6th International Workshop on DEPFET Detectors and Applications

2011/02/07

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The PXD Simulation with the BASF2 Framework

- History
- Status of basf2
- The PXD in the basf2 framework

Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)

MAX-PLANCK-GESELLSCHAFT

Belle II

Excellence Cluster
Universe

PXD simulation studies are **necessary**:

- ✓ PXD performance
- ✓ PXD parameter optimization

Two software frameworks were available:

BELLE: BASF (**B**elle **A**naly**S**is **F**ramework) | **ILC: Mokka** and **Marlin**

ⓘ "Simulation group" had a strong ILC background

ILC was chosen:

- ✓ Experience in ILC software
- ✓ Adding PXD to BASF is difficult

Since then, work done with the ILC software:

- **Optimization studies** (*Kolja Prothmann, Andreas Moll*)
- **Background studies** (*Kolja Prothmann, Martin Ritter*)
- **First physics studies done in ILC** (*Burkard Reisert, Kolja Prothmann, Oksana Brovchenko*)

ILC software had to be modified:

Added simple model of beampipe — *Zbynek Drasal*
Added PXD geometry — *Kolja Prothmann*
Added SVD geometry — *Andreas Moll*
Modified existing TPC → CDC — *Martin Ritter*
Simulation (e.g. data input)

New PXD digitizer based on Alexei Raspereza's work — *Zbynek Drasal*
New PXD clusterizer — *Benjamin Schwenker*
New SVD digitizer
New SVD clusterizer

Data model (LCIO) — *Burkard Reisert*

New background merging tools — *Kolja Prothmann*
New analysis tools

Incompatible with the official ILC software

Source code was provided as Releases by Kolja Prothmann

Please note:

- No software group behind it
- Was not clear if it will get official software

Spring 2010 it became clear

- ✓ ILC will **not become** the official framework for Belle II
- ✓ BASF will **not be continued**

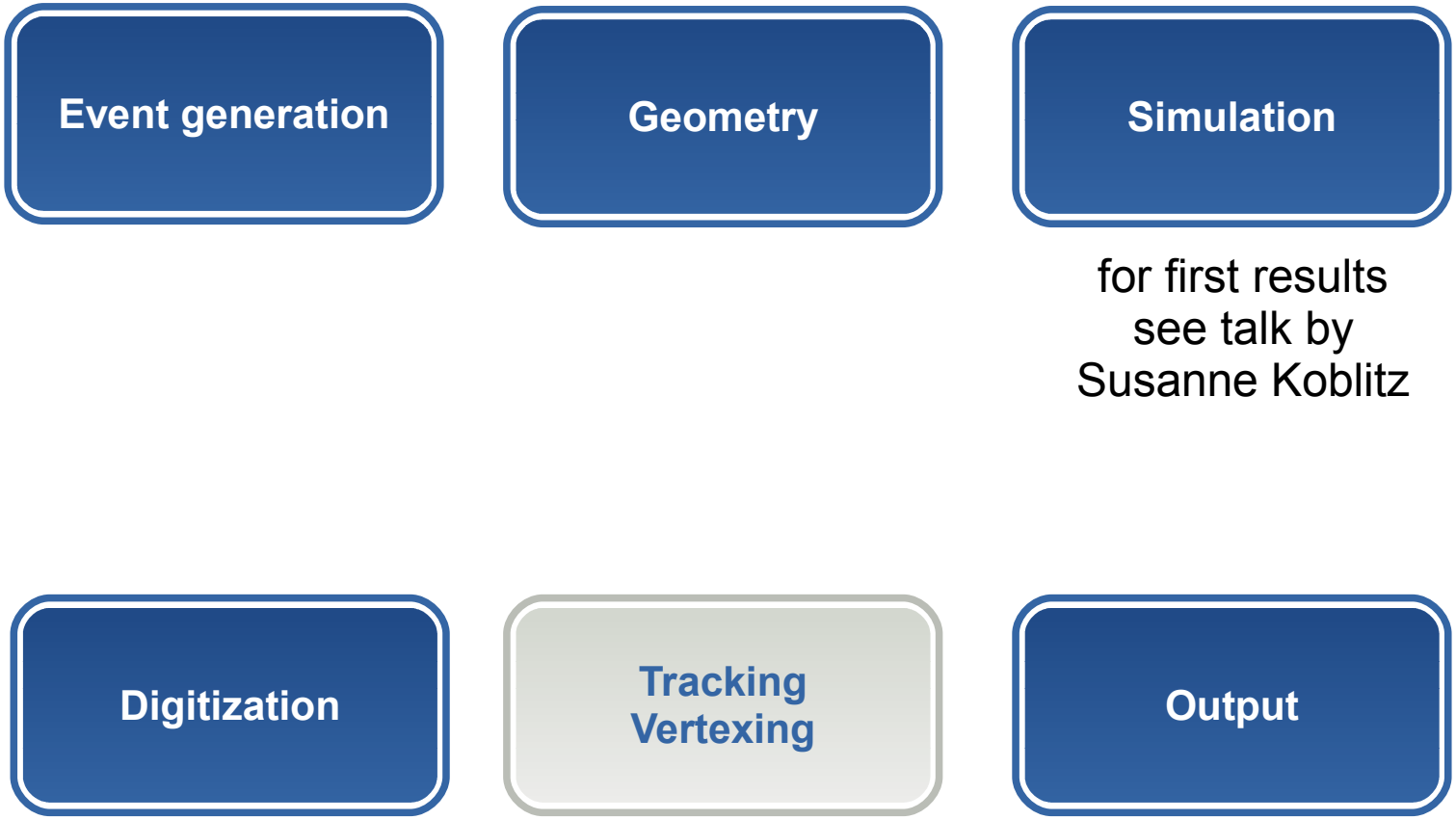
➡ Development of the new software framework **BASF2** started in ***April 2010***

