Pion detector

Collaboration meeting E158

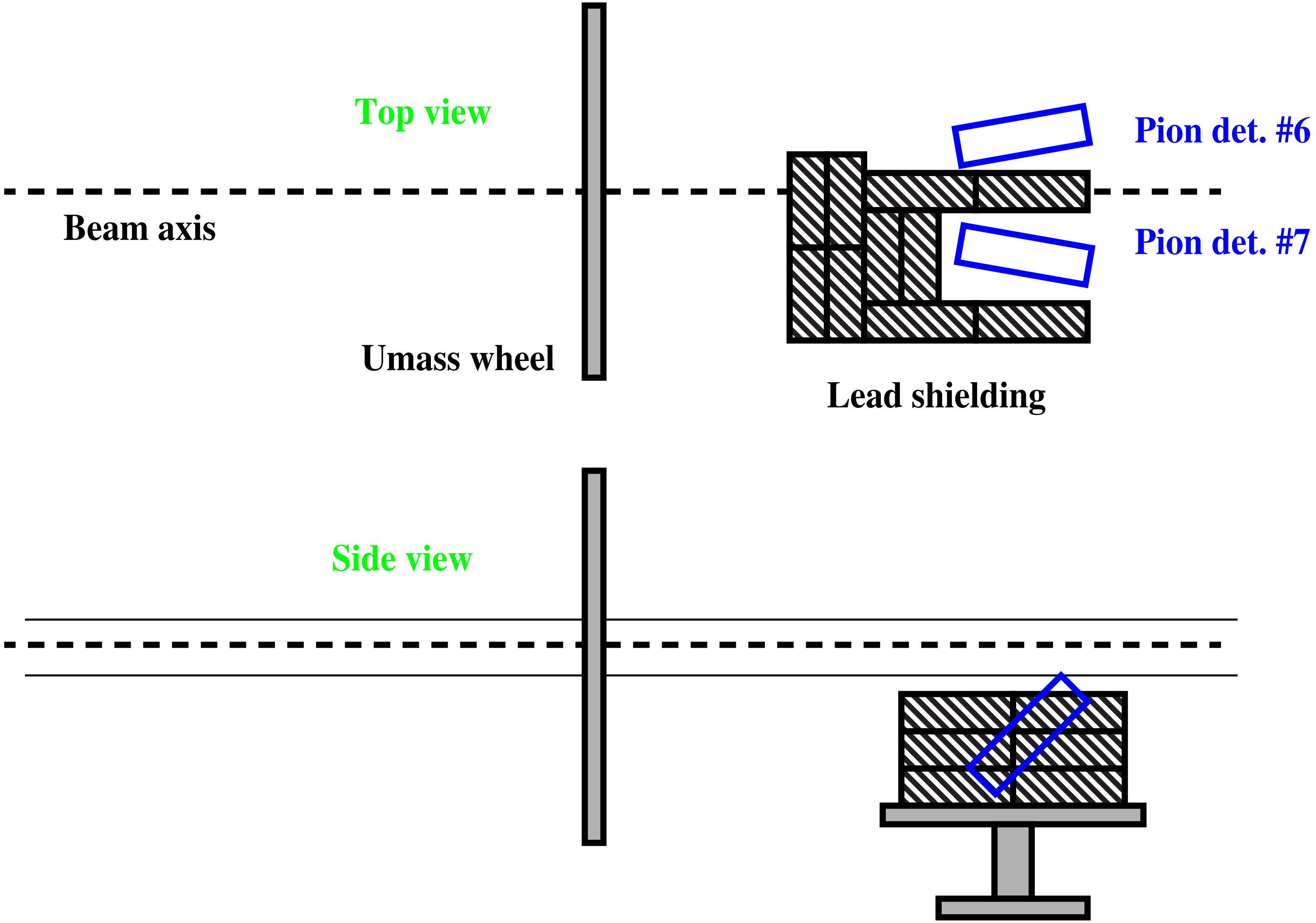
June 28 - 2001

- **April Run:** - Electron bkg in π det.
