Status report on B->hh'

U.Gasparini, S. Lacaprara, M. Margoni,
P. Ronchese, F. Simonetto, M. Tosi

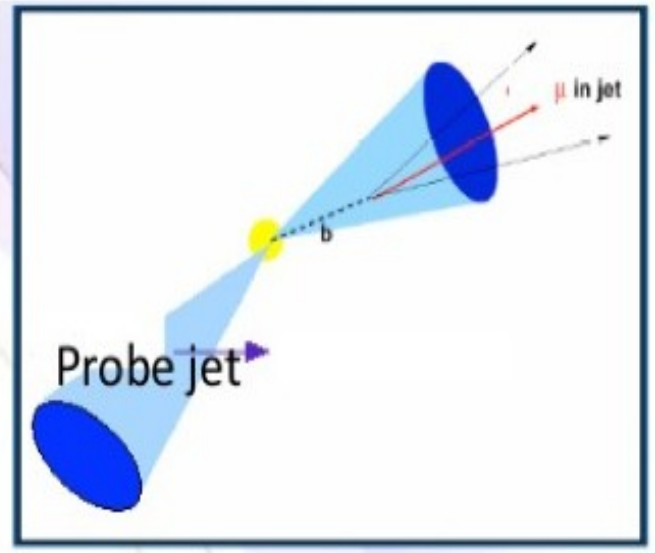
INFN and Universita' Padova

B->MuMu CheckPoint #5

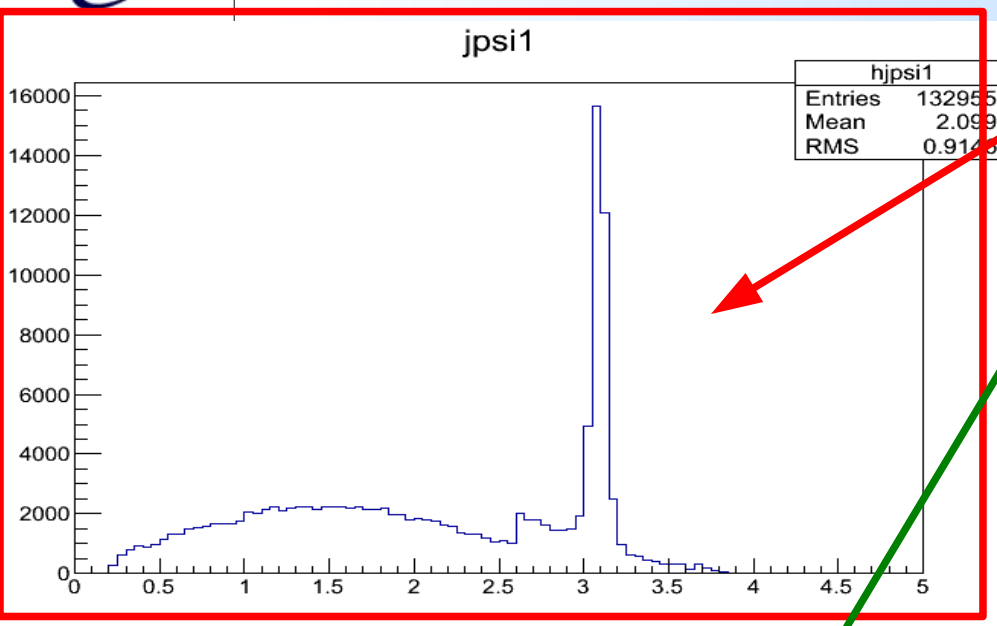
CERN, 15/3/2013

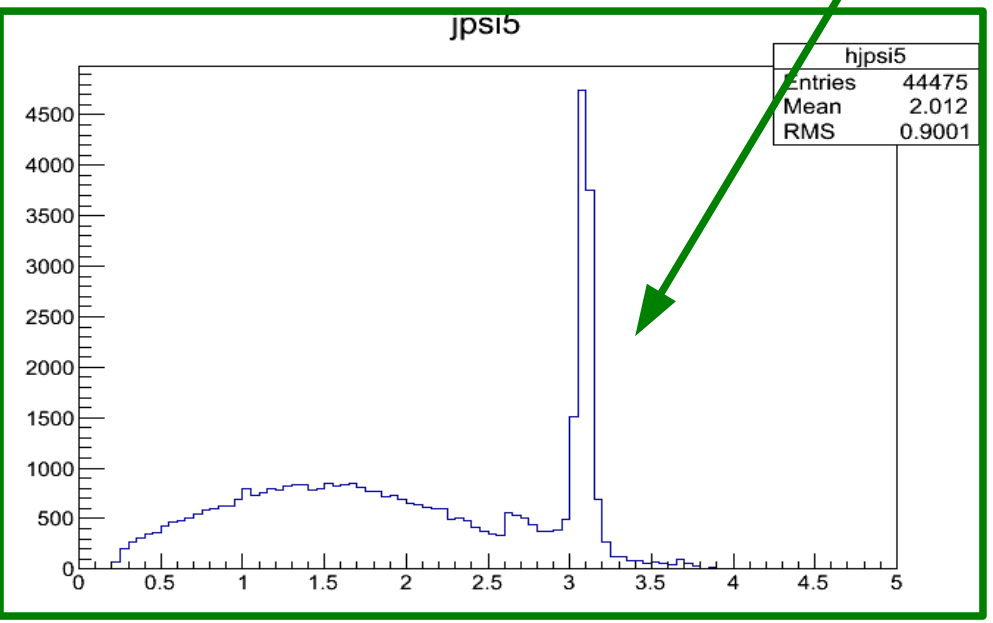
Introduction

- **Goal:**
  - Estimate the B->hh' background in B->μμ analysis, with the two h mis-identified as μ.
  - Use different trigger path wrt standard analysis:
    - μ (pt>12 GeV) + 2 jets (pt>40, 20) + 2 b-tagged jets
      - MuHad (RunA) and SingleMu (RunB/C/D)
  - Use same normalization sample as standard analysis:
    - $B^+ \to J/\Psi K^+$
      - Using same trigger as for signal sample
- **Strategies:**
  - Look for B->hh' and $B^+ \to J/\Psi K^+$ in jets w/o the triggering muons (probe jets)
    - Fast) Use the secondary vertex in jets
      - Update today
    - Strong) Build secondary vertex from hh' candidates
      - As in the standard B->μμ analysis.
        - We are making progress, but will show no results today on this.

