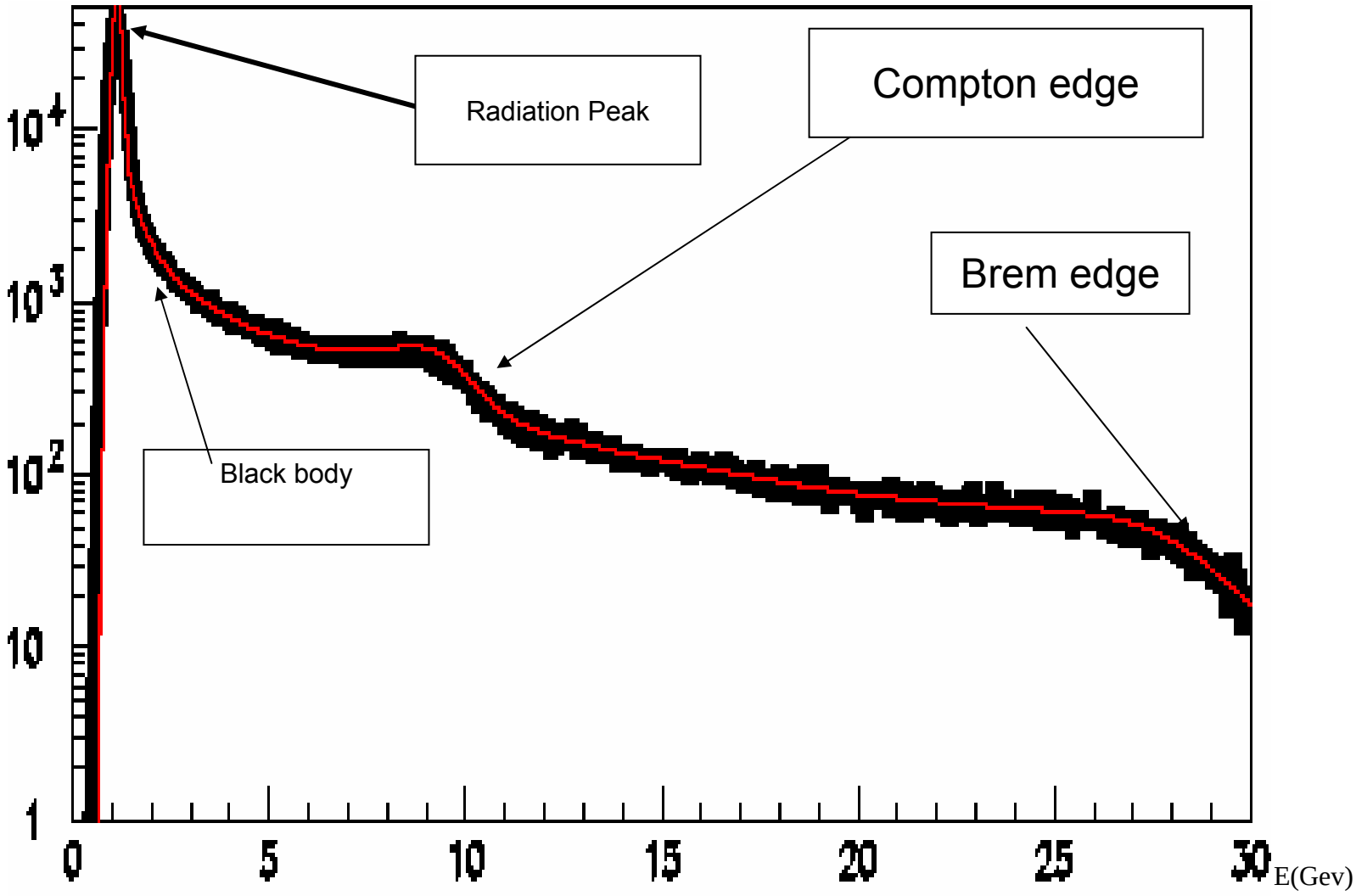
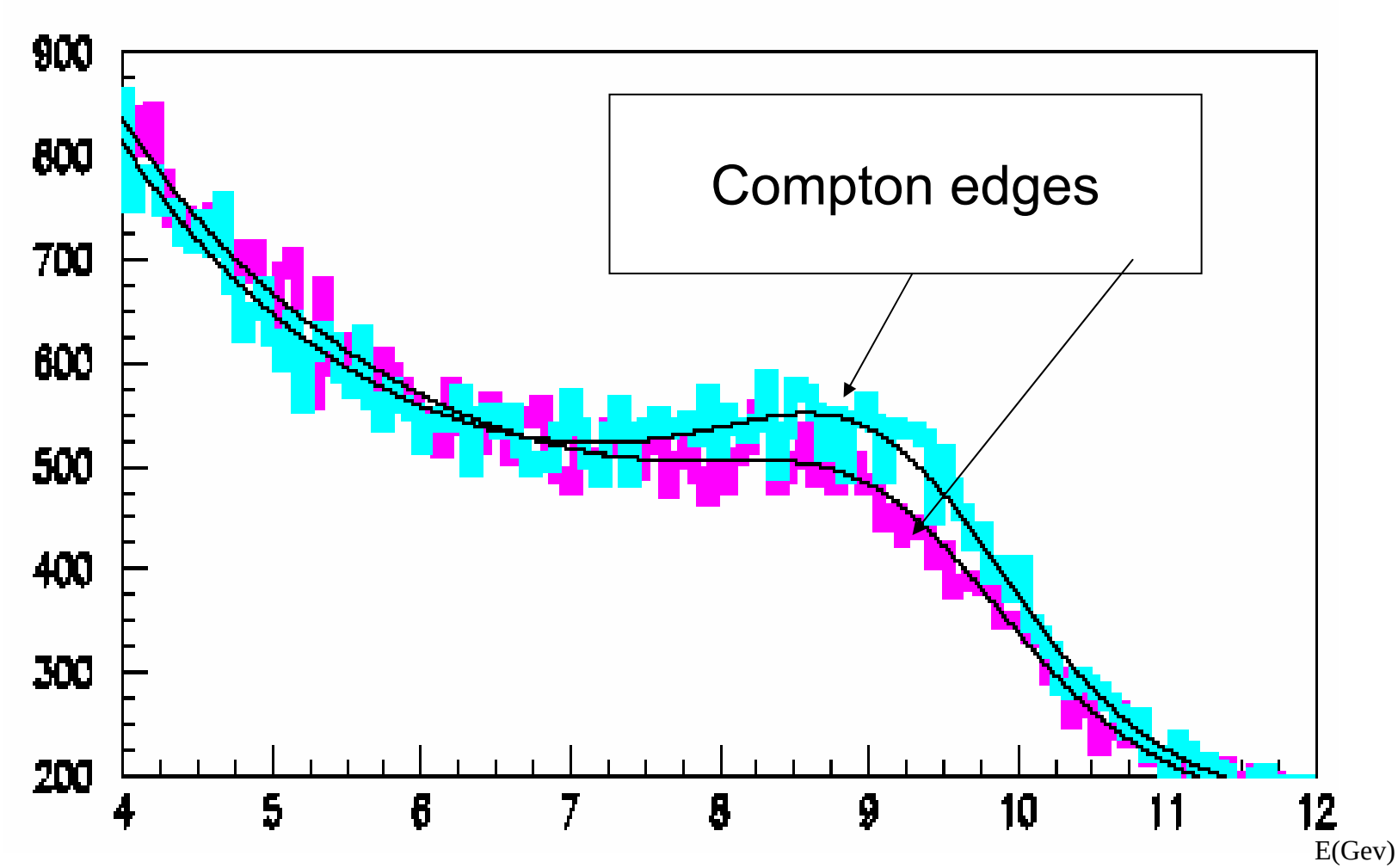
Data Taking

- First usable data 26 July 2006
- Efficient running during about 450 hours (from 6 oct 2006 to end)
- Brems : 2 Tera
- Comptons : 900 Giga
- Left and Right laser polarization differ by 60 Giga
- Systematics dominated

