Update on optimization of the SiD detector for CEPC studies

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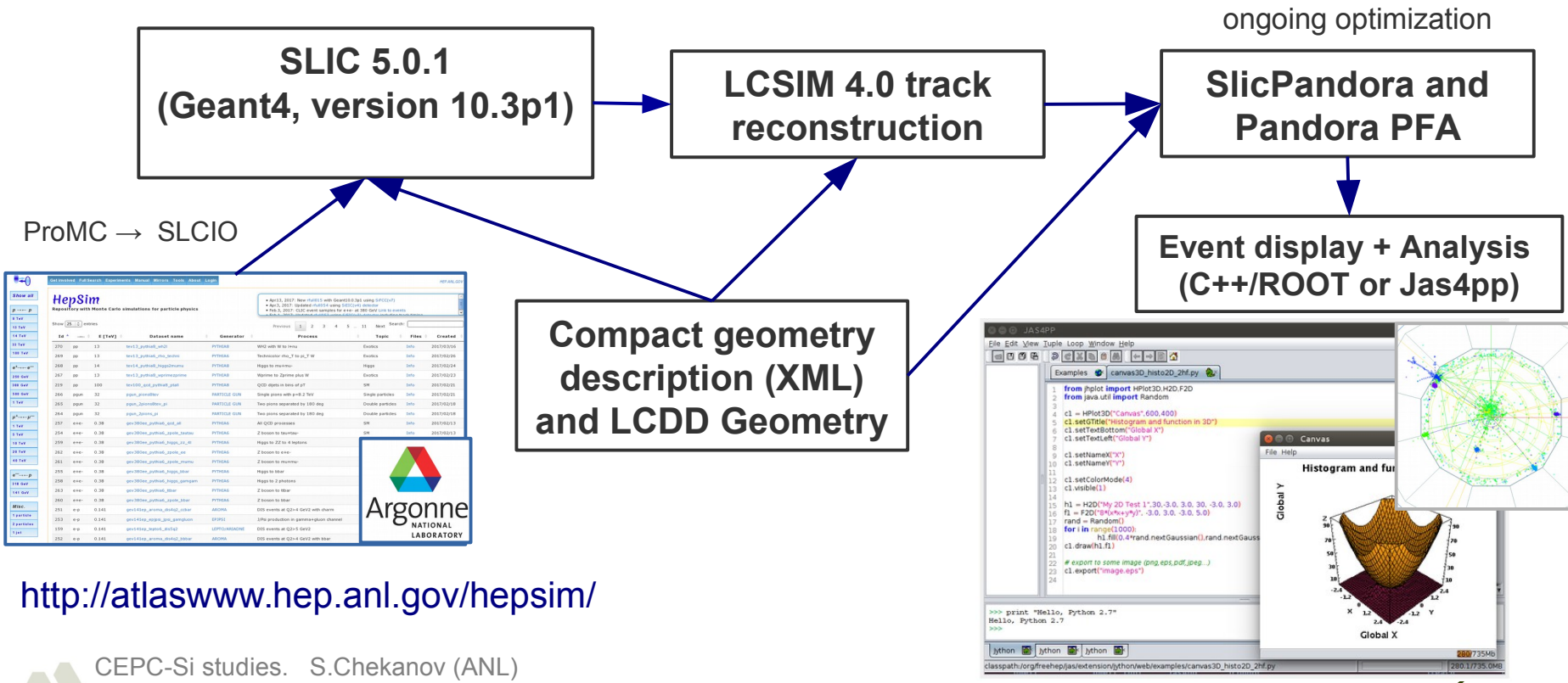
HEP/ANL

