SciTil and SciRod Tests at COSY Proton Beam

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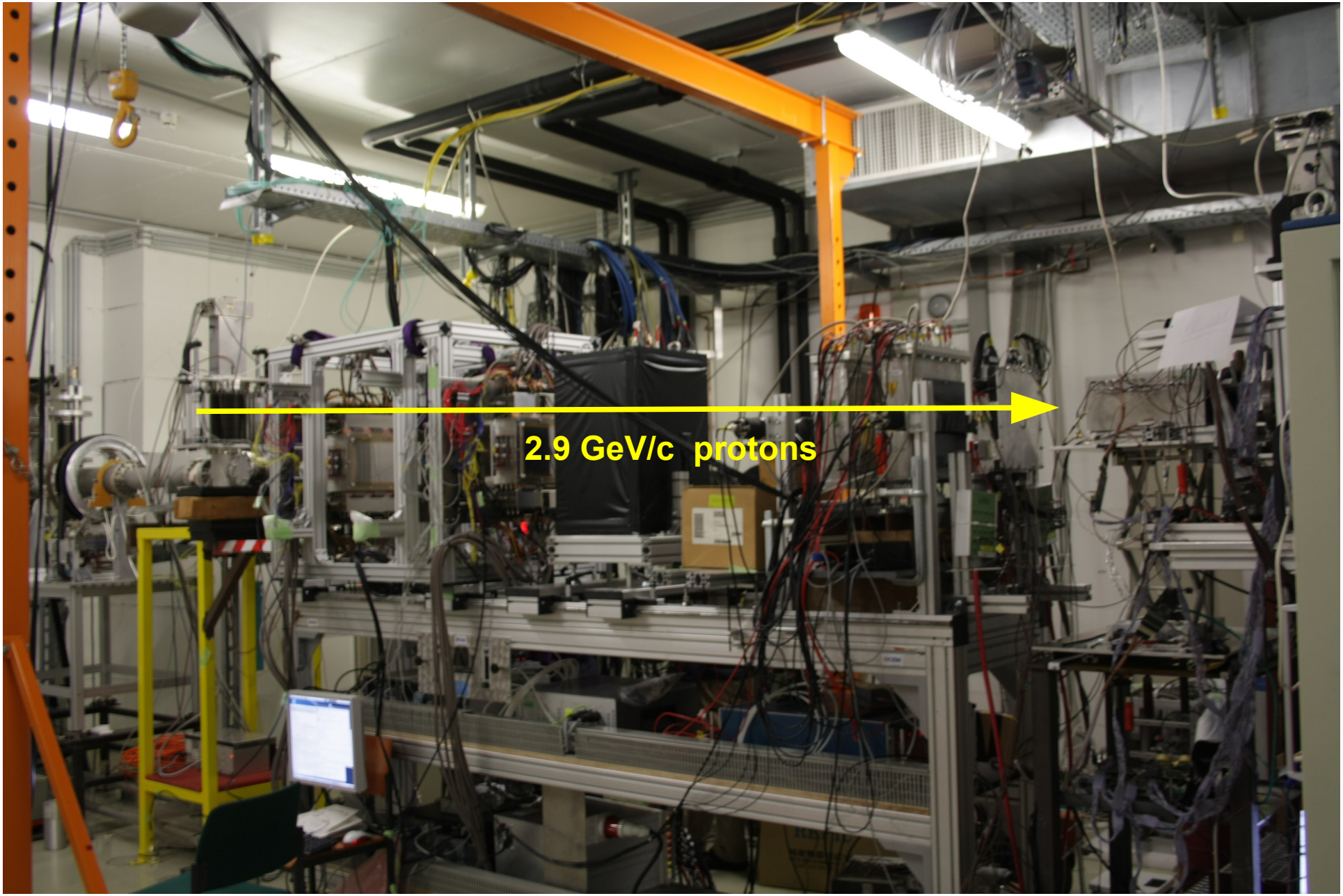
- Introduction
- Testbeam setup
- Results of threshold scans
- Summary