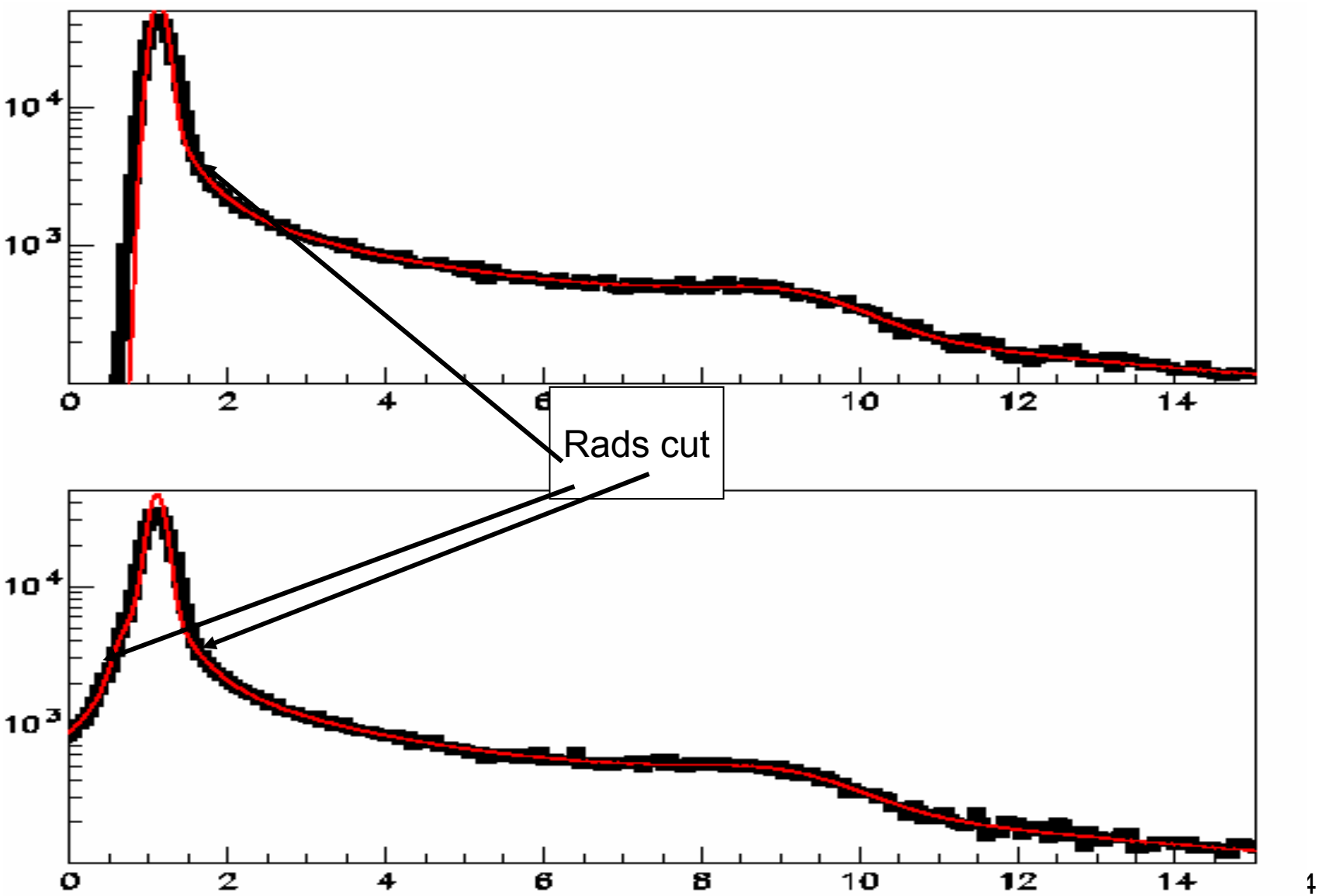
Measurement example



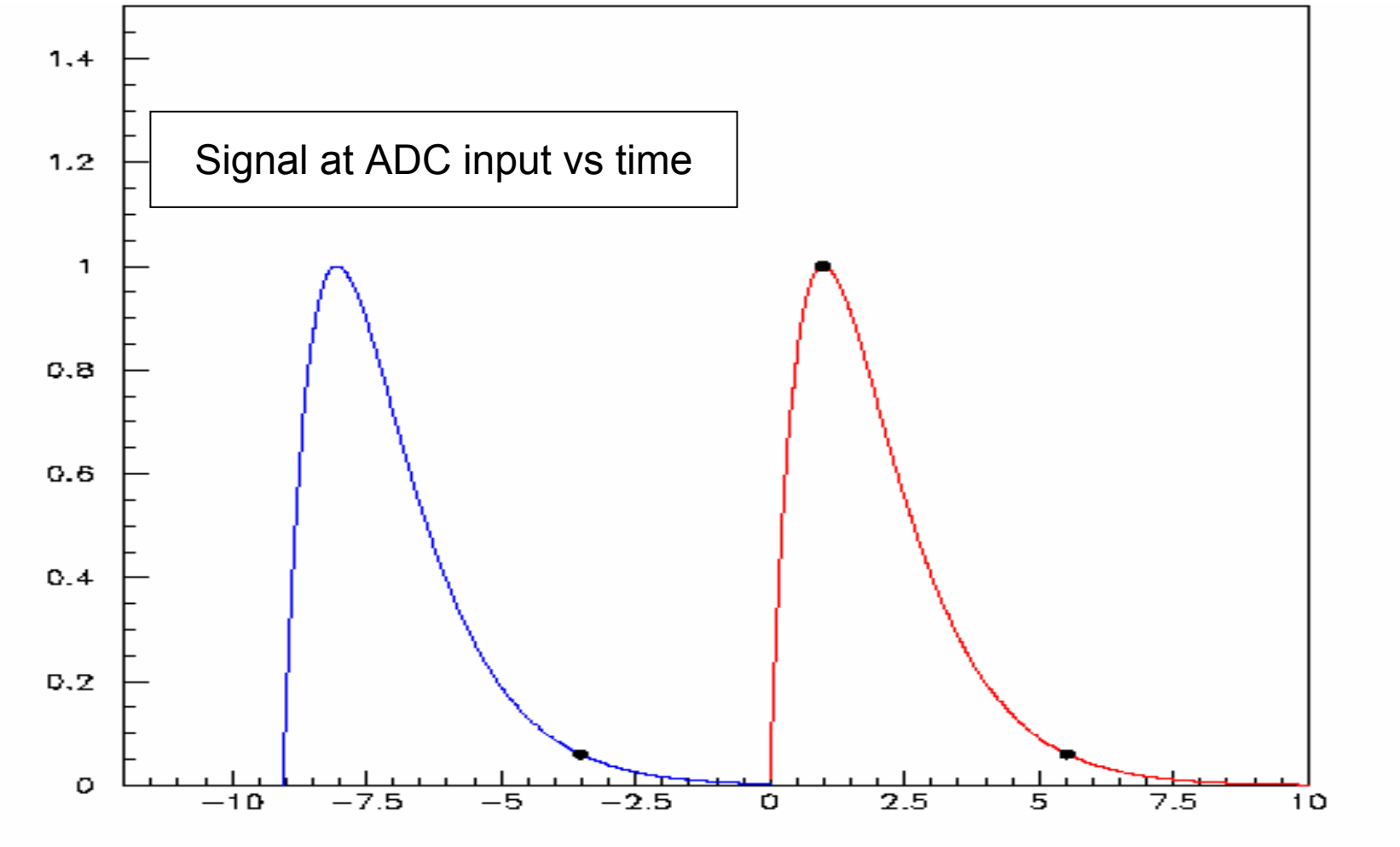
Measurement principle



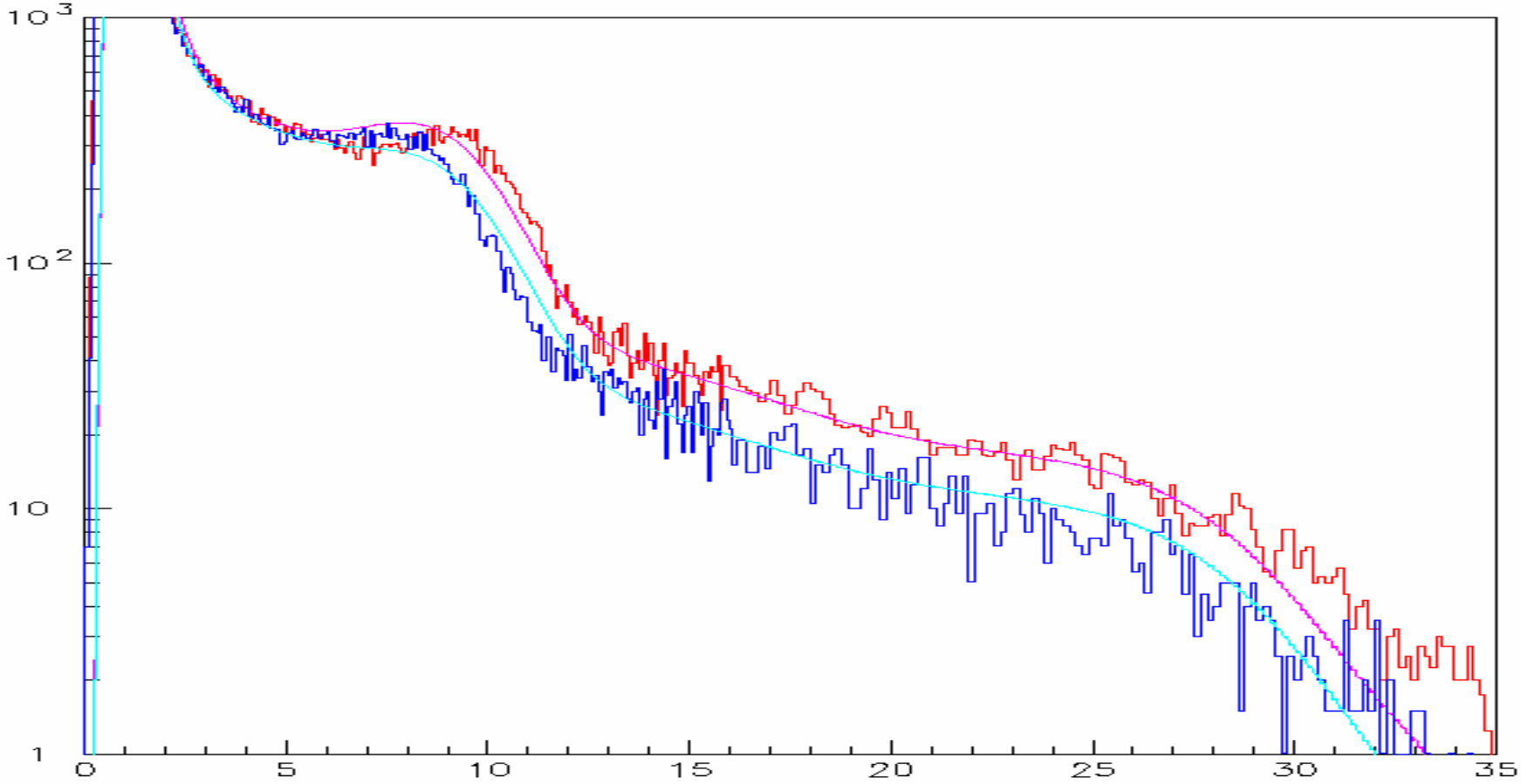
Leak effect



Leak effect and it origin

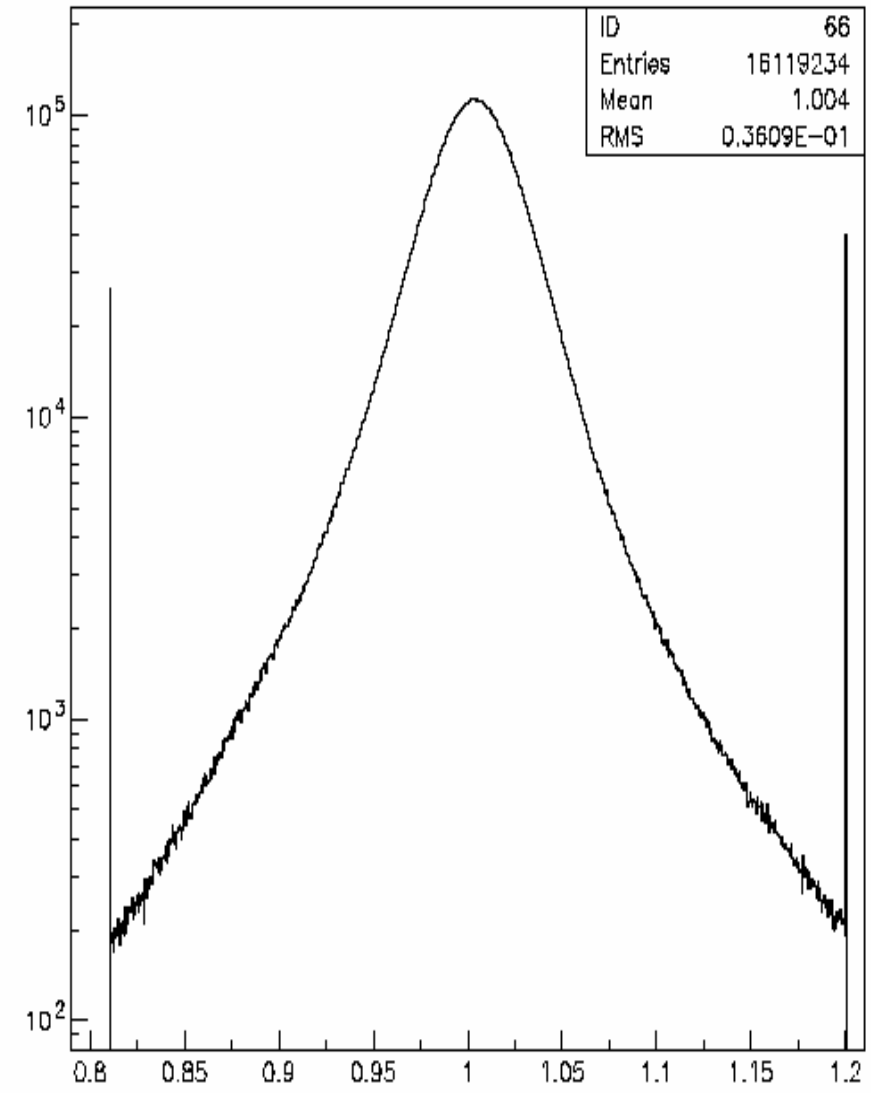


Hera Beam moves

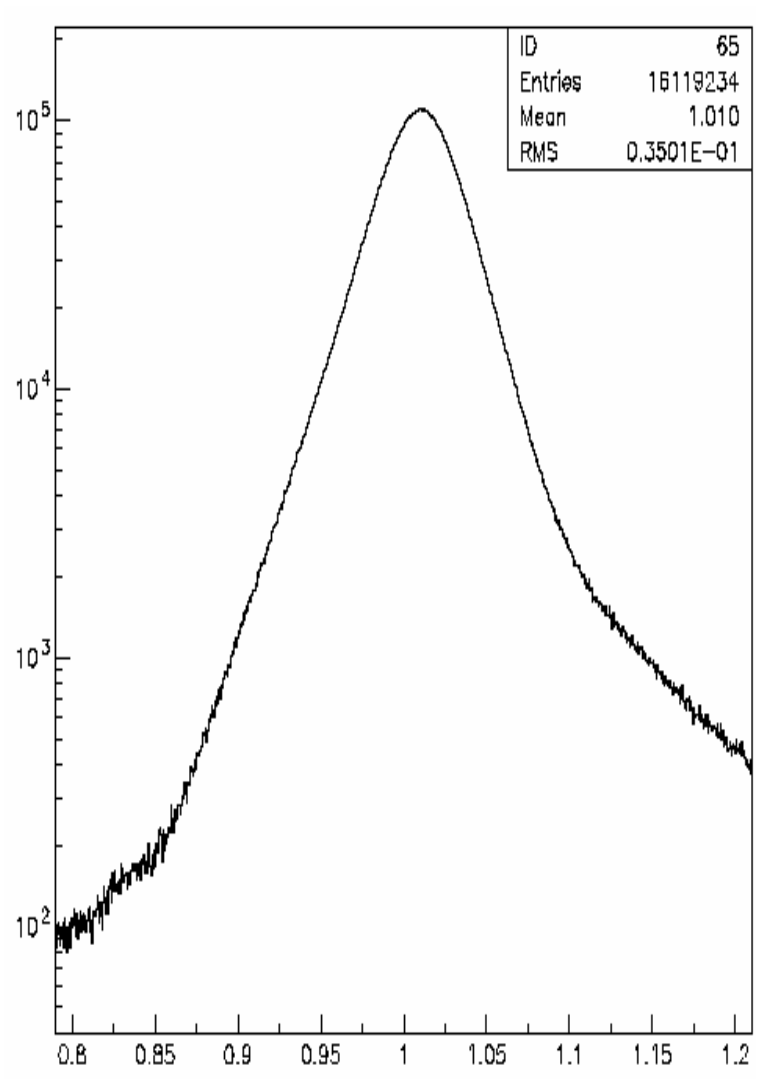


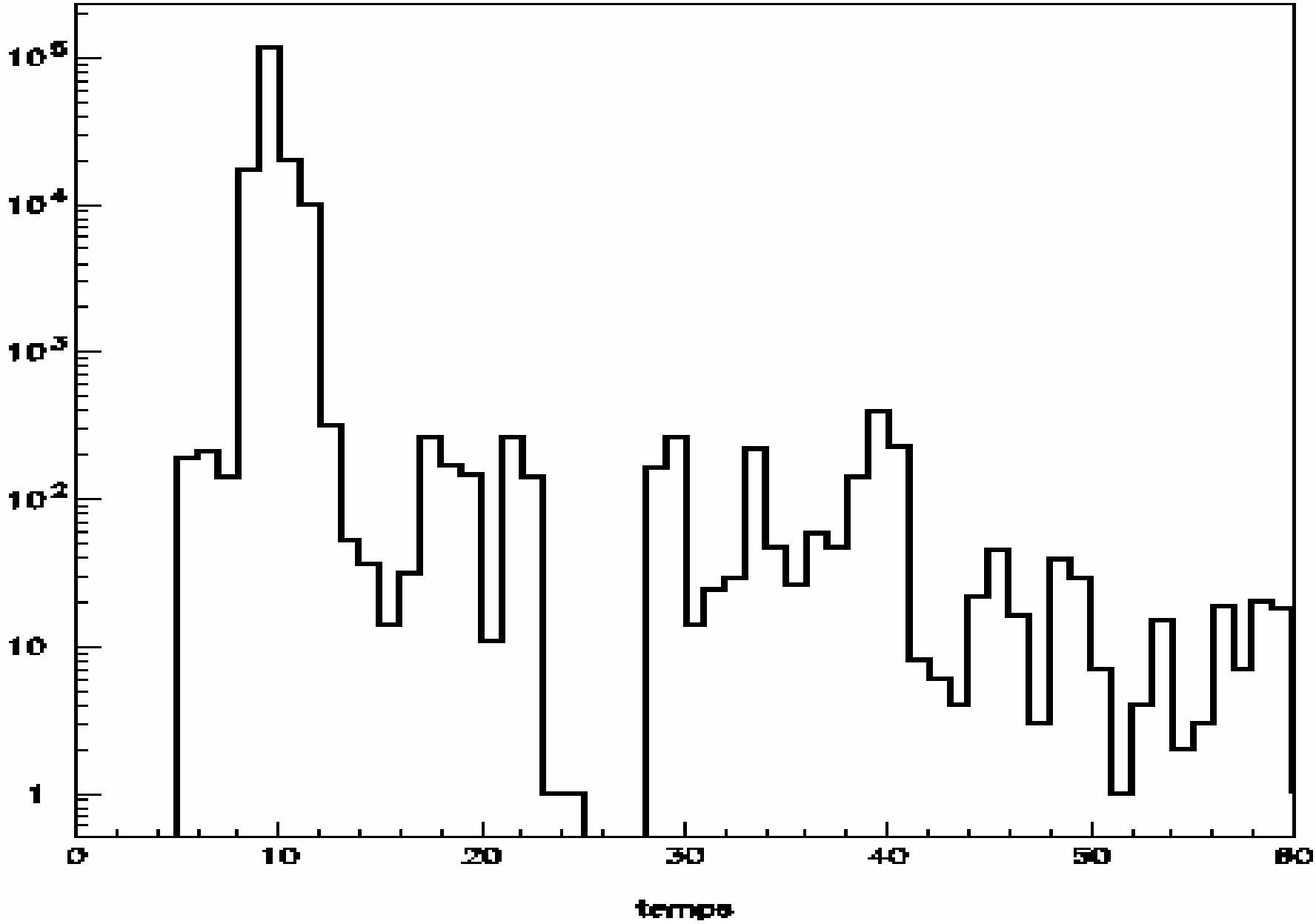
Histoset ratios

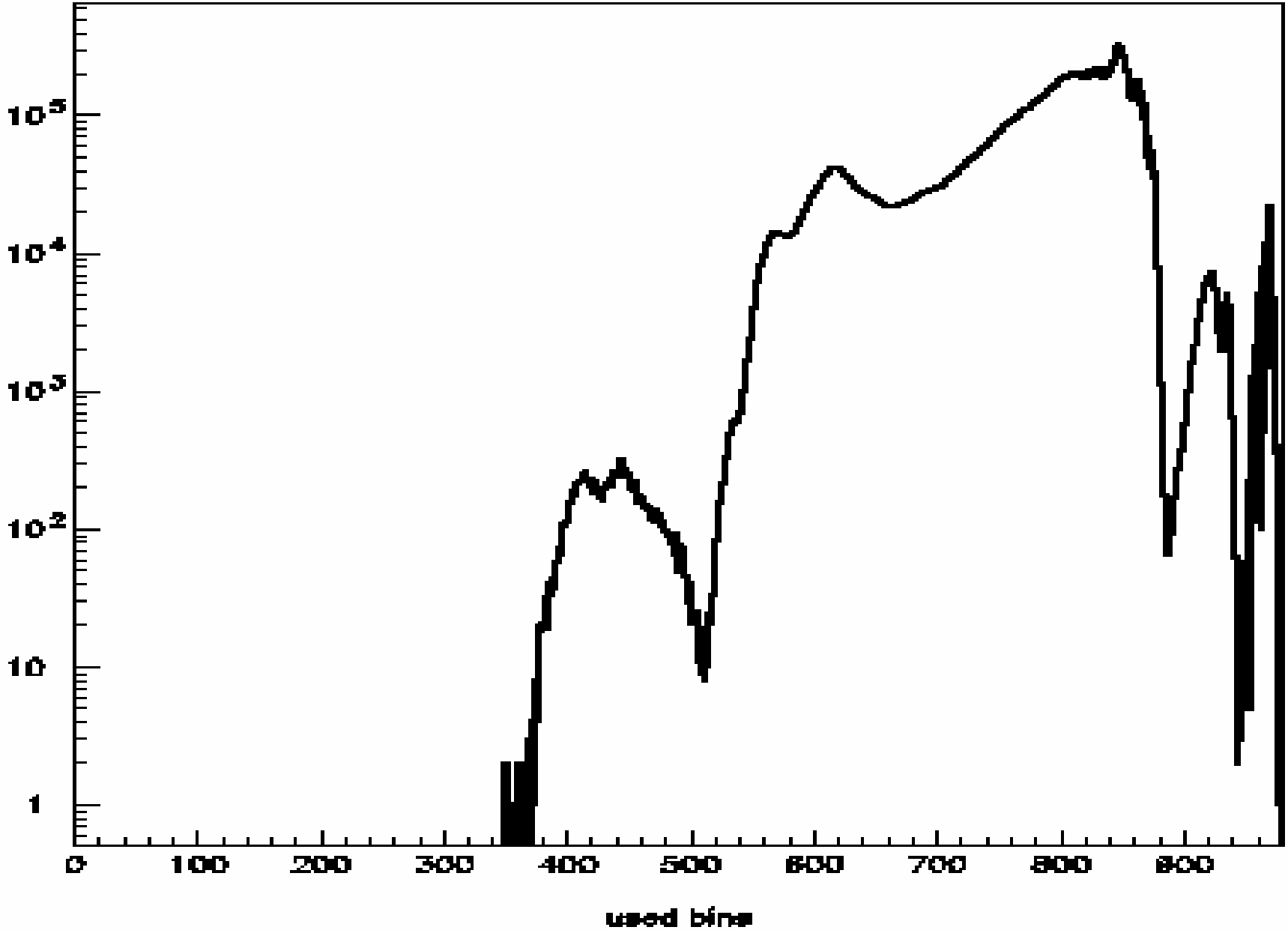
For Brem

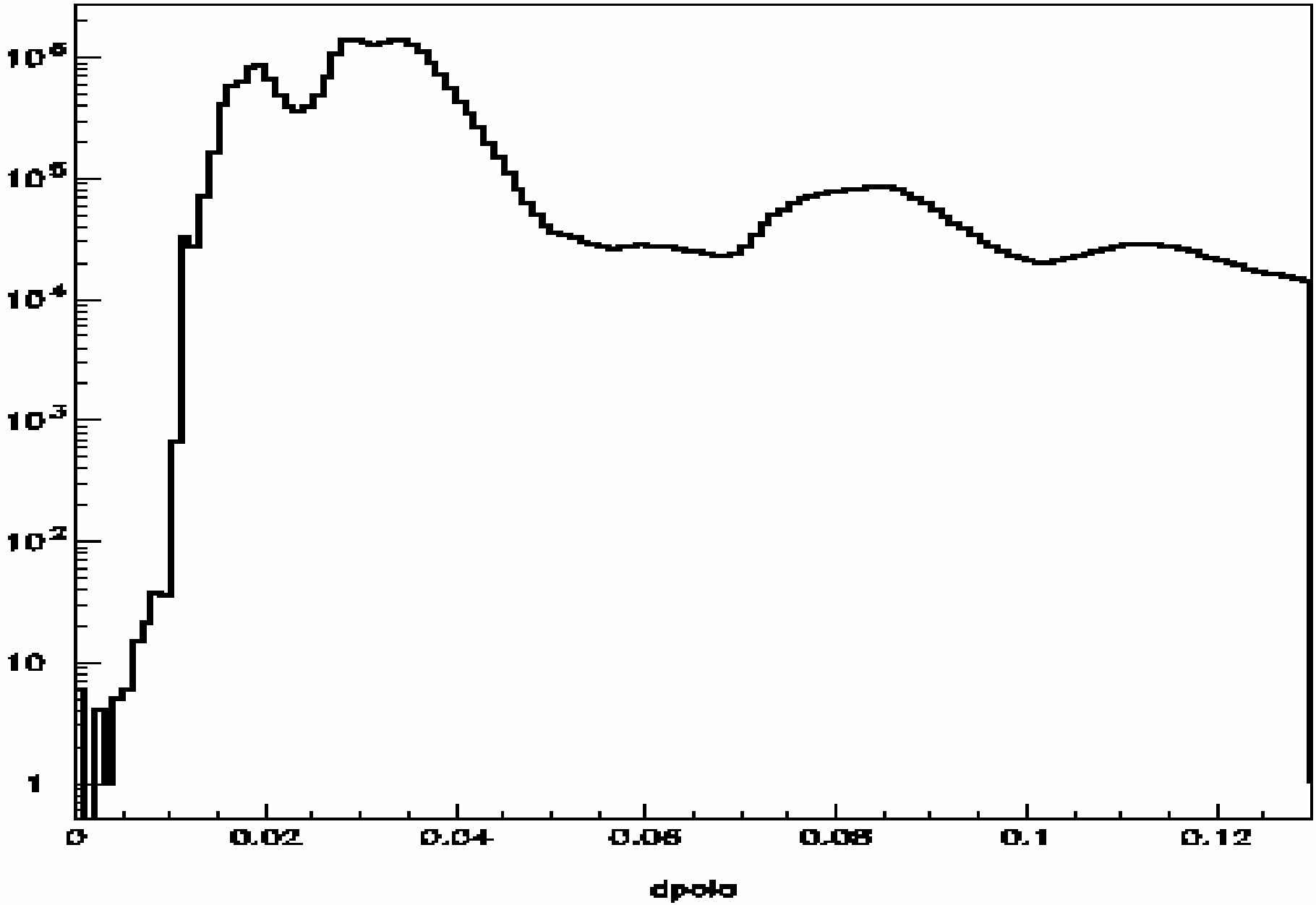


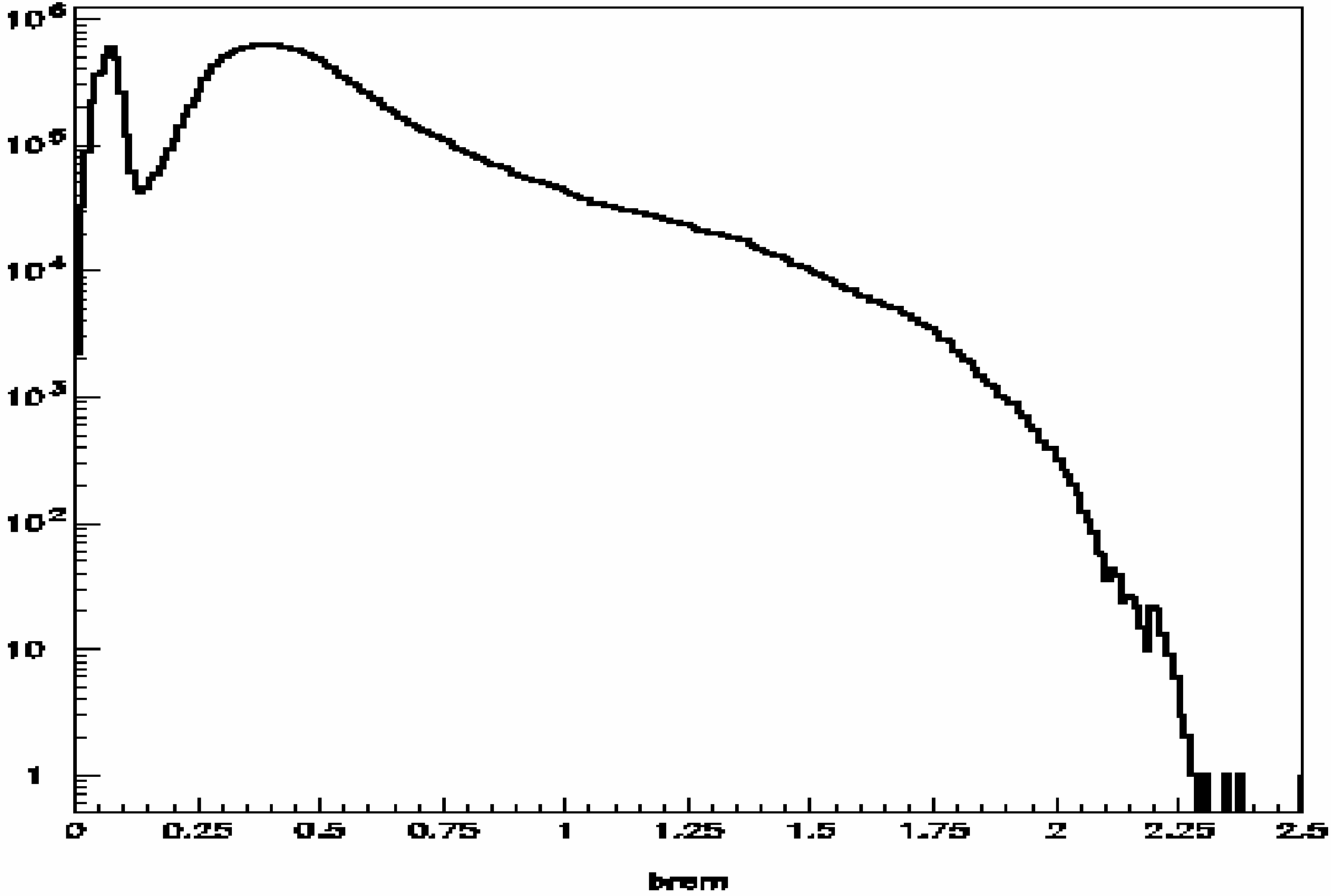
For Compton

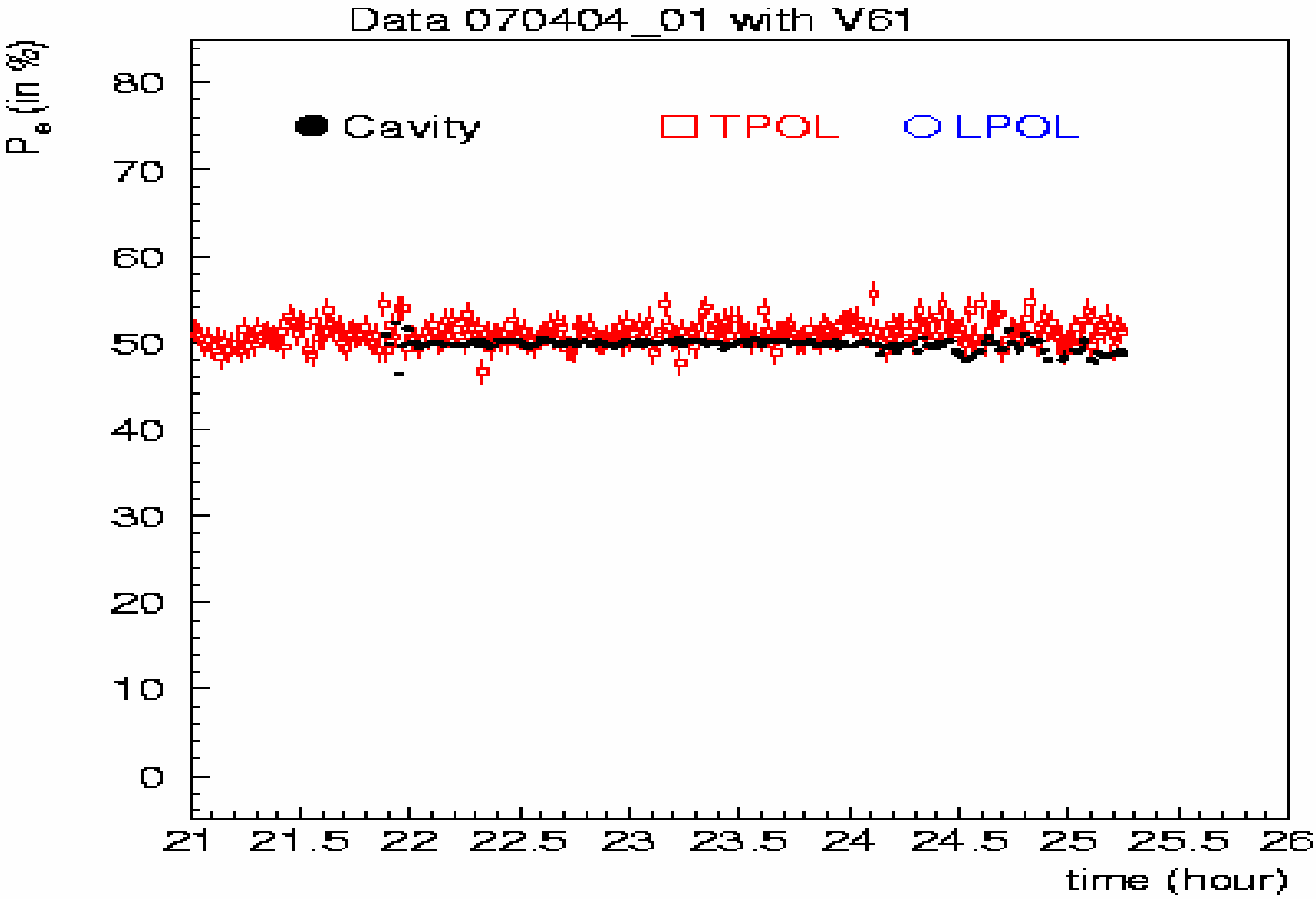


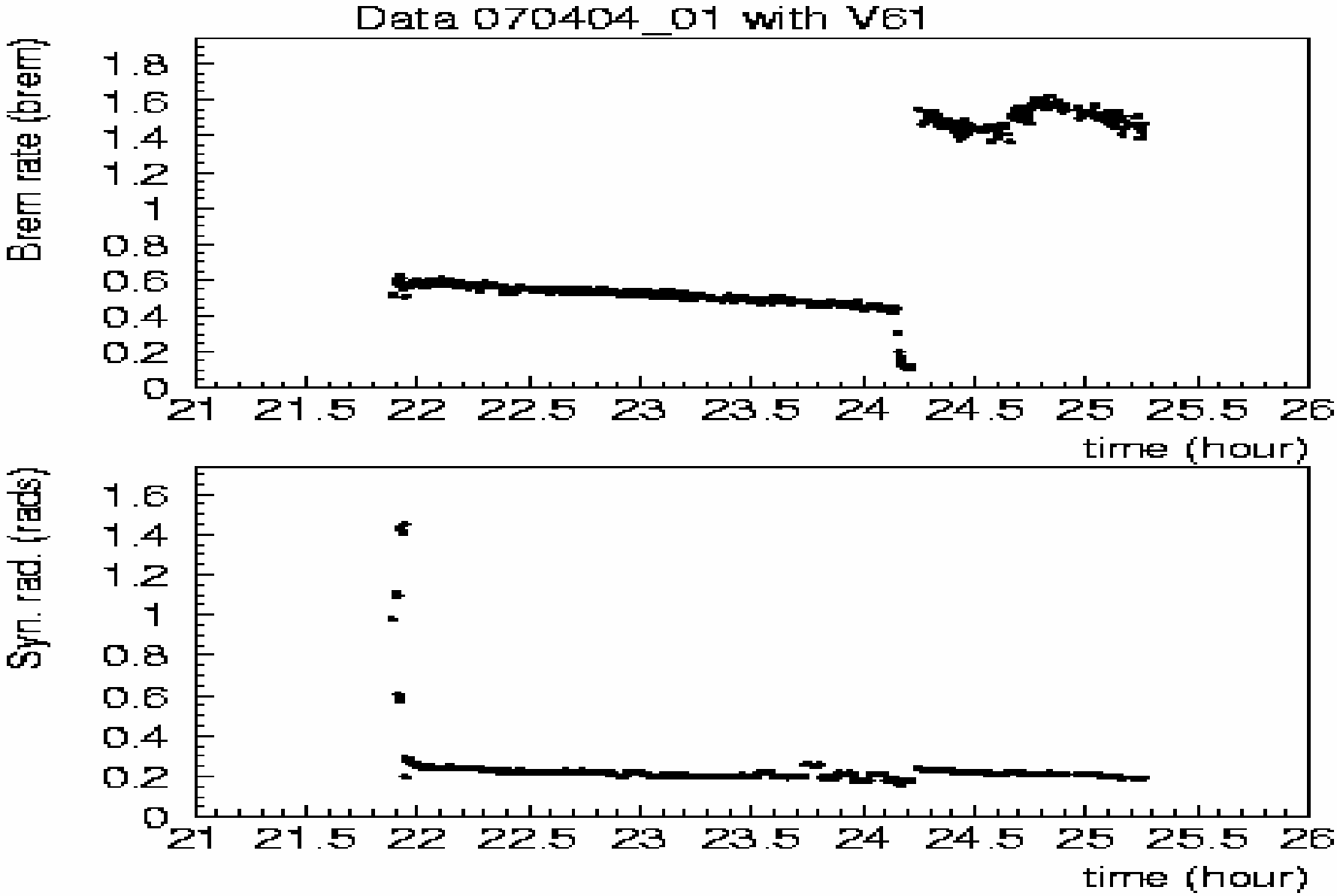

10⁵
10⁴
10³
10²
10
1
0
10
20
30
40
50
60
tempo

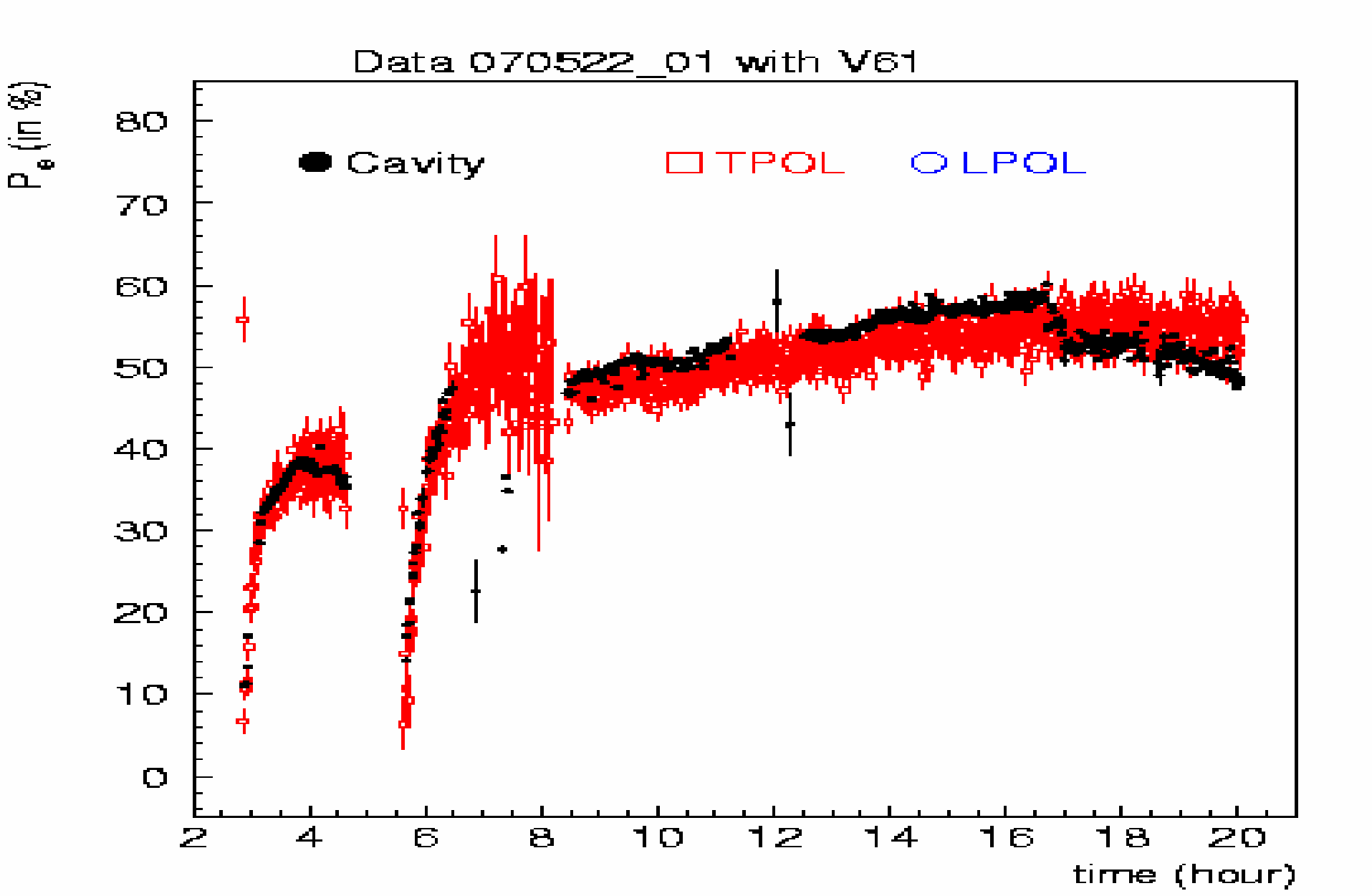

10^5
10^4
10^3
10^2
10
1
0
100
200
300
400
500
600
700
800
900
used bins

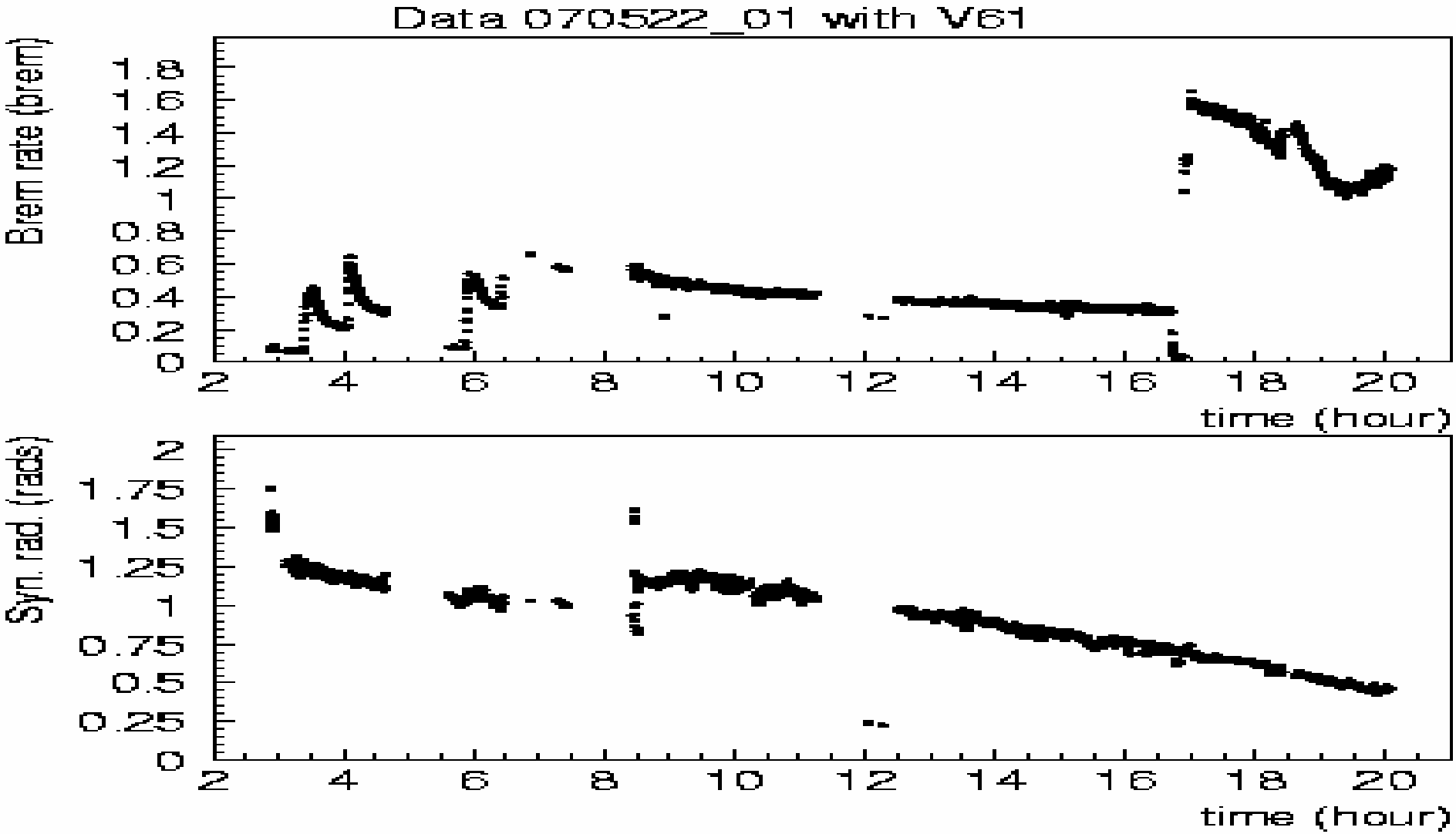

10^6
10^5
10^4
10^3
10^2
10
1
0
0.02
0.04
0.06
0.08
0.1
0.12
dpola


10⁶
10⁵
10⁴
10³
10²
10
1
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
2.25
2.5
brem

