Summary of RUN Period 21

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Start:	27/10/1992
End:	20/11/1992
People on shift:	40
Number of Spills:	222
Average beam rate:	615 kHz
$\Sigma\,\overline{p}$	$\approx 7 \cdot 10^{11}$
used $\overline{p}$	32%
Recorded events on tape	$260 \cdot 10^{6}$
Sum of written tapes:	2898
On Exabyte:	$\cong$ 60%
Average number	
of tapes/shift	42
in best days	54
maximum	71

Contents

1 Day by day summary of RUN Period 21

- 27/10/1992 Beam arrived at 21^{oo}. Beam tuning lasted until 3^{oo} in the morning.

- 28/10/1992 First T1 tapes were written. Calibration for streamer tubes and pids started. Problem with trigger, P_T cut was not properly initialised. $VSCP08$ crashed twice. Trigger tests and DC-readout tests were done. PID HV was tuned. Bad curvature calculation by trigger, cured by switching off and on the crate. Low extraction efficiency, problems with supercycle. Data taking with full trigger started at 21^{40}.

- 29/10/1992 New DC readout didn't worked. The DC information doesn't match with the other detectors in 10% of the events on 41 tapes (HK7912 - HK7954). ST and PC trips were recorded. Some HV channels on S1 and S2 were readjusted. P_K/P_π cut was not set correctly. One spill to trap (1h45min).

  High P_T cut introduces bias in the normalisation ratio $\frac{K+}{K-}$ due to some misalignment of the chambers. Tapes with different P_T and P cut were taken. Decision was made to run with P_T cut at 270 MeV/c and a P cut at 350 MeV to have an equal normalisation factor for each field polarity.

- 30/10/1992 Again bad curvature. SUMPF module for curvature was changed. Time lost due to HWP problem and LEAR problem. MSP valet broke and replaced.

- 31/10/1992 New DC readout installed, it works. Average readout time for DC now 550 μsec. LEAR had problems after spill to the trap (2h20min). UXCP02 crashed. One spill to trap (2h20min).

- 1/11/1992 Tapes with bad labels appeared. Test with JD-trigger, to much unwanted events. Very efficient data taking. interspill times of 15 minutes.

- 2/11/1992 UXCP02 crashed (30 min lost), LEAR operator didn't notice end of spill (30 min lost), Problem with CALO, EB and Run Control (1 h20 min lost). A lot of wrong labeled tapes. Break of 16 hours due to change of french powerlines to swiss powerlines. AA was stopped.

- 3/11/1992 Problem with beam (no beam for 2h). We have to share from now on the beam with PS203. Very low intensity. Crashes of UXCP02 and VSCP08. Trigger problems, rate down. Solved by switching of and on some trigger crates (lost 2 h 30 min). It was finally decided to swap hardware for curvature and epsilon calculation. Epsilon is less important. Low rate ($500 - 700$ kHz). A bad ADC motherboard caused some problems to the cherenkov information for HWP2. The rejection rate of HWP2.5 is too high, the HWP2.5 sees less showers than usual. Reason unknown, we switch to four track trigger. Tests with new busy logic. One spill to trap (2h15min).

- 4/11/1992 Problem with beam, big spikes at the end (3MHz). Mean intensity around 700 khz. Some beam time lost due to short shots for PS203. Installation of a new busy logic results in 15% increase of readout rate. Test were made to understand the HWP2.5 problem. PID 22 leaks and has serious bubble, but we have to live with it for the moment. PID monitor system (LED, DAC and Laser) works. One spill to trap and PS203 (2h30min). Exabyte copy procedure started.

- 5/11/1992 Strange streamertube hitmap. Problem with cassettes and tape drive (lost about 5 h). Magnet tripped (again 2 hours lost). Trigger tests with ToF. Processor works with 100% efficiency, but number of good events/time doesn't change. Only less background on tape. Problem with new busy logic and HWP2.5 passive discovered, solved now. Problem with bad cassettes. No news about HWP2.5, continuing with 4 track trigger. Rest of spill to PS203 (30min?) and fast extraction (1h15min).

