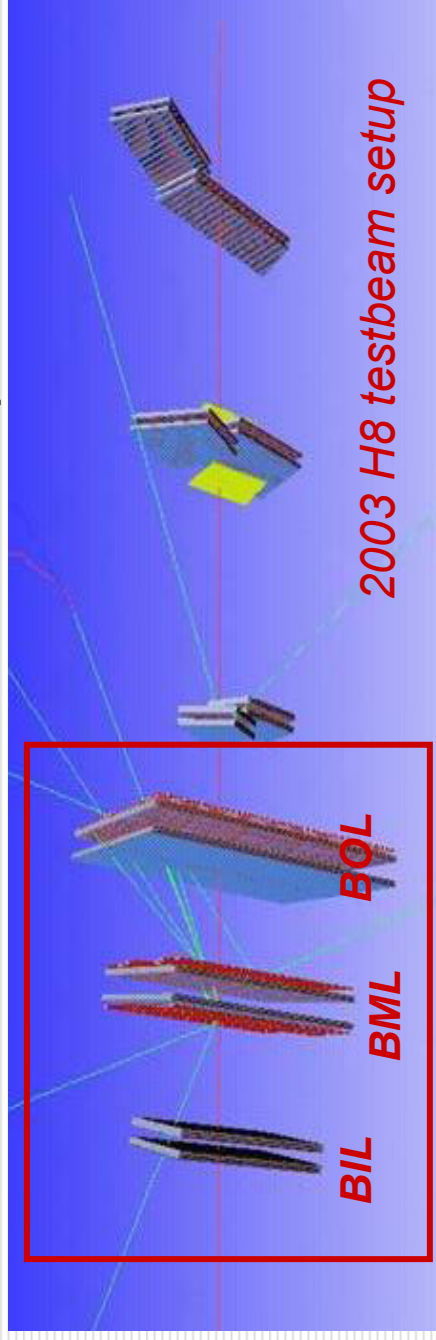

Status of Geant4 Simulation (and Reconstruction) of H8 2003 Testbeam



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ATLAS Muon Week, April, 27th 2004

Geant4 Simulation

- Hand-coded geometry from amdb_simrec.H8.2003_barrel.a.01
 - Two BILs, two BMLs equipped with RPCs, two BOLs with RPC
 - MDT and RPC geometry and material recently validated
- Muon tracks interact with SD and produce *MDTSimHits* and *RPCSimHits*
 - MDTSensitiveDetector optimized for secondary particle production (N.VE)
 - *Hard scattering, internal tube hits, muon hit shielded by a secondary*
- Cuts on Aluminum MDTDriftWall at the same level of the gas volume (N.VE)
 - *Threshold on secondary production $\sim 8\text{KeV}$*
- H8 beam simulation tuned on 2003 data (ATL-COM-MUON-2003-014)



Digitization

- Processes *MDTSimHits* and *RPCSimHits*, and generates *MdtDigits* and *RpcDigits*



- defined by the reconstruction group
 - resemble the detector output (same objects as for real data)
-
- Connection to DD via offline ID helpers
 - *Separation between event and detector data*
 - ASCII file to initialize the offline ID helpers
 - IdDictMuonSpectrometer.H8.xml (common dictionary for 2003 and 2004 testbeam setups, written by Stefano and Ketevi) in DetectorDescription/IdDictParser

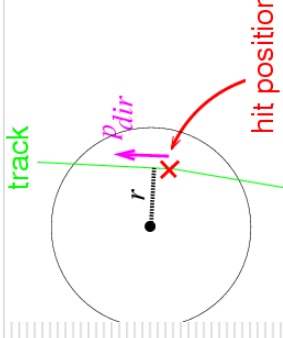


Digitization

□ MDT_Digitization

Drift radius \rightarrow time conversion for the MDT tubes via external
rt relation updated to Garfield simulation for gas properties
(G.Ciapetti *et al.* ATL-COM-MUON-2003-028)

