Optically read out GEM detector in H4 test beam

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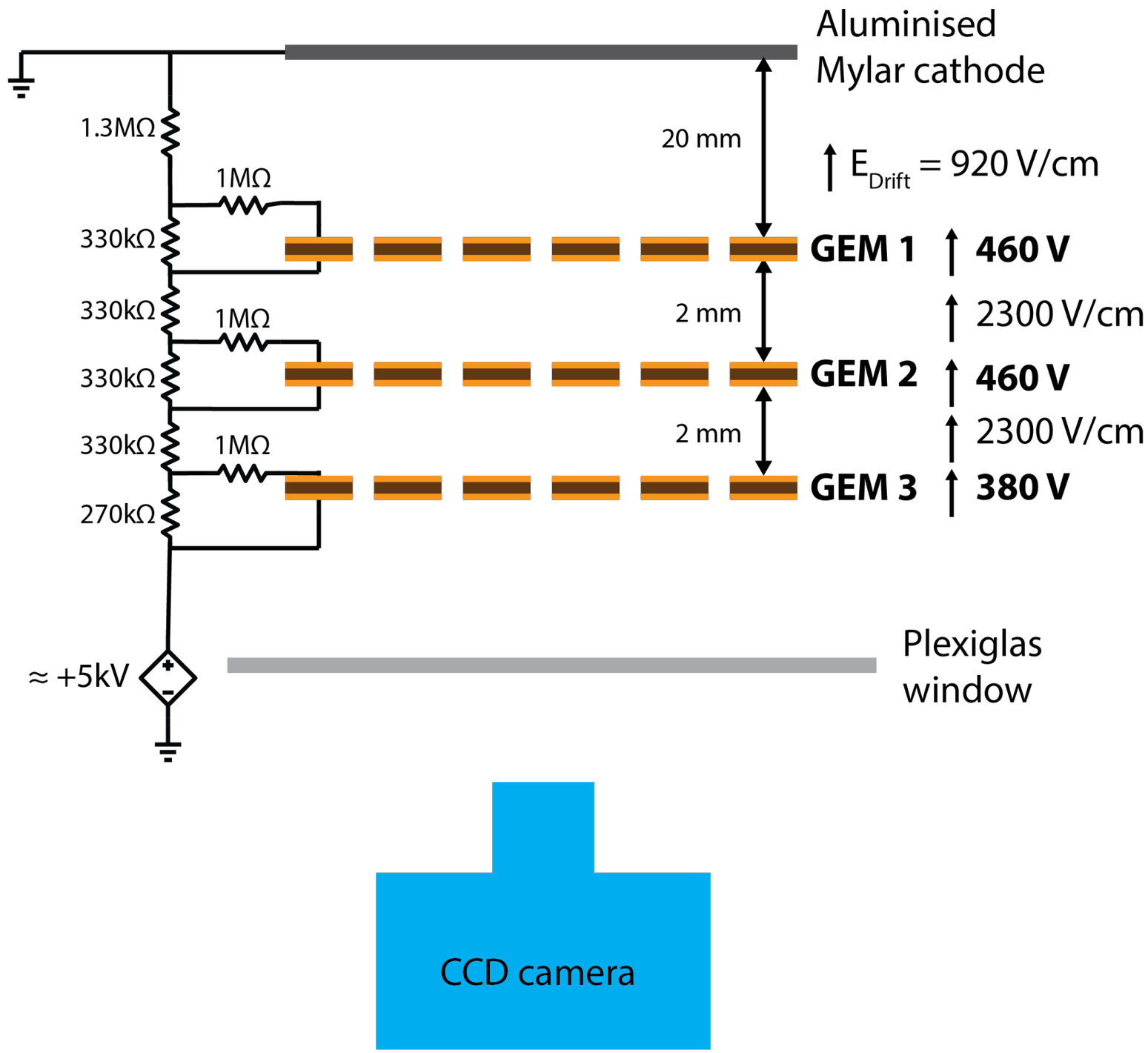
Motivation

Visualise events in H4 muon and pion test beam

Optically read out triple GEM-based detector was operated in recent RD51 test beam

