
- ✓ LogBook for Experiment
- ✓ Run configuration DB
- ✓ TPC calibration
- ✓ TPC alignment parameters
- ✓ TOF calibration
- ✓ ECAL instrumentation
- ✓

MPD geometry alignments DB

[Home](#) [TPC alignments](#) [TOF alignments](#)

MPD
Collaboration list

MPD Monte-Carlo DB

Free for the users

MPD e-Log

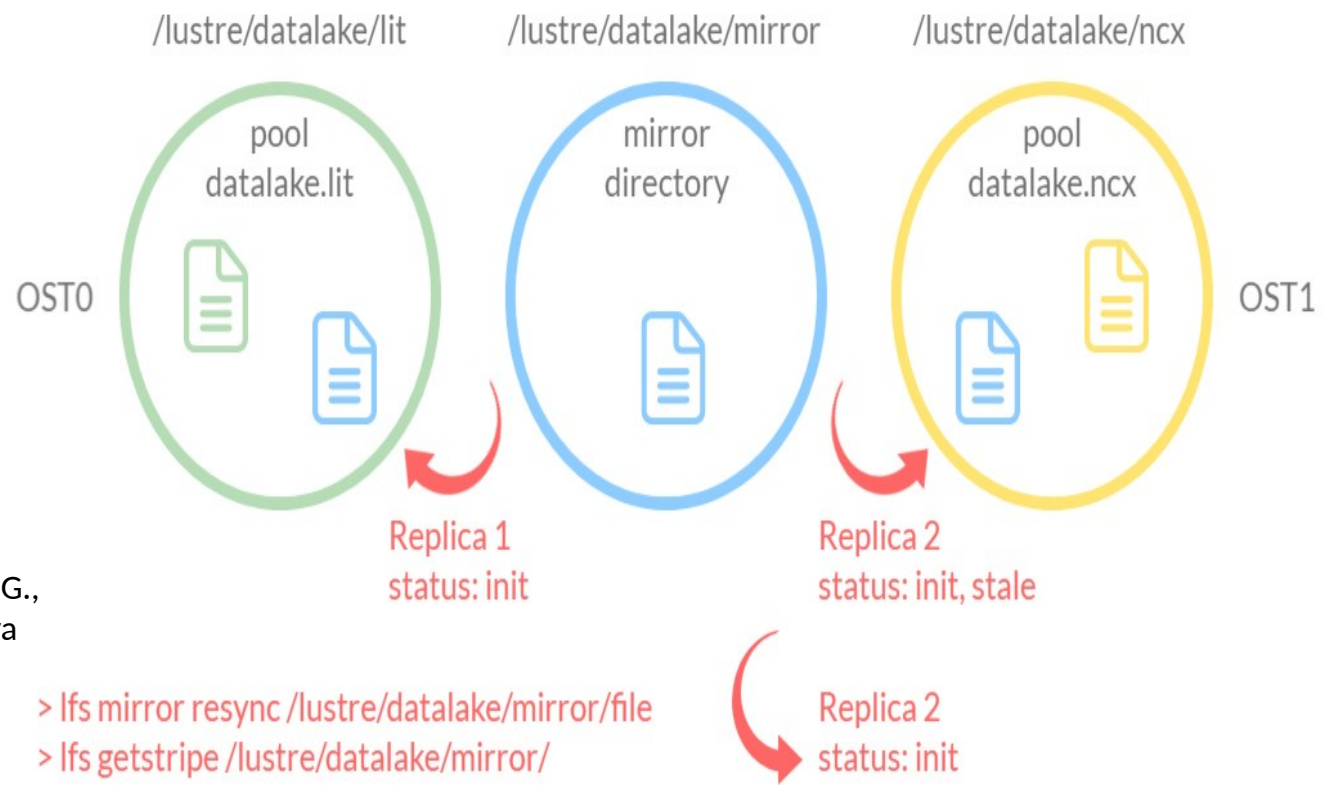
Data storage system for NICA experiments



MLIT Team
 Belyakov D.V., Dolbilov A.G.,
 Kokorev A.A., Lyubimova
 M.A., Pelevanuk I.S.,
 Podgainy D.V.



LHEP Team
 Moshkin A.A.,
 Rogachevsky O.V.,
 Slepov I.P.



