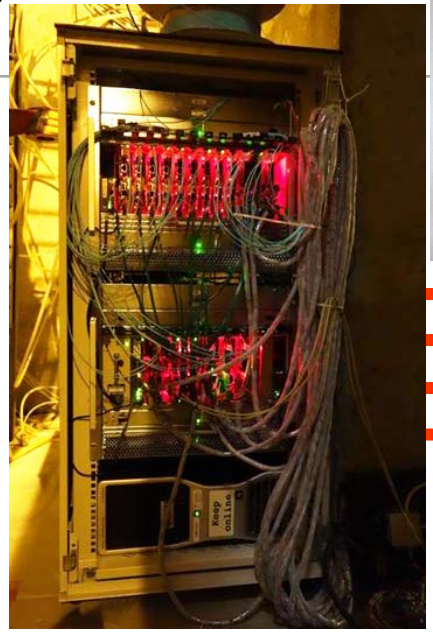
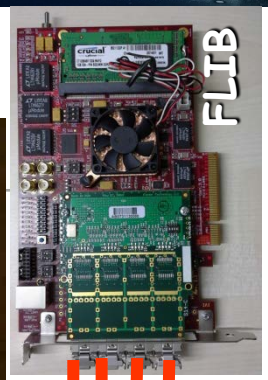
mCBM@SIS18 – a CBM full system test-setup at GSI

Christian Sturm et al. , GSI Helmholtz Center
for the CBM Collaboration

mCBM@SIS18 - a test facility for the

- CBM FLES
  (HK 15.1,J. de Cuveland
  HK 63.6, D.Hutter)
- CBM free-streaming DAQ System
  (HK15.4,D. Emschermann)





Introduction and status of the project:

- Motivation and Concept
- Present Design
- Preparations

CBM experimental challenges

Perform measurements at unprecedented reaction rates

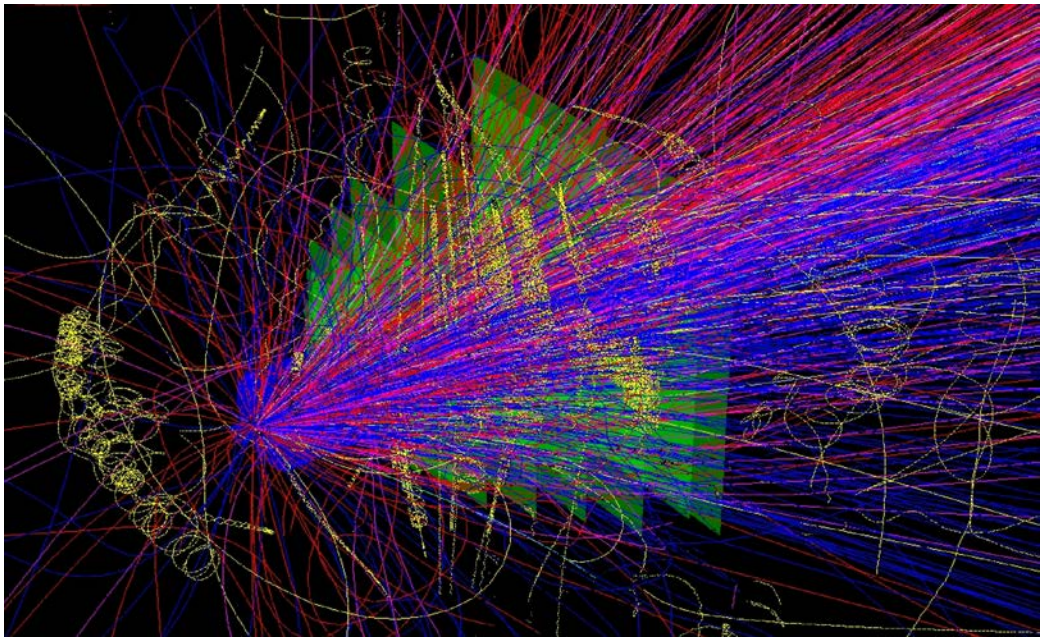
10^5 - 10^7 Au+Au reactions/sec

→ fast and radiation hard detectors

→ free-streaming read-out electronics

→ high speed data acquisition and high performance computer farm for online event selection

→ 4-D event reconstruction

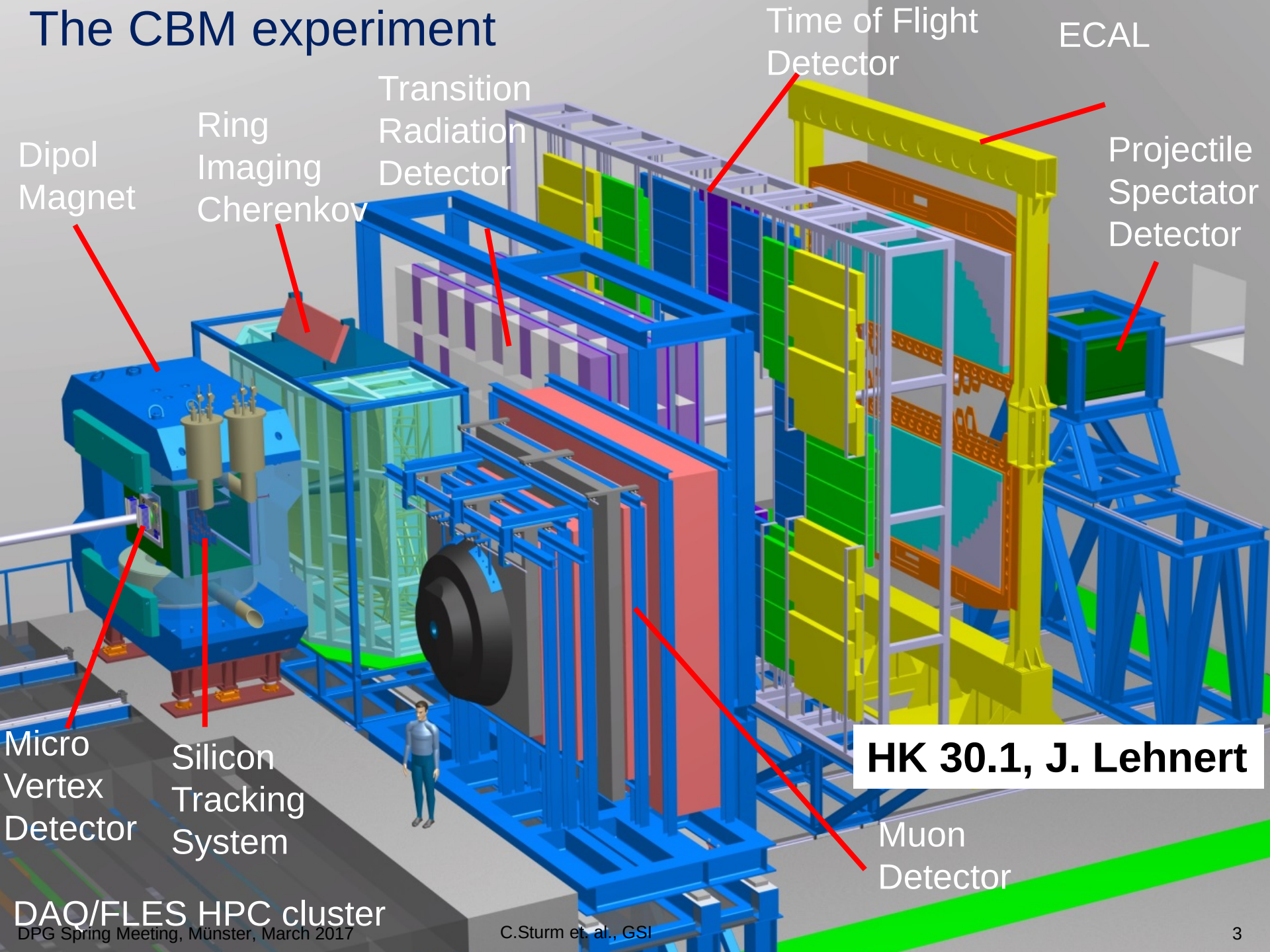


Central Au+Au at 25 A GeV / UrQMD+GEANT4:
160 p, 400 π^+, 400 π^+, 44 K^+, 13 K^-

