TRIGGER EFFICIENCIES - TAG AND PROBE WITH J/Ψ →μμ

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Introduction/1

- In J/psi→μμ events is possible to identify a self-triggering reconstructed muon (the tag) and search for a second reconstructed muon without using trigger system (the probe)
- The efficiency is defined as

$$\frac{\#\text{ probes that match the trigger}}{\#\text{ total number of selected probes}}$$

- Work mainly driven by "J/Psi cross section and Ratio" paper
  - Data sample
  - Trigger selection
  - Selection cuts

Data Samples & Analysis

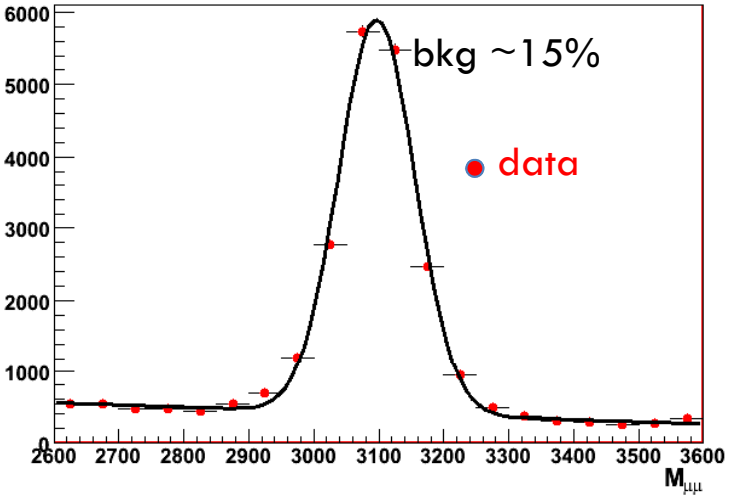
- Data Samples:
  - due to different configuration (complicated by the trigger commissioning) not all the data available have been used
  - period B+C+D1
    - tested trigger L1_MU0
    - L= ~50nb^{-1}
  - period E6 – E7
    - tested trigger EF_mu4
    - L= ~350nb^{-1}
  - Period F
    - tested trigger EF_mu6
    - L= ~2pb^{-1}

- Analysis developed in the Jpsilt package
  - information of L1 ROI (on/off time), HLT trigger objects
  - extrapolation of reconstructed track to the pivot plane
  - trigger matching between offline reconstructed objects and HLT reconstructed objects (from B physics analysis tools)

Selection

- Selection of dimuon candidates from the J/psi mass (selection baseline as the one for reconstruction efficiencied → Stefania'talk)
  - 2 opposite sign muons
    - at least 1 combined muon
    - the other one can be a combined or segment-tagged (low pt)
    - p>3GeV
    - nPixels>0, nSCT>5, nTRT>10
    - 0.3<DeltaR<2.5
  - "Tag" muon matched with the trigger object that gives the event trigger
    - period B+C+D1: L1_MU0
    - period E : EF_mu4
    - period F: EF_mu6
  - "Probe" muon used to test

  different trigger selection (both L1 and HLT)
- trigger match:
  - DR(L1)<0.4, accepted RoIs in -2, -1, 0 BCs
  - DR(EF)<0.05



LVL1 TurnOn curves

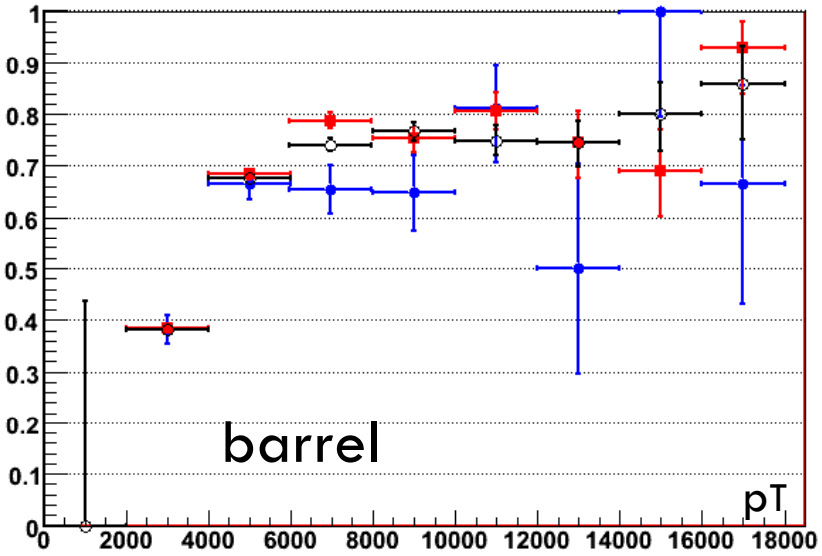
L1 turnon curves for the MU0 threshold for different data periods

