Beam BG effect in mass difference($m_{\mu\mu\gamma}$-$m_{\mu\mu}$) $B^+ \rightarrow \chi_{c1} K^+$

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@ECL parallel session

2008 July 4th

γ detection under higher Higher beam BG

- High energy region(~2GeV):
  - Tested by $B^0 \rightarrow K_S \pi^0 \gamma$ decay by Y.Ushiroda
- Low energy region(~100MeV):
  - Tested by $B \rightarrow D^{*0} K$, $D^{*0} \rightarrow D^0 \pi^0$, $D^0 \gamma$ by P.Krokovny.

- What decay mode is functional as a benchmark for intermediate energy γ (a few×100MeV)?

Event generation

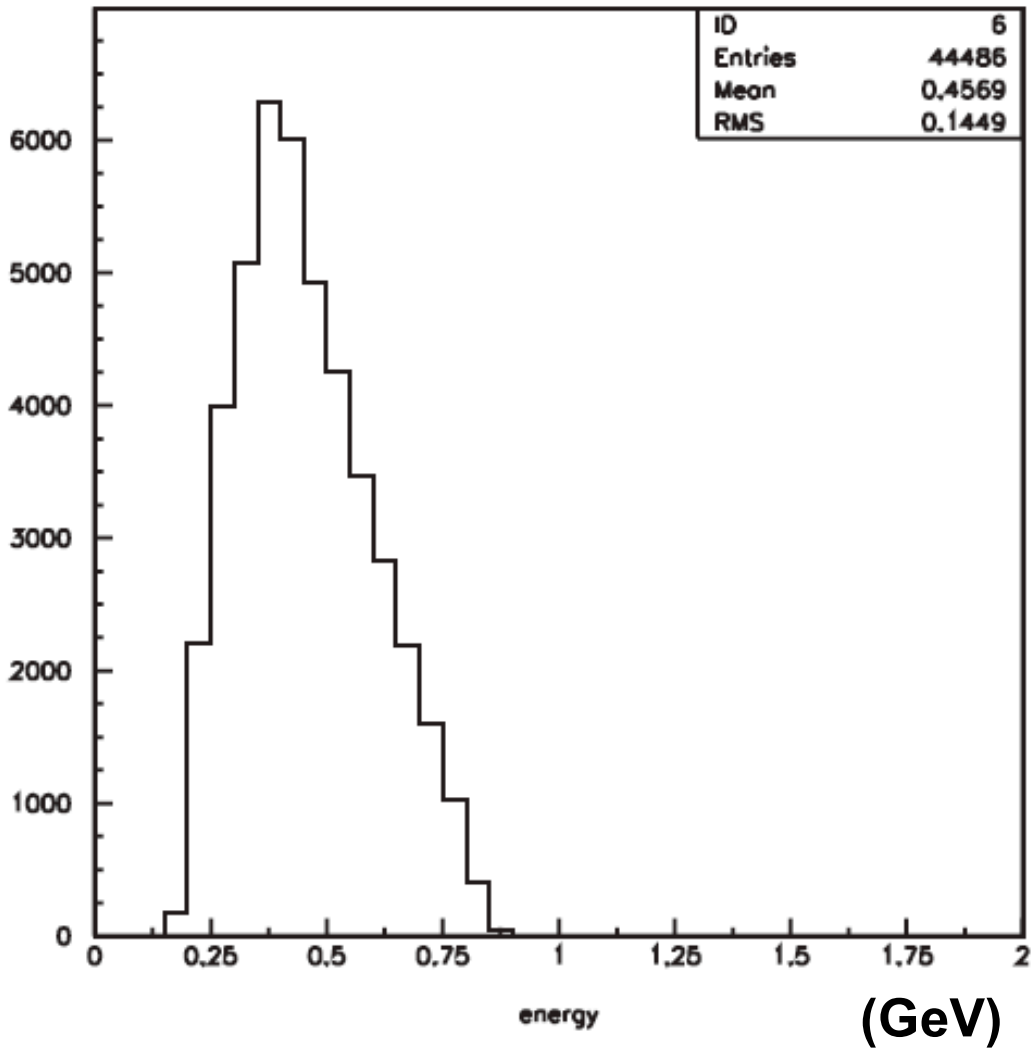
In order to check intermediate energy photon's efficiency and resolution;

$B^+ \rightarrow \chi_{c1} K^+$
$\chi_{c1} \rightarrow J/\psi \gamma$
$J/\psi \rightarrow \mu^+ \mu^-$

(Other B generic decay)

What happen in x3 beam b.g.?
Effect of endcap pure CsI?
100k events are processed for several cases.