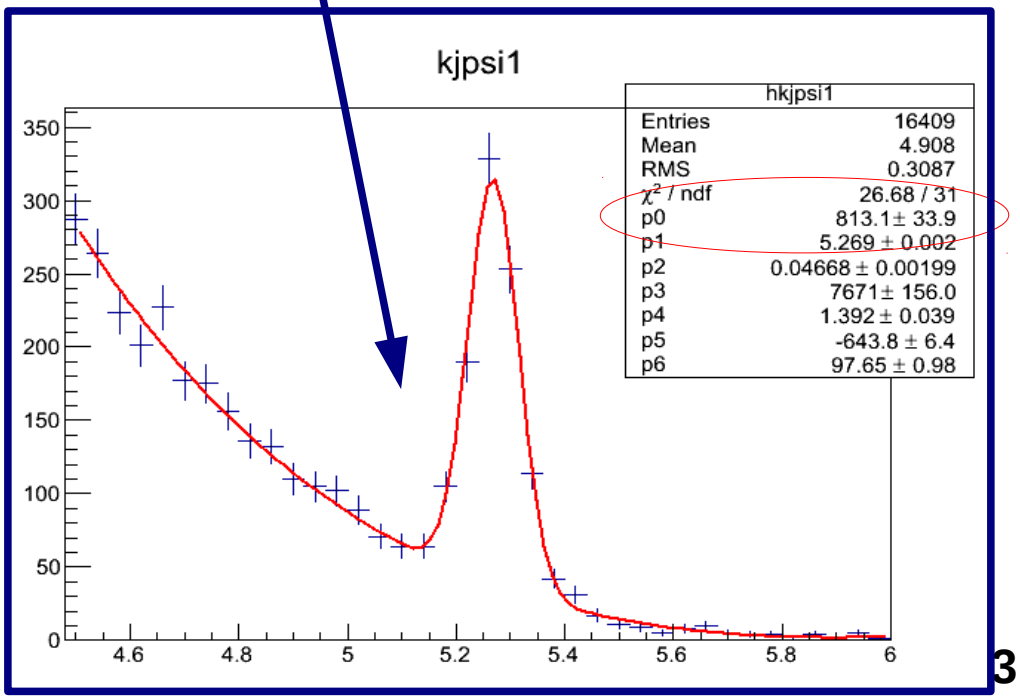


Results for normalization channel $B^+ \to J/\Psi K^+$

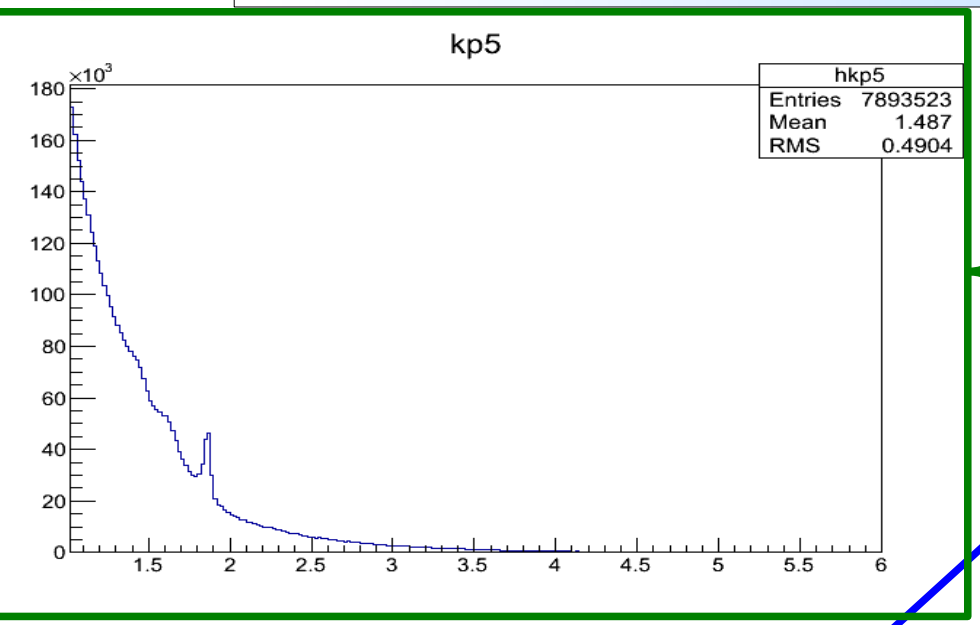




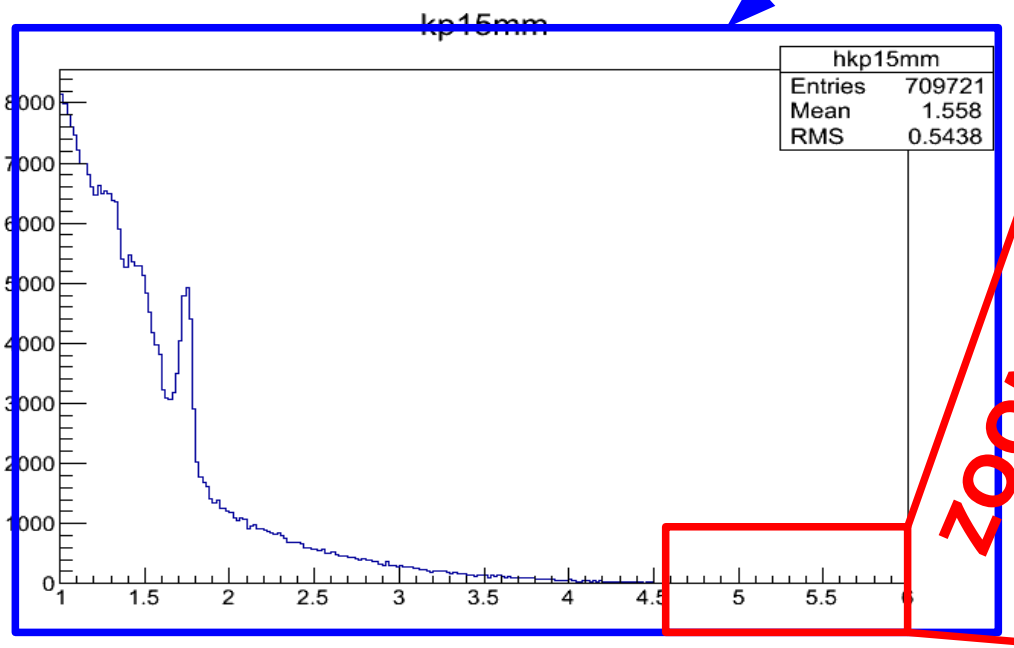
- About 30'000 J/Ψ in probe jets
  - About 10'000 from secondary vertex with 3 tracks
- Assuming the third track is a Kaon:
  - $N(B^+ \to J/\Psi K^+) \sim 800$



