UPDATES ON J/PSI POLARIZATION

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CMS Pisa meeting

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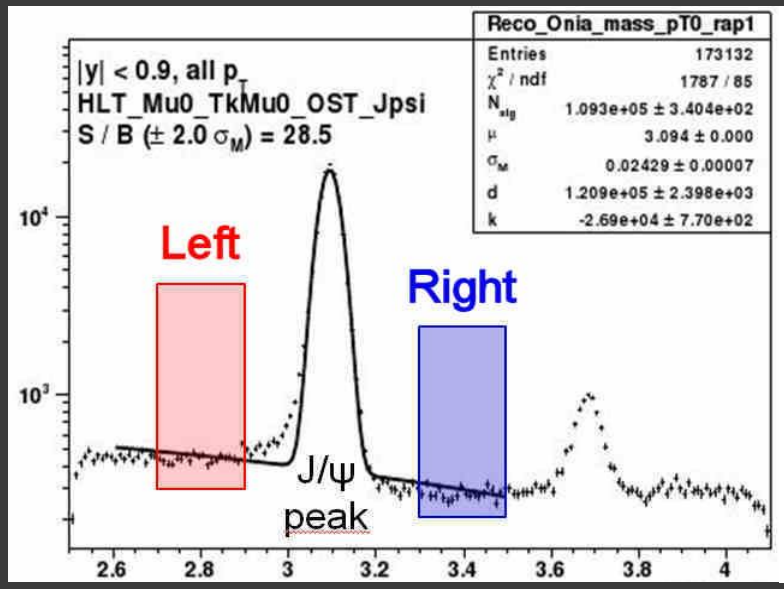
Outline

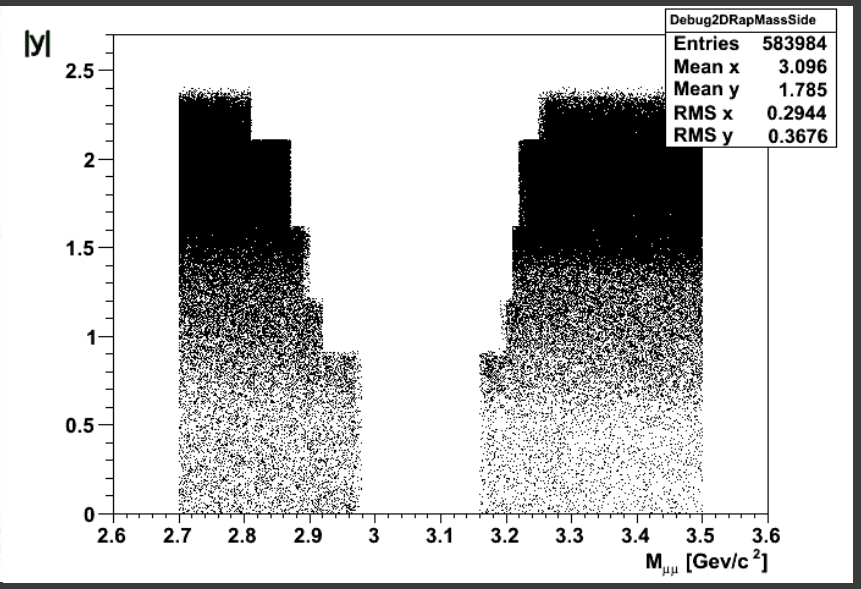
- Data used for this analysis
- Definiton of sidebands
- Simulations on the contamination of the background by the signal, in the sidebands
- P_T dimuon distribution for different triggers
- *Cos* θ and φ distributions in different reference frames of the positive muon

Data used in the analysis

- Used data from October 30th production
- Run 2010A data
  - HLT_DoubleMu0
  - HLT_Mu0_TkMu0_Jpsi
- Run 2010B data
  - HLT_Mu0_TkMu0_OST_Jpsi
  - HLT_Mu0_TkMu0_OST_Jpsi_Tight_v1
- Implementing now code for new released data TTrees
  - Nov 4th ReReco – Dec 6th production

Defining Sidebands





Left sideband: from 2.7 GeV/c² to 5σ left of the J/ψ peak

Right sideband: from 3σ right of the peak to 3.5 Gev/c²

The peak **position** and **σ** depend on the **|η|** bin being considered.

This is shown in the figure on the right, a 2D plot of events accepted into the sidebands in the **|η| - $M_{\mu\mu}$** plane

