

H4 beam line simulations **final** results (Composition & Rates)

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Simulation with GEANT4

- H4 upstream + H4-VLE fully modeled
 - Target, magnets, Collimators and Instrumentation
 - All known material modelled. Scintillators, Cherenkov's with right gas and pressures (following H2 plan as described in the note)
- All energies 0.4-7 GeV/c simulated (including “charge flip”)
 - 6M events on secondary target per momentum
 - Files already available in EOS, in the usual path “SP”.
 - **Only the ntuples in “TARGSEC” must be used, other files are there but don't use *only for experts***

Beam Composition – GEANT4

Momentum [GeV/c]	e+	K+	mu+	p+	pi+
-7	27.43%	3.39%	0.97%	1.28%	66.92%
-6	33.46%	2.85%	1.16%	1.27%	61.26%
-5	43.21%	1.93%	1.28%	1.07%	52.52%
-4	54.55%	1.10%	1.37%	0.63%	42.34%
-3	28.38%	1.14%	2.28%	1.41%	66.78%
-2	48.89%	0.26%	1.83%	0.39%	48.63%
-1	81.68%	0.16%	1.09%	0.16%	16.93%
-0.4	98.27%	0.00%	0.43%	0.00%	1.30%
0.4	99.07%	0.00%	0.00%	0.46%	0.46%
1	69.26%	0.00%	1.56%	15.30%	13.88%
2	34.94%	0.64%	2.46%	22.93%	39.04%
3	19.93%	2.75%	1.81%	18.93%	56.59%
4	47.07%	1.58%	1.28%	8.75%	41.33%
5	37.04%	2.84%	1.28%	9.35%	49.50%
6	28.07%	3.98%	1.32%	10.42%	56.21%
7	20.59%	5.15%	0.98%	10.65%	62.64%

Target : R=50mm L=300mm W if $E \leq 3$ GeV and Cu if $E > 3$ GeV

Trigger Rate for 10^6 incident particles (hadrons)

Rate [Hz]	Particle						
Momentum [GeV/c]	anti-p	K-	K+	p	pi-	pi+	Grand Total
-7	2.64	7.01	0.00	0.00	138.40	0.00	148.06
-6	2.36	5.28	0.00	0.00	113.61	0.00	121.25
-5	1.77	3.19	0.00	0.00	87.15	0.00	92.12
-4	1.08	1.88	0.00	0.00	71.91	0.00	74.86
-3	0.56	0.45	0.00	0.00	26.39	0.00	27.40
-2	0.10	0.07	0.00	0.00	12.95	0.00	13.13
-1	0.03	0.03	0.00	0.00	3.78	0.00	3.85
-0.4	0.00	0.00	0.00	0.00	0.10	0.00	0.10
0.4	0.00	0.00	0.00	0.03	0.00	0.03	0.07
1	0.00	0.00	0.00	4.10	0.00	3.72	7.81
2	0.00	0.00	0.24	8.75	0.00	14.90	23.89
3	0.00	0.00	1.53	10.52	0.00	31.46	43.51
4	0.00	0.00	3.09	17.15	0.00	81.04	101.28
5	0.00	0.00	5.69	18.75	0.00	99.31	123.75
6	0.00	0.00	9.03	23.61	0.00	127.40	160.03
7	0.00	0.00	12.95	26.81	0.00	157.64	197.40

