

# Rozproszenie elastyczne proton-proton

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$$p + p \rightarrow p + p$$

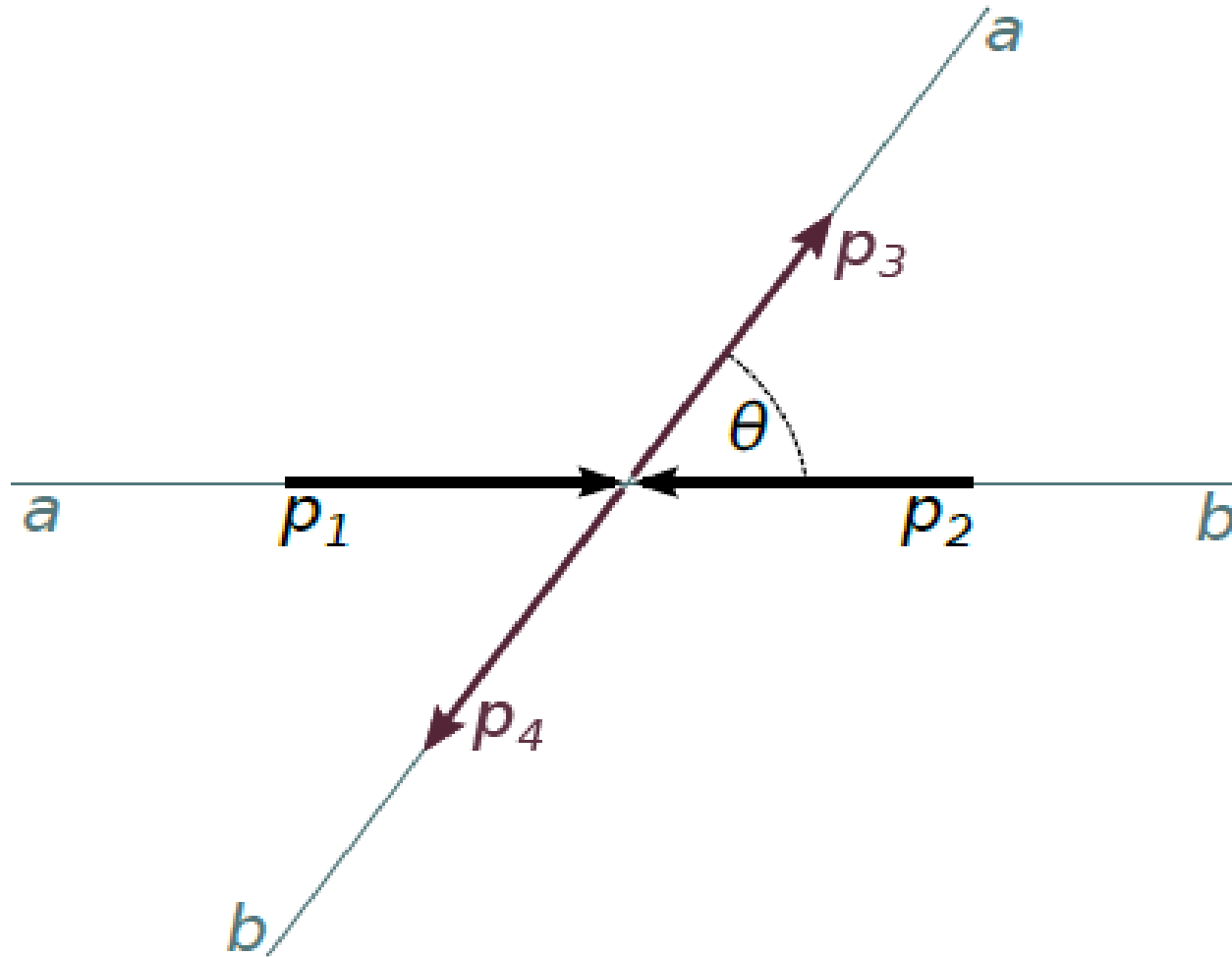
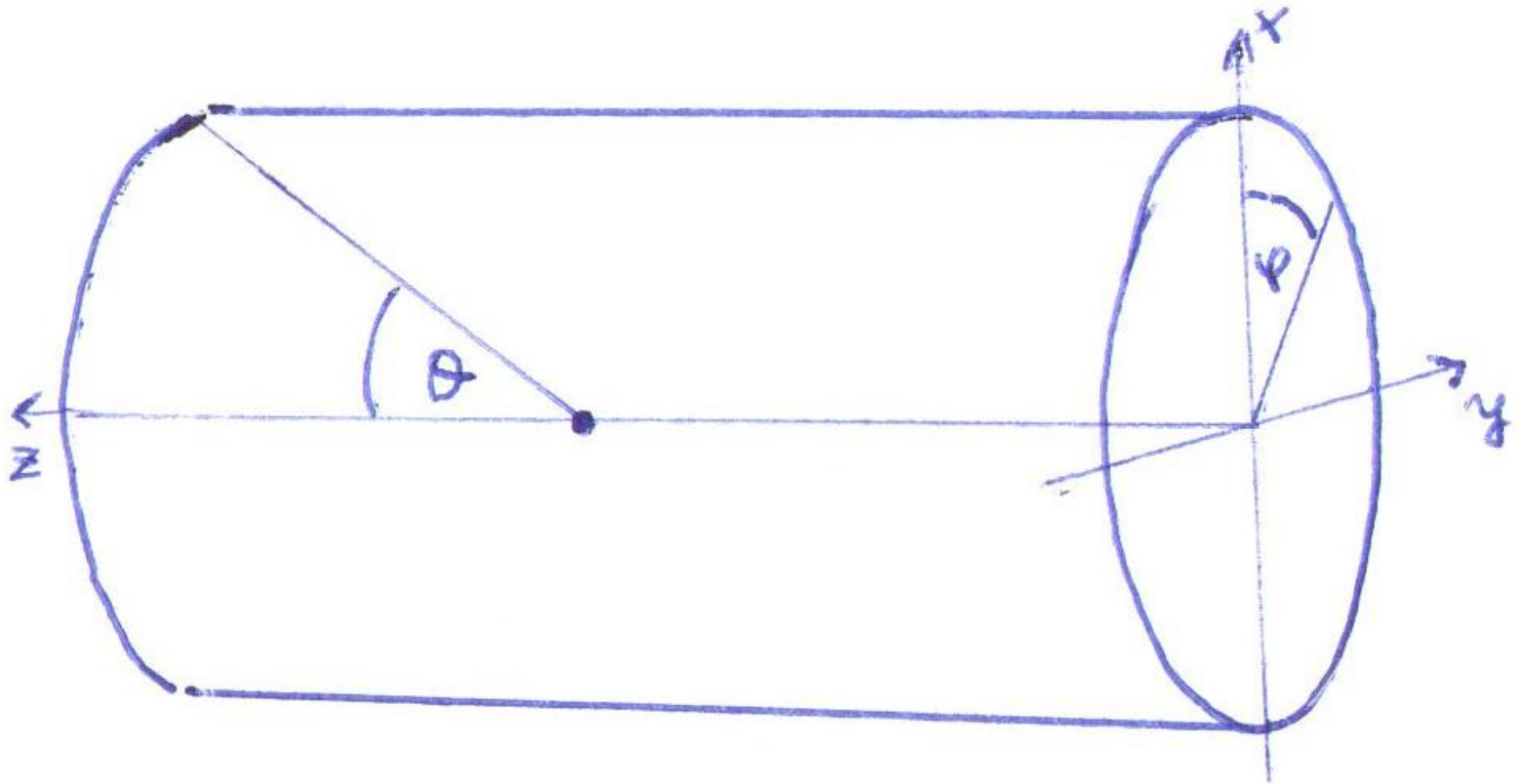


Figure 2.1: Elastic scattering in the centre-of-mass frame.

