BEAST (Belle Exorcism for A STable experiment)

Status of IP background measurements

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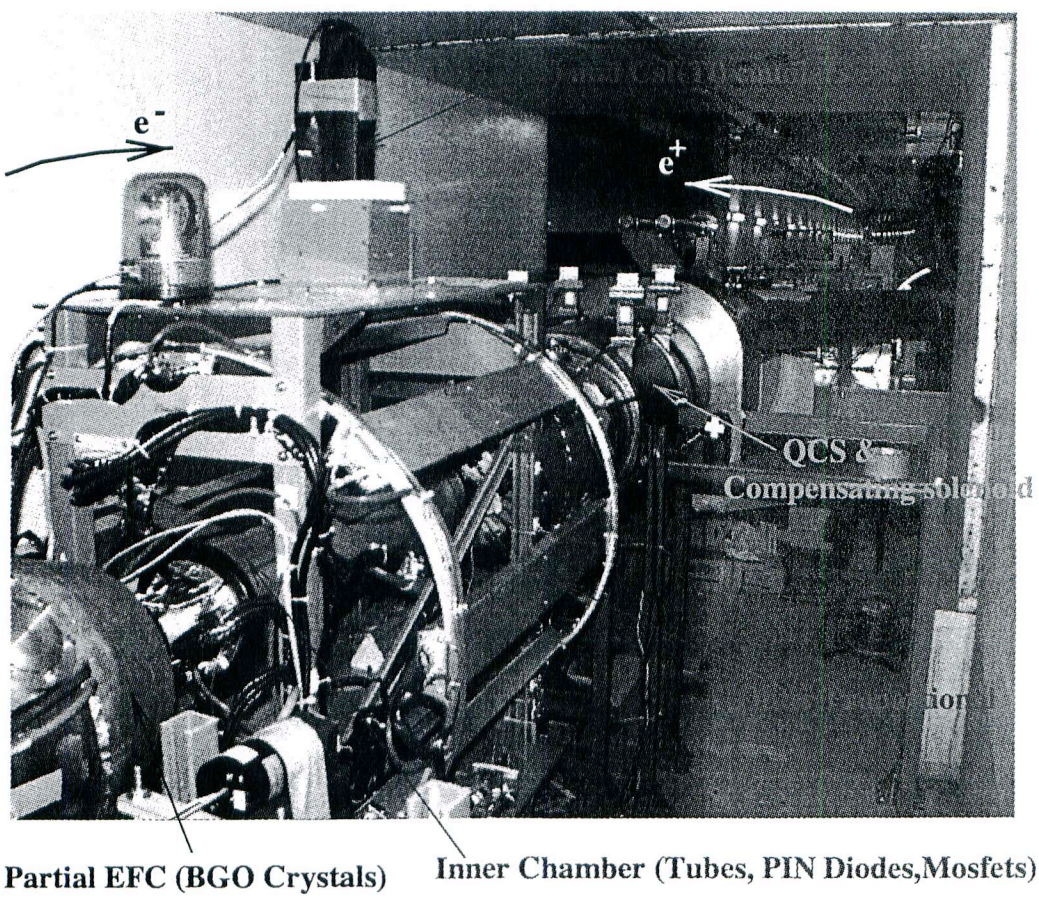
1 Introduction

BEAST detector installed on the beamline of KEK-B

www.phys.hawaii.edu/~beast

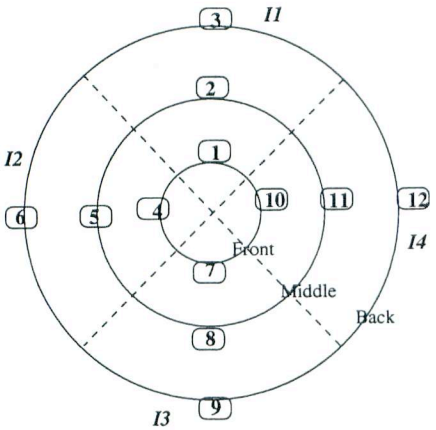
Goal : Measure the background rate
Compare with Simulation
Reduce dose rate by tuning KEK-B parameters