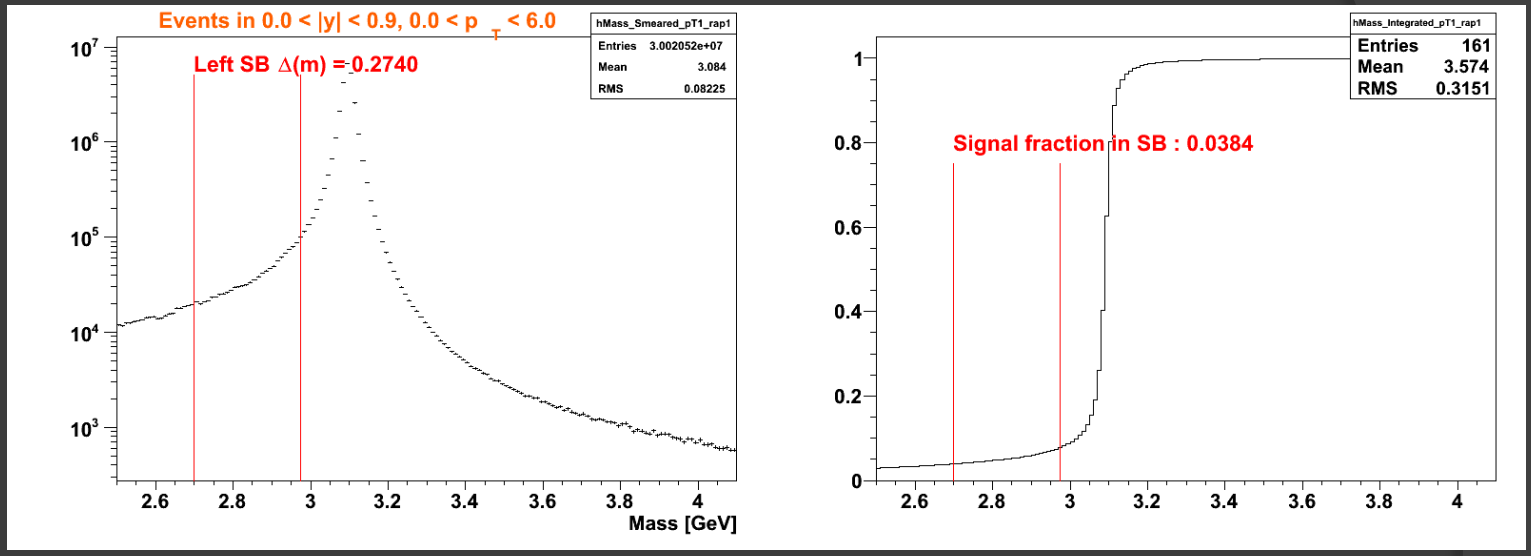
Contamination of the SB with signal

- Took a MC sample of dimuons coming from J/ψ decay, with detector and FSR smearing
- Estimated the amount of signal falling into the left sideband due to FSR tail
  - Total: 1.7%
  - Worst: 3.8% (low P_T, mid rapidity)
  - Best: 0.7% (high P_T, forward rapidity)