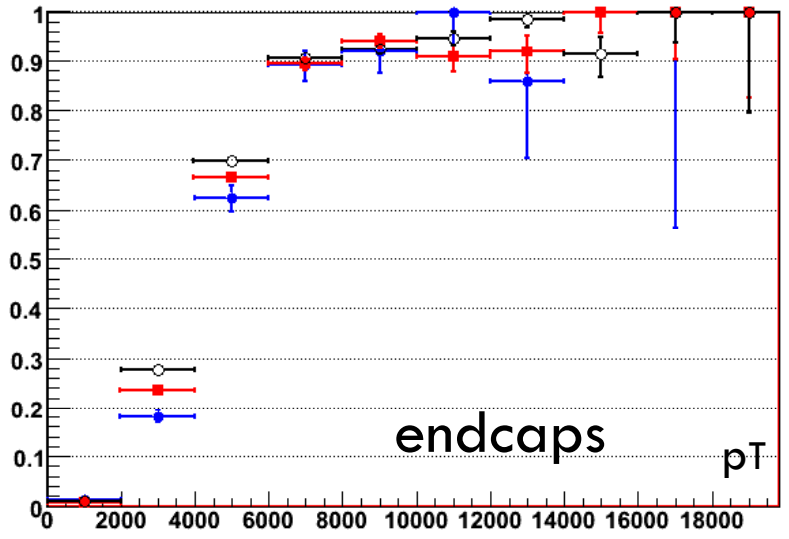
period B+C+D1

period E

period F

L1MU0





Eta/Phi Efficiencies

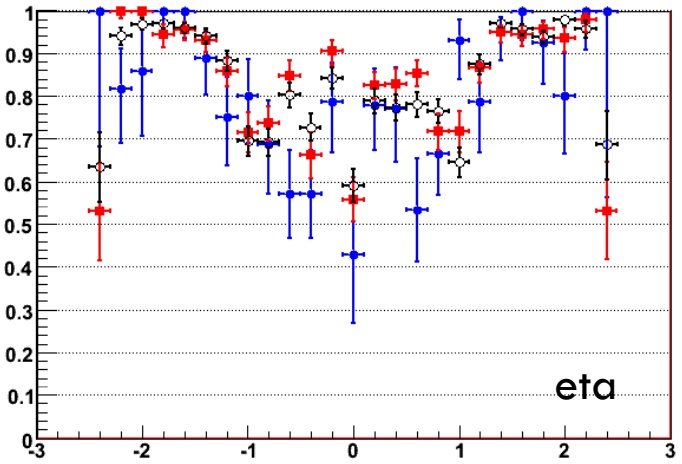
L1MU0

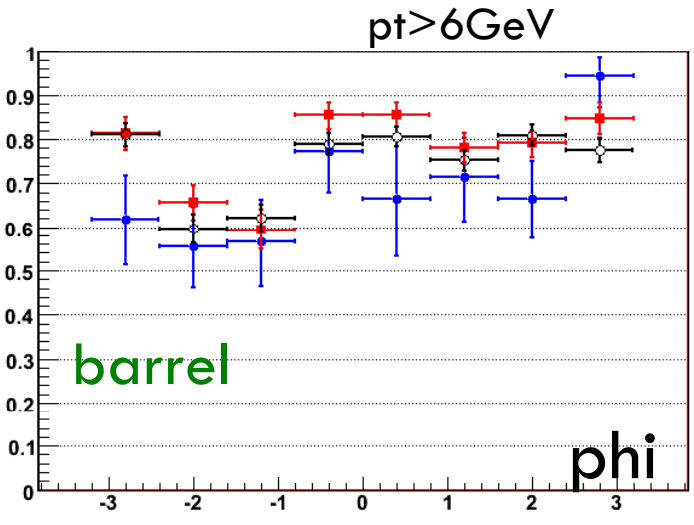
period B+C+D1

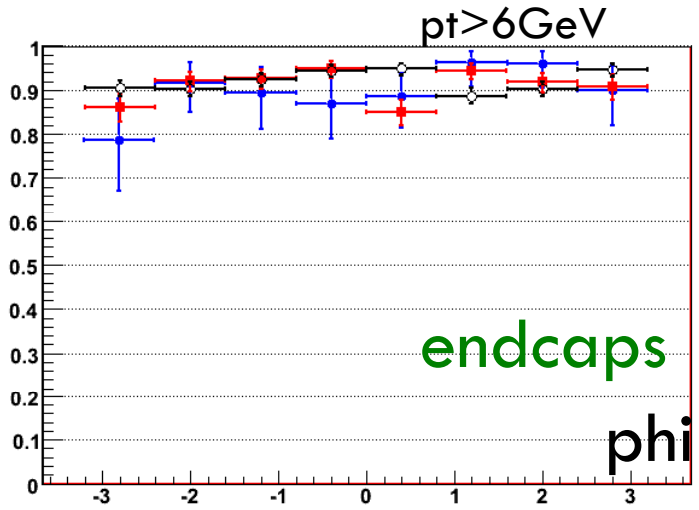
period E

period F

L1 efficiencies for p_T>6GeV wrt eta/phi for the MU0 threshold for different data periods