Energy distribution of γ

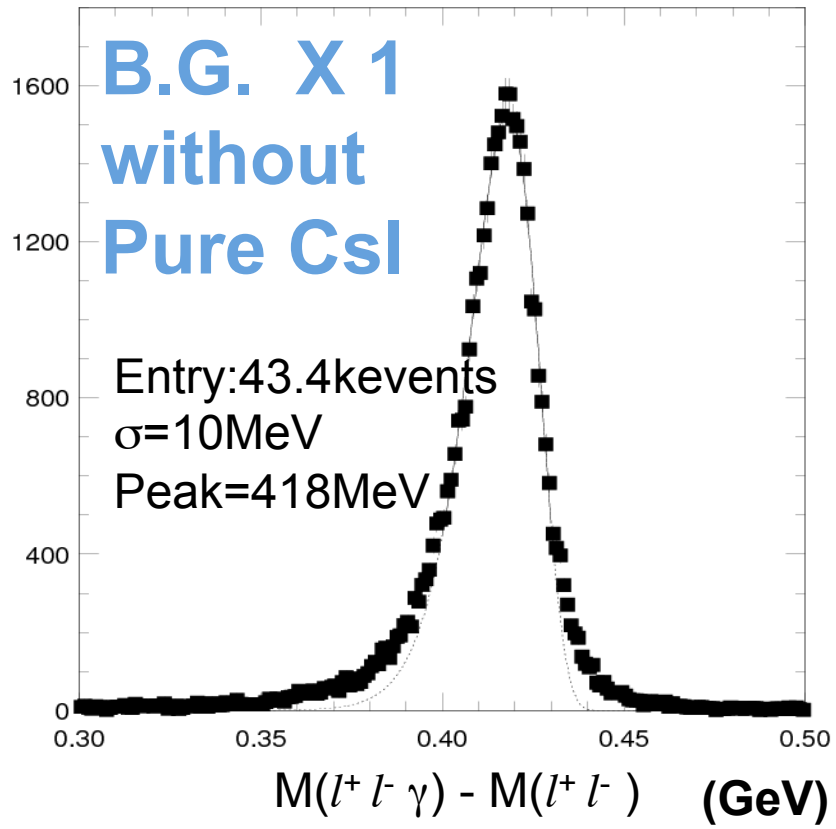


The energy range is intermediate; from 0.25GeV up to 0.8GeV in lab. frame.

Select correct combination of $l^+ l^- \gamma$ by generator information and see mass difference.
Core part of the distribution is fitted with Logarithmic Gaussian.

