Summary on COFFEE May testbeam

XU Zijun, CAI Yuman, WANG Boxin, LI Qinze, LI Yiming, ZHANG Hui,
FU Yisheng, SHI Tianyu, LIU Kang, YUAN Yuan

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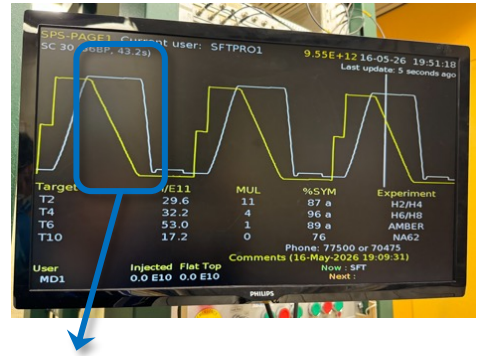
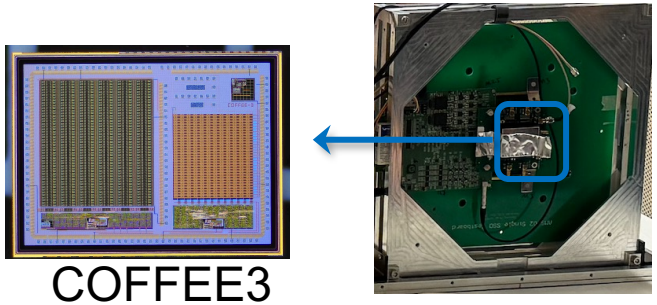
Basic information

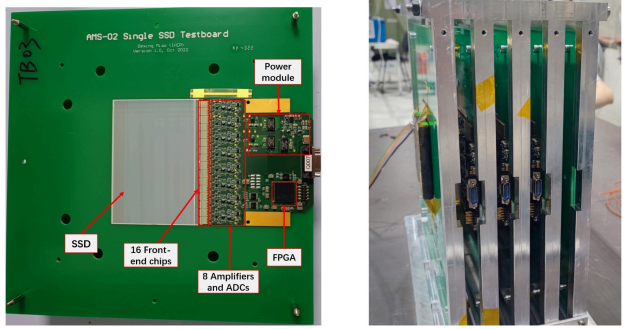
- Facility & beam time
  - SPS H6: secondary hadron beam with $p_{\max}$ ~205 GeV
  - 13-20 May 2026
  - As a DRD3 user, run in paralle with RSD team
- Device under test:
  - COFFEE3: two chips tested on (v2.0-2, v2.0-4)
  - Focused on left (CMOS) array, double column 1
- Beam monitor system:
  - Silicon strip telescope, up to 6 layers
  - Equipped with 2 scintillators for trigger
  - Common mechanical frame to accommodate COFFEE



Typical spill length: 4.8s, 2 x 10^5 ptcl/spill



COFFEE3

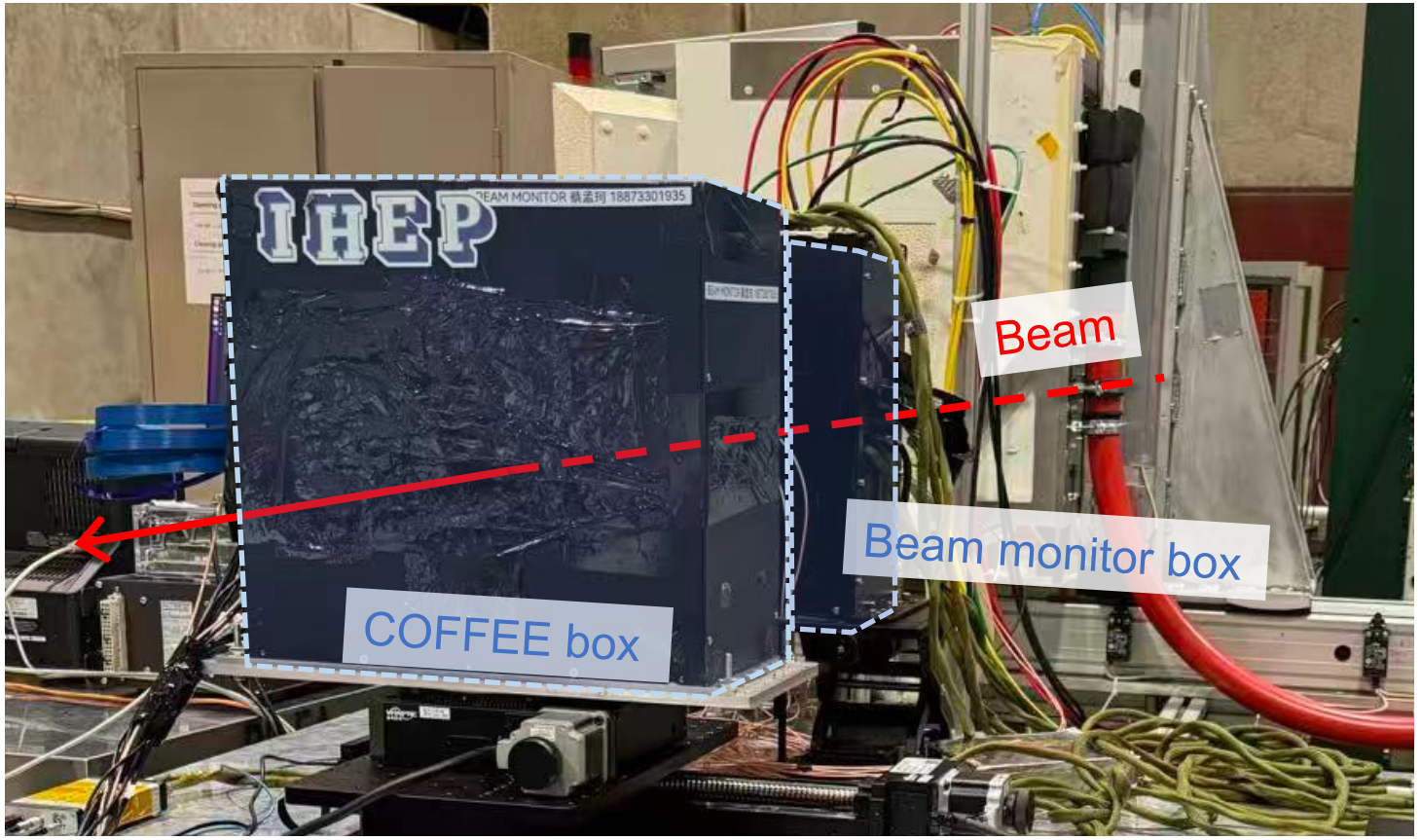


Silicon Strip telescope
'Beam Monitor'

