

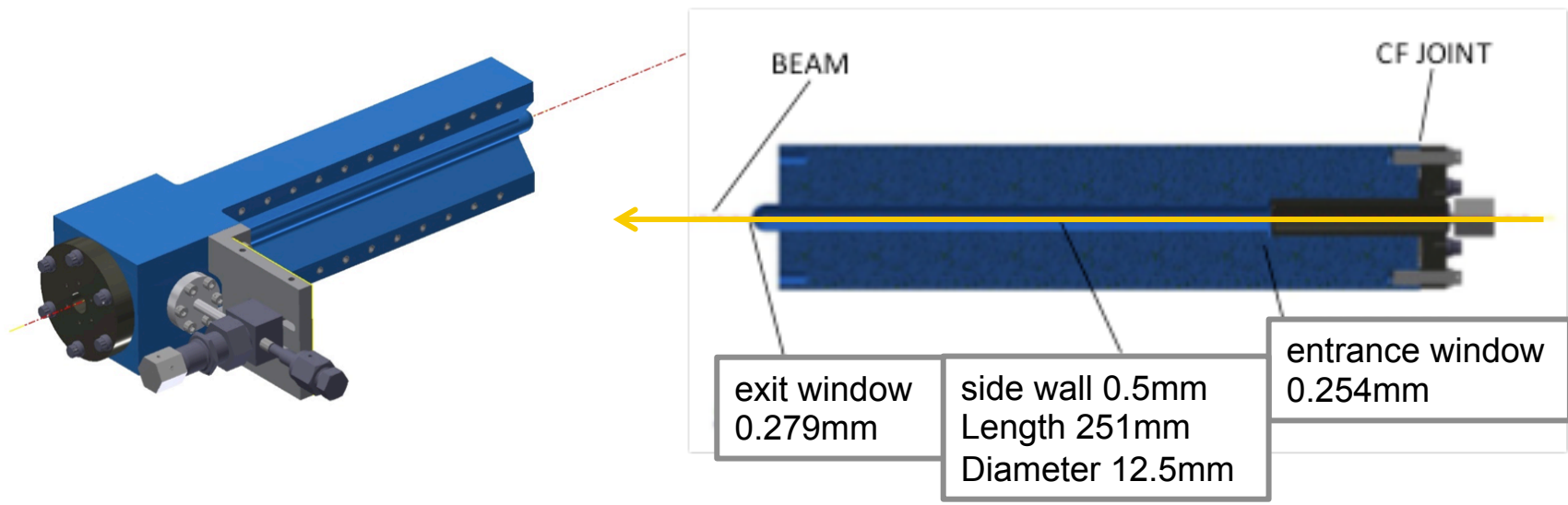
RATE ESTIMATION FOR E12-11-112 WITH SINGLE-ARM SIMC

**SHUJIE LI, WITH DIEN NGUYEN, ERIC CHRISTY
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TARGET CELL

CELL CROSS SECTION



https://wiki.jlab.org/jlab_tritium_target_wiki/index.php/File:Hall_A_Tritium_Target_System-1.docx

TARGET CELL

* 20% density reduction at 25 uA

Target	Total Window Thickness	Gas Thickness	Gas Rad Length
Tritium Cell	0.16 g/cm ²	0.075 g/cm ²	183.6 cm
Helium 3 Cell	0.16 g/cm ²	0.075 g/cm ²	71.07 cm
Deuterium Cell	0.16 g/cm ²	0.12 g/cm ²	122.6 cm

<http://hallaweb.jlab.org/collab/meeting/2017-winter/Hall%20A%20Tritium%20Target%20Status.pptx>

