SPD offline computing software architecture and current status

Artem Petrosyan on behalf of the SPD collaboration
GRID’2025, MLIT, JINR
July 8, 2025

Introduction

- The SPD (Spin Physics Detector) experiment at the NICA collider at JINR is evolving as an international collaboration of physicists from various institutes working together to achieve their stated goals in the field of studying the spin structure of nucleons

- In order to provide the participants of the experiment, both inside and outside JINR, equal opportunities in the field of working with data and computing, it is necessary to select an offline computing architecture and create a distributed computing environment of the experiment with the following characteristics: a single entry point for users, data management mechanisms, equitable distribution of available computing resources, security, scalability

Current list of participants

Participants (MOUs signed)

Joint Institute for Nuclear Research (JINR)
Dubna, Russia — A. Guskov, V. Ladygin

Budker Institute of Nuclear Physics of the Russian Academy of Sciences
Novosibirsk, Russia — A. Barnyakov

Tomsk State University
Tomsk, Russia — S.Filimonov, I. Shreyber

Samara National Research University
Samara, Russia — V. Saleev

Peter the Great St. Petersburg Polytechnic University (SPbPU)
St. Petersburg, Russia — Ya. Berdnikov

University of Belgrade
Belgrade, Serbia — D. Maletic

Institute of Nuclear Physics
Almaty, Kazakhstan — S. Sakhiyev

Institute for Nuclear Research RAS
Troitsk, Russia — E. Usenko

National Research Nuclear University MEPhI
Moscow, Russia — P. Teterin

Institute for Nuclear Problems of BSU
Minsk, Belarus — A. Lobko

Skobeltsyn Institute of Nuclear Physics of the Moscow State University
Moscow, Russia — A. Berezhnoy

Petersburg Nuclear Physics Institute (NRC KI – PNPI)
Gatchina, Russia — V. Kim

National Science Laboratory
Yerevan, Armenia — N. Ivanov

Lebedev Physical Institute of the Russian Academy of Sciences
Moscow, Russia — V. Andreev

Belgorod National Research University
Belgorod, Russia — A. Kubankin

St. Petersburg State University
St. Petersburg, Russia — V. Vechernin

iThemba LABS
Somerset West, South Africa — N. Stodart

Participants

National Research Center Kurchatov Institute
Moscow, Russia — I. Alexeev

Cairo University
Cairo, Egypt — R. El-Kholy

Tsinghua University
Beijing, China — Y. Wang

CTEPP, UNAB
Santiago, Chile — S. Kuleshov

China Institute of Atomic Energy
Beijing, China — X. Li

B.I. Stepanov Institute of Physics of the National Academy of Sciences of Belarus
Minsk, Belarus — Yu. Kulchitsky

Higher Institute of Technologies and Applied Sciences (InSTEC)
Havana, Cuba — K. Shtejer

Higher School of Econimics
Moscow, Russia — F. Ratnikov

Institute of applied physics of the NAS of Belarus
Minsk, Belarus — R. Shulyakovsky

SAPHIR
Santiago, Chile — S. Kuleshov

Gomel State Technical University
Gomel, Belarus — V. Andreev

National University of Science and Technology
Moscow, Russia — M. Gorshenkov

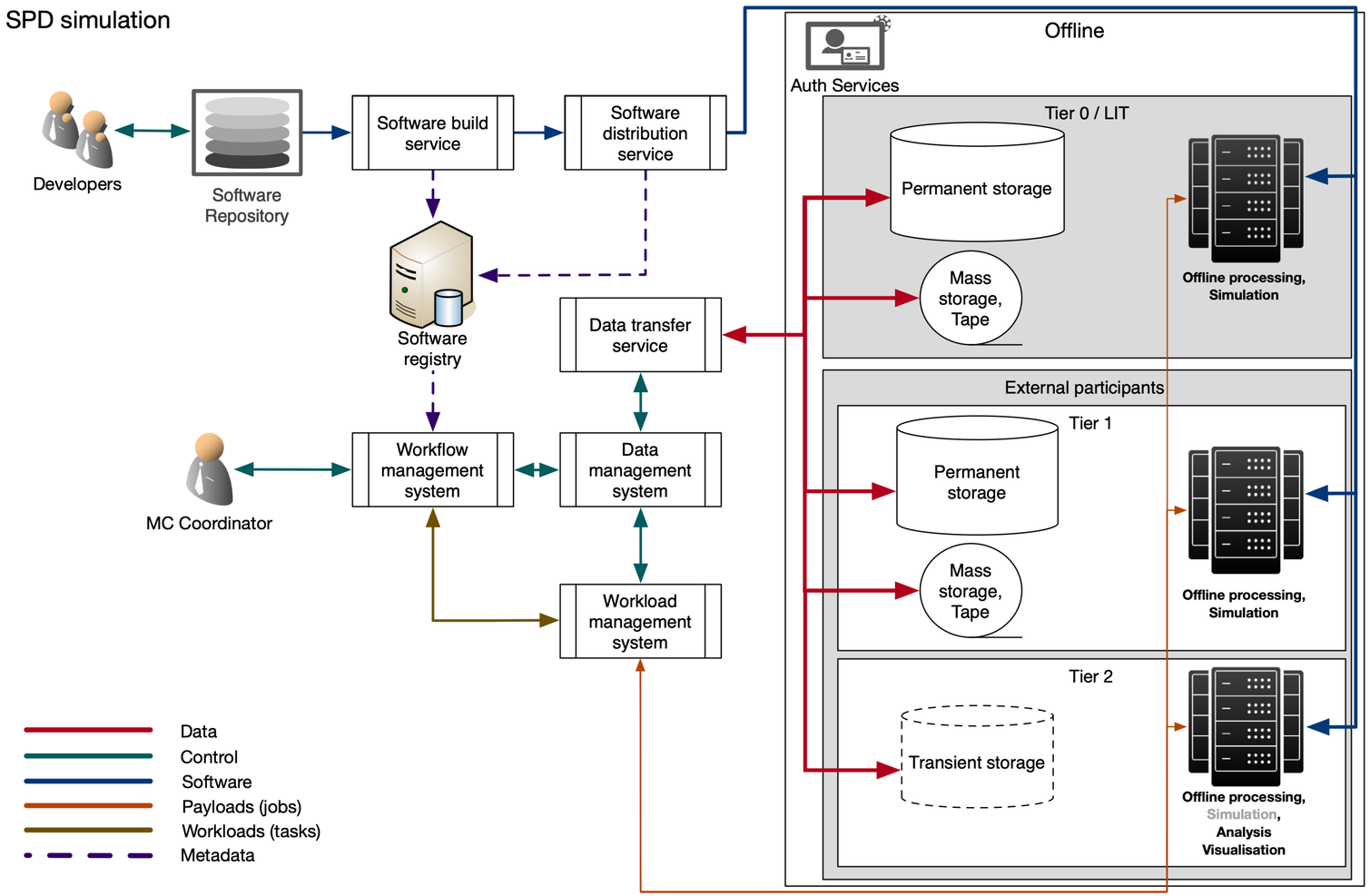
Institute for High Energy Physics
Protvino, Russia — S. Golovnya