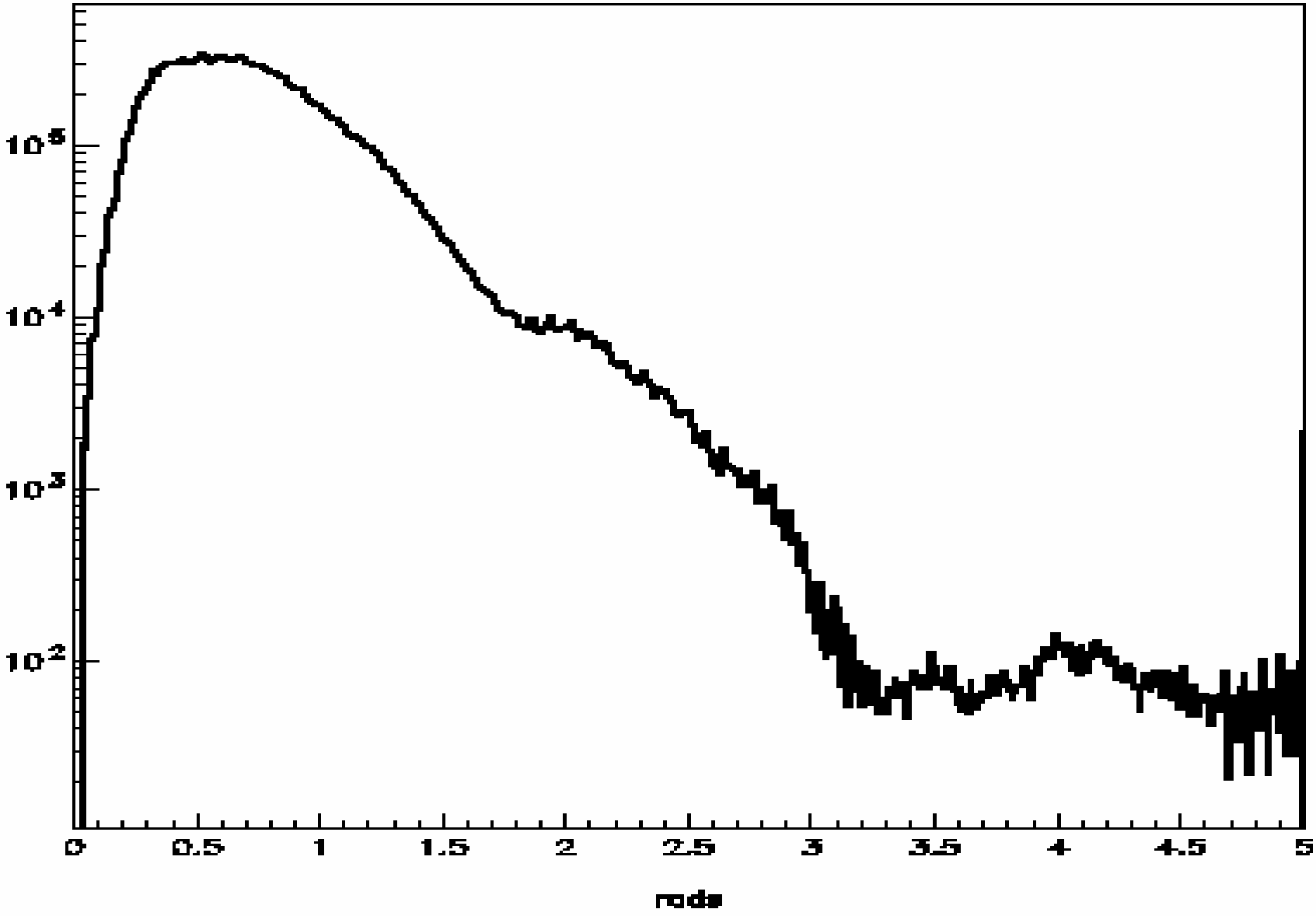

Data 070404_01 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
21
21.5
22
22.5
23
23.5
24
24.5
25
25.5
26
time (hour)

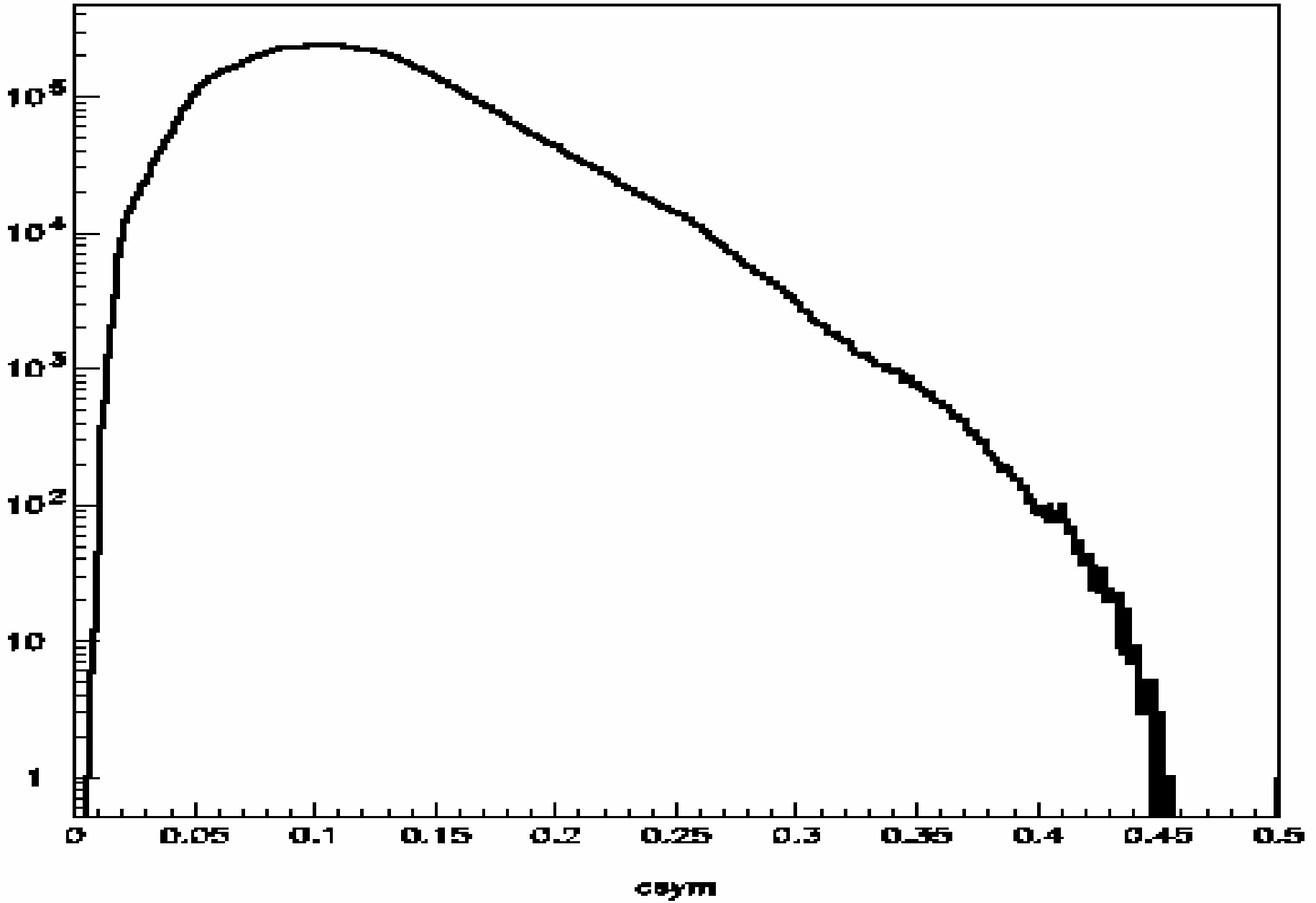

Data 070404_01 with V61
Brem rate (brem)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
21
21.5
22
22.5
23
23.5
24
24.5
25
25.5
26
time (hour)
Syn. rad. (rads)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
21
21.5
22
22.5
23
23.5
24
24.5
25
25.5
26
time (hour)


Data 070522_01 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
time (hour)



- 1% error in description for gammas>5


10^5
10^4
10^3
10^2
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
rads


10^5
10^4
10^3
10^2
10
1
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
csym

Analysis method

- Simulation

Cross section: (Brem,Compton,Black) or Energy (synchrotron peak)

Calo simulation: Rad peak $\sigma_r^2 = aE$ photon $\sigma_\gamma{}^2 = aE+bE^2$

Or $E=\alpha x^\mu$ x following a χ^2 distribution

E to ADC conversion: five alternate models such as A=cE/(1+d/E+E*s)

Electronic noise: Gaussian

- Likelihood to compare simulation and histogram

  Obtain Erads Brem Black Compton polar (and histo ratios)
- Calo optimization

Considered points

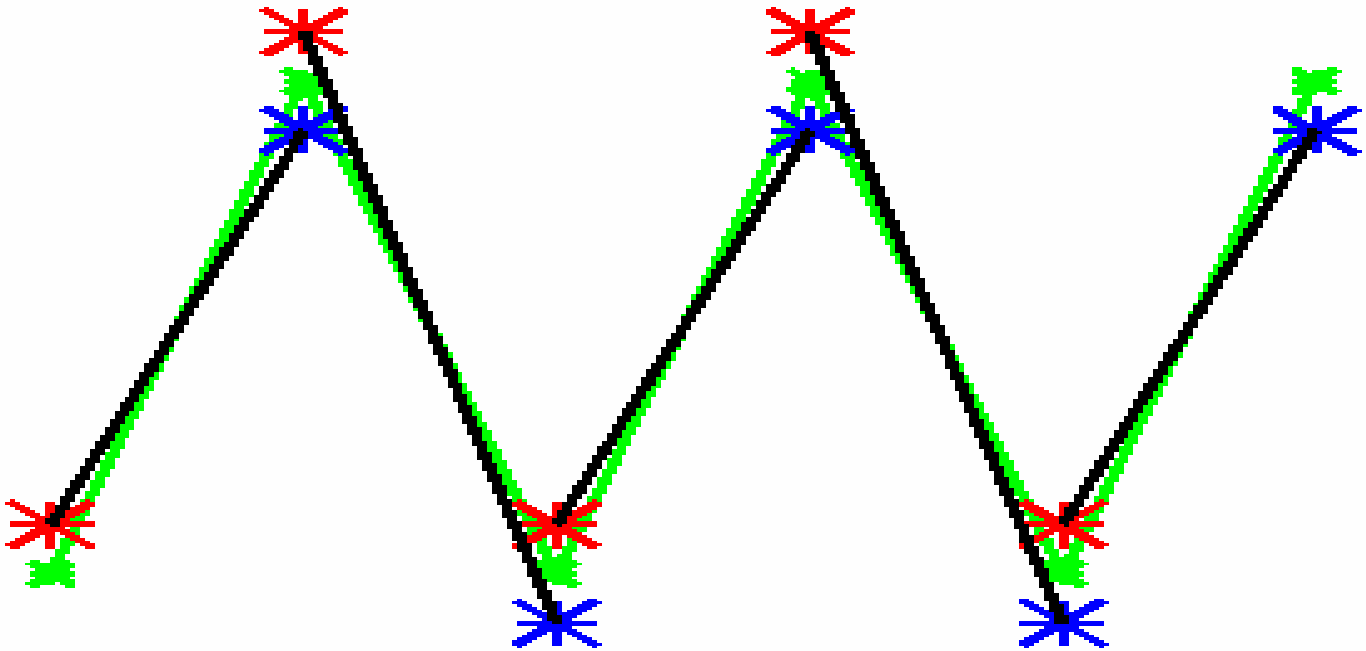
- Detector fitting
- Laser power
- Laser polarisation (moco)
- Hera beam at interaction
- Calorimeter position
- Leak effect
- LPOL and TPOL comparaison

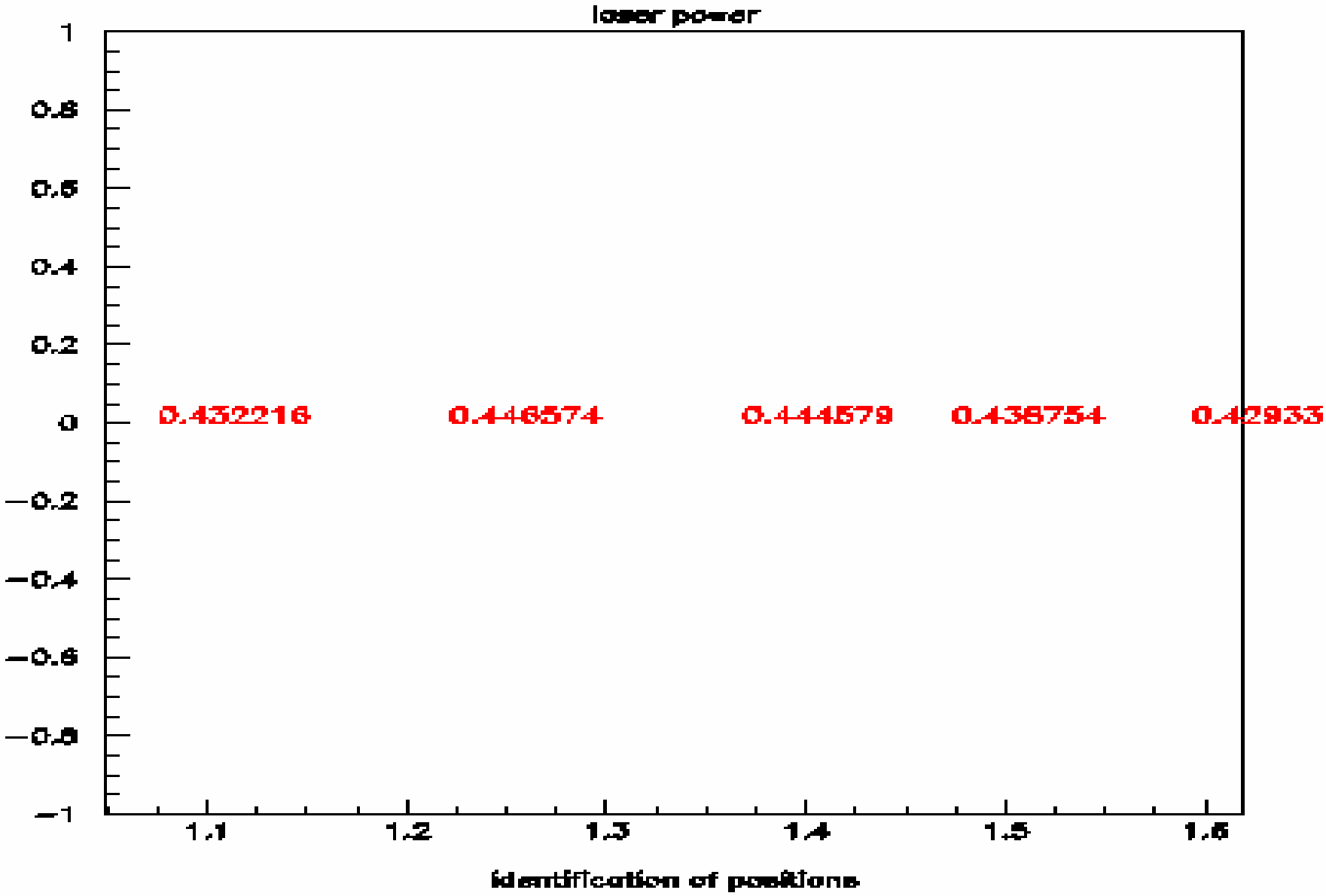
Errors induced by detector determination

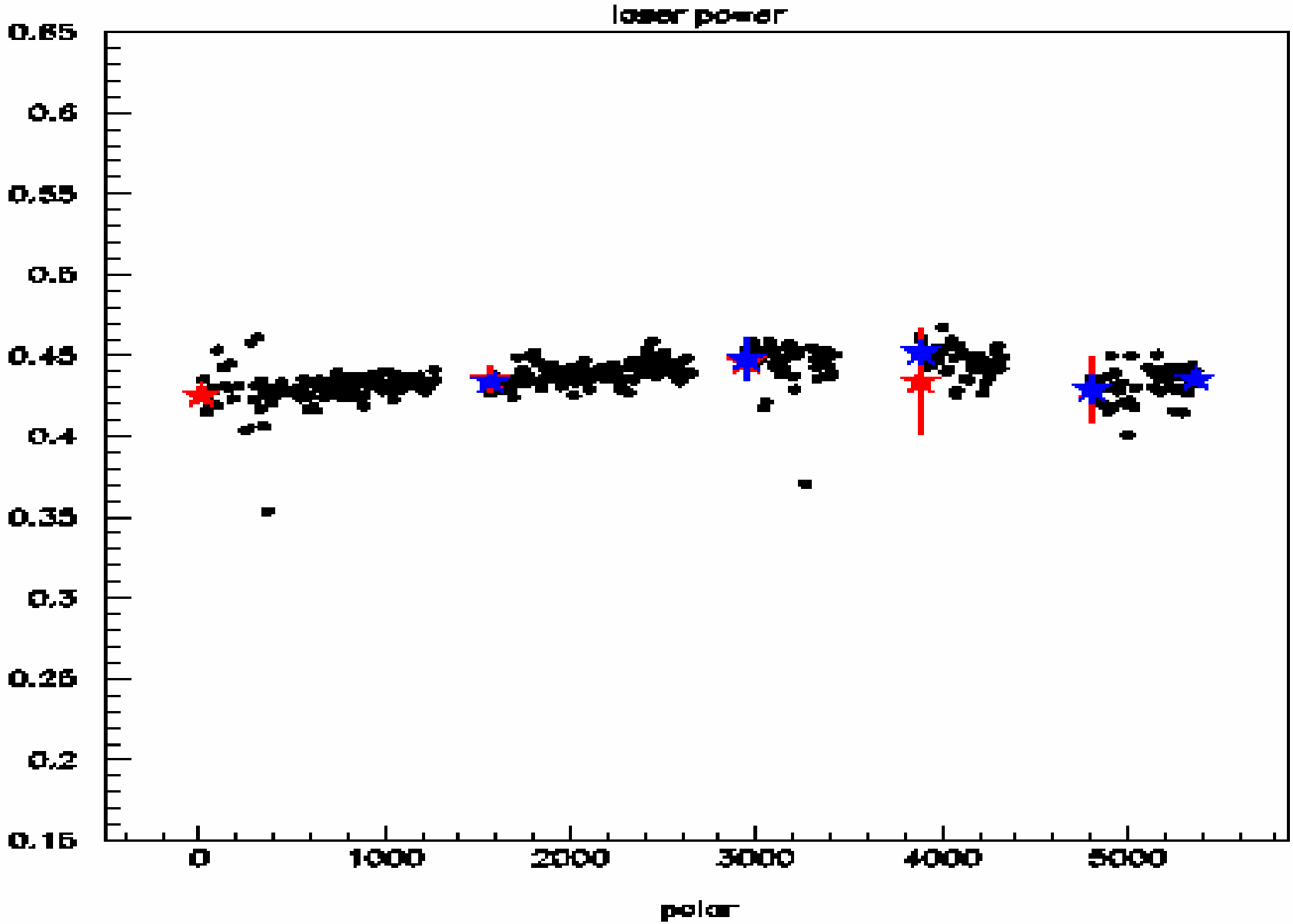
- Produce all the doublets
- Subdivide whole sample in ~80 sub periods
- Discriminate on rads brem compton and Tpol flatness
- For each potential systematic error source choose a smaller sub sample (10,6,2) and vary conditions
- Run detector parameter measurements every 25 doublets
- Run polarization measurements
- Make plots comparison
- THEN
- Make full production with best detector ansatz
- Redo full production in reduced space 8 -> 5

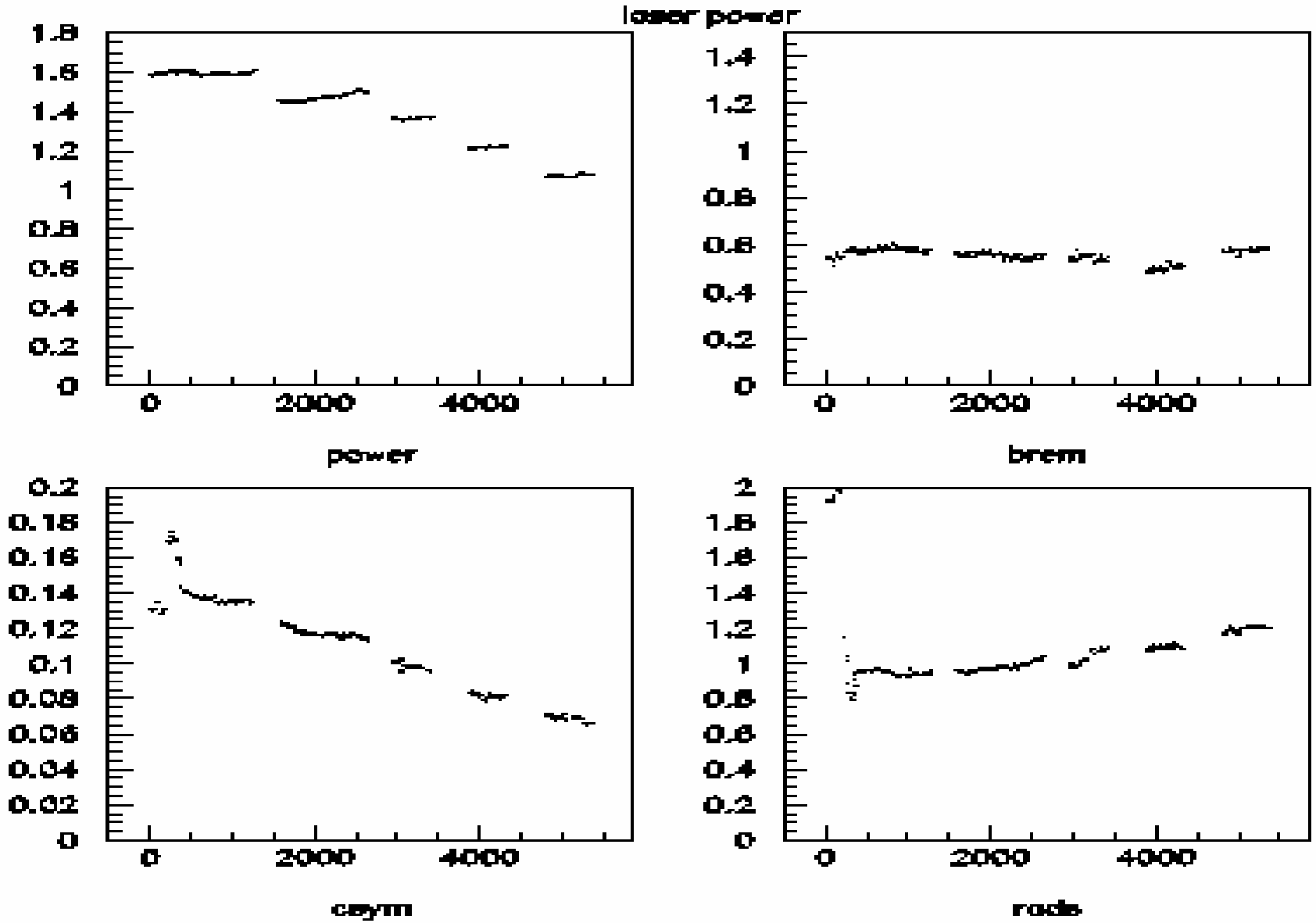
Polarisation scan analysis principle of the method

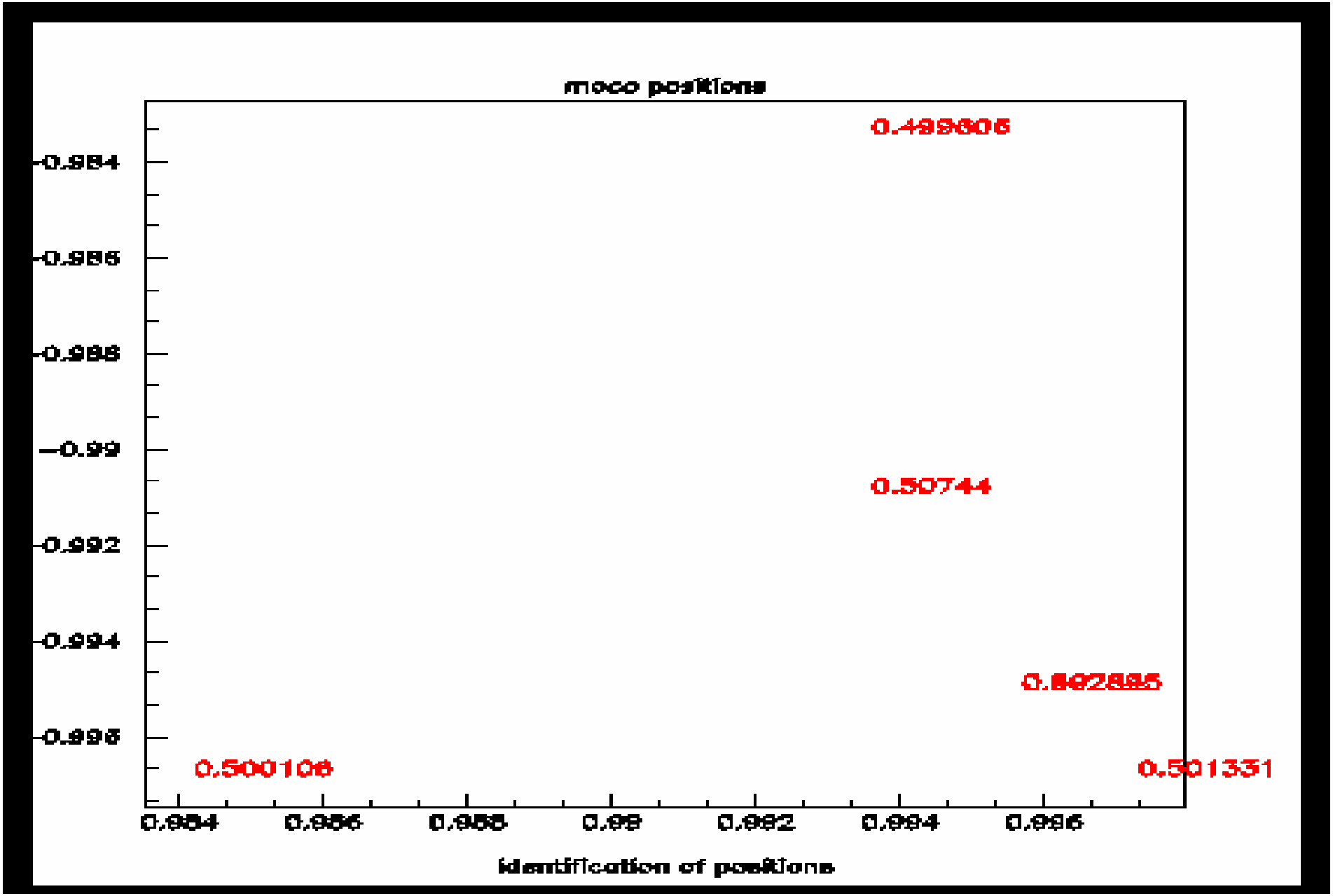
laser power, moco, calo positions, beam position