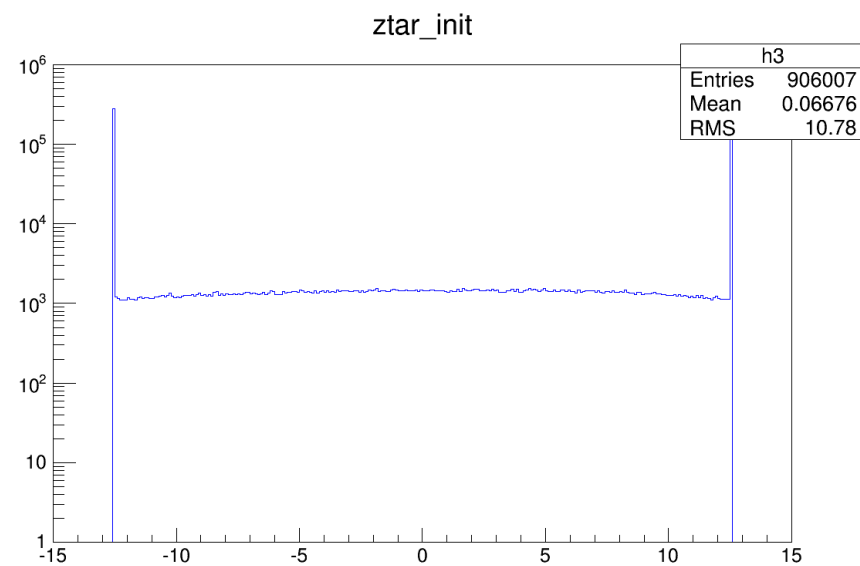
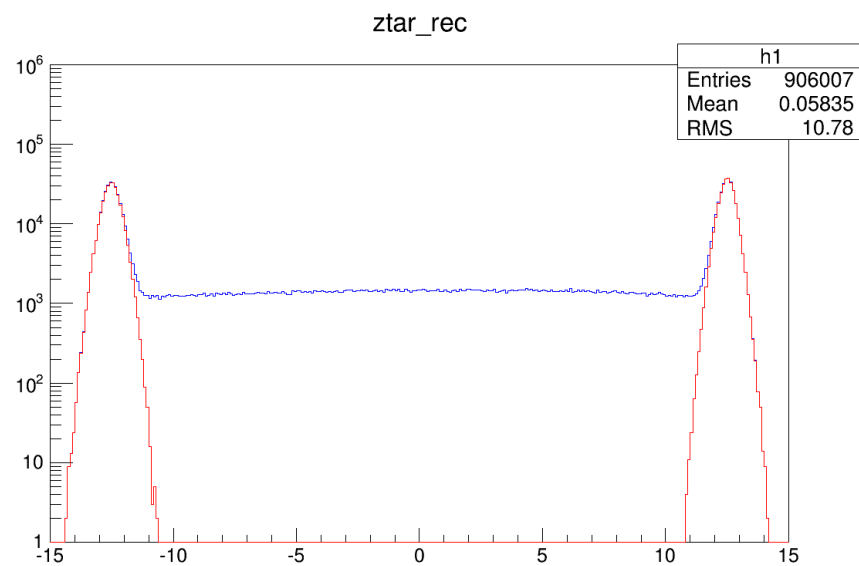


