DCH Efficiency and Resolution at high Luminosity

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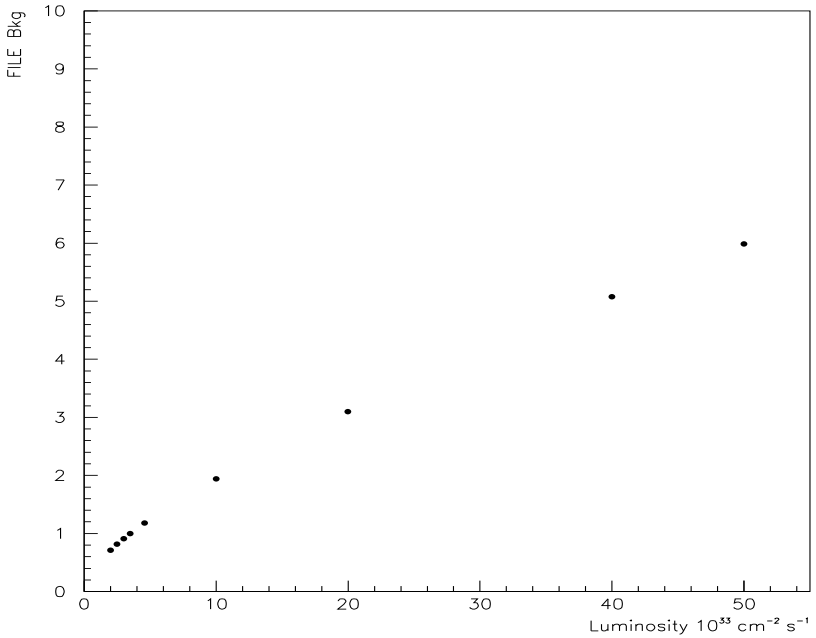
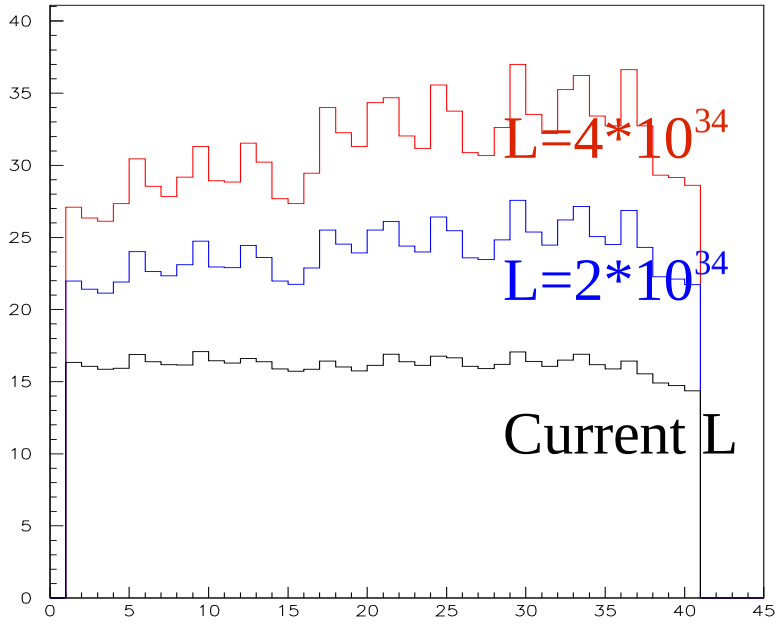
Since last collaboration meeting:

- Improvement of the Background extrapolation versus the Beam Currents
- Increased MC sample
- Efficiency and Resolution study
- Preliminary results for $L=2*10^{34}\ cm^{-2}s^{-1}$ and $L=4*10^{34}cm^{-2}s^{-1}$

- MC Sample: 10000 B^+B^-events were produced with different BKG amount (release 10.3.1a+analysis−13b)
- The average Ndigi/event increases of about 170 for each BKG file added.
- Our extrapolation at the Current Luminosity overestimated by ~30% the Bkg amount: a correction was applied and a 30% systematic error on the extrapolation method was taken into account.
- This error reflects in an uncertainty < 2% on the Efficiency expectation (depending on the particle species).



Bkg files vs L



Ndigi/Layer/event

•The **Efficiency** and the **Resolution** for each particle species **(e, μ, π, K, p)** and for each track selection kind **(ChargedTracks, GoodTracksVeryLoose, GoodTracksLoose, GoodTracksTight)** were computed from the charged tracks surviving the following cuts:

•**Pt> 180 MeV**

•θ = .41–2.41 **rad**

•Starting point of the track in the transverse plane **Rs<0.5 cm**

•Starting point of the track in the z direction **Zs<1 cm**

The Ratios of the results for the high Luminosity scenarious and the current Luminosity were then computed in bins of several variables **(P, Pt,** θ, ϕ)

Average Ratio (%) vs particle species and Selection category:

$L=2*10^{34}$/Current

Particle	CT	GTVL	GTL	GTT
e	98.6±.2±.6	98.2±.2±.7	97.7±.3±1.2	97.1±.3±1.2
μ	98.8±.4±.6	98.8±.4±.8	98.2±.4±1.1	97.8±.6±1.6
π	99.4±.1±.3	99.4±.1±.4	98.9±.1±.6	98.7±.1±.8
K	99.0±.2±.5	99.1±.2±.6	98.4±.2±.9	98.1±.2±1.1
p	99.2±.3±.5	98.8±.3±.9	97.7±.5±1.0	97.0±.6±1.0
ave	**99.2±.1±.4**	**99.1±.1±.4**	**98.6±.1±.7**	**98.3±.1±1.0**

$L=4*10^{34}$/Current

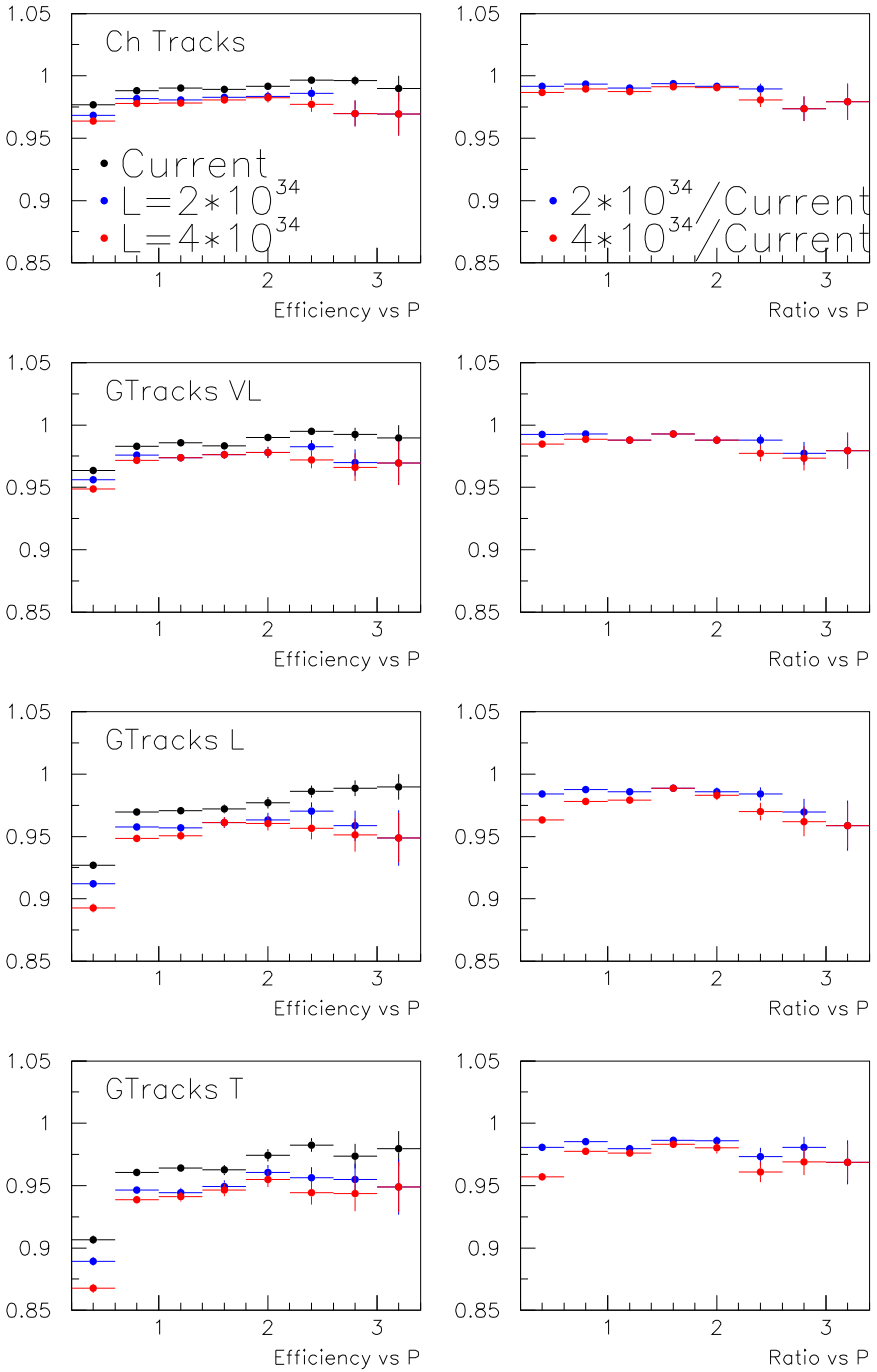
Particle	CT	GTVL	GTL	GTT
e	98.2±.2±.5	98.0±.3±.9	97.1±.3±1.0	96.2±.3±1.1
μ	98.3±.4±.2	98.3±.4±.3	97.6±.5±.3	97.2±.6±.5
π	99.0±.1±.4	98.9±.1±.5	97.5±.1±1.1	97.3±.1±1.0
K	98.5±.2±.5	98.0±.2±.4	97.7±.3±.6	97.3±.3±.6
p	98.5±.4±.5	98.0±.4±1.1	96.1±.6±1.2	95.6±.6±1.2
ave	**98.8±.1±.4**	**98.7±.1±.6**	**97.4±.1±1.0**	**97.1±.1±1.0**

Efficiency vs P

Black Bullets:
Current Lumi.