Identification
of leptons and hadrons

Determination of
(displaced) vertices ($\sigma \approx 50$ μm)

The CBM experiment



HK 30.1, J. Lehnert

Motivation and Concept

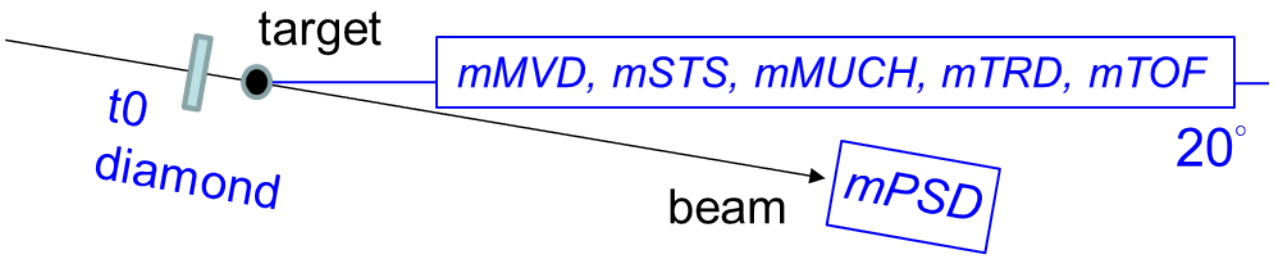
mCBM@SIS18 - a CBM full system test-setup in high-rate nucleus-nucleus collisions at GSI/FAIR, 2017 – 2021

with focus on the

- free streaming data transport to a mFLES or FLES
- online reconstruction
- offline data analysis
- controls

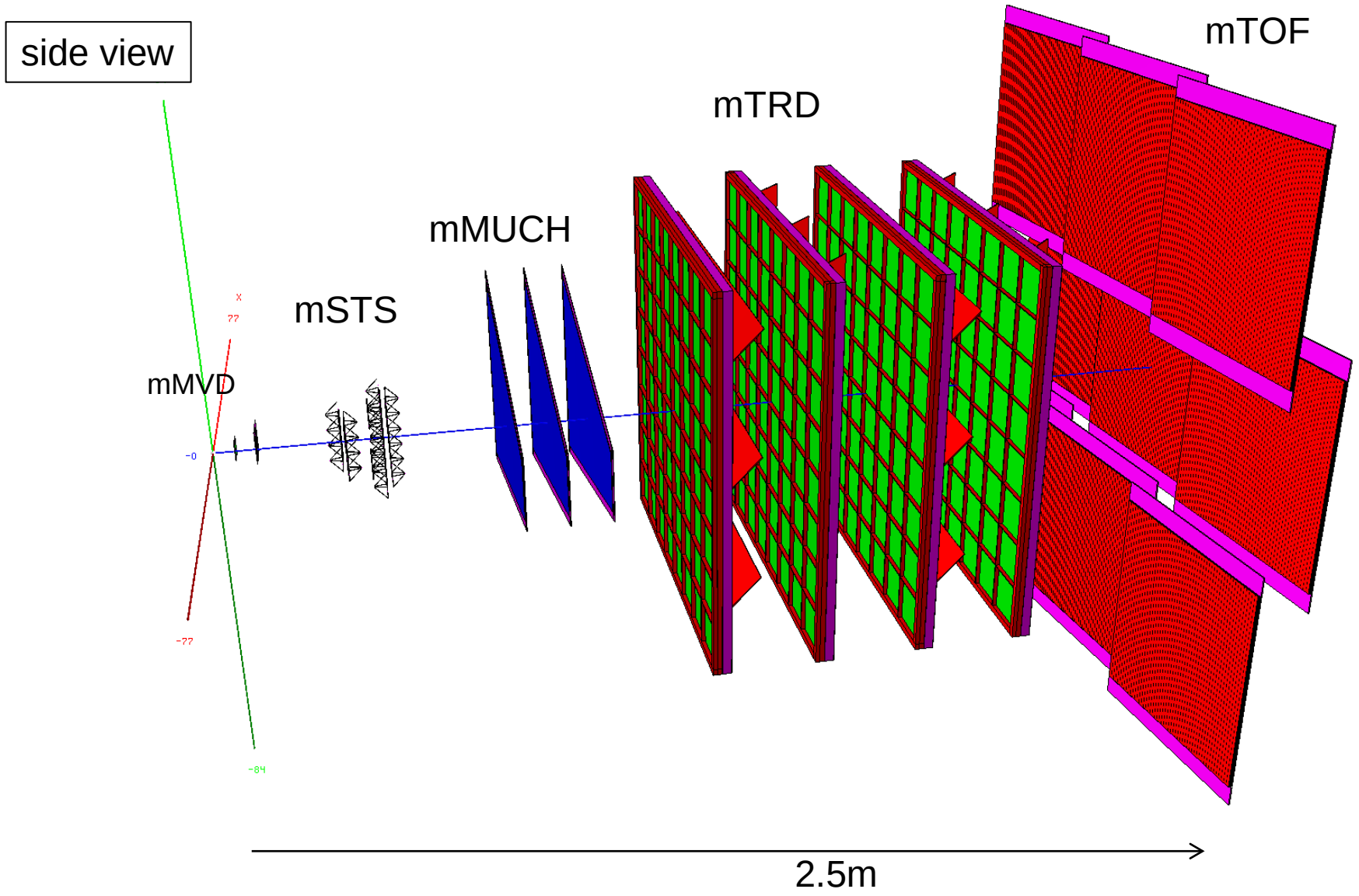
✓ **permanent test-setup at the host lab**