TARGET CELL IN SIMULATION

- Randomly generate $N_{tot}=5000000$ vertices in each windows/gas within

$$\Omega_{tot} = 8(10\% * P_0)(100mr)(100mr)$$

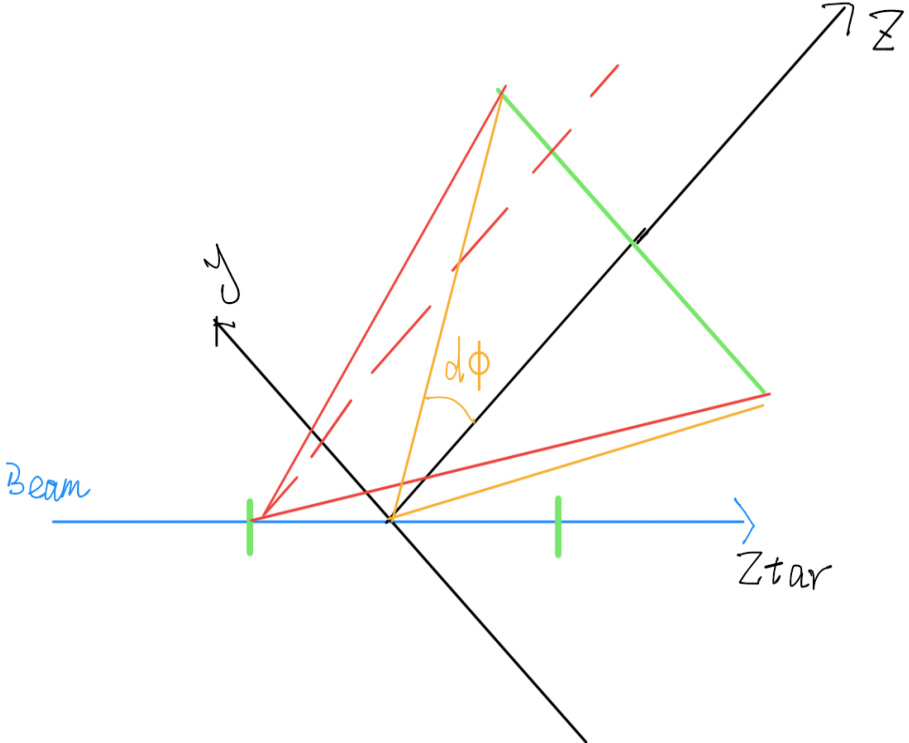
- Include multiple scattering for entire target cell
- Not include energy loss (TBD)
- Only “good” event recorded in ntuples