Blue Bullets:
$L=2*10^{34}$

Red Bullets:
$L=4*10^{34}$



Blue Bullets:
$L=2*10^{34}$/Current

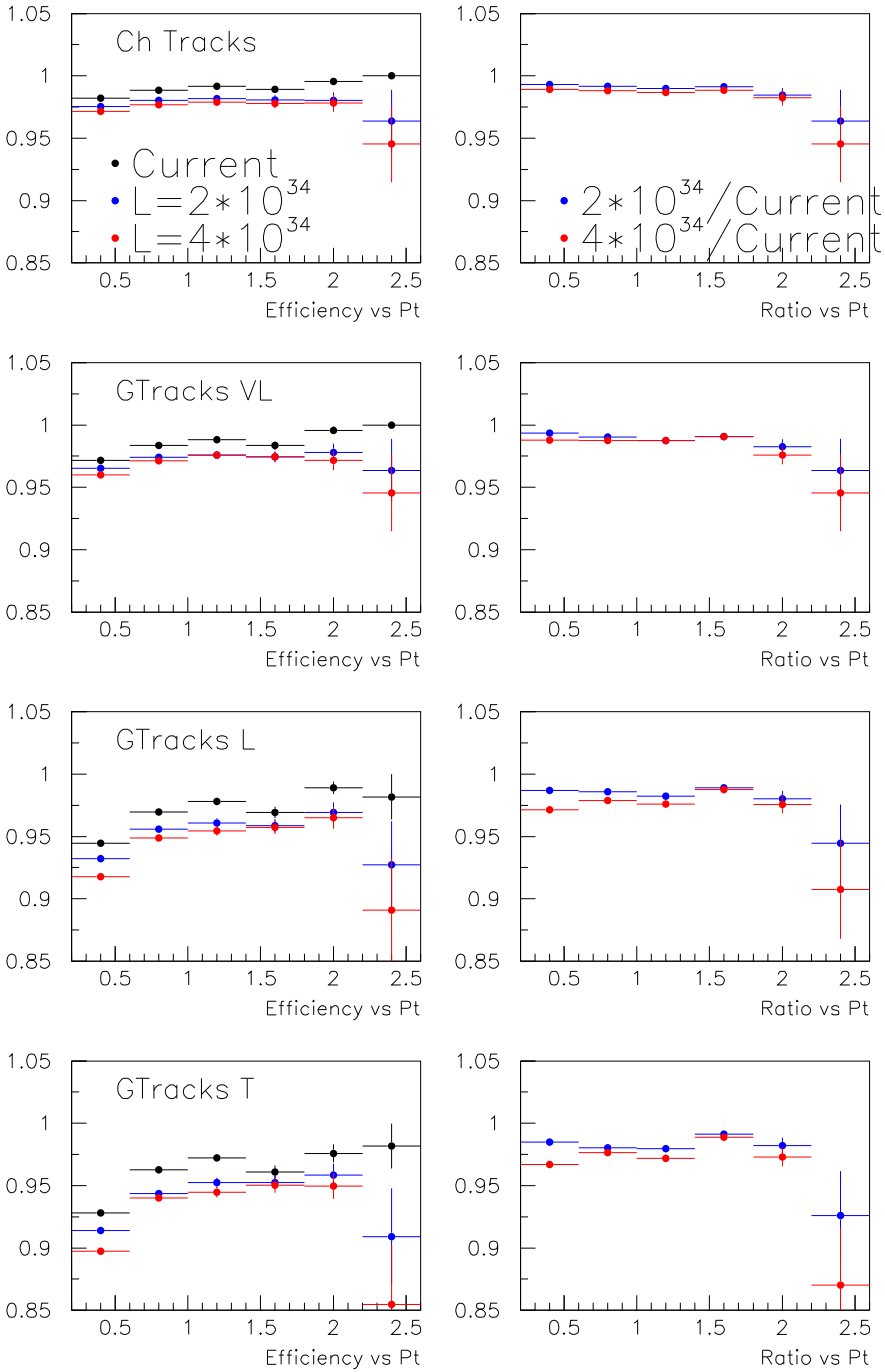
Red Bullets:
$L=4*10^{34}$/Current

Efficiency vs Pt

Black Bullets:
Current Lumi.