✓ **test of final detector prototypes**

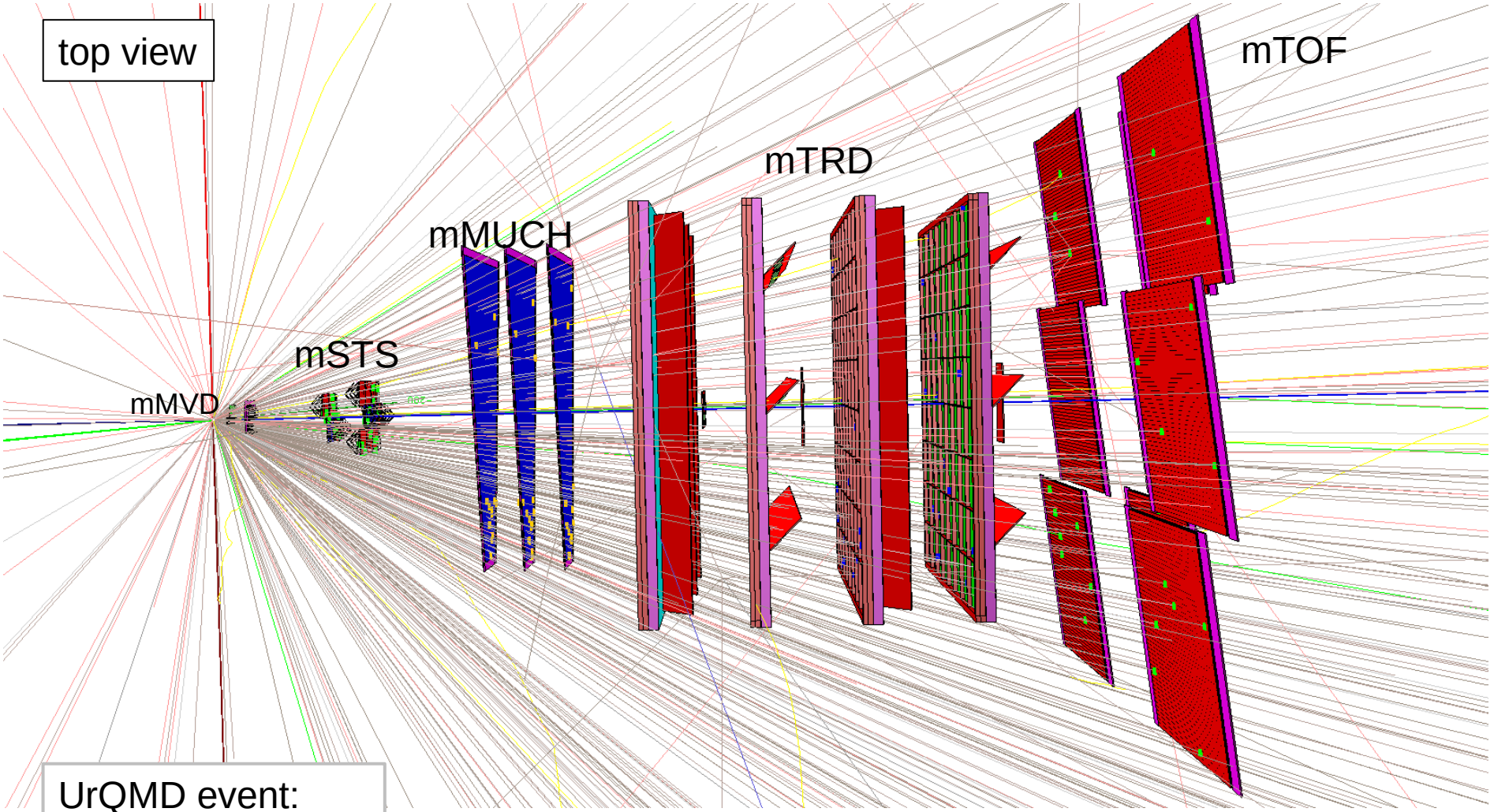


- detector prototypes at $\theta_{lab} \approx 15° - 20°$
- straight tracks, no B-field
- high resolution TOF (t_0 – TOF stop wall)
- event characterization with PSD prototype

Present design of mCBM@SIS18



Present design of mCBM@SIS18

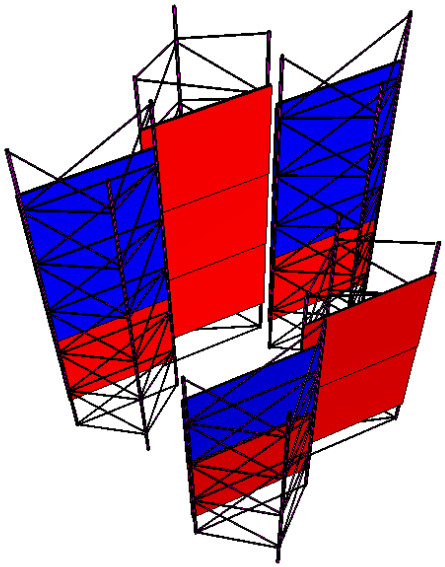


UrQMD event:
Ag+Ag 1.65 AGeV
central collision

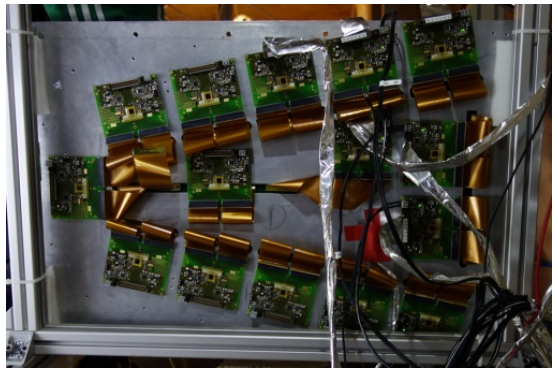
First results from simulation: $< M_{track} > \approx 7$

mCBM - contributions by subsystems: STS and MUCH

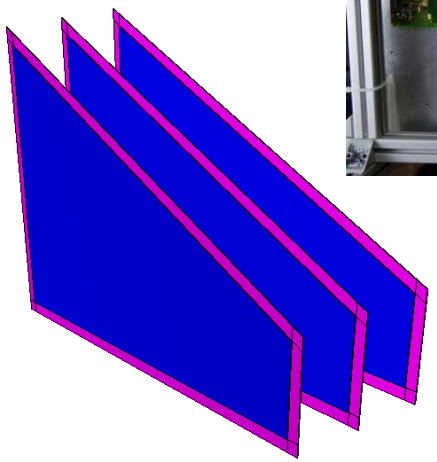
mSTS



mMUCH



SPS2016



mSTS: 2x stations

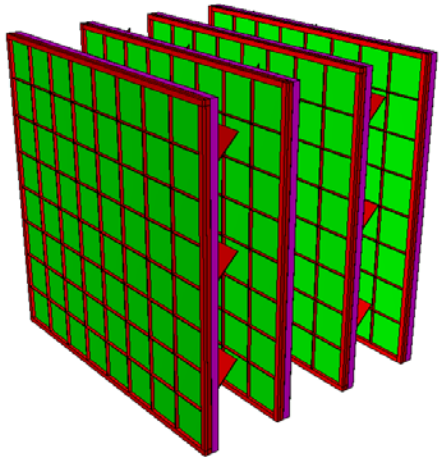
- 1st: 2x2 modules
- 2nd: 3x3 modules
  = 5 half-ladders
  = 13x 6x6 cm² sensors
- all components available
  ... except FEB-8

mMUCH: 3x layers

- 3x M2 GEM modules
- 18x FEBs per module (STS-XYTER)
- used during CERN beamtest 2016

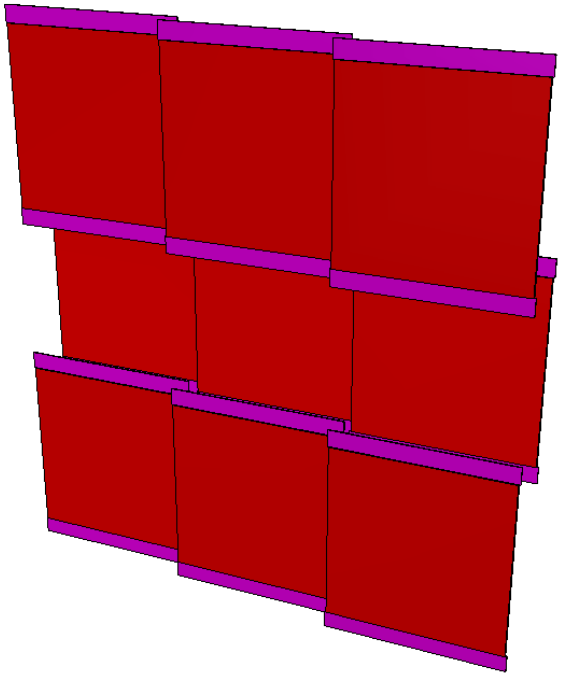
mCBM - contributions by subsystems: TRD and TOF

