University & INFN Torino

Pandaroot in Turin

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MVD-TDR Metting, Turin 23-25th March 2011

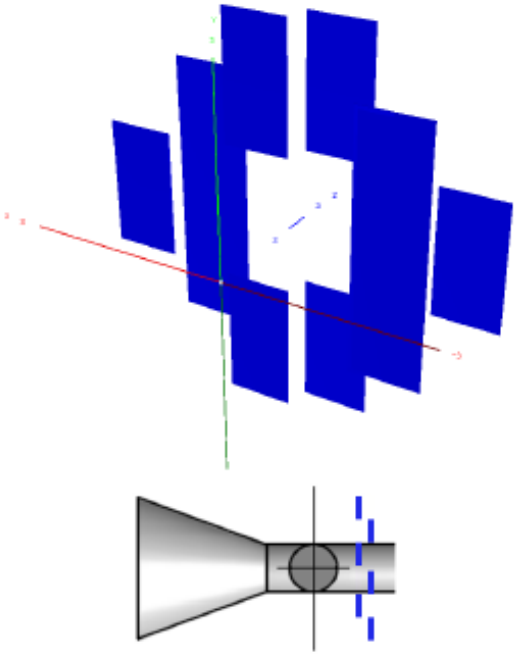
Outlines

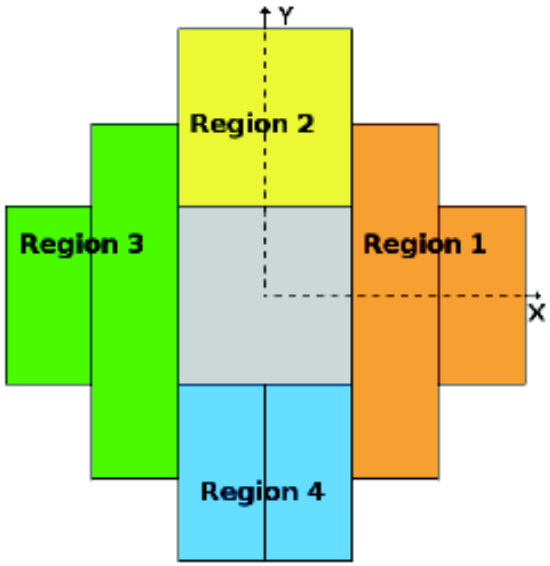
- Detector Angular Coverage
- Time in Rate Studies
- Comments

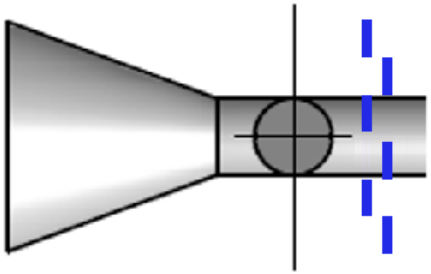
Detector Angular Coverage

Problem

- Can some tracks be lost due to a not complete angular coverage of the disk?
- How many tracks pass through the “death” angular region?
- How many hits have the tracks lost from the first disk?