Blue Bullets:
$L=2*10^{34}$

Red Bullets:
$L=4*10^{34}$



Blue Bullets:
$L=2*10^{34}$/Current

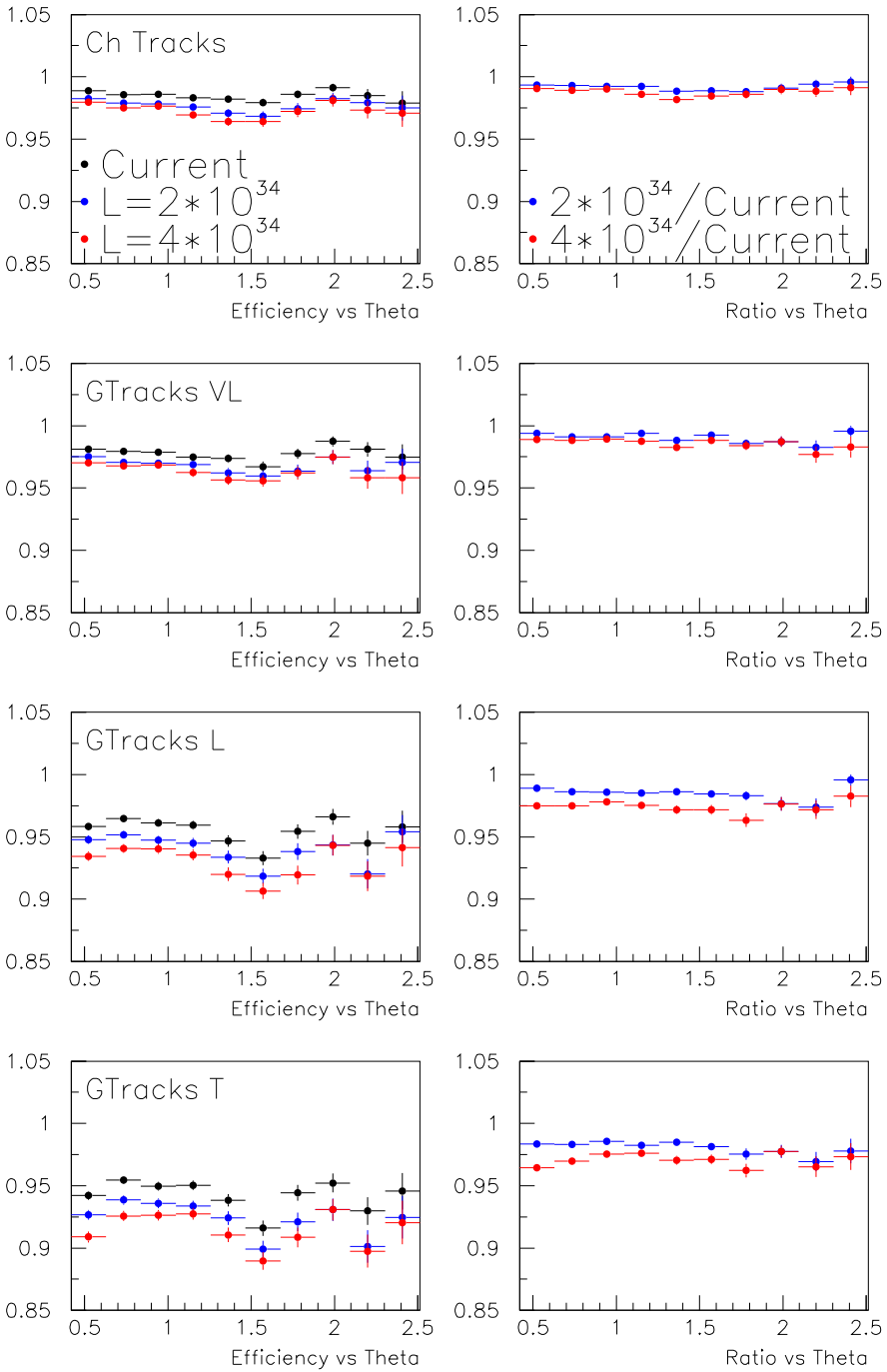
Red Bullets:
$L=4*10^{34}$/Current

Efficiency vs θ

Black Bullets:
Current Lumi.

