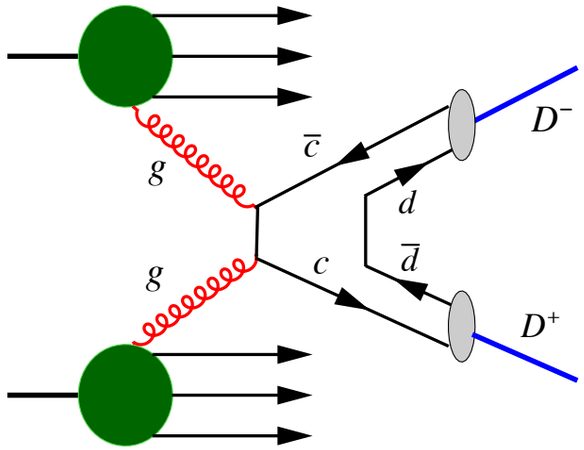
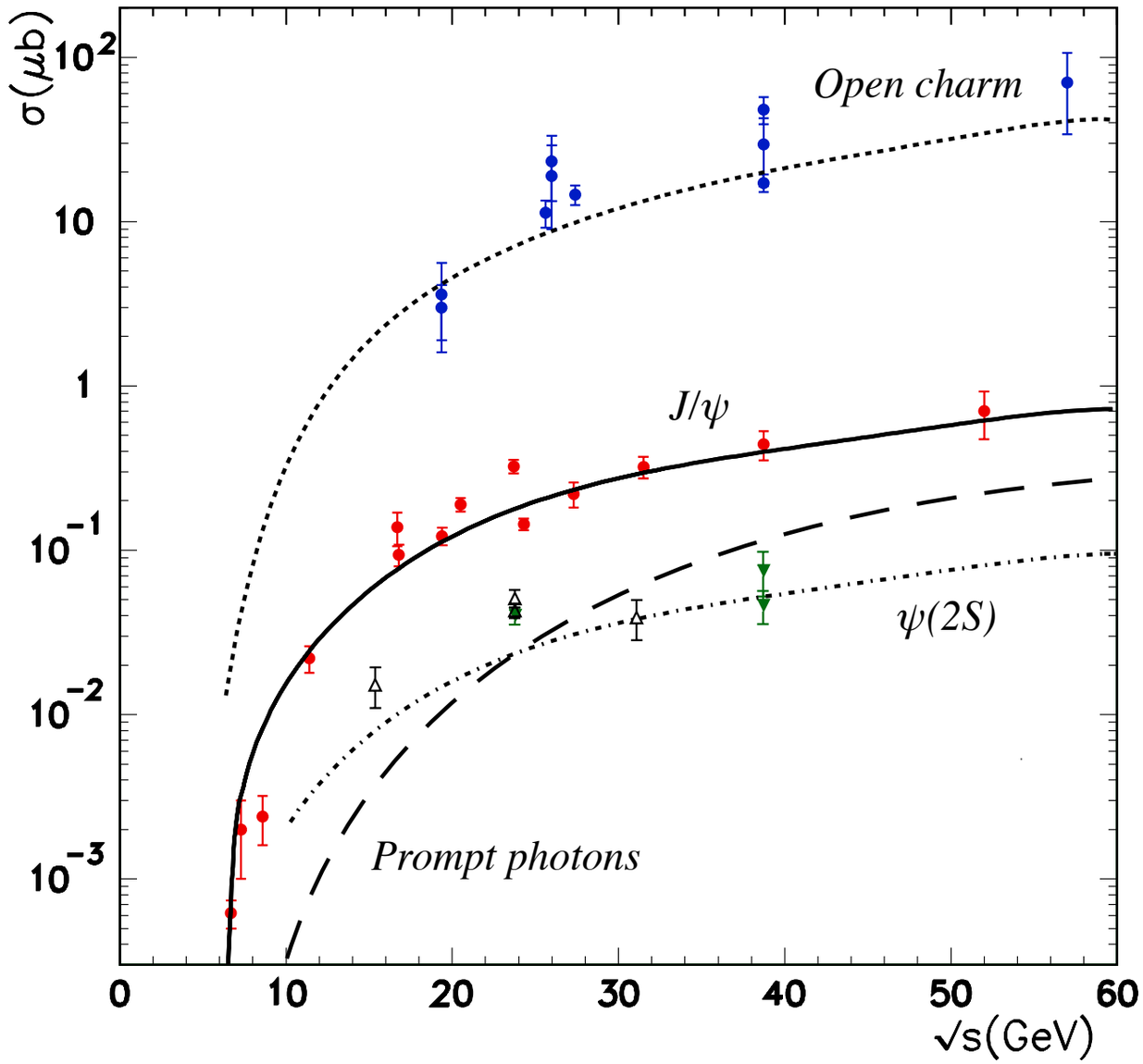
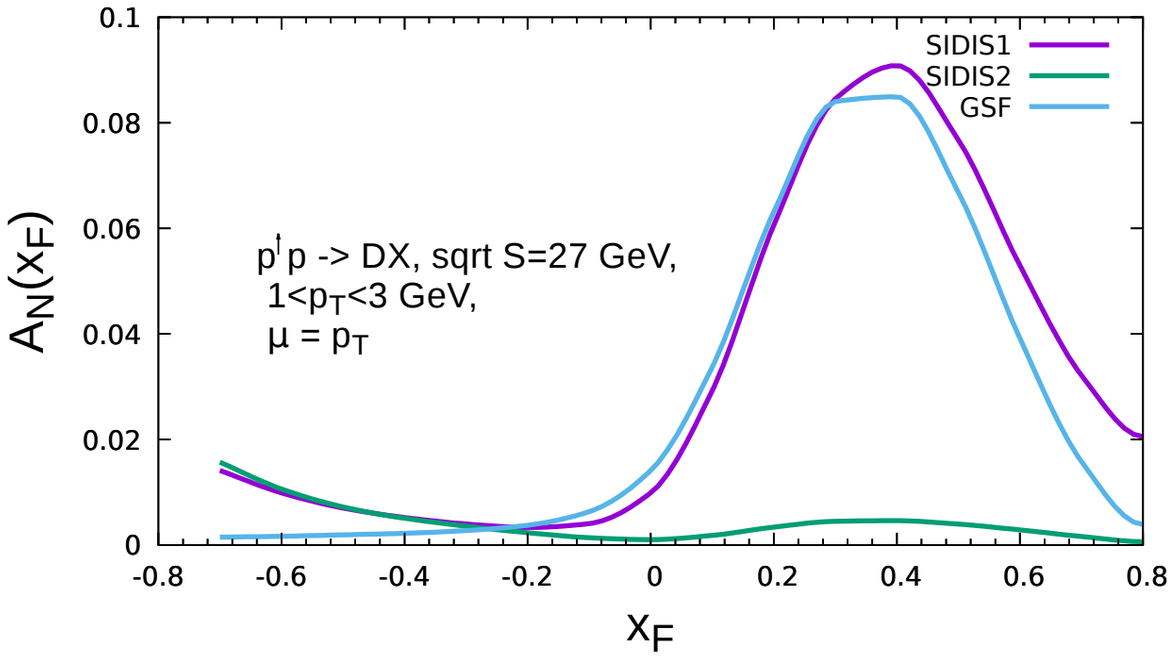
Some estimations for D-mesons at SPD