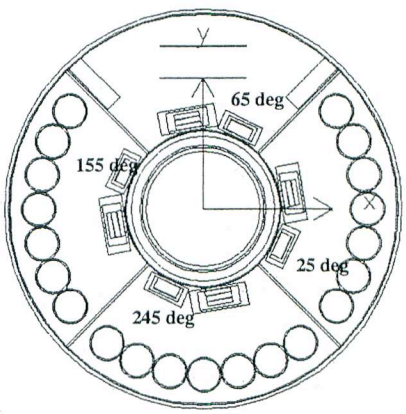


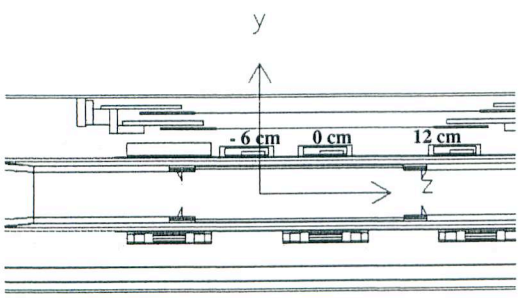
2 The BEAST

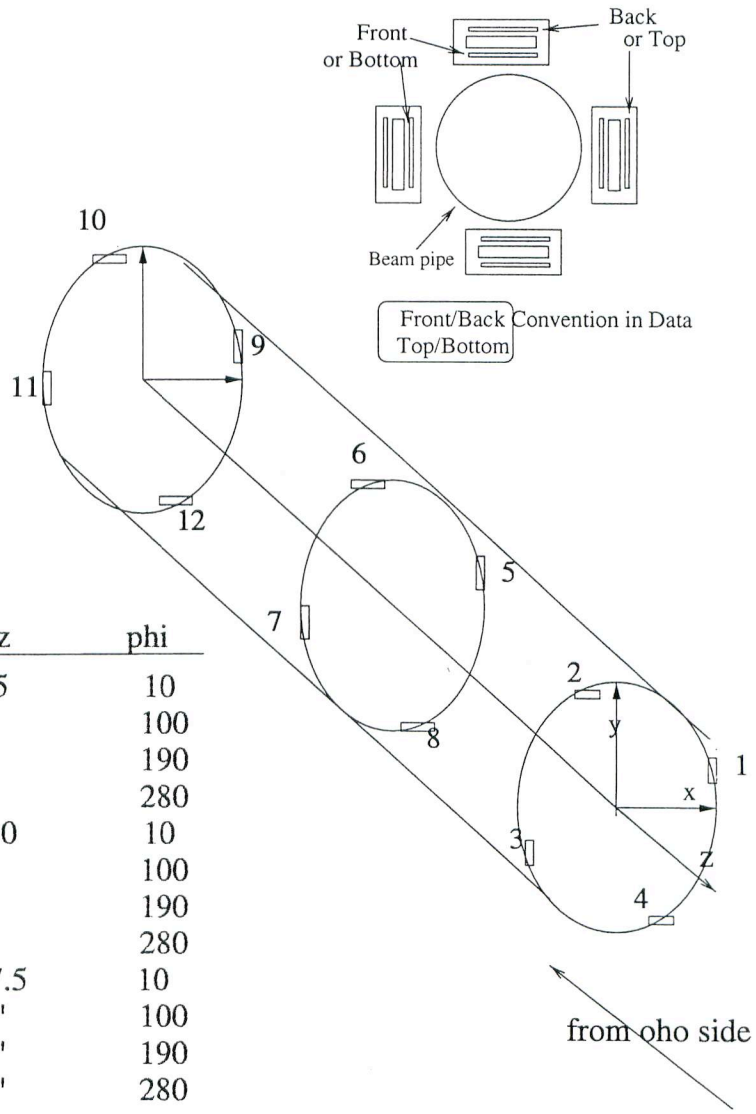
- **Sandwich Diodes (Instantaneous Dose)**
- **Proportional tubes (Instataneous Dose / Phi distribution)**
- **MOSFETS (Integrated Dose)**
- **CsI crystals (Energy spectrum)**
- **Partial EFC (Luminosity)**
- **RTDs (Temperature measurement)**
- *NEW!!* **SVD ladder (SVD occupancy)**