- **Official** software framework of the Belle II experiment
- Supported and developed by the **Belle II computing group**
- **MPI** is strongly involved in the development
- Each subdetector has developers assigned
- Nightly builds
- Bug tracking system
- Wiki with installation instructions and a beginners guide
- Software is shipped with examples

First official release, tomorrow February 8th

Status

of basf2


Event generation
Geometry
Simulation
for first results
see talk by
Susanne Koblitz
Digitization
see talk by
Peter Kvasnicka
Tracking
Vertexing
see talk by
Martin Heck
Output

Event generation → MonteCarlo particle collection: **MCParticles**

Events can be generated by

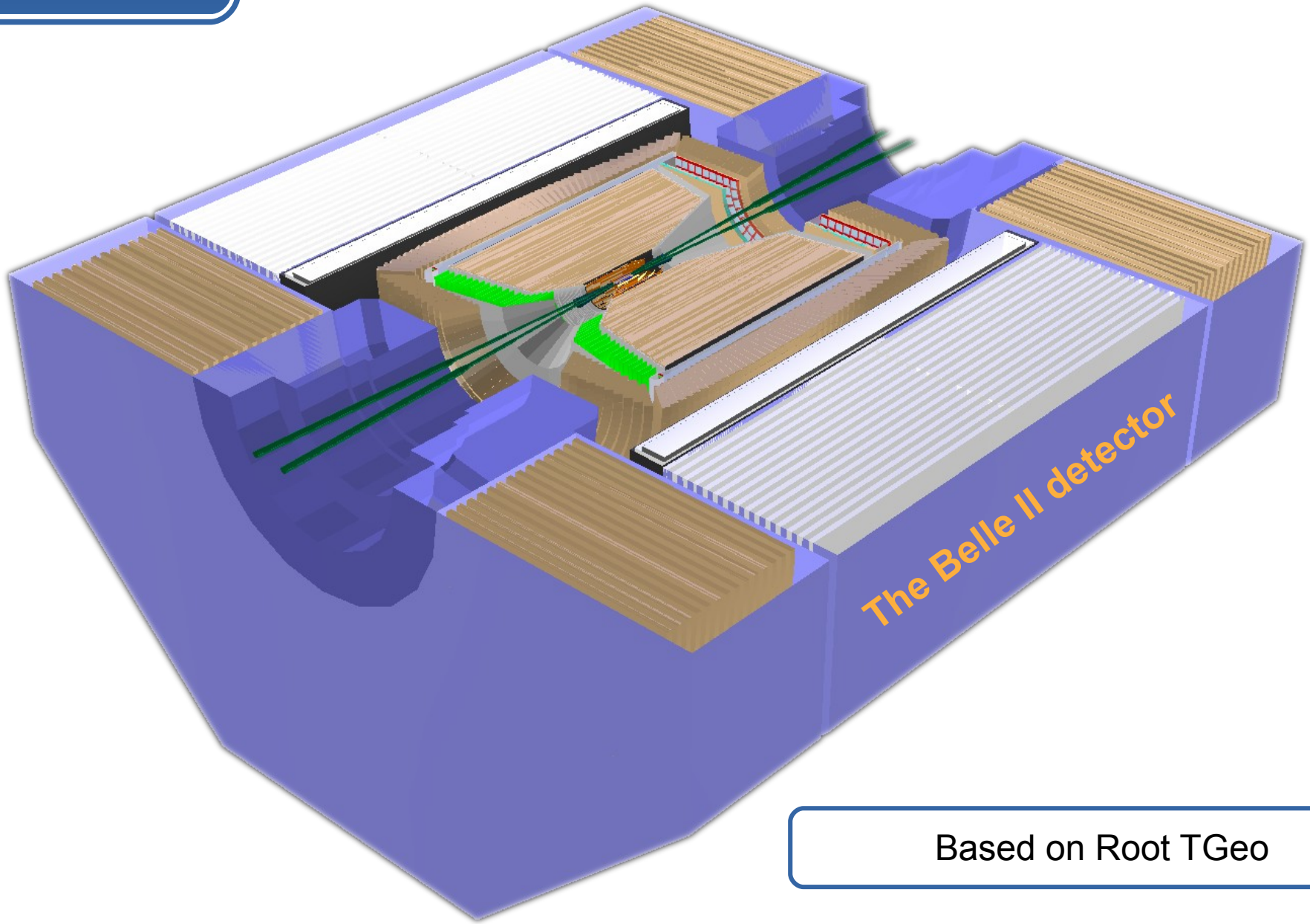
- **Particle gun**
  - Direction (*Phi, Theta*)
  - Vertex (*x, y, z*)
  - Momentum

  } Available distributions: ***Fixed***, ***Uniform***, ***Gaussian***

  - Particle type
- **HepEvt files**
  - Physics events (e.g. EvtGen, Pythia)
  - Beam background events (e.g. koralW, BHWide, BBrems)
- **Beam background**
  - Touschek

Geometry

- Almost all **subdetectors** are in (except barrel KLM)

