

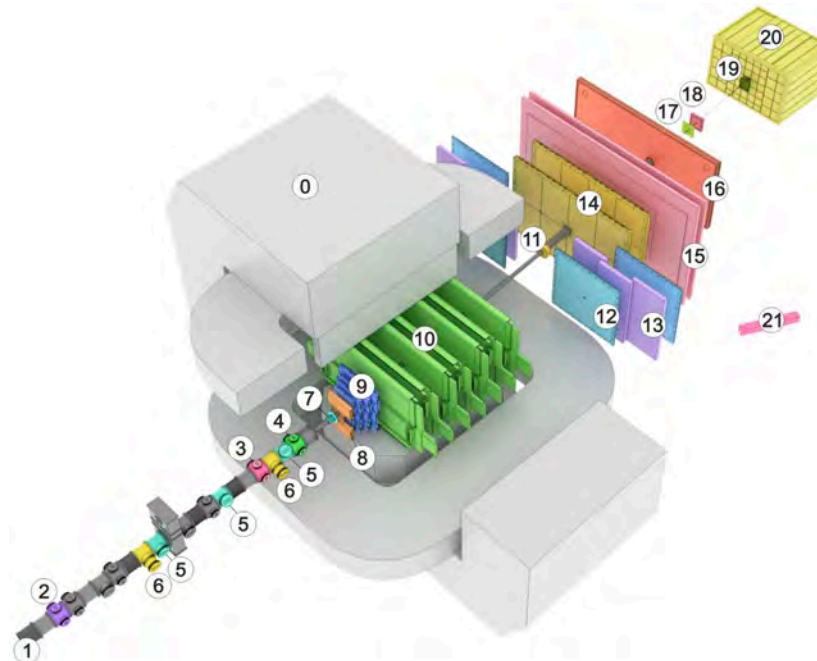
BM@N 14th collaboration meeting

Preparation of DIRAC distributed computing infrastructure for BM@N Run 9

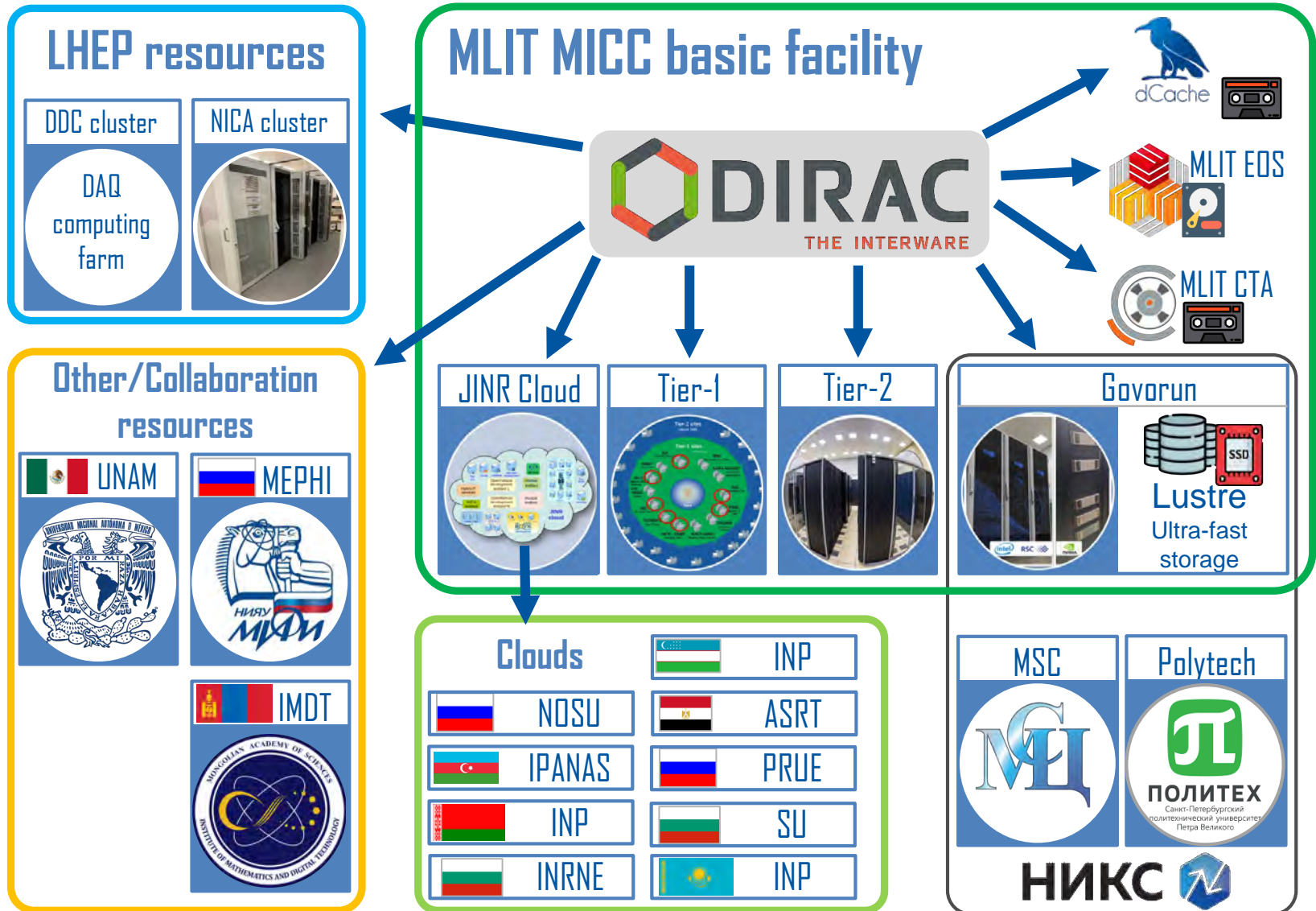
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LHEP