- **May Run:** – π flux

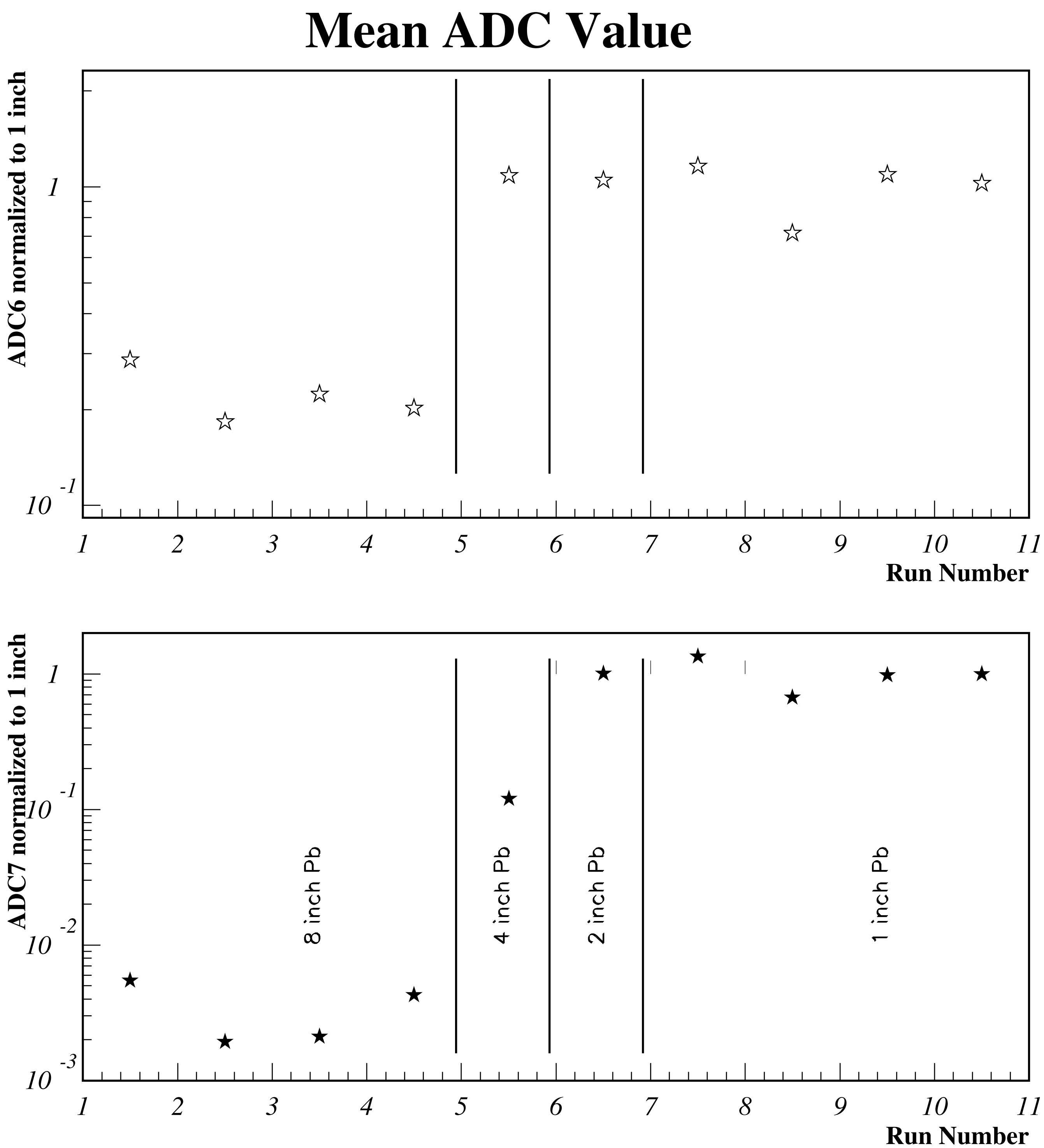
  - Asymmetry

Electron Bkg

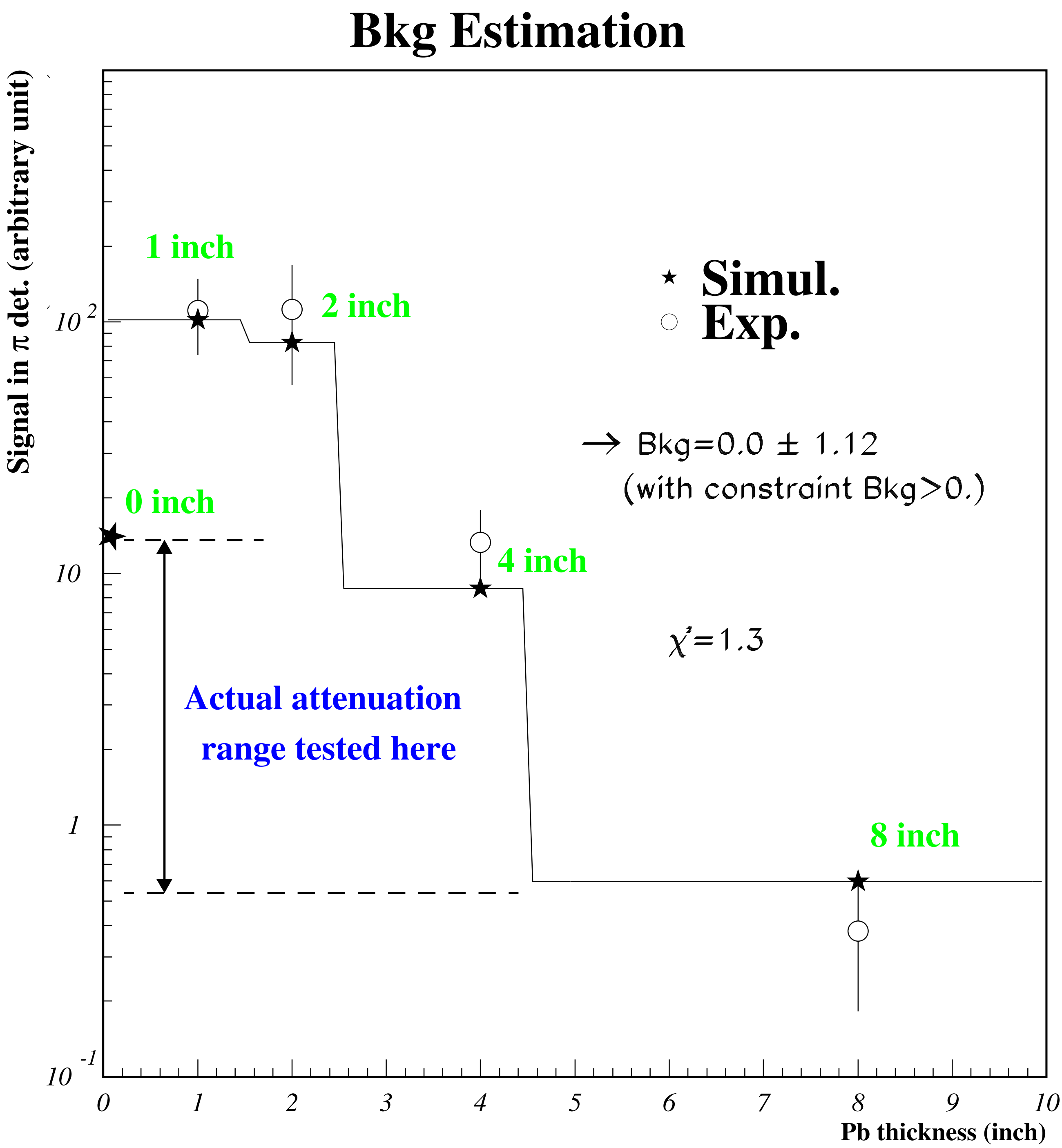
Exp. setup:



Electron Bkg



Electron Bkg

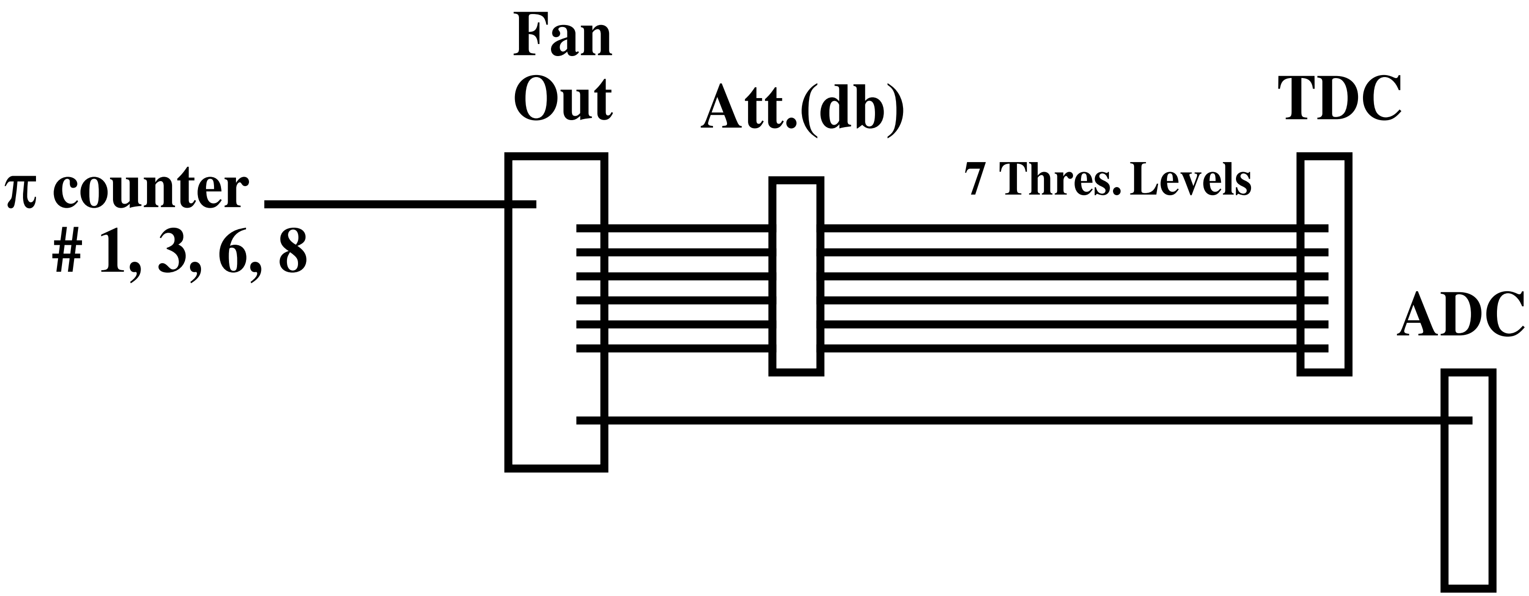


- Before Moller det. : 4 pions / 10000 e^-.

- Need to test an attenuation of 10,000 compared to no shielding → this test is clearly insufficient.