mTRD



SPS 2016

mTOF



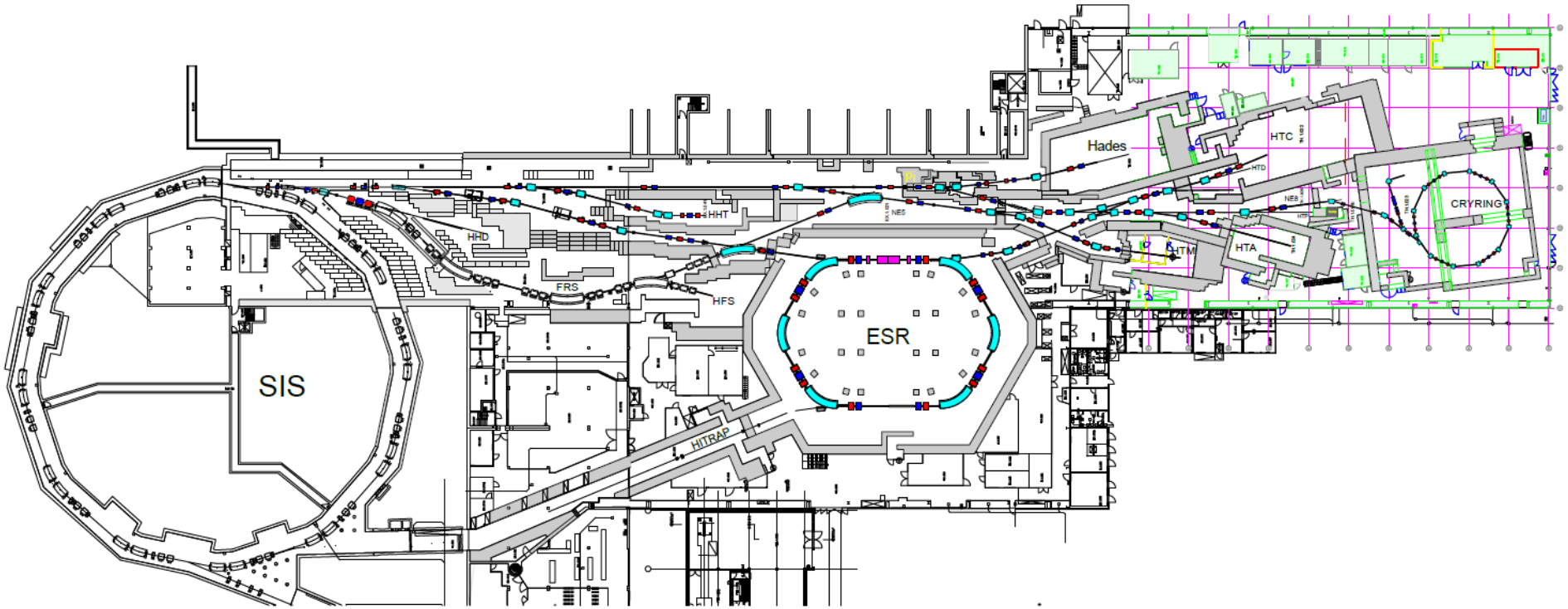
mTRD: 4 layers

- TRD modules (Frankfurt/Münster) incl. read-out from CERN test beam Nov./Dec. 2016

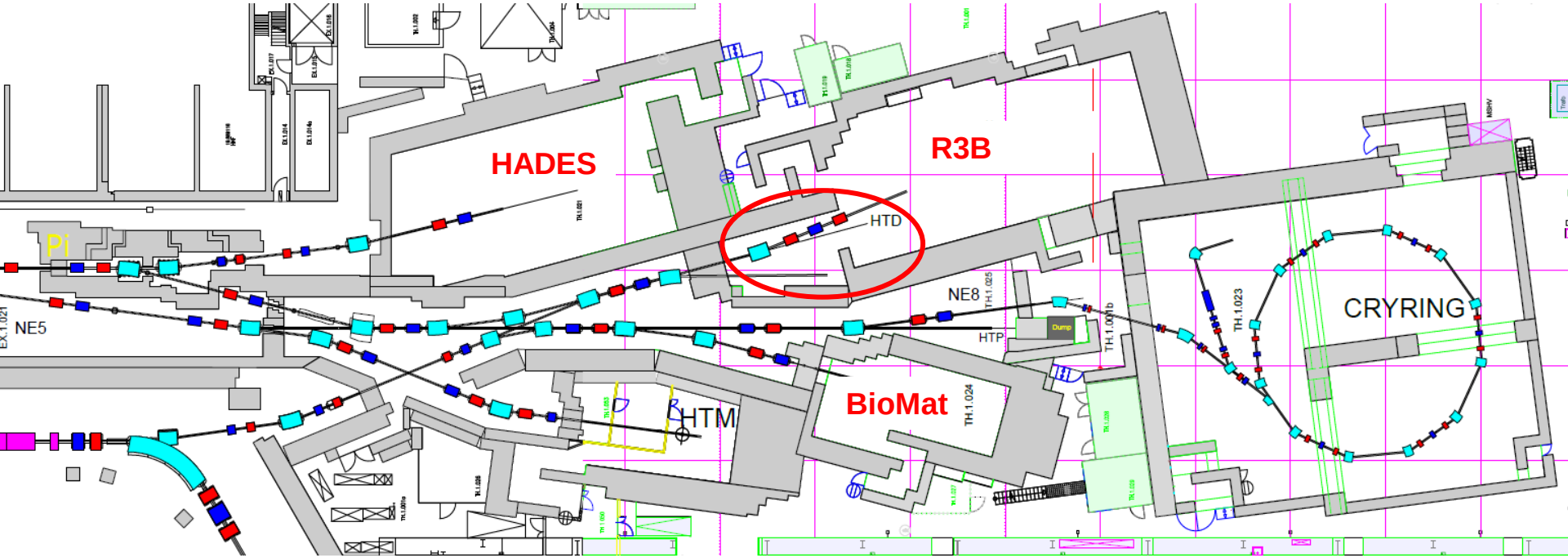
mTOF:

- 3x STAR modules
- 3x MRPC counter / module
- read-out scheme is identical to the STAR setup

