Summary of RUN Period 28

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Run duration	24.4. – 6.6.1995
People on shift:	≈ 50
Number of Spills:	≈ 590
Average beam rate:	750 kHz
Days without beam:	6 out of 41 = 15%
$\Sigma\,\overline{p}$	$1.6 \cdot 10^{12}$
used $\overline{p}$	50%
Recorded events on tape	$\approx 800 \cdot 10^{6}$
$\pi^{+}\pi^{-}$ candidates	$\approx 70 \cdot 10^{6}$
$\pi^{o}\pi^{o}$ candidates	$\approx 7 \cdot 10^{6}$
Sum of written tapes:	8307
Average number	
of tapes/shift	73
in best days	104 (old trigger)
	75 (new trigger)
maximum	124 (old trigger)

Contents

1 Summary of RUN Period 28

P28 started 10 days delayed due to the sabotage in the PS complex. First beam arrived on monday, 24th of april. LEAR invented a feedback system using our beamcounter rate as input to tune the extraction parameters. This worked very well over the whole run and gave a stable beam intensity over the entire spill time. The average number of antiprotons per day delivered by LEAR increased by about 40% compared to last year. The best days of LEAR have been before the beam sharing with X-Barrel and OBELIX when the average spill time was around 90 minutes at 800 kHz. Towards the end of the run the beam became unstable because of problems with the electron and stochastic cooling system. Two days have been lost due to problems of restarting the PS after a MD and four days have been lost after an EDF power cut when LEAR had first a problem with the vacuum, then the RF system was not working and at the end the extraction didn't worked.

PC0 and the small target have been installed for the whole run and 1640 full-trigger tapes are available with PC0 passiv. After we convinced ourselves about the functionality and stability of PC0, we decided to change the trigger and accept only events with two clusters in PC0. This removed almost all the annihilation background with four tracks (see page 24) and reduced therefore the trigger and readout deadtime from 60% to 35% (see page 23). With this improvement we have been able to release the trigger to accept any event with at least one kaon and two primary tracks of opposite charge. The improvement of the number of good $\pi\pi$ events per unit of time is shown on page 25. A possible bias of secondary tracks to the normalisation should be reduced with this new trigger.

On two occasions we had a problem with the PC0 gas supply (leak at the entrance to PC0) and the extraction of PC0 was required. On both occasions, no beam time was lost, since it was once before the start of the run and the other time during the breakdown of LEAR after the EDF power cut. The Saclay group will try to find a permanent solution to the gas supply problem until the start of the next run in july. The beamtuning (finding the position with minimum annihilations in the target entrance wall) still requires several hours. Afterwards the target has to be repositioned (requires survey) according to the offline results of the beam stopping distribution in order to have the $\overline{p}$ stopping in the middle of the detector. An average stopping point at $z = 0$ was achieved by reducing the target pressure to 26 bar. The beam sharing with other experiments influenced our beam position and caused an increase of $\overline{p}$ annihilations in the target front window. This increase was not visible with minimum bias trigger, it only showed up with the full trigger because of its selectivity on protons. Retuning our beamline solved this problem.

Main problems on our side have been caused by failures of the CAEN HV monitoring. Either the corresponding crate 13 stopped working, causing trips of chambers during beam time or the connection to the CAEN crates was disturbed and the monitoring and automatic correction of tripped channels didn't worked. The addition of one CAEN crate with the ID=0 might have reduced the problem but it didn't disappeared completely. The low voltage of PC0 is for the moment not monitored by the Slow Control and caused several times a stop of the readout. One free channel of the Slow Control is still available and should be connected to the PC0 low voltage. The gas flow for the calorimeter was again increased to reduce the number of extra hits in the chambers towards the end of a layer. Large fluctuations of the ToF resolution in individual channels seen in the CHECKT4 output were probably due to low stastics. Therefore the number of events used for the CALVER analysis will be increased to 8000 for the next run. The average ToF resolution calculated with "good" events was stable at around 330 ps (see page 13). The efficiency of the Cherenkov counter in sector 6 is slightly less than last year. The two driftchambers (5 and 6) had a dark current which will be investigated during the shutdown.

The data acquisition worked very well in general and especially the general help system was very powerful for solving problems. Only the procedure to reboot the DAQ valets (EB, MSP and Tape) and/or the CALO readout system is still a bit complicated for an average shift person.

2 Problems in P28

- The Slow control HV monitoring stops from time to time due to CAEN network problems.
- PC0 gas leak.
- Trips of PC0 low voltage.
- Two exabyte drives broke at the begin of the run.

3 Conclusion

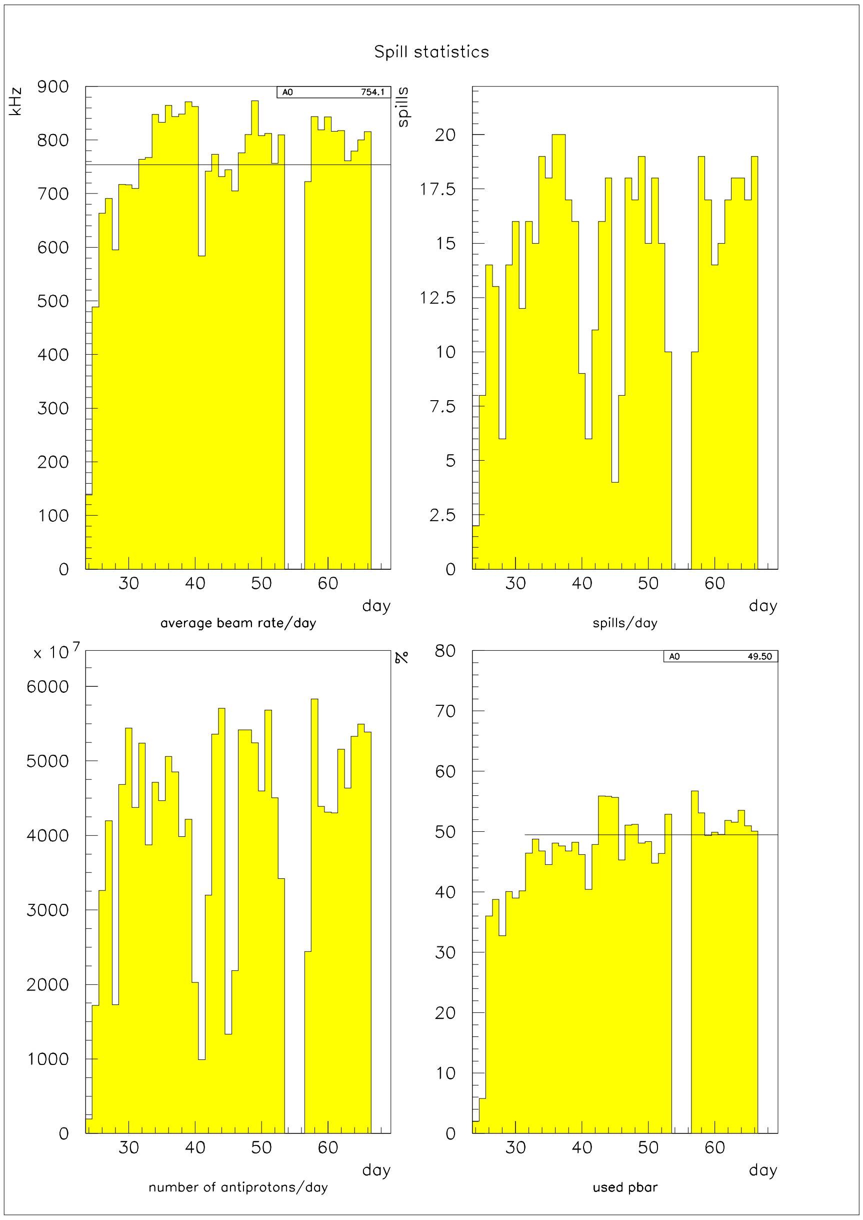
In general very stable data taking condition. No major problems with detector readouts, trigger performance, data acquisition system and the slow control. Using PC0 in the early stage of the trigger reduced the deadtime and by releasing in addition the trigger cuts we have been able to accept about a factor of 2.5 more useful events for the $\pi^+\pi^-$ and semileptonic analysis.

