Brief Summary of GEM Efficiency from Calibration Run

Efficiency from calibration run

- GEM and HyCal mounted on transporter.

- Photon beam.

- Scintillators installed in front of GEM.

- TDC information from scintillator and HyCal.

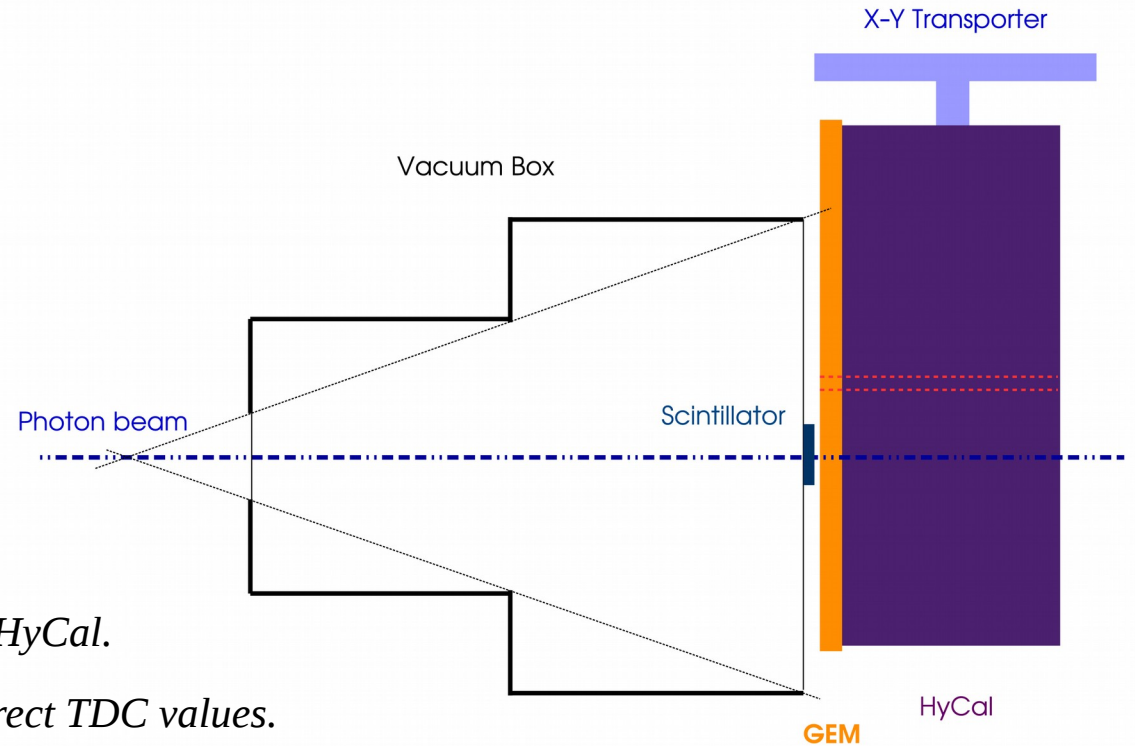- Use software coincidence signal.

$$\epsilon = N_{gem} / N_{trigger}$$

N_{gem} : events that gem has matching clusters with HyCal.

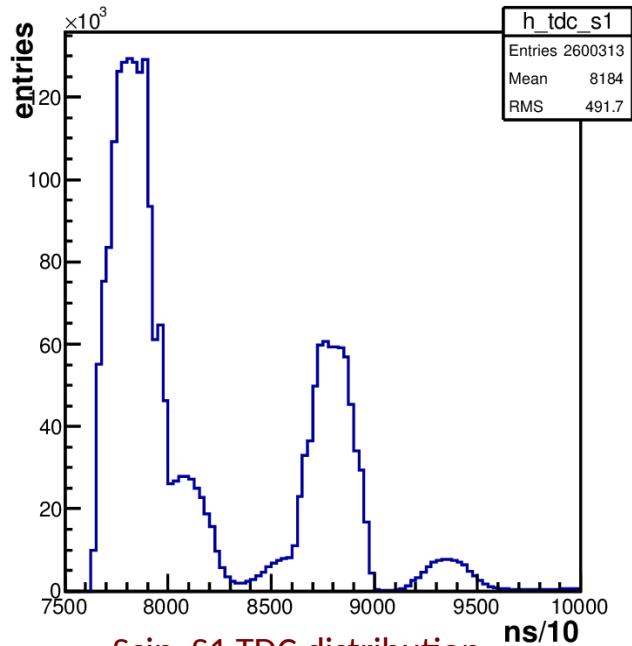$N_{trigger}$: events that HyCal and scintillator have correct TDC values.