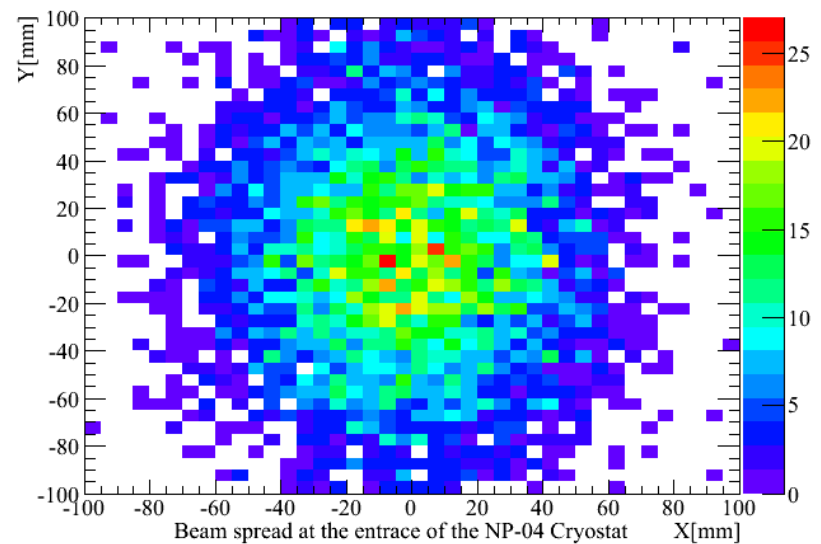
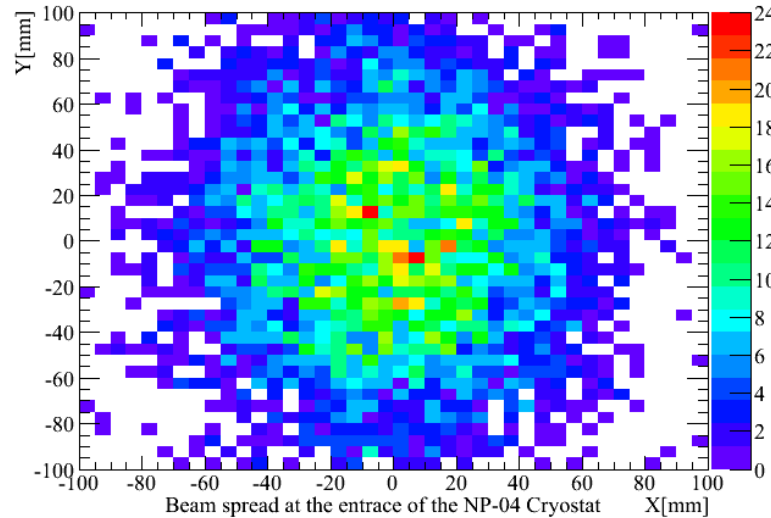
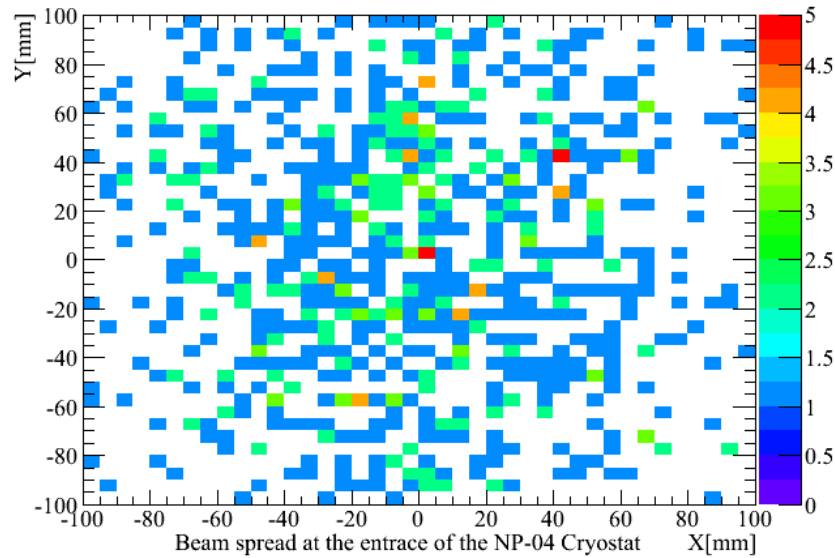
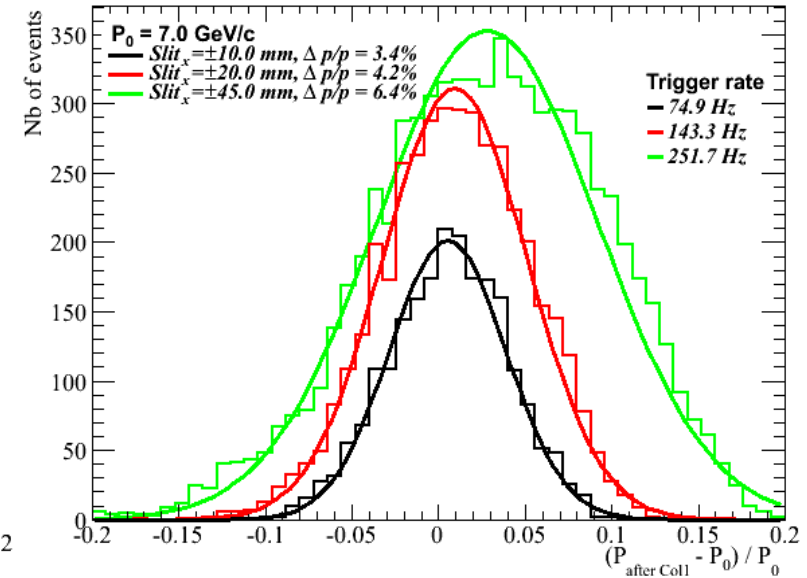