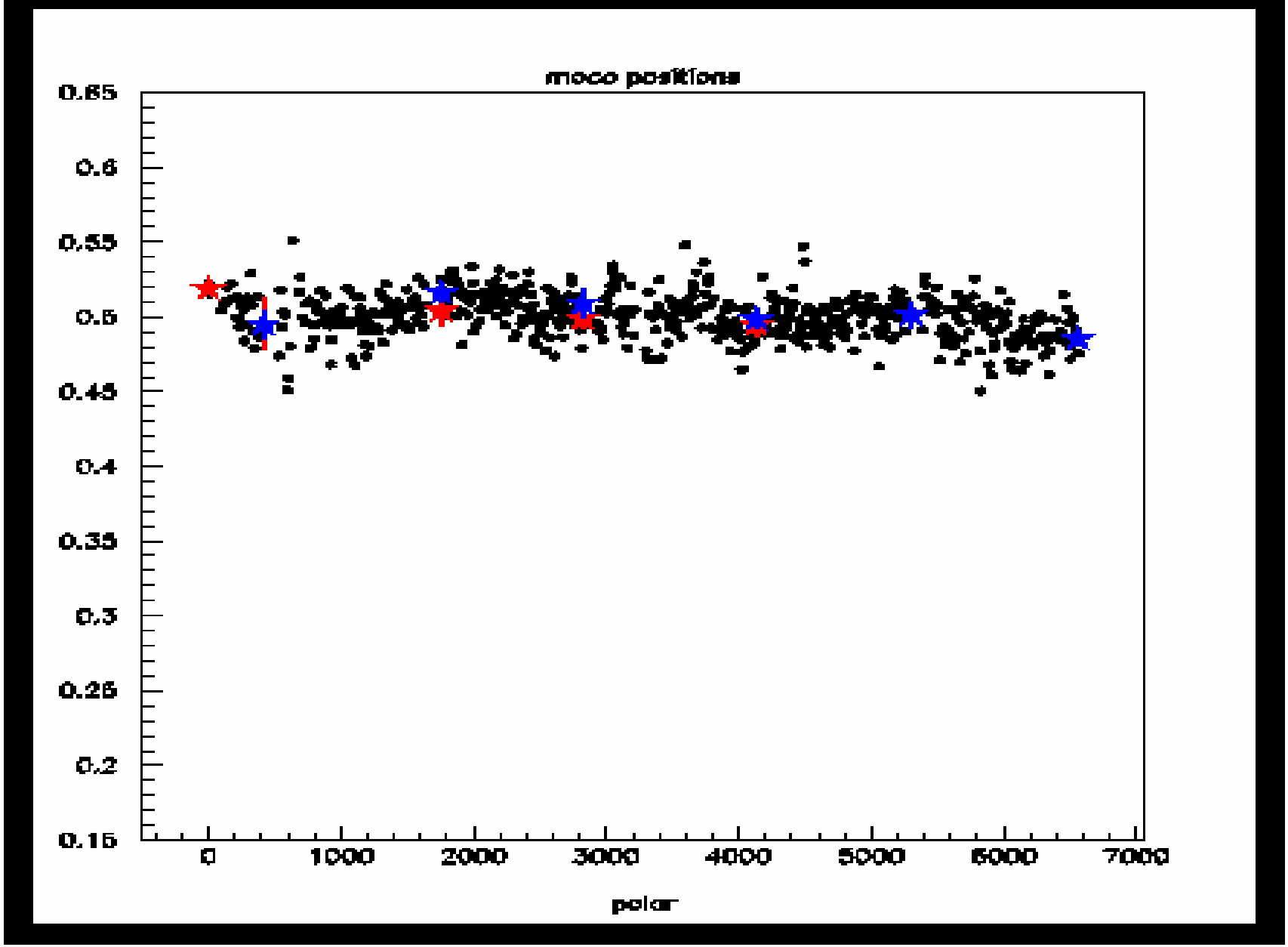


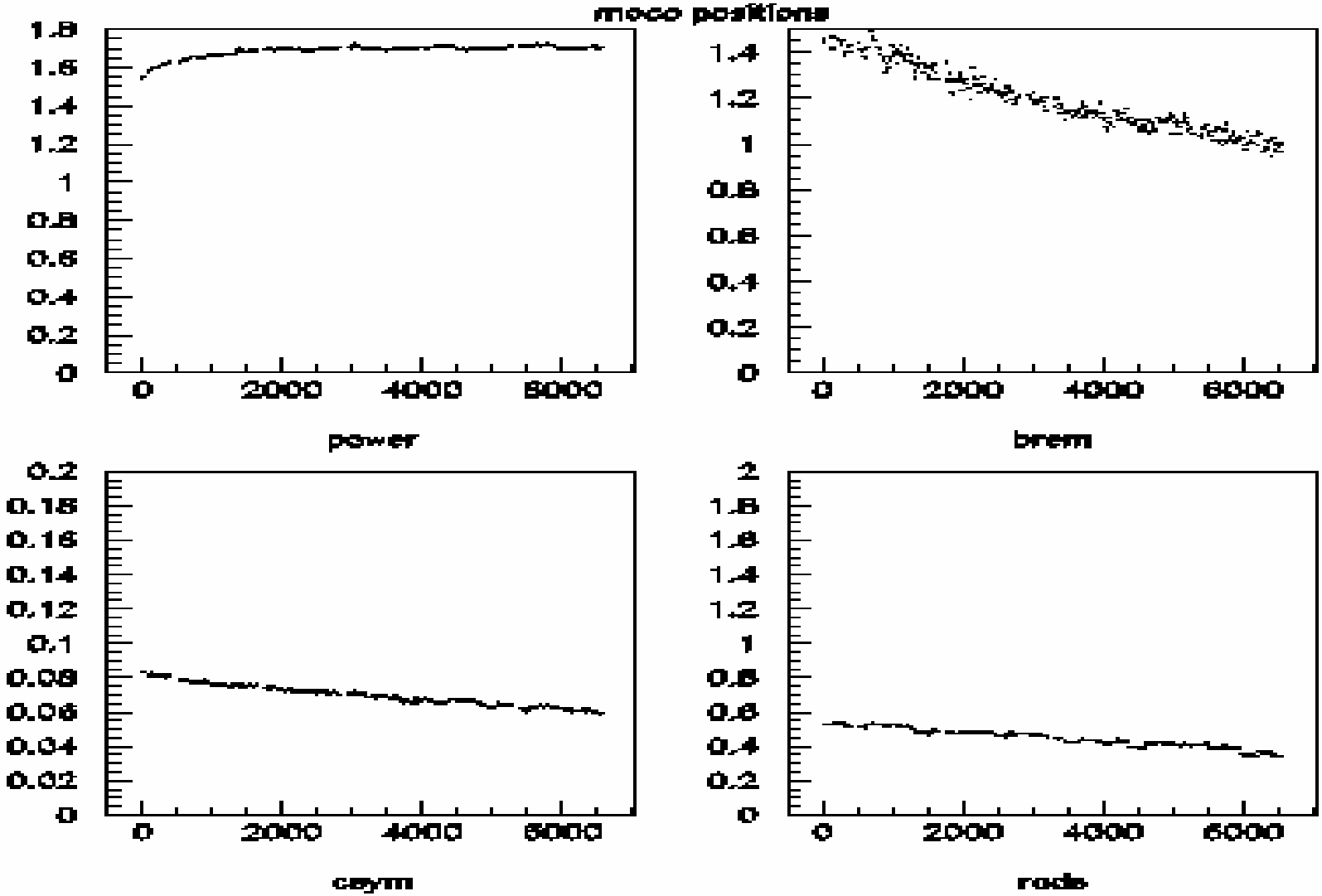

laser power
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0.432216
0.446574
0.444579
0.438754
0.42933
1.1
1.2
1.3
1.4
1.5
1.6
identification of positions

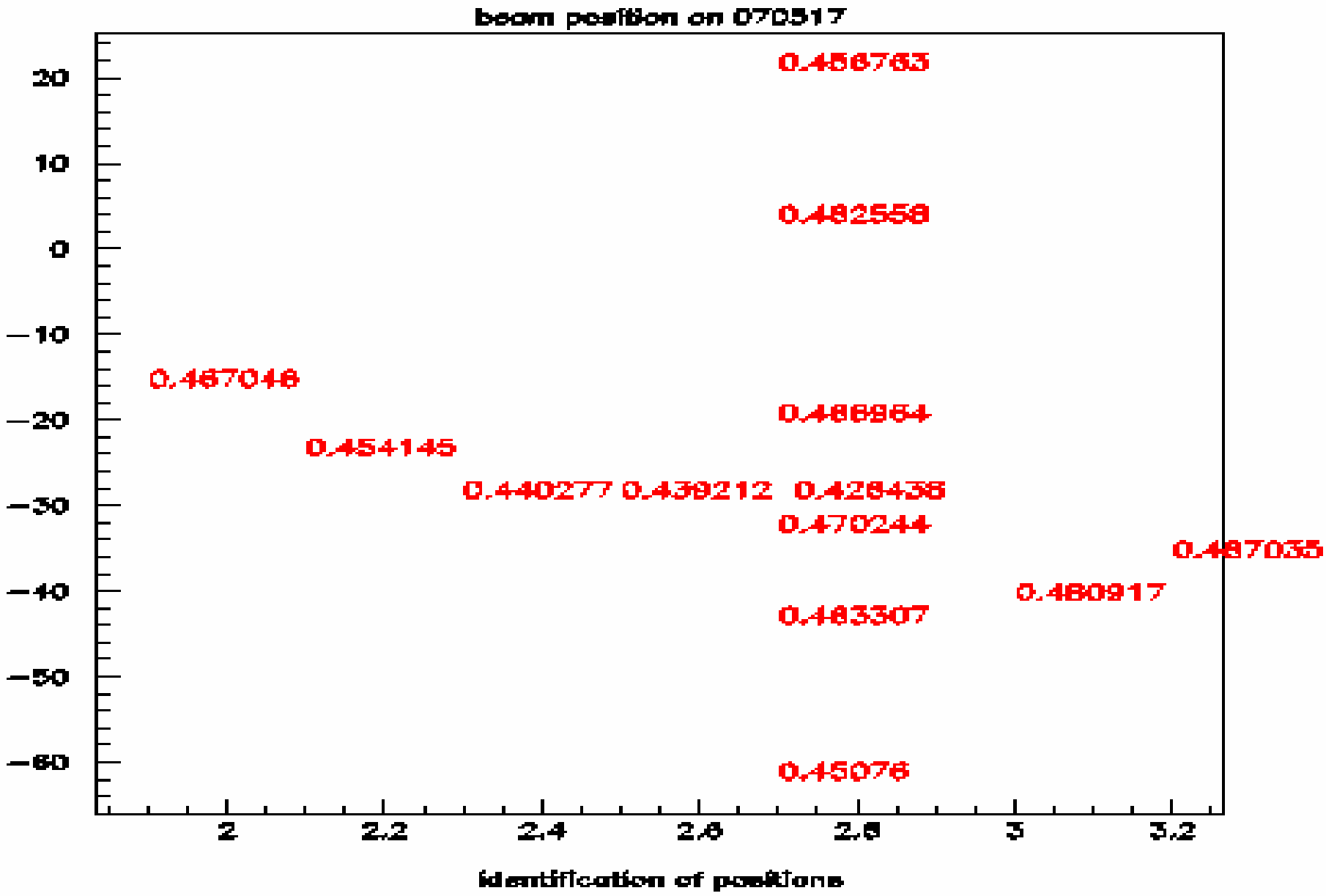

laser power
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0
1000
2000
3000
4000
5000
polar

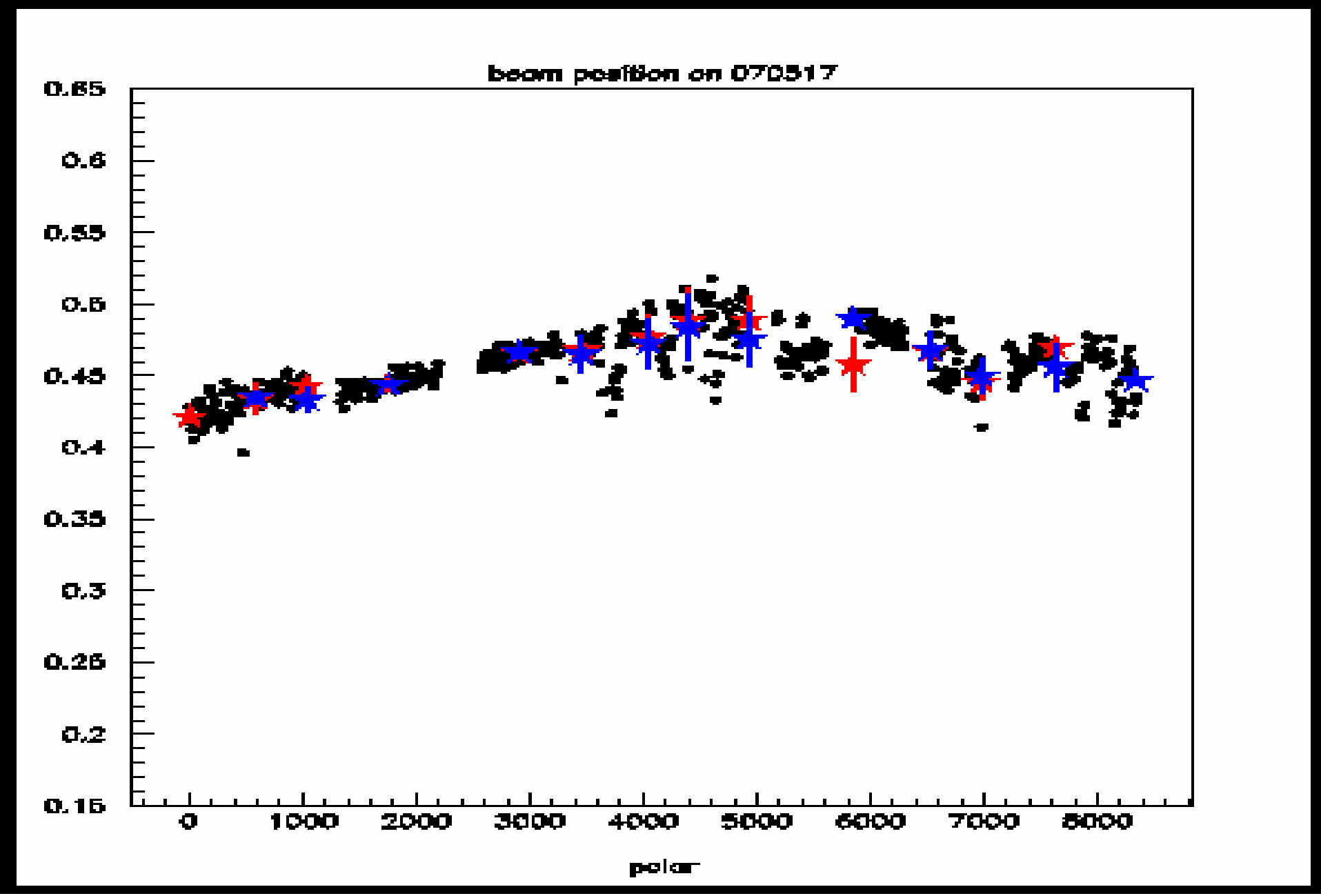

laser power
power
brem
ceym
rods

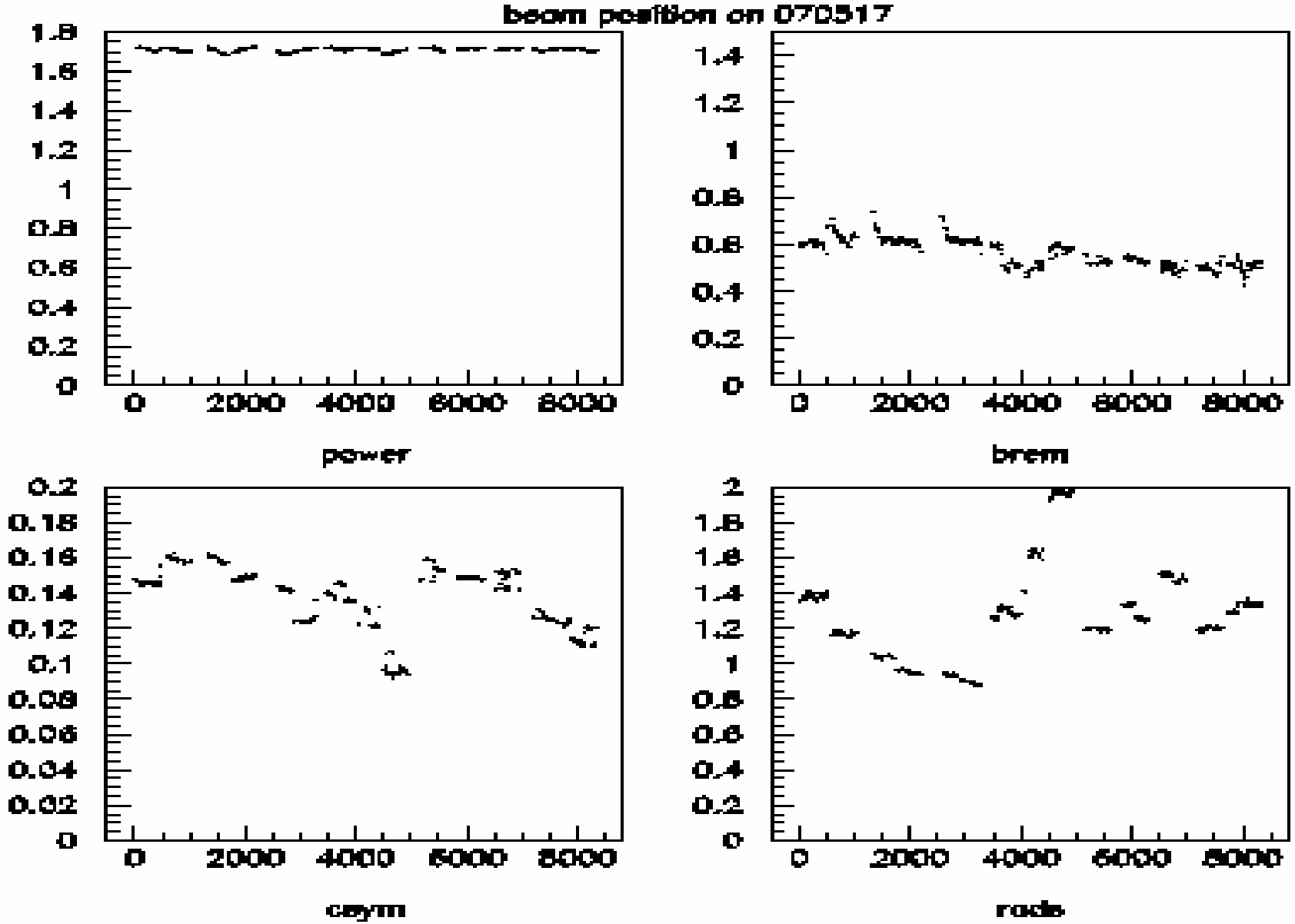

moco positions
0.499606
0.50744
0.502895
0.500106
0.501331
0.984
0.986
0.988
0.99
0.992
0.994
0.996
0.984
0.986
0.988
0.99
0.992
0.994
0.996
identification of positions

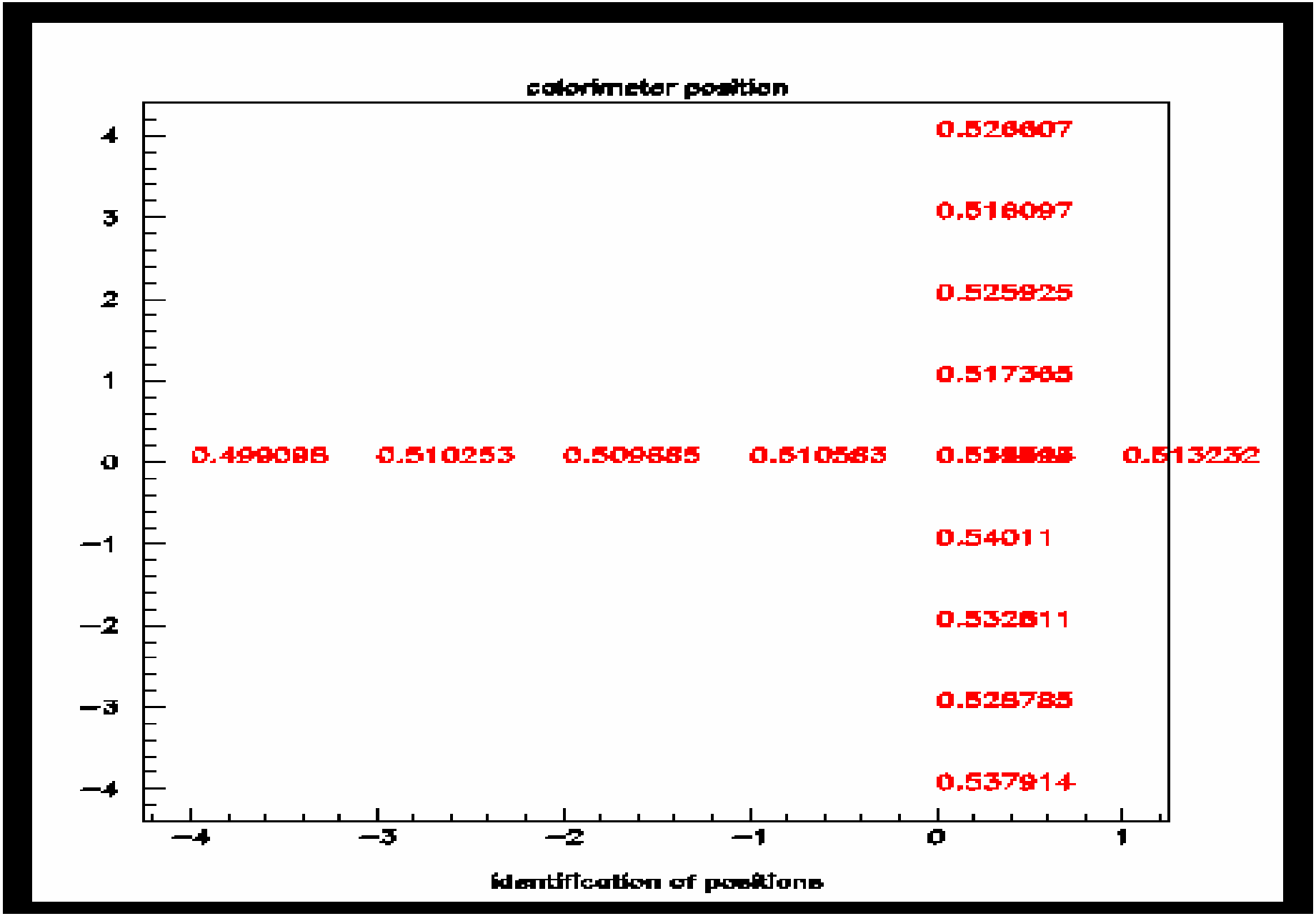

moco positions
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0
1000
2000
3000
4000
5000
6000
7000
polar

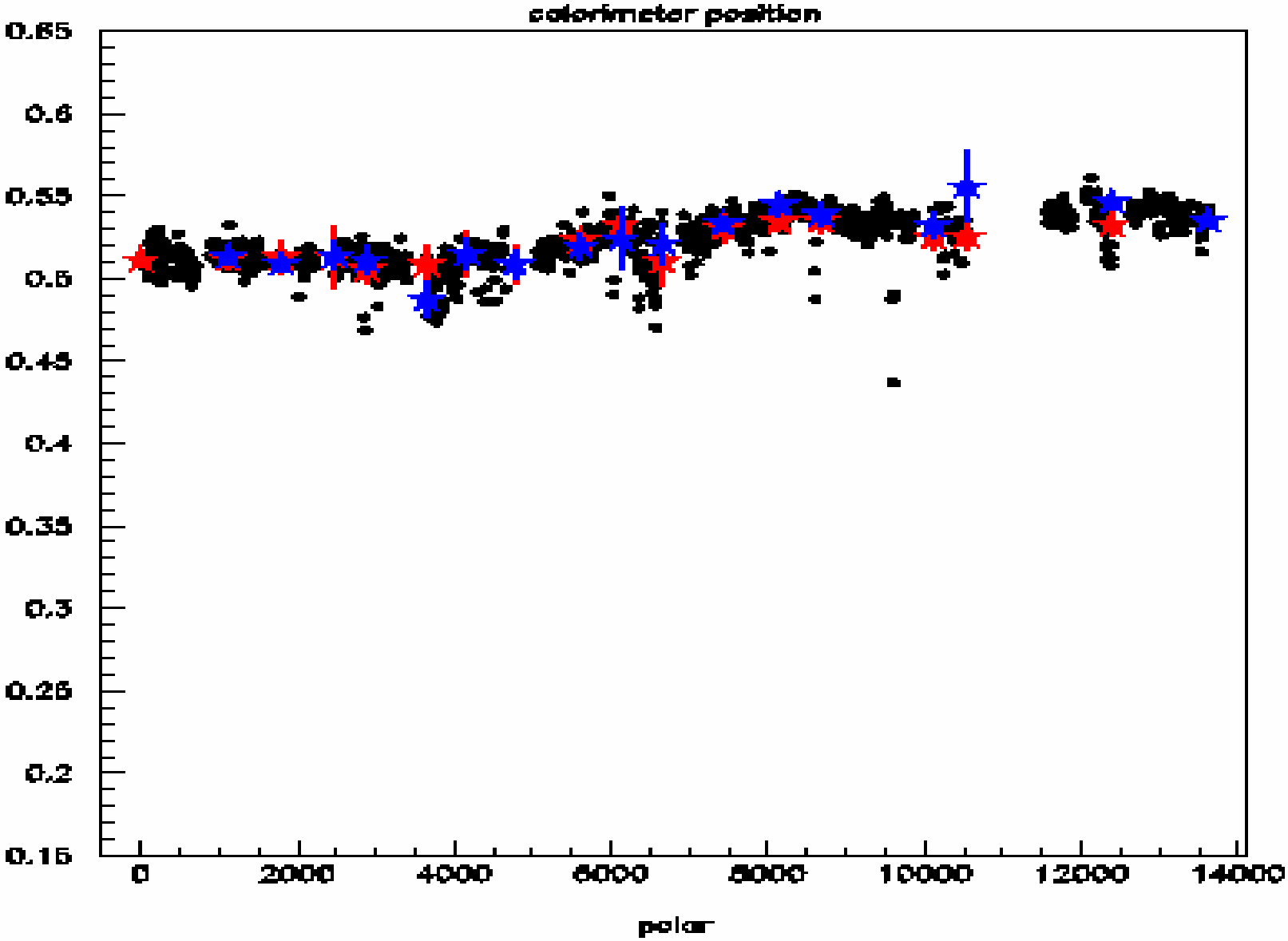

moco positions
power
brem
ceym
rods

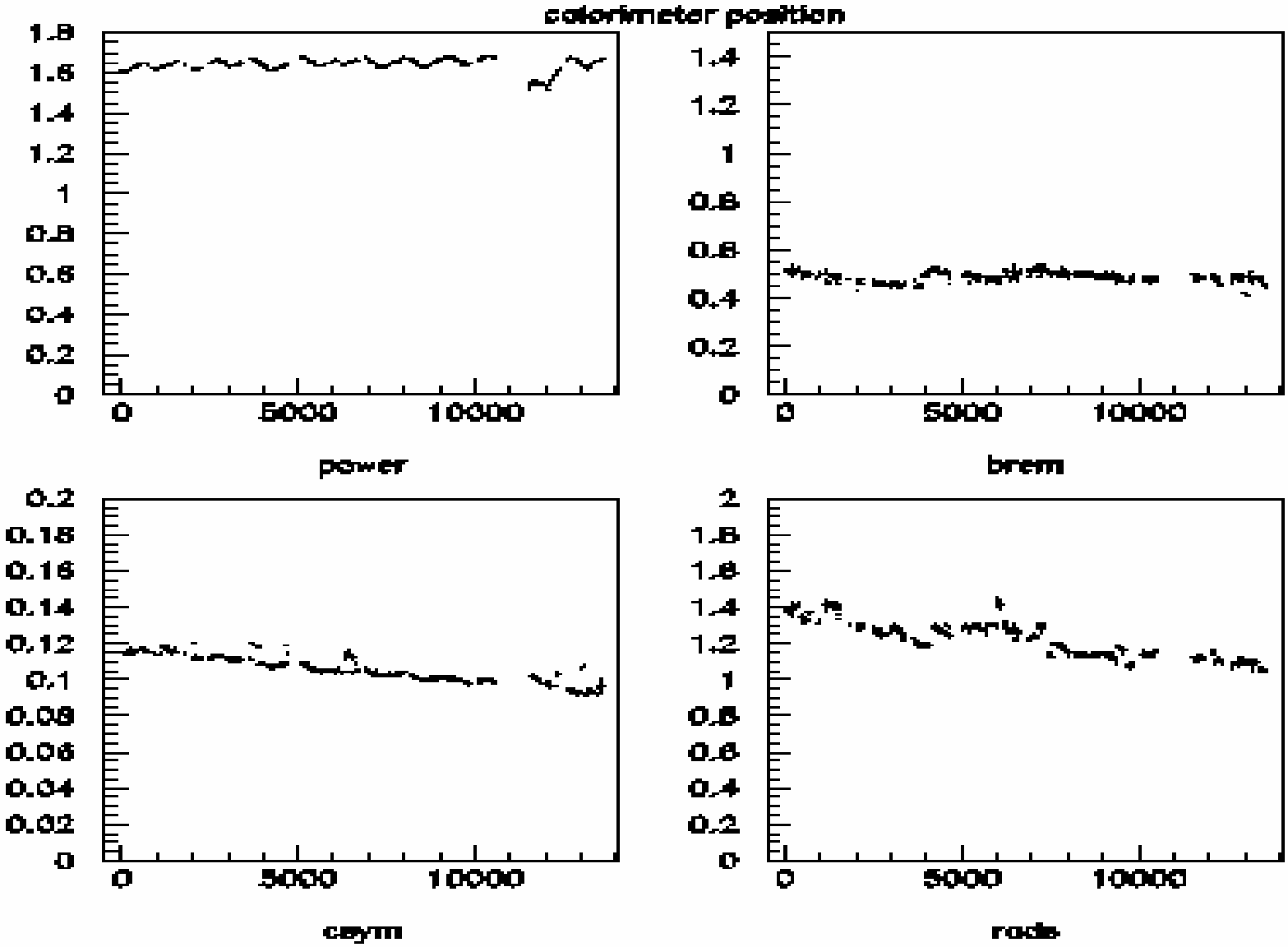

beam position on 070517
0.456763
0.492558
0.467048
0.486964
0.454145
0.440277
0.439212
0.428436
0.470244
0.487035
0.480917
0.483307
0.45076
20
10
0
−10
−20
−30
−40
−50
−60
2
2.2
2.4
2.6
2.8
3
3.2
identification of positions

