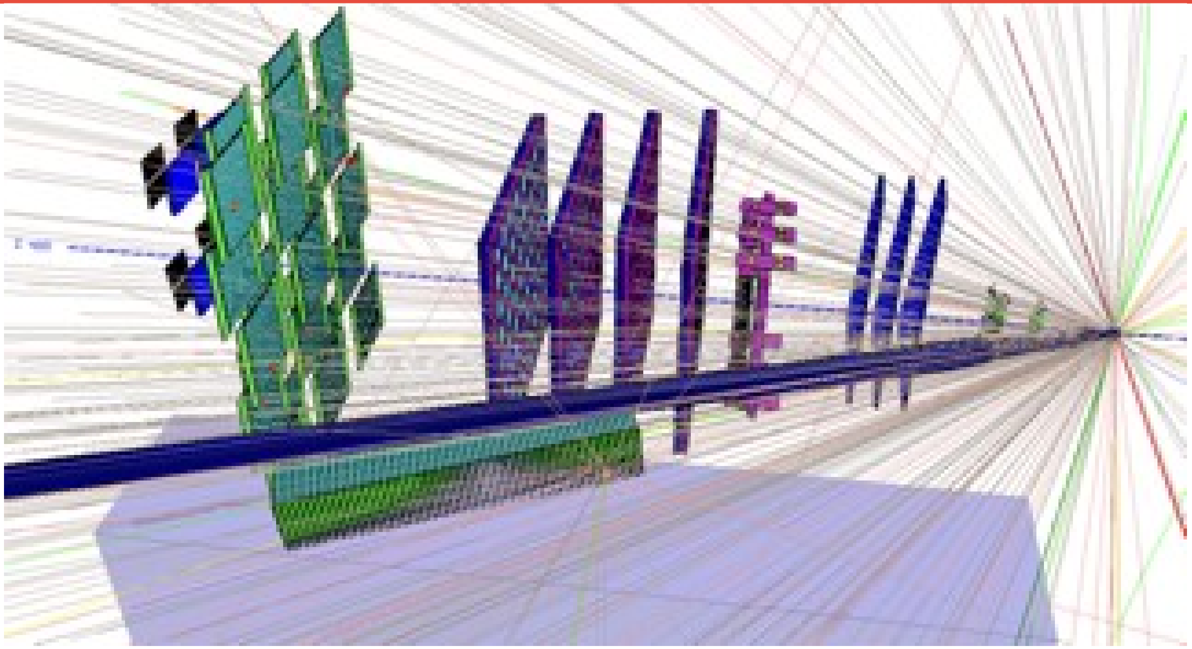
mCBM@SIS18



Motivation and Concept

- **Full system test with focus on the**
  - free streaming data transport to a mFLES compute cluster
  - online monitoring
  - online reconstruction
  - offline data analysis
  - Controls
- **Experimental setup will consist of**
  - detector prototypes at $\theta_{lab} \approx 15° - 25°$
  - no magnetic field => straight tracks
  - high resolution TOF (t_0 – TOF stop wall)

Benchmark Observable

- **Verify the performance of the CBM data taking concept**
  - Use mCBM setup to reconstruct physics observable
  - Choose a particle with a low production probability to get a CBM-like challenge
    - Reconstruct online the decay of $\boldsymbol{\Lambda \rightarrow p\pi^-}$
  - Compare the results with published data
  - Feasibility study was done using CbmRoot for simulation, reconstruction and analysis
  - Study shows that the reconstruction of **Λ** at beam energies below 2 AGeV is possible with mCBM

Location

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Finland
United Kingdom
Denmark
Estonia
Latvia
Lithuania
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Netherlands
Belgium
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Belarus
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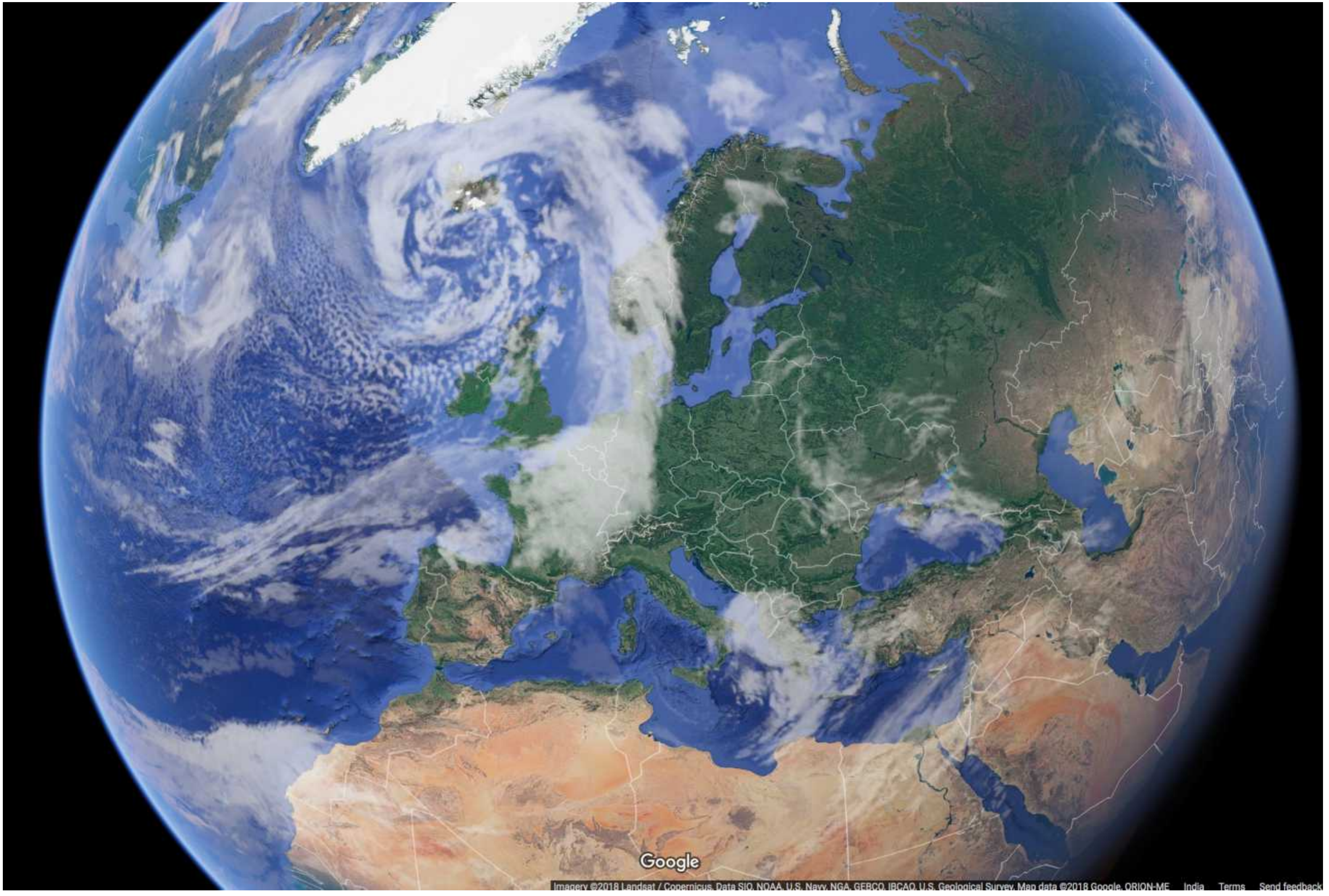
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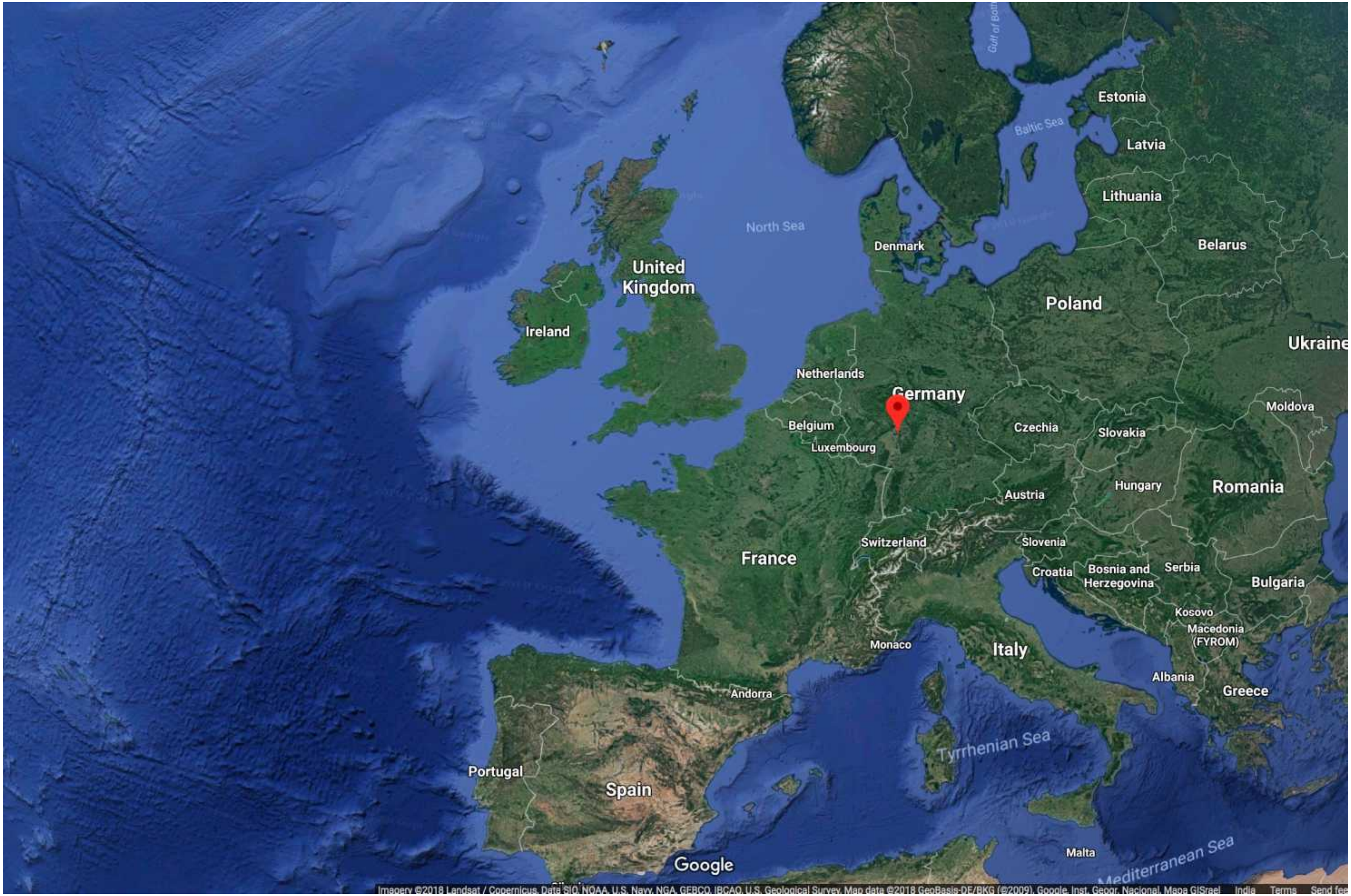