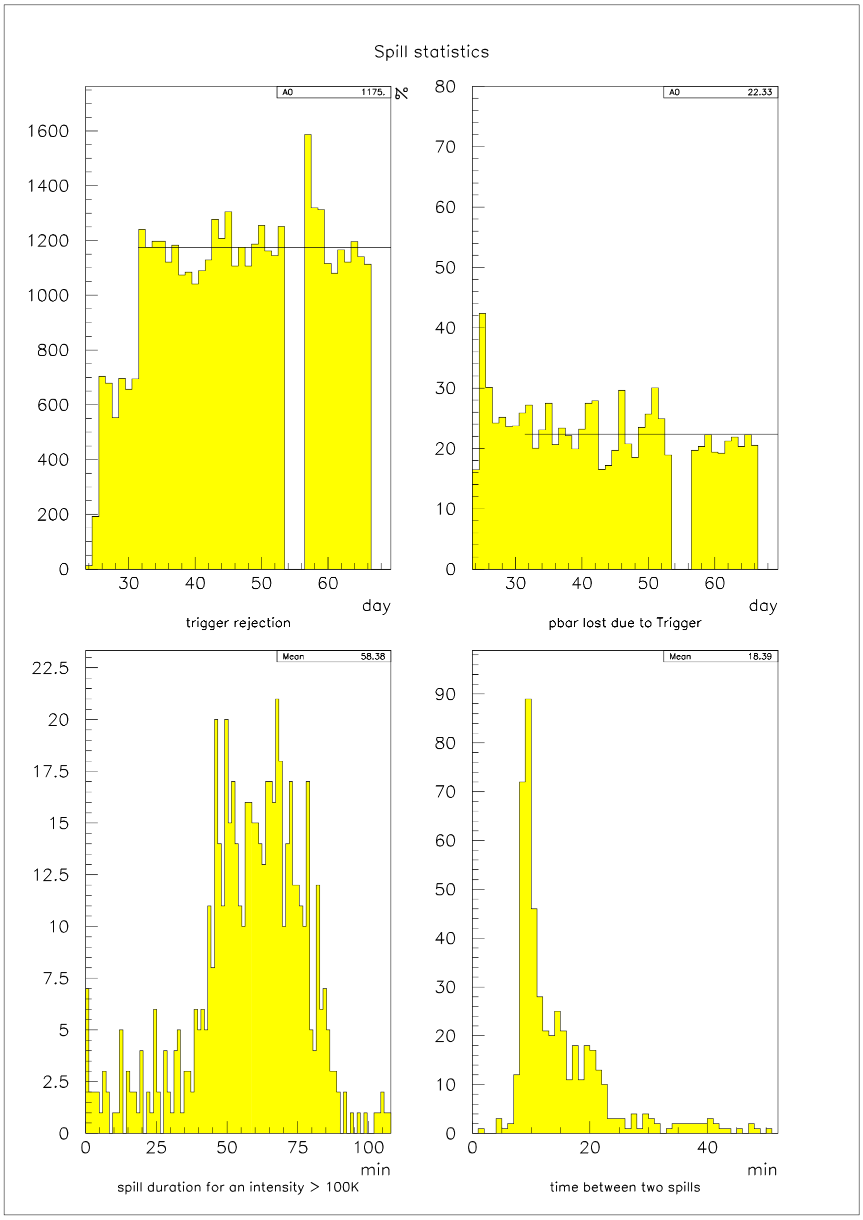
4 Tape Summary

Trigger	positve field	negative field
1	99	119
5	0	20
163323	1	
5163323	1	
505163323	3	
507110026	3201	3172
507163323	862	778
507163326	8	38
607110026		4
all tapes: 8307		

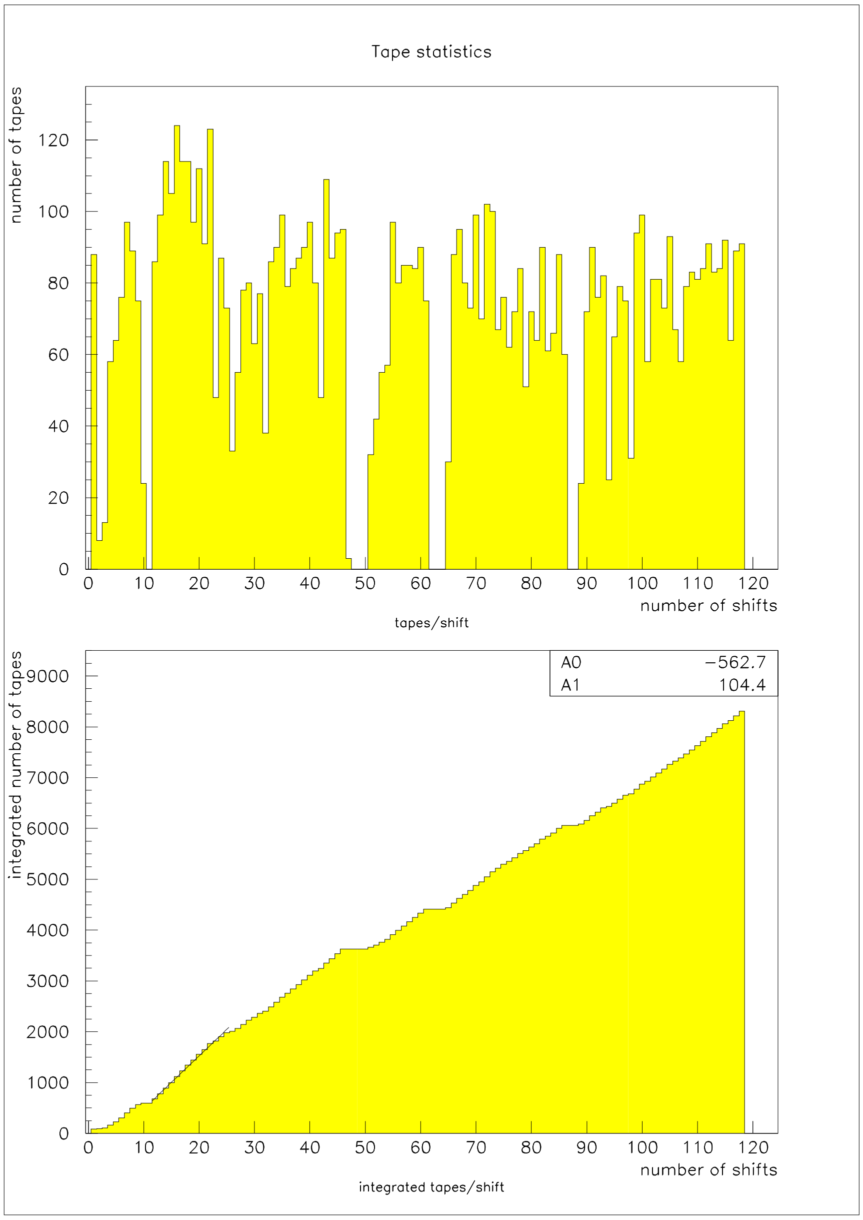
5 List of Histograms

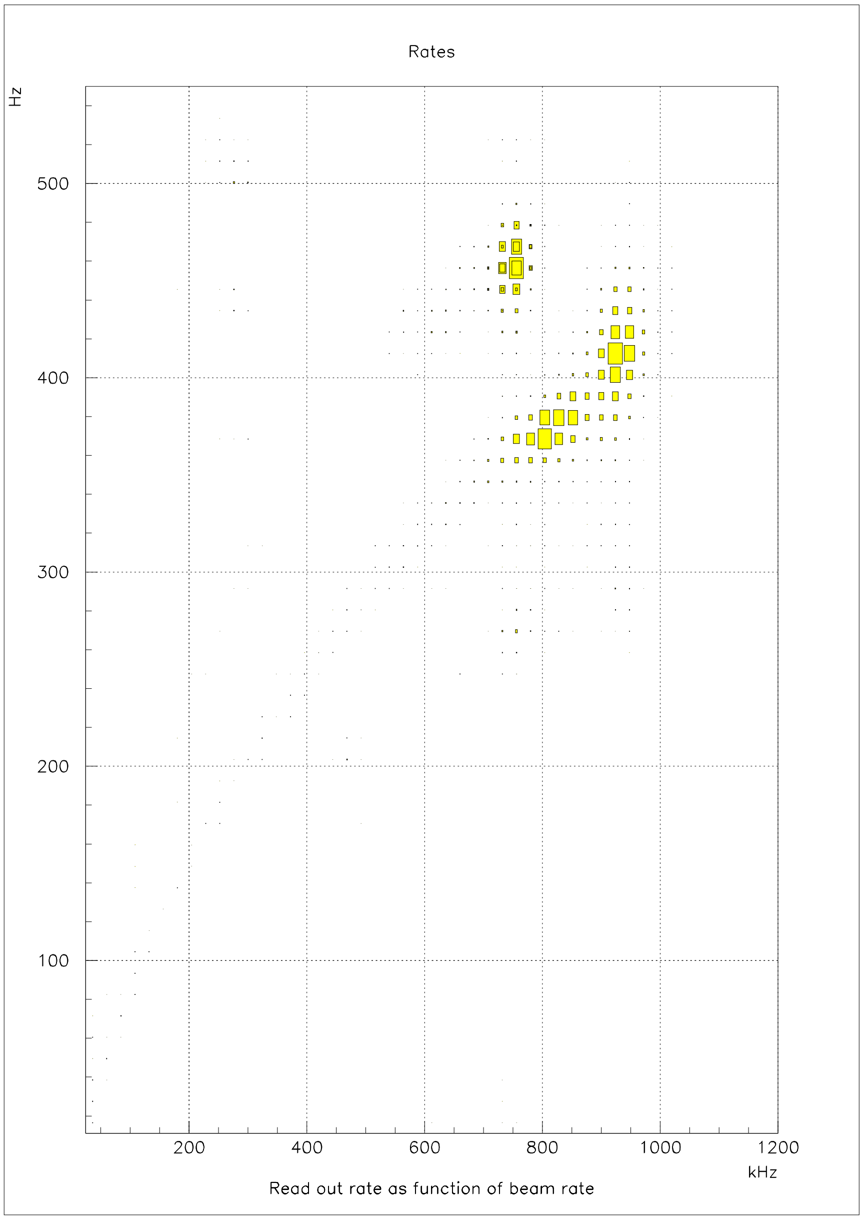
The histograms (page 18–20) which show results based on VME-scalers should be looked at with caution. Some fluctuations are due to temporary incorrect functionings of the VME-scalers. At the end of the run the number of good $\pi^+\pi^-$ decreased by about 0.5%. This might be connected with the fact, that the number of $\overline{p}$ annihilations in the front wall was slightly higher after the second insertion of PC0. No summary plots about the efficiency of PC0 exist so far.