MLIT



DIRAC in JINR



1. Request #7 – Ready

<https://bmn-forum.jinr.int/t/request-7-dst-production-for-run-8-25-04-0/203>

Raw: 30006 files

Digi: 29932 files (-74)

Dst: 29714 files (-218)

All error logs are on the forum.

Raw2Digi ~ 1500 cores ~ 1.5 days

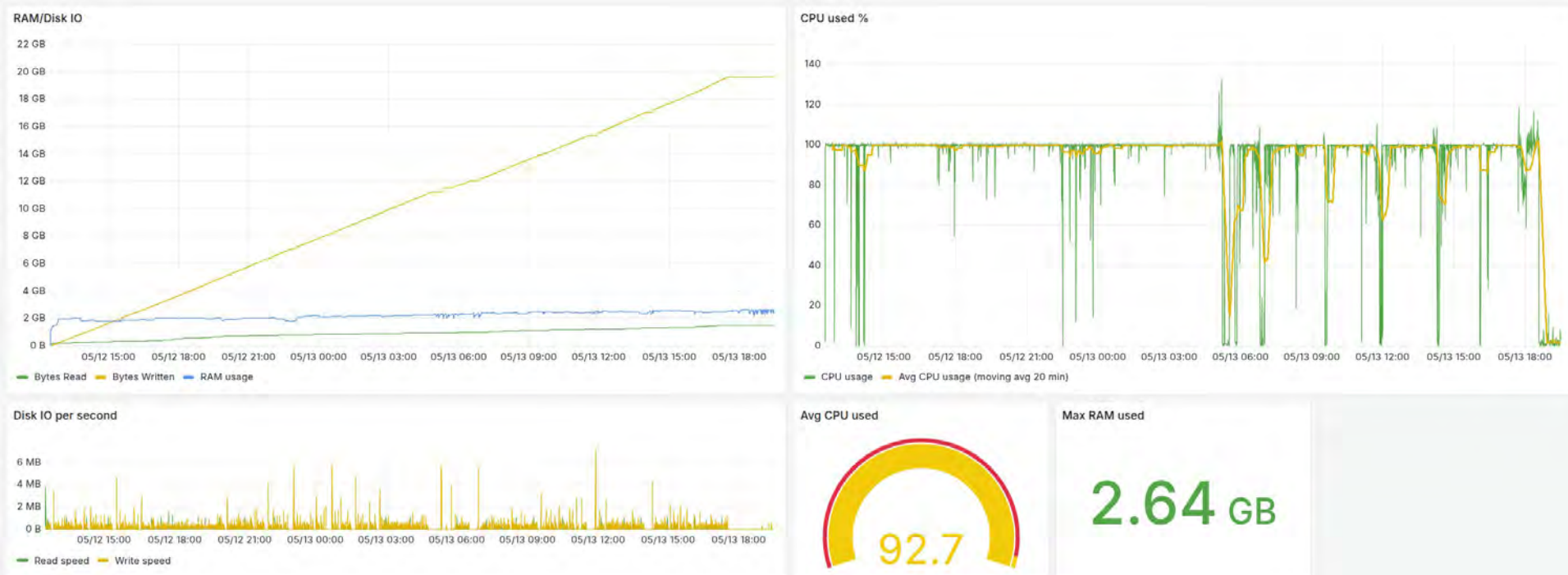
Digi2Dst ~ 2500 cores ~ 5 days

For Digi2Dst – automatic data upload to NCX cluster.

1. Request #7 – Issue 1



1. Request #7 – Issue 1



DST size growth! (Issue 2)

DST version	Total size	Total files	Avg file size
24.02.0	66,5 T	29830	2,23 GB
24.04.0	66,1 T	29887	2,21 GB
24.12.0	67,1 T	29877	2,24 GB
25.04.0	105,3 T	29715	3,55 GB (+60%)

DIGI size growth!

