

Time Over Threshold on Sector Prototype

Mariusz Sapiński

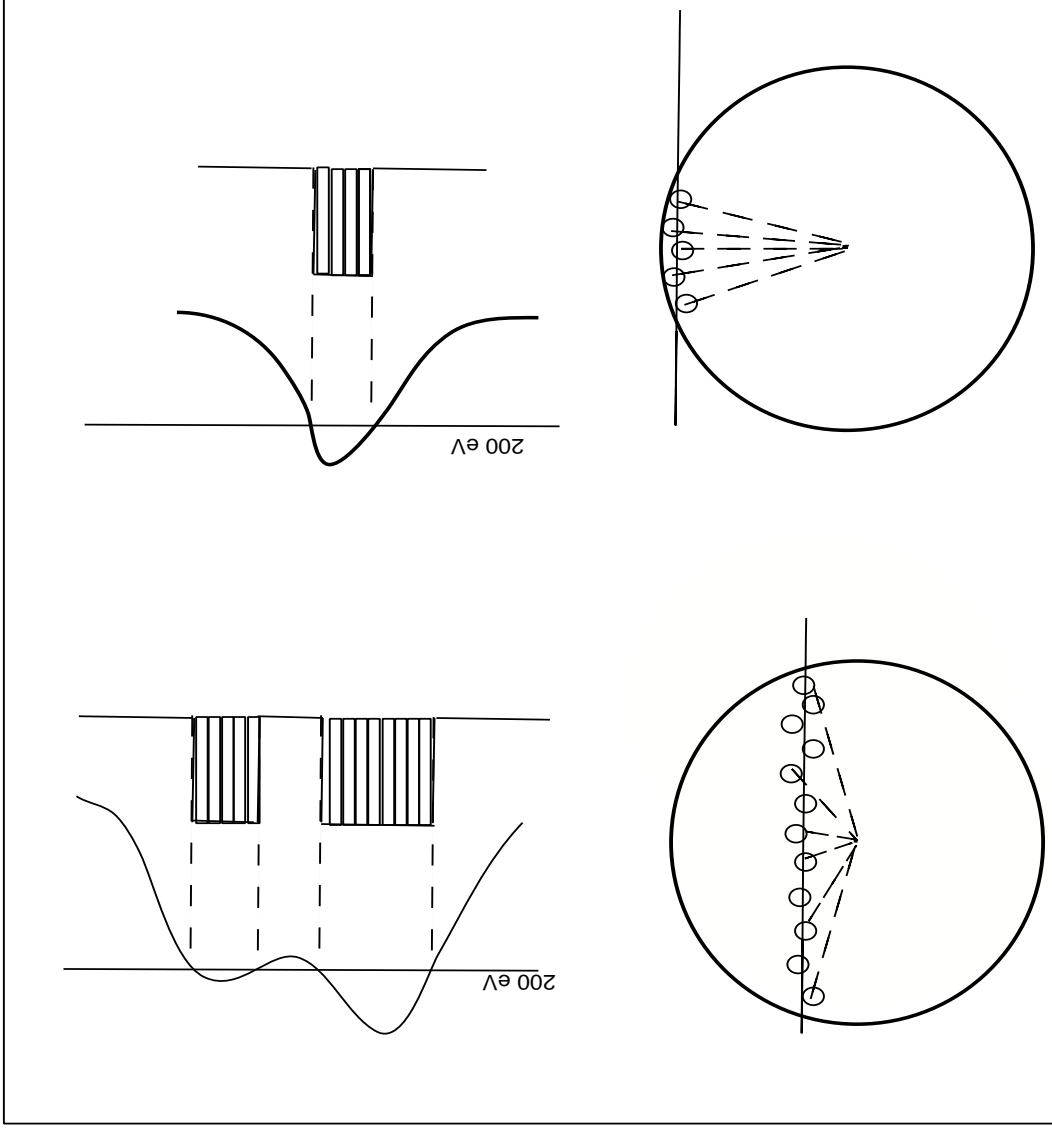
- idea of ToT method
- experimental setup
- problem of 5 GeV pions statistics
- Andrea-like pseudotracks
- glued sector tracks
- conclusions