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Baltic Sea
Estonia
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Ireland
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Luxembourg
Czechia
Slovakia
Moldova
Austria
Hungary
Romania
Switzerland
France
Slovenia
Croatia
Bosnia and Herzegovina
Serbia
Bulgaria
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Macedonia (FYROM)
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Italy
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Location

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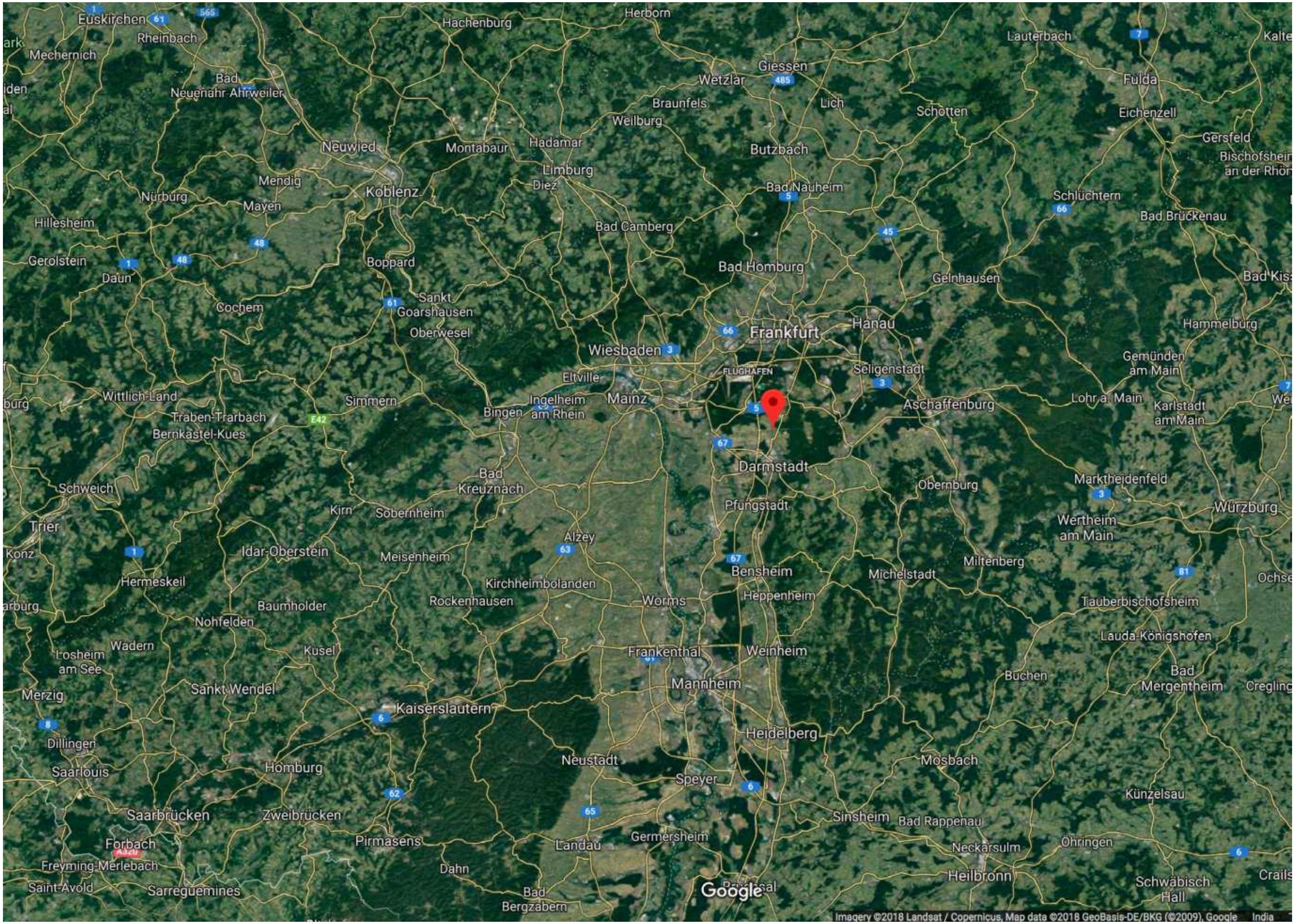
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Hermeskeil
Kirchheimbolanden
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Lauda-Königshofen
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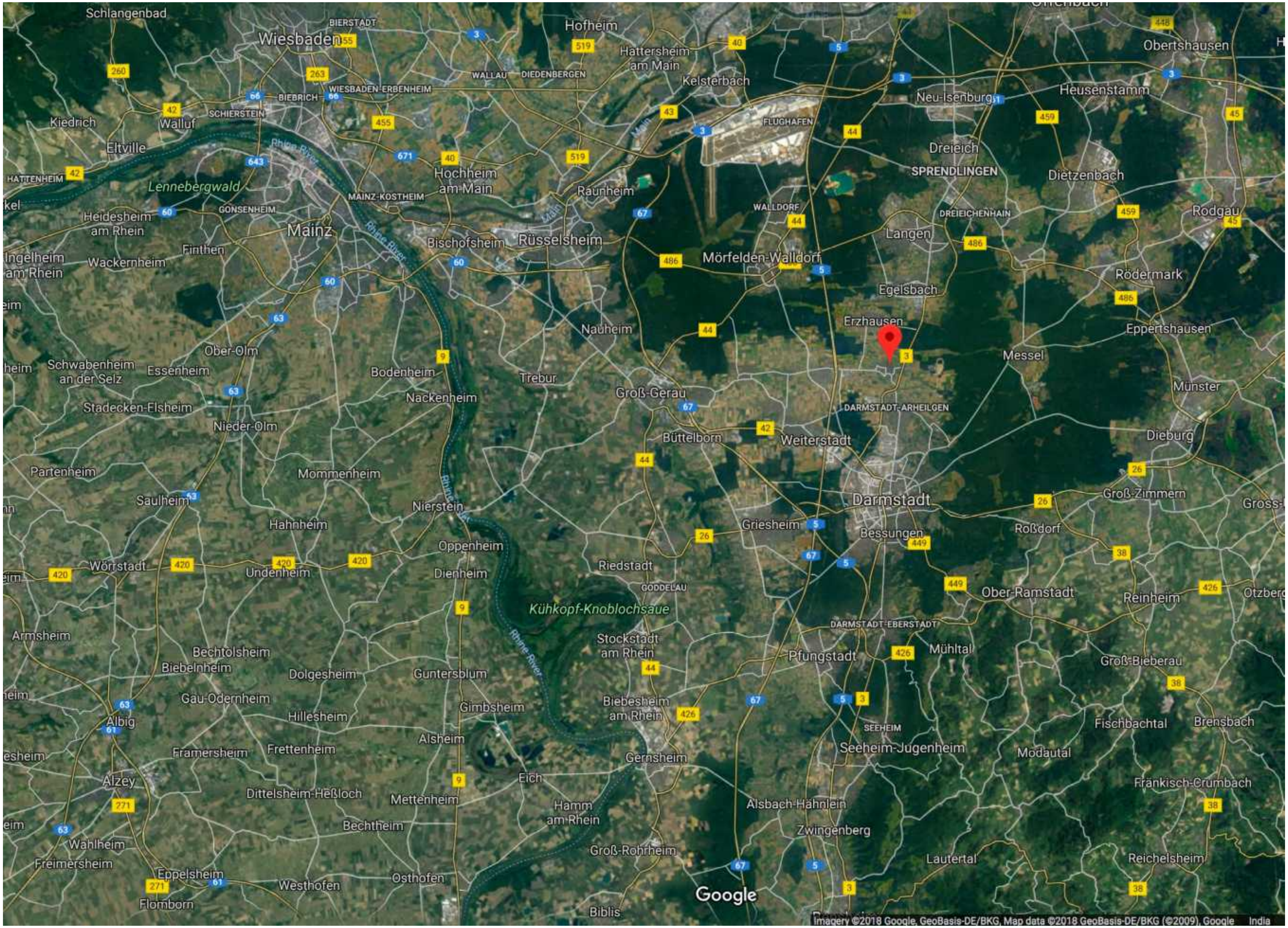