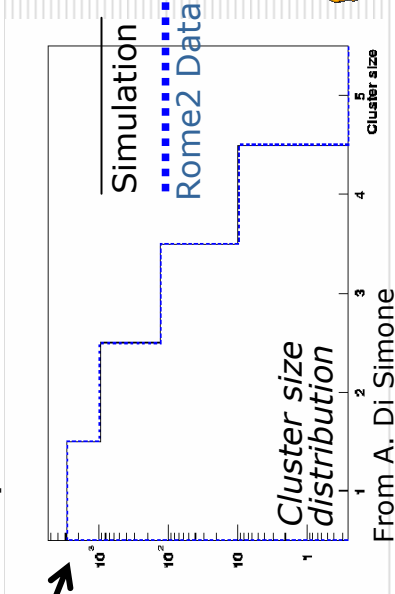
- temperature dependence (2 ns / 0.7°)
- gas mixture dependence (2 ns / 3×10^{-4} % Ar)
- water content dependence (2ns / 40 ppm)



□ RPC_Digitization

Cluster size and cluster spread simulation reproduce the
experimental distributions

signal propagation along the strips



□ Digitization can act

- On the fly on generated G4 hits
- On persistified hits (POOL file)



Reconstruction (S.Rosati)

- MOORE reconstruction
 - On the fly after the simulation
 - On persisted objects
 - Digits ↔ RDOs ↔ Bytestream

G4Digits are decoded to make the RDOs

- **Reconstruction features**
 - MuonDetDescr Detector Description
 - Same rt relation as used to digitize MDTs
- Track segments reconstructed on each station
- CBNT_Athena ntuple services in MuonSpectrometer/MuonTestBeam to monitor the reconstruction parameters

The code used to reconstruct testbeam data is, apart from the calibrations, the same as used to reconstruct simulated events



Web

Reachable from the Geant4 simulation web pages follow WingM's Subdetector Simulation (Spectrometer) > Muon Testbeam > Muon Testbeam2003

Welcome to the web page for the 2003 H8 Muon TestBeam Simulation with Geant4, Digitization and Reconstruction (Athena rel 8.0.1)

Contents is page and links:

- [Installing/Running the general Simulation in Athena for the 2003 H8 TestBeam](#)
- [Installing/Running the Simulation-Digitization-Reconstruction chain in Athena for the 2003 Muon TestBeam](#)
- [Instructions to run the full simulation/digitization/reconstruction chain in the AtlasG4Sim environment with athena 8.0.1](#)

The adopted procedure is exactly the same as the one adopted for the Atlas Spectrometer.

- Phase 1:
 - login to hpcus
 - edit the requirements file
 - source setup.sh -tag=opt(modify first your setup.sh accordingly)
 - cd \$MATHATLASSIMDIR
 - cmt co Simulation/G4Sim/AtlasG4Sim
 - cd Simulation/G4Sim/AtlasG4Sim/AtlasG4Sim-*/cmt
 - copy this requirements file in your present cmt dir (this operation is needed since digitization and reconstruction packages are used here)
 - cmt config
 - cmt broadcast cmt config
 - cmt broadcast make
 - source setup.sh
- Phase 2:
 - cd \$MATHATLASSIMDIR



Comparison with data

- Analysis studies and comparison with testbeam data (A.Policicchio)

- **H8 2003 Data Samples**

- **Run #700077** @180 GeV- trigger 10X10
calibration_data_new/rt_rels/rt_030001_030018
t0_ba_700069_700122.dat
- **Run #1559** @80 GeV- trigger hodoscope
calibration_data_new/rt_rels/rt_030001_030018
t0_ba_001559_001559.dat

