Gruppo CMS Pixel

Luigi

CdS, 6 Luglio ‘09

Gruppo Pixel MI-Bicocca: 8.3 FTEs

Ricercatori	Qualifica	%
Cerati Giuseppe	Ass. Ric. INFN	100
Malvezzi Sandra	Prim. Ric. INFN	100
Menasce Dario	Prim. Ric. INFN	100
Moroni Luigi	Dir. Ric. INFN	100
Pedrini Daniele	Dir. Ric. INFN	100
Sala Silvano	Prim. Ric. INFN	100
Taroni Silvia	Dottorando	100

Tecnologi	Qualifica	%
D'angelo Pasquale	Tecn. INFN	100
Dini Paolo	Tecn. INFN	30

Attivita' nel 2009

- Commissioning dei Forward Pixel
  - Luigi, D'Angelo e Sala
- Interfaccia con GUI al DataBase per la gestione dell'intero sistema a pixel, Barrel & Forward
  - Menasce e Rovere
- Sviluppo, Miglioramento & Validazione del codice di ricostruzione tracce
  - Cerati e Luigi
- Analisi dati CRAFT
  - Cerati

Attivita' nel 2009

- Analisi $H/A \rightarrow \tau\tau$
  - Cerati e Malvezzi
- Analisi B_c
  - Taroni, Malvezzi e Pedrini
- Analisi $D^0 \rightarrow \mu\mu$
  - Pedrini
- SLHC
  - Abbiamo finalmente precise idee e un programma da finalizzare

MSSM Higgs $\rightarrow \tau\tau \rightarrow$ e+μ+MET analysis update

- 10 TeV run, $\int L=200\ pb^{-1}$
- Clean final state but small BR. Do not expect many events!
  - Cuts cannot be too severe
- Using TauAnalysis common software
  - Digested and customized (default cuts are for Z… a background for us).
  - Now exploiting the plenty of tools it provides!
- Can use two Skims
  - h->2tau->lepton+jet (Monica): trigger lepton + jet (ET>20, $\Delta R>0.5$, $|\eta|<2.6$)
  - h->WW->2leptons (Javier): 2 leptons, pT>(10,20), $m_{ll}>6$, $electron_{H/E}<0.5$

Signal and Background

sample	σ [pb]	BR [%]	events	L [pb^{-1}]	skim eff.	skim evts
AH→ττ→ll m=115	30.08	12.4	106650	28593	15.57%	16605
AHbb→ττ→ll m=115	53.52	12.4	2053958	309495	16.64%	341706
AH→ττ→ll m=160	6.30	12.4	105960	135637	19.82%	20996
AHbb→ττ→ll m=160	16.69	12.4	2488418	1202390	20.76%	516623
ZJets-madgraph	3700	100	1099405	297	0.86%	9419
TTJets-madgraph	317	100	1983780	6258	11.14%	220962
WJets-madgraph	40000	100	7877223	197	0.25%	20078
WW	44.8	100	204722	4570	2.72%	5562
TW	27.3	100	156952	5749	8.33%	13079
VQQ	289	100	966772	3345	1.35%	13056