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Idea of TOT method

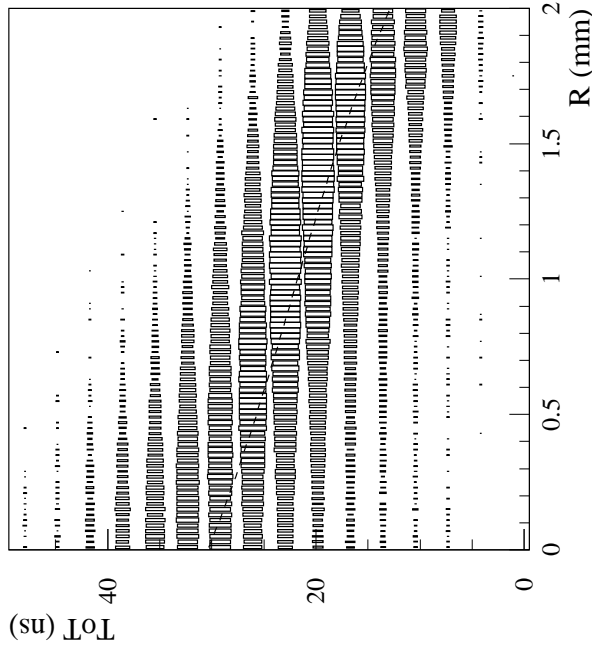
- $dE/dx = dE/dx(pc/M)$
- $T_{OT} = f(dE/dx)$



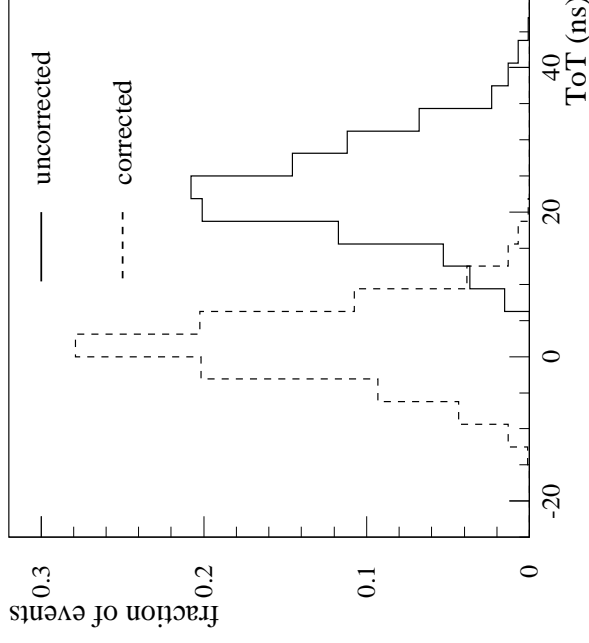
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Correction on ToT(R)

For every straw for LowThr=200 eV and 400 eV separately:



