Combined tracking performance in M6 and re-processing readiness.

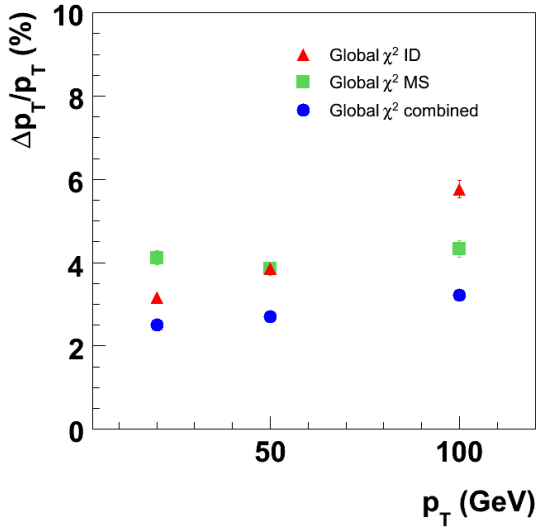
Thijs Cornelissen (CERN)
María Costa Mezquita (IFIC-Valencia)
María Moreno Llácer (IFIC-Valencia)

Contents

- Introduction
- Combined tracking performance in M6
- Preliminary data/MC comparisons
- Future plans
- Conclusions

Introduction

Combined ID-Muon fit



- Incorporates ID and MS measurements into a single track fit with O(100) degrees of freedom.

  Has several advantages over ID and MS standalone fits:

  - Gives best possible momentum resolution
  - Allows to perform global ID-muon alignment
  - Reduces fakes from e.g.pion decay

- Material effects in the calorimeter are not yet taken into account for cosmics

- B=0 for all real data taken so only looking at ID and Muons information for now

Combined tracking performance in M6

M6 setup

INNER DETECTOR

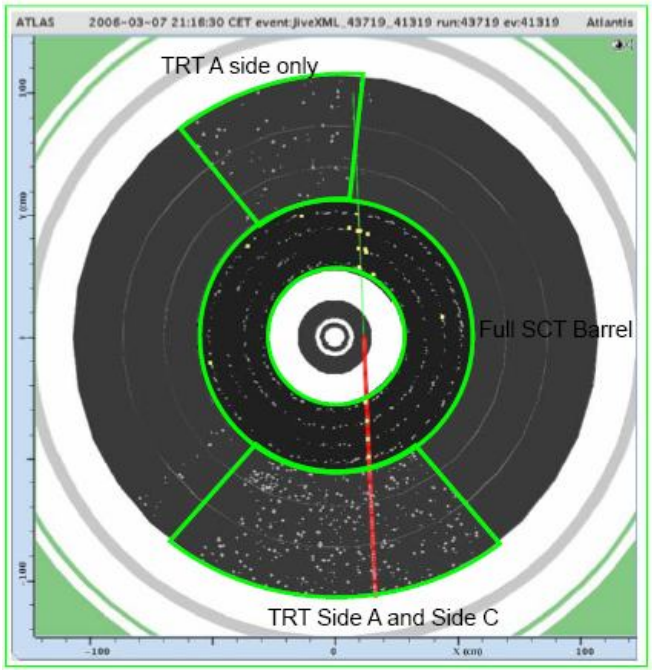
- SCT: full barrel

- TRT:

top and bottom sections on barrel

– 25% of barrel on side A

– 10% of barrel on side C



MUON SPECTROMETER

RPC: sector 7 & 8 (side)

– |η|<1.05 and 2π/8 in Φ

MDT

Barrel Sector 1 to 12

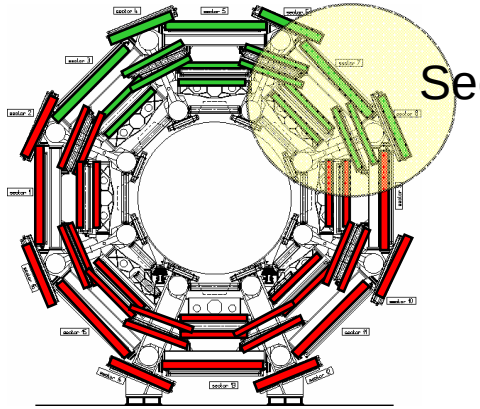
Small Wheel Side C

Big wheel Side A and C (wo/ HV)

650 chambers!

TGC

Sector 9 to 11 both sides (~14%)



Sectors 7 and 8

Data analyzed

M6 DATA

Input:
http://atlas.web.cern.ch/Atlas/tzero/prod1/monitoring/tables/M6/M6_RAW_STAGED_atlcal.txt

Runs:
43500, 43516, 43539, 43636, 43638, 43667, 43674, 43678, 43687, 43705, 43706, 43710, 43719, 43824, 43826, 43829, 43841, 43843, 43845, 43847, 43859, 43860, 43861, 43864, 43865, 43866, 43867, 43868, 43869, 43872, 43873, 43878, 43979, 44006, 44032, 44053, 44094, 44215, 44237, 44274, 44304, 44316, 44518.

Stream: AllTeIDSelected
(all triggers -scintillator, RPC,TGC & Tile-
+ HLT selecting events with TRT tracks pointing to SCT volume)

