Summary of RUN Period 27

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Run duration	6.9. – 10.10.1994
People on shift:	≈ 50
Number of Spills:	≈ 440
Average beam rate:	540 kHz
Days without beam:	4 out of 30 $\equiv$ 13%
$\Sigma\,\overline{p}$	$\approx 0.8 \cdot 10^{12}$
used $\overline{p}$	40%
Recorded events on tape	$550 \cdot 10^6$
$\pi^+\pi^-$ candidates	$26 \cdot 10^6$
$\pi^o\pi^o$ candidates	$1.8 \cdot 10^6$
Sum of written tapes:	6085
Average number	
of tapes/shift	72
in best days	90
maximum	108

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1 Summary of RUN Period 27

The DC readout problem of last run was solved before this run and was due to not properly functioning STR302 modules. During the run the same problem appeared for the HWP readout system.

First useful beam to start debugging the experiment came on 7th September, 10am, almost two days late. As in the previous period, it took almost two weeks until LEAR was able to give us stable beam with modest intensity. This is clearly visible by looking at the integrated number of antiprotons received per day (Fig.3, page 6). Two days of LEAR machine development and one day of our beam time were used to study the source of the problems and only minor mistakes were found. Nevertheless the beam became more stable and the integrated $\overline{p}$ rate per day was almost doubled after the MD. One day was lost because of a power cut and a succeeding loss of the AA-stack. At another day the AA stopped because of a waterleak.

The PID-TDC controller board and the spare board were modified at the beginning of the run to improve the efficiency of the PID-HWP2 communication. The modifications caused a much lower efficiency and therefore ToF couldn't be used in the first week in the trigger. After several iterations of modifications, one board gave indeed a better efficiency compared to last period.

PC0 and the small target were in from the beginning of the run and several hundreds of tapes are available with PC0 information on (PC0 physically in until RUN 270865). The problems we had last time concerning noise on PC1 and PC2, P_T cut inefficiency caused by the electronics of PC0 didn't appear again. After one week PC0 didn't stand anymore voltages above 2000V. Later it was found out that this was due to a bad capacitor. All the capacitors will be changed for next year. The insertion and alignment of the small target is still a bottle neck (it needs the geometers, can take more than 12 hours). It has to be improved for next years running. During the extraction of PC0, one brass piece of the PC0 electronics shielding got stuck between the target extraction tube and the PC1 end-flange. Fortunately it didn't destroy the PC1 inner wall and we were able to continue the run, but only with the small target and without PC0 mounted on it. The small target itself was stable over the whole period and the H_2 losses were less than 1bar per 24 hours. Losses at the beginning of the run were due to a uncorrectly closed valve.

The beam stopping distribution was shifted downstream (+0.7 cm) due to missing material on the target entrance window. Because of the problems with the target alignment, we decided not to modify it.

One wire of DC1 broke on the 24th of September and DC1 couldn't stand anymore the HV. After disconnecting one sector (1 of 32) it was possible to run again with DC1.

The HWP2 logic was changed in such a way that all the events are tested to fullfil the $K\pi\pi\pi$ hypothesis (valid from RUN 271181 on). Before the event was tested either for the $K\pi\pi\pi$ or for the $KK\pi\pi$ hypothesis depending on the kaon flag of track 2 which caused different efficiencies for 2, 3 and 4 primary events.

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 P27

- Waterleak under rack Z16.
- Modified PID TDC controller board caused low efficiency for the PID-HWP dialogue during the first week.
- Frequent crashes of HWP valet; solved after changing the STR302 module.
- Broken wire in DC1, data taking stopped for 3 hours. 3-4% loss for the rest of the run.
- One stop of the DC gas system, lost 2 hours.
- Part of the PC valet crashes are explained by a bad Fastbus power supply.
- The Slow control HV monitoring stops from time to time due to CAEN network problems. To have one CAEN crate with address 0 might help to correct this problem in future. CAEN network hangups also happened several times in the independent CALO HV system which is monitored via a VME interface.
- The SLOW control was also several times the cause of a hangup of the online cluster.
- CALO cabling error for U-strips, run number 270225 - 270715.
- Frequent ST trips at the beginning of the run at modest beam intensities ($\approx$ 600kHz), then later trips only occured if beam quality was bad.
- HWP2.5 got sometimes the information to set a cut at shower number -1, causing actually a cut at 7 clusters and removing most of the two track events.
- Problems caused by never ending PID Endspill procedure. Solved by allowing the run control to stop the endspill procedures.

- The close relationship of CHI, EB, Tape and MSP causes from time to time losses in case of a crash because the procedure to reboot everything correctly was not followed by everybody.
- The update of the calibration file or the creation of LUT's failed sometimes. A more compact procedure would help very much.

3 Achievements in P27

- HWP2 logic changed in order to have particle identification only for the first register (from RUN 271181 on).
- Online help facility, trouble shooting guide.
- In general very stable data taking condition. No major problems with detector readouts, trigger performance, data acquisition system and the slow control.

4 Tape summary

Trigger	positve field	negative field
1	75	64
505163323	89	56
507163323	2388	2413
605163323	333	239
606163323	219	209
	all tapes: 6085	

5 Conclusions

Compared to the last period we wrote 35% more tapes during the time we had beam due to the solved problems of the EB software and DC readout hardware. During times with minor LEAR problems we wrote 300 tapes per day compared to 200 tapes per day averaged over the whole period. The main reason for this 50% loss is the so called GHOST phenomenon in LEAR causing instabilities, low intensity and short spills. The time lost due to problems in the AA accounts only for about 13%.