Model of collaboration member

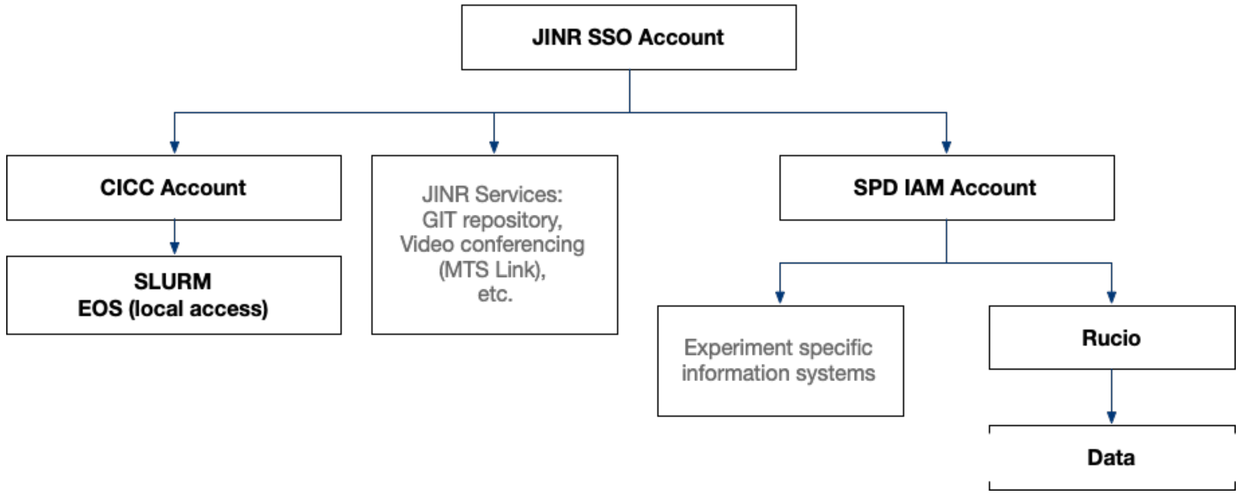
- Physics group
  - Without computing site
    - Not going to setup any computing site
    - Need resources for physics analysis
      - We provide assistance in connection to the JINR computing infrastructure
    - Would like to setup a computing site
      - We provide connection methodology, assistance in documents preparation, consultations with suppliers, etc.
  - With computing site
    - Not going to participate in the SPD computing
    - Would like to participate in the SPD computing
      - Without experience in grid computing and would like to start using grid
        - We help to setup a grid site
      - With experience in grid computing
        - We provide assistance in connection of the existing site to our computing environment
- Computing site
  - We provide instructions how to connect to our computing environment

How we foresee an offline computing environment services for the SPD

- Authentication system: JINR SSO
- Authorization system: IAM
- Information system: CRIC
- Software distribution service: CVMFS
- Data management system: Rucio
- Data transfer service: FTS
- Workload management system: PanDA
- Workflow management system: PanDA/Control Panel