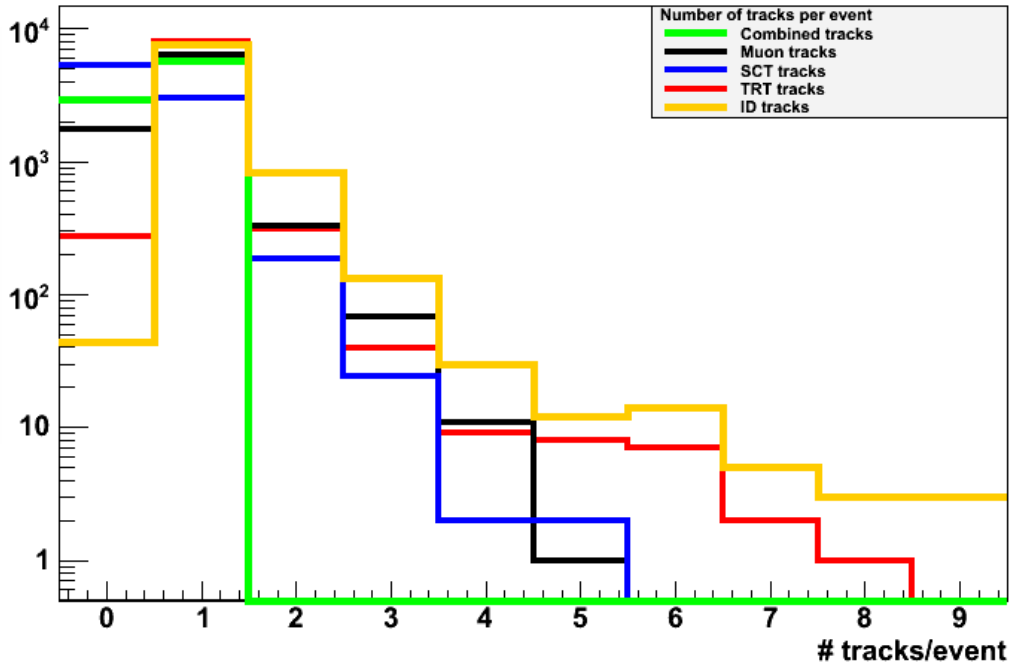
Release:13.2.0.16
Geometry description: `DetDescrTag= ATLAS-CommNF-05-00-00´

8569 events

Rate of tracks reconstructed

Run Number	M6 (AllTeIDSelected)
# events	8569
Rate SCT tracks	38 %
Rate TRT tracks	97 %
Rate ID traces (*)	100 %
Rate Muon tracks	79 %
Rate Combined tracks	66 %

(*) No suffix collection -the used for combined fit-.



Note:

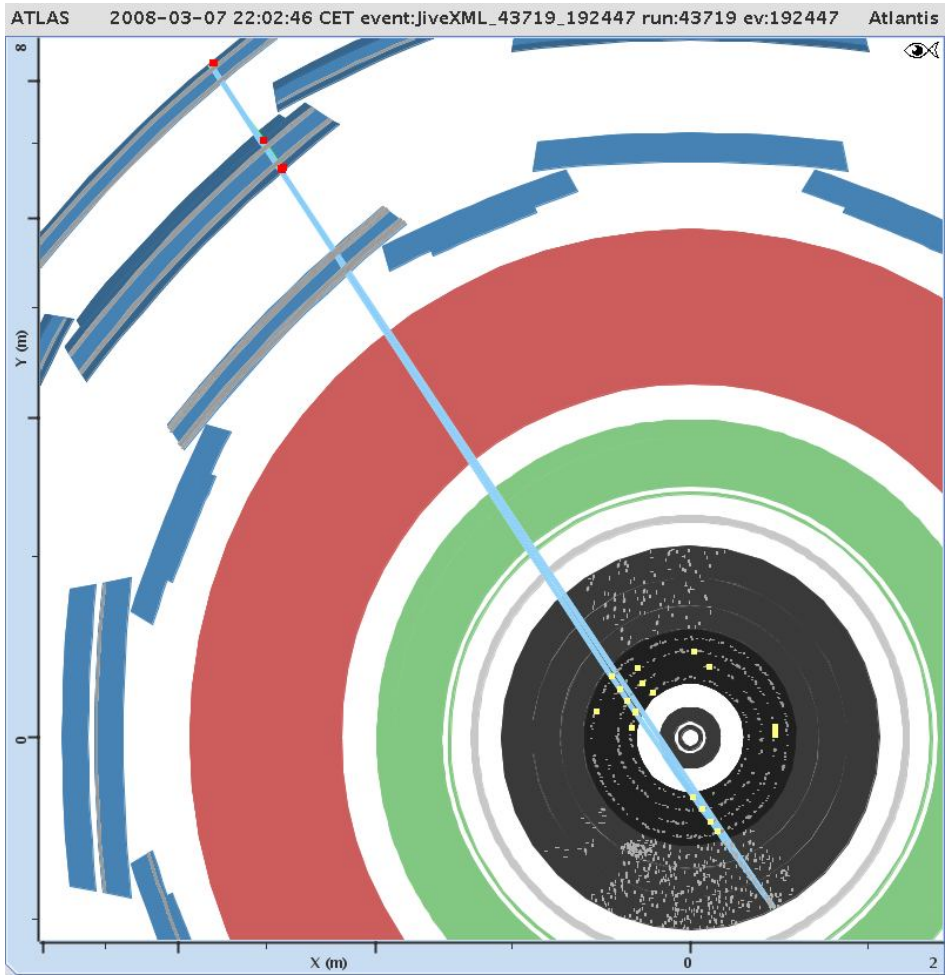
There are events where no combined tracks are found but there are tracks ID and MS:

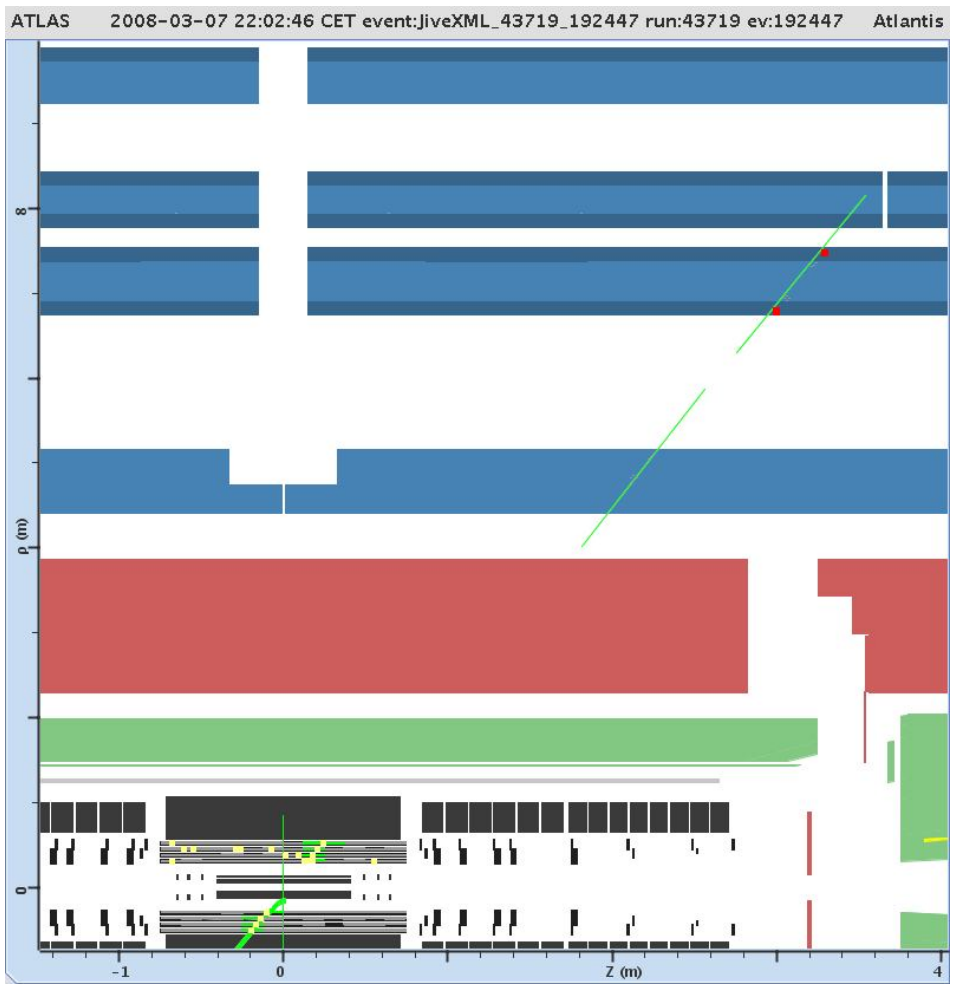
1 track in ID and > 1 track in MS: 278 events (3 %)