Brief timeline

- 13-15 May: setup
  - Installation complete on 13th, beam profile study using beam monitor
  - Tracing and removing a low-freq noise in system due to Rasperry pi
  - Fine tune COFFEE noise to find a working point using C1R0 CSA output
  - Fine tune COFFEE position to align with beam center
- 15-18 May: single pixel study
  - Confirm CSA response to beam, study correlation of TOA
  - Use CSA to trigger Beam monitor → confirm tracking passing COFFEE
- 19-20 May: reconfigure system
  - Put COFFEE within beam monitor layers
  - Short data-taking two full columns & full DAQ
- Elog:
  - General elog & beam monitor:
    - https://docs.qq.com/sheet/DZnJudGt1UmJKRHpM?tab=p5af5v
  - Detailed setup & tuning:
    - https://docs.qq.com/doc/DVE1zZFJteFFjRHF2?nlc=1
    - https://docs.qq.com/doc/DVEdDS3NueFFNb1pV?nlc=1

Initial setup



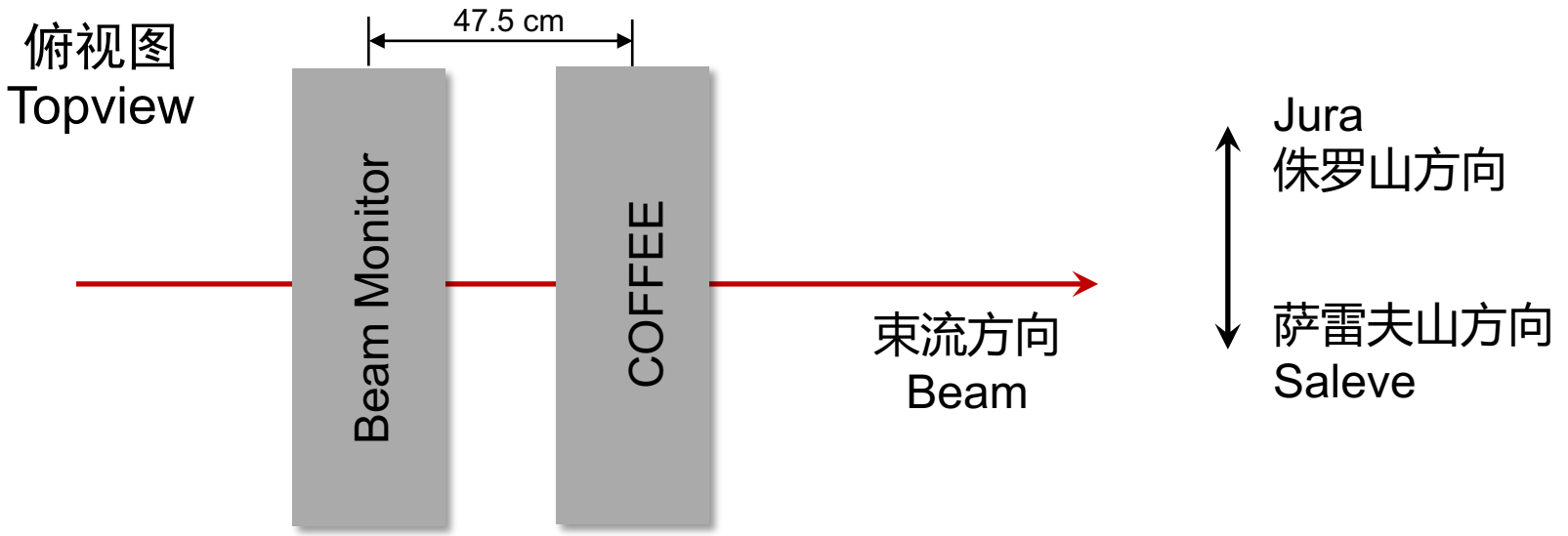
Setup done on 13th May at H6 / PP156 @ SPS.
Beam monitor and COFFEE run independently.