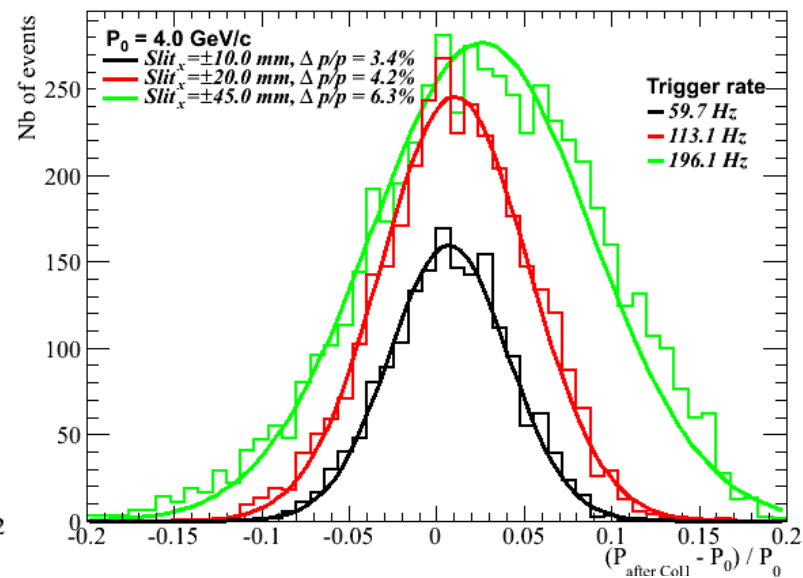
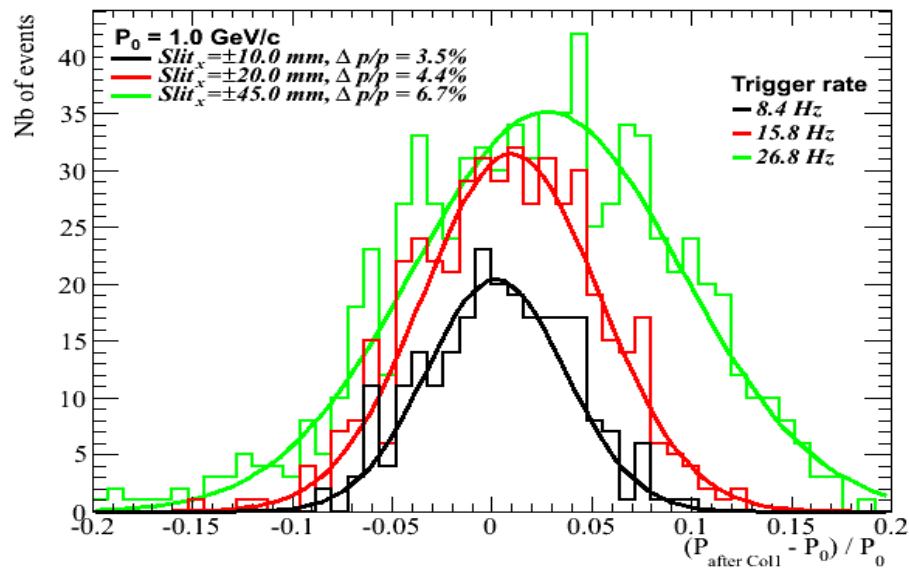
Target : R=50mm L=300mm W if $E \leq 3\text{GeV}$ and Cu if $E > 3\text{ GeV}$