Simulation and reconstruction

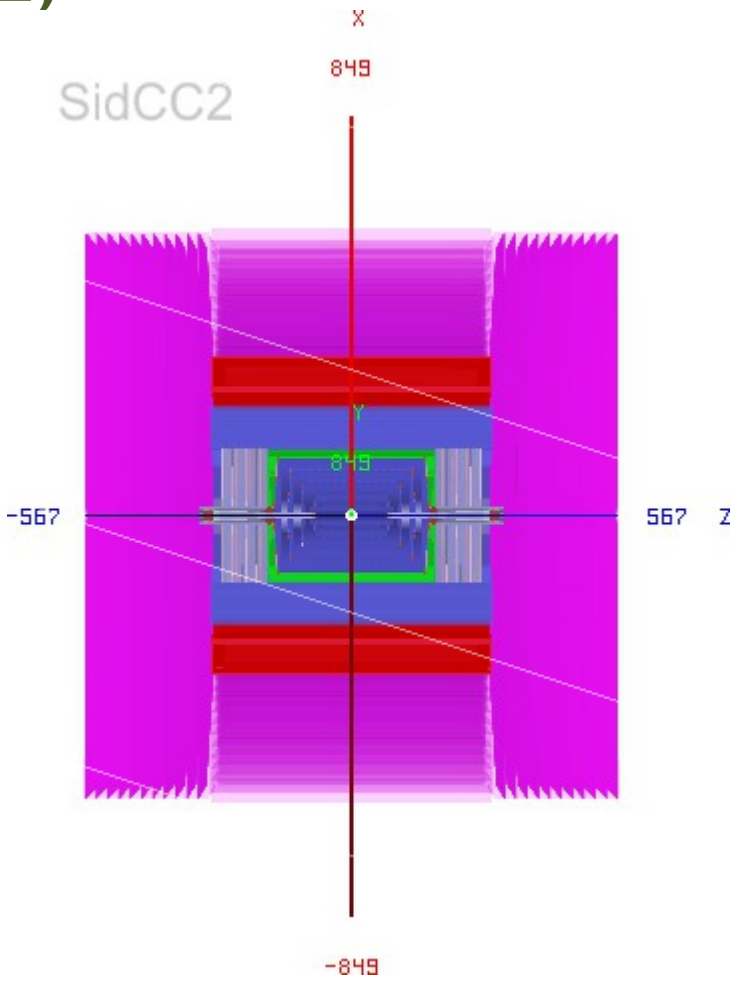
- SLIC simulation:
  - updated for Geant 10.3p1 by J.McCormick, W.Armstrong, D.Blyth, S.C
- LCSIM track reconstruction developed at SLAC (J.McCormick, T.Johnson, N.Graf etc.)
  - speed up by a factor 7 compared to LCSIM 2016 version by D.Blyth (ANL)
- Fast PandoraPFA (J.Marshall, M.Thomson)
- Software packages decoupled from ILCsoft (all are based on git)
- Runs as image inside “singularity” (docker) – portable for HPC and other resources



http://atlaswww.hep.anl.gov/hepsim/

SiD optimized for CEPC (version 2)

Differences compared to the version discussed in Conceptual Design Studies for a CEPC Detector. arXiv:1604.01994 (S.Chekanov, M. Demarteau)