DIGI version	Total size	Total files	Avg file size
24.02.0	34,6 T	29979	1,15 GB
24.04.0	34,9 T	29996	1,16 GB
24.12.0	34,9 T	30004	1,16 GB
25.04.0	44,1 T	29932	1,47 GB (+27%)

Previous production DST size

24.12.0

6.9G	Jan	6	05:27	mpd_run_Top_7257_ev0_p1.root
6.9G	Jan	5	16:28	mpd_run_Top_7257_ev1_p0.root
6.9G	Jan	7	11:41	mpd_run_Top_7257_ev1_p2.root
6.9G	Jan	16	19:37	mpd_run_Top_7257_ev1_p1.root
6.9G	Jan	10	05:01	mpd_run_Top_7257_ev0_p0.root
6.9G	Jan	6	20:29	mpd_run_Top_7257_ev0_p2.root
5.8G	Jan	6	23:24	mpd_run_Top_7838_ev0_p0.root
5.7G	Jan	5	19:31	mpd_run_Top_7838_ev1_p0.root
5.5G	Jan	6	06:48	mpd_run_Top_8307_ev1_p5.root
5.5G	Jan	6	05:29	mpd_run_Top_8307_ev0_p5.root
5.4G	Jan	6	17:06	mpd_run_Top_7839_ev1_p0.root
5.4G	Jan	8	23:36	mpd_run_Top_8307_ev0_p1.root
5.3G	Jan	6	04:25	mpd_run_Top_8307_ev1_p1.root
5.3G	Jan	6	05:08	mpd_run_Top_8307_ev0_p4.root
5.3G	Jan	6	03:25	mpd_run_Top_8307_ev1_p4.root
5.3G	Jan	5	21:33	mpd_run_Top_7839_ev0_p0.root
5.3G	Jan	8	23:01	mpd_run_Top_8307_ev1_p3.root
5.3G	Jan	6	01:45	mpd_run_Top_8307_ev0_p0.root
5.3G	Jan	6	04:14	mpd_run_Top_8307_ev0_p3.root

Current DST size!

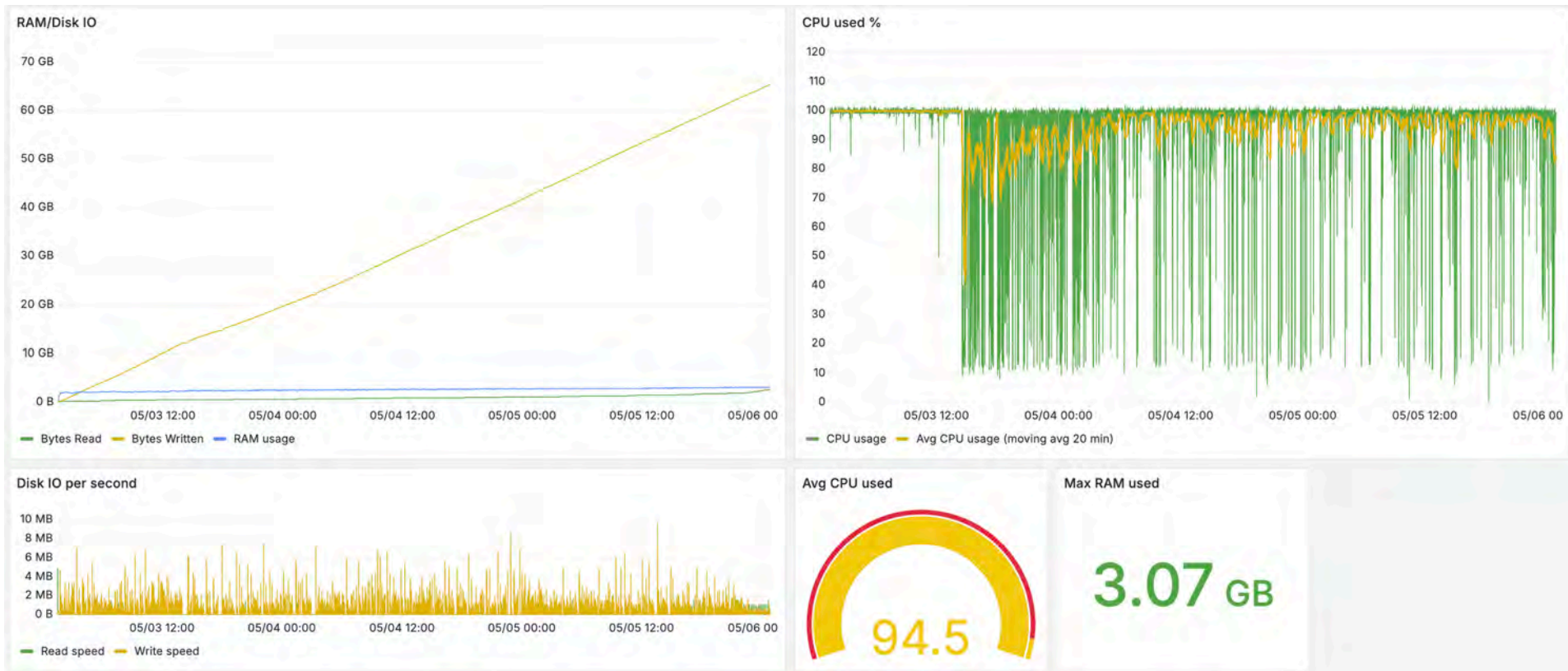
25.04.0

```
59G May 6 01:05 mpd_run_Top_7705_ev1_p8.root
39G May 4 12:25 mpd_run_Top_7705_ev0_p6.root
37G May 4 12:51 mpd_run_Top_7705_ev1_p6.root
37G May 7 09:04 mpd_run_Top_8334_ev1_p32.root
36G May 9 07:50 mpd_run_Top_8334_ev0_p32.root
32G May 8 12:55 mpd_run_Top_8335_ev1_p4.root
31G May 9 02:17 mpd_run_Top_8335_ev0_p4.root
31G May 6 18:55 mpd_run_Top_8334_ev1_p39.root
31G May 6 21:54 mpd_run_Top_8335_ev1_p2.root
31G May 9 10:06 mpd_run_Top_8335_ev0_p2.root
31G May 9 03:46 mpd_run_Top_8335_ev1_p3.root
30G May 8 19:14 mpd_run_Top_8335_ev0_p3.root
29G May 8 22:57 mpd_run_Top_8334_ev1_p33.root
29G May 9 02:21 mpd_run_Top_8335_ev1_p0.root
28G May 8 08:05 mpd_run_Top_8335_ev0_p0.root
28G May 6 17:38 mpd_run_Top_8334_ev0_p0.root
28G May 9 00:01 mpd_run_Top_8334_ev1_p7.root
28G May 8 06:09 mpd_run_Top_8334_ev0_p7.root
28G May 9 06:57 mpd_run_Top_8334_ev0_p8.root
```