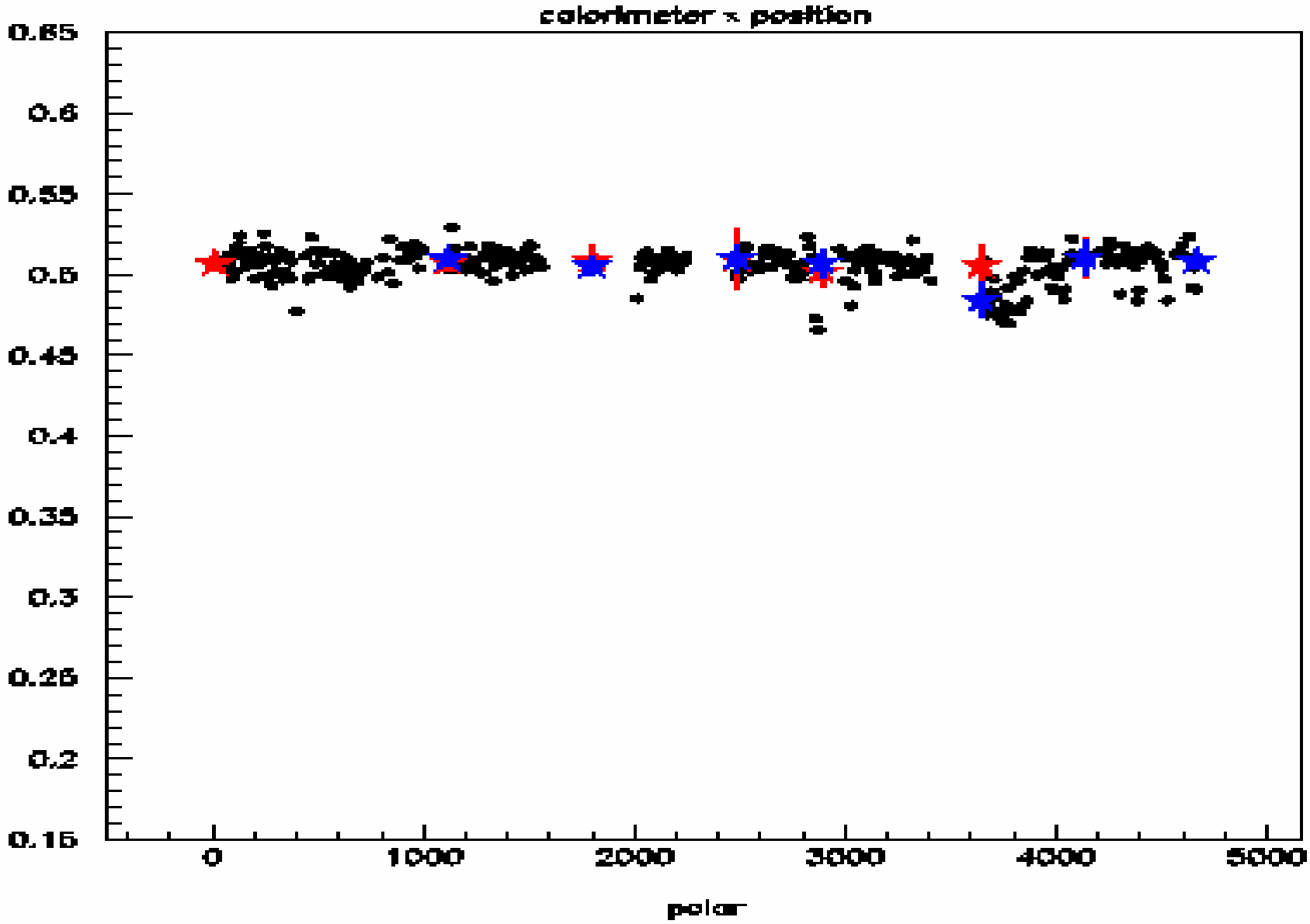

beam position on 070517
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0
1000
2000
3000
4000
5000
6000
7000
8000
polar

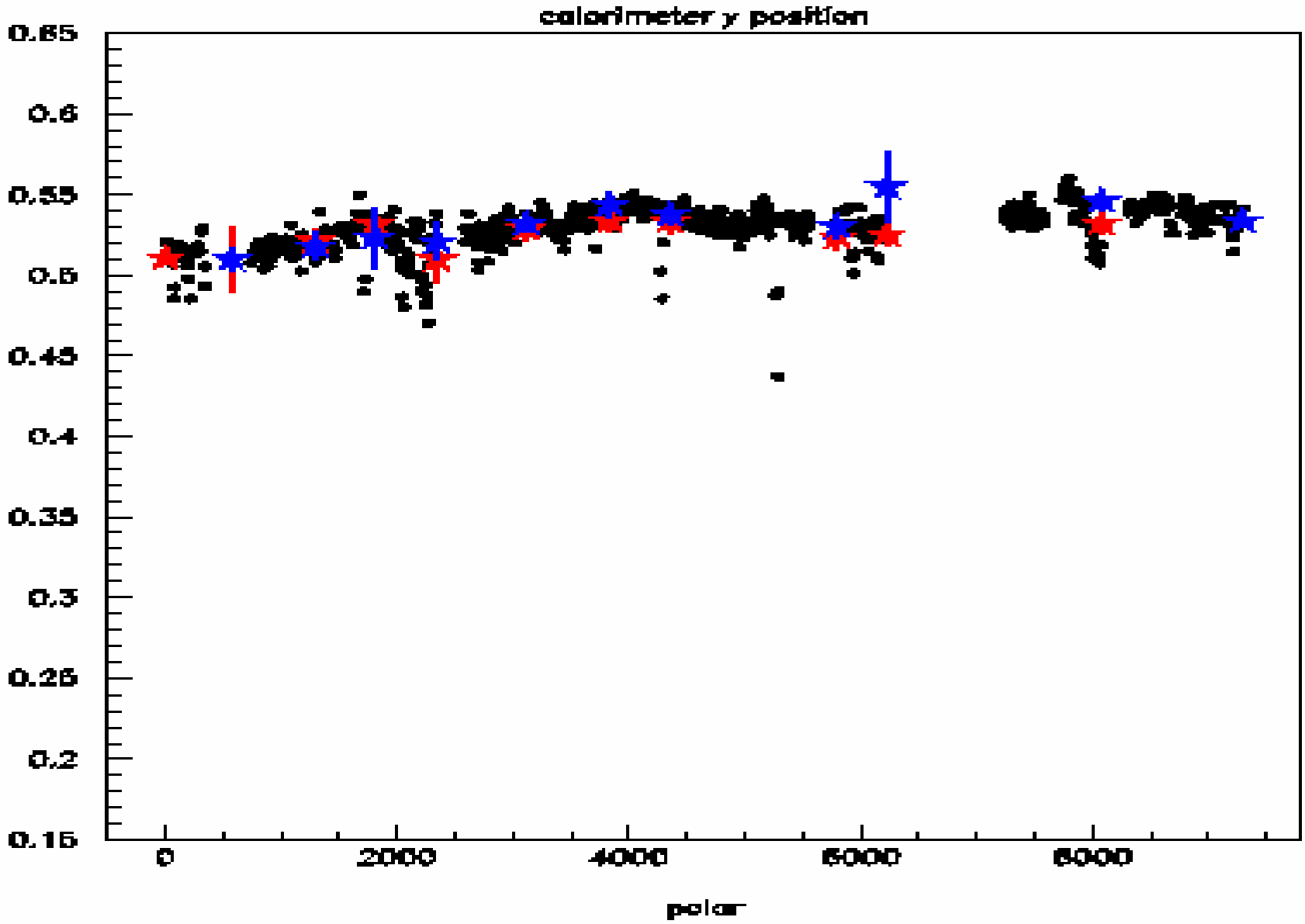

beam position on 070517
power
brem
ceym
rocb

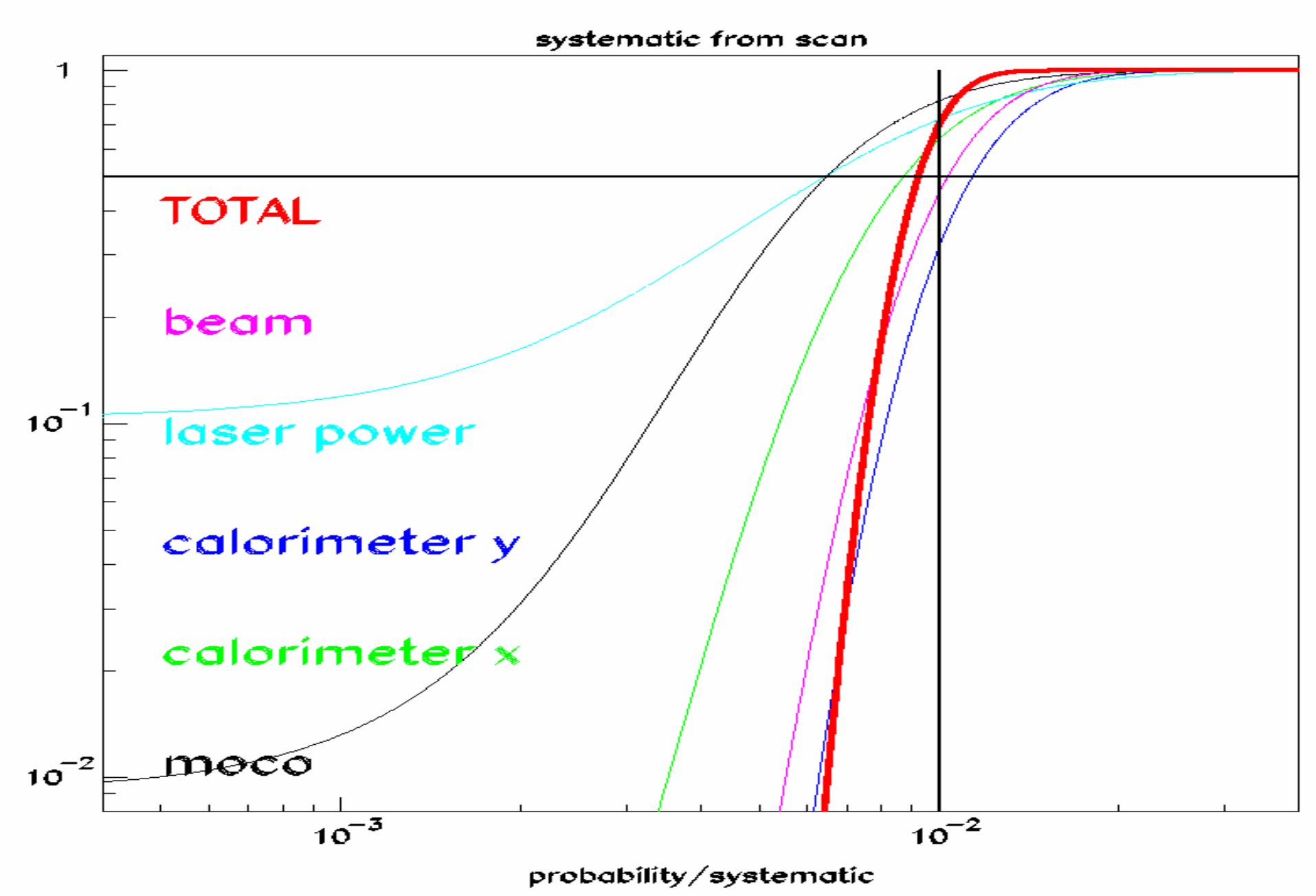

colorimeter position
0.526607
0.516097
0.525825
0.517365
0.499096
0.510253
0.509685
0.510563
0.513232
0.54011
0.532611
0.528785
0.537914
4
3
2
1
0
−1
−2
−3
−4
−4
−3
−2
−1
0
1
identification of positions


calorimeter position
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0
2000
4000
6000
8000
10000
12000
14000
polar


calorimeter position
power
brem
ceym
rade


calorimeter x position
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0
1000
2000
3000
4000
5000
polar


calorimeter y position
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0
2000
4000
6000
8000
polar


systematic from scan
1
10^{-1}
10^{-2}
TOTAL
beam
laser power
calorimeter y
calorimeter x
meco
10^{-3}
10^{-2}
probability/systematic

systematics at prob(50%)

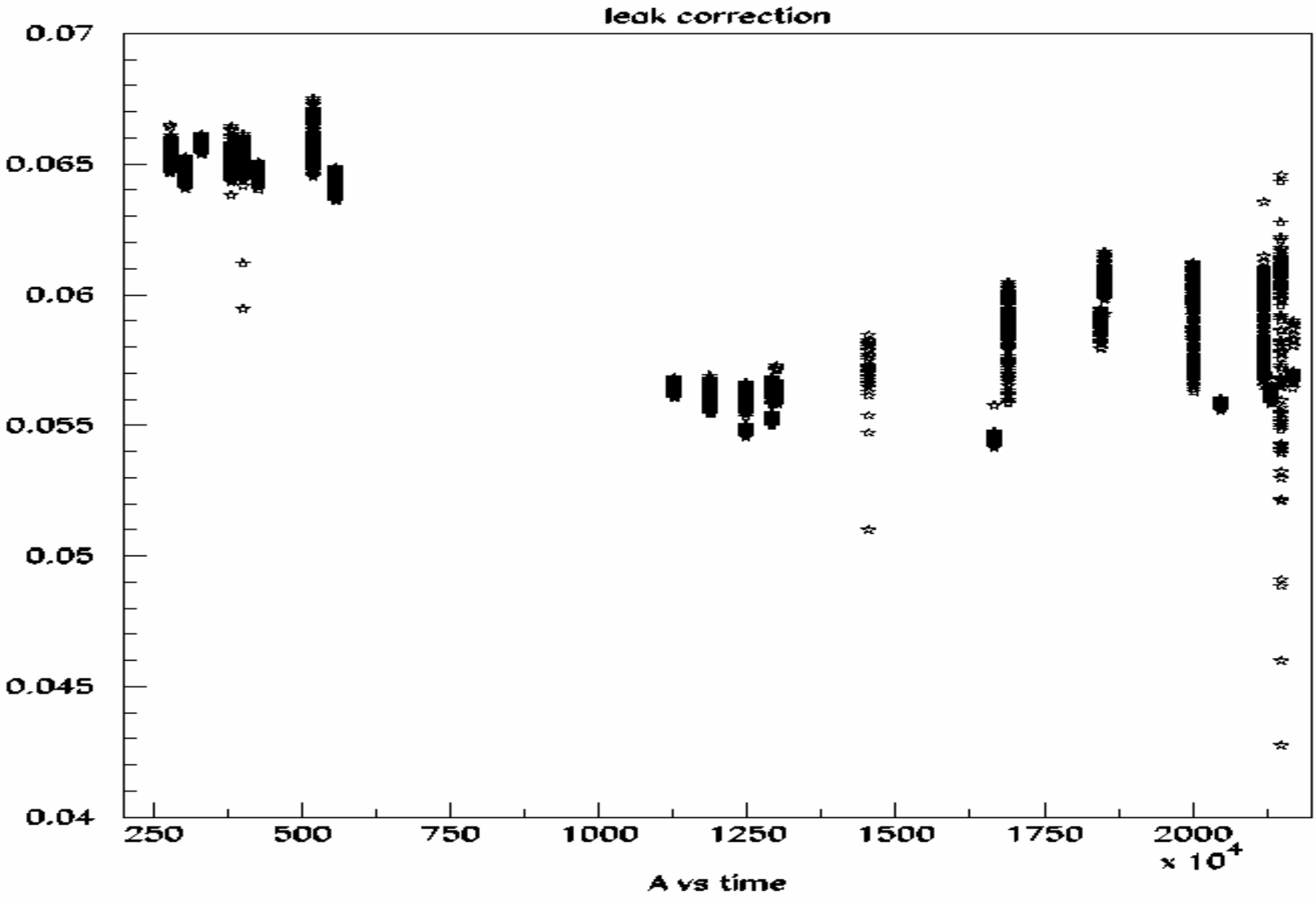
moco positions	lines: 5	syst: 0.0065
calorimeter x position	lines: 6	syst: 0.00873
calorimeter y position	lines: 10	syst: 0.01137
laser power	lines: 4	syst: 0.00644
beam position	lines: 12	syst: 0.01035

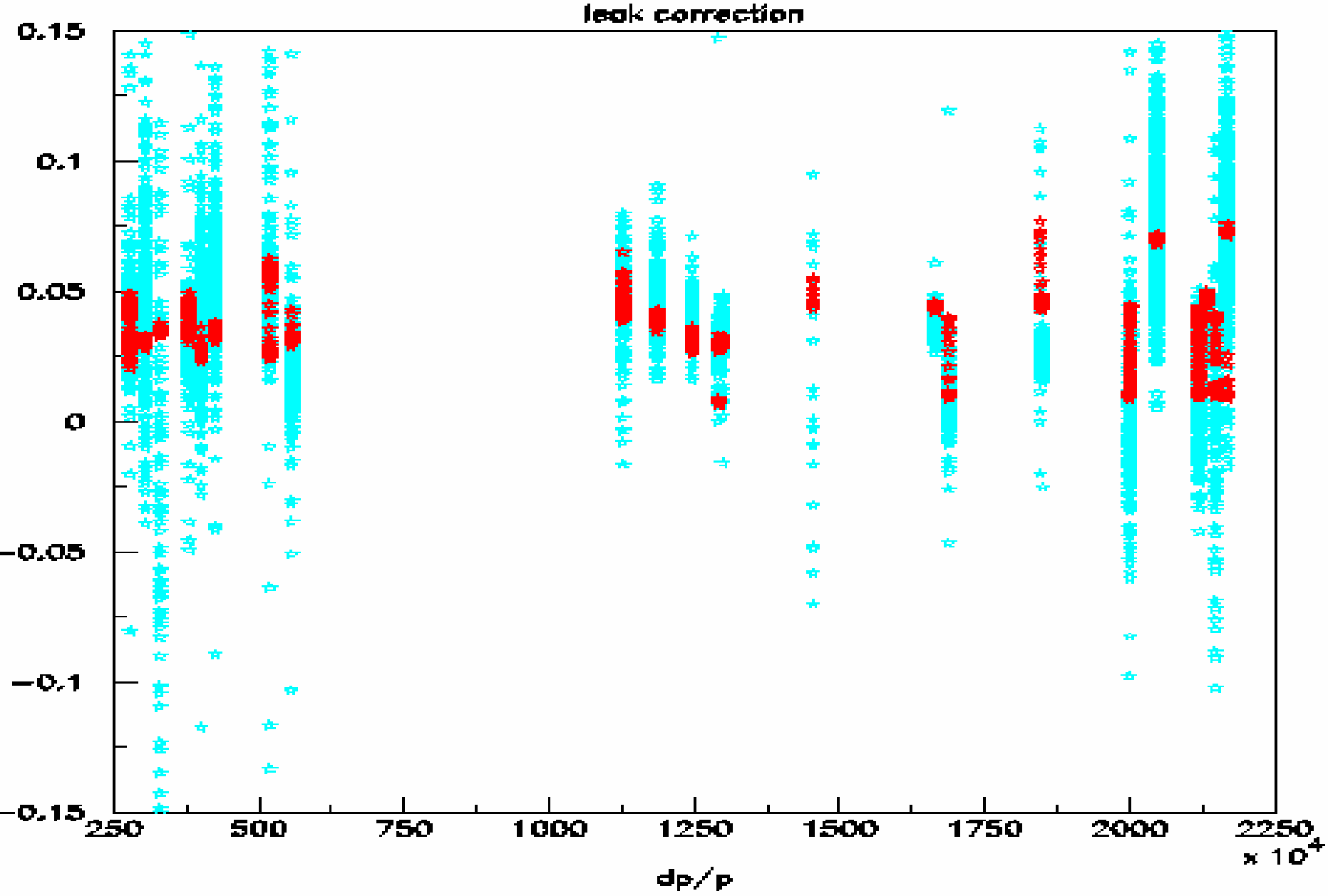
TOTAL syst: 0.00922

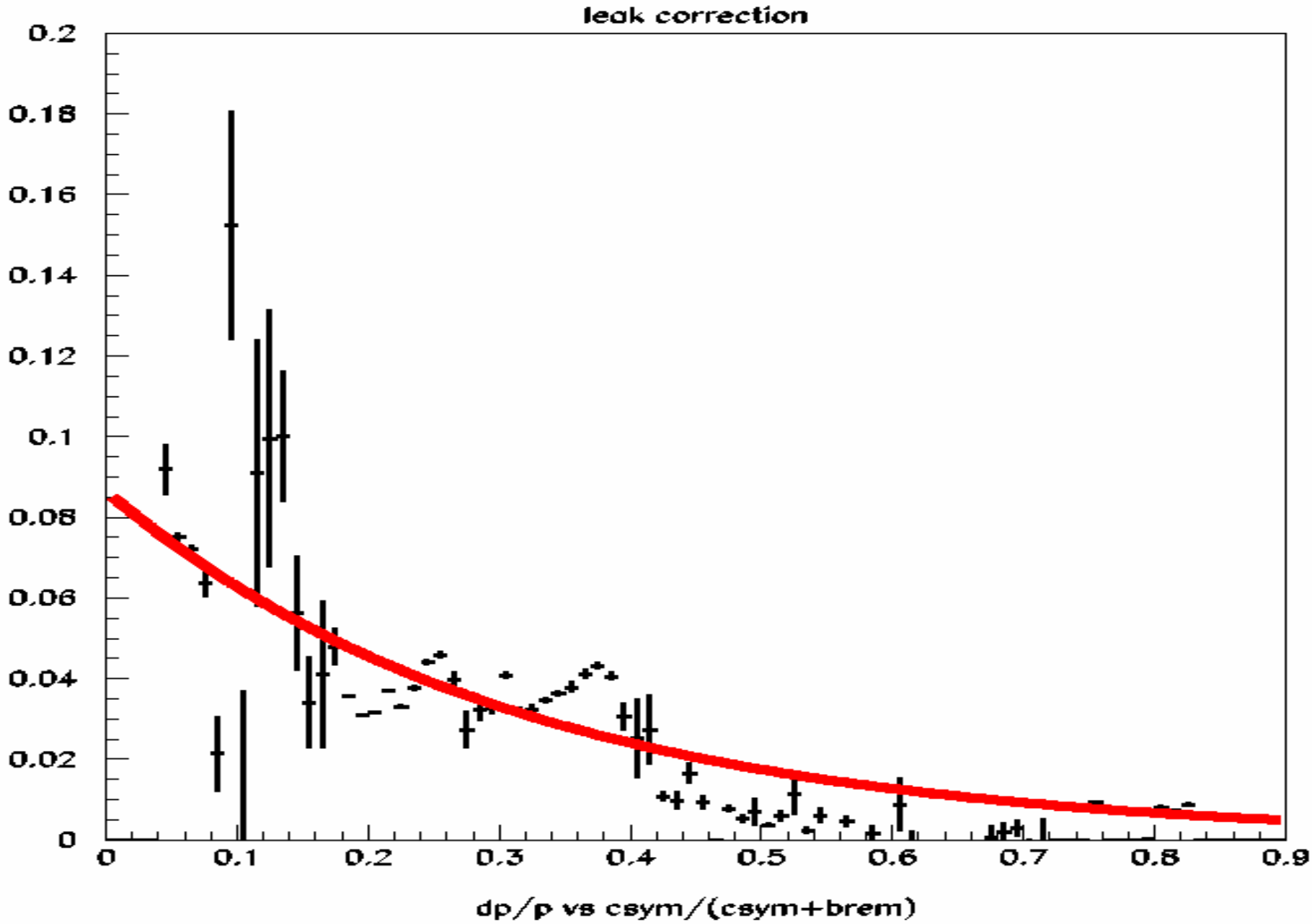
Leak effect study

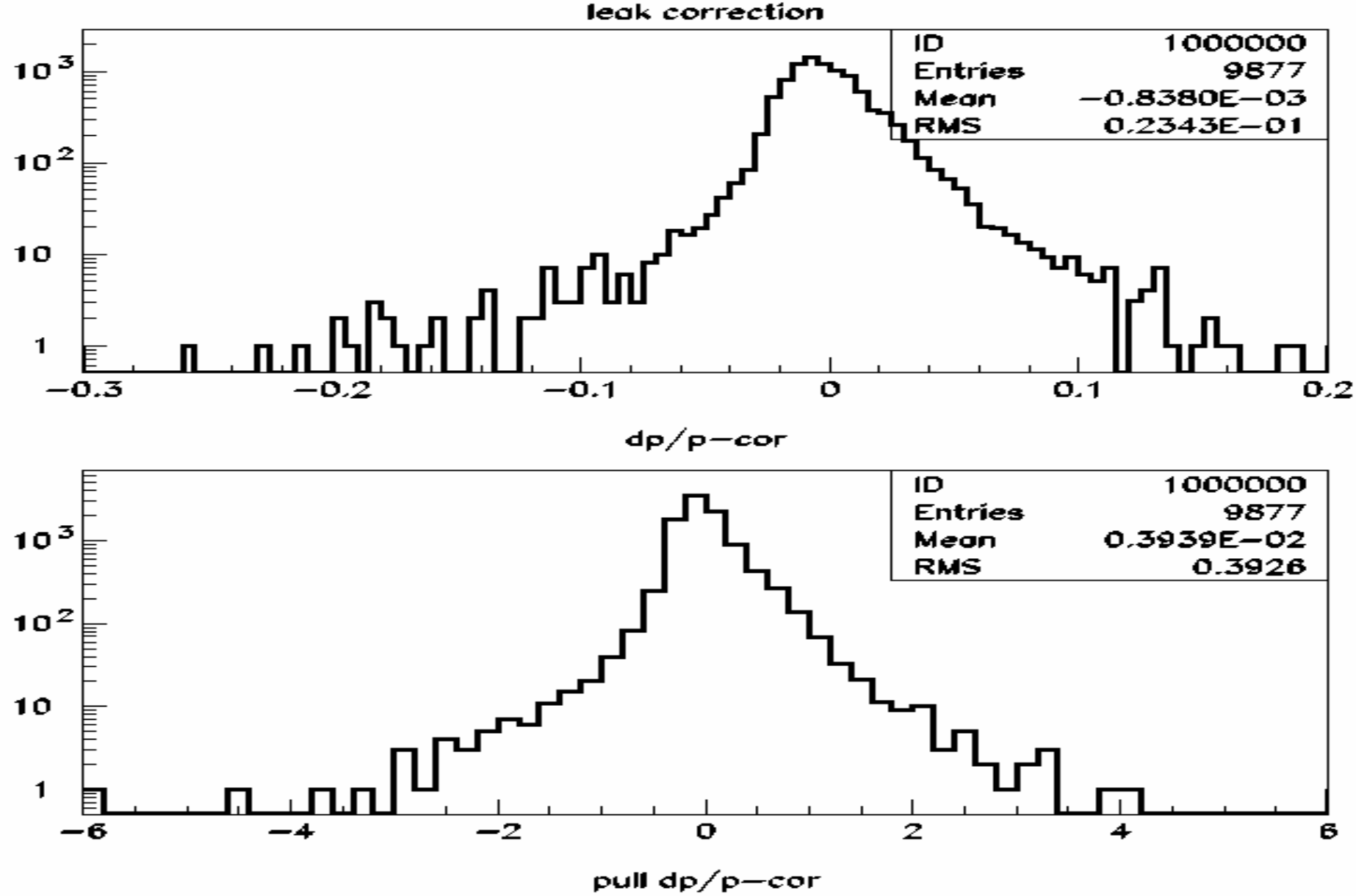
- According to the leak model, Energy measured by the adc systemis E_b - A*E_{b-1} . Theoretical hisograms are modified sequentially according to that formula starting from the previous=16 bunch 1.

