Rucio for SPD data management

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Current status[1/2]

At the moment, the required set of system components of three Rucio-servers are deployed in Docker containers based on JINR cloud computing infrastructure:

- Prod Rucio-server. The main Rucio-server which work stable and used for the needs of the SPD collaboration.
- Dev Rucio-server. This server is used for development, testing and debugging.
- Int Rucio-server. All updates and innovations are checked and tested on this installation before being put on the Prod Rucio-server.

Current status[2/2]

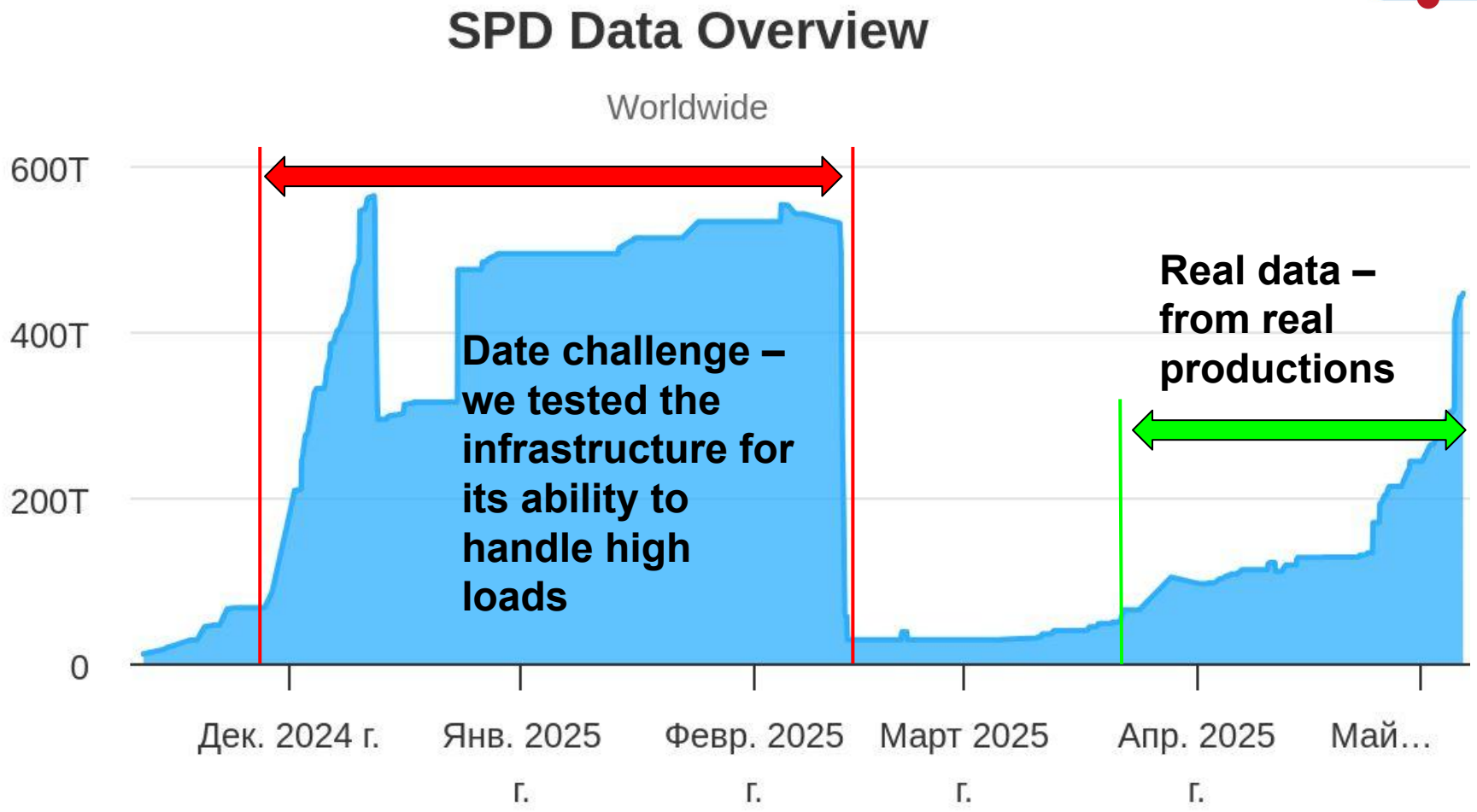
We have updated the Rucio-server to the next LTS version.

