Determination of the Muon Reconstruction Efficiency using the Z->μμ events in p-p Collisions

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Introduction:

- We want to estimate the muon reconstruction efficiency in ATLAS .

- The muons we use are from Z boson decays which are almost background free.

- We apply Tag and Probe method to estimate the muon reconstruction efficiency.
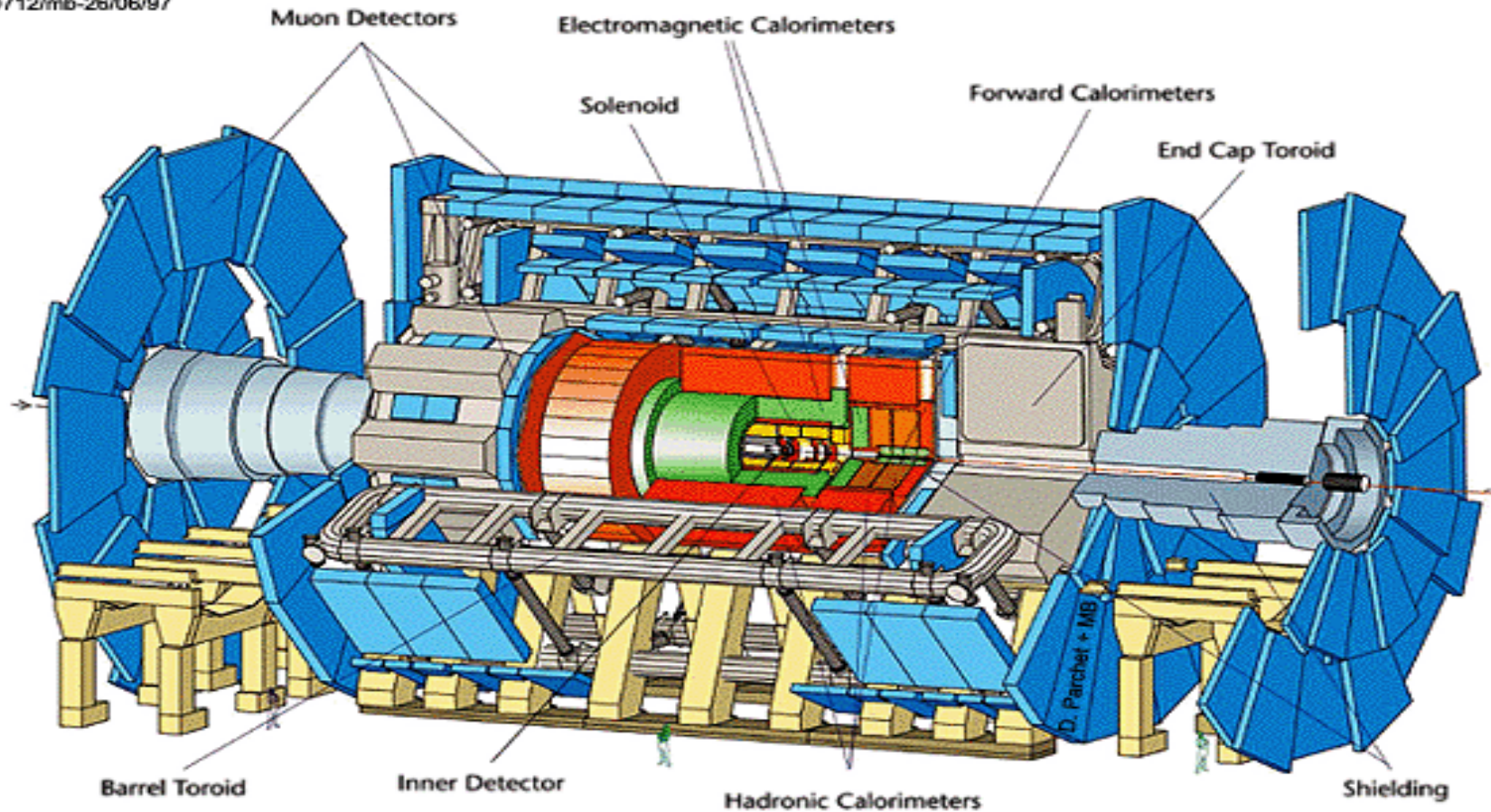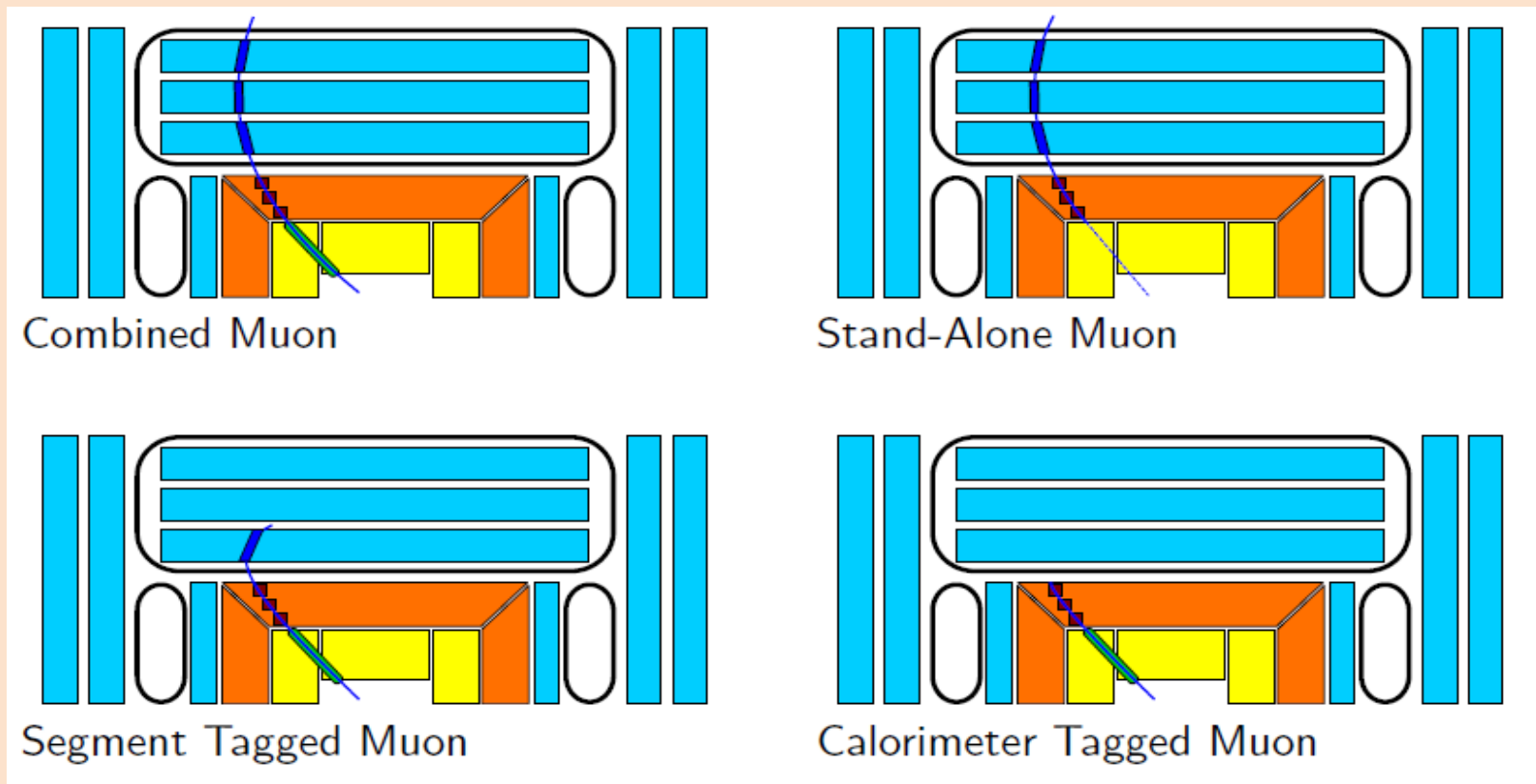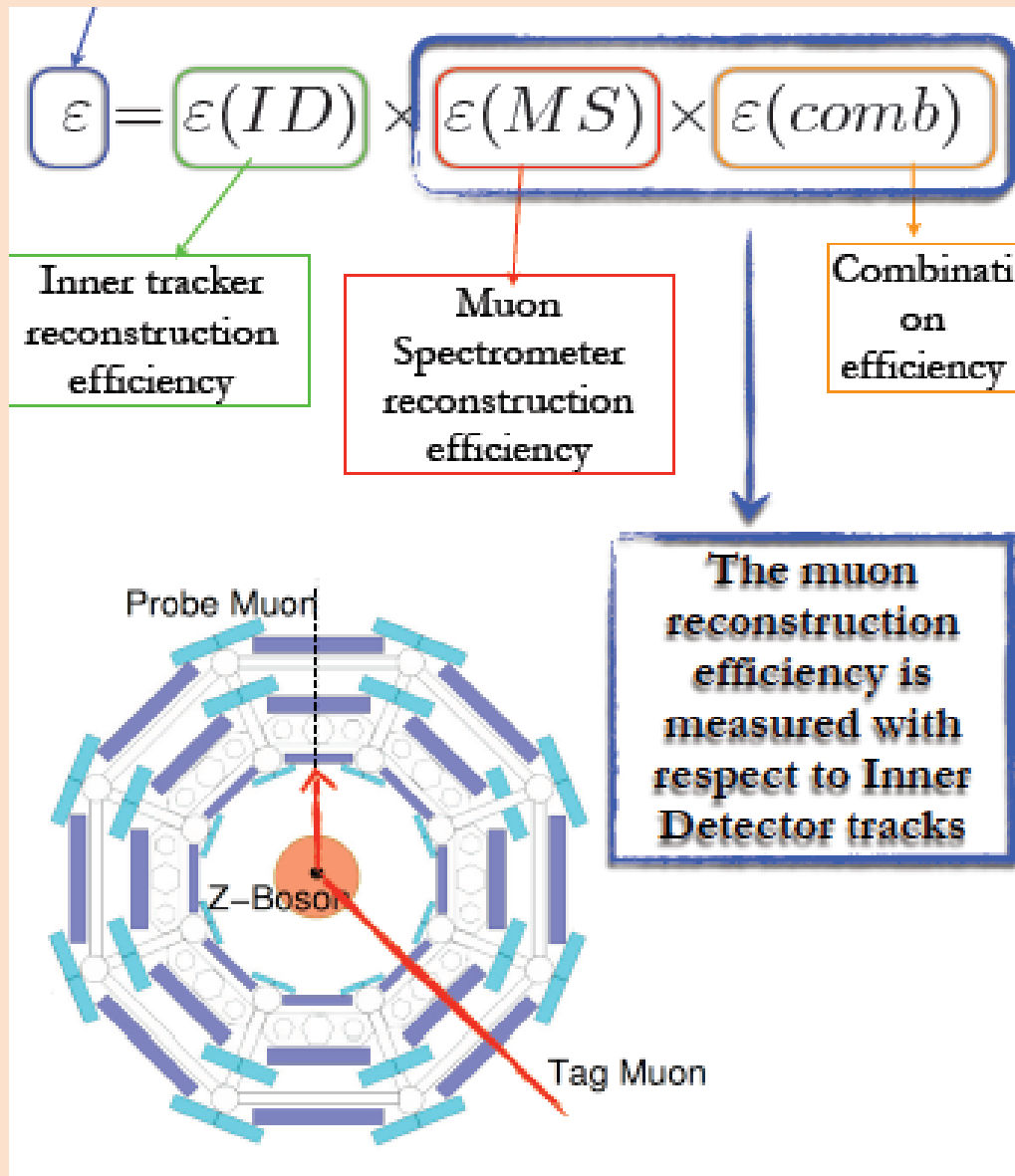
The ATLAS detector