- No alignment performed

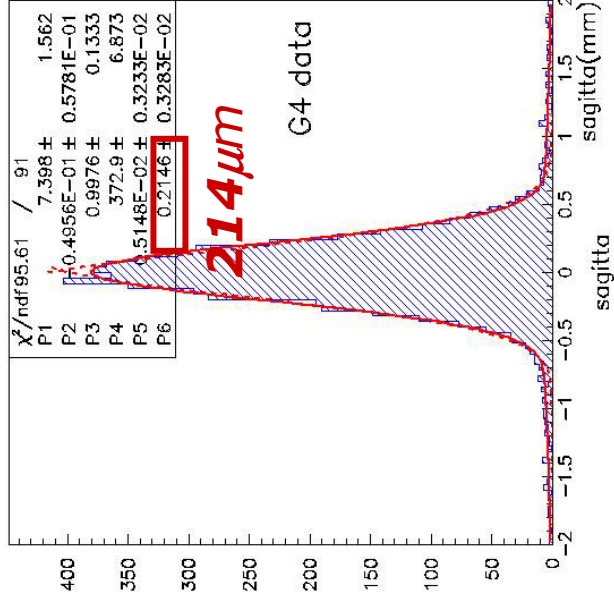
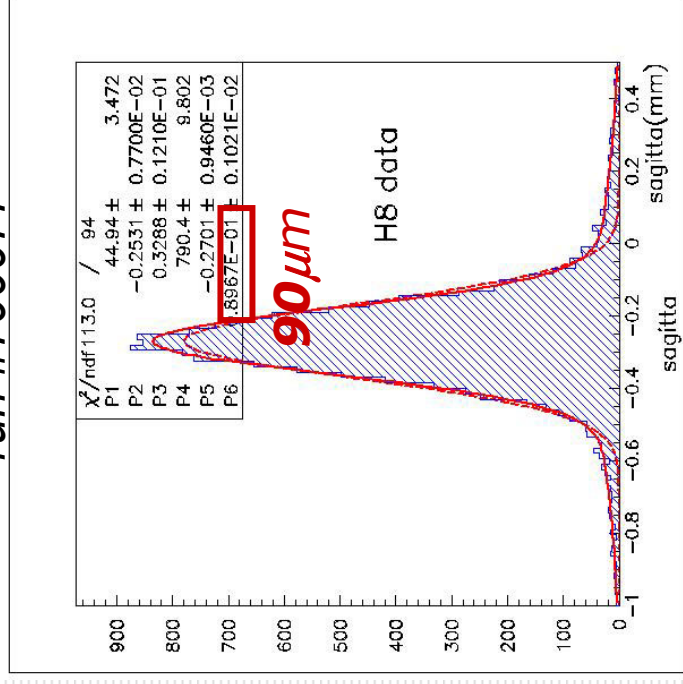
→ **First results on MTDs**



Sagitta measurements

Nominal beam momentum 180 GeV

run #700077



Geant4 overestimate the multiple scattering contribution → under investigation



Sagitta measurements

- ❑ Same exercise repeated at different beam momentum
- ❑ Values from data from K.Mair and SR