$$\sigma_{uncorrected} = 6.5 \text{ ns}$$



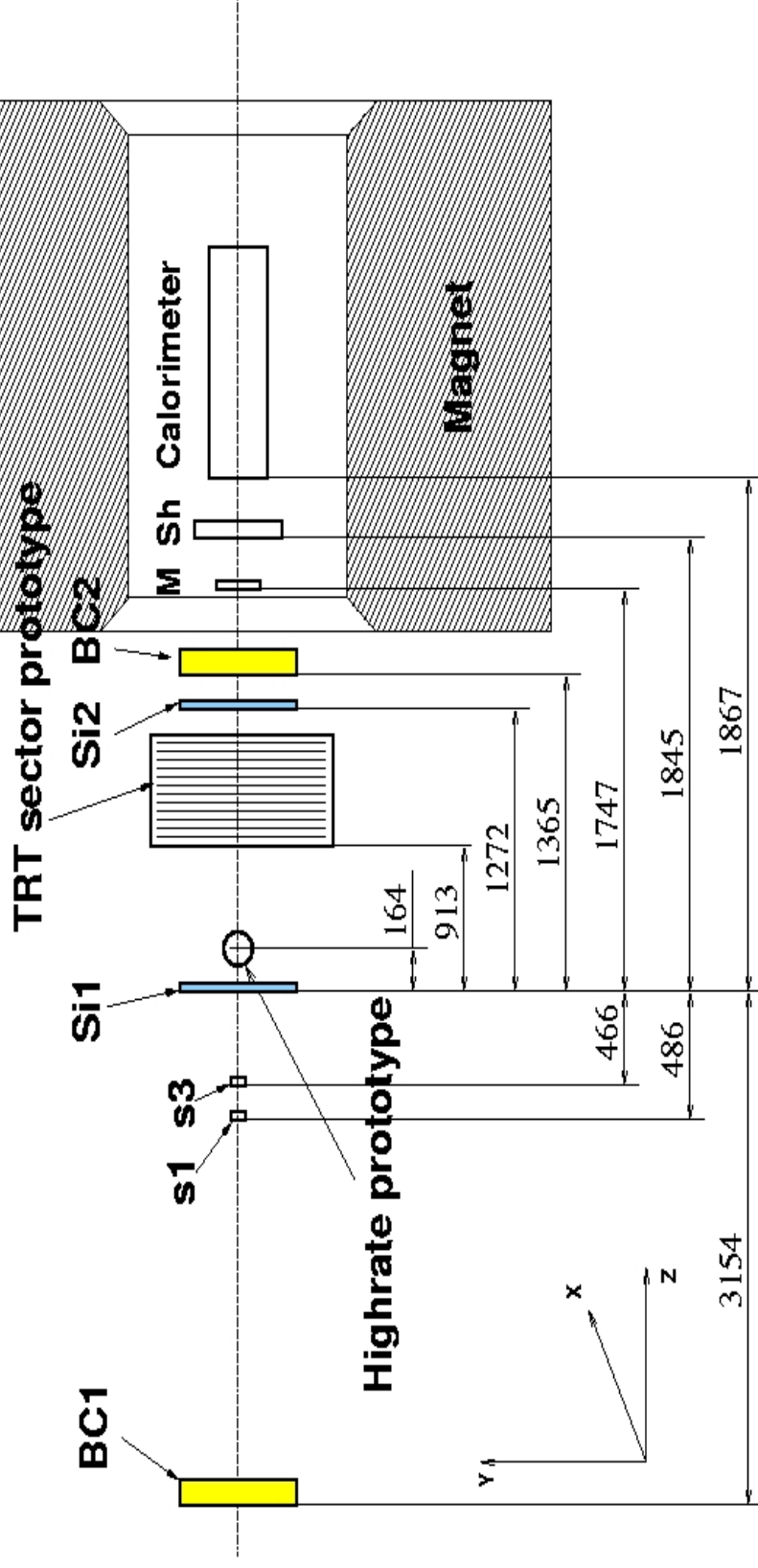
$$\sigma_{corrected} = 4.9 \text{ ns}$$

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TRT experimental setup (July 2000 ver.2)