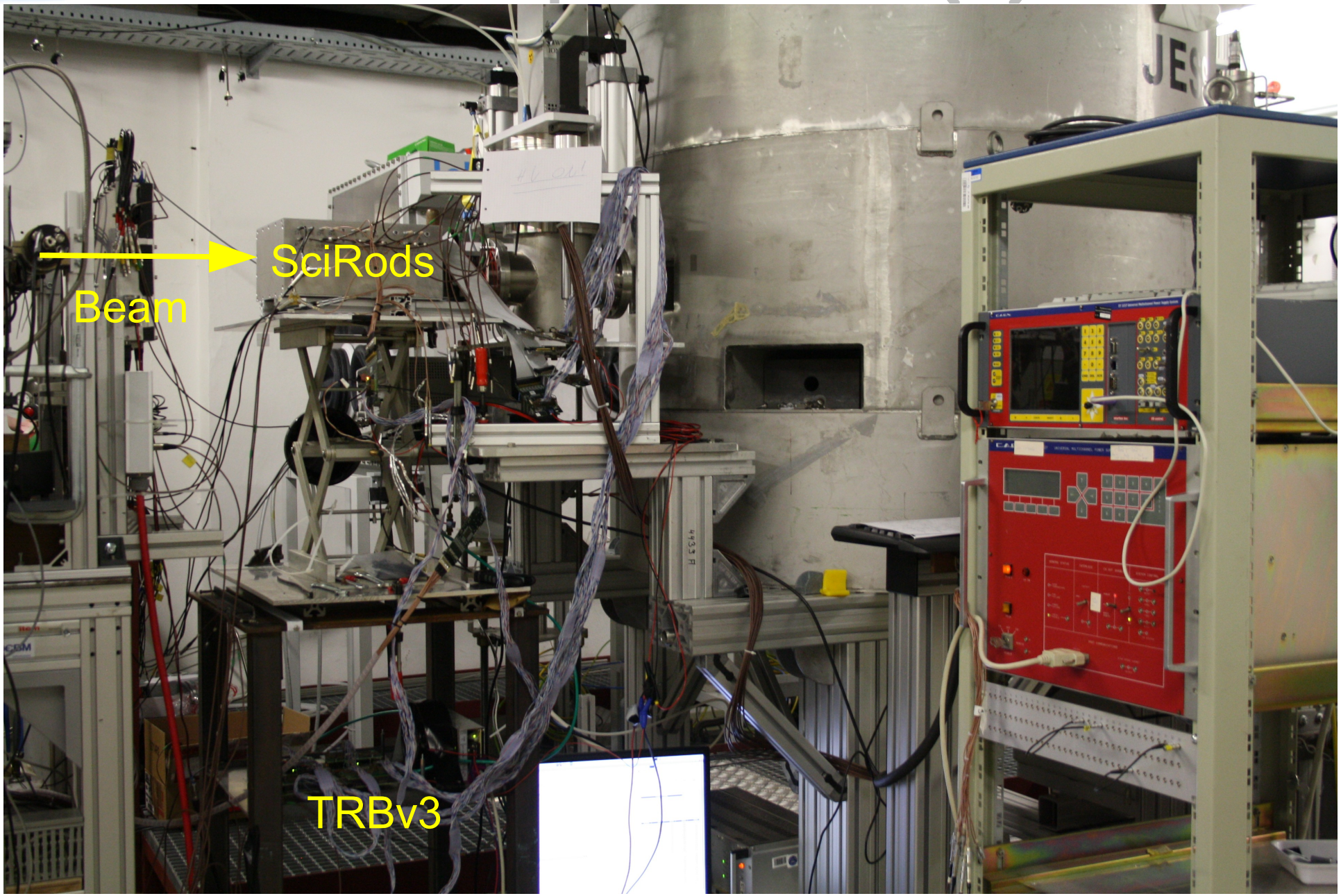
Introduction

- SciTil/SciRod time resolution tests at 2.9 GeV/c COSY proton beam
  - 27 Jan – 3 Feb 2014
- 5 scintillator/SiPM configurations measured simultaneously [enclosed in aluminium box]
  - 5x5x120 mm^3 BC420; MPPC S12572-100P; AD8000
  - 5x10x120 mm^3 BC420; MPPC S12572-100P; 2 MAR-6
  - 5x5x50 mm^3 BC420; MPPC S12572-050P; AD8000
  - 5x10x50 mm^3 BC420; MPPC S10931-100P; AD8000 [did not work]
  - 30x30x5 mm^3 BC408; MPPC S12652-050C; AD8000
- Rough tracking with 8x8 pixel MCP-TOF behind alubox
- TRBv3 data aquisition with PADIWA boards (10x amplifier)
- Several threshold scans of time differences (resolutions) done