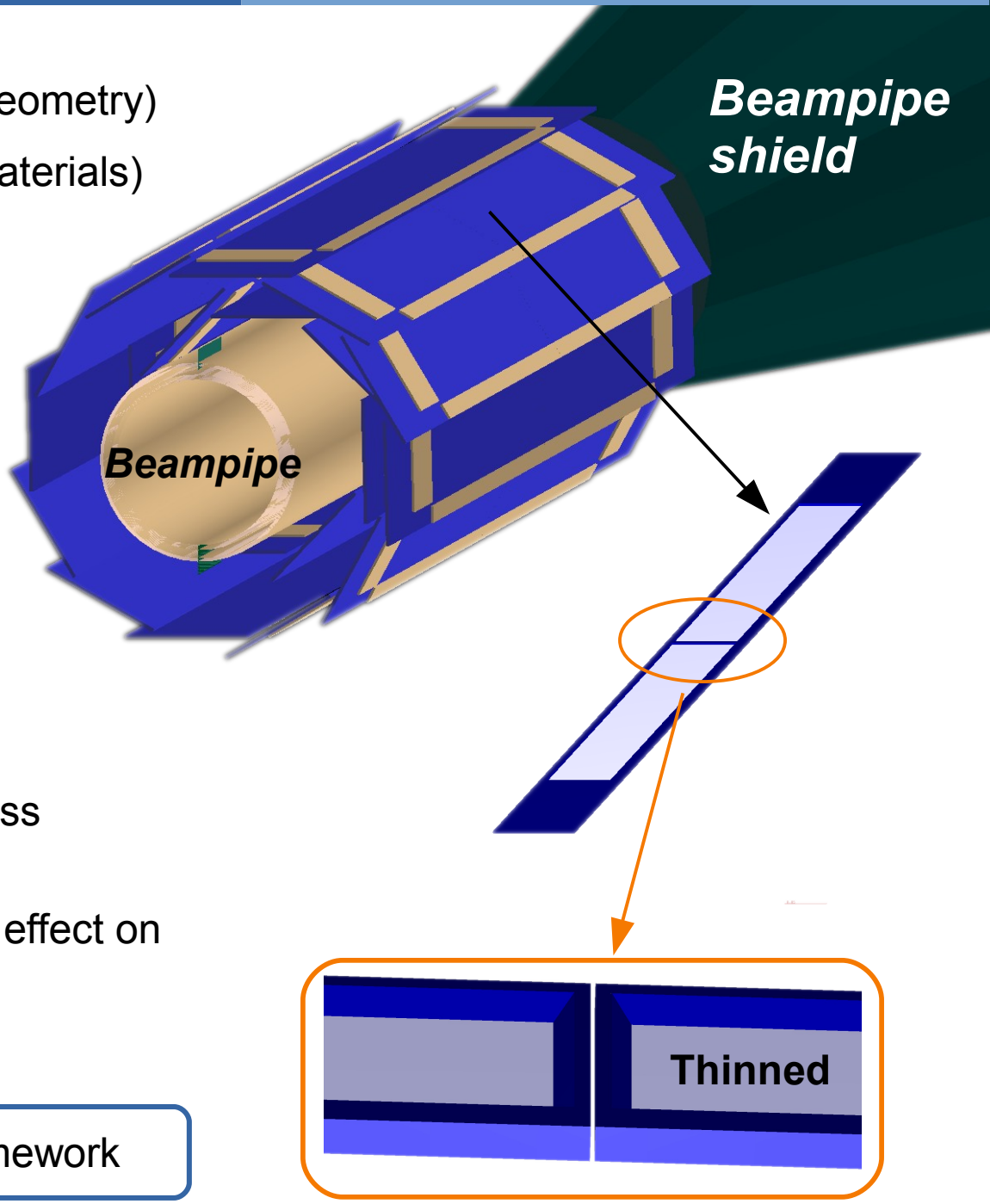


Based on Root TGeo

Implemented by:

Christian Oswald (Geometry)

Peter Kodys (Materials)



Available geometry:

- Ladder
- Thinned sensors
- Gaps
- Switchers

Idea:

Simplified geometry but correct mass of components

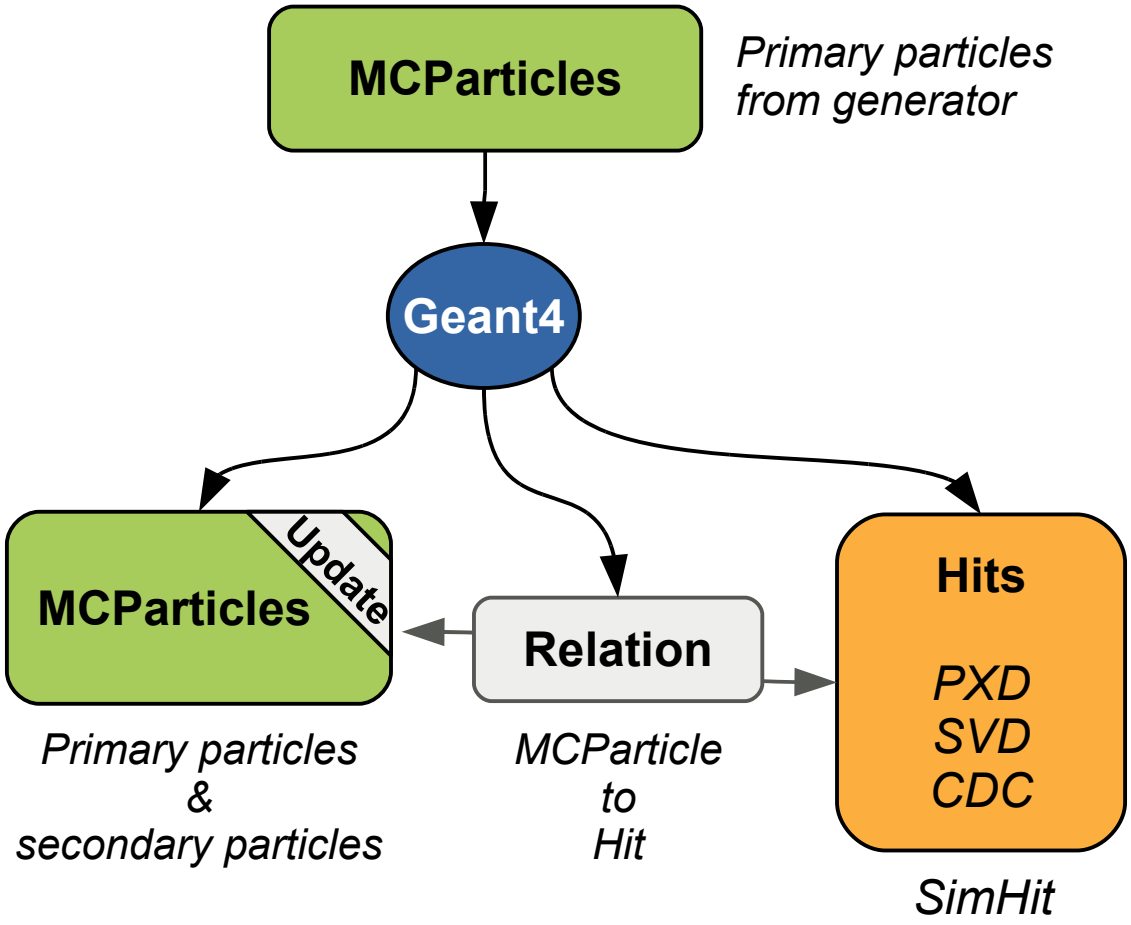
➡ realistic simulation of the