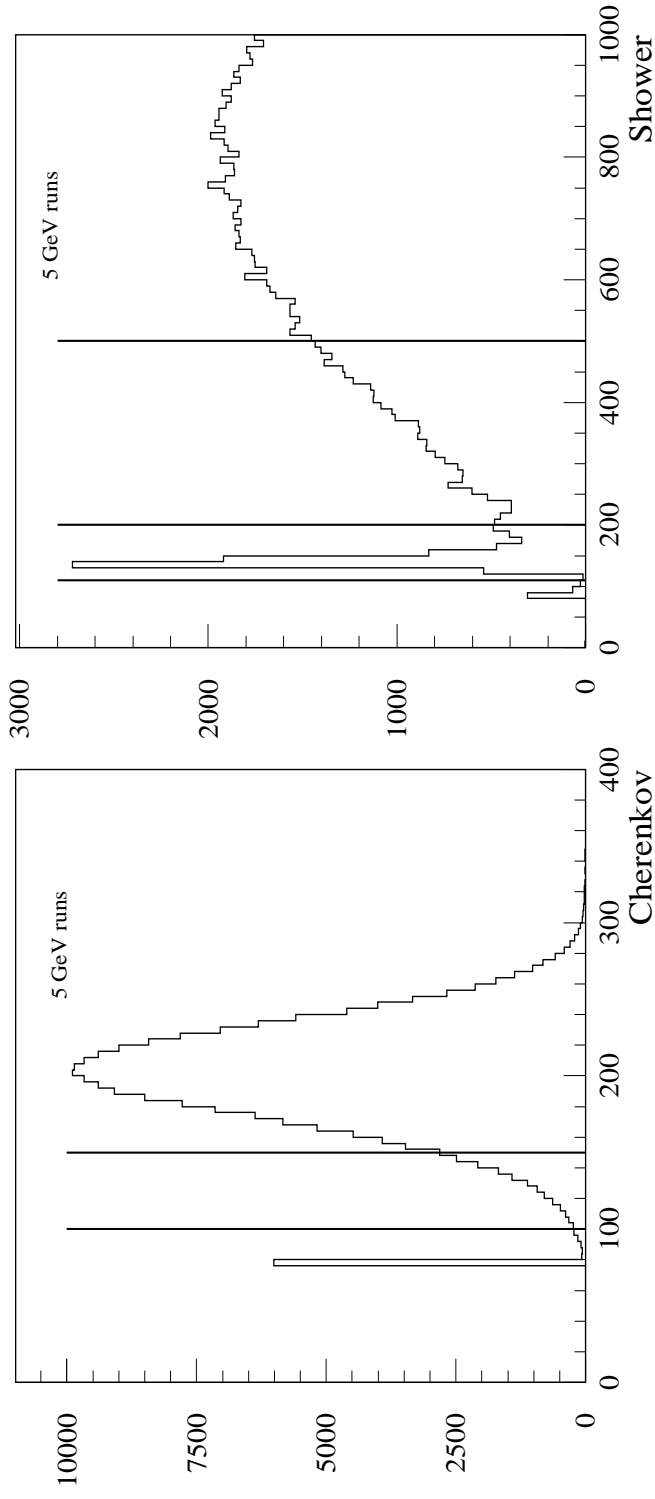
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Problem of 5 GeV pions statistics - 1

- 350.000 - at the beginning
- 220.000 - after selection on counters (65% - can increase)



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Problem of 5 GeV pions statistics - 2

- only 5500 pion-like events found (2.5% of previous number)
- 4200 - BC flags
- 1000 - Si-BC track match, Si2X hole
- 330 - track quality, 9-th bit, etc.

main hardware problems:

- silicons readout
- silicon hole (~ 20 channels)
- Cerenkov

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Statistics - summary For $LoThr=200$ eV statistics consists of:

- 5 GeV pions - 330 events
- 5 GeV electrons - 9900 events
- 10 GeV pions - 6200 events
- 10 GeV electrons - 2900 events (might increase)
- 20 GeV pions - 20000 events
- 20 GeV electrons - 10000 events

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Hits selection

- reject dead, noisy and not well-illuminated straws
(30 good straws: within the beam, not noisy
not in the shadow of dead region in Si2)
- take only hits with $|X_{Si} - X_{RT}| < 390\mu m$
(ie. about $2 \cdot \sigma$)