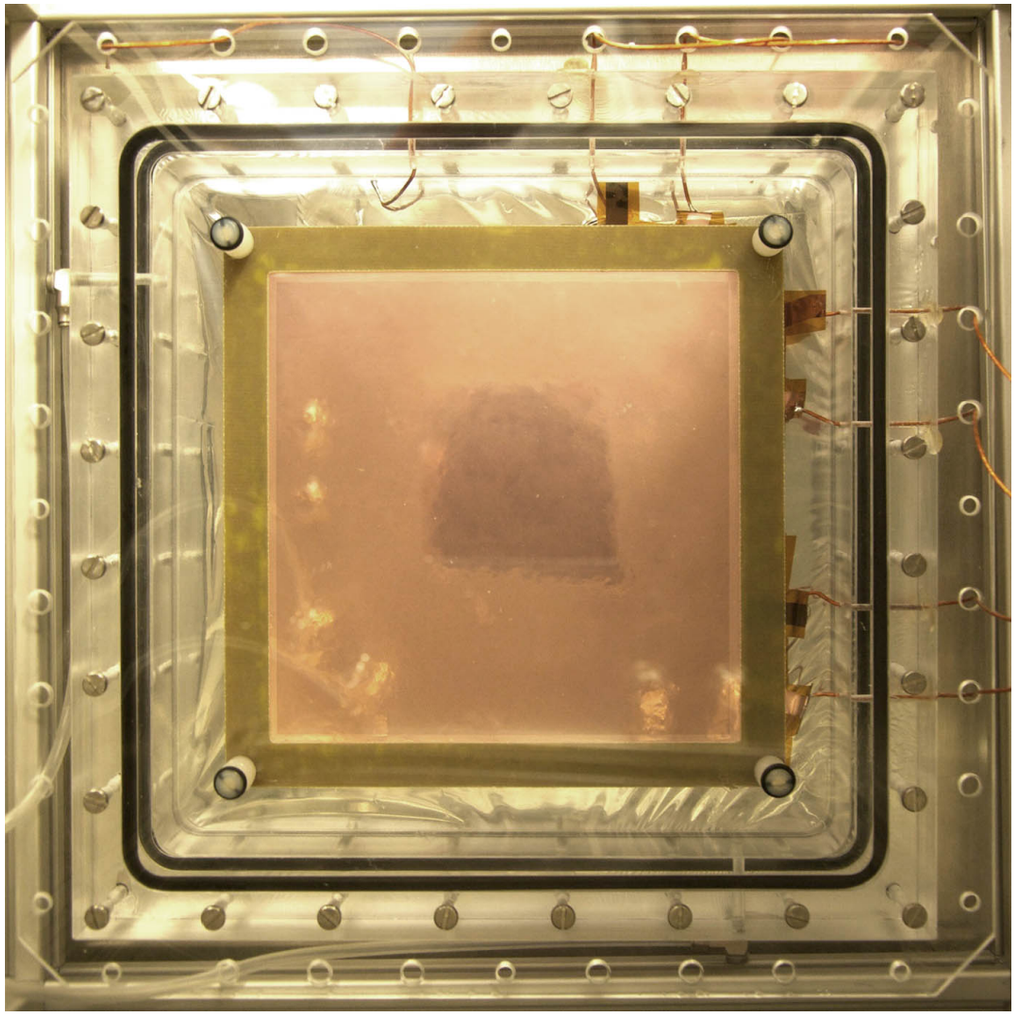
Highly mobile detector: self-contained and operation in sealed mode after filling with Ar/CF_4 (80/20 %)

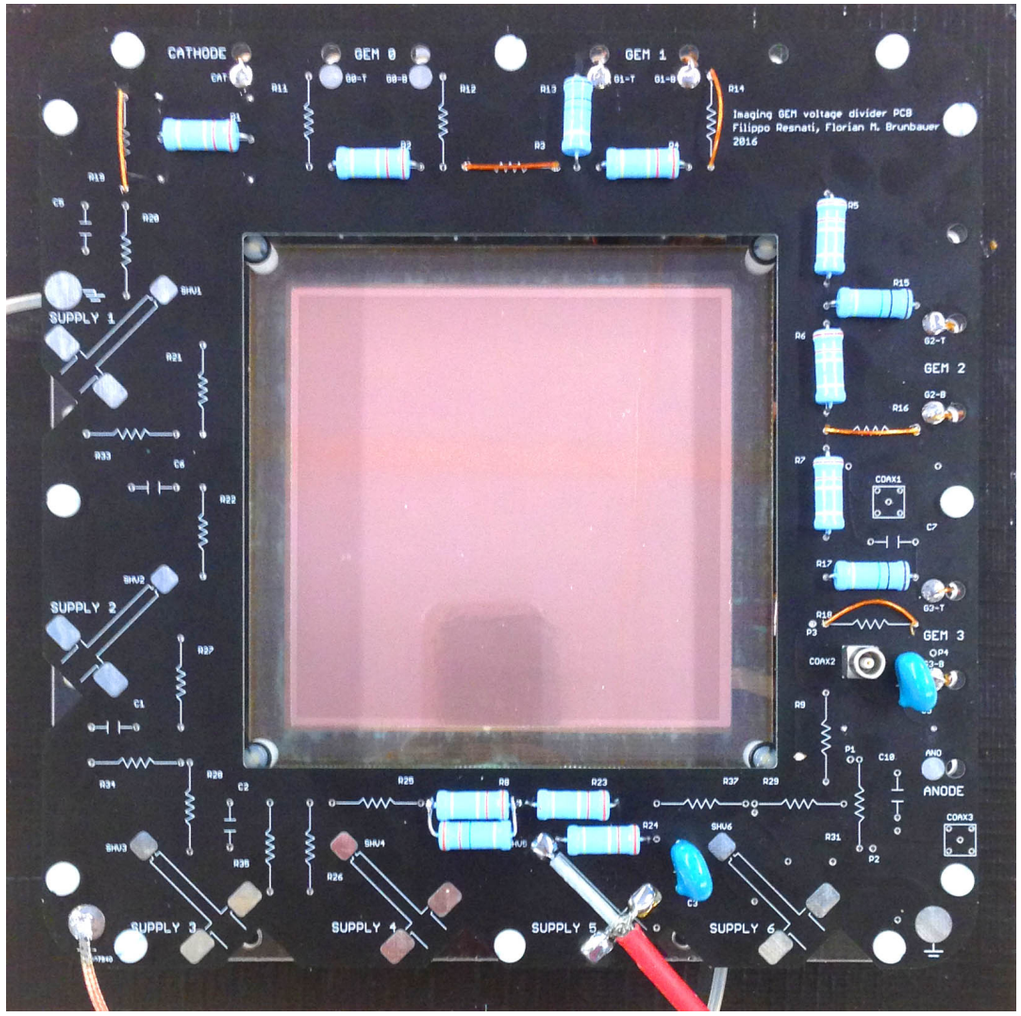
Optical imaging detector



1 bar Ar/CF_4
(80/20 %)