Yield for 200 pb^{-1}

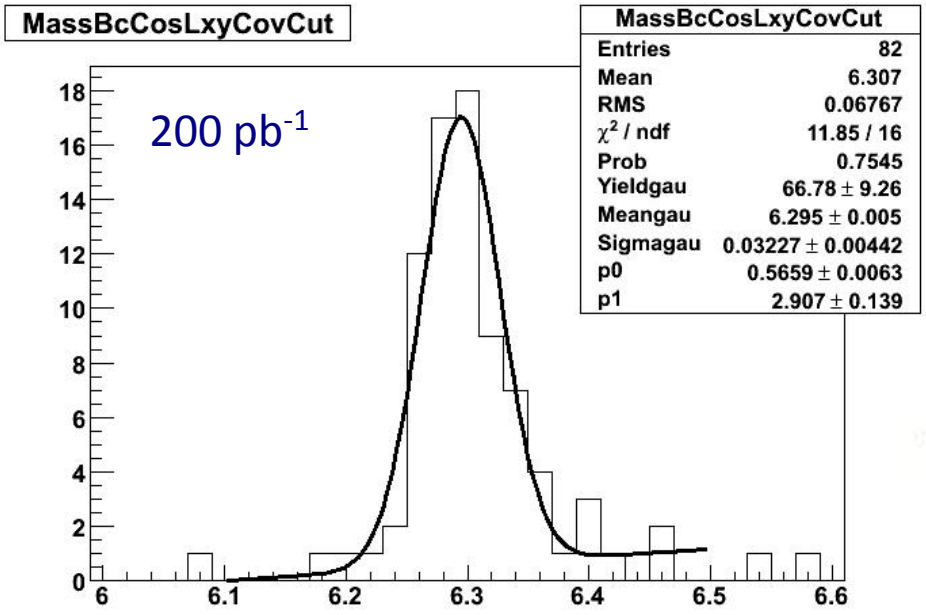
Sample	Coll. Mass	Vis. Mass
AH→ττ m=115	11.33	20.60
AHbb→ττ m=115	20.51	40.20
TOT SIGM=115	31.84	60.80
AH→ττ m=160	4.09	11.80
AHbb→ττ m=160	6.61	20.51
TOT SIG M=160	10.70	32.31
ZJets-madgraph	89.51	315.64
TTJets-madgraph	15.60	69.26
WW	1.28	10.43
TW	1.51	8.44
VQQ	1.98	5.40
TOT BKG	109.88	409.17

- Eventually, use this in conjunction with l+τ-jet channel to set a possible exclusion limit with the 200 pb^{-1} run

$B_c \rightarrow J/\psi\pi$ Analysis Status Update

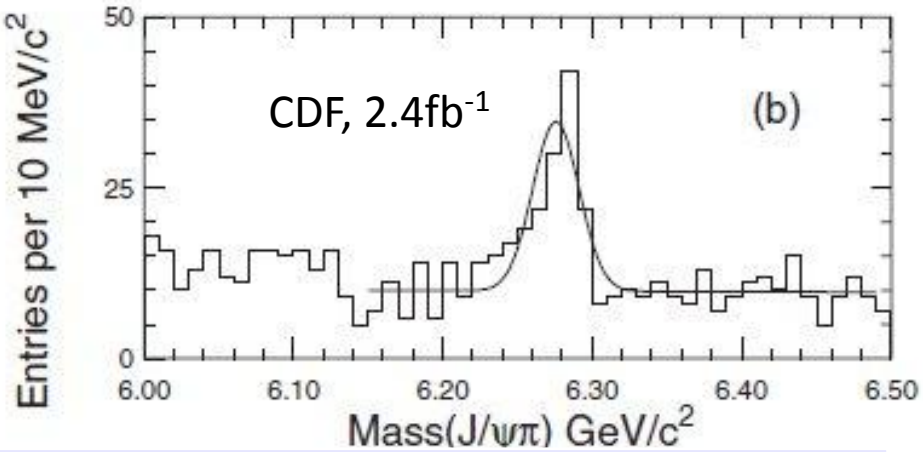
- Interesting channel:
  - Lifetime determination with a fully reconstructed invariant mass
    - So far lifetime measurement in semileptonic channel only
  - Good signature: 3 tracks
    - 2 muons from J/ψ: well detected in CMS
    - 1 charged non-muon track
- B_c are produced with a dedicated generator: completely integrated in CMSSW by Milano Group
  - BCVEGPY, see https://twiki.cern.ch/twiki/bin/view/CMS/SWGuideBcGenerator
- B_c ~70 events (ε~0.53%) @ 200 pb^{-1} with ~8 background events
- No contamination from J/ψ prompt with $l/\sigma>3$