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Alzey
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Bechtheim
Zwingenberg
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Erzhausen
Hegbachaue bei Messel
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Im Morsbacher Grund von Darmstadt
Messel
Silzwiesen von Darmstadt-Arheilgen
UNESCO Welter Grube Mess
DARMSTADT-ARHEILGEN
AWS Abfall...
Weiterstadt
Bürgerpark Nord
Waldspirale
MARTINSVIERTEL
Scheftheimer Wiesen bei Darmstadt
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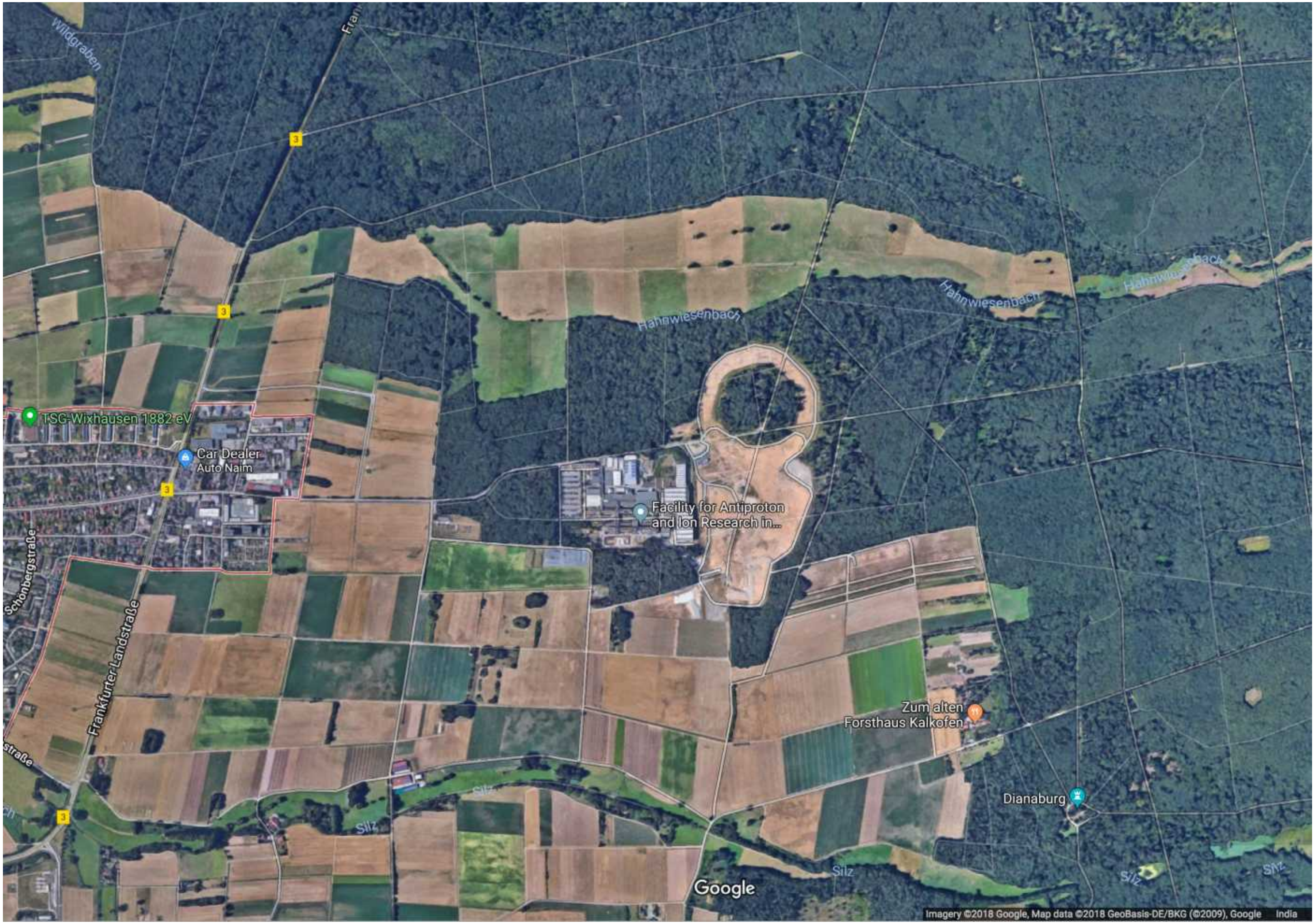
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TSG-Wixhausen 1882 eV
Car Dealer
Auto Naim
Facility for Antiproton
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Prinzenschneise
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Planckstraße
Planckstraße
GSI Helmholtzzentrum für Schwerionenforschung
GSI Helmholtzzentrum fuer...
Facility for Antiproton and Ion Research in...
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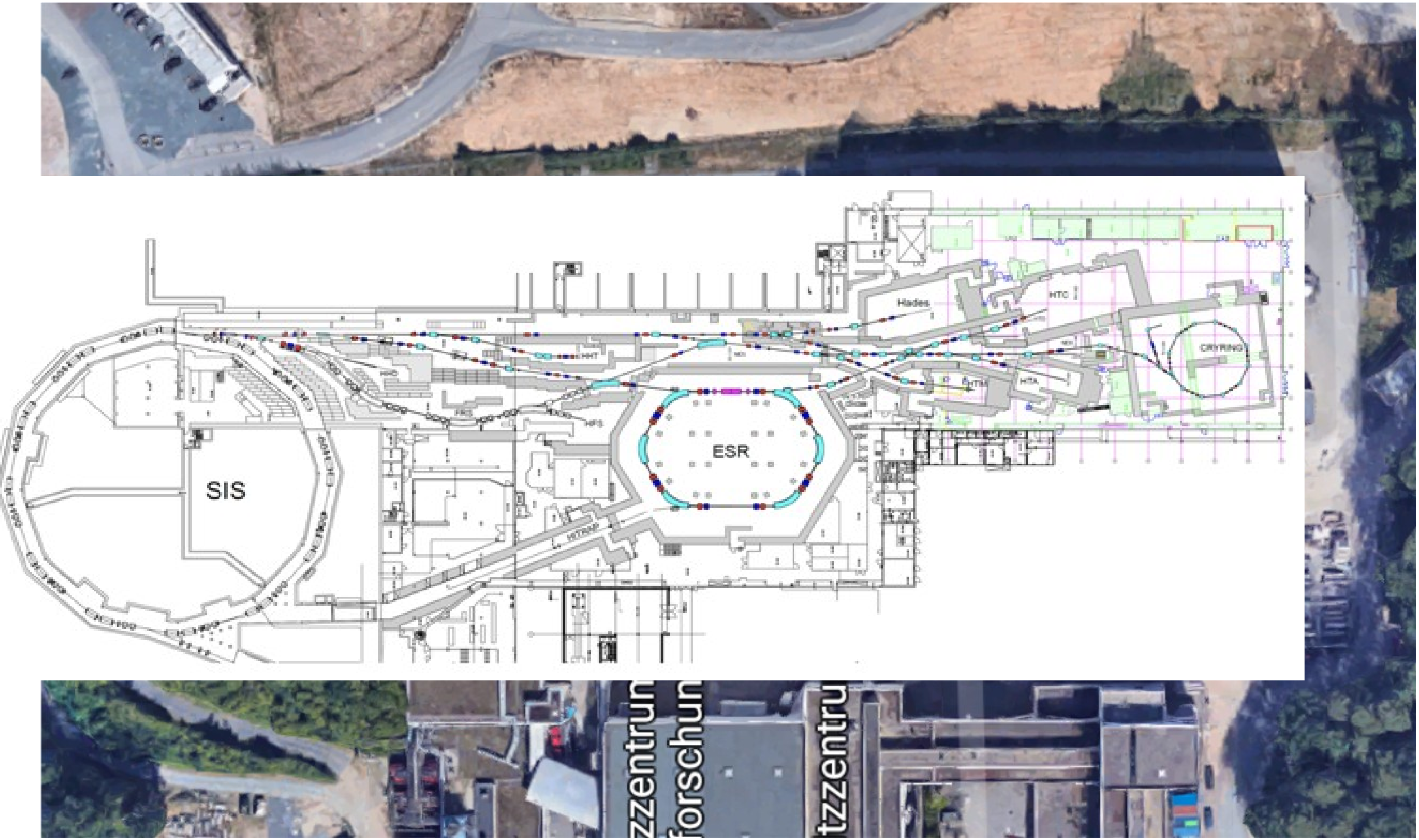
Location

Location



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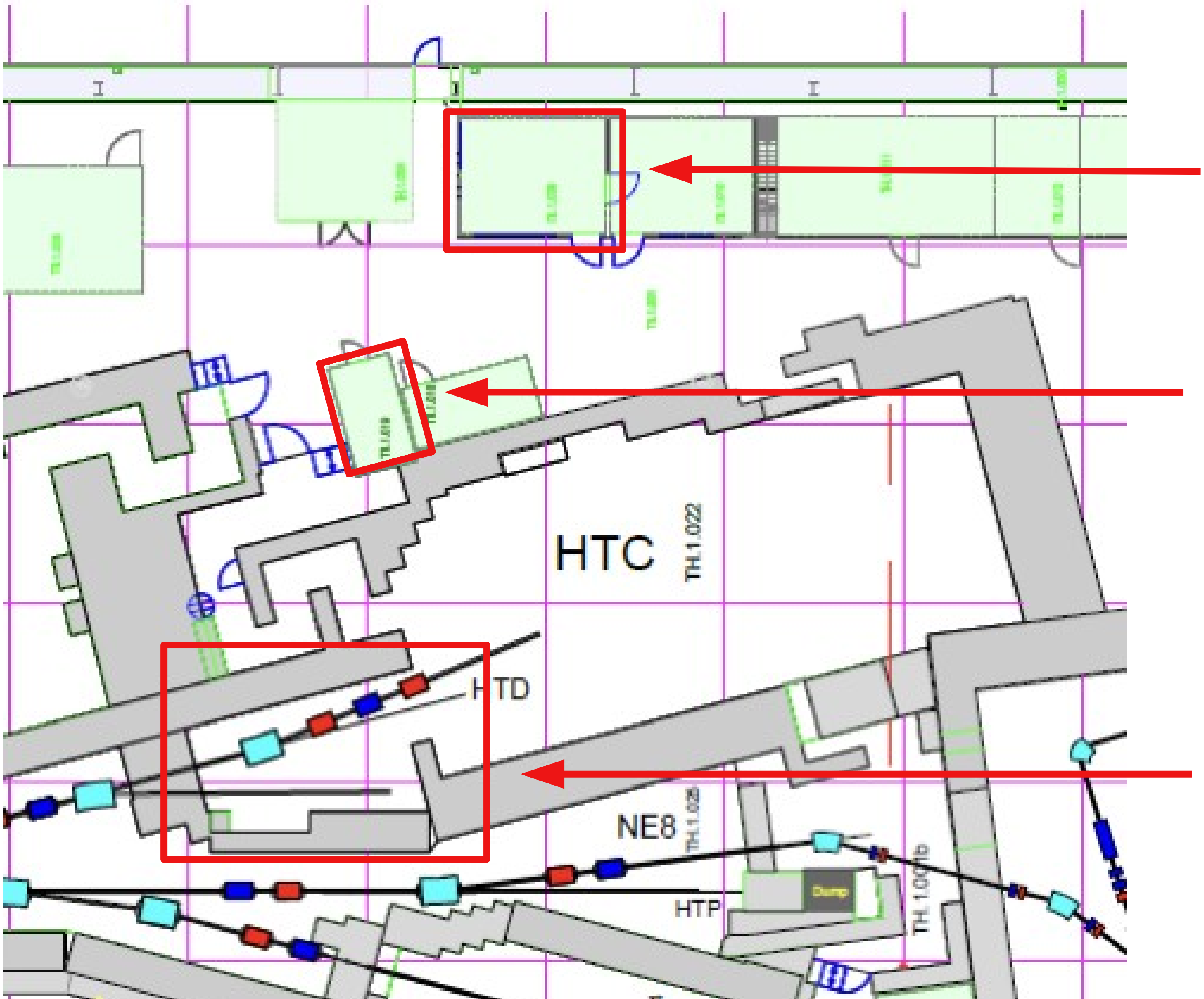


