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PRC Referee Meeting
DESY-HH

J/ψ analysis status

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Outline

* Total statistics available
* J/$\psi \rightarrow \mu^+\mu^-$ analysis status
* J/$\psi \rightarrow e^+e^-$ analysis status and Electron particle identification
* Conclusions

Major data sets, 2000

Type	Start	Stop	Trigger			Events	Time (min)	
			Pre	FLT	SLT	$\cdot 10^6$	total	live
Min Bias	10 Apr	14 Apr	-	-	-	2	2000	-
Di-lepton	29 Apr	13 Jun	E	-	V,2	12	10387	7508
Di-lepton	15 Jun	27 Jun	E	-	OV,2	1	1385	953
Di-lepton	28 Jun	16 Aug	Eμ	-	OV,2	3.7	9363	4853
Hard γ	17 Aug	17 Aug	E	-	-	0.6	390	375
Single lepton	17 Aug	18 Aug	μ	1	OV,1	1.4	362	116
Di-lepton	18 Aug	18 Aug	Eμ	2	OV,2	0.4	470	390
Di-lepton	18 Aug	22 Aug	Eμ	1	OV,2	1.0	1297	995
Single lepton	24 Aug	25 Aug	Eμ	1	OV,1	3.1	831	465

Notes

Interaction rate: mainly 5 MHz, except Single lepton: 2 MHz

Pretriggers: E $\Rightarrow$ ECAL, $\mu \Rightarrow$ Muon

FLT: 1 $\Rightarrow$ 1 track

SLT:
- 1 $\Rightarrow$ 1 track, 2 $\Rightarrow$ 2 tracks
- V $\Rightarrow$ Vertex detector tracking
- O $\Rightarrow$ Outer tracker tracking

Status of the analysis

Type	Events	Reprocessing	Status
Min Bias	2	I	***
Di-lepton I	4.3	I	**
Di-lepton II	7.7	I-	*
Di-lepton Slicer e	1	-	*
Di-lepton Slicer e-μ	3.7	II	***
Hard γ	0.6	-	*
Single lepton I	1.4	II	**
Di-lepton FLT	0.4	-	*
Di-lepton FLT	1.0	-	*
Single lepton II	3.1	II	**

Notes

Reprocessing:
I = First reprocessing (June-July)
II = Second version (end of August)

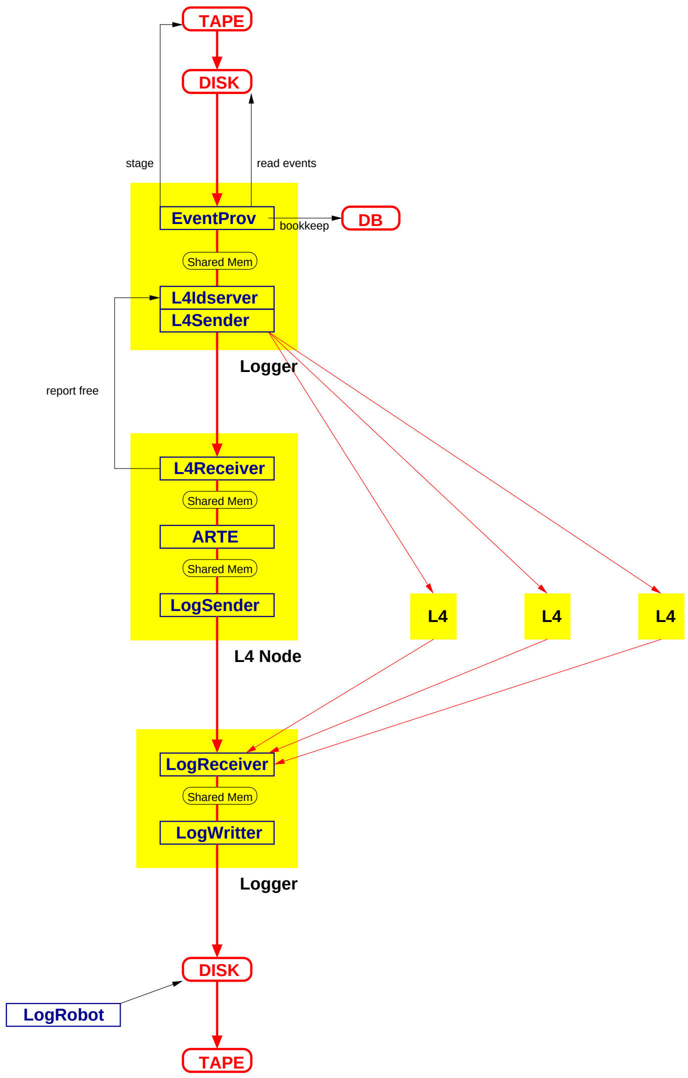
Status:
(*) beginning, (**) first results, (***) advanced