Blue Bullets:
$L=2*10^{34}$

Red Bullets:
$L=4*10^{34}$



Blue Bullets:
$L=2*10^{34}$/Current

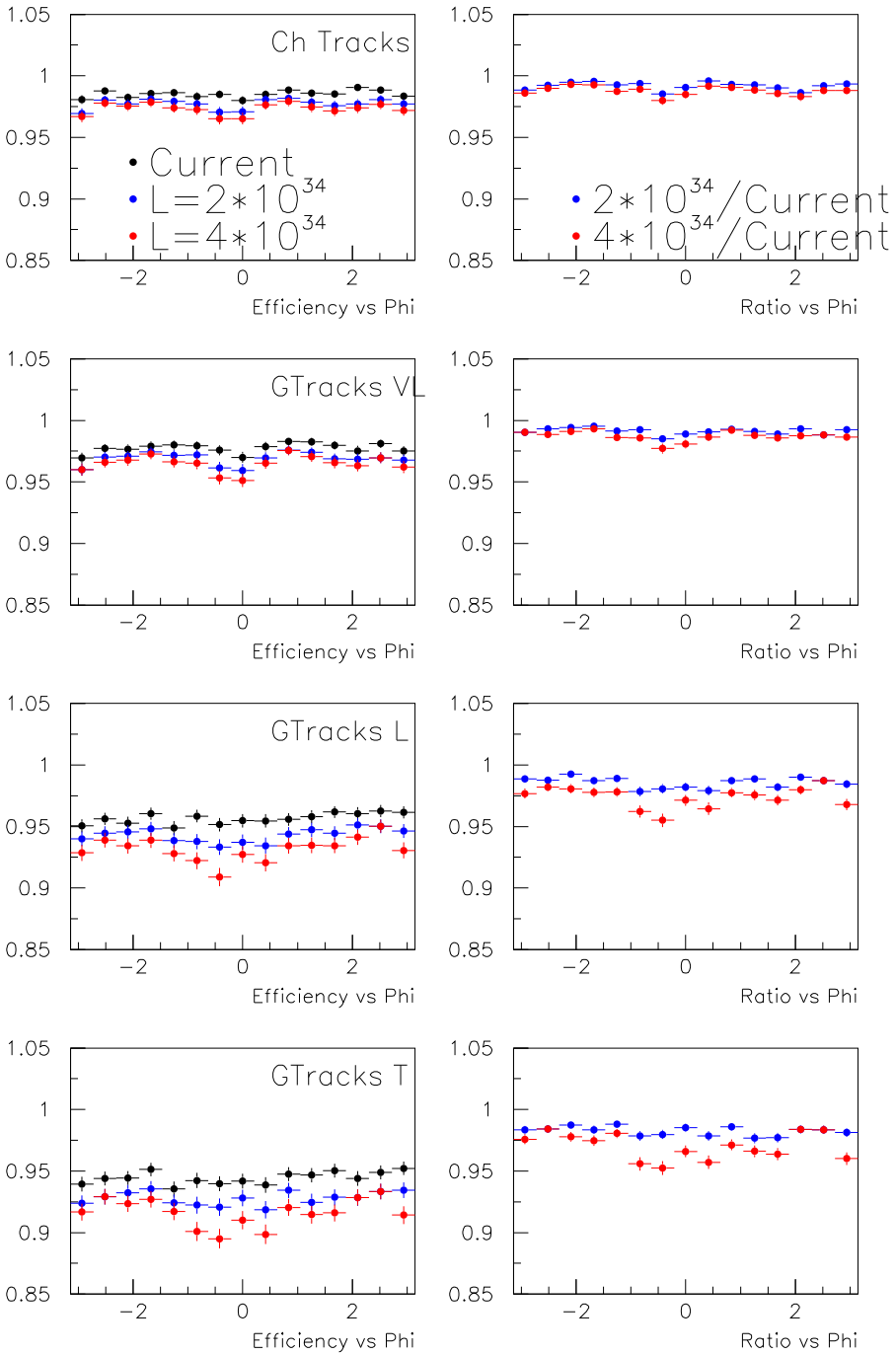
Red Bullets:
$L=4*10^{34}$/Current

Efficiency vs ϕ

Black Bullets:
Current Lumi.

Blue Bullets:
$L=2*10^{34}$

Red Bullets:
$L=4*10^{34}$



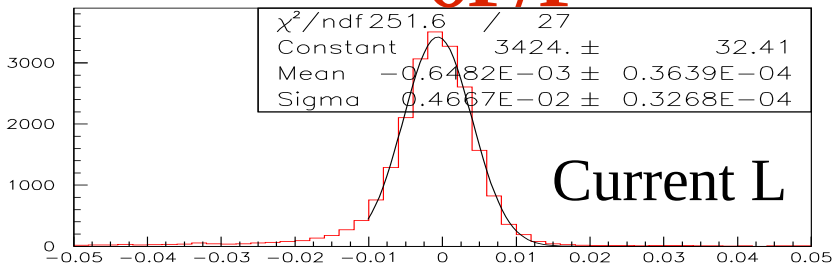
Blue Bullets:
$L=2*10^{34}$/Current

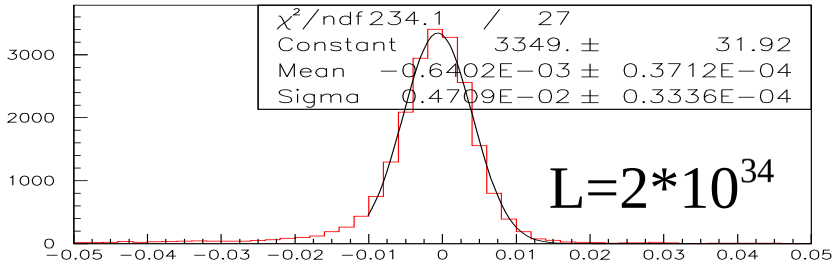
Red Bullets:
$L=4*10^{34}$/Current

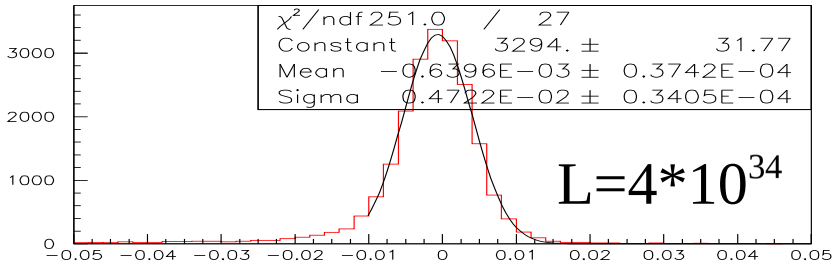
Average Momentum Resolution

- The average resolution is roughly independent on the selection category;
- The δP/P worsening is at the level of $\Delta=4.2*10^{-5}$ and $\Delta=5.5*10^{-5}$ respectively in the two high luminosity scenarious (δPt/Pt worsening $\Delta=8.5*10^{-5}/1.16*10^{-4}$)