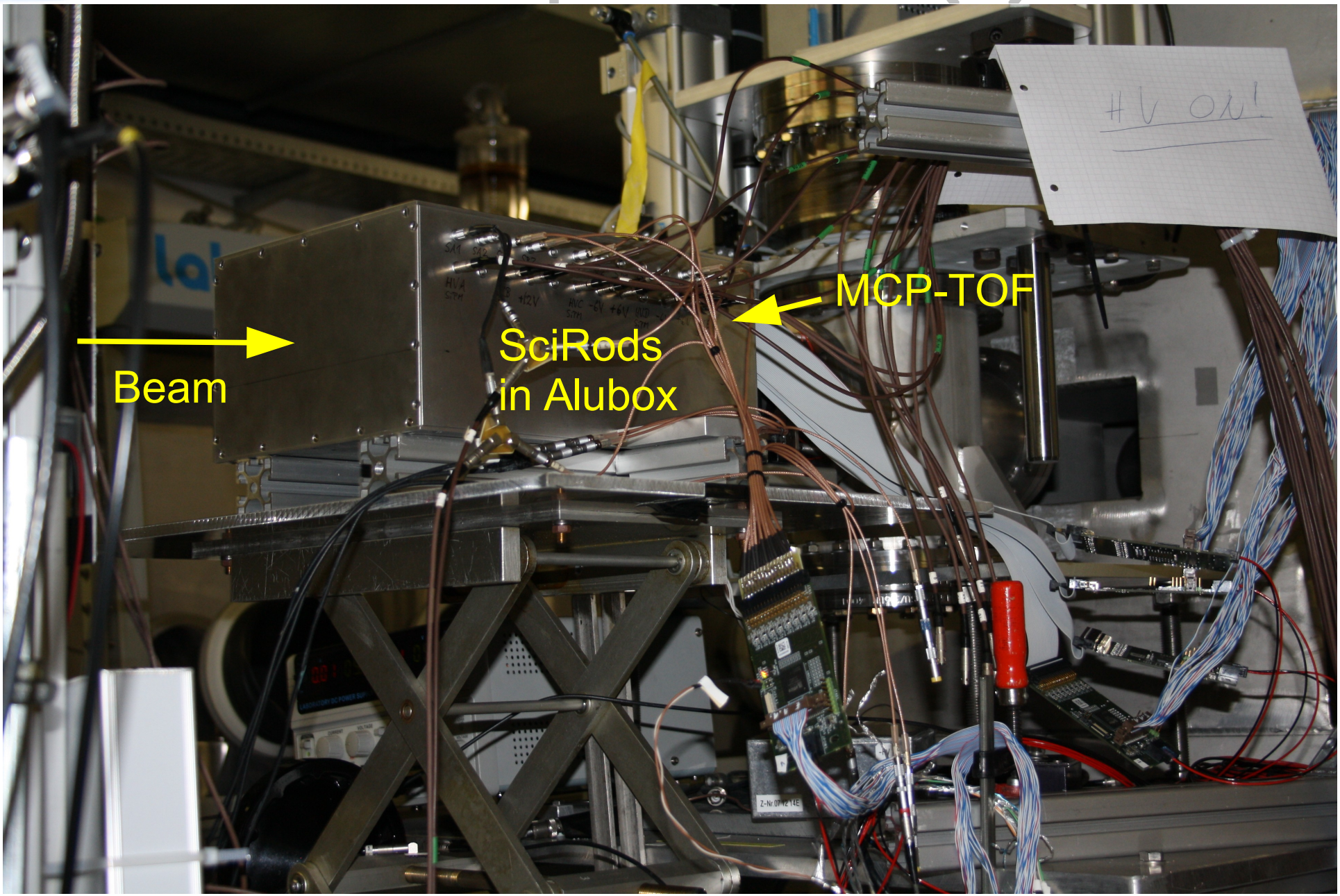
Beamline in Julich



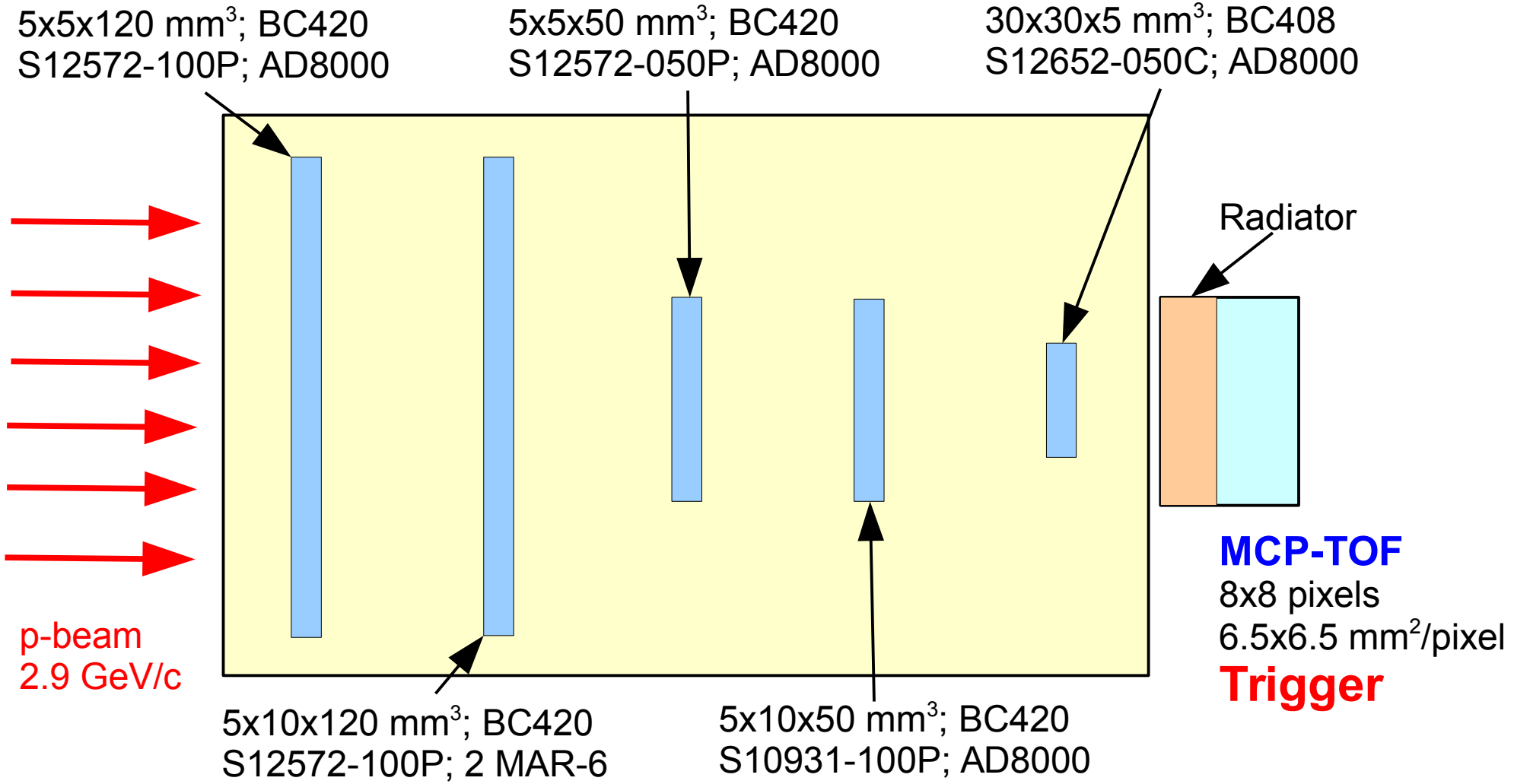
SciRod Setup in Julich (1)



