Status of Mainz-Simulations

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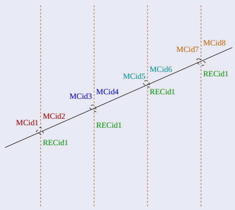
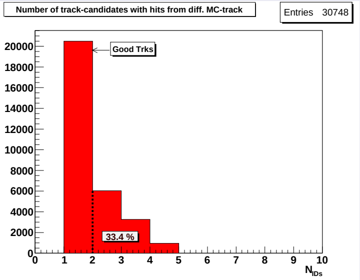
Basic idea of efficiency study

Simulation: Box generator (10^4 events)

$4\bar{p}$ track per event. $\theta \in$(2,12) mrad, $\phi \in$(0,2π) rad.

Rec_{ID} (ID of reconstructed tracks)
MC_{ID} (ID of simulated track)



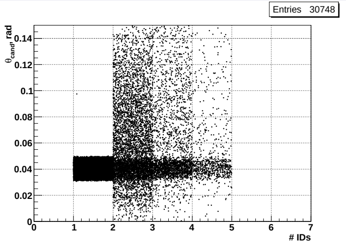


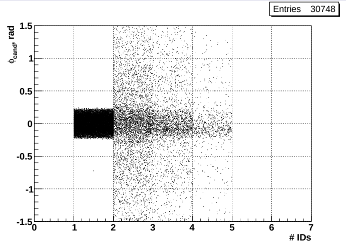
Good Track: All MC_{ID} of the track are the same

Reduction of ghost tracks

$4\bar{p}$ track per event. $\theta \in (2,12)$ mrad, $\phi \in (0,2\pi)$ rad.

θ and ϕ from Track-Candidates



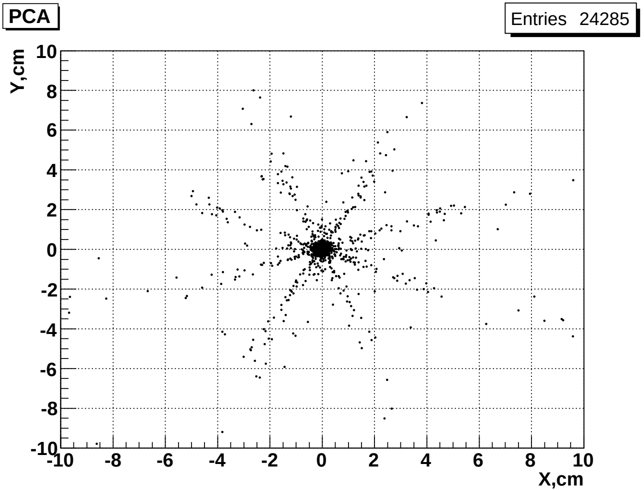


Cuts for track-candidates:

- $\theta_{cand} \in [30 \div 50]\ mrad$
- $\phi_{cand} \in [-0.26 \div 0.26]\ rad$

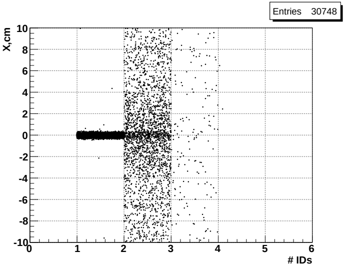
Selection of good tracks. Point of closest approach(X,Y)

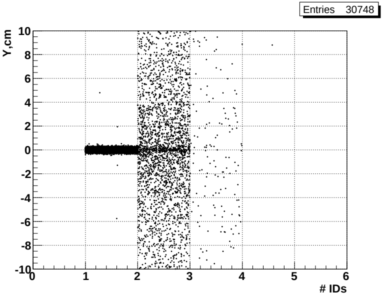
$4\bar{p}$ track per event. $\theta \in(2,12)$ mrad, $\phi \in(0,2\pi)$ rad.