The current version is 35.6.1

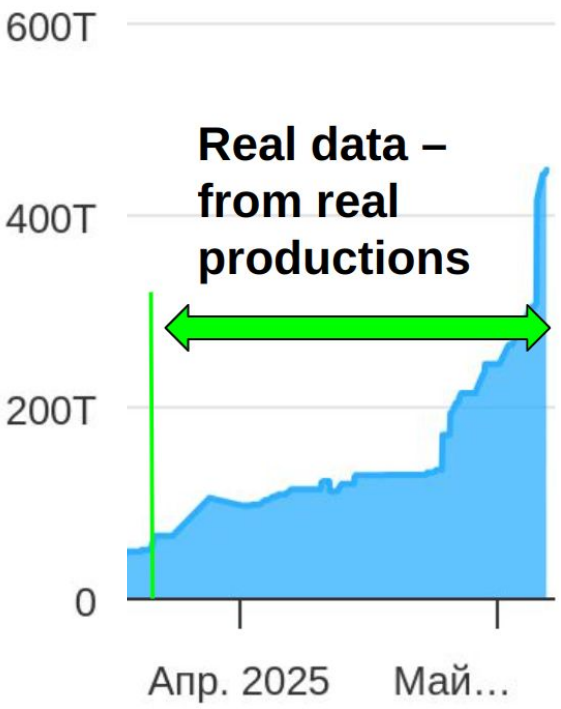
The previous version is 32.8.1

Version	Code name	Release date	Supported until
39	Grand Theft Donkey	*2025-11*	*2026-03*
38 LTS	Donkirk	*2025-07*	*at least 2027-07*
37	Dungeons & Donkeys	*2025-03*	*2025-07*
36	**Donkey Unchained**	**2024-12**	*2025-03*
35 LTS	**Donkey and the Data Factory**	**2024-07**	*at least 2026-07*
34	Donkey Potter and the Data Cache	2024-03	2024-07
33	Eternal Sunshine of the Donkey's Mind	2023-12	2024-03
32 LTS	**The Good, The Bad and the Donkey**	**2023-08**	**2025-08**

Data Management [1/3]



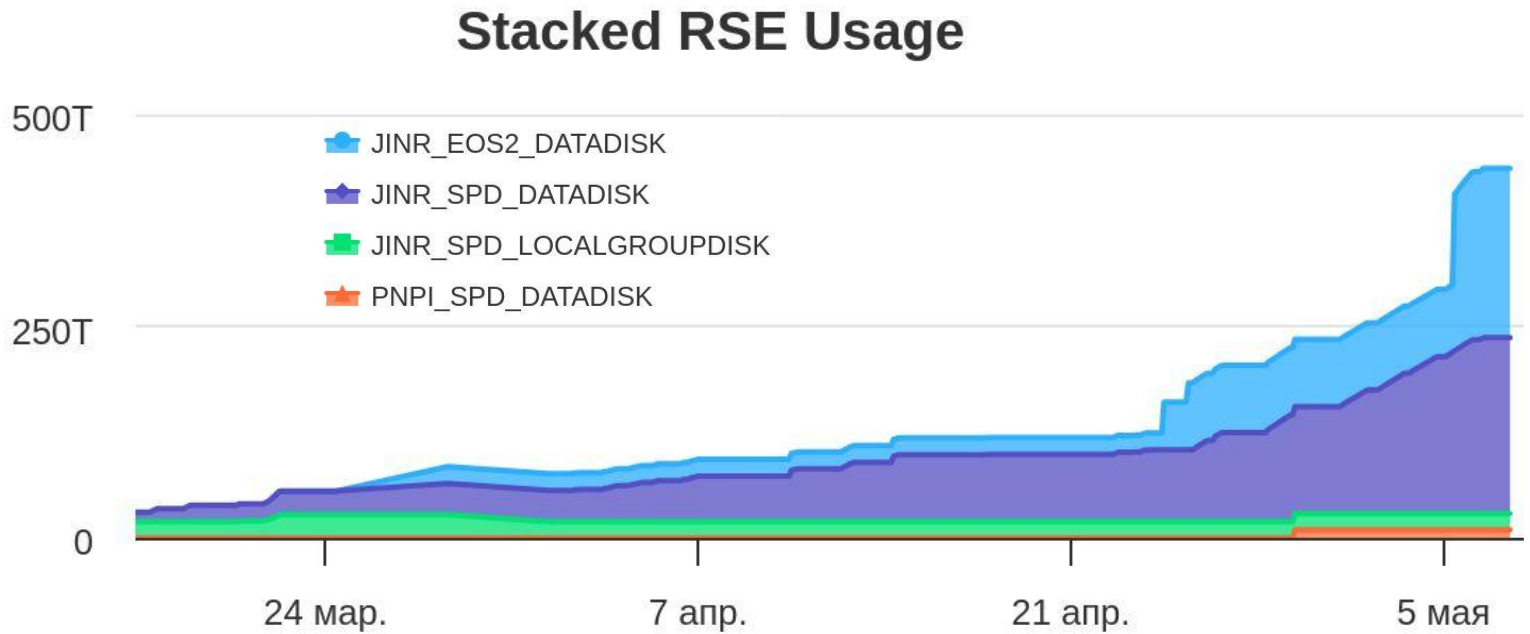
Data Management [2/3]