6 Some histograms

Page 6	Fig.1:	Average beam rate during a day
	Fig.2:	Total number of $\overline{p}$ received during a day
	Fig.3:	Number of spills during a day
	Fig.4:	Percentage of used antiprotons
Page 7	Fig.1:	Percentage of antiprotons lost due to readout deadtime
	Fig.2:	Percentage of antiprotons lost due to trigger deadtime
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		Step due to trigger change T607163323 to T507163323
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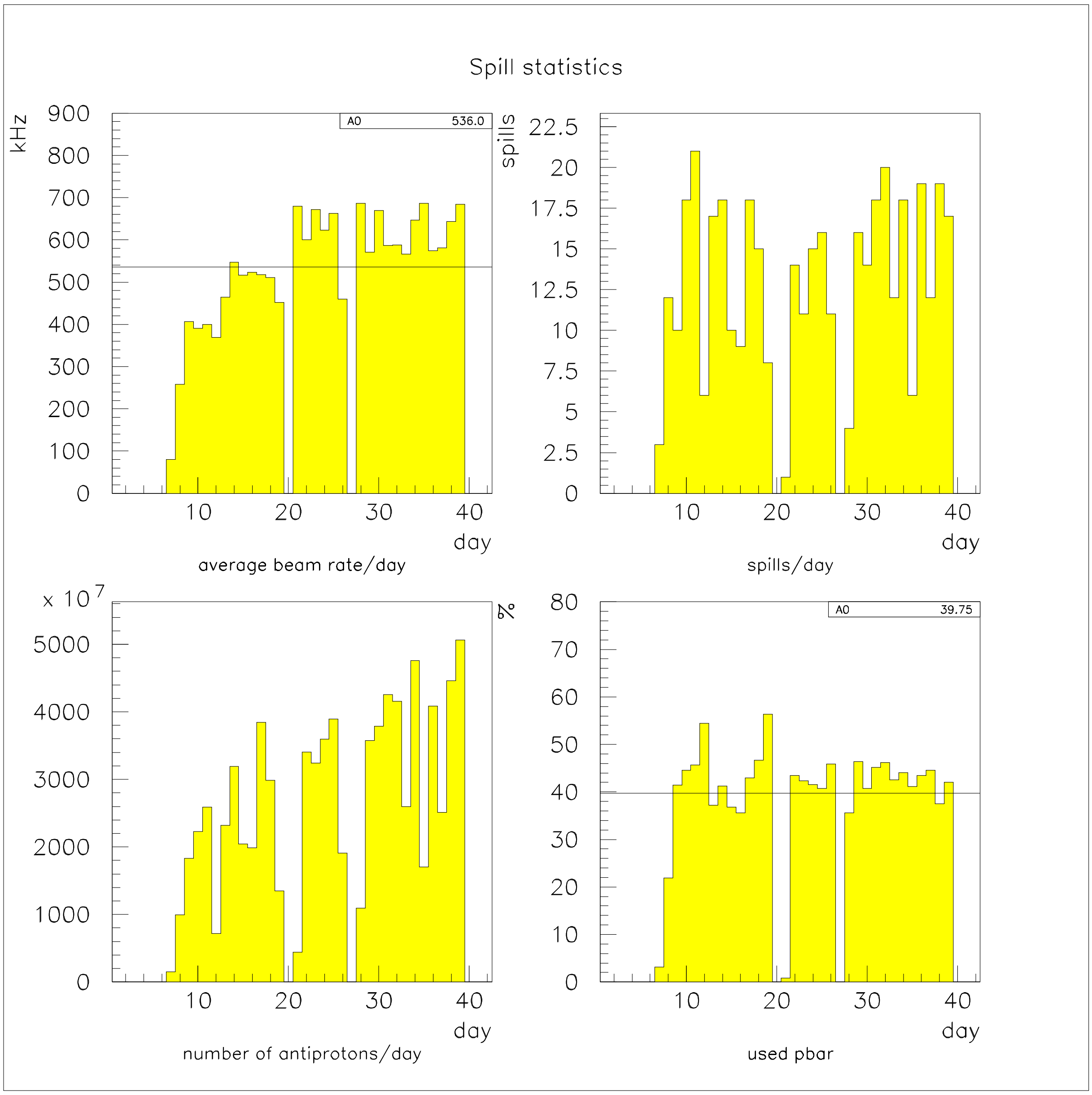
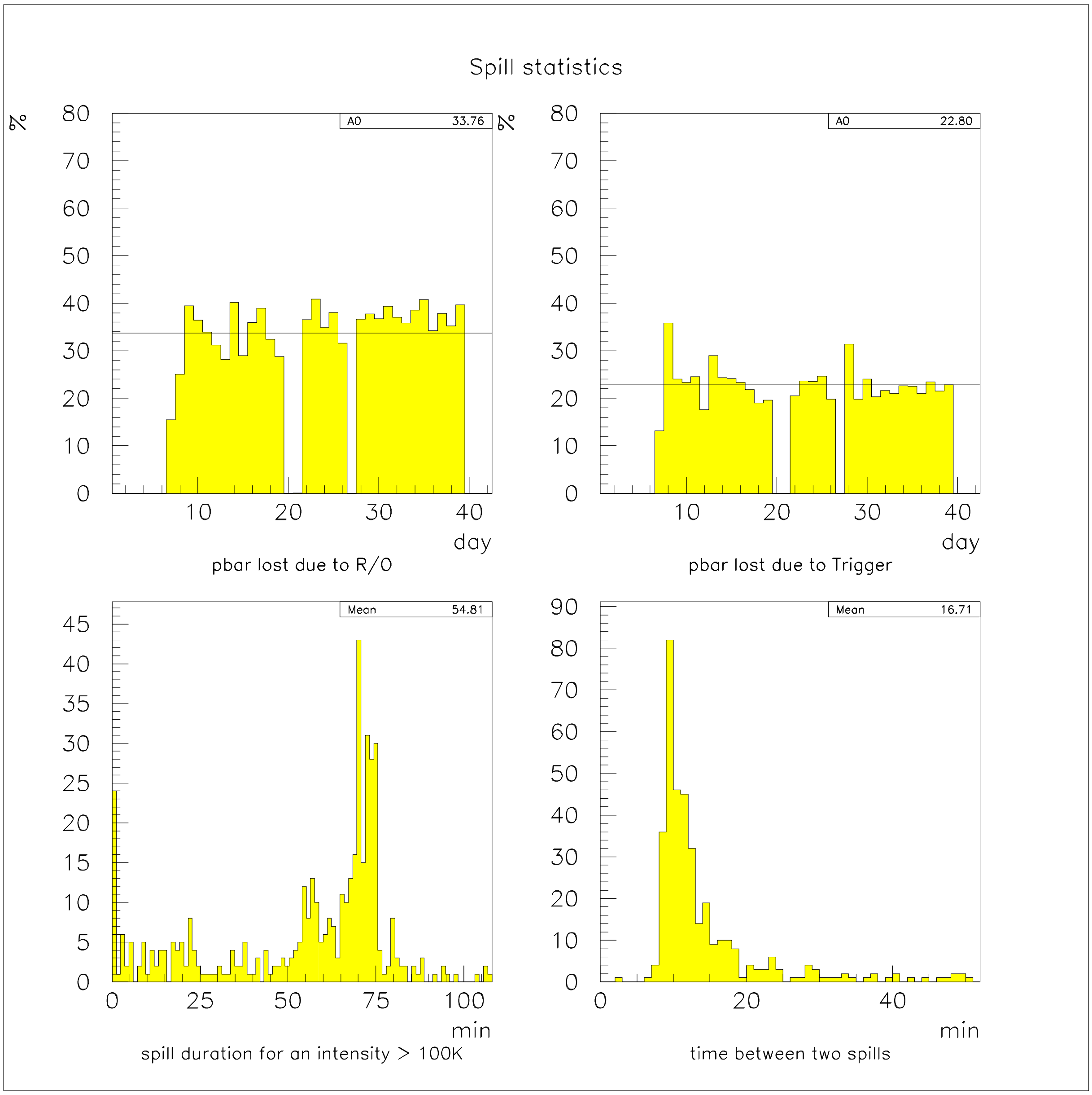
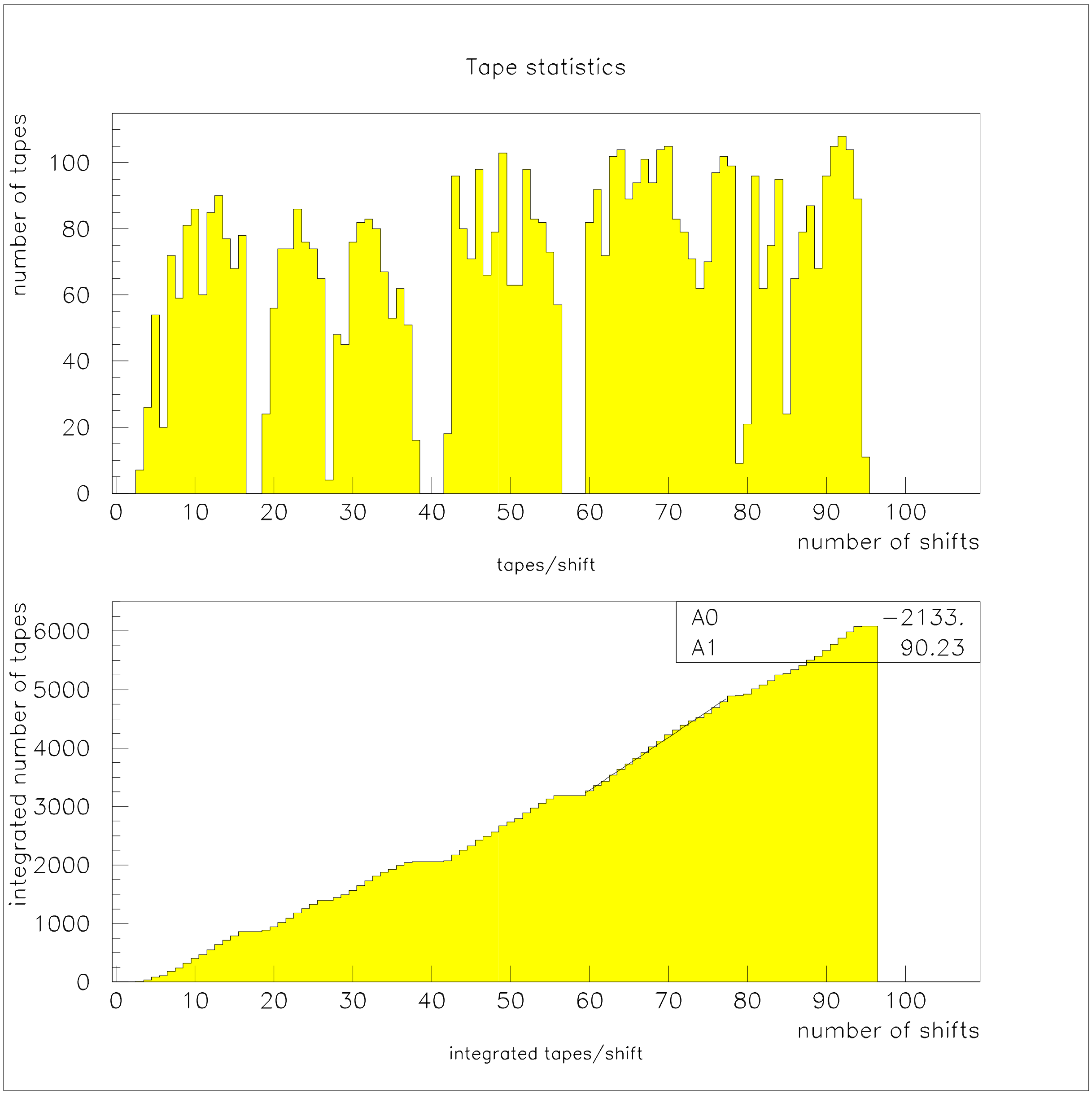
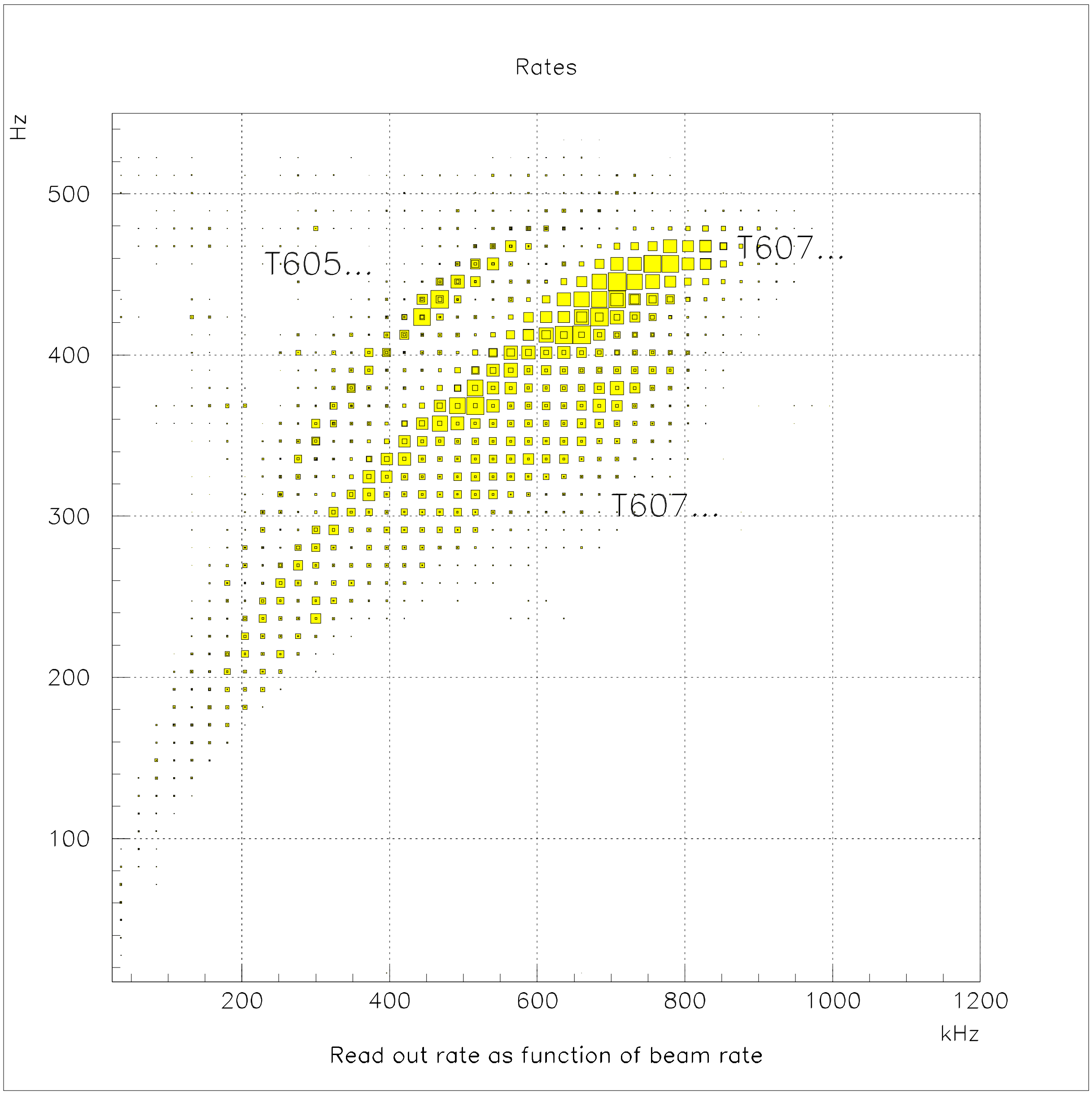
Page 21	Fig.1:	Beam stability



