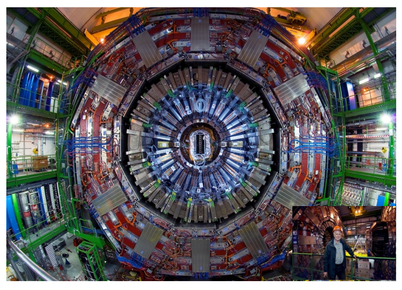


Muons in minimum bias events from the first CMS data

Lucia Barbone (for the CMS Collaboration)

Dipartimento Interateneo di Fisica "M. Merlin"
dell'Università degli Studi di Bari e INFN Sezione di Bari, Italy

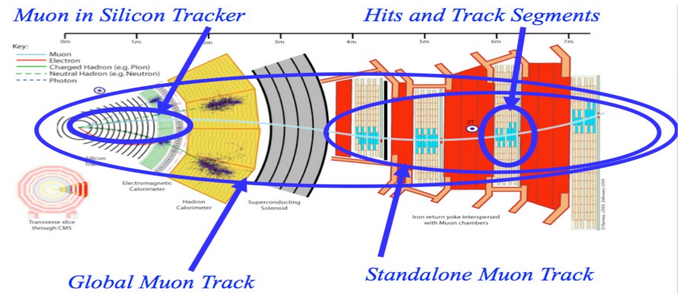
DATA: sample of Minimum Bias events in pp collisions at √s=7TeV, collected during Spring 2010, corresponding to an integrated luminosity of 0.2nb^{-1}; it includes only good runs portions (stable beam conditions and detector fully operational);

MC: 7 TeV Minimum Bias sample (Pythia D6T tune, CTEQ6L PDF)

Standard preselection of minimum-bias events is applied: "right" trigger bits; background from non-collision events reduced by requiring a "good" primary vertex; beam induced background events rejected.

Considered two types of muon candidates:

GLOBAL MUONS (OUT-IN) obtained from a combined fit of muon hits/track segments and a Si-tracker track. They are taken out-of-the-box (as much inclusive as possible).



TRACKER MUONS (IN-OUT) obtained by tracker tracks matched to at least one segment in the muon system.

Low-p_T cutoff and slightly higher contamination require the application of muon-ID quality selectors.

All the TrackerMuons presented in the plots have *TMLastStationAngTight* selector applied; this muon-ID algorithm implements both position/pull cuts and angular cuts to the segment match in the deepest required station.

The presented plots provide not only the data-MC comparison for shape distributions but also the MC composition, based on the MC truth identification set by using the *MuonAssociatorByHits* standard tool that implements matching at the level of reconstructed and simulated hits.

MC composition categories of Minimum Bias events at 7 TeV

TRUE MUONS:
- **Muons from heavy flavour decays,** originating from charmed and beauty hadrons
- **Muons mainly from light hadron decays in flight** (π, K) (and occasionally from calorimeters showers and from interactions within material)

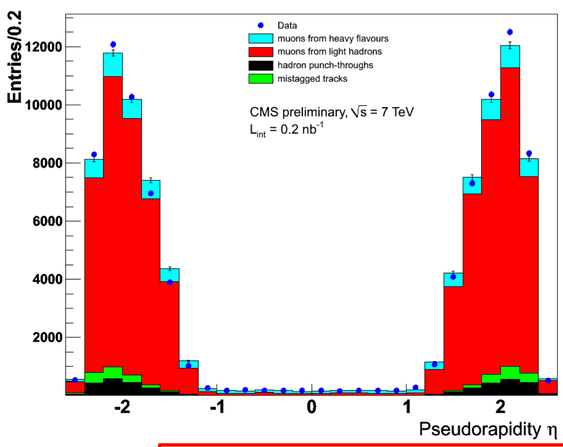
HADRONS:
- **Hadronic punch-through and sail-through,** originating from hadrons faking muons

MISTAGGED TRACKS:
- **Additional tracks** due to accidental matches of non-muon tracks with segments produced in muon chambers by closeby muons