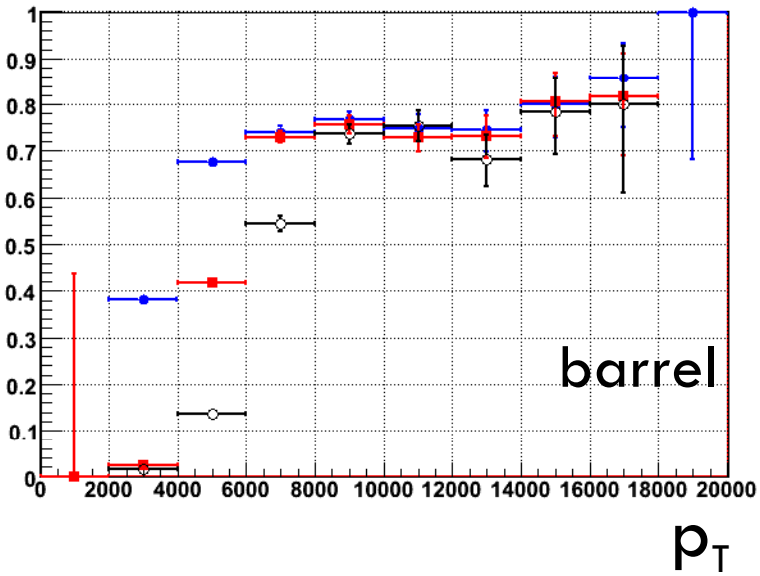


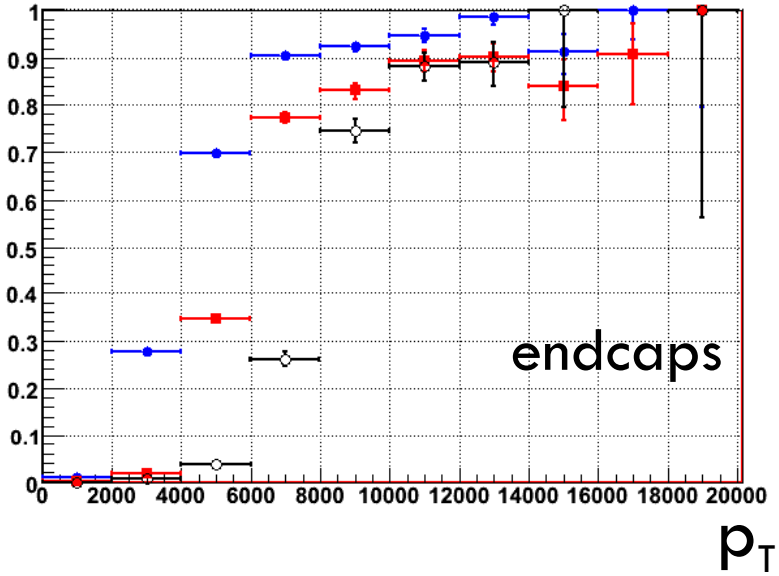
L1 Low p_T thresholds

Period F

L1MU0
L1MU6
L1MU10

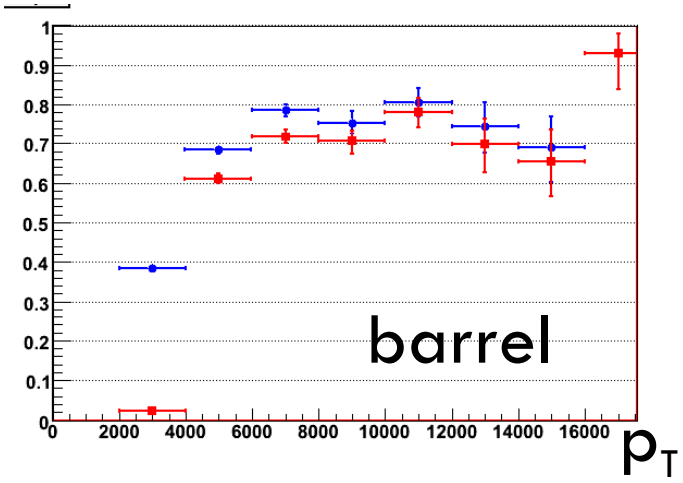
- L1 turnon curves for the low-pt thresholds for data period F
- Lower plateau for MU6/MU10 in barrel can be due to bkg – under study

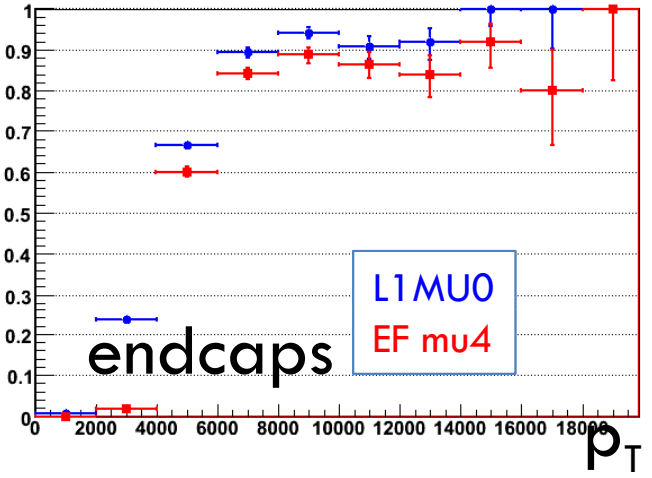


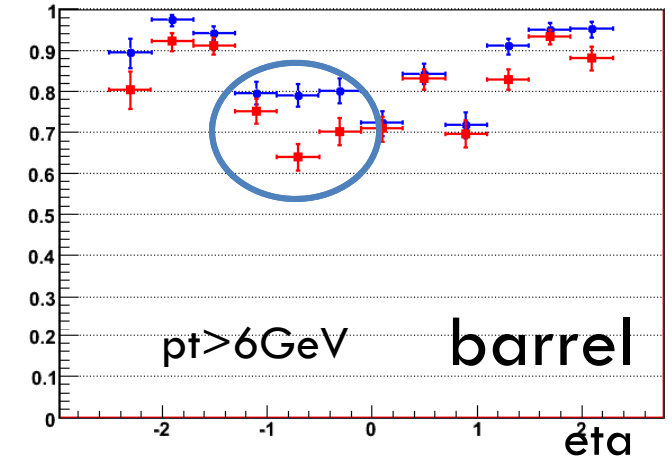


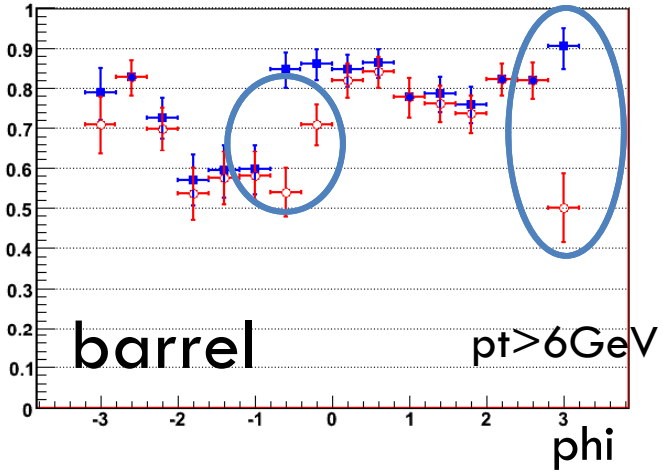
EF_mu4 – period E

- L1MU0 and EF_mu4 efficiency in period E
- eta/phi region in which HLT efficiency is low