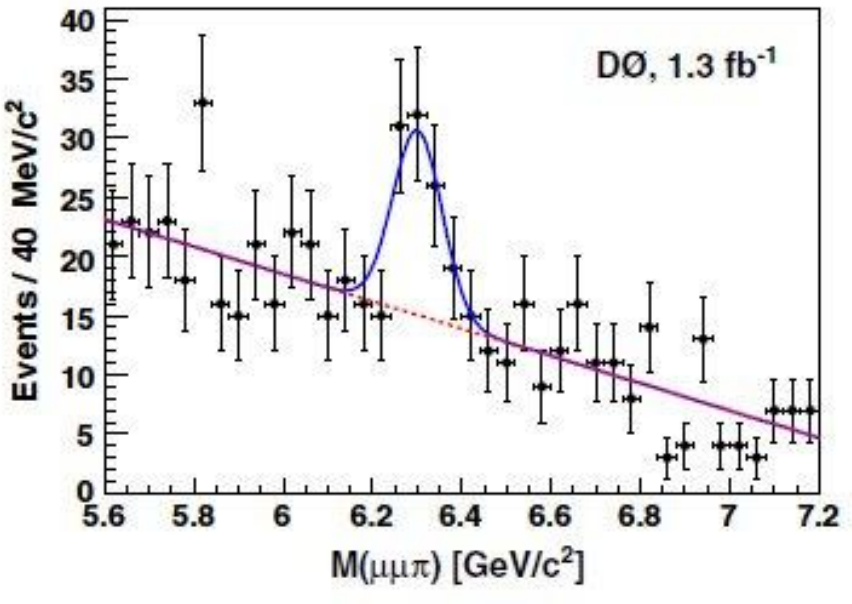
Mass



B_c:
67 ± 9 candidates

Mass = 6.295 ± 0.005 GeV/c^2
Width = 0.0322 ± 0.0044 GeV/c^2





CDF: 108 ± 15 candidates
PRL 100,182002 (2008)
Mass = 6.2756 ± 0.0029 ± 0.0025 GeV/c^2

D0: 54 ± 12 candidates
PRL 101,012001 (2008)
Mass = 6.300 ± 0.014 ± 0.005 GeV/c^2

Lifetime @ 1fb^{-1}

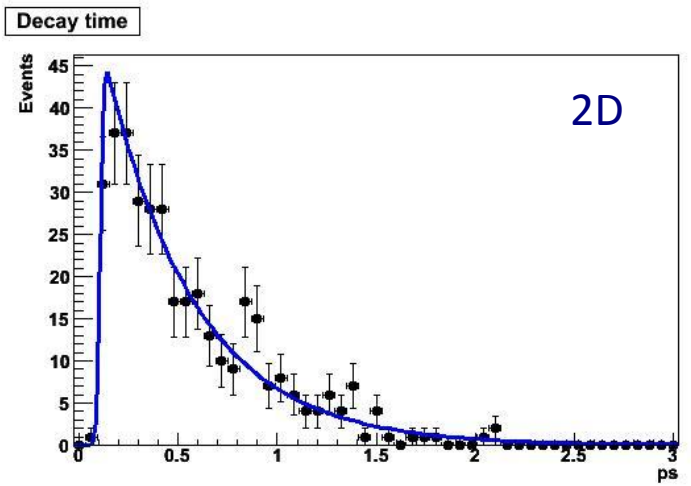
$$t^{2D}_{B_c} = \frac{m_{B_c} L_{xy}}{c P_T} \qquad t^{3D}_{B_c} = \frac{m_{B_c} L_{xyz}}{c P}$$

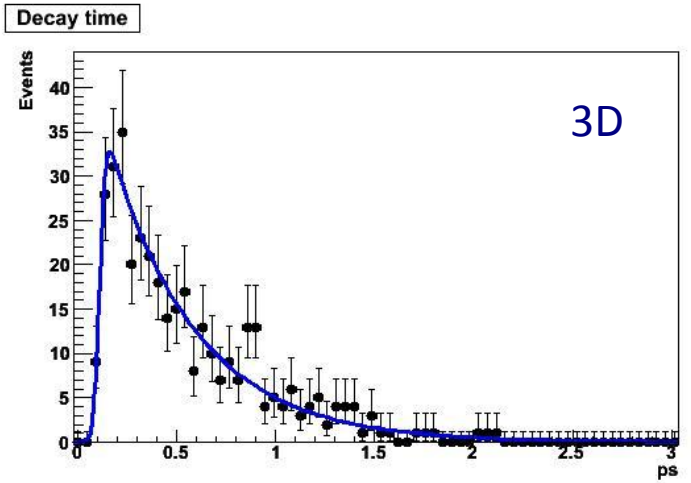
- With events in the mass peak surviving the L/σ>3 cut, we can obtain a preliminary result, using the fitting function:

$$F = N\, G(t) \otimes e^{-t/\tau}$$

- 2D: $\tau = 0.455 \pm 0.025$ ps
- 3D: $\tau = 0.441 \pm 0.025$ ps

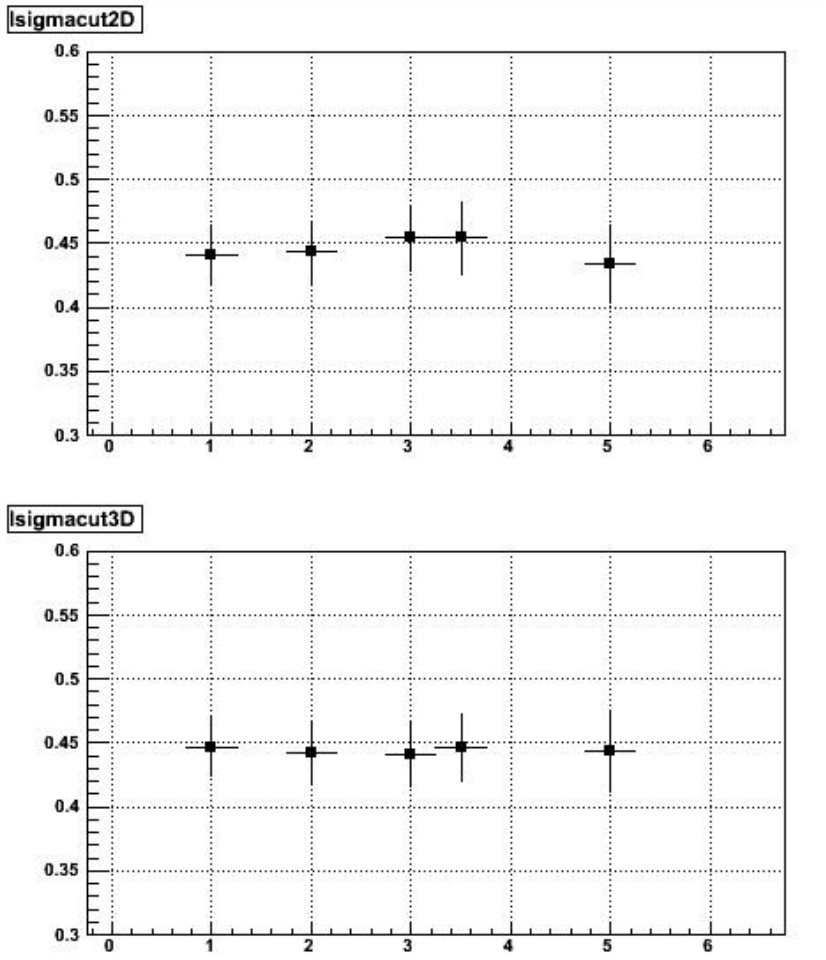
  - Input from PDG(2008): 0.46±0.07 ps





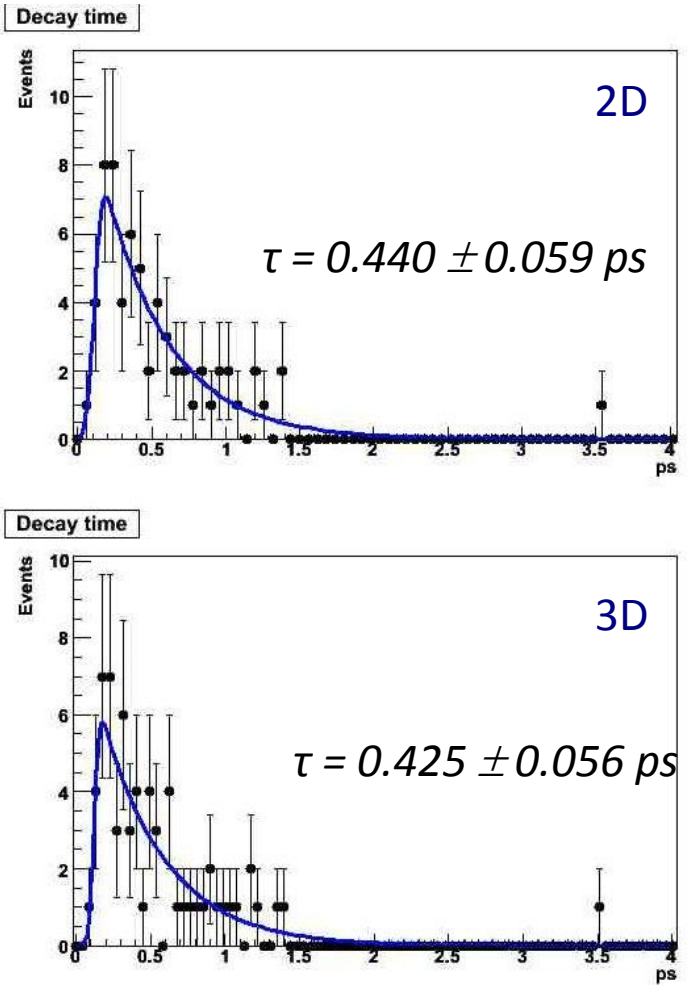
Stability against L/σ cut

- At this statistics, the result is stable vs the L/σ cut



Lifetime from 200pb^{-1}

- Even at this statistics the measurement is consistent with the input value of 0.46 ps
- Need additional investigation

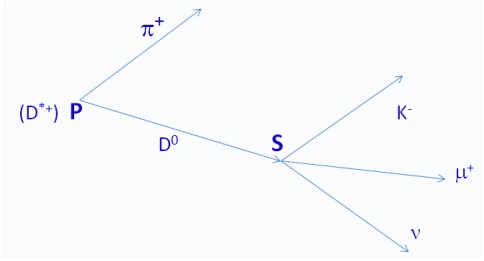


$D^0 \rightarrow \mu^+\mu^-$ analysis