- To estimate A_{best} LPOLARGATE is run with three diffferent values of A : 0.050 0.055 and 0.060
- For each pola and wlik are summed for each doublet
- Parabola adjustement give the best A and the best pola
- Comparaison with non A pola gives the correction


leak correction
0.07
0.065
0.06
0.055
0.05
0.045
0.04
250
500
750
1000
1250
1500
1750
2000
x 10^4
A vs time


leak correction
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
250
500
750
1000
1250
1500
1750
2000
2250
x 10^4
dp/p


leak correction
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
dp/p vs csym/(csym+brem)

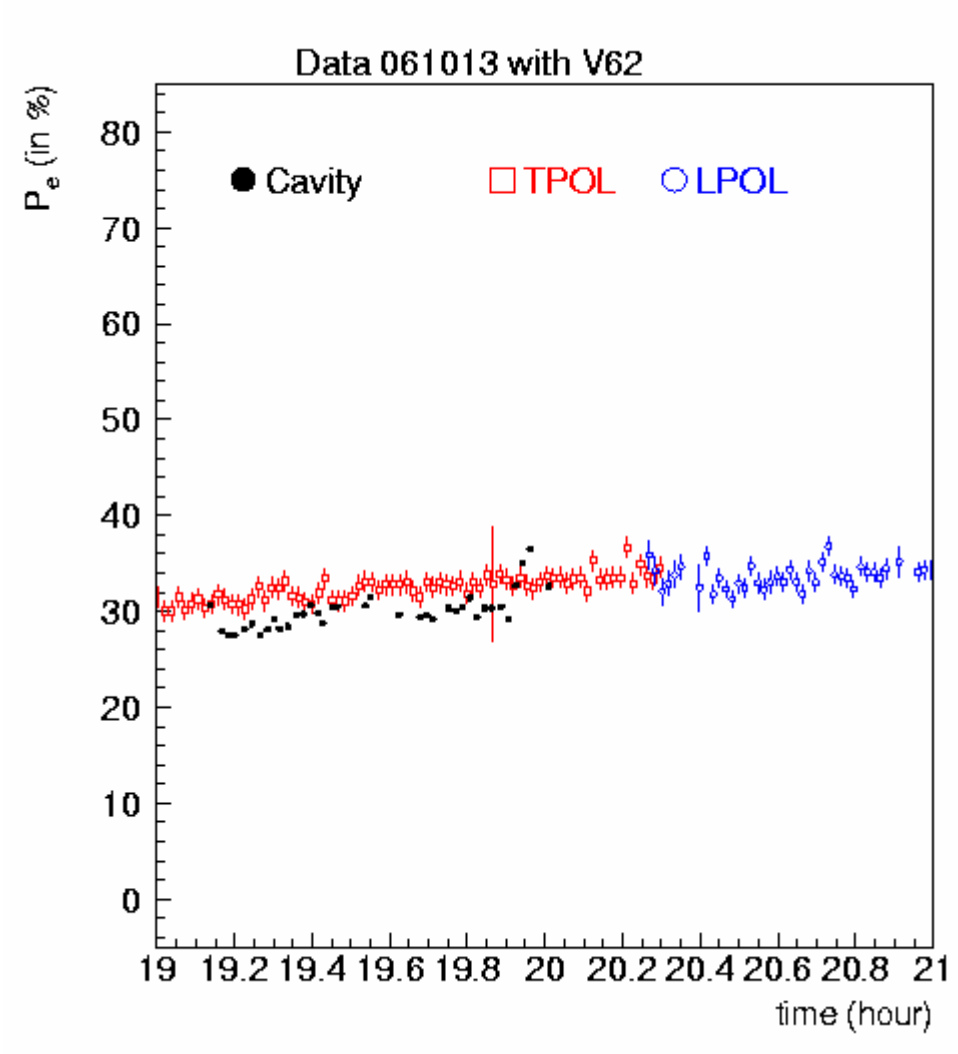

leak correction
ID 1000000
Entries 9877
Mean −0.8380E−03
RMS 0.2343E−01
10³
10²
10
1
−0.3
−0.2
−0.1
0
0.1
0.2
dp/p−cor
ID 1000000
Entries 9877
Mean 0.3939E−02
RMS 0.3926
10³
10²
10
1
−6
−4
−2
0
2
4
6
pull dp/p−cor

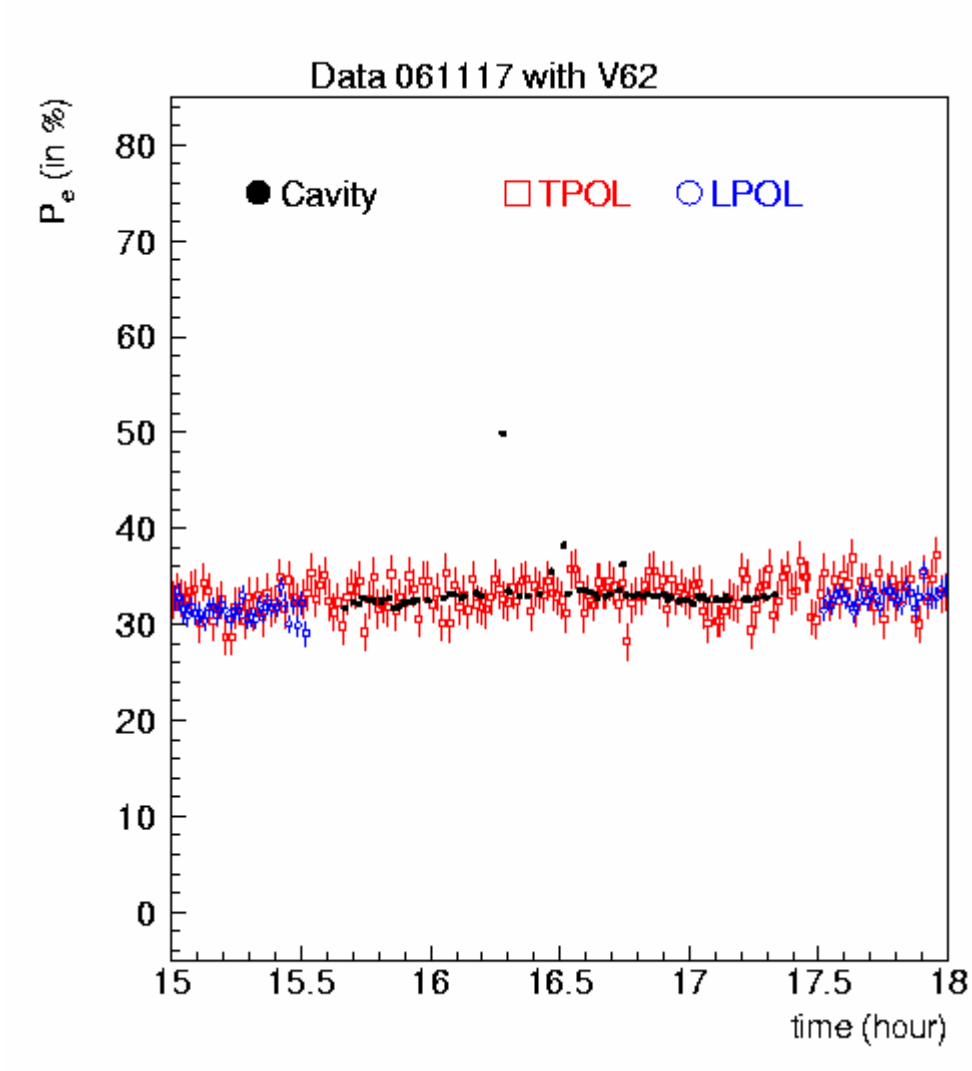
Statistical uncertainties

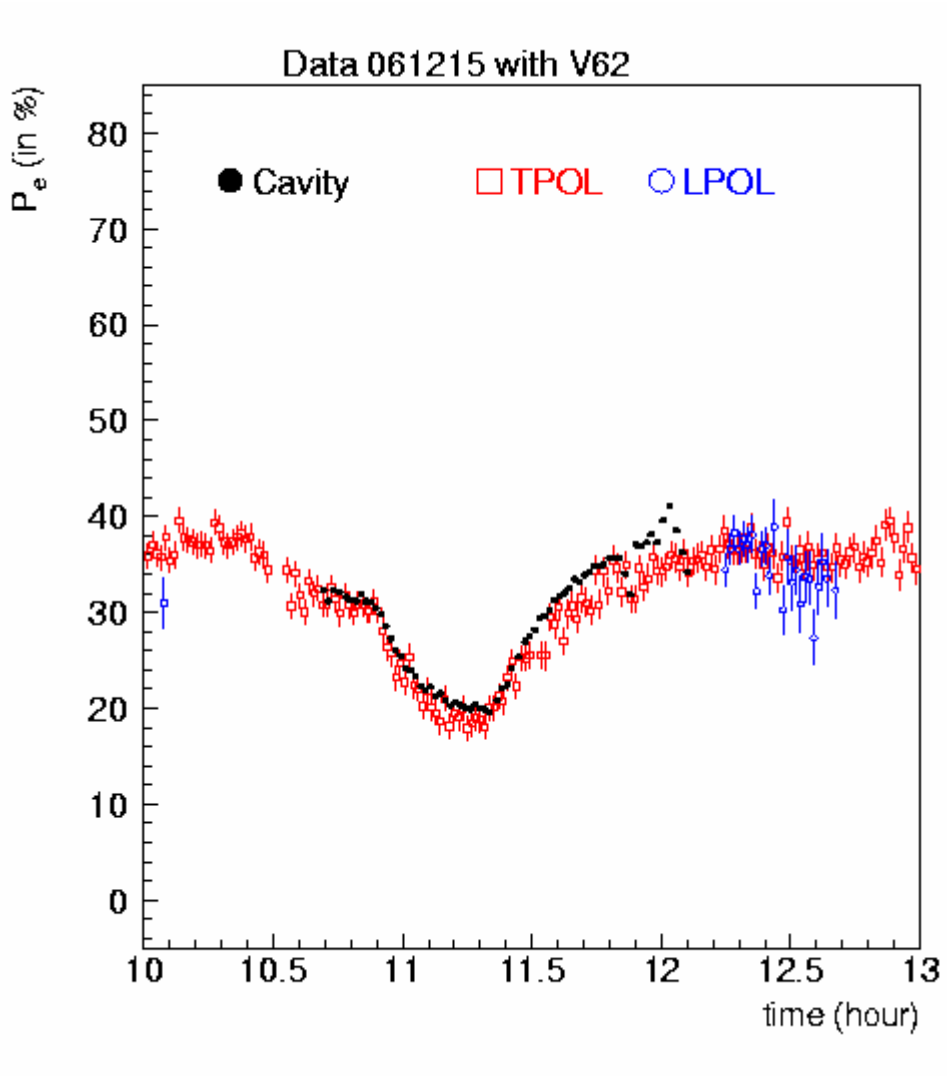
- Pola error per bunch and for 10s : 3%
- From detector parameters (*) : 0.5 % (fully bunches and doublet correlated during 6mn)

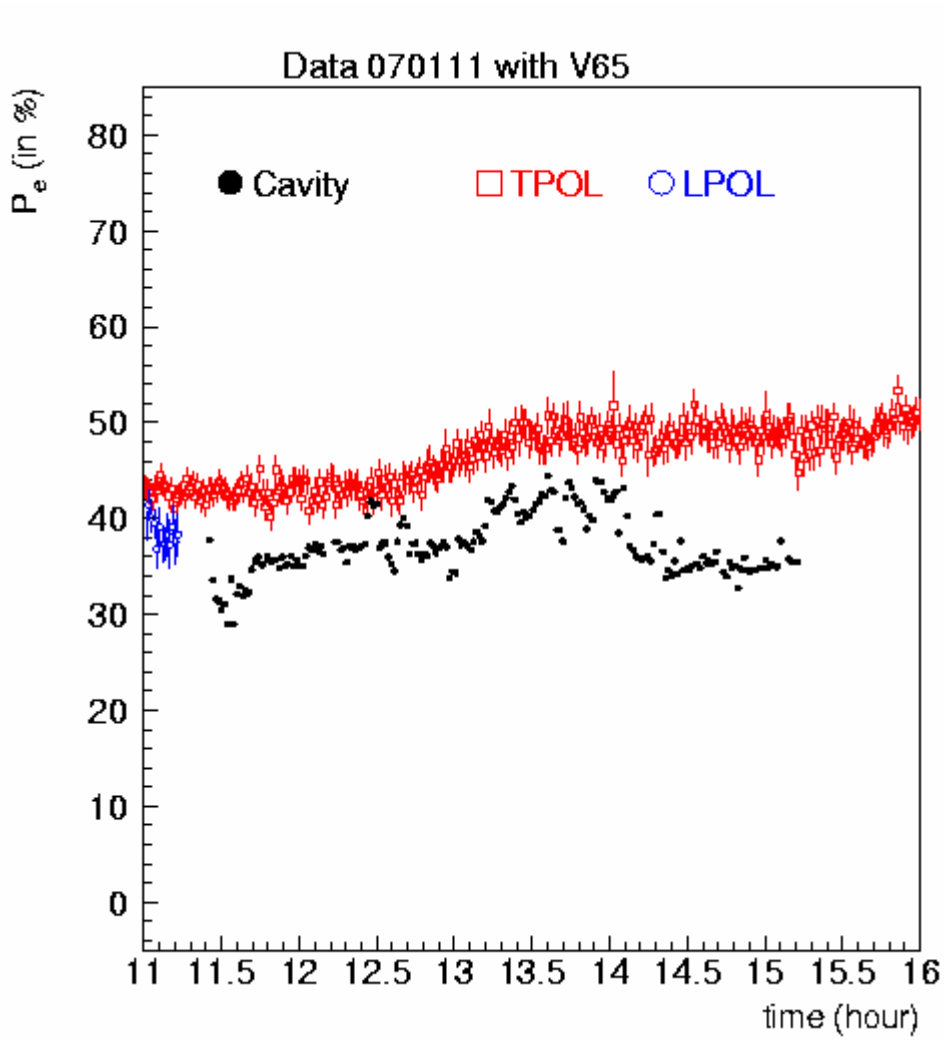
Systematic uncertainties

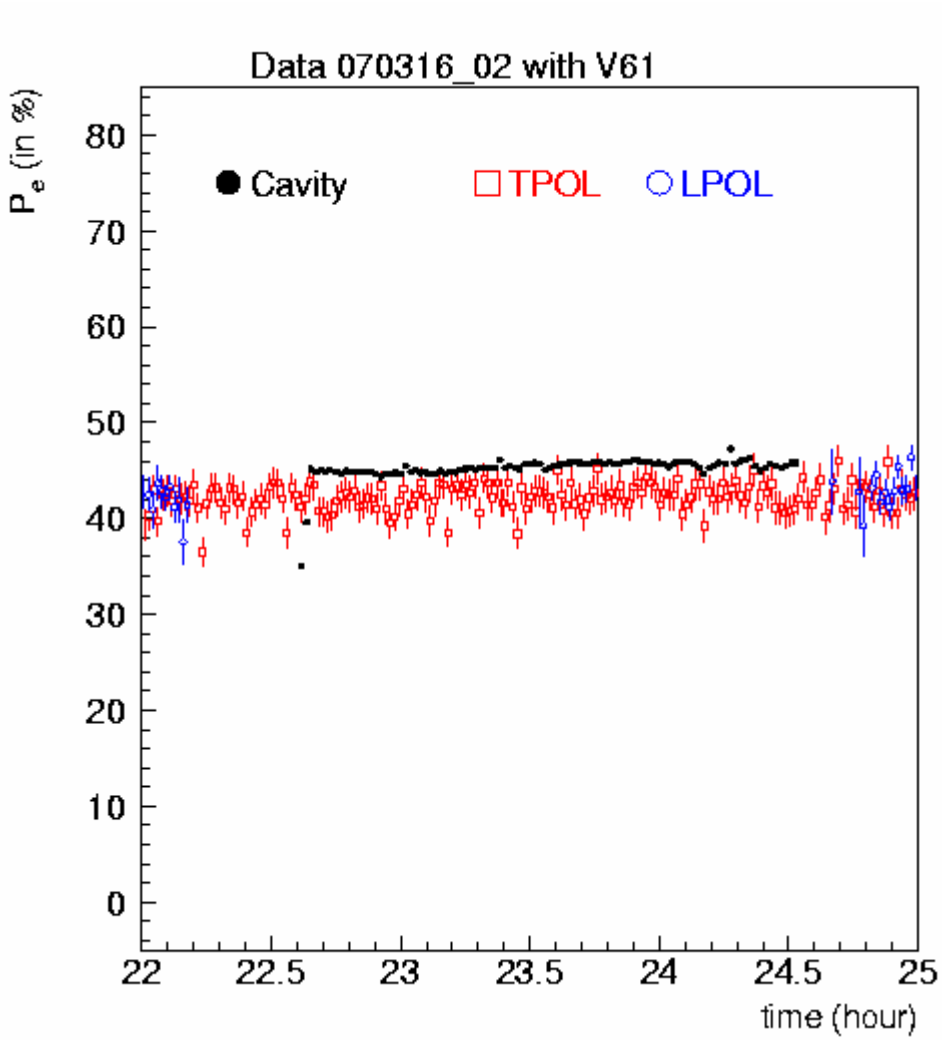
- From Hera : 0.70%
- From Laser : 0.75%
- From detector: 0.10%
- ----------
- Total 1. %

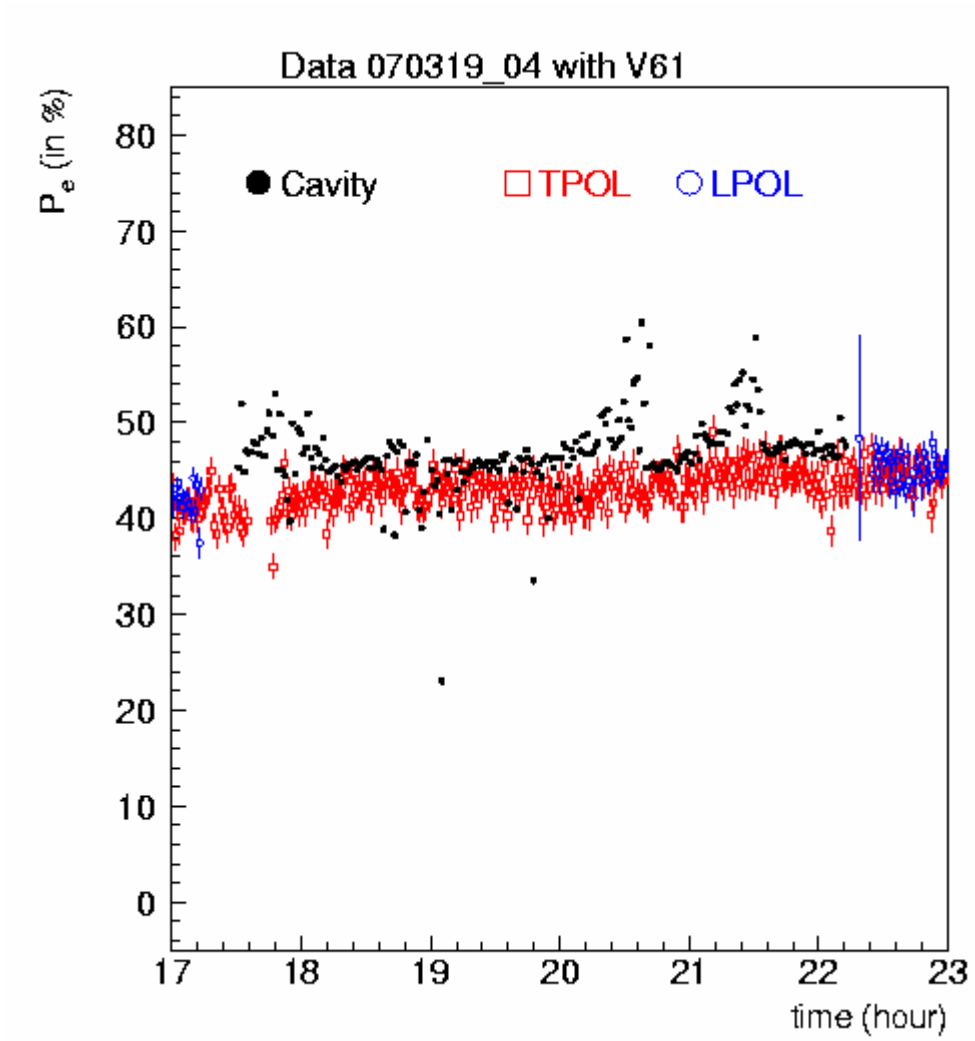

Data 061013 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
19
19.2
19.4
19.6
19.8
20
20.2
20.4
20.6
20.8
21
time (hour)

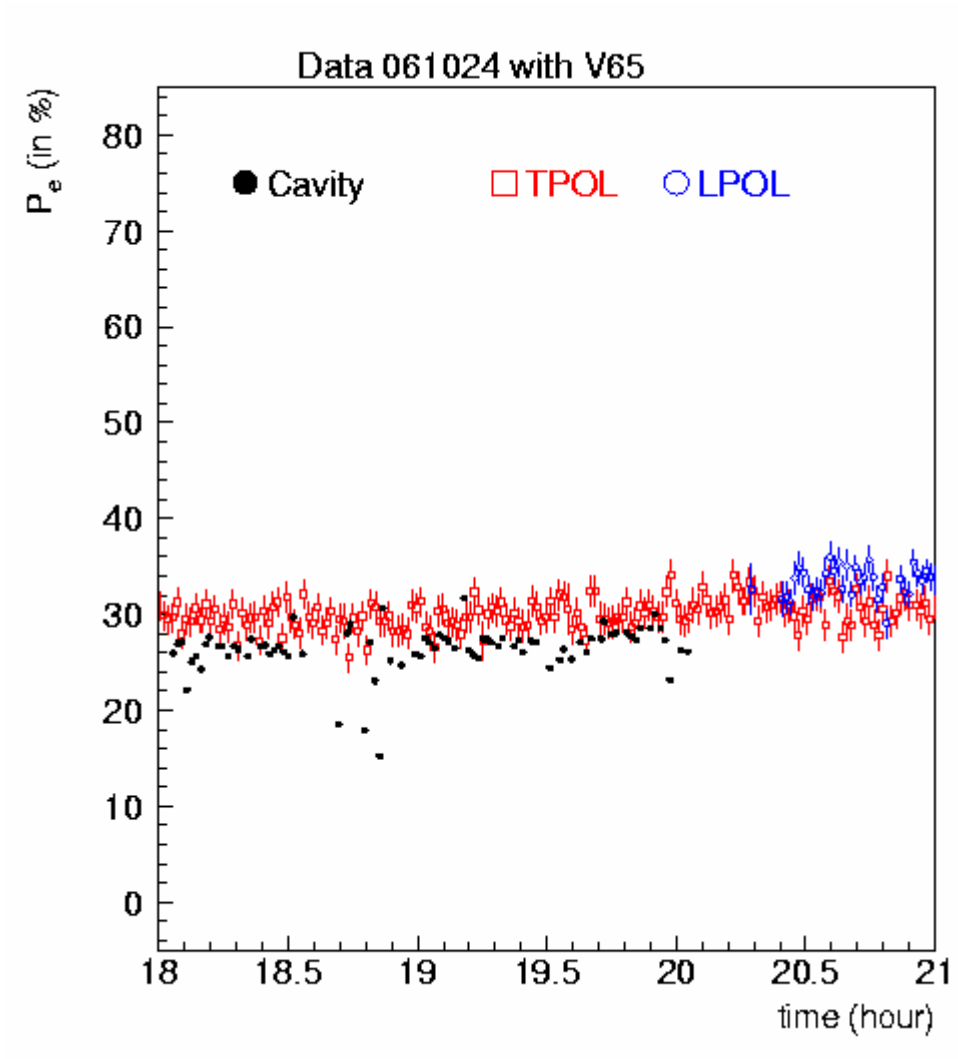

Data 061117 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
15
15.5
16
16.5
17
17.5
18
time (hour)


Data 061215 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
10
10.5
11
11.5
12
12.5
13
time (hour)

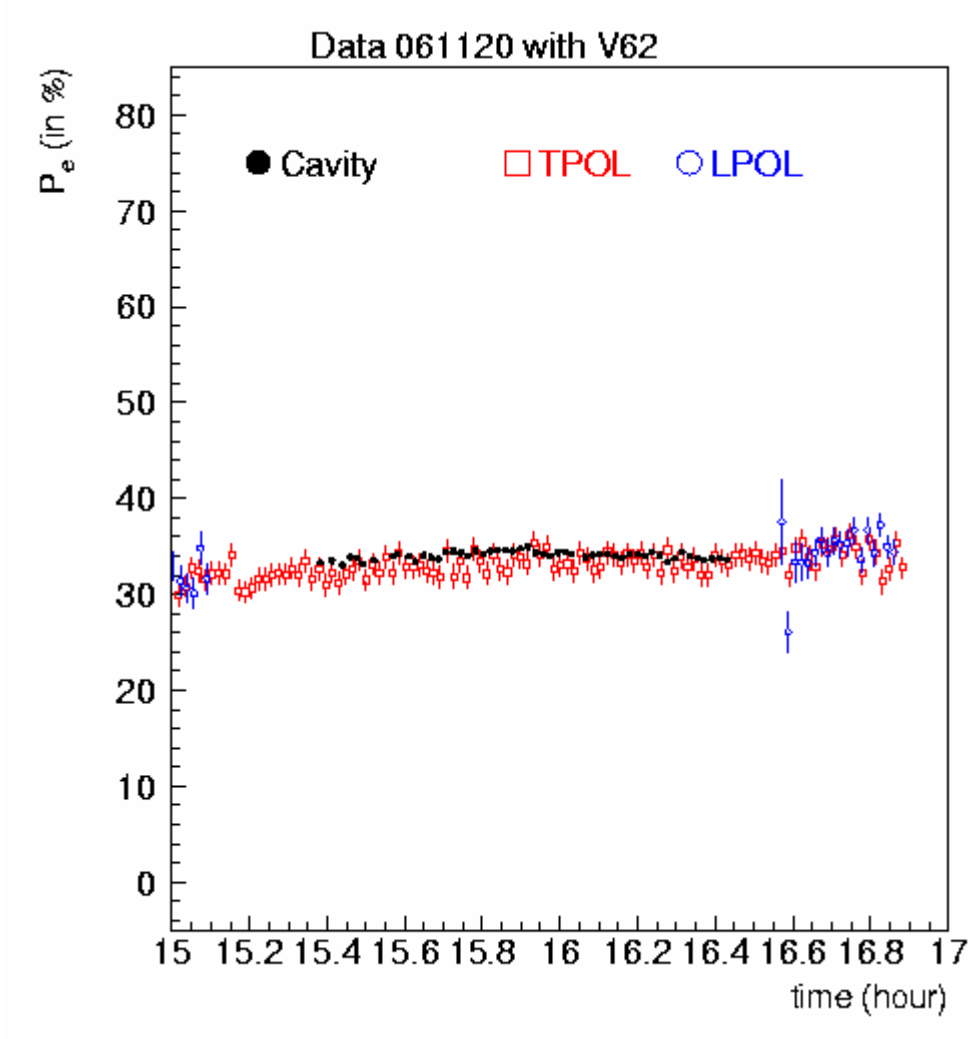

Data 070111 with V65
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
11
11.5
12
12.5
13
13.5
14
14.5
15
15.5
16
time (hour)