Binomial error:

$$\delta \epsilon = \sqrt{\epsilon(1-\epsilon)/N_{trigger}}$$
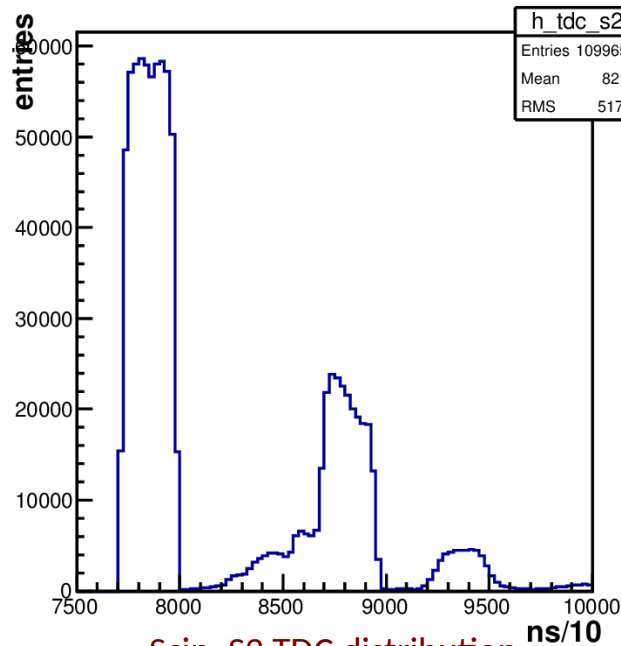
Measuring efficiency for a specified gem area