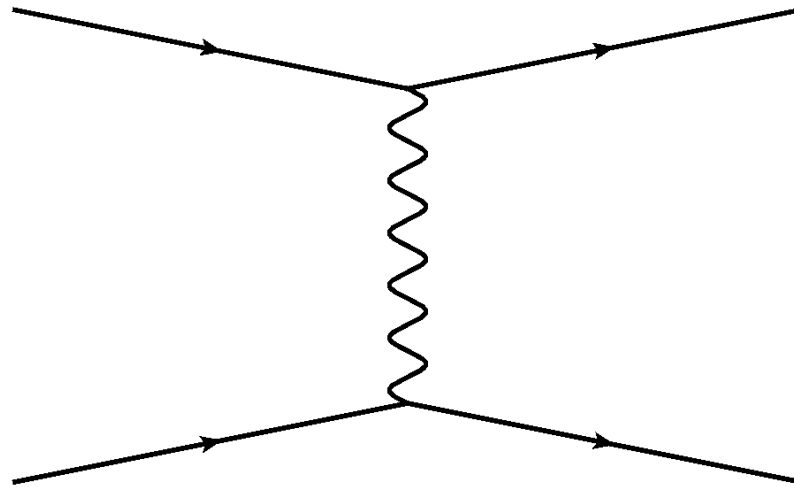


t – niezmiennik

dla małych kątów  $t \approx -(p\theta)^2$

# Oddziaływania

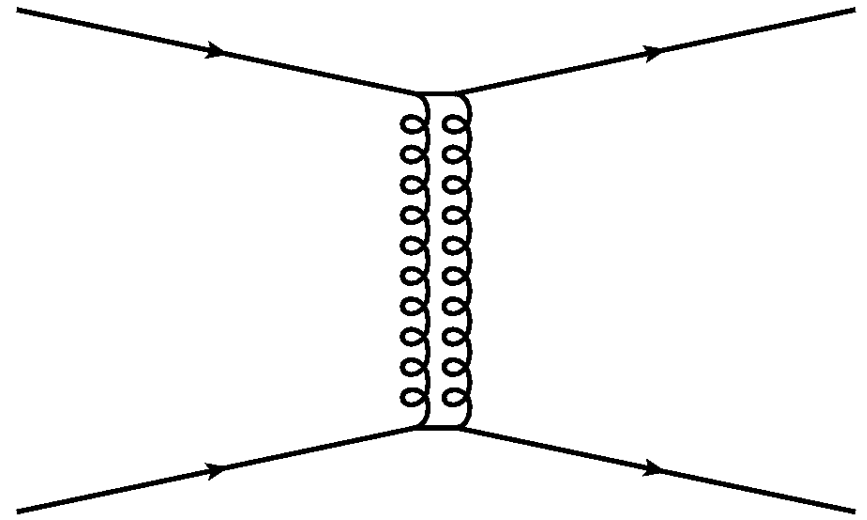
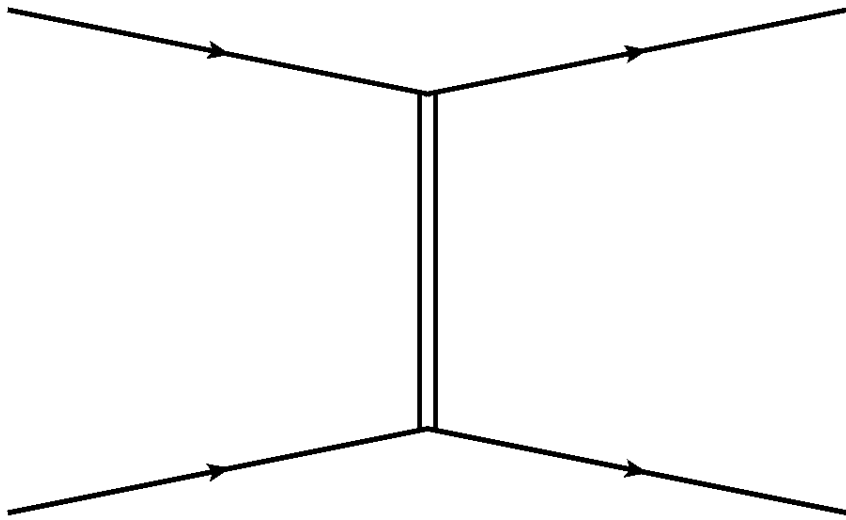
- kulombowskie (elektromagnetyczne)



$$\frac{d\sigma_C}{dt} = \pi \left| \frac{-2\alpha G^2(t)}{|t|} \right|^2$$

# Oddziaływania

- silne



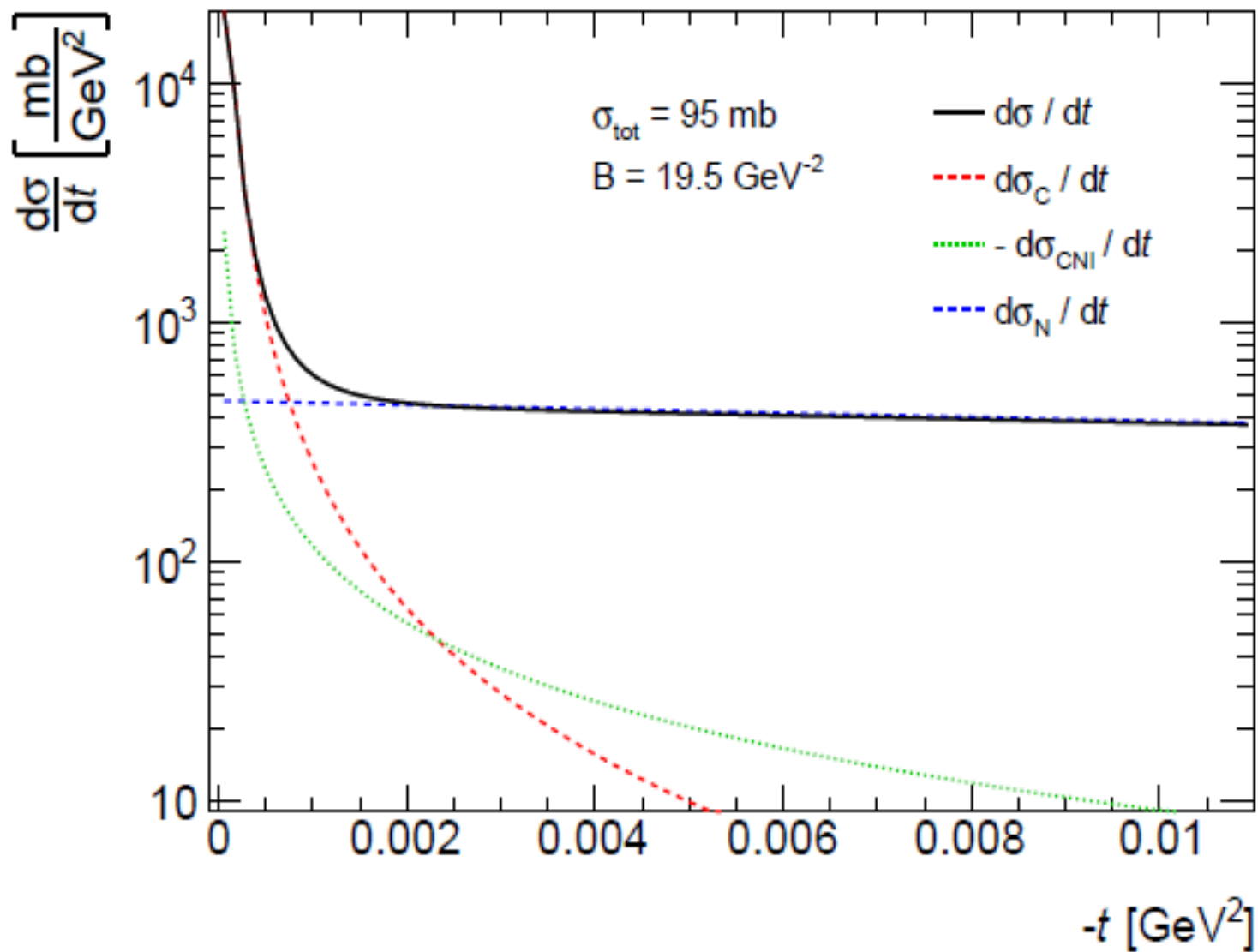
$$\frac{d\sigma_N}{dt} = \pi \left| (\rho + i) \frac{\sigma_{\text{tot}}}{4\pi} e^{-B|t|/2} \right|^2$$