Spill statistics
kHz
A0 754.1
average beam rate/day
spills
spills/day
x 10^7
number of antiprotons/day
%
A0 49.50
used pbar
day

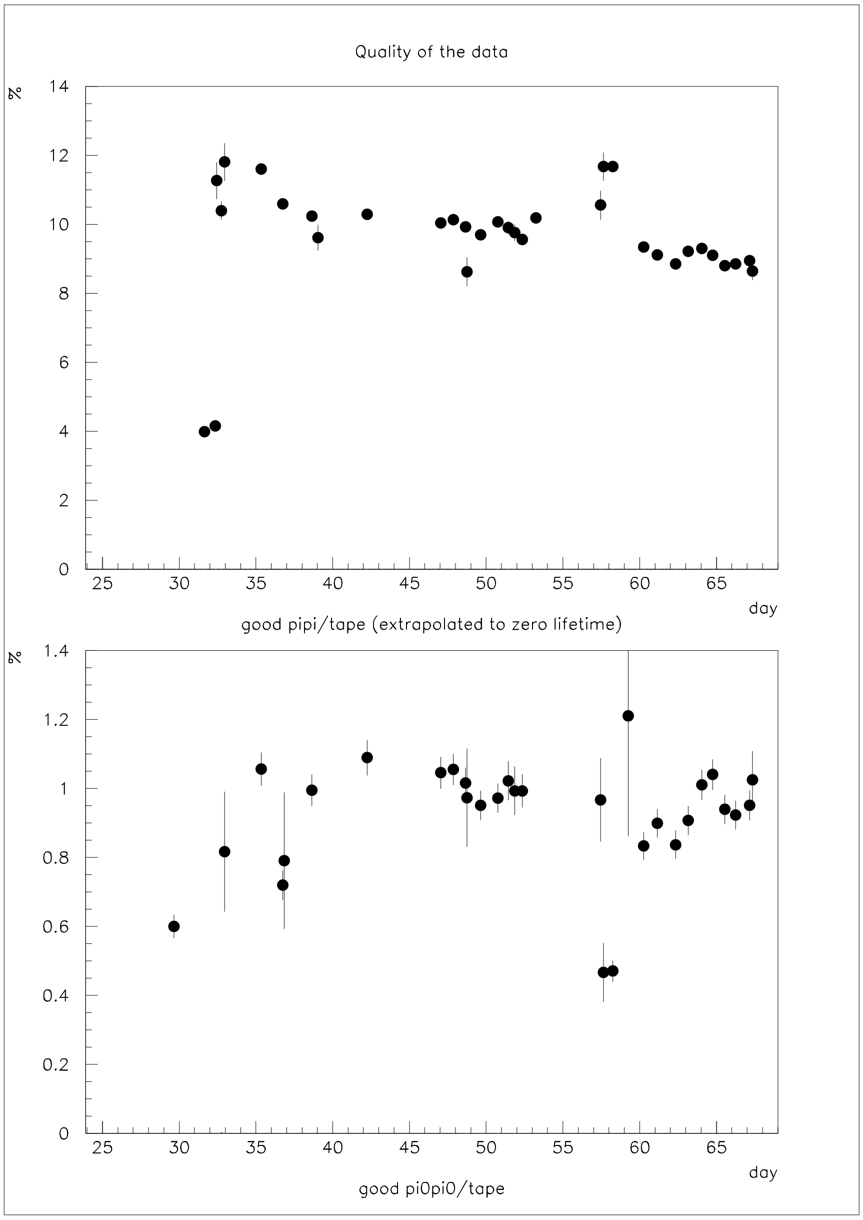


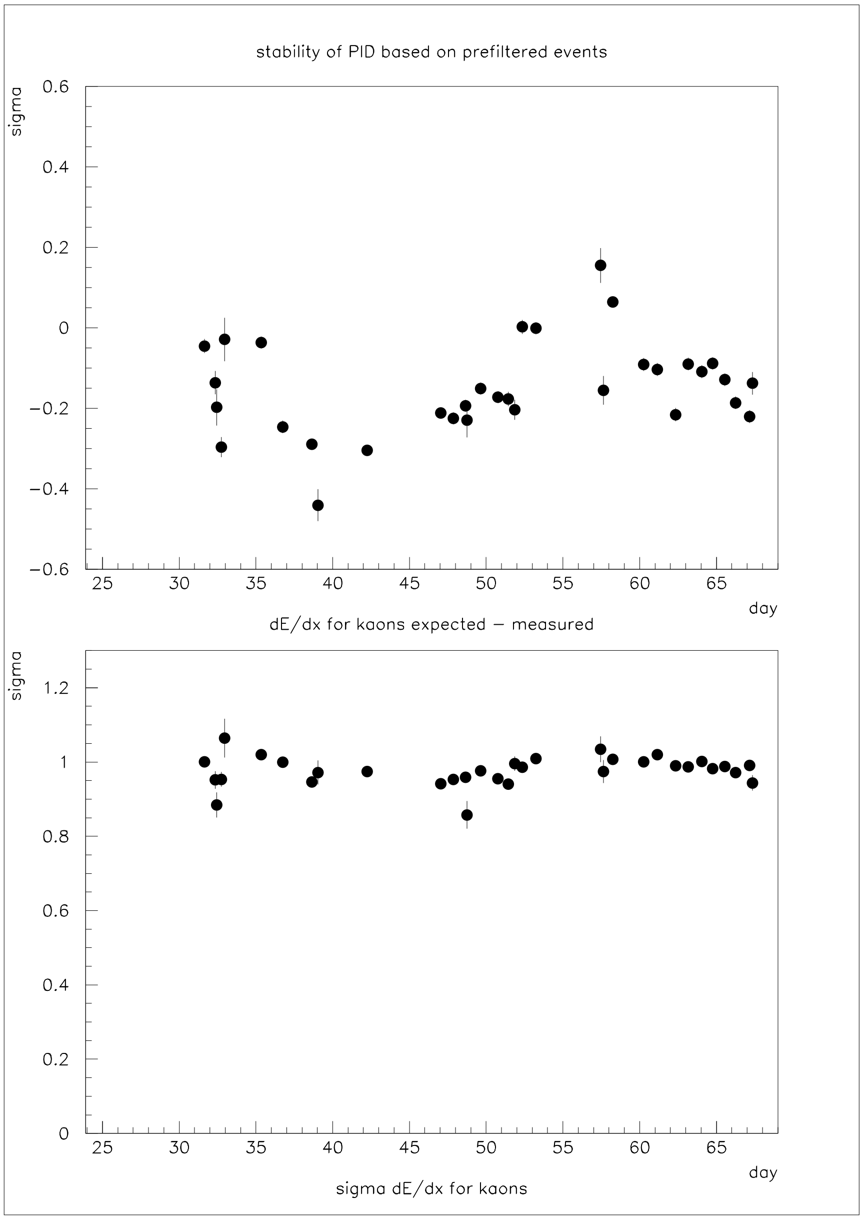
Spill statistics
A0 1175.
trigger rejection
day
A0 22.33
pbar lost due to Trigger
day
Mean 58.38
spill duration for an intensity > 100K
min
Mean 18.39
time between two spills
min


Tape statistics
number of tapes
120
100
80
60
40
20
0
0 10 20 30 40 50 60 70 80 90 100 110 120
number of shifts
tapes/shift
A0 −562.7
A1 104.4
integrated number of tapes
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0 10 20 30 40 50 60 70 80 90 100 110 120
number of shifts
integrated tapes/shift