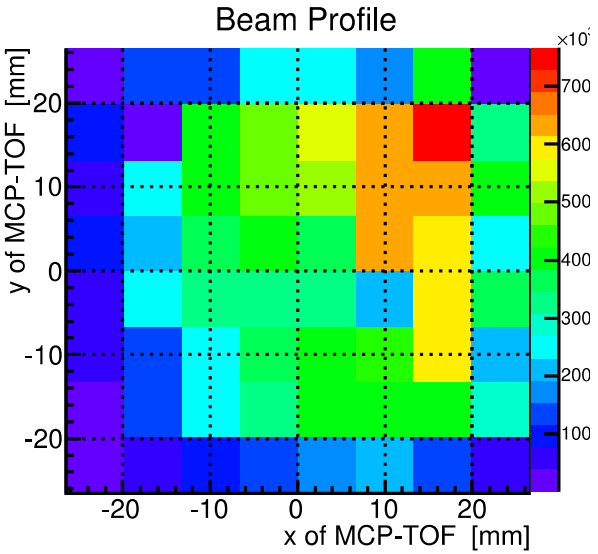
SciRod Setup in Julich (2)

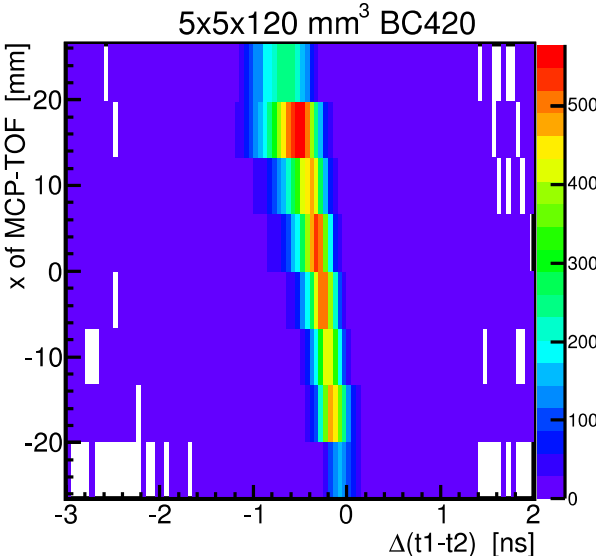


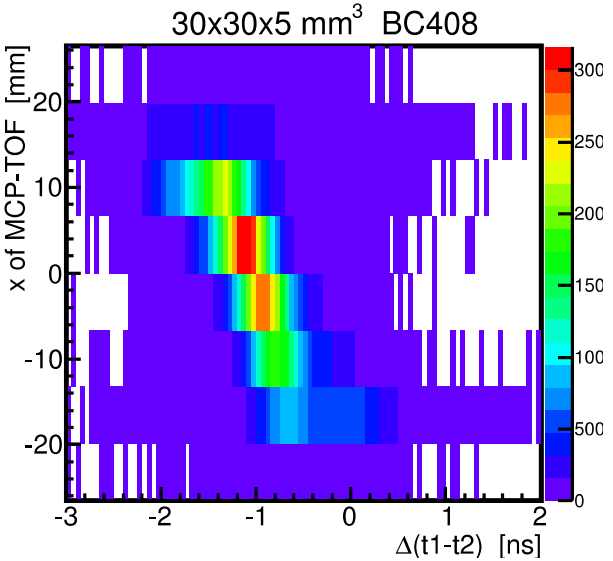
Setup in Julich



Tracking with MCP-TOF