VIEW from Oho Side





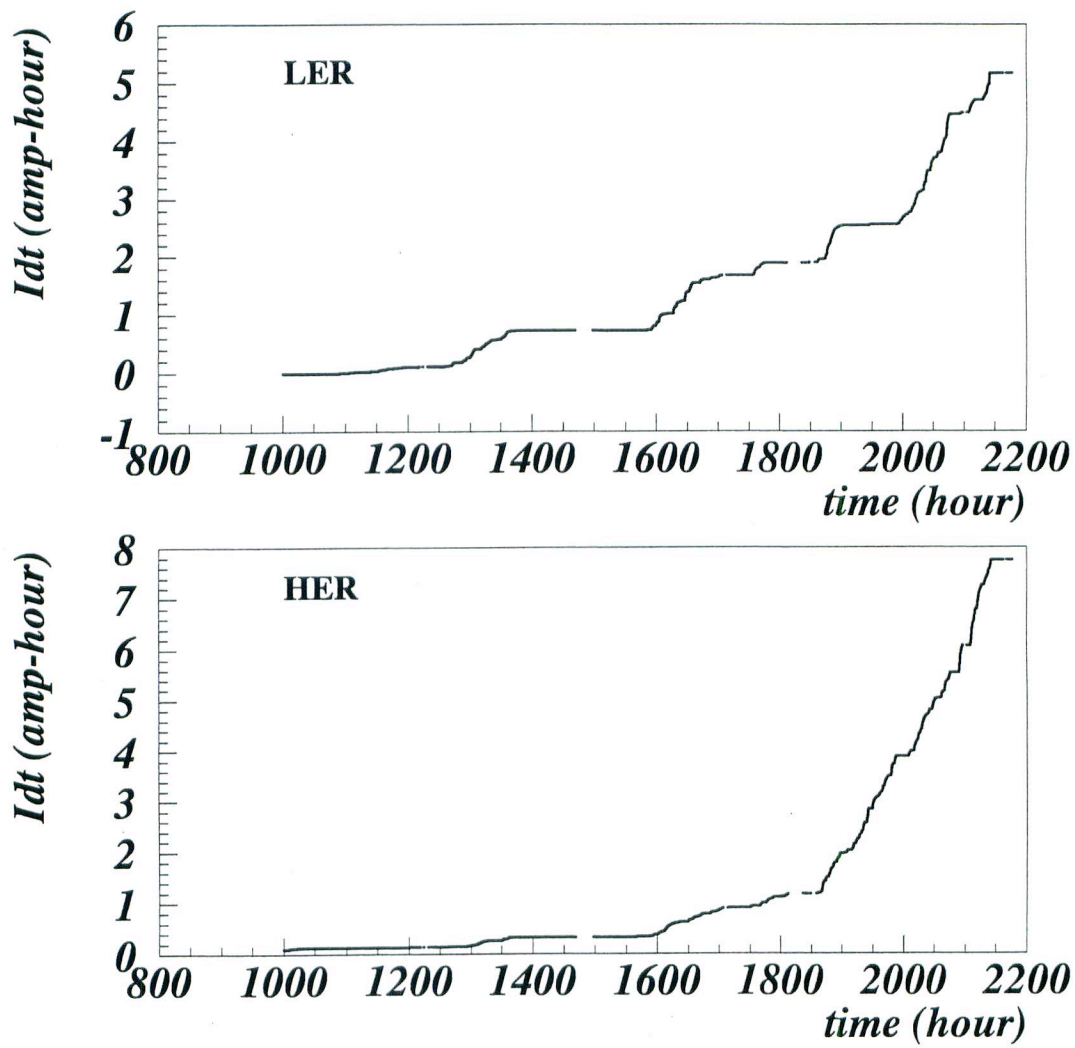


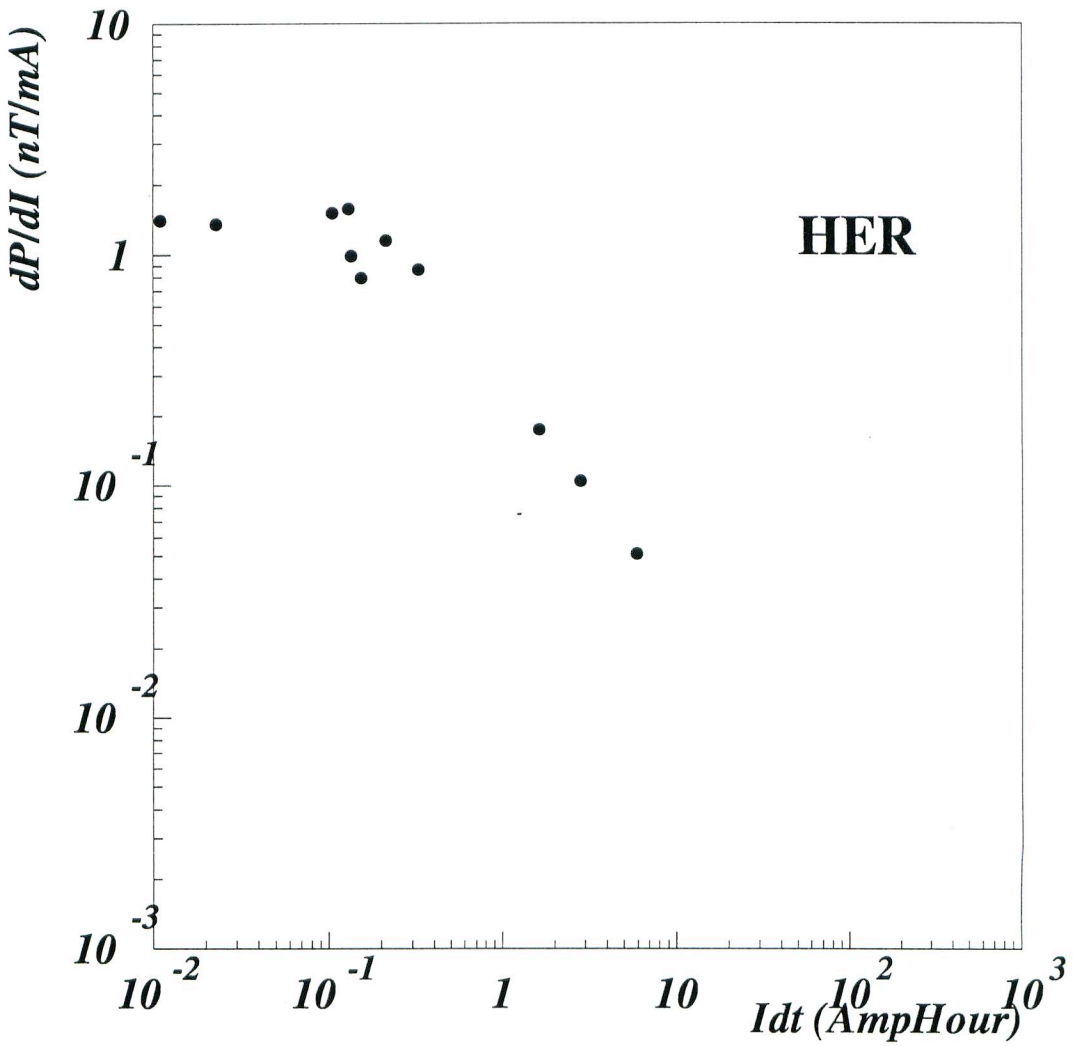


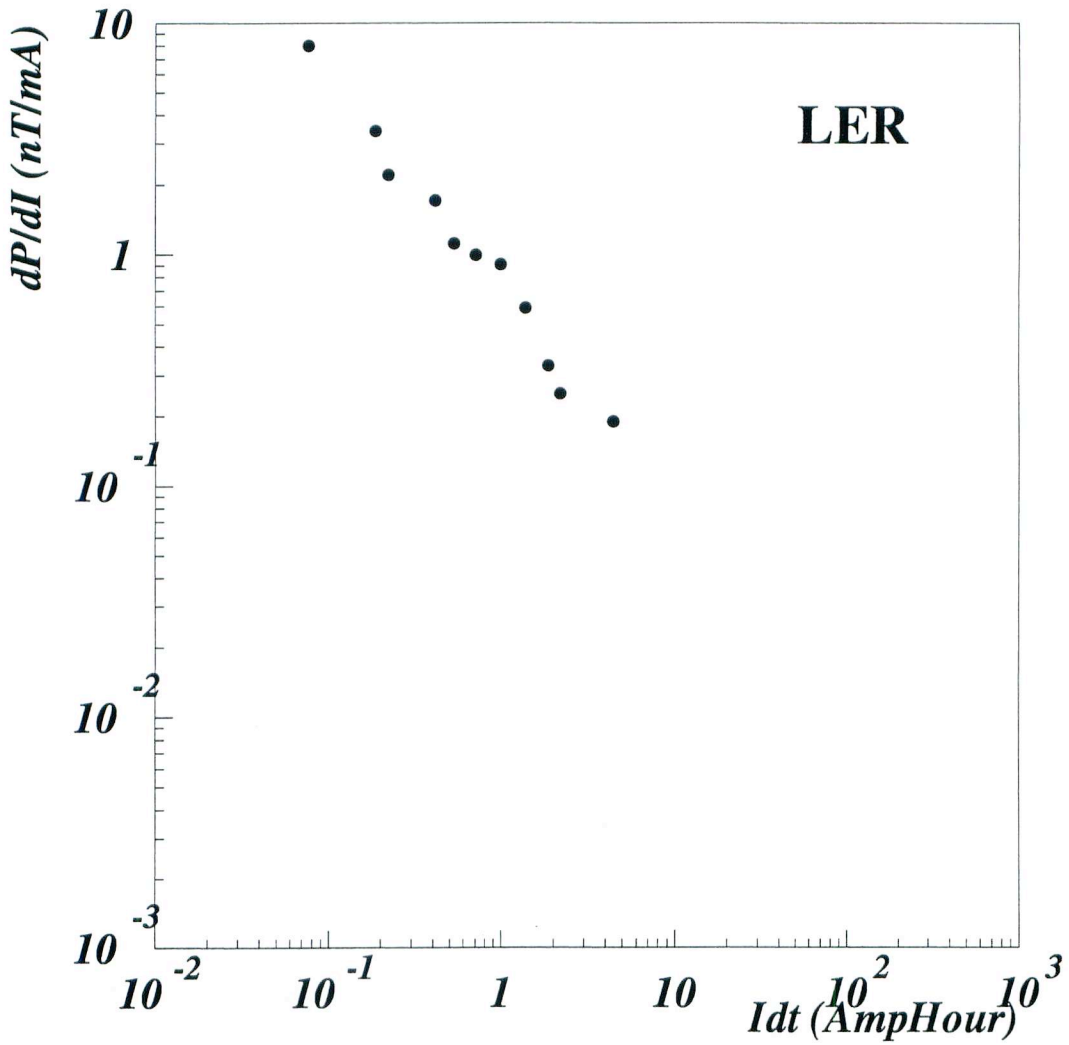
Diode #	Module	z	phi
1 & 2	1	17.5	10
3 & 4	2	"	100
5 & 6	3	"	190
7 & 8	4	"	280
9 & 10	5	5.0	10
11 & 12	6	"	100
13 & 14	7	"	190
15 & 16	8	"	280
17 & 18	9	-7.5	10
19 & 20	10	"	100
21 & 22	11	"	190
23 & 24	12	"	280