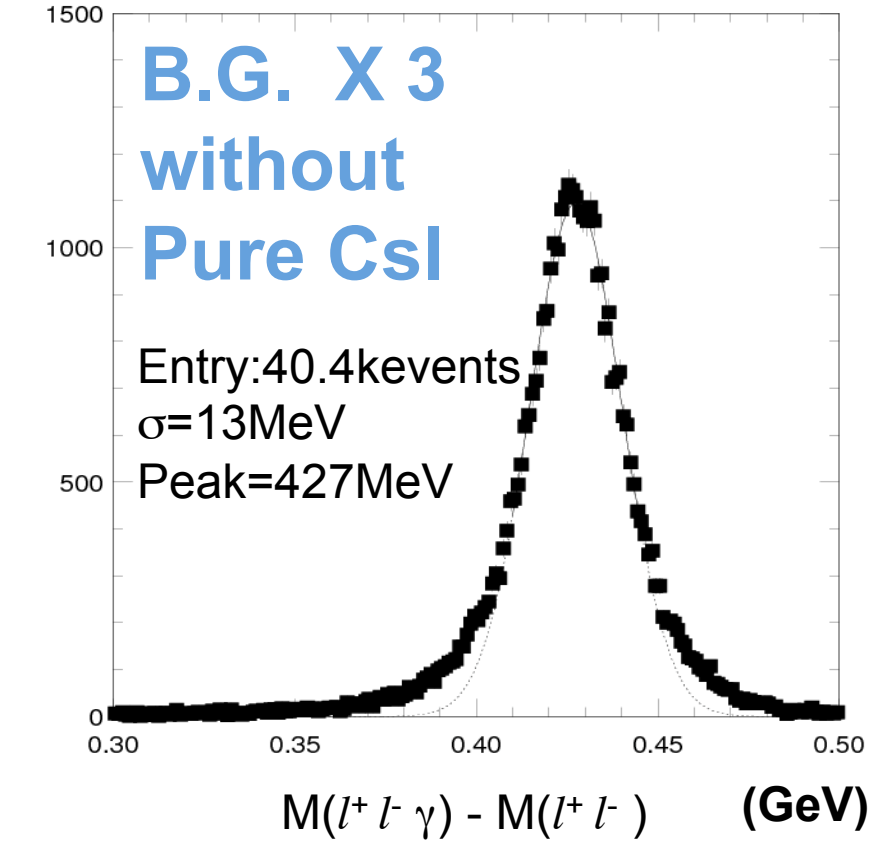
MINUIT Likelihood Fit to Plots
M(jpsi-gamma)-M(jpsi)_2
File: reconc1_100.hbk 10-JUN-2008 16:43
Plot Area Total/Fit 43387. / 32369. Fit Status 0
Func Area Total/Fit 37282. / 32362. E.D.M. 1.00
Likelihood = 44.1
χ^2= 43.5 for 30 - 4 d.o.f., C.L.= 1.7%

Errors		Parabolic		Minos		
Function 1: LOGGAUSS						
* NORM	37282.	± 273.9	-	270.2	+	0.000
* MEAN	0.41809	± 1.3977E-04	-	1.4357E-04	+	0.000
* SIGMA	9.55630E-03	± 8.8105E-05	-	0.000	+	8.9407E-05
* ASYM	0.25293	± 2.1921E-02	-	2.2524E-02	+	0.000