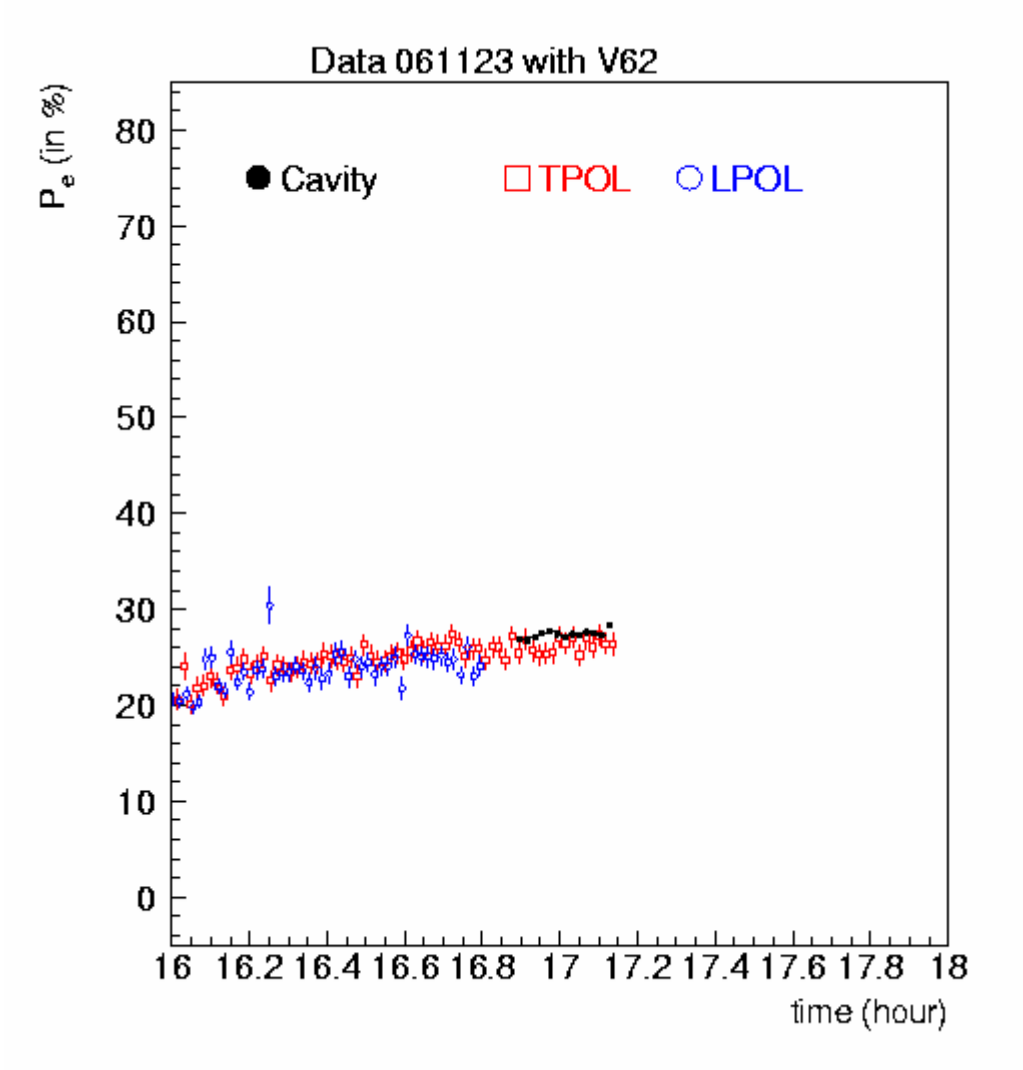

Data 070316_02 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
22
22.5
23
23.5
24
24.5
25
time (hour)

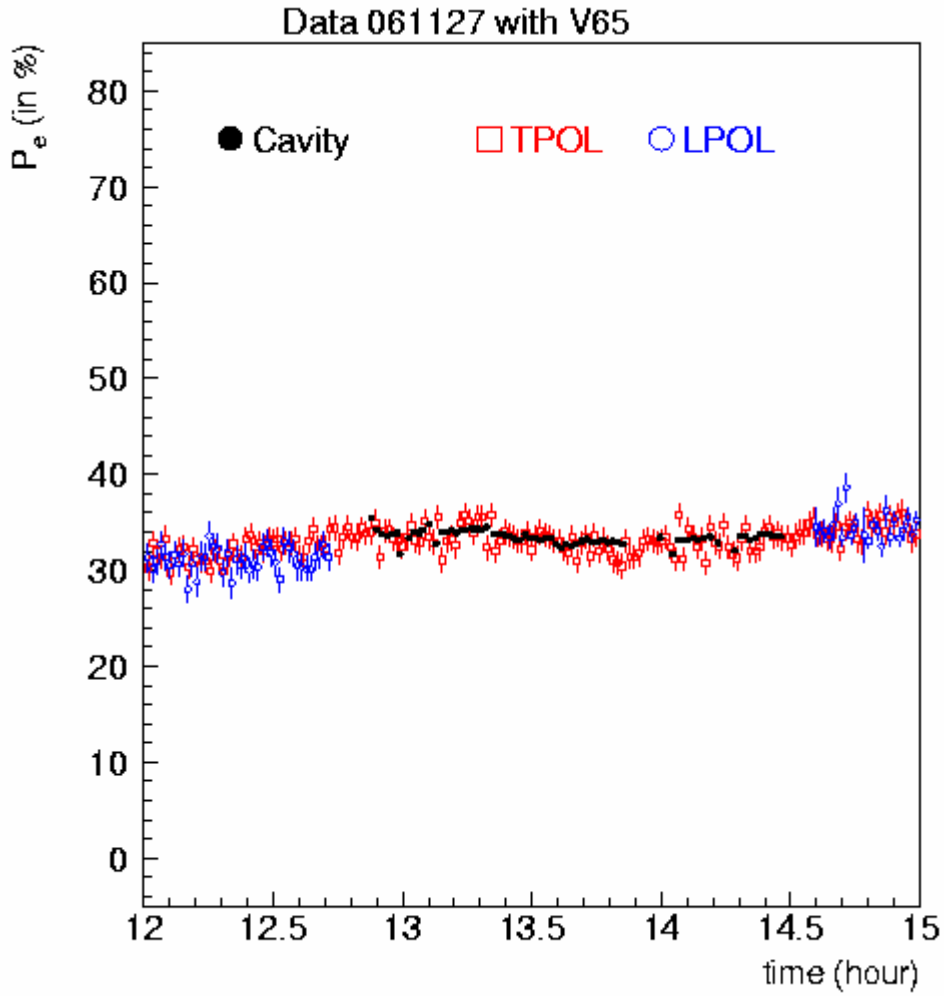

Data 070319_04 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
17
18
19
20
21
22
23
time (hour)

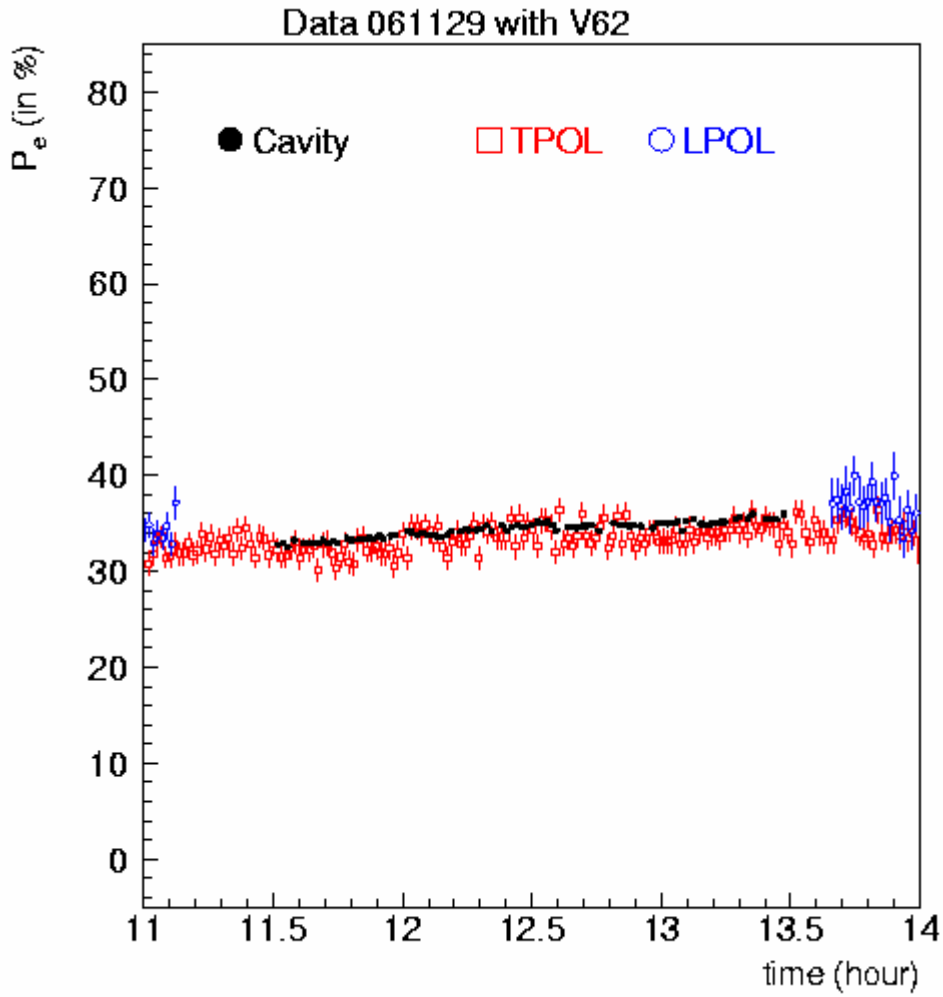

Data 061024 with V65
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
18
18.5
19
19.5
20
20.5
21
time (hour)

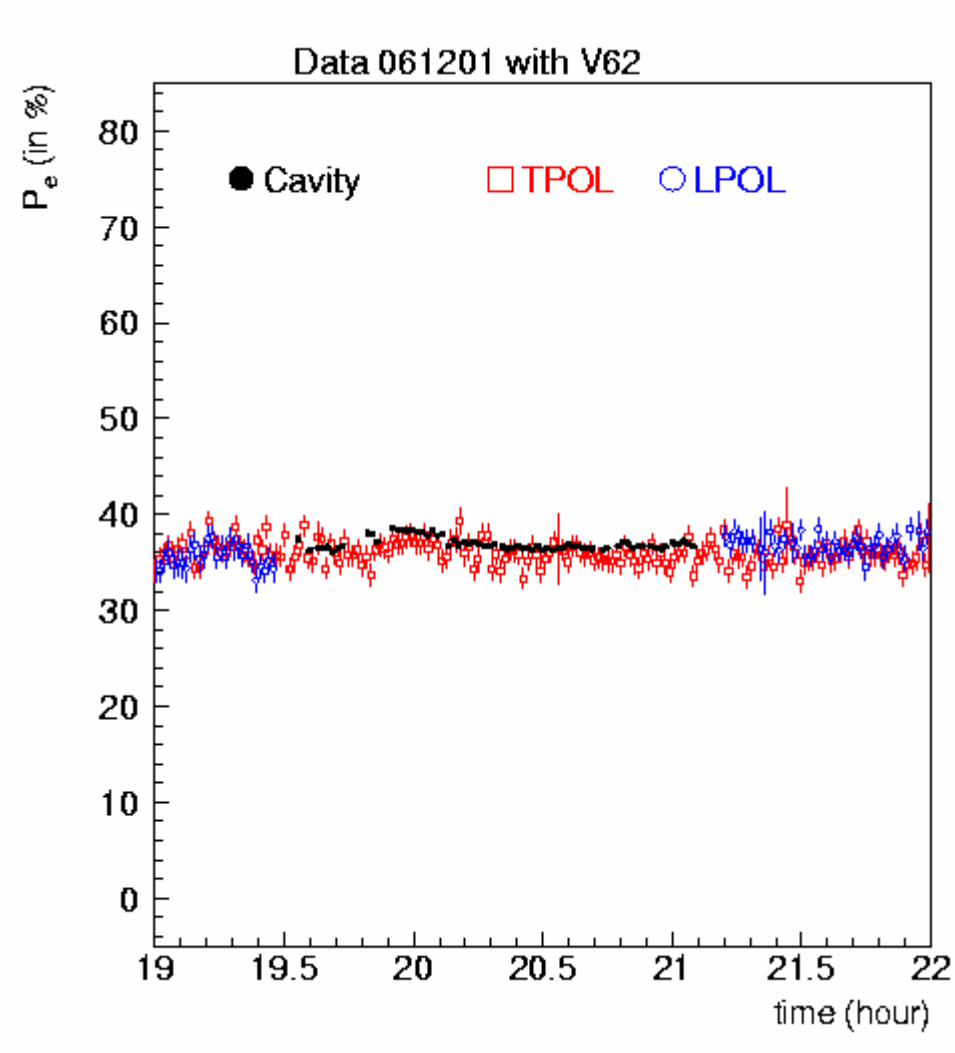
END

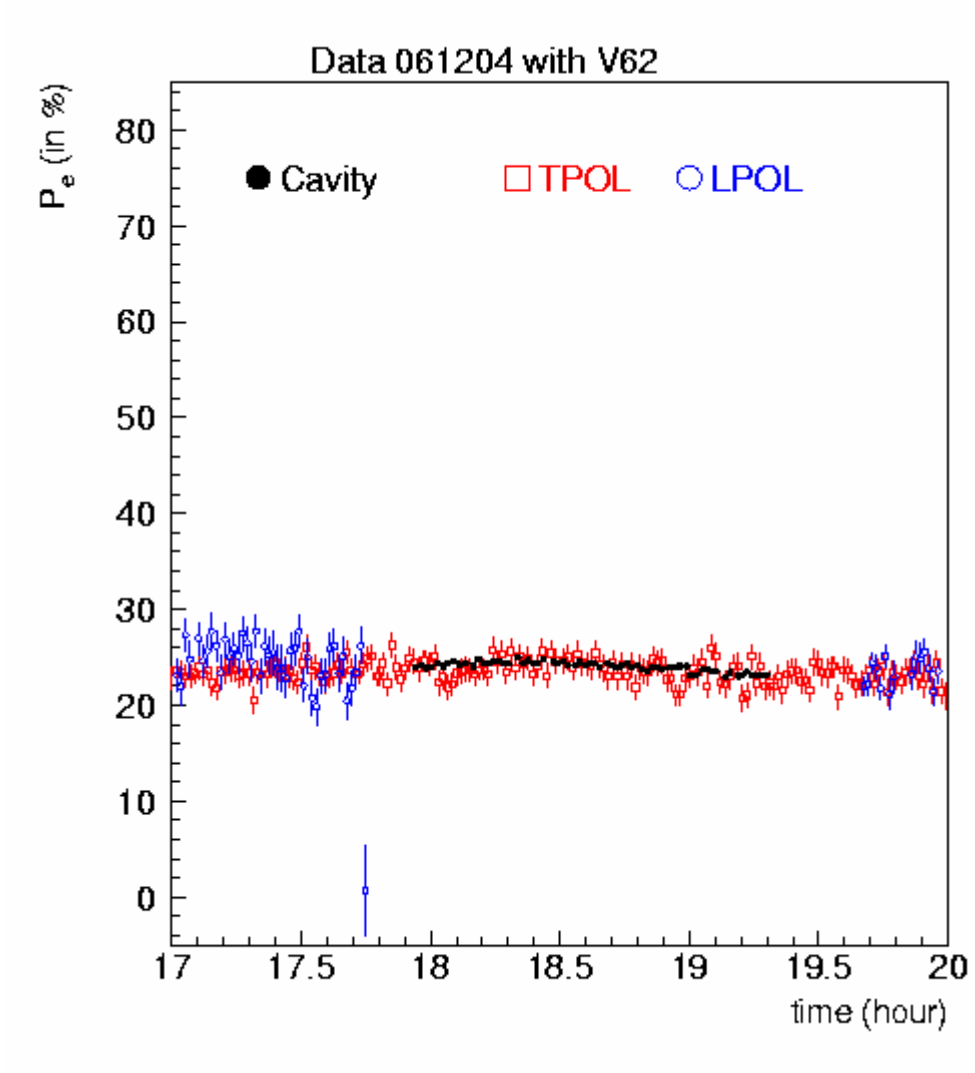

Data 061120 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
15
15.2
15.4
15.6
15.8
16
16.2
16.4
16.6
16.8
17
time (hour)

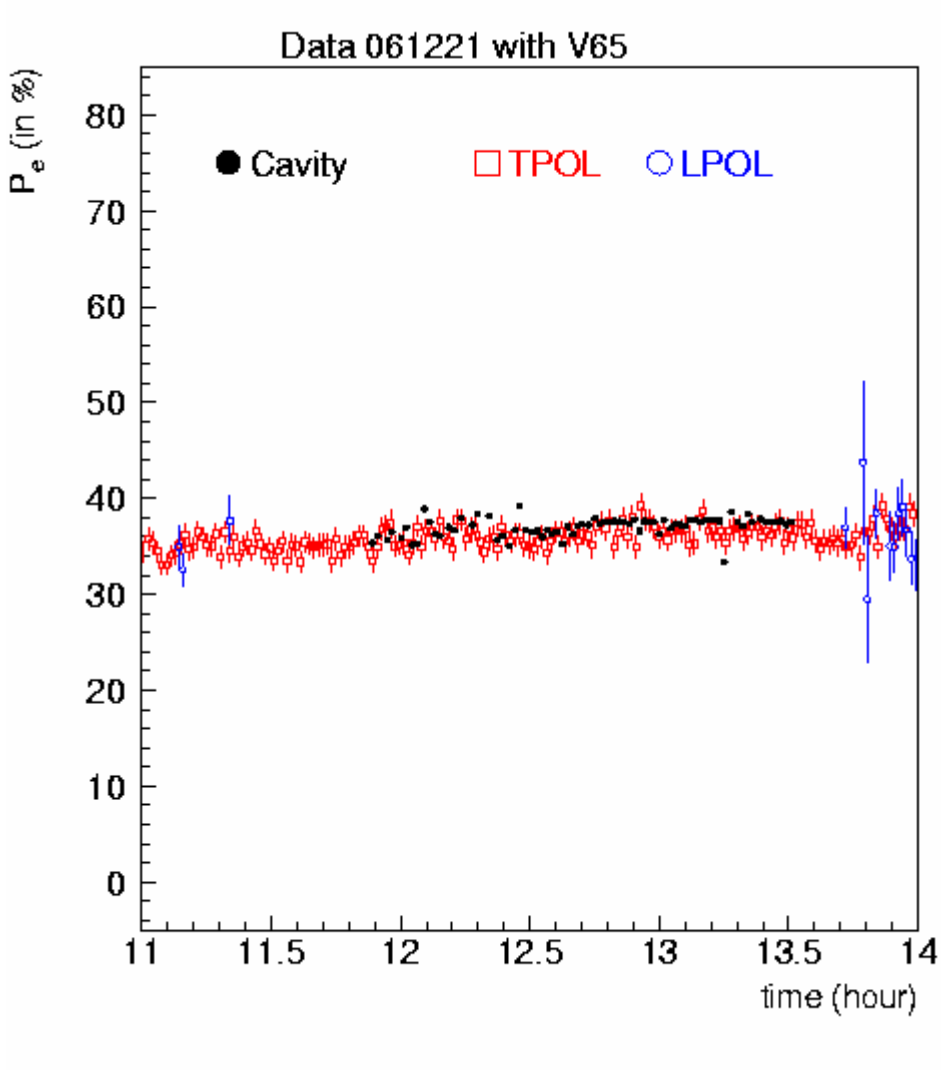

Data 061123 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
16
16.2
16.4
16.6
16.8
17
17.2
17.4
17.6
17.8
18
time (hour)

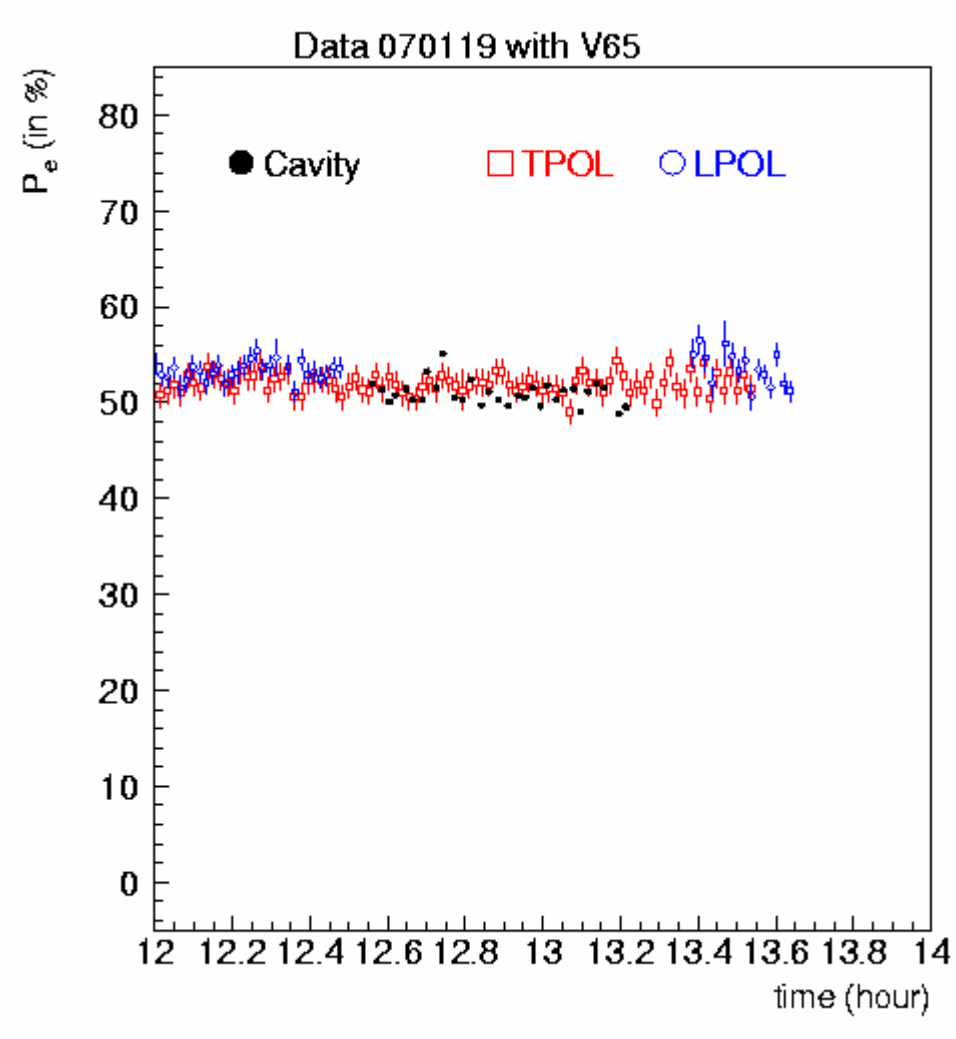

Data 061127 with V65
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
12
12.5
13
13.5
14
14.5
15
time (hour)

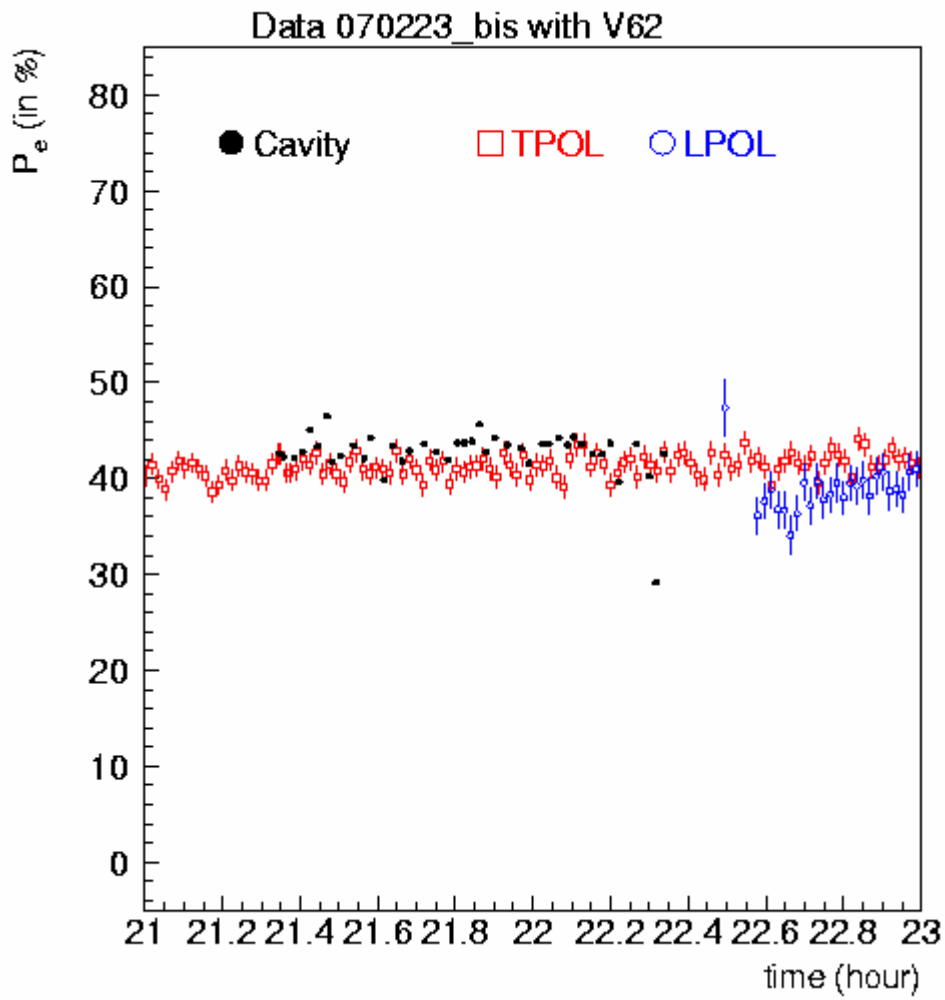

Data 061129 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
11
11.5
12
12.5
13
13.5
14
time (hour)

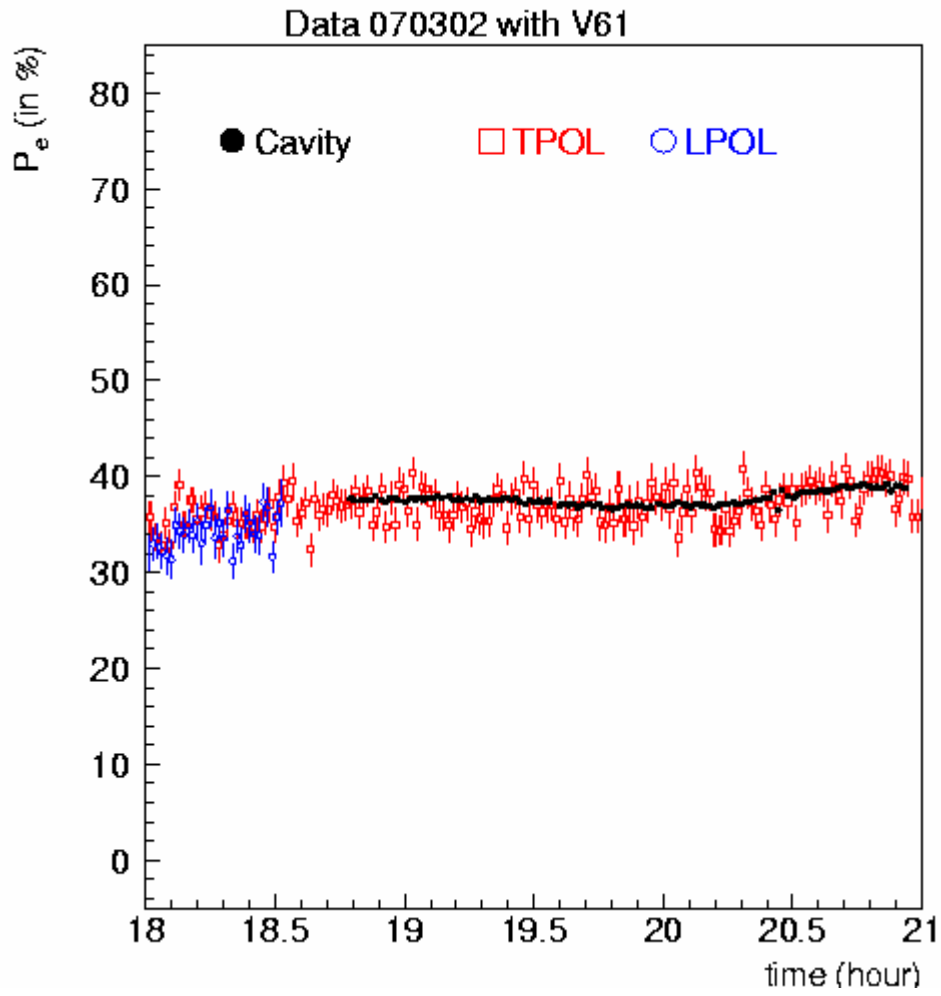

Data 061201 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
19
19.5
20
20.5
21
21.5
22
time (hour)