# Oddziaływania

- elektromagnetyczne
- silne
- wkład od interferencji

$$\frac{d\sigma}{dt} = \frac{d\sigma_C}{dt} + \frac{d\sigma_{CNI}}{dt} + \frac{d\sigma_N}{dt}$$

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# generator Pythia

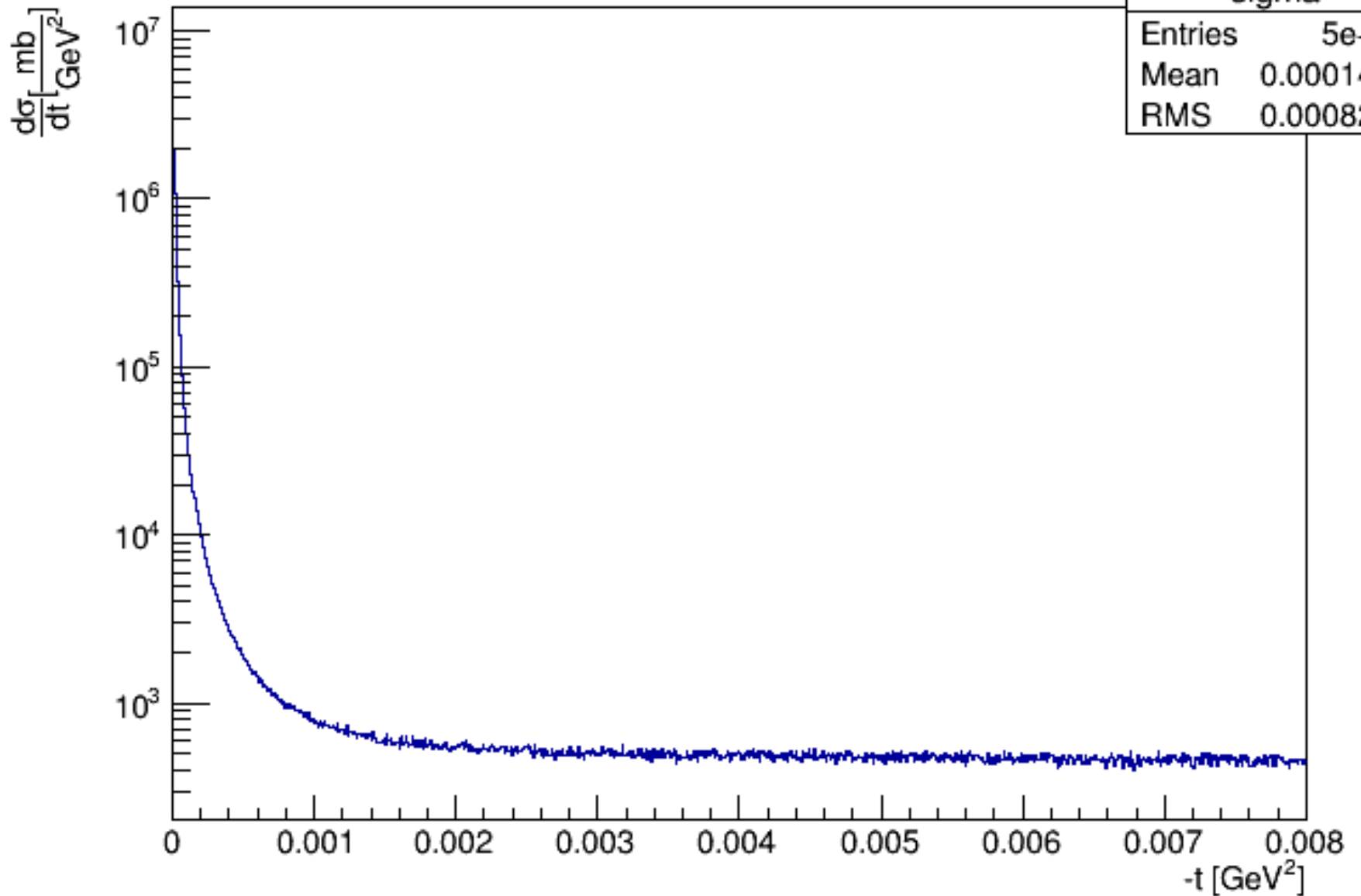
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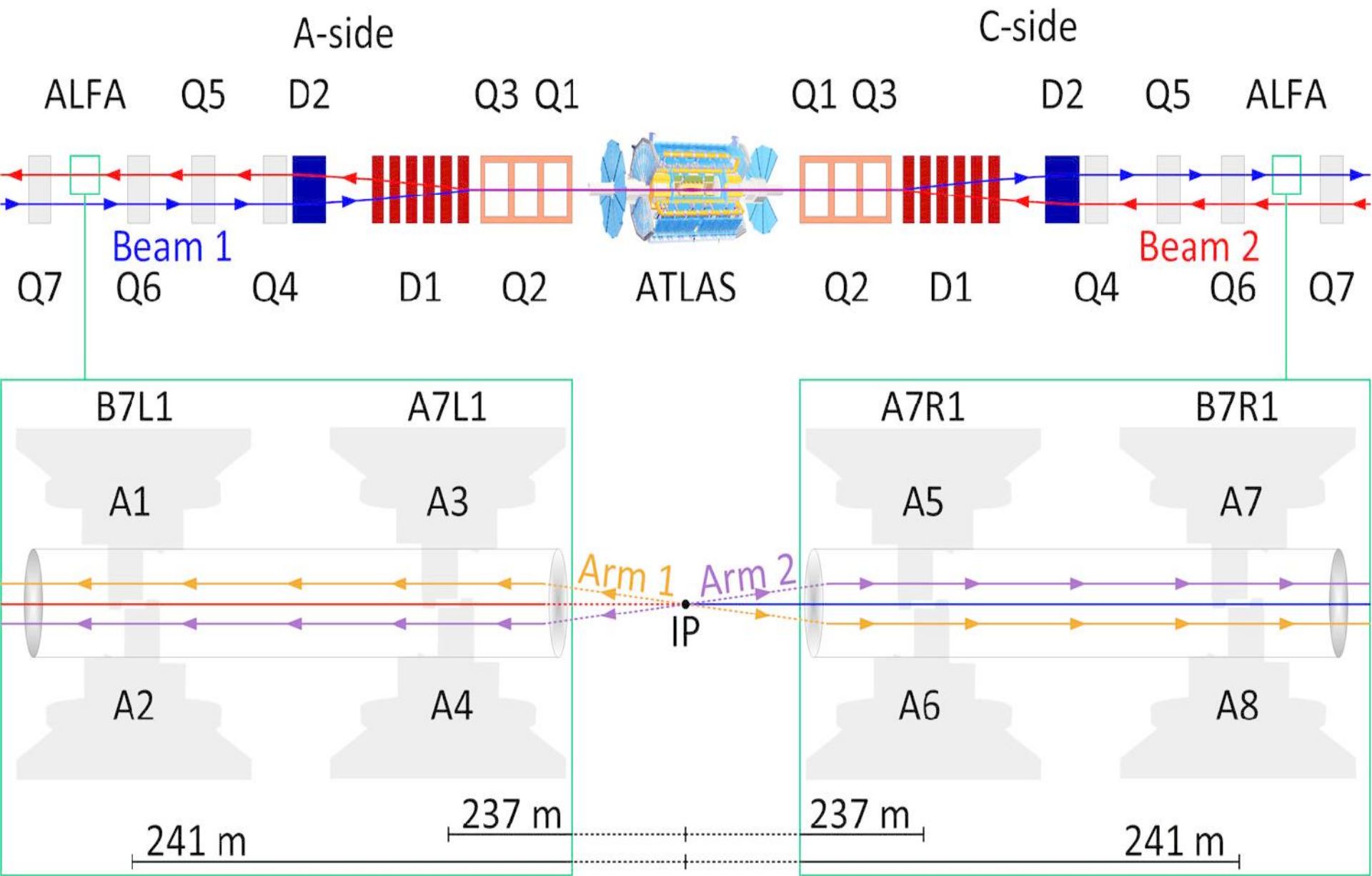
106 ----- PYTHIA Info Listing -----
107
108 Beam A: id = 2212, pz = 4.000e+03, e = 4.000e+03, m = 9.383e-01.
109 Beam B: id = 2212, pz = -4.000e+03, e = 4.000e+03, m = 9.383e-01.
110
111 In 1: id = -2, x = 1.071e-02, pdf = 5.029e-01 at Q2 = 4.532e+04.