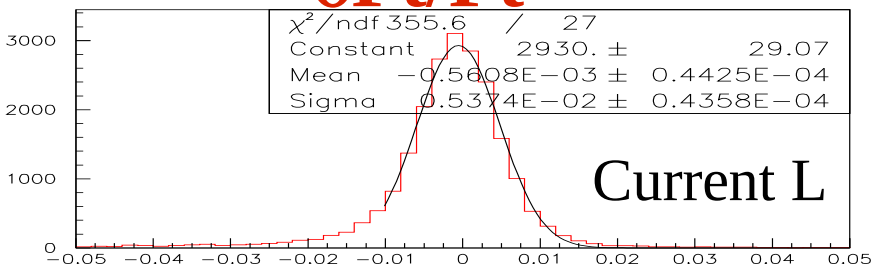
δP/P

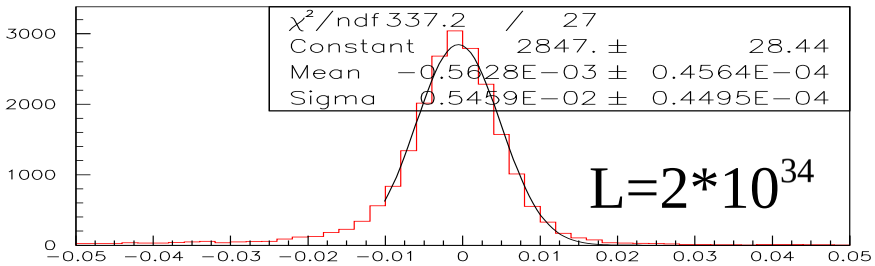


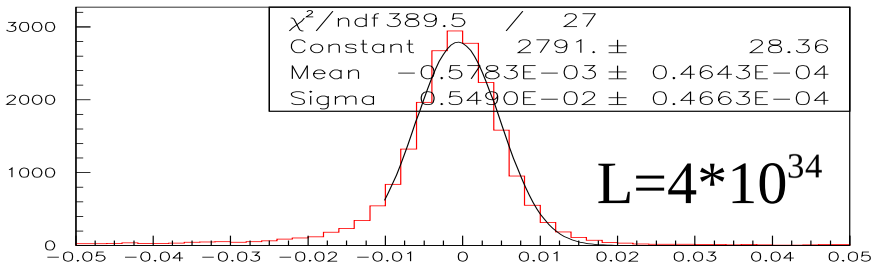




δPt/Pt

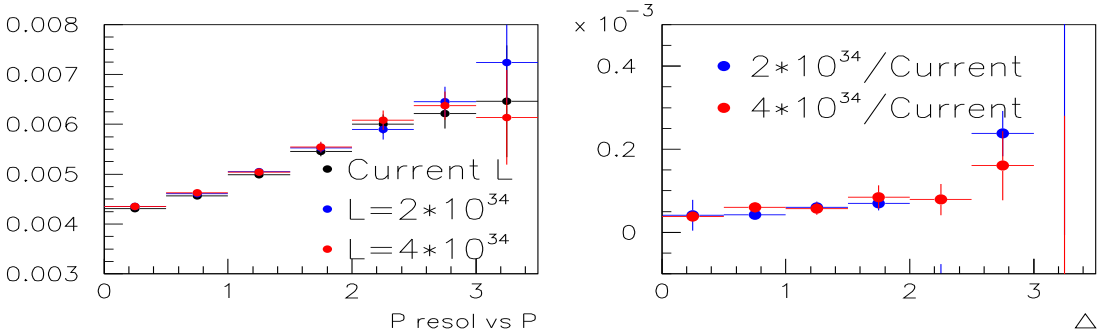




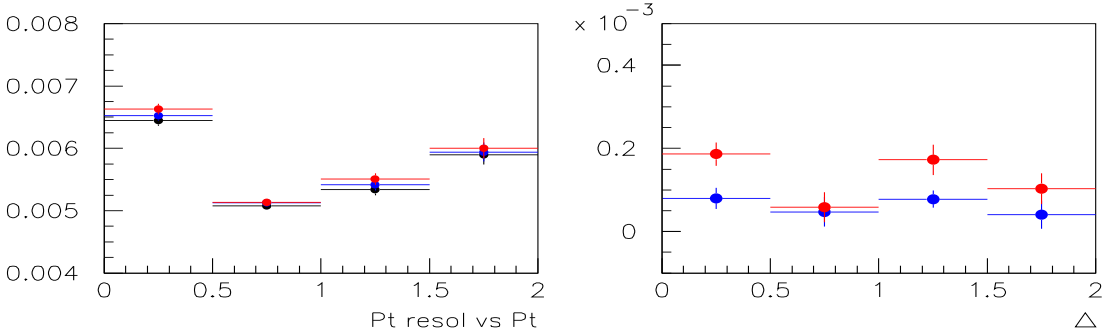


Resolution

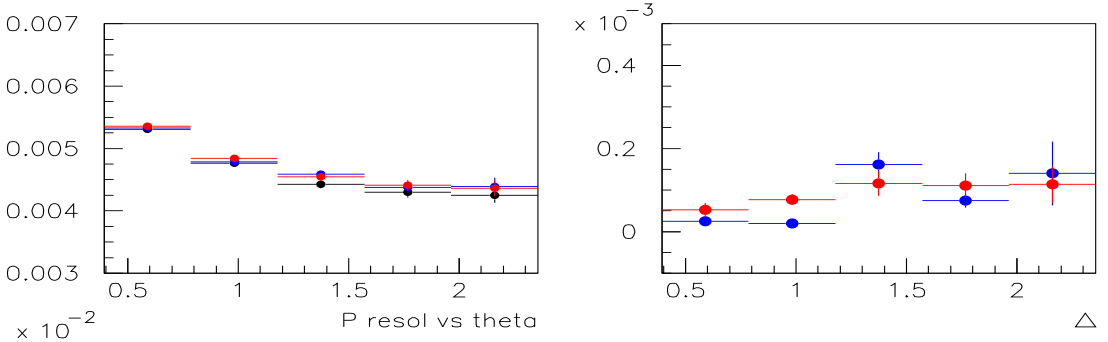
δP/P vs P



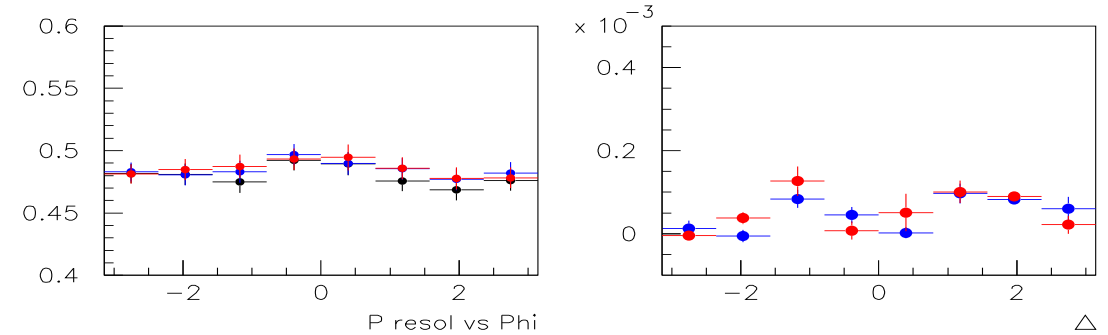
