Muon Trigger and Identification Efficiencies with the DØ Detector at the Tevatron

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The identification of muons with the DØ detector is performed through three dedicated subsystems and toroidal magnets. The muon tracking is operated by proportionnal drift tubes in the central region (for pseudorapidities $\eta \leq 1.0$), and mini-drift tubes in the forward region ($1.0 < \eta \leq 2.0$). Scintillation counters provide muon triggering and background rejection [1].
To improve the resolution of the muon momentum measurement, muons detected in the muon system (local muons) can be asked to match tracks detected by the central tracking system, which has an accurate momentum resolution and a high tracking efficiency.
Trigger and identification rates are estimated by the Tag and Probe method. The decay of the Z^0 boson into two muons is examined through data taken by the DØ detector and Monte-Carlo samples. The event selection requires one (tag) muon to fulfill sufficient identification criteria in the muon system, and to be matched to a central track. The Probe object can either be a central track or a local muon of good quality, but the invariant mass of the tag muon and the probe object must be in the mass region of the Z^0 boson. Matching a probe central track or a probe local muon to, respectively, a local muon or a central track, will provide muon detector or central tracking efficiencies (figure 1).

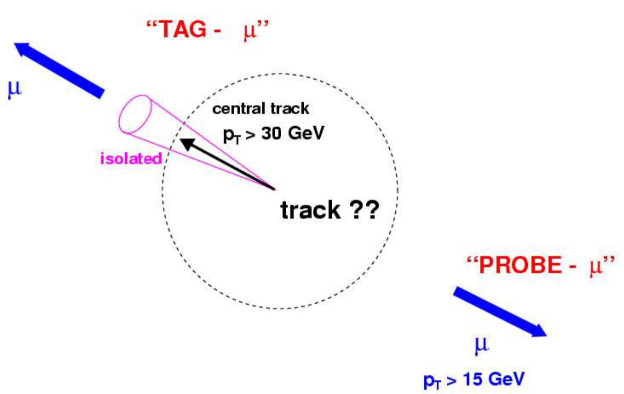

Fig. 1: Schematic representation of the Tag and Probe method in the case of the central tracking efficiency measurement. The tag muon and the probe muon are of good quality.

The DØ detector has three triggering levels (L1, L2, L3) that can be combined to define a trigger. We extended an existing DØ package to be able to estimate the efficiencies of all muon triggers. Previously only a small number of triggers were implemented. New L1 and L3 muon triggering and central tracking terms have been added (figure 2). Efficiencies for existing muon trigger terms and muon identification requirements have been updated (figure 3).

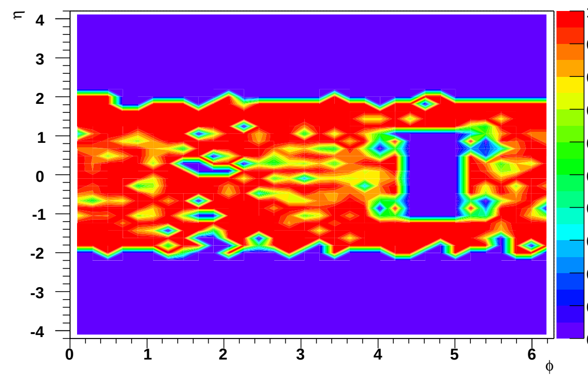

Fig. 2: L1 term efficiency (versus η and ϕ) for a muon with tight scintillator and loose wire requirements. The efficiency is calculated with respect to a loose central track matched offline muon.

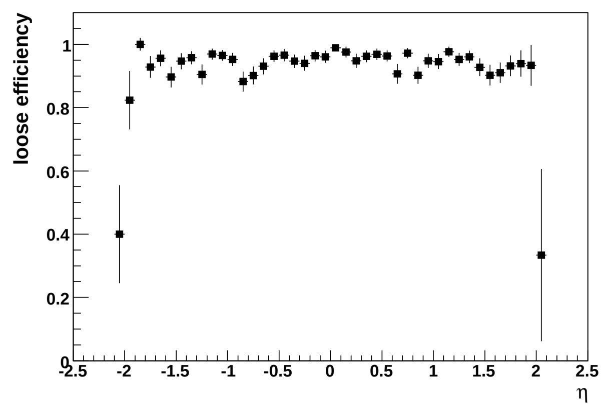

Fig. 3: Identification efficiency (versus η) for a muon of loose quality.

Muon identification, muon trigger, and central tracking rates have been measured for both data and Monte-Carlo samples. We wrote the tools to store the efficiencies to the specific file format designed for the DØ common analysis environment. The ratio between data and Monte-Carlo efficiencies is exploited to reweight Monte-Carlo samples. A DØ package gathers the results and the format conversion tools.

References

[1] R. Ströhmer *et al.*, Annual report 2001, p. 43.
T. Christiansen *et al.*, Annual report 2000, p. 34.