A. Guskov, DLNP, JINR 17.6.20

Open charm production







D-mesons

$D^{\pm}$

$I(J^P) = \frac{1}{2}(0^-)$

Mass $m = 1869.65 \pm 0.05$ MeV
Mean life $\tau = (1040 \pm 7) \times 10^{-15}$ s
$c\tau = 311.8\ \mu$m

$K^- 2\pi^+$	[c]	(9.38 ± 0.16) %

D^0

$I(J^P) = \frac{1}{2}(0^-)$

Mass $m = 1864.83 \pm 0.05$ MeV
$m_{D^\pm} - m_{D^0} = 4.822 \pm 0.015$ MeV
Mean life $\tau = (410.1 \pm 1.5) \times 10^{-15}$ s
$c\tau = 122.9\ \mu$m

$K^- \pi^+$	(3.950± 0.031) %

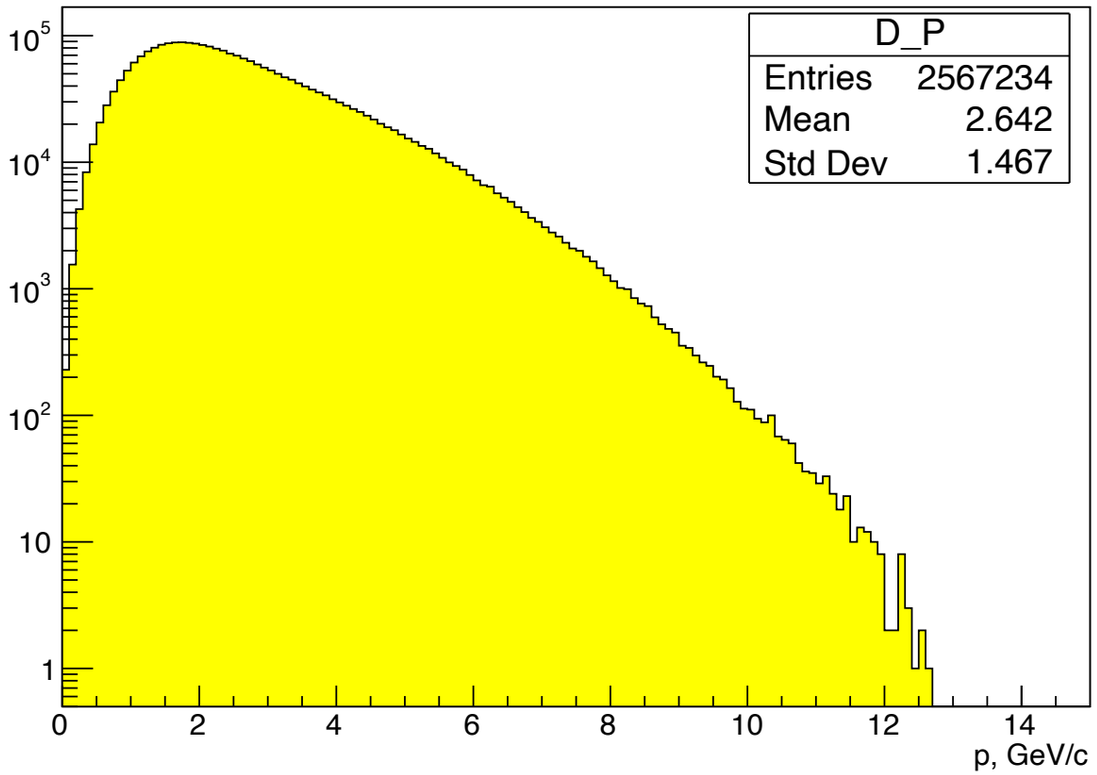
$D^*(2007)^0$

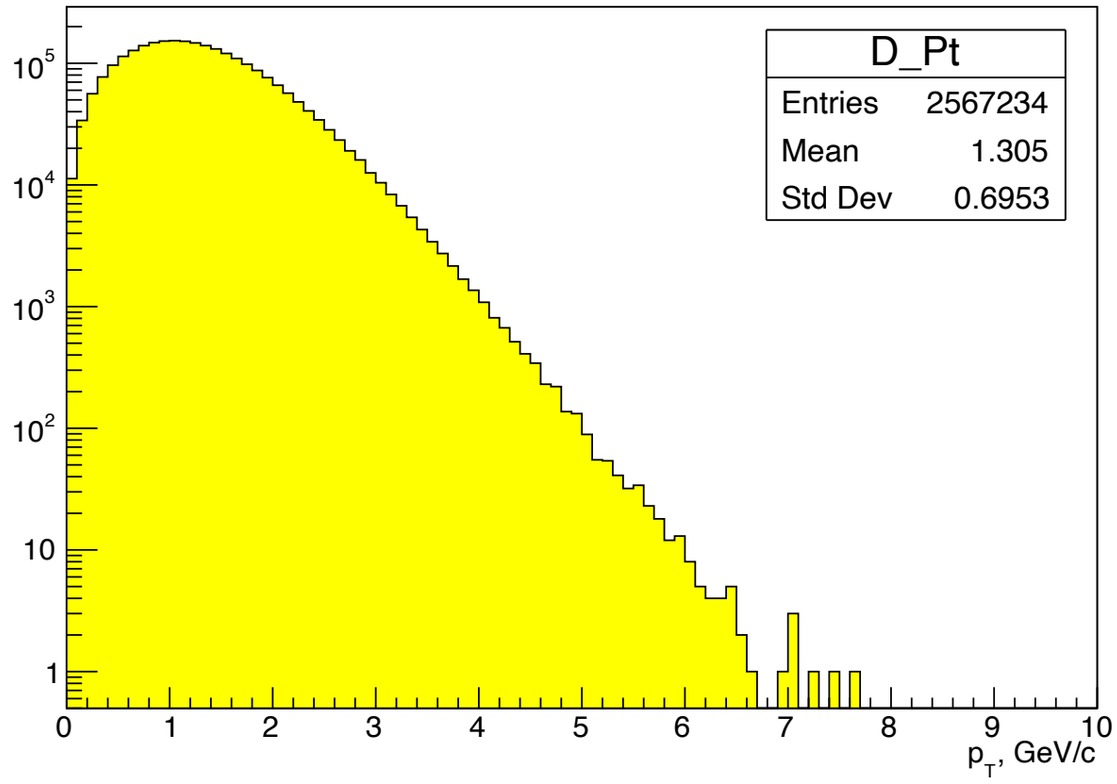
$D^*(2007)^0$ DECAY MODES	Fraction (Γ_i/Γ)
$D^0 \pi^0$	(64.7±0.9) %