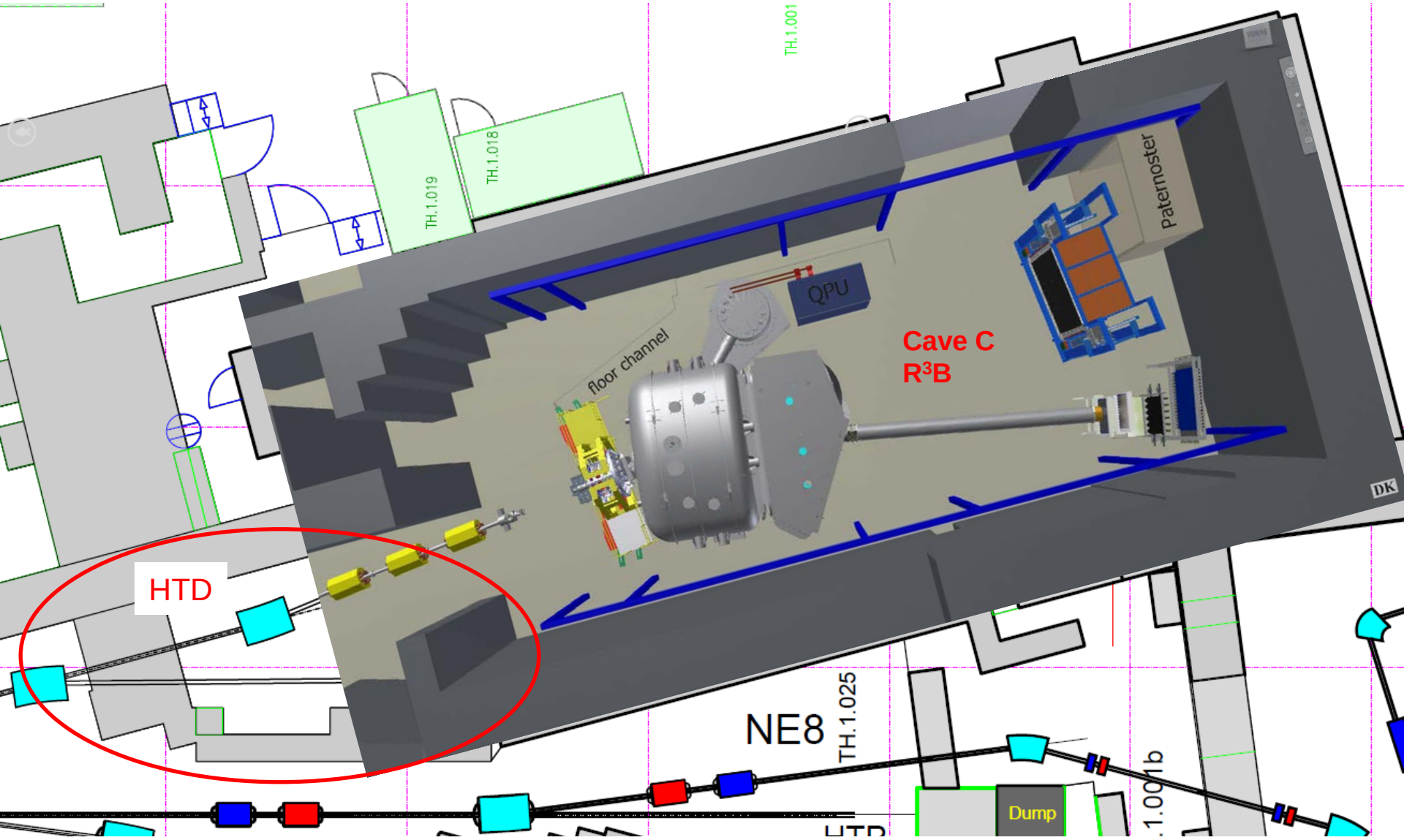
Present GSI SIS18 Facilities



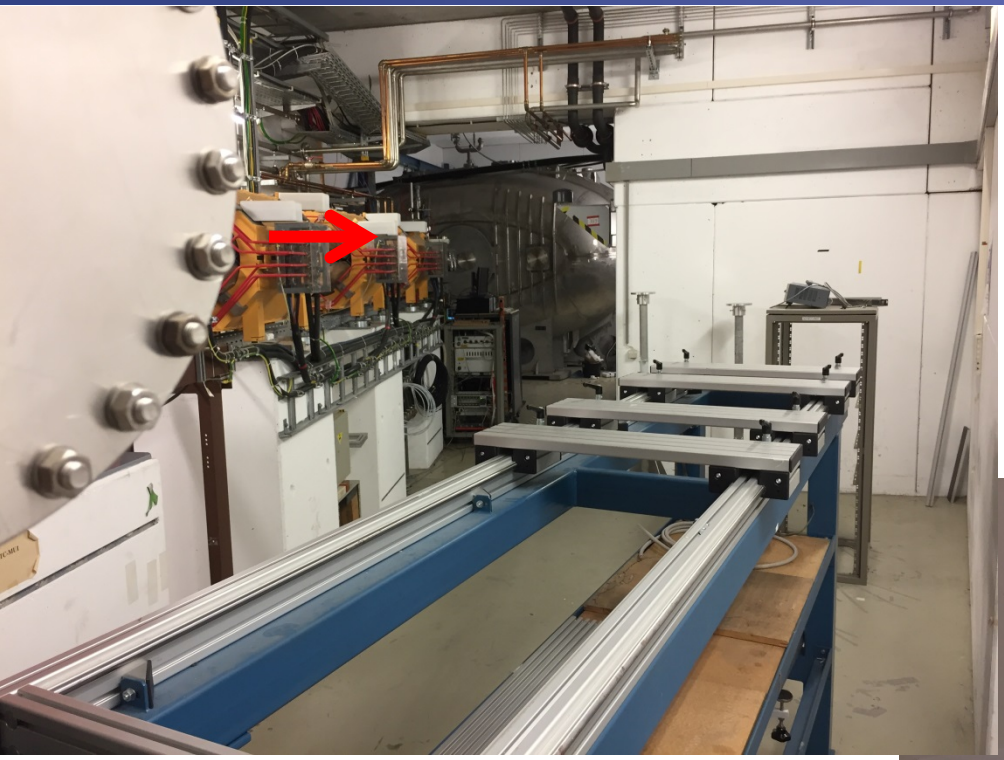
Zoom-in: Present SIS18 Target Hall



Cave C and HTD Test Stand

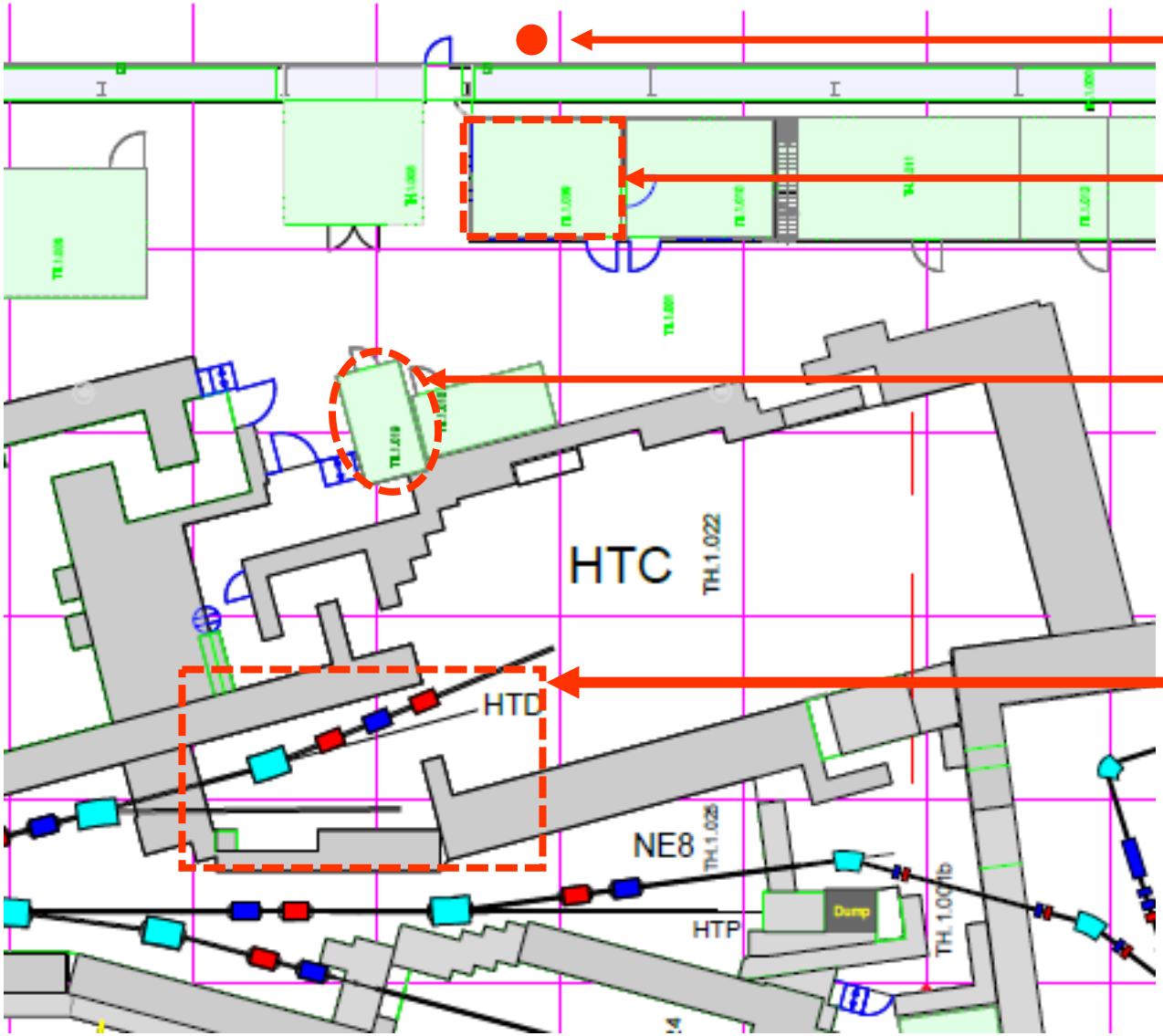


mCBM Cave - HTD at present



March 24th, 2017

mCBM – support infrastructure