FIG. 1: Lay-out of the ATLAS detector with its major sub-system components. The diameter is about 25m, the total length about 46m, and the weight 7000 Tons.

Muon Categories at ATLAS

Combined Muon

Stand-Alone Muon

Segment Tagged Muon

Calorimeter Tagged Muon

- Combined muon: reconstructed by matching the measurements from Inner Detetor (ID) and Muon Spectrometer (MS)

- StandAlone muon: MS track extrapolated to interaction point

- Segment tagged muon: ID track matched to MS segments

- Calorimeter tagged muon: ID track matched to clusters in Calorimeter

The Tag and Probe Method

$$\varepsilon = \varepsilon(ID) \times \varepsilon(MS) \times \varepsilon(comb)$$

Inner tracker reconstruction efficiency

Muon Spectrometer reconstruction efficiency

Combination efficiency

The muon reconstruction efficiency is measured with respect to Inner Detector tracks

Probe Muon

Z–Boson

Tag Muon

- Tag: selected from the combined muons with high quality.
- Probe: selected from Inner Detector tracks which satisfy a set of quality criteria.
- Matching: the muon reconstruction efficiency is determined as the probability for the probe to match a reconstructed combined or segment-tagged muon.

Preliminary results with 7TeV Zmm MC:

Efficiency vs. Eta

Efficiency vs. pT

Efficiency vs. Phi
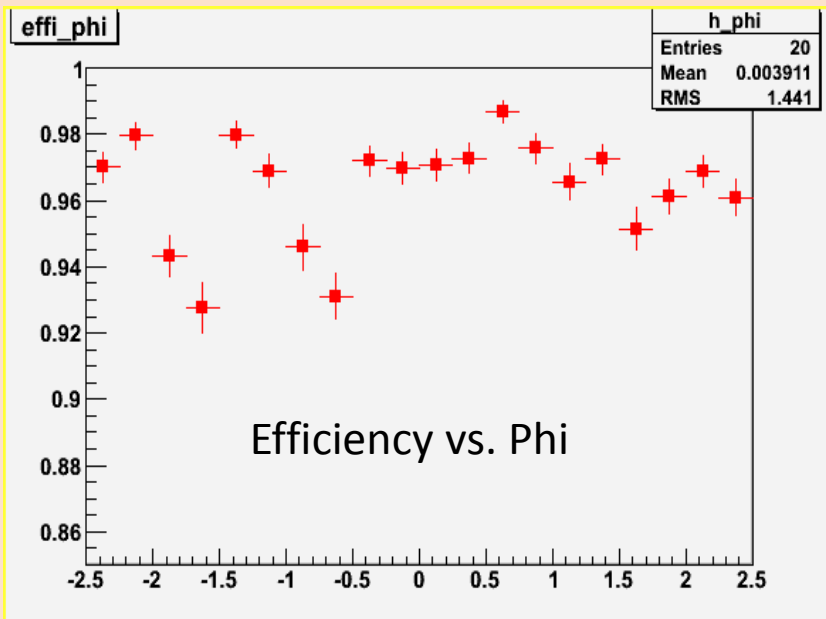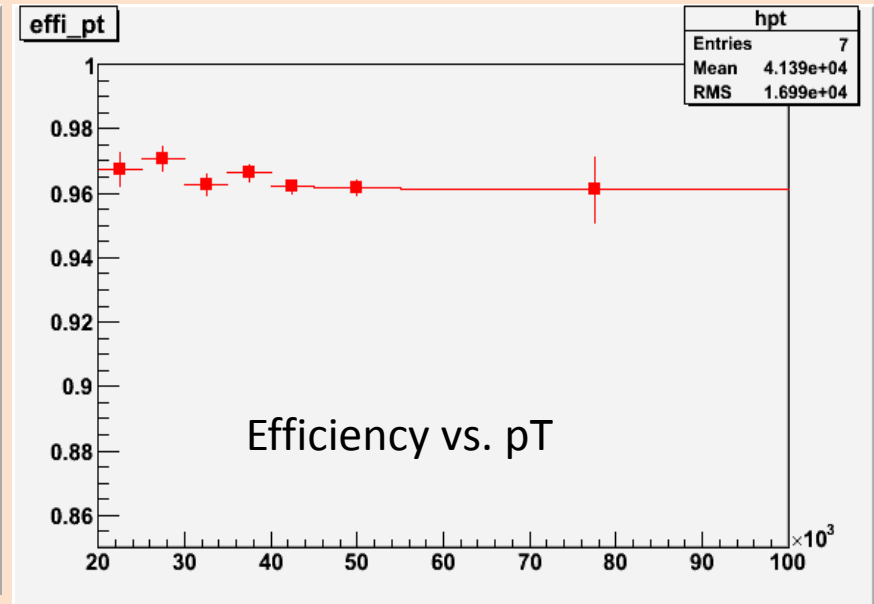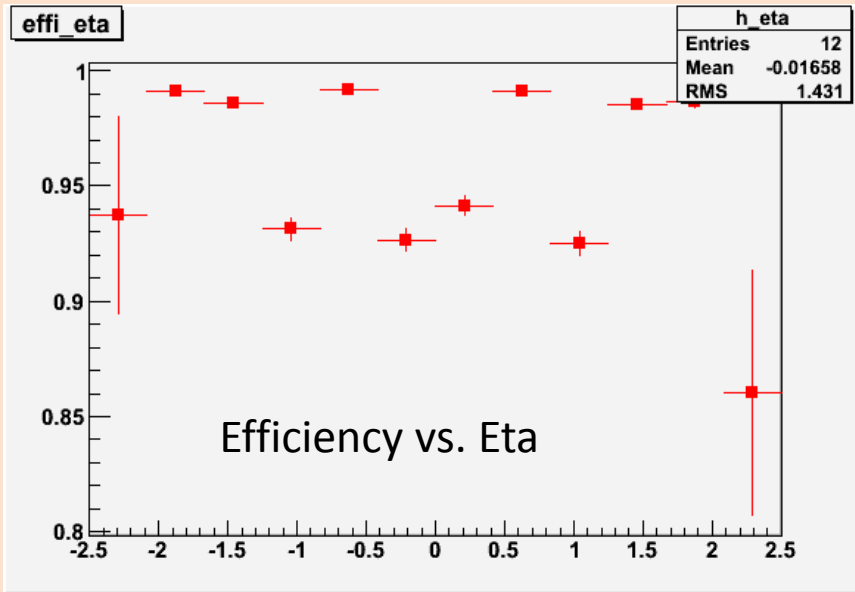
- These efficiencies are measured for combined muons.
- Efficiencies are slightly higher than the official results. This is being investigated.

Next steps

- We will fine-tune the selection and matching cuts in the current analysis to get consistent results with official ones.

- Then we will apply the tag-probe analysis to the 8TeV real data collected this year, and determine the muon reconstruction efficiencies, and perform systematic uncertainty studies.

Thanks