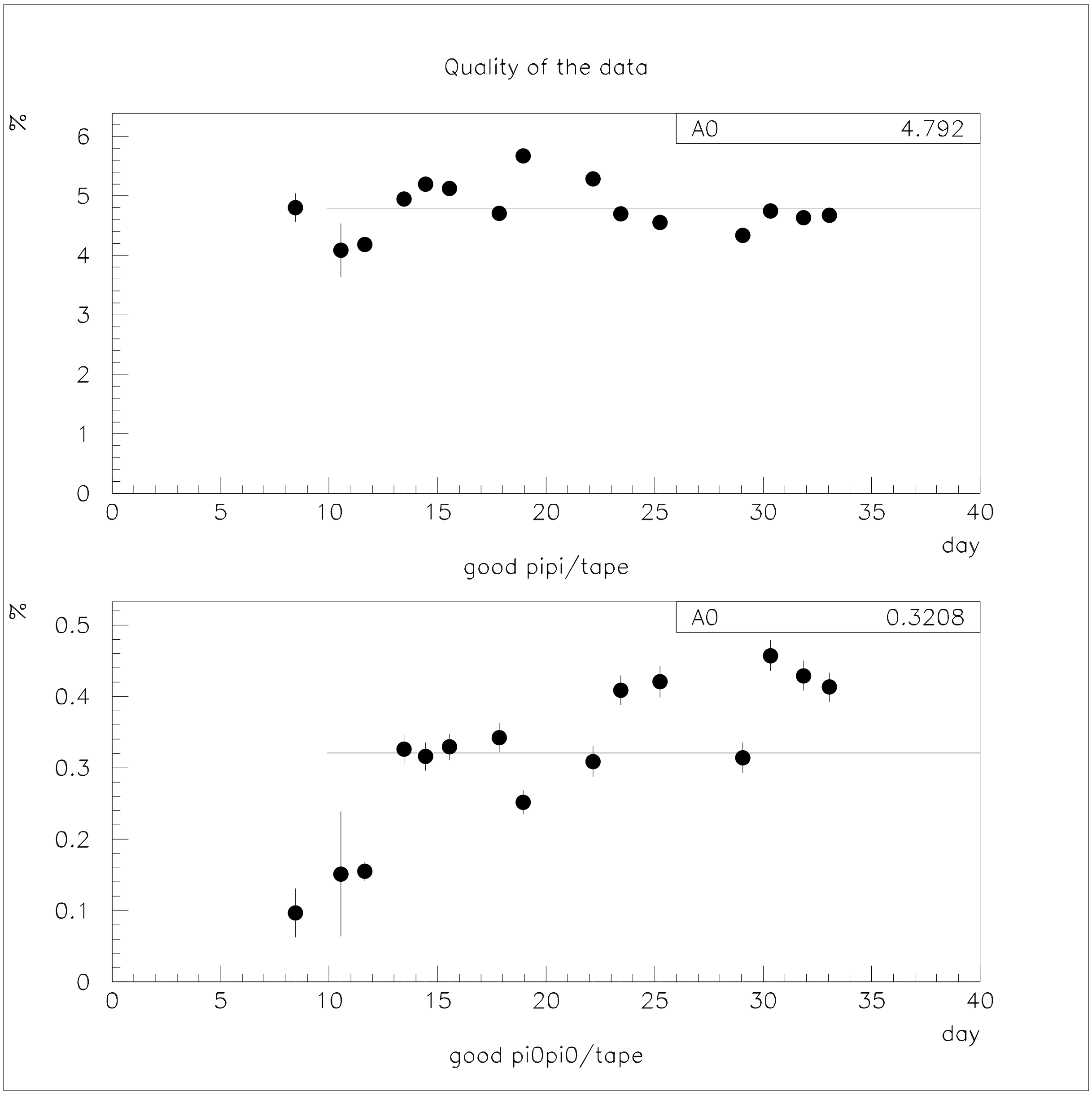
Spill statistics
kHz
A0 536.0
900
800
700
600
500
400
300
200
100
0
10
20
30
40
day
average beam rate/day
spills
22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
10
20
30
40
day
spills/day
x 10 7
5000
4000
3000
2000
1000
0
10
20
30
40
day
number of antiprotons/day
%
A0 39.75
80
70
60
50
40
30
20
10
0
10
20
30
40
day
used pbar


Spill statistics
%
80
70
60
50
40
30
20
10
0
A0 33.76
10
20
30
40
day
pbar lost due to R/O
A0 22.80
day
pbar lost due to Trigger
45
35
25
15
5
Mean 54.81
0
25
50
75
100
min
spill duration for an intensity > 100K
90
Mean 16.71
min
time between two spills