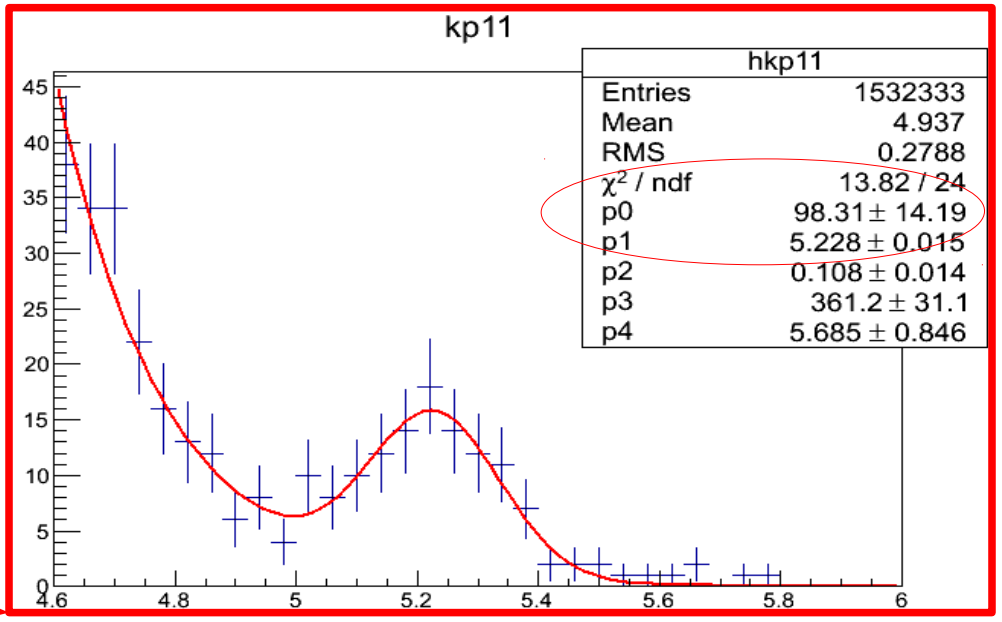
Results signal channel B^0->hh'



- **Two tracks invariant mass**
  - opposite charge,
  - pt>3.5 GeV,
  - not id as muon
  - from same secondary vertex
  - Isolation for hh' candidate (sumPt on a cone $\Delta R<0.3$)
- **μ mass hypotesis for both h**
  - N(B->hh')~100



ZOOM



Acceptance and efficiency per channel

Sample	$F_{u/s}$ * BR	Acc (%)	ε_{Ana}(%)	Acc*ε_{Ana}
B^0->KK	1 * 1.3e-7	10.2	1.51±0.39	1.54±0.4 e-3
B^0->Kπ	**1 * 1.95e-5**	5.76	1.38±0.04	0.79±0.02 e-3
B^0->ππ	1* 5.19e-6	14.6	1.42±0.09	2.07±0.13 e-3
B_s^0->KK	**0.267 * 2.54e-5**	4.92	1.32±0.03	0.65±0.01 e-3
B_s^0->Kπ	0.267 * 5.0e-6	6.1	1.40±0.12	0.85±0.07 e-3
B_s^0->ππ	0.267 * 7.3e-7	5.12	1.50±0.15	0.77±0.08 e-3
Combined (weighted with f*BR)				**0.96±0.04 e-3**
B^+->J/ψK^+		100 (no filter)	0.169±0.006	**1.69±0.06 e-3**