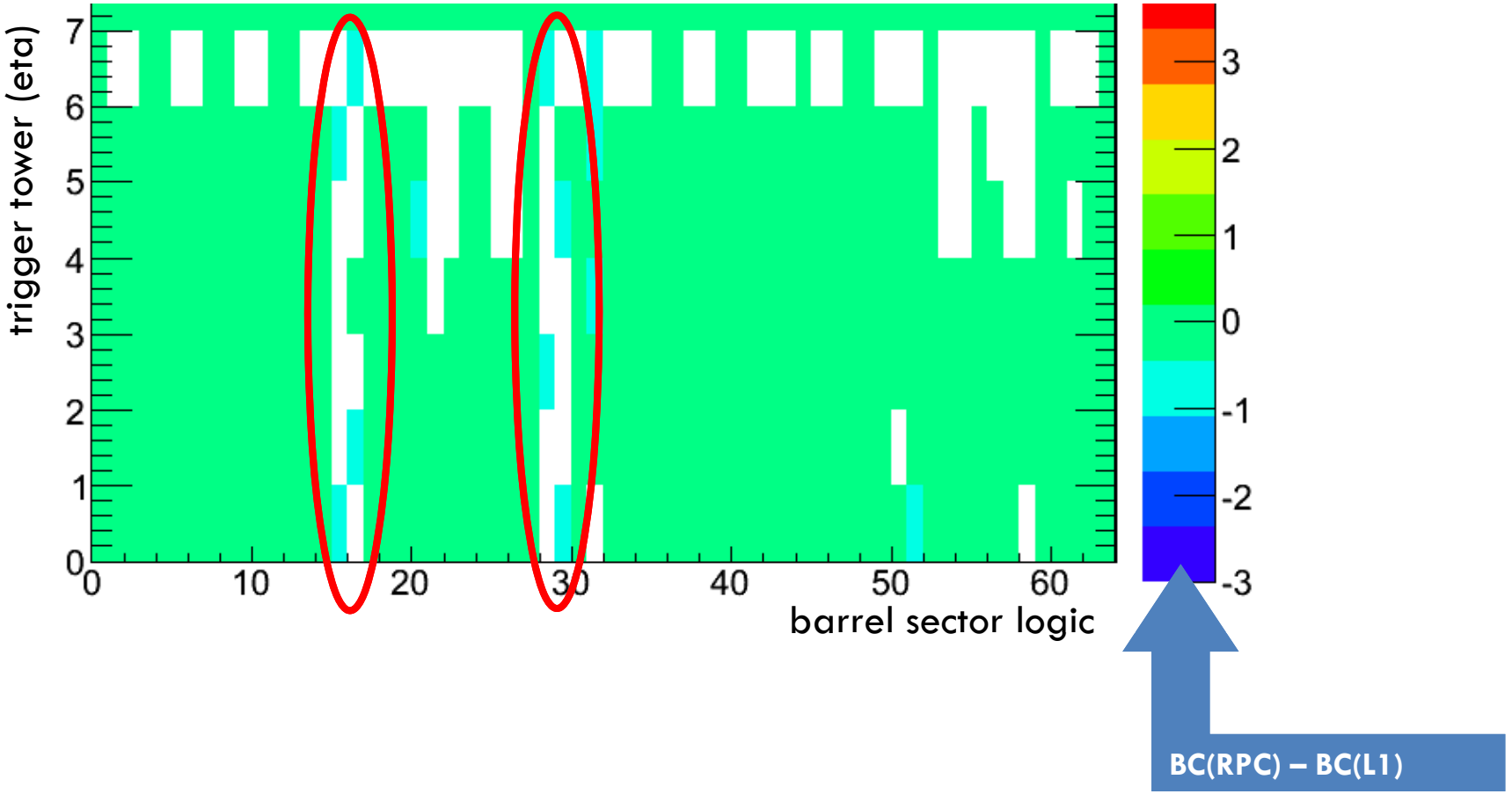


period E6+E7

tag and probe method used to monitor the trigger timing :

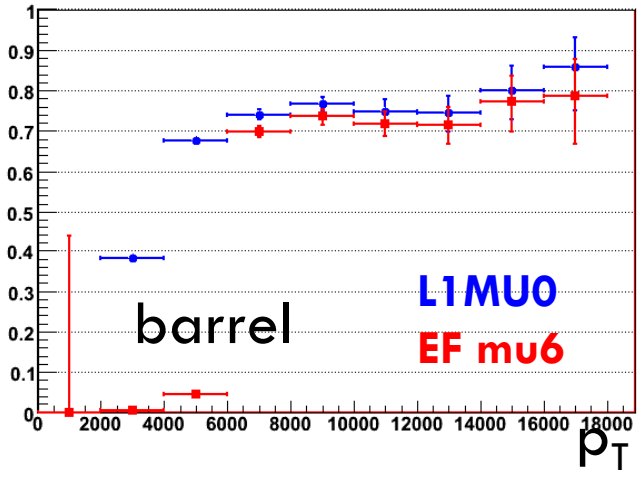
-tag muon “in time”