Selection of good tracks. PCA (X,Y coordinates)

$4\bar{p}$ track per event. $\theta \in (2,12)$ mrad, $\phi \in (0,2\pi)$ rad.



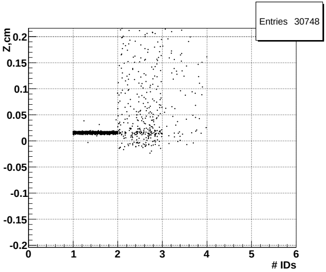


- $|X_{PCA}| < 5\ mm$
- $|Y_{PCA}| < 5\ mm$

Selection of good tracks. PCA (Z coordinate)

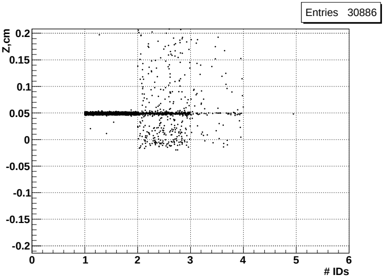
$4\bar{p}$ track per event. $\theta \in(2,12)$ mrad, $\phi \in(0,2\pi)$ rad.

$P_{beam} = 15GeV/c$



$\Delta Z \sim 150\mu m$

$P_{beam} = 11.91GeV/c$



$\Delta Z \sim 500\mu m$

- $|Z_{PCA}| < 600\ \mu m$

Resolution for reconstructed tracks after Back-propagation

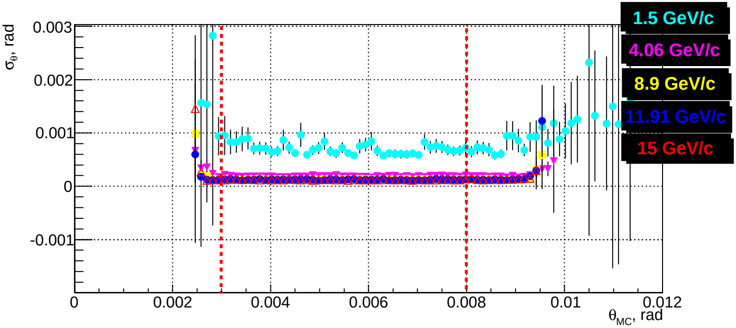
4$\bar{p}$ track per event with $\theta \in$(4,8) mrad, 10^4 events

$P,\ \frac{GeV}{c}$	$\Delta\theta,\ \mu rad$	$\sigma_\theta,\ \mu rad$	$\Delta\phi,\ mrad$	$\sigma_\phi,\ mrad$
15	-0.6	129	-0.7	13
11.91	-26	115	1.3	13
8.9	-1.4	137	0.1	17
4.06	1.73	195	-0.3	32
1.5	19	502	-1	95

$\Delta X,\ mm$	$\sigma_X,\ mm$	$\Delta Y,\ mm$	$\sigma_Y,\ mm$	$\Delta Z,\ \mu m$	$\sigma_Z,\ \mu m$
-0.2	1.1	0.007	1.1	154	8
0.1	1	0.1	1	489	9
0.04	1.2	-0.008	1.2	4	9
-0.002	1.7	0.005	1.7	0.4	11
-0.06	4	0.06	3	0.2	15

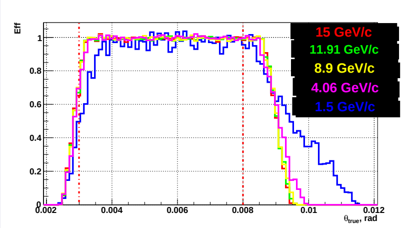
θ resolution

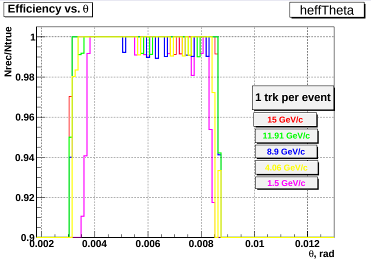
$4\bar{p}$ track per event. $\theta \in$(2,12) mrad, $\phi \in$(0,2π) rad. (sensor thickness 150 μm)



Behaviour of θ resolution corresponds to multiple scattering effect.