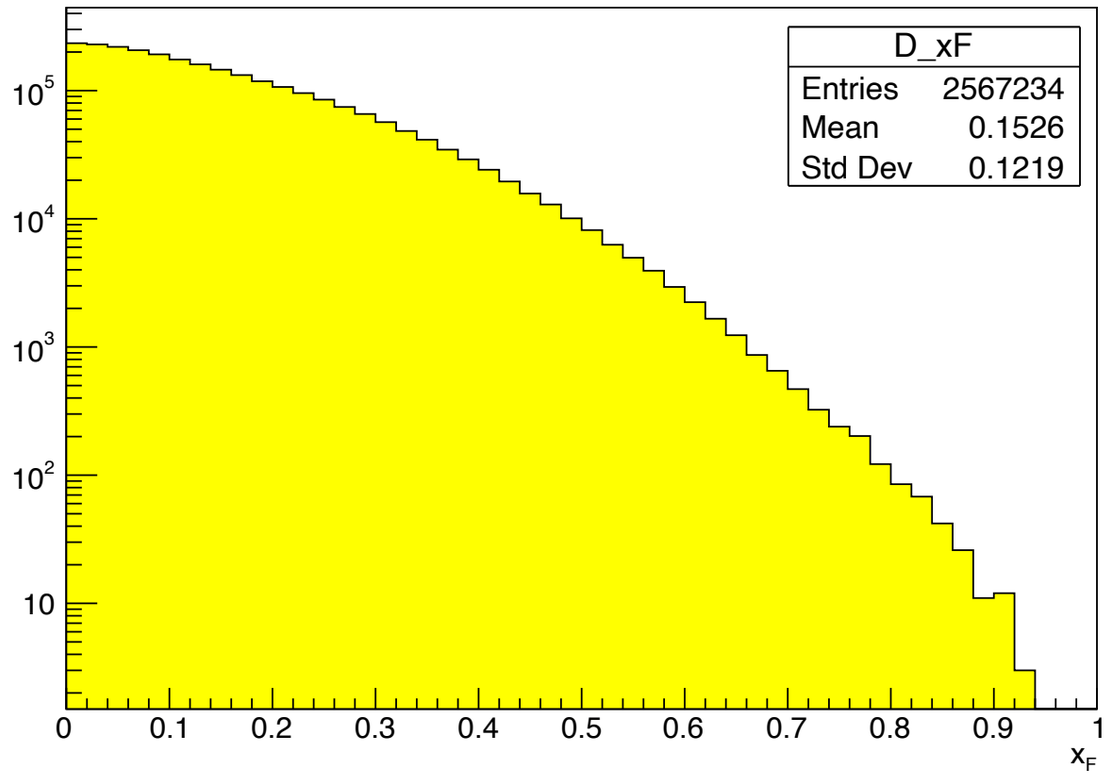
$D^*(2010)^{\pm}$

$D^*(2010)^{\pm}$ DECAY MODES	Fraction (Γ_i/Γ)
$D^0 \pi^+$	(67.7±0.5) %
$D^+ \pi^0$	(30.7±0.5) %

