

# **SPD OnLine Filter.**

## **Status update**

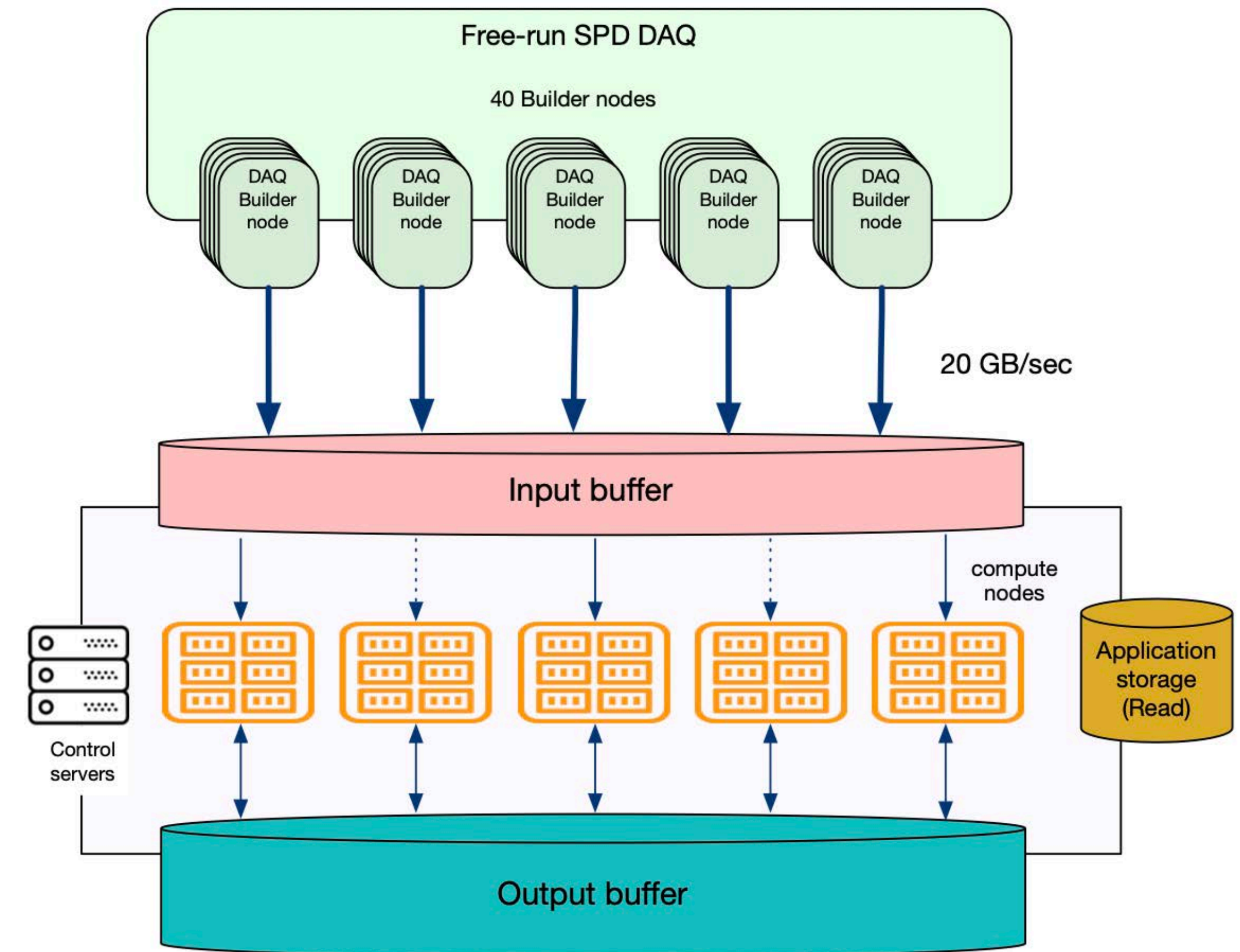
**VII SPD Collaboration Meeting. 23.05.2024**  
**Oleynik Danila.**