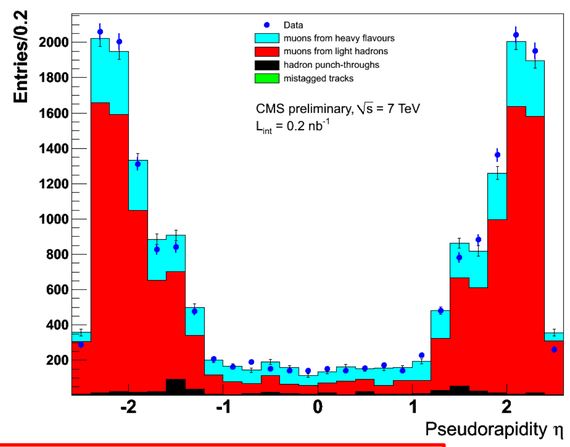
Tracker Muons	
Muons from heavy flavours	8.9%
Muons from light hadrons	83.9%
Hadronic punch-through + Mistagged tracks	7.2%

Global Muons	
Muons from heavy flavours	23.7%
Muons from light hadrons	73.4%
Hadronic punch-through + Mistagged tracks	2.9%

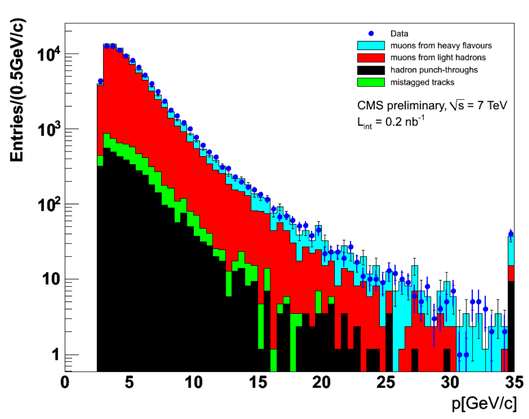
In the following plots MC is normalized to the number of muons in the data.
Data blue dots are superimposed to stacked MC histograms of different truth categories

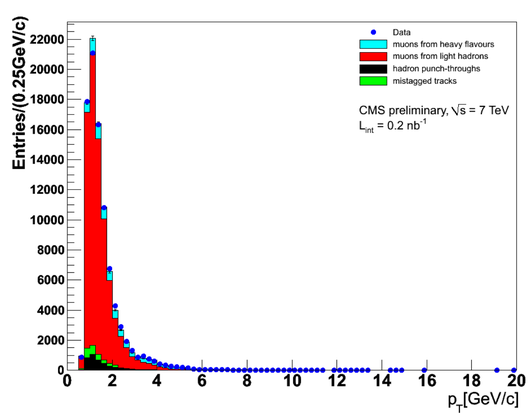


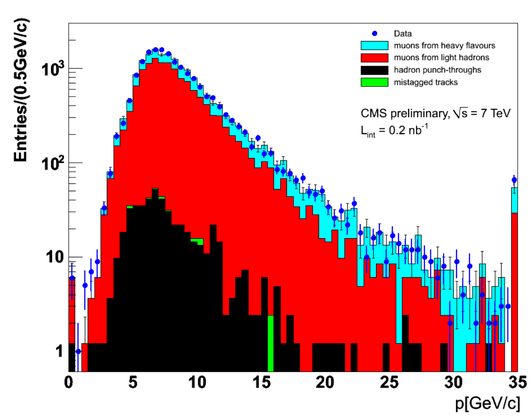
Mostly low-p_T muons from decays of light hadrons.
Pseudorapidity distribution peaks in the forward region because of a lower p_T threshold to reach muon stations.