Kinematics at 27 GeV

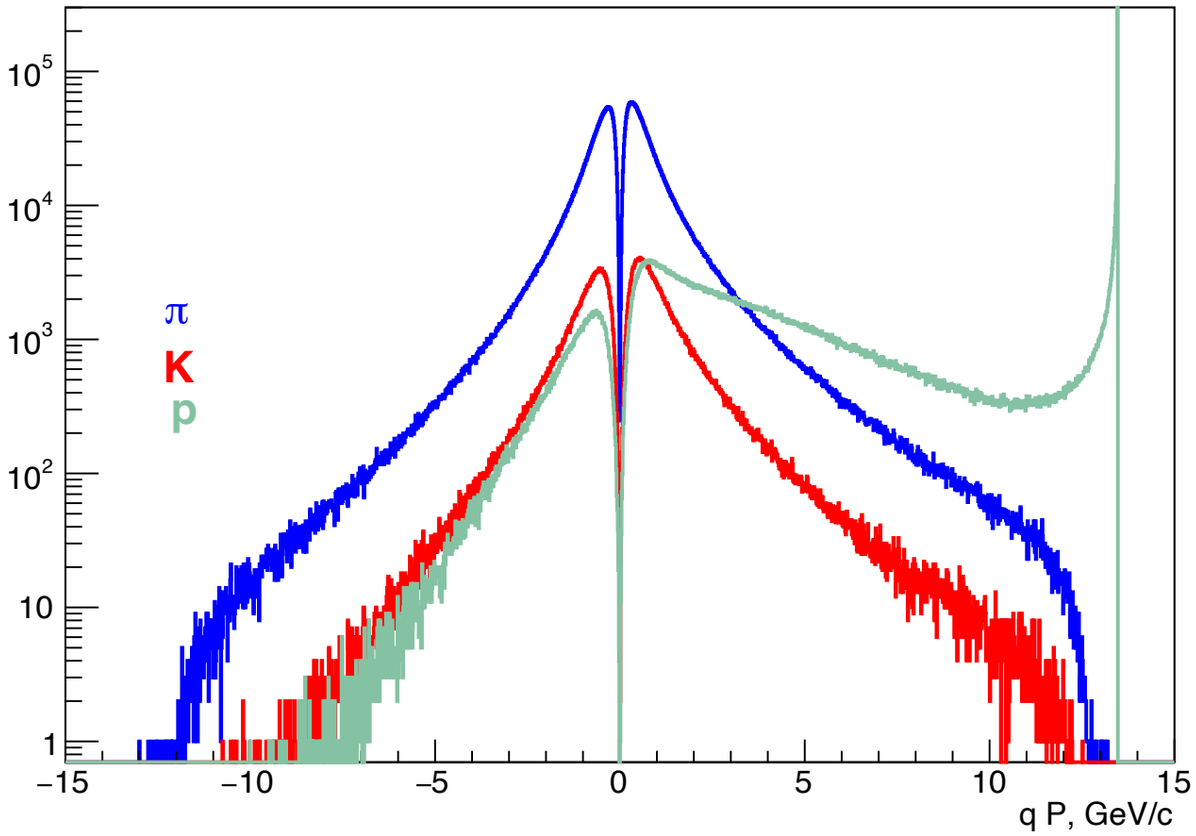


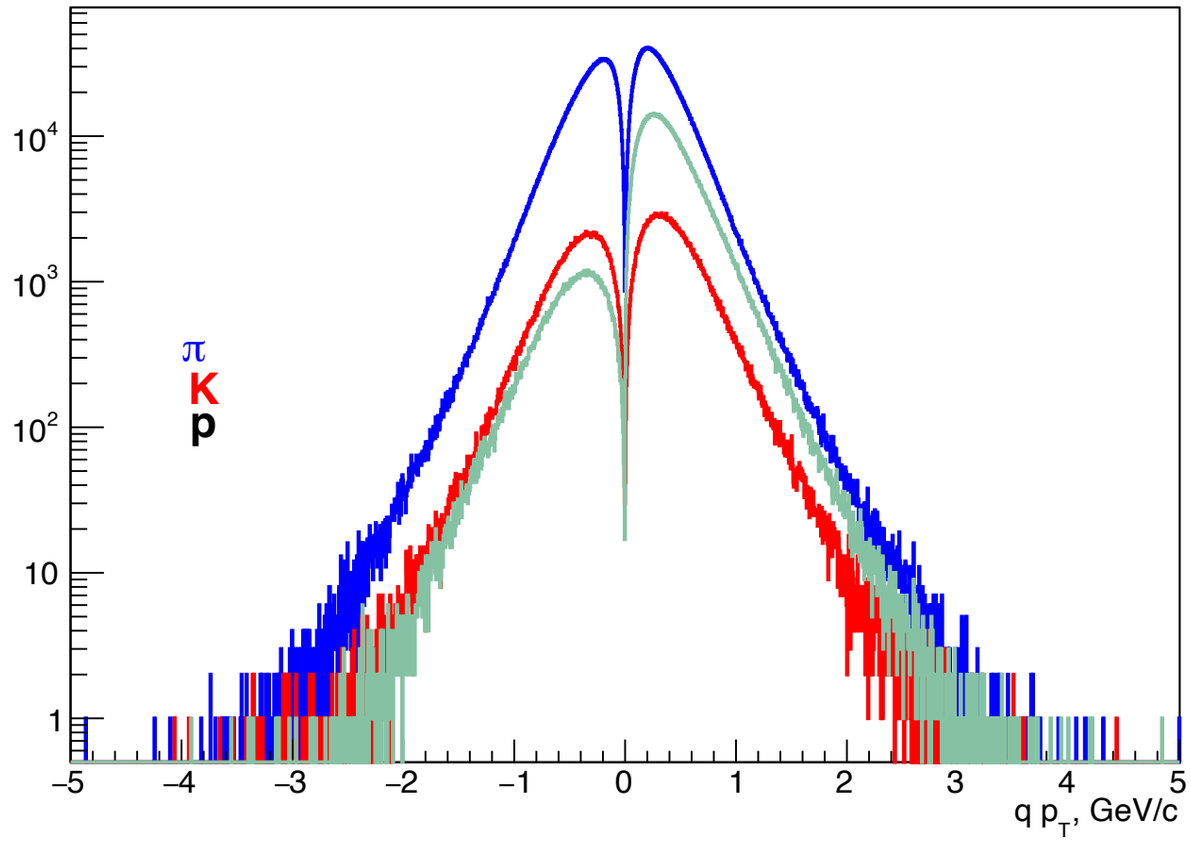