↑ ODD = TOP/BACK ; EVEN = BOTTOM/FRONT diode

3 Amp hours


LER
Idt (amp-hour)
6
5
4
3
2
1
0
-1
800
1000
1200
1400
1600
1800
2000
2200
time (hour)
HER
Idt (amp-hour)
8
7
6
5
4
3
2
1
0
800
1000
1200
1400
1600
1800
2000
2200
time (hour)


dP/dI (nT/mA)
10
1
10 -1
10 -2
10 -3
HER
10 -2
10 -1
1
10
10 2
10 3
Idt (AmpHour)


LER
dP/dI (nT/mA)
10
1
10 -1
10 -2
10 -3
10 -2
10 -1
1
10
10 2
10 3
Idt (AmpHour)

4 Backgrounds (What we have learnt)

4.1 Injection

Integrated dose to date is about 65kRad.
→ *This is dominated by injection*
LER injection is much worse that HER injection.
LER injection improved from Feb 5 (O(300 rad)) to Feb 20th (O(30 rad)). BUT, from Feb 26th injection became much worse.
No clear dependence of IP background on beam current of IP pressure

4.2 Storage

HER:
0.01mRad/(sec.mA.nTorr)

LER:
0.04mRad/(sec.mA.nTorr)

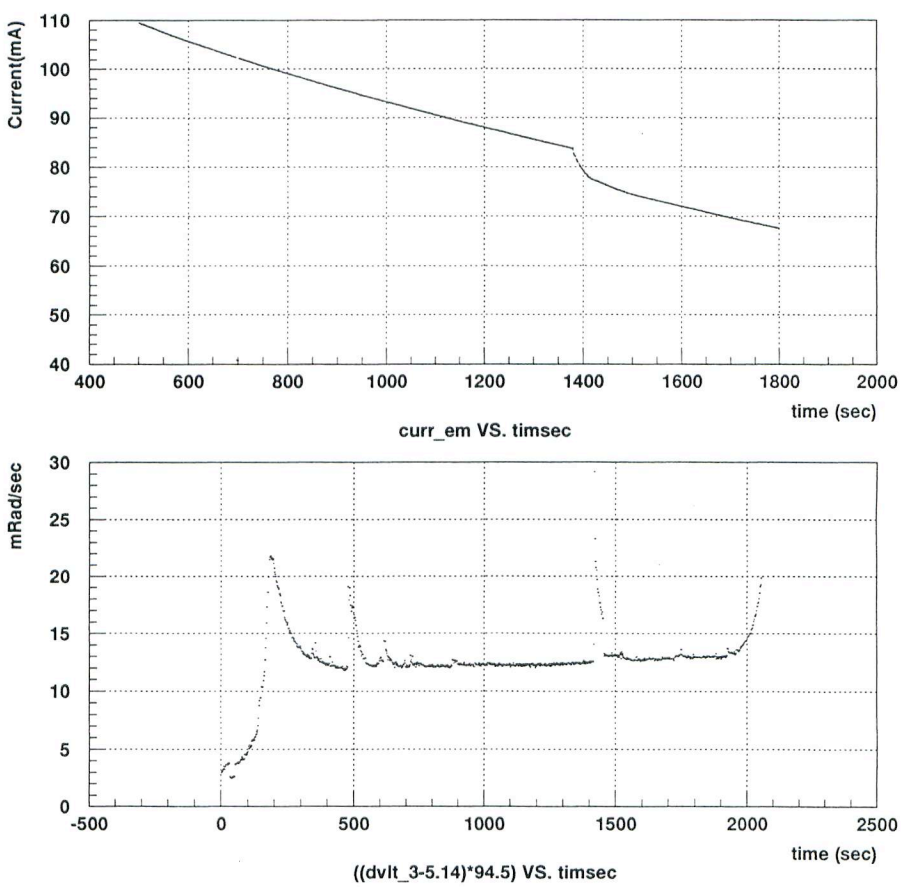
4.3 Dust

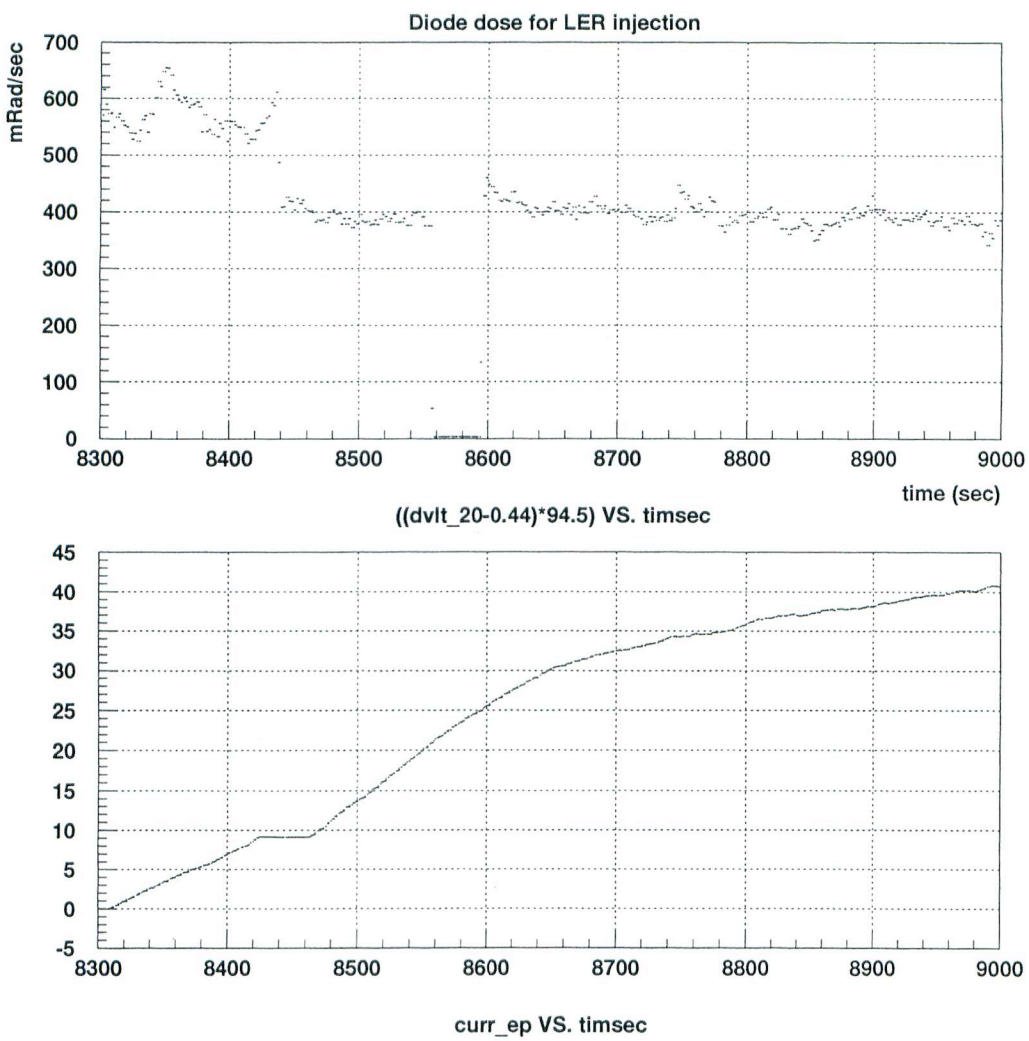
We have observed a new type of background in the HER from positively charged *"dust"*. (see plot)