SCOPE:NAME	FILES	SIZE
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-015.SIM.1.S	1282	N/A
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-015.SIM.1.P	1282	N/A
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-014.RECO.1.R	10051	N/A
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-014.SIM.1.S	10000	19.698 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-014.SIM.1.P	10000	14.893 GB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-013.RECO.1.R	9992	19.903 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-013.SIM.3.S	10000	19.697 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-013.SIM.3.P	10000	14.887 GB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-012.SIM.1.S	10000	19.700 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-012.SIM.1.P	10000	14.893 GB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-012.RECO.1.R	9993	19.914 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-011.SIM.1.S	1250	2.463 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-011.SIM.1.P	1250	1.862 GB
MC2025_S1:MC2025_S1.minbias-P8-spdroot4172-dev.27GeV-UU.PROD2025-011.RECO.1.R	1250	2.491 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.4GeV-UU.PROD2025-010.SIM.1.S	1250	276.743 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.4GeV-UU.PROD2025-010.SIM.1.P	1250	1.775 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.4GeV-UU.PROD2025-010.RECO.1.R	1244	308.961 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-009.SIM.2.S	10000	7.566 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-009.SIM.2.P	10000	14.220 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-009.RECO.1.R	9997	7.961 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-009.SIM.1.S	9997	7.563 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-009.SIM.1.P	9997	14.214 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-008.SIM.1.S	10000	3.437 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-008.SIM.1.P	10000	14.216 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-008.RECO.1.R	9997	3.641 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-007.SIM.1.S	10000	3.437 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-007.SIM.1.P	10000	14.220 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-007.RECO.1.R	9993	3.639 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-006.SIM.1.S	1231	931.417 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-006.SIM.1.P	1231	1.750 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.10GeV-UU.PROD2025-006.RECO.1.R	1535	1.223 TB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.S	1250	429.681 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.P	1250	1.778 GB
MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.RECO.1.R	1221	444.210 GB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.RECO.1.R	9993	8.450 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.RECO.1.R	4997	4.216 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.S	5000	4.109 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.P	5000	7.109 GB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.2.R	4996	4.214 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.S	1250	1.027 TB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.P	1250	1.777 GB
MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.RECO.1.R	1249	1.053 TB

Data Management [3/3]

We have several storage facilities:
- **SPD EOS**: Since this year, SPD has own EOS in JINR and we are now transferring data from the old to the new one.
- JINR EOS: **DATADISK** – for production data generation, **LOCALGROUPDISK** – is used for results of test data productions.
- **PNPI EOS**: It currently stores a bit of data. It will be used to store replicas.

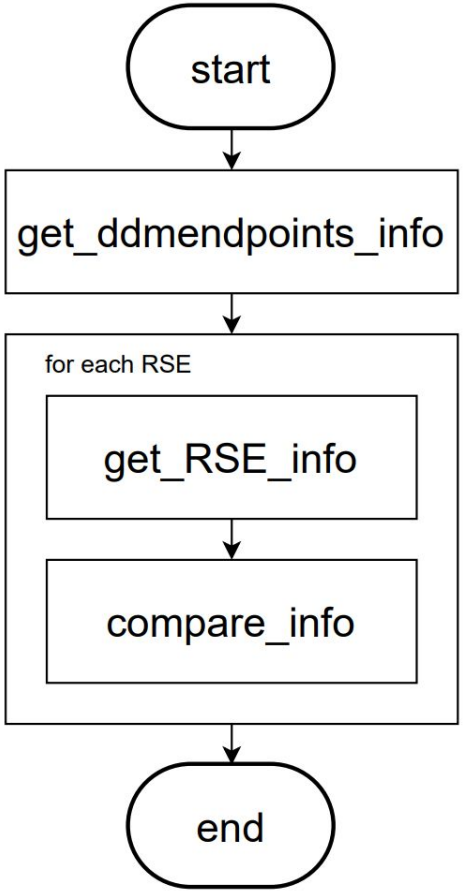


CRIC integration [1/2]

The Computing Resource Information Catalog (CRIC) is a system designed to manage and provide information about computing resources used in distributed computing infrastructures. (More information about the CRIC is in Alexey Anisenkov's report this afternoon.)

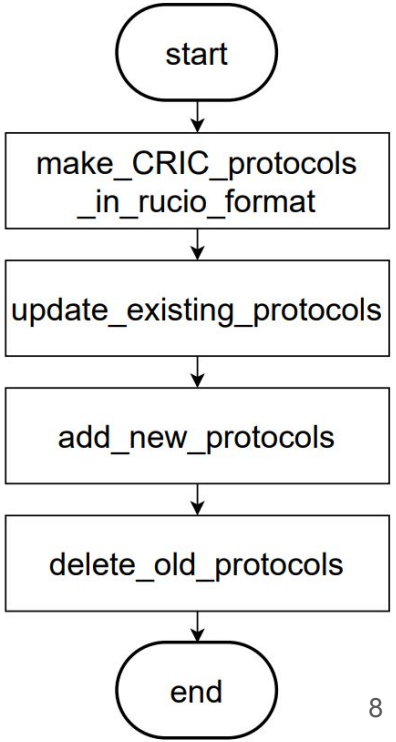
CRIC is integrated with Rucio to manage storage system configuration from a single location, by an administrator.