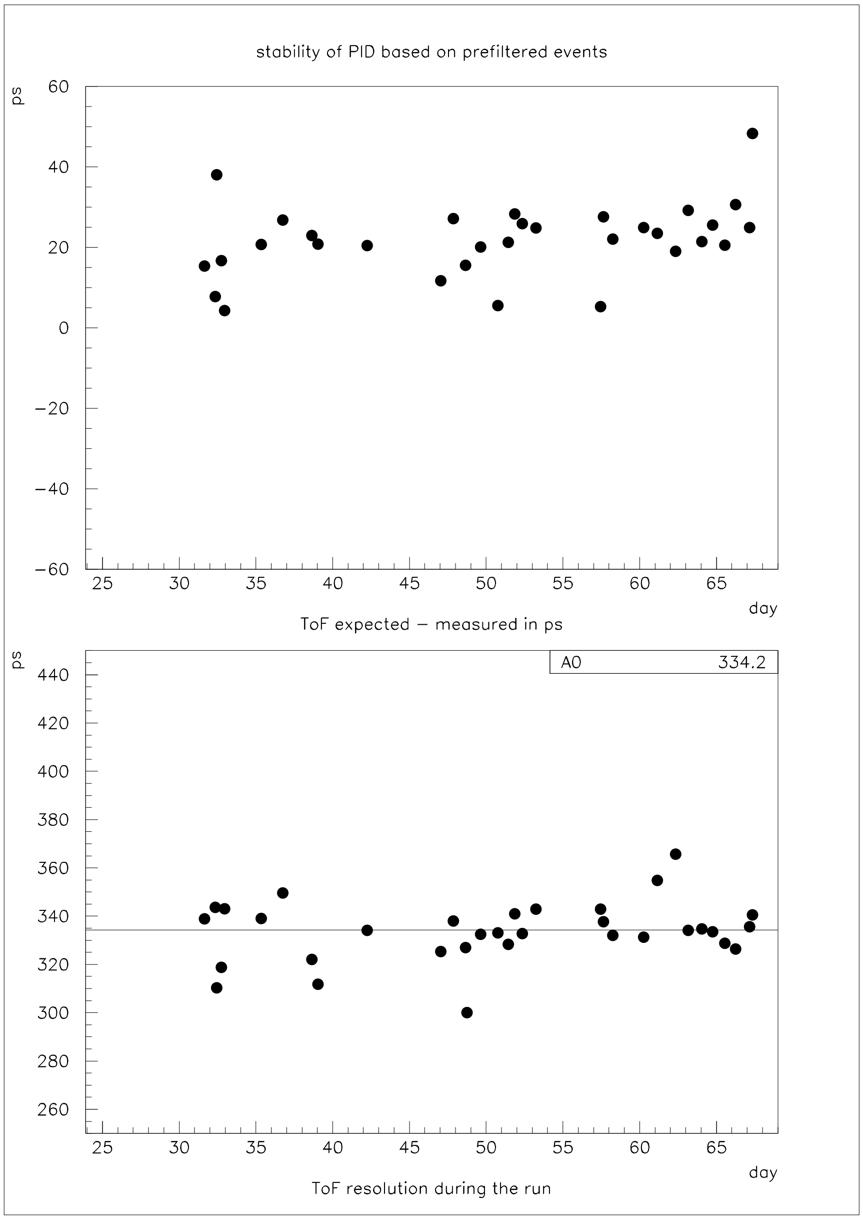


Rates
Hz
500
400
300
200
100
200
400
600
800
1000
1200
kHz
Read out rate as function of beam rate

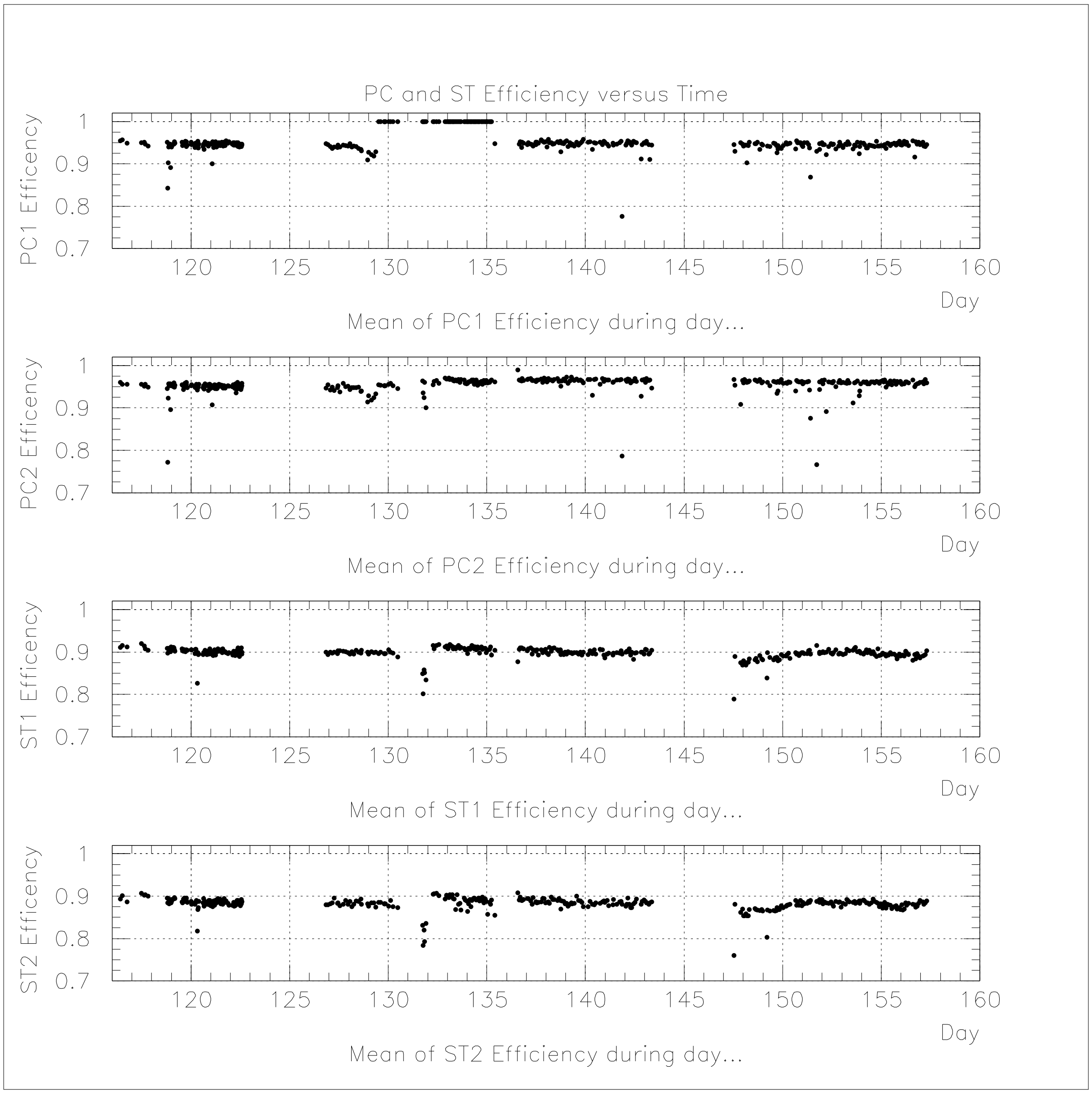

Quality of the data
%
14
12
10
8
6
4
2
0
25
30
35
40
45
50
55
60
65
day
good pipi/tape (extrapolated to zero lifetime)
%
1.4
1.2
1
0.8
0.6
0.4
0.2
0
25
30
35
40
45
50
55
60
65
day
good pi0pi0/tape



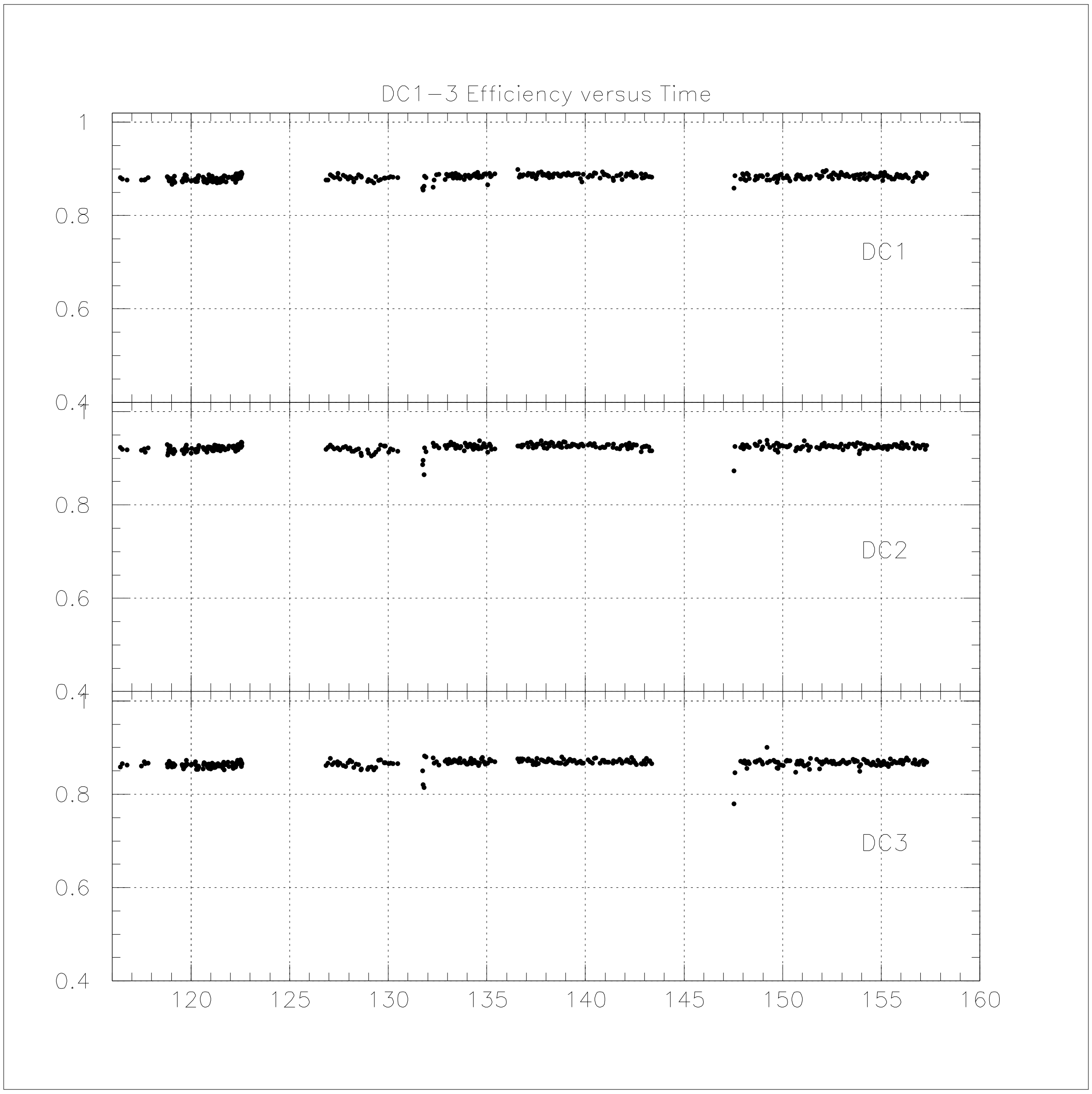
stability of PID based on prefiltered events
sigma
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
25
30
35
40
45
50
55
60
65
day
dE/dx for kaons expected − measured
sigma
1.2
1
0.8
0.6
0.4
0.2
0
25
30
35
40
45
50
55
60
65
day
sigma dE/dx for kaons