Contamination of the SB with signal

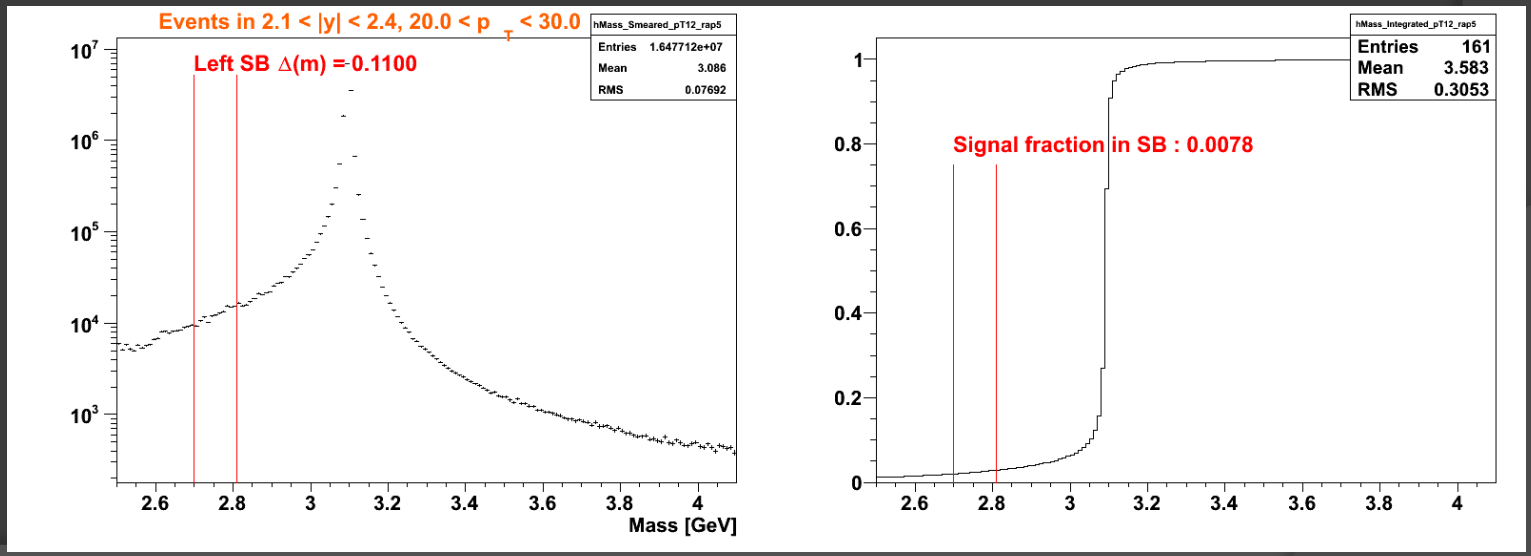
0.0<|η|<0.9
0.0<P_T<6.0

Worst case



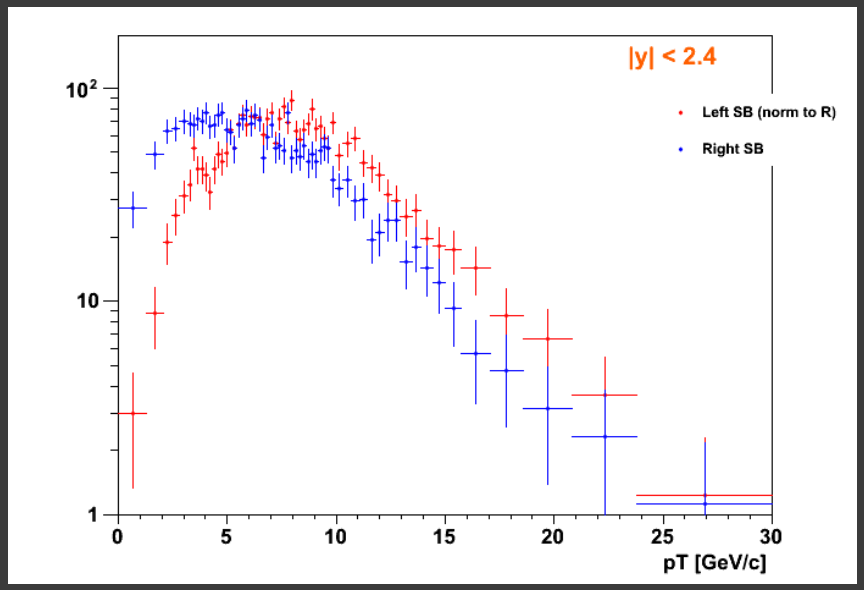
2.1<|η|<2.4
20.0<P_T<30.0

Best case



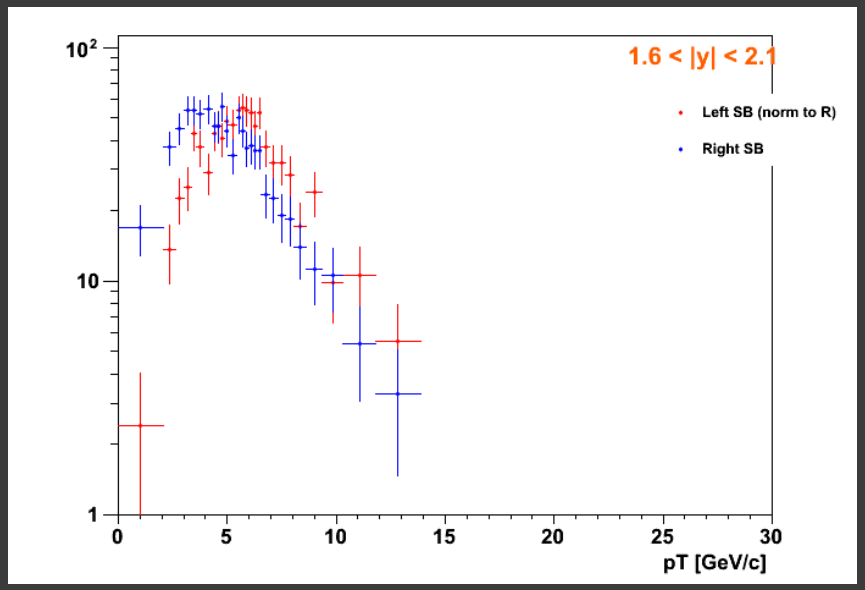
P_T spectrum for HLT_DoubleMu0

|y| < 2.4



Big difference in P_T between two sidebands

1.6 < |y| < 2.1

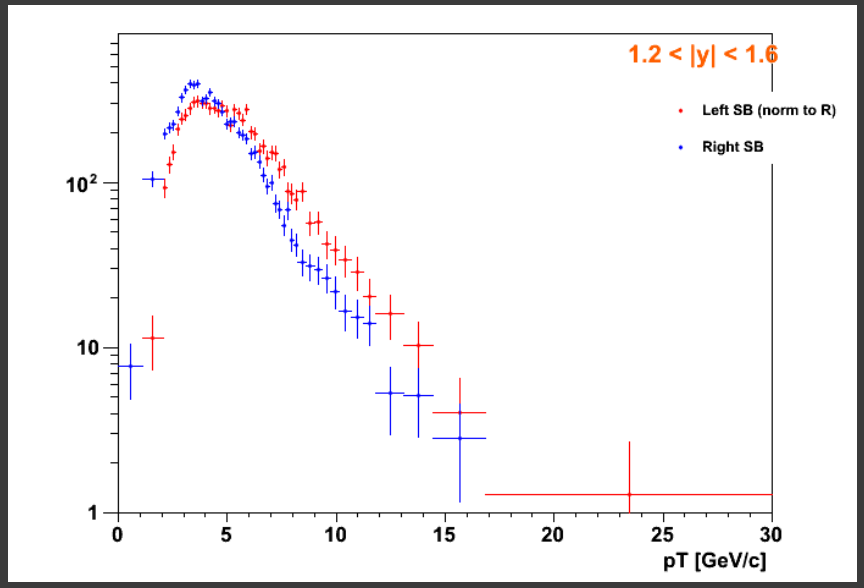


Detail for 1.6 < |y| < 2.1