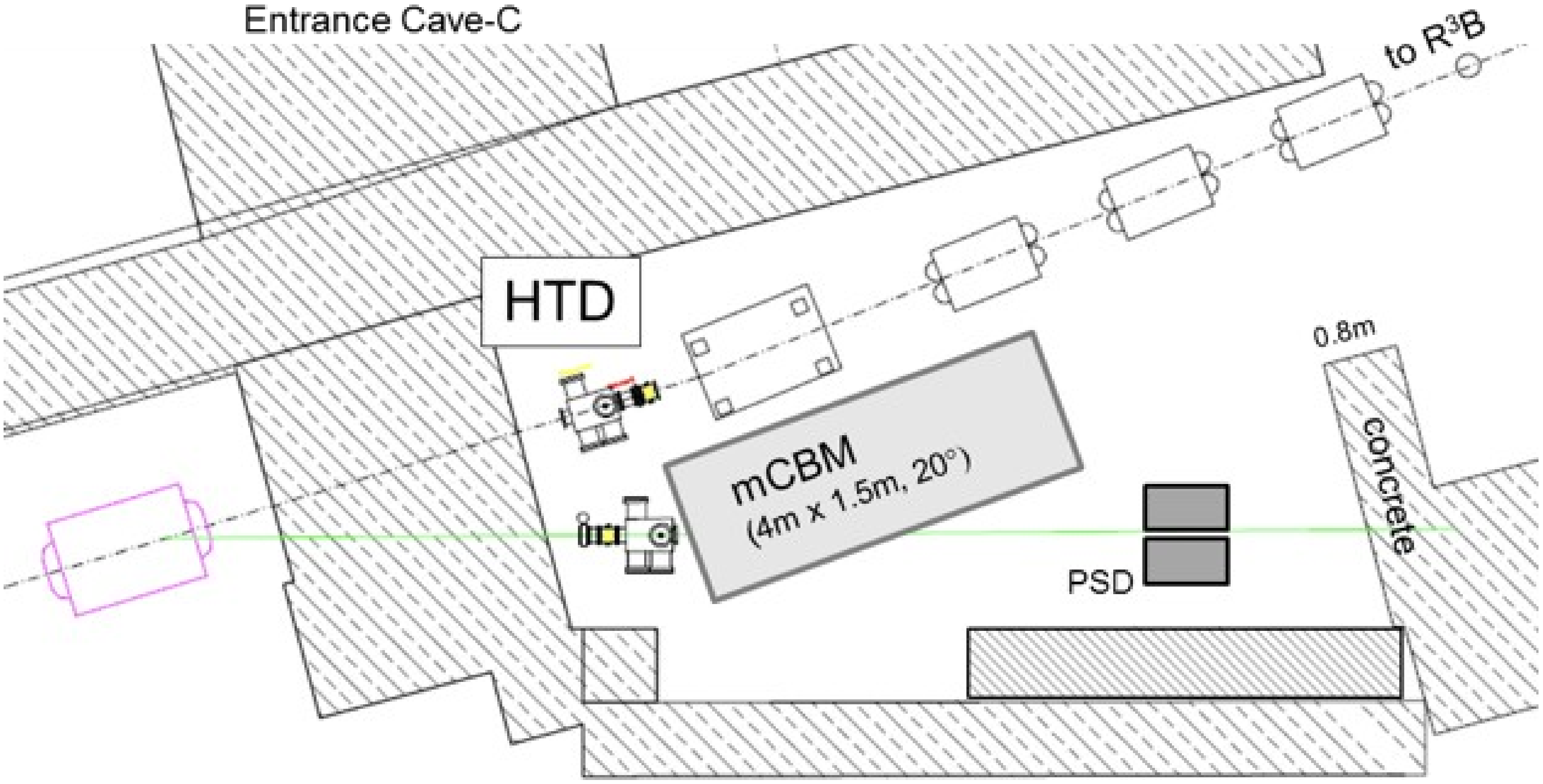
Counting Room ??

DAQ container

mCBM cave

mCBM Cave – before rebuild

First simulations

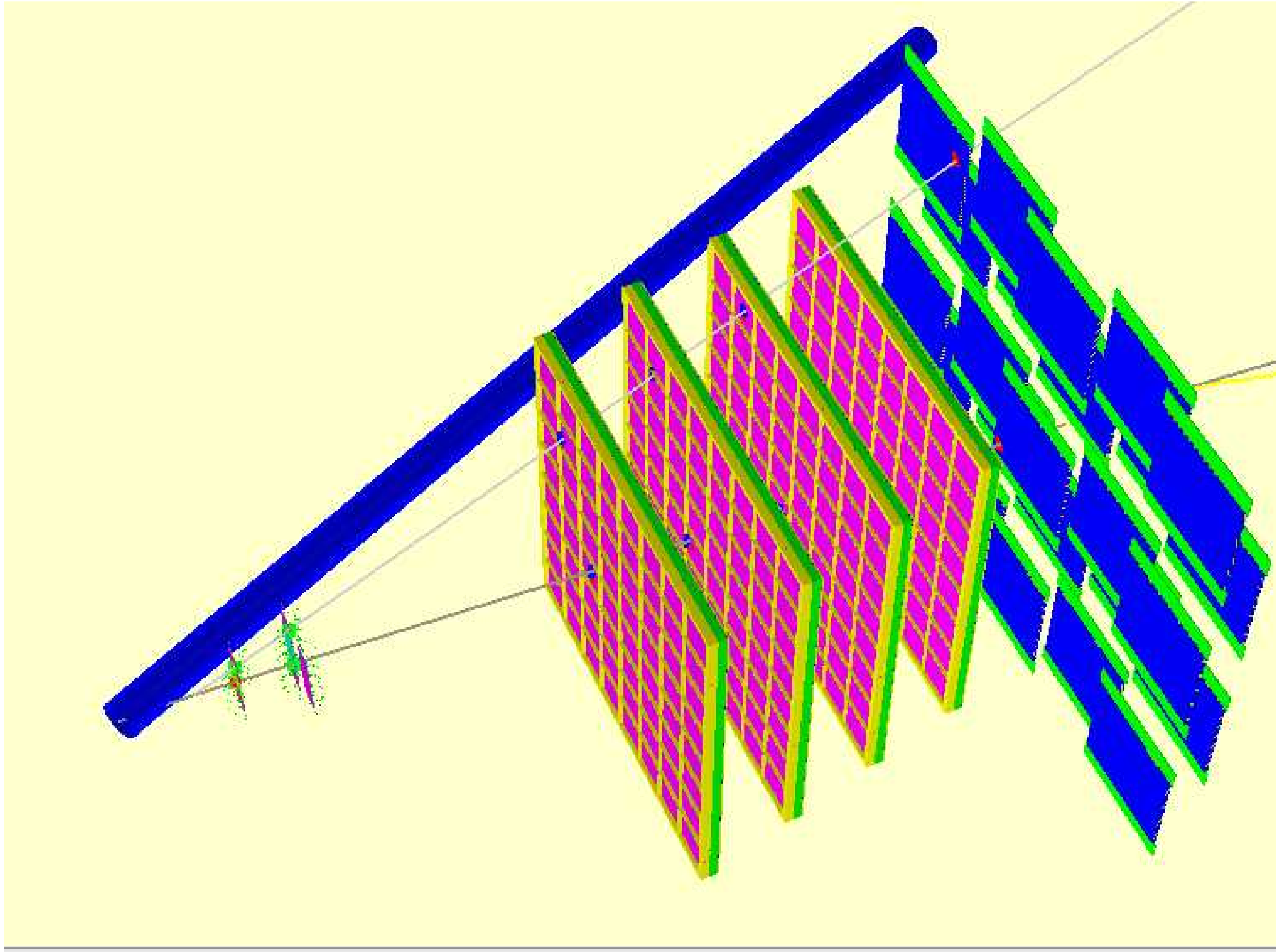


Now the problems starts

- **No possibility to get a stronger magnet**
  - Limited to low beam energies
- **Change beam line from 15° to 8°**
  - Maximum beam energy from SIS18 can be used for mCBM
  - Need to rework the vacuum chamber of the existing magnet

Simulations

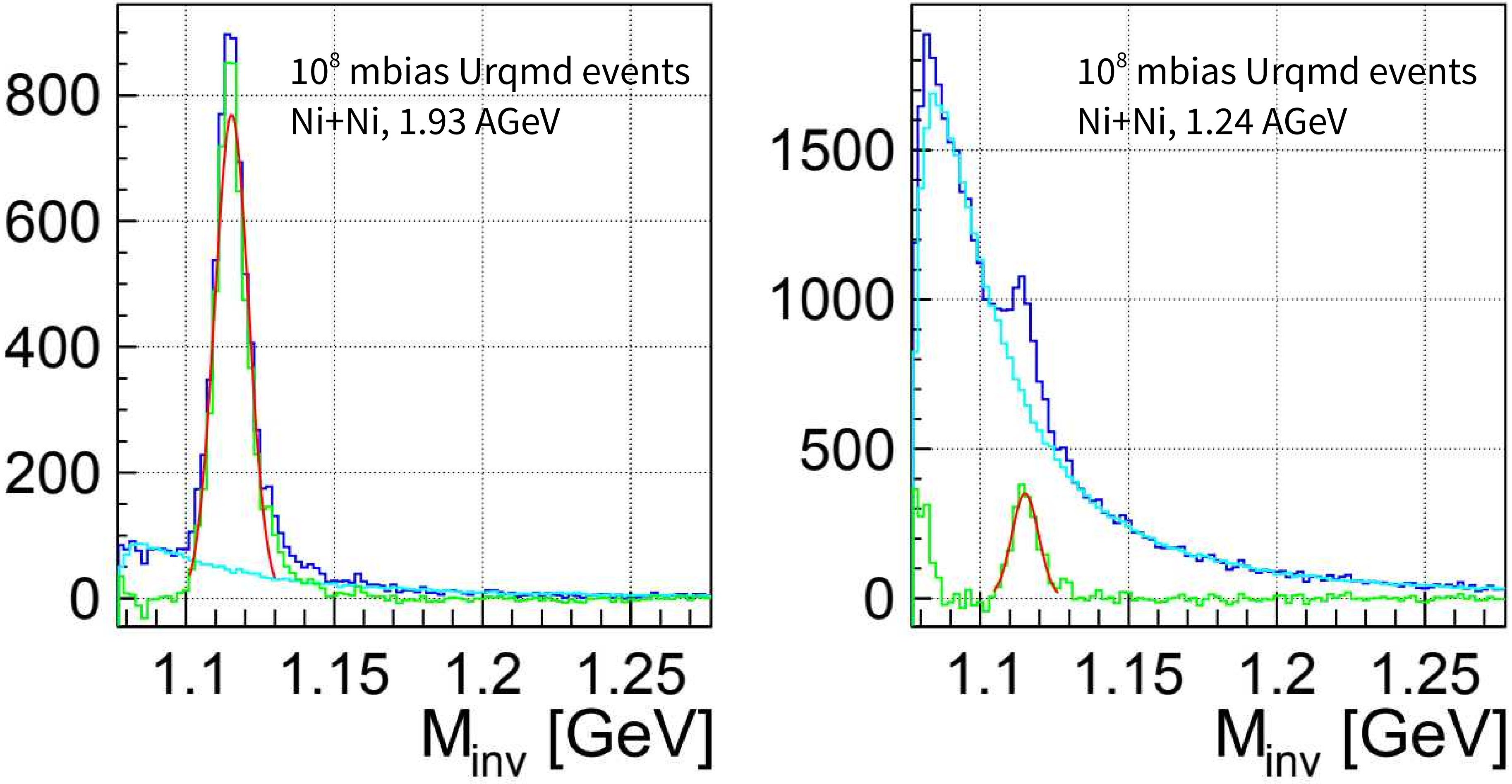
- mCBM setup at an 25° angle with respect to the beam line (8° beam line)
- Not all sub detector systems present in first simulation
- Needed for mCBM proposal