Pion Flux

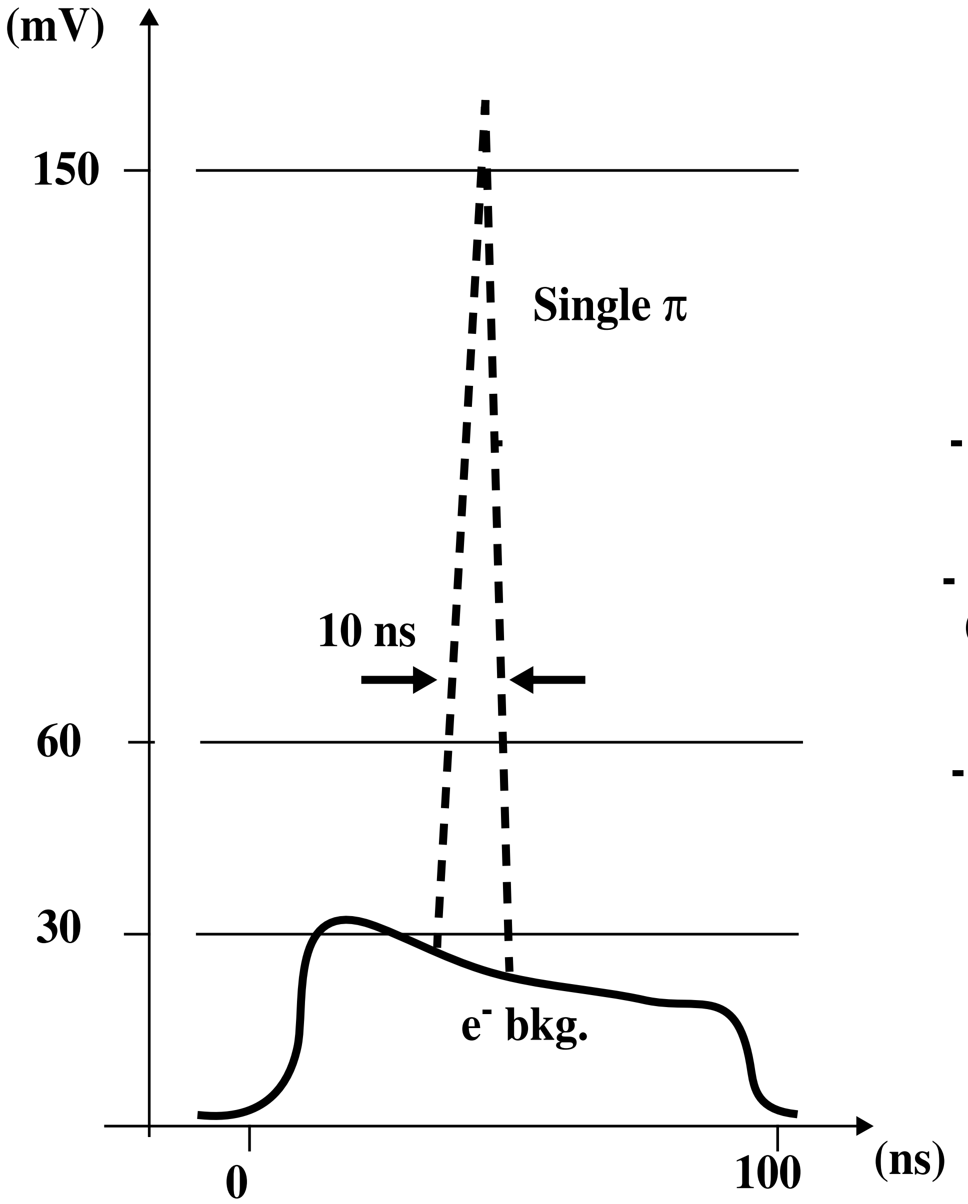
Setup: Use electronics of the 4 Lead-Glass counters



