Application for testing CBM detectors in beam at COSY in Q2/2019

- *Impact of last beamtime at COSY in Q1/2018*
- *Detector tests in mCBM at GSI/FAIR – and needs beyond*
- *Beamtime application at COSY for Q2/2019*

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Look back:
CBM beamtime at COSY, Feb./Mar. 2018

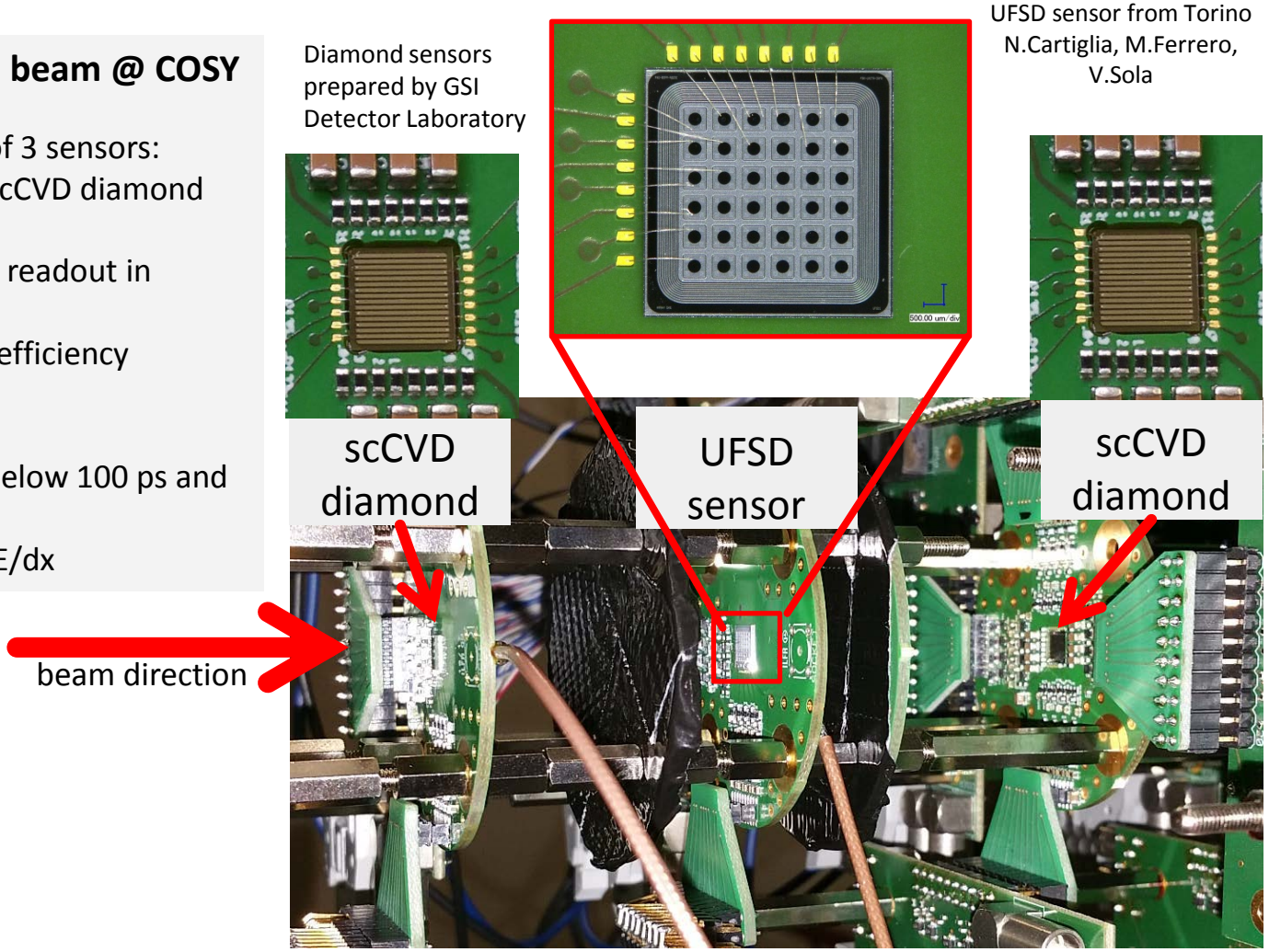
- JESSICA cave, protons of E_{kin} = 1 GeV
- set-up of equipment in the MD week prior to the beamtime
- detectors tested:
  - CBM-STS:
    - test of prototype modules with near-final integration of sensor, microcable and read-out ASIC STS-XYTER v2.0
    - high importance for Sensor Production Readiness Review, April 2018
  - CBM-MUCH:
    - GEM detector test had to be cancelled due to travel clearance issue of the team from VECC, India
  - HADES/CBM Start-Veto:
    - first test of Ultra-Fast Silicon Detectors with beam