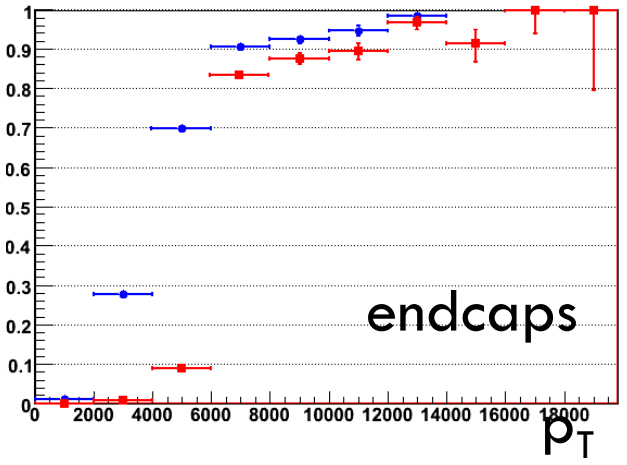
-probes test the arrival of the RPC trigger (wrt the L1A) instead of the efficiency

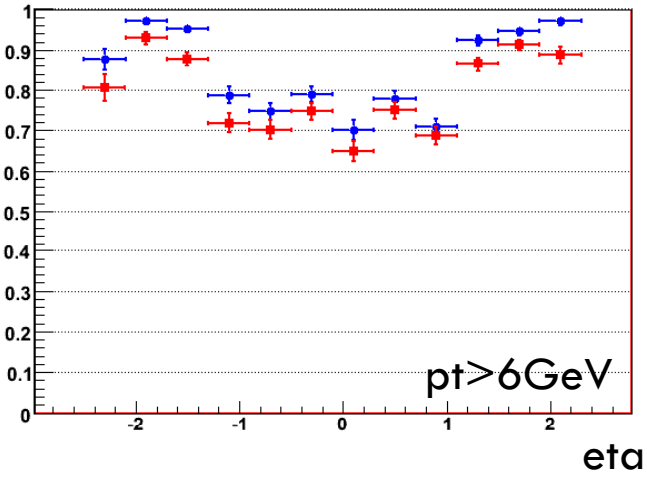


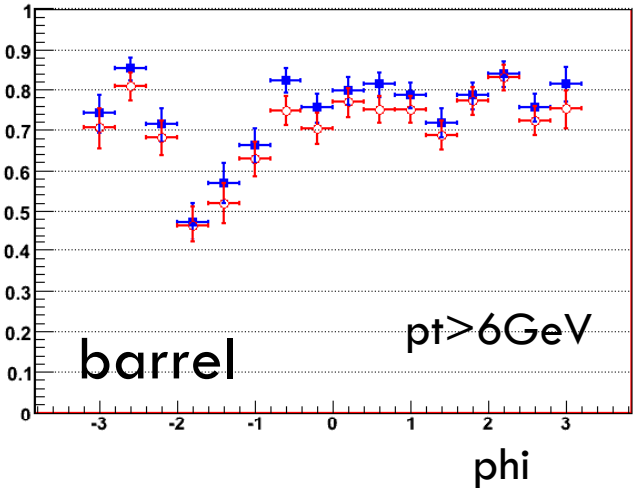
EF_mu6 – period F

- L1MU0 and EF_mu6 efficiency in period F







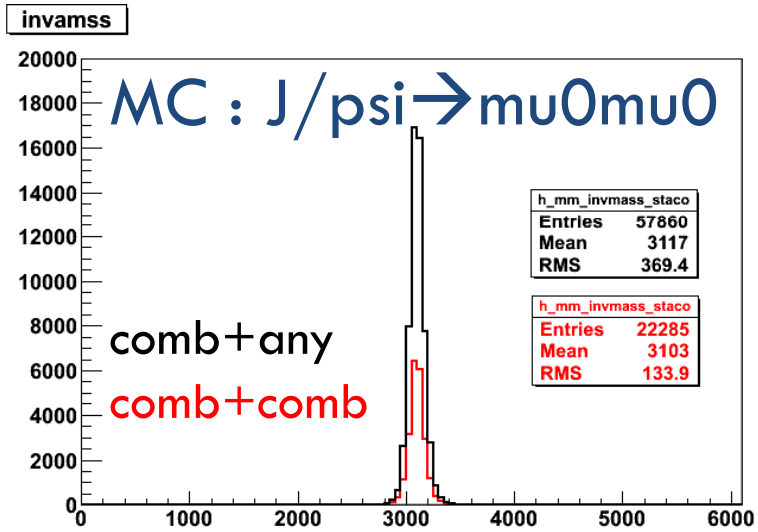


MC Comparison: L1_MU0/ L1_MU6

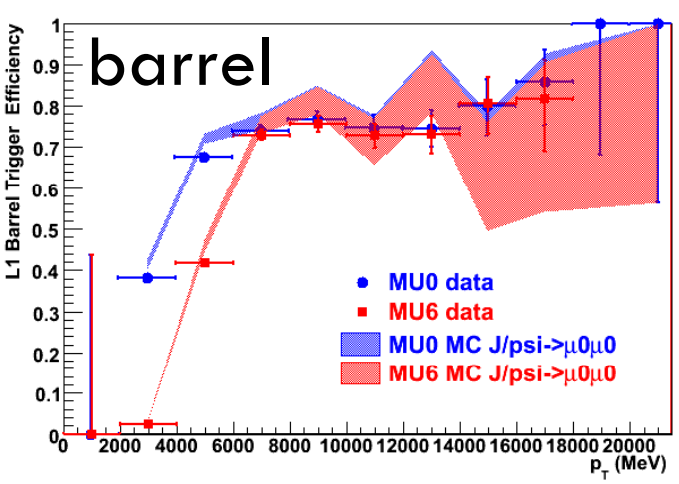
Period F