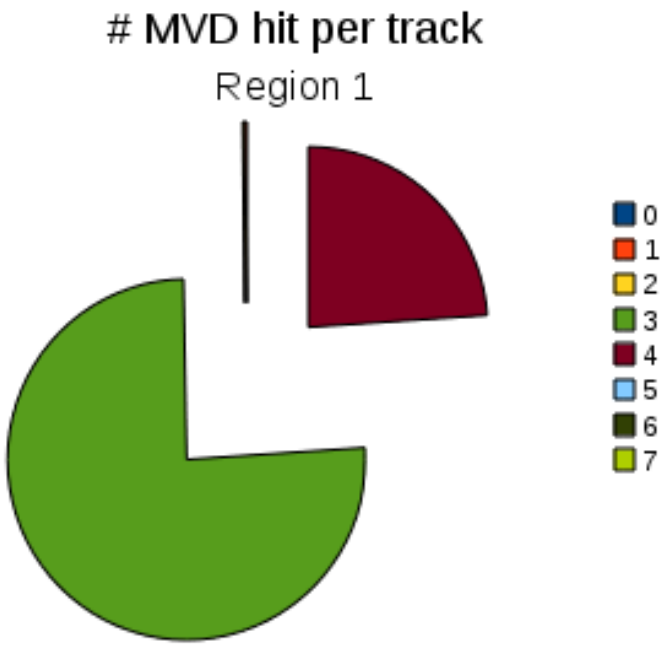


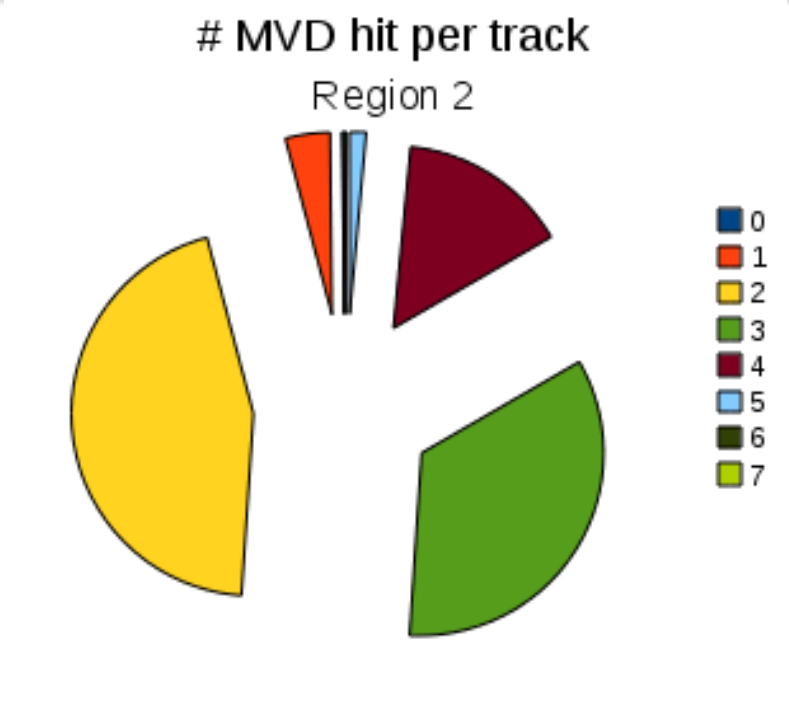
$\Delta\theta = 5.35'$

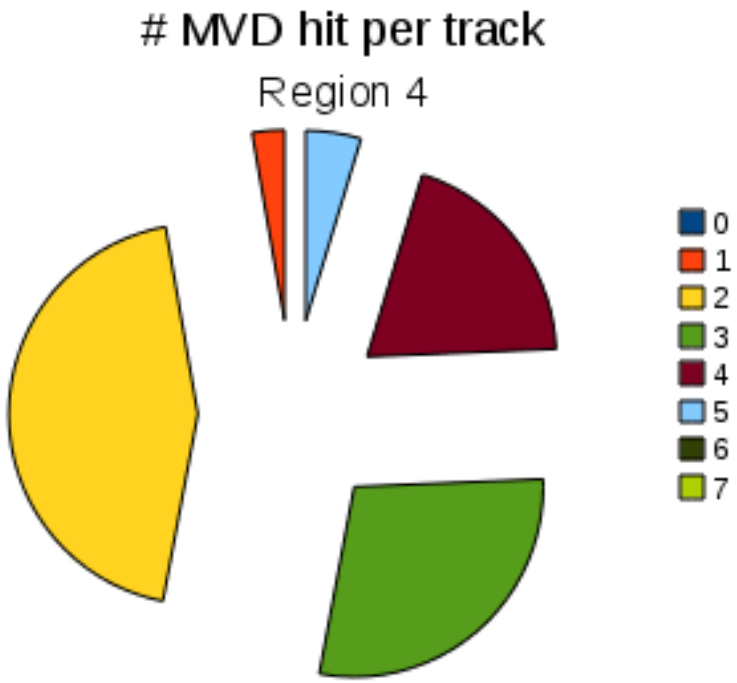
now x=2.9 cm -> maybe x=2.5 cm

Particle	Region 1	Region 2	Region 4
μ @ 1 GeV/c	17 %	4.9 %	5.2 %
μ @ 500 MeV/c	17.2 %	4.9 %	5.1 %
p @ 1 GeV/c	17.6 %	5.3 %	4.8 %
p @ 500 MeV/c	17.6 %	5.6 %	4.6 %
π @ 1 GeV/c	17.6 %	5.3 %	4.9 %
π @ 500 MeV/c	16.5 %	5.6 %	4.6 %