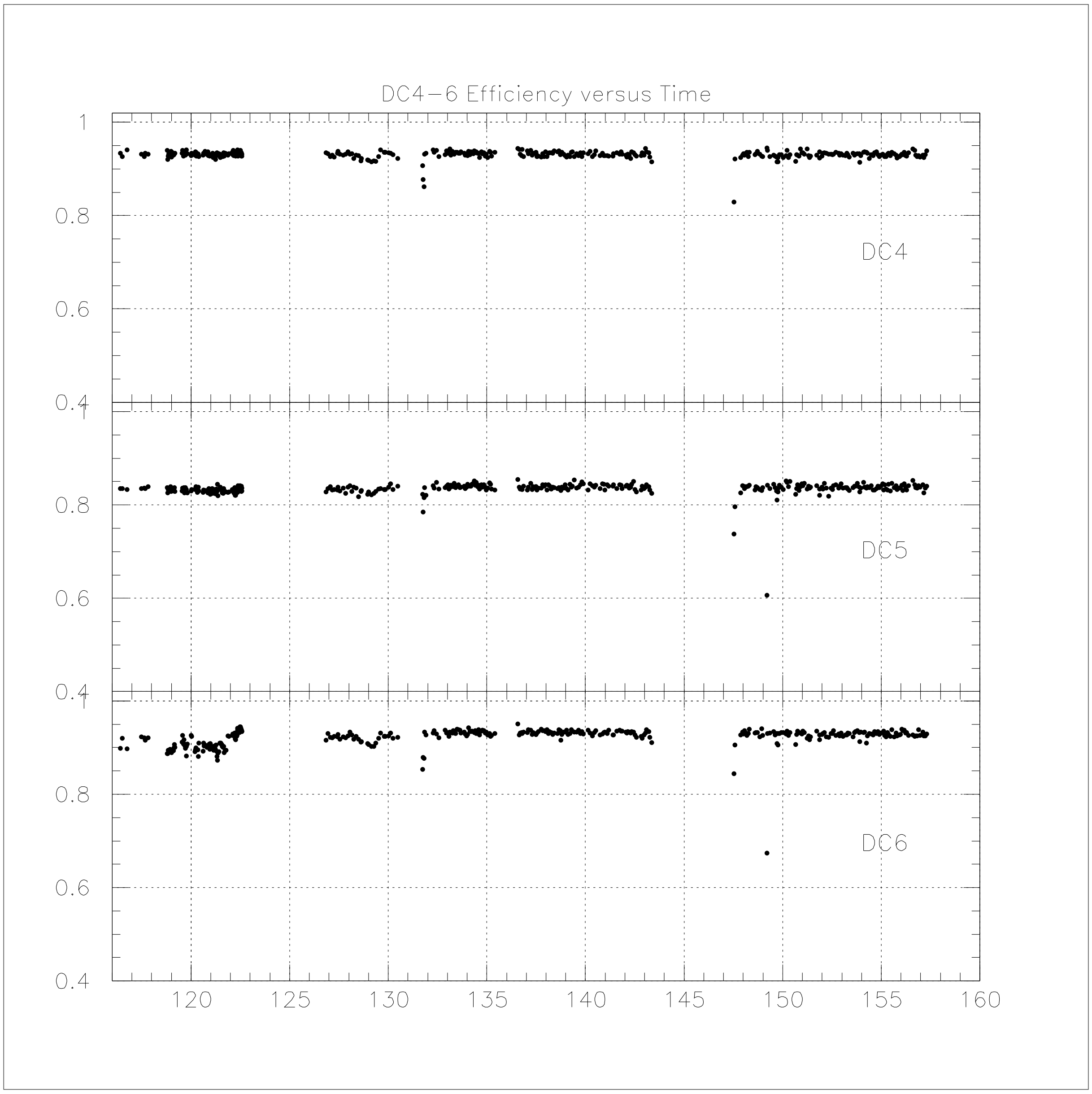


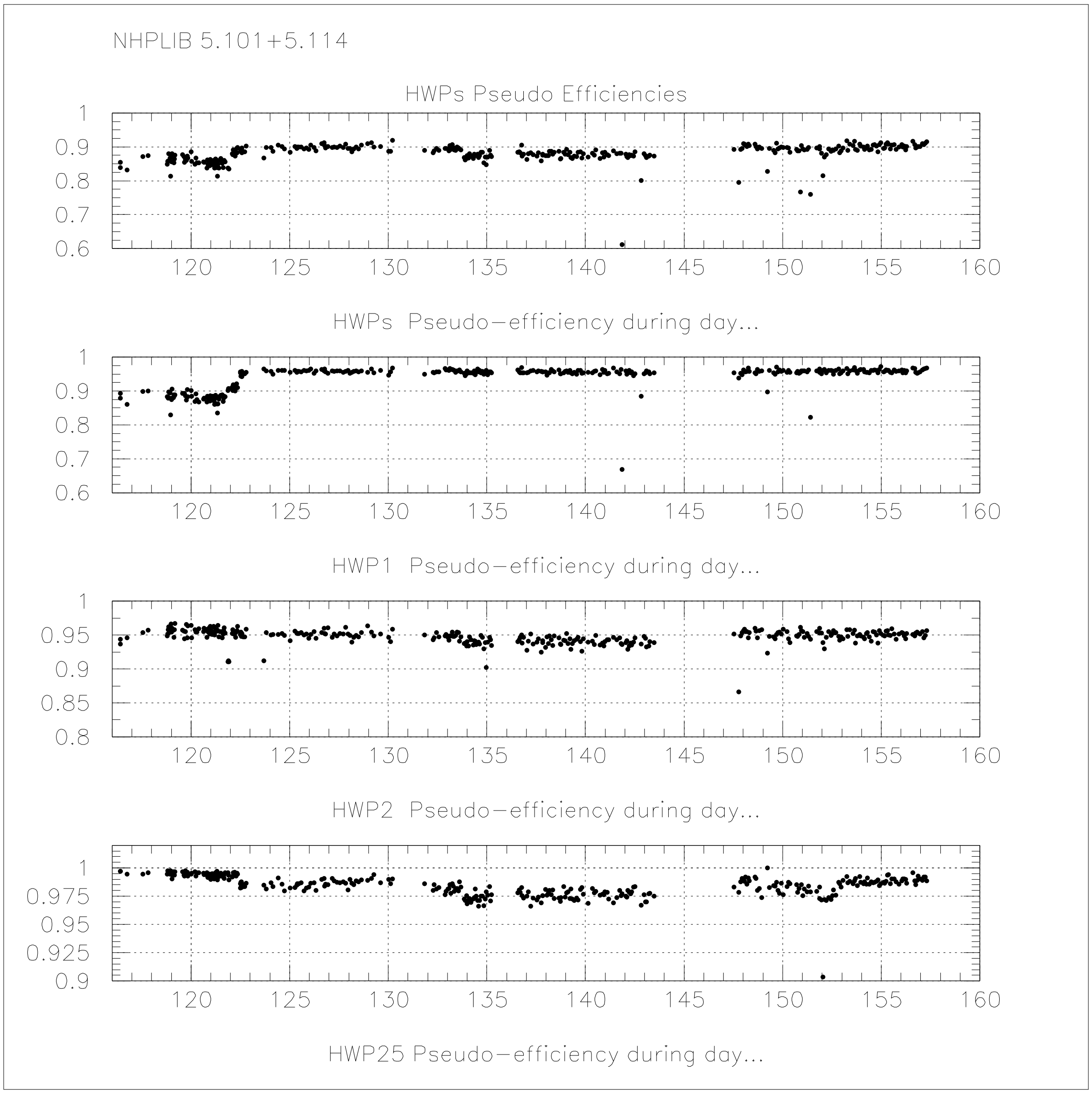
stability of PID based on prefiltered events
ps
60
40
20
0
−20
−40
−60
25 30 35 40 45 50 55 60 65
day
ToF expected − measured in ps
ps
A0 334.2
440
420
400
380
360
340
320
300
280
260
25 30 35 40 45 50 55 60 65
day
ToF resolution during the run

