

# Simulation update

acceptance & yields

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# Yields Study

- To understand the beam-dependence yields effect
- beam position and raster size as input
- Simulation in g2psim:
  - ✓ Combined N, He, H yields (production target)
  - ✓ Radiation effects
  - ✓ Acceptance effects

# Yields Drift Summary

Production Settings	Momentum Settings (drift/tot)	Drifts Setting Runs /total	Comments
2.2GeV, 2.5T Tran	6/31	84/259	Around 21/259 runs drift
1.7GeV, 2.5T Tran	4/18	66/213	Around 18/259 runs drift
1.1GeV, 2.5T Tran	4/25	72/344	Around 13/344 runs drift
2.2GeV, 5T Tran	1/15	7/90	Beams seems no drift for 1.6GeV
2.2GeV, 5T Long	2/14	120/179	Actually just 6/179 runs drift >3.5%
3.3GeV, 2.5T Tran	2/6	11/52	Beams seems no drift for 2.342, 2.492GeV

Yields spread >3.5%

At least 7% (76 runs) have drift (total 1137 runs) Note: here assume drift runs : smaller run group in settings

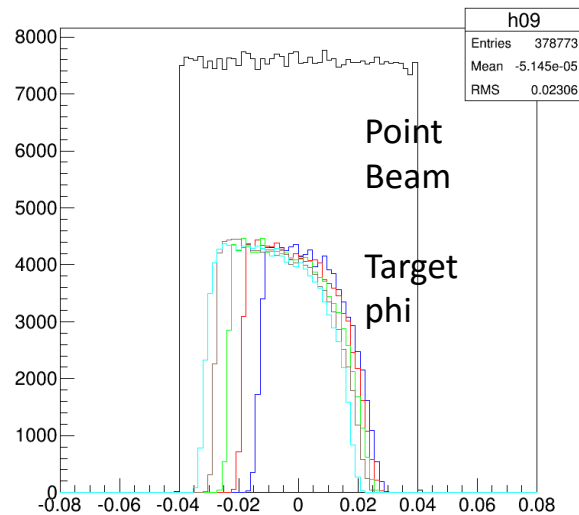
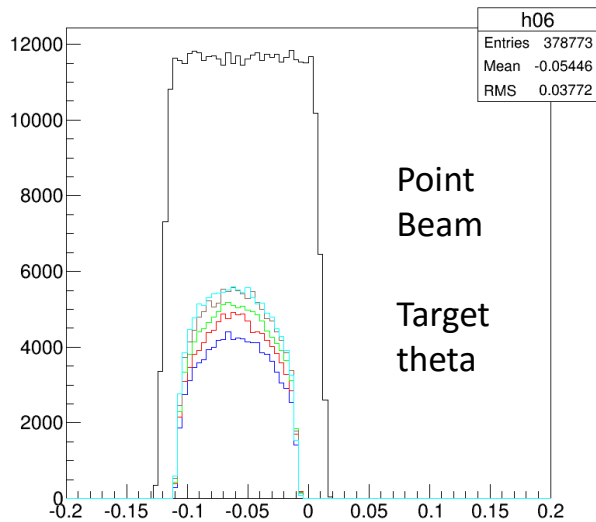
32% (360 runs) are in the momentum setting which have drift runs.

# Yields Study

- Simulation in g2psim:
  - ✓ Point beam, acceptance & yields
  - ✓ Raster beam, acceptance & yields
  - ✓ Combined N, He, H yields (production target)
  - ✓ Radiation effects (acceptance first, then average the yields within acceptance using the functions)
- Two Previous Study:
  - ✓ One using only pbosted model, July 6
  - ✓ the other using elastic + pbosted in g2psim, Oct 14
  - ✓ both with the energy loss model for radiation effects

