The HERMES beam loss monitor

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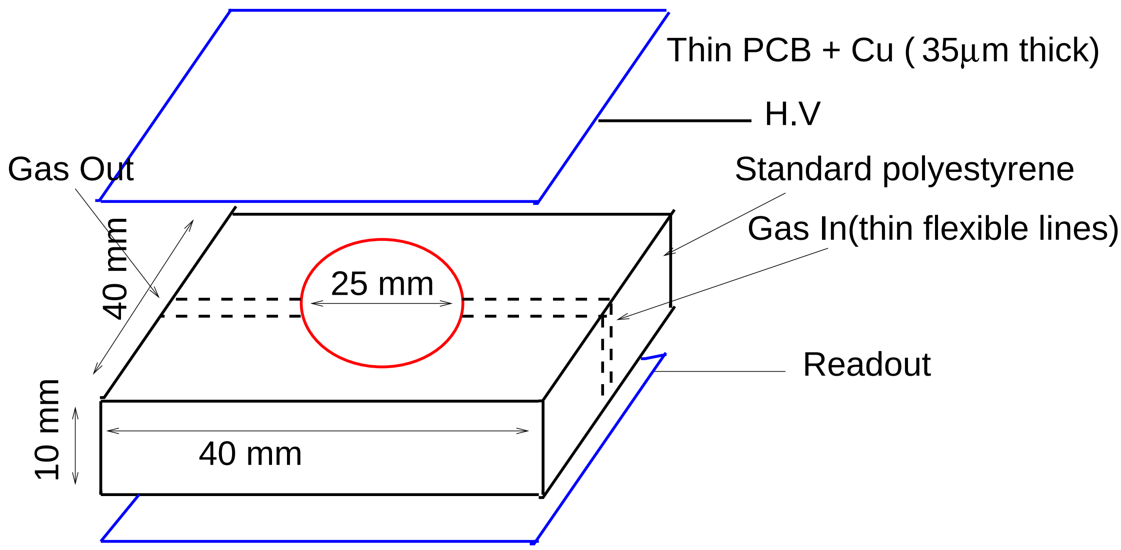
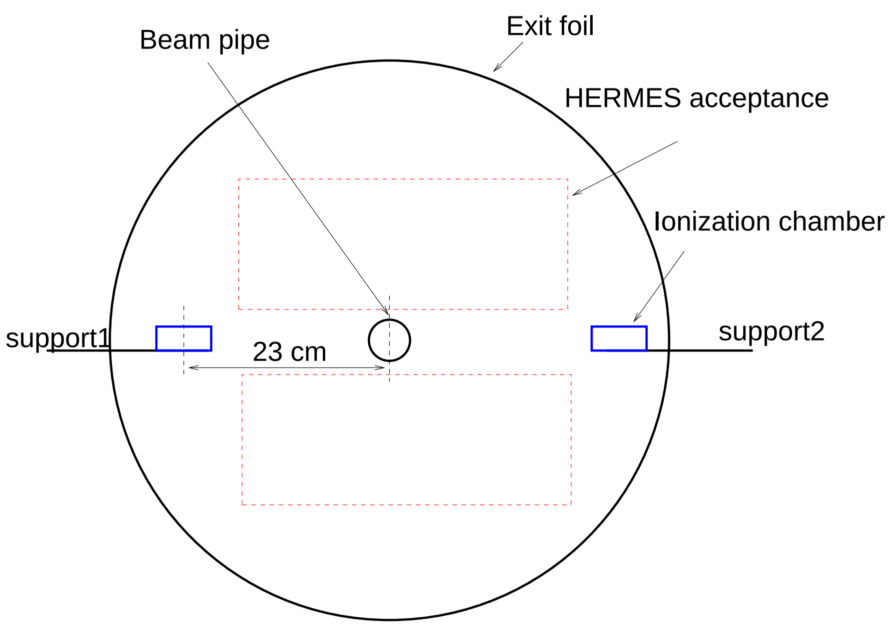
Ionization chamber

Simple ionization chamber design, two parallel electrodes, no grids. Argon or neon gas without admixtures. E≈400 V cm^{-1}