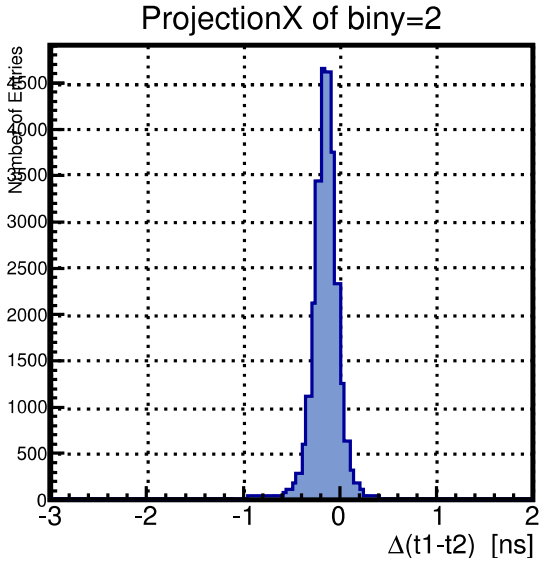


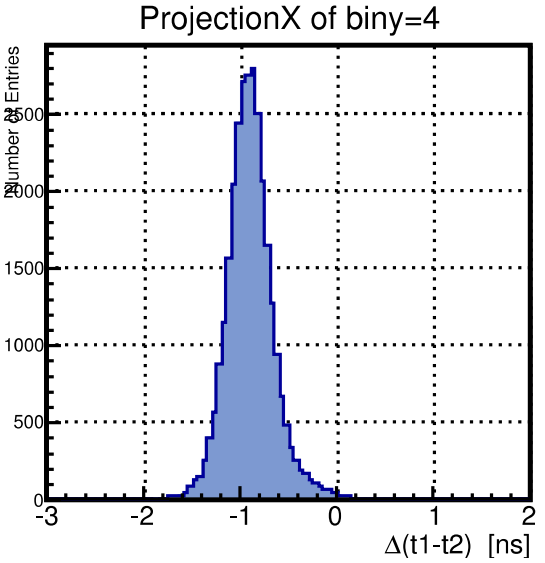




Defocussed beam

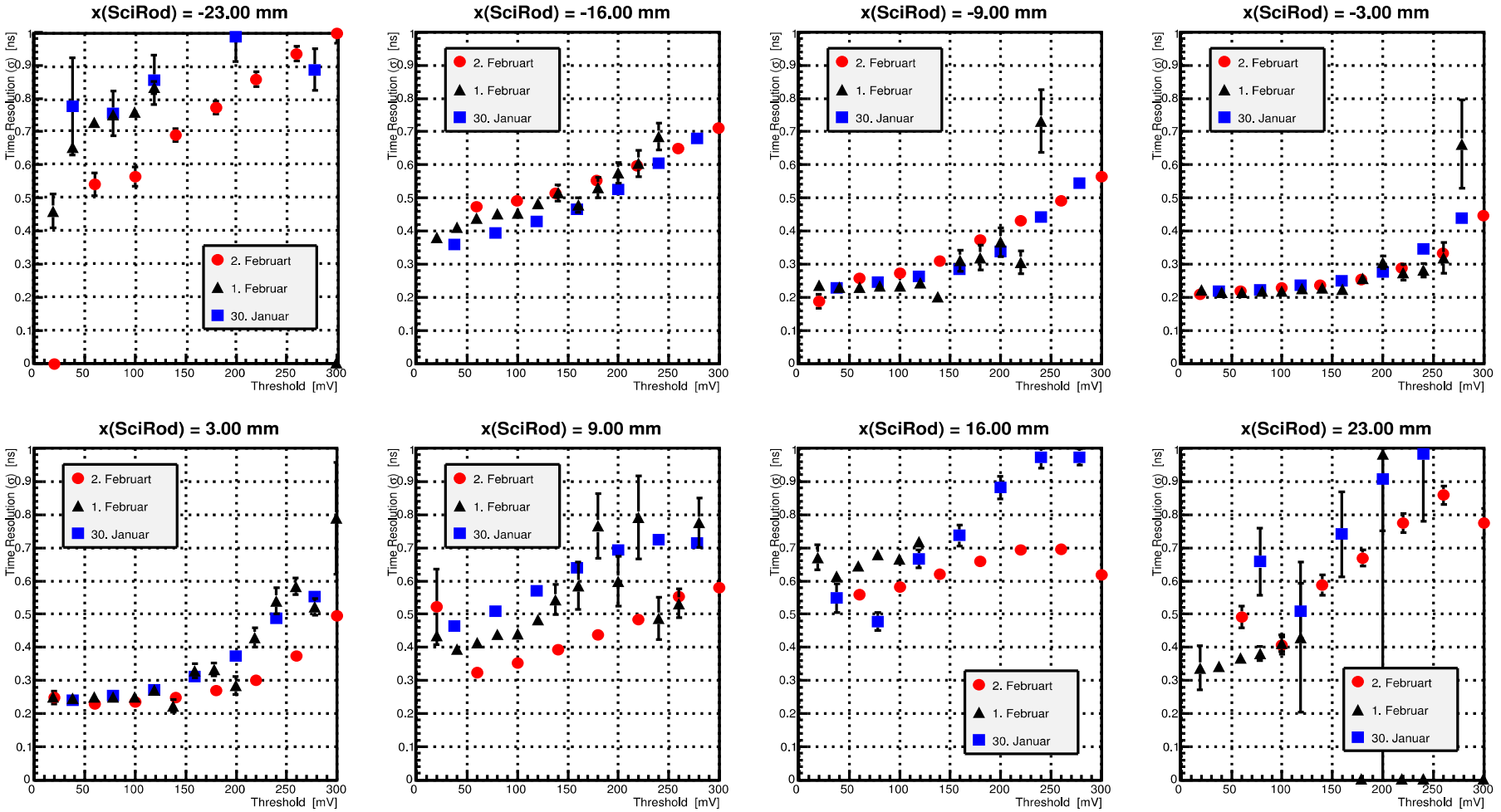
Tracking essential to account for time difference along SciRods