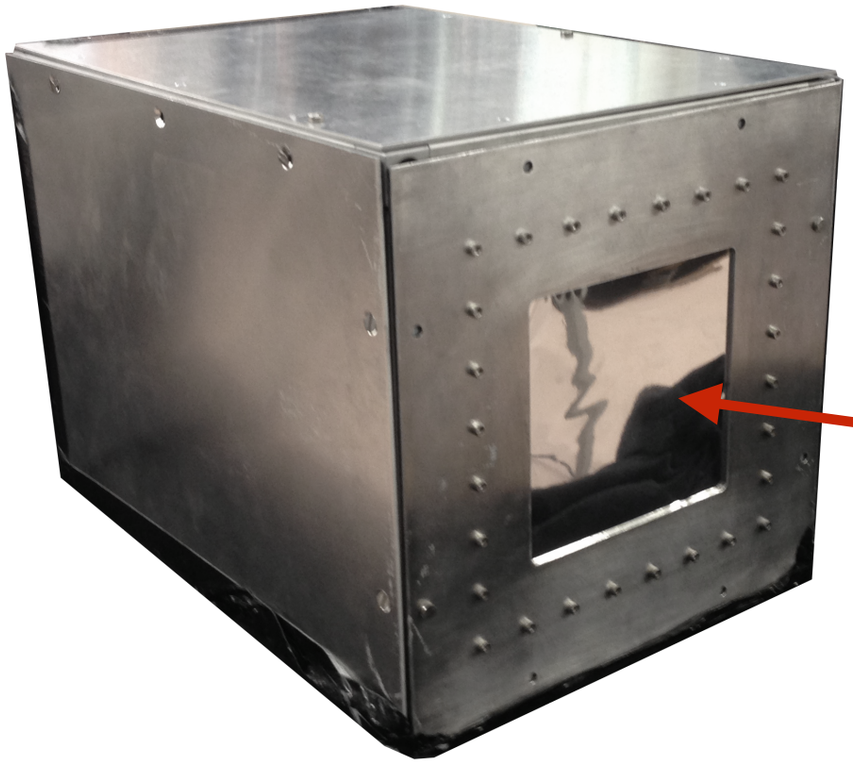
View facing 3rd GEM





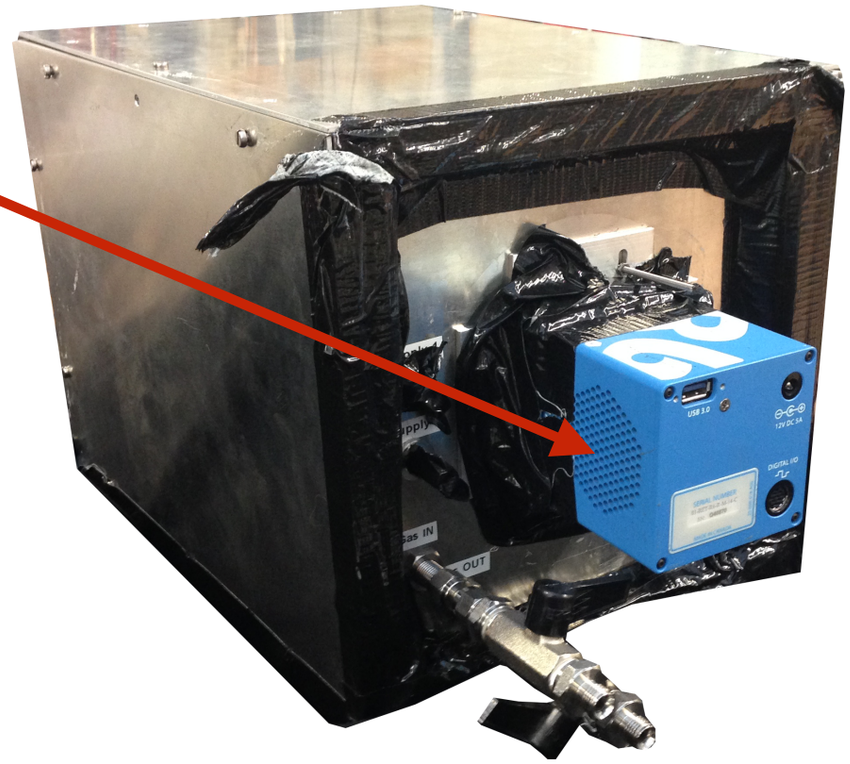
Plexiglas gas volume
housing three 10x10cm² GEMs