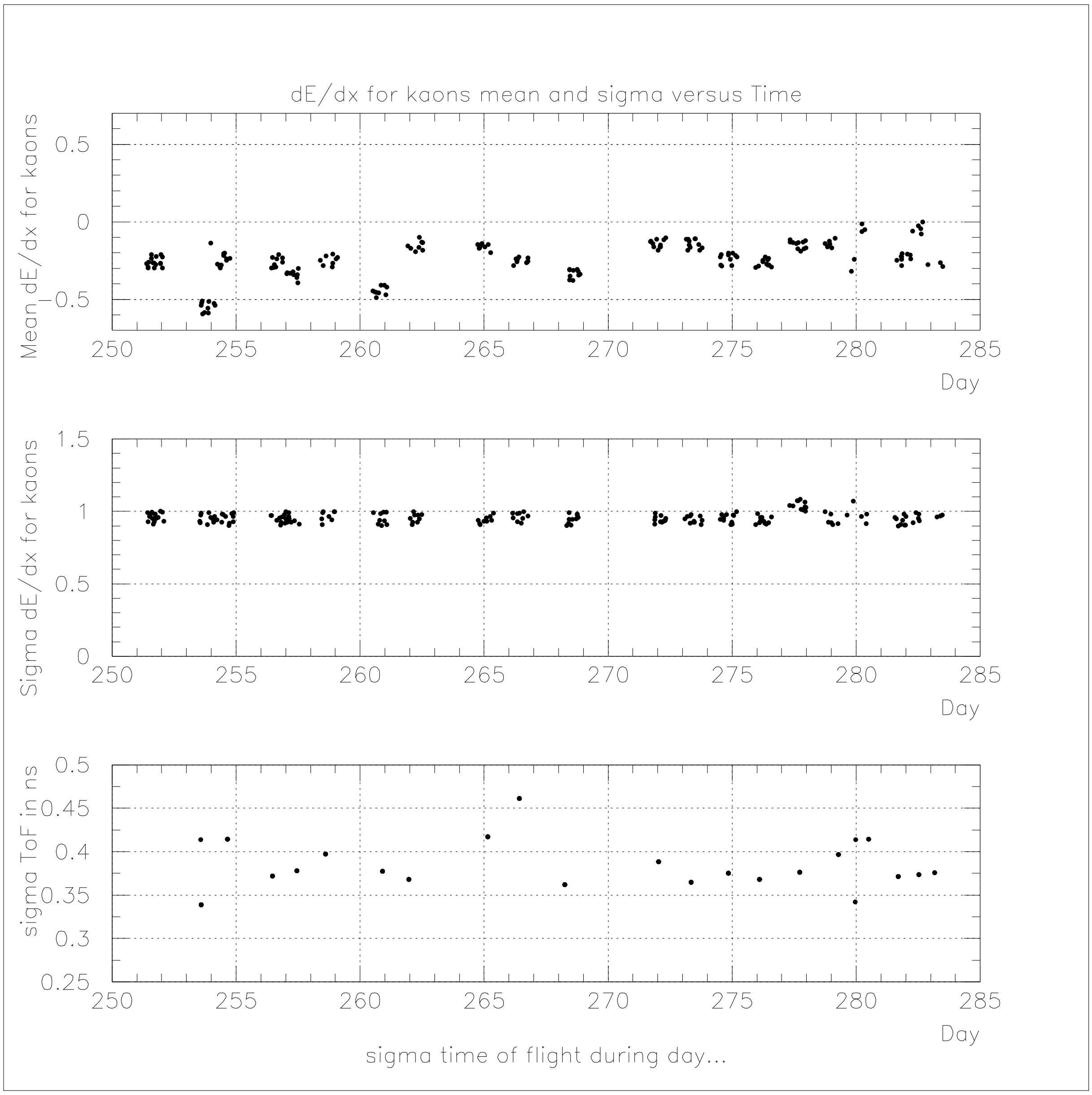

Tape statistics
number of tapes
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
number of shifts
tapes/shift
integrated number of tapes
6000
5000
4000
3000
2000
1000
0
A0
−2133.
A1
90.23
0
10
20
30
40
50
60
70
80
90
100
number of shifts
integrated tapes/shift

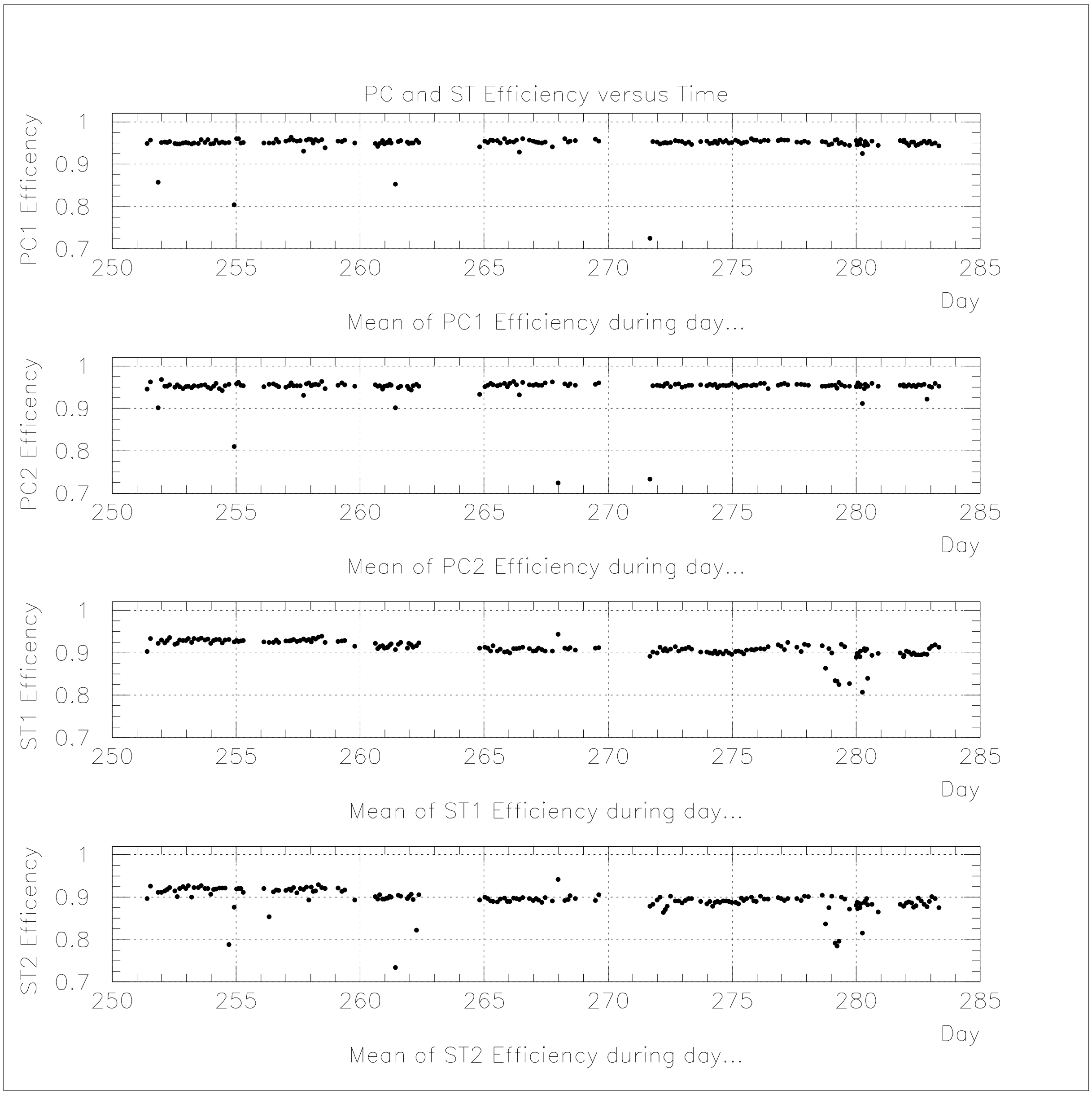


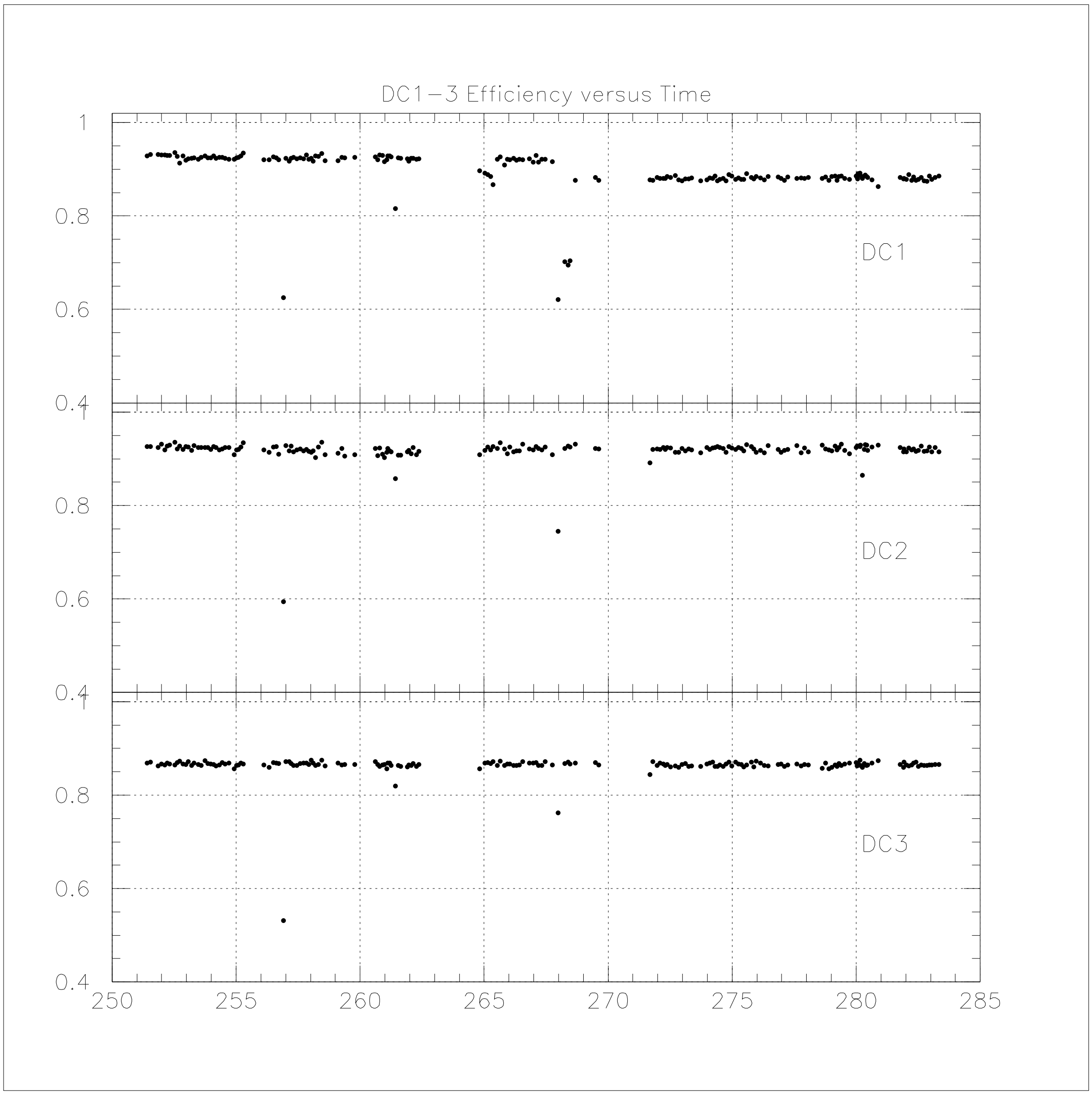
Rates
Hz
500
400
300
200
100
200
400
600
800
1000
1200
kHz
T605...
T607...
T607...
Read out rate as function of beam rate