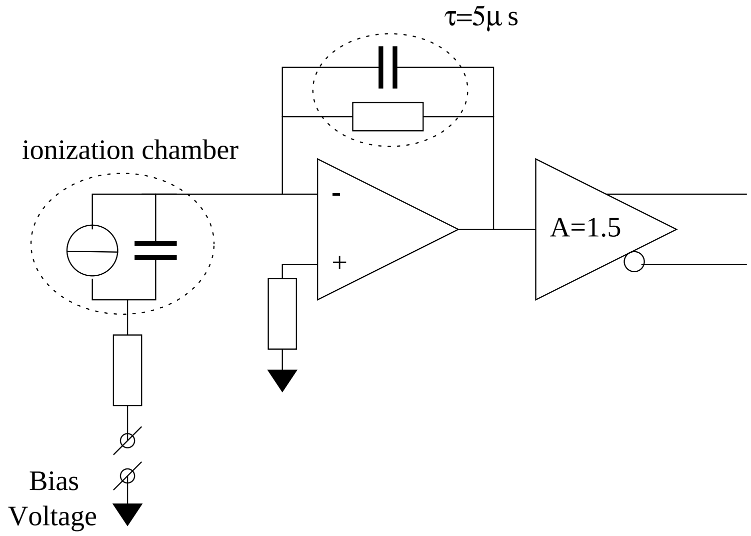


Position in the plane of the HERA machine, 23 cm from the beam axis. Free line of sight to C2-collimator

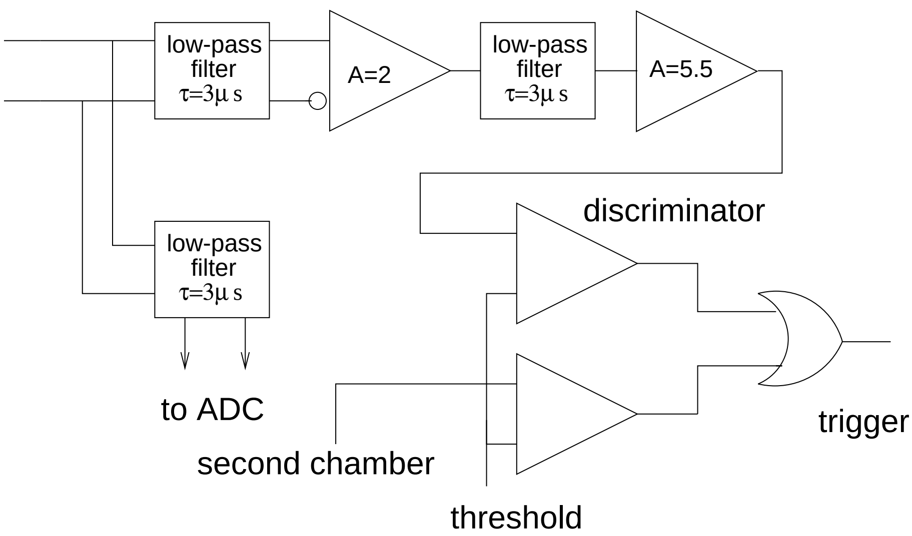


Ionization chamber electronics

Frontend electronics: charge amplifier, timeconstant 5 μs backed by a line-driver