# SPD Online filter

## Reminder :-)

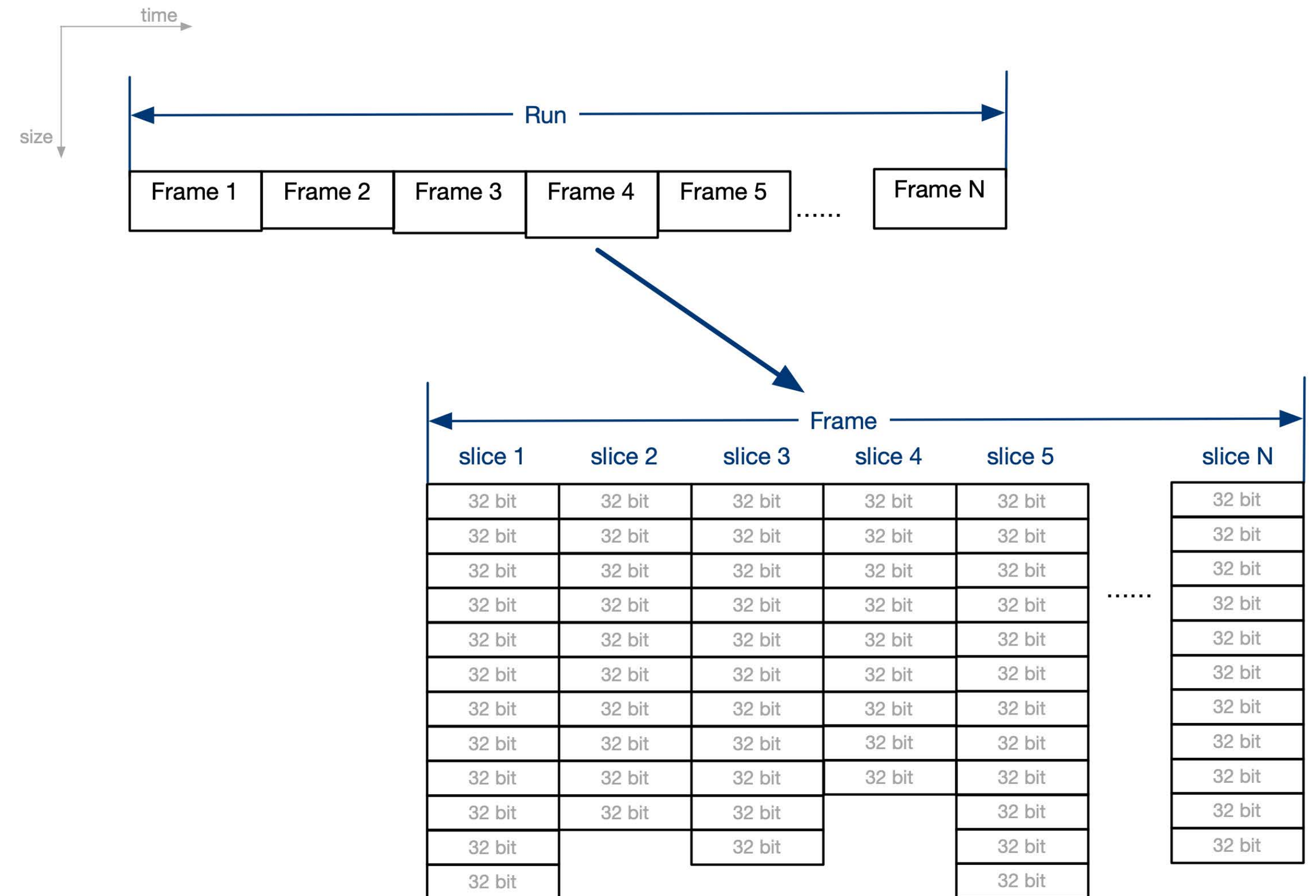
*Online filter is the first stage in data processing chain for SPD Experiment (right after DAQ)*

- SPD Online Filter is a high performance computing system for high throughput processing
  - High speed (parallel) storage system for input data written by DAQ.
  - Compute cluster with two types of units: multi-CPU and hybrid multi CPU + Neural network accelerators (GPU, FPGA etc.)
  - A set of dedicated servers for middleware which will manage processing workflow, monitoring and other service needs.
  - Buffer for intermediate output and for data prepared for transfer to long-term storage and future processing.