Thanks for the support at IKP!

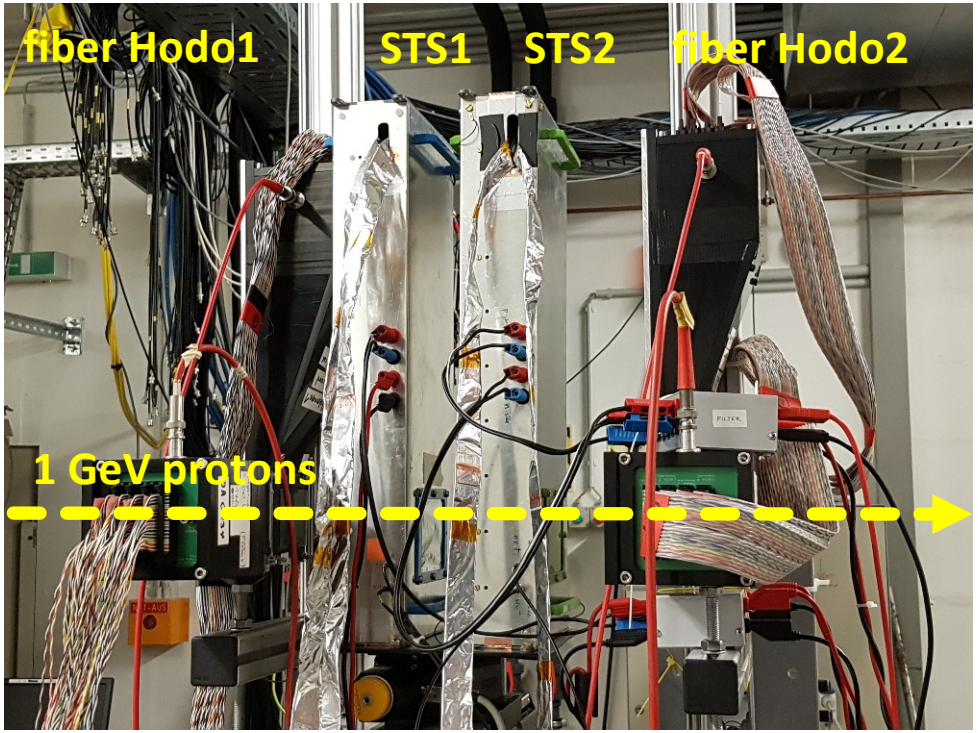
(1) Ultra-Fast Silicon Detectors for the HADES/CBM Start-Veto System tested in 2018