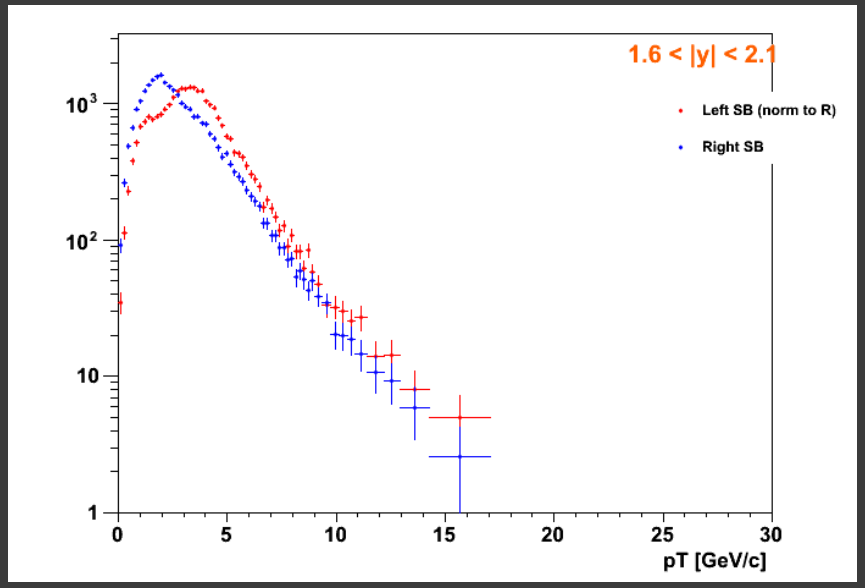
Statistics is low

P_T spectrum for HLT_Mu0_TkMu0_Jpsi

1.2 < |y| < 1.6



1.6 < |y| < 2.1



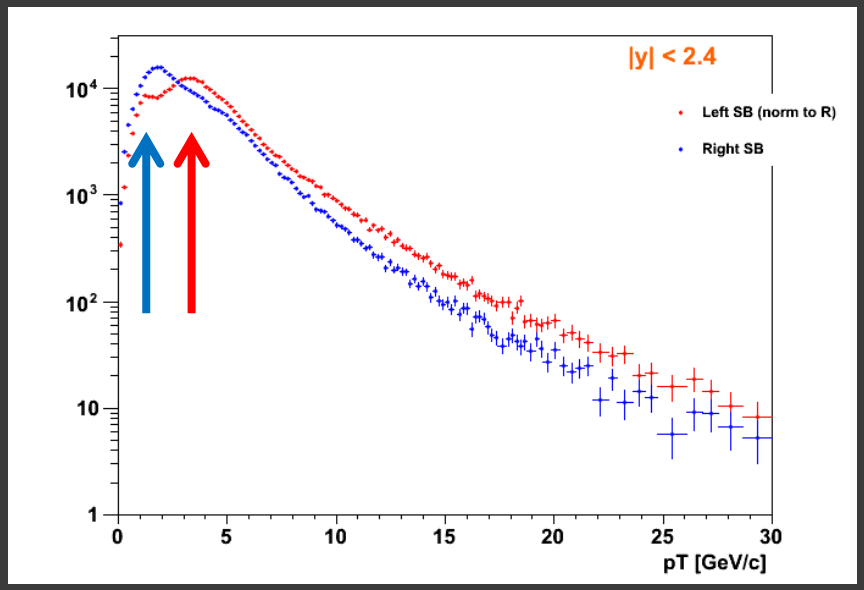
P_T spectrum is "similar" in this rapidity bin…

…but behaves differently in the next one

P_T spectrum for HLT_Mu0_TkMu0_OST_Jpsi

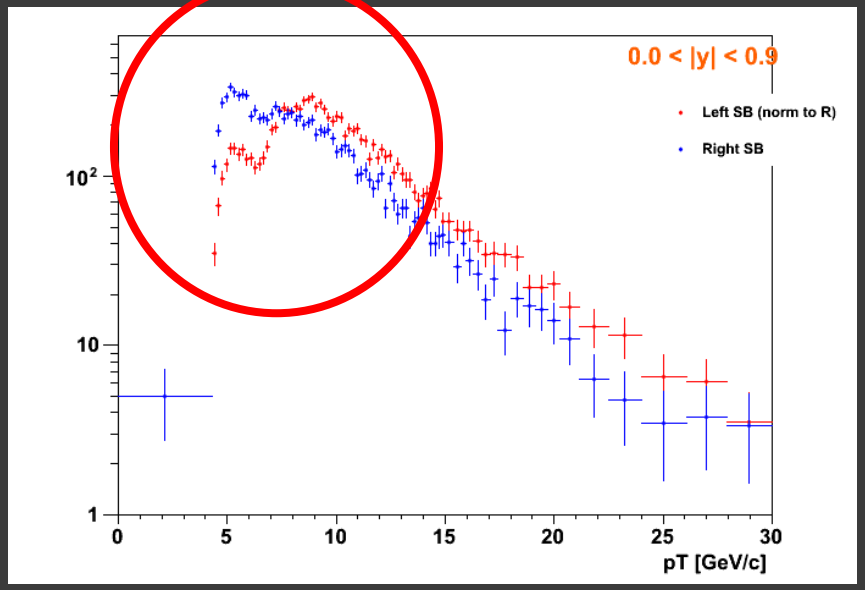
(the trigger which had the biggest statistics in the data used)