112 In 2: id = 2, x = 3.131e-01, pdf = 2.864e-01 at same Q2.
113
114 Subprocess q qbar -> t tbar with code 602 is 2 -> 2.
115 It has sHat = 2.146e+05, tHat = -4.208e+04, uHat = -1.172e+05,
116 pTHat = 1.394e+02, m3Hat = 1.715e+02, m4Hat = 1.609e+02,
117 thetaHat = 1.044e+00, phiHat = 2.341e+00.
118 alphaEM = 7.895e-03, alphaS = 1.146e-01 at Q2 = 4.705e+04.
119
120 Impact parameter b = 6.830e-01 gives enhancement factor = 1.614e+00.
121 Max pT scale for MPI = 0.000e+03, ISR = 0.000e+03, FSR = 0.000e+03.
122 Number of MPI = 8, ISR = 17, FSRproc = 47, FSRreson = 9.
123
124 ----- End PYTHIA Info Listing -----
125
126 ----- PYTHIA Event Listing (hard process) -----
127
128 no id name status mothers daughters colours p_x p_y p_z e m
129 0 90 (system) -11 0 0 0 0 0 0.000 0.000 0.000 8000.000 8000.000
130 1 2212 (p+) -12 0 0 3 0 0 0.000 0.000 4000.000 4000.000 0.938
131 2 2212 (p+) -12 0 0 4 0 0 0.000 0.000 -4000.000 4000.000 0.938
132 3 -2 (ubar) -21 1 0 5 6 0 101 0.000 0.000 42.833 42.833 0.000
133 4 2 (u) -21 2 0 5 6 102 0 0.000 0.000 -1252.359 1252.359 0.000
134 5 -6 (tbar) -22 3 4 7 8 0 101 -97.119 100.032 -387.911 446.443 171.457