- 6/11/1992 Problem with the PS (2 h lost). Streamer tube problem cured (to 95%). HWP2.5 works again, problem solved by switching on and off the CALO CPM-crate?

- 7/11/1992 Smooth data taking, but beam intensity very low (600 kHz).

- 8/11/1992 Still low beam intensity (650 kHz), but 69 tapes written in one shift.

- 9/11/1992 After solving a problem with the $\overline{p}$-transfer to PS203 our beamrate is back to 1 MHz. Two spills to the trap (2h45min).

- 10/11/1992 Again low beam intensity and beam instabilities during the night. HWP2.5 problem appeared again and solved by restarting CAL CPM-crate. Streamer tubes are running now with DMA. Twenty tapes with wrong label found.

- 11/11/1992 The CAL-CPM power supply was changed. It was designed for only 220A but because of the second CHI, which was installed for this run, we were using 250A. It seems clear that this caused also the HWP2.5 problem. Problem with the streamer tube gas and readout (6 hours lost).

- 12/11/1992 Again a bit low beam intensity (750 kHz). Problem in PS (lost 2 hours). No beam for 9 hours due to a problem in the AA. When beam was back not seen by our experiment. Reason: HV power supply for beam counter and beam monitor was screwed up, took 45min to discover. One hour lost with problems in the busy logic (one cable was inverted) and the ST readout. One spill to trap (1h15min).

- 13/11/1992 Tests with JD-trigger and ToF. After first analysis (looking at trigger performance and offline quality) the decision was made to run for the rest of the period with $T507163323$ (JD-trigger + ToF). Problems with EB-valet (one hour lost) and ST readout (30min). Problems with CAL-noise on the strips. One spill to trap (2h15min).
- 14/11/1992 Problems with tape drive (1 hour). Crash of UXCP02.
- 15/11/1992 Some trips of the PC's. Three hours lost during the night with run control problems. Again CAL-noise on strips in sector 1. Problem with ST-readout hangups. Test with new EB and tape software (lost 2h of beam). Magnet tripped (lost 3h of beam). One spill to trap (3h15min) together with PS problem.
- 16/11/1992 Tape drive problem (2h lost). Gas alarm, DC gas supply was stopped. Took 4 hours to come back. Trips of streamer tube and PC. New beam alignment (2 hours). One spill to trap (1h).
- 17/11/1992 Problem with EB/DDS (lost 1 h20 min). Trigger test for events with more than 4 tracks. Bad spill structure, lot of small wiggles. Might be the reason for various ST and PC trips. The decision was made to reduce the beam intensity to 800 kHz. Long interspill time (30min) due to supercycle in the PS. Some time lost due to tests in the PS. One spill to trap (1h15min).
- 18/11/1992 Crash of VSCP04 and then problems with CAL and CHI (1h30min lost). Still ST trips and ST readout hang ups. PS and LEAR problem, together 1h30min. Again long interspill time. Two spills to trap (3h) together with PS problem.
- 19/11/1992 PC and ST trips. Beam stopped at 8^{oo}. Switched to cosmic run. New cosmic trigger (the OR between several S1) works. Low voltage of calorimeter was switched off.
- 20/11/1992 Not enough FC72 for the Cherenkov's with falling temperature. First eight layers of CAl LV switched on again. Run ended at 18^{30}. All HV channels are turned off.

2 Achievements in P21

- PID stability. Monitoring and calibration worked well.
- CAL readout time with 2 CHI's now 590 μs.
- After showing the importance of using double buffering for CAL and DC a second busy logic was installed to use double buffering for all other equipments. The effective average readout time is now 780μs (see fig.1). This number includes 100μs for the eventbuilder which in principle can be hidden in the second busy time of the detectors. One of the slowest readouts is now the one of the HWP2.5 (640μs).

- Installation of a new trigger in order to enhance long lifetime events. ToF works.

- A new target alignment system will allow in future much faster positioning of the target.