- 3 runs of ~1h: 2.10^{11} e/spill, Fe target, QC1A In or Out

- Threshold levels (mV): 30, 60, 150, 300, 600, 1500, 3000

Pion Flux

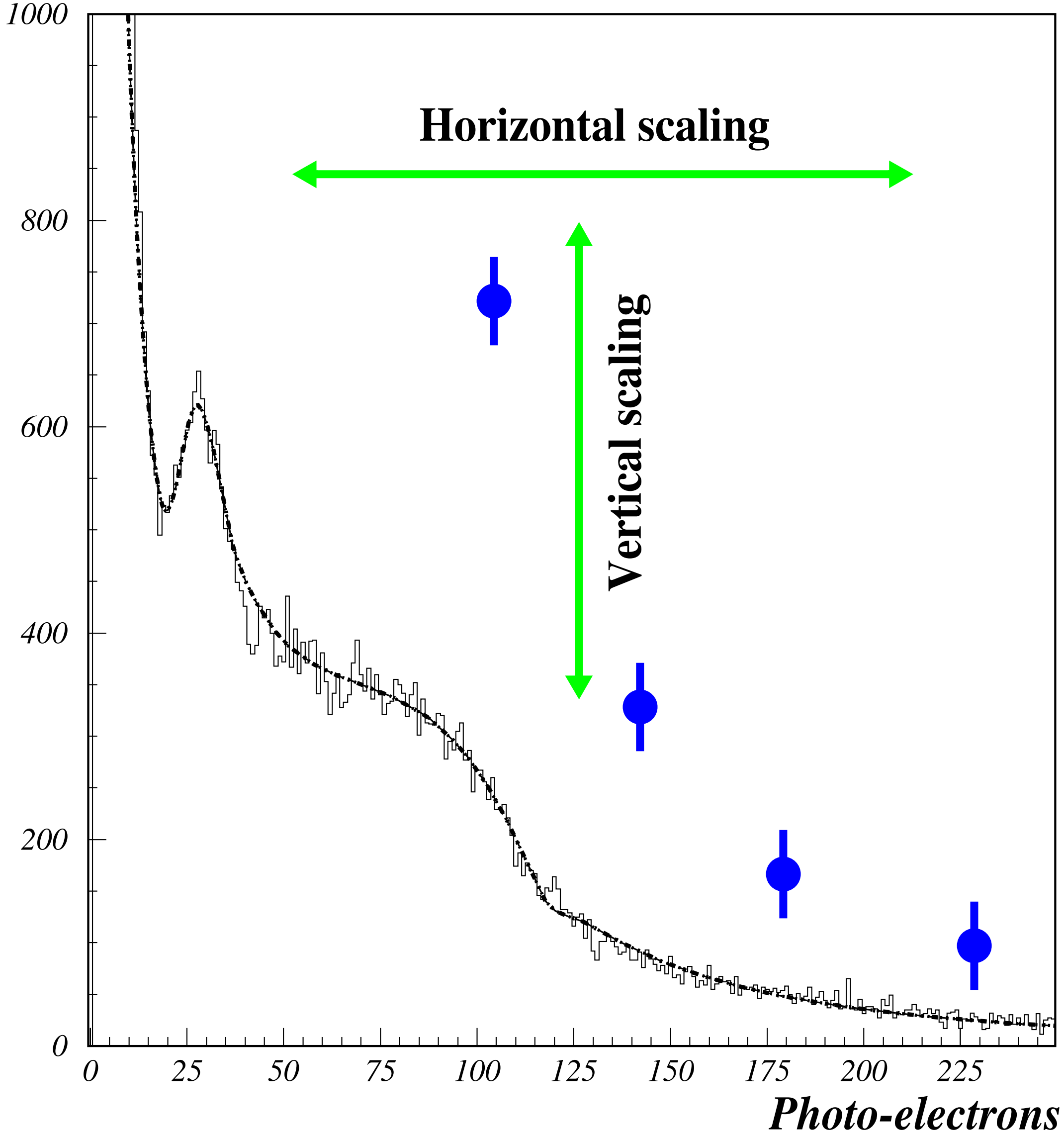


- Single pion events clearly identified.

- Beam tune non optimal
  (would need a flat box)

- Method requires several thresholds
  just above the bkg level
  (see conclusion).

Pion Flux



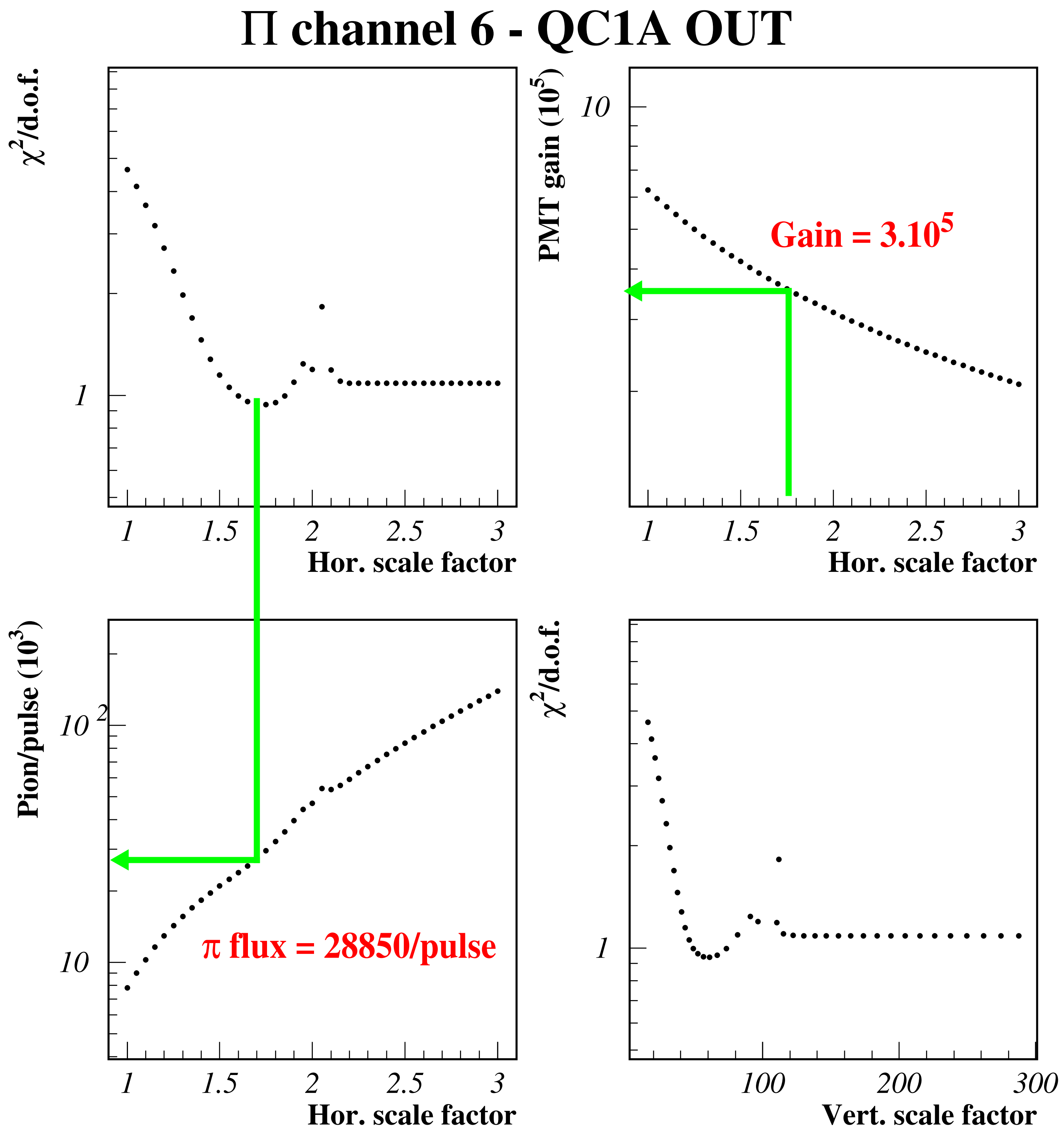
- Simulated spectrum fitted with a smooth function.

- Vertical and Horizontal scaling factors are free parameters adjusted to fit the experimental points.