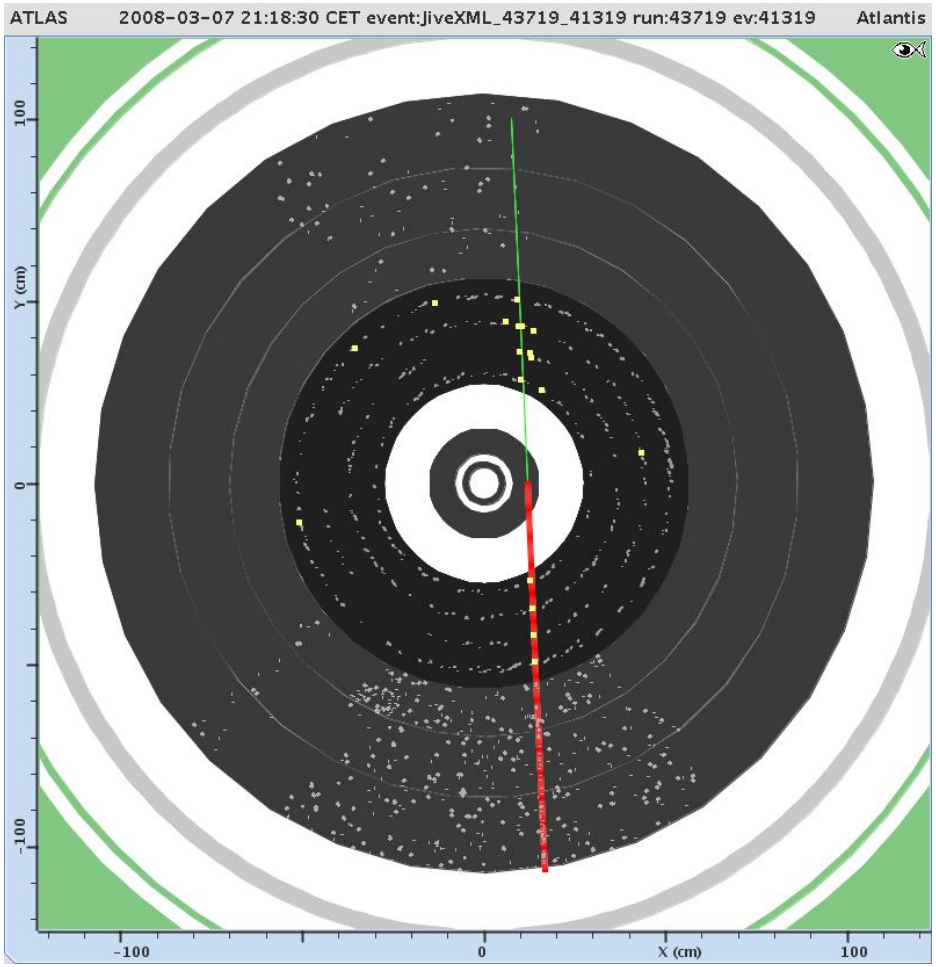
1 track in MS and > 1 track in ID: 768 events (9 %)

1 track in ID and 1 track in MS: 11 events (0.13 %)

Nice events

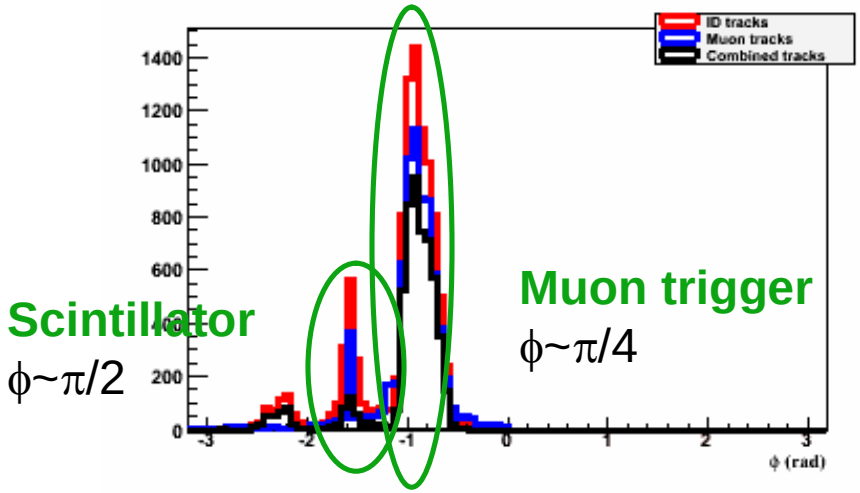

ATLAS 2008-03-07 22:02:46 CET event:JiveXML_43719_192447 run:43719 ev:192447 Atlantis
Y (m)
X (m)
8
0
2


ATLAS 2008-03-07 22:02:46 CET event:JiveXML_43719_192447 run:43719 ev:192447 Atlantis
ρ (m)
Z (m)
8
0
-1
0
4