Time Resolutions vs Threshold (1)

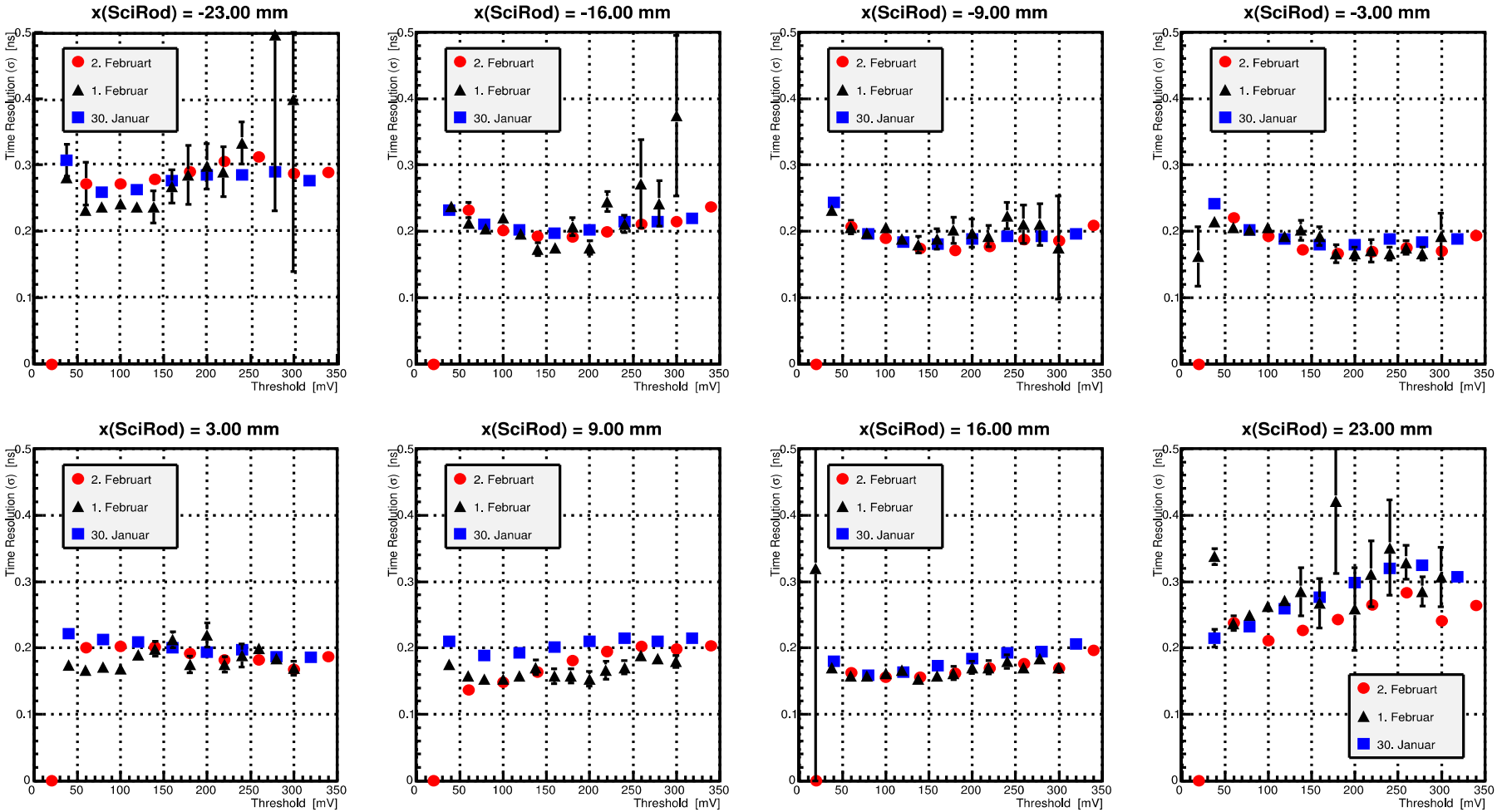
30x30x5 mm^3 Scintillator BC408
MPPC S12652-050C; 1x AD8000