Voltage divider PCB
tapered voltage divider with ≈20% lower voltage on 3rd GEM

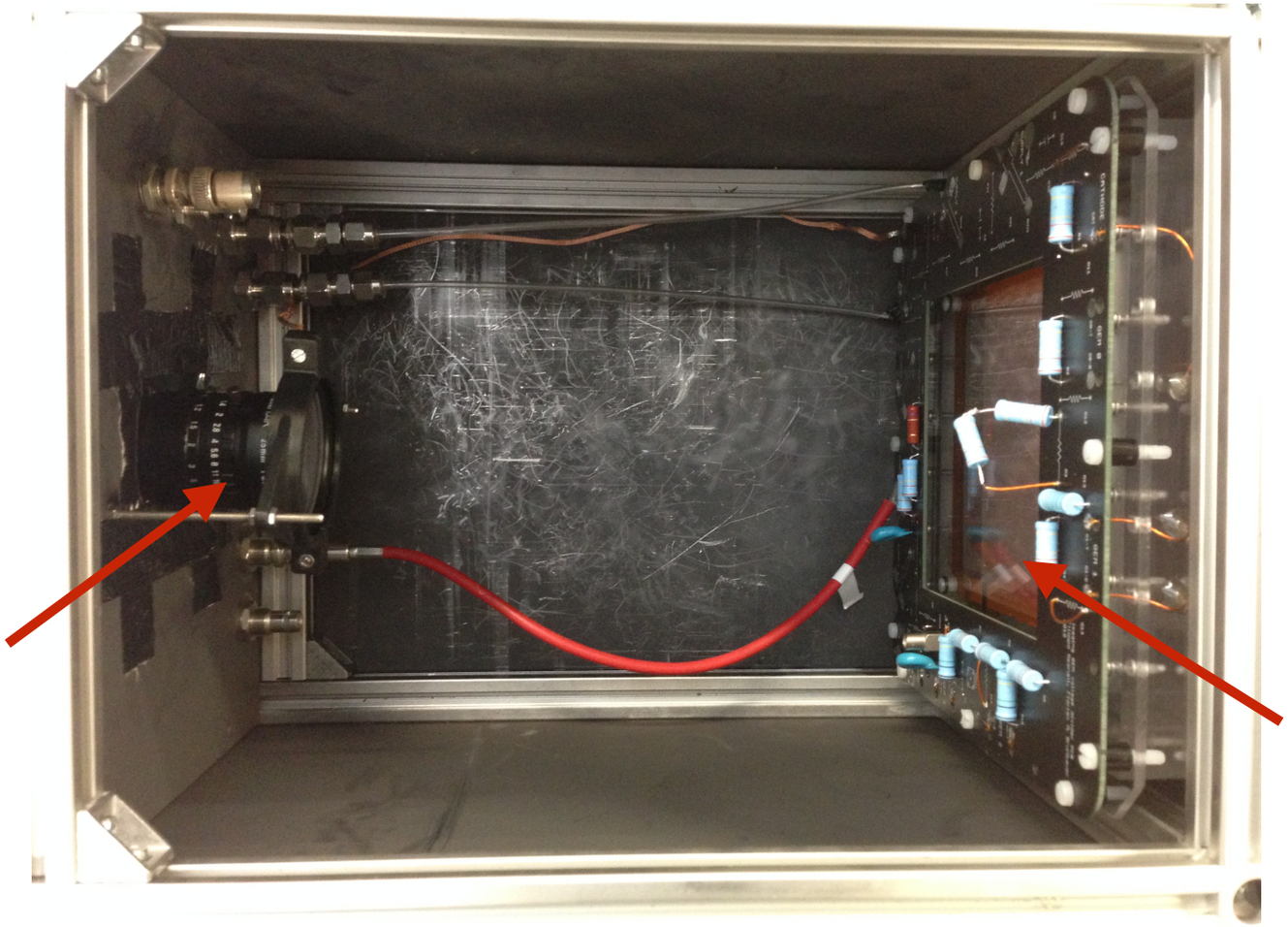


CCD camera

Aluminised
Mylar cathode

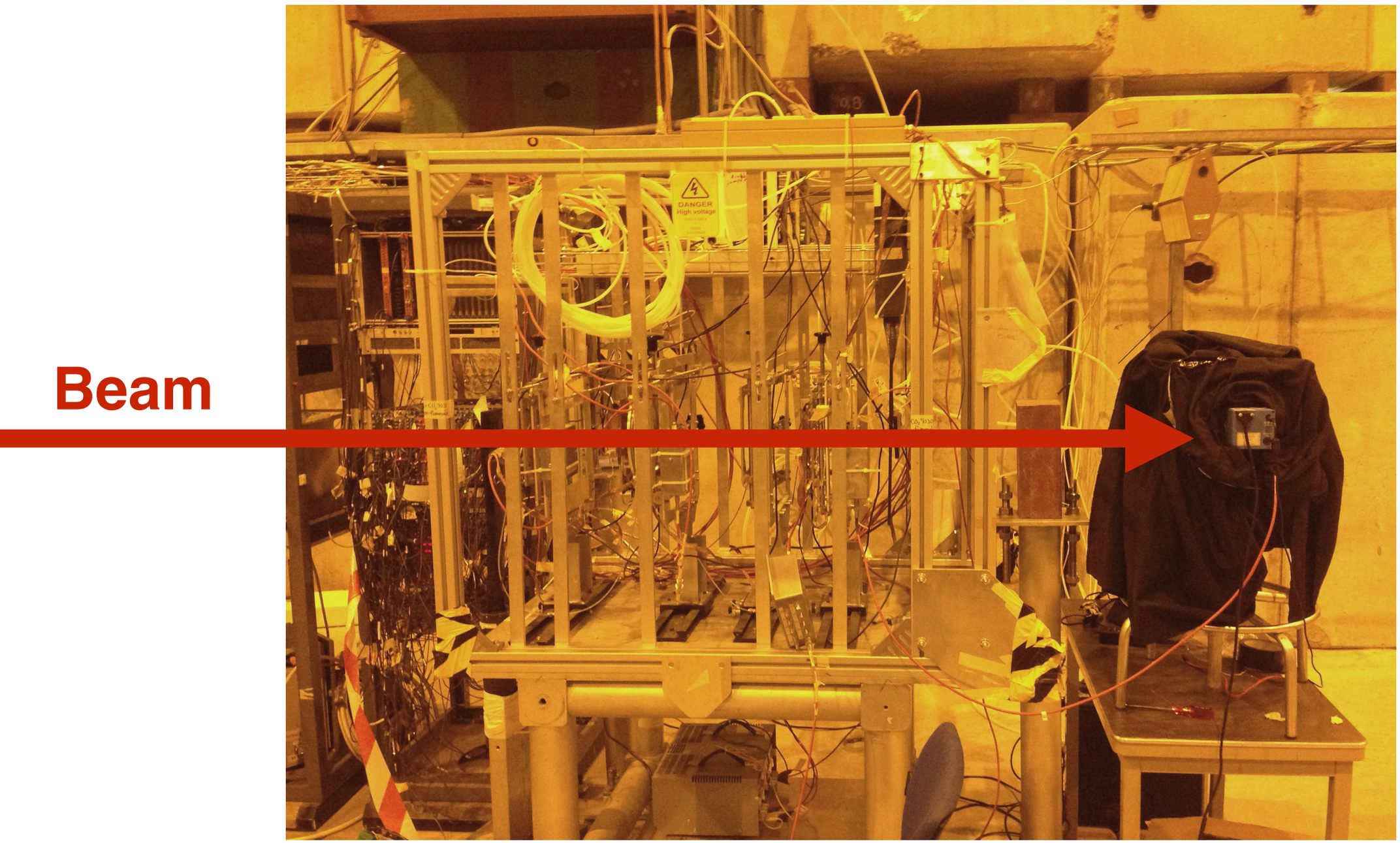


Inside

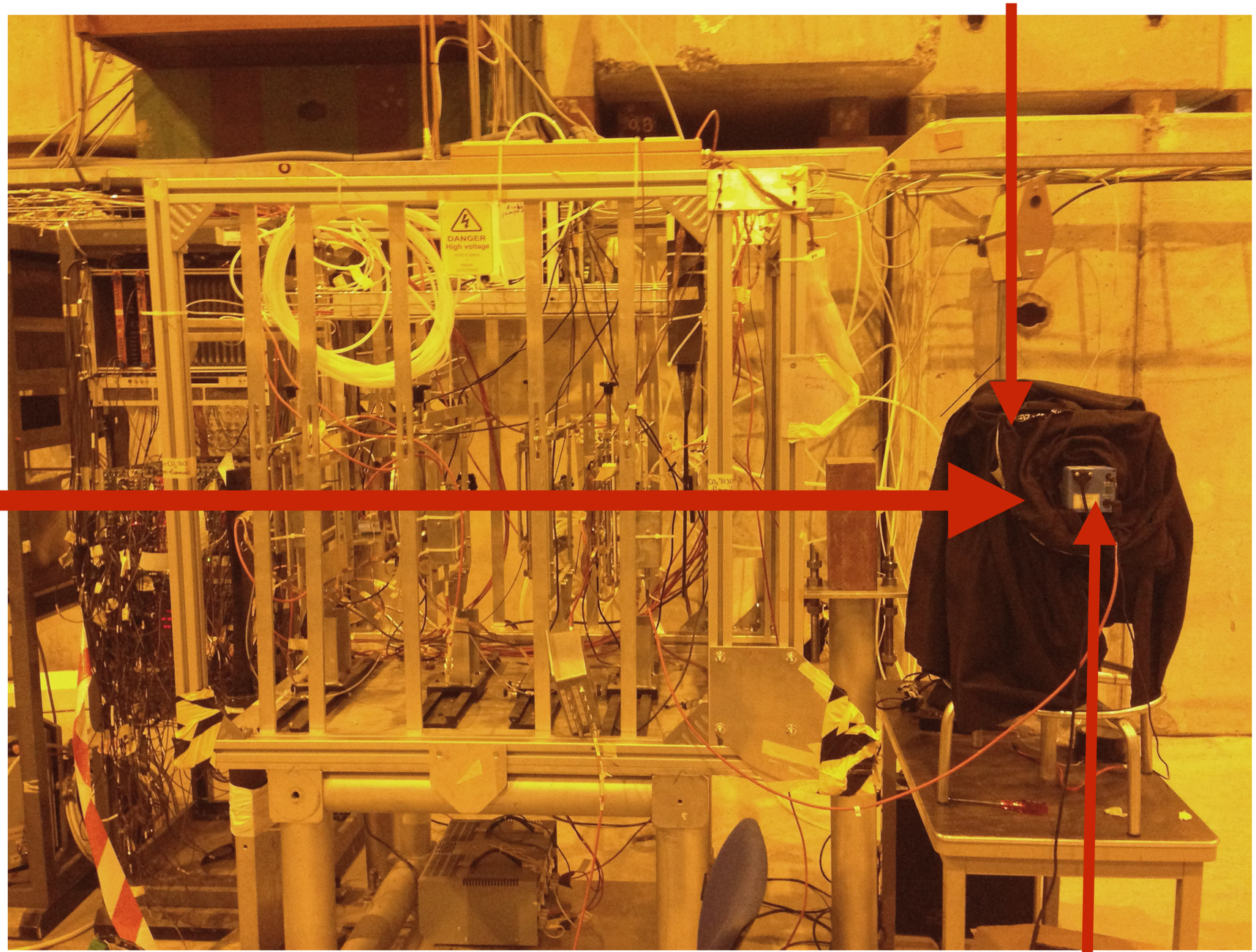


Camera lens

Triple GEM


Beam
DANGER
High voltage

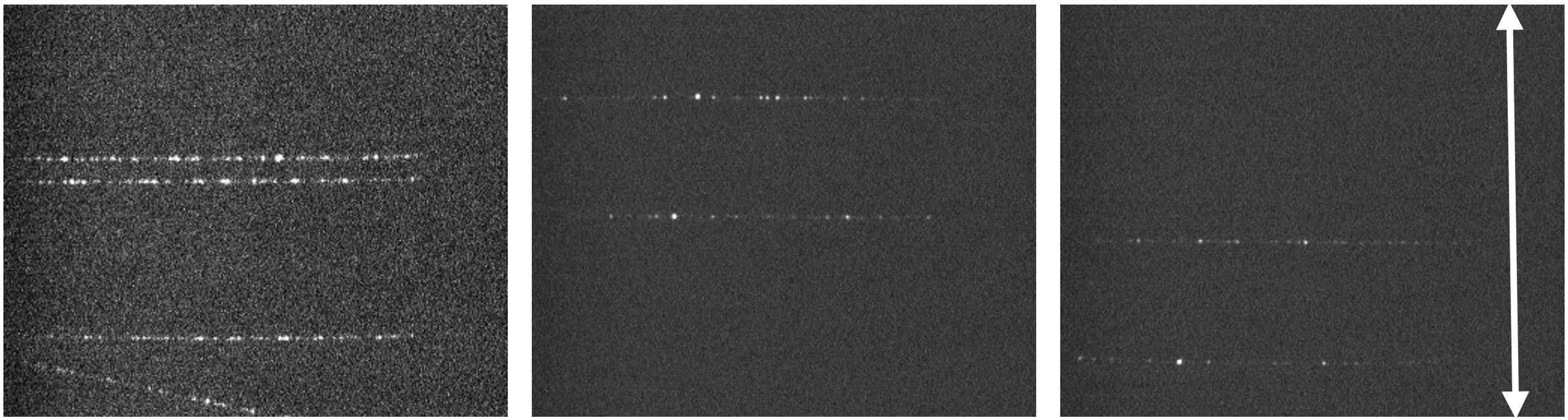