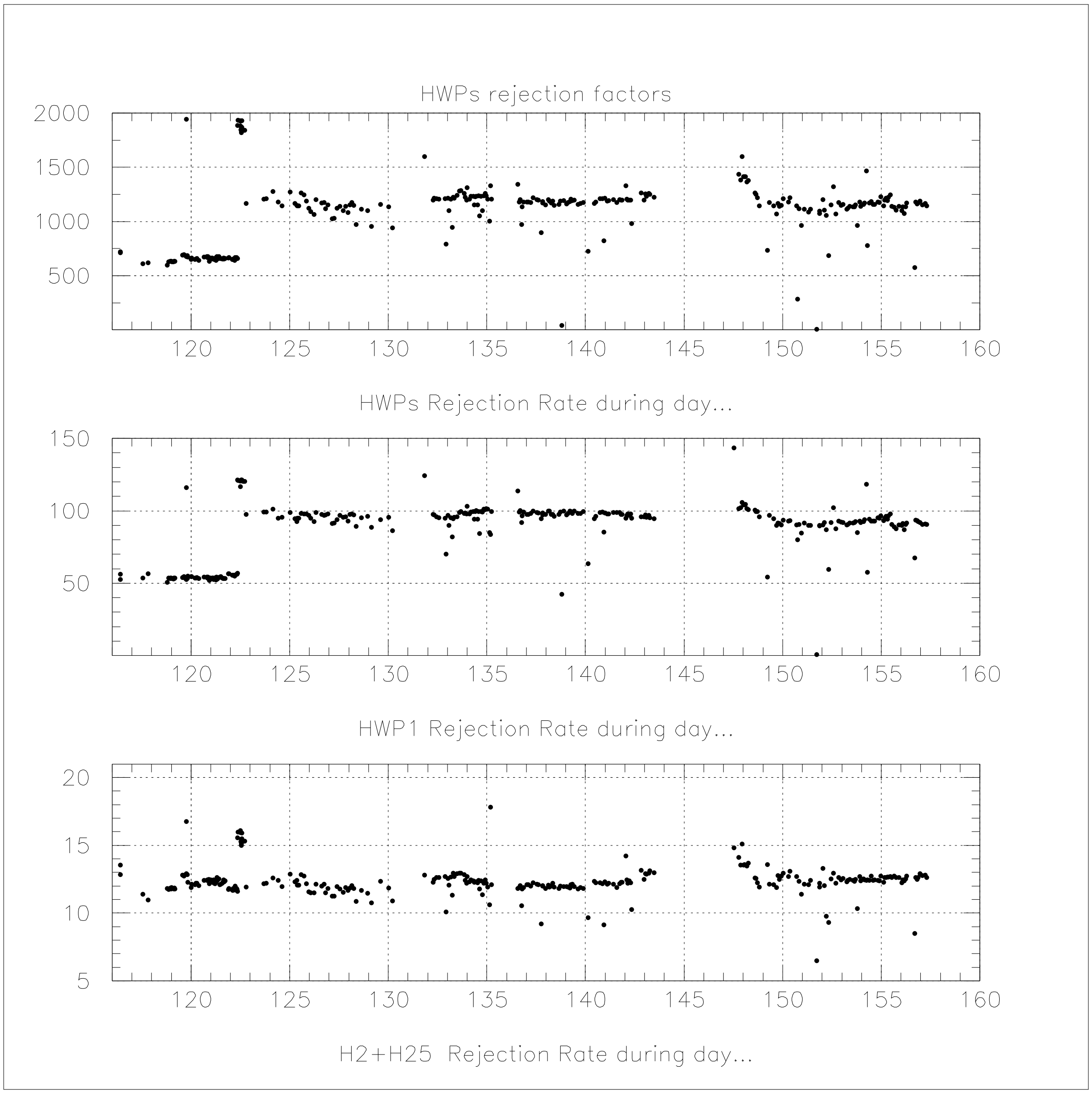


PC and ST Efficiency versus Time
PC1 Efficency
1
0.9
0.8
0.7
120
125
130
135
140
145
150
155
160
Day
Mean of PC1 Efficiency during day...
PC2 Efficency
Mean of PC2 Efficiency during day...
ST1 Efficency
Mean of ST1 Efficiency during day...
ST2 Efficency
Mean of ST2 Efficiency during day...

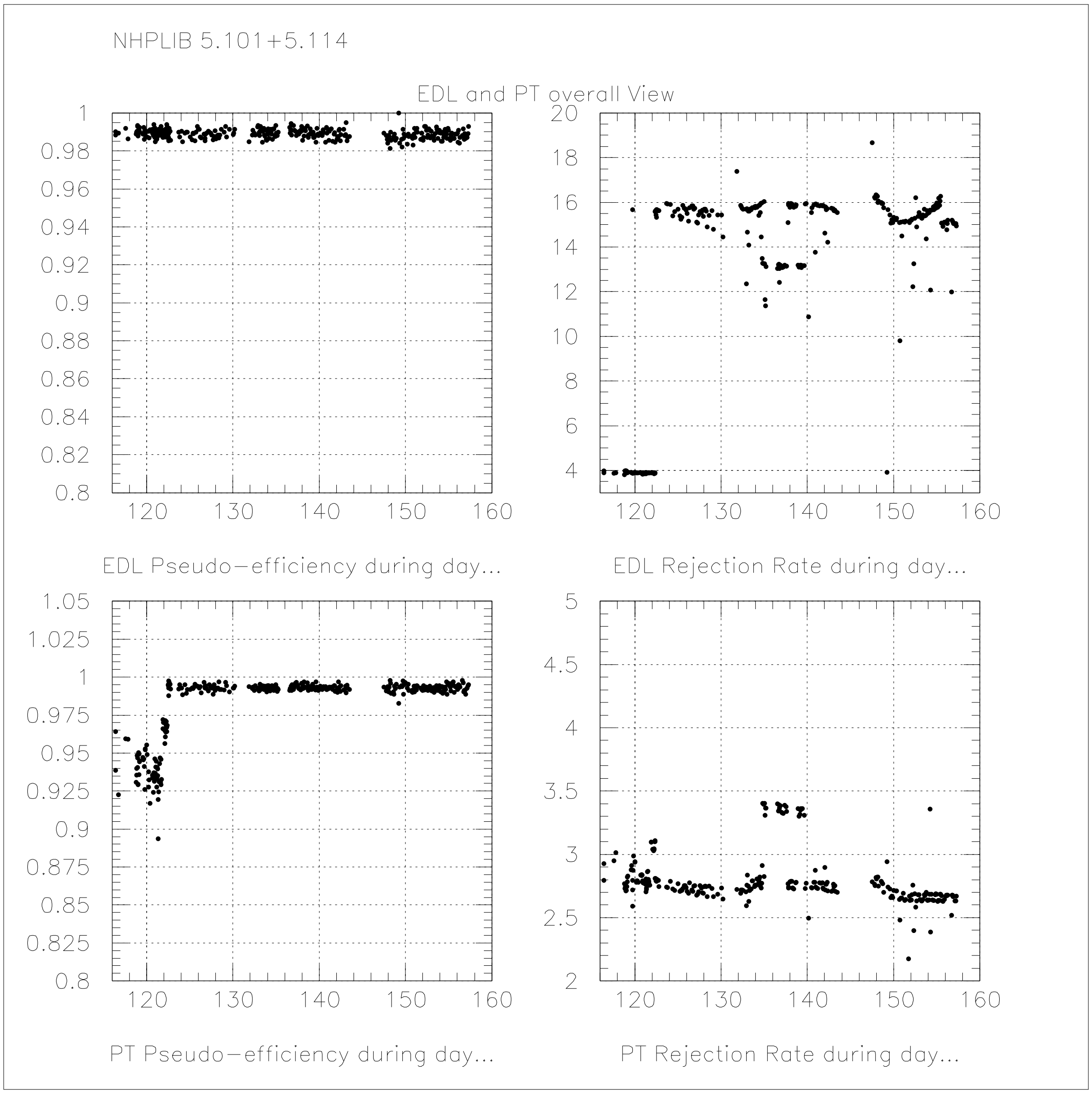

DC1−3 Efficiency versus Time
DC1
DC2
DC3
1
0.8
0.6
0.4
120
125
130
135
140
145
150
155
160