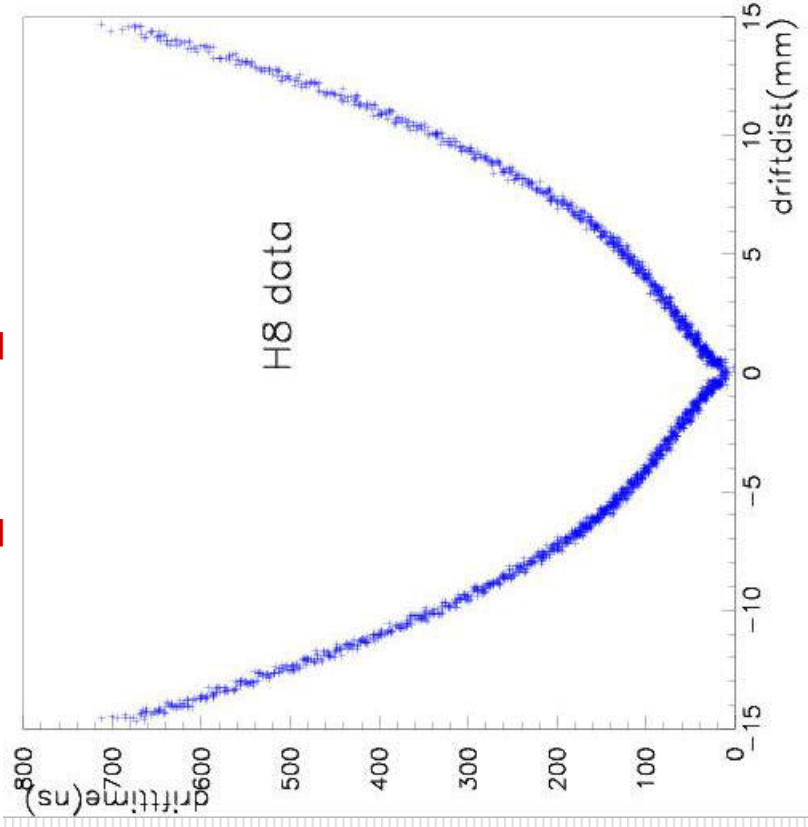
Beam Momentum	Expected	Geant4.6.0	Geant4.6.1	Fast_Physics
180 GeV	(70) 90 μm	252 μm	214 μm	50 μm
80 GeV	150 μm	485 μm	445 μm	