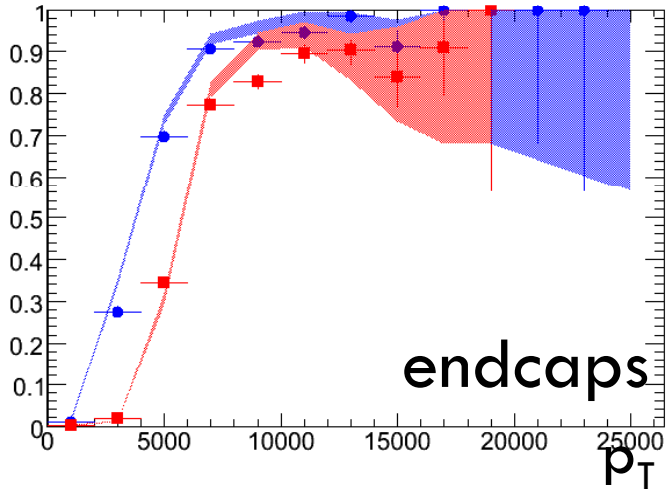
L1MU0

L1MU6



turnon curves for MU0 and MU6 threshold for data (periodF) and MC





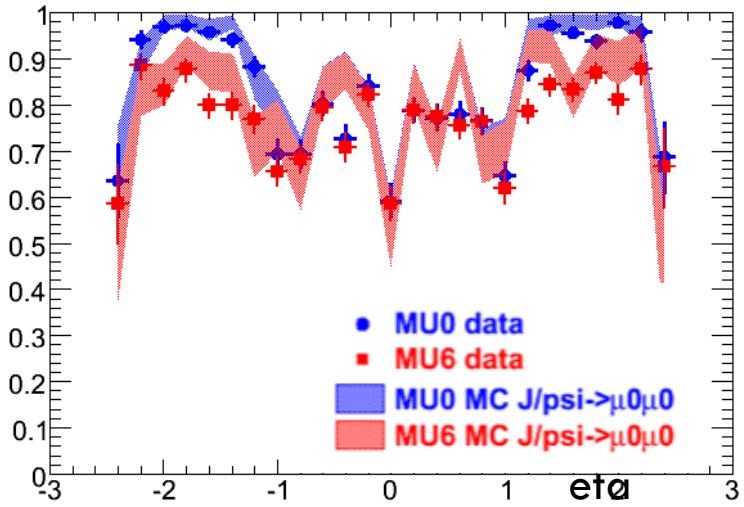
MC Comparison L1_MU0/ L1_MU6

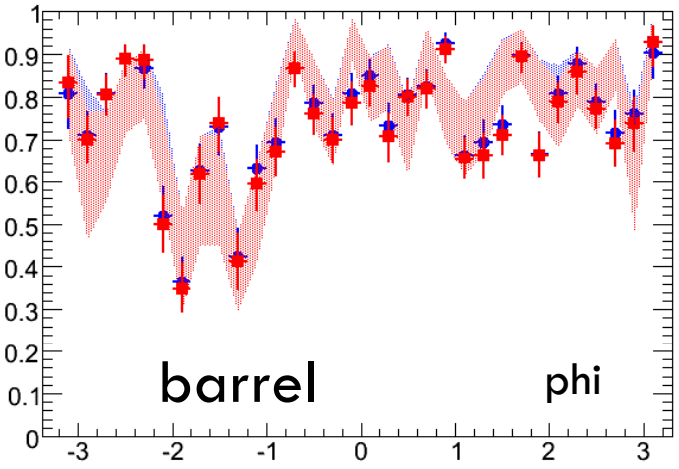
Period F

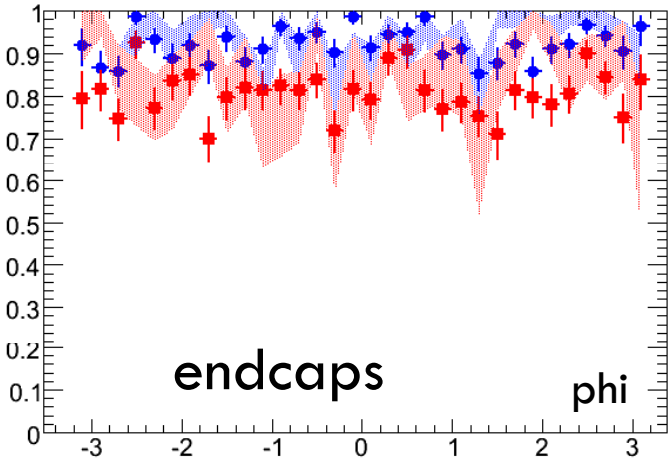
L1MU0

L1MU6

L1 efficiencies for p_T>6GeV wrt eta/phi for the MU0 and MU6 thresholds for data period F