all |y| < 2.4



The higher mass SB has a peak at lower P_T than the low mass SB

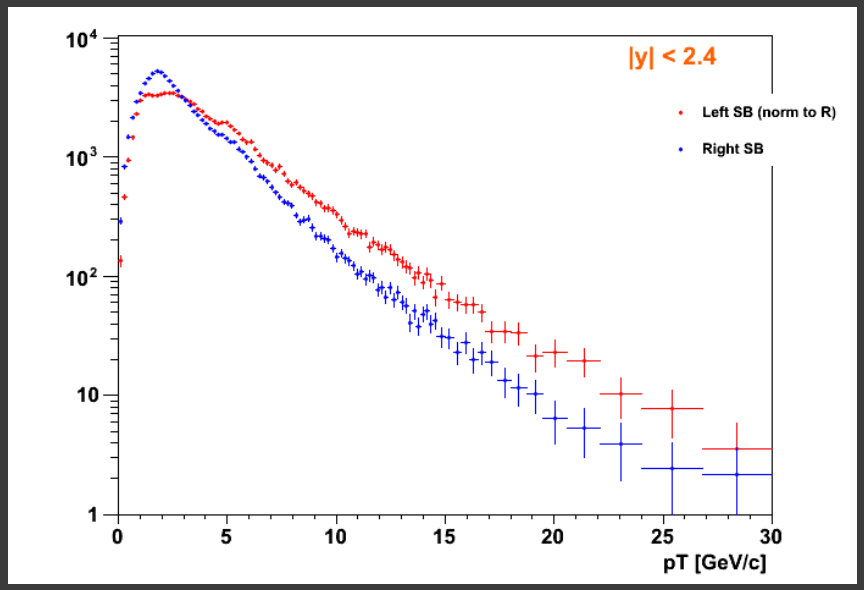
0.0 < |y| < 0.9



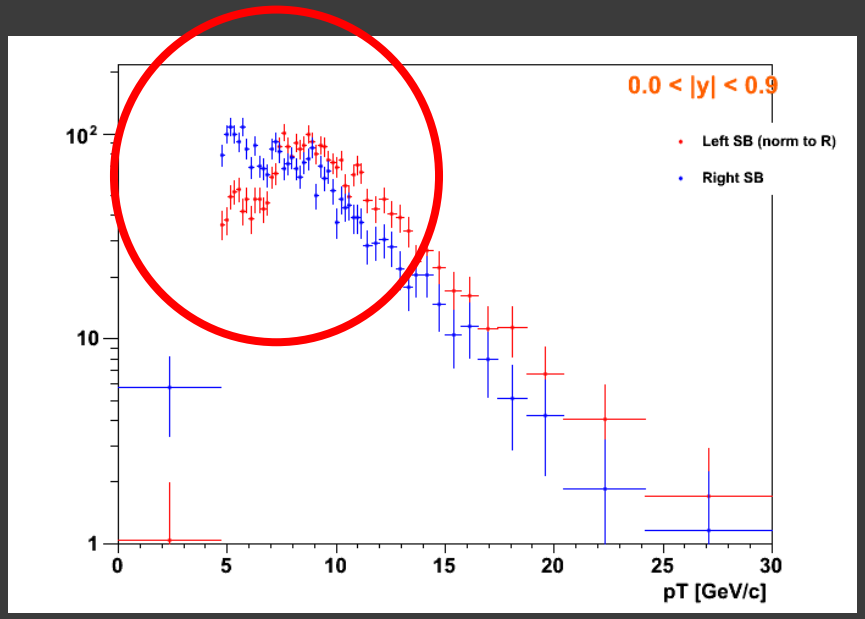
For this trigger, the mid rapidity distribution shows a strange pattern due to kinematics cuts

P_T spectrum for HLT_Mu0_TkMu0_OST_Jpsi_Tight_v1 (this trigger is a close parent of the former)

all |y| < 2.4



0.0 < |y| < 0.9

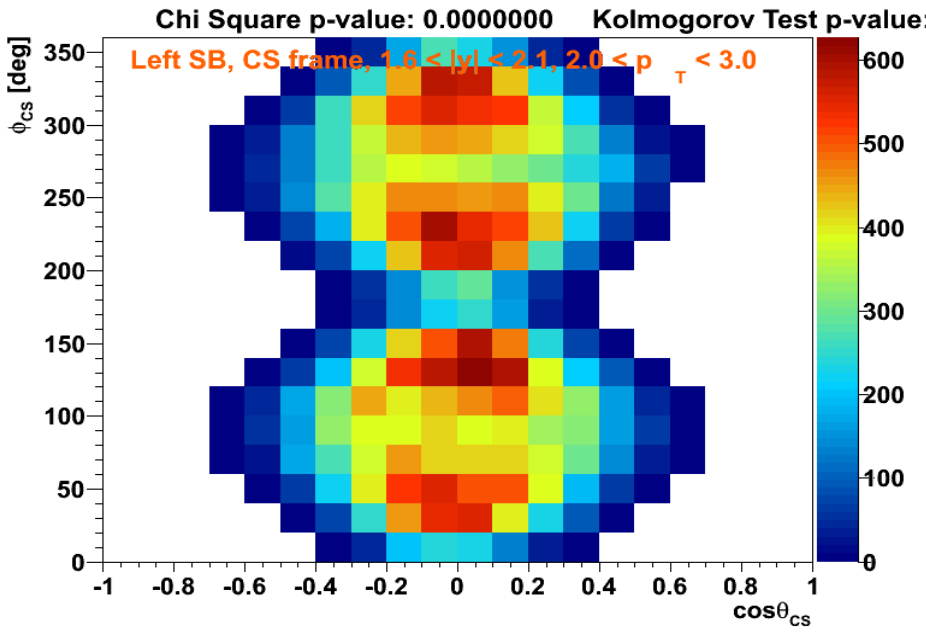


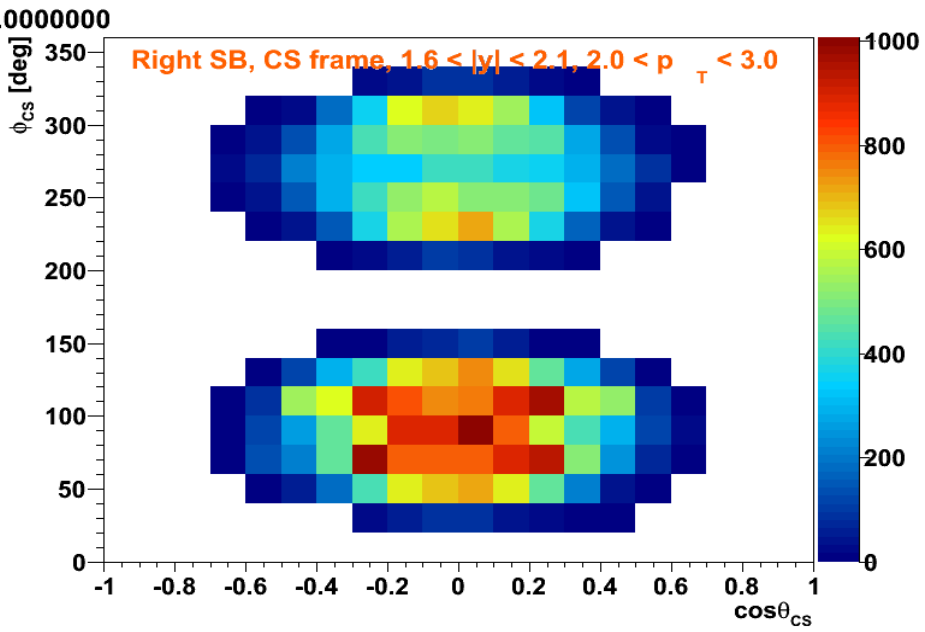
The left (low inv. mass) sideband seems to be harder in P_T than the right one