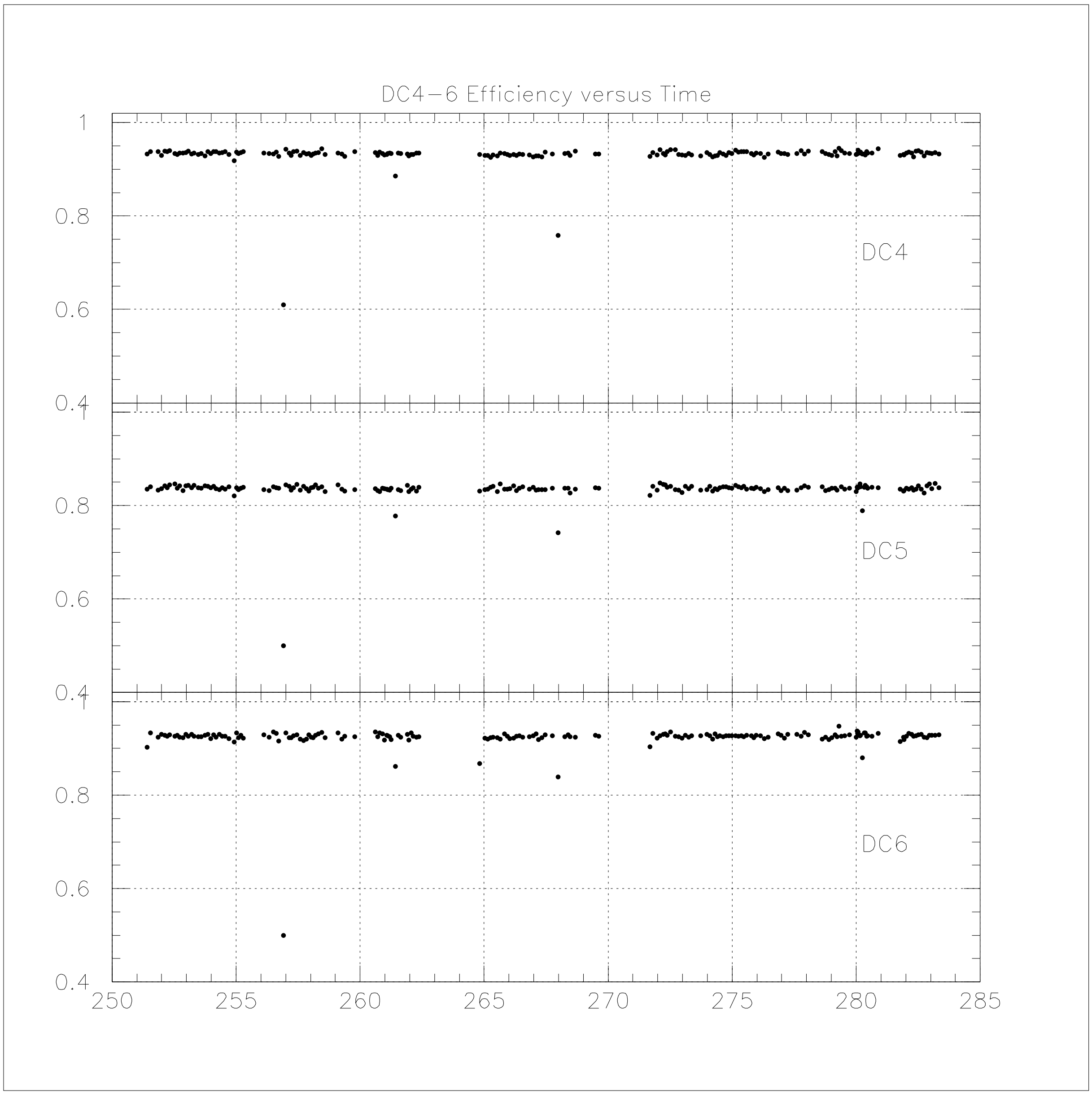


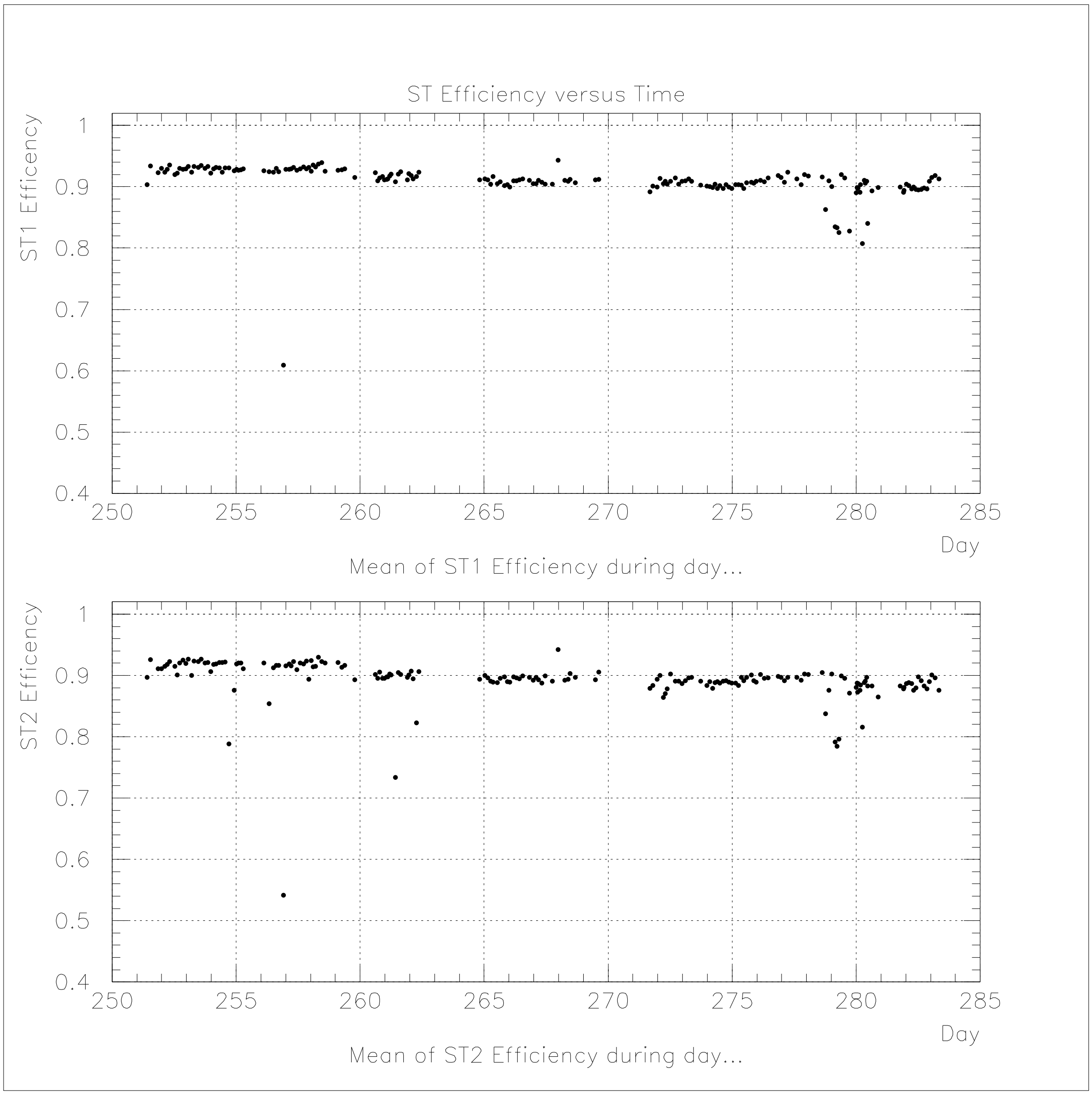
Quality of the data
%
A0 4.792
day
good pipi/tape
%
A0 0.3208
day
good pi0pi0/tape