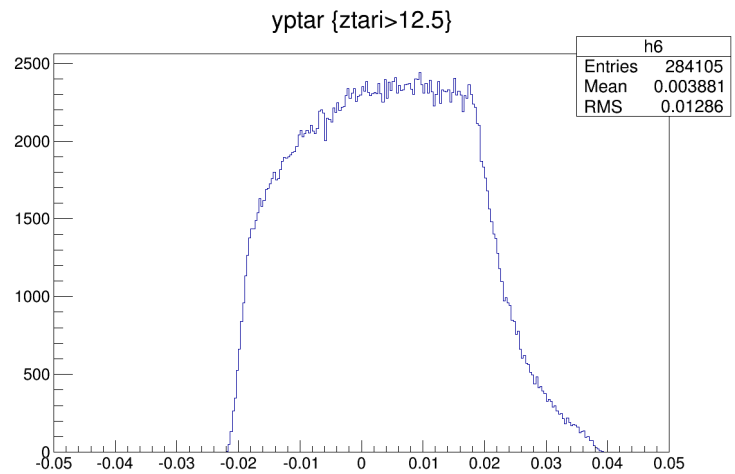
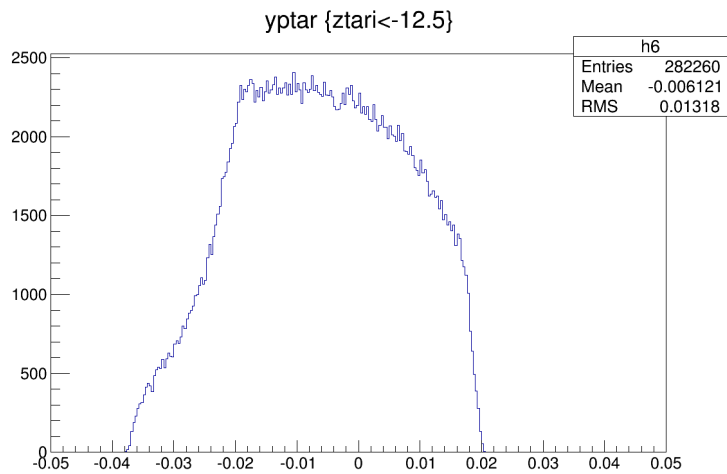
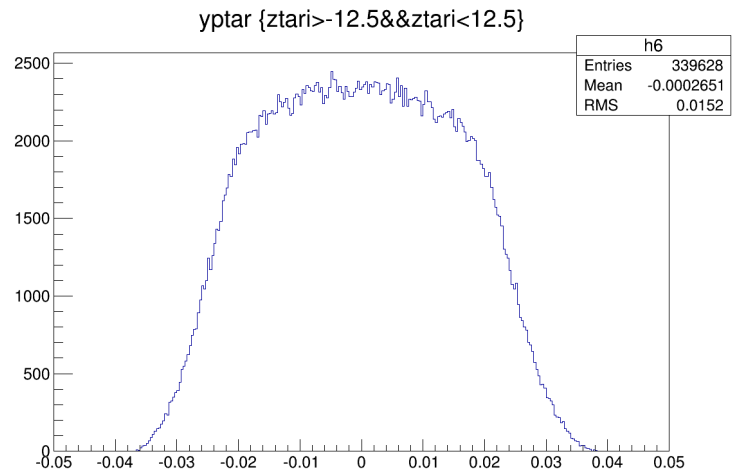
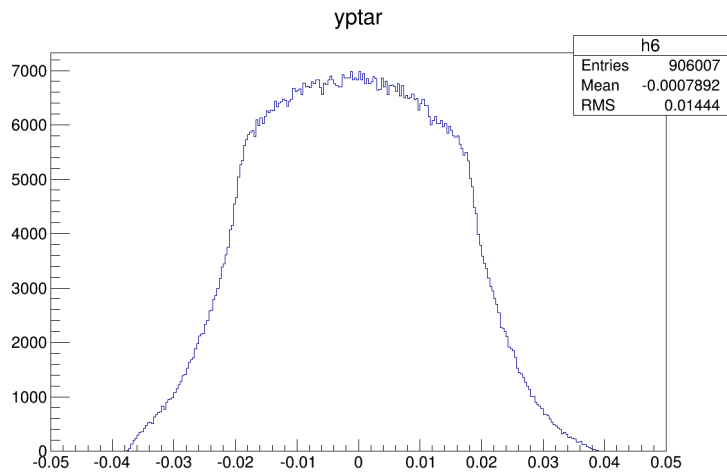


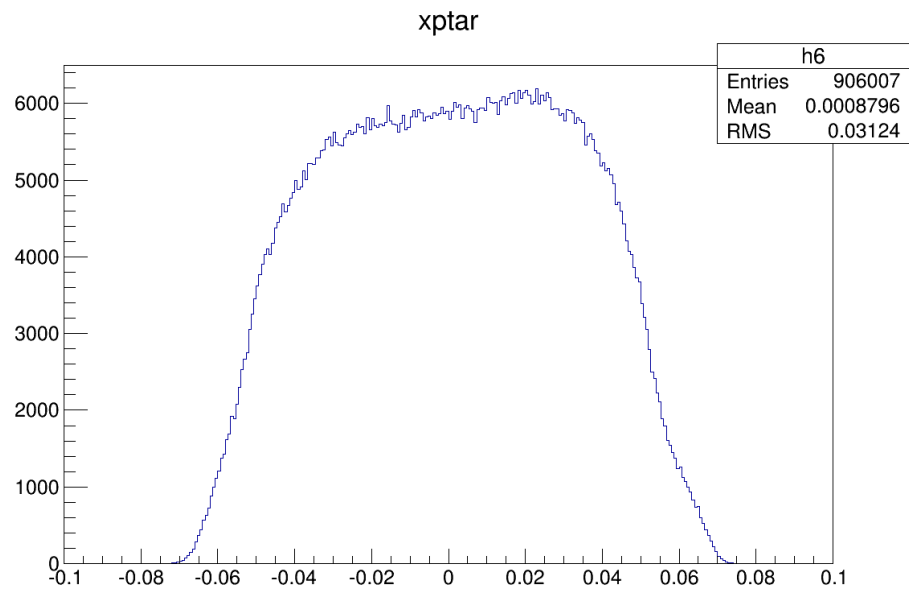
- To combine *.rzdat : **call hmerge(nfile,infiles[],outfile)** in Fortran
- To combine *.root : **hadd outfile infile1..infileN** in command line