Chamber intrinsic resolution

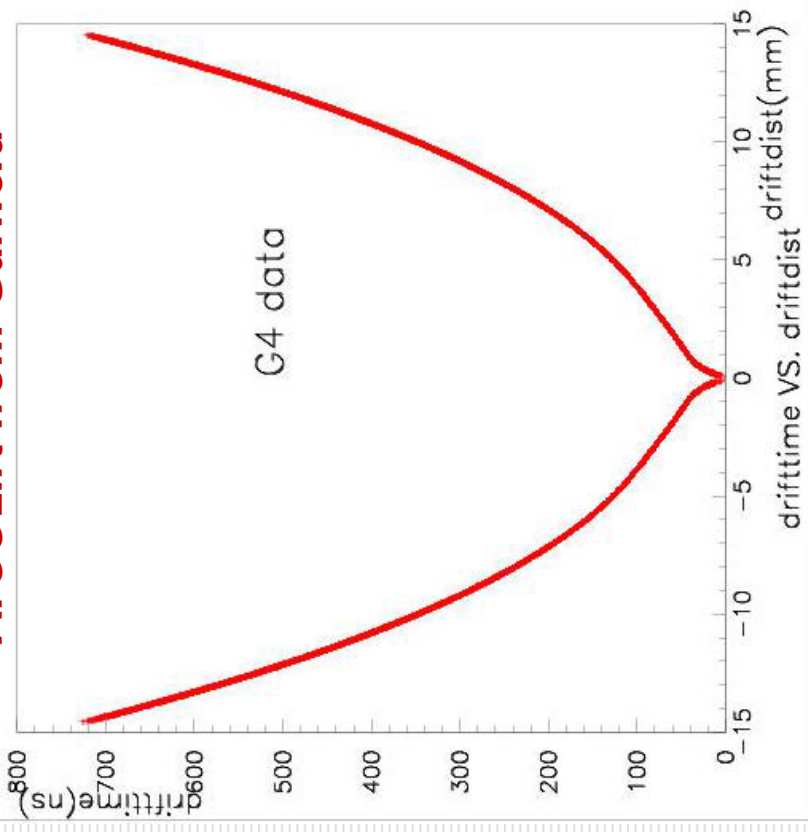


Drift radius VS Drift Time

rt_030001_030018



ArCO2.rt from Garfield



Conclusion and Plans

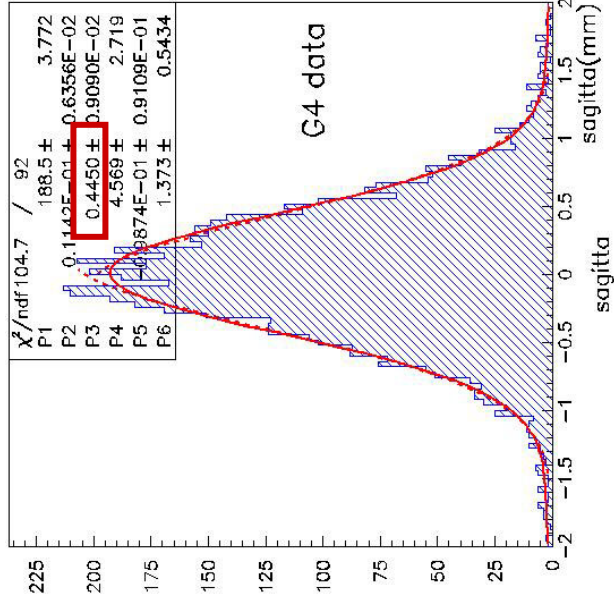
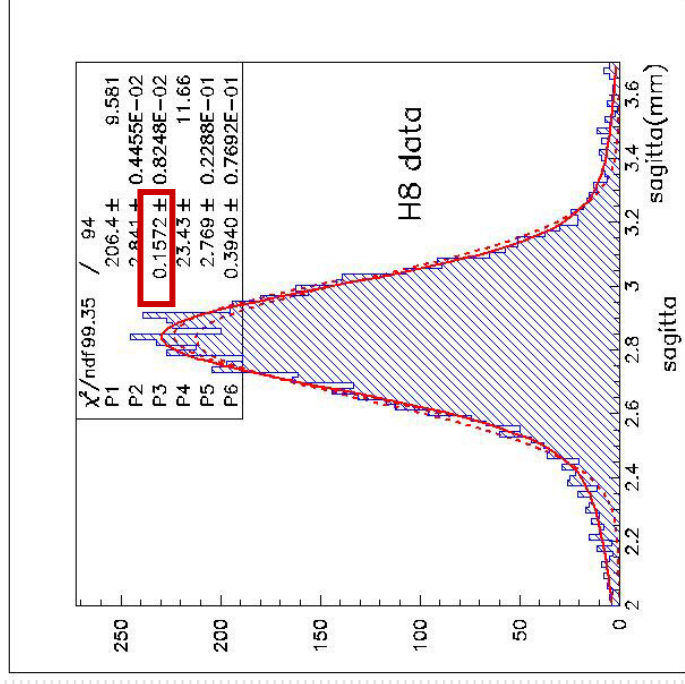
- **Analysis plans**
 - MDT: understand Geant4 ms overestimation
 - Add RPC information
 - sagitta and resolution as a function of the beam momentum and with presence/absence of concrete/dead material along the beam line
 - H8 2003 runs with Aluminum block in between the EM and EO end-cap stations
 - Effects of secondaries produced in the Al block and in the dead materials on the reconstruction efficiency
- **The web page**
 - merges different athena packages and functionality
 - Will be updated to athena 8.0.2
 - *Please report bugs and/or comments to Stefano and me*