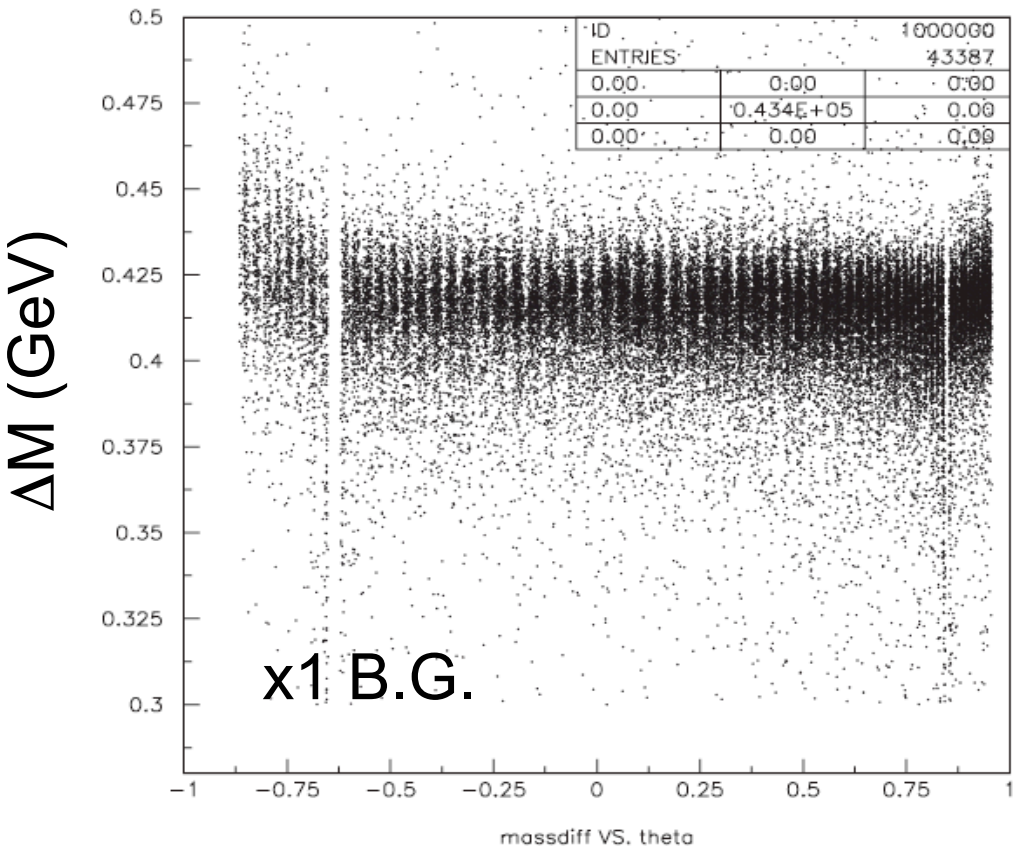


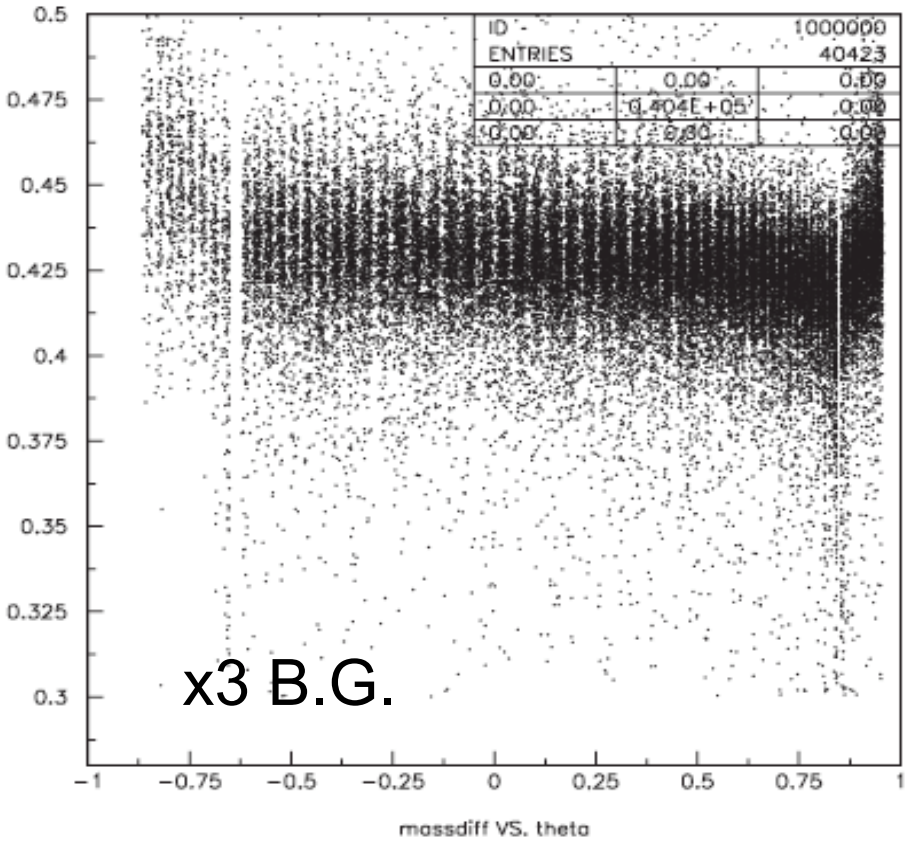
MINUIT Likelihood Fit to Plots
M(jpsi-gamma)-M(jpsi)_2
File: reconc3_100.hbk 10-JUN-2008 17:01
Plot Area Total/Fit 40423. / 28988. Fit Status 0
Func Area Total/Fit 34826. / 28985. E.D.M. 1.00
Likelihood = 40.9
χ^2= 40.5 for 35 - 4 d.o.f., C.L.= 11.8%

Errors		Parabolic		Minos		
Function 1: LOGGAUSS						
* NORM	34826.	± 178.8	-	0.000	+	0.000
* MEAN	0.42746	± 1.5656E-04	-	1.1828E-04	+	0.000
* SIGMA	1.26857E-02	± 1.7924E-05	-	0.000	+	0.000
* ASYM	2.86289E-03	± 4.0126E-06	-	0.000	+	0.000