实验设置

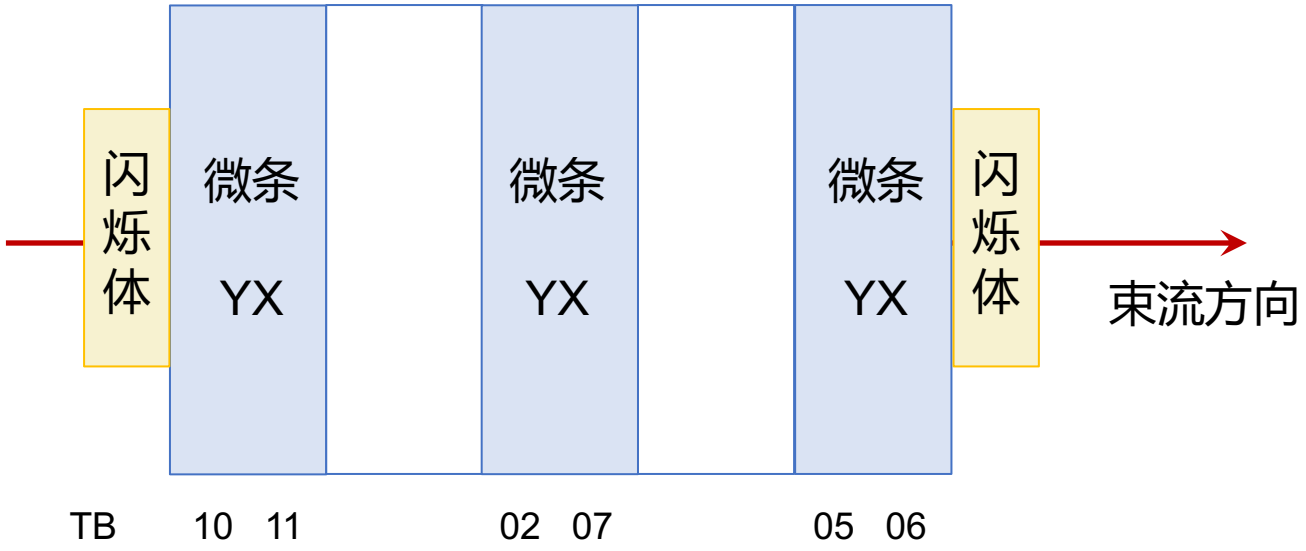
2026.05.15 ~ 05.19

Beam Monitor 与COFFEE
两套系统独立运行

COFFEE 背向束流



微条探测器系统
Beam Monitor

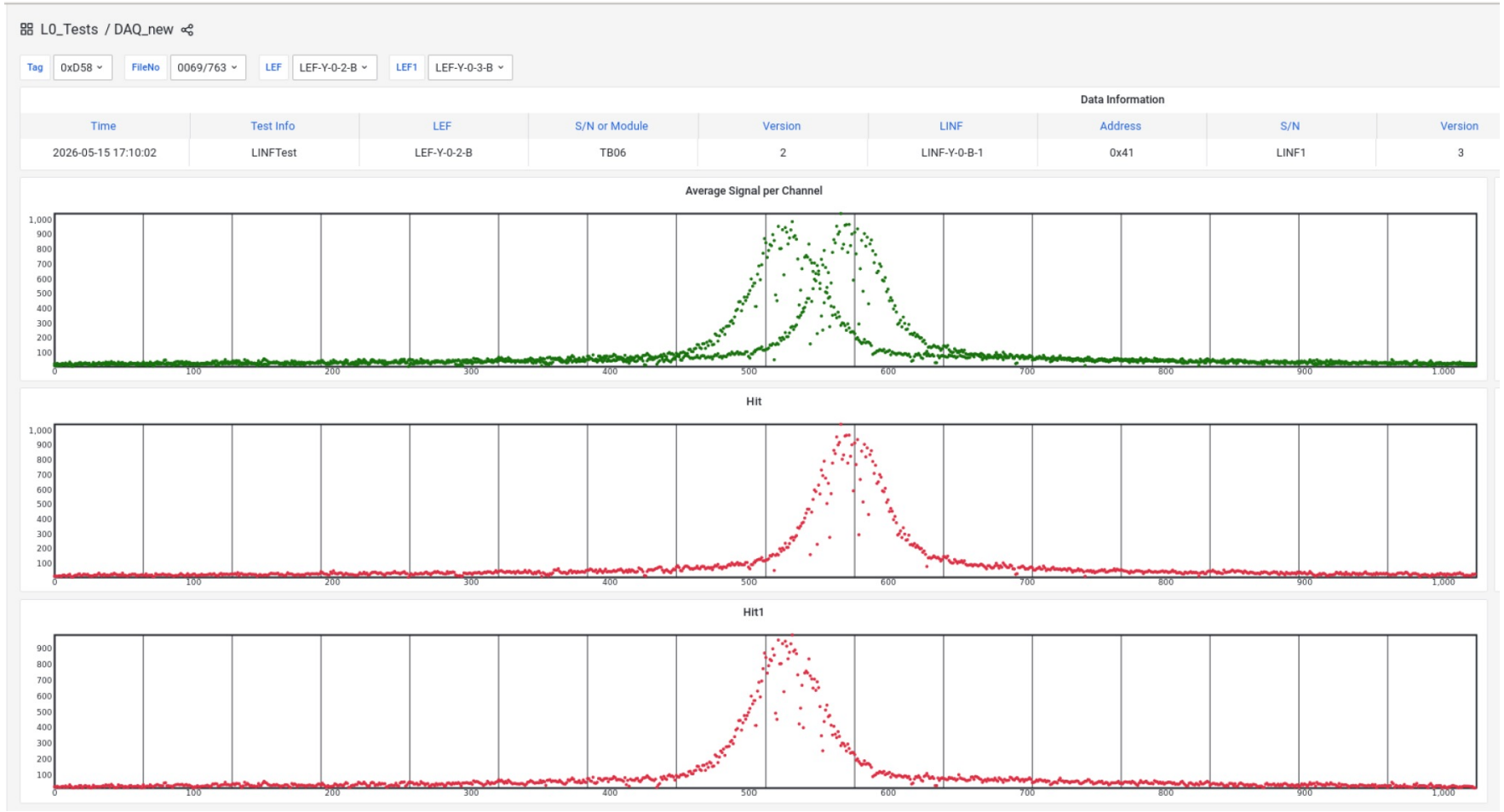