Analysis scheme

Usually the events are processed and reconsrtructed directly at 4LT and the DST are saved on tape.
Selection of interesting events stored on disk (due to limited disk space)
$\rightarrow$ Actually selection of half of the Di-Lepton statistics directly accessible

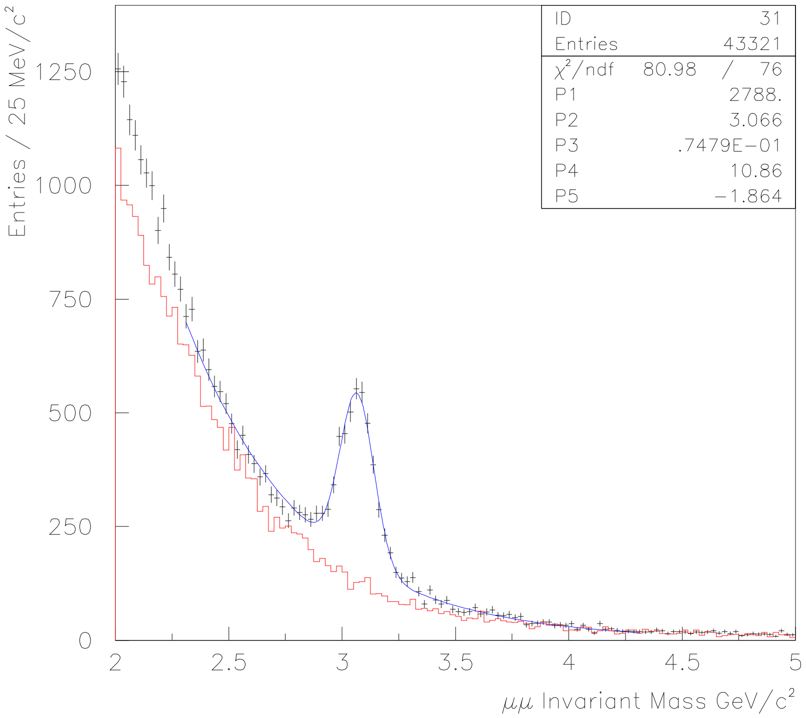
When new reconstruction codes or new calibration/alignment files are available the data are staged again on disk and reprocessed, exploiting the DAQ scheme.

Reprocessing scheme



$J/\psi \rightarrow \mu^+\mu^-$

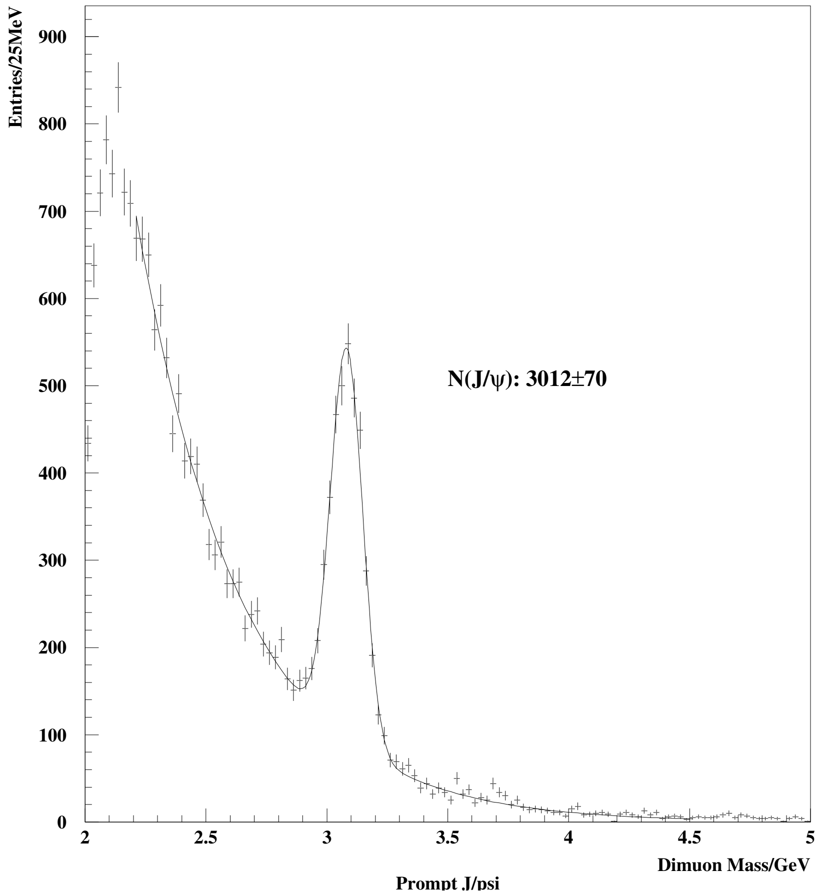
Analysed most of the statistics ($\sim$ 80%). On this sample most of the software tools were developped and tuned.
First approach was to use the SLT information for J/ψ reconstruction:



On the same sample the secondary vertex distribution was studied.