Also for this trigger the mid rapidity distribution shows a zig-zag pattern (the triggers are parents)

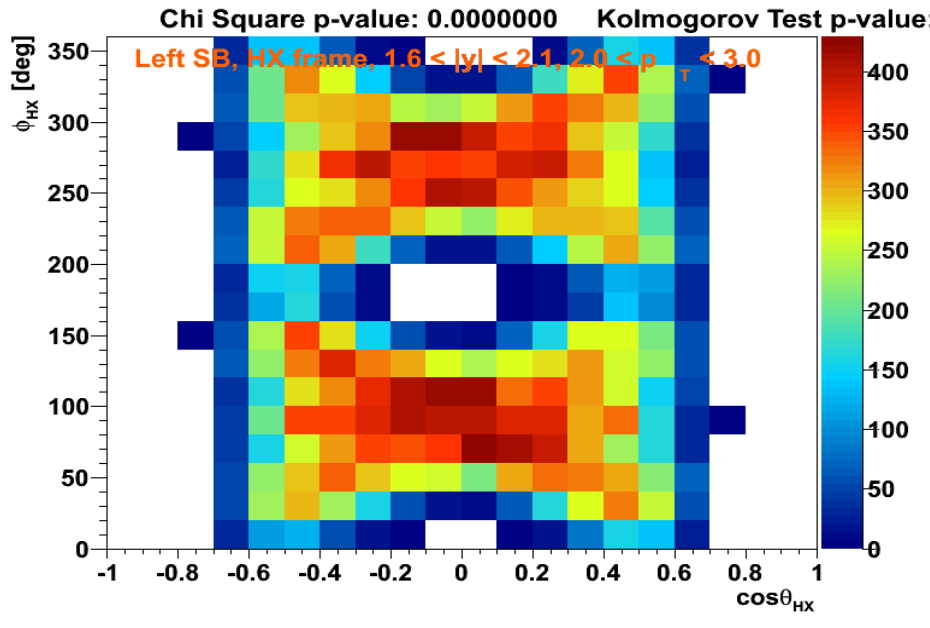
Cosθ and φ in different frames

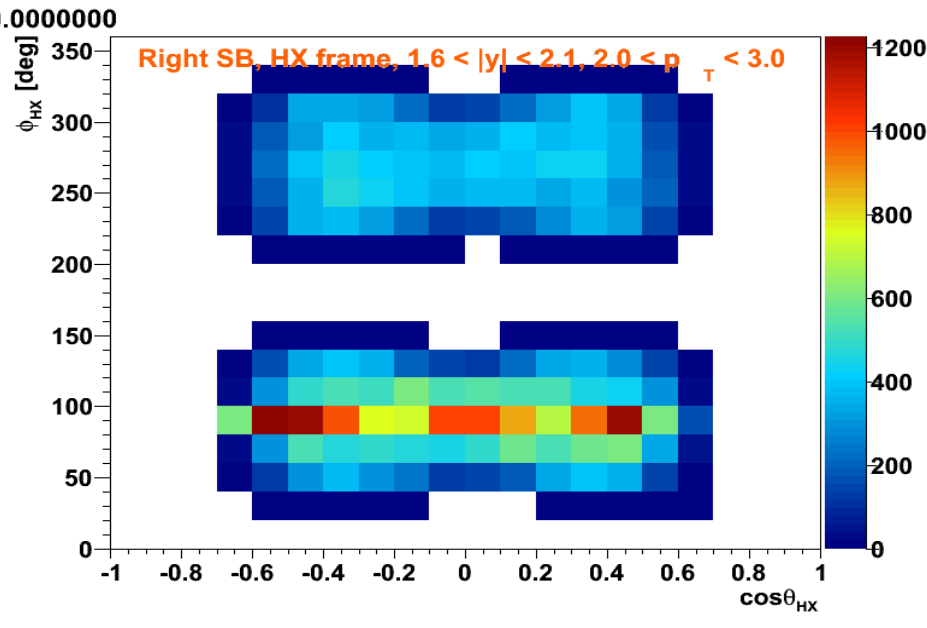
- The following are 2D plots of the Cosθ and φ of the positive muon in the dimouns considered, for different reference frames.
- In the plots a cinematic dependence of the distribution in the two variables can be seen as we cycle trough different rapidity and P_T bins.
- Last but not least, there may be an effect due to ‘‘cowboy’’ dimuons inefficency.
- I will show data for the trigger path for which we have the highest statistics: ***HLT_Mu0_TkMu0_Jpsi***