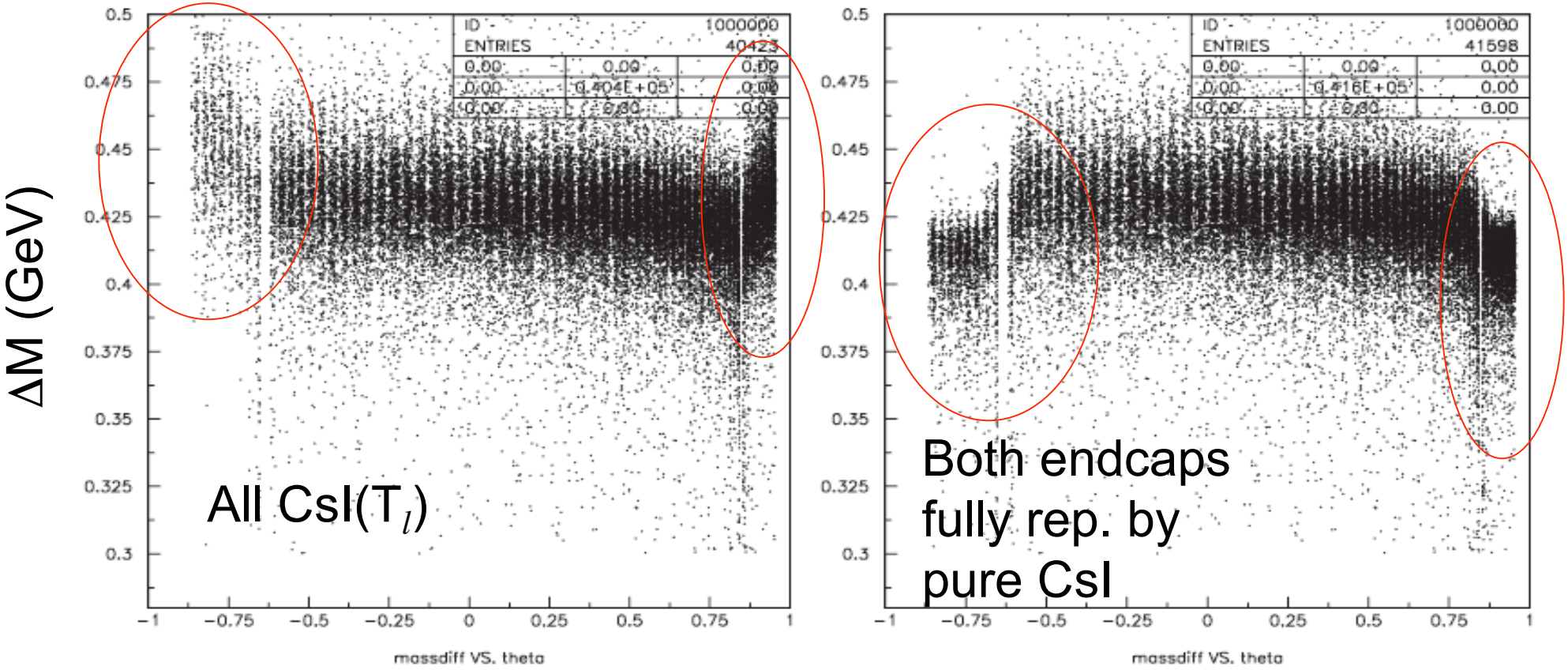
ΔM vs cosθ x1 and x3 B.G.





Energy scale shift is seen.

ΔM vs cosθ in x3 B.G.