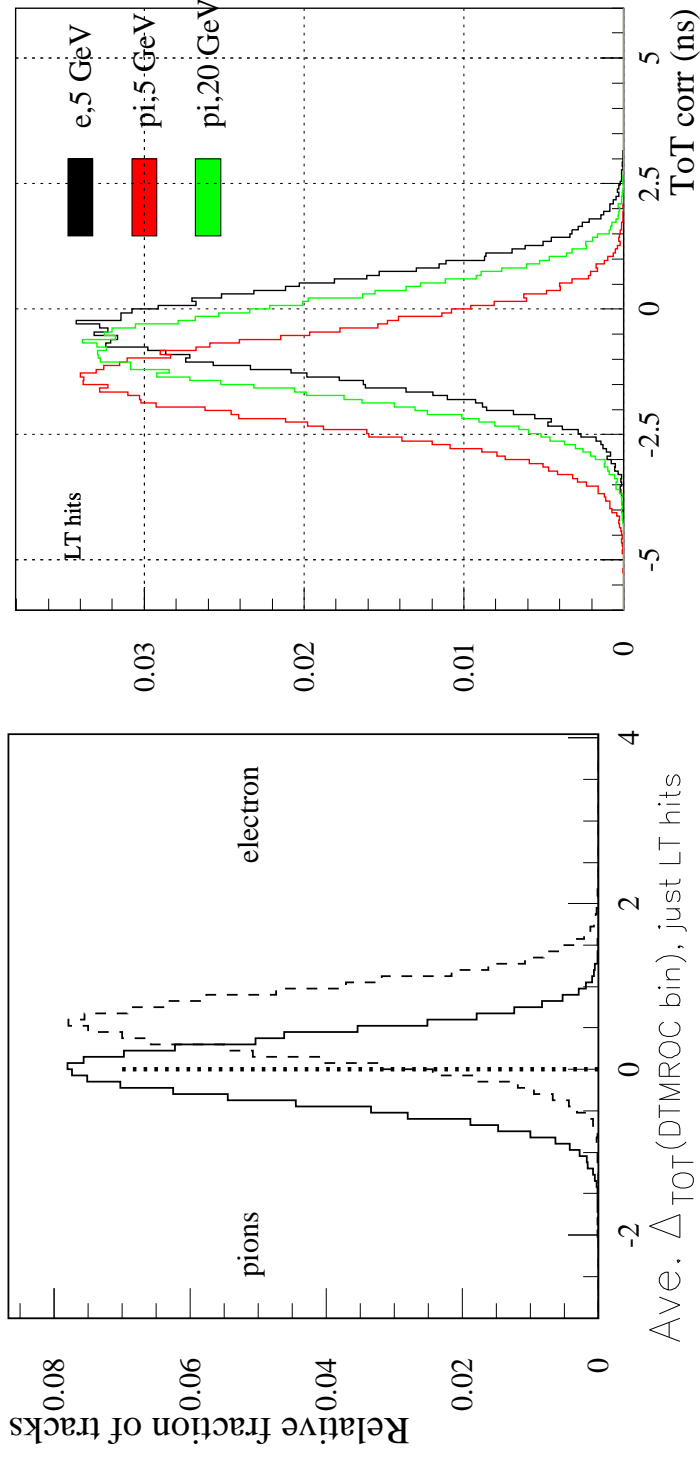
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Andrea-like pseudotracks

with LT+HT randomly taken hits (32 ± 2 hits)



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	ToT corr.		
	mean	σ	$\Delta / < \sigma >$
2000			
$\pi, 5 \text{ GeV}$	0.00 ± 0.10	0.87 ± 0.10	-
$\pi, 20 \text{ GeV}$	0.68 ± 0.01	0.84 ± 0.01	0.80 ± 0.14
$e, 5 \text{ GeV}$	1.06 ± 0.01	0.85 ± 0.01	1.23 ± 0.14
Andrea 1999			
$\pi, 5 \text{ GeV}$	0.00 ± 0.01	1.13 ± 0.01	-
$e, 5 \text{ GeV}$	1.66 ± 0.01	1.20 ± 0.01	1.43 ± 0.01

2000 vs 1999:
different ASDBLR (shaping function) and no radiator!!