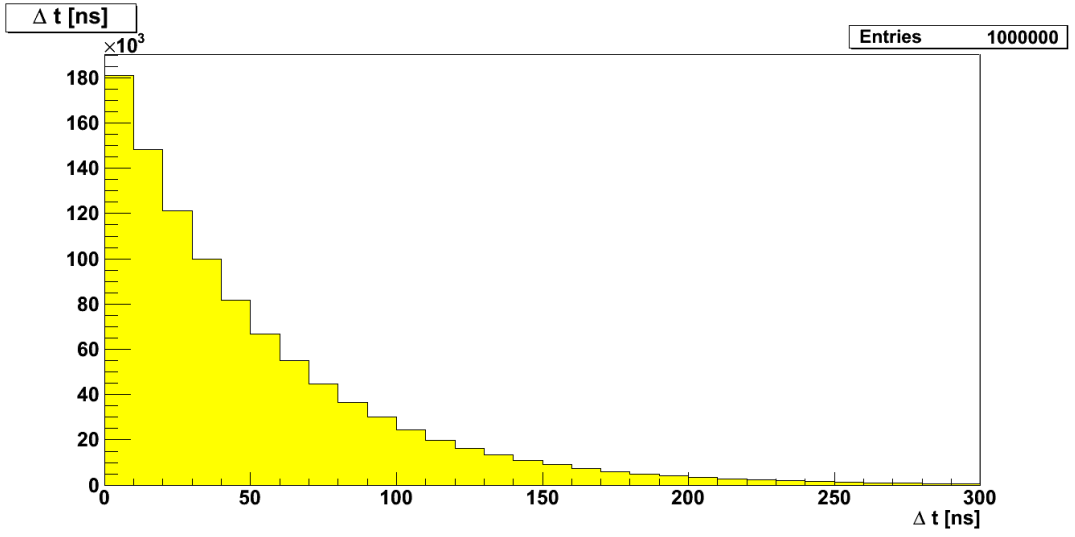
p @ 1 GeV/c

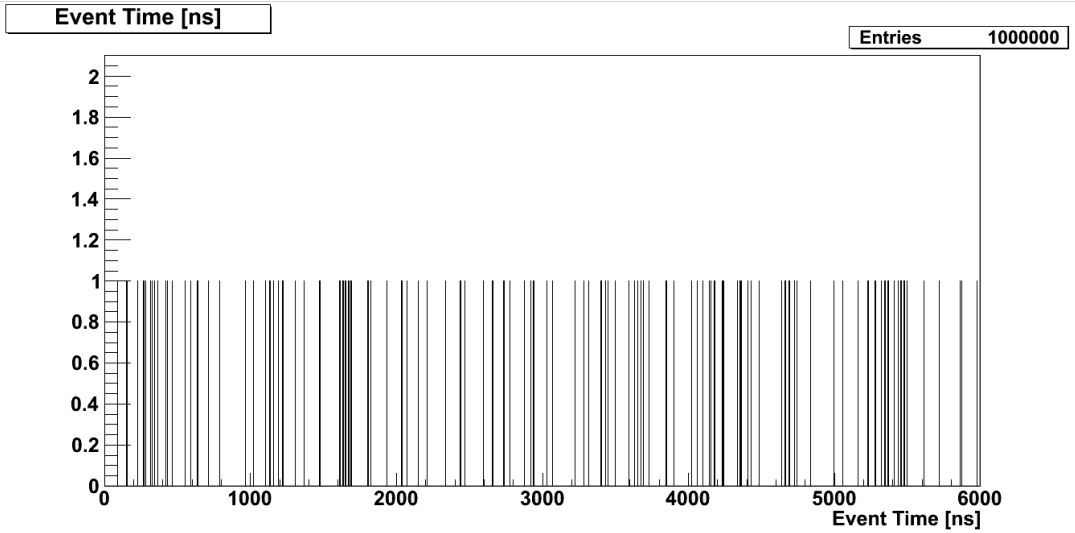

MVD hit per track
Region 1
0
1
2
3
4
5
6
7


MVD hit per track
Region 2
0
1
2
3
4
5
6
7