$J/\psi \rightarrow \mu^+\mu^-$ - II

Reanalysis with seeded reconstruction code: tracks required to matched with SLT ones using "χ^2" in VDS and OTR, estimated total selection efficiency: 97%.

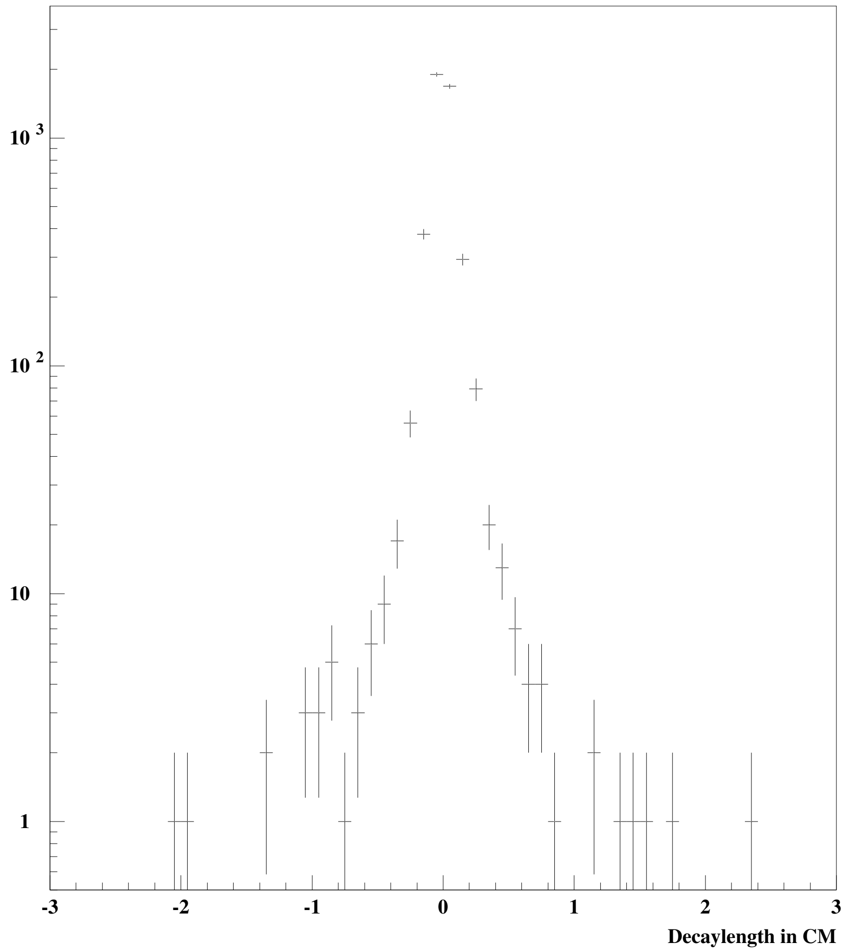


Number of J/ψ found: 3012 ± 70

Mass resolution: 65 MeV

Detached vertices

Decaylength for dimuon events using geometrical fit:
2.9 GeV<mass<3.3 GeV



10 events with decaylength larger than 1cm.

9 events with decaylength less than -1cm.

MonteCarlo efficiency

Monte Carlo simulation includes full SLT+RECO chain.

Muon inefficiencies are not in - assumed to be the same for prompt J/ψ's and B decay.

Prompt J/ψ efficiency:ϵ_{prompt}=6.7%
B →J/ψ efficiency: 7.3%

Taking into account the effects of dead channels in MUON and OTR, the Muon Pad efficiency the prompt J/ψ efficiency is decreased to ϵ_{prompt} ∼1.3%.

The B →J/ψ efficiency is decreased by a factor ~ 2 for $\Delta z \geq$ 0.5 cm and by a factor ~ 3 for $\Delta z \geq$ 1.0 cm.

$\mathbf{J}/\psi \rightarrow e^+e^-$

Analysed $\sim$ 45% of the statistics exploiting the selected events present on disk.