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Hypohotesis

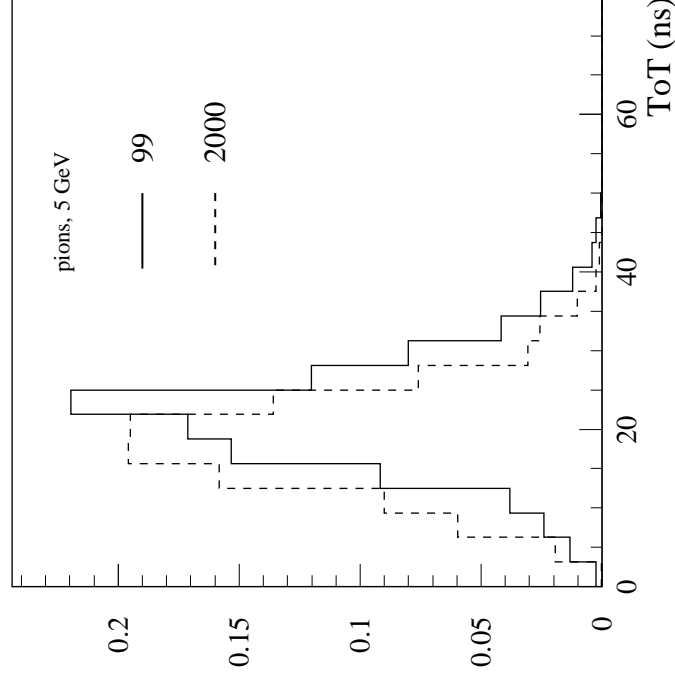
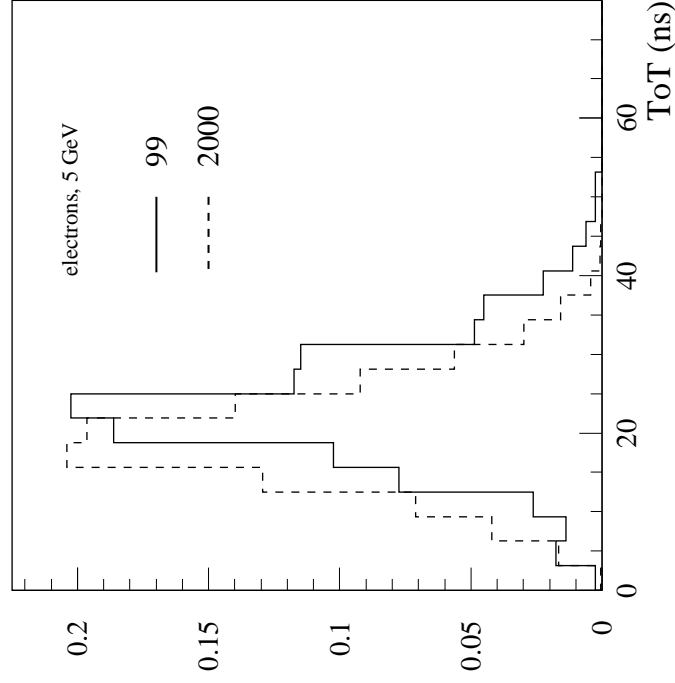
```
if((I got better resolution thanks to electronics)
.and.
(Andrea had better separation due to radiator))
then
adding radiator to new electronics
2.0 $\sigma$  separation could be expected
(with LT hits only!!!)
endif
```

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Hypothesis c.d.