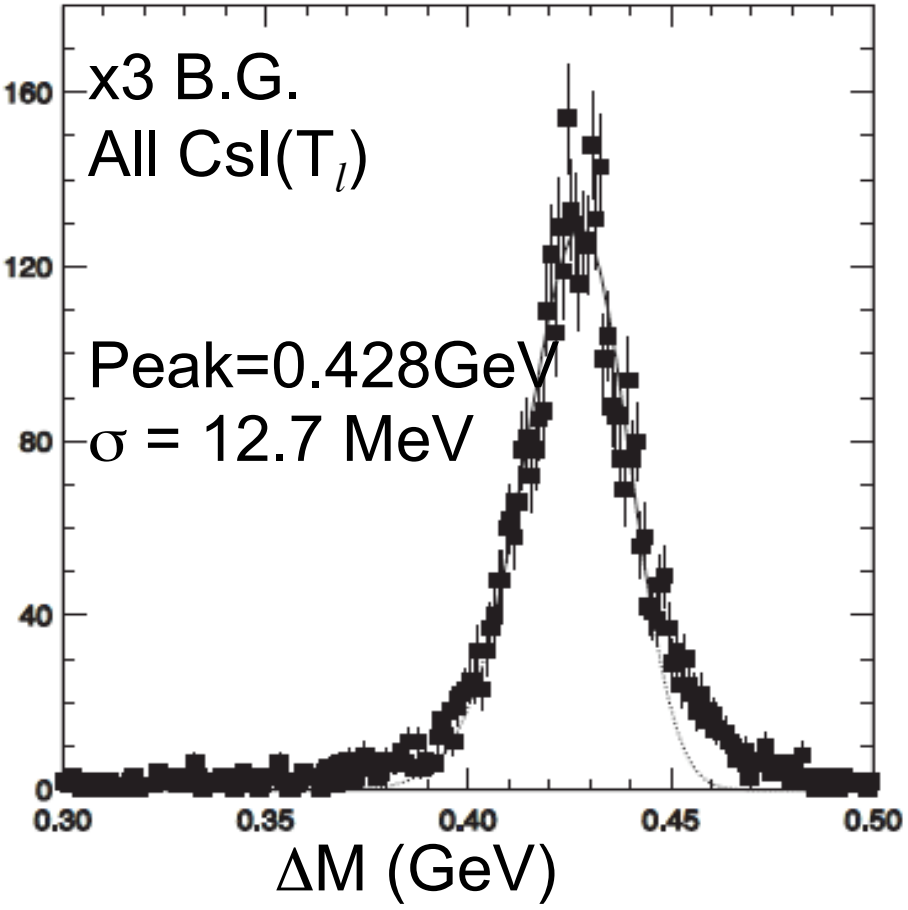


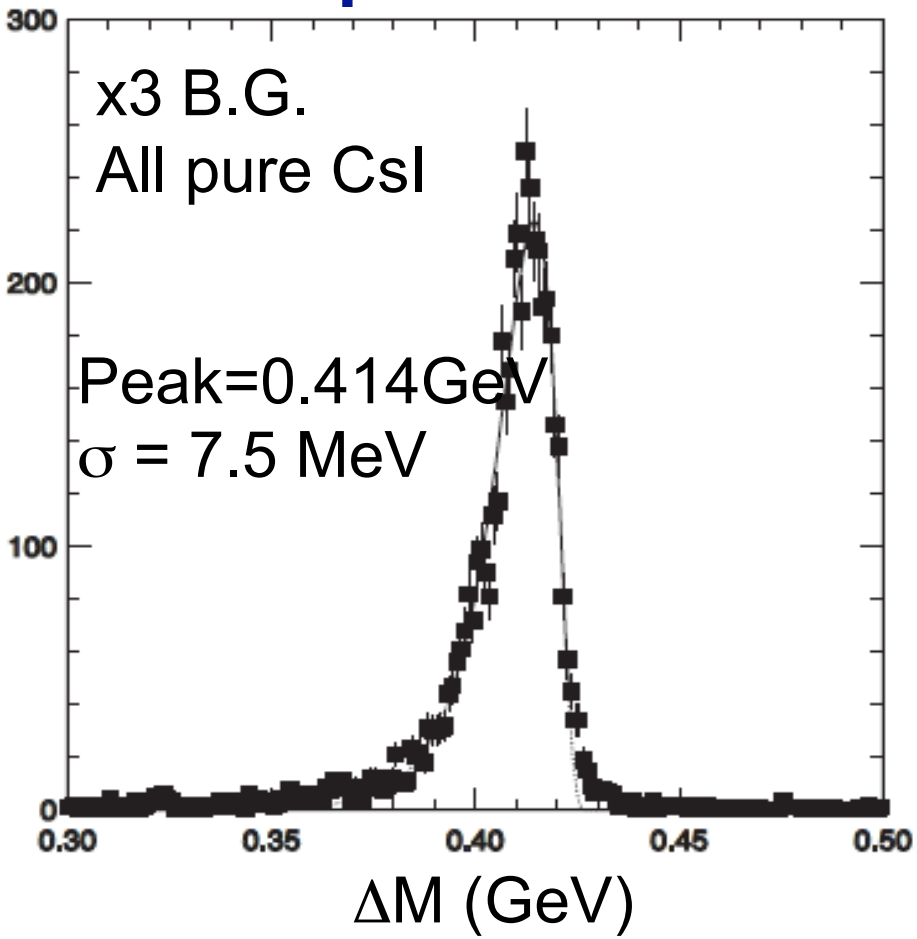
cosθ (in lab.)

cosθ (in lab.)