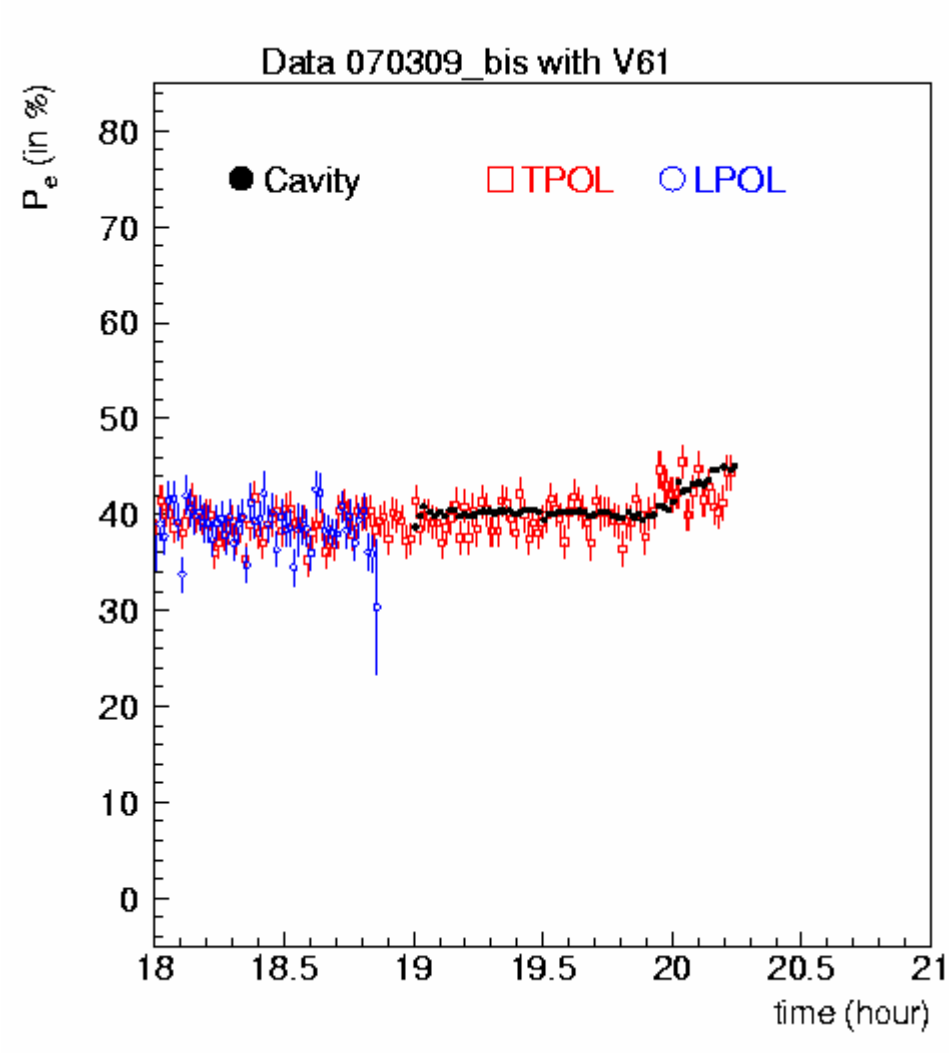

Data 061204 with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
17
17.5
18
18.5
19
19.5
20
time (hour)

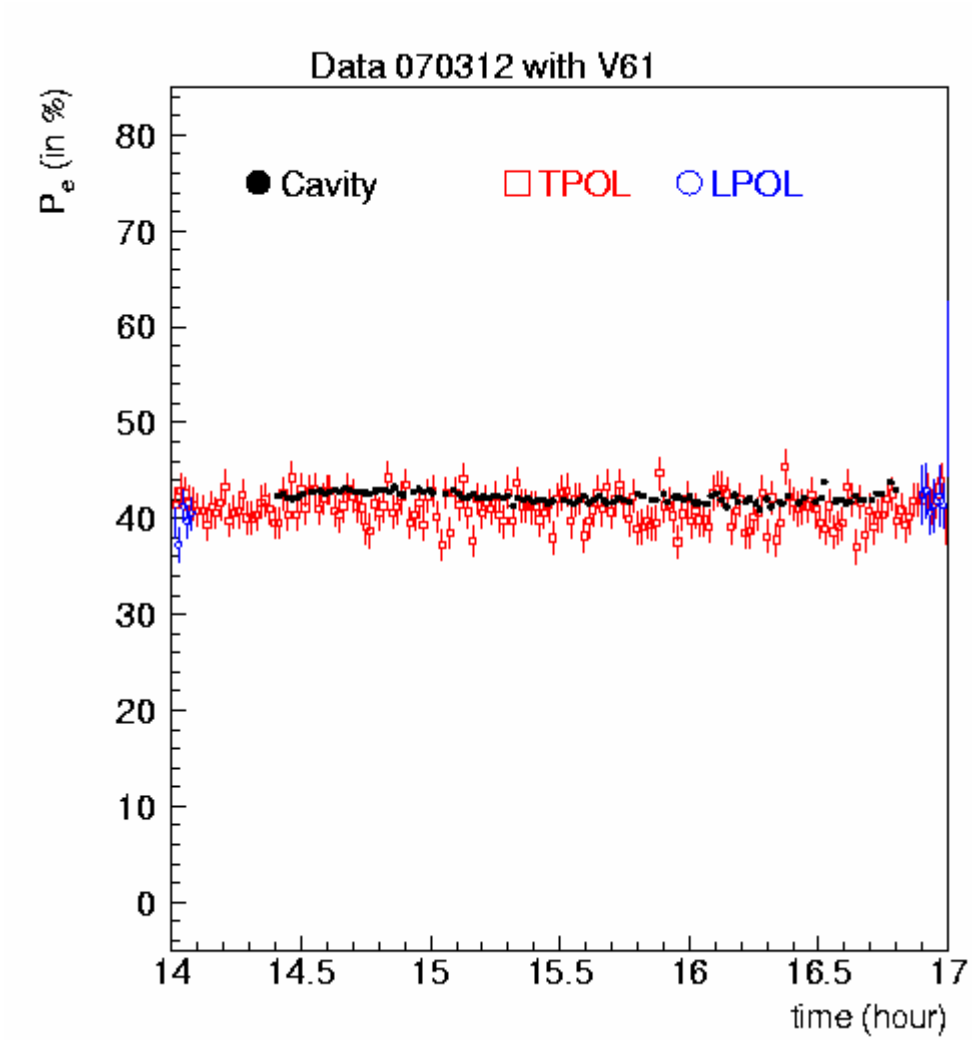

Data 061221 with V65
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
11
11.5
12
12.5
13
13.5
14
time (hour)

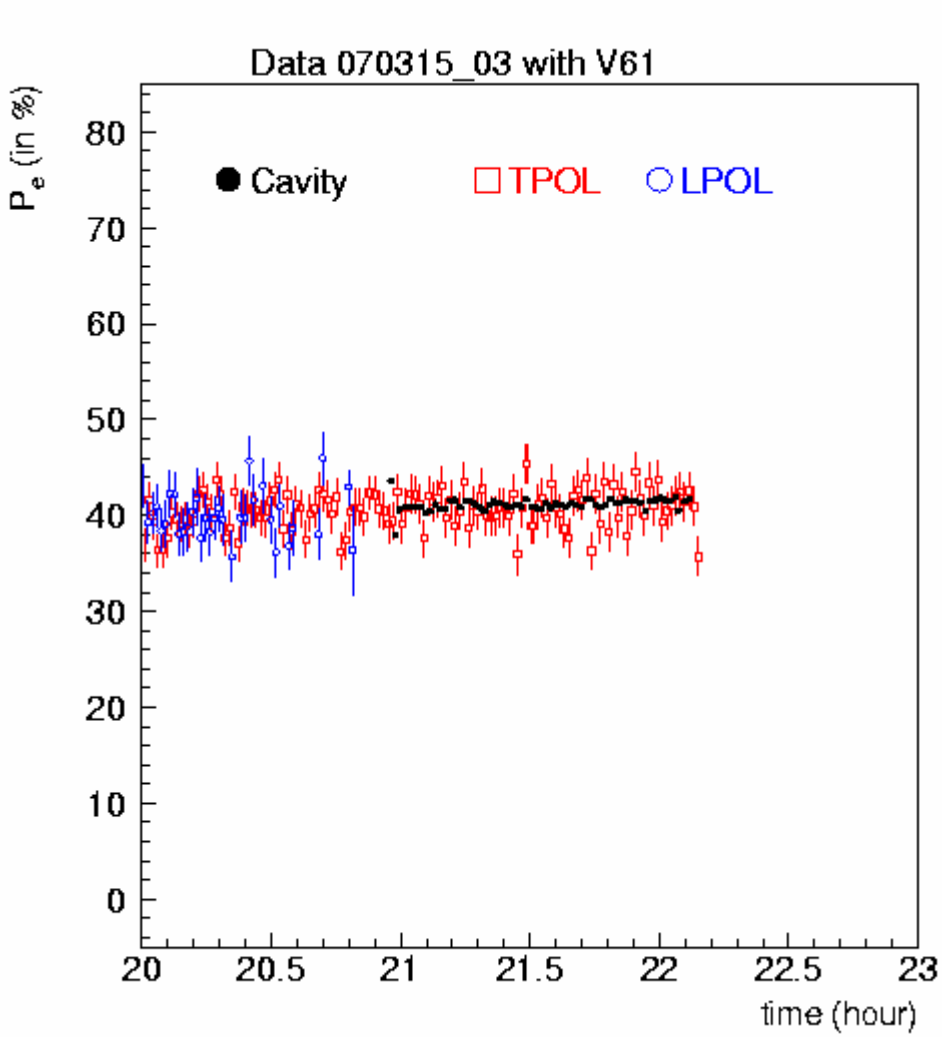

Data 070119 with V65
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
12
12.2
12.4
12.6
12.8
13
13.2
13.4
13.6
13.8
14
time (hour)

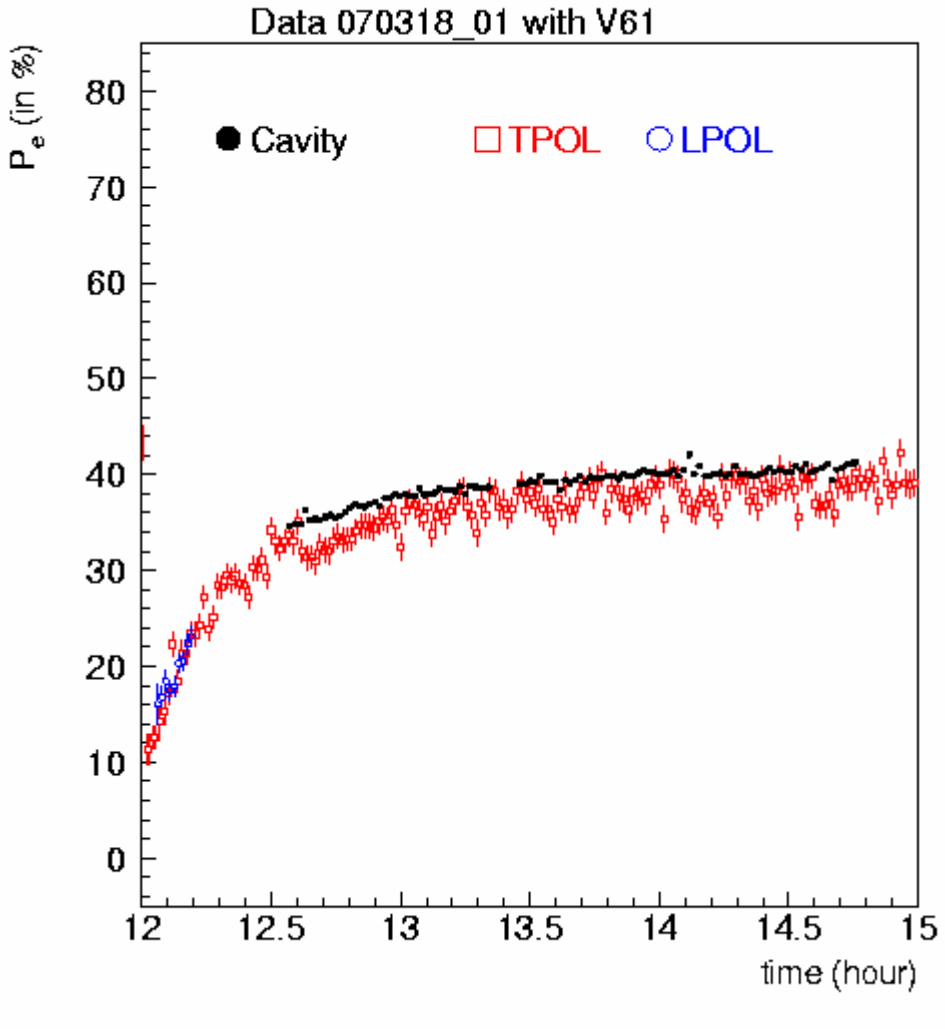

Data 070223_bis with V62
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
21
21.2
21.4
21.6
21.8
22
22.2
22.4
22.6
22.8
23
time (hour)

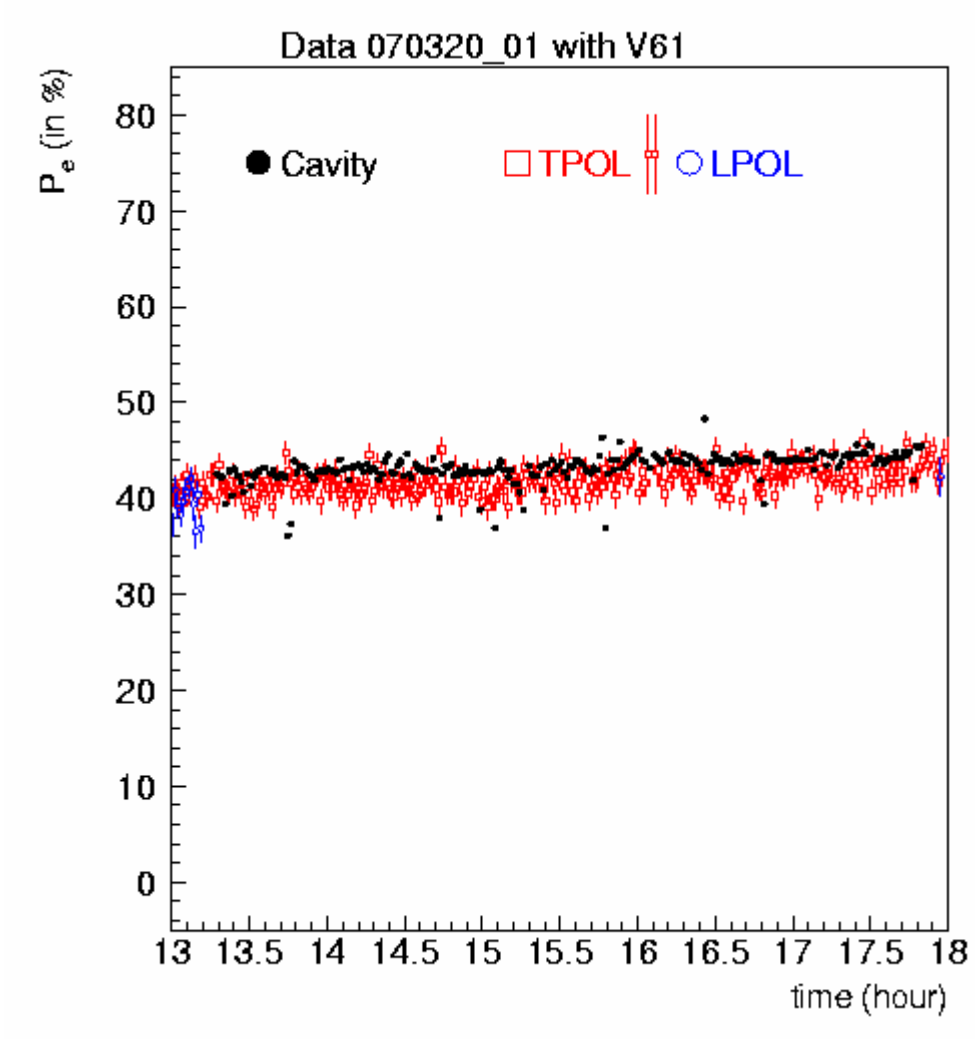

Data 070302 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
18
18.5
19
19.5
20
20.5
21
time (hour)

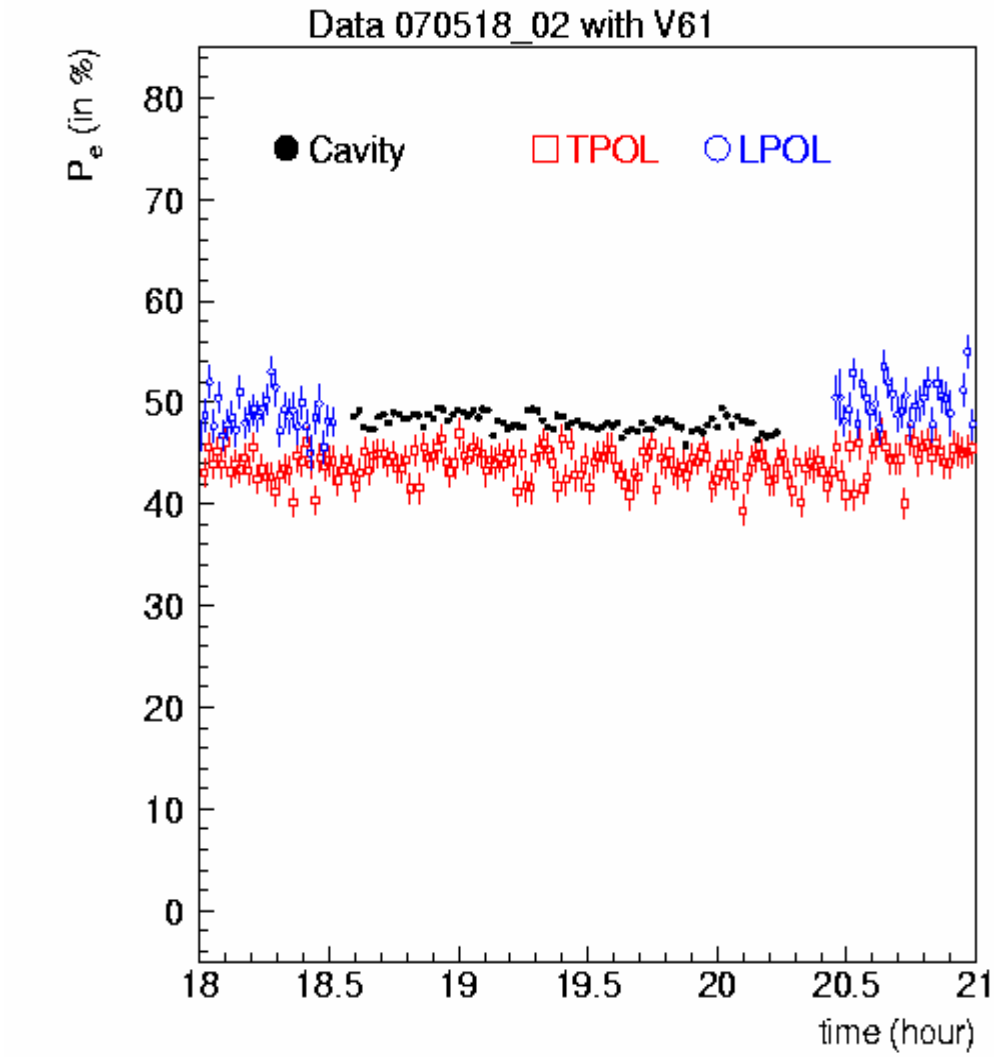

Data 070309_bis with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
18
18.5
19
19.5
20
20.5
21
time (hour)

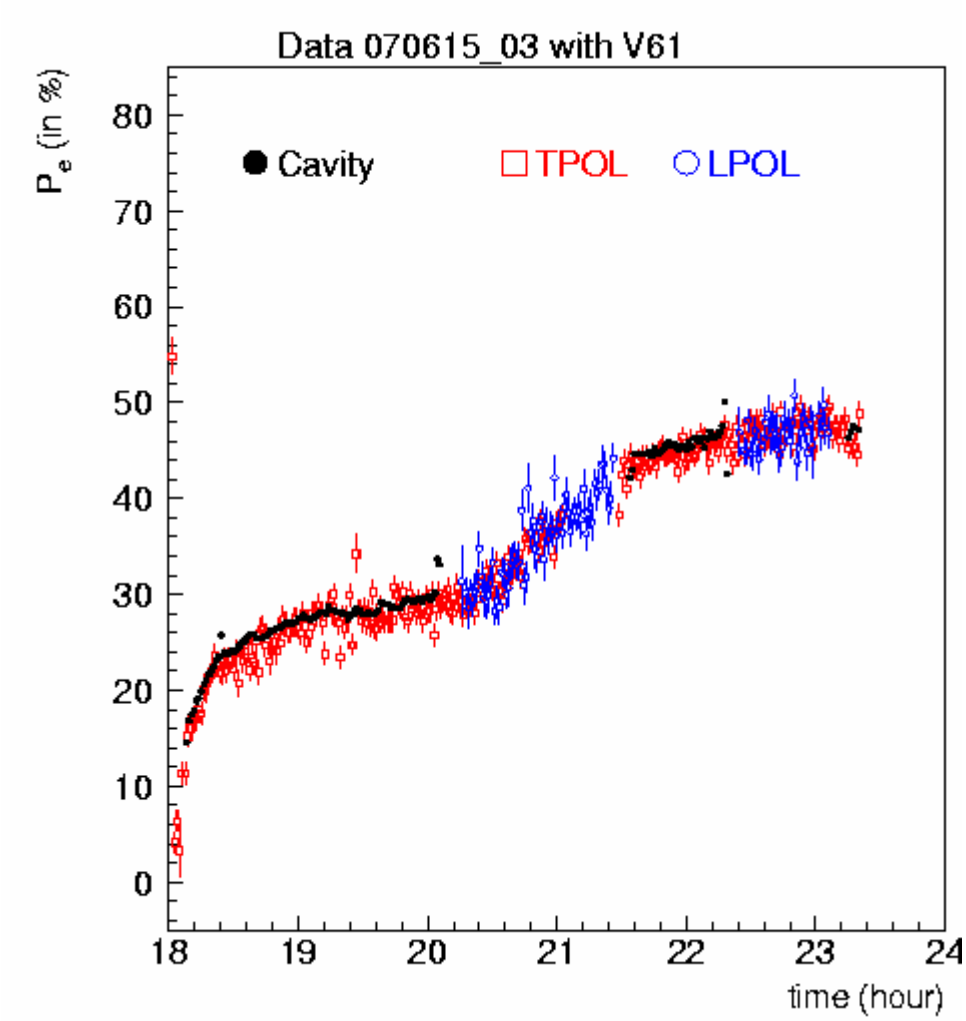

Data 070312 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
14
14.5
15
15.5
16
16.5
17
time (hour)

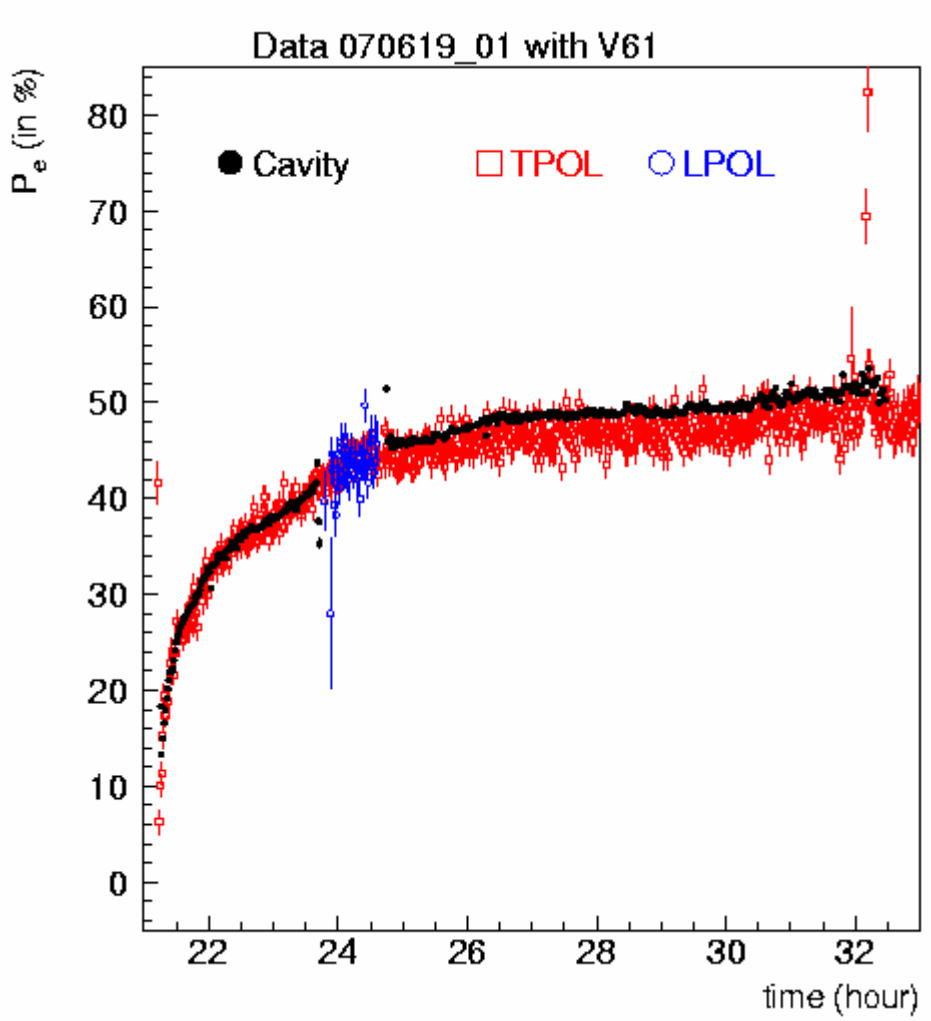

Data 070315_03 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
20
20.5
21
21.5
22
22.5
23
time (hour)


Data 070318_01 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
12
12.5
13
13.5
14
14.5
15
time (hour)


Data 070320_01 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
13
13.5
14
14.5
15
15.5
16
16.5
17
17.5
18
time (hour)


Data 070518_02 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
18
18.5
19
19.5
20
20.5
21
time (hour)


Data 070615_03 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
18
19
20
21
22
23
24
time (hour)


Data 070619_01 with V61
P_e (in %)
Cavity
TPOL
LPOL
80
70
60
50
40
30
20
10
0
22
24
26
28
30
32
time (hour)