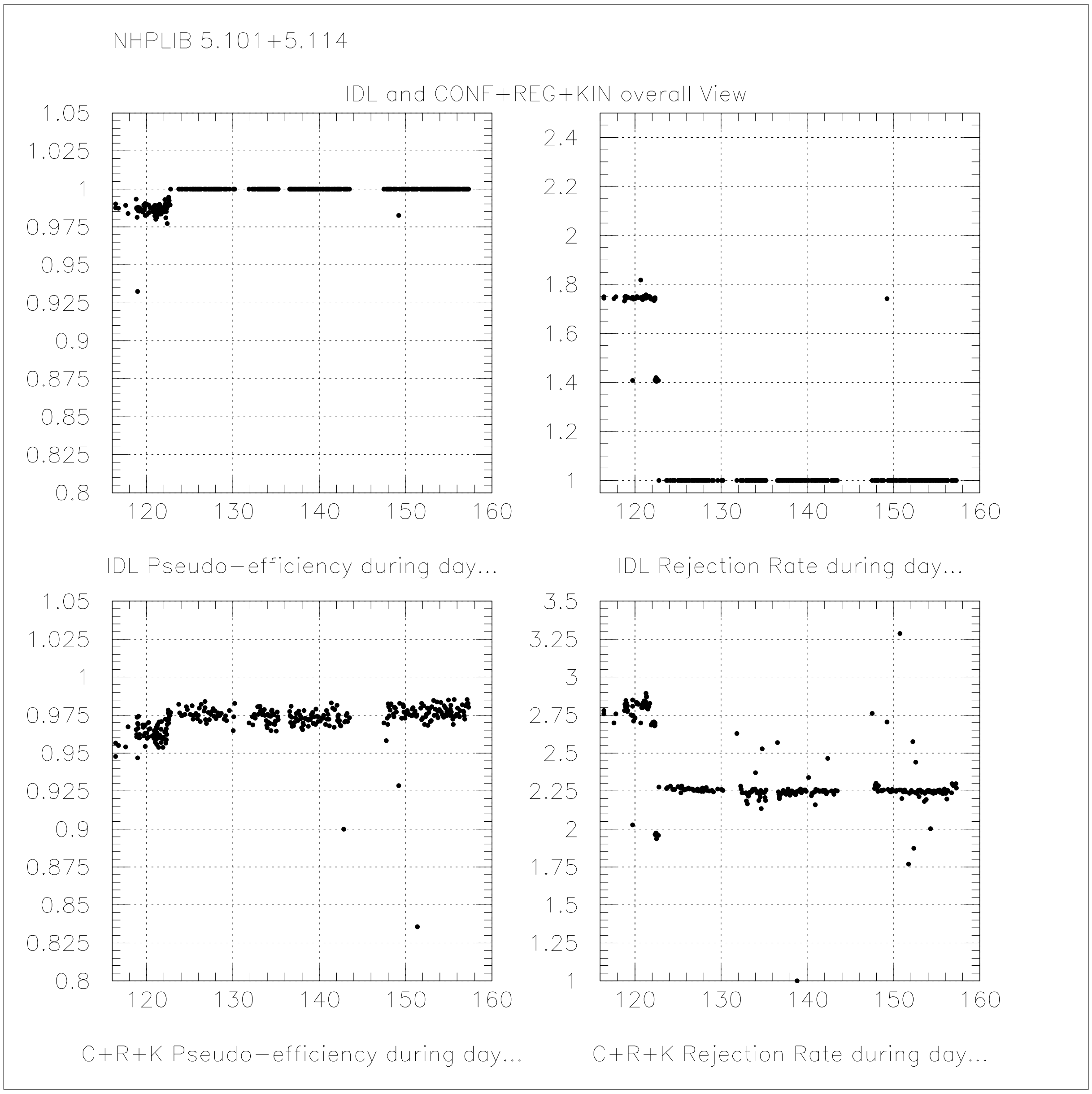

DC4−6 Efficiency versus Time
DC4
DC5
DC6
1
0.8
0.6
0.4
120
125
130
135
140
145
150
155
160


NHPLIB 5.101+5.114
HWPs Pseudo Efficiencies
HWPs Pseudo−efficiency during day...
HWP1 Pseudo−efficiency during day...
HWP2 Pseudo−efficiency during day...
HWP25 Pseudo−efficiency during day...