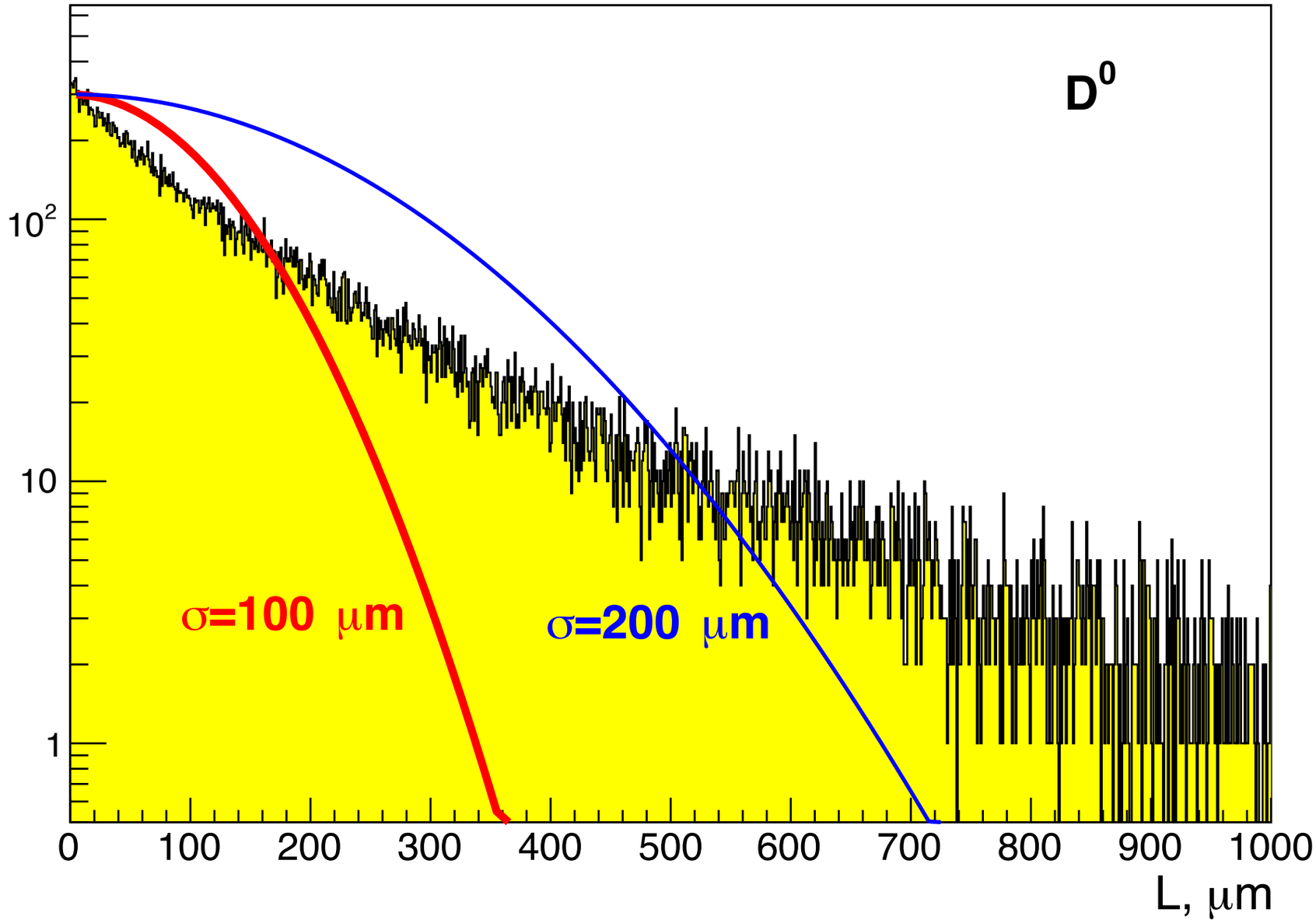
p-p collisions at 27 GeV

Secondary particles