Formula

Normalzation sample in std and Padova analysis, Accounting for acceptance & efficiencies

Signal sample acceptance and efficiencies

$$N_{hh'} = \left(\frac{N_B +}{N_B +(PD)}\right)\left(\frac{Acc * \epsilon_{ana}(B^+)(PD)}{Acc * \epsilon_{ana}(B^+)}\right)\left(\frac{\epsilon_{trig}(B^+)(PD)}{\epsilon_{trig}(B^+)}\right)$$

$$\left(\frac{Acc * \epsilon_{ana}(B^0)}{Acc * \epsilon_{ana}(B^0)(PD)}\right)\left(\frac{\epsilon_{trig}(B^0)}{\epsilon_{trig}(B^0)(PD)}\right)$$

$$\omega_{\mu\mu}(B^0)\, N_{hh'}(PD)$$

Num of B^0->hh' seen as B^0->μμ

μ mis-identification probability

Num of B^0->hh' Seen by Padova analysis

Formula

$$N_{hh'} = \left(\frac{N_B +}{N_B +(PD)} \right) \left(\frac{Acc * \epsilon_{ana}(B^+)(PD)}{Acc * \epsilon_{ana}(B^+)} \right) \left(\frac{\epsilon_{trig}(B^+)(PD)}{\epsilon_{trig}(B^+)} \right)$$
$$\left(\frac{Acc * \epsilon_{ana}(B^0)}{Acc * \epsilon_{ana}(B^0)(PD)} \right) \left(\frac{\epsilon_{trig}(B^0)}{\epsilon_{trig}(B^0)(PD)} \right)$$
$$\omega_\mu(B^0)\, N_{hh'}(PD)$$

PADOVA: normalization

N(B^+->J/ΨK$^+$) = 809 ± 34

Acc*ε_{Ana} (B^+) = 0.169 ± 0.006%

ε_{Trig} (B^+) = ? soon

PADOVA: signal

N(B^0->hh') = 94 ± 14

Acc*ε_{Ana} (B^0) = 0.096 ± 0.004%

ε_{Trig} (B^0) = ? soon

Standard: normalization

N(B^+) = 192562 (33968) barrel (endcap)

Acc*ε_{Ana} (B^+) = 0.294±0.005% (0.096 ± 0.004%)

ε_{Trig} (B^+) = 53.2±0.1% (37.5±0.1%)

Standard: signal

N(B^0) = 13336 (2045) barrel (endcap)

Acc*ε_{Ana} (B^0) = 0.76% (0.41%)

ε_{Trig} (B^0) = 62% (45%)

Some assumptions on numbers

- **For standard analysis efficiency get weighted average of barrel/endcap ones**
  - with #events in barrel/endcap as weights
- **Same trigger efficiency for B^0 and B^+ for Padova analysis**
  - We do use the same trigger for both sample
  - We look only at probe jets, no trigger bias on μ
- **$\omega_{\mu\mu}(B^0)$ [probability to mis-id as μ both daughter of a B^0] from Danek**
  - From D* (2012)
    - $\omega_{\mu}(K) = 3.18(44)e\text{-}3$
    - $\omega_{\mu}(\pi) = 1.38(36)e\text{-}3$
  - **$\omega_{\mu\mu}(B^0 \rightarrow K\pi)=4.39(0.13)e\text{-}6$ [for $K\pi$ hypotesis]**

VERY preliminary results

- **Mostly to see if we are playing in the same ballpark!**
- We predict for the standard analysis
  - **$N_{hh'}$=147'000 x $\omega_{\mu}(B^0)$ events**
    - **$N_{hh'}$ = 0.65 events in the B^0->μμ analysis**
- **Uncertainties:**
  - For our analysis:
    - Statistical ~10%
    - Systematics: hard to say, expect ~30% ???
  - From Muon-Id
    - σ_{ω} / $\omega_{\mu}(B^0)$ ~ 30%
  - **Combined:**
    - **Maybe ~50% ????**