Studies of ω(782)->$\pi^0\gamma$ in pp collisions at $\sqrt{s_{NN}}$ = 7 TeV with ALICE electromagnetic calorimeters

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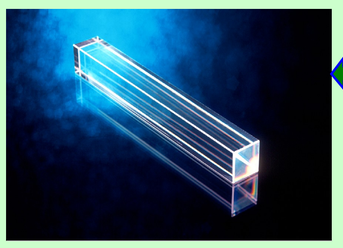
1 Physics motivation

- Test of pQCD
- Probe the properties of hot-dense matter created in heavy-ion collisions
- A comprehensive study with two other decay channels of $\pi^0\pi^+\pi^-$ and e+e-
- Feasibility study of the mass shift for the vector meson

2 ALICE electromagnetic calorimeters: PHOS and EMCAL

PHOS -- PHOton Spectrometer
EMCAL -- ElectroMagnetic CALorimeter

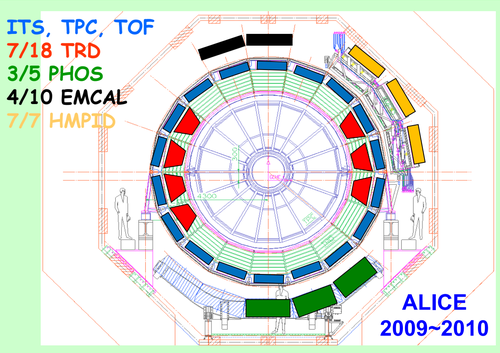


PbWO4 crystal

EMCAL module

- Sandwich of lead/scintillator
- 77 layers
- with optic fibers traversing them

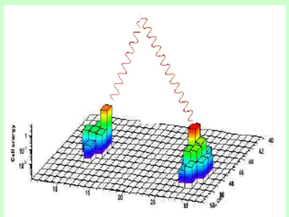
	Material	|η|	Δφ	Granularity	Resolution	
					Energy(GeV)	Position(mm)
PHOS	PbWO4	<0.12	100	0.004*0.004	3.3%/√E⊕1.1%	0.7⊕2.3/√E
EMCAL	PbSc	<0.7	100	0.0143*0.0143	11%/√E⊕1.7%	1.5⊕5.3/√E



Poster by: Bjorn S. Nilsen, The ALICE EMCal overview and status

3 Extraction methods

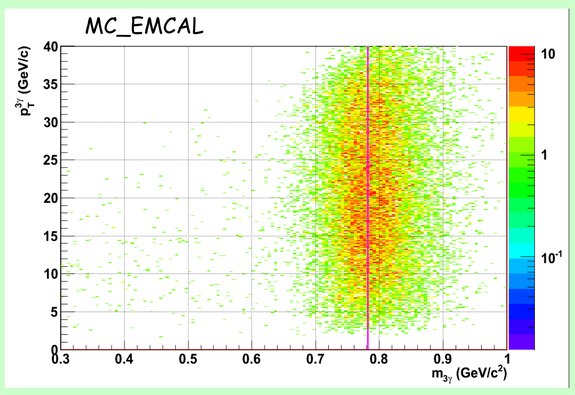
Depending on the p_T reach, three methods are used for π^0 extraction.



PHOS → 25 → 50 →
Invariant mass analysis → Shower shape → Isolation cut methods
EMCAL → (6~10) → 20 →
p_T (GeV/c)

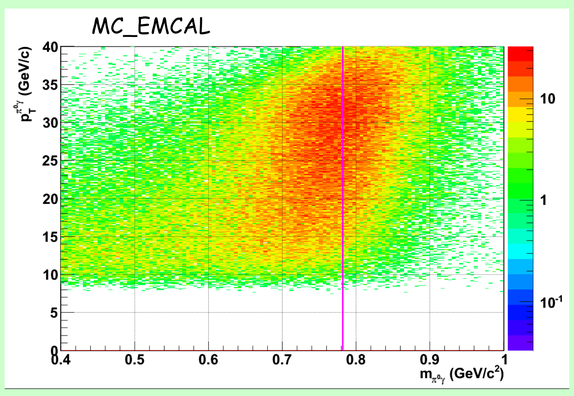
Method 1. ω(782)->$\pi^0\gamma$->3γ

- Construct the π^0 candidates
- Loop the π^0 candidates with the third photon in an event to reconstruct the invariant mass of 3γ



Method 2. ω(782)->$\pi^0\gamma$

- Without cluster unfolding
- Assume the high p_T clusters (> 25GeV/c for PHOS and > 6 GeV/c for EMCAL) are overlapped by two decay photons from π^0
- Loop the assumed π^0 candidates with the second photon in an event to reconstruct the invariant mass of $\pi^0\gamma$