Trigger Rate for 10^6 incident particles (total)

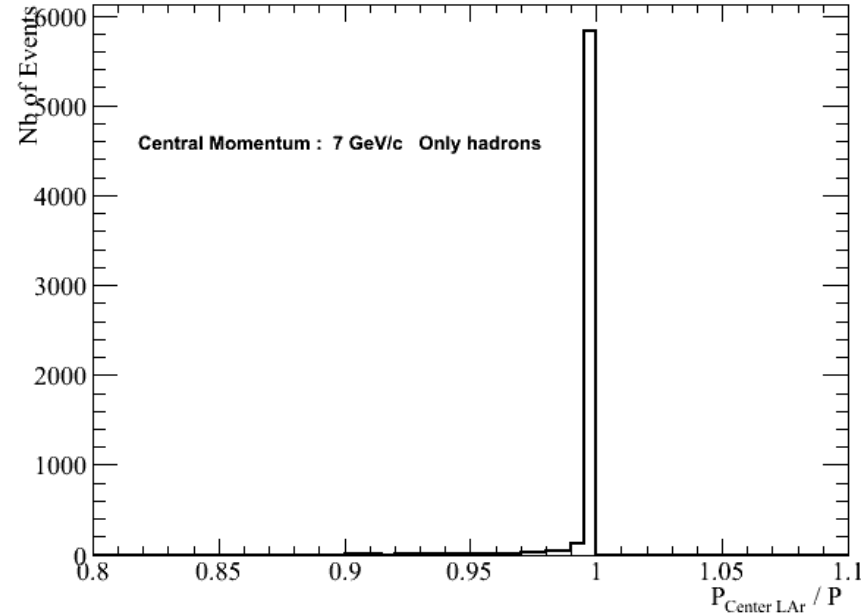
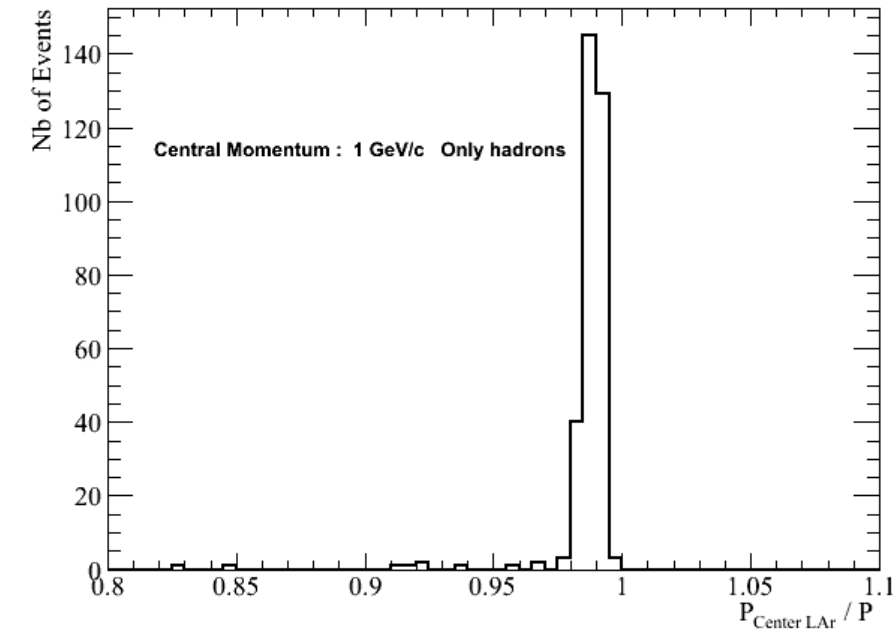
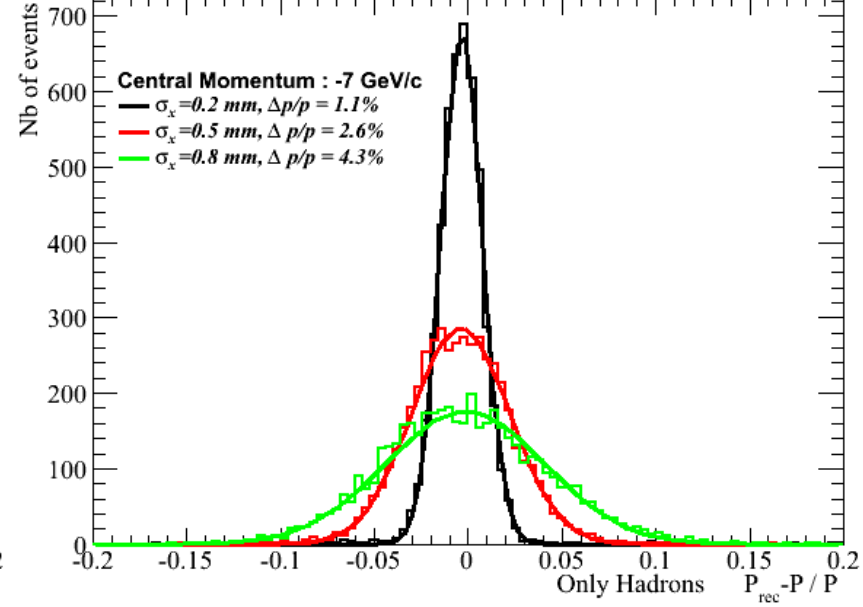
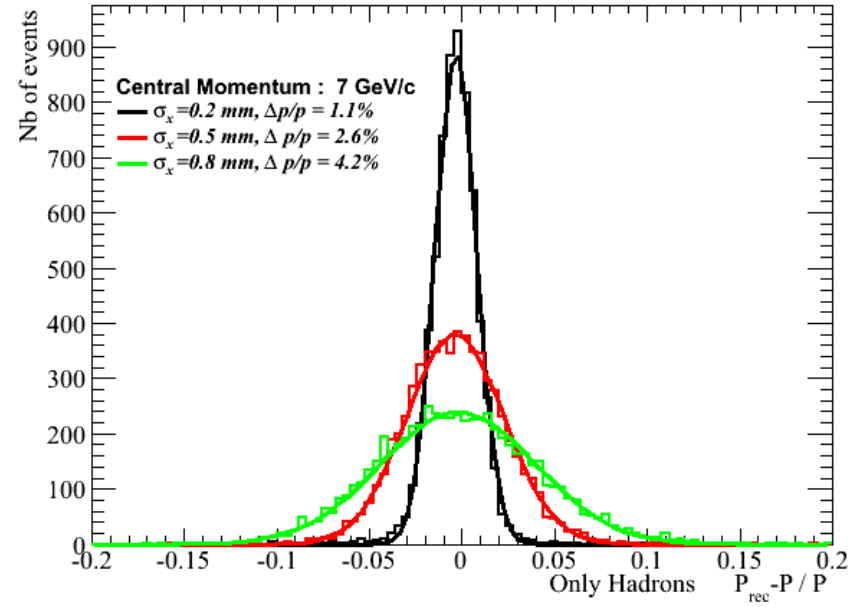
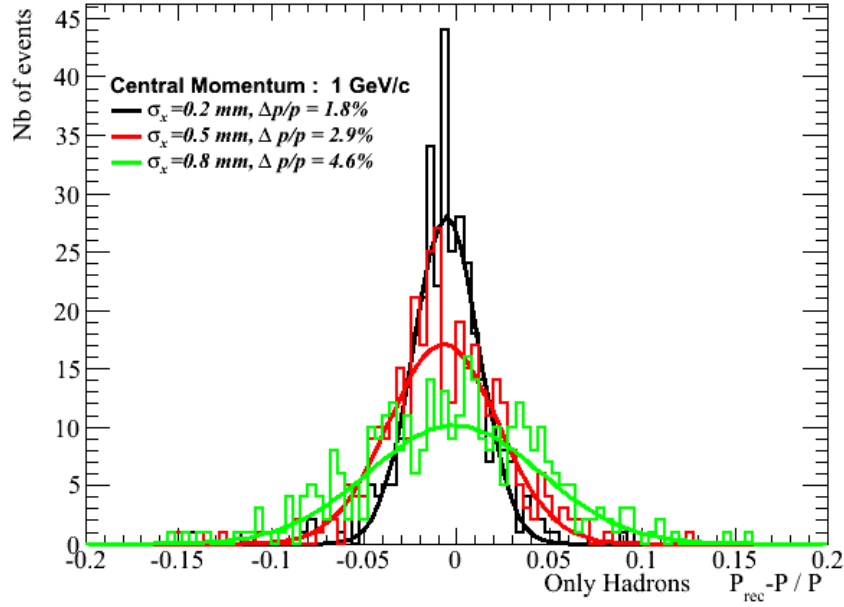
Rate [Hz]	Particle										
Momentum [GeV/c]	anti-p	e-	e+	K-	K+	mu-	mu+	p	pi-	pi+	Grand Total
-7	2.64	56.74	0.00	7.01	0.00	2.01	0.00	0.00	138.40	0.00	206.81
-6	2.36	62.05	0.00	5.28	0.00	2.15	0.00	0.00	113.61	0.00	185.45
-5	1.77	71.70	0.00	3.19	0.00	2.12	0.00	0.00	87.15	0.00	165.94
-4	1.08	92.64	0.00	1.88	0.00	2.33	0.00	0.00	71.91	0.00	169.83