X-Y Transporter

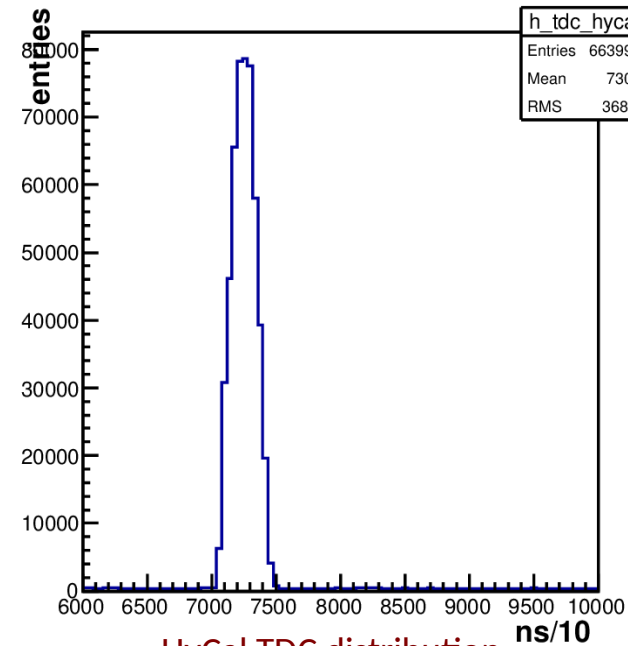Vacuum Box

Photon beam

Scintillator

GEM

HyCal

TDC cut

Scin. S1 TDC distribution
Scin. S2 TDC distribution
HyCal TDC distribution
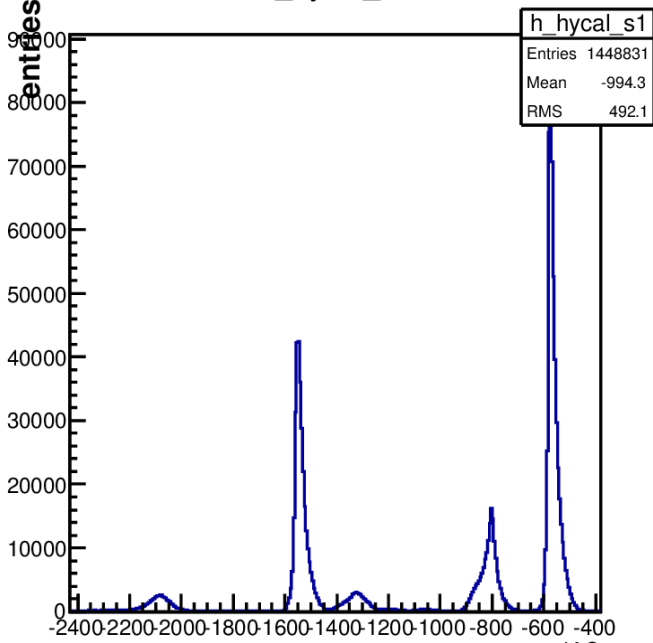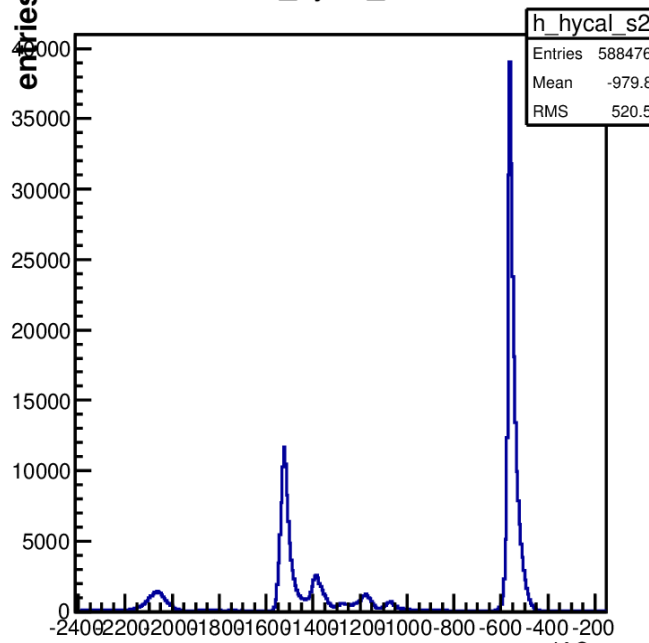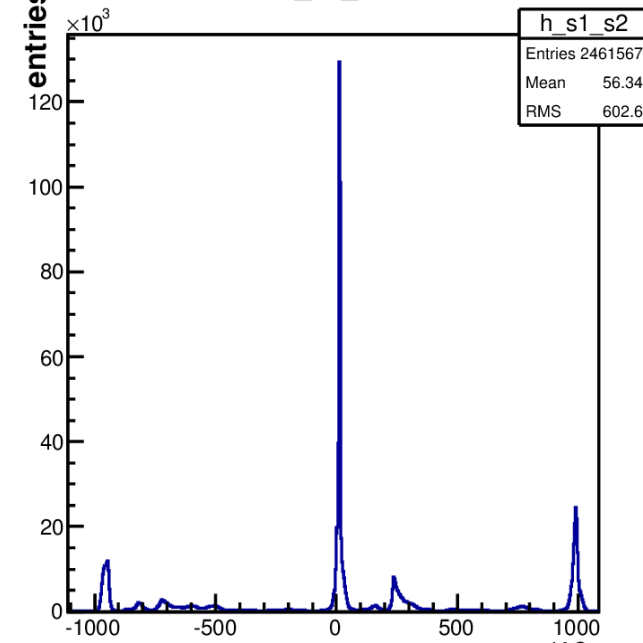
$T_{hycal} - T_{S1}$
$T_{hycal} - T_{S2}$
$T_{S1} - T_{S2}$