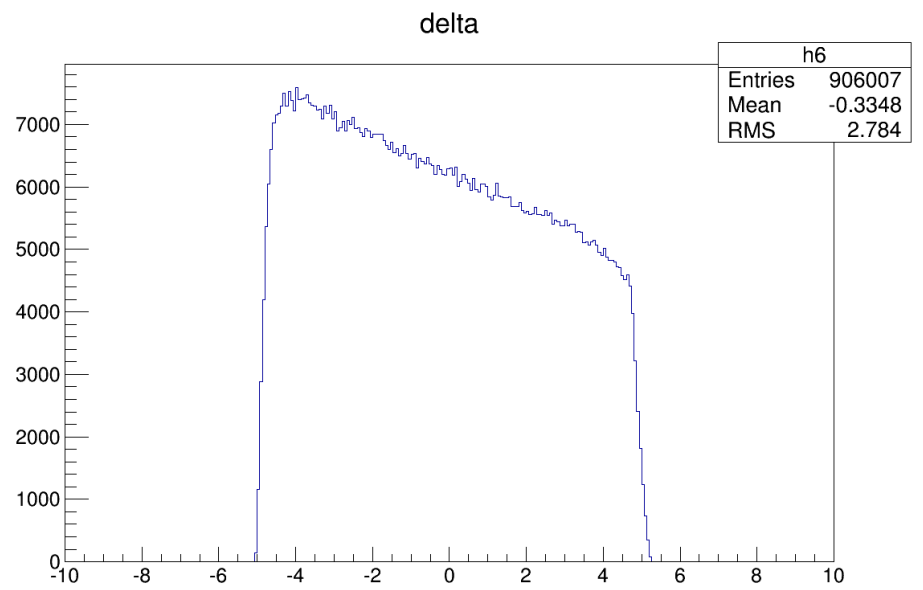
TARGET CELL IN SIMULATION







Show rootfile



RATE ESTIMATION

$$rate = I \cdot \rho_l / A \cdot \int_{\Omega_{eff}} \frac{d\sigma}{d\Omega} d\Omega = I \cdot \rho_l / A \cdot \int_{\Omega_{tot}} \frac{d\sigma}{d\Omega} \varepsilon(\Omega) d\Omega$$

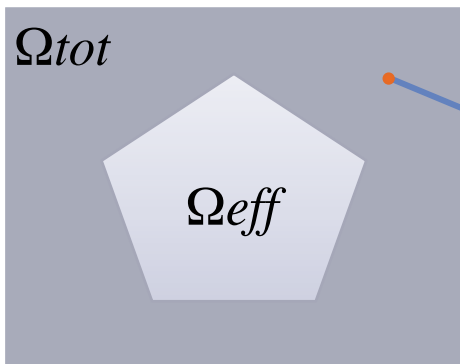
Atomic mass

of scattering centers per area = $g/cm^2 / (g/mol) * 6.02e23$ atoms/mol

of electron /sec = $uA / (1.602e-19$ C per $e^-)$

RATE ESTIMATION

$$rate = I \cdot \rho_l / A \cdot \int_{\Omega_{eff}} \frac{d\sigma}{d\Omega} d\Omega = I \cdot \rho_l / A \cdot \int_{\Omega_{tot}} \frac{d\sigma}{d\Omega} \varepsilon(\Omega) d\Omega$$