Reconstruction of $\Lambda \rightarrow p\pi^-$

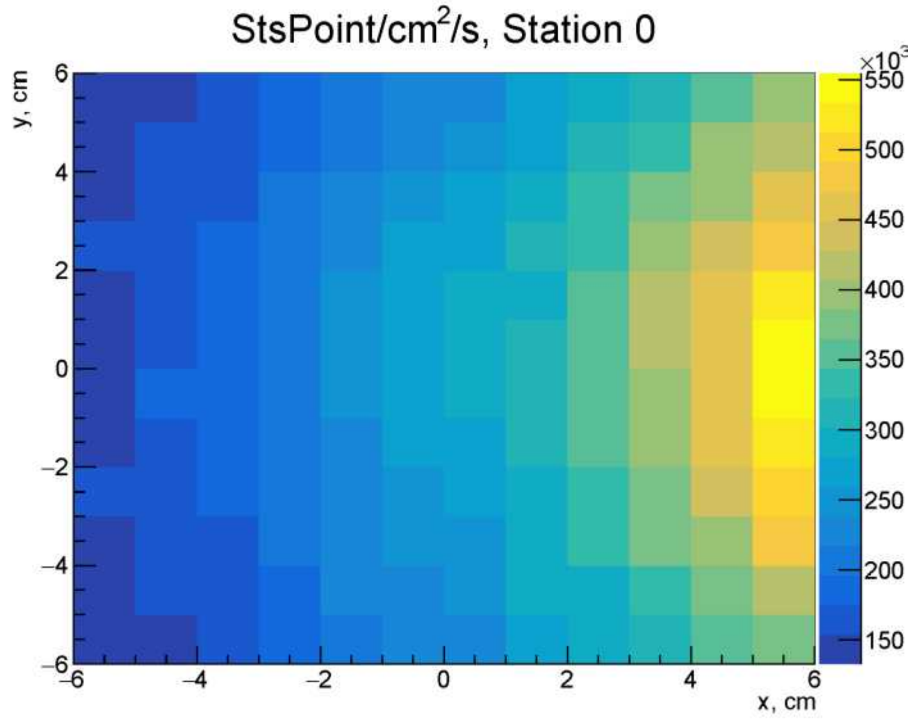
1. Create track candidates
   1. Create straight track candidates between primary vertex at (0,0,0) and TOF hits
   2. Find matching hit in second STS which is within a cut window (Δd_1) from the extrapolated track
   3. Create straight tracks using STS hit from 1.2. and primary vertex at (0,0,0)
   4. Accept as track candidate if a STS hit in the first STS station is within a cut window (Δd_2) from the extrapolated track
2. Hits accepted in a track candidate are not used for other tracks
3. Find secondary protons
   1. Create straight tracks from STS hits from track candidates found in 1.
   2. Accept as secondary proton if impact parameter of track is larger then a cut value
4. Find secondary pion
   1. Use TOF-STS hit pairs which were rejected in 1.2.
   2. Create straight tracks from this pairs
   3. Search for a STS hit in the second station which was not used and is within a cut window (Δd_{pion}) from the extrapolated line
5. Form proton/pion candidate pairs if they fulfill several conditions (opening angle, closest distance, decay length) and calculate invariant mass of the pair
6. Subtract mixed event background

Results

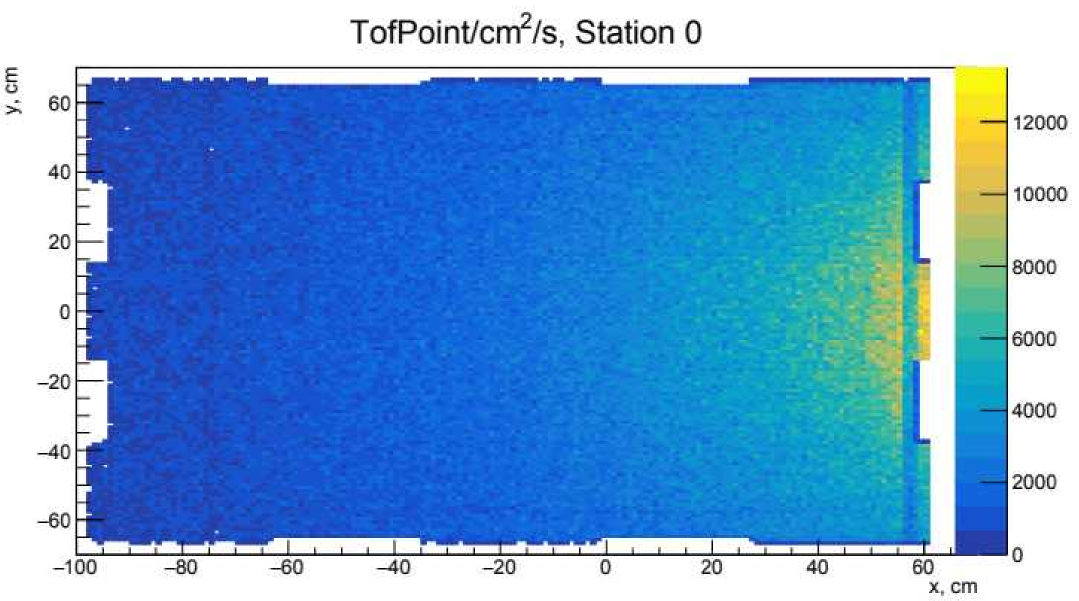


10^8 events correspond to roughly 10s data taking

Expected hit rates

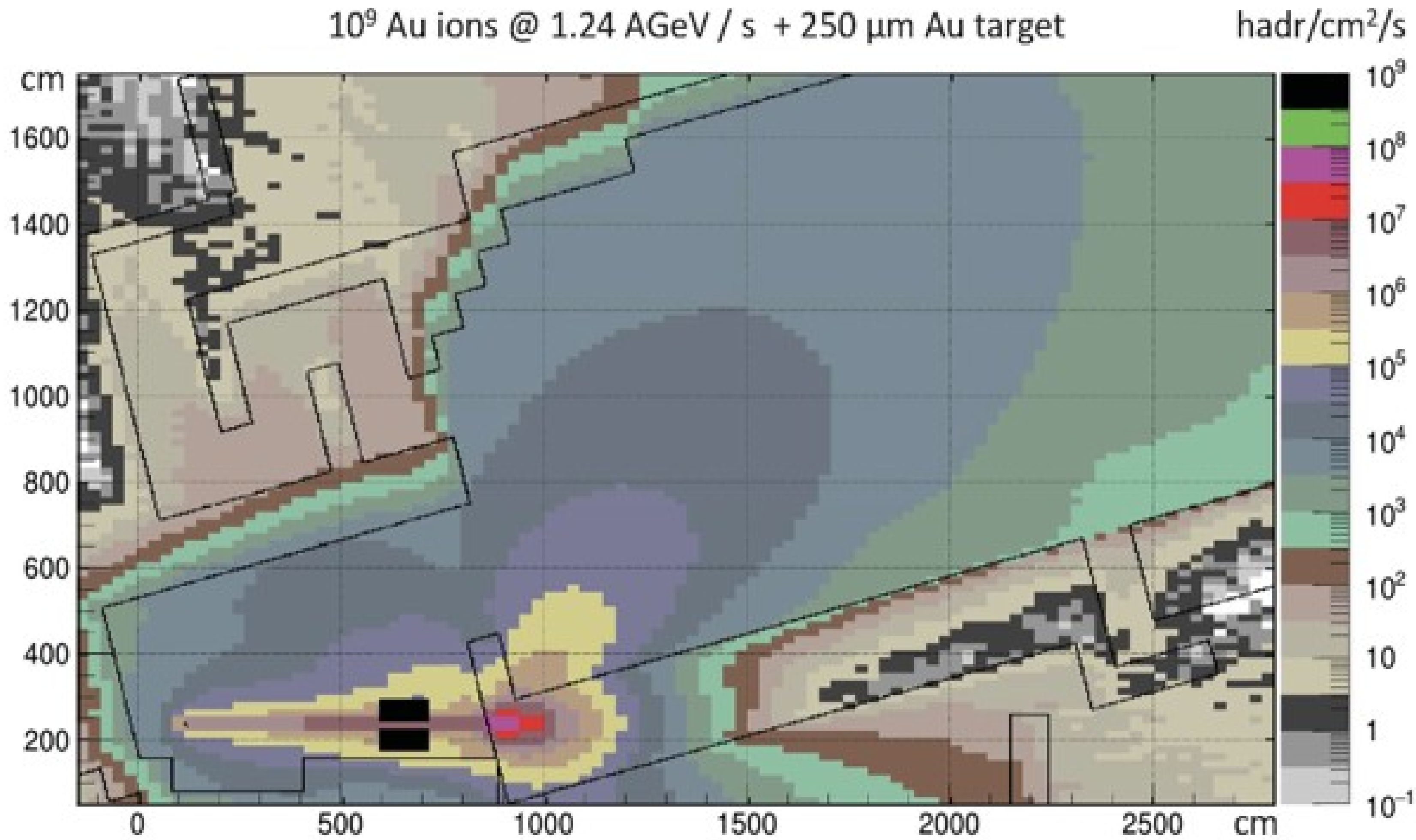


Input:
UrQMD, Au+Au 1.24 AGeV, mbias
The rates are normalized to 10^7 collisions per second