135 6 6 (t) -22 3 4 9 10 102 0 97.119 -100.032 -021.615 848.749 160.890
136 7 -24 (W-) -22 5 0 11 12 0 0 -102.452 20.764 -177.890 221.098 81.214
137 8 -5 (bbar) 23 5 0 0 0 0 101 5.332 79.268 -210.821 225.345 4.800
138 9 24 (W+) -22 6 0 13 14 0 0 41.835 -45.924 -675.294 603.169 82.697
139 10 5 (b) 23 6 0 0 0 102 0 55.204 -54.108 -146.321 165.500 4.800
140 11 13 (nu-) 23 7 0 0 0 0 0 -32.056 -24.935 -96.691 104.874 0.106
141 12 -14 (nu_mubar) 23 7 0 0 0 0 0 -70.395 45.699 -80.399 116.223 0.000
142 13 -15 (tau+) 23 9 0 0 0 0 0 60.656 -51.649 -603.146 600.300 1.777
143 14 16 (nu_tau) 23 9 0 0 0 0 0 -18.821 5.724 -72.147 74.781 0.000
144 Charge sum: 0.000 Momentum sum: -0.000 0.000 -1209.526 1295.192 463.215
145

```

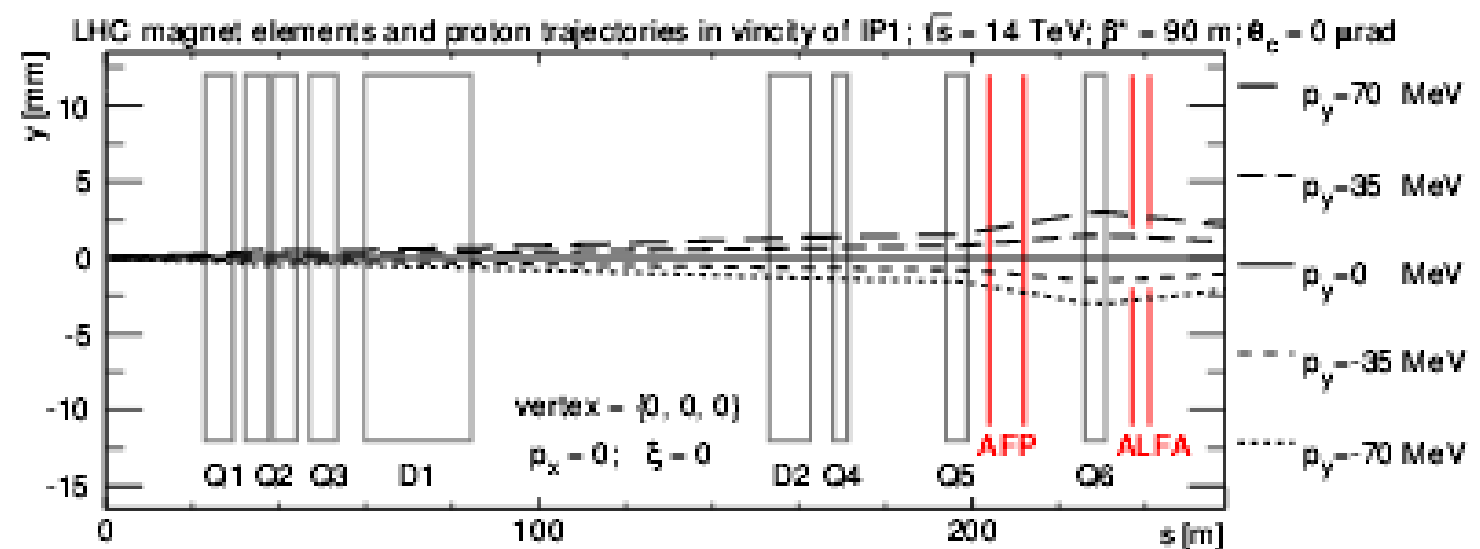
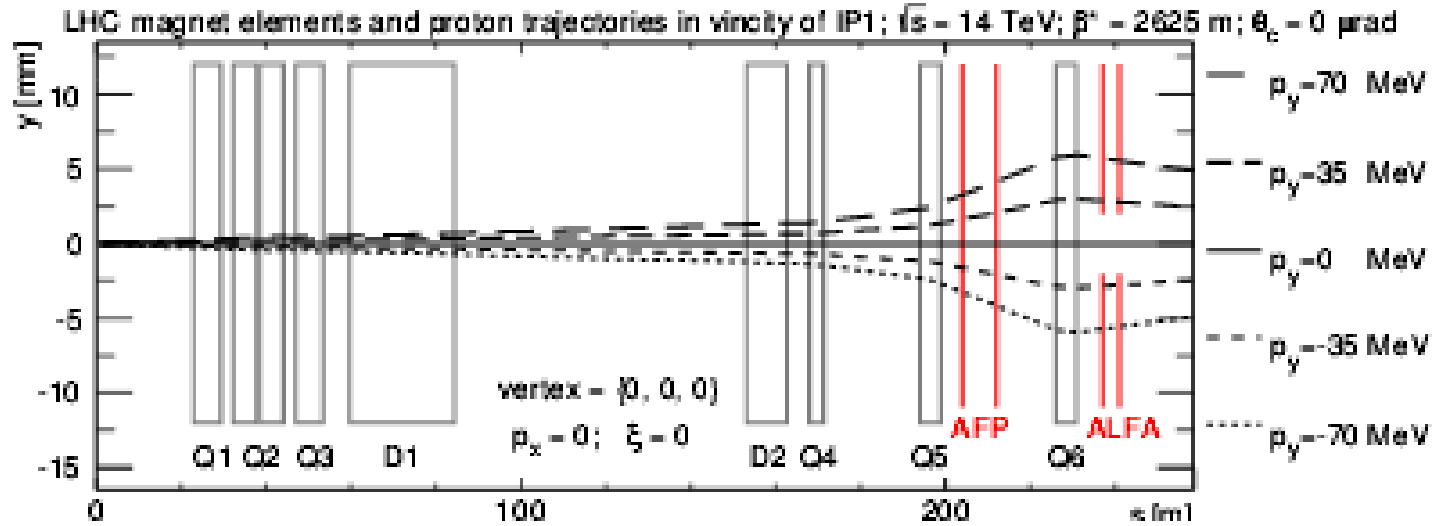


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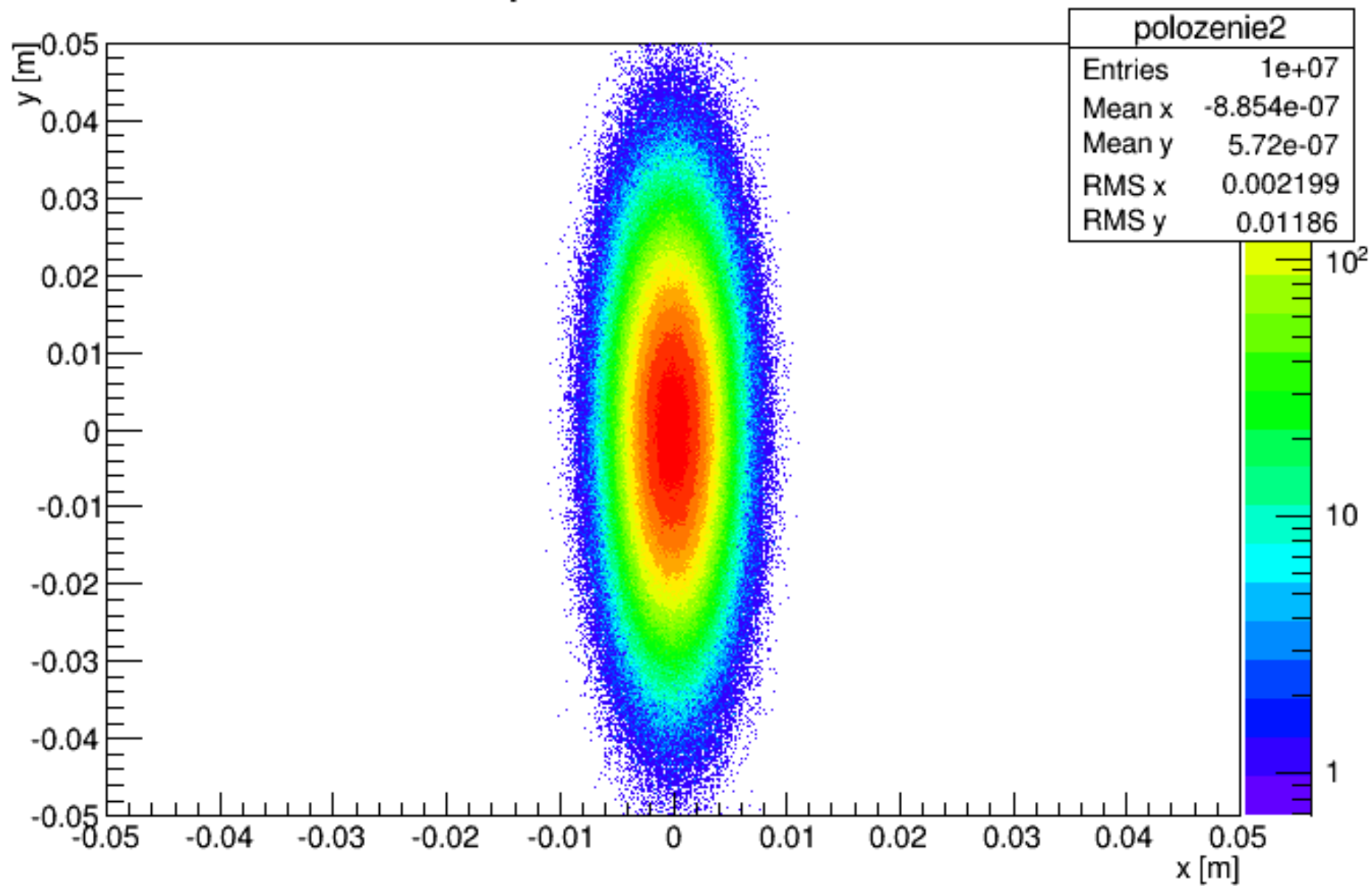


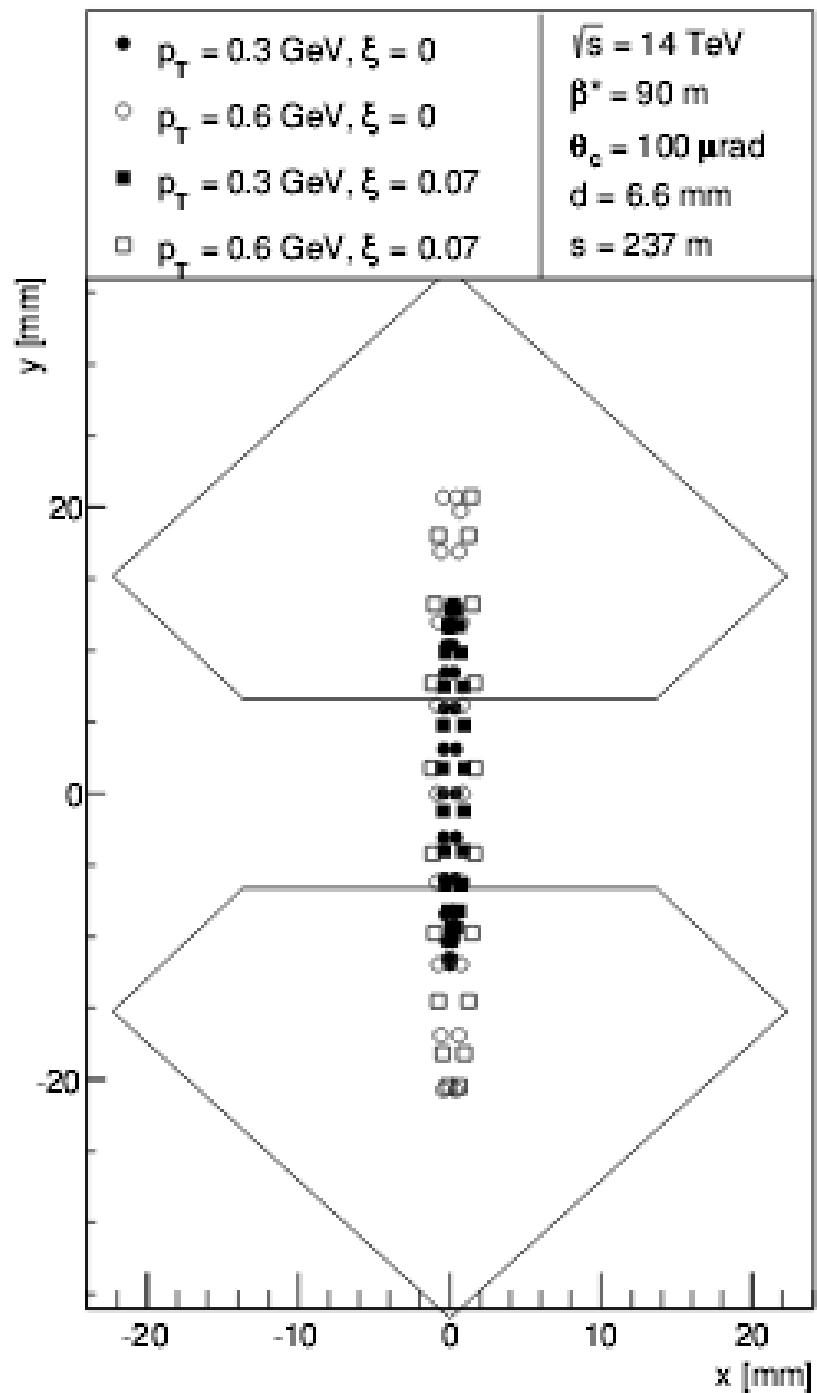


# Optyka LHC

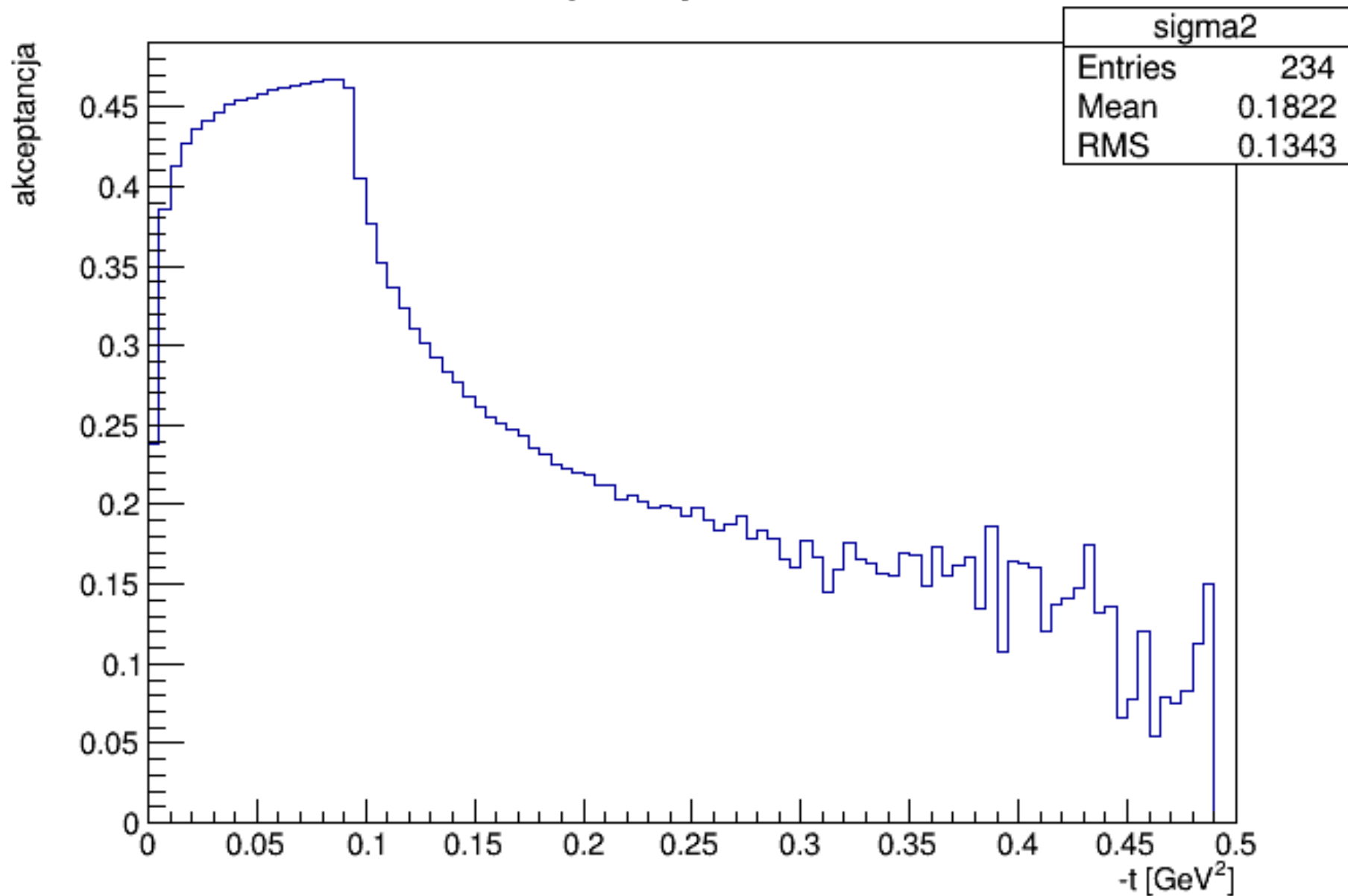


# polozenie 2.5km

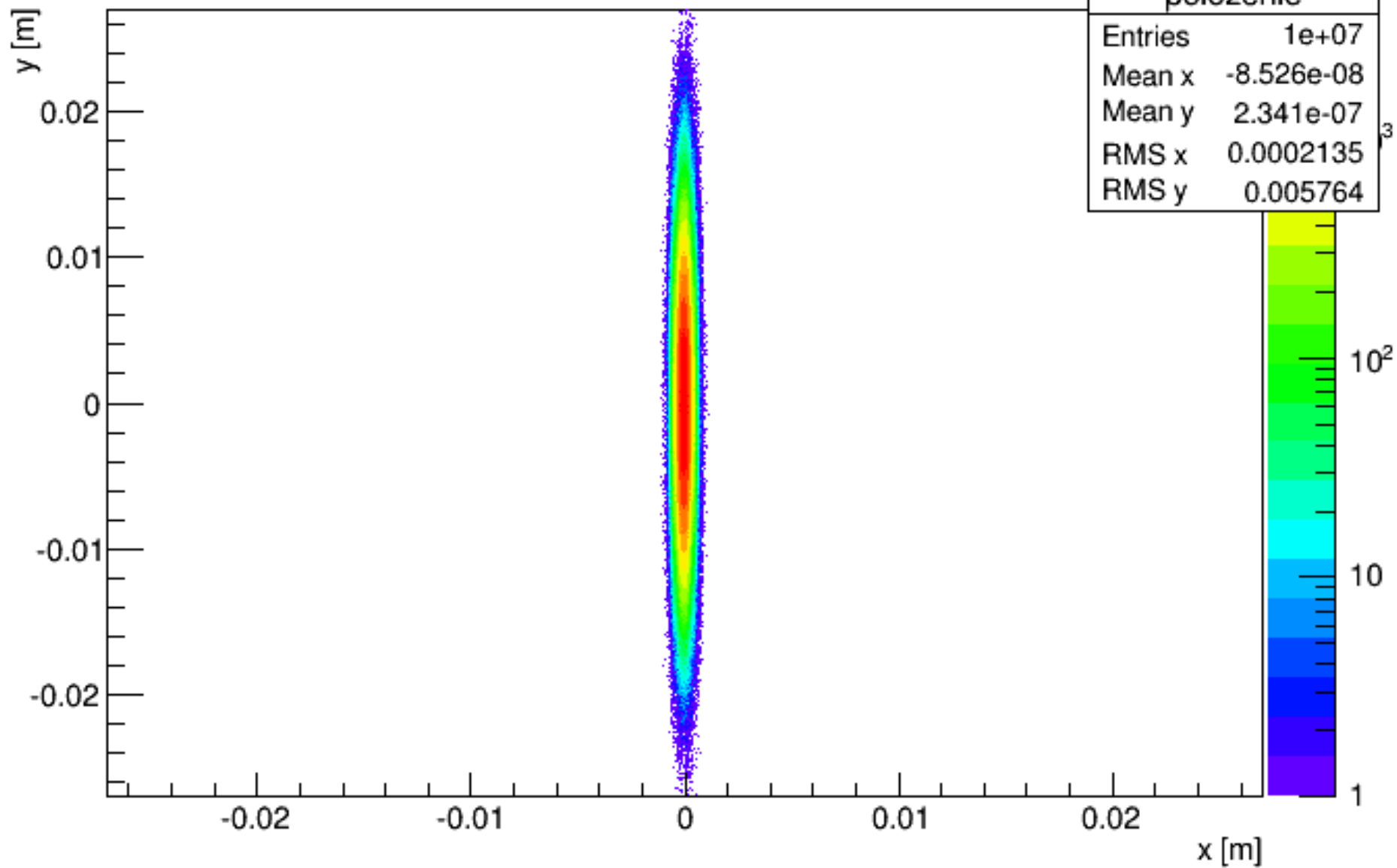




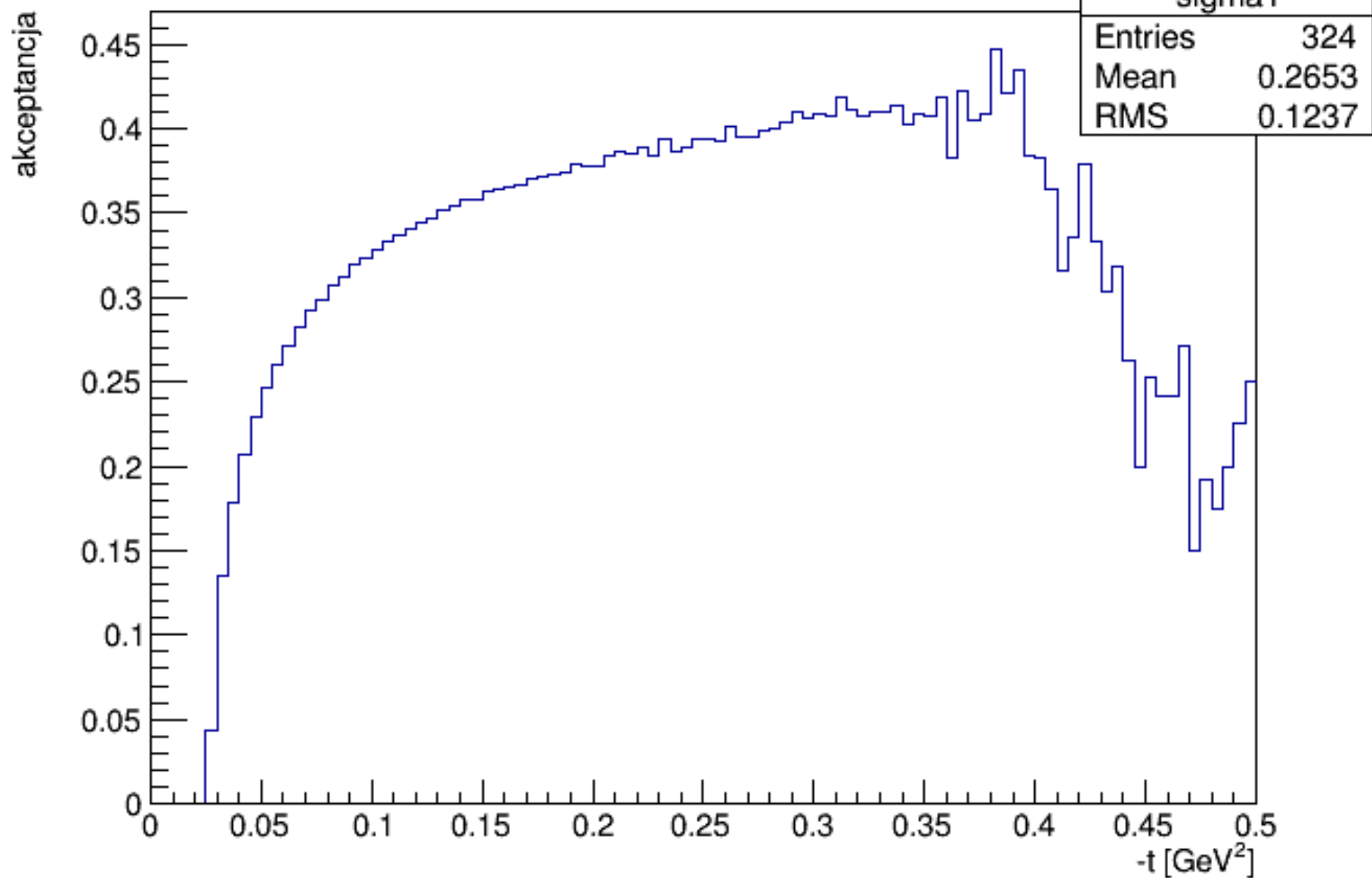
# akceptancja 2.5km



# polozenie 90m

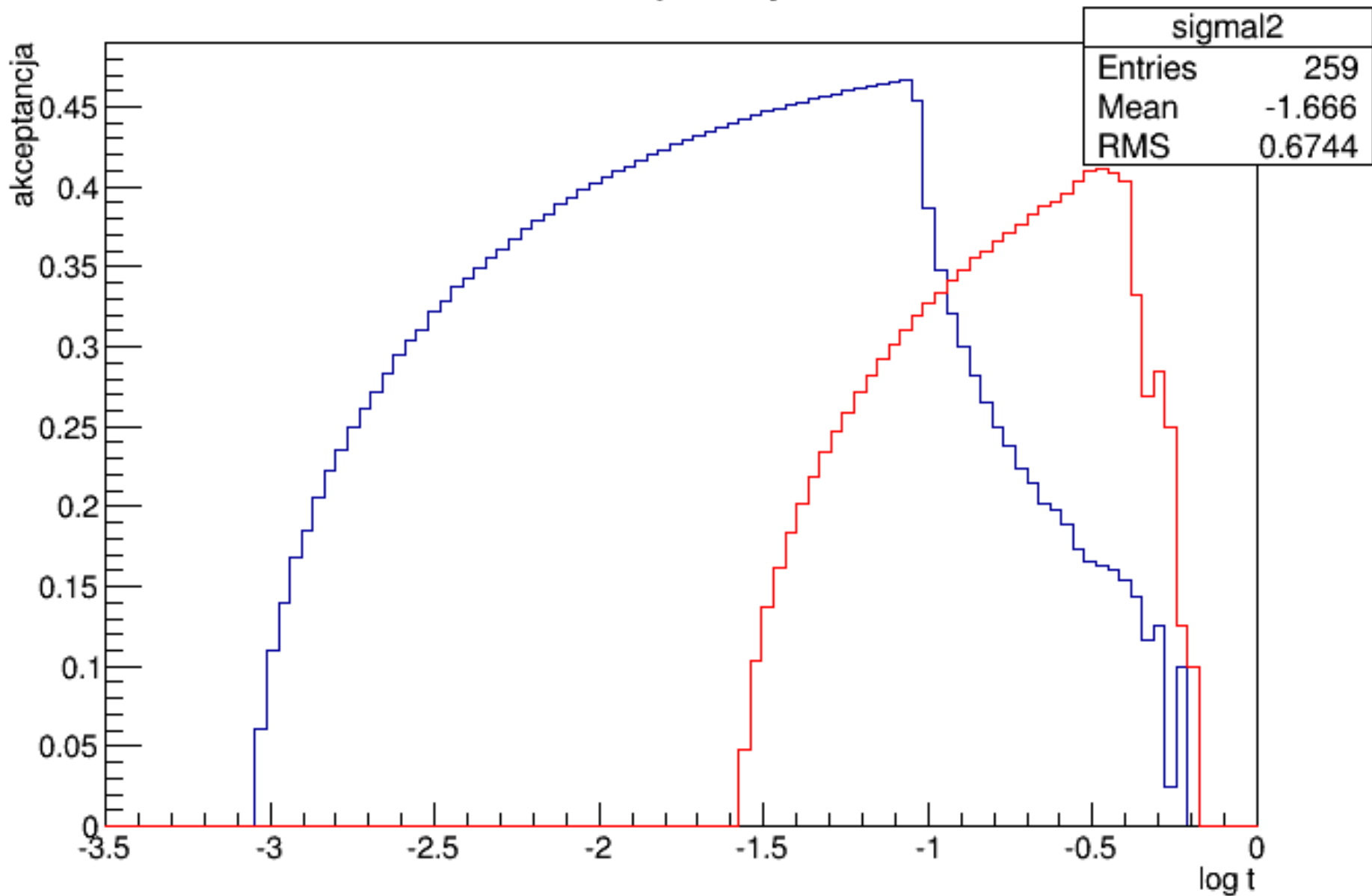