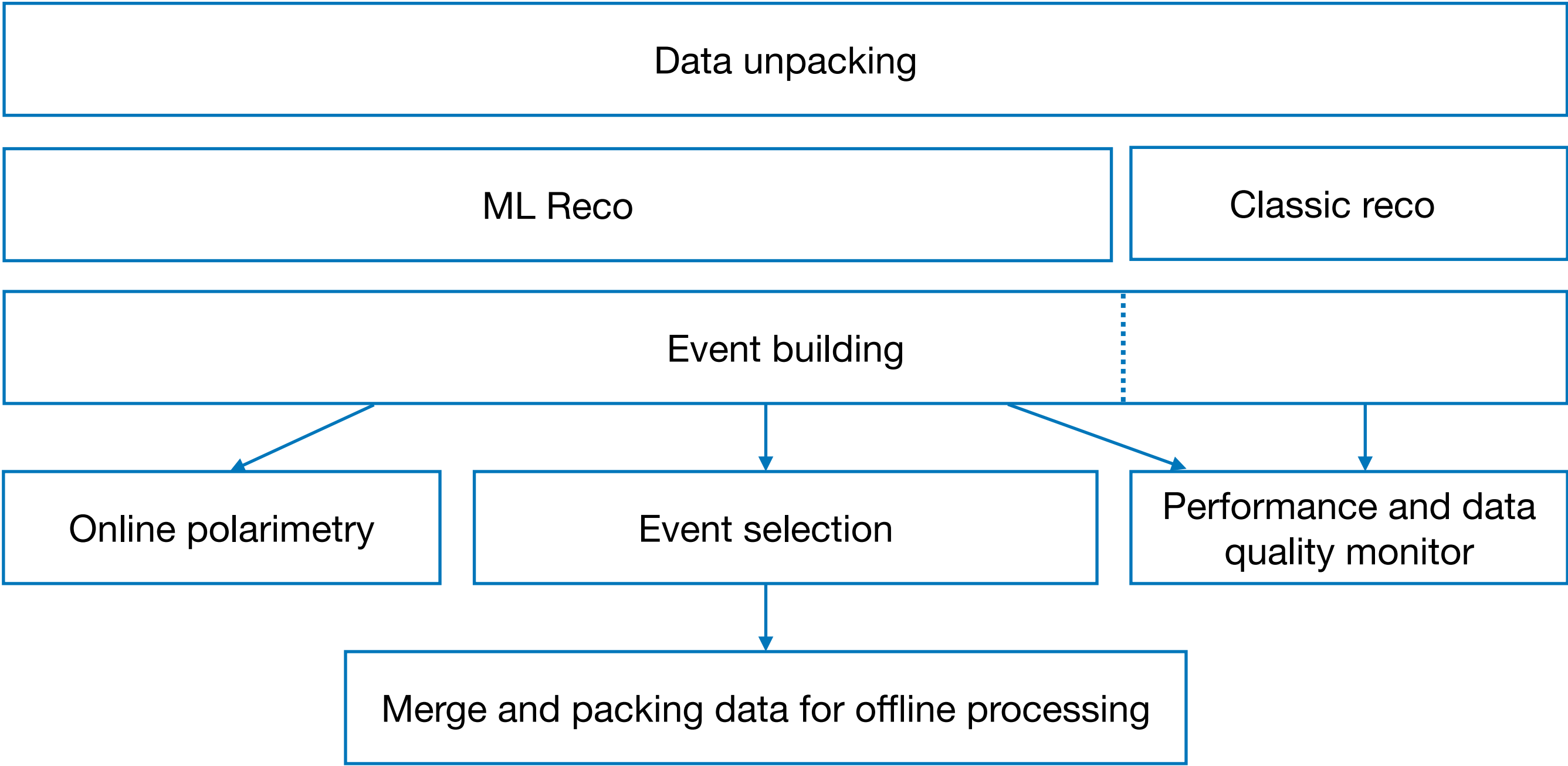
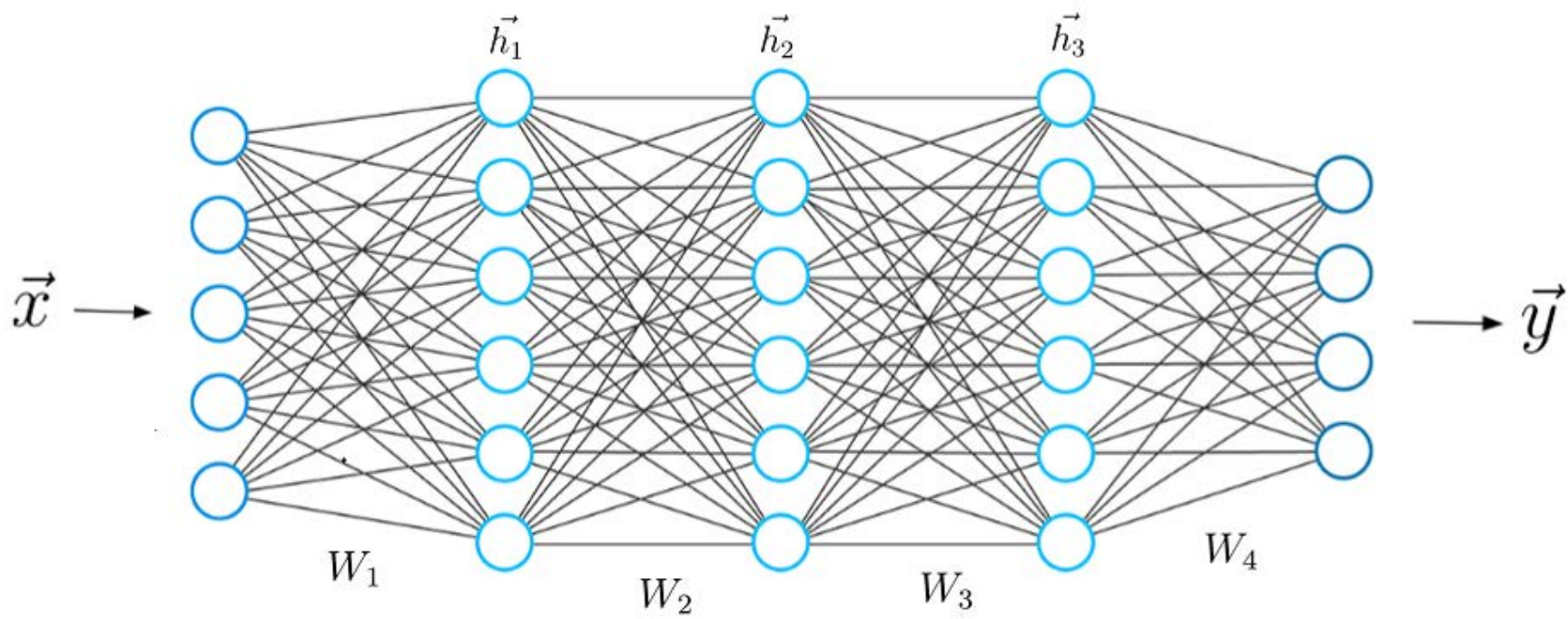
# Initial data

- Free run DAQ, means that the output of the system will not be a dataset of raw events, but a set of signals from detectors organized in time slices
- Primary data unit: time slice ( $\sim 10 \mu\text{s}$ )  
Time slices combined in time frames (1-10 sec.)
- Every slice will contain signals from a few to many collisions (events)
- Event building have to unscramble events from a series of time slices





# Base payload



# Online filter

- **Infrastructure**
  - Hardware part: network, storages, compute units, control servers
  - Core software part: base OS, common services
- **Middleware** - software complex for management of multistep data processing and efficient loading (usage) of computing facility
  - Workflow management
  - Data management
  - Workload management
- **Applied software** - performs actual data processing
  - Framework - responsible for unified algorithm interfaces, IO, multithreading etc.
  - Algorithms - responsible for a single pieces of processing

# Infrastructure

It's too early to start thinking about real hardware but...