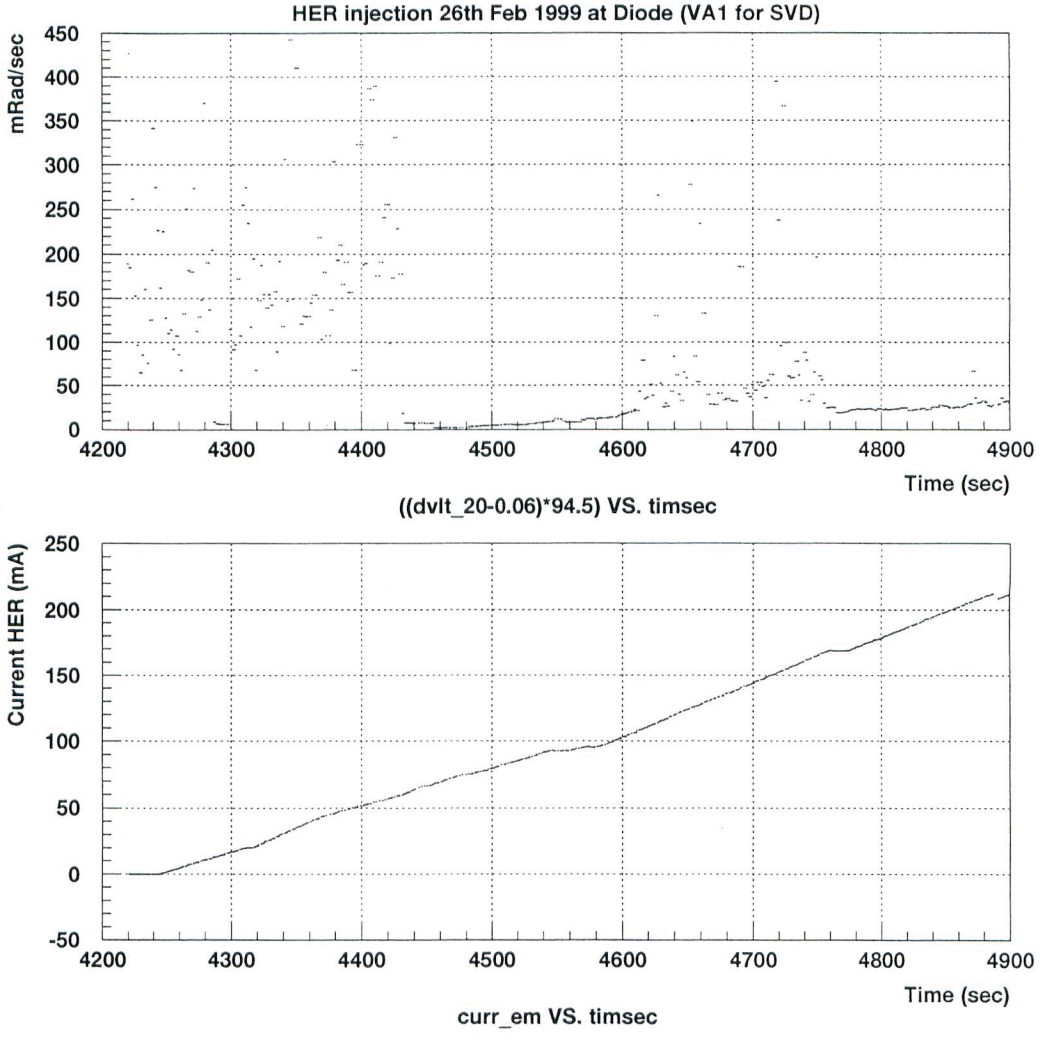
- Associated with sudden drops in lifetime
- Obeserved bursts of background diring fill

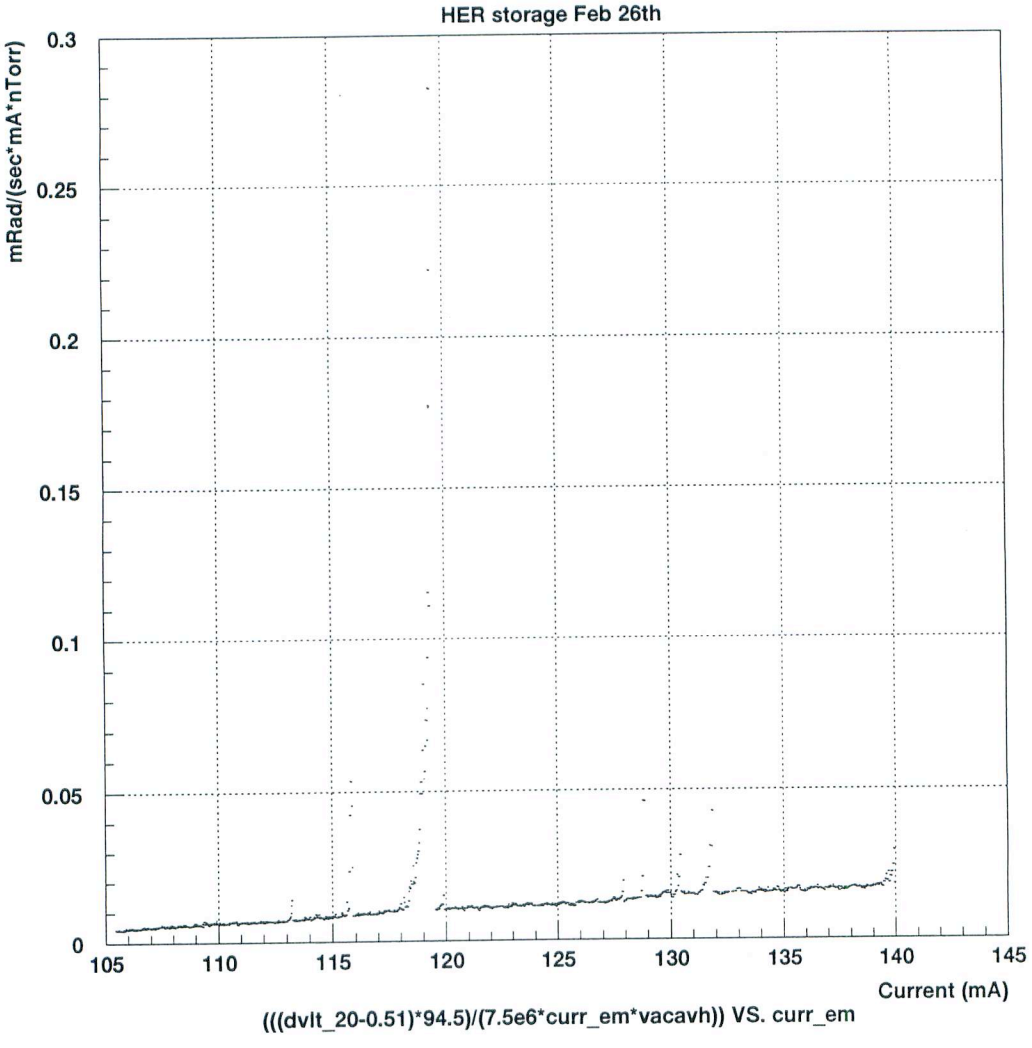
- Qualitatively different behaviour of Background vs. Current