CRIC integration [2/2]



A module has been developed for importing configuration information about storage systems from CRIC to Rucio. This utility is configured to run in cron once per hour.

1) Takes information from CRIC about all storage systems registered in it.
2) Requests protocols and attributes of RSE from Rucio.
3) Compares info (changes it if necessary):
   - checks attributes;
   - checks fts;
   - checks protocols.



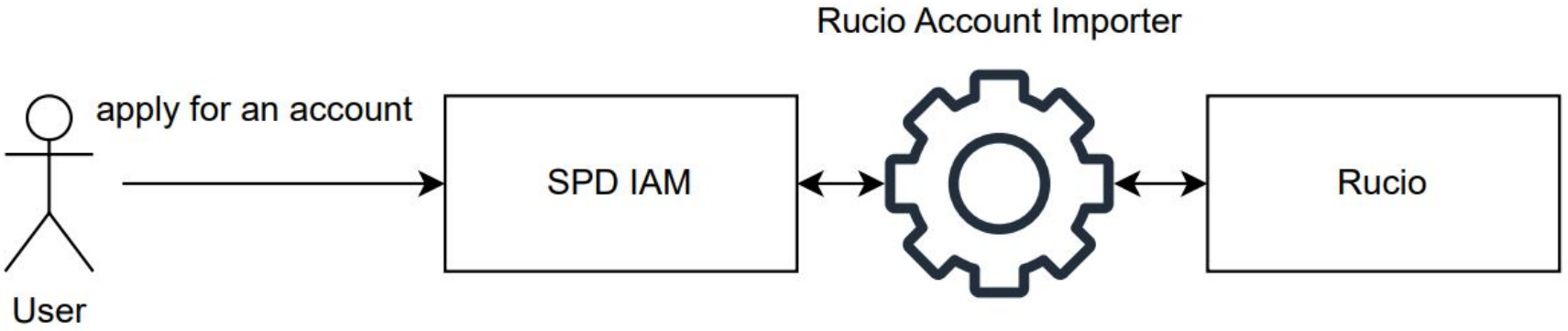
PanDA integration

We have developed an utility that once per day takes info from Rucio and creates a special json file. This file describes current storage usage.

Here's how PanDA finds out about the storages space usage. If the estimated task output size is larger than the storage space left, task will not be created.

Account management [1/2]

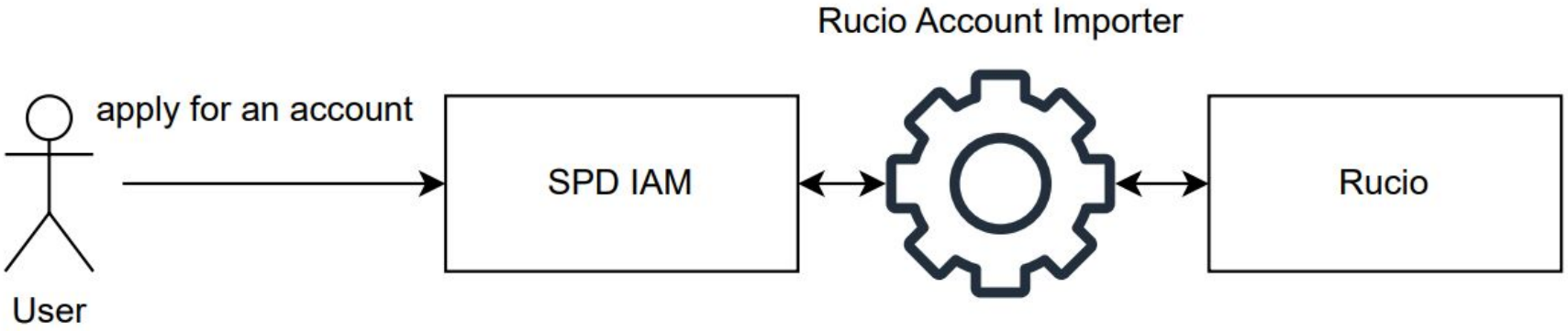
We have developed an utility that imports **user** and **group** accounts from SPD IAM to Rucio. This solution simplifies the access control process.



Account management [2/2]

The Rucio Account Importer is configured to run in cron once per day. The utility adds new accounts and updates the identification information of existing Rucio accounts.

We have also added functionality for automatic import of group accounts. Currently, there are no phys groups in SPD IAM. For their registration and management, please contact Danila Oleynik or Artem Petrosyan.