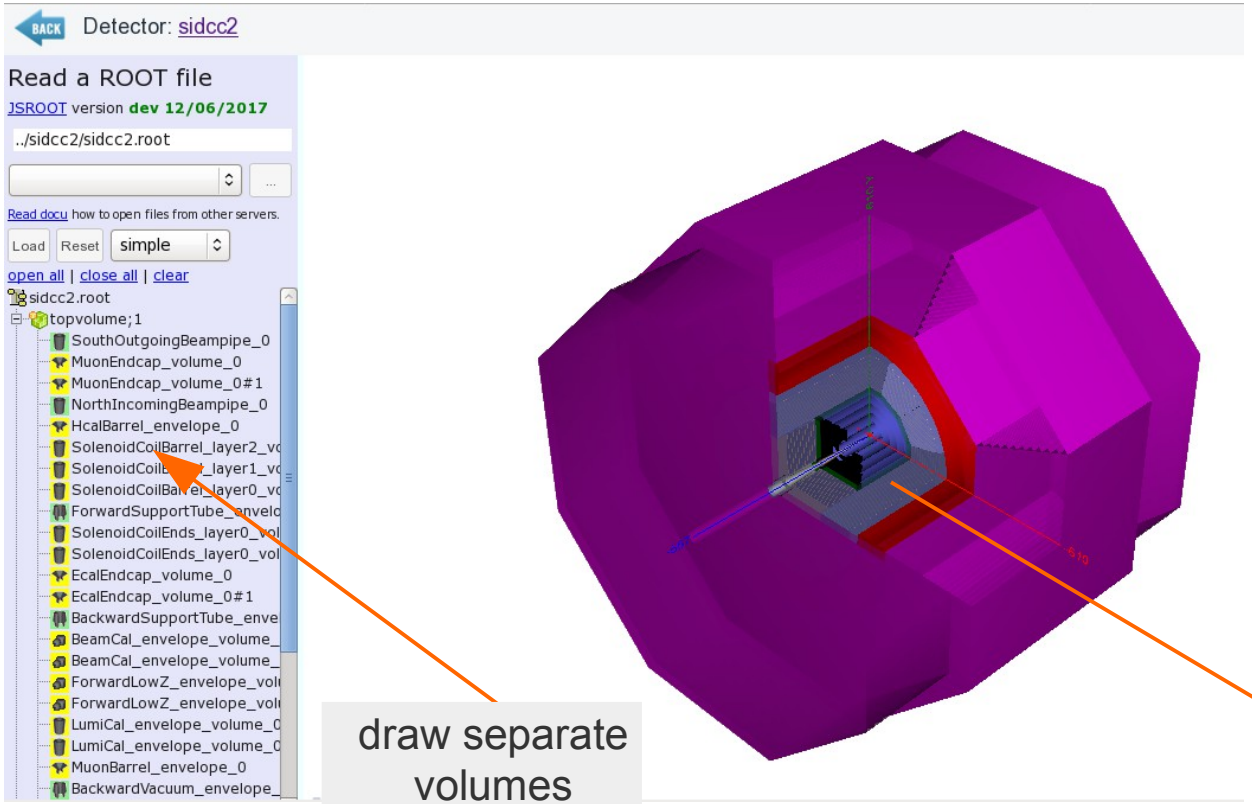
- 3 T field (agreed with Manqi)
- Thinner calorimeter (35 layers)
- Min number of hits 5
- Outer tracking radios is 1.25 m (as for SiD)
- Smaller sizes compared to SiD
- Robust, well understood all-sillicon vertexing and tracking

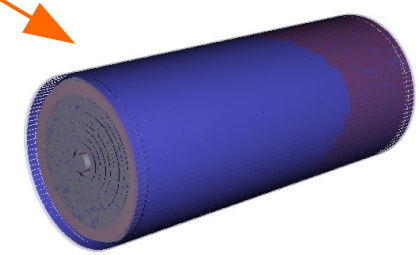
Complete details on geometry:

http://atlaswww.hep.anl.gov/hepsim/detectorinfo.php?id=sidcc2

3D browser for detector geometry

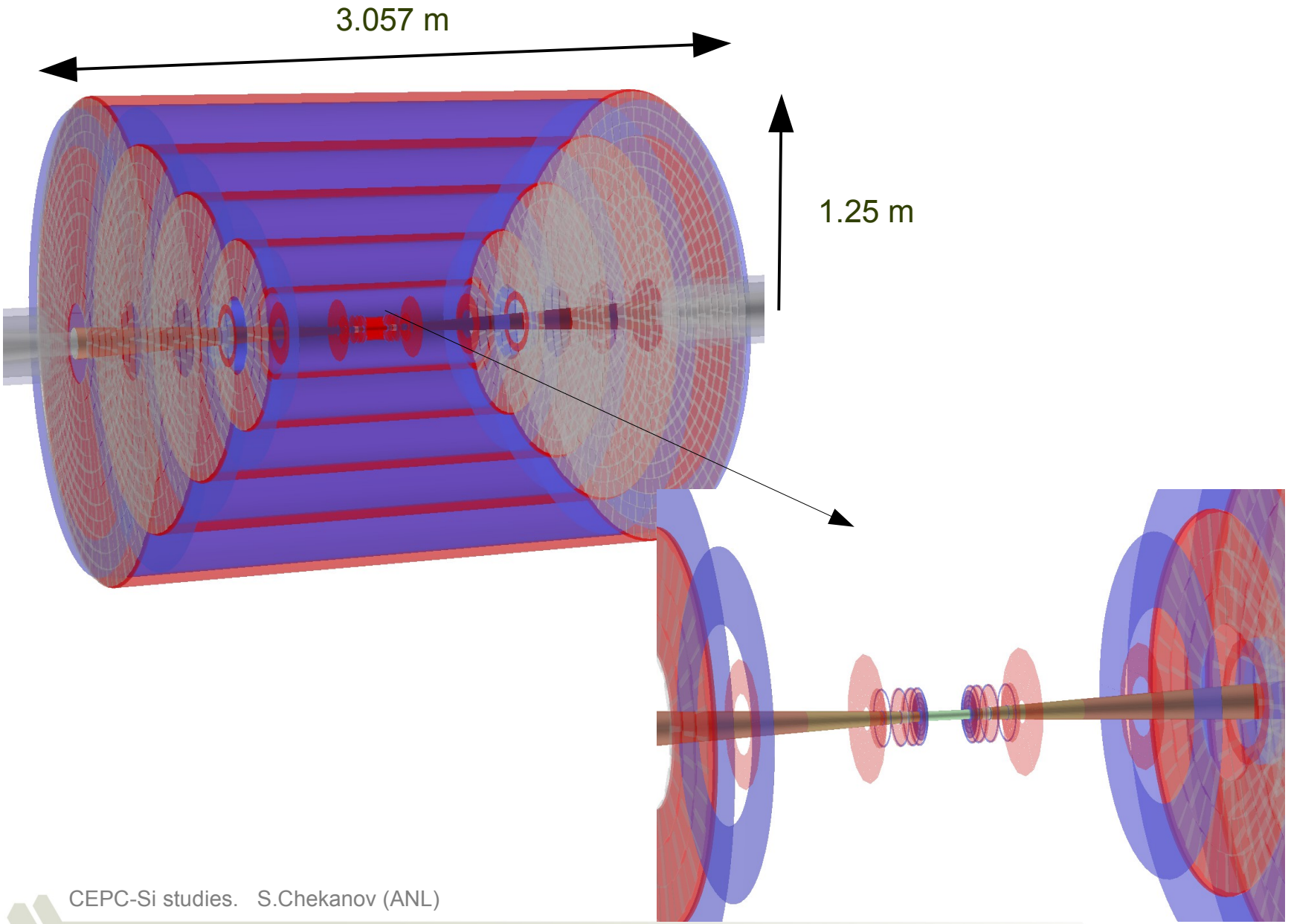
- Detector volumes can interactively be studied in 3D using GeoManager