This phenomena has been previously observed at HERA.


Current(mA)
110
100
90
80
70
60
50
40
400
600
800
1000
1200
1400
1600
1800
2000
time (sec)
curr_em VS. timsec
mRad/sec
30
25
20
15
10
5
0
-500
0
500
1000
1500
2000
2500
time (sec)
((dvlt_3-5.14)*94.5) VS. timsec

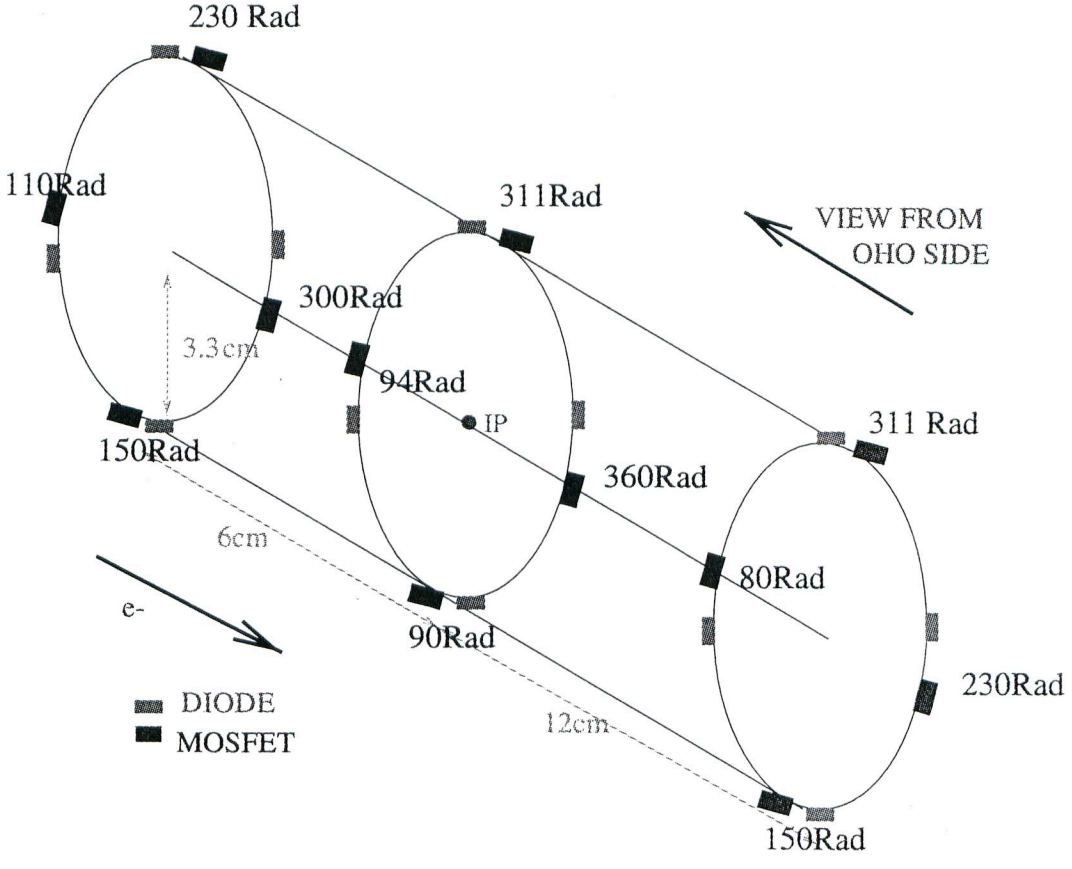

Diode dose for LER injection
mRad/sec
700
600
500
400
300
200
100
0
8300
8400
8500
8600
8700
8800
8900
9000
time (sec)
((dvlt_20-0.44)*94.5) VS. timsec
45
40
35
30
25
20
15
10
5
0
-5
8300
8400
8500
8600
8700
8800
8900
9000
curr_ep VS. timsec


HER injection 26th Feb 1999 at Diode (VA1 for SVD)
mRad/sec
450
400
350
300
250
200
150
100
50
0
4200
4300
4400
4500
4600
4700
4800
4900
Time (sec)
((dvlt_20-0.06)*94.5) VS. timsec
Current HER (mA)
250
200
150
100
50
0
-50
4200
4300
4400
4500
4600
4700
4800
4900
Time (sec)
curr_em VS. timsec