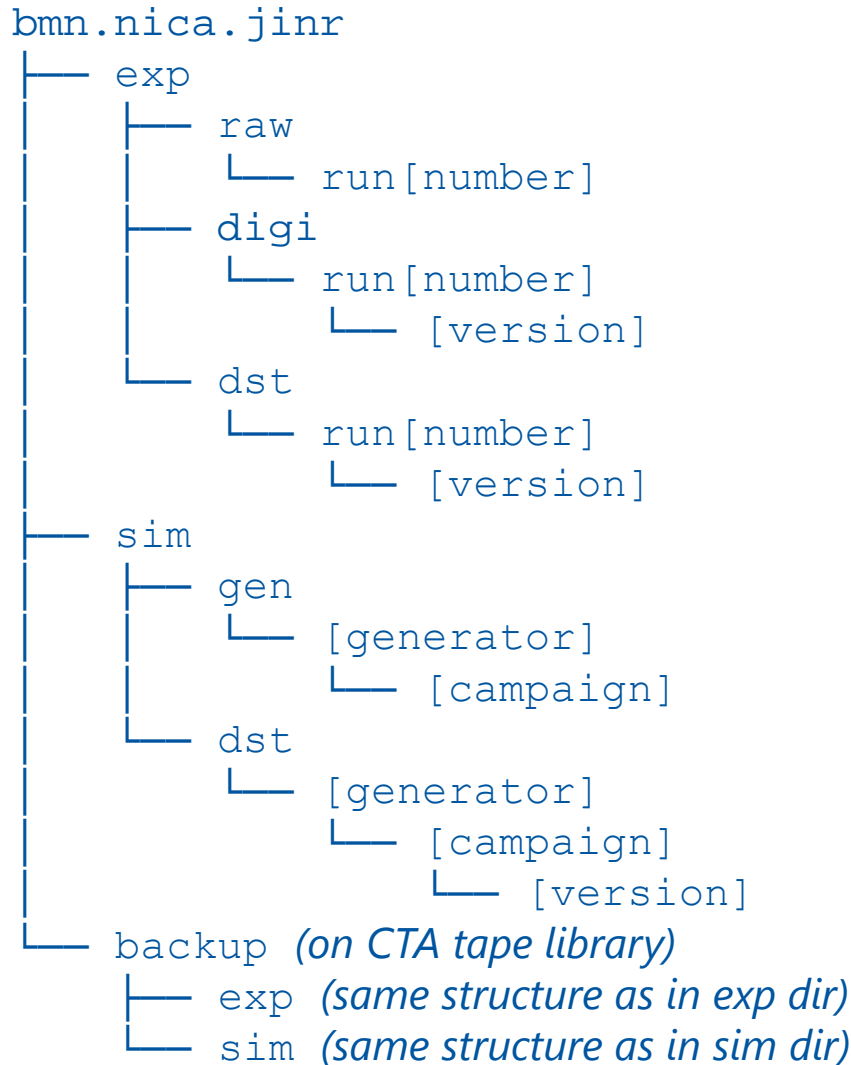
Corresponding job's profile

25.04.0

59G May 6 01:05 mpd_run_Top_7705_ev1_p8.root



2. DIRAC directory structure



Directory structure in DIRAC is now similar to NCX directory structure.

Still requires some work to do, to make it absolutely the same.