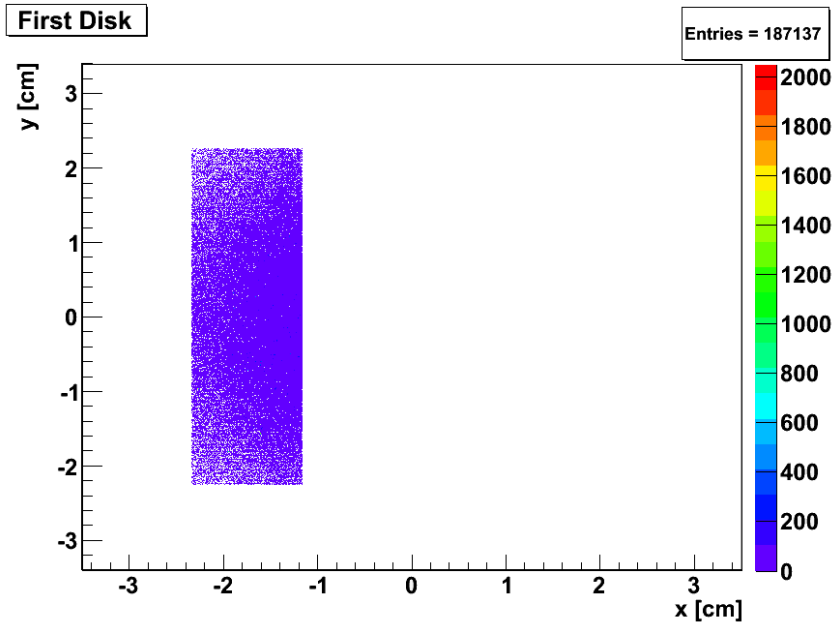

MVD hit per track
Region 4
0
1
2
3
4
5
6
7

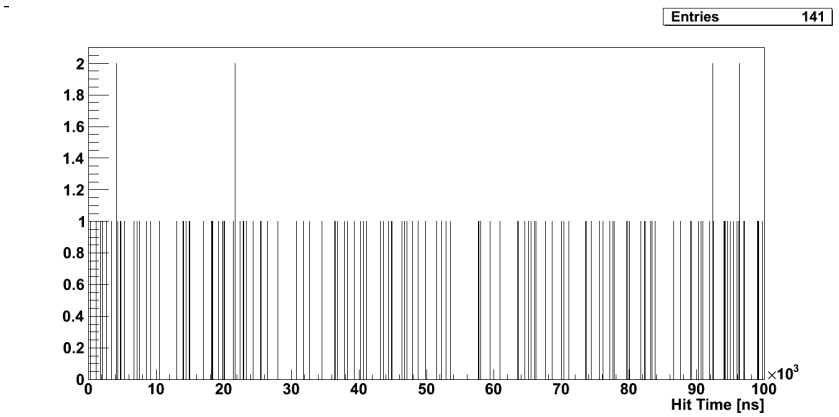
Time in Rate Studies



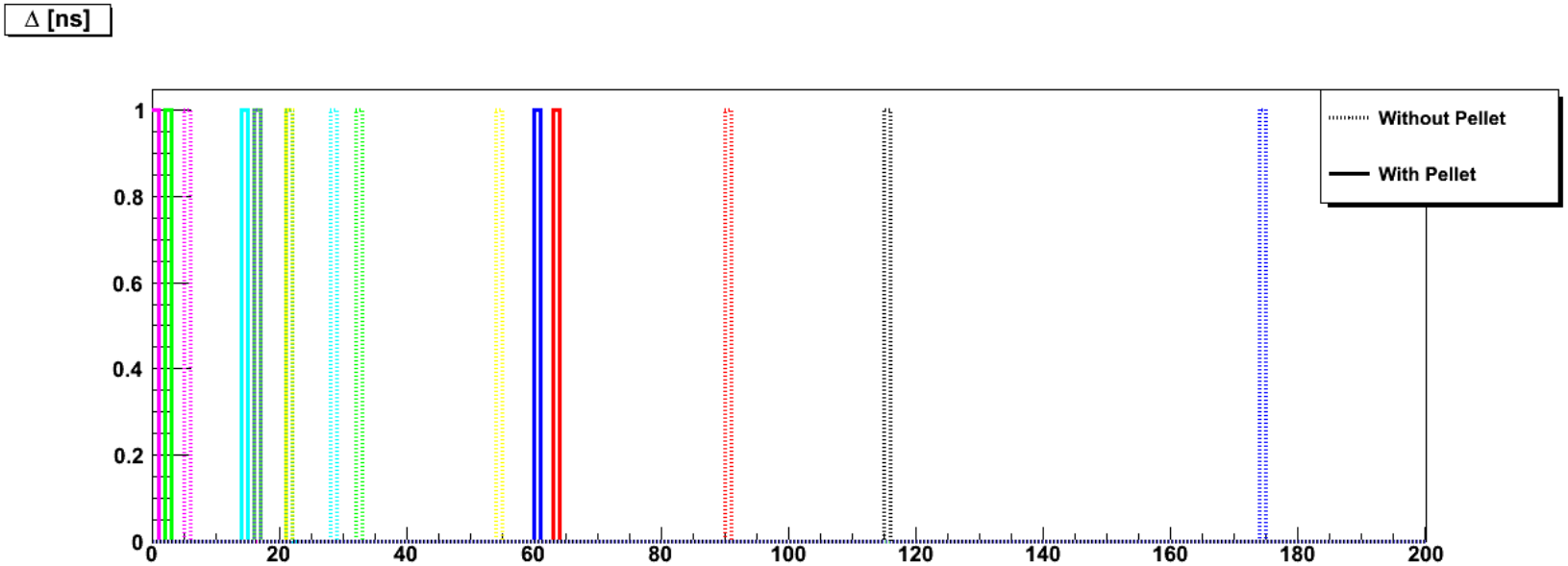


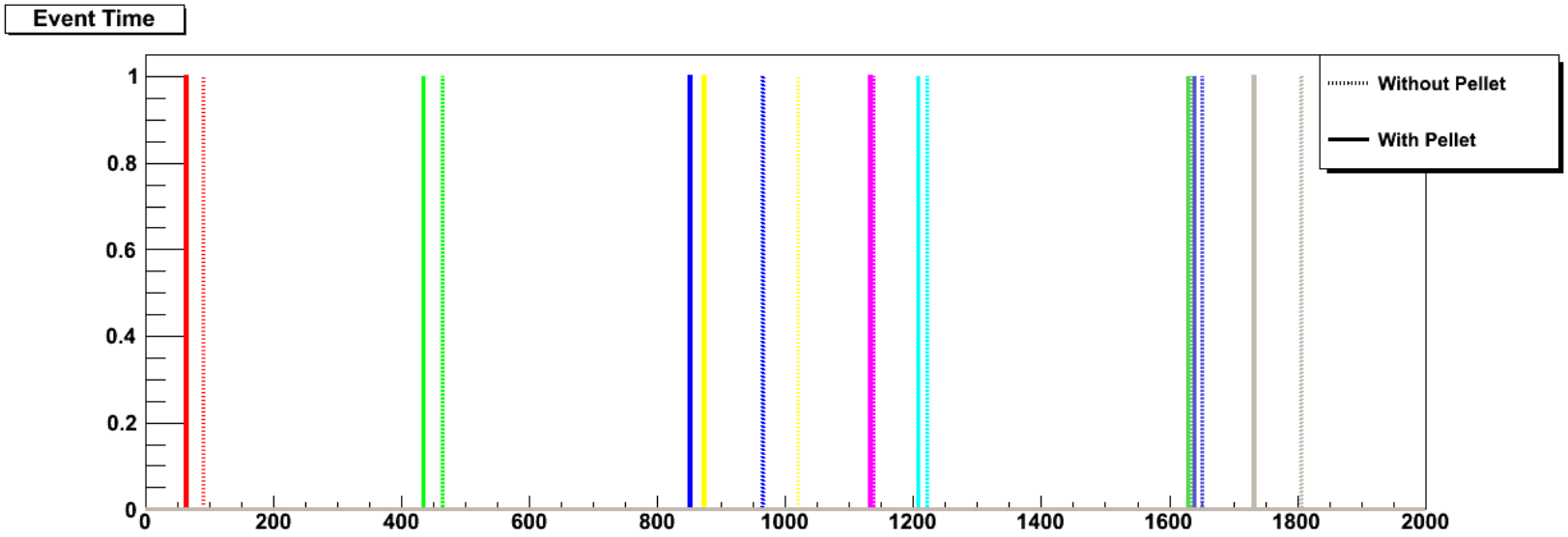
$$t_{hit} = t_{event} + t_{tof} + t_{electronics}$$





-> Pile Up Study
-> Dimension of Buffer


Δ [ns]
Without Pellet
With Pellet
0
0.2
0.4
0.6
0.8
1
0
20
40
60
80
100
120
140
160
180
200