-3	0.56	11.22	0.00	0.45	0.00	0.90	0.00	0.00	26.39	0.00	39.51
-2	0.10	13.02	0.00	0.07	0.00	0.49	0.00	0.00	12.95	0.00	26.63
-1	0.03	18.26	0.00	0.03	0.00	0.24	0.00	0.00	3.78	0.00	22.36
-0.4	0.00	7.88	0.00	0.00	0.00	0.03	0.00	0.00	0.10	0.00	8.02
0.4	0.00	0.00	7.43	0.00	0.00	0.00	0.00	0.03	0.00	0.03	7.50
1	0.00	0.00	18.54	0.00	0.00	0.00	0.42	4.10	0.00	3.72	26.77
2	0.00	0.00	13.33	0.00	0.24	0.00	0.94	8.75	0.00	14.90	38.16
3	0.00	0.00	11.08	0.00	1.53	0.00	1.01	10.52	0.00	31.46	55.59
4	0.00	0.00	92.29	0.00	3.09	0.00	2.50	17.15	0.00	81.04	196.08
5	0.00	0.00	74.31	0.00	5.69	0.00	2.57	18.75	0.00	99.31	200.63
6	0.00	0.00	63.61	0.00	9.03	0.00	2.99	23.61	0.00	127.40	226.63
7	0.00	0.00	51.81	0.00	12.95	0.00	2.47	26.81	0.00	157.64	251.67

Target : R=50mm L=300mm W if $E \leq 3\text{GeV}$ and Cu if $E > 3\text{ GeV}$

Momentum byte and spot size at NP-04 entrance



Momentum reconstruction



Summary & Conclusion

- Extensive simulations finished for H4
 - Target and secondary beam line adjusted to maximize the rate reaching the experiment
 - Momentum reconstruction results similar with H2
 - All the ntuples available in EOS (“TARGSEC”)
 - Muon studies for both beam lines ongoing.
- Addendum to the H2 note with specific H4 results being prepared and due to be published soon.