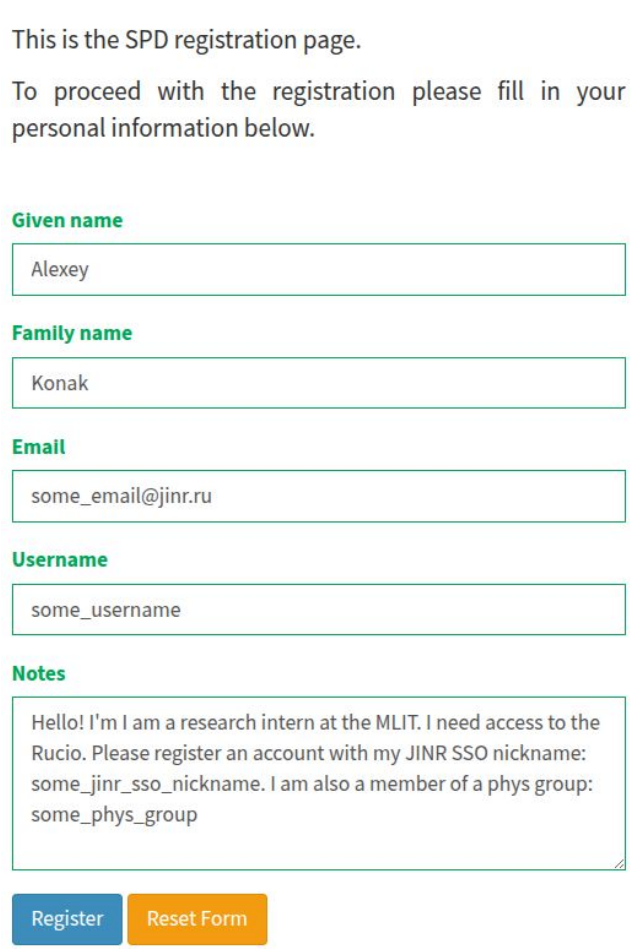


Registration Request

When requesting registration at SPD IAM, specify in “Notes” section that **you need access to Rucio** and provide your **JINR SSO nickname**. Then a user account in Rucio will be created for you. If you are a member of a group, this should also be indicated in the registration request.

Example of reason for your registration request:

Hello! I'm I am a research intern at the MLIT. I need access to the Rucio. Please register an account with my JINR SSO nickname: some_jinr_sso_nickname. I am also a member of a phys group: some_phys_group

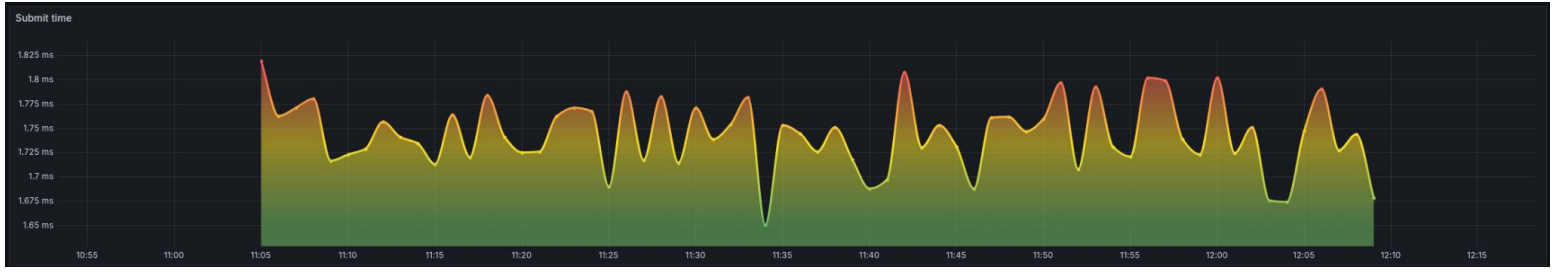


Monitoring System (requests and traces)

We work on the monitoring system. By now we have some health checks and control panel of system performance.

Monitoring System (replication process)[1/2]

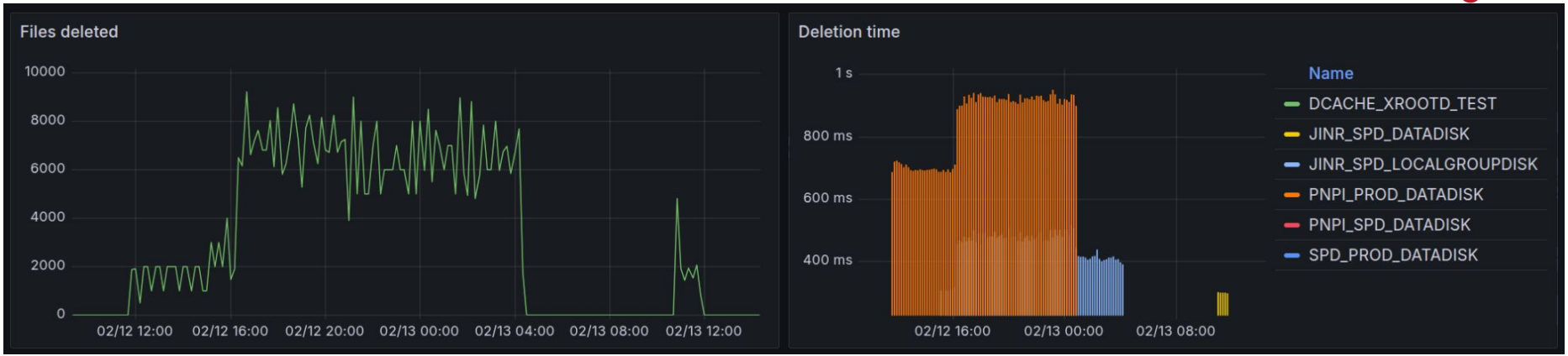
Indicators of success/failure requests for transfer, and time spent per actions.