- Integration infrastructure deployed on JINR Cloud resources on 6 VM's (currently)
  - 4 VM for debugging of general services components
  - 1 - imitation of storages
  - 1 - Dedicated DBMS Server with PostgreSQL 16
  - Rabbit MQ dedicated facility are going to deploy soon
- AlmaLinux 9 - base OS. It will work for us next few years, security support till the middle of 2032
- GIT based CI/CD functionality provided by JINR Cloud as a service

# Middleware

## Data management;

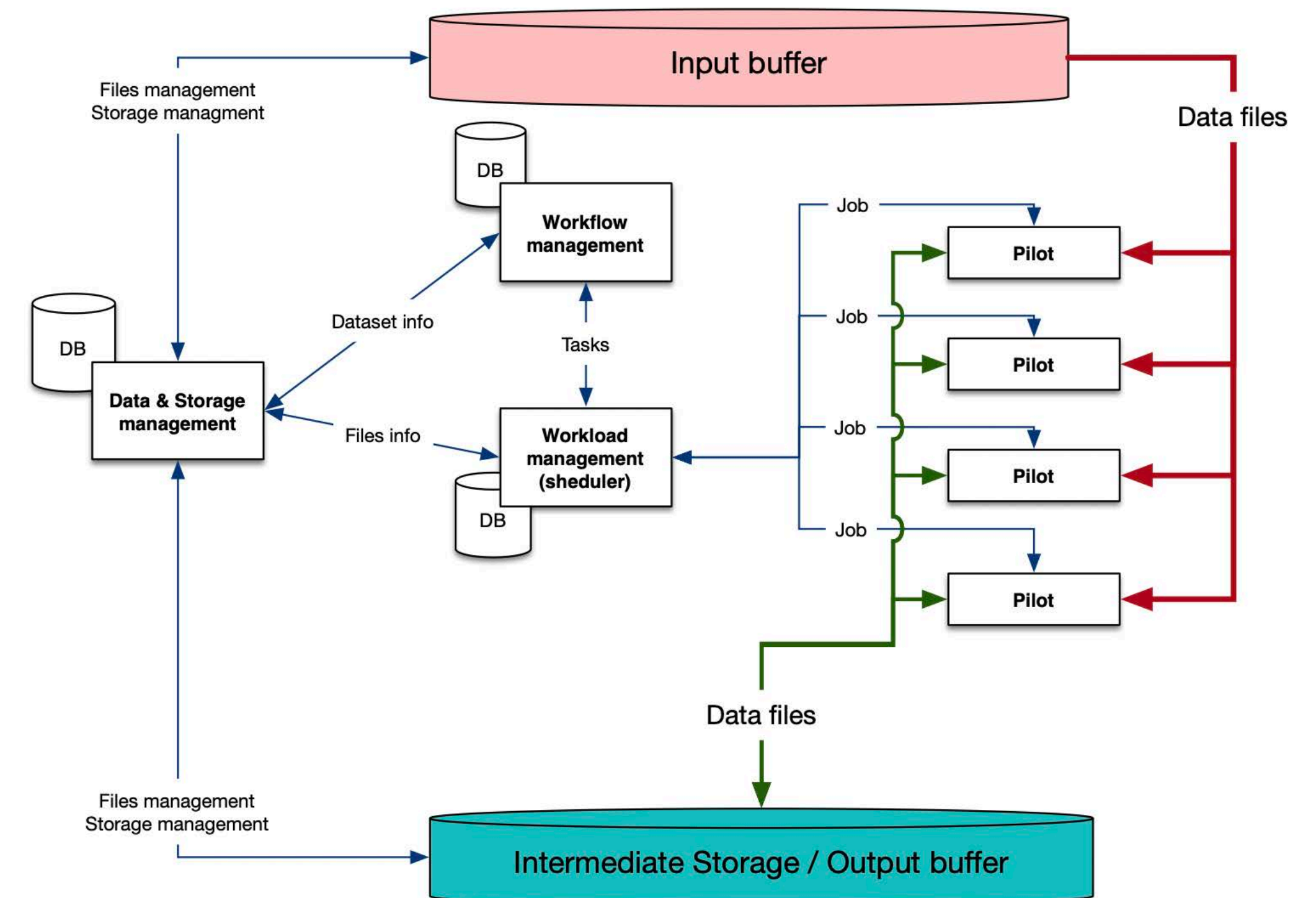
- *Support of data life-cycle and storage usage;*

## Workflow management;

- *Definition of processing chains;*
- *Realisation of processing chains as set of computations tasks;*
- *Management of tasks execution;*

## Workload management:

- *Generation of required number of processing jobs for performing of task;*
- *Control of jobs executions through pilots, which works on compute nodes;*





# Middleware

## Current status

- Each subsystem were engineered and partially prototyped
  - Microservice architecture with domain driven design was chosen
  - Flexibility, scalability, easy for long-term support
- Data management: defined three microservices dsm-register, dsm-manager, dsm-inspector
  - most requested (for the moment) functions were implemented recently to provide registration of files and data sets in catalogue, in progress tight integration with workload management system (API specification, formats etc.)