In the endcaps, pure CsI's reduction power of beam background effect is seen.

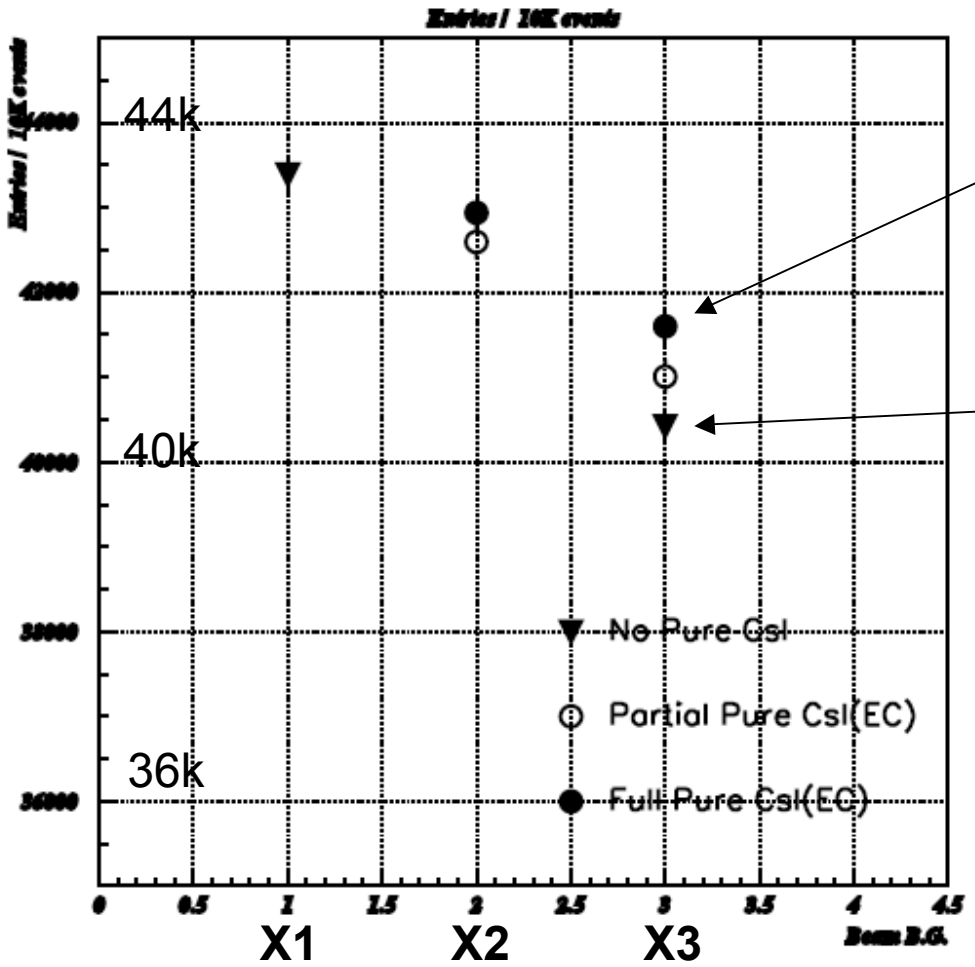
Forward Endcap





As far as the energy deposit of each crystal is properly obtained, shower can be reconstructed, but need care about energy scale and error matrix.

Efficiency(#entries/100k ev.)



Entire endcaps pure CsI

Without pure CsI

~8% deficit in x3 B.G(Note that J/ψ deficit is only ~2%).

~4% recovered with Pure CsI to entire Endcaps.

Summary

- Using B→ χ_{c1} K mode, we checked beam background effect to efficiency and resolution for intermediate energy(a few × 100 MeV) photons.
- In x3 B.G. ~6% deficit, recovered to ~2% deficit by Pure CsI in entire Endcaps.
- Energy resolution for CsI(Tl) part gets worse ~30%, i.e. ~10MeV in x1 B.G. → ~13 MeV in x3 B.G.
- At the reconstruction, energy scale and error matrix have to be carefully treated, especially difference between CsI(Tl) and pure CsI.