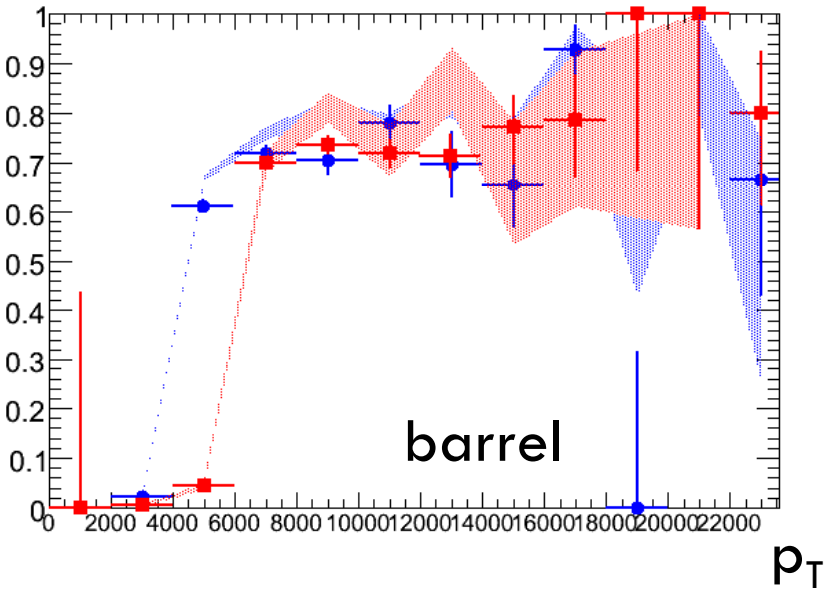


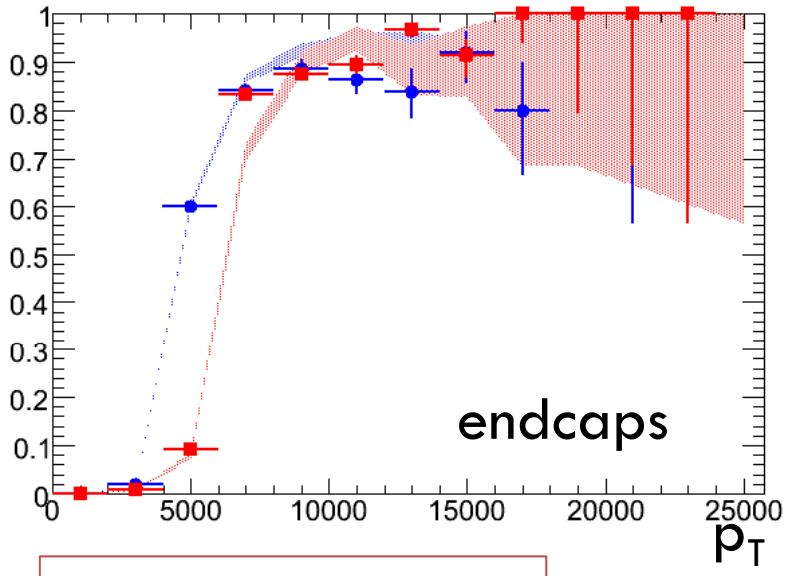


MC Comparison EF_mu4/ EF_mu6

Period E+F

turnon curves for mu4 and mu6
threshold for data (periodF) and MC



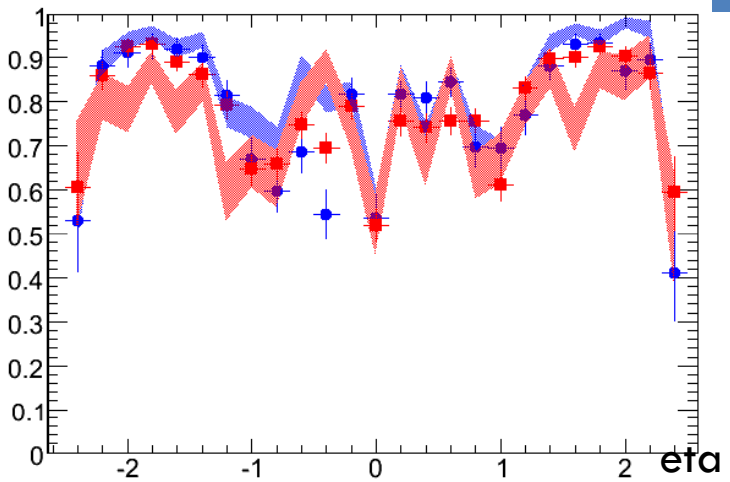


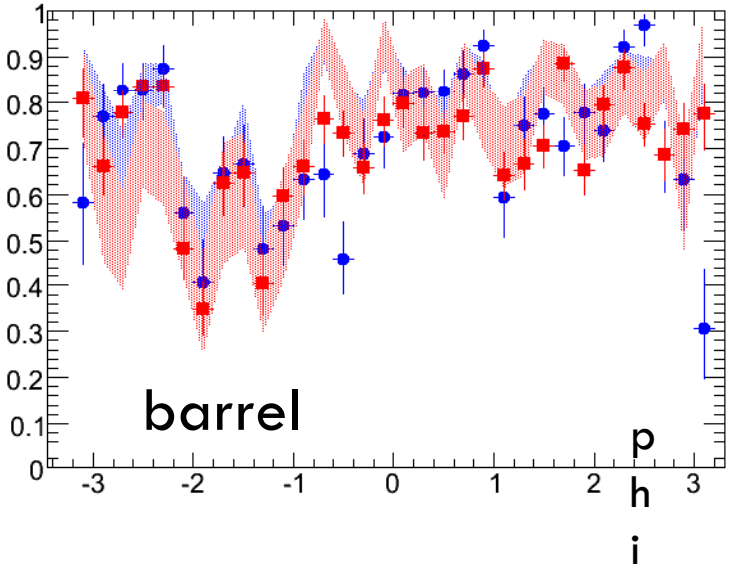
note : EF_mu6 in MC
is seeded by L1_MU6

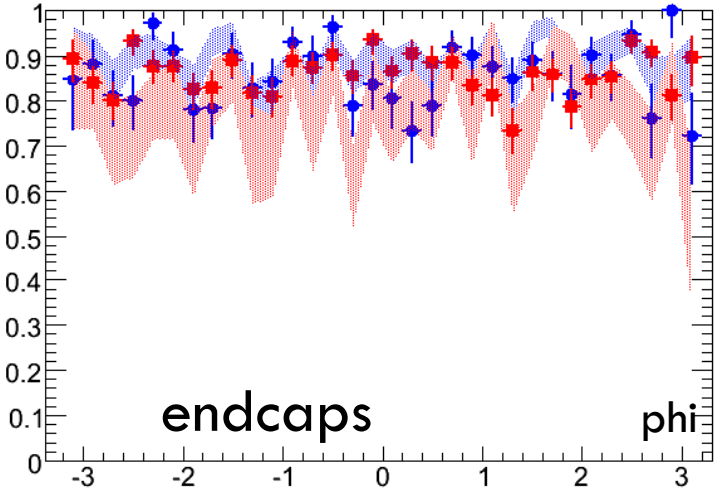
MC Comparison EF_mu4/ EF_mu6

Period E+F

EF efficiencies for p_T>6GeV wrt eta/phi for the mu4 and mu6 thresholds for data period F

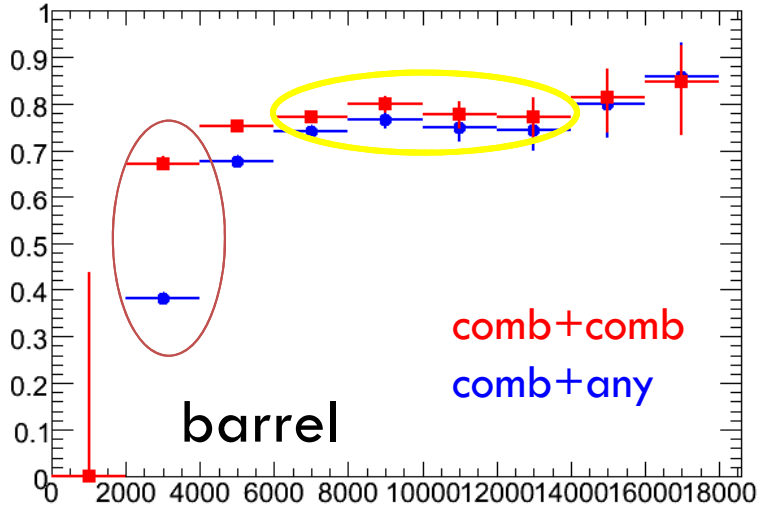


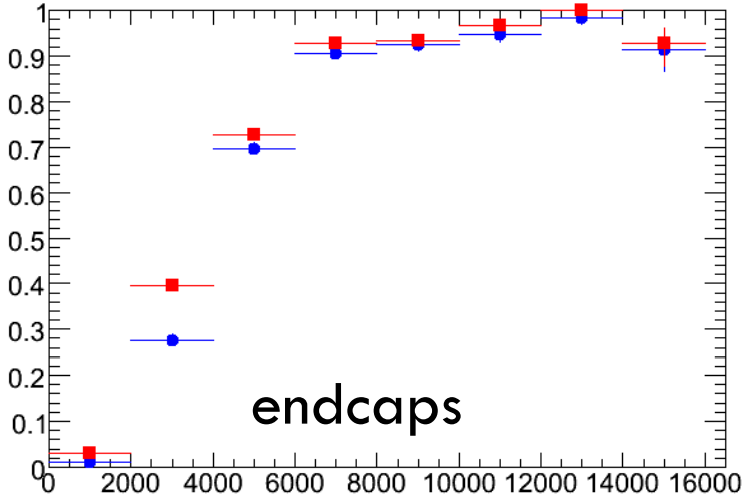




note : EF_mu6 in MC is seeded by L1_MU6