gas area

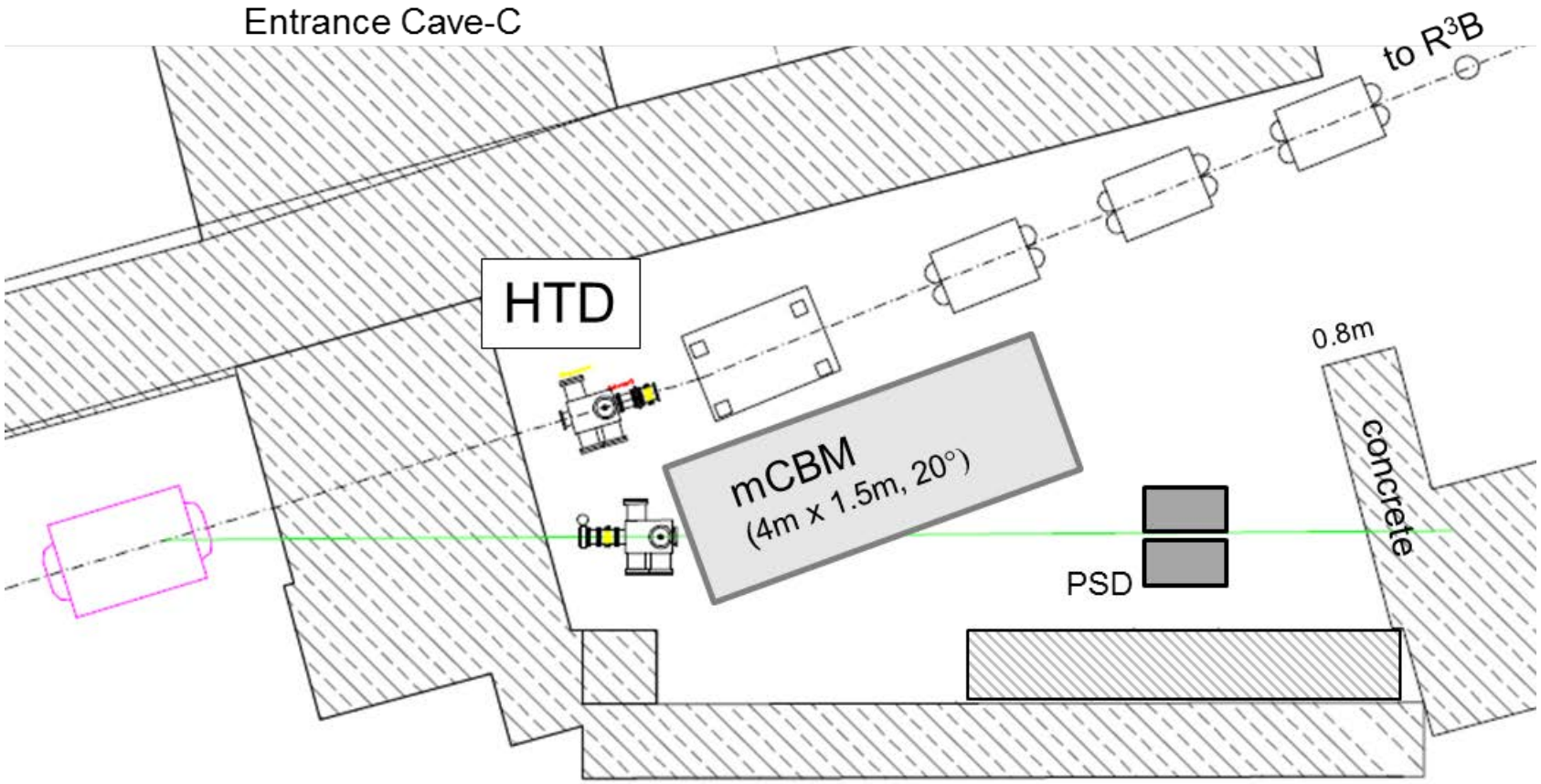
counting house

DAQ container

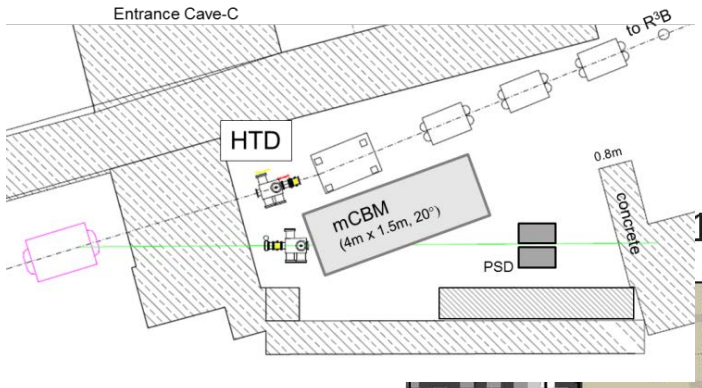
mCBM cave

Green Cube

Sketch of the mCBM Cave – Test Stand HTD



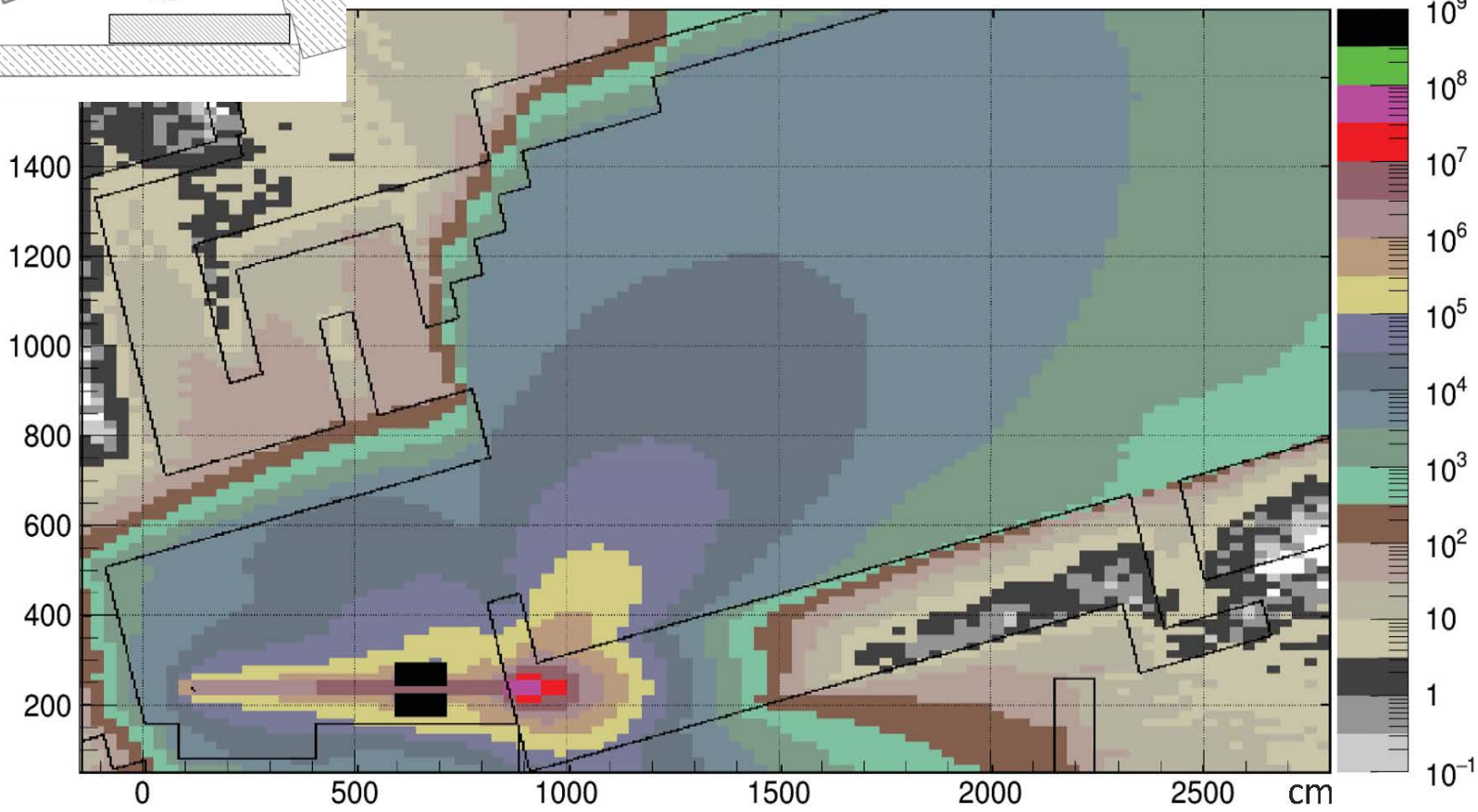
Radiation level simulation at top SIS18 energies and CBM collision rates