- Start of online copying the raw tapes to exabyte. Can be used for production at PSI, Saclay, CERN,... Will allow to use cartridges again next year.

3 Problems in P21

It is very hard to estimate the beam time loss due to the various problems. There is first the time loss until the problem is discovered (most of the time this results in inefficient data taking) and second the time used to fix the problem. In addition the time specifications in the runbook are not very precise. The above estimated time losses should be understood as a very rough estimated to give some feeling about the severity of the problem.

In arbitrary order:

- No cosmic run before beam came due to DAQ software development (EB, Tape and Runcontrol). One should start earlier next time in order to have a serious test of all components (detectors, readouts, DAQ, Trigger) without beam.

- Beeps were not very reliable. One should also leave the private phonenumber of the expert.

- Trigger performance: P_T cut, P_K/P_π cut, wrong curvature (7h). Most problems during startup phase.

- HWP2.5 low shower multiplicity. Reason was most likely a weak power supply in one of the CAL-CPM crates. No two track events in about 300 tapes.

- CALO noise on u- and v-strips resulted in 20% less events on about 20 tapes.

- ST readout hang ups after change to new busy logic and DMA transfer (7h).

- ST wrong gas mixture (6h).

- DC gas alarm (4h).

- Two trips of the magnet (5h).

- No AA (15h).

- LEAR and PS problems (7h).

- Low beam intensity when running parallel with PS203. Very hard to estimate beam time loss ($10-20\%$).

- sometimes long interspill time, especially when PS runs with supercycle. Precise measurement of interspill time missing.

- tapes with wrong lable (3h). Problem cured after installation of checktape exec.
- human factor: to find the correct action if problem with the run control appears (EB flag not seen, one detector or EB/DDS are blocking some action,...) (9h).
  Solution:
  - a) Improve run control to be 100% monkey proved.
    Not very promising, already very reliable.
  - b) More training for people on shift. Studying of errors of previous shifts.

4 Future improvements

- New tape software: We will gain $\approx 20\%$ more events/time, 10% which we don't dump anymore to nowhere and 10% by shortening the time to change two tapes.
- Real upgrade of detector readout's (change of cathlib and detector ISR).
- Trigger efficiency $> 80\%$?
- Reduction of the bubbles in the pids (specially for PID 22).

5 Conclusions

- We have reached the status of efficient data taking. Nevertheless further improvements are necessary.
- If we learn from our mistakes then an average of 160 tapes/day over the whole period for next year seems realistic.

6 Short tape summary

Trigger	no magnet	positve field	negative field
1	8	57	59
3	0	8	17
23	0	0	2
33	0	0	2
201	0	0	1
163323	0	0	1
5163323	0	0	1
5172223	0	2	3
5172233	0	0	1
5192223	0	151	129
7192223	0	1	0
505172223	0	0	2
600163323	0	4	0
605163323	0	17	3
605172223	0	801	777
605172233	0	30	59
607163323	0	398	344
607172223	0	1	18