# Middleware

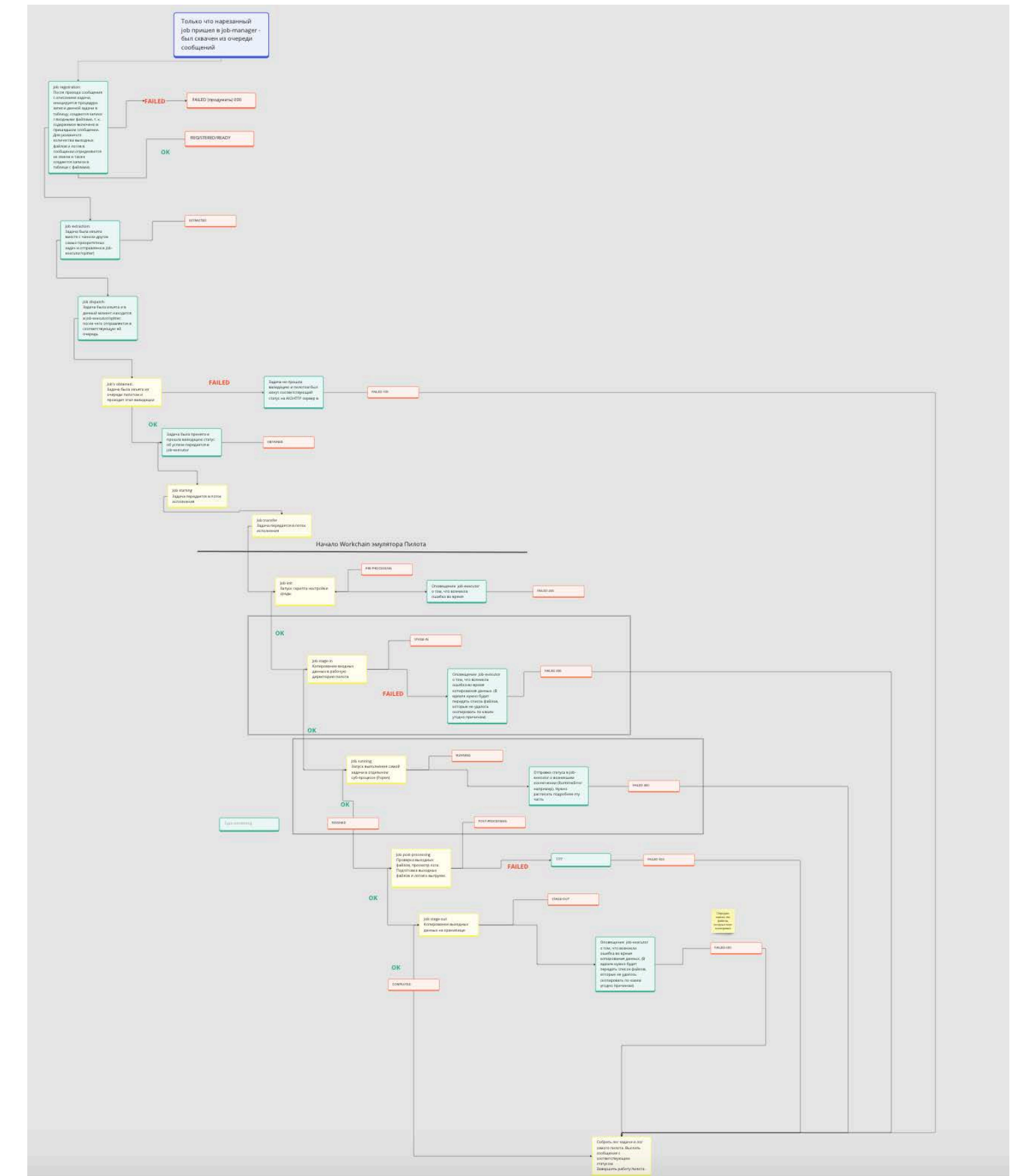
## Current status 2

- Workflow management
  - “Chain definer” - user oriented application which allow define sequences of processing steps
  - “Processing starter” - microservice responsible for triggering of processing chains
  - “Chain executor” - microservice responsible for control of execution of processing sequences
- Master student takes care about realization of WFMS in the scope of graduation task
- WFMS is the system where some user-friendly interface expected
  - Probably, some incorporation with Run control system may be considered