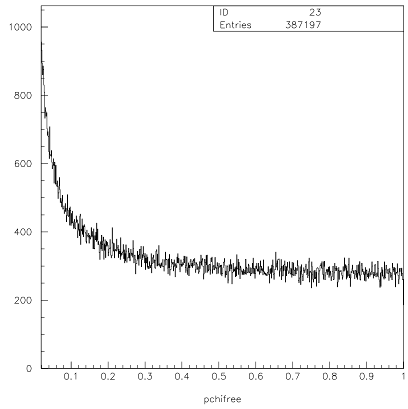
Applied the following cuts in reconstruction:

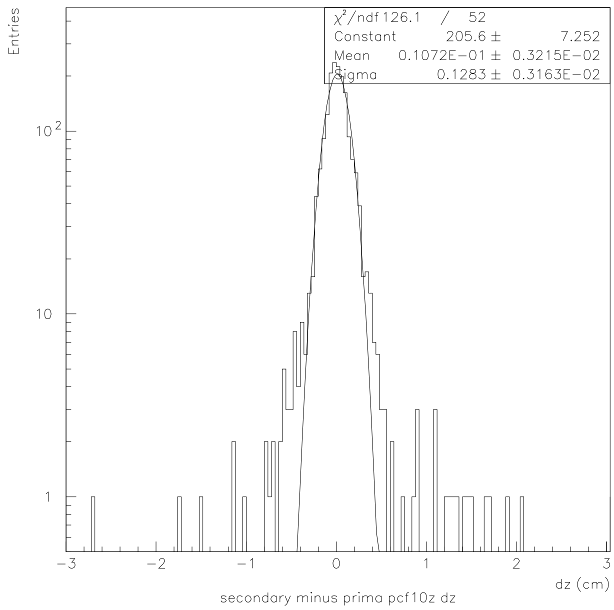
$$E_T \geq 1\, GeV/c \; ;$$
$$|e/p - 1| \leq 0.3 \; ;$$
$$\chi^2(vertex) \leq 8$$

The electron identification mainly using bremsstrahlung. The data were submitted to the same procedue for searching detached veritces.

Detached vertices

Decaylength for electron events using geometrical fit:
2.9 GeV<mass<3.3 GeV





27 events with decaylength larger than 0.5cm (Downstream)

22 events with decaylength less than -0.5cm (Upstream)

Detached vertices without BR

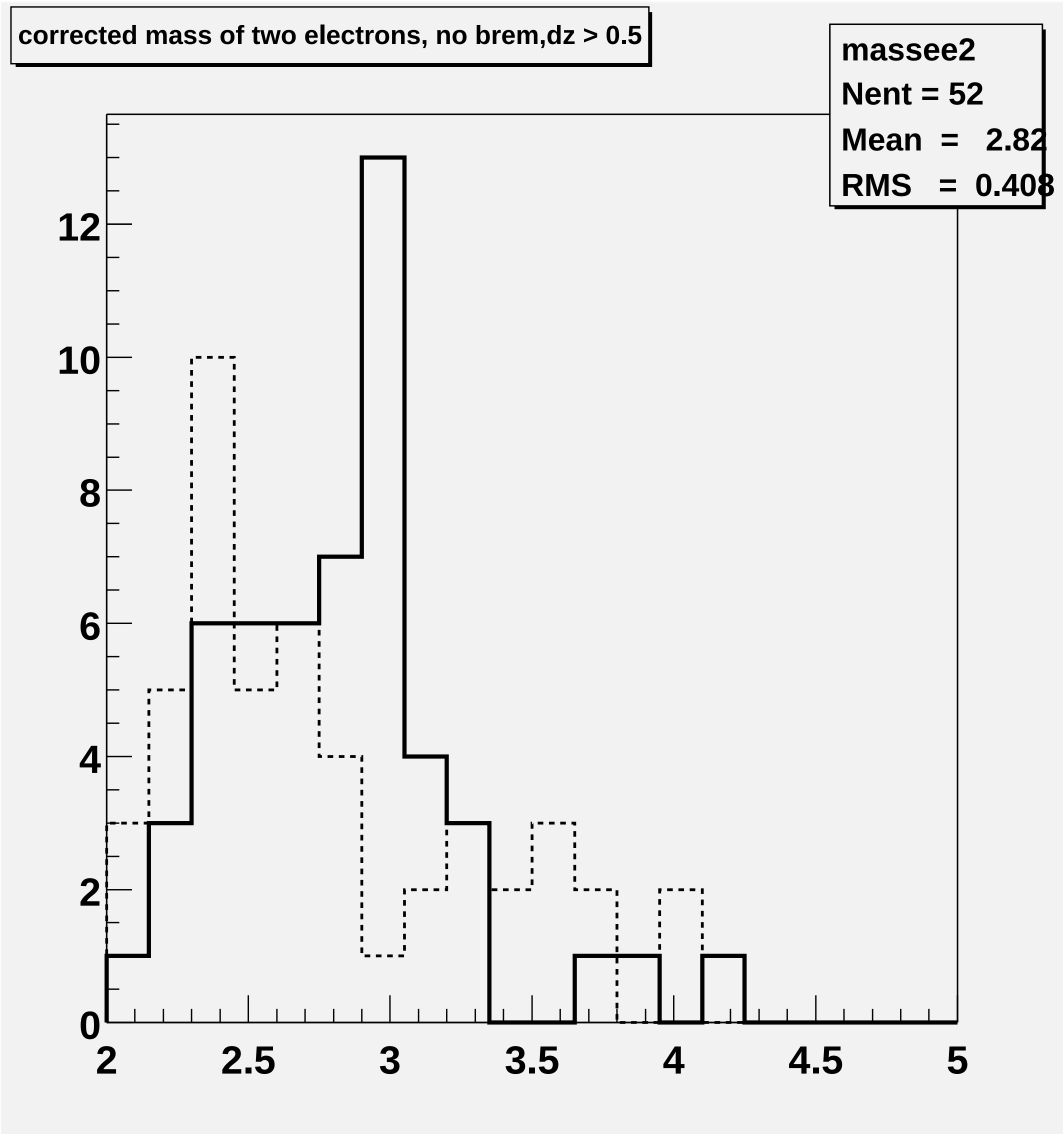
Applied a different strategy in the secondary vertex search:

- same cuts for event selection, but NO Bremsstrahlung request

- number of tracks in the primary vertex greater than 6

- Check if extra tracks are attached to the dilepton vertex and require the following cut is fullfilled: $1 \leq N_{EXTRA} \leq 4$

- plot the dilepton invariant mass distribution for secondary vertices sitting upstream [-3:-0.5]cm and downstream [0.5:3]cm.


corrected mass of two electrons, no brem,dz > 0.5
massee2
Nent = 52
Mean = 2.82
RMS = 0.408
0
2
4
6
8
10
12
2
2.5
3
3.5
4
4.5
5

Electron ID

Different electron ID method are under investigation. Mainly:

- E/P: the widrh of the distribution is too large due to momentum measurement, ECAL elctronic noise $\rightarrow$ calibration.
  Under development but not yet finalized.

- Cluster shape in ECAL: affected by electronic noise at the moment.

- Early showering in OTR: it looks for many hits in the OTR close to the electron track.
  Not working at the moment: it needs more investigations.

- Early showering in RICH: it counts the number of photons in β=1 rings, because the shower electrons are traveling in parellel.
  Promising: it can identify electrons with $\sim 27\%$ efficiency. $\rightarrow$

B cross section perspectives

- From the Muon Di-Lepton sample we can expect $\sim$ 4000 prompt J/ψ
- From the Electron Di-Lepton samples we can expect $\sim$ 20000 prompt J/ψ requiring at least 1 BR
$\rightarrow$ $\sim$ 40000 prompt J/ψ on tape.

- Taking into account al possible losses, we can estimate, in a conservative way, to be able to reconstruct $\sim$ 30000 prompt J/ψ from the available samples.

- For $\sigma_{b\bar{b}} \sim 12nb$ / $nucleon$ the production ratio between prompt and J/ψ from $b\bar{b}$ is $\sim$ 1500.

- Taking into account a loss of a factor $\sim$ 2 due to the decay lenght cut we can estimate:

$$N_{J/\psi}\,(b\bar{b}) = \frac{N_{J/\psi}\,(prompt)}{1500 \cdot 2} \sim 10$$

the precision on the measurement can be improved by studying B semileptonic decays.

- The final statistics and consequently the measurement precision is depending on the $\sigma_{b\bar{b}}$ value, wher the theoretical previsions are ranging from 8 nb up to 62 nb.

Summary

- Large progresses have been made in the last months in understanding the data
- The analysis of the Muon sample is advanced, most of the software tools have tuned on these data
- The analysis of the electron sample is started
- The optimization of the electron identification is ongoing: different approaches are under study
- A reprocessing procedure to improve the quality of reconstructed data has been set up
- The measurement of the $b\bar{b}$ cross section is still possible even if the statistics is at the limit