- black dots: SiPMs more noisy (radiation !); red dots: +0.5 V voltage
- **best time resolution: σ(t1-t2) ≈ 220 ps at ~2-3 p.e. threshold**

Time Resolutions vs Threshold (2)

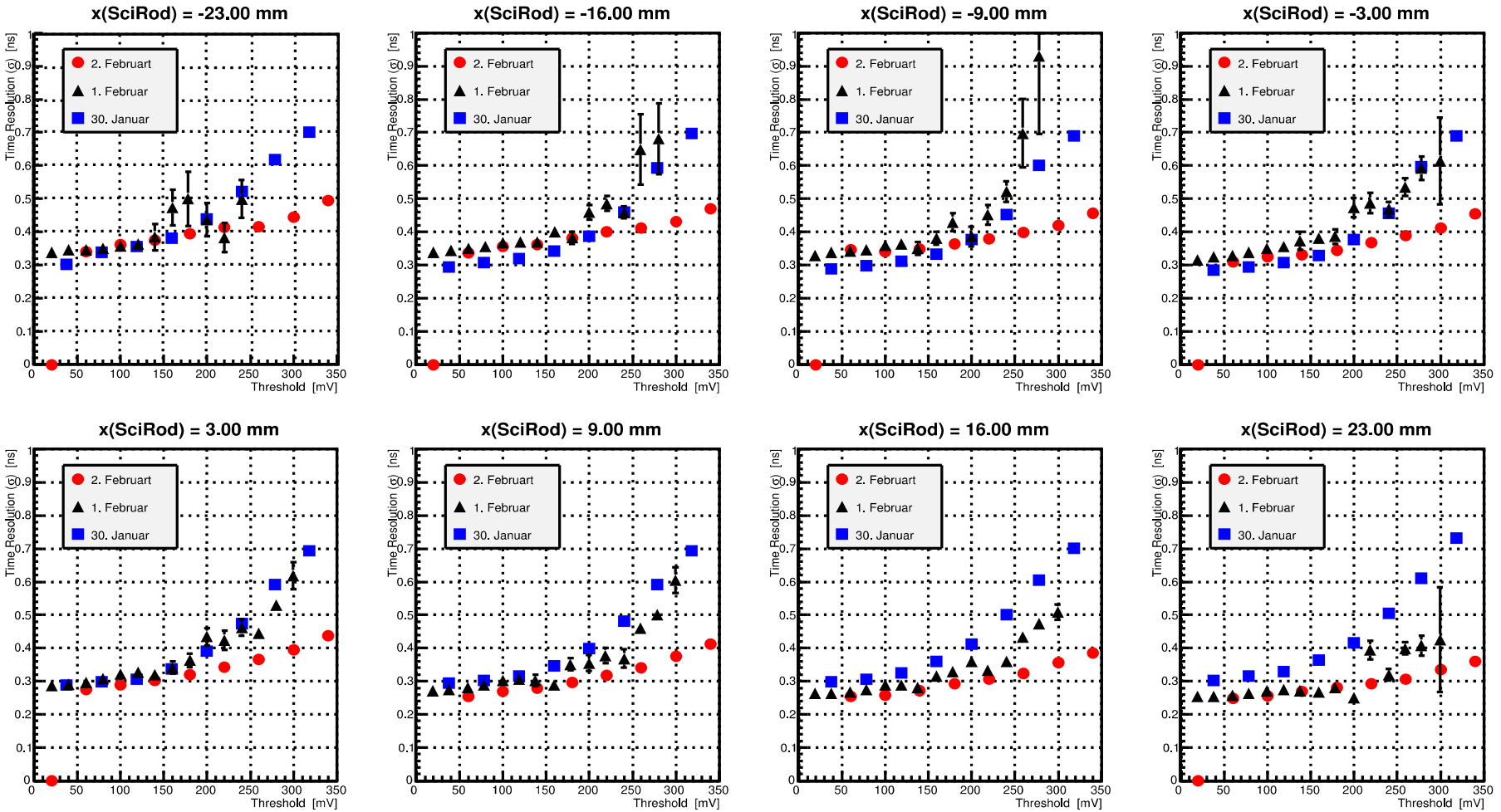
5x5x50 mm^3 Scintillator BC420
MPPC S12572-050P; 1x AD8000



- black dots: SiPMs more noisy (radiation !); red dots: +0.5 V voltage
- **best time resolution: σ(t1-t2) ≈ 160 ps at ~2-3 p.e. threshold**

Time Resolutions vs Threshold (3)