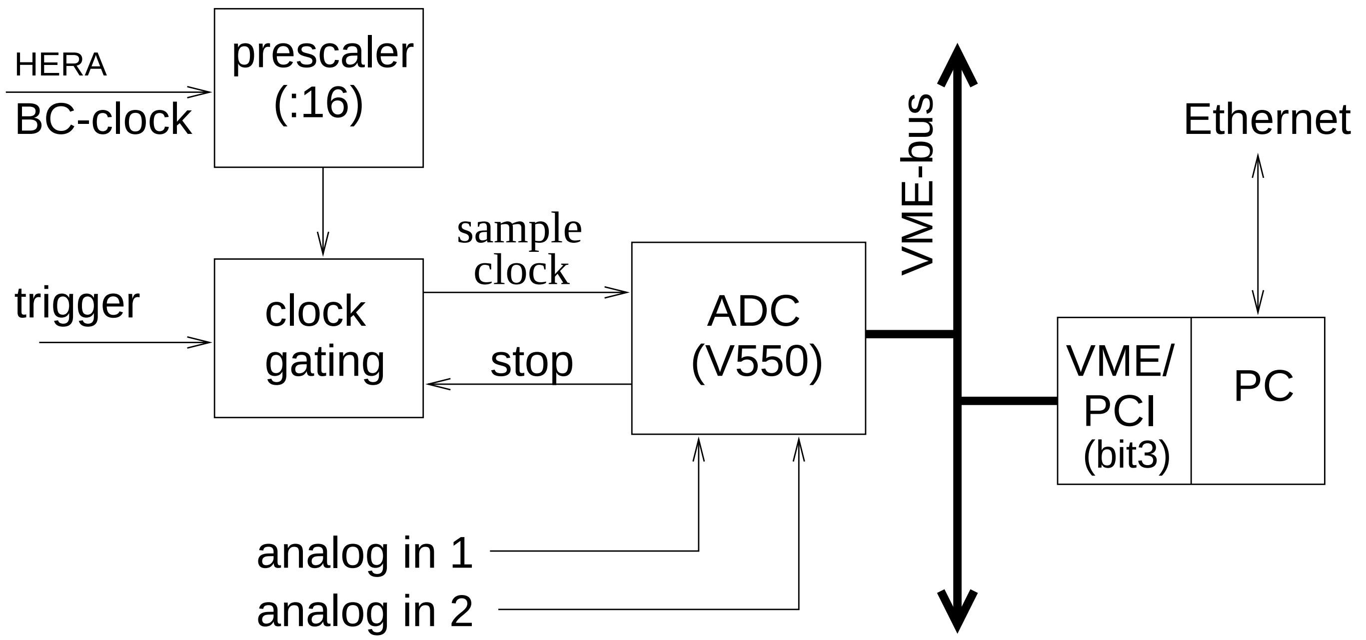


Filter and trigger



Ionization chamber DAQ

Data-acquisition: 3.14 ms of signal after the trigger is digitized

