

# **Status of SPD computing**

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# Software and Computing activities in SPD

## *Structured list*

- **Software** - application software related part
  - Algorithms, methods and their implementation in code
  - Common framework - allows to organise and set of algorithms into application, responsible for external and internal interfaces
- **Computing** - infrastructure related part responsible for execution of application software and storing and providing of any produced data
  - Compute and data storage infrastructure, hardware requirements, interaction with system software
  - Middleware: workflow and workload management, data management, operational support
  - IT Services: software compiling and distribution, database management, middleware services support, etc.

# Application Software

- Application software – develop and support by physicist
  - Major requirement - correctness and trustability of algorithms and methods
  - Efficient utilisation of compute resources
  - Definition of data types
- Common framework – (should be) develop and support mostly by software engineers
  - Allow to organise set of algorithms into application workflow
  - IO interfaces responsible as for interaction with external sources, so for transmitting data among algorithms
  - Supporting of multithreading and accelerators (GPU)
  - Supporting interaction with middleware, at least providing a common format of monitoring and accounting data like: number of processed events, time of processing, exceptions and errors.
- Settle hardware requirements for compute units (node configuration)
- Allows to estimate requirements for storage system

# Computing infrastructure (1)

A set of middleware for workflow and workload management in distributed computing environment were deployed and initially tuned for SPD

We move forward to manage first mass processing (simulation) in 2023.

- Data organization
  - Defining of all required input data, and sources of this data (if exist)
  - Agreeing Event Data Model and corresponded data types
  - Settling initial rules for grouping data in scopes and datasets

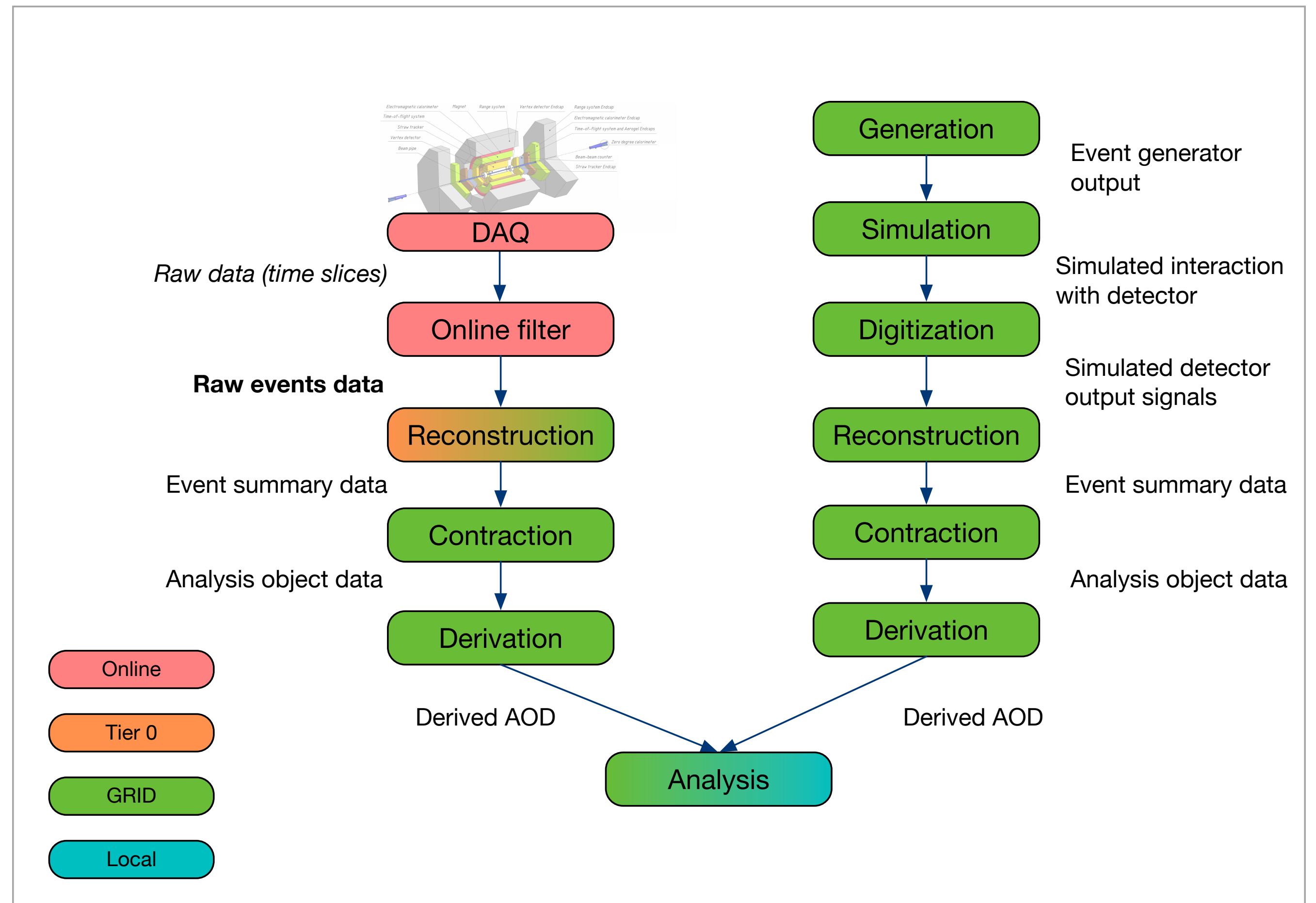
# Computing infrastructure (2)

- Declaring of requirements for compute resources
  - System platform
  - Application software release content
  - Containerisation of application software
  - Distribution of releases and releases repository structure: “fat” containers on CVMFS?  
Docker repo?
- More tight integration with application software framework
  - Defining job definition notation;
  - Node (environment) configuration for execution of compute job;
  - Collecting of monitoring information

# SPD Computing model

## Reminder

- As reconstruction as simulation – are multistep workflows
  - Each step produces own data type, which correspond to different representation of events
  - So size of event will be different in different data type
- Why we need different types?
  - Some types of processing, like raw data, quite expensive or unique, producing of other types is resource consuming, another types good for long term storage but not optimal for final analysis because of redundancy



# Event data model

*more info in dedicated report*

Initial step of data organisation

- Must be able to encapsulate the required event data
- Separation of Event/Non-event data: GeoModel should not be stored in event data, but should be referred etc.
- Must allow the correct level of modularity to fulfil the computing model (association between data type and processing step)
- Should promote code re-use by:
  - Allowing the factoring out of common tools;
  - Sharing data classes:
    - Between offline application software, and the online filter
    - Between the sub-detector systems ...
  - Along with minimising/preventing unnecessary dependencies

# Why SPD need the Event Index?

## *and what is it?*

- Expected yearly volume of collected and processed events by SPD is measured in trillions
  - Data will be packed in hundreds of thousands of files, and tens of thousands of datasets:
    - event is a data unit;
    - file or set of files are a processing unit;
    - dataset - replication unit;
- Navigation through this data or searching of particular set of events is tricky and require non-trivial technological solutions, and required particularly on each processing step
- Event Index is the special service which allow search events by different criteria
  - detailed report about Event Index for SPD will be today



# IT Services

## *with some support*

- SPD Computing system growing step by step
  - Number of services and subsystems grows accordingly
  - More and more routine but time consumption work will appear
- We need to think about speed up of routine operations
  - Speed up of deployment of server nodes: updated and preconfigured vm images (?), puppetizing of infrastructure at least for central services
- Using central supported digital services: gitlab, wiki, docdb, etc.
- Looking forward for PAAS starting from DBMS

Thank you!

Let's proceed for thematic talks.