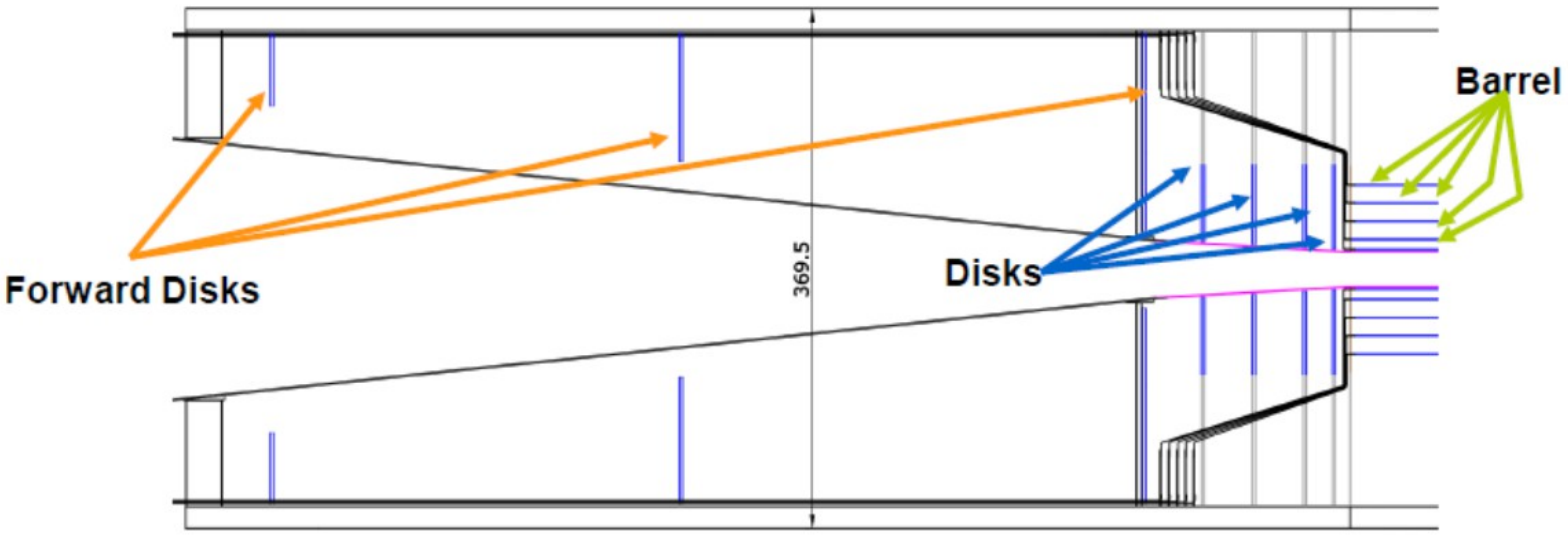


http://atlaswww.hep.anl.gov/hepsim/viewdet.php?det=sidcc2&br=1

Closer look

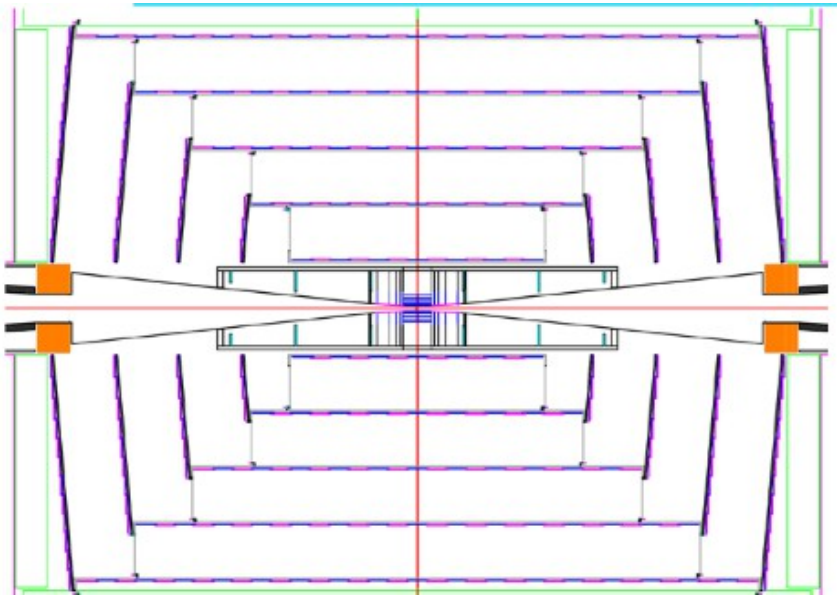


Closer look: Vertex detector



Requirements
< 5 μm hit resolution
– 0.1 % X per layer

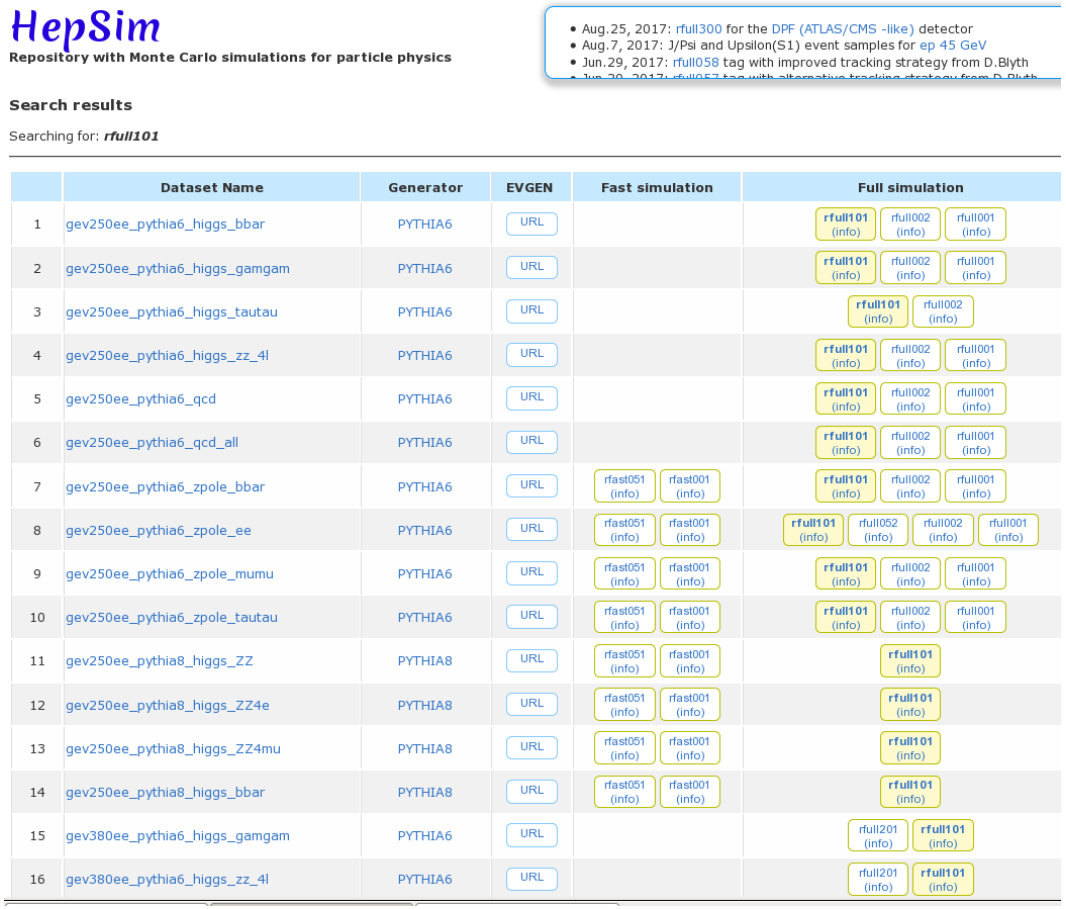
Closer look: Tracker



Available data for performance studies

rfull101 tag: http://atlaswww.hep.anl.gov/hepsim/list.php?find=rfull101

25 LCIO samples with single particles and e+e- events from Pythia6/Pythia8



HepSim

Repository with Monte Carlo simulations for particle physics

- Aug.25, 2017: rfull300 for the DPF (ATLAS/CMS -like) detector
- Aug.7, 2017: J/Psi and Upsilon(S1) event samples for ep 45 GeV
- Jun.29, 2017: rfull058 tag with improved tracking strategy from D.Blyth