Beam profile as seen by Beam monitor

interposed

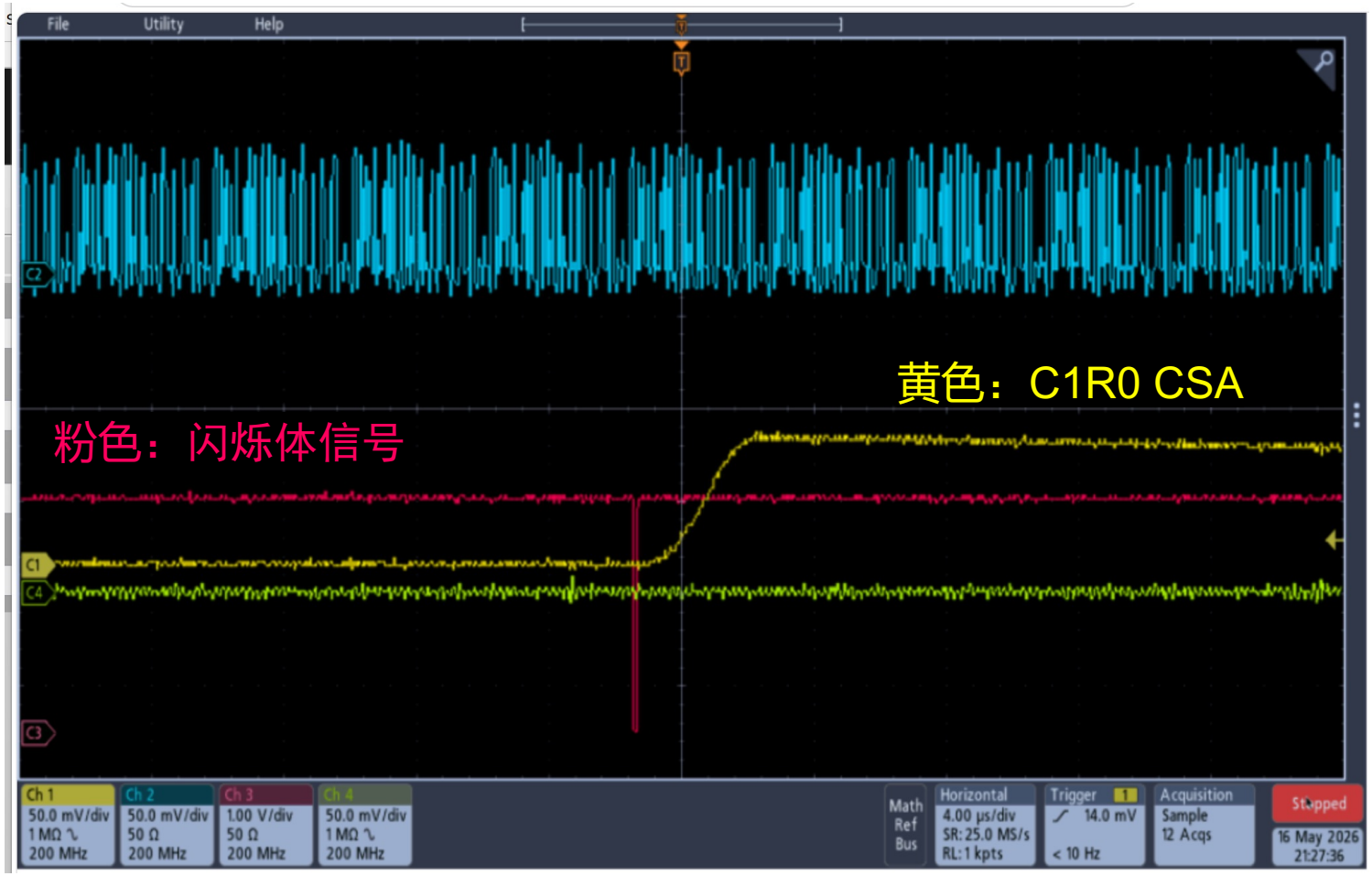
Y

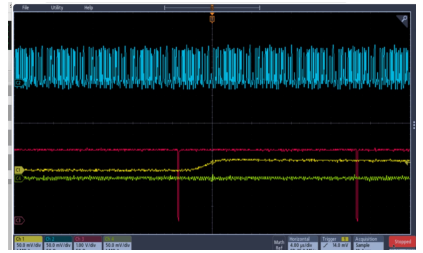
X

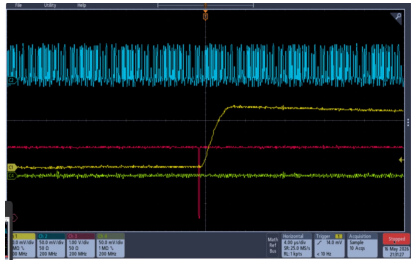


FWHM ~ 4mm

COFFEE sees the beam!