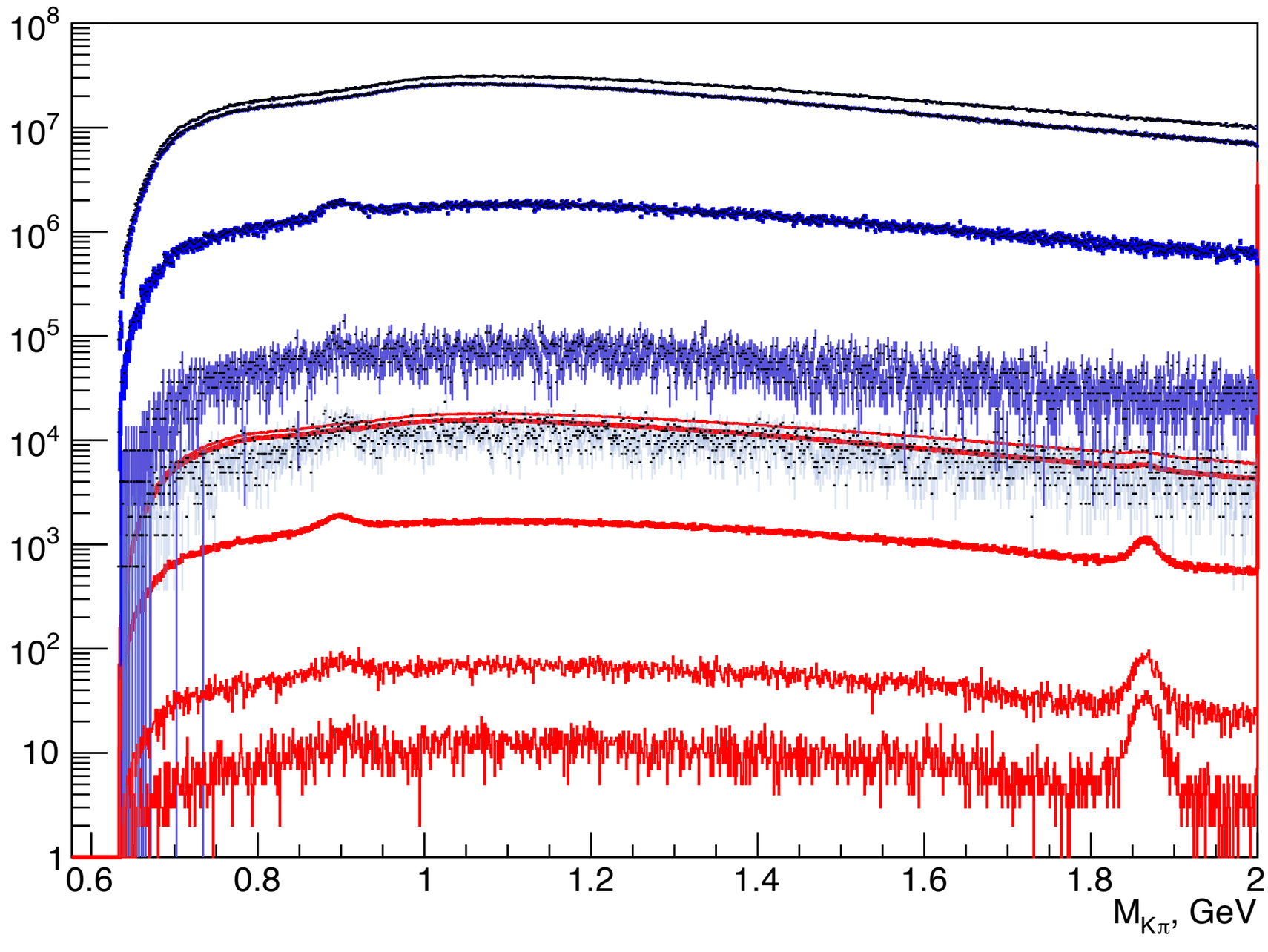


Secondary vertex



Signal and background