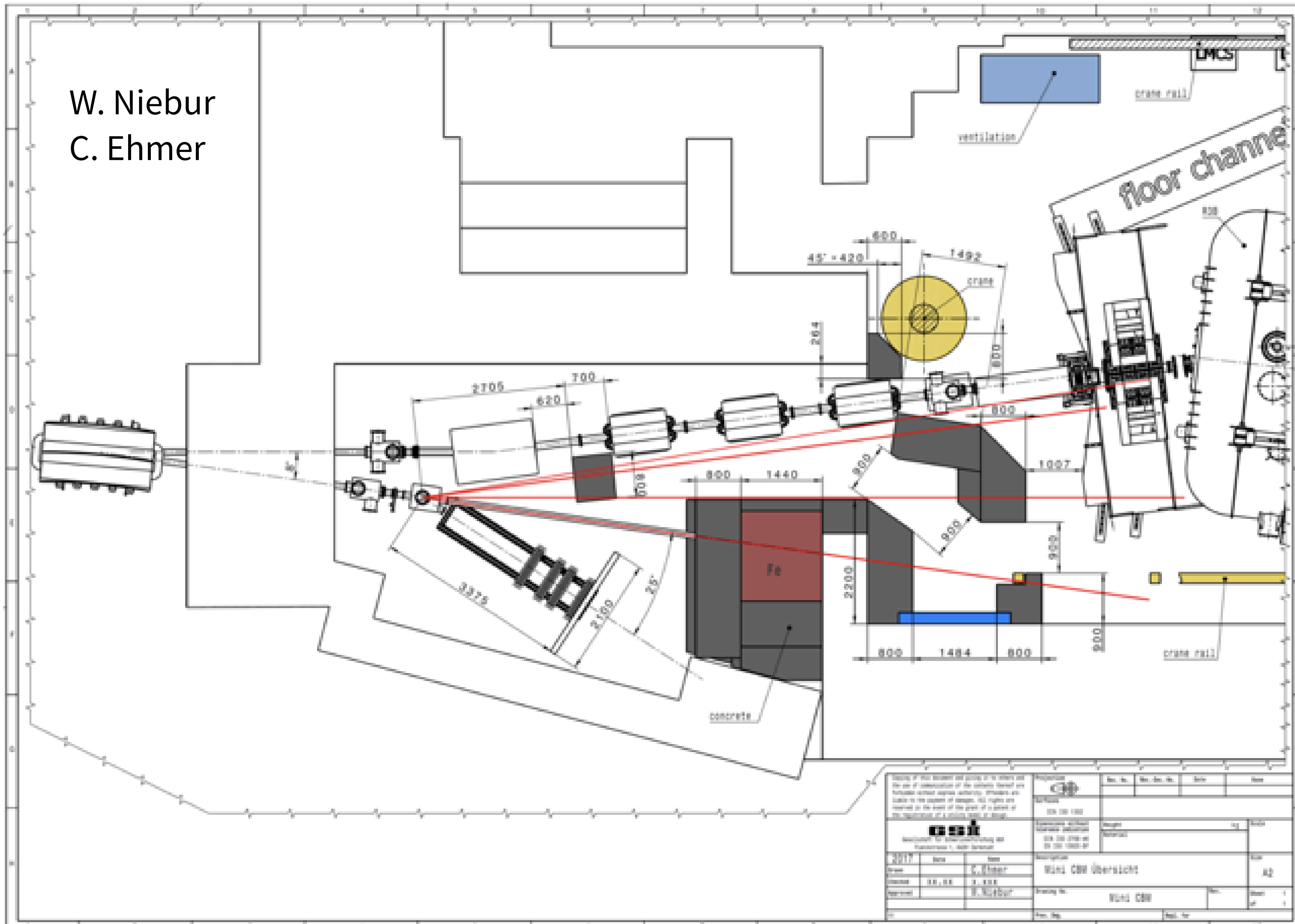
Radiation level simulations at top SIS18 energies and CBM collision rates