Search results

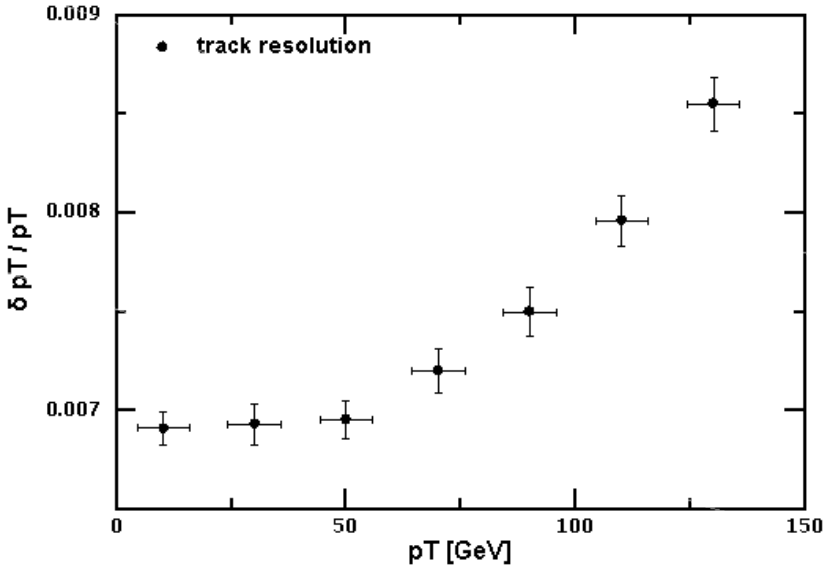
Searching for: ***rfull101***

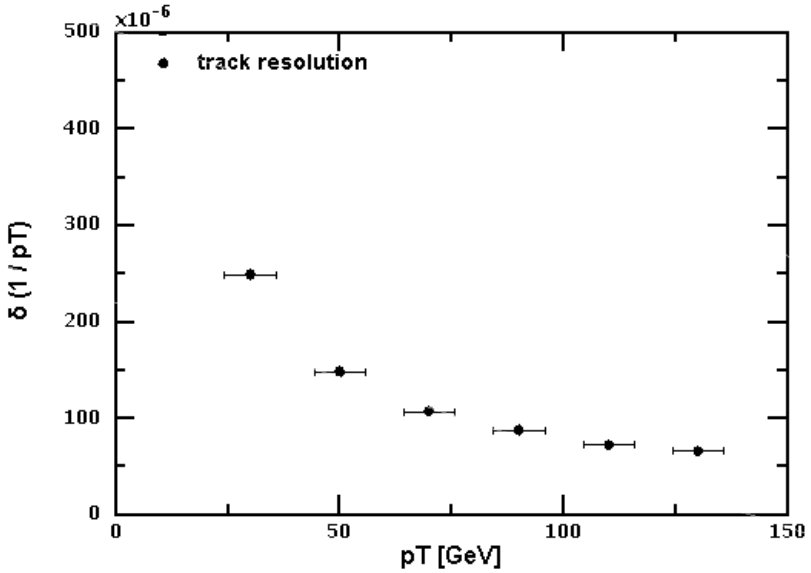
	Dataset Name	Generator	EVGEN	Fast simulation	Full simulation
1	gev250ee_pythia6_higgs_bbar	PYTHIA6	URL		**rfull101** (info) rfull002 (info) rfull001 (info)
2	gev250ee_pythia6_higgs_gamgam	PYTHIA6	URL		**rfull101** (info) rfull002 (info) rfull001 (info)
3	gev250ee_pythia6_higgs_tautau	PYTHIA6	URL		**rfull101** (info) rfull002 (info)
4	gev250ee_pythia6_higgs_zz_4l	PYTHIA6	URL		**rfull101** (info) rfull002 (info) rfull001 (info)
5	gev250ee_pythia6_qcd	PYTHIA6	URL		**rfull101** (info) rfull002 (info) rfull001 (info)
6	gev250ee_pythia6_qcd_all	PYTHIA6	URL		**rfull101** (info) rfull002 (info) rfull001 (info)
7	gev250ee_pythia6_zpole_bbar	PYTHIA6	URL	rfast051 (info) rfast001 (info)	**rfull101** (info) rfull002 (info) rfull001 (info)
8	gev250ee_pythia6_zpole_ee	PYTHIA6	URL	rfast051 (info) rfast001 (info)	**rfull101** (info) rfull052 (info) rfull002 (info) rfull001 (info)
9	gev250ee_pythia6_zpole_mumu	PYTHIA6	URL	rfast051 (info) rfast001 (info)	**rfull101** (info) rfull002 (info) rfull001 (info)
10	gev250ee_pythia6_zpole_tautau	PYTHIA6	URL	rfast051 (info) rfast001 (info)	**rfull101** (info) rfull002 (info) rfull001 (info)
11	gev250ee_pythia8_higgs_ZZ	PYTHIA8	URL	rfast051 (info) rfast001 (info)	**rfull101** (info)
12	gev250ee_pythia8_higgs_ZZ4e	PYTHIA8	URL	rfast051 (info) rfast001 (info)	**rfull101** (info)
13	gev250ee_pythia8_higgs_ZZ4mu	PYTHIA8	URL	rfast051 (info) rfast001 (info)	**rfull101** (info)
14	gev250ee_pythia8_higgs_bbar	PYTHIA8	URL	rfast051 (info) rfast001 (info)	**rfull101** (info)
15	gev380ee_pythia6_higgs_gamgam	PYTHIA6	URL		rfull201 (info) **rfull101** (info)
16	gev380ee_pythia6_higgs_zz_4l	PYTHIA6	URL		rfull201 (info) **rfull101** (info)

Track performance (all rapidity |y|<3, B=3 T)