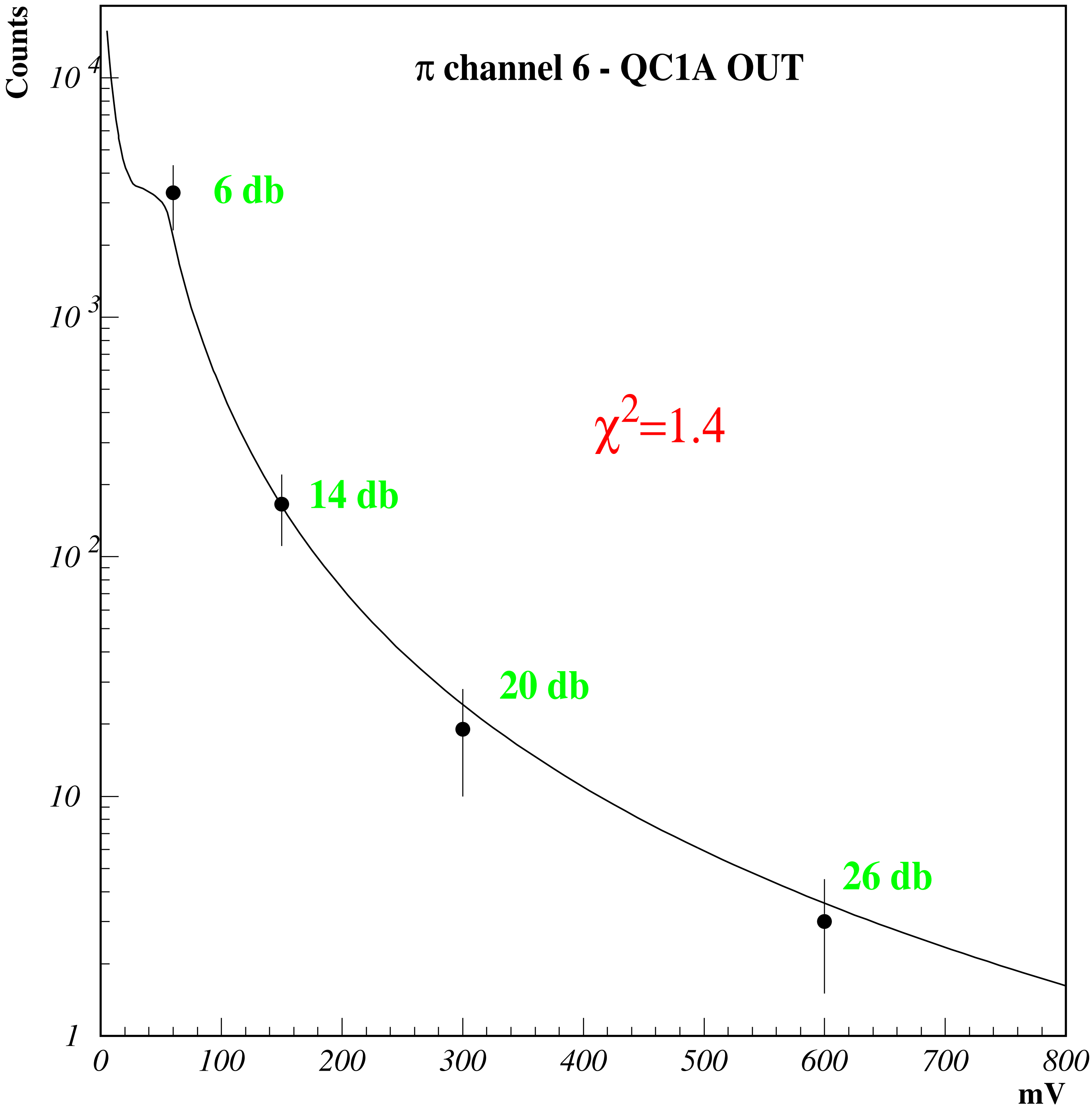
- Vert. scale --> π flux.

- Hor scale --> PMT gain.

Pion Flux


Π channel 6 - QC1A OUT
χ^2/d.o.f.
1
1.5
2
2.5
3
Hor. scale factor
PMT gain (10^5)
10
Gain = 3.10^5
Pion/pulse (10^3)
10^2
10
π flux = 28850/pulse
100
200
300
Vert. scale factor

Pion Flux



- First threshold level not used because of bad beam tune

Pion Flux

DATA:

Pion Counter	QC1A	G_{PM} (10^5)	π flux (/ spill)	χ^2
1	IN	3.6	13015	1.3
6	IN	[3.1-4.6]	[2150-5670]	1.4
1	OUT	-- defective TDC --		
6	OUT	3.6	28853	1.4

Assuming same simulated spectrum

MC:

- At 2.10^{11} electron/spill we expect:

  * $1.5\ 10^7$ Moller e-/spill

  * $6.\ 10^4$ π/spill → $6.\ 10^3$ π/counter/spill

  * Expect attenuation from QC1A ~ 1/5

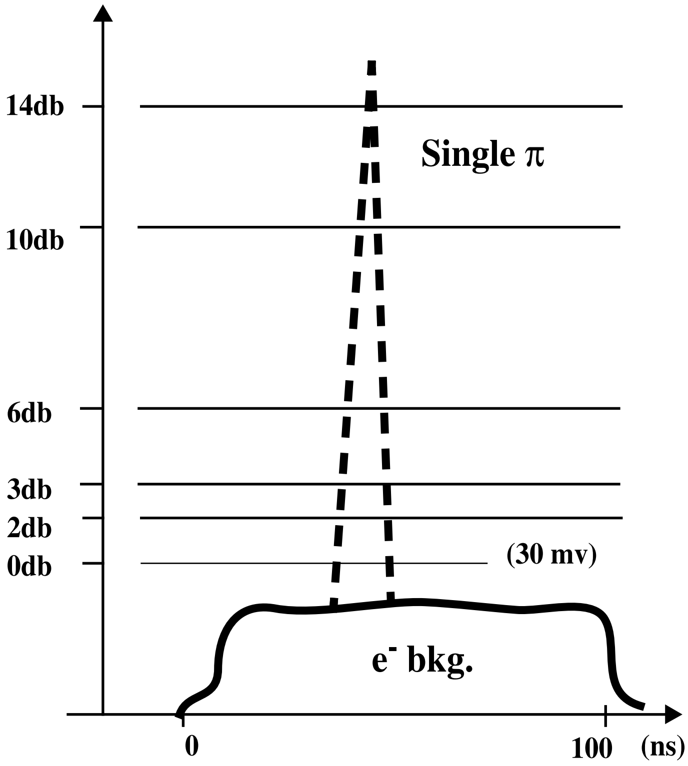
Pion Flux

Conclusion:

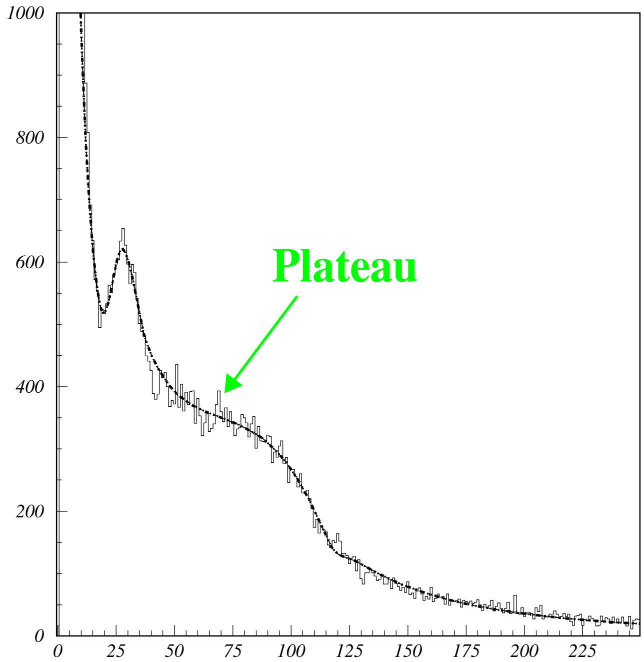
- We believe this test validates the method:

  * at $G_{PM} = 3.6\ 10^5$ 30mv $\leftrightarrow$ 52 γ_e

  * a good pulse shape and optimized set of threshold levels can put several pts on the plateau of the π spectrum and constraint the π flux.

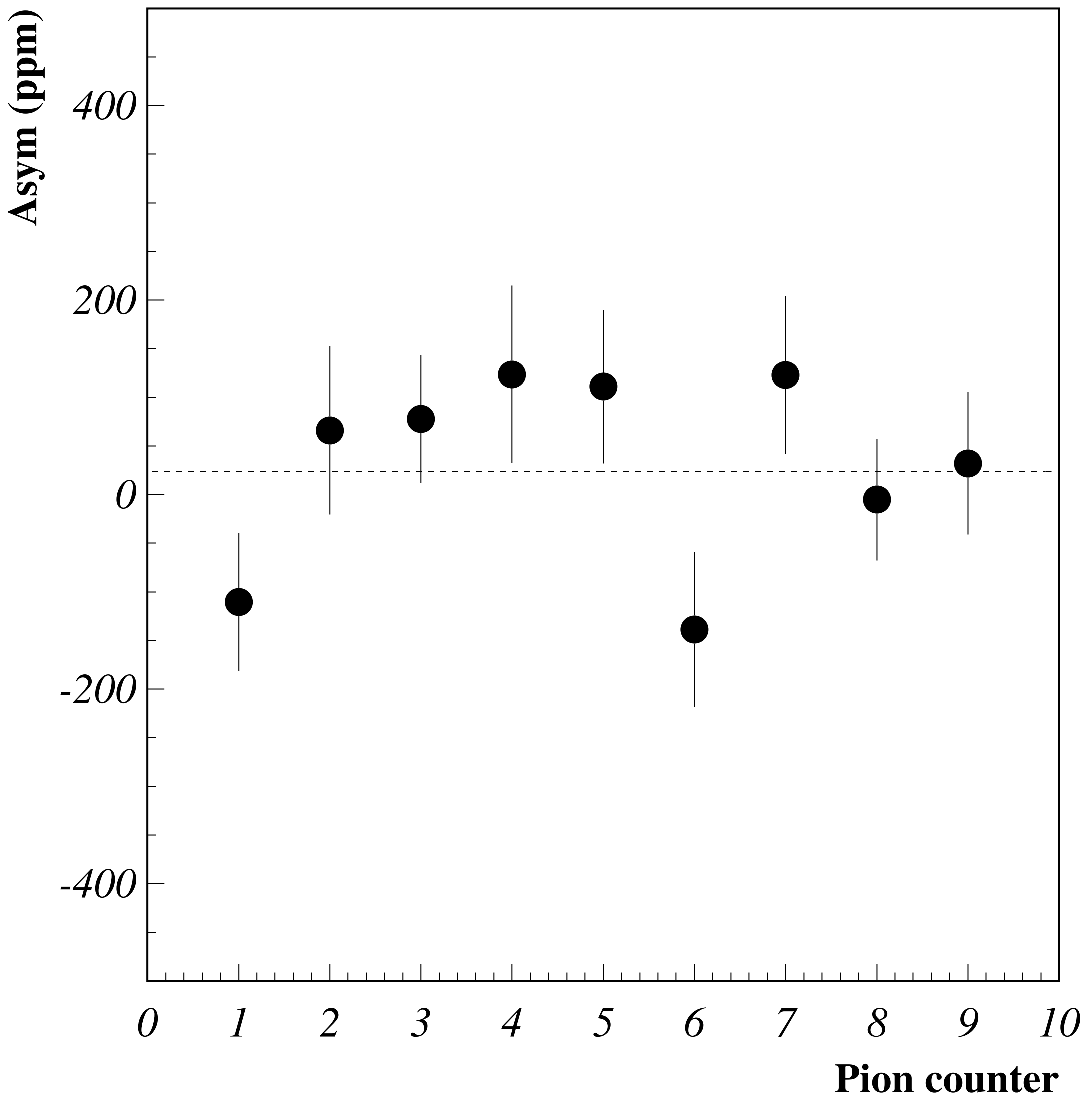


- Not enought data points to conclude on the π flux this time.