Fluka simulations by A. Senger



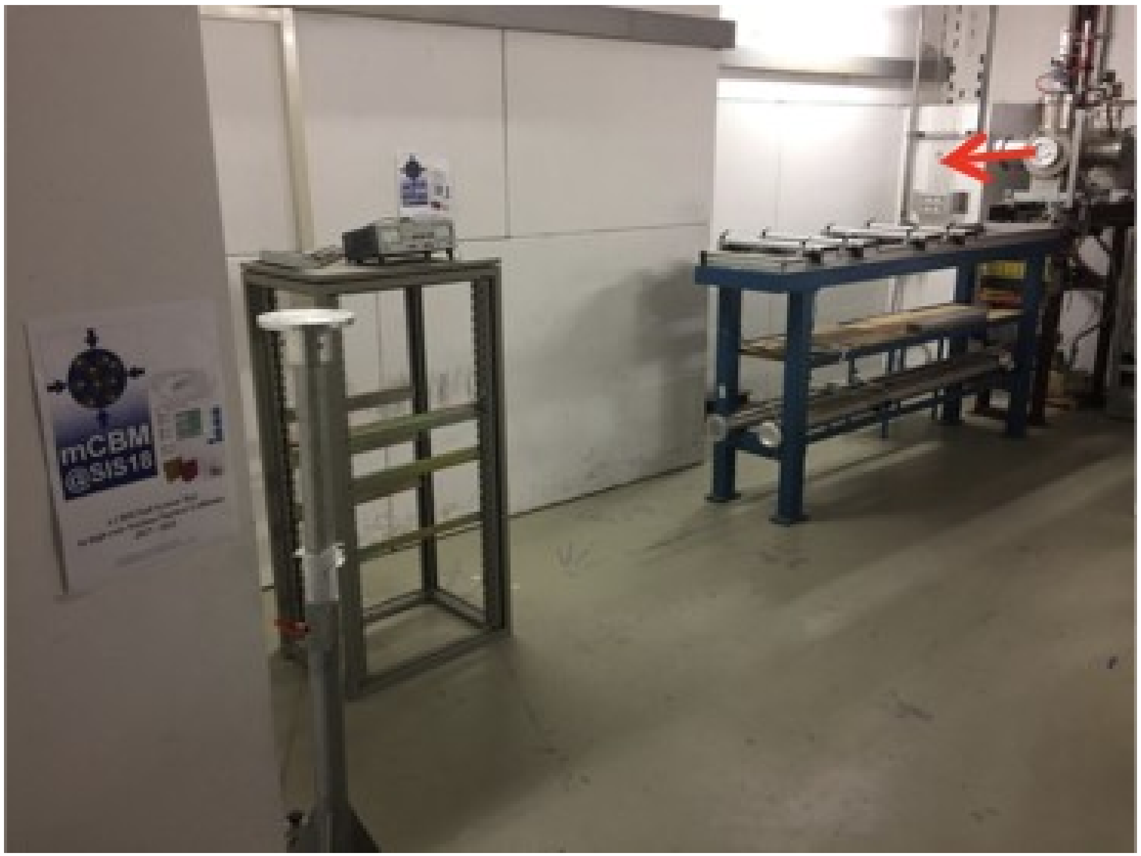
mCBM Cave reconstruction

W. Niebur
C. Ehmer



mCBM Cave reconstruction

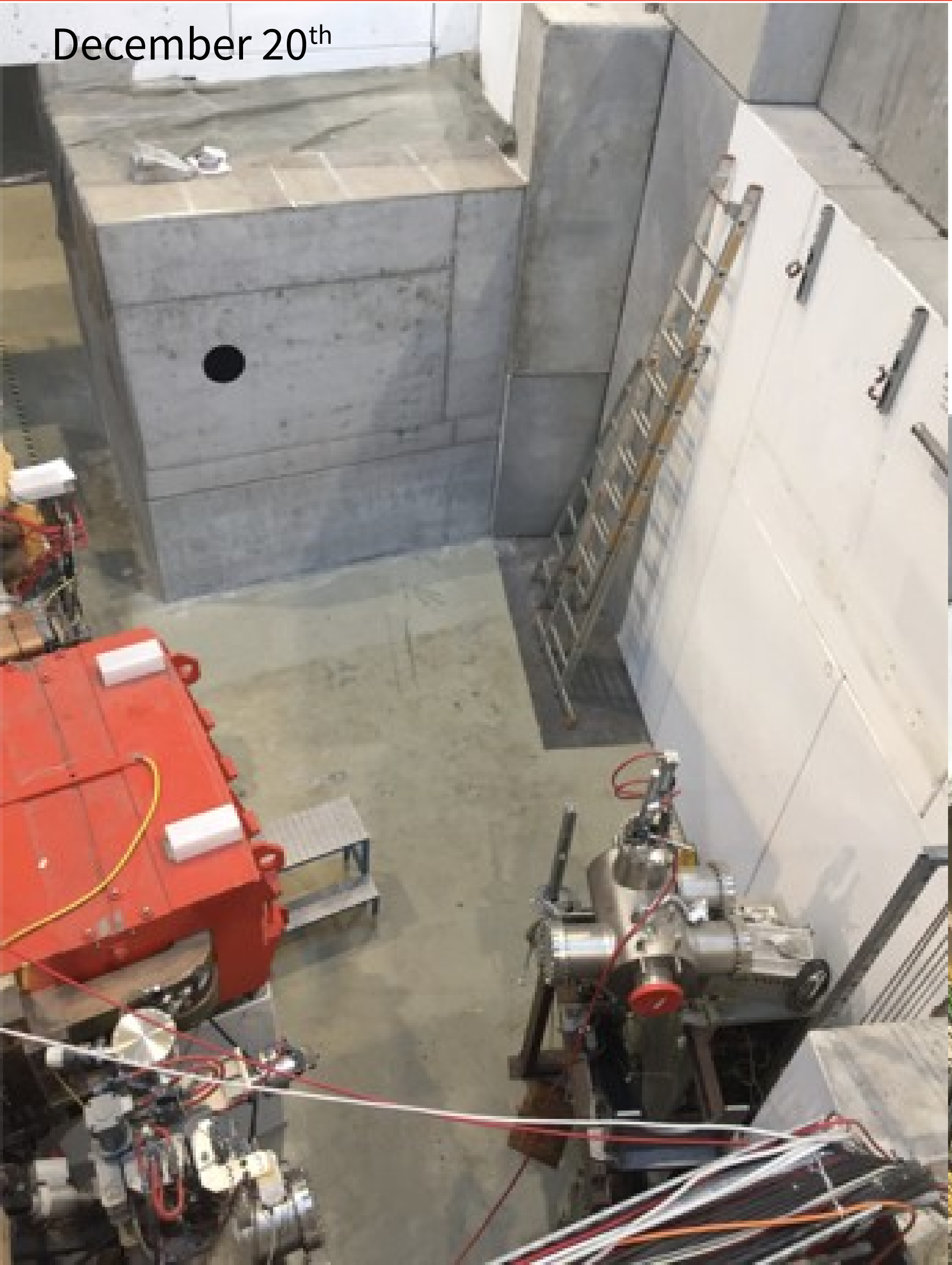
August 2017



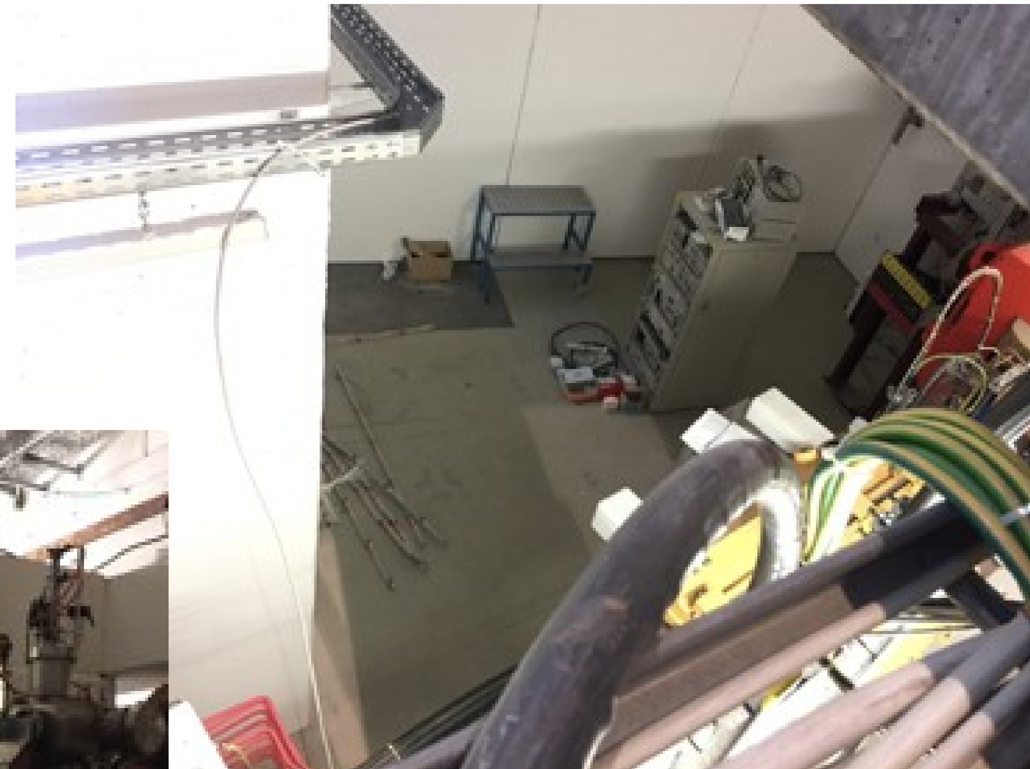
W. Niebur

November 3rd 2017

mCBM Cave reconstruction

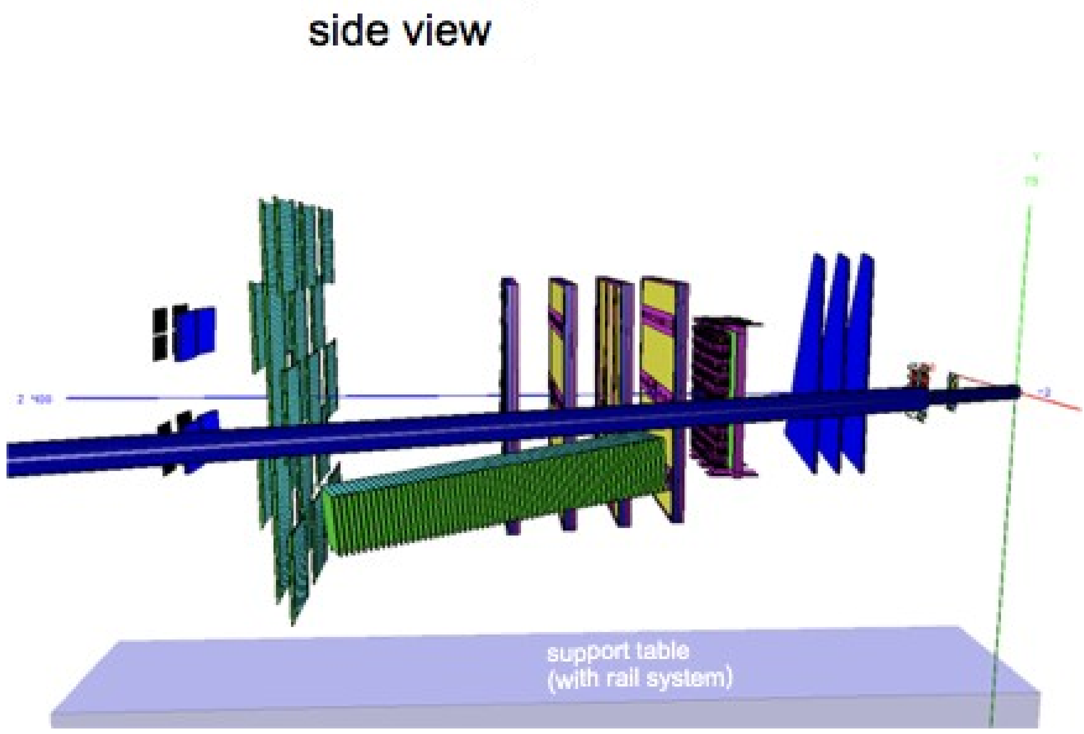


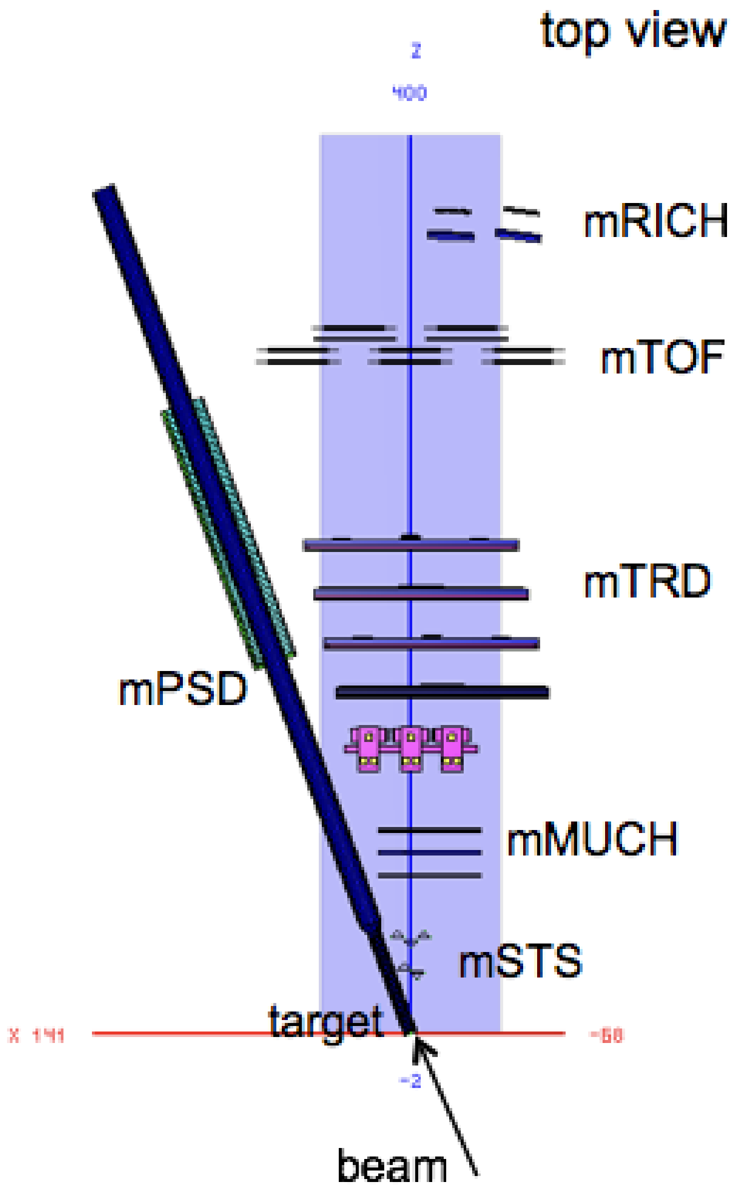
mCBM Cave reconstruction



8th February 2018

Status of mCBM simulation



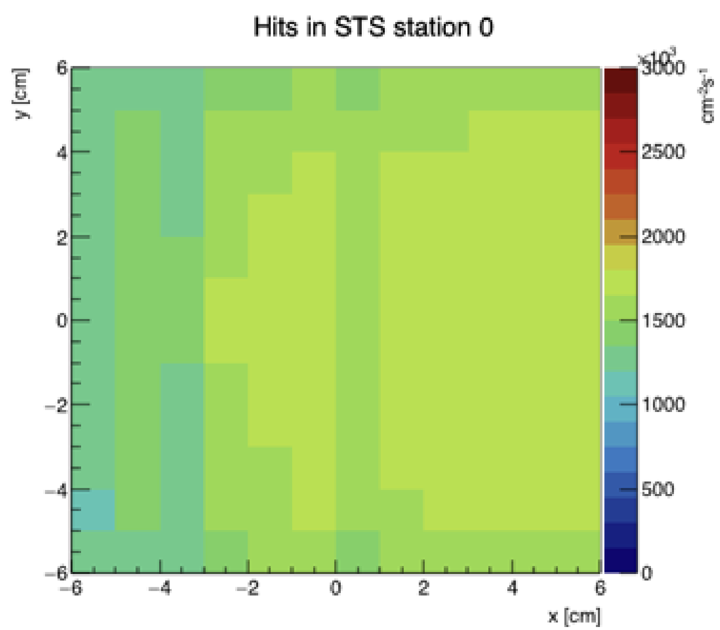


Status mCBM simulations

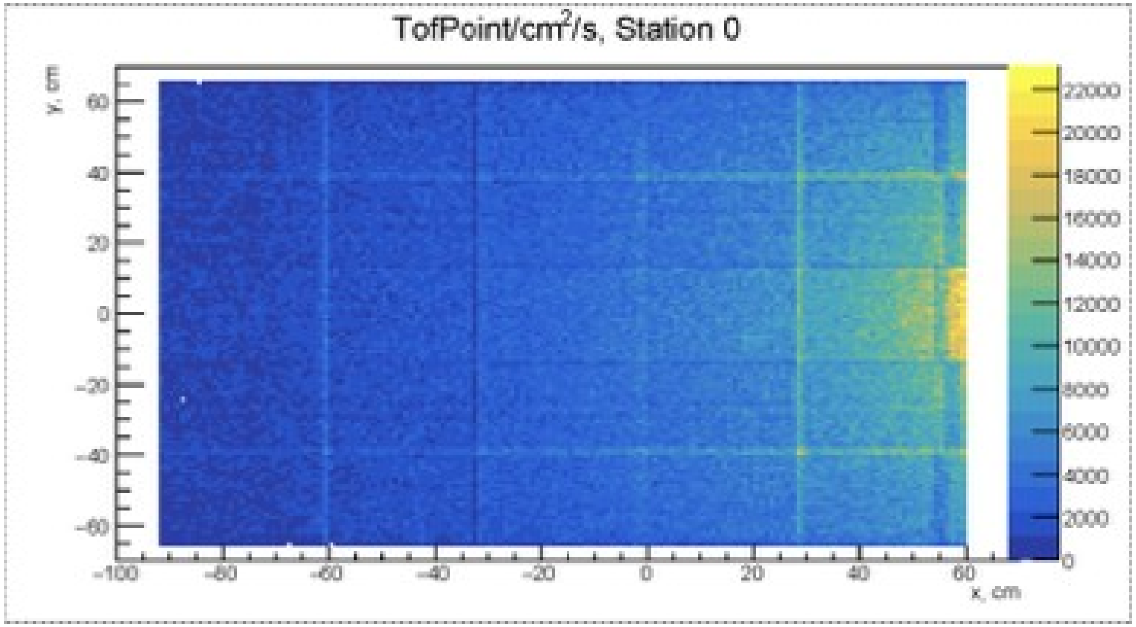
- **Redid the mCBM simulations recently**
  - Use up-to-date detector setup
  - Include all detector subsystems in the simulation
  - Redo **Λ** reconstruction