mean effect on particle transport

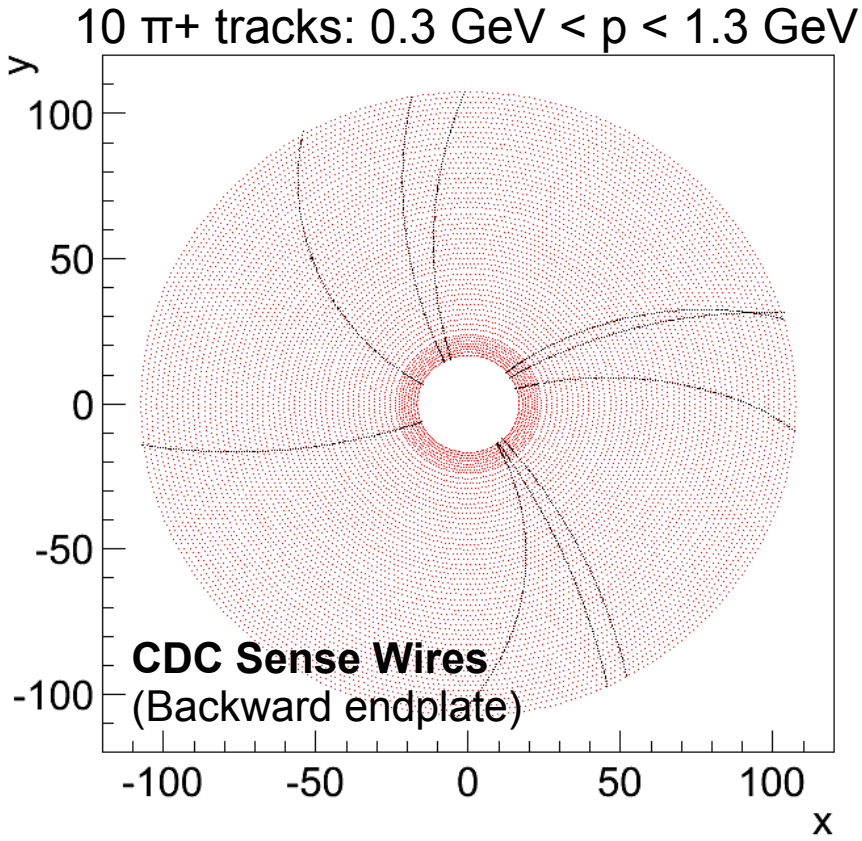
Better description than in the ILC framework