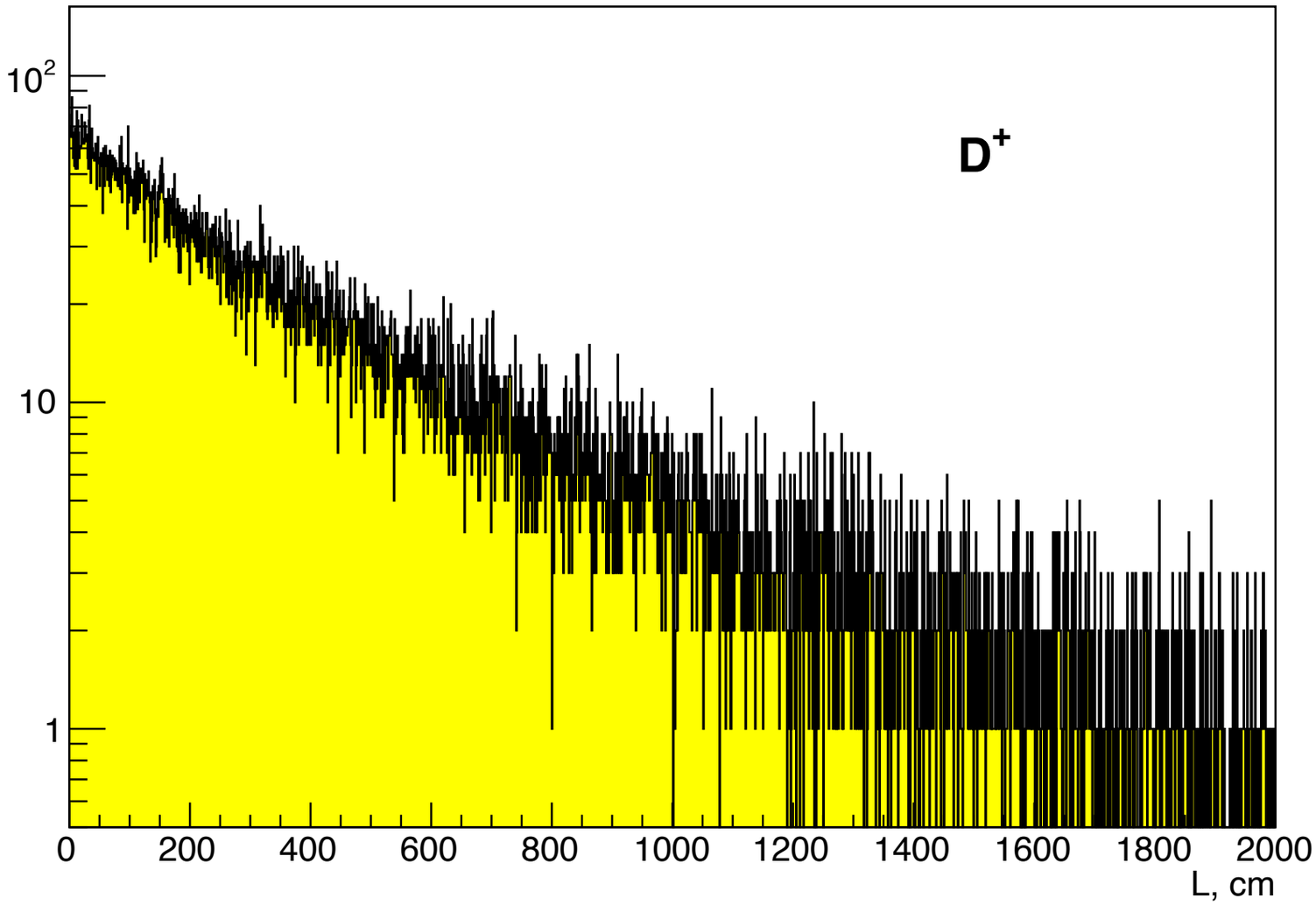
Pythia8, no setup simulation, $\sigma_p/p = \dfrac{p}{p_T} \times 2\,\%$