A simple example created for comparison with the studies by Wei-Ming Yao

http://atlaswww.hep.anl.gov/hepsim/doc/doku.php?id=fcs:cepc:2017





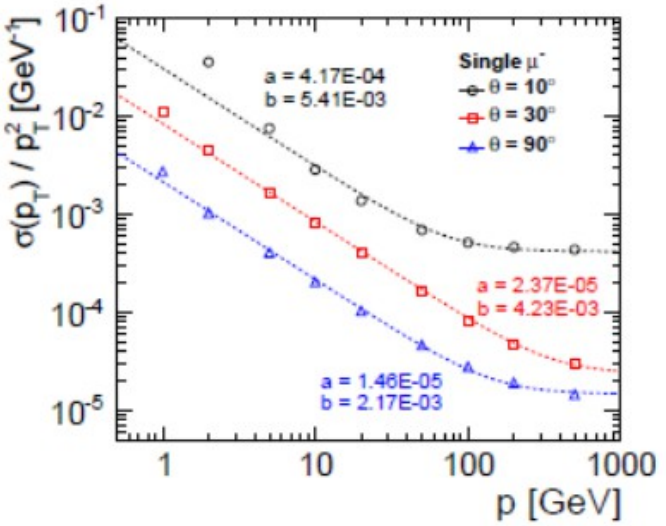
Track resolution using single muons

Backup:

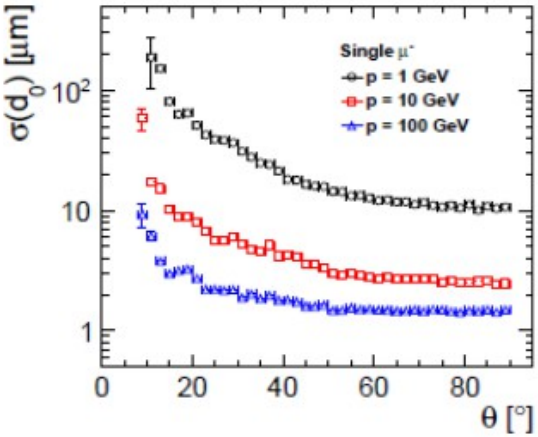
SiD detector with 5 T field
(from SiD detector concept, A.White's talk)

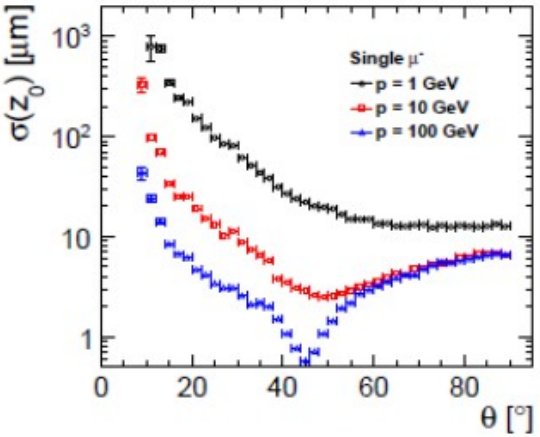
Performance

Momentum resolution



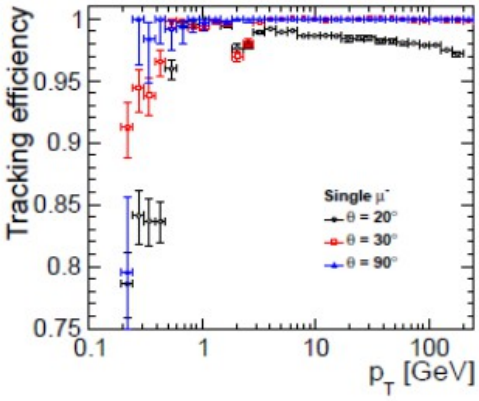
Impact parameter

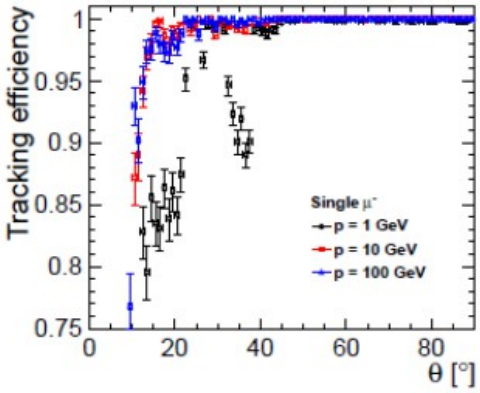




Performance - efficiency

Single muons





Di-jet Z'
(M = 1 Tev/c^2)