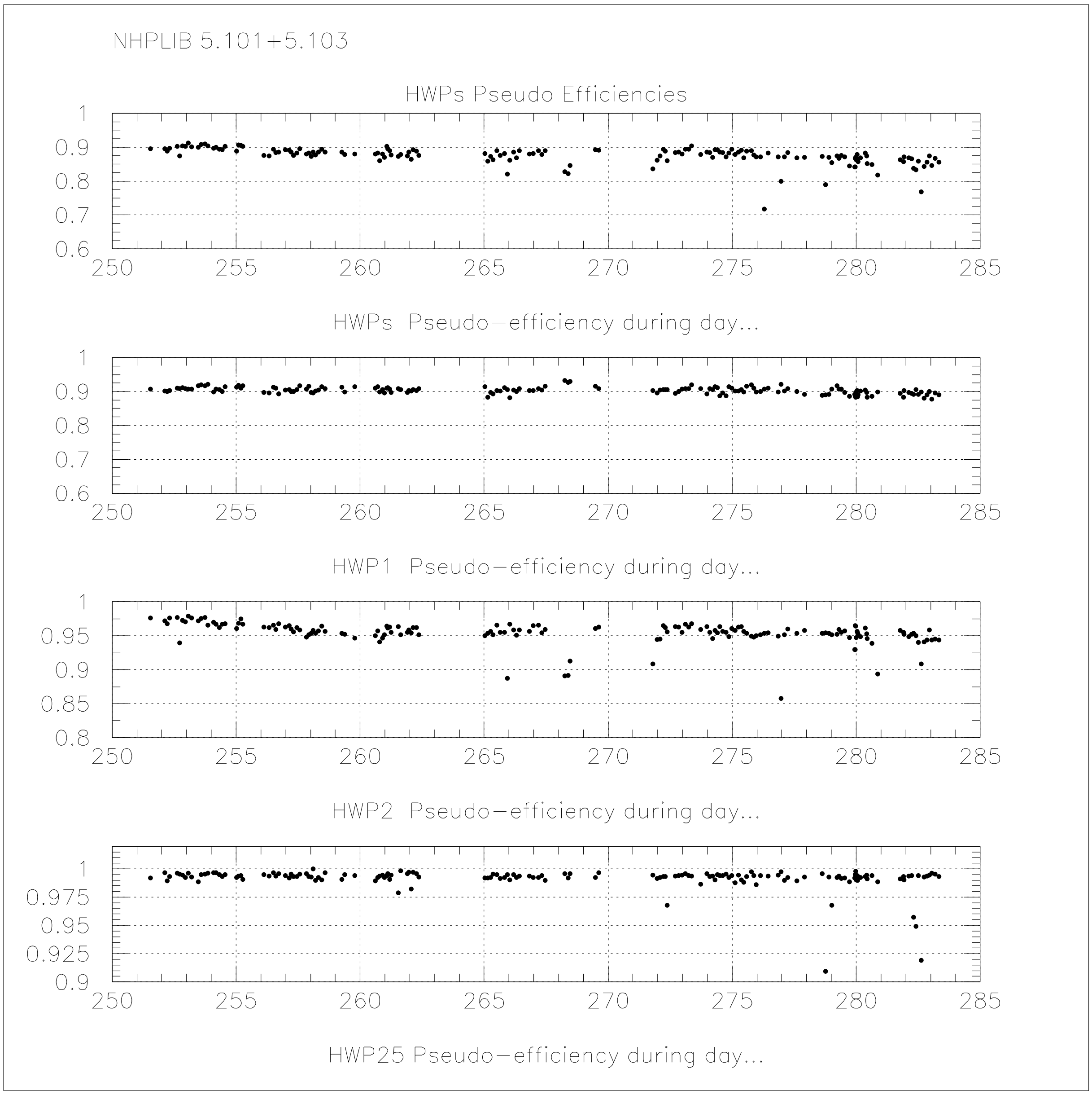

dE/dx for kaons mean and sigma versus Time
Mean dE/dx for kaons
0.5
0
−0.5
250
255
260
265
270
275
280
285
Day
Sigma dE/dx for kaons
1.5
1
0.5
0
250
255
260
265
270
275
280
285
Day
sigma ToF in ns
0.5
0.45
0.4
0.35
0.3
0.25
250
255
260
265
270
275
280
285
Day
sigma time of flight during day...

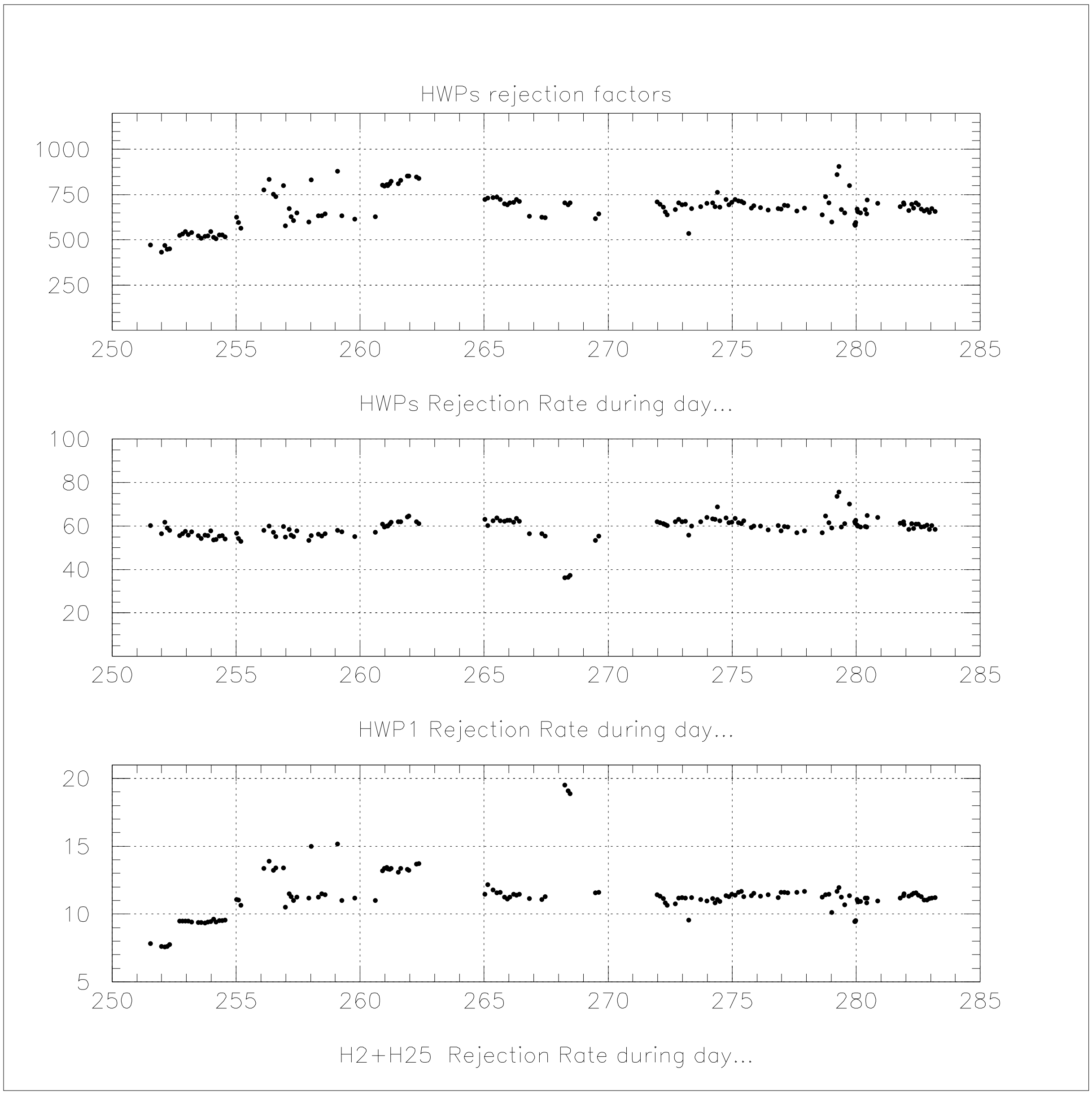

PC and ST Efficiency versus Time
PC1 Efficency
1
0.9
0.8
0.7
250
255
260
265
270
275
280
285
Day
Mean of PC1 Efficiency during day...
PC2 Efficency
Day
Mean of PC2 Efficiency during day...
ST1 Efficency
Day
Mean of ST1 Efficiency during day...
ST2 Efficency
Day
Mean of ST2 Efficiency during day...