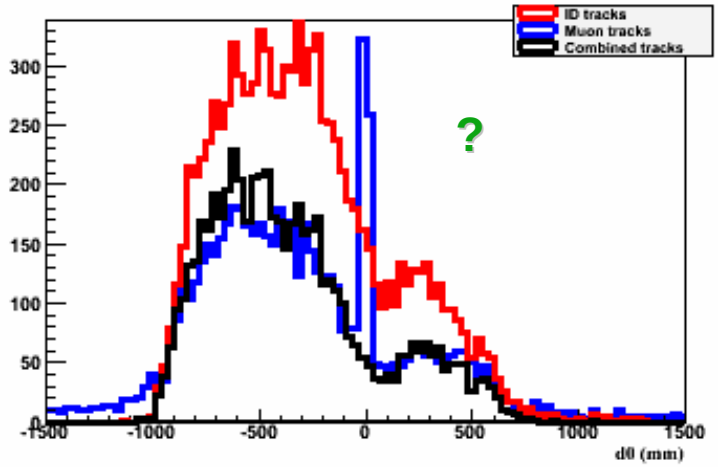
An nice event in upper and lower parts of SCT and TRT detectors!

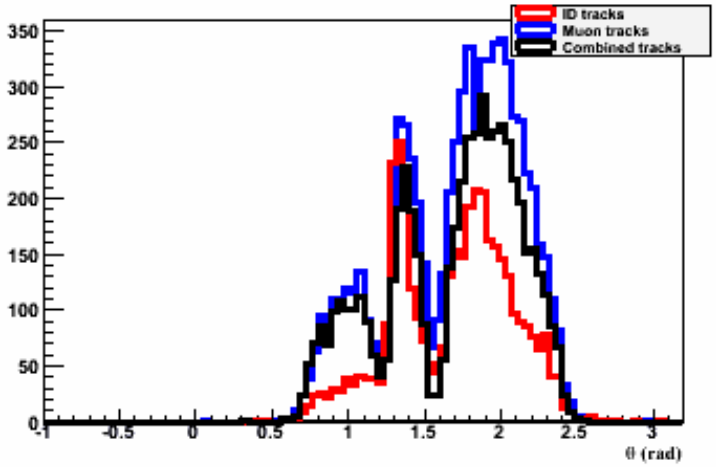
Comparison ID and MS track parameters

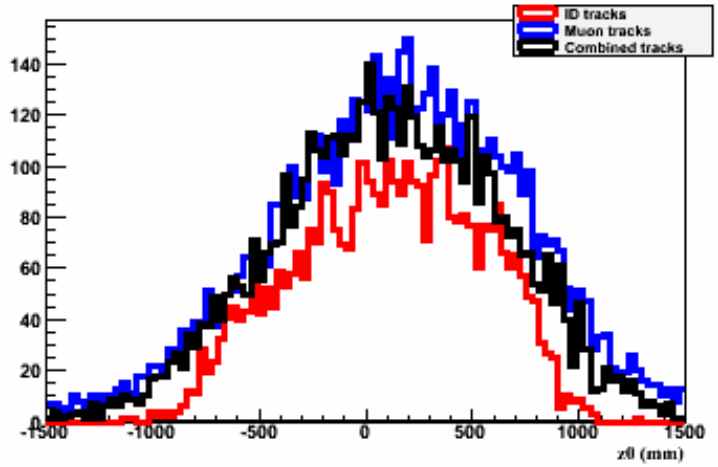


Scintillator
$\phi \sim \pi/2$

Muon trigger
$\phi \sim \pi/4$







Note: Track parameters definition

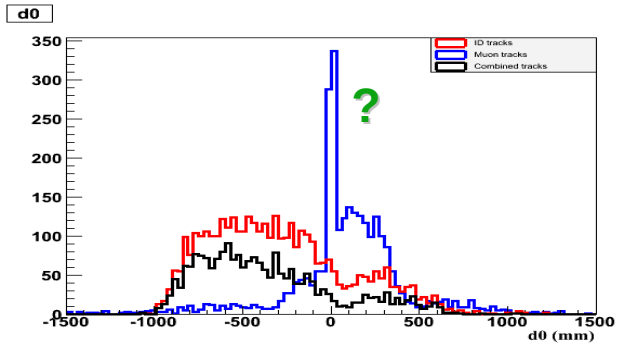
$$\phi_{0,ID} < 0$$

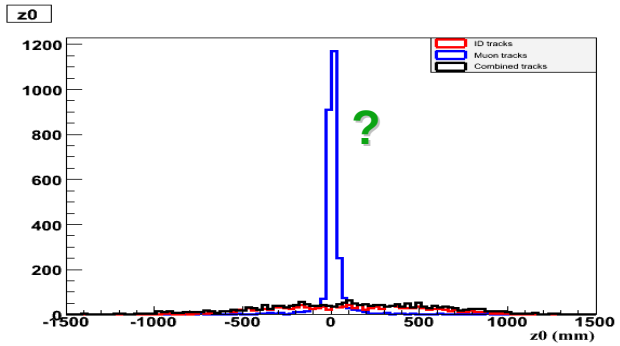
$$\phi_{0,MUON} \rightarrow \pi - \phi_{0,MUON}$$

$$d_{0,MUON} \rightarrow -d_{0,MUON}$$

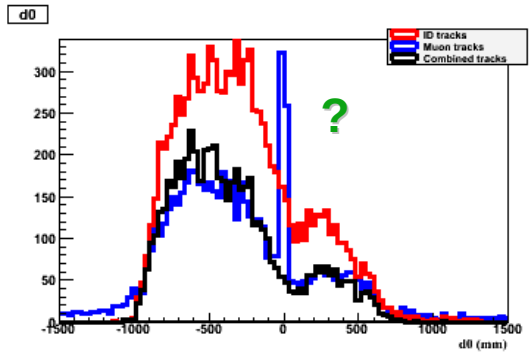
$$\theta_{0,MUON} \rightarrow \pi - \theta_{0,MUON}$$

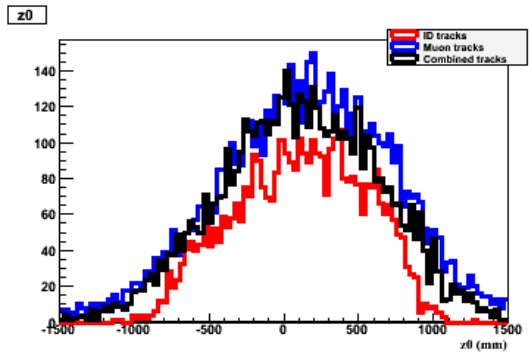
Comparison ID and MS track parameters





Tier-0 processing.