# Middleware

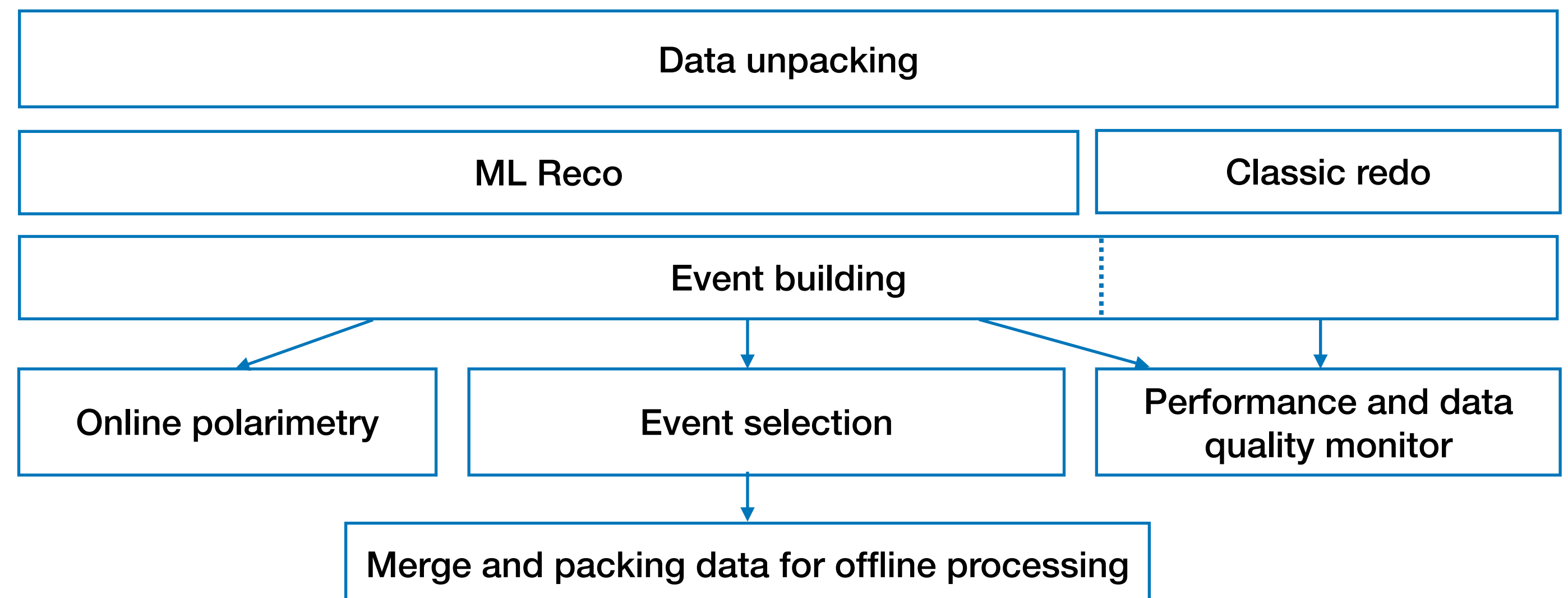
## Current status 3

- Workload management
  - Realize a task execution process by shredding a required number of jobs to provide controlled loading to compute facility, tacking into account priority of tasks and associated jobs.
  - Detailed progress will be presented in the dedicated talk
- Manpower: two PHD students (SPbSU), one full time researcher (JINR), two master students (MEPHI), most of activity coordinated by me