# akceptancja 90m

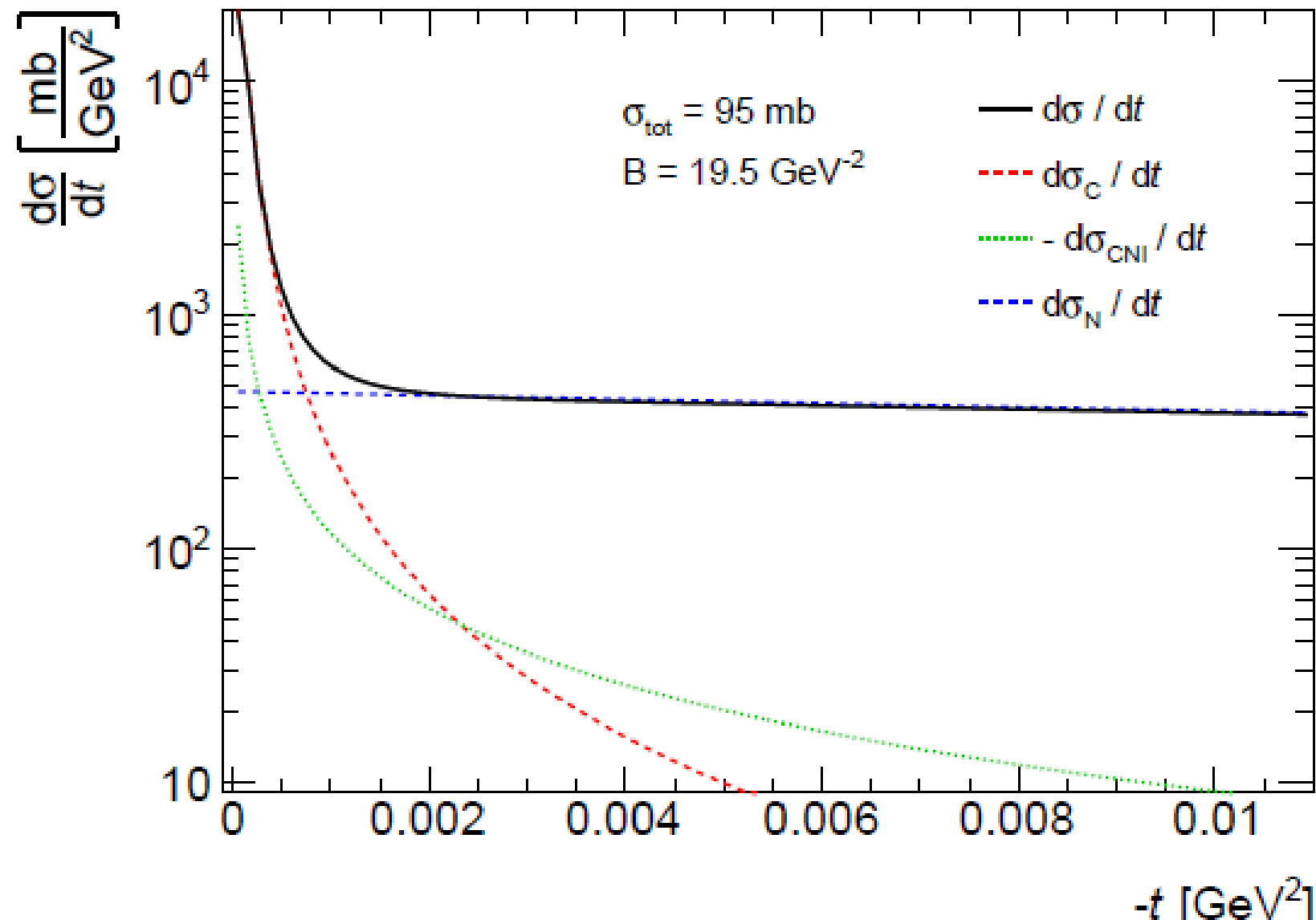




# akceptancja



$$\frac{d\sigma}{dt} = \frac{d\sigma_C}{dt} + \frac{d\sigma_{\text{CNI}}}{dt} + \frac{d\sigma_N}{dt}$$



# Podsumowanie

- Zapoznanie się z narzędziem Pythia
- Użycie Pythii do generacji przypadków rozpraszania elastycznego
- Użycie macierzy transportu do wyliczenia pozycji protonów w detektorze ALFA
- Obliczenie akceptancji detektora ALFA
- Porównanie akceptancji różnych ustawień (optyk) detektora LHC

Wniosek :

Dla optyki 90m detekcja oddziaływań jądrowych, a dla optyki 2.5km jest szansa detekcji oddziaływań elektromagnetycznych