δPt/Pt vs Pt



δP/P vs θ



δP/P vs ϕ



Tracks with no link to the simulation

- Only 21 tracks/10000 MC events have no link to the simulation at the current luminosity, which become 500 at L = $4*10^{34}$

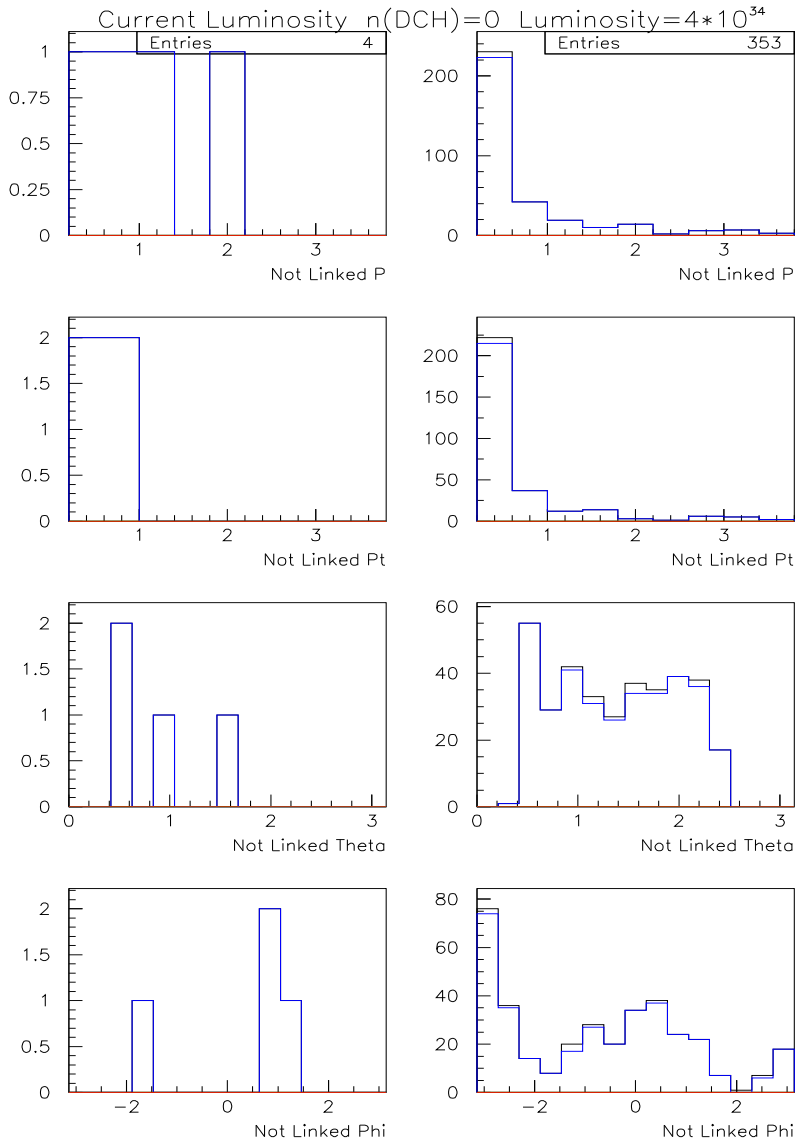
...but they are mostly removed just requiring some DCH hits and some selection requirement:

	Current L	**L = $4*10^{34}$**
No DCH hits:		
CT	4	353
GTVL	4	343
DCH hits:		
CT	17	147
GTVL	3	49
GTL	3	49
GTT	1	34

Tracks without DCH hits

CT GTVL GTL GTT

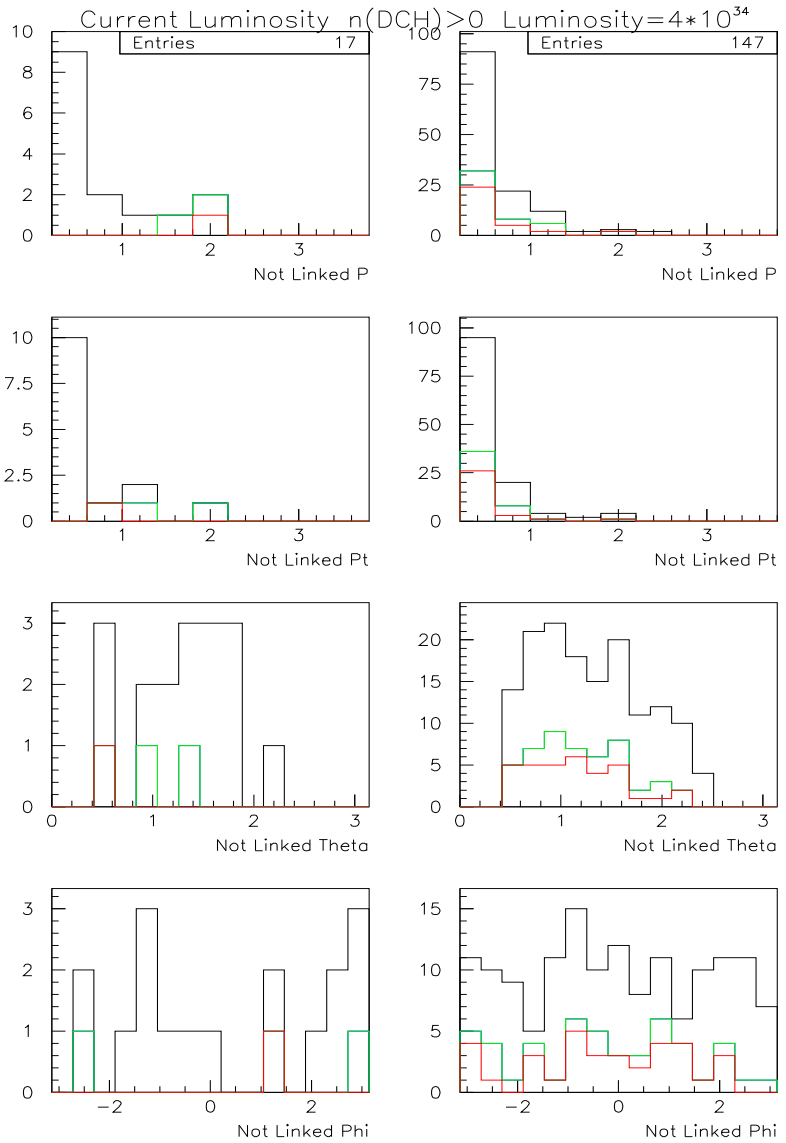
Current L L = $4*10^{34}$



Tracks with DCH hits

CT GTVL GTL GTT

Current L L = $4*10^{34}$



Preliminary Conclusions:

- In a high Luminosity scenario the Track Efficiency seems to be lowered from 1−2% ($L=2*10^{34}$) to 3−4% ($L=4*10^{34}$) depending on the particle species and the selection category.

- The Momentum Resolution seems to be less affected ($\delta P/P$ worsening $\Delta=4.2*10^{-5}$, $\Delta=5.5*10^{-5}$; $\delta Pt/Pt$ worsening $\Delta=8.5*10^{-5}$, $\Delta=1.16*10^{-4}$ in the two scenarious)

- The number of tracks with no link to the simulation increases up to ~1/20 events at the highest Luminosity (~1/70 events requiring some DCH hits).