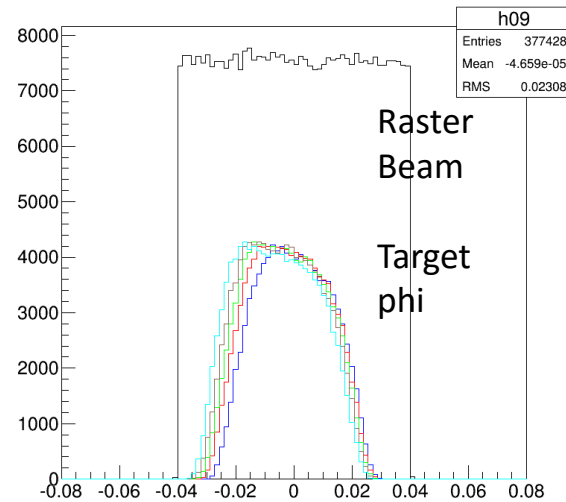
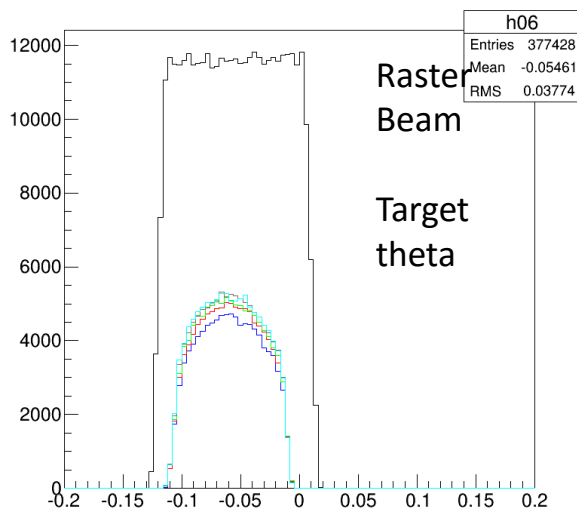
# Yields Drift Study from Simulation