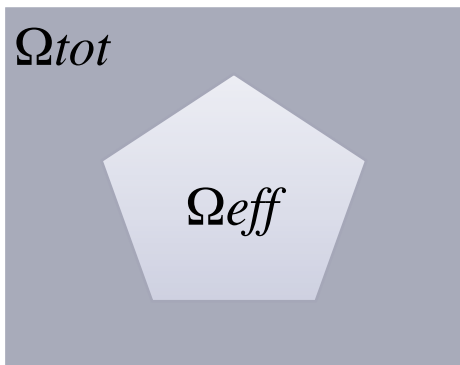


$\varepsilon(\Omega) = 0$ if

1. Events generated in that phase space area can not arrive the focal plane
2. Events in that area is unphysical (i.e. $w^2 < 0$)

RATE ESTIMATION

$$rate = I \cdot \rho_l / A \cdot \int_{\Omega_{eff}} \frac{d\sigma}{d\Omega} d\Omega = I \cdot \rho_l / A \cdot \int_{\Omega_{tot}} \frac{d\sigma}{d\Omega} \varepsilon(\Omega) d\Omega$$



$$rate_{MC} = I \cdot \rho_l / A \sum_{N_{tot}} \frac{d\sigma}{d\Omega} \varepsilon(\Omega) \frac{\Omega_{tot}}{N_{tot}}$$

RATE ESTIMATION

$$rate_{MC} = I \cdot \rho_l / A \sum_{N_{tot}} \boxed{\frac{d\sigma}{d\Omega}} \varepsilon(\Omega) \frac{\Omega_{tot}}{N_{tot}} \cdot efficiency$$