TDC cut
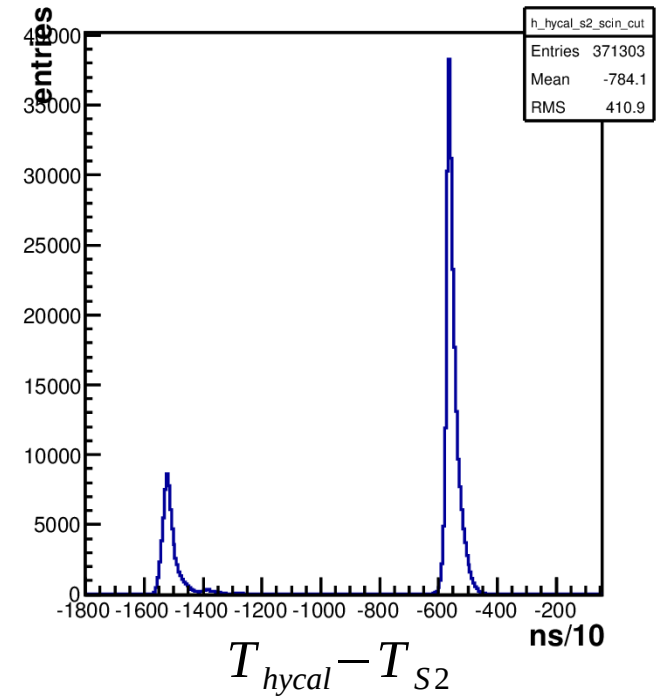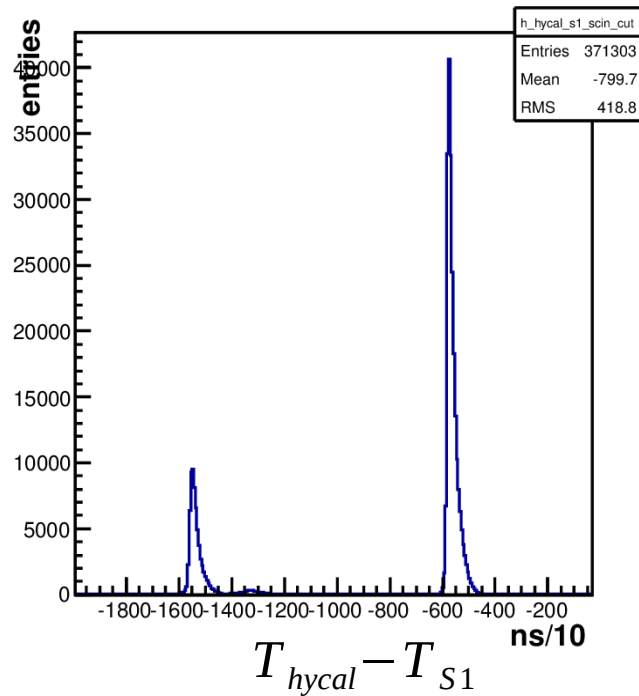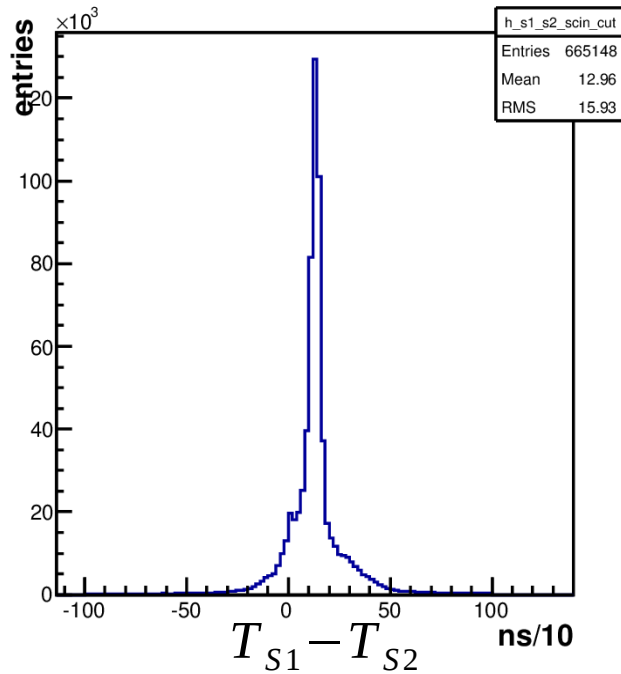
- Scintillator timing window: 20 ns.

- Choose the most right peak on the right two plots.

- Peak difference (HyCal scintillator): 55 ns. Used timing window: 140 ns.

- Noise peak: ~ 40 ADC, average: ~24 ADC : (~4 ADC/ns).

- Signal peak: ~ 40000 ADC.

- Noise / Signal: 0.0001.