- in the $D0 \rightarrow \mu+\mu-$ analysis one needs a normalization decay mode
- the CMS HLT triggers reduces strongly the hadronic decay modes (for example the mode $D^0 \rightarrow \pi^+\pi^-$ is selected by "HLT_Mu3" only at the level of 1%)

Solution: normalize with the semileptonic decay $D^0 \rightarrow K^-\mu^+\nu$

(using of the tecnique described by E691)



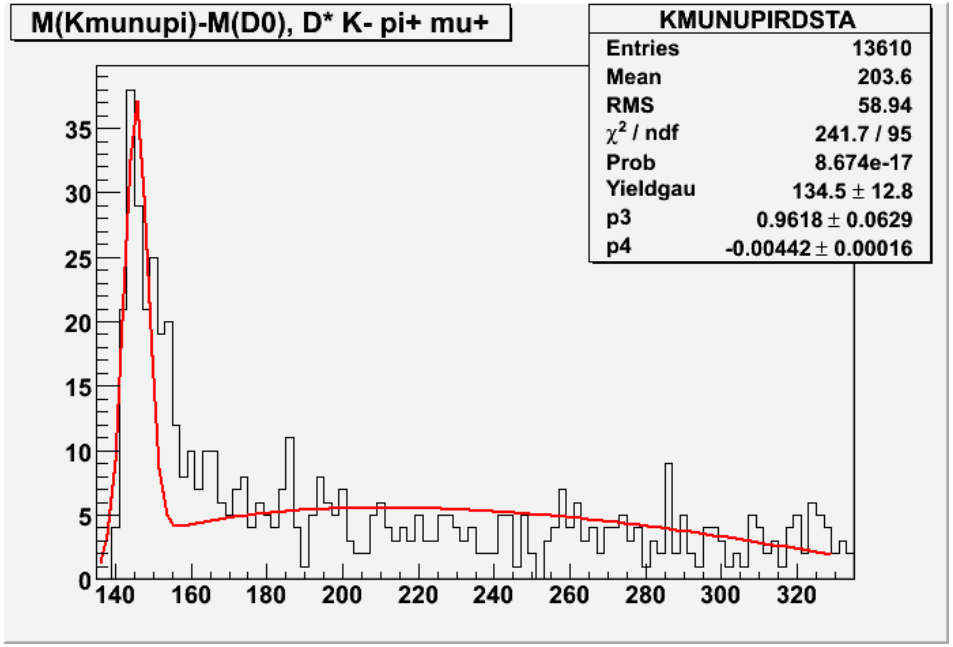
- pros: this semileptonic mode has a direct link with the HLT used
- cons: presence of the neutrino $\rightarrow$ lower reconstruction efficiency