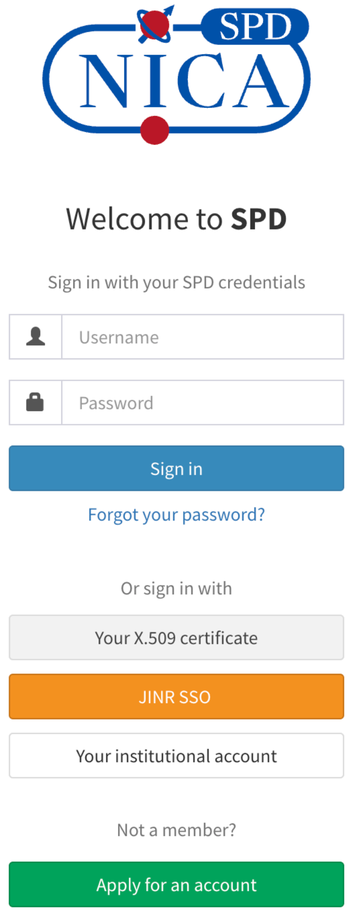
Authentication services



- At the moment we have ~150 users from the JINR and expecting to have at least the same amount of participants from different institutions
- All users have to have a SSO account (authentication backend for collaboration members) in order to use CICC services
  - Internal have it basing on their user contracts, also have to be in the SPD group in the LDAP
  - External have to become an associate member (sign an MoU, send a letter to the Director of the JINR with a list of persons who is going to use JINR's digital services)
- To start using VO services of the SPD users have to apply for account in the SPD IAM (authorization system only for collaboration members)
- We do not store passwords and any other sensitive information in the db of our identity and access management service, we fully rely on the JINR's SSO which we access via API of Keycloak

Identity and access management

- Address: spd-iam.jinr.ru
- We moved all internal operations between middleware services based on X.509 proxy from the VOMS service to the SPD IAM service
- lxui.jinr.ru, CICC computing and storage resources were configured to work with the SPD IAM as VOMS provider
- A rpm which helps adding IAM VOMS configuration to any computing site was prepared
- An integration between SSO and IAM is now finished, users can log in to IAM (and all underlying services) using JINR SSO account (use JINR SSO button at the SPD IAM login page)
- We have finished transition from VOMS to IAM and we have one entry point for all our computing services — the SPD IAM
- IAM is a source of info about users and their rights in the distributed computing environment of the SPD experiment including personal quotas in Rucio and EOS
- Middleware services like Rucio and PanDA must be registered in the IAM as well



Information system

cosmo | Core | Core API | NICA | NICA API | Admin | Logs | Help | artem.petrosyan@ji…

Export | Columns 14/20 | Filter | Reload — NICA Site list — 200

spd	filter by NICA Site	ACTIVE	filter	filter by Site	filter by Country	filter by Storage Units	filter by PanDA Sites	filter by	filter by	filter by	filter by c	filter by	filter by Data polic
VO	**NICA Site**	**State**	**Tier**	**Site**	**Country**	**Storage Units**	**PanDA Sites**	**ADC notify**	**Auto proxy**	**core power**	**core energy**	**cloud**	**Data policy**
spd	JINR-SPD	ACTIVE	T0	JINR	Russian Federation	SPD-JINR-DATA	JINR-SPD-PS	✓	✗	10	0	RU	
spd	PNPI-SPD	ACTIVE	T1	PNPI	Russian Federation	SPD-PNPI-DATA	PNPI-SPD-PS	✓	✗	6	0	RU	
spd	SSAU-SPD	ACTIVE	T2	SSAU	Russian Federation			✗	✗	10	0	RU	
VO	**NICA Site**	**State**	**Tier**	**Site**	**Country**	**Storage Units**	**PanDA Sites**	**ADC notify**	**Auto proxy**	**core power**	**core energy**	**cloud**	**Data policy**

Showing 1 to 3 of 3 entries — Previous 1 Next

cosmo | Core | Core API | NICA | NICA API | Admin | Logs | Help | artem.petrosyan@ji…

Export | new RSE | Columns 13/18 | Filter | Reload — DDMEndpoint list — 200

filter by DDMEndpoint	filter by Experiment si	filter by Storage Unit	filter	filter by Ty	filter by Endpoint	ACTIVE	filter by Resource	filter by	filter by d	filter by	filter by	filter by Space metho
DDMEndpoint	**Experiment site**	**Storage Unit**	**Tier**	**Type**	**Endpoint**	**State**	**Resource**	**cache**	**determ**	**volat**	**mkdir**	**Space method**
JINR_EOS2_DATADISK	JINR-SPD	SPD-JINR-DATA	T0	DATADISK	production/	ACTIVE	SPDDATA@JINR_SPD_EOS	✗	✓	✗	✗	rucio
PNPI_SPD_DATADISK	PNPI-SPD	SPD-PNPI-DATA	T1	DATADISK	datadisk/rucio/	ACTIVE	SPDDATA@PNPI_EOS	✗	✓	✗	✗	rucio
DDMEndpoint	**Experiment site**	**Storage Unit**	**Tier**	**Type**	**Endpoint**	**State**	**Resource**	**cache**	**determ**	**volat**	**mkdir**	**Space method**