Expected for Tier-1 re-processing.

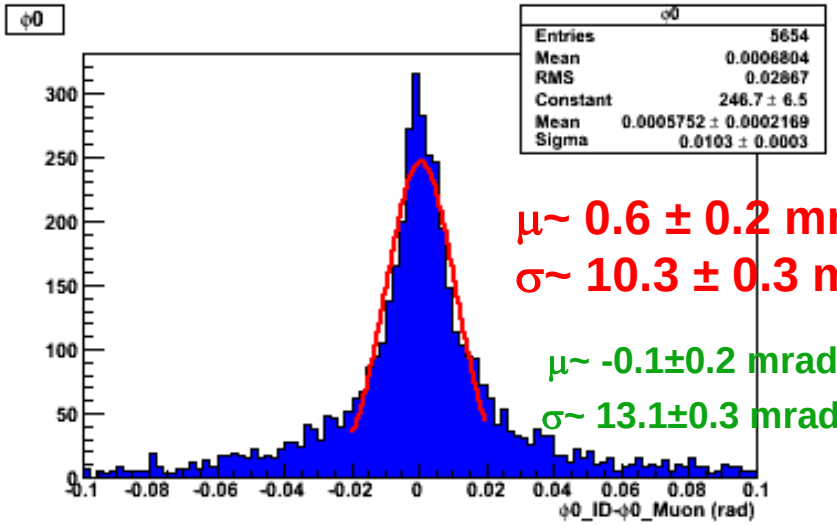
New tag (InDetTestBeamCBNT-00-01-92)
in which muon tracks are extrapolated to the beam line.

(Muon tracks parameters are given at the entrance of the MS
while ID tracks are defined respect to the origin.)