Signal to background ratio: D^0

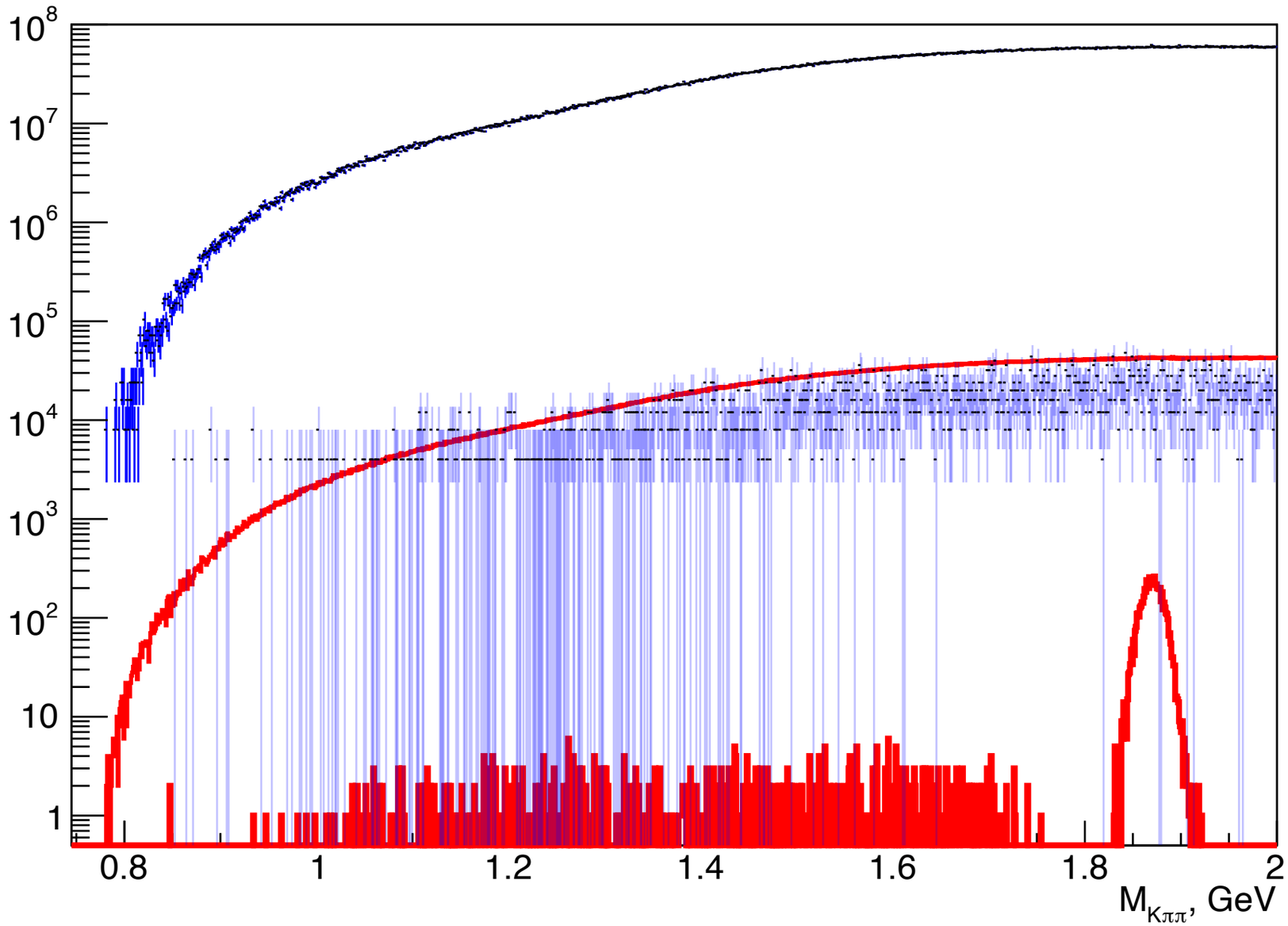
	Selection	S/B	Signal
1	No cuts	3.6×10^{-5}	1
2	100% protons rejected	5.2×10^{-5}	1
3	**2** + 100% K / π identification	6.0×10^{-4}	1
4	**3** + L>350 μm, σ_L=200 μm	2.2×10^{-3}	0.12
5	**3** + L>500 μm, σ_L=200 μm	6.8×10^{-3}	0.07
6	**3** + L>200 μm, σ_L=100 μm	7.5×10^{-3}	0.28
7	**3** + L>300 μm, σ_L=100 μm	0.08	0.18

Secondary vertex



Signal and background

Pythia8, no setup simulation, $\sigma_p/p = \dfrac{p}{p_T} \times 2\,\%$



Signal to background ratio: D^0 ,$D^{\pm}$

	Selection	S/B	Signal	S/B	Signal
1	No cuts	3.6×10^{-5}	1	1.5×10^{-5}	1
2	100% protons rejected	5.2×10^{-5}	1	1.9×10^{-5}	1
3	**2** + 100% K / π identification	6.0×10^{-4}	1	2.8×10^{-4}	1
4	**3** + L>350 μm, σ_L=200 μm	2.2×10^{-3}	0.12		
5	**3** + L>500 μm, σ_L=200 μm	6.8×10^{-3}	0.07	0.013	0.23
6	**3** + L>200 μm, σ_L=100 μm	7.5×10^{-3}	0.28		
7	**3** + L>300 μm, σ_L=100 μm	0.08	0.18		

Summary

- Open charm is a promising instrument to access the gluon content of proton.
- Both PID and secondary vertex reconstruction sre needed to extract D-meson signal
- $D^{\pm}$ looks a bit more attractive than D^0 due larger life-time
- Even in the best possible case S/B ratio <<1
- **D*?**