7 Some histograms

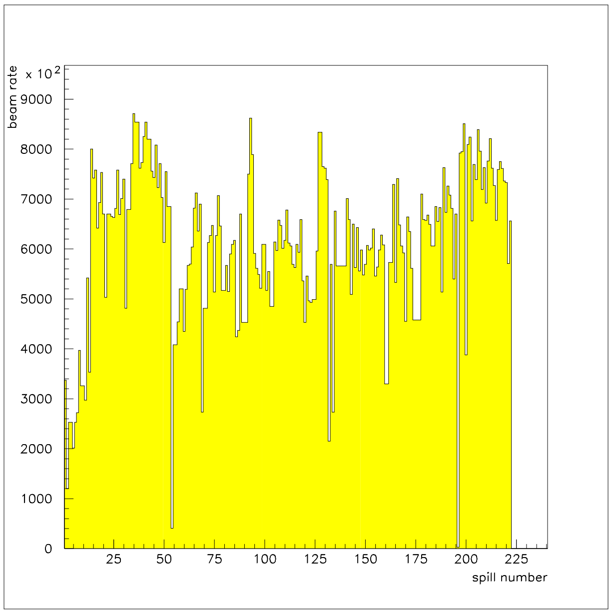


Figure 1. Average beam rate

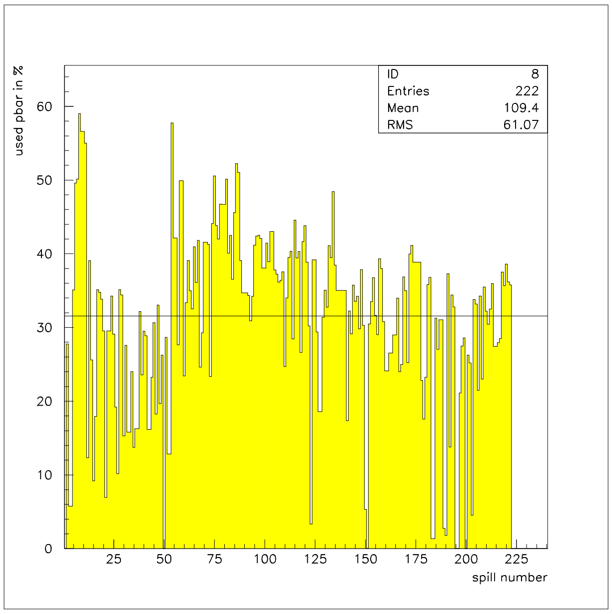


Figure 2. Used antiprotons

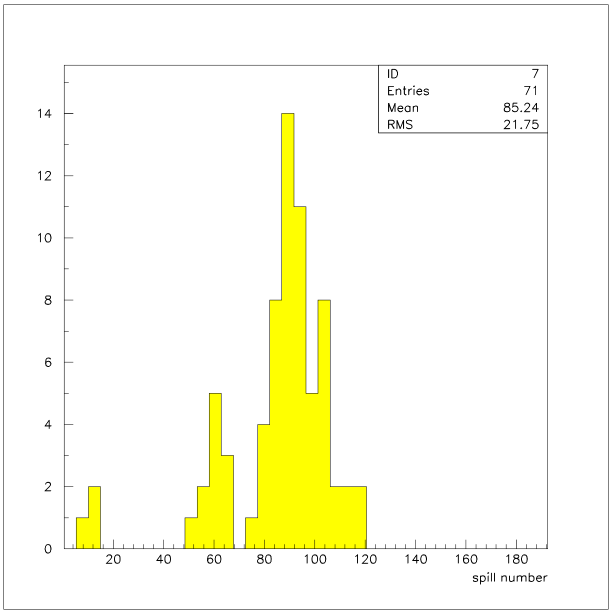


Figure 3. Spill duration

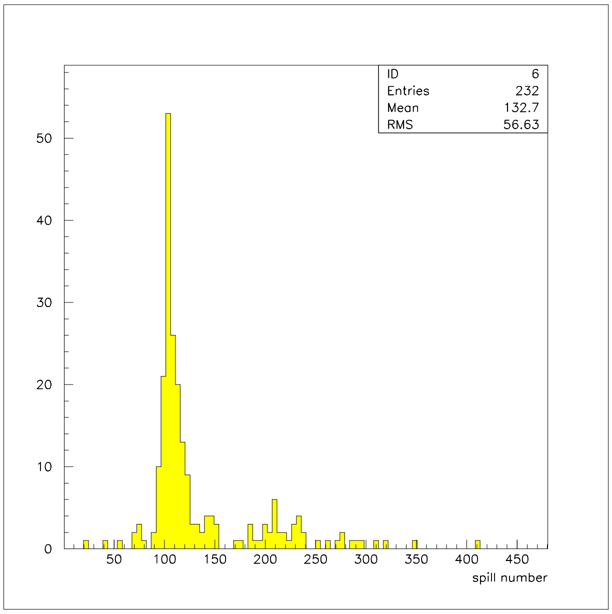