Preliminary

mSTS, 1st station
max. (design) rate: 1.5 MHz/cm2



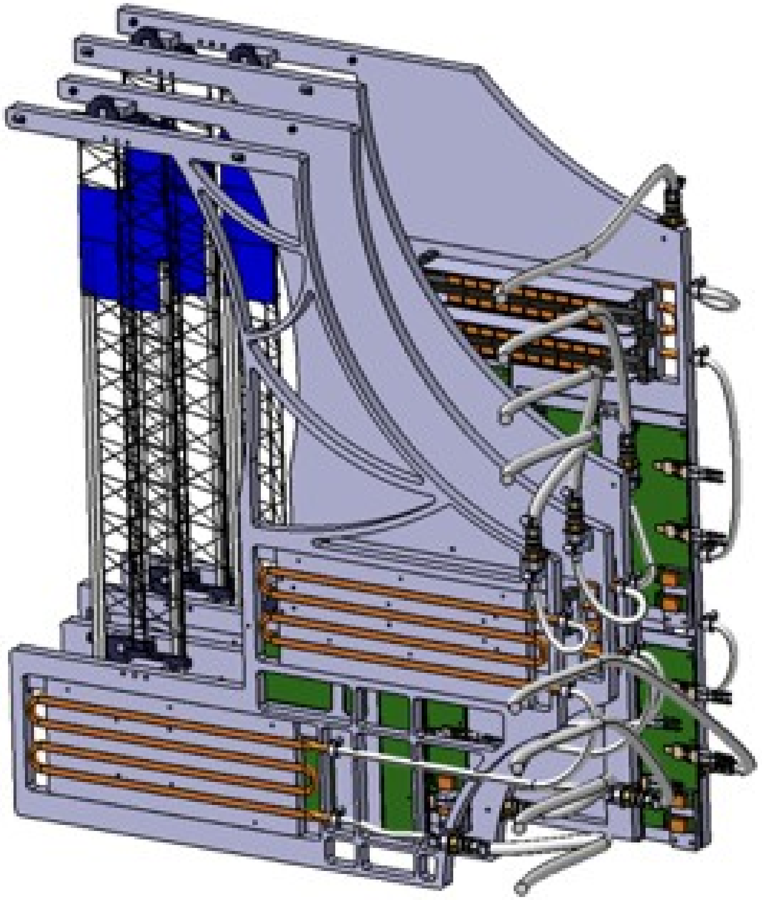
mTOF
max. (design) rate: 20 kHz/cm2

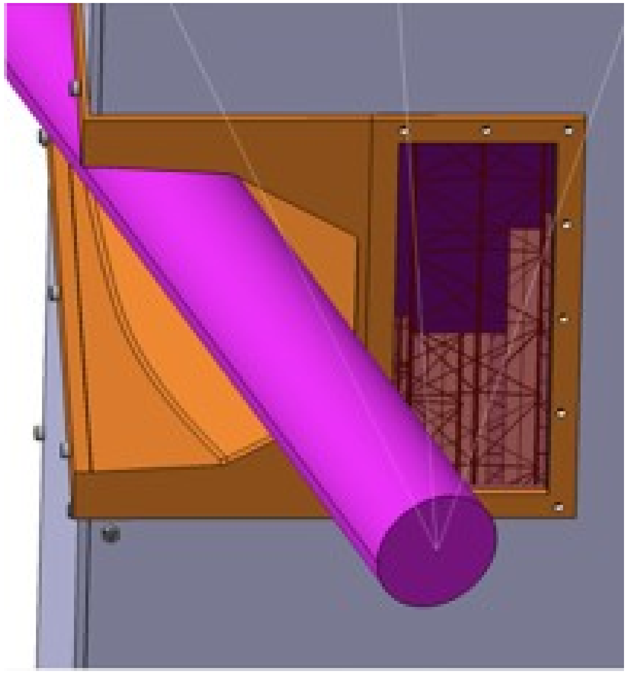


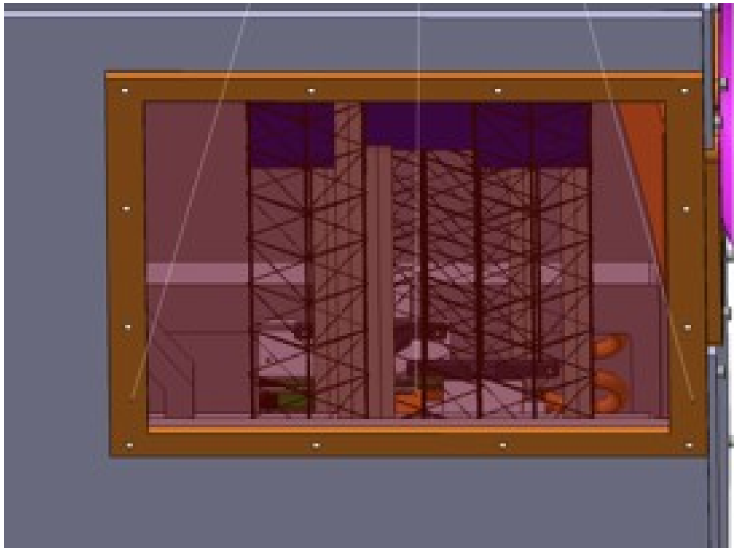
Status mSTS

4 C-frames ("Units")

- holding the ladders with modules
- holding the read-out and powering electronics (FEB, C-ROB, POB) on cooling plates

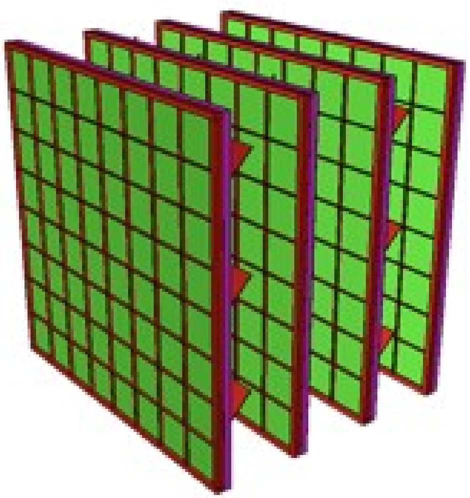




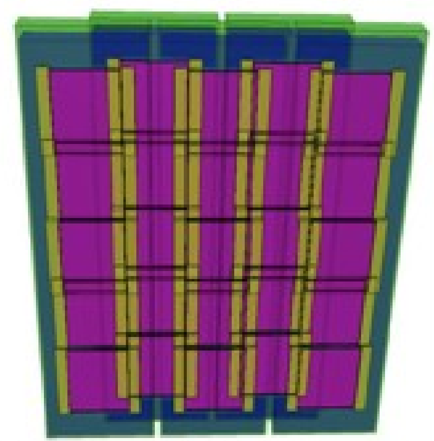


Status mTRD and mTOF

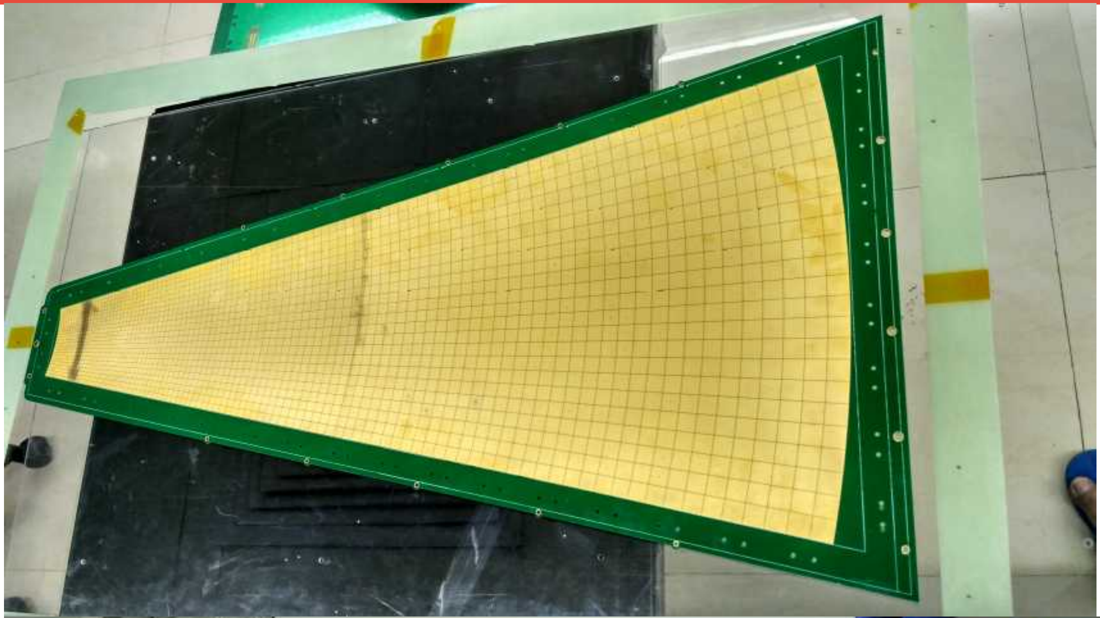
mTRD setup
4 layers
TRD modules
from DESY/CERN tests 2017