Optical imaging detector



Beam

CCD camera

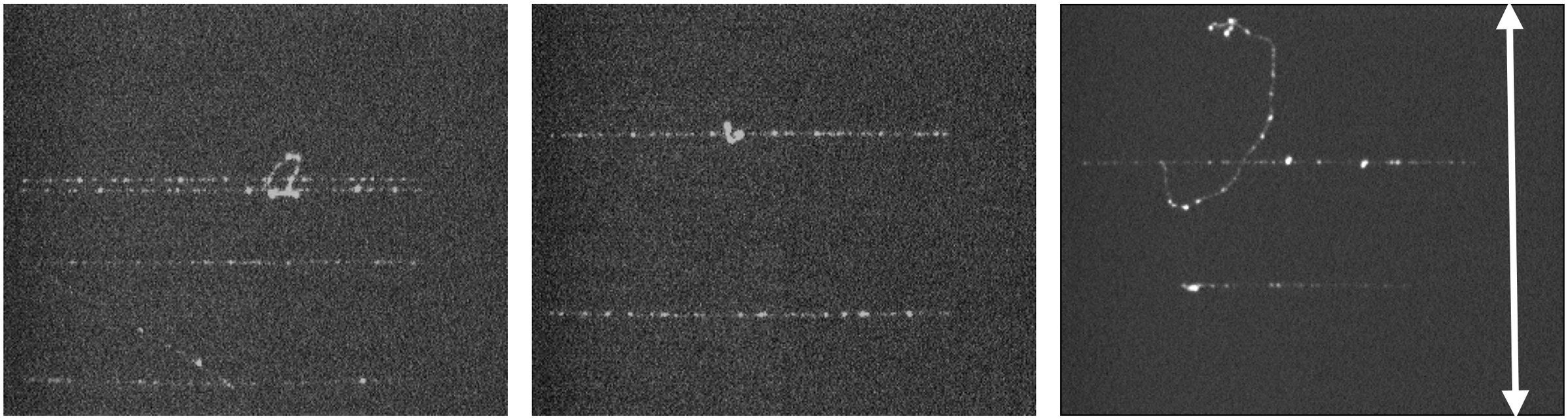
Muon tracks



10cm

H4 muon beam
1ms exposure, 8x8 binning

Muon tracks & delta rays

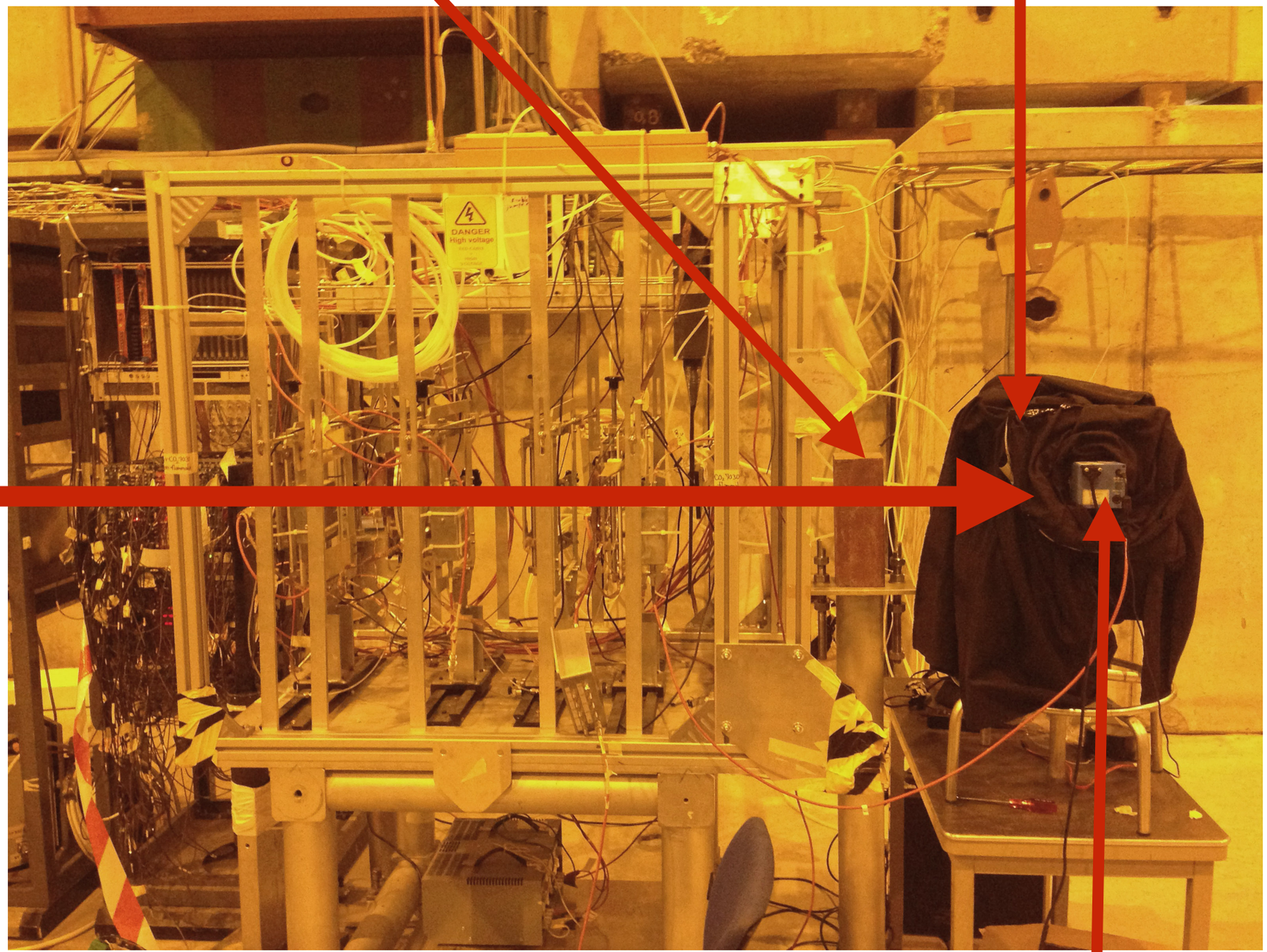


10cm

H4 muon beam
1ms exposure, 8x8 binning

Fe block

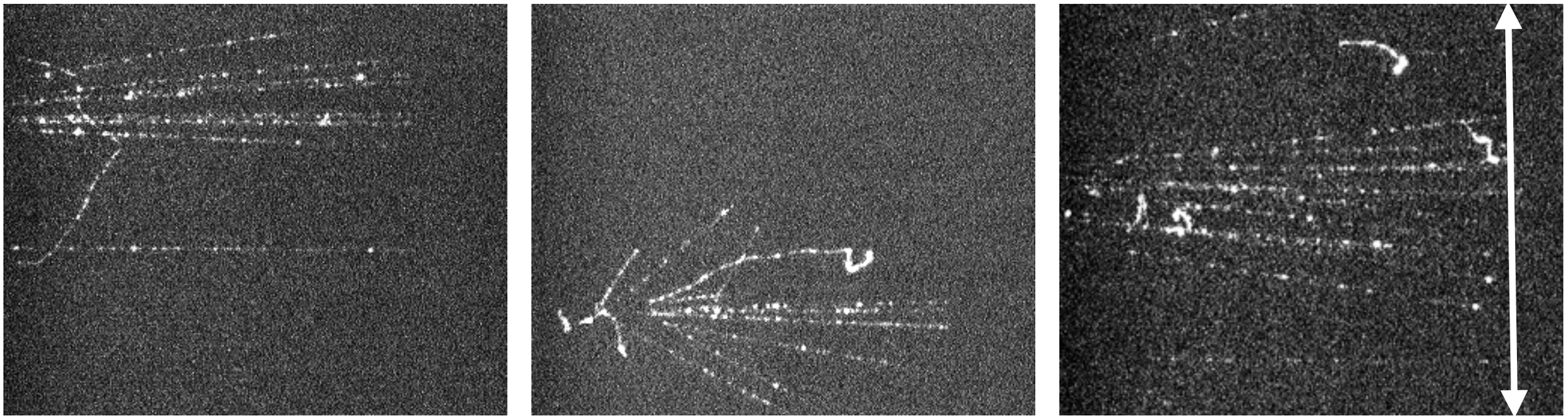