Figure 4. Time between two end_of_spill procedures

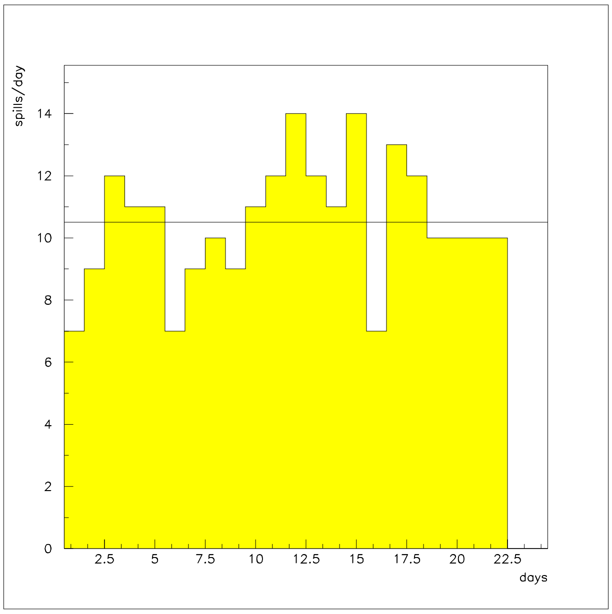


Figure 5. Number of spills/day

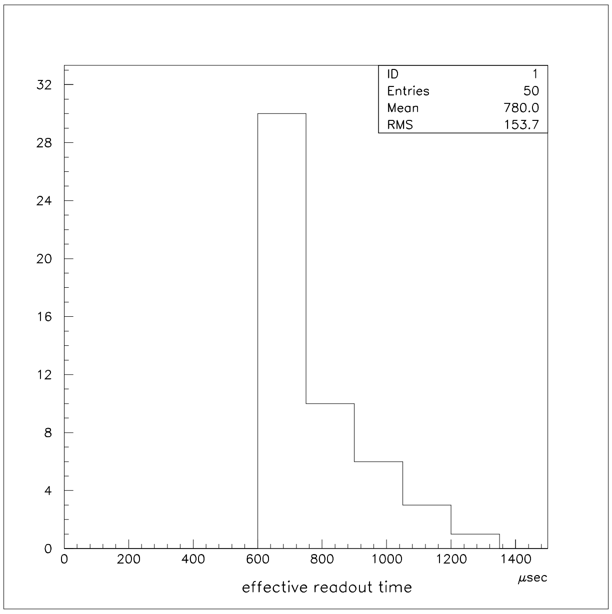


Figure 6. Effective global read out time

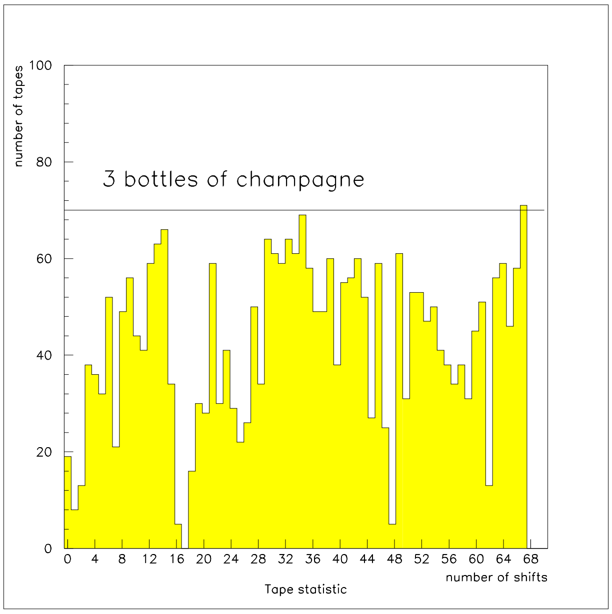


Figure 7.