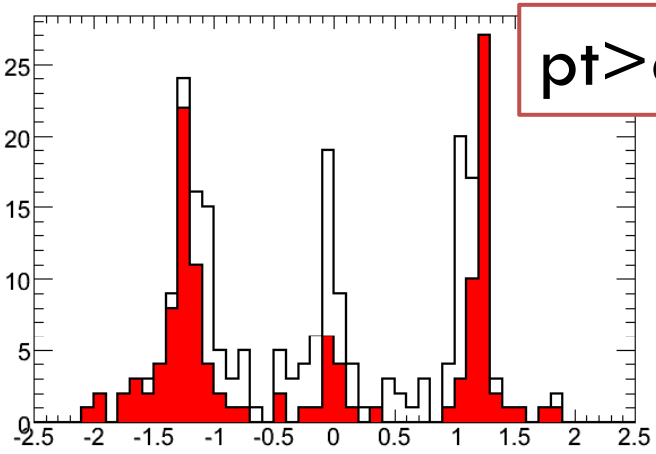
Comb+Comb vs Comb+any Selection





any=comb or tagged muons

different sets of efficiency maps provided



all tagged muons

tagged matched with trigger

Conclusions

Trigger efficiency from Jpsi->$\mu\mu$ using Tag&Probe method:

-Both L1 and EF studies are already in place

-work ongoing to include also L2

- Efficiency wrt to pT, eta and phi

- Comparison between periods or/and thresholds

-MC comparison

-On going:

- *Study of Systematics*
  - *Look at the bkg level impact on trigger efficiencies*
  - *Trigger matching*
  - *Selection cuts*