FLUKA simulation

10^9 Au ions @ 1.24 AGeV / s + 250 µm Au target

hadr/cm²/s



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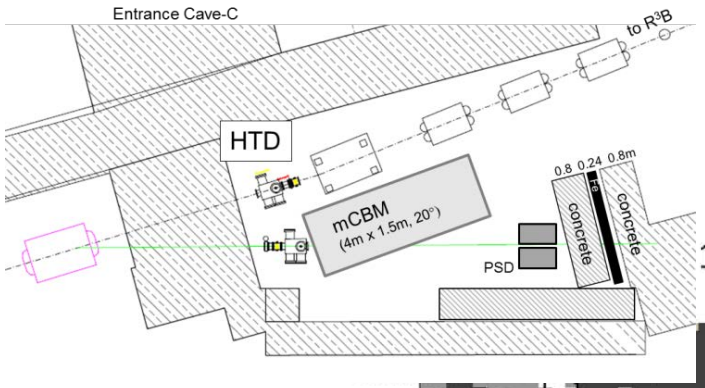

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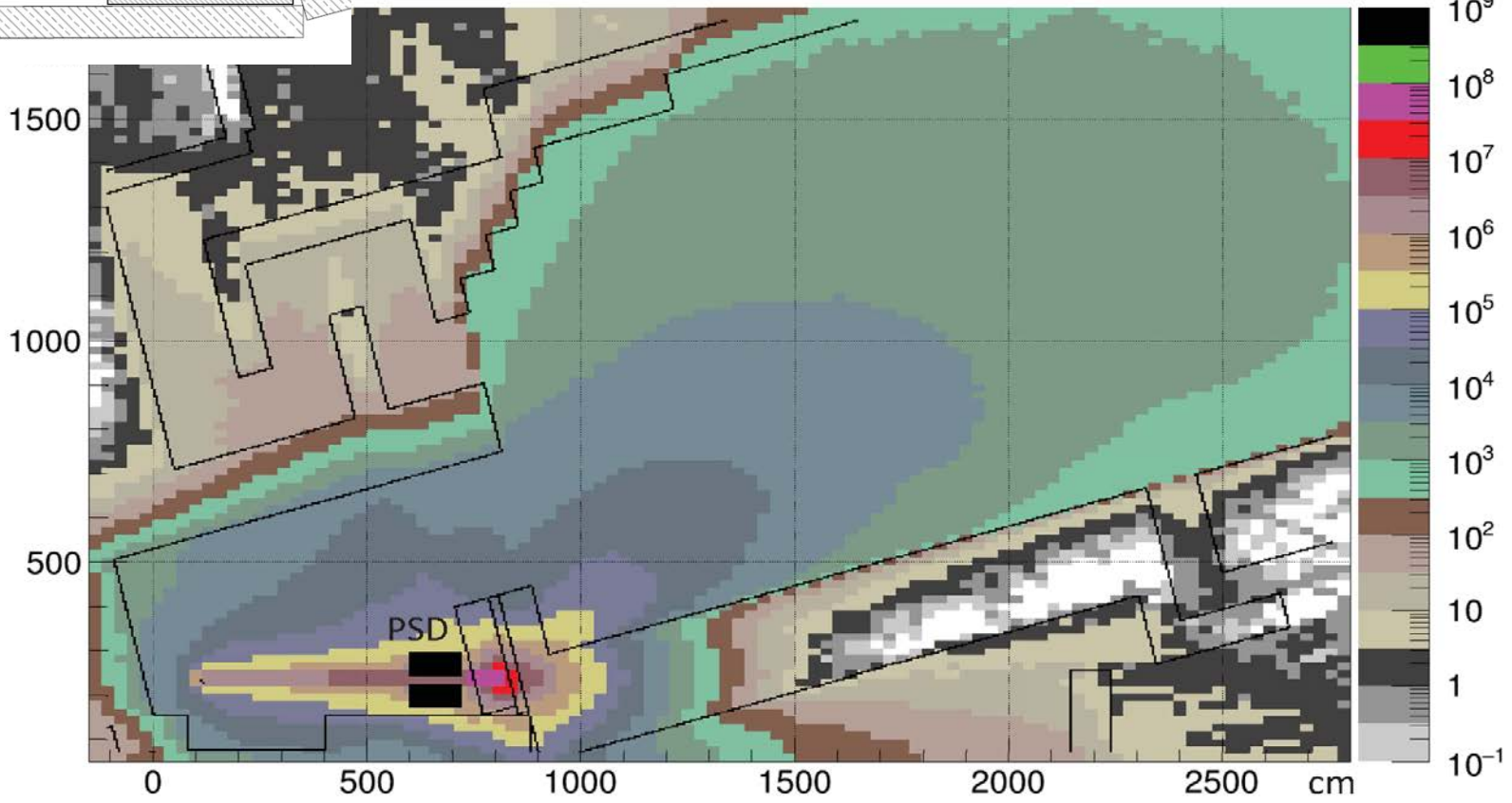
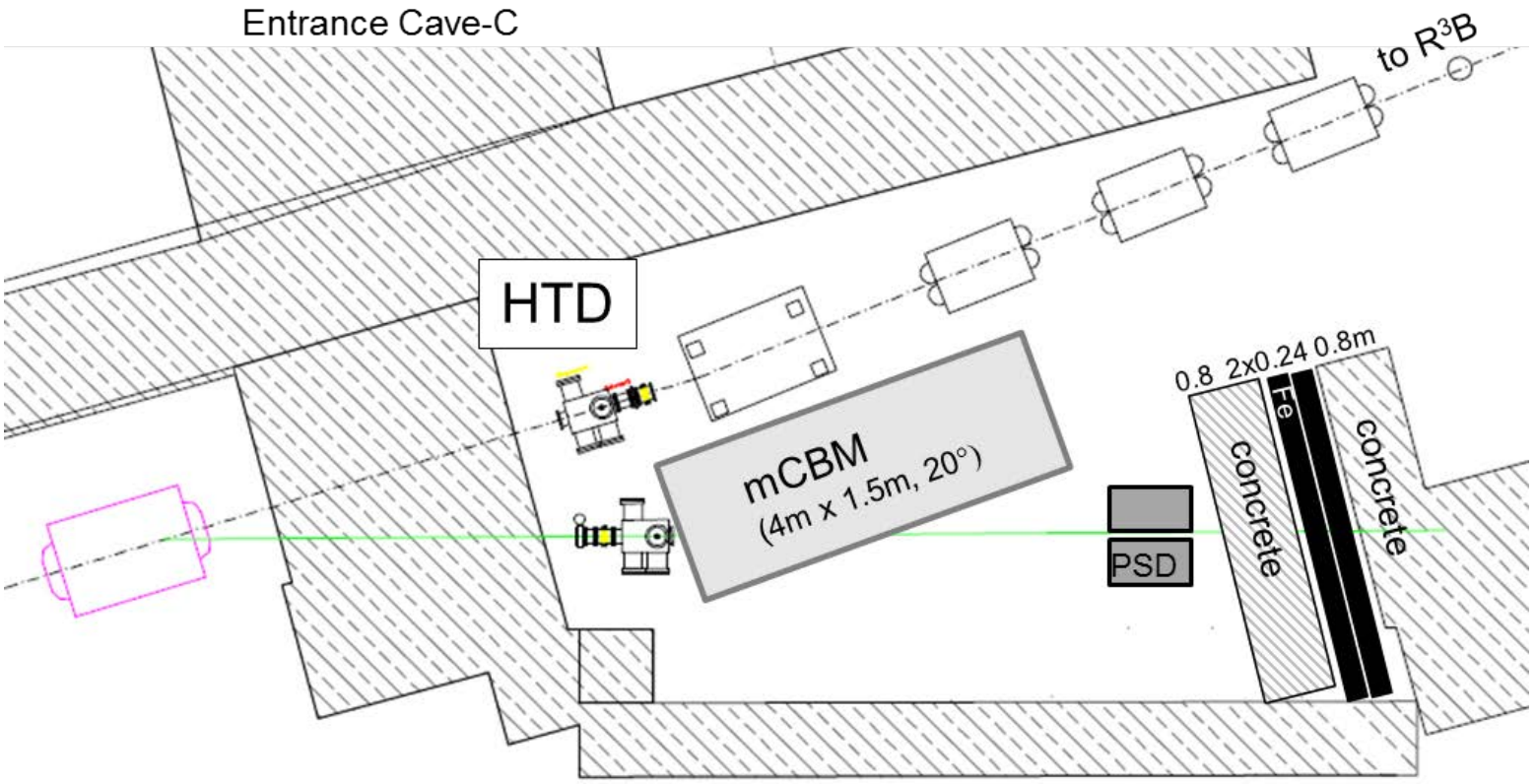