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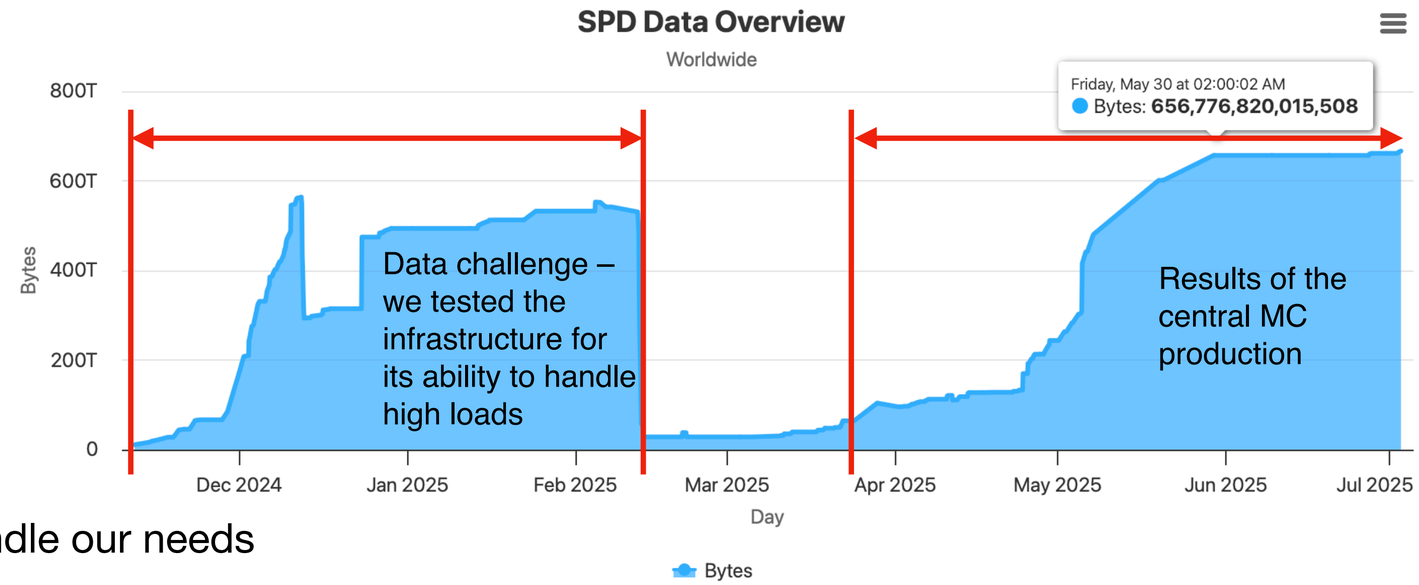
Distributed data management



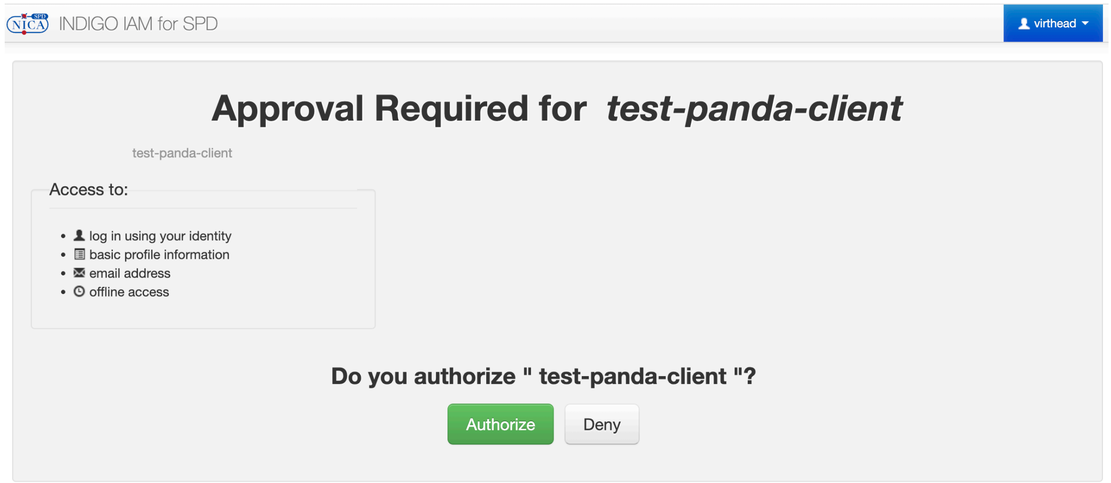
- Distributed data managed by Rucio
- Tested throughly to be sure that it can handle our needs
- Several daemons were developed to integrate Rucio with the SPD IAM (users, groups, quotas) and CRIC (storages configuration)
- An export module was developed to deliver storages usage info to PanDA
- Rucio clients installed at the CVMFS and available at lxui.jinr.ru
- Since this year, SPD has its own EOS in JINR
- An EOS instance in PNPI also used to store results of central MC productions

more about data management in the talk by Alexey Konak

PanDA IAM integration

- We finished configuring a JWT based authentication in PanDA
- Users can submit tasks via command line client or (preferable) via the Control Panel
- During task submission, in order to identify themselves, users being redirected to the SPD IAM
- The same identity is now used to log in to the Control Panel and to submit a task, it allows us to set up an end-to-end accounting
- PanDA supports auto-registration, so, unlike Rucio, there is no need to develop any identity import service

```
(test) [virthead@vm221-128 task]$ export PANDA_URL=http://vm221-128.jinr.ru:25080/server/panda
(test) [virthead@vm221-128 task]$ export PANDA_URL_SSL=https://vm221-128.jinr.ru:25443/server/panda
(test) [virthead@vm221-128 task]$ export PANDA_CONFIG_ROOT=/home/virthead/pandaclient
(test) [virthead@vm221-128 task]$ export PANDA_USE_NATIVE_HTTPLIB=1
(test) [virthead@vm221-128 task]$ export PANDA_AUTH=oidc
(test) [virthead@vm221-128 task]$ export PANDA_VERIFY_HOST=off
(test) [virthead@vm221-128 task]$ export SSL_CERT_DIR=/etc/grid-security/certificates/
(test) [virthead@vm221-128 task]$ export PANDA_AUTH_VO=spd.nica.jinr:production
(test) [virthead@vm221-128 task]$ python testOpenCharm_simu.py
INFO : Please go to https://spd-iam.jinr.ru/device?user_code=Y1XBDB and sign in. Waiting until authentication is completed
INFO : Ready to get ID token?
[y/n]
y
INFO : All set
(0, [True, 330, None])
```