Monitoring System (replication process)[2/2]

Statuses of transfers and size of bulk transfer

Monitoring System (deletion)



Files deletion time per storage

Number of deleted DIDs

Future plans

- Monitoring system – finalizing of a monitoring system to monitor the state of the system and its performance, as well as user activity and storages status.
- User policy – dividing users into groups and reviewing the allowed actions for these groups.
- Start using TAPE storages.

Thank you for your attention!

Backup slides

About Rucio

Rucio is an open-source software framework that provides functionality for data management and access in a distributed storage environment. Rucio also provides protection against data loss and speed up access to data through a controlled number of replicas.

Currently, the Rucio system can be used to:
– organize data in a hierarchical structure for easy navigation and management;
– unified interaction of a heterogeneous network and storage infrastructure;
– distribute data for storage;
– adaptive data replication and recovery;
– automated data transfer between storages;
– storage of all types of experimental data;
– data lifecycle management;
– storage and management of metadata;
– provides metrics for monitoring data usage, system performance and the status of various components.

Official Rucio documentation: https://rucio.cern.ch/documentation/

Quick terminology recap

File – the smallest operational unit of data in Rucio.

Dataset – a named set of files.

Container – a named set of datasets or, recursively, containers

DID – rucio LFN for data (file/dataset/container) as combination of a scope and a name.

Scope – a scope partitions the namespace into several sub namespaces.

Replica – a managed copy of a file.

RSE – the logical abstraction of a storage system for physical files. It has a unique identifier and a set of meta attributes describing properties.

Contact information and additional resources

For all question contact:
- konak@jinr.ru

Official Rucio documentation:
- https://rucio.cern.ch/documentation/

Previous guide:
- https://git.jinr.ru/nica/spdroot/-/wikis/Rucio%20basics

New rucio guide:
- https://git.jinr.ru/spd/spd-dc/rucio/ddm-utils/-/blob/dev/userguide/README.md

Current Naming Convention

Grouping tier	Field	Description	Example
0	[YEAR]	Main Scope - the year of data production	2050
1	[MC | DATA]	Real data or simulated data	DATA
2	[energy][polarization]		250LT
3	[desc]	Short name of physics aim	minbias
4	[RunNumber]	Run number for DATA, ID for MC	27189
5	[data type]	EVGEN, SIMUL, RECO….	RAW
6	[DatasetUID]	unique ID of the dataset	636763fd78df7d
7	[Version]	for reprocessing	0

Using the rucio-client at cvmfs

1) Enter at lxui.jinr.ru using ssh. Run command at CLI:
   ssh <sso_nickname>@lxui.jinr.ru

```
alex@alex-konak573:~$ ssh konak@lxui.jinr.ru
konak@lxui.jinr.ru's password:
Last login: Tue Mar 11 15:06:43 2025 from bk081.jinr.ru
```

2) Activate rucio client. Run command:
   source /cvmfs/spd.jinr.ru/sw/ddm/rucio-clients/latest/bin/activate

```
lxui04:~ > source /cvmfs/spd.jinr.ru/sw/ddm/rucio-clients/latest/bin/activate
(1.31.7) lxui04:~ >
```

3) Authenticate in rucio. You can use any rucio-client command. For example: **rucio whoami**

```
(1.31.7) lxui04:~ > rucio whoami
account_type : USER
status       : ACTIVE
suspended_at : None
created_at   : 2024-08-01T12:19:41
email        : konak@jinr.ru
account      : konak
deleted_at   : None
updated_at   : 2024-08-01T12:19:41
```

Install your own rucio-client

You can install a rucio-client on your workstation, by following this instruction.

https://git.jinr.ru/spd/spd-dc/rucio/ddm-utils/-/blob/dev/userguide/client_installation.md

It describes the steps performed to prepare for installation and two installation methods.

If you have any questions, please contact konak@jinr.ru

How to authenticate

We offer two flow of authentication in rucio-client.

Using proxy-certificate	Using SPD-IAM
You need to have user certificate issued by **Russian Data Intensive Grid** (https://ca.grid.kiae.ru/RDIG/) or **JINR Grid Certification Authority** (https://ca.jinr.ru/)	With authentication command need to specify parameter "**-S=oidc**" or export this - **export RUCIO_AUTH_TYPE=oidc**
Usercert and userkey in ".pem" format need to be placed in **<home_dir>/.globus** with access mode 600 and 400	You need using browser to authenticate
You need to register user certificate in SPD-IAM	
Generate proxy-certificate with command `voms-proxy-init -voms spd.nica.jinr:/spd.nica.jinr</Role>`	
export proxy-cert with command `export X509_USER_PROXY=/tmp/<proxy_cert>`	
rucio-client at cvmfs use auth method with proxy by default	