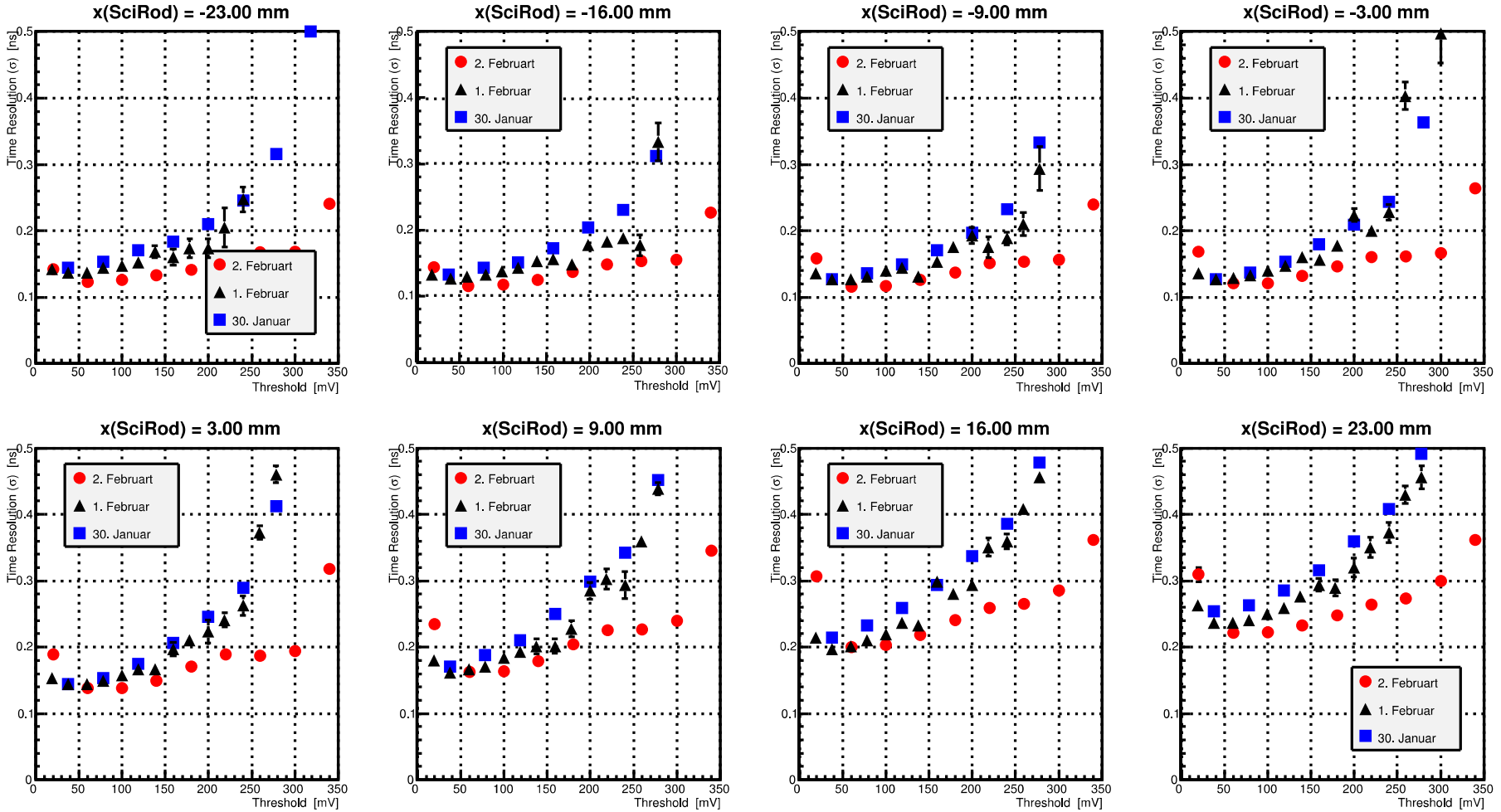
5x10x120 mm^3 Scintillator BC420
MPPC S12572-100P; 2x MAR-6



- black dots: SiPMs more noisy (radiation !); red dots: +0.5 V voltage
- **best time resolution: σ(t1-t2) ≈ 250 ps at ~2-3 p.e. threshold**

Time Resolutions vs Threshold (4)

5x5x120 mm^3 Scintillator BC420
MPPC S12572-100P; 1x AD8000



- black dots: SiPMs more noisy (radiation !); red dots: +0.5 V voltage
- **best time resolution: σ(t1-t2) ≈ 120 ps at ~2-3 p.e. threshold**

Summary and Outlook

- Threshold scans show better time resolutions at lower thresholds as expected
- Some results are not yet understood
- Time resolutions obtained with proton beam and TRBv3 DAQ are consistent with those measured with 90Sr source
    - SciTil (BC408): ~220 ps
    - SciRod (BC420): ~120 ps
- SiPMs got more noisy after only one day in beam (100 kHz regime)
- Outlook:
    - More data analysis needed