	jeditaskid [PK] bigint	taskname character varying (256)	status character varying (64)	username character varying (128)
266	346	PROD2025-009.SIM.1	done	Elena Zemlyanichkina
267	347	PROD2025-009.RECO.1	finished	Elena Zemlyanichkina
268	348	MC2025_S1-003-SIM.1	aborted	Artem Petrosyan
269	349	MC2025_S1-003-SIM.1	aborted	Artem Petrosyan
270	350	MC2025_S1-003-SIM.1	aborted	Artem Petrosyan
271	351	MC2025_S1-003-SIM.3	aborted	Artem Petrosyan
272	352	MC2025_S1-003-SIM.3	failed	Artem Petrosyan
273	353	MC2025_S1-003-SIM.4	done	Artem Petrosyan
274	354	PROD2025-010.SIM	done	Elena Zemlyanichkina
275	355	PROD2025-010.RECO	finished	Elena Zemlyanichkina

Example of the MC task definition 1/2

- Step 1: simulation
- User defines an output dataset name
- Desired total number of events and events per job
- The system divides the total number of events by the number events per job and generates the required number of jobs
- User can specify either a specific computing queue or a cloud; in the second case, the jobs will be distributed among the queues of the specified cloud
- Jobs execution is performed in the container

```
TaskName = '2024.27GeV.test-MB.2st.DSSD.simu'
DatasetName = '2024.MC.27GeV.test-minbias.00001.SIMUL.0'
#DatasetName = 'jeditest.000023.simu'

taskParamMap = {}

taskParamMap['nEventsPerJob'] = 4000
taskParamMap['nEvents'] = 20000000
taskParamMap['noInput'] = True
taskParamMap['skipScout'] = True
taskParamMap['taskName'] = TaskName
taskParamMap['userName'] = 'Artem Petrosyan'
taskParamMap['vo'] = 'spd.nica.jinr'
taskParamMap['taskPriority'] = 900
taskParamMap['architecture'] = 'x86_64'
taskParamMap['transUses'] = 'A'
taskParamMap['transHome'] = None
taskParamMap['transPath'] = 'https://159.93.221.125:8080/spd_simu_VA_transform.sh'
taskParamMap['processingType'] = 'step1'
taskParamMap['prodSourceLabel'] = 'managed'
taskParamMap['taskType'] = 'test'
taskParamMap['workingGroup'] = 'spd.nica.jinr'
taskParamMap['cloud'] = 'JINR'
taskParamMap['ramCount'] = 1900

outDatasetNameLog = '{0}.log'.format(DatasetName)
outDatasetNameS = '{0}.S'.format(DatasetName)
outDatasetNameP = '{0}.P'.format(DatasetName)

taskParamMap['log'] = {'dataset': outDatasetNameLog,
                       'type':'template',
                       'param_type':'log',
                       'token':'DATADISK',
                       'value':'{0}.${{SN}}.log.tgz'.format(DatasetName)}

taskParamMap['jobParameters'] = [
    {'type': 'constant',
     'value': '''singularity run --bind /cvmfs/spd.jinr.ru/production/MC/2024.27GeV.test-MB.2st.DSSD:/prod -H
     ./:/WORKDIR
    /cvmfs/spd.jinr.ru/images/spdroot-4.1.6.sif spdroot.py -b -q \'/prod/simu.C({0}, '''.format(taskParamMap['nEventsPerJob']),
     },
```

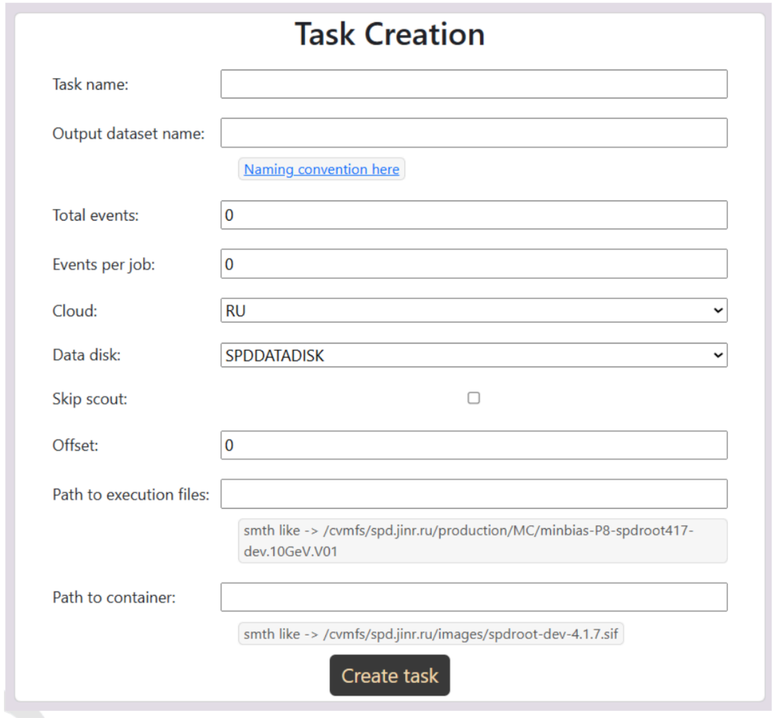
Example of the MC task definition 2/2

- Step 2: reconstruction
- User defines a name of the input dataset, in this example there are two input datasets of the same size (have the same number of files)
- Sets a name of the output dataset
- Set how many jobs needs to be created per each file in the dataset
- At the job generation stage, the workload management system communicates with the data management service, reads the size (number of files) of the dataset and generates the appropriate number of jobs
- The input files will be staged-in from the storage closest to the computing node