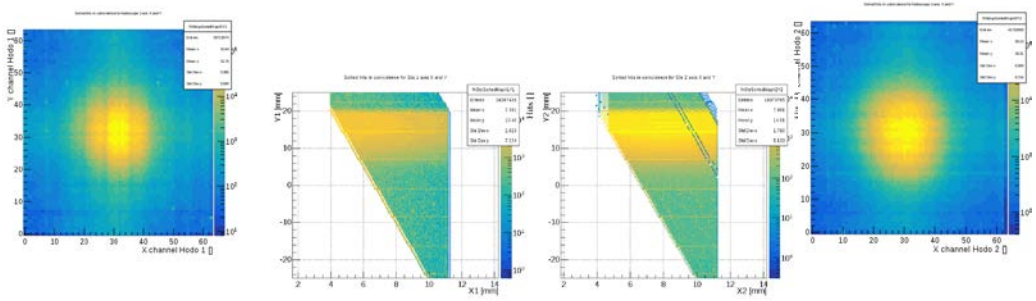
First test with 1 GeV proton beam @ COSY

- A beam telescope made of 3 sensors:
  - Two double-sided scCVD diamond sensors
  - One UFSD with pad readout in between
  - time precision and efficiency determination
- Data analysis in progress
- Expected time precision below 100 ps and high rate capability
- Possible PID by ToF and dE/dx

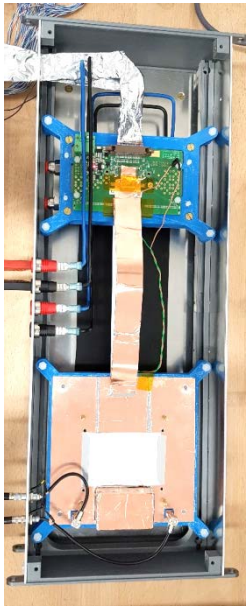


(2) CBM Silicon Tracking System tested in 2018





prototype STS module



read out with prototype free-streaming DAQ system

STS-XYTER v2.0 on FEB-B

micro cables, 25 cm long

silicon microstrip sensor
- *285 µm thick*
- *strips 4 cm long*
- *2-sided, 7.5 ° stereo angle*
- *128 channels/side read out*

→ *triangular overlap area*

results

sensor operated at 150 V bias

- noise:
  1040 ±79 e (n)
  1330 ±76 e (p)
- signal (MPV):
  14745 e (n)
  26728 e (p)
- read-out threshold:
  7861 e (n), 7088 e (p)
- signal-to-noise:
  14.2 ± 1.3 (n)
  12.5 ± 1.7 (p)
- hit efficiency: > 95%

Impact of STS results from COSY 2018

Sensors:

$\rightarrow$ Sensor performance OK

Production Readiness Review held in April 2018

Detailed summary report to be released (CBM Technical Note # 18010)

- "go ahead" was given for tendering sensor series production
- tendering started 8/2018
- close to completion: award of production contract in 1/2019

Front-end electronics:

logic error uncovered in ASIC STS-XYTER v2.0:

- multiplication and suppression of output hit data under certain hit multiplicity and hit time situations
- visible in beamtime application
- verified in detailed lab study
- confirmed in dedicated ASIC simulation, then fixed in the design.

12/2018:

- STS-XYTER v2.1 produced, having redesigns of the analog and digital part
- ready for module integration and refined testing in lab and beam
  $\Rightarrow$ Production Readiness Review 6/2019

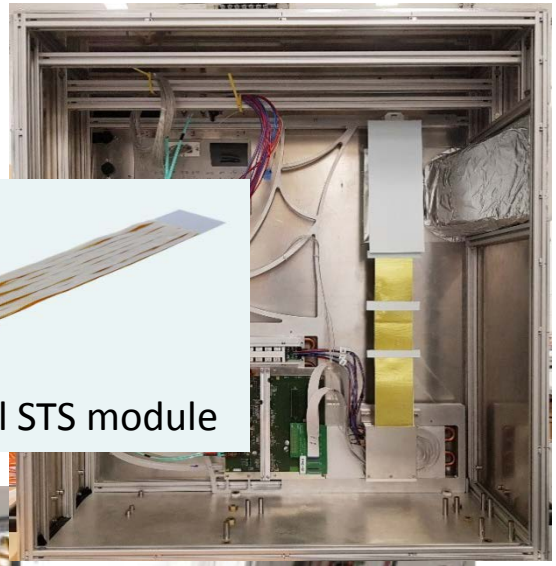
Detector tests in *miniCBM* at GSI/SIS18