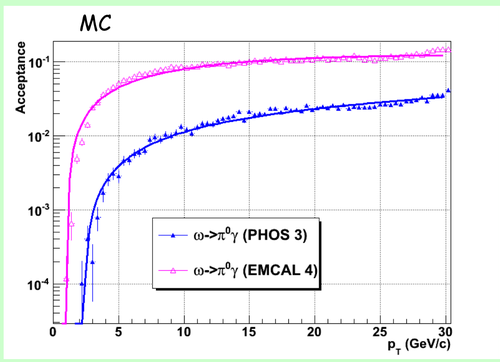


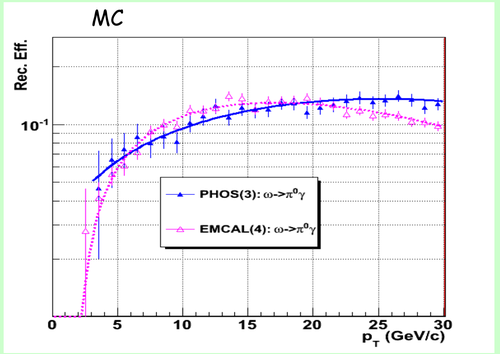
4 Expected yield

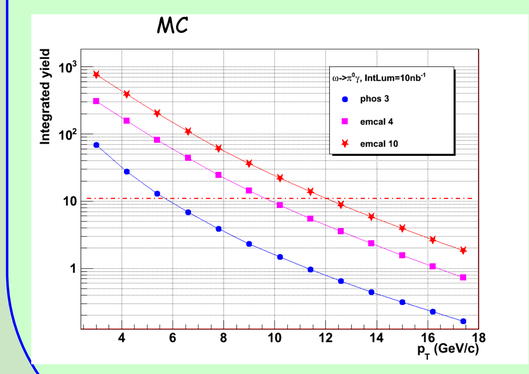
$$E\frac{d^3\sigma}{dp^3} = \frac{1}{2\pi p_T}\frac{d^2\sigma}{dp_T dy} = \frac{1}{2\pi p_T}\frac{d\sigma}{dp_T}\Big|_{\Delta y=1}$$

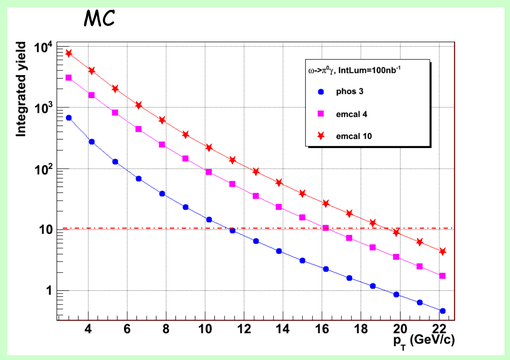
$$\frac{dN}{dp_T} = \mathcal{L}_{int}\cdot A\cdot\epsilon\cdot Br\cdot\frac{d\sigma}{dp_T}$$

- The invariant cross section is estimated by PYTHIA Simulation
- The new cluster finding and unfolding algorithms will enhance π^0 extraction
- Two integral luminosities of 10 nb^{-1} and 100 nb^{-1} are used for the estimation
- Suppose the dN/dp_T> 10 is measurable
- We could reach a p_T up to 15~20 GeV/c





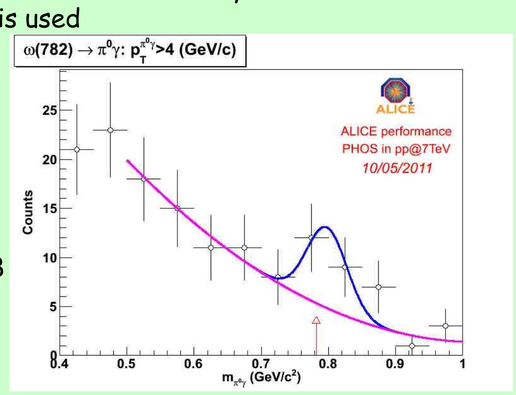


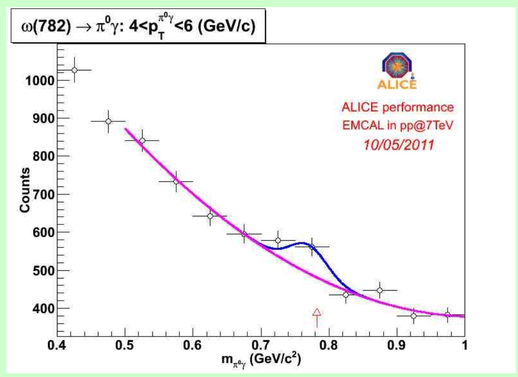


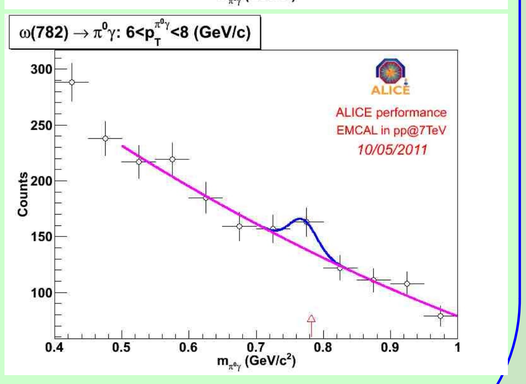
5 Results from pp@7TeV

- π^0 and η have been measured for both calorimeters
  - *Posters by: Olga Driga, Paraskevi Ganoti, Yuri Kharlov*
- 170 million min-bias events in pp collisions at 7 TeV are analyzed
- ω(782)->$\pi^0\gamma$->3γ invariant mass analysis is used

- Cluster/photon selection
  - Track matching: ΔR > 8 cm
  - Cell multiplicity of cluster: > 2cells
  - Cluster p_T: > 0.3 GeV/c
  - Distance to bad channel: > 1 cell size
  - Energy asymmetry cut of π^0->2γ: <0.8







- Clusterizers and unfolding for EMCAL
  - *Poster by: Ermes Braidot and Fengchu Zhou*

6 Conclusions

- The 3γ decay channel has been validated and estimated by simulation
- The ω(782) peaks have been observed from data

A Large Ion Collider Experiment
European Organisation for Nuclear Research
QUARK MATTER 2011
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