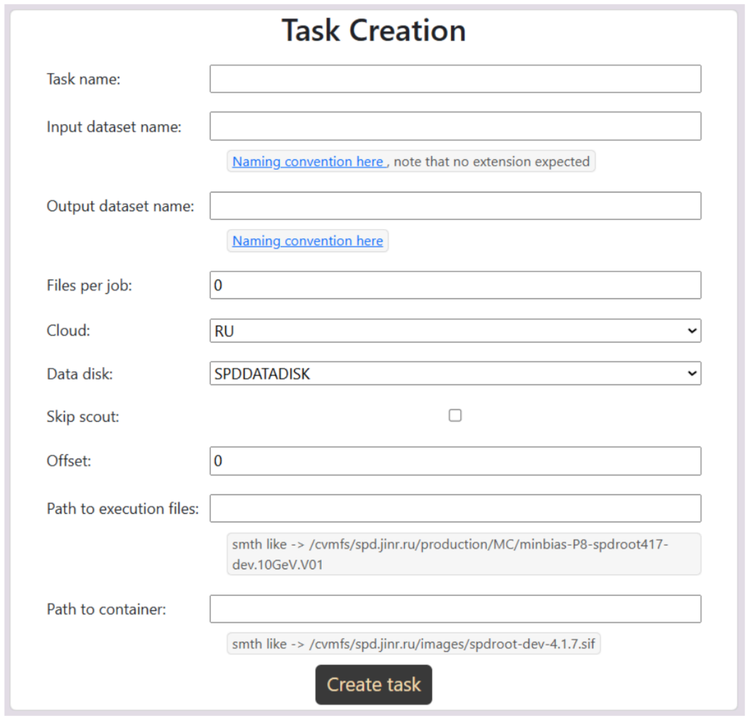
```
scope = '2024'
inDatasetName = '2024.MC.27GeV.test-minbias.00001.SIMUL.0'
outDatasetName = '2024.MC.27GeV.test-minbias.00001.RECO.2'

inDatasetNameS = '{0}.S'.format(inDatasetName)
inDatasetNameP = '{0}.P'.format(inDatasetName)
outDatasetNameR = '{0}.R'.format(outDatasetName)
outDatasetNameLog = '{0}.log'.format(outDatasetName)

taskParamMap = {}

taskParamMap['nFilesPerJob'] = 1
taskParamMap['nEventsPerJob'] = 4000
taskParamMap['noInput'] = False
taskParamMap['taskName'] = TaskName
taskParamMap['userName'] = 'Artem Petrosyan'
taskParamMap['vo'] = 'spd.nica.jinr'
taskParamMap['taskPriority'] = 900
taskParamMap['architecture'] = 'x86_64'
taskParamMap['transUses'] = 'A'
taskParamMap['transHome'] = None
taskParamMap['transPath'] = 'https://159.93.221.125:8080/spd_simu_VA_transform.sh'
taskParamMap['processingType'] = 'step2'
taskParamMap['prodSourceLabel'] = 'managed'
taskParamMap['taskType'] = 'test'
taskParamMap['workingGroup'] = 'spd.nica.jinr'
taskParamMap['cloud'] = 'JINR'
taskParamMap['ramCount'] = 1900

taskParamMap['log'] = {'dataset': outDatasetNameLog,
                       'type': 'template',
                       'param_type': 'log',
                       'token': 'DATADISK',
                       'value': '{0}.${{SN}}.log.tgz'.format(outDatasetName)}

taskParamMap['jobParameters'] = [
    {'type': 'constant',
     'value': '''singularity run --bind /cvmfs/spd.jinr.ru/production/MC/2024.27GeV.test-MB.2st.DSSD:/prod -H
     ./:/WORKDIR /cvmfs/spd.jinr.ru/images/spdroot-4.1.6.1.sif spdroot.py -b -q \'/prod/reco.C({0}, '''
     .format(taskParamMap['nEventsPerJob'])
     },
```

Control panel of the production manager

Simulation



Reconstruction

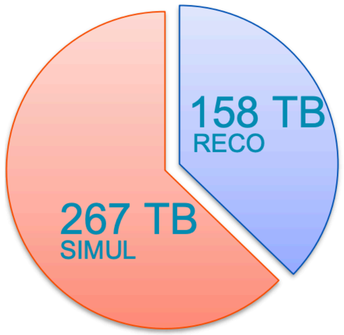


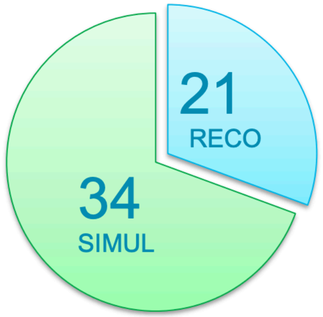
- An application allowing users to easily define a MC chain processing via Web UI was put into pre-production in late 2024
- It is integrated with the SPD IAM, and, thus, allows to pass user information to PanDA
- The web ui allows one to define each processing step individually, as well as set the entire chain at once
- During several last months a couple dozens of productions were processed basing on requests done by our production manager