Simulation

Geant4 based full detector simulation

Collection data flow:





Digitization

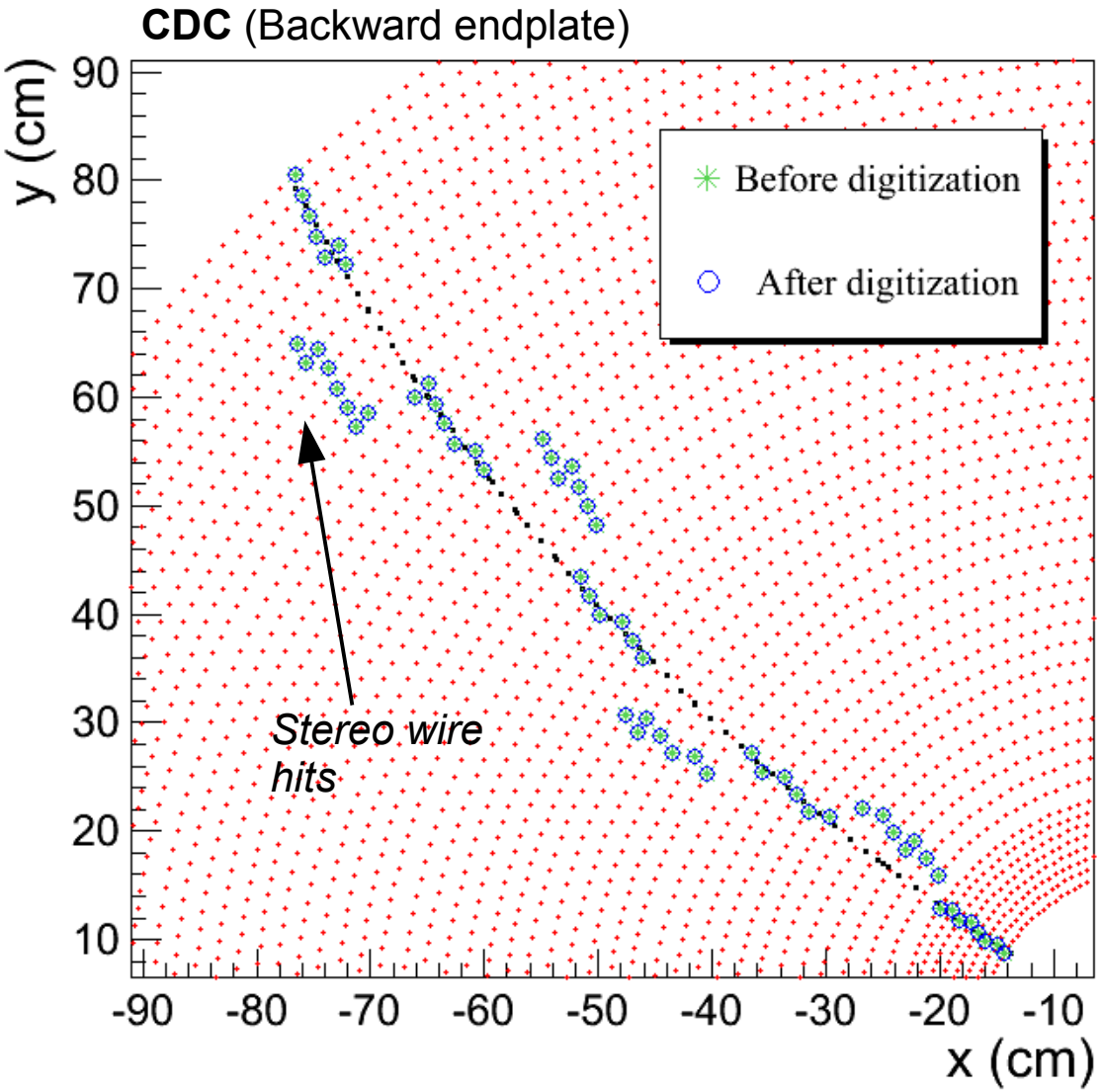
➡ **Simulation** of the detector response