Event Time
Without Pellet
With Pellet
0
0.2
0.4
0.6
0.8
1
0
200
400
600
800
1000
1200
1400
1600
1800
2000

Comments

$\overline{\text{P}}$anda-MVD - note 007

Rate Study in the Pixel part of the MVD

L. Zotti [1,2]
D. Calvo [2], P. Kliemt [3]

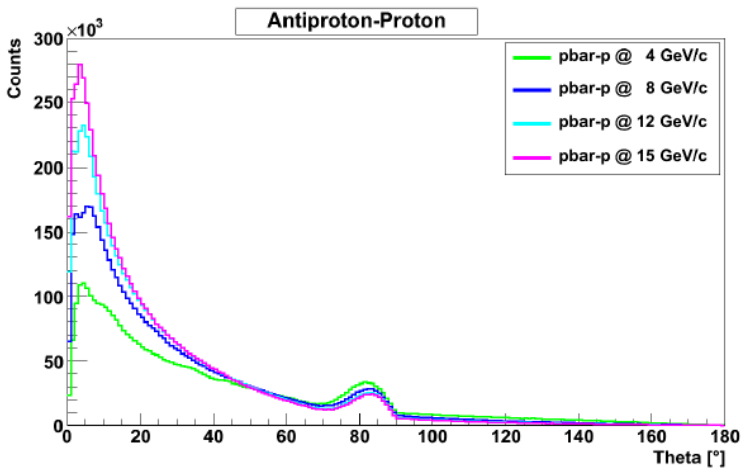


Figure 4: The particle theta distribution for $\overline{\mathsf{p}} - \mathsf{p}$ annihilations at different momenta (10^6 simulated events).

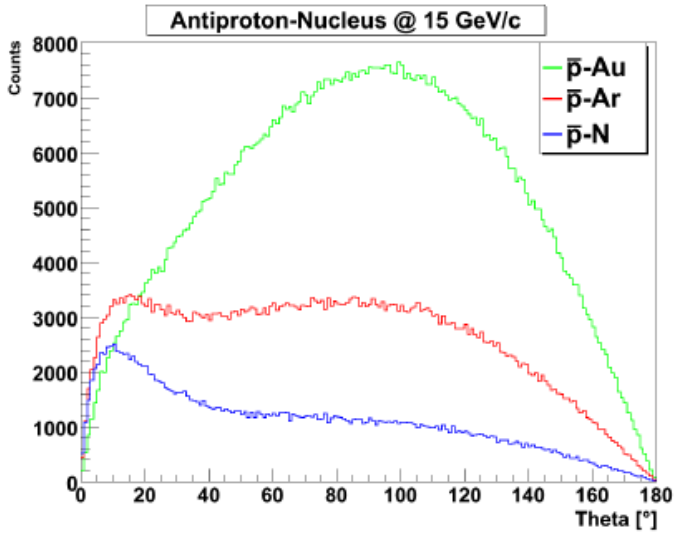


Figure 7: Theta distribution for different $\overline{\mathsf{p}} - \mathsf{N}$ annihilations

Disk	Hadrons	Hadron Flux $[cm^{-2}\ s^{-1}]$	Leptons	Lepton Flux $[cm^{-2}\ s^{-1}]$
5	$5.22 \cdot 10^6$	$5.33 \cdot 10^5$	$3.10 \cdot 10^5$	$31.7 \cdot 10^3$
6	$7.41 \cdot 10^6$	$7.58 \cdot 10^5$	$5.93 \cdot 10^5$	$60.6 \cdot 10^3$
7	$13.3 \cdot 10^6$	$2.11 \cdot 10^5$	$1.52 \cdot 10^6$	$24.1 \cdot 10^3$
8	$13.9 \cdot 10^6$	$2.21 \cdot 10^5$	$2.04 \cdot 10^6$	$32.5 \cdot 10^3$
9	$13.7 \cdot 10^6$	$2.17 \cdot 10^5$	$2.35 \cdot 10^6$	$37.3 \cdot 10^3$
10	$9.84 \cdot 10^6$	$1.56 \cdot 10^5$	$2.13 \cdot 10^6$	$33.8 \cdot 10^3$

Table 2: Numbers of hits for hadrons and leptons on the different MVD disks for $8.5 \cdot 10^6$ events simulated and fluxes evaluated taking into account the $\overline{\text{P}}$ANDA annihilation rate.