20 μ A

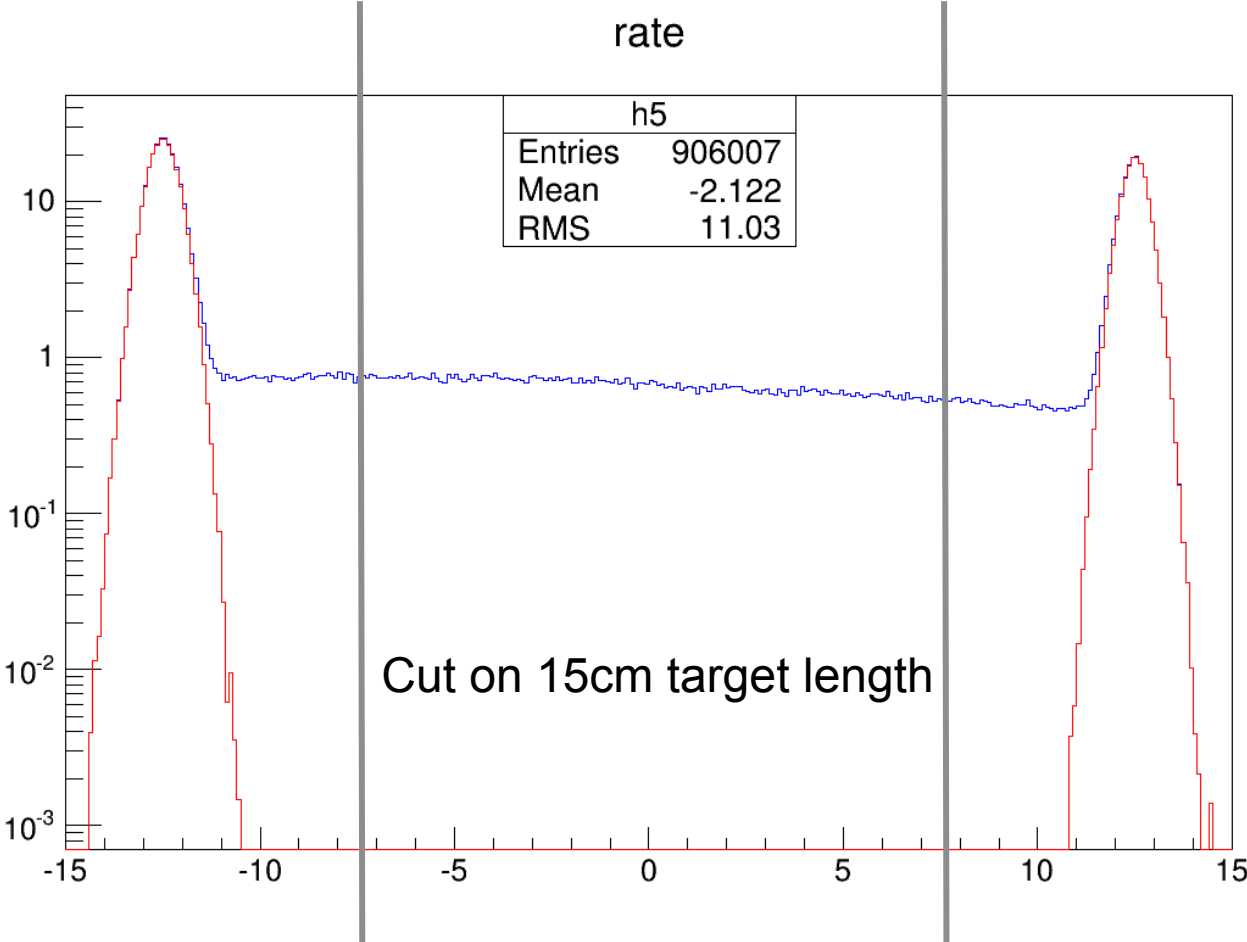
Good events in simulation and XEMC

of trials in simulation
(!! The single arm simulation will only record good events)

Cross section tables generated from XEMC model:

- from Zhihong
- Included bremsstrahlung radiation
- y-scaling. Use He3 fitting parameter for H3

RATE ESTIMATION

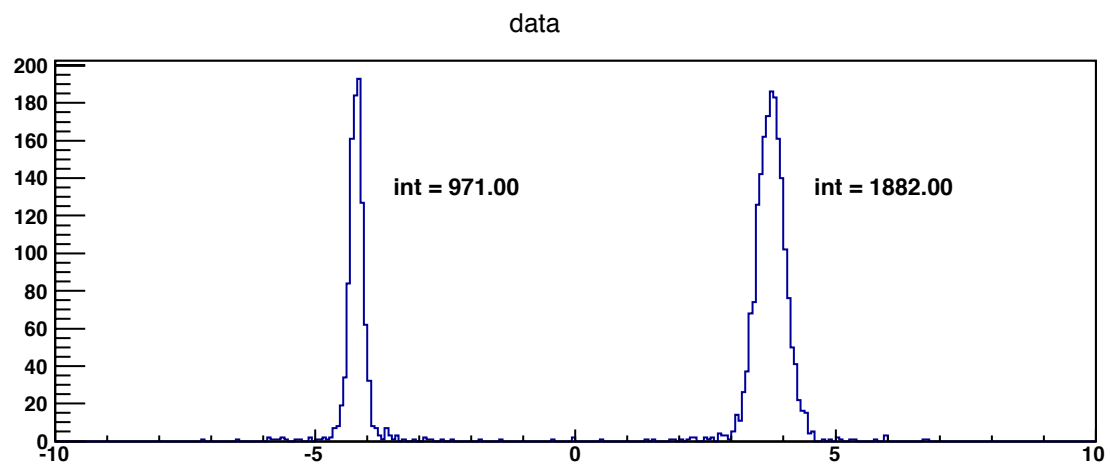
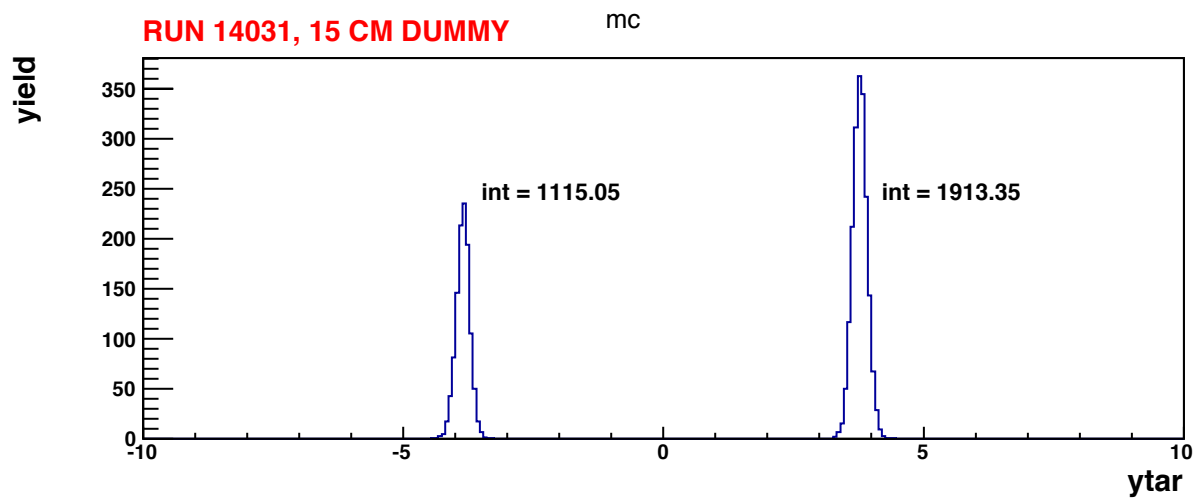