Difference of track parameter for events with 1 combined track

M6 data

simulation with full detector

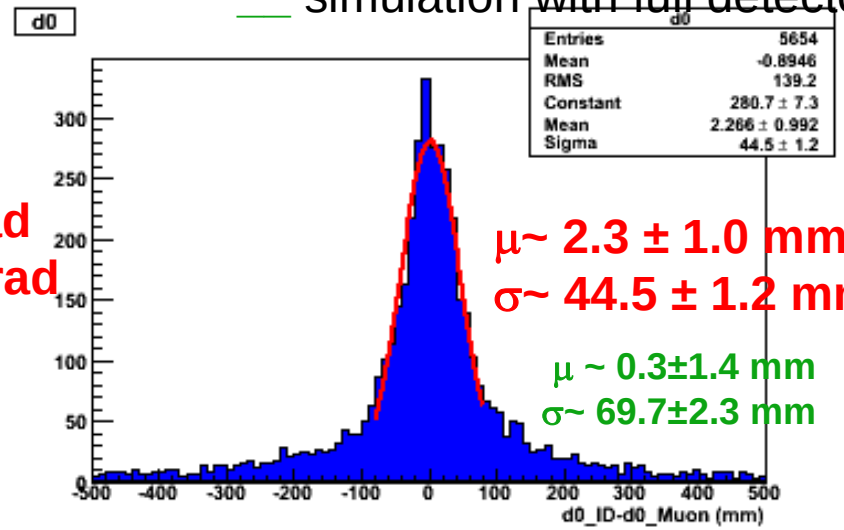


μ~ 0.6 ± 0.2 mrad

σ~ 10.3 ± 0.3 mrad

μ~ -0.1±0.2 mrad

σ~ 13.1±0.3 mrad

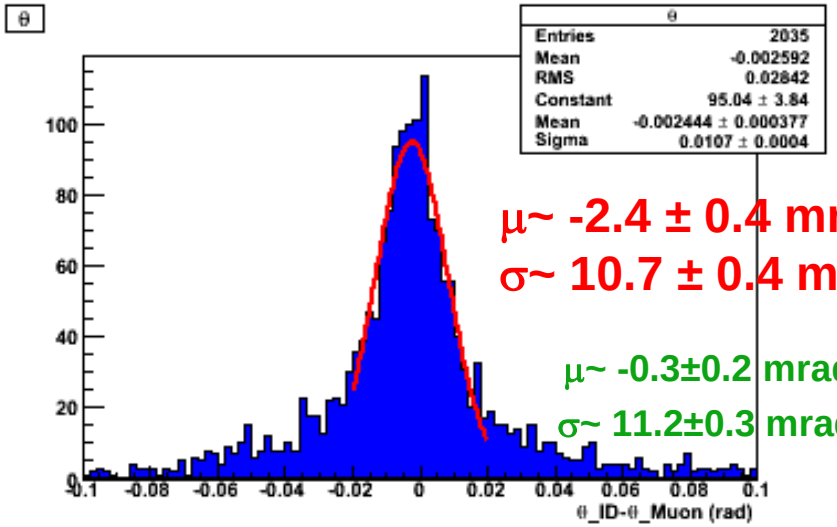


μ~ 2.3 ± 1.0 mm

σ~ 44.5 ± 1.2 mm

μ ~ 0.3±1.4 mm

σ~ 69.7±2.3 mm

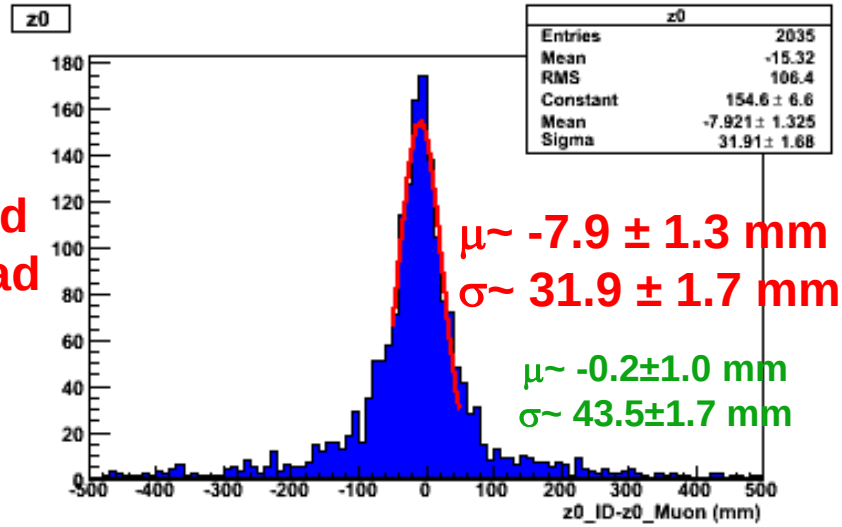


μ~ -2.4 ± 0.4 mrad

σ~ 10.7 ± 0.4 mrad

μ~ -0.3±0.2 mrad

σ~ 11.2±0.3 mrad



μ~ -7.9 ± 1.3 mm

σ~ 31.9 ± 1.7 mm

μ~ -0.2±1.0 mm

σ~ 43.5±1.7 mm

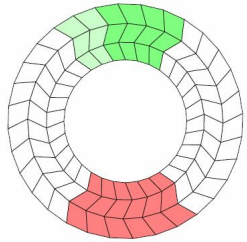
Why resolution is worse for simulations?

Preliminary data/ mc comparisons

M4 setup

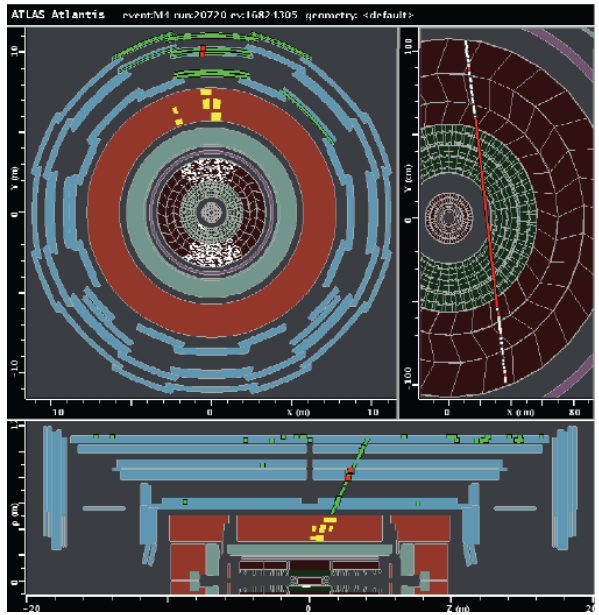
INNER DETECTOR

- TRT:
  - 11 out of 32 barrel sectors



MUON SPECTROMETER

- MDT:
  - barrel A/C (sectors 3,4,5,6) + endcap C
- RPC:
  - Complete sector 5 (trigger)
- TGC:
  - sectors 9 (TGC 1, 2, 3)
  - sectors 10, 11 (TGC 1)



Data analyzed

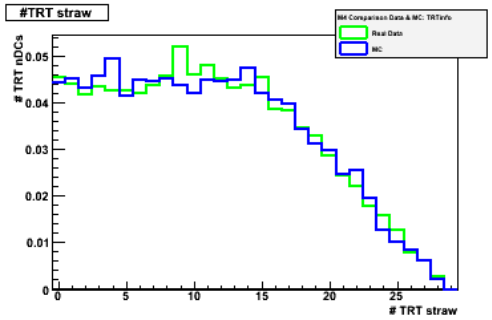
REAL DATA

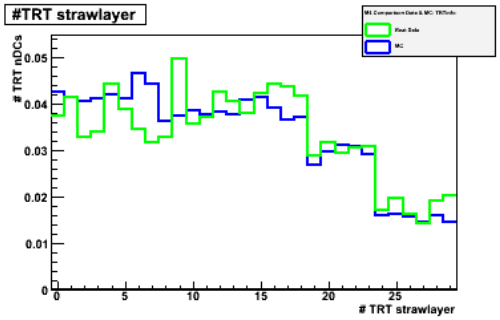
~700 events
Run 20270
Input files:
/castor/cern.ch/grid/atlas/t0/perm/DAQ/"daq.m4_combined.0020720.debug.*"
Release: 13.2.0.16

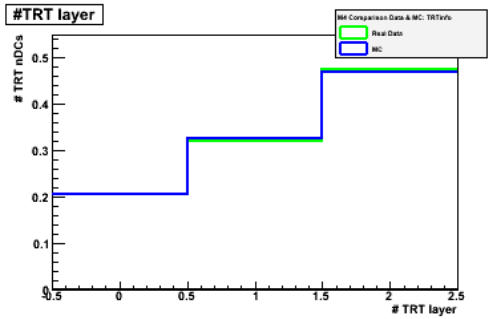
SIMULATION

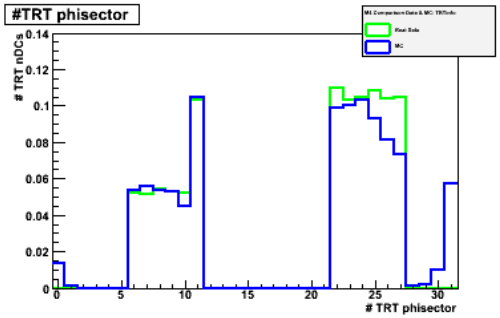
1k events
Input files: /castor/cern.ch/user/l/lytken/cosmic_13030/digitization/M4/
Geometry description: ATLAS-CommNF-03-00-00 (M4)
Release: 14.0.10.Y
Masking ON (only checked for TRT)