Nucleus	Hadron Flux $[cm^2\ s^{-1}]$	Disk N.	Lepton Flux $[cm^2\ s^{-1}]$	Disk N.
$\overline{\mathrm{p}} - \mathrm{N}$	$5.80 \cdot 10^5$	6	$3.75 \cdot 10^4$	6
$\overline{\mathrm{p}} - \mathrm{Ar}$	$3.20 \cdot 10^5$	5	$1.50 \cdot 10^4$	6
$\overline{\mathrm{p}} - \mathrm{Au}$	$9.34 \cdot 10^4$	5	$1.25 \cdot 10^3$	5

Table 4: Maximum hadron and lepton extrapolated flux on the disk region.

Nucleus	Hadron Flux $[cm^2\ s^{-1}]$	Lepton Flux $[cm^2\ s^{-1}]$
$\overline{\mathrm{p}} - \mathrm{N}$	$3.12 \cdot 10^5$	$6.37 \cdot 10^3$
$\overline{\mathrm{p}} - \mathrm{Ar}$	$2.52 \cdot 10^5$	$3.60 \cdot 10^3$
$\overline{\mathrm{p}} - \mathrm{Au}$	$1.03 \cdot 10^5$	$5.77 \cdot 10^2$

Table 5: Maximum hadron and lepton extrapolated flux on the first barrel.

Nucleus	Hadron Flux $[cm^2\ s^{-1}]$	Lepton Flux $[cm^2\ s^{-1}]$
$\overline{\mathrm{p}} - \mathrm{N}$	$7.25 \cdot 10^4$	$3.60 \cdot 10^4$
$\overline{\mathrm{p}} - \mathrm{Ar}$	$5.77 \cdot 10^4$	$2.06 \cdot 10^4$
$\overline{\mathrm{p}} - \mathrm{Au}$	$2.26 \cdot 10^4$	$3.94 \cdot 10^3$

Table 6: Maximum hadron and lepton extrapolated flux on the second barrel.

Comparison with Previous Results

Study	Simulated Events	Particle Rate $[cm^{-2}s^{-1}]$
Previous	$4 \cdot 10^4$	$3.64 \cdot 10^6$
This	$8.5 \cdot 10^6$	$6 \cdot 10^6$

Table 8: Comparison with previous rate study for the $\overline{\mathsf{p}} - \mathsf{p}$ annihilations 15 GeV/c, the particle rate is normalized to $2 \cdot 10^7$ annihilations/s.

Study	Simulated Events	Particle Rate $[cm^{-2}s^{-1}]$
Previous	10^6	$1.11 \cdot 10^5$
This	$2.5 \cdot 10^6$	$1.6 \cdot 10^5$