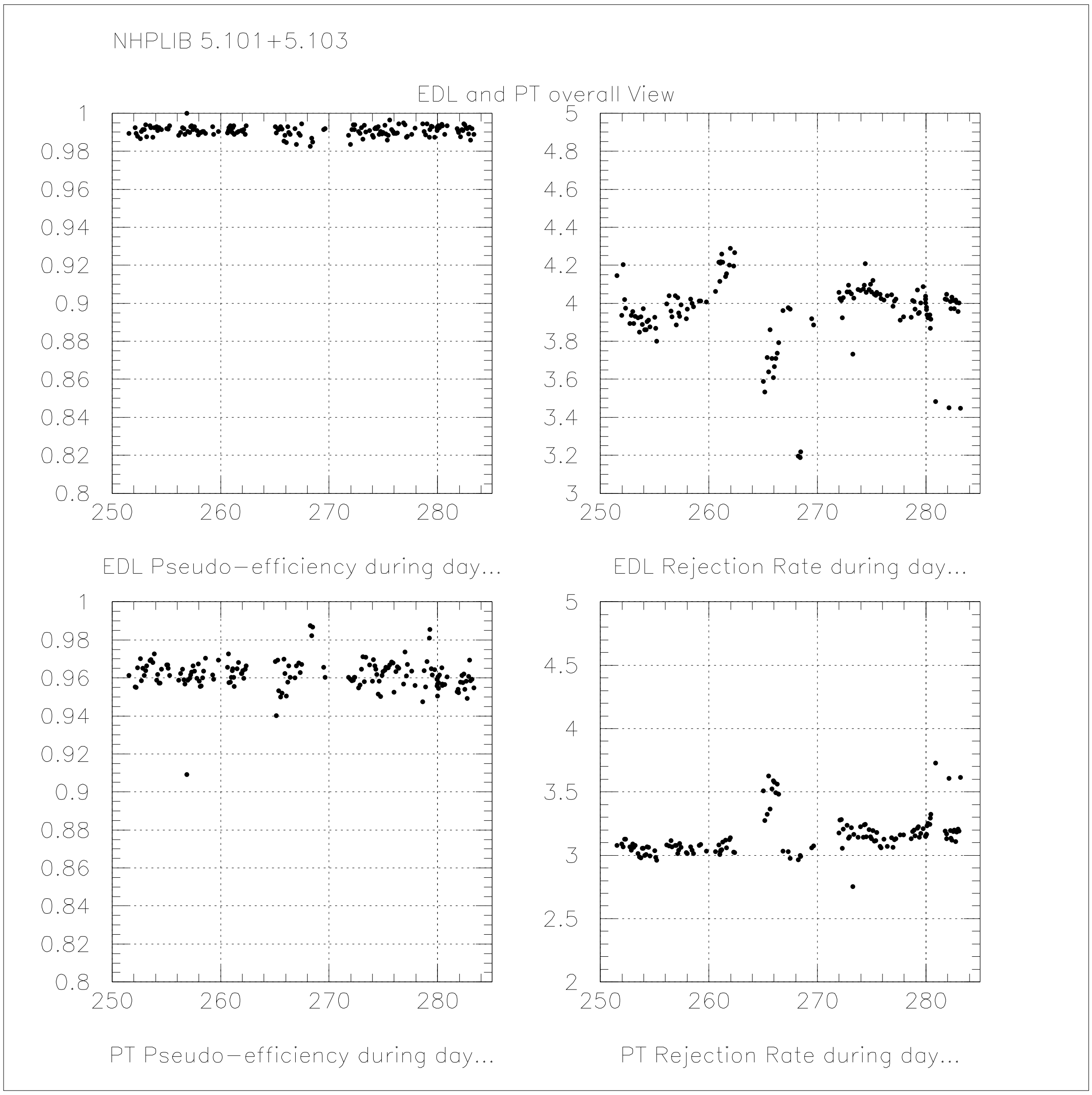

DC1−3 Efficiency versus Time
DC1
DC2
DC3
1
0.8
0.6
0.4
250
255
260
265
270
275
280
285

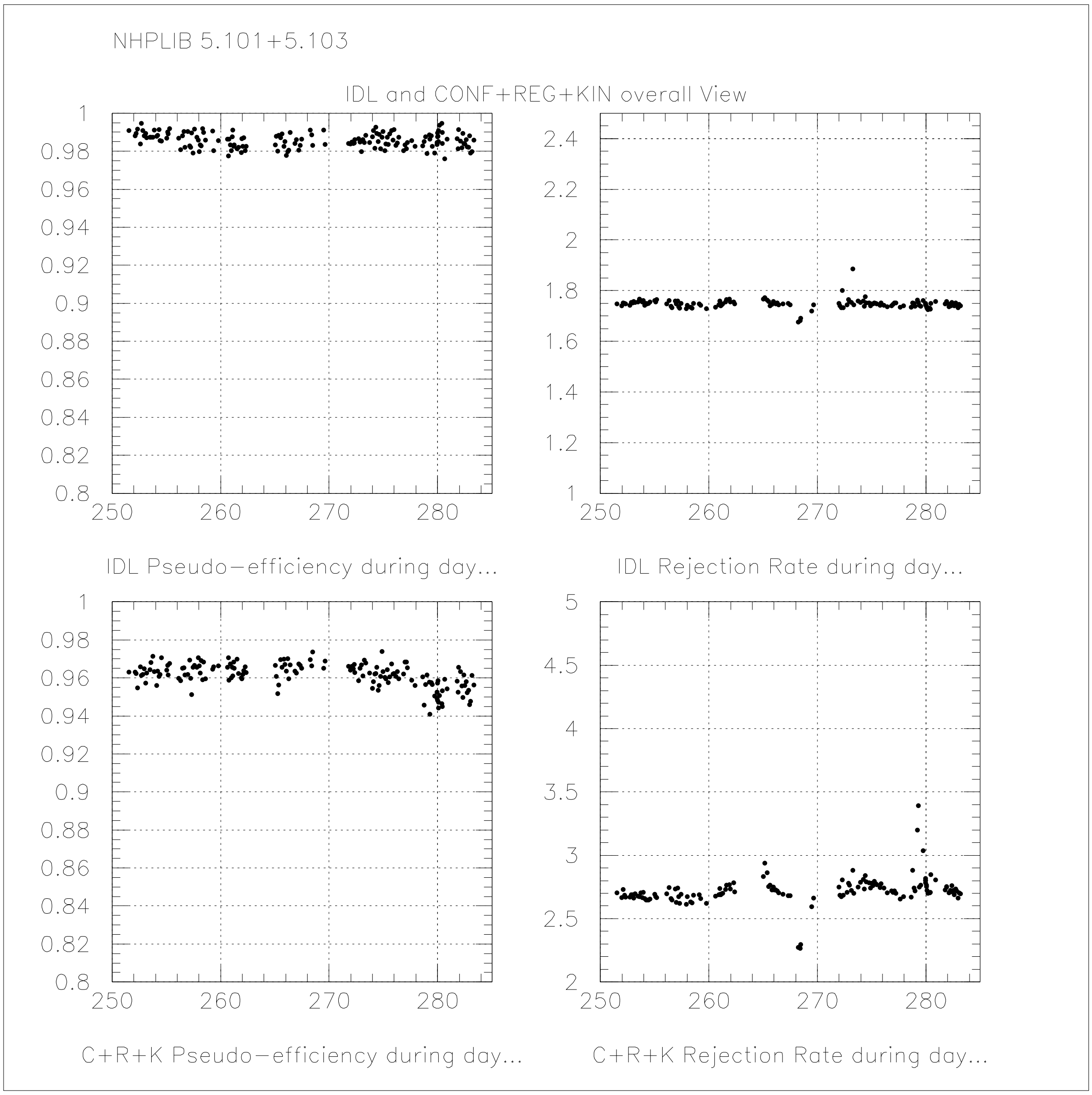

DC4−6 Efficiency versus Time
DC4
DC5
DC6
1
0.8
0.6
0.4
250
255
260
265
270
275
280
285

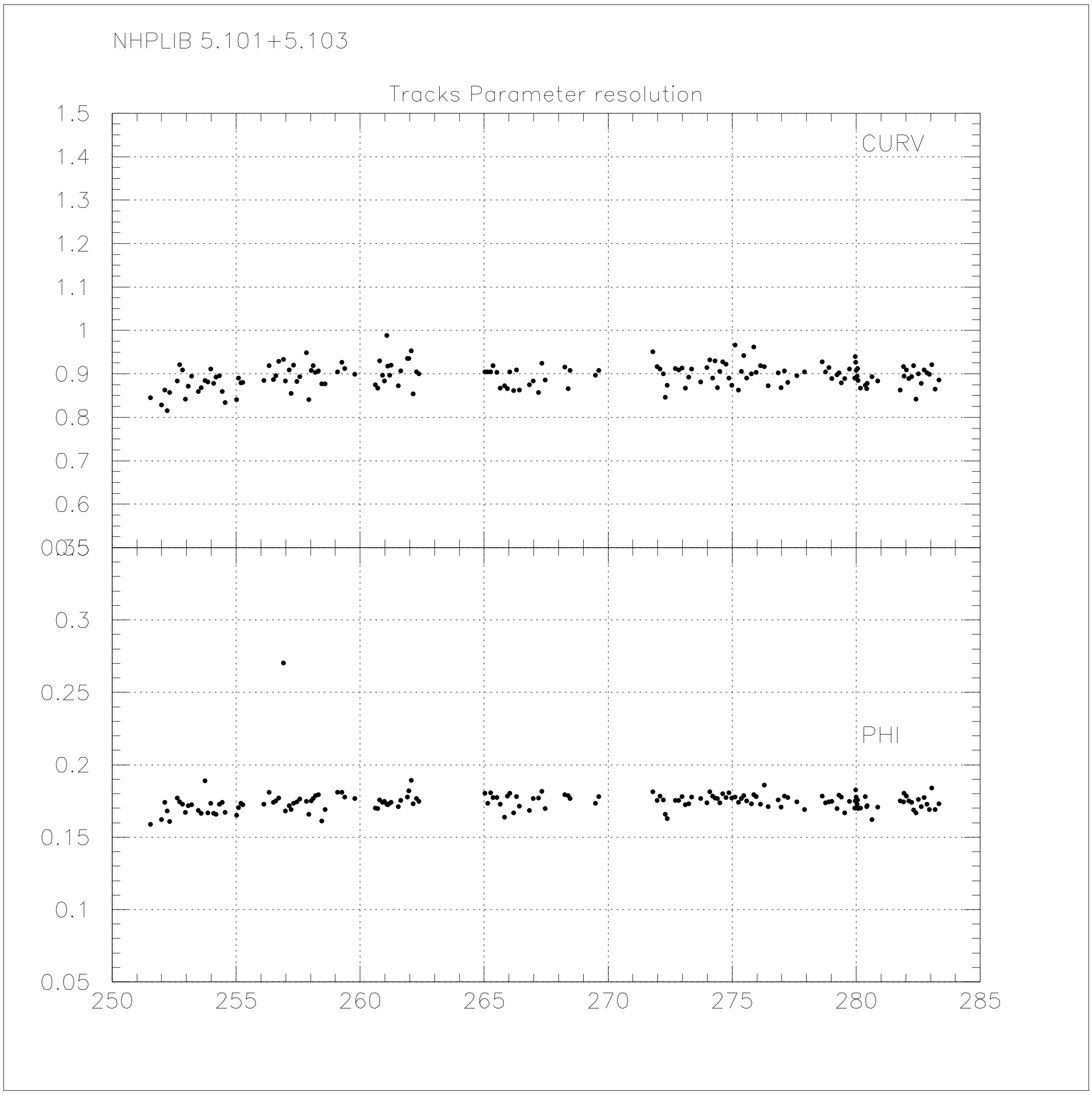

ST Efficiency versus Time
ST1 Efficency
1
0.9
0.8
0.7
0.6
0.5
0.4
250
255
260
265
270
275
280
285
Day
Mean of ST1 Efficiency during day...
ST2 Efficency
1
0.9
0.8
0.7
0.6
0.5
0.4
250
255
260
265
270
275
280
285
Day
Mean of ST2 Efficiency during day...