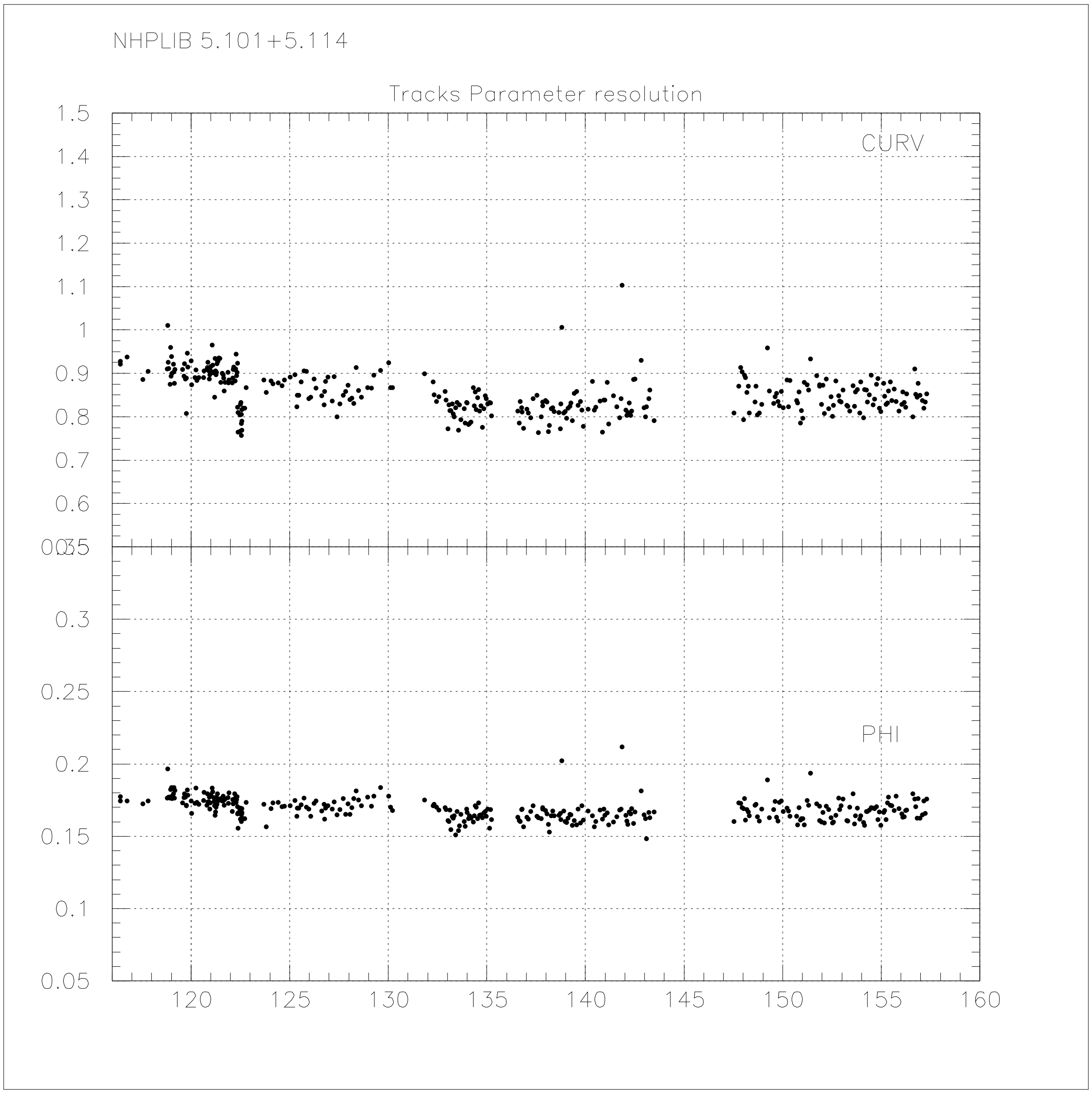


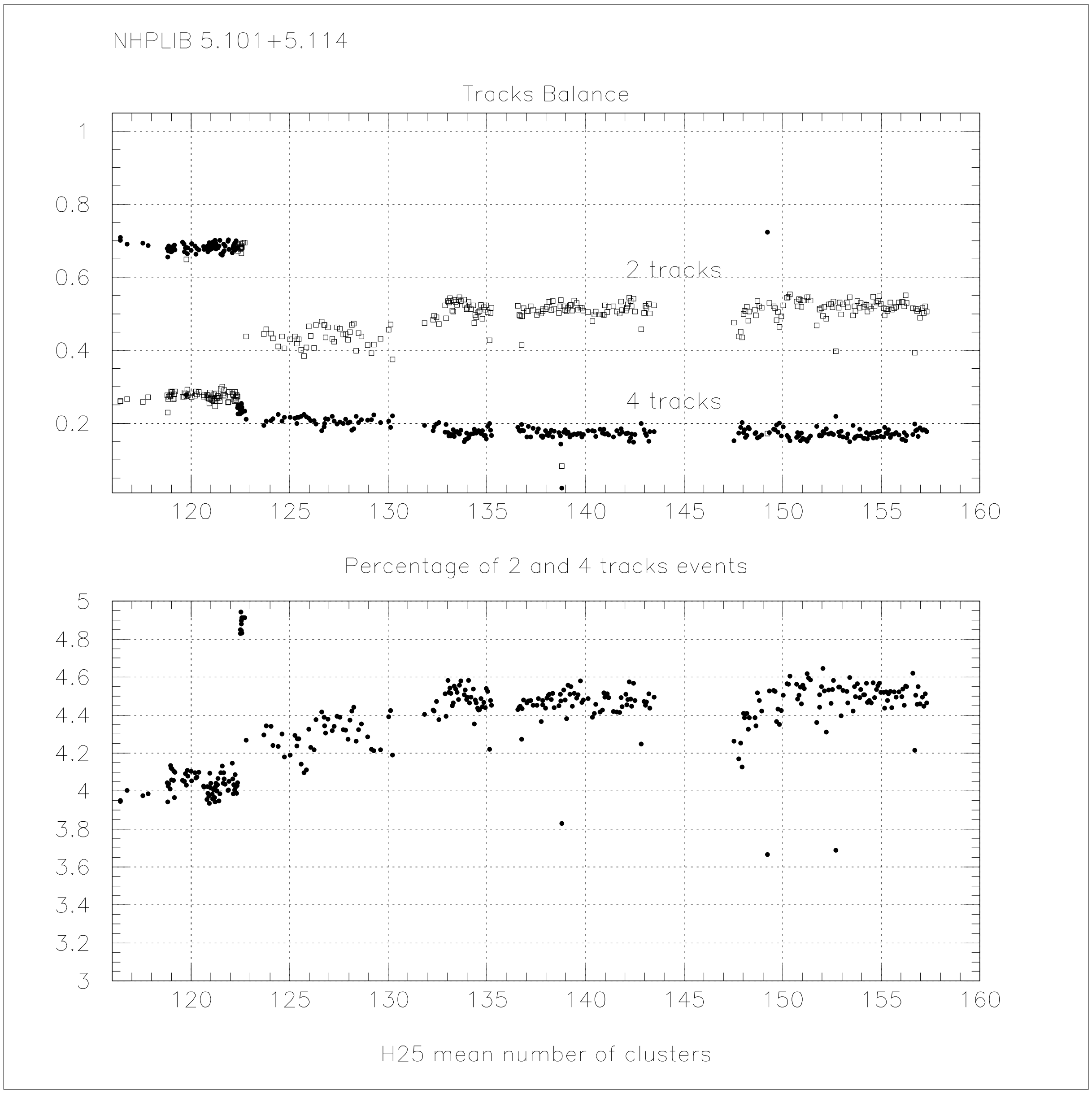
HWPs rejection factors
2000
1500
1000
500
120 125 130 135 140 145 150 155 160
HWPs Rejection Rate during day...
150
100
50
120 125 130 135 140 145 150 155 160
HWP1 Rejection Rate during day...
20
15
10
5
120 125 130 135 140 145 150 155 160
H2+H25 Rejection Rate during day...


NHPLIB 5.101+5.114
EDL and PT overall View
EDL Pseudo−efficiency during day...
EDL Rejection Rate during day...
PT Pseudo−efficiency during day...
PT Rejection Rate during day...

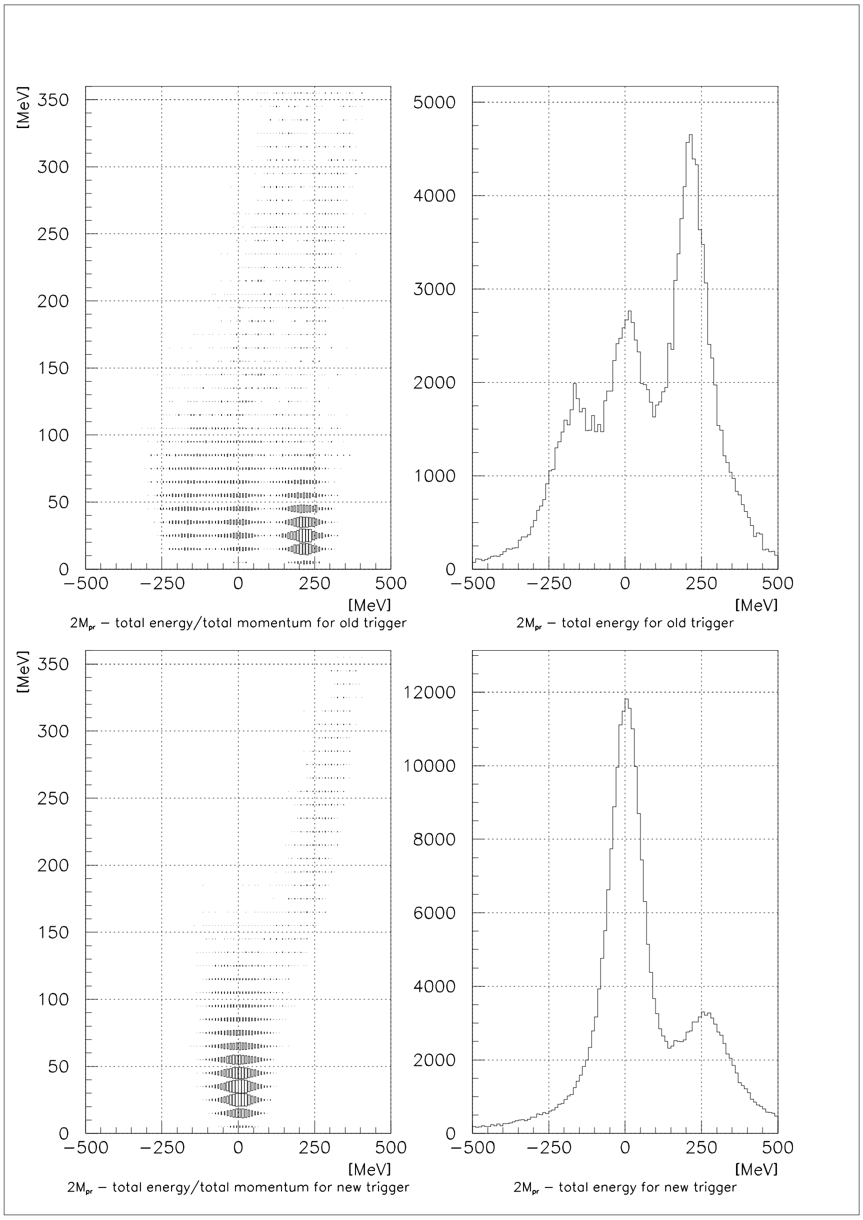


NHPLIB 5.101+5.114
IDL and CONF+REG+KIN overall View
IDL Pseudo−efficiency during day...
IDL Rejection Rate during day...
C+R+K Pseudo−efficiency during day...
C+R+K Rejection Rate during day...

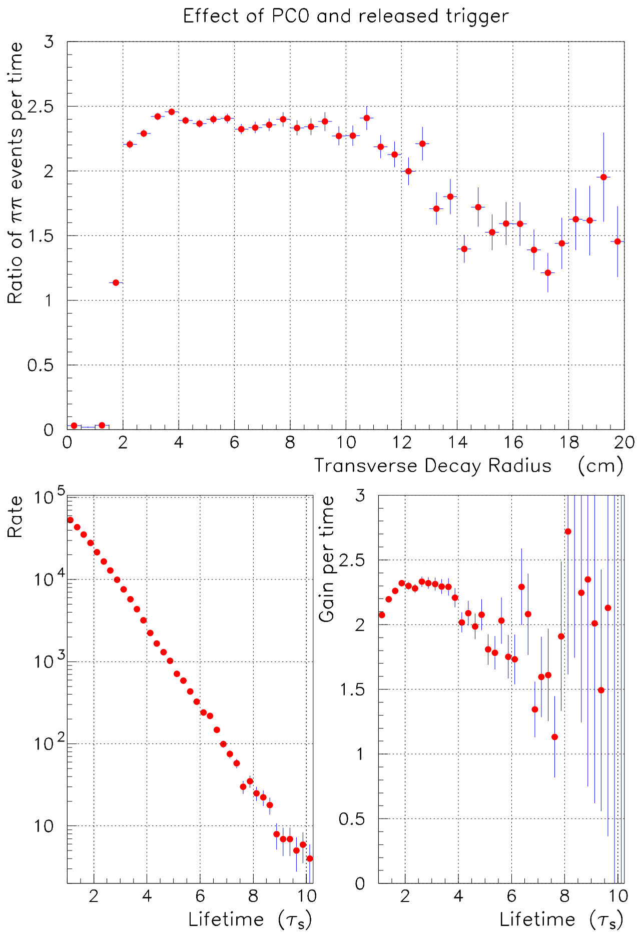

NHPLIB 5.101+5.114
Tracks Parameter resolution
CURV
PHI
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.35
0.3
0.25
0.2
0.15
0.1
0.05
120
125
130
135
140
145
150
155
160


NHPLIB 5.101+5.114
Tracks Balance
2 tracks
4 tracks
Percentage of 2 and 4 tracks events
H25 mean number of clusters


Spill summary for Spill z1788z z
%
old trigger
2 clusters in PC0
≧ 2 prim tracks
[min]
percentage of used antiprotons
Hz
[min]
readout rate during a spill, pbar rate 800kHz



[MeV]
2M$_{pr}$ − total energy/total momentum for old trigger
2M$_{pr}$ − total energy for old trigger
2M$_{pr}$ − total energy/total momentum for new trigger
2M$_{pr}$ − total energy for new trigger



Effect of PC0 and released trigger
Ratio of ππ events per time
Transverse Decay Radius (cm)
0
0.5
1
1.5
2
2.5
3
0
2
4
6
8
10
12
14
16
18
20
Rate
10^5
10^4
10^3
10^2
10
Lifetime (τs)
Gain per time
Lifetime (τs)