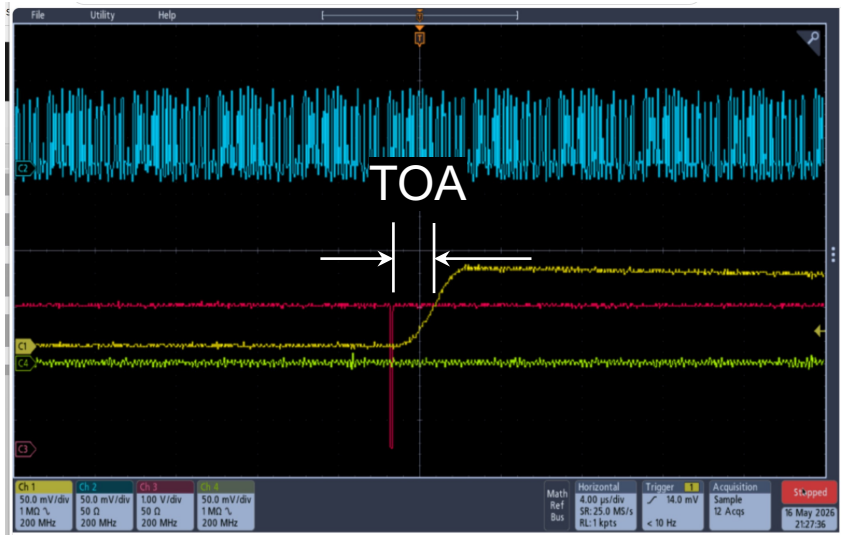


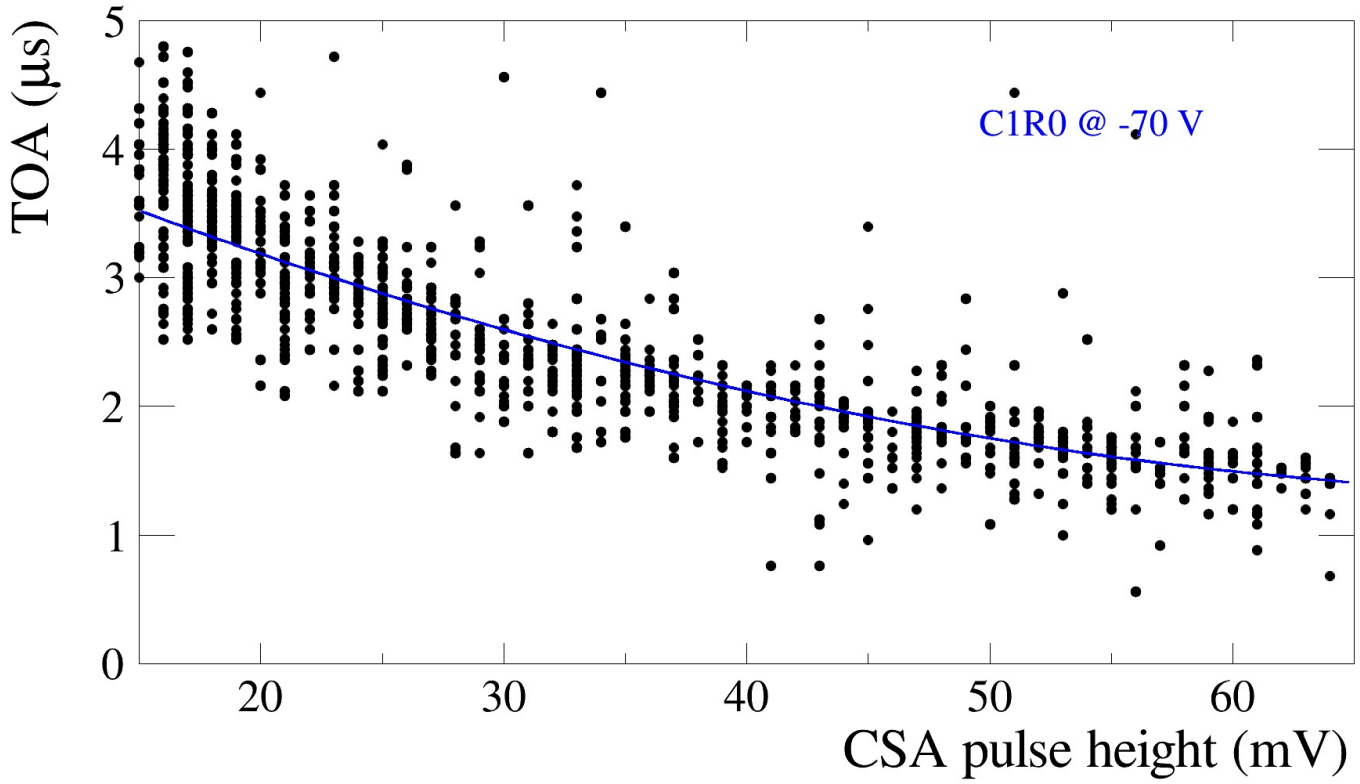




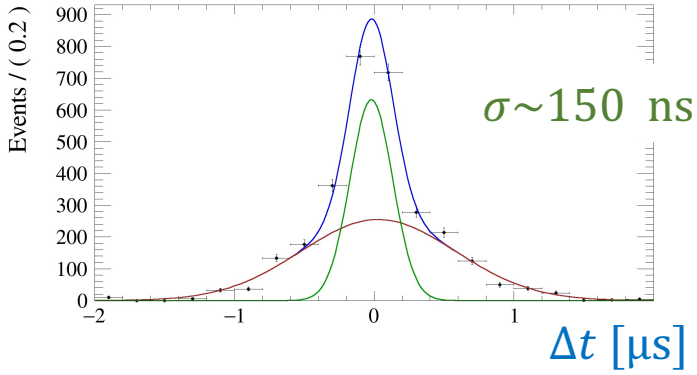
Larger signal, smaller delay

TOA – a rough estimation



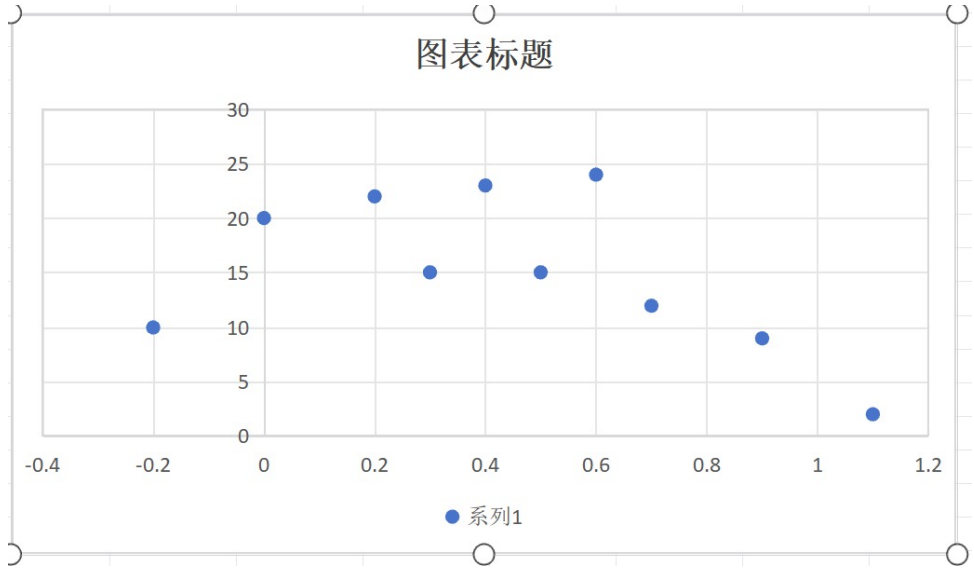


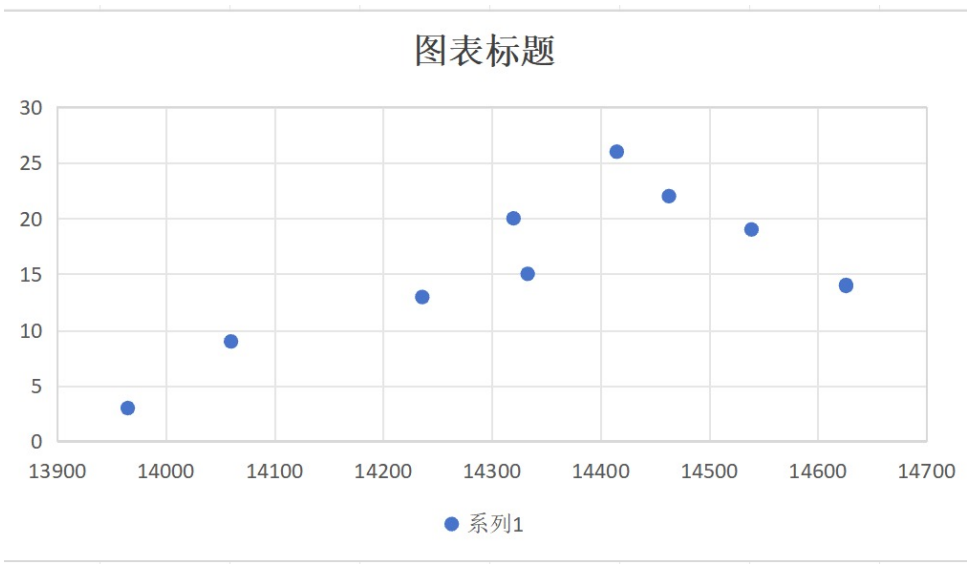
Δt



Position scan using CSA

- X & Y scan using COFFEE CSA hit rate
  - Beam FWHM ~ 4-5 mm, consistent with BM