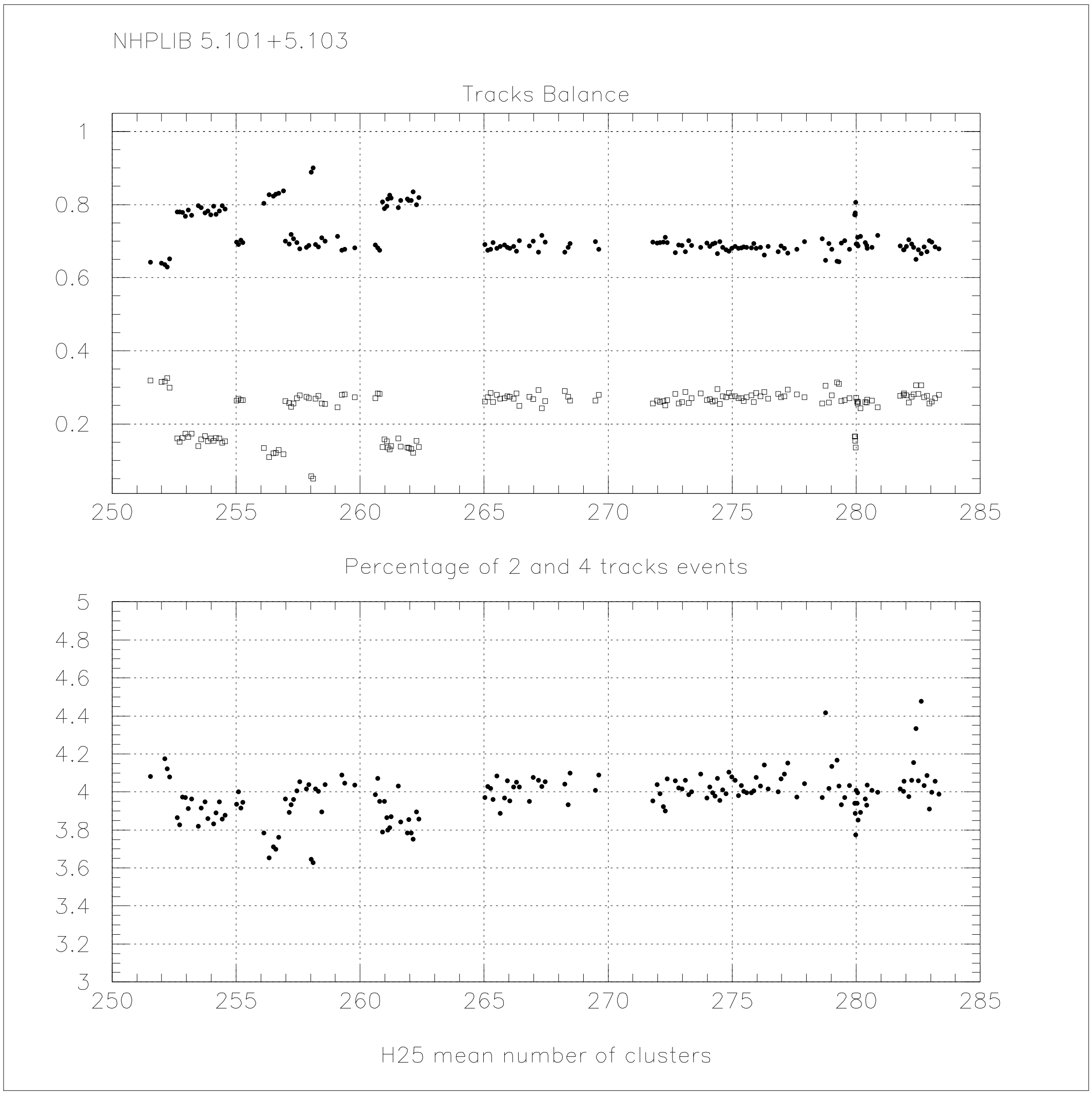

NHPLIB 5.101+5.103
HWPs Pseudo Efficiencies
HWPs Pseudo−efficiency during day...
HWP1 Pseudo−efficiency during day...
HWP2 Pseudo−efficiency during day...
HWP25 Pseudo−efficiency during day...

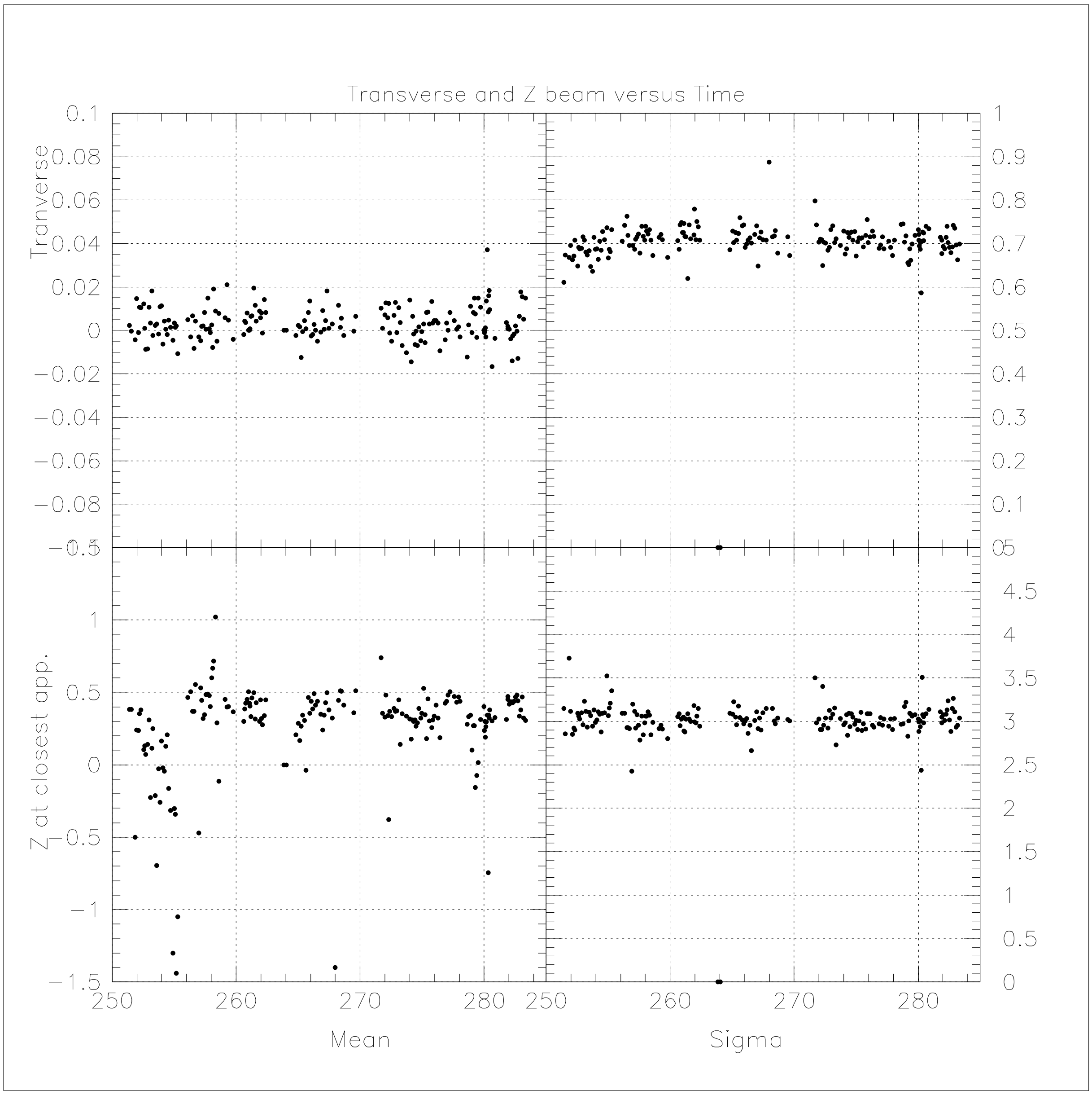

HWPs rejection factors
1000
750
500
250
250 255 260 265 270 275 280 285
HWPs Rejection Rate during day...
100
80
60
40
20
250 255 260 265 270 275 280 285
HWP1 Rejection Rate during day...
20
15
10
5
250 255 260 265 270 275 280 285
H2+H25 Rejection Rate during day...


NHPLIB 5.101+5.103
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+5.103
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+5.103
Tracks Parameter resolution
CURV
PHI
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.35
0.3
0.25
0.2
0.15
0.1
0.05
250
255
260
265
270
275
280
285


NHPLIB 5.101+5.103
Tracks Balance
1
0.8
0.6
0.4
0.2
250
255
260
265
270
275
280
285
Percentage of 2 and 4 tracks events
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
H25 mean number of clusters


Transverse and Z beam versus Time
Tranverse
Z at closest app.
Mean
Sigma
0.1
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1
0.5
0
−0.5
−1
−1.5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
250
260
270
280