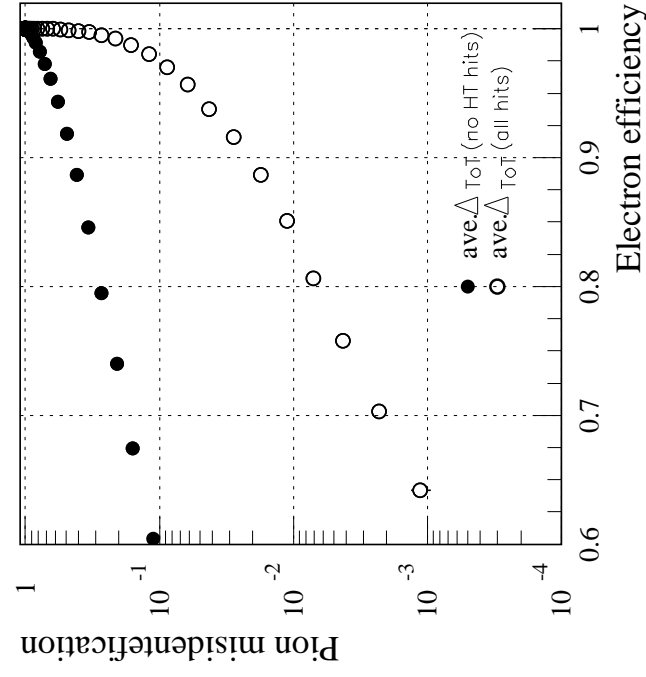
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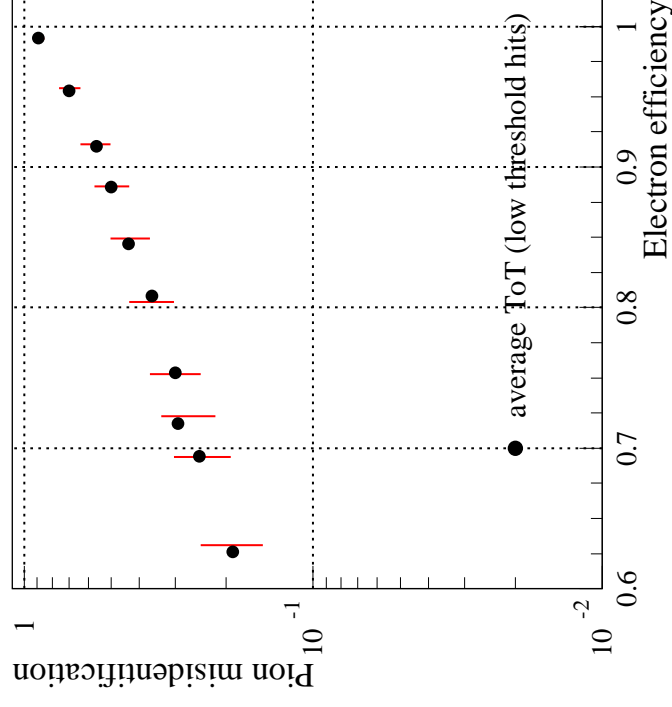
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Efficiencies

1999



2000

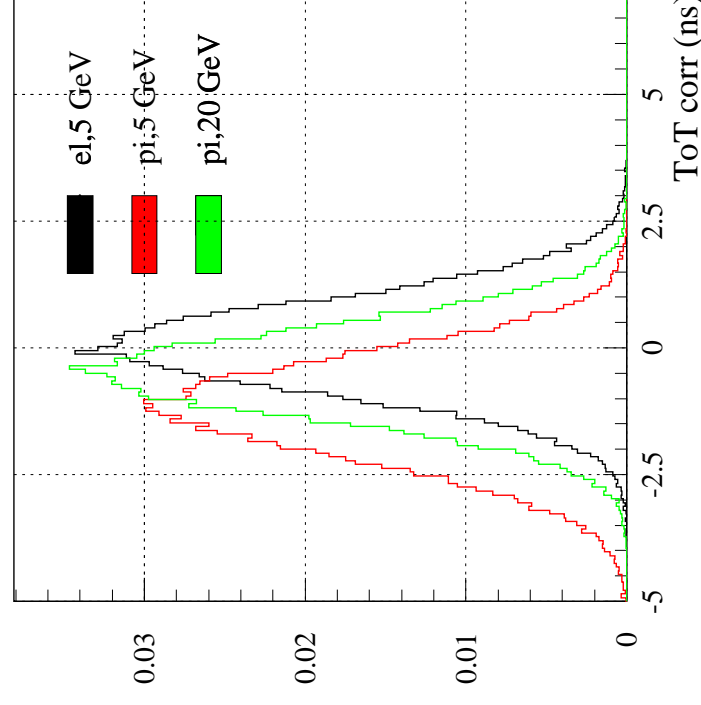
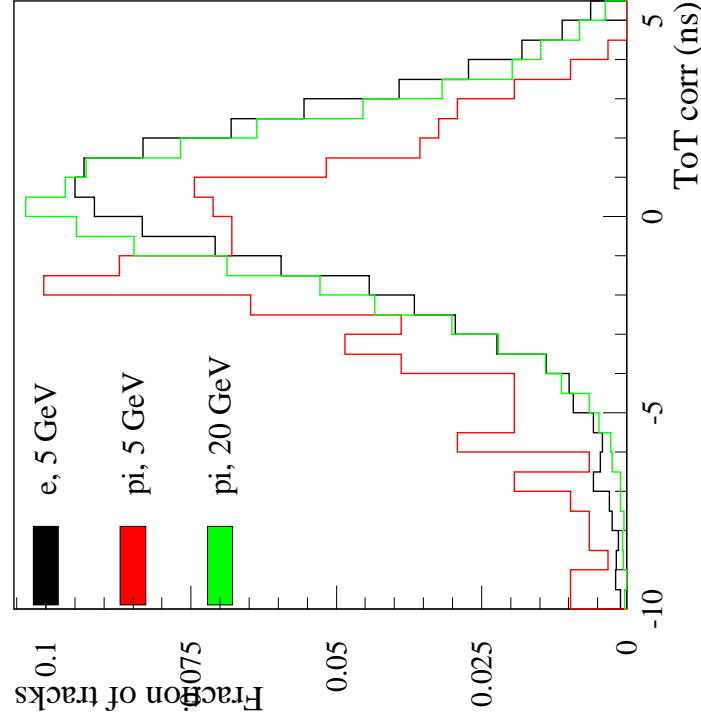