PXD + SVD

- ✓ Gaussian smearing of hit
- ✓ Resolution:
  Spline interpolation depending on theta angle
- ✓ Spline taken from fit to MC data
  - ➡ Result: **smeared hits**

CDC

- ✓ Calculate drift length to wires
- ✓ Smear drift length with double Gaussian

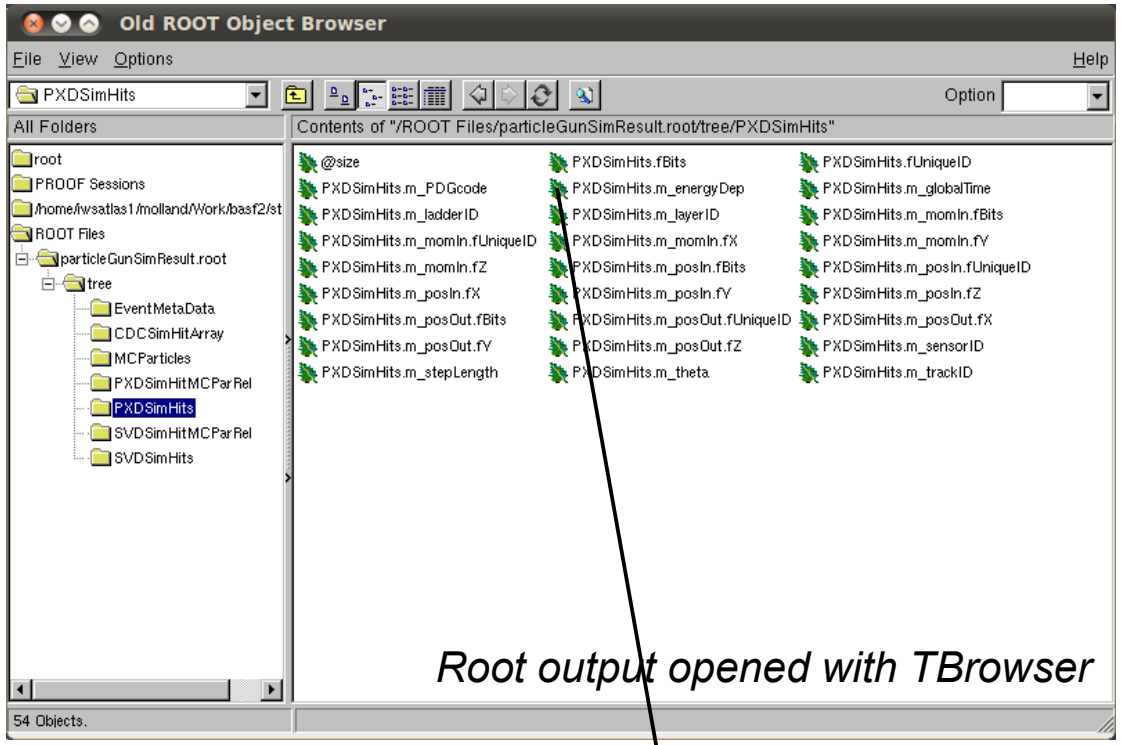


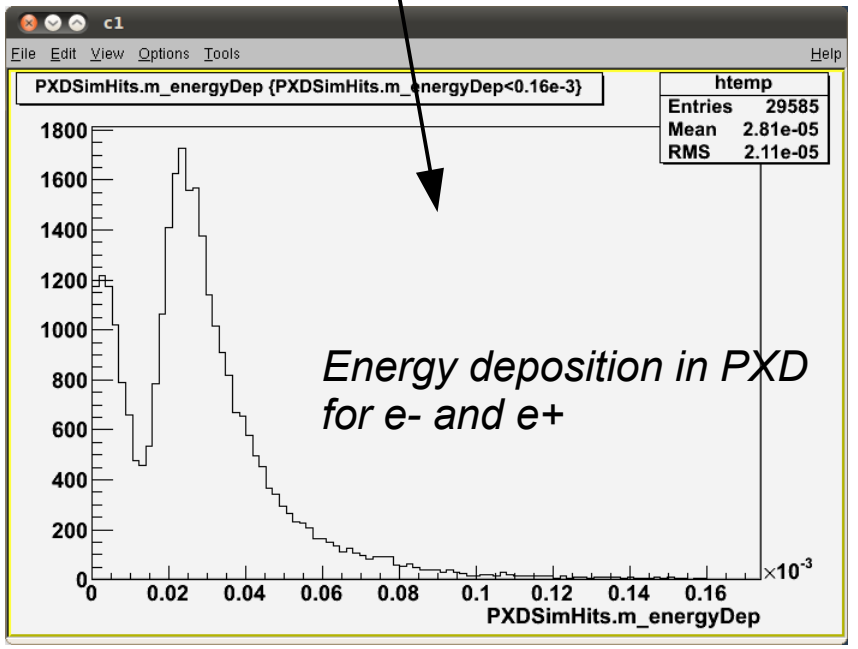
Output

Root file

Format

- Root tree with branch for every collection
- Collections are stored as TClonesArray
  - *MCParticles, Hits, Relations*





Advantage of Root files compared to ILC software

- Open Root file in TBrowser (GUI for plotting)
- Access content with Root scripts. Create code automatically via *TTree->MakeClass()*
  - *(see examples shipped with framework)*

Summary

and outlook

- **BASF2**: new and official Belle II framework
- Replaces the **ILC** framework for PXD studies
- Particle generation, geometry, simulation, simple digitization is available
- Input for signal and background events is available
- Peter Kvasnicka is working on porting Zbynek's **digitizer** to BASF2

Outlook

- ✓ Port Zbynek's digitizer in order to produce Pixel raw data

  (see talk by Peter Kvasnicka)
- ✓ Add signal with background merging to BASF2
- ✓ Background studies (Touschek, Synchrotron radiation)
- ✓ Data for hardware tests (DHH, DAQ, data reduction) can be produced

Please try the software yourself

see links at the next slide

TWiki	http://b2comp.kek.jp/~twiki/bin/view/Computing
Nightly builds	http://b2comp.kek.jp/internal/development_build/index.html
Redmine (bug tracking)	http://b2comp.kek.jp/redmine
SVN	http://b2comp.kek.jp/browse/viewvc.cgi/svn/trunk/software/

- **Registration**

  http://b2comp.kek.jp/~twiki/bin/view/TWiki/TWikiRegistration

- **basf2 software portal**

  http://b2comp.kek.jp/~twiki/bin/view/Computing/Basf2SoftwarePortal

  Installation instructions

  http://b2comp.kek.jp/~twiki/bin/view/Computing/SoftwareInstallation