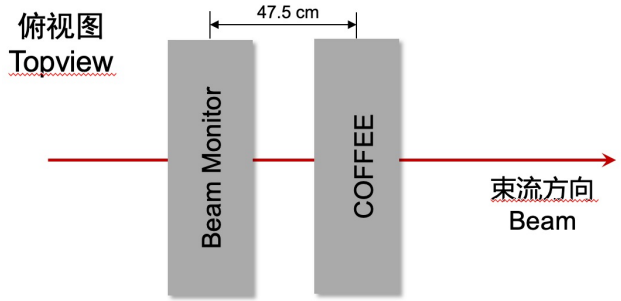
COFFEE sees tracks

- Using CSA output to trigger beam monitor

X

Y

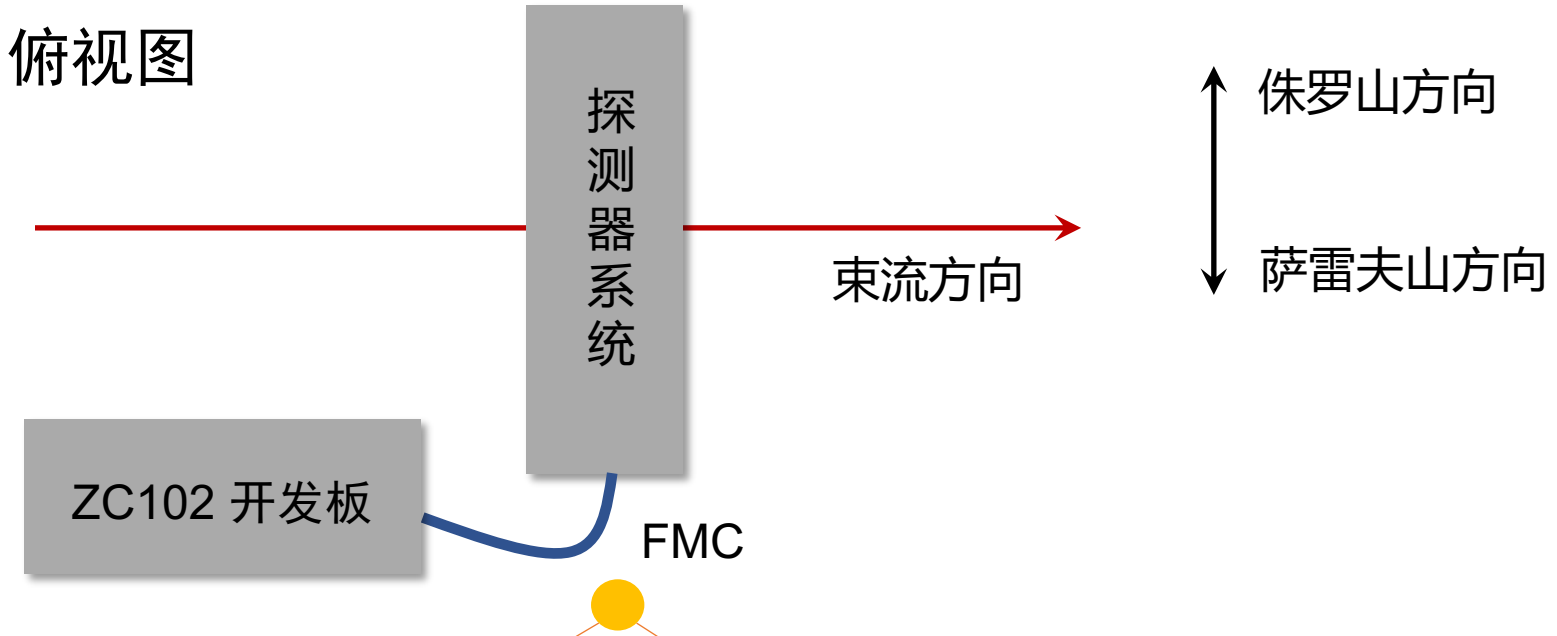
Region of interest at BM: a few hundred um, larger than single pixel pitch (36 um x 130 um)