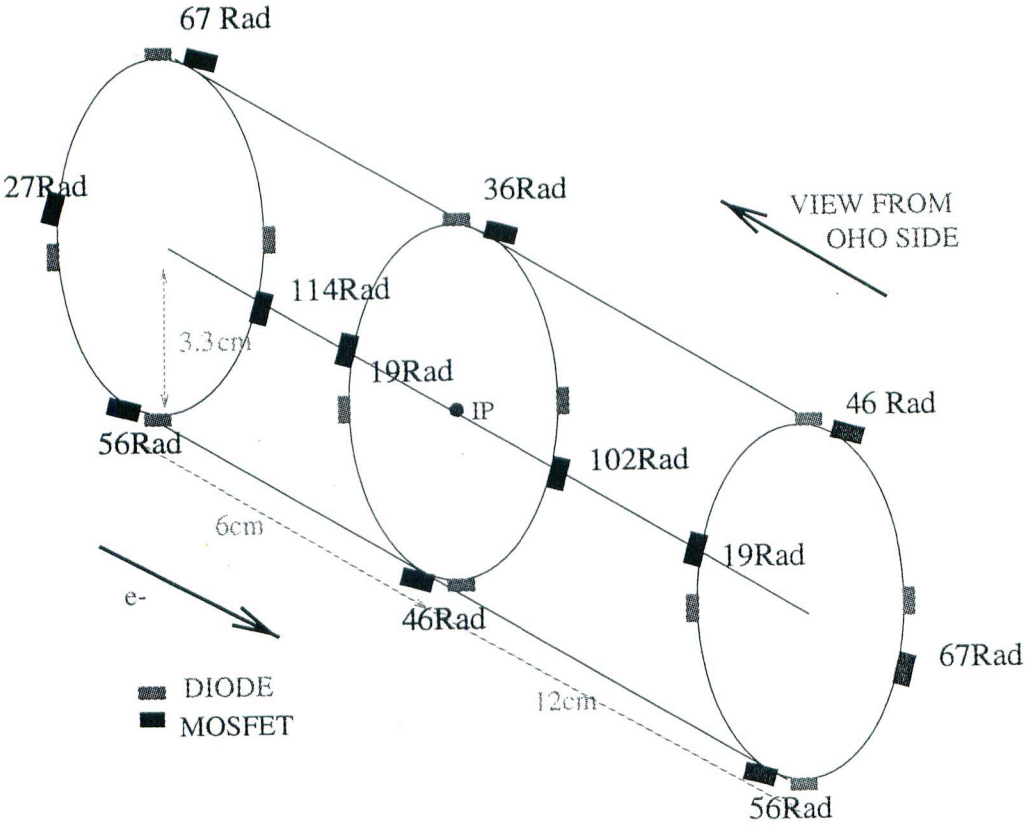

HER storage Feb 26th
mRad/(sec*mA*nTorr)
0.3
0.25
0.2
0.15
0.1
0.05
0
105
110
115
120
125
130
135
140
145
Current (mA)
(((dvlt_20-0.51)*94.5)/(7.5e6*curr_em*vacavh)) VS. curr_em