Auth with proxy-certificate

1) Create proxy-certificate using command **voms-proxy-init -voms <VO:VO-role>**

```
lxui03:~ > voms-proxy-init -voms spd.nica.jinr:/spd.nica.jinr/Role=production
Contacting spd-voms.jinr.ru:15000 [/C=RU/O=JINR/OU=GRID/OU=hosts/CN=spd-voms.jinr.ru] "spd.nica.jinr"
Remote VOMS server contacted succesfully.


Created proxy in /tmp/x509up_u8102.

Your proxy is valid until Tue Apr 01 02:34:53 MSK 2025
```

2) Export created proxy-certificate

```
lxui03:~ > export X509_USER_PROXY=/tmp/x509up_u8102
```

3) Authenticate with activated rucio-client

```
(1.31.7) lxui04:~ > rucio whoami
account_type : USER
status       : ACTIVE
suspended_at : None
created_at   : 2024-08-01T12:19:41
email        : konak@jinr.ru
account      : konak
```

Auth with SPD-IAM [1]

1) **export RUCIO_AUTH_TYPE=oidc**

```
lxui03:~ > export RUCIO_AUTH_TYPE=oidc
```

2) Authenticate with activated rucio-client

```
(1.31.7) lxui03:~ > rucio whoami

Please use your internet browser, go to:

    https://spd-rucio.jinr.ru/auth/oidc_redirect?mz6Chd3grZtm57vrYcLWKQv

and authenticate with your Identity Provider.
Copy paste the code from the browser to the terminal and press enter:
```

3) Use your internet browser to authenticate in SPD-IAM with following link

Auth with SPD-IAM [2]

4) Allow authorization through the client

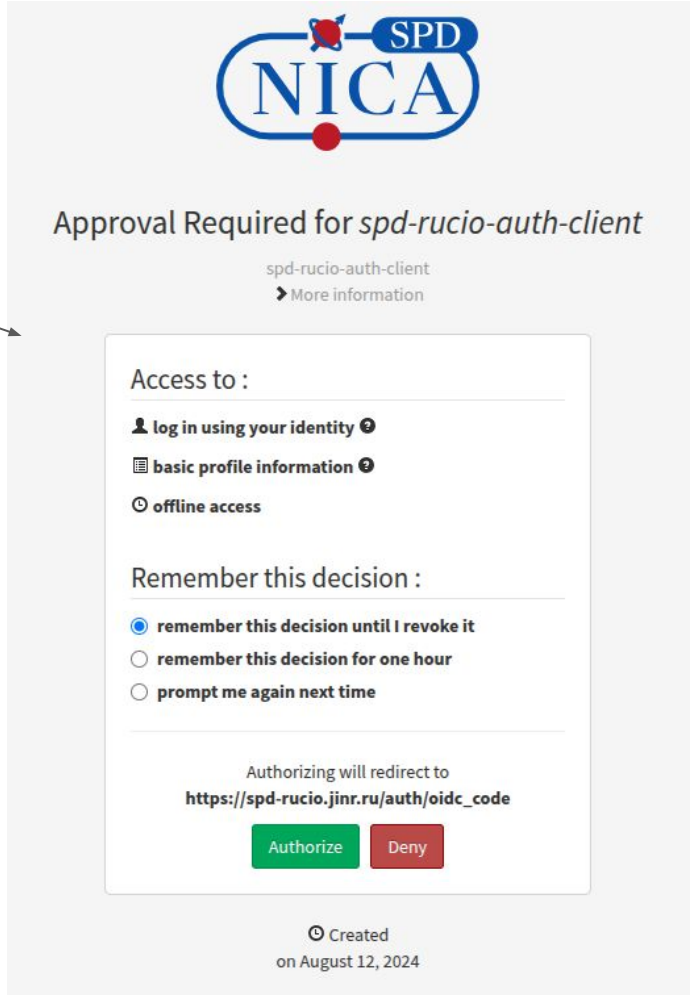
5) Copy special code from Rucio Web UI and paste it to the terminal

RUCIO

SCIENTIFIC DATA MANAGEMENT

Please copy-paste the following code to the open terminal session with Rucio Client in order to get your access token:

ehY3NT9VhozkugICpGx4wUIEA9ZyfBaJaRGMvt133mZ9RBYolo



Auth with SPD-IAM [3]

6) Paste special code to the terminal

```
(1.31.7) lxui03:~ > rucio whoami

Please use your internet browser, go to:

    https://spd-rucio.jinr.ru/auth/oidc_redirect?mz6Chd3grZtm57vrYcLWKQv

and authenticate with your Identity Provider.
Copy paste the code from the browser to the terminal and press enter:
ehY3NT9VhozkuglCpGx4wUIEA9ZyfBaJaRGMvt133mZ9RBYolo
account_type : USER
status       : ACTIVE
suspended_at : None
created_at   : 2024-08-01T12:19:41
email        : konak@jinr.ru
account      : konak
deleted_at   : None
updated_at   : 2024-08-01T12:19:41
```

How to explore data [1]