- Calibration runs: 849, 850, 851, 852, 982, 983, 987, 988

Run 982 qualitative plots

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Run 982

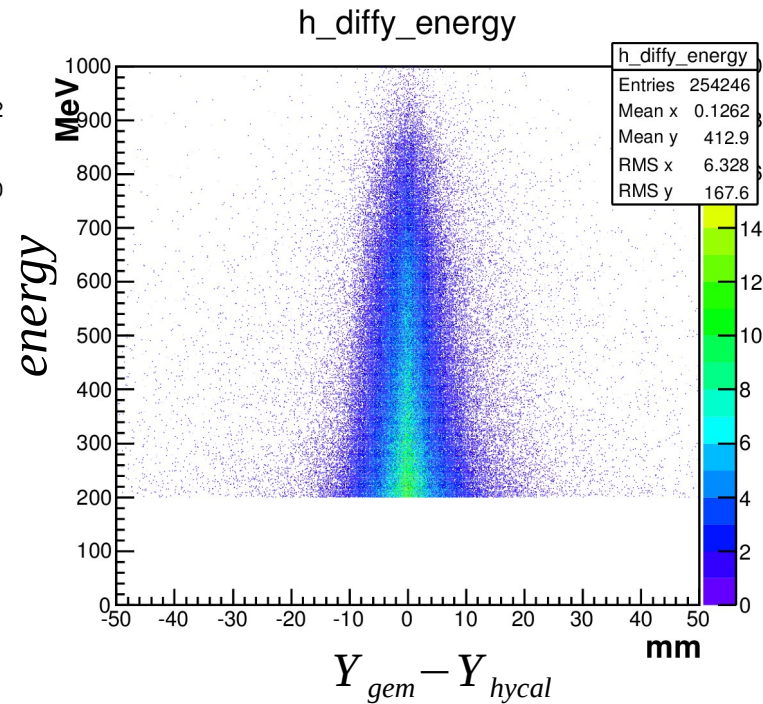