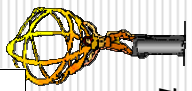
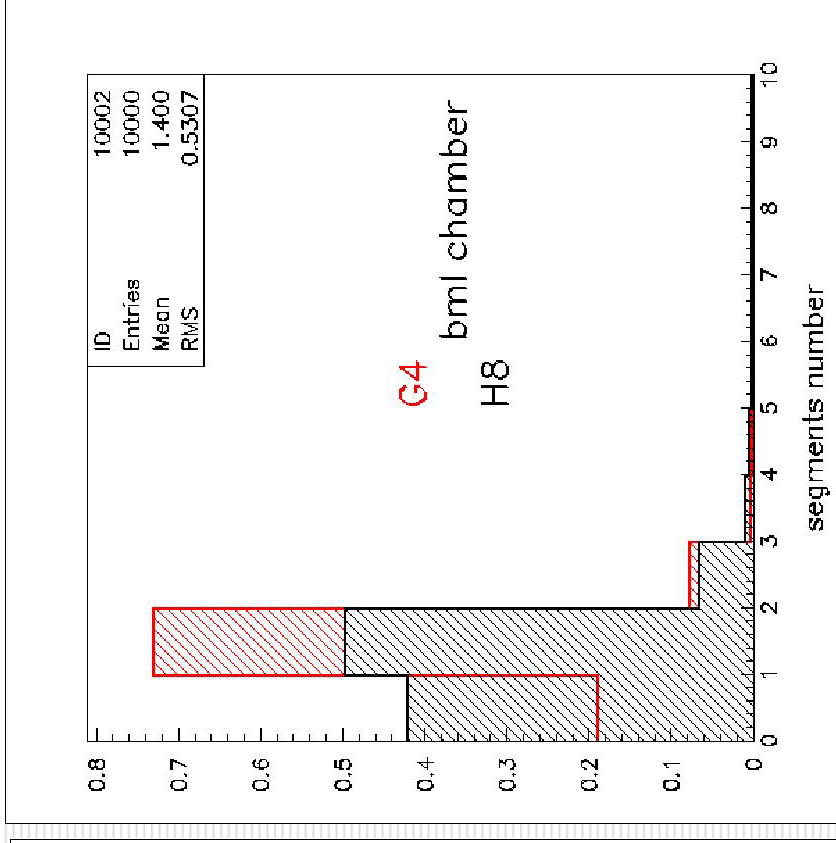
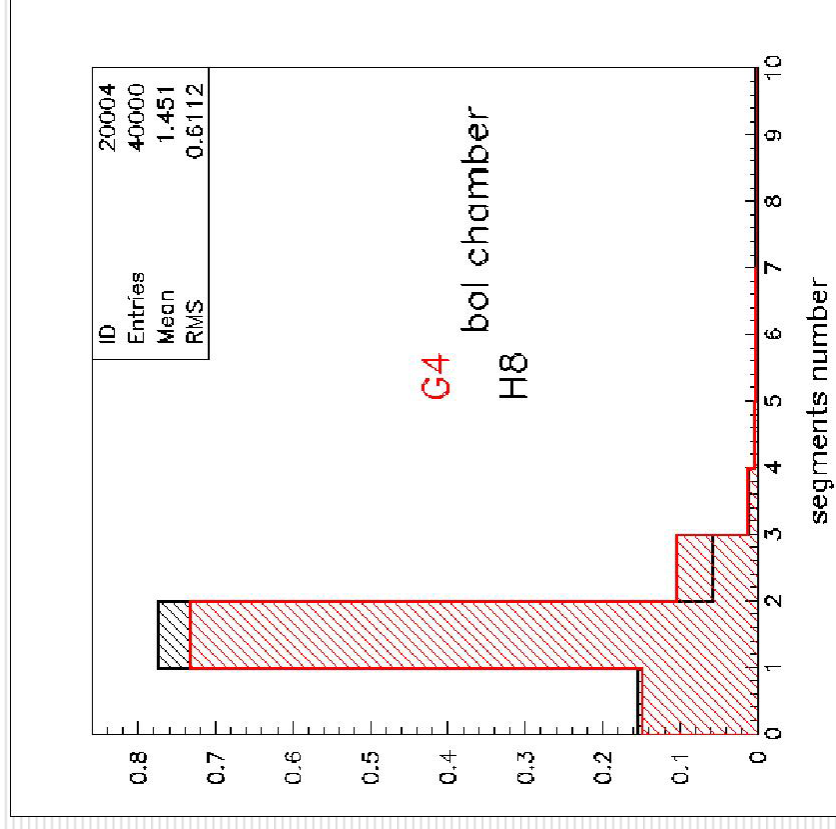
Sagitta measurements

Nominal beam momentum 80 GeV

run #1559



Reconstructed segments



Reconstruction efficiency ~85%

Residuals

Station BIL multilayer 1 layer 1