$D^{*+} \rightarrow D^0(K^-\mu^+\nu)\,\pi^+$ analysis

5960000 events generated, 109317 $D^0 \rightarrow K^-\mu^+\nu$ filtered

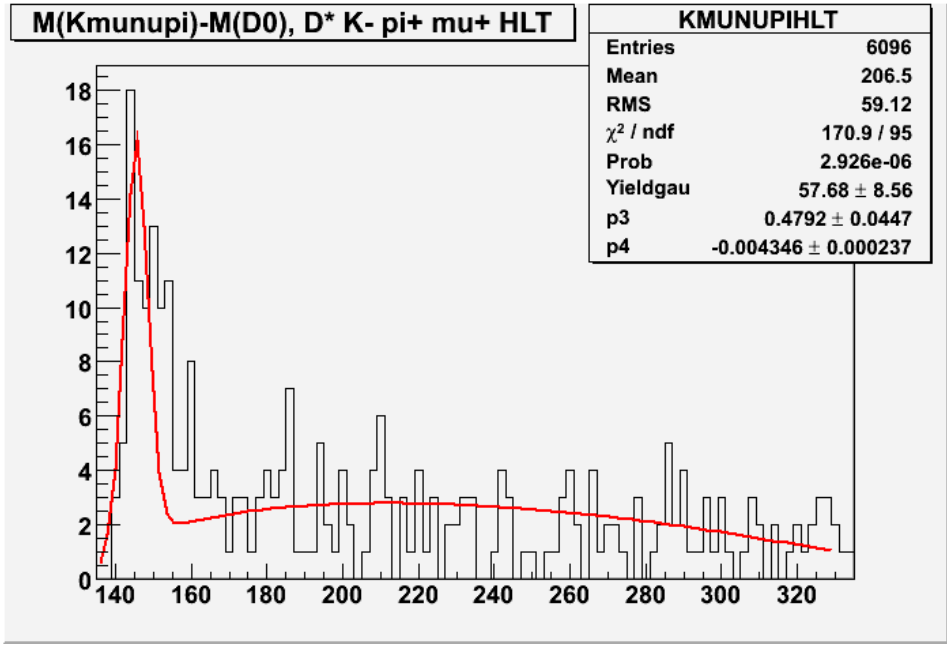
More statistics is probably necessary!

134 D^{*+} candidates without HLT_Mu3 trigger



$\Delta M = M(D^{*+}) - M(D^0)$ MeV

58 D^{*+} candidates with HLT_Mu3 trigger



$\Delta M = M(D^{*+}) - M(D^0)$ MeV

trigger "HLT_Mu3" selects ~43% of the candidates

$D^0 \to \mu^+\mu^-$ in CMS

Upper limit estimate

so with $L_{int} = 100\ pb^{-1}$ at $\sqrt{s} = 10$ TeV

$$B(D^0 \to \mu^+\mu^-) \leq B(D^0 \to K^-\mu^+\nu) \times N(\mu\mu)/N(K\mu\nu) \times \varepsilon_{tot}(K\mu\nu)/\varepsilon_{tot}(\mu\mu) \times a(K\mu\nu)/a(\mu\mu)$$

$$B(D^0 \to \mu^+\mu^-) \leq 3.31\times10^{-2} \times (2.7\times10^{6})^{-1} \times 5.4\times10^{-2} \times 0.77 \sim$$

$$\sim 5.1 \times 10^{-10}$$

Richieste (quelle vere!)

- MI
  - 8FTE×1.5 k€/FTE=12k€
- ME
  - Metabolismo: 8FTE×1.0 mu/FTE=8mu
  - MoA:8FTE ×2.0weeku/FTE=4mu
  - Pixel Maintenance&Support: 4mu
  - Pixel DB e DQM:4mu
  - Physics Analysis:3FTE ×1.0 mu/FTE=3mu
  - R&D for Phase1 Forward Pixels (preparazione rivelatori e testbeam per pixel in diamante): 4mu
  - SLHC Upgrade Activity: 2mu
- Cons
  - Metabolismo: 8FTE×1.5 k€/FTE=12k€
  - Test Station for Diamond Pixel R&D: 4k€
- Inv
  - ???
    - Devo capir meglio le nostre necessita' per il calcolo e/o eventuale strumentazione