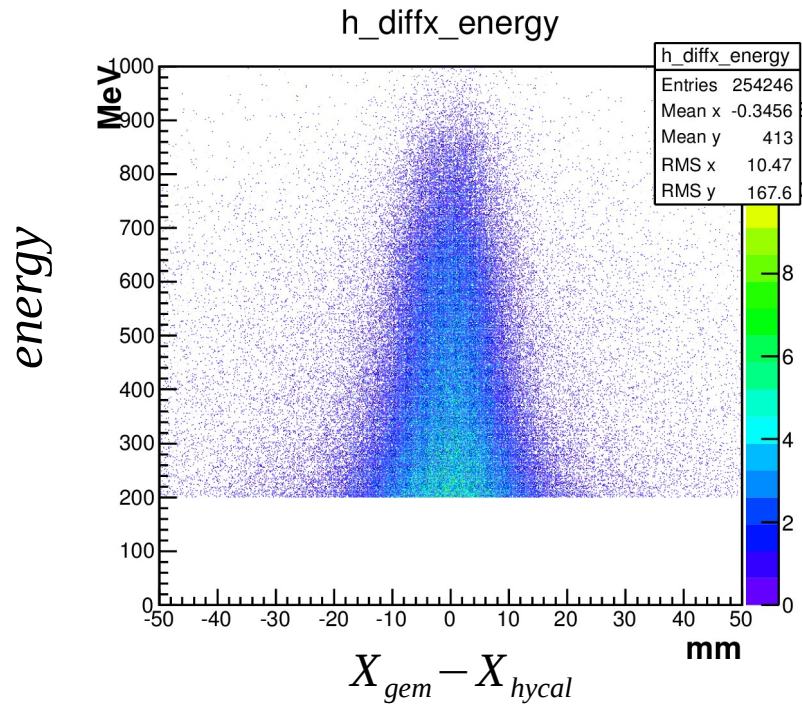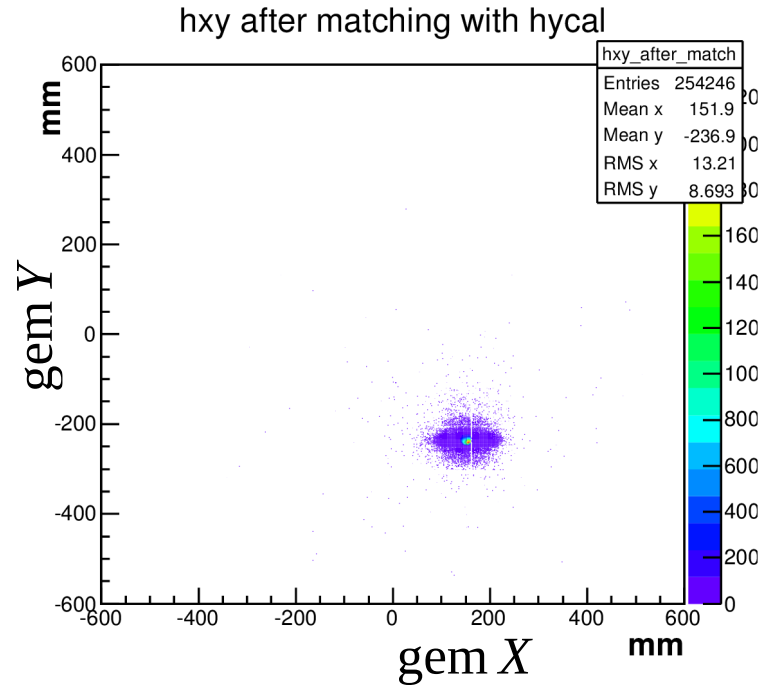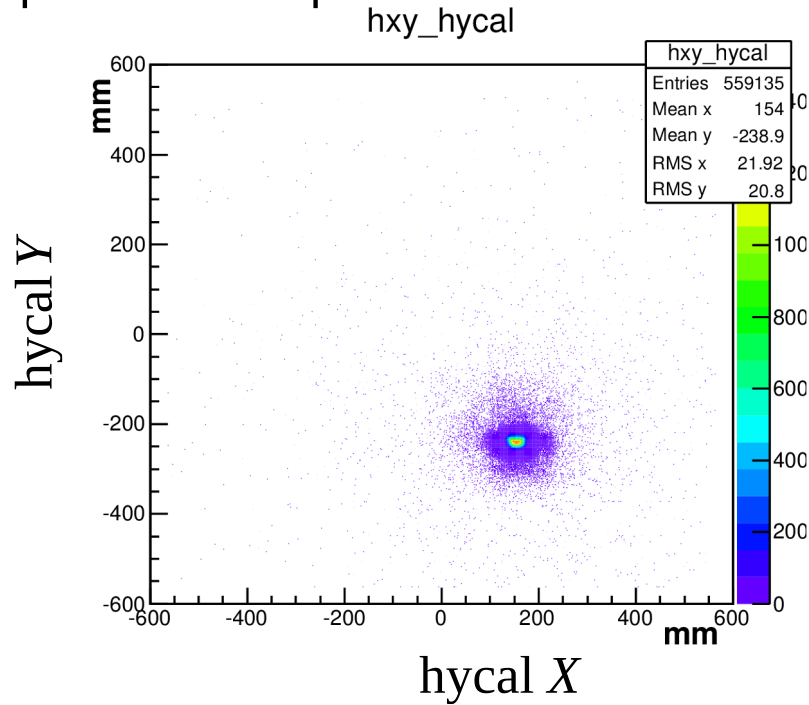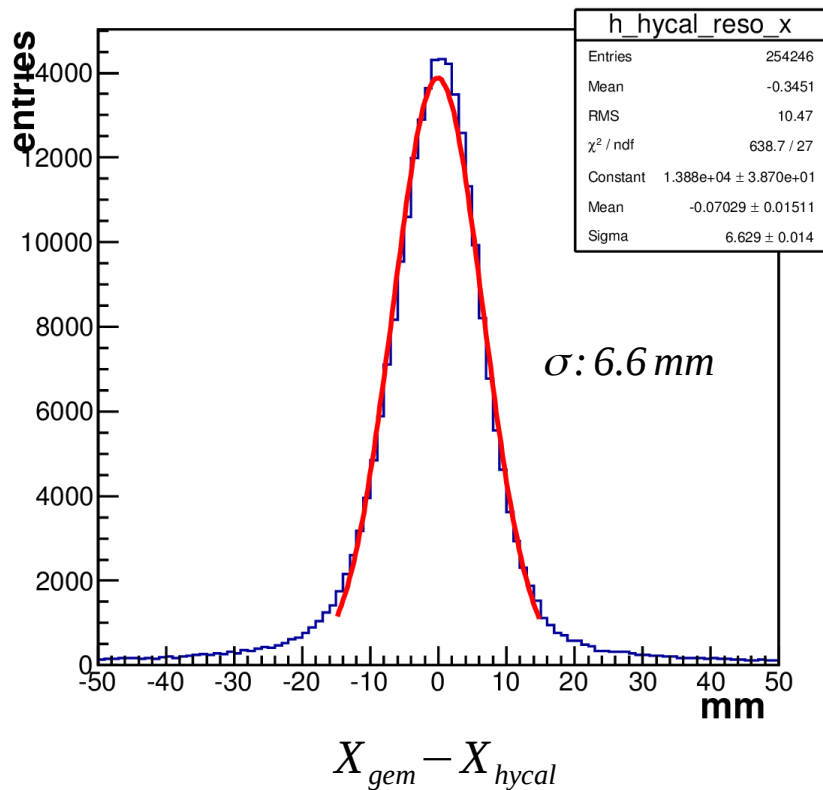- Within timing window, coincidence event: 120132.