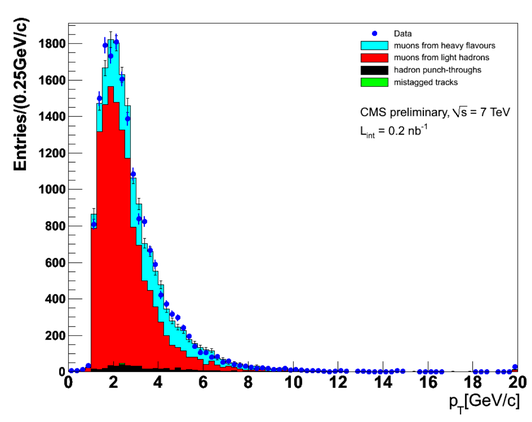


Heavy flavour contribution is a relevant fraction in the tails of the momentum distribution (as expected).

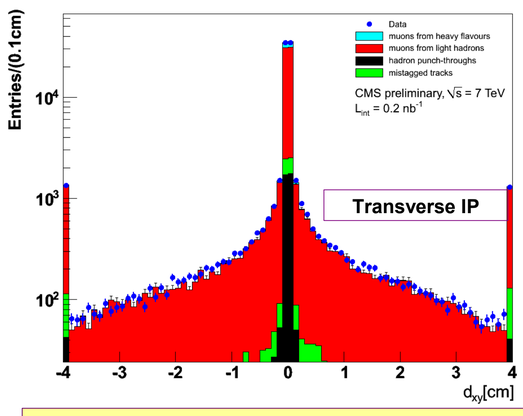


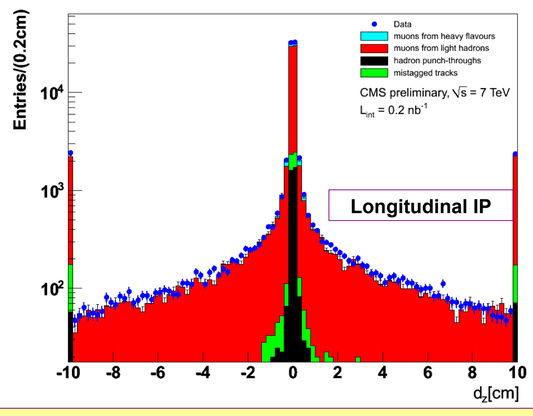


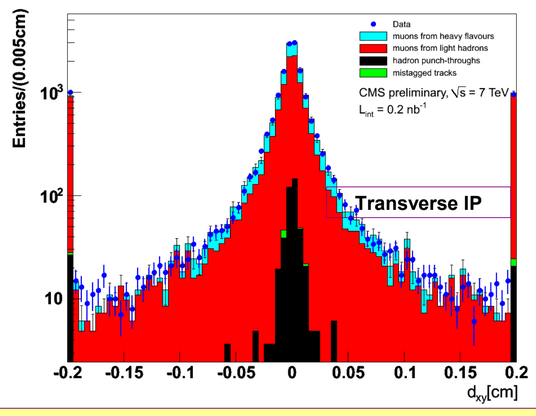


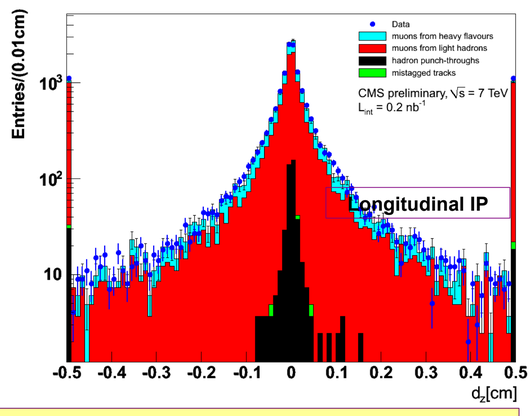


Heavy flavour signal contributes mostly to the few bins closest to the center of the IP distributions leaving the long tails to the muons from pions and kaons decays (as expected).









Muon signatures are extremely important in the challenging environment of collisions at the LHC. Understanding the observed muon yield from Standard Model processes is the first task for all analyses including muons.
The first CMS observations of muons in Minimum Bias data - presented here - show a remarkably good agreement with MC expectations.
This result was not to be expected given the extended inclusive nature of the considered sample of muons and represents a reference baseline for those forthcoming analyses concerning the heavy flavour production to be measured at the LHC energies.