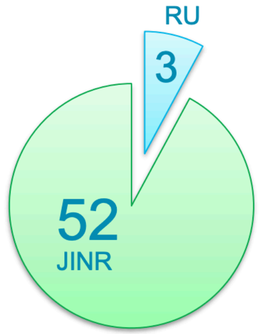
more about the control panel in the talk by Nikita Monakov

Central production stats

- Successfully processed about 300k jobs across 55 tasks







- Total output datasets volume – more than 425 TB

Task ID	Task name ↑ ↓	Status	Start date	End date	Walltime	Total events	Events per job	Total jobs	Out DS size, GB	Out Log size, GB
364	PROD2025-014.SIM	done	03 May 2025	04 May 2025	24612	40000000	4000	10000	18358.86	1.96
363	PROD2025-013.RECO	finished	02 May 2025	04 May 2025	20	None	None	9992	18536.20	5.06
362	PROD2025-013.SIM.2	done	30 Apr 2025	02 May 2025	24899	40000000	4000	10000	18357.95	1.93
359	PROD2025-012.RECO	finished	28 Apr 2025	29 Apr 2025	24	None	None	9993	18546.74	5.08
358	PROD2025-012.SIM	done	25 Apr 2025	26 Apr 2025	23316	40000000	4000	10000	18360.80	1.89
357	PROD2025-011.RECO	done	23 Apr 2025	24 Apr 2025	10	None	None	1250	2319.57	0.63
356	PROD2025-011.SIM	done	22 Apr 2025	23 Apr 2025	22496	5000000	4000	1250	2295.55	0.24
355	PROD2025-010.RECO	finished	18 Apr 2025	18 Apr 2025	37	None	None	1244	287.74	0.49
354	PROD2025-010.SIM	done	17 Apr 2025	17 Apr 2025	0	5000000	4000	1250	259.39	0.13
353	MC2025_S1-003-SIM.4	done	17 Apr 2025	17 Apr 2025	0	1000	100	10	0.21	0.00

Productions requests db

SPD Data processing

Requests Config API artem.petrosyan@ji…

Export Columns 17/23 Filter Reload Processing Request list 100

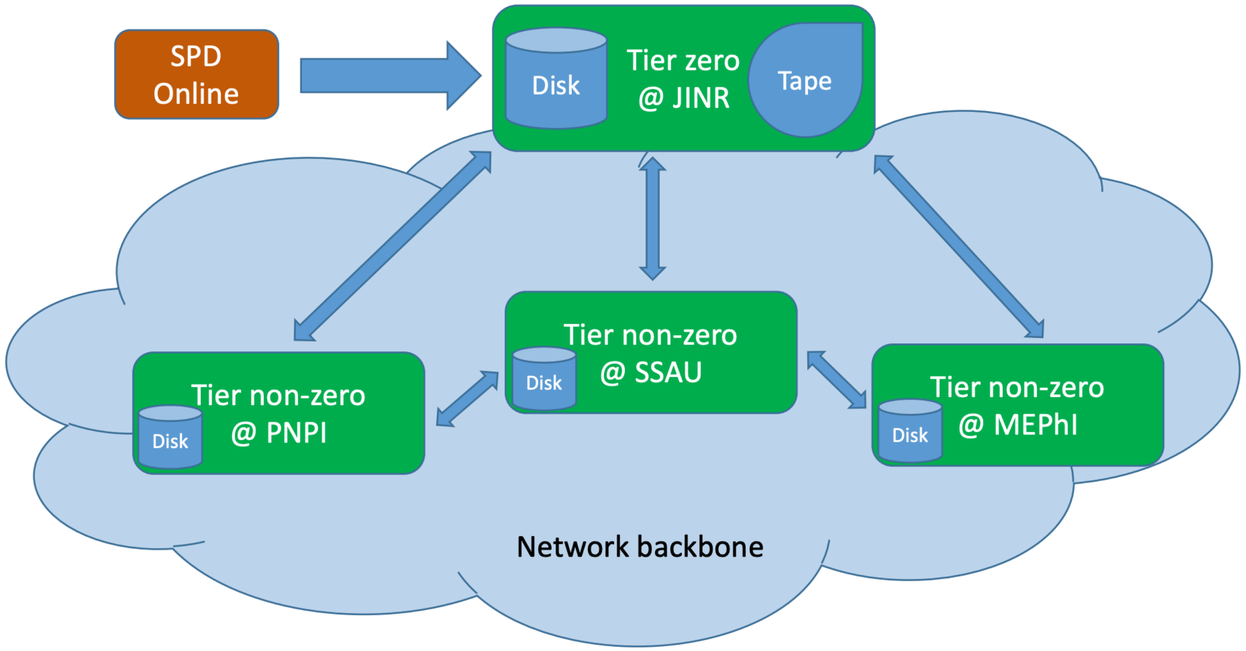
Request	campaign	status	# procs	swproject	version	stage	C	E	P	Events	EF	Tag	S	S	Geometry	description
17 PROD2025-001	SPD MC 2025	DONE	0	spdroot-dev	4.1.7.0	S1	pp	10	UU	5000000	4000	minbias-P8-spdroot417-dev test	1	1250	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	PRE-PRODUCTION obsolete
16 PROD2025-002	SPD MC 2025	DONE	0	spdroot-dev	4.1.7.0	S1	pp	10	UU	20000000	4000	minbias-P8-spdroot417-dev	1	5000	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	/eos/nica/spd/users/elenazem/productions/PROD2025-002_recofiles.txt PROD2025-002_paramfiles.txt
15 PROD2025-003	SPD MC 2025	DONE	0	spdroot-dev	4.1.7.0	S1	pp	10	UU	20000000	4000	minbias-P8-spdroot417-dev	5001	10000	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	/eos/nica/spd/users/elenazem/productions/PROD2025-003_recofiles.txt PROD2025-003_paramfiles.txt
14 PROD2025-004	SPD MC 2025	DONE	0	spdroot-dev	4.1.7.0	S1	pp	10	UU	40000000	4000	minbias-P8-spdroot417-dev	1	10000	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	/eos/nica/spd/users/elenazem/productions/PROD2025-004_recofiles.txt PROD2025-004_paramfiles.txt
13 PROD2025-005	SPD MC 2025	DONE	0	spdroot-dev	4.1.7.1	S1	pp	5	UU	5000000	4000	minbias-FTF-spdroot4171-dev	1	1250	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	/eos/nica/spd/users/elenazem/productions/PROD2025-005_recofiles.txt PROD2025-005_paramfiles.txt
12 PROD2025-006	SPD MC 2025	DONE	0	spdroot-dev	4.1.7.1	S1	pp	10	UU	5000000	4000	minbias-FTF-spdroot4171-dev	1	1250	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	/eos/nica/spd/users/elenazem/productions/PROD2025-006_recofiles.txt PROD2025-006_paramfiles.txt