## □ Beam along BPM x (horizontal)



**Point Beam:**  
 (-10, 0): Blue  
 (-5, 0): Red  
 (0, 0): Green  
 (5, 0): Light  
 (10, 0): Cyan

Angle unit: rad



**Raster Beam:**  
 (-5, 0): Blue  
 (-2, 0): Red  
 (0, 0): Green  
 (2, 0): Light  
 (5, 0): Cyan

# Yields Drift Study from Simulation

- Point Beam (x horizontal, y vertical), E2.2GeV, P1.4GeV, 2.5T

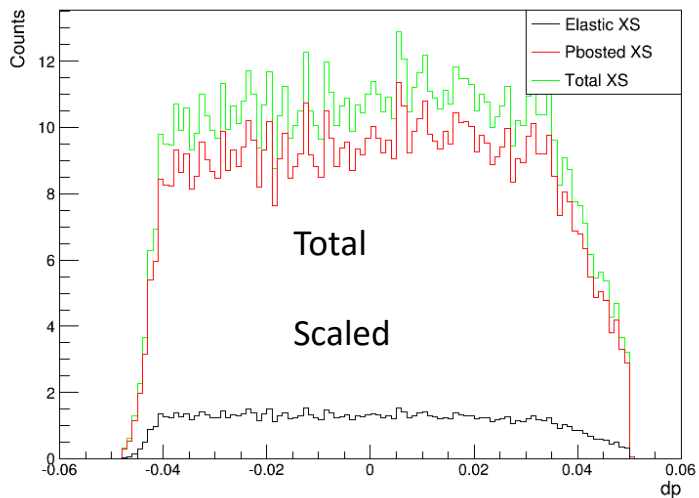
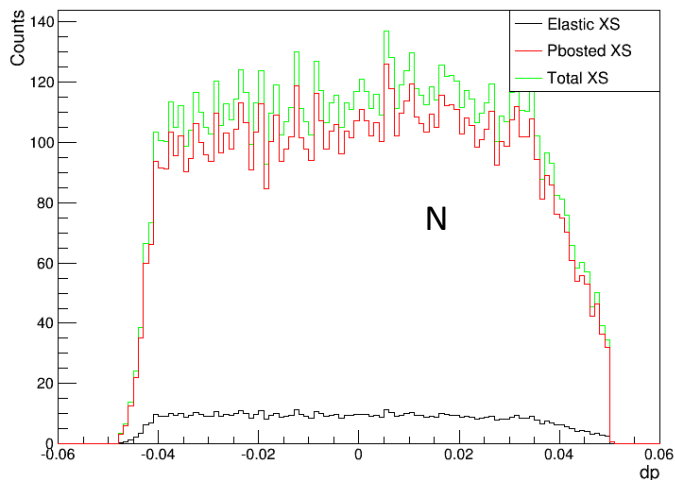
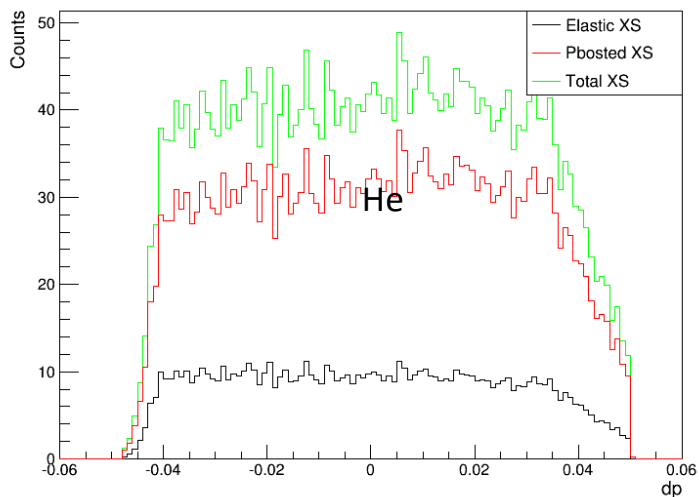
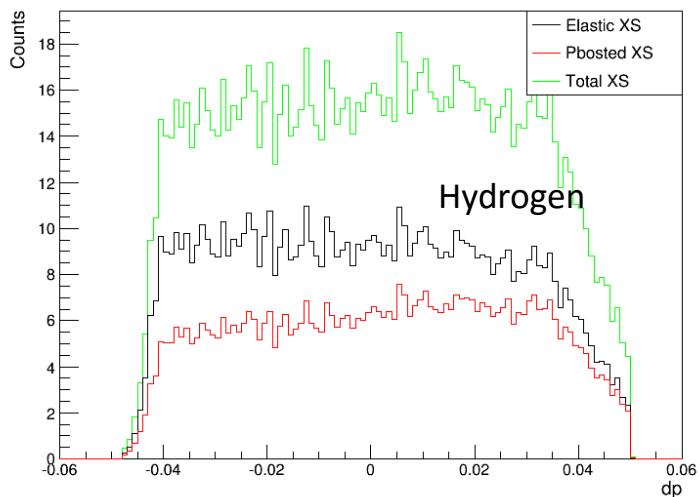
Horizontal x(mm)	Vertical y(mm)	Acceptance ratio	Yields ratio
0	0	1	1
5	0	1.03	1.16
-5	0	0.91	0.78
0	5	0.97	0.98
0	-5	1.00	0.97

- Raster Beam (x horizontal, y vertical), E2.2GeV, P1.4GeV, 2.5T

Horizontal x	Vertical y	Acceptance ratio	Yields ratio
0	0	1	1
-5	0	0.90	0.79
-2	0	0.94	0.89
2	0	1.00	1.05
5	0	1.03	1.24

# Yields Drift Study from Simulation

□ Production Target Yields (2.2GeV, 1.4GeV, 2.5T Trans, Run 3556)



# Yields Drift Problem

## 2.2 GeV 2.5T Trans (Yields spread >3%)

Momentum /MeV	Material	Runs	Beam x/mm	Beam th/rad	Beam y/mm	Beam ph/rad	Exp. Yields	Note:
1003	8	3654	2.39	0.061	0.88	0.001	1.06	Beam down ~6 hours
1003	8	3646	1.60	0.061	1.55	0.001	1	
1247	7	3602	4.27	0.061	1.12	0.002	1.06	Beam off after HWP change
1247	7	3603	1.55	0.061	0.64	0.001	1	
1441	7	3556	2.34	0.061	0.84	0.001	1.06	slow raster size from 2cm to 1.8 cm
1441	7	3554	0.55	0.061	1.23	0.000	1	
1792	7	3730	1.89	0.062	1.39	0.001	1.17	5 days between
1792	7	3510	4.24	0.063	3.20	0.005	1	
1927	7	3716	2.43	0.062	1.58	0.001	1.04	Beam x drift slowly
1927	7	3722	4.34	0.064	2.65	0.004	1	
2072	7	3711	4.67	0.063	1.76	0.005	1.12	8.5hours gap, beam position and raster changed
2072	7	3690	0.00	0.060	0.53	0.001	1	
2072	8	3460	5.51	0.063	2.66	0.005	1.34	Beam off 2.5hour
2072	8	3454	5.14	0.063	3.13	0.005	1	