mCBM@SIS18

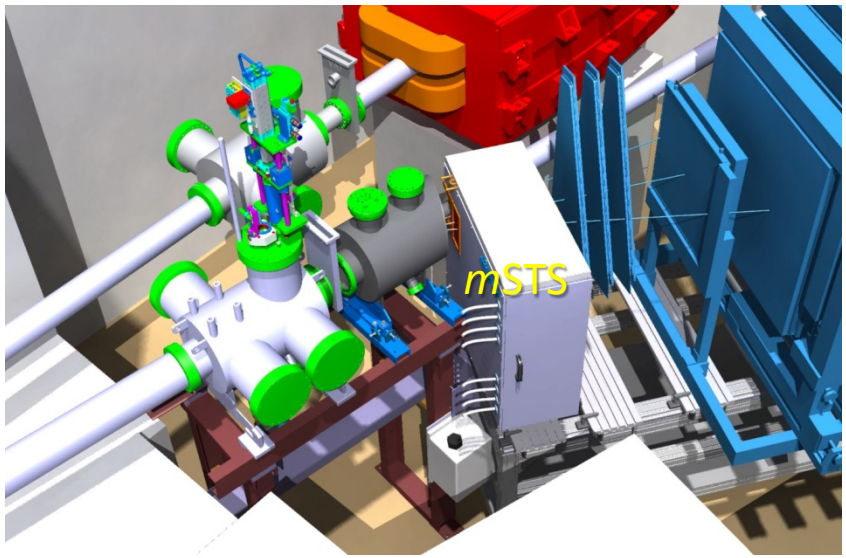
A CBM full system test setup for high-rate nucleus-nucleus collisions at GSI/FAIR

- CBM prototype detector systems
- free-streaming read-out + data transport to mFLES
- up to 10 MHz collision rate
- first commissioning with beam took place in 12/2018
- beamtime 3/2019: several parasitic „shift blocks“ parallel to HADES, R3B

*m*STS



full STS module



Beamtime application at COSY for Q2/2019

Aim: Test of CBM detectors equipped with new STS-XYTER v2.1 ASIC

In order to exclude any potential risk regarding the qualification of the front-end electronics towards the STS-XYTER Production Readiness Review in 6/2019, we consider – next to tests in the *mCBM* demonstrator experiment (parasitic beamtime in 3/2019) – a further, dedicated test of the detectors with their latest read-out electronics in the proton beam at COSY essential.

- full STS module
- MUCH GEM chamber [+ optionally RPC chamber]
- DAQ prototype chain

Prototypes of the detectors are ready to be equipped with the new ASIC.

The DAQ chain exists as a second copy to *mCBM* in the laboratory.

One week of beamtime will be sufficient to operate and to test the detectors.

If carried out not later than in the 1st half of May, then there will be enough time to prepare results for the ASIC review scheduled in 6/2019.

Further aim: Refined test of Ultra-Fast Silicon Detectors (with independent read-out).

Beamtime application at COSY for Q2/2019

Total number of particles and type of beam (p,d,polarization)	Momentum range (MeV/c)	Intensity or internal reaction rate (particles per second)	
		minimum needed	maximum useful
p	**p ~ 2700**	**~ 10^4 – 10^6**	**up to 10^8**
Experimental area	Safety aspects (if any)	Earliest date of installation	Total beam time (No.of shifts)
JESSICA Cave	**None**	**one week at end of April/1st half of May 2019**	**7 days around the clock**

- Experimental set-up:
  - JESSICA cave
  - test beam table installed
  - additional space in rack room close to the JESSICA door
  - “Wasaquarium” as control room
- During the tests, access to the cave will be required in order to reconfigure the set-up, days and nights. The participating teams will be of moderate size in personnel.
- Delivery and installation of equipment during the week prior to the beam time could be helpful and efficient for the timely start of using the beam.