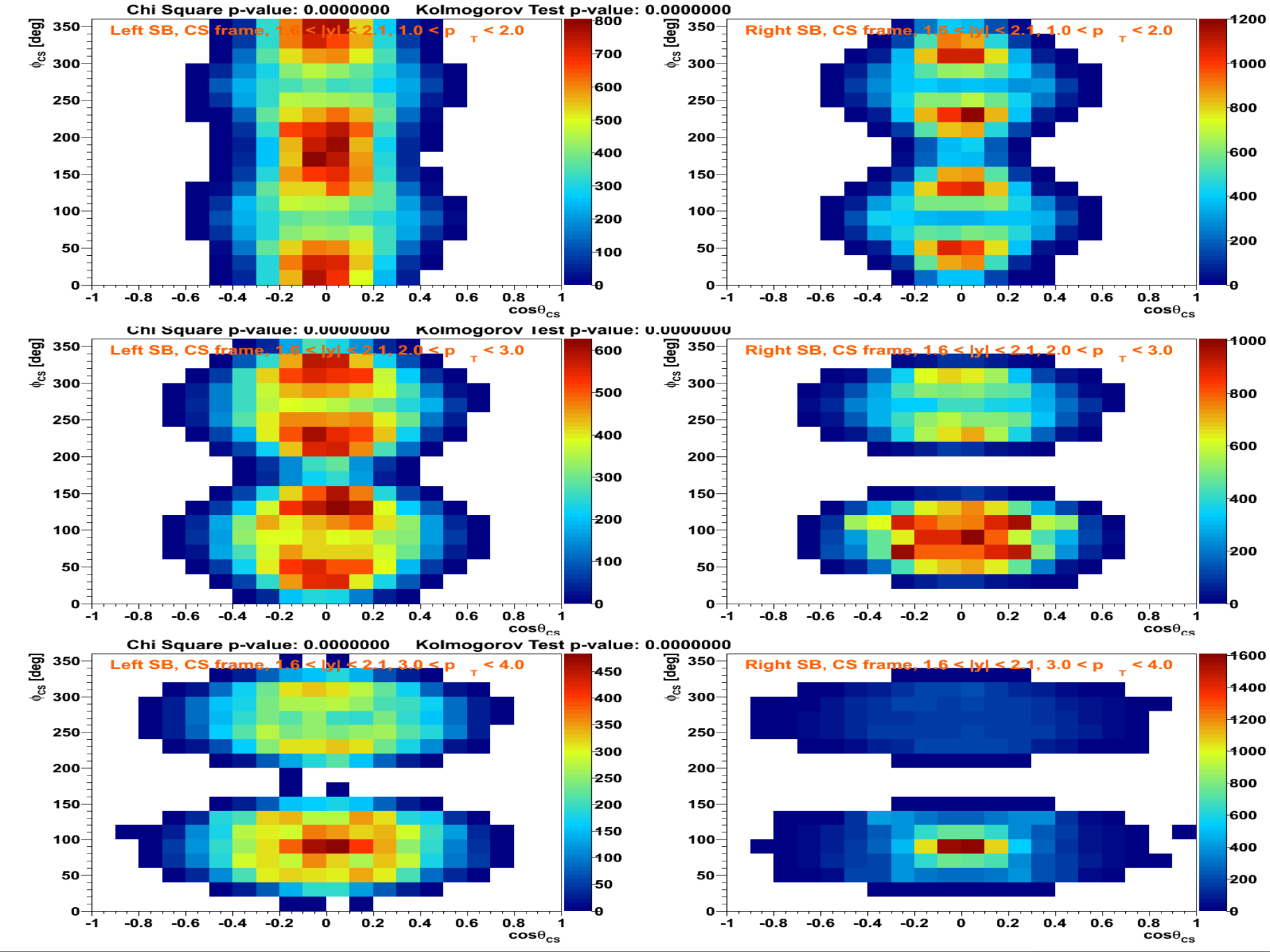




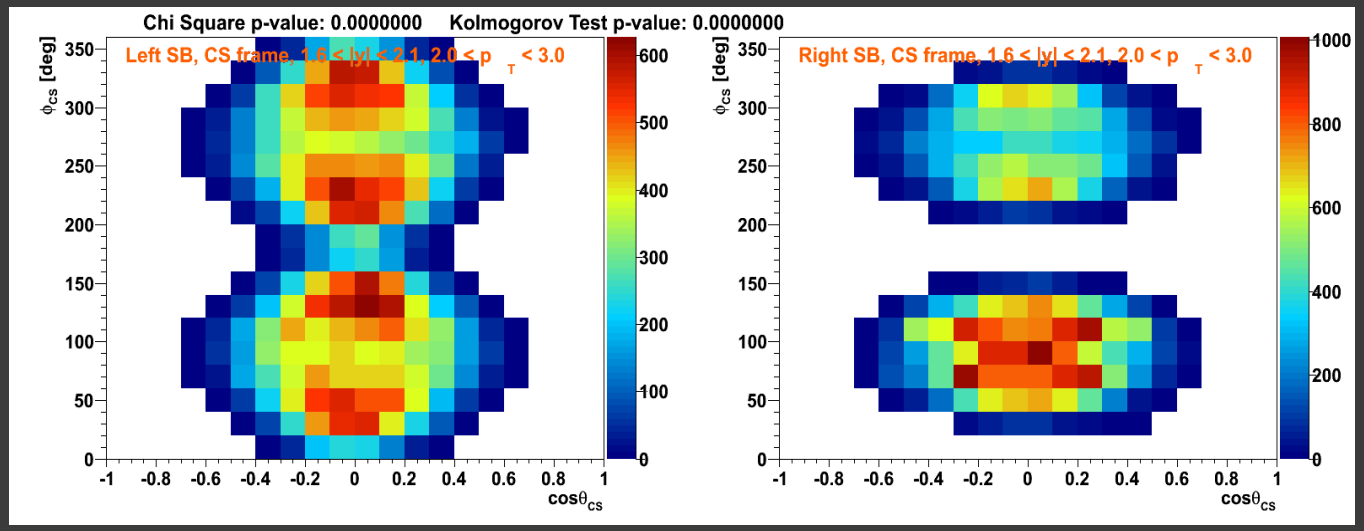
CS and HX frames HLT_Mu0_TkMu0_Jpsi $1.6 < |y| < 2.1$ $2.0 < P_T < 3.0$