## Yields Drift - 2.2GeV, 2.5T Trans

Momentum /MeV	Material	Runs	Beam x/mm	Beam th/rad	Beam y/mm	Beam ph/rad	Exp. Yields	Simu. Yields	Accp Ratio
1003	8	3654	2.39	0.061	0.88	0.001	1.06	1.06	1
1003	8	3646	1.60	0.061	1.55	0.001	1	1	1
1247	7	3602	4.27	0.061	1.12	0.002	1.06	1.20	1
1247	7	3603	1.55	0.061	0.64	0.001	1	1	1
1441	7	3556	2.34	0.061	0.84	0.001	1.06	1.11	1
1441	7	3554	0.55	0.061	1.23	0.000	1	1	1
1792	7	3730	1.89	0.062	1.39	0.001	1.17	0.80	1.02
1792	7	3510	4.24	0.063	3.20	0.005	1	1	1
1927	7	3716	2.43	0.062	1.58	0.001	1.04	0.82	0.98
1927	7	3722	4.34	0.064	2.65	0.004	1	1	1
2072	7	3711	4.67	0.063	1.76	0.005	1.12	1.40	1.03
2072	7	3690	0.00	0.060	0.53	0.001	1	1	1
2072	8	3460	5.51	0.063	2.66	0.005	1.34	1.01	1
2072	8	3454	5.08	0.068	2.24	0.005	1	1	1

# Yields Drift - 2.2GeV, 5T Long

Momentum /MeV	Material	Runs	Beam x/mm	Beam y/mm	Beam th/rad	Beam ph/rad	Exp. Yields	Simu. Yields	Accp Ratio
1885	8	5790	-0.49	0.000	-3.89	0.000	1.04	0.93	1
1885	8	5794	0.72	-0.001	-3.82	0.000	1	1	1
2049	7	5718	0.63	-0.001	-4.28	0.000	1.11	1.01	1
2049	7	5720	0.61	-0.001	-4.29	0.000	1	1	1
2227	8	5640	-0.33	0.000	-3.45	-0.001	1	1	1
2227	8	5652	0.34	0.000	-3.65	0.000	1.10	1.23	1.01
2227	7	5698							
2227	7	5700							

Note: run 5698, no bpm information

# Yields Drift - 1.1GeV, 2.5T Trans

Momentum /MeV	Material	Runs	Beam x/mm	Beam th/rad	Beam y/mm	Beam ph/rad	Exp. Yields	Simu. Yields	Accp Ratio
1017	11	4791	3.51	0.117	-8.58	0.002	1	1	1
1017	11	4831	2.63	0.117	-7.28	0.001	0.97	0.97	0.97
809	14	5185	-0.61	0.118	-4.94	0.000	1	1	1
809	14	5281	0.52	0.119	-5.16	0.000	0.96	1.06	1
752	13	5204	-1.14	0.118	-5.58	0.000	1	1	1
752	13	5282	0.24	0.118	-5.50	0.000	0.95	1.10	1
583	12	4987	2.91	0.117	-5.30	0.001	1	1	1
583	12	4995	1.90	0.118	-4.32	0.001	0.96	0.95	1

# Yields Drift - 1.7GeV, 2.5T Trans

Momentum /MeV	Material	Runs	Beam x/mm	Beam th/rad	Beam y/mm	Beam ph/rad	Exp. Yields	Simu. Yields	Accp Ratio
1589	7	4221	4.12	0.077	-1.25	0.004	1	1	1
1589	7	4240	2.55	0.079	-1.07	0.002	1.05	0.82	0.99
1494	8	4336	1.67	0.077	-1.03	0.004	1	1	1
1494	8	4564	2.17	0.078	-1.30	0.003	1.12	0.96	1.01
1405	8	4297	2.68	0.078	-1.39	0.002	1	1	1.
1405	8	4324	2.99	0.079	-0.17	0.003	0.97	1.05	1.01
1320	8	4350	1.50	0.078	-0.01	0.004	1	1	1
1320	8	4565	2.34	0.077	-1.74	0.003	1.08	0.97	0.99

## □ Summary

- This method: get acceptance in g2psim first, and then average the acceptance to get yields by using the radiative functions.
- Results similar to the two previous study
- Some setting agrees well, some setting even has opposite sign.  
Eg, 1.7GeV Trans.
- Writing a summary technote