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Sector tracks and glued tracks



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Pseudotracks and glued tracks

selection	Glued tracks			Pseudotracks		
	$\pi 5$	e5	$\pi 20$	$\pi 5$	e5	$\pi 20$
N_{hit}	32.2	32.6	34.3	32.0		
RMS_{hit}	3.0	2.9	2.8	3.0		
$mean_{ToT}$	0.00	1.08	0.59	0.00	1.07	0.68
σ_{ToT}	0.85	0.81	0.80	0.87	0.86	0.84
$\Delta / < \sigma >$	-	1.31	0.72	-	1.24	0.80

Errors of 5 GeV π $mean_{ToT}$ and σ are about 0.1 ns.

Other errors ~ 0.01

resolution on glued tracks: significantly better!!!

also Δ (e5,pi20) better for glued (0.49 ns) then pseudo (0.39 ns)!!!

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Pion misidentification at 90% electron efficiency

pion efficiency	
year 1999 data	
ToT, no HT hits	0.46±0.01
ToT, all hits	0.026±0.001
cluster counting	0.0072±0.0003
cluster counting + ToT	0.0037±0.0004
without HT hits	
year 2000 data	
ToT, no HT hits	0.5±0.1
cluster counting + ToT	0.0040±0.0009
without HT hits	

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Pseudotracks and glued tracks for LoThr=400 eV

selection	Glued tracks			Pseudotracks		
	$\pi 5$	e5	$\pi 20$	$\pi 5$	e5	$\pi 20$
N_{hit}	28.9	30.4	31.1	32.0		
RMS_{hit}	2.8	2.9	2.8	3.0		
$mean_{ToT}$	0.00	1.36	0.49	0.00	1.28	0.87
σ_{ToT}	0.97	0.95	0.98	0.90	0.92	0.92
$\Delta / < \sigma >$	-	1.43	0.51	-	1.40	0.96

Errors of 5 GeV π $mean_{ToT}$ and σ are about 0.12'ns.

Other errors ~ 0.01

Δ (e5,pi20) better for glued (0.87 ns) then pseudo (0.41 ns)!!!

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Conclusions:

- the new method with ultimate TRT electronics is confirmed.
- e/π separation $(1.3 \pm 0.1)\sigma$ at 200 eV and $(1.4 \pm 0.1)\sigma$ at 400 eV
- K/π separation $(0.7 \pm 0.1)\sigma$ at 200 eV
- the correlations along real track does not spoil separation.
- small amount of 5 GeV π limit quantification of these results!

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