Efficiency vs. θ





- efficiency $\sim 99\%$ in $\theta \in$(4,8) mrad for all P_{beam}
  For P_{beam}> 4 GeV/c => $\theta \in$(3.5,8)
- number of ghost tracks after all cuts < 5 %.

Results & Plans

Results

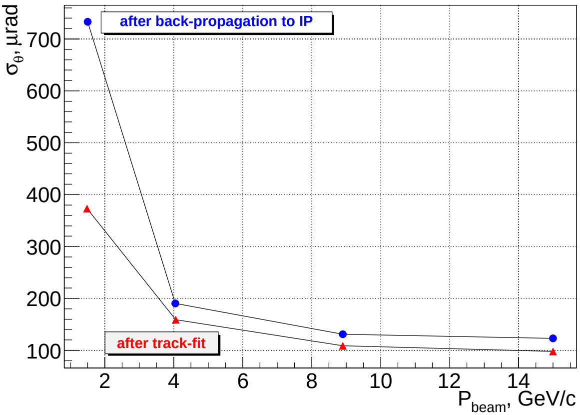
- Cuts for track-candidates (independent from P_{beam})
  - $\theta_{cand} \in [30 \div 50]\ mrad$
  - $\phi_{cand} \in [-0.26 \div 0.26]\ rad$
- Track reconstruction efficiency $\sim 99\%$ in θ $\in$(4,8) mrad for all P_{beam}, better for higher P_{beam}
- $\theta(\phi)$ resolution is almost constant in $\theta(\phi)$ range and it's behaviour corresponds to multiple scattering effect.

Plans

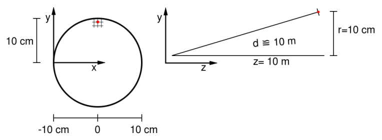
- Optimization of Track-Finder
  (search on 1&2, 1&3 planes) (M.Michel)
- Improvement of Track-Fitter
- Background study

BACK-UP

θ resolution before and after back-propagation



$\Delta\phi$ vs. $\Delta\theta$



$$\cos\phi = \frac{x}{r},\ \Delta\cos\phi = \frac{\Delta x}{r}\sqrt{1+\frac{x}{r}}$$
$$\cos\theta = \frac{z}{d},\ \Delta\cos\theta = \frac{\Delta x}{d}\sqrt{1+\frac{z}{d}}$$

$$\Delta y = \Delta x$$
$$r = \sqrt{x^2+y^2},\ \Delta r = \Delta x$$
$$\Delta z \simeq \Delta x$$

$$\Delta\cos\theta/\Delta\cos\phi \ \simeq\ \frac{r}{d} = 10^{-2}$$

sensor thickness 150 μm, without magnetic field, $\theta = (4-8) mrad$, $\phi = (89^\circ - 91^\circ)$

"pulls" parameters for coordinate distribution

P_{beam}	X_{mean}	X_σ	Y_{mean}	Y_σ
15	0.012	1.013	0.0024	1.056
8.9	-0.023	1.041	-0.0033	1.051
4.06	0.045	1.004	0.0063	1.025
1.5	-0.008	0.969	0.0015	1.014

"pulls" parameters for momentum distribution

P_{beam}	P^x_{mean}	P^x_σ	P^y_{mean}	P^y_σ	P^z_{mean}	P^z_σ
15	-0.015	1.17	-0.002	1.096	-0.003	1.1
8.9	-0.021	1.23	-0.032	1.12	0.020	1.12
4.06	-0.022	1.39	0.008	1.21	-0.009	1.22
1.5	-0.038	1.61	-0.012	1.48	0.029	1.474