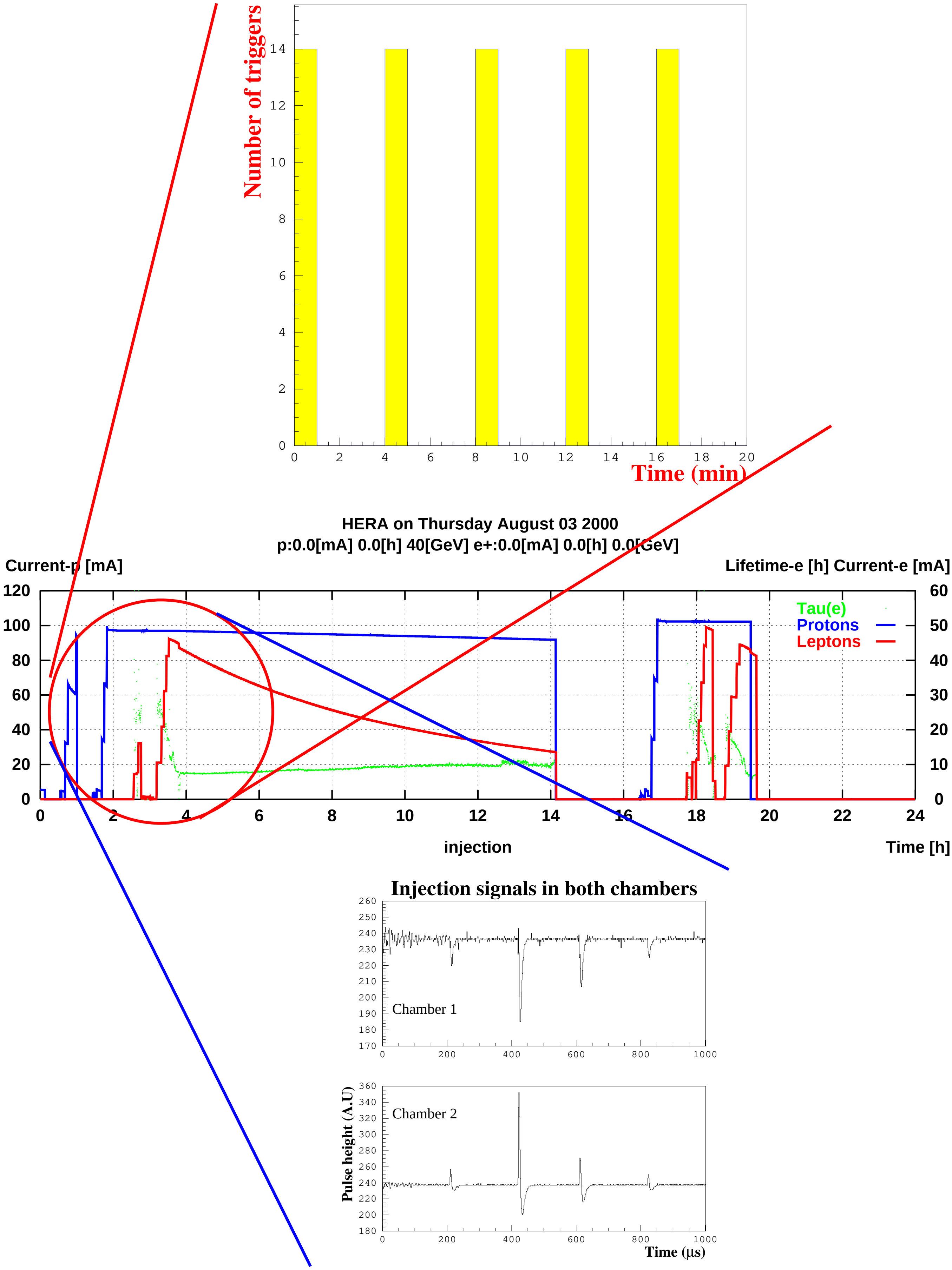


Features of the system

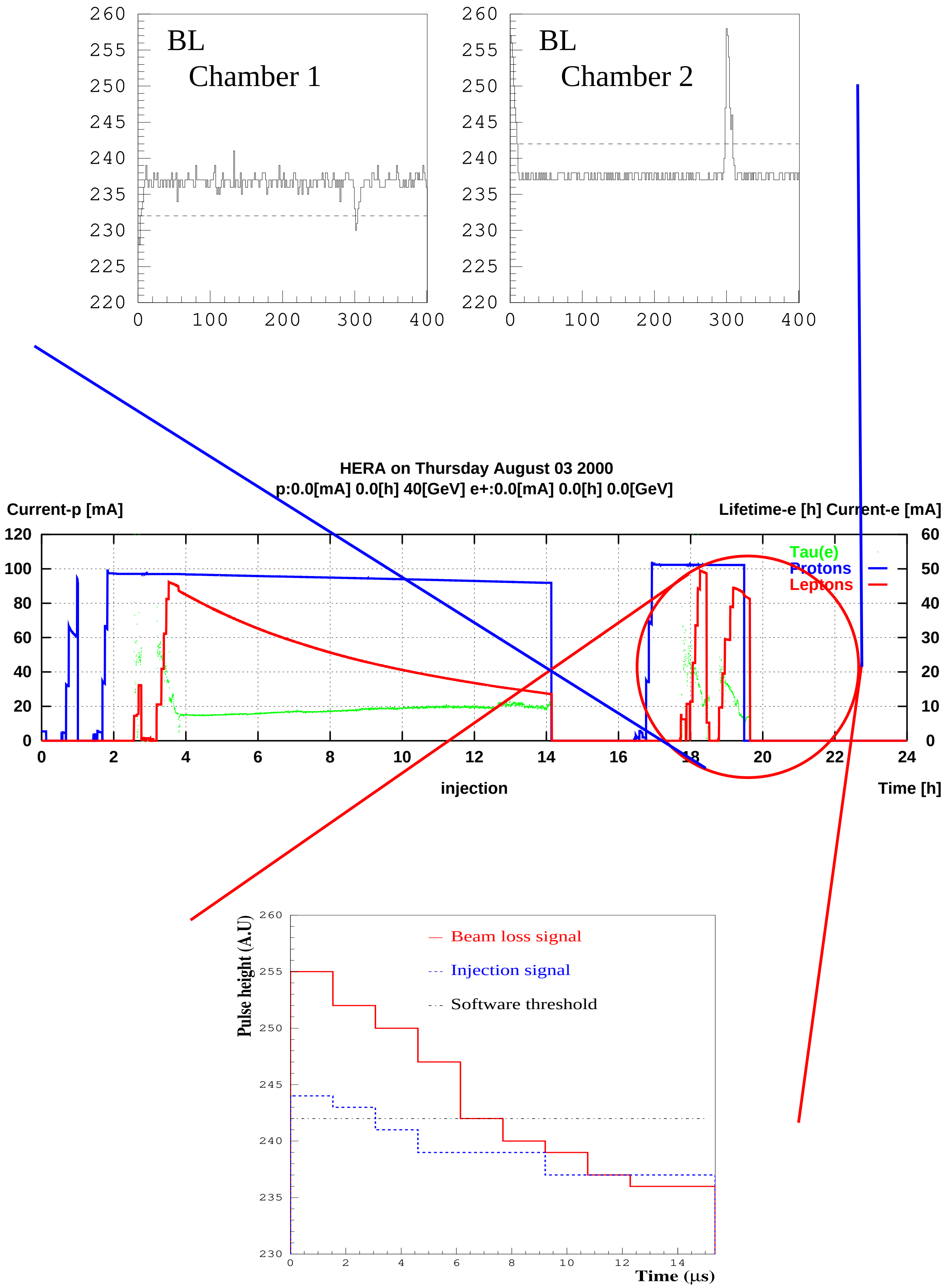
During 36 days :