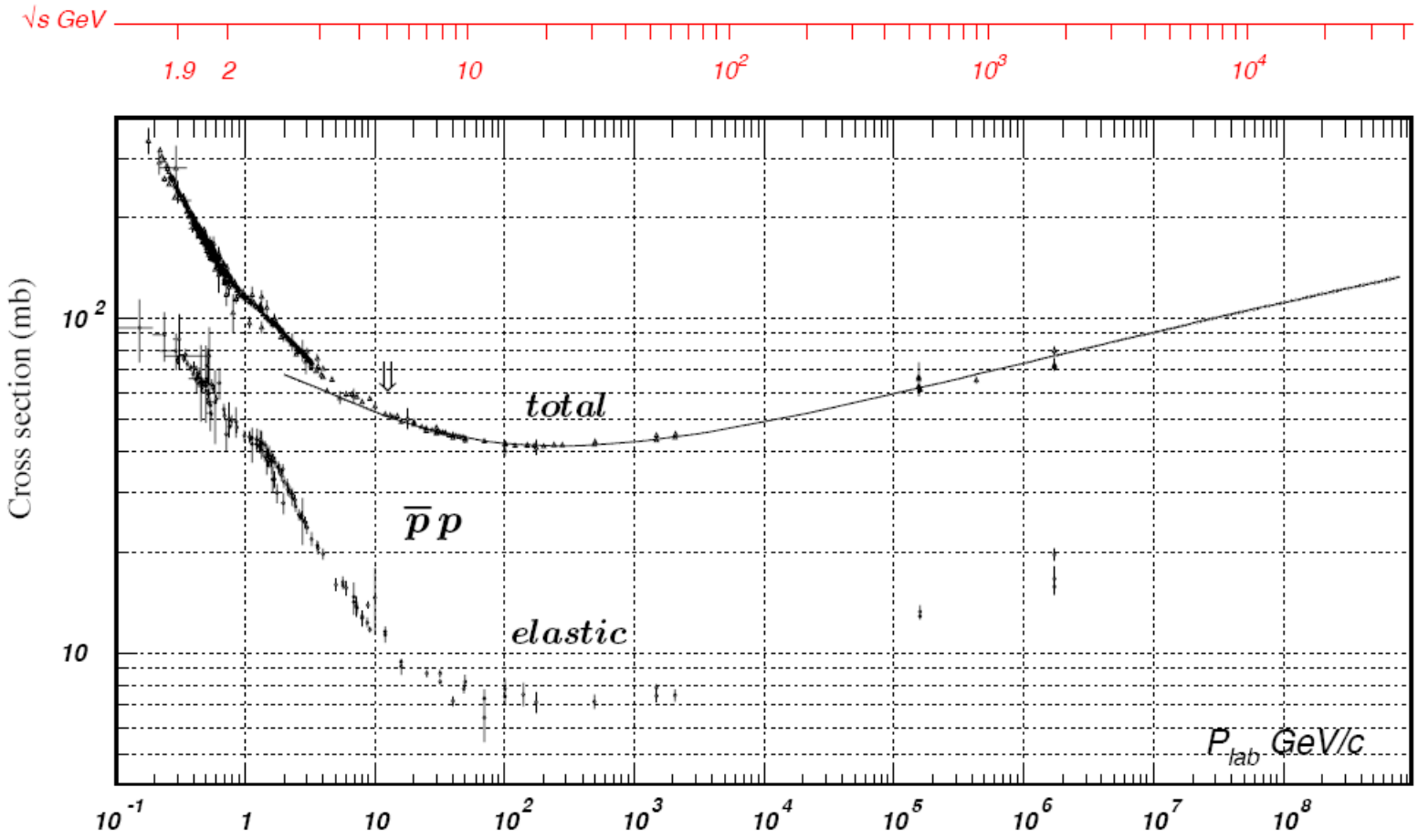
Table 9: Comparison with previous rate study for the $\overline{\mathsf{p}} - \mathsf{Au}$ annihilations 15 GeV/c, the particle rate is normalized to $2 \cdot 10^5$ annihilations/s.

$$R = L \cdot \sigma_{int}$$

$$\sigma_{\overline{p}-p} = \pi r_p^2 \qquad \sigma_{\overline{p}-Nucleo} = \pi(R_a + r_p)^2 \text{ with } R_a = r_0 A^{1/3}$$

Annihilation	Maximum Average Luminosity [$cm^{-1}\ s^{-1}$]
$\overline{p} - P$	$2.0 \cdot 10^{32}$
$\overline{p} - N$	$9.0 \cdot 10^{31}$
$\overline{p} - Ar$	$2.4 \cdot 10^{31}$
$\overline{p} - Au$	$2.2 \cdot 10^{30}$

Annihilation	σ @ 1.5 GeV/c	σ @ 15 GeV/c	R @ 15 GeV/c
$\overline{p}$-p	100 mbarn	50 mbarn	10^7
$\overline{p}$-N	451 mbarn	225 mbarn	$2 \cdot 10^7$
$\overline{p}$-Ar	786 mbarn	393 mbarn	$2 \cdot 10^7$
$\overline{p}$-Au	1951 mbarn	976 mbarn	$2 \cdot 10^6$


√s GeV
1.9
2
10
10^2
10^3
10^4
Cross section (mb)
10^2
10
total
p̄p
elastic
P_lab GeV/c
10^-1
1
10
10^2
10^3
10^4
10^5
10^6
10^7
10^8

Nucleus	Average Rate [$cm^2\ s^{-1}$]	Maximum Rate [$cm^2\ s^{-1}$]
$\bar{p} - p$	$7.58 \cdot 10^5$	$6 \cdot 10^6$
$\bar{p} - N$	$6.20 \cdot 10^5$	$1.23 \cdot 10^6$
$\bar{p} - Ar$	$3.30 \cdot 10^5$	$6.80 \cdot 10^5$
$\bar{p} - Au$	$1.03 \cdot 10^4$	$1.60 \cdot 10^5$