- Propose a new test during next run, need ~1 shift.

Asymmetry



Preliminary results from 250000 evt. at 2.3 10^{11} e/spill:

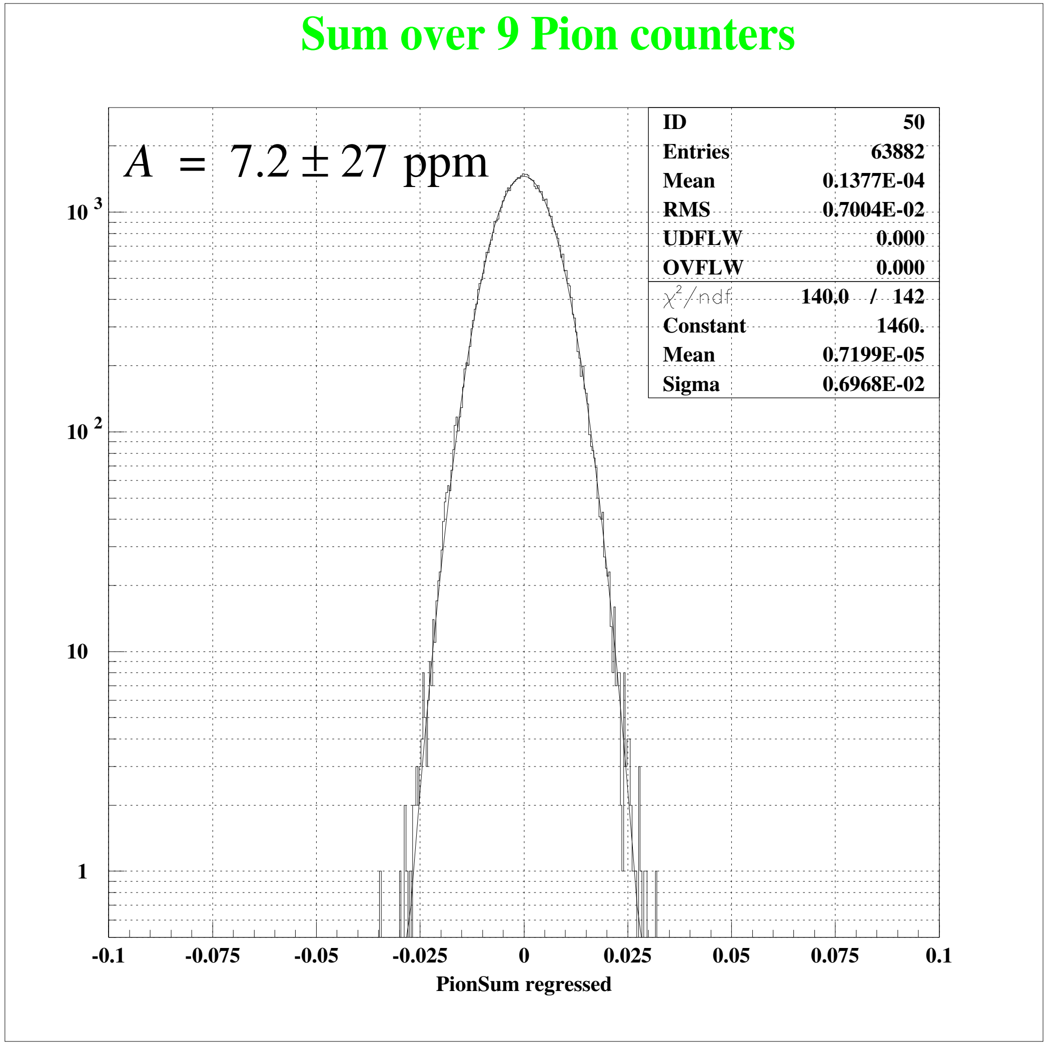
- **All pion counters in agreement**

  but dA/pair~17890 ppm is large

- **No sensitivity to position or angle from individual counter.**

- **When summing over all counters see some effect in X and Y angle but slopes are unstable.**

Asymmetry



Preliminary results from

250000 evt. at 2.3 10^{11} e/spill:

$$\delta A^{pair} = 1/(\sqrt{2N_{\pi/\mathrm{spill}}}) \times \sqrt{1 + resol^2}$$

From MC, resol~200%, ε~20%

→ 5721 π detected/counter/spill

→ π flux at the Moller det:

2.6 10^5 π/spill, 6.10^4 expected

- **good agreementwith preliminary study on the π flux...**
- **Need further studies to put error bars on these numbers!**

Conclusion

- ❐ Pion det. is operational

- ❐ Believe we have a method to count pions.
  Need more data with optimized beam and threshold tuning.

- ❐ Preliminary results seems to indicate a π flux
  4.5 times higher than expected.

- ❐ Missing constraints on bkg level (dilution).