Offline Software & Analysis

PXD Extended Meeting
24 January 2019

Introduction

Offline = BASF2 (Belle II Analysis Software Framework) + associated Conditions Database

  ‣ From simulation, reconstruction to physics analysis

  ‣ Every sub-detector has its own package (there are `pxd` package and a common `vxd` package)

Benjamin Schwenker has taken care of majority of the offline tasks in the past years

People currently involved:

  ‣ Benjamin Schwenker (main source of expertise, leaving)

  ‣ Björn Spruck (connection to online & tracking)

  ‣ Sally Stefkova (beam background studies)

  ‣ Maiko Takahashi

+ some other members of the PXD group performing studies

We need to distribute the tasks to more people during Phase 3

WARNING!
This presentation is based on my current understanding.
More to be discussed & planned in the near future

Offline Components & Tasks

Geometry

Simulation

Reconstruction

Data Unpacking   → not in this talk

Data Quality Monitoring   → not in this talk

(Alignment)   → dedicated **`alignment`** package, work by Jakub and Tadeas

Calibration

Tracking Support   → not in this talk

Performance studies

Beam background studies

Software maintenance

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Simulation & Reconstruction

Geometry

▶ Geometrical arrangement & properties of sensors + material budget incl. support structure

▶ Phase2, early Phase3 and final Phase3 geometries defined (in Conditions DB)

▶ Some offset & distortion observed in Phase2 data & B4 cosmic alignment

Simulation

▶ Simulation of the particles through the detector done by GEANT4 → not part of pxd package

▶ Emulation of readout & operation condition: digitisation & gated-mode

▶ Gated-mode emulation relatively recently implemented (V. Chekelian @ Software workshop, May 2018) → need further updates & studies with data

Reconstruction

▶ From hits to clusters

▶ Apply masks, energy calibration & cluster position estimation

Calibration
To be performed within Data Production stream
B. Schwenker @Tracking f2f, Oct 2018

▶ Hot & Dead pixels (Bad runs & events?) → importing online information

▶ Gain calibration → recent study to include track angle correction to be implemented (S. Skambraks @weekly meeting, Aug 2018)

▶ Cluster shape calibration → recent development, not used for Phase2, further performance verification & feedback from tracking desired

▶ Lorentz angle measurement → to be implemented within alignment framework & tested

Data Analysis & Software Maintenance

Performance studies & developments

▸ Study basic detector performance (can also analyse local runs with basf2)
  → interplay with online studies, DQM & operational aspects

▸ Evaluation of radiation & ageing effects and their implications for the future

▸ Verification of calibration, reconstruction algorithms etc & further improvements

Beam background studies

▸ Understand different types of backgrounds (Injection, Touschek, Beam gas, etc) and beam conditions, impact on the detector operation and performance

▸ Work in connection with Background, Beast II, BCG (Belle II Commissioning Group) & MDI (Machine-Detector Interface) groups

▸ Phase2 analysis status → B. Schwenker @B2GM, Oct 2018

▸ Currently following up on Phase2 analysis and preparing for Phase3

Software maintenance

▸ Codes are often written & maintained by the people who work on the topics, but not always

▸ A role of "package librarian" exists to control the content of the package and to follow the basf2 regulations & developments

Summary

This is an incomplete overview of the PXD Offline Software & Analysis activities

Anything that are not mentioned here? Please let us know!!

PXD-Offline is generally lacking in expertise and manpower

At minimum, we need to keep the offline performance under control
→ maintain the functionality of offline software & the database up-to-date

Ready for Phase3? – things have already been prepared by Benjamin & Björn, we are learning as we go…

With Phase3 data, this is the time to make more studies & developments to evaluate the performance and make improvements to the current algorithms

A f2f discussion envisaged in late Feb @DESY to define all the tasks, future plans and coordinate

Anyone interested in offline effort are very much welcome!