MLIT servers

2x
 Dell PowerEdge R730xd

2x 160 TB, SAS

Motherboard	PowerEdge R730/R730xd System Board
Processor	2x Intel Xeon E5-2660 v4 @ 2.00 GHz
Memory	8x Micron DDR4 2400 MHz, 16 GB (128 GB)
RAID	Dell PERC H730P
Disk	2x Dell MFC6G (Samsung) SSD SAS, 400 GB (2x 400 GB) 16x HGST UltraStar HE10 SAS, 10TB (160 TB)
Network	Dell 99GTM (Intel X540-T2 2x 10 Gb/s + Intel I350 Dual Port 2x 1 Gb/s)
Power	2x 750W Redundant Power Supply

Data flow rates 100 Gbps

LHEP servers

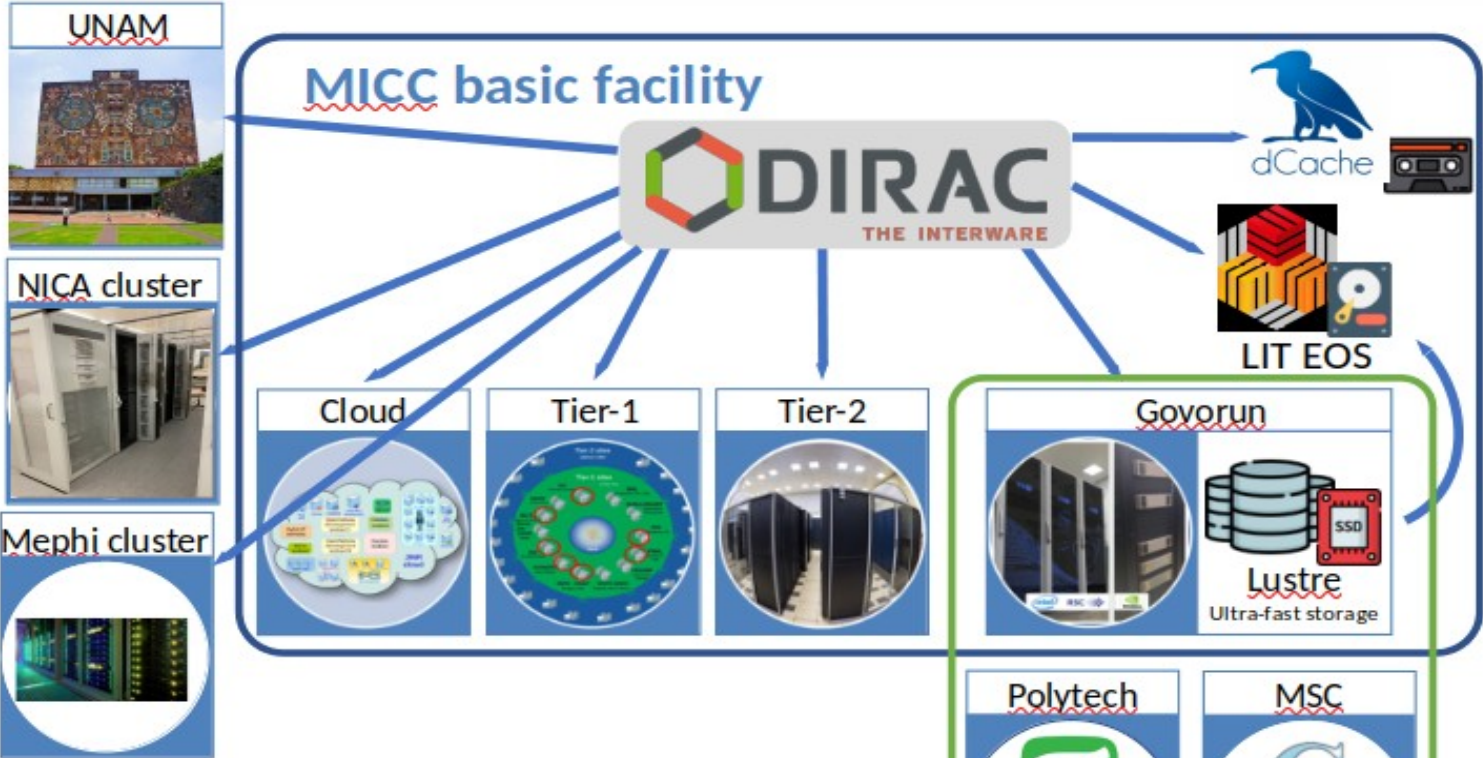
2x
 Supermicro SSG 1029P-NEL32R

2x 244.8 TB, NVMe (Rulers)

Motherboard	Supermicro X11DPS-RE
Processor	2x Intel Xeon Gold 6230R @ 2.10 GHz
Memory	12x Samsung DDR4 2993 MHz, 64 GB (768 GB)
Disk	2x Apacer SSD NVMe m.2, 512 GB (2x 512 GB) 16x Intel DC P4510 SSD NVMe (Ruler), 15.3TB (244.8 TB)
Network	Intel X550-T Dual Port 2x NVIDIA (Mellanox MT27800) ConnectX-5 Dual Port 2x 100 Gb/s Ethernet
Power	2x 1600W Redundant Power Supply