2. DIRAC directory structure

Special metadata applied for run9 data directories. This is crucial for further automatic processing!

```
bmn.nica.jinr
├── exp
│   ├── raw {type: raw}
│   │   └── run9 {run_number: 9}
│   ├── digi {type: digi}
│   │   └── run9 {run_number: 9}
│   │       └── 25.04.0
│   └── dst {type: dst}
│       └── run9 {run_number: 9}
│           └── 25.04.0
```

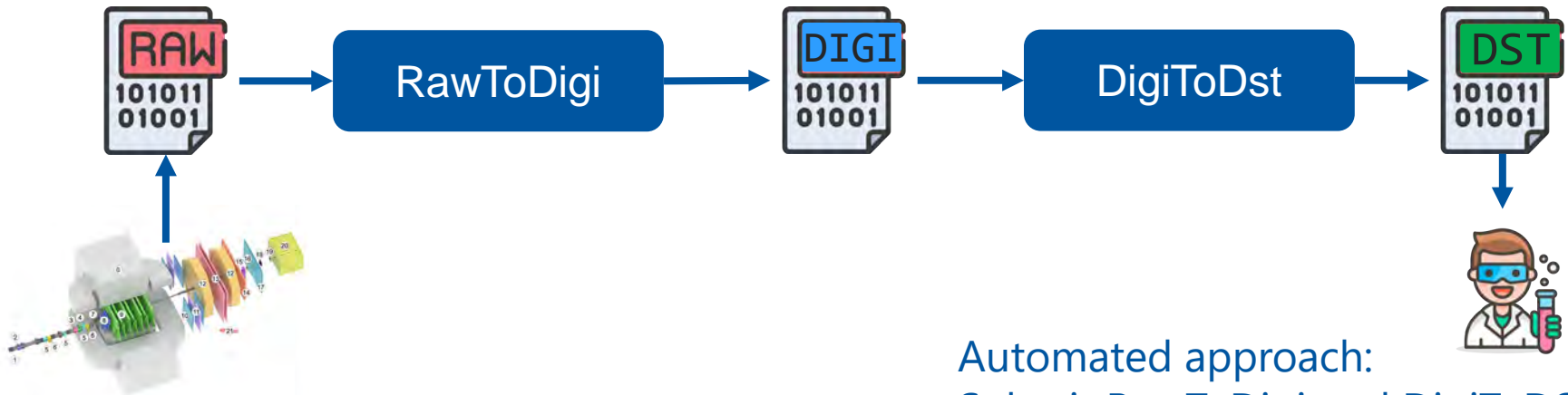
With that schema it is possible to select files by metadata:

```
$ dirac-dms-find-lfns type=raw run_number=9
/bmn.nica.jinr/exp/raw/run9/file_1_v0_p0.data
/bmn.nica.jinr/exp/raw/run9/file_2_v0_p0.data
/bmn.nica.jinr/exp/raw/run9/file_3_v0_p0.data
```

...

3. Job submission automation

Automation of raw data processing serves one purpose:
Provide access to the DST data files as soon as they appear.

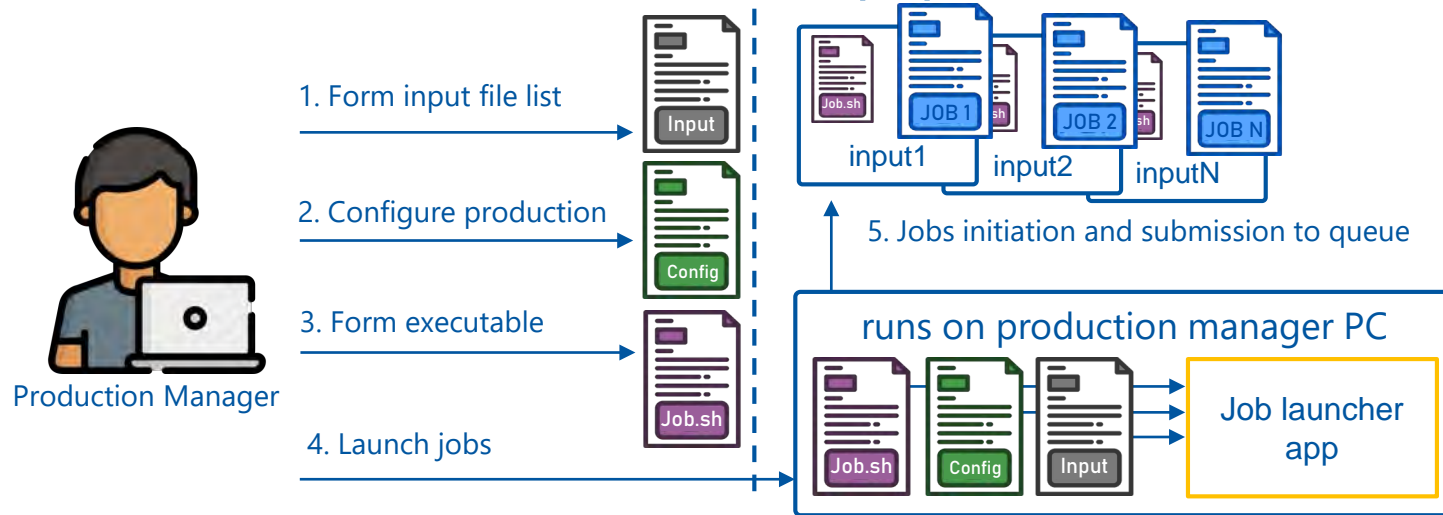


Standard approach:

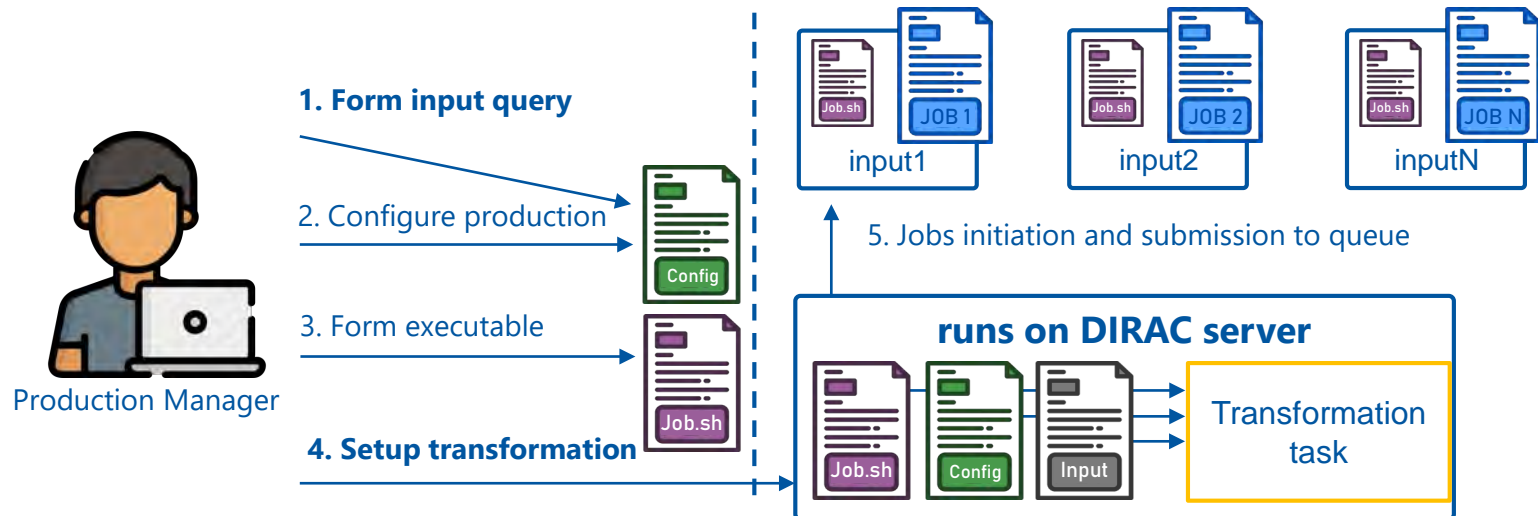
1. Wait until all *raw* files are collected.
2. Submit jobs for all *raw* files.
3. Submit jobs for all *digi* files.
4. Upload all *dst* files to NCX.

Automated approach:
Submit RawToDigi and DigiToDST
job immediately when source files
appear

Standard approach



Automated approach



Automation schema

To automate job processing the following tasks should be completed:

1. **Upload** new *raw* file to DIRAC file catalog.
2. **Detect** new *raw* file in DIRAC file catalog and **submit** RawToDigi job for each new *raw* file.
3. **Detect** new *digi* file in DIRAC file catalog and **submit** DigiToDst job for each new *digi* file.
4. **Upload** *digi* and *dst* files to NCX cluster.

The core of automation system is DIRAC File Catalog.

Transformation service – is a main service which is responsible for:

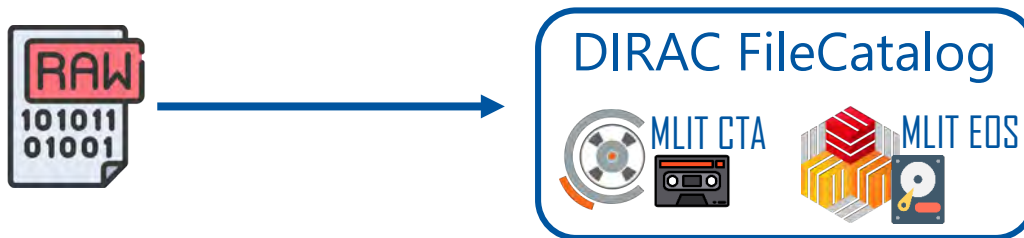
1. Detection of a new files that appear and satisfy configured query
Example of query: {type=raw, run_number=9}
2. Submission of jobs. For each new file – new job is submitted.
3. Tracking of new files and submitted jobs.
4. From production manager's point of view, creation of a transformation is similar to creation of a job. But instead of launching a job PM just configure the File Catalog query.

Automation schema

To automate job processing the following tasks should be completed:

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3. **Detect** new *digi* file in DIRAC file catalog and **submit** DigiToDst job for each new *digi* file.
4. **Upload** *digi* and *dst* file to NCX cluster.