- all injections (e+ and p beams) were detected with their specific injection steps (14 groups of bunches every 4 minutes for the e+ beam);
- during Lumi. Run. 3 triggers have been seen;
- during controlled beam dumps no trigger was seen;
- the system reacted for 18 unexpected beam losses (total or partial).

Injection signals

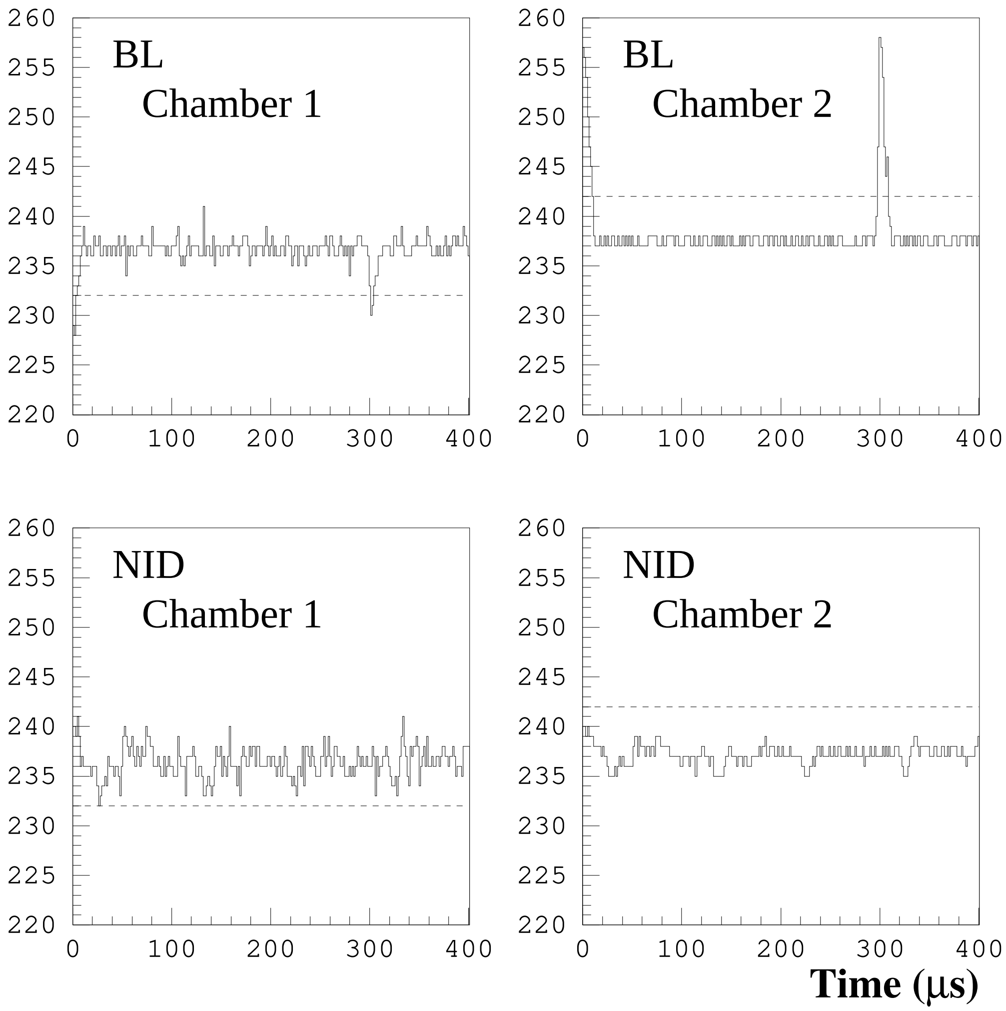


Beam-loss signals



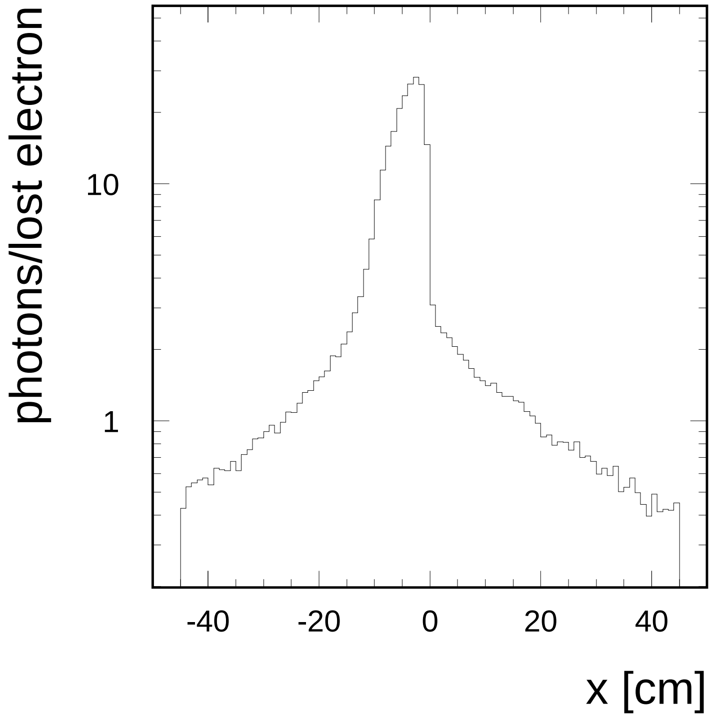
Timestructure

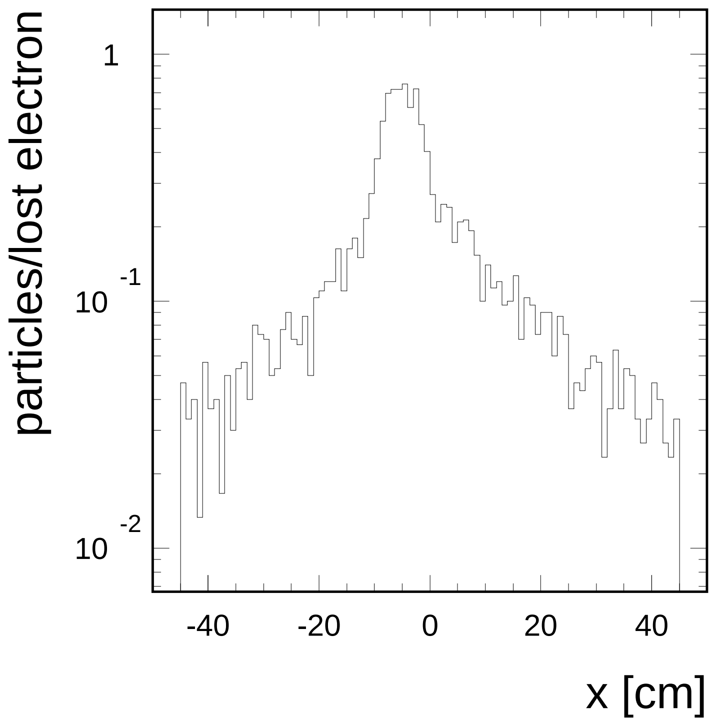
	Time in ms unless indicated otherwise
BL 1	0
BL 2	0-0.39-1.34-1.71-1.72-
BL 3	0-0.29- 7 min -0-25
BL 4	0
BL 5	0-0.39- 0.64-0.97-1.00
BL 6	0
BL 7	0-0.45- 2s 0-0.21
BL 8	0
BL 9	0-0.15
BL 10	strange behaviour, large fluctuations
BL 11	0
BL 12	0-2s-0-17s-0-9s-0
BL 13	0
BL 14	0-2.79
BL 15	0
BL 16	0
BL 17	0
BL 18	0


BL
Chamber 1
BL
Chamber 2
NID
Chamber 1
NID
Chamber 2
260
255
250
245
240
235
230
225
220
0
100
200
300
400
Time (μs)

Positioning

Spatial extension of the showers from the C2-collimator





Conclusion

- The ionization chamber can be used for the measurement of high radiation levels
- The measurement range is set on the low side by the levels which can be measured by the scintillators already present
- and on the high side by the dynamic range of the electronics
- The use of a time-over-threshold trigger reduces false triggers but also reduces the reaction time to a few μs
- Three detectors will be used, and the trigger requires at least two signals over threshold. This protectts against false triggers by noisy electronics
- Interference will be reduced by a spare channel which has no gas-chamber