- At the first we agreed to keep all production requests in the Google doc spreadsheet
- At the second we decided to create a special application to manage requests
- Since this is a database it can be used for some analysis, extended, integrated with other services, etc.

more about information systems in the talk by Fedor Prokoshin

What is currently deployed in total

- JINR
  - Production system services (prod and devel instances)
  - Computing (2200 cores), usually up to 1500
  - Storage (7.2 PB raw with 27% redundancy = 5.3 PB)
  - Monitoring (somewhat)
- PNPI
  - Computing (288 cores)
  - Storage (190 TB redundant)
  - Monitoring
- SSAU
  - Computing (256 cores)
  - Storage is on the way (240 TB raw with 17% redundancy = 200 TB)
- MEPhI
  - Ongoing negotiations



more about computing infrastructure in the talk by Andrey Kiryanov

JINR certification authority

- Address: ca.jinr.ru
- Finally in production, thanks to the LIT network operation service
- JINR CA is online CA, certificates are issued immediately, which allowed us to optimize our operations a lot
- Any user with JINR SSO account can request user certificate
- LIT CICC computing and storage resources were configured to support JINR CA certificates
- YUM repo with the rpm was prepared to ease installation process
- Can be used as a JINR-centric certification authority for all JINR hosted experiments

ⓘ Петросян Артем Шмавонович - Petrosyan Artem Shmavonovich

Мои действительные Host сертификаты: 14

Серийный номер	Имя сертификата
335280838662608440995013	CN=cric.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
330556999940689005096270	CN=vm221-125.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
325831556579249782268863	CN=vm221-128.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
321119164890131102487796	CN=spd-iam.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
382510806361247941477048	CN=10-220-18-146.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
368331973398402739946155	CN=spd-rucio.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
476943422706006476611360	CN=vm221-122.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
491123808586845481041803	CN=spd-fts.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
524181107038056702859853	CN=spd.ssau.ru,OU=hosts,OU=GRID,O=JINR,C=RU
604447717501248574904455	CN=10-220-18-77.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
609173767607513757762429	CN=cric-dev.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
628061244881506981510336	CN=10-220-16-10.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
632795307202027113861823	CN=spd-cric.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU
637506996081636867403667	CN=vm221-126.jinr.ru,OU=hosts,OU=GRID,O=JINR,C=RU

Conclusions

- The results of the six-month operation of the created distributed computing environment by users confirm the correctness of the chosen architecture of the offline computing system:
  - One point of entry allows to manage users and their access rights, as well as applications which are allowed to work in the environment
  - It has become easier to organize centralized mass productions using the web interface
  - The calculations themselves are performed more transparently and users get data for analysis much quicker
  - The results are stored at the common storages and available to all users
  - The system copes well with the load
  - The addition or replacement of computing and storage elements takes place without any/much negative consequences

Next steps

- User interfaces development
  - UI/UX improvement of Control panel
  - New features like tasks cloning mechanism in the Control Panel
  - Monitoring and analysis tools
- Integration with the new applied software framework Sampo, transition from SPDRoot to Sampo
- More operation activity along with improvement of the system
  - Finish transition to tokens at services level
- Add more automation for the routine procedures
  - Import users from the SSO database to the IAM automatically basing on LDAP groups
- Users support
  - Finish users data migration from the central JINR EOS to the dedicated one
- Documentation

more about Sampo framework in the talk by Lev Simbiryatin

Thank you!