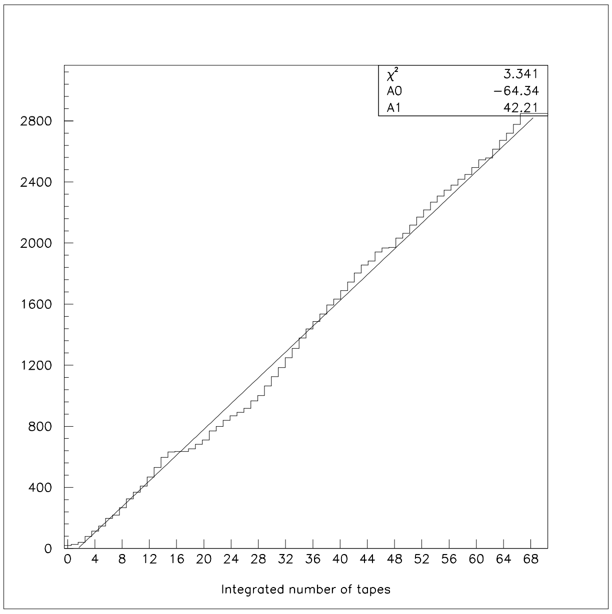
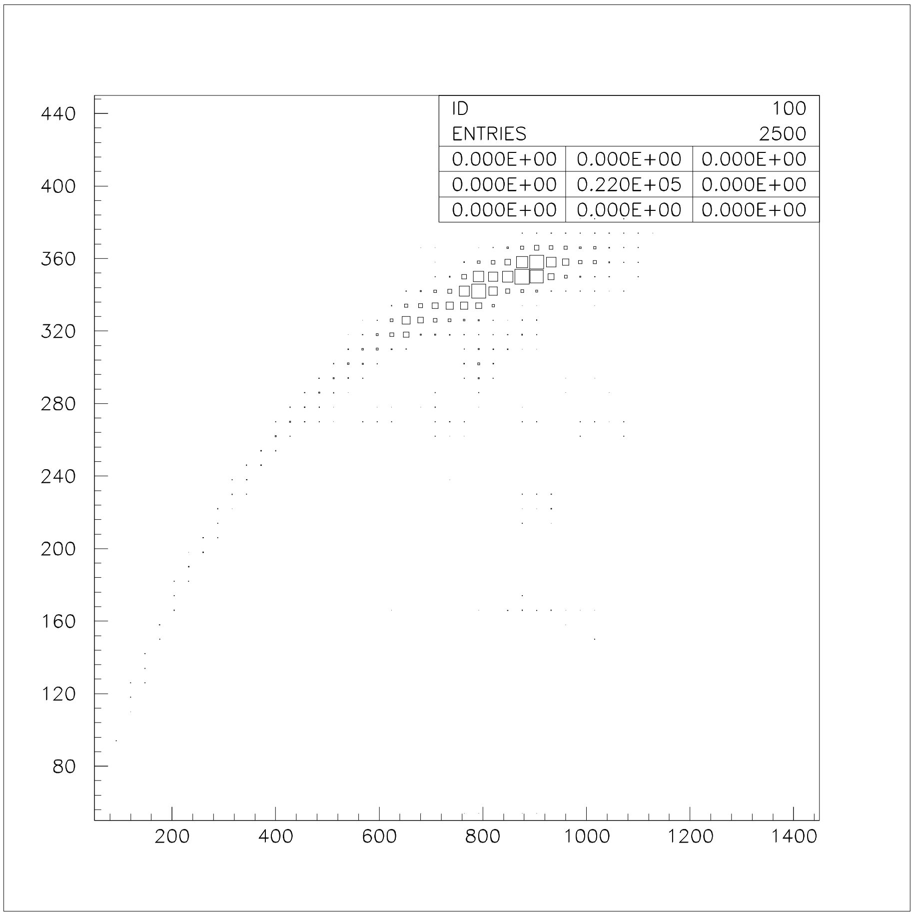


Figure 8.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0.000E+00 0.000E+00 0.000E+00
440
400
360
320
280
240
200
160
120
80
200
400
600
800
1000
1200
1400

Figure 9.