Optical imaging detector



Beam

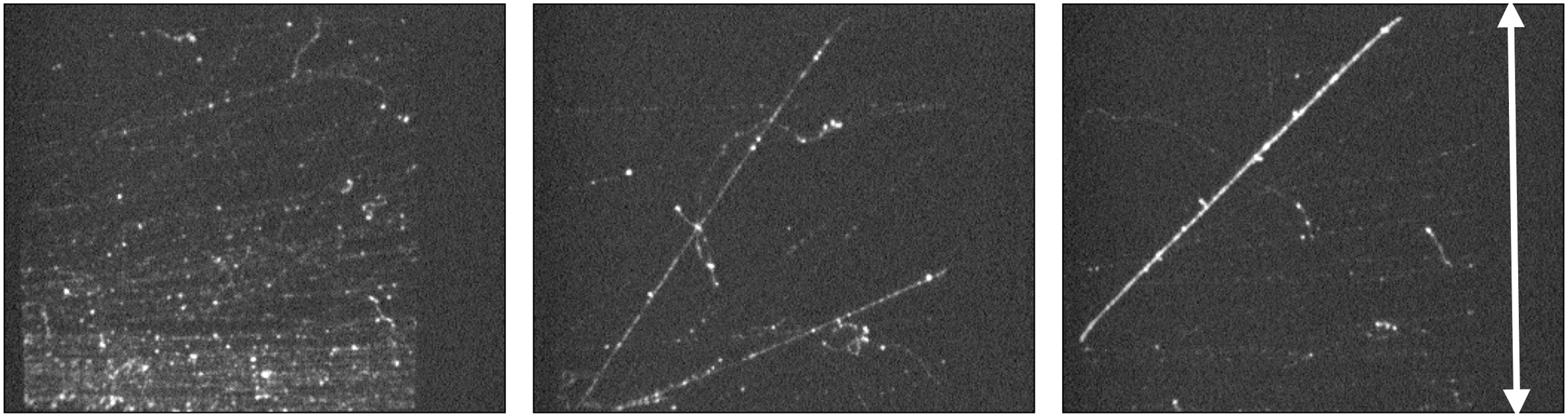
CCD camera

Showers



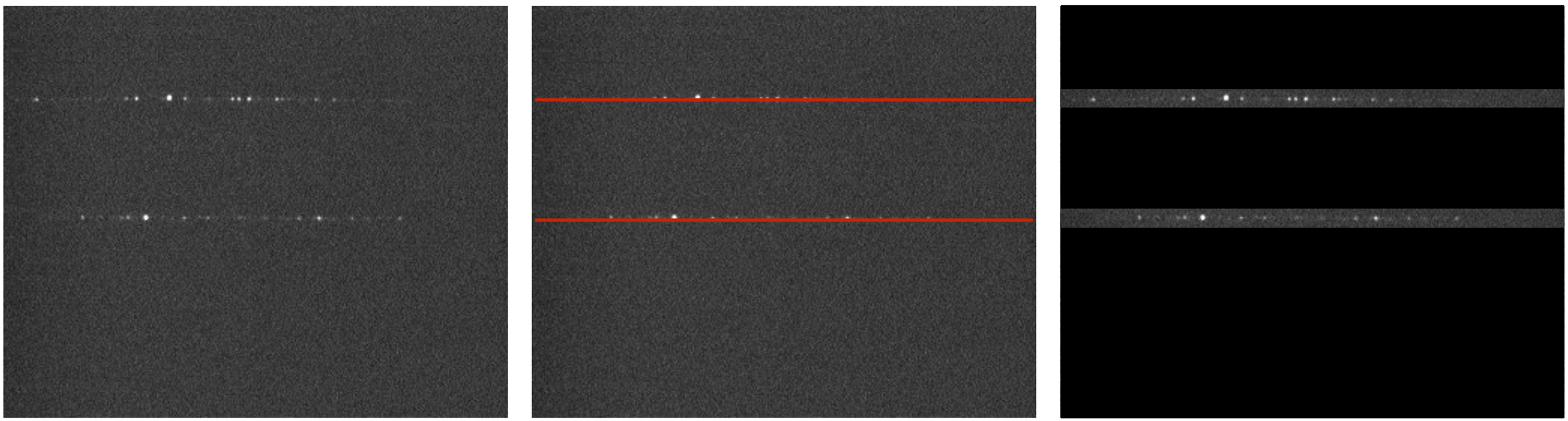
H4 muon beam
1ms exposure, 8x8 binning

Pion beam



H4 pion beam
1ms exposure, 8x8 binning

Purity & gain changes



- Muon track recognition by Hough transformation
- Integration of intensity along tracks
- Intensity spectra built to investigate signal degradation
- Results pending

Conclusion

- Muon tracks recorded by optically read out triple GEM-based detector
- Sealed mode operation of detector possible for several hours but significant signal degradation after longer times
- Low signal-to-noise ratio limited by detector stability in beam (beam induced discharges at highest gain in pion beam)

Outlook

Thicker drift region

- Improved containment

Gas flushing

- Avoid signal degradation due to contamination

4 GEMs

- Increased stability due to smaller voltage required across each GEM
- Increased signal-to-noise ratio