NB: COFFEE downstream of BM, multiple scattering playing a role

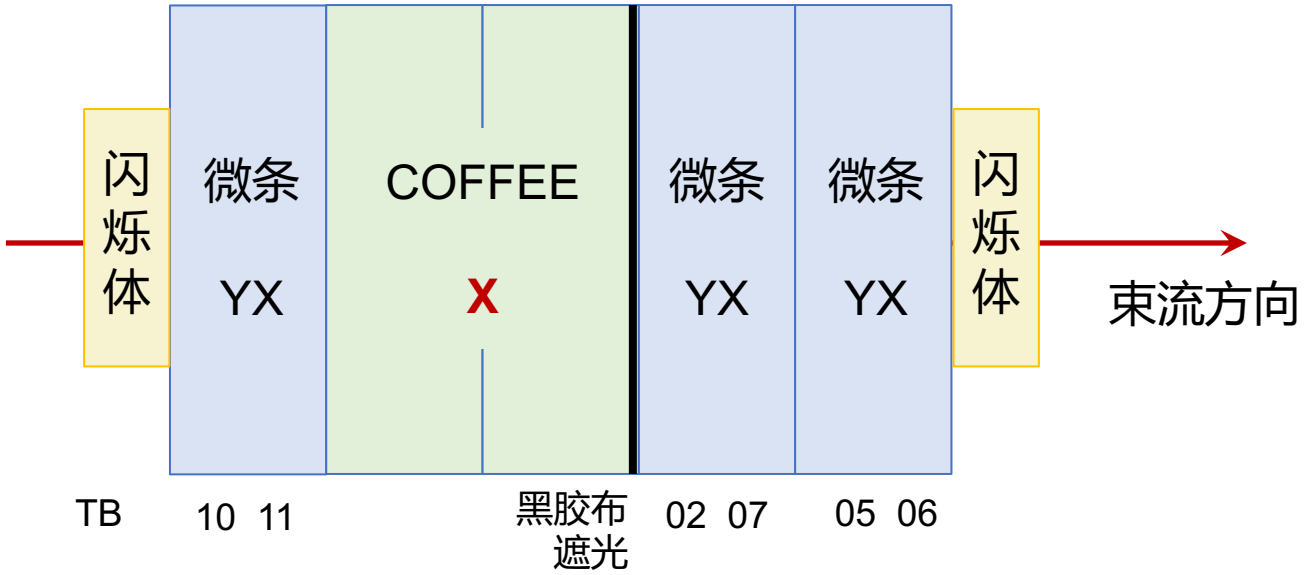
改装计划

2026.05.19
系统改装，集成COFFEE
与硅微条，研究空间分辨

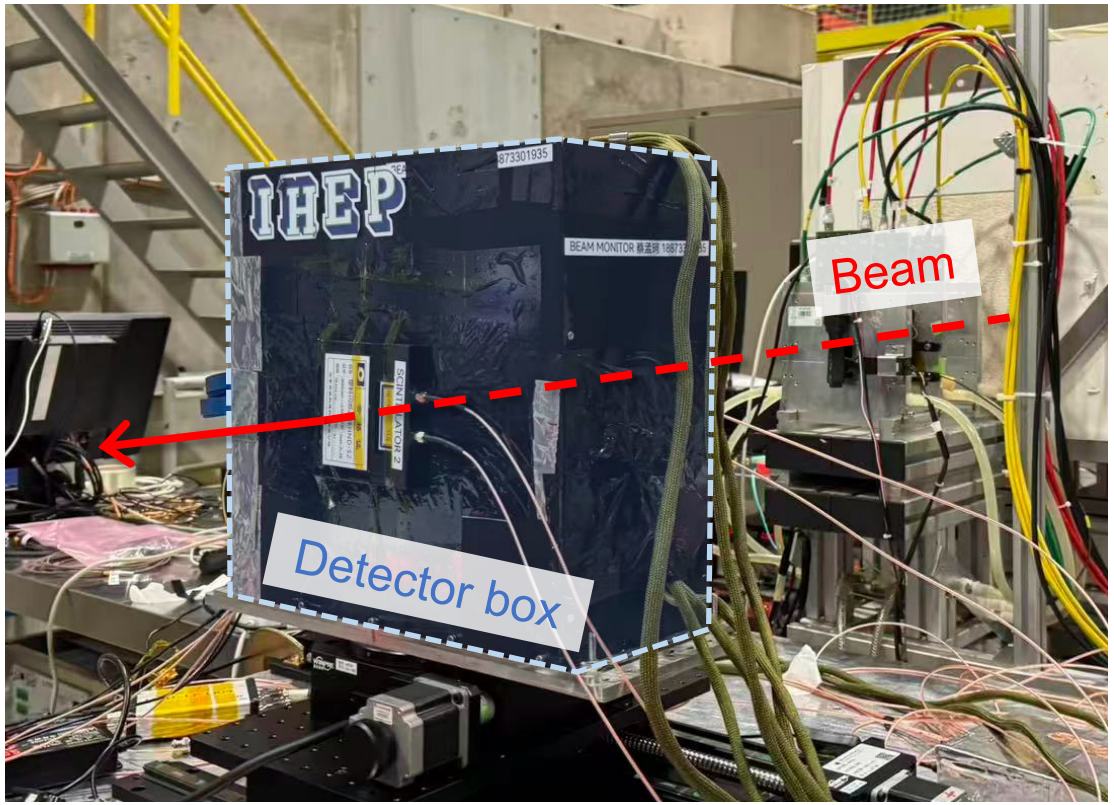


探测器系统结构

X/Y指位置测量敏感方向。
X=微条竖直，Y=微条水平

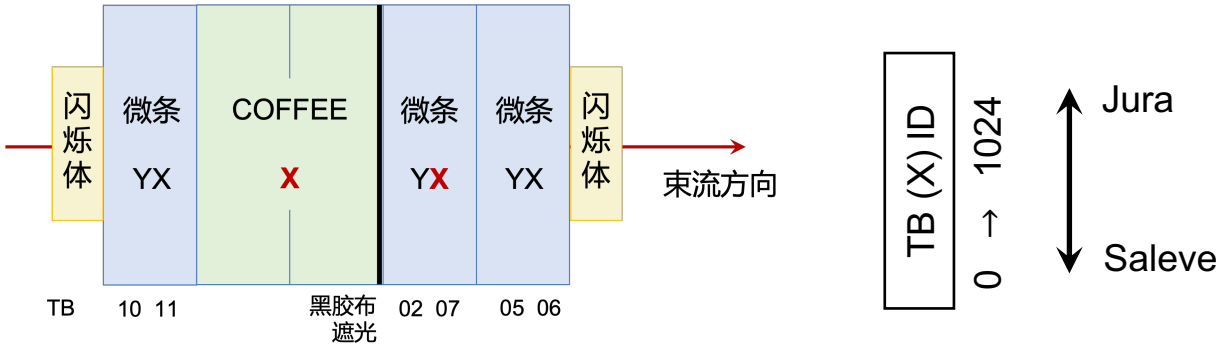


New setup



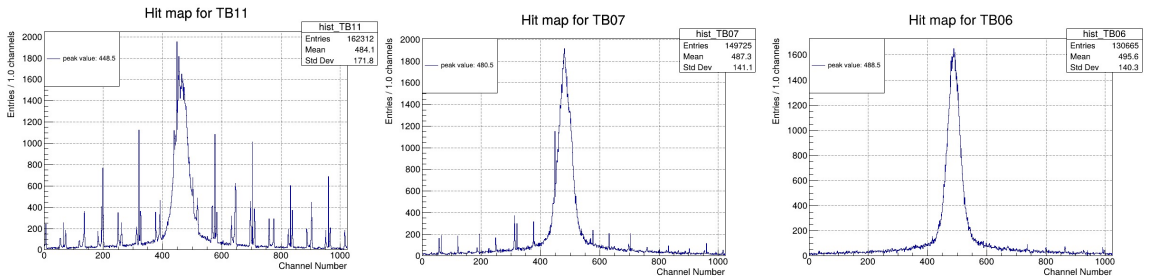
Setup updated on 19th May
COFFEE v2.0-4 placed between Si strip layers