# Applied software for Online Filter

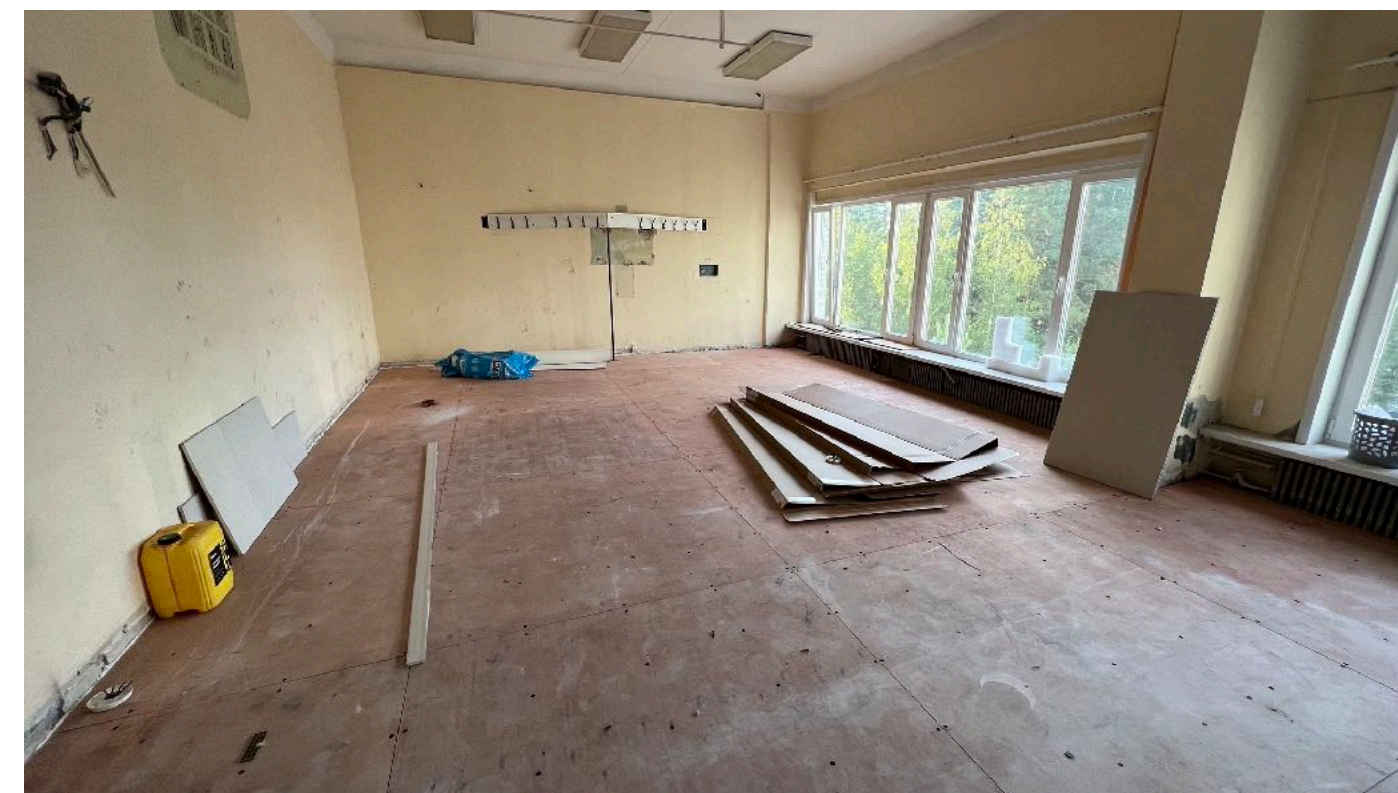
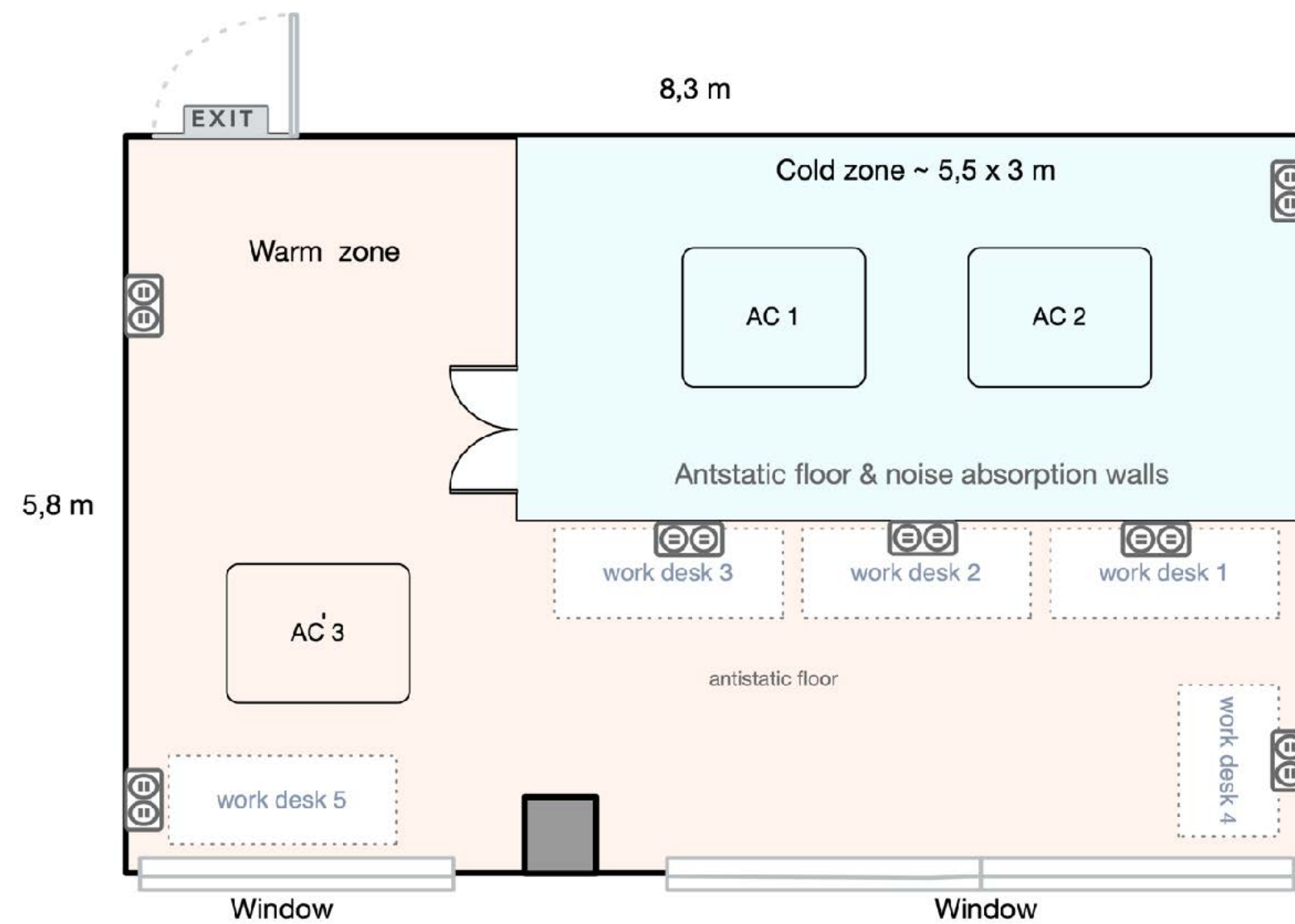
- Code development is stalled for the moment due to lack of manpower
- It seems that Gaudi based framework will work as common solution for online and offline applied software
- Regular activity for establishing of processing chains and domain decomposition
- Continuous research in ML area: performance, quality etc.
- Manpower are still to be estimated