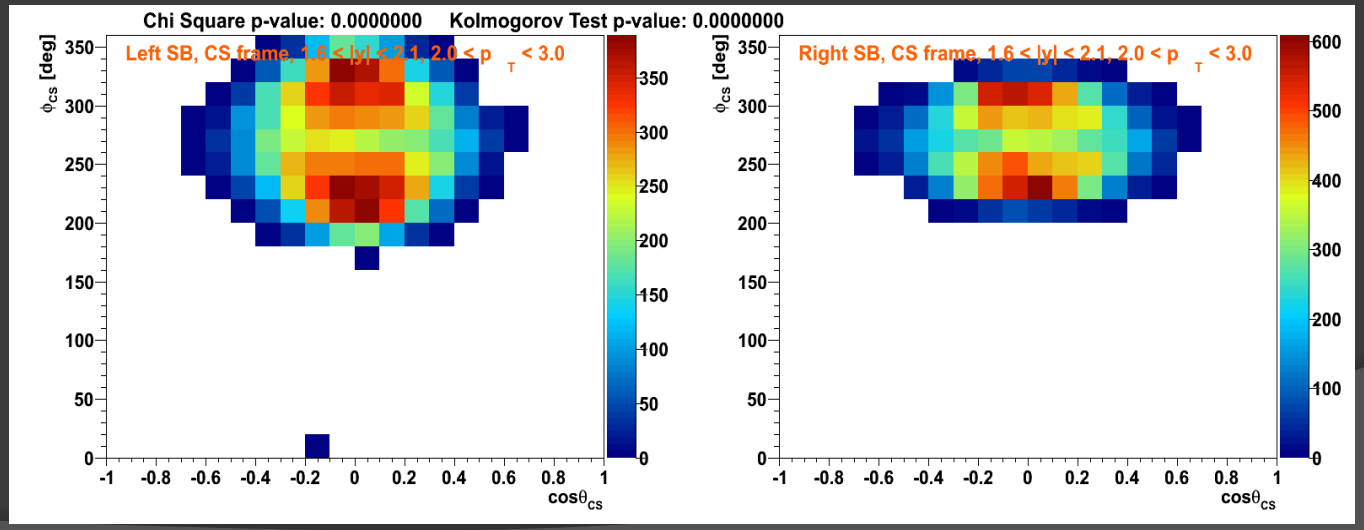





Chi Square p-value: 0.0000000 Kolmogorov Test p-value: 0.0000000
Left SB, CS frame, 1.6 < |y| < 2.1, 1.0 < p T < 2.0
Right SB, CS frame, 1.6 < |y| < 2.1, 1.0 < p T < 2.0
Left SB, CS frame, 1.6 < |y| < 2.1, 2.0 < p T < 3.0
Right SB, CS frame, 1.6 < |y| < 2.1, 2.0 < p T < 3.0
Chi Square p-value: 0.0000000 Kolmogorov Test p-value: 0.0000000
Left SB, CS frame, 1.6 < |y| < 2.1, 3.0 < p T < 4.0
Right SB, CS frame, 1.6 < |y| < 2.1, 3.0 < p T < 4.0
ϕcs [deg]
cosθcs

Differences between HLT_Mu0_TkMu0_OST_Jpsi and HLT_Mu0_TkMu0_OST_Jpsi_Tight_v1



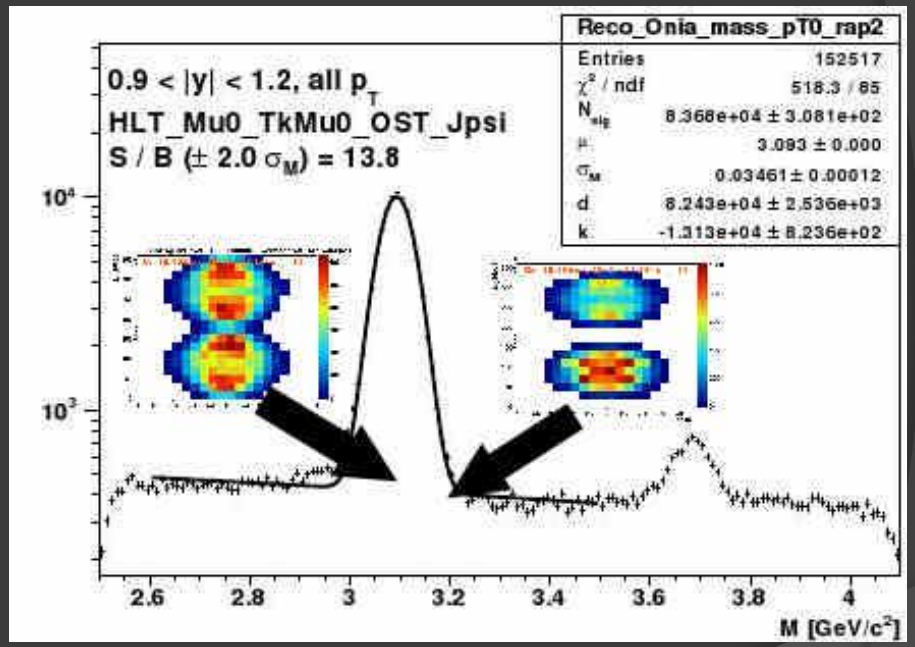


The former has been configured to reject all the dimouns which are “cowboys”.

This rejection can be seen in these pictures, indeed there are no events in the lower part.

Purpose of the previous graphs

- Get an estimate of the «polarization» of the background muons under the peak from those in the two SB
- Take an intermediate value of the two to estimate the contribution of background to the polarization fit



Where to find more infos

- QTF Workspace > Polarization > Data Quality Checks > Distributions from Mass Sidebands
  https://espace.cern.ch/cms-quarkonia/onia-polarization/Data%20Quality%20Checks/Mass%20sidebands.aspx
- QTF Workspace > Polarization
  https://espace.cern.ch/cms-quarkonia/onia-polarization/
- About reference frames and the analisys
  http://arxiv.org/abs/1006.2738
- "Seagulls and Cowboys"
  https://espace.cern.ch/cms-quarkonia/upsilon/Lists/slides/Attachments/31/correlations_gavin_2010_05_10.pdf
  https://espace.cern.ch/cms-quarkonia/onia-polarization/Lists/Meetings/DispForm.aspx?ID=39