Additional shielding required



Additional iron and concrete layer

- radiation level simulation
- optimization ongoing

1st Preparation Meeting

Preparing for mCBM@SIS18

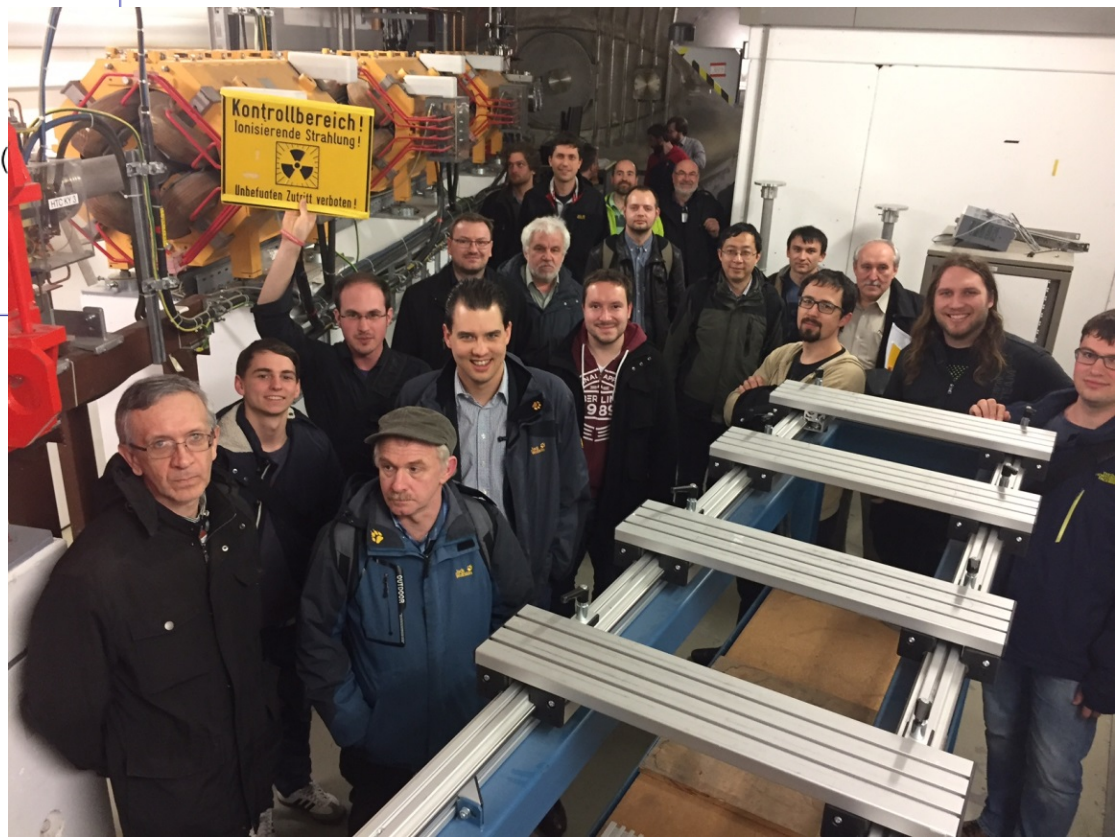
mCBM@SIS18 - a CBM full system test 2018 - 2021
in high-rate nucleus-nucleus collisions

Fixed set-up and in-beam test at the host lab
1st preparation meeting:

- Participating Detector Subsystems
  - Present geometries in CbmROOT (David)
  - Planned FEE + data transport (David)
  - Discussion on contributions by subsystems (
  - To do (ALL)
- On-site visit

CBM Week, GSI, March 2017 C.Sturm & D.Emschermann, GSI

Tuesday, March 20, 2017



Summary and Outlook

mCBM@SIS18 – a CBM full system test at GSI

A test facility for the

- High-performance free-streaming DAQ system
- FLES
- Final detector prototypes

❖ 2016 – 2018 design and construction phase

❖ 2018 – 2021 permanent test-setup incl. beam tests with high-rate A+A collisions

Next steps

Design freeze of the

- Contributions by subsystems
- HTD cave

Preparation of the installation site

GSI core team

D. Emschermann
J. Frühauf
W. Niebur
P-A. Loizeau
A. Senger
F. Uhlig
C. Sturm