5 Integrated dose

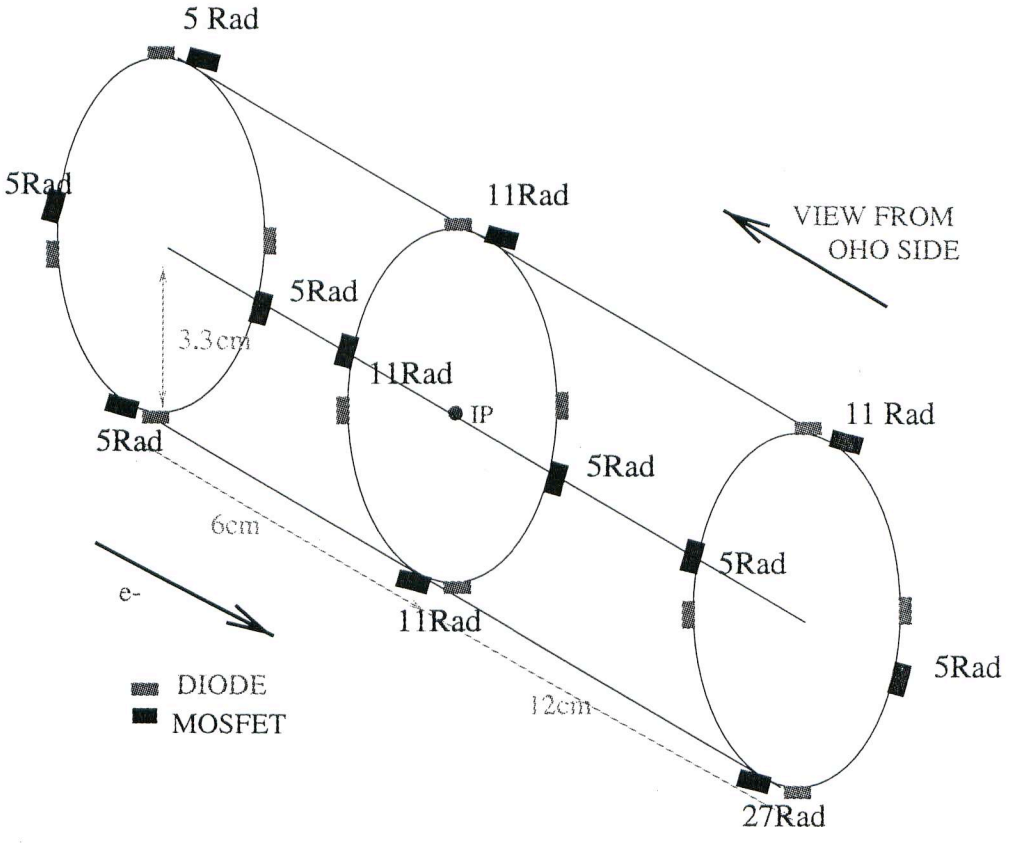
7th Feb 1999 LER injection 80mA



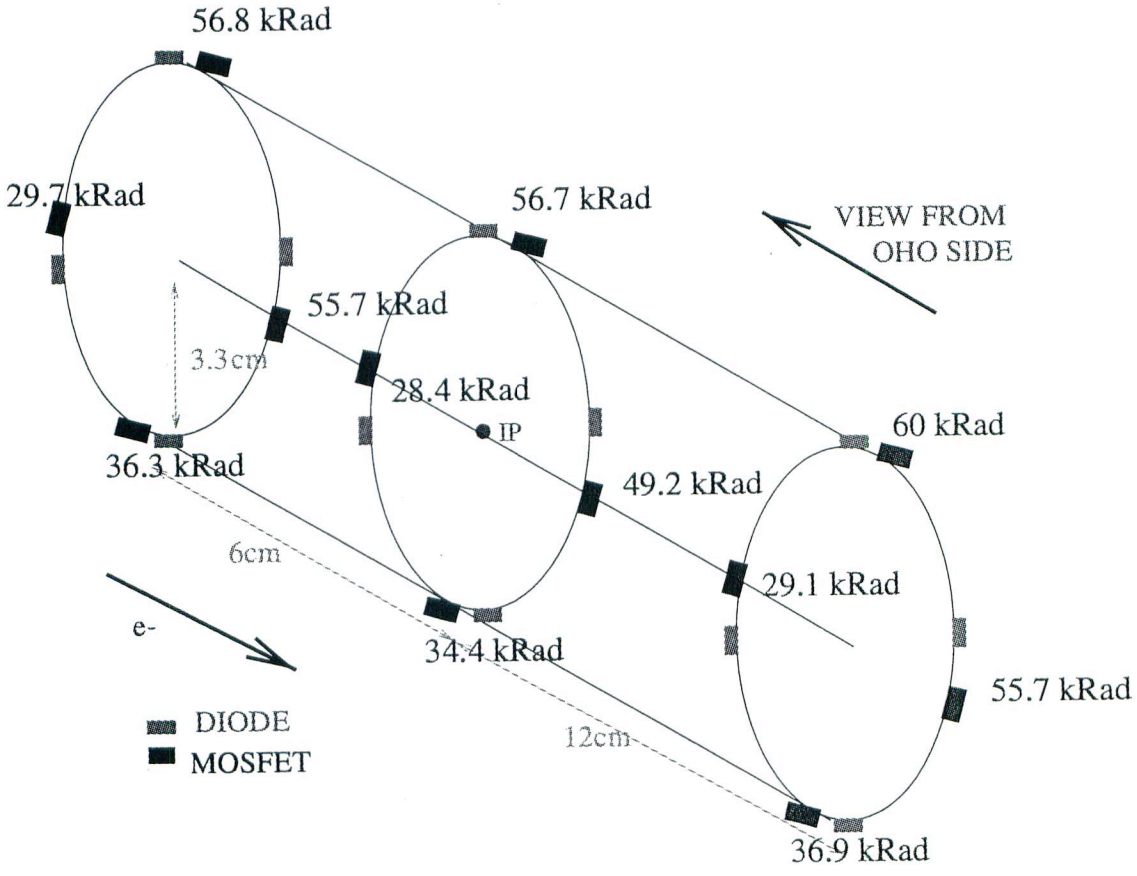
23rd Feb 1999 LER injection 150mA



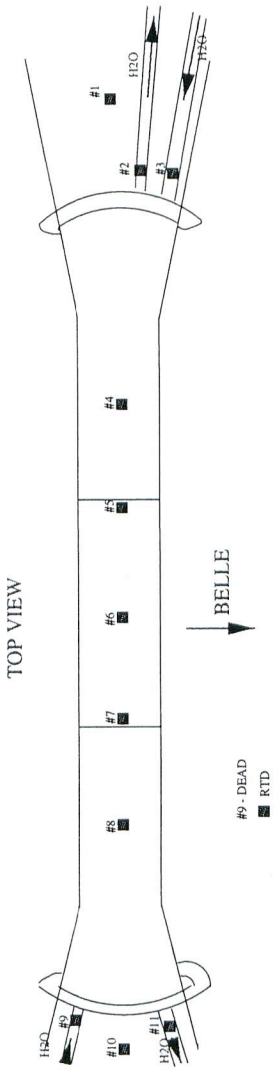
19th Feb 1999 HER injection 200mA

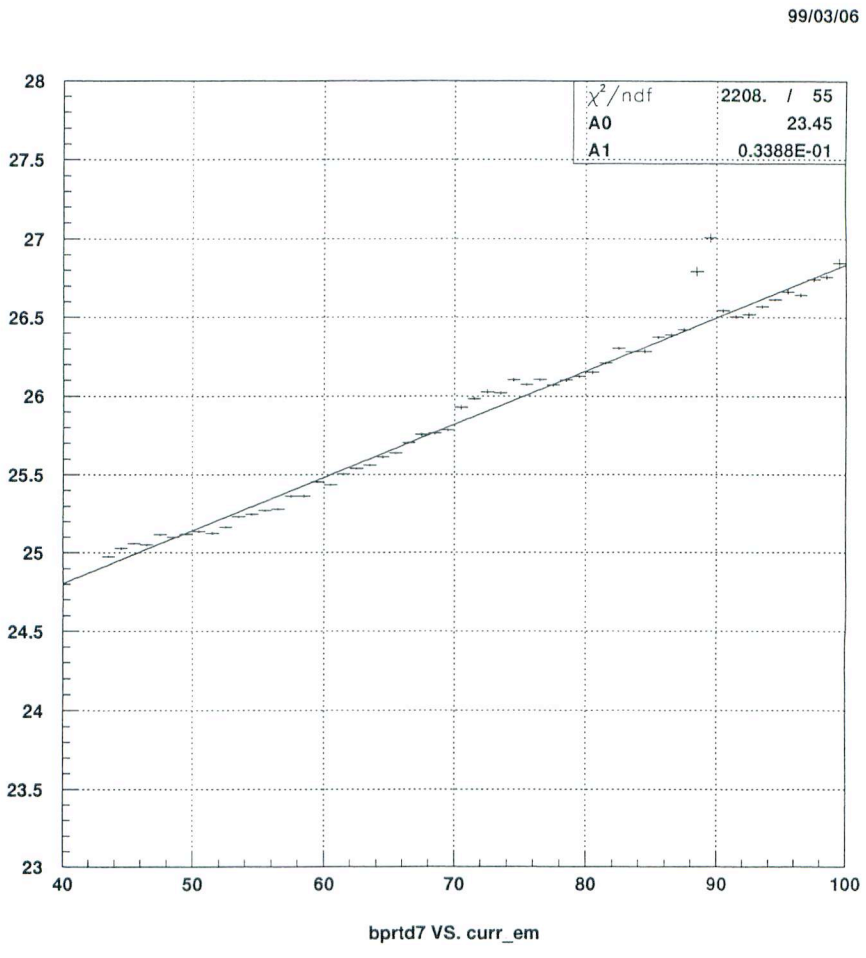


TOTAL DOSE (till 3rd March)



6 Beampipe Temperature





From this data, for the HER heating is explained at 0.6W for 50mA. Linear with current

$\rightarrow$ 12 Watts/Amp for HER.

this is within the cooling design tolerance for BELLE.

7 BEAST plans for Commissioning

- Observe improvements of HER, LER backgrounds with baking of the vacuum and improvements in optics. (Like: 1 BEAST run/week - Long sequential LER and HER fills and storage)
- Systematically test effects of collimators on the beam background. (Simulation suggests factor of 5 reduction is possible) (2 shifts)
- Help understand background from injection.
- Understand effects of steering/magnets on beam background. (2 shifts)
- Find local sources of background (With stable conditions, study pressure bumps) (2 shifts)
- Study Multiple turn effects. (Collimators at Fuji) (1 shift)
- Read out SVD ladder and understand SVD occupancies and leakage current as a function of beam current and vacuum pressure.

total shifts we would like $= 7 + 1$ per week