- To view the list of DIDs, use the command **rucio list-dids <did_pattern>** (shows a list of dids match given pattern)

```
(1.31.7) lxui03:~ > rucio list-dids MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001*
+-------------------------------------------------------------------------------------+--------------+
| SCOPE:NAME                                                                          | [DID TYPE]   |
|-------------------------------------------------------------------------------------+--------------|
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.2.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.2.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.5.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.5.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.5.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.1.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.1.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.1.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.RECO.1.log      | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.RECO.1.R        | DATASET      |
+-------------------------------------------------------------------------------------+--------------+
```

```
(1.31.7) lxui03:~ > rucio list-dids MC2025_S1:MC2025_S1.minbias-FTF*
+-------------------------------------------------------------------------------+--------------+
| SCOPE:NAME                                                                    | [DID TYPE]   |
|-------------------------------------------------------------------------------+--------------|
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.log | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.S   | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.P   | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.RECO.1.R  | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.RECO.1.log | DATASET      |
+-------------------------------------------------------------------------------+--------------+
```

```
(1.31.7) lxui03:~ > rucio list-dids MC2025_S1:*RECO*
+-------------------------------------------------------------------------------+--------------+
| SCOPE:NAME                                                                    | [DID TYPE]   |
|-------------------------------------------------------------------------------+--------------|
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.RECO.1.log | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.RECO.1.R   | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.1.R   | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.RECO.1.log | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.RECO.1.R  | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.2.log | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.2.R   | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.RECO.1.R   | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.RECO.1.log | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.1.log | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.RECO.1.R   | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.RECO.1.log | DATASET      |
+-------------------------------------------------------------------------------+--------------+
```

```
(1.31.7) lxui03:~ > rucio list-dids MC2025_S1:*
+-------------------------------------------------------------------------------------+--------------+
| SCOPE:NAME                                                                          | [DID TYPE]   |
|-------------------------------------------------------------------------------------+--------------|
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.2.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.2.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.5.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.5.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.5.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.1.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.1.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.1.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.SIM.3.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.RECO.1.log      | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-001.RECO.1.R        | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.1.R        | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.2.log      | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.2.R        | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.SIM.1.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.SIM.1.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.SIM.1.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.SIM.1.P         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.RECO.1.log     | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.RECO.1.log      | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.SIM.1.log       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.SIM.1.S         | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.log      | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.S        | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.NA.PROD2025-004.SIM.331               | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.SIM.1.P        | DATASET      |
| MC2025_S1:MC2025_S1.minbias-FTF-spdroot4171-dev.5GeV-UU.PROD2025-005.RECO.1.R       | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.RECO.1.R        | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-003.RECO.1.log      | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.RECO.1.log      | DATASET      |
| MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-004.RECO.1.R        | DATASET      |
+-------------------------------------------------------------------------------------+--------------+
```

We do not recommend searching all over the production scope! This loads the system and may take a long time to complete. Check the table (slide 3) and search for the production you are interested in.

How to explore data [2]

- To get content from dataset/container use **rucio list-files <did>**

```
(1.31.7) lxui03:~ > rucio list-files MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.P | head -n 8
+-------------------------------------------------------------------------------------------+--------------------------------------+-------------+-----------+----------+
| SCOPE:NAME                                                                                | GUID                                 | ADLER32     | FILESIZE  | EVENTS   |
|-------------------------------------------------------------------------------------------+--------------------------------------+-------------+-----------+----------|
| MC2025_S1:p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000001.root.1 | 61BBC477-7554-45BE-948C-BBFEED0419E1 | ad:76e05c6b | 1.422 MB  |          |
| MC2025_S1:p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000002.root.1 | E5B745C7-E285-4D84-ABDA-0252CA694D45 | ad:53cc796a | 1.422 MB  |          |
| MC2025_S1:p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000003.root.1 | BC9D8822-466B-4491-8831-723AB58C3482 | ad:71da4ed5 | 1.422 MB  |          |
| MC2025_S1:p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000004.root.1 | BC830E72-AC7C-47B3-9363-552953AE3603 | ad:054aac17 | 1.422 MB  |          |
| MC2025_S1:p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000005.root.1 | E752A5F4-410C-4A4F-A022-92B4F64EF709 | ad:e6cfaba0 | 1.422 MB  |          |
```

- To get PFNs use **rucio list-file-replicas <did> --pfns**

```
(1.31.7) lxui03:~ > rucio list-file-replicas MC2025_S1:MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.P --pfns | head -n 8
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/49/cf/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000001.root.1
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/5b/c1/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000002.root.1
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/ae/24/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000003.root.1
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/79/8e/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000004.root.1
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/9e/41/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000005.root.1
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/89/d5/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000006.root.1
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/08/ce/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000007.root.1
root://eos.jinr.ru:1094//eos/nica/spd/datadisk/rucio/MC2025_S1/7a/0a/p.MC2025_S1.minbias-P8-spdroot417-dev.10GeV-UU.PROD2025-002.SIM.1.000008.root.1
```