

# Software plan for 2021

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Main goal of the software project in 2021: TDR preparation

- Simulation and reconstruction for physics studies
- R&D for the chapter 'Computing and Offline Software' for the TDR

Software plan:

- Current SpdRoot developments
- Software & Computing R&D

# SpdRoot developments in 2021

## **Detector response (resolution, efficiency, noise):**

- ITS (DSSD/MAPS)
- STS
- TOF/Cherenkov(?)
- ECAL
- RS
- BBC (?)
- ZDC (?)

## • **Reconstruction:**

- GenFit speed
- Track finding
- ECAL clustering and showers
- RS reconstruction

## • **Framework**

- Refined EDM (particle - vertex — track)
- Calib & Align (?)
- New gitlab tests and deployment
- ??

# Next release - mid. February 2021

- Migration to FairRoot 18.4.2 (= Ubuntu 20.04)
  - do we need any support of SL6 so far?
- New event structure (particle-track-vertex)
  - shall we also review the output ROOT file's content this time?
- Physics examples
- Update of geometry to the one of CDR
- Cleanup of obsolete code, geometry options etc.
- ECAL reconstruction
- New CI

# Software & Computing R&D in 2021

- Online Filter prototype
- HDF5 as a data format
- Multithreading and alternative architectures
- FairRoot vs Gaudi
- Conditions DB, Calib&Align
- Computing system prototype and a mock-up test

# Online Filter prototype

**Goal: to demonstrate that the Online Filter is capable to handle the SPD data rate**

- Simulation of the continuous data stream
- MC simulation for ML training and validation
- ML algorithms for fast track reconstruction, primary vertex reconstruction
- python → C++
- Event unscrambling
- Software trigger criteria
- ML monitoring

# HDF5 as a data format

**Goal: to evaluate HDF5 as an intermediate data format for the SPD**

- ROOT is a good format for the current approaches to the data analysis using ROOT
- Less good for the computing system
- Less good for the Python data analysis ecosystem
- Attempts to use HDF5 in FairRoot and Gaudi/Key4HEP (via Podio) were made already

# Multithreading and alternative architectures

**Goal: to improve the SPD algorithms and software to be able running at multicore machines and GPU and/or FPGA coprocessors**

- Online Filter
- Simulation
- Reconstruction
- Core framework



# FairRoot vs Gaudi

**Goal: to evaluate Gaudi/Key4HEP as an SPD software framework**

	<b>Gaudi/Key4HEP</b>	<b>FairRoot</b>
Multithreading and alternative architectures	++	+
Support	+++ (HSF, ATLAS, LHCb, FCC)	+ (FAIR, NICA, ALICE?)
Use in real experiments	+++ (ATLAS, BESIII, LHCb)	? (BM@N)

# Conditions DB, Calib&Align

**Goal: to develop a solution to handle geometry, conditions and calibration data**

- The Database (10 PB/year ~  $O(100000)$  running jobs)
- Geometry description
- Alignment
- Run info and conditions
- Calibration procedure and constants
- Integration to the computing system

# Computing system prototype and a mock-up test

**Goal: to demonstrate that the computing system is capable to handle the SPD data rate**

- Information system
- Data management
- Task management
- Working prototype and a mock-up test of ~1 PB scale (from the online filter to reco to data analysis) — end of the year?