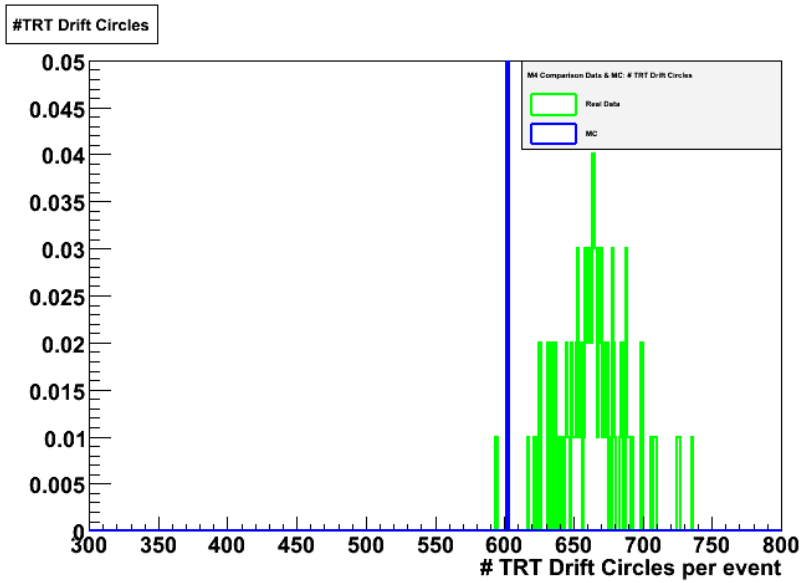
Masking of TRT checked





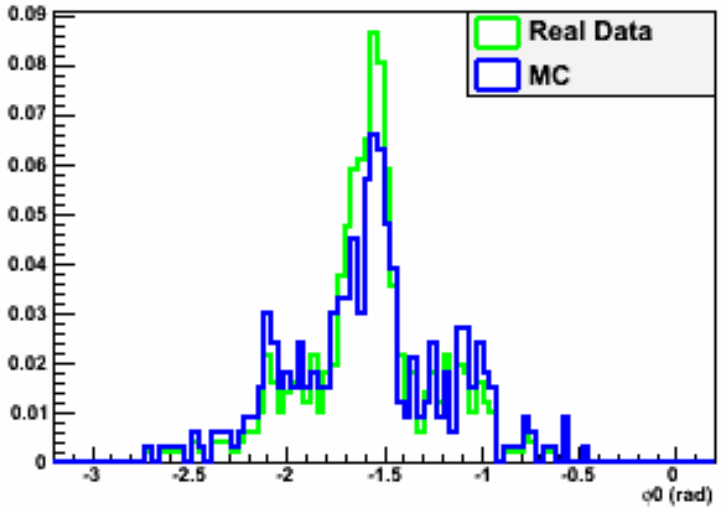


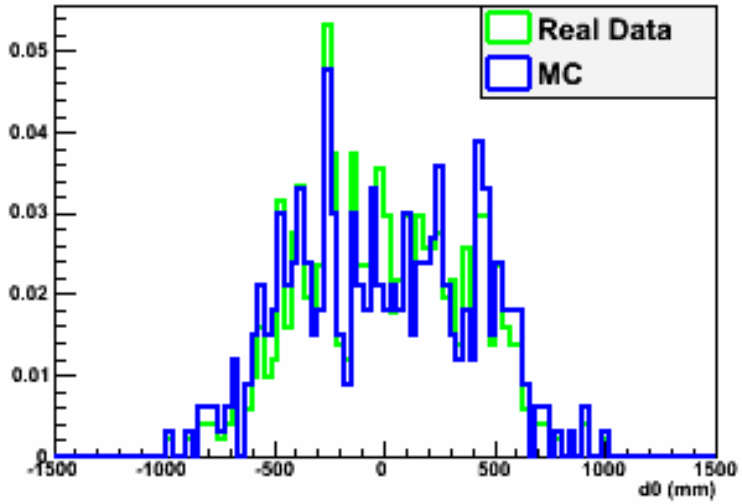


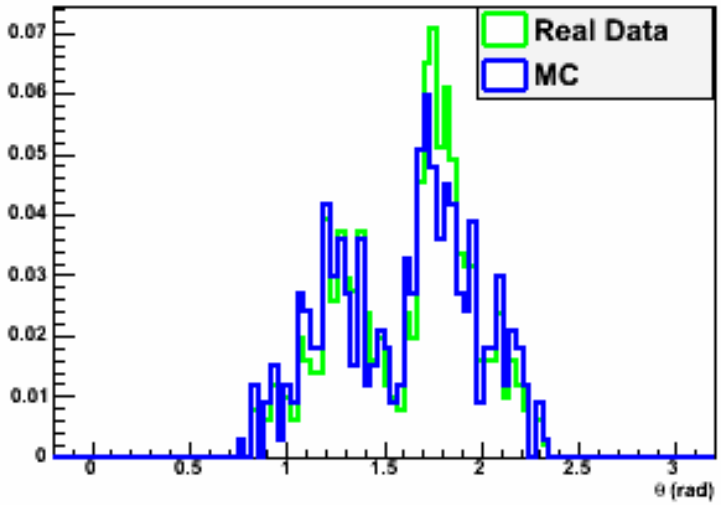


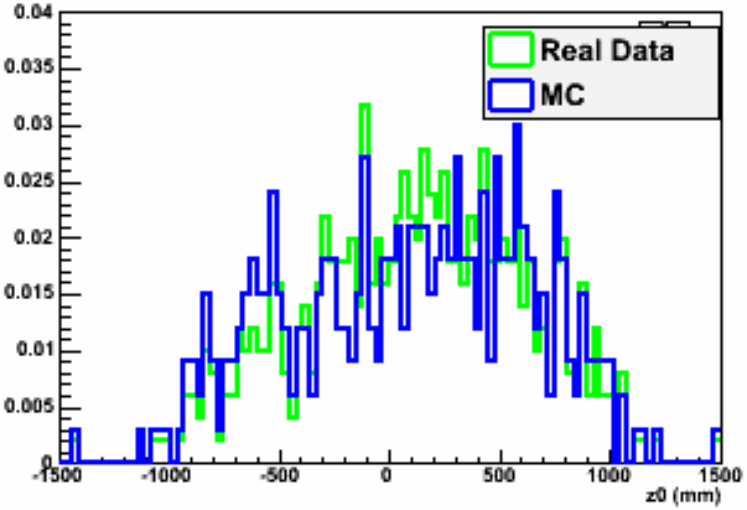
M4 simulation: ~602 DC/event
M4 data: ~663 DC/event

Comparison data/MC track parameters for combined tracks.

