Report of the software coordinator

IX SPD collaboration meeting

Danila Oleynik, 12.05.2025



SPD Software&Computing

SPD OnLine Filter

Compute cluster Middleware Applied software

Applied Software framework

SPD Root

Sampo

SW release building and packing



SPD Distributed Computing

Production system Data management Infrastructure

Information systems (IS) & databases

Monitoring, analysis accounting

SPD Online filter

- Steady progress with middleware development:
 - Integration testing of subsystems working in co-operation, provides more input for tune of code and architecture of micro-services
 - "Load testing" (quite regular JINR Cloud VM's, simplified synthetic payload)
 - 100 concurrently running pilots
 - ~2100 jobs completed in 7 min
 - Pilot overhead ~15 seconds (with stage-in, stage-out) lacksquare
- In progress purchasing of hardware for prototyping of compute cluster
 - Not as planned with future NICA Computing data center, but in consideration with SPD DAQ testbed.
- We expect to have 256 CPU Cores, 1TB RAM, 120TB HDD across four quite fat servers. No significant progress with applied software and algorithms
 - Collecting of requirements for applied software should be started ASAP



Applied Software frameworks SPD Root

- Integrated with Production system
 - Bug fixes mostly to cope critical issues with reliability
- Despite clear direction for decommission, some development still appears
 - Required functionality in successor (Sampo) should be considered
- Scalability limitations work against efficiency
 - Simple example: maximum number of event per job ~4000 case usually quite short processing time, but produces a lot of files. That will affect efficiency of data management and final analysis



Applied Software frameworks Sampo

- HepMC3 as main format for produced events (tested with already integrated Pythia8 as primary vertex generator)
- Geant4 support added, including HepMC3 events as primary generator action, magnetic fields and GeoModel for detector geometry
- Gaudi Docker image on top of almalinux9 for developers (ready and tested), also Sampo Docker image for end users (raw, CI/CD configuration in process).



Applied Software Sampo development

- We are almost ready to involve more developers for implementation of detector specific parts in Sampo
 - Sensitive detectors and hit production
 - Digitization and reconstruction
- Basic knowledges of software engineering is required for developers Sampo should obtain required functionality, correctness and reliability firstly, but efficiency and maintainability also very
- important.

more details in Lev's talk: https://indico.jinr.ru/event/5000/contributions/30815/







Production System testing November - December 2024

- JINR & PNPI resources used
 - x*10⁵ performed jobs n*10⁵ produced files
- >500M events produced
- Data distribution on 2 sites (automatically)
- 0,5 PB of data managed by Rucio

Mathebra Review of naming convention "
Productions registry" required ☑Operational monitoring required **M** Brokerage tune required





Bytes



📥 JINR_SPD_LOCALGROUPDISK 🛛 📥 PNPI_PROD_DATADISK

Stacked RSE Usage



Production system in operation

"Production" - an amount of MC data produced with fixed set of parameters and measured in number of events.

- More or less routine starting from March 2025
 - > 400M events produced (> 800M events processed due to 2-step processing chain)
 - > 200TB of data produced
- Output datasets have size up to 20TB
 - too big to be processed/analysed with desktop workstation
- Please participate in round table on Wednesday to discuss possible solutions for analysis facilities



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Production name/ID	Status	Stage	Collision type	Geometry type	Energy	Polarization	Software type/version	naming)	events
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PROD2025-002	Done 🔻	S1	pp	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	10 GeV	UU	spdroot417-dev	minbias-P8-spdroot417-dev	20 000 000
PROD2025-003	Done 🔻	S1	pp	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	10 GeV	UU	spdroot417-dev	minbias-P8-spdroot417-dev	20 000 000
PROD2025-004	Done 🔻	S1	pp	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	10 GeV	UU	spdroot417-dev	minbias-P8-spdroot417-dev	40 000 000
PROD2025-005	Done 🔻	S1	рр	Micromegas, TS, ECal, RS, BBC, ZDC (sketch)	5 GeV	UU	spdroot-dev-4.1.7.1	minbias-FTF-spdroot4171-dev	5 000 000

Stacked RSE Usage



SPD EOS in JINR

- There were some technical and operational issues with central EOS instance eos.jinr.ru at the end of 2024
 - After discussion with the MLIT Director it was decided to deploy a dedicated storage for SPD at JINR MLIT
 - Equipment was secured around mid-February 2025:
 - 18 servers
 - 3 head (metadata) nodes
 - 15 disk nodes (24 drives of 20TB each)
 - 7.2 PB raw capacity (5.3 PB of usable space)
- Disk volume at JINR should be enough for next 3-4 years
 - Longterm data storage policy should be agreed



Monitoring and analysis

- Definitely required for operation and proper maintains
- For the moment, it's some uncoordinated solutions
- Requirements should be collected and analysed
- Technology stack should be considered

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	All dashboards / Global	view									< Zoom out > 🕓	2025-04-24 15:21:43 - 202
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Software & Computing session

Wed 14/05

09:00

	SPD Online filter middleware status
10:00	Data management system for SPD Online filter
	Sampo status update
	Detector description in Sampo
11:00	Coffee break
	Production system/ Current status and next steps.
	Production manager control panel
12:00	Rucio in SPD
	Databases and Information systems. Status update
	Lunch
13:00	
14.00	
14:00	Storage & Computing infrastructure
	SPD CRIC (TBD)
	SPD Distributed computing round table
15:00	
	Tour to Cognac Factory



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