Done by using AirFlow. Data copied to DIRAC file catalog both to tape and to disk storage.

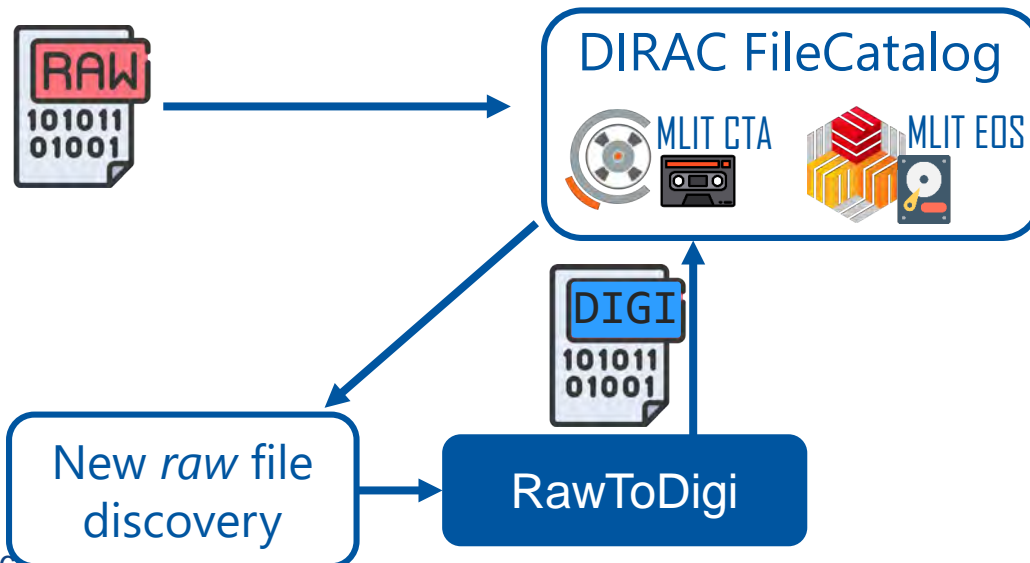


Automation schema

To automate job processing the following tasks should be completed:

1. **Upload** new *raw* file to DIRAC file catalog.
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3. **Detect** new *digi* file in DIRAC file catalog and **submit** DigiToDst job for each new *digi* file.
4. **Upload** *digi* and *dst* file to NCX cluster.

Special request to DIRAC FileCatalog created to get list of raw files from run9. For each new raw file RawToDigi job started.

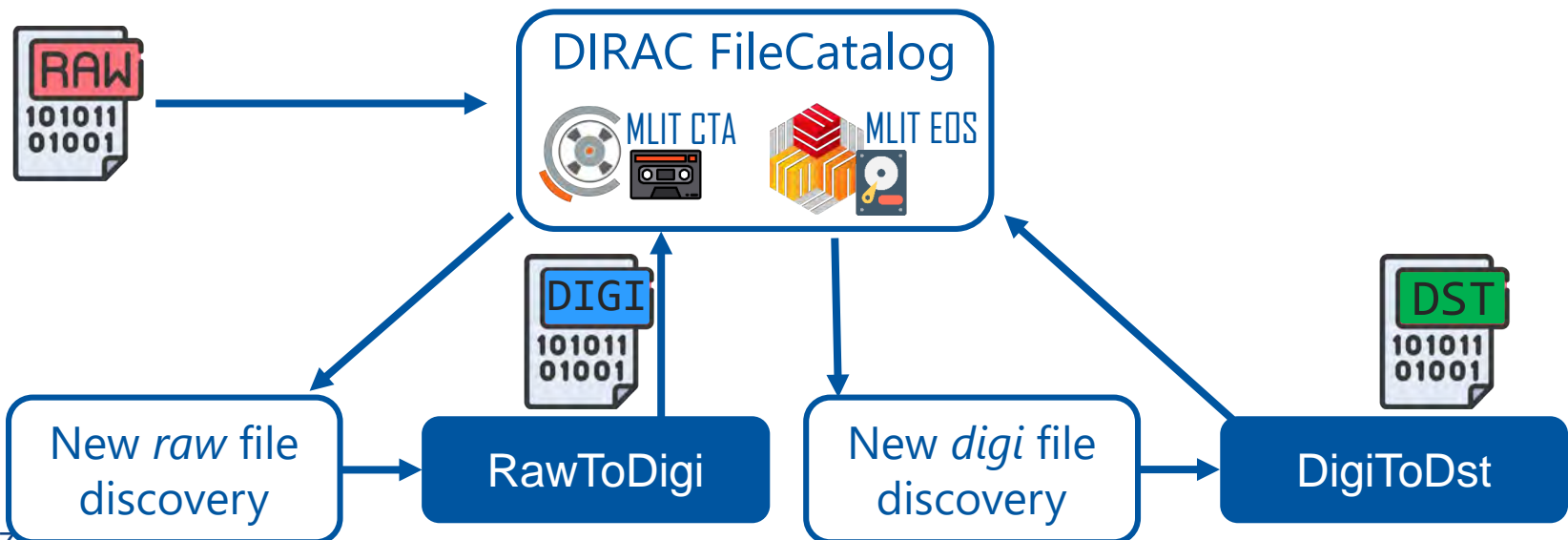


Automation schema

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1. **Upload** new *raw* file to DIRAC file catalog.
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4. **Upload** *digi* and *dst* file to NCX cluster.