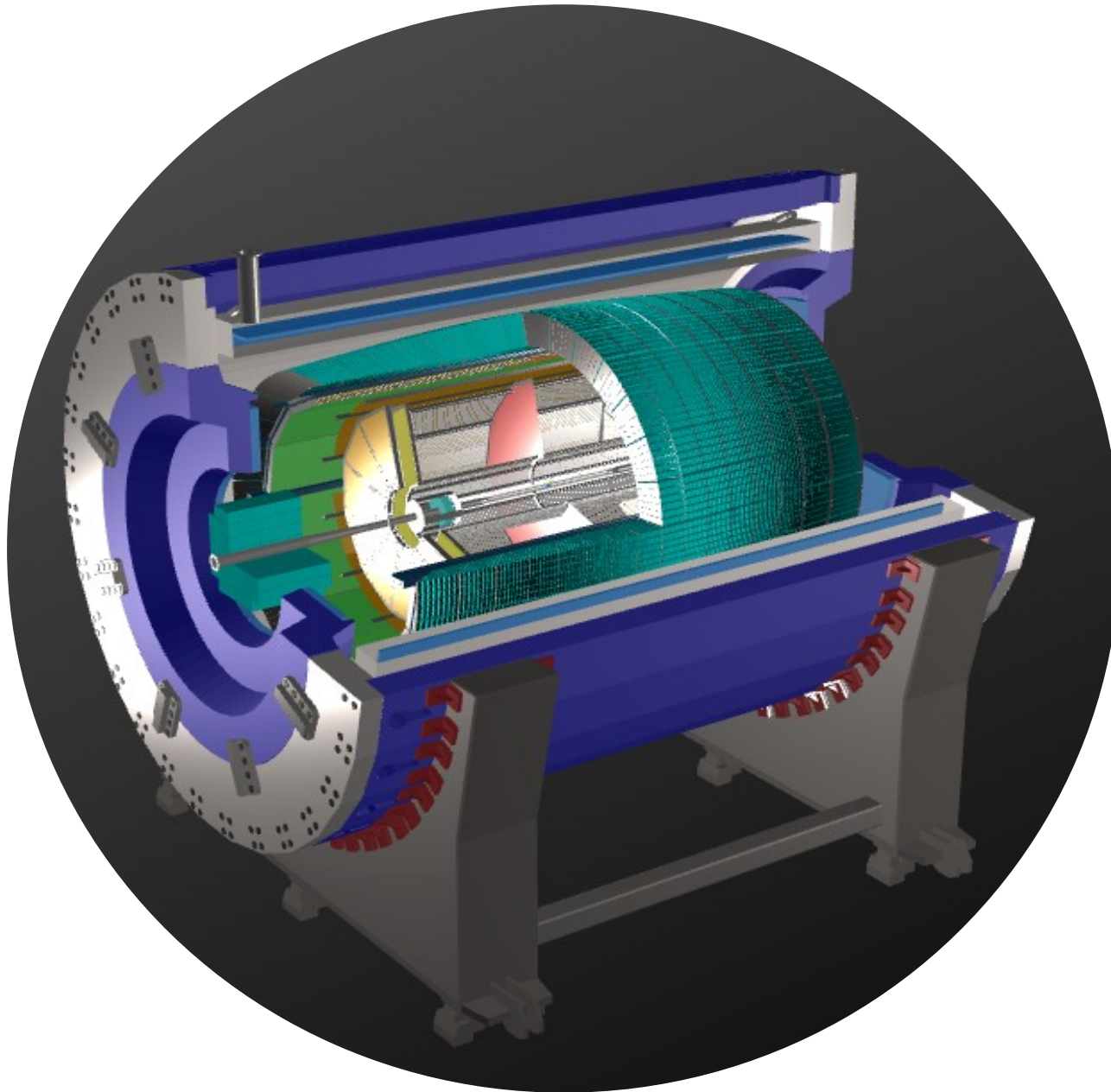
Computing resources for MPD

- ❖ Centralized Analysis Framework for access and analysis of data:
 - ✓ consistent approaches and results across collaboration, easier storage and sharing of codes and methods
 - ✓ reduced number of input/output operations for disks and databases, easier data storage on tapes
- ❖ Analysis manager reads event into memory and calls wagons one-by-one to modify and/or analyze data:



- NICA offline cluster 1000 cores(limit for users)
 - GOVORUN up to 3260 cores in last production
 - Tier1 1400 cores
 - Tier2 1000 cores
 - Clouds(JINR and JINR Member States) 70 cores
 - UNAM(Mexico University) 100 cores
 - National Research Computer Network of Russia (now resources from SPBTU and JSCC) 672 cores
- Mass production storages integrated in Dirac File Catalog have size 4,2 PB.

Thanks for your attention



MPD software development team

LHEP	LIT	OTHER
Bychkov A. Krylov A. Moshkin A. Rogachevsky O.	Alexandrov E. Alexandrov I. Balashov N. Belyakov D. Busa J. Hnatic S. Pelevanyuk I. Podgainy D. Zuev M.	Kuzmin V. Krylov V.

*Volunteers
Are
welcome*