2013 runplan

Scaled by current

target	E	Ep_c	theta_c	xbj_c	Q2_c	current	Rphys	Rtot	Rphys_new	Rtot_new	Rphys_new/old
He3	4.4	3.71	17	1.1	1.43	20	145	3167	133.22	620.72	1.15
H3	4.4	3.71	17	1.1	1.43	20	94	2928	101.25	570.83	1.35
D2	4.4	3.71	17	1.1	1.43	20	229	3506	247.02	801.00	1.35
He3	4.4	3.98	17	1.94	1.53	20	1.6	275	17.08	120.29	13.34
H3	4.4	3.98	17	1.94	1.53	20	1	265	12.73	112.82	15.91
He3	4.4	3.535	19	1.04	1.69	20	62	1338	59.54	256.45	1.20
H3	4.4	3.535	19	1.04	1.69	20	41	1241	46.46	236.21	1.42
D2	4.4	3.535	19	1.04	1.69	20	122	1331	110.87	335.89	1.14
He3	4.4	3.79	19	1.59	1.81	20	1.8	193	11.84	66.70	8.23
H3	4.4	3.79	19	1.59	1.81	20	1.2	184	8.72	61.59	9.09
D2	4.4	3.79	19	1.59	1.81	20	1.5	182	19.61	79.94	16.34
He3	2.2	1.87	22	0.97	0.6	20	1302	4563	735.20	2866.50	0.71
H3	2.2	1.87	22	0.97	0.6	20	800	4998	527.37	2553.12	0.82
D2	2.2	1.87	22	0.97	0.6	20	1890	4954	1381.69	3843.90	0.91
He3	2.2	1.77	26.2	0.99	0.8	20	374	3606	211.08	679.77	0.71
H3	2.2	1.77	26.2	0.99	0.8	20	236	3285	154.21	596.70	0.82
D2	2.2	1.77	26.2	0.99	0.8	20	570	3999	414.50	974.80	0.91
He3	2.2	1.665	30.3	1	1	20	114	2303	72.49	187.55	0.79
H3	2.2	1.665	30.3	1	1	20	73	2097	53.51	161.24	0.92
D2	2.2	1.665	30.3	1	1	20	187	2603	146.72	290.03	0.98

Gmp:



NEED MORE WORK...

- **Missing background rates, energy loss**
- **Possible bugs in simulation**
- **Cross section model for H3 ??**
- **Need to understand the non-Gaussian part of the window tails**
- **Waiting for the dummy run from Argon experiment 😊**