# DAQ & Online filter testbed

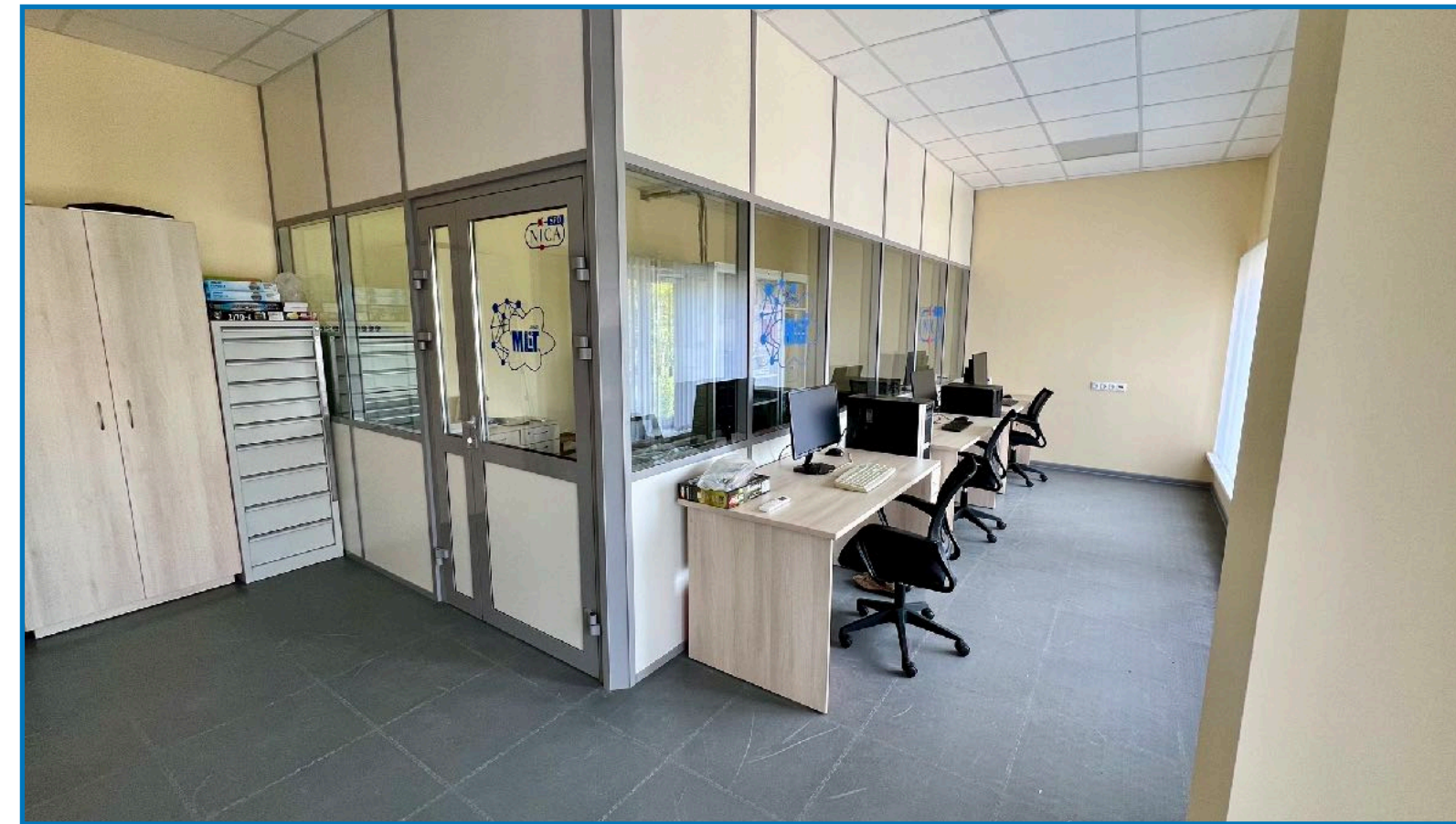
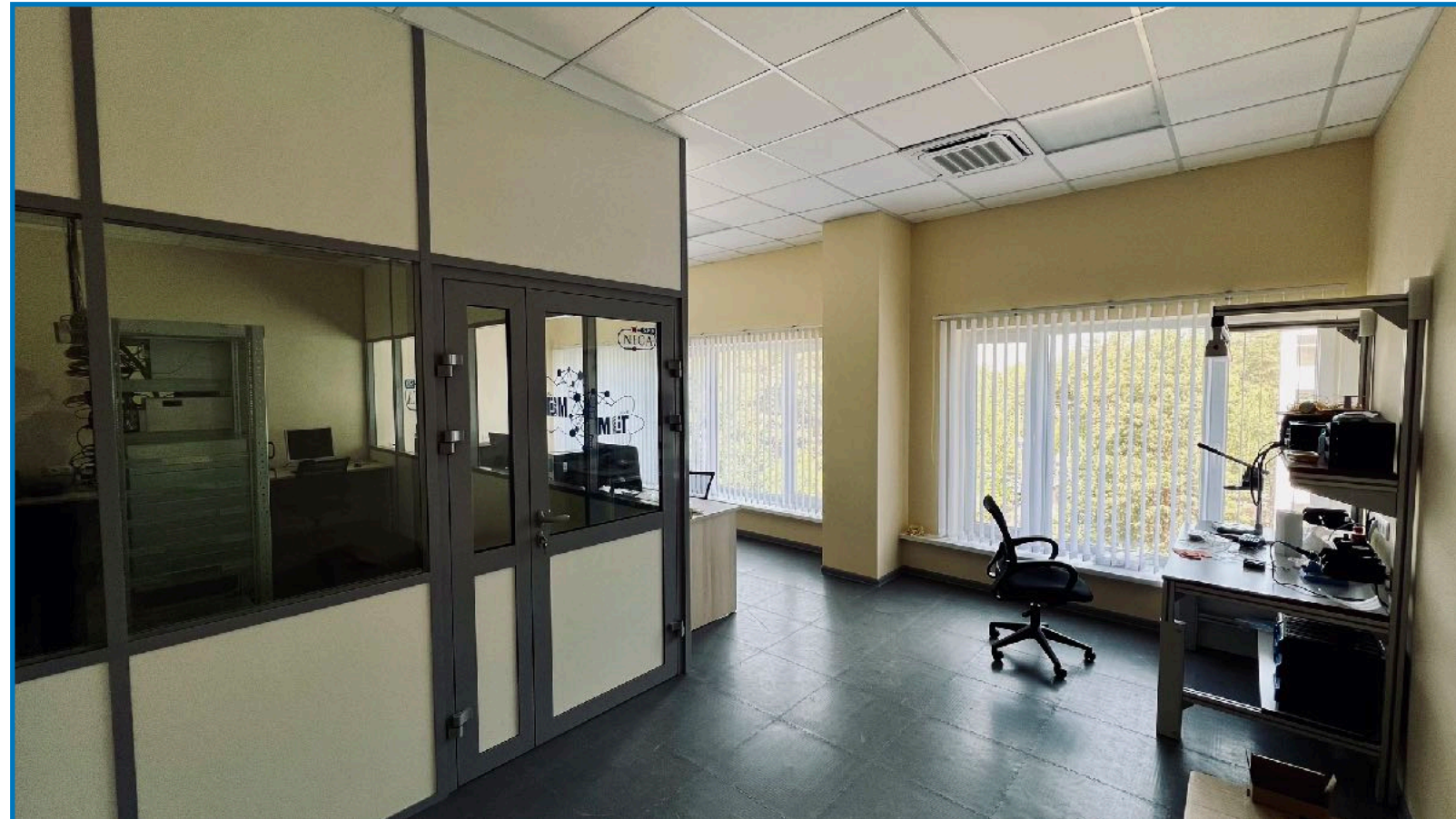
- Construction works was started in July 2023





# DAQ & Online filter testbed

- Testbed is almost ready since middle of march 2023
- Waiting for habitants ;-)







Thank you!

С САМОГО НАЧАЛА  
У МЕНЯ БЫЛА КАКАЯ-ТО



И Я ЕЁ ПРИДЕРЖИВАЛСЯ