- GEM active events: 111150.

- Efficiency: 92.5%.

- After remove background: 92.9%.

- Statistical error: 0.07%.

- HyCal Clustering: 5X5.

GEM coordinates projected to HyCal

h_hycal_reso_x	
Entries	254246
Mean	-0.3451
RMS	10.47
χ^2 / ndf	638.7 / 27
Constant	1.388e+04 ± 3.870e+01
Mean	-0.07029 ± 0.01511
Sigma	6.629 ± 0.014

$\sigma : 6.6\,mm$

$X_{gem} - X_{hycal}$

GEM coordinates projected to HyCal

h_hycal_reso_y	
Entries	254246
Mean	0.1261
RMS	6.327
χ^2 / ndf	884 / 7
Constant	2.695e+04 ± 8.738e+01
Mean	-0.1584 ± 0.0091
Sigma	3.076 ± 0.011

$\sigma : 3.1\,mm$

$Y_{gem} - Y_{hycal}$
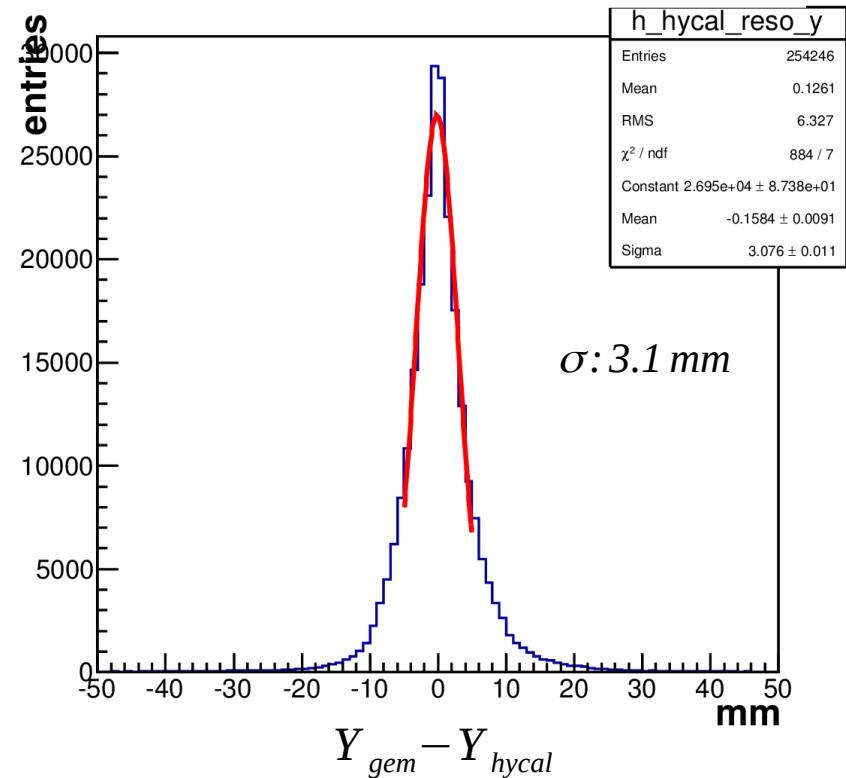
Summary

Mapped HyCal position	N_gem	N_trigger	efficiency	error
W280	82594	91440	90.3%	0.1%
W293	97835	102785	95.2%	0.07%
W302	72803	79531	91.5%	0.1%
w977	111150	120132	92.9%	0.07%
W860	136066	150144	90.6%	0.08%
W854	233792	257714	90.7%	0.06%