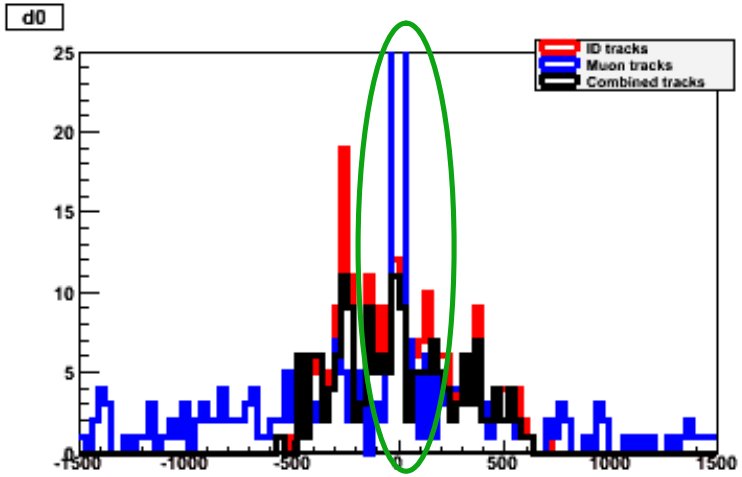




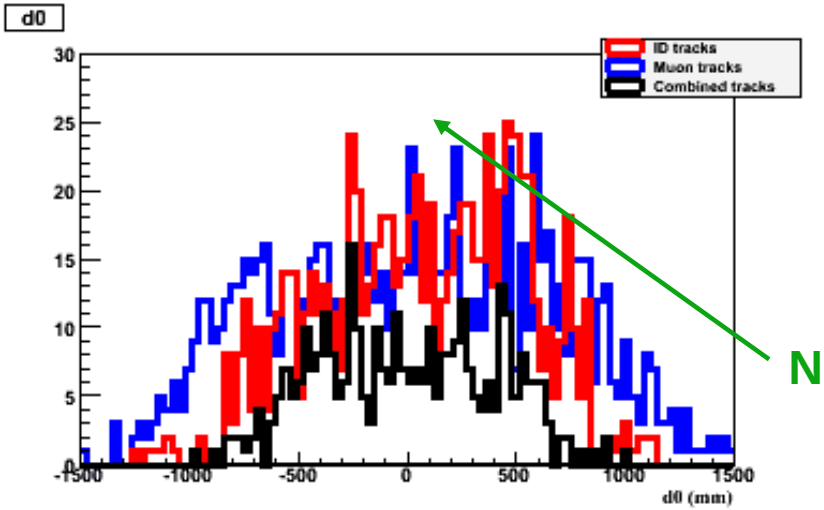




Muon track d0 distribution peak?



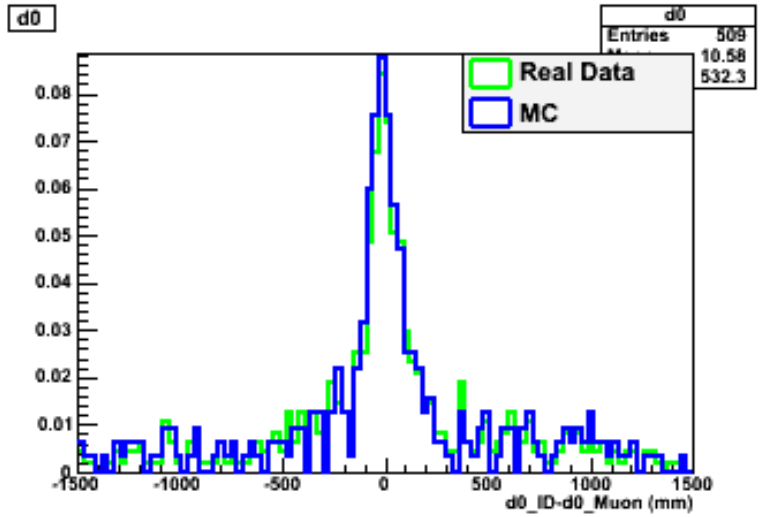
M4 data
Release: 13.2.0.16



M4 simulation
Release: 14.0.10.Y

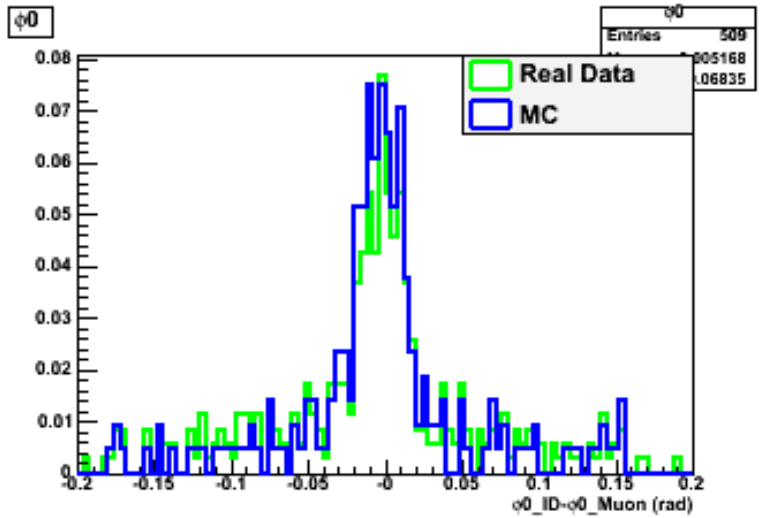
No peak at d0=0!

Difference of track parameters ID-Muon for events with combined tracks



μ ~ -7.2 ± 6.3 mm
σ~ 55.8 ± 9.6 mm

μ~ -5.8 ± 8.5 mm
σ~ 57.7 ± 12.9 mm



μ ~ -2.4 ± 1.8 mrad
σ~ 13.3 ± 1.8 mrad

μ ~ -3.3 ± 2.3 mrad
σ ~ 14.3 ± 2.5 mrad

Again worse resolution in MC!

Future plans

Improvements for the M6 re-processing

- Muon track parameters in CBNT are now expressed to the origin as is the case for the ID (new tag of InDetTestBeamCBNT).

Future improvements for release 14 AtlasPoint1

-Take calorimeters material properly into account for cosmics (already done for LHC data).
-Use new ID-Muons track matching algorithm
(adapting the one just introduced for LHC data by C. Schiavi)

Conclusions

- First combined tracks with SCT, TRT, RPC, MDTs have been reconstructed successfully with real data from M6 at Tier0.

- No new functionalities expected for the re-processing in 13.2.0.Y:
    - just the fix to allow for ID-Muons tracks comparisons via CBNT
    -and the use of new alignment corrections (if available)

- Work is on going to implement material effects in the calorimeters and to apply ID-Muons track matching.