位置验证



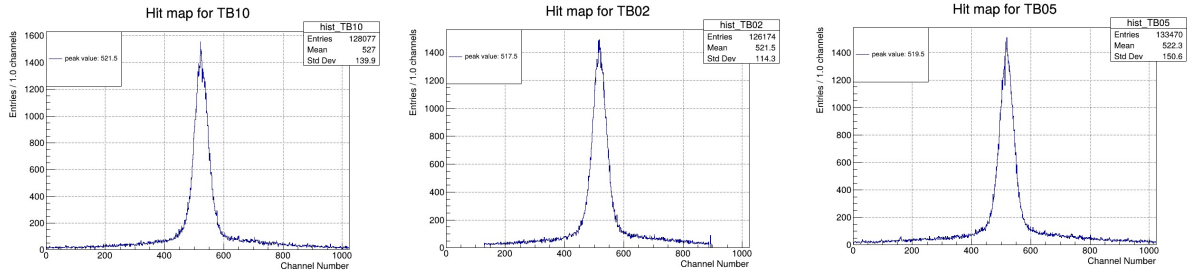
闪烁体触发 （束流分布）

X



peak 448.5 480.5 488.5

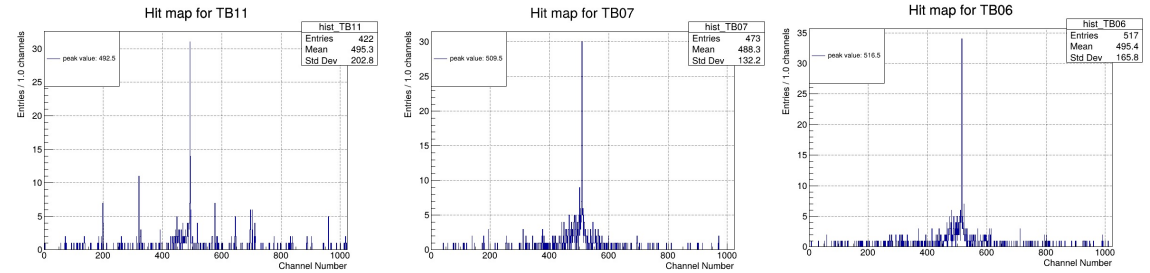
Y



peak 521.5 517.5 519.5

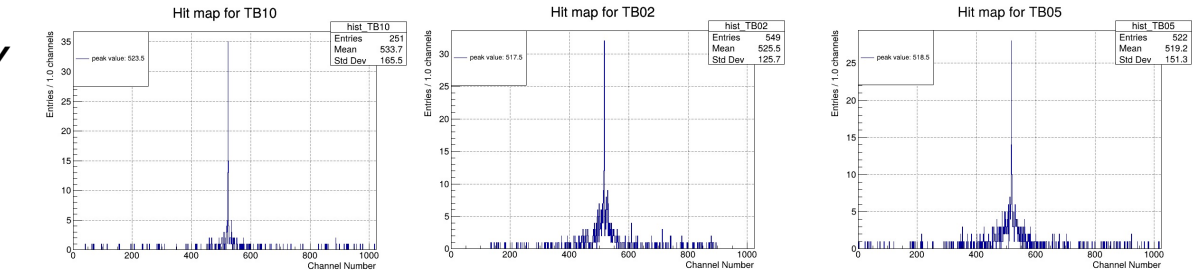
COFFEE C1R0 CSA触发 （像素位置）

X



peak 492.5 509.5 516.5

Y



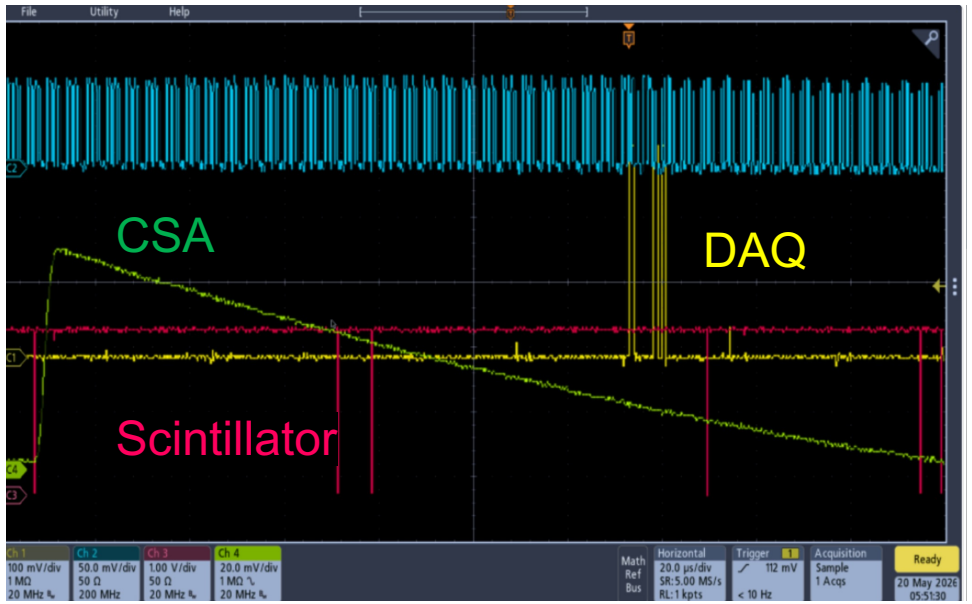
peak 523.5 517.5 518.5

X：水平方向 COFFEE 与束流中心差29微条 ~3.16 mm

Y：竖直方向 COFFEE正对束流中心

COFFEE DAQ as trigger

- For the last few hours of the week, the COFFEE DAQ used as trigger
- Managed to turn on the first double-column for ~10 minutes
- Simultaneous data-taking with Beam Monitor



X

Y

130 um x 2 col

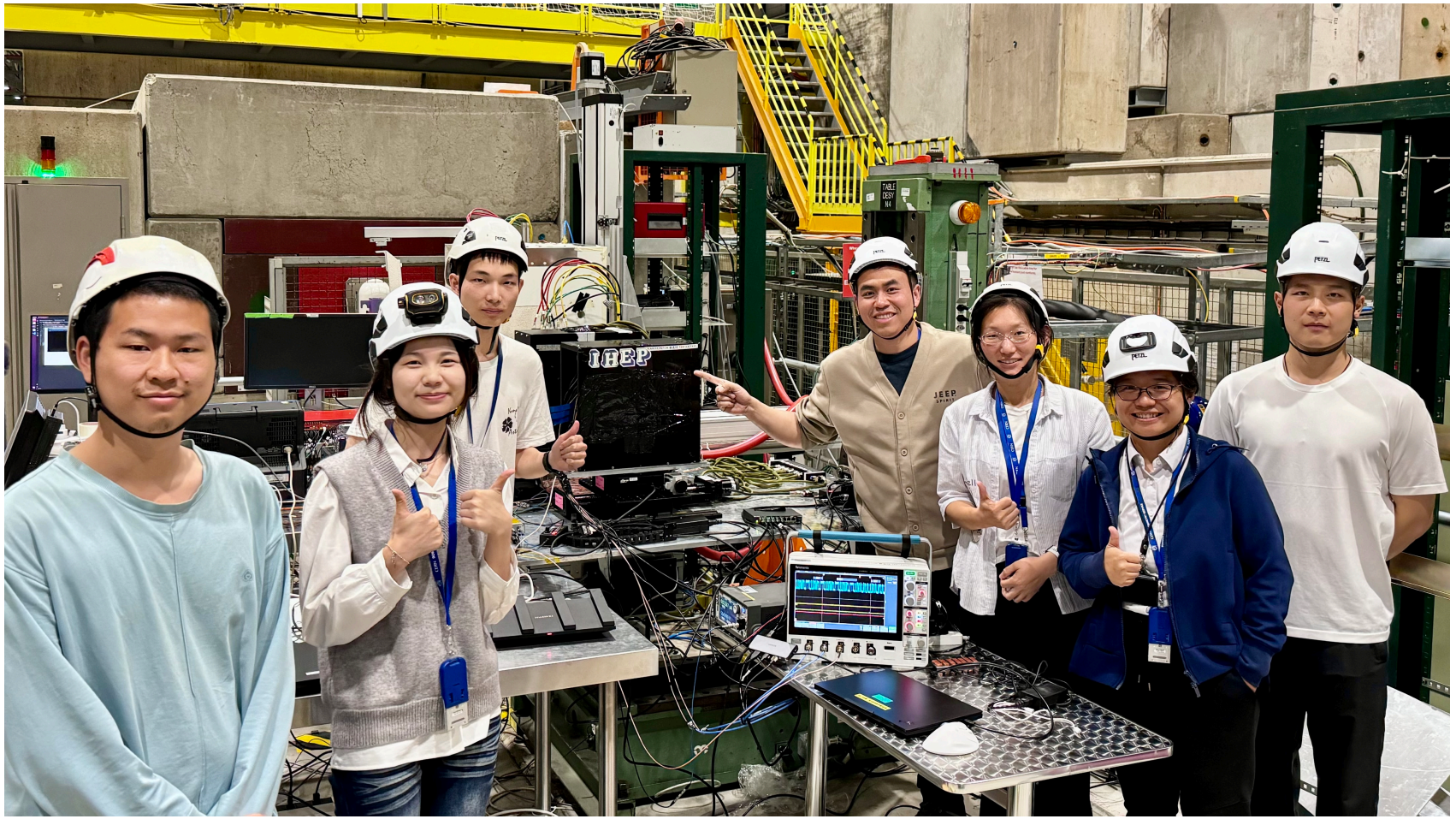
36 um x 48 row

BM hit positions consistent with double column size

Summary

- COFFEE alive in beam!
- More analysis needed for an estimation of resolution
- For future beamtests proper trigger setup needed

The team



2026.05.13 installation complete

Many thanks to everyone!

- Zijun: excellent leadership
- Yuman/Boxin: babycaring COFFEE all through with patience
- Qinze: master of BM
- Kang, YuanYuan, Yang, Leyi…: strong support offsite on mechanics, DAQ, design
- Hui, Yisheng, Tianyu: onsite support & transportation

- Great thanks to DRD3, esp Marcos Fernandez as user contact