Same approach to find new digi files related to run9. Automatically starts DigiToDst jobs for new files.

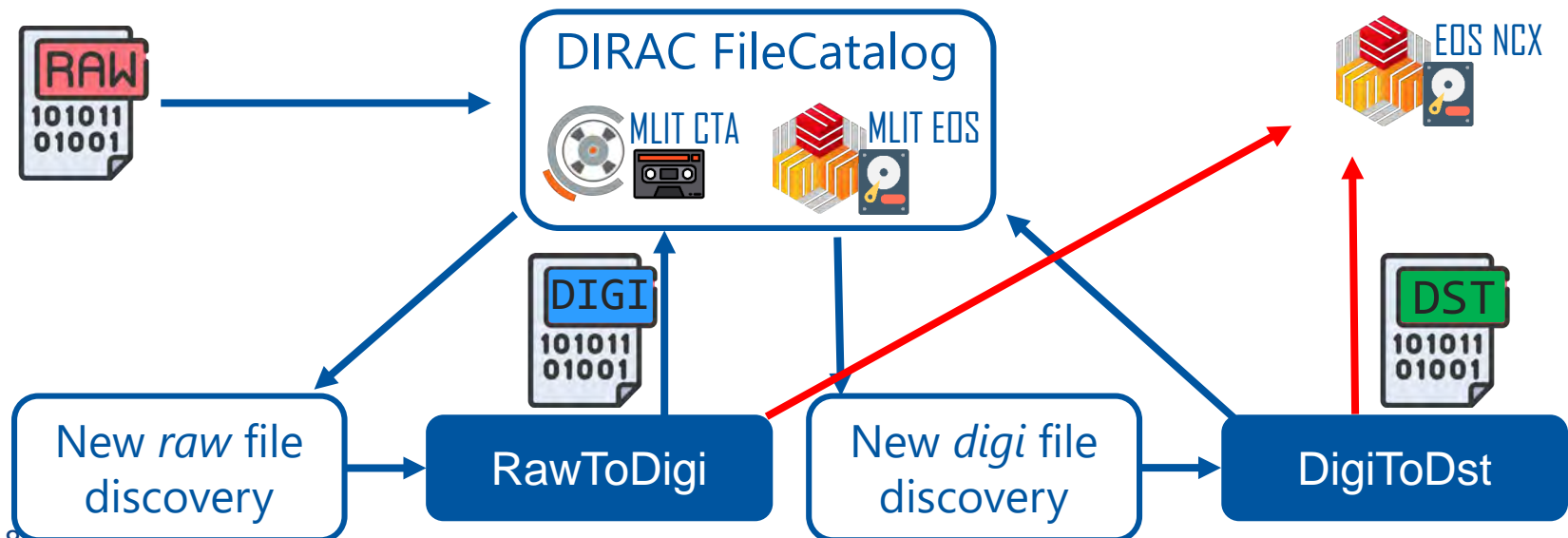


Automation schema

To automate job processing the following tasks should be completed:

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4. **Upload** *digi* and *dst* file to NCX cluster.

Digi and *dst* files automatically copied during corresponding RawToDigi and DigiToDst jobs execution



Automation plan

To automate job processing the following tasks should be completed:

1. Wait until we start receive data in DIRAC FileCatalog
2. Check the size of files and run test RawToDigi and DigiToDst jobs manually for these subset of files.
3. If everything is ok, run automatic RawToDigi and DigiToDst job submission.
4. Turn off RawToDigi job execution if *raw* file has size more than 16 GB.

This should be done during one first week of data taking.

Important notice

- Automation is a good thing **only for rock solid workflows.**
- The only advantage of automation – is a decreasing of a delay between appearance of *raw* data and providing access to *dst* data.
- BM@N is the first experiment trying automation among DIRAC users on JINR.
- There are many way to organize automatic data processing. DIRAC is just one way that we want to try and test.

List of participants

DIRAC: Igor Pelevanyk

BM@N: Konstantin Gertsenberger

Responsible for resources:

Tier-1, Tier-2, EOS: Valery Mitsyn

CTA Tape library: Vladimir Trofimov

Govorun: Dmitry Podgainy, Dmitry Belyakov, Aleksandr Kokorev, Maxim Zuev

NICA cluster: Ivan Slepov

DDC cluster: Ilia Slepnev

Network: Andrey Dolbilov

Results from 13th B@MN collaboration

- 2 full data productions performed.
- During last production DDC cluster were not used only because BM@N users were using it actively.
- Reports about productions are collected and saved in GitLab and usually available in dedicated topic on the BM@N forum.

Example of the last production report is attached to the indico page with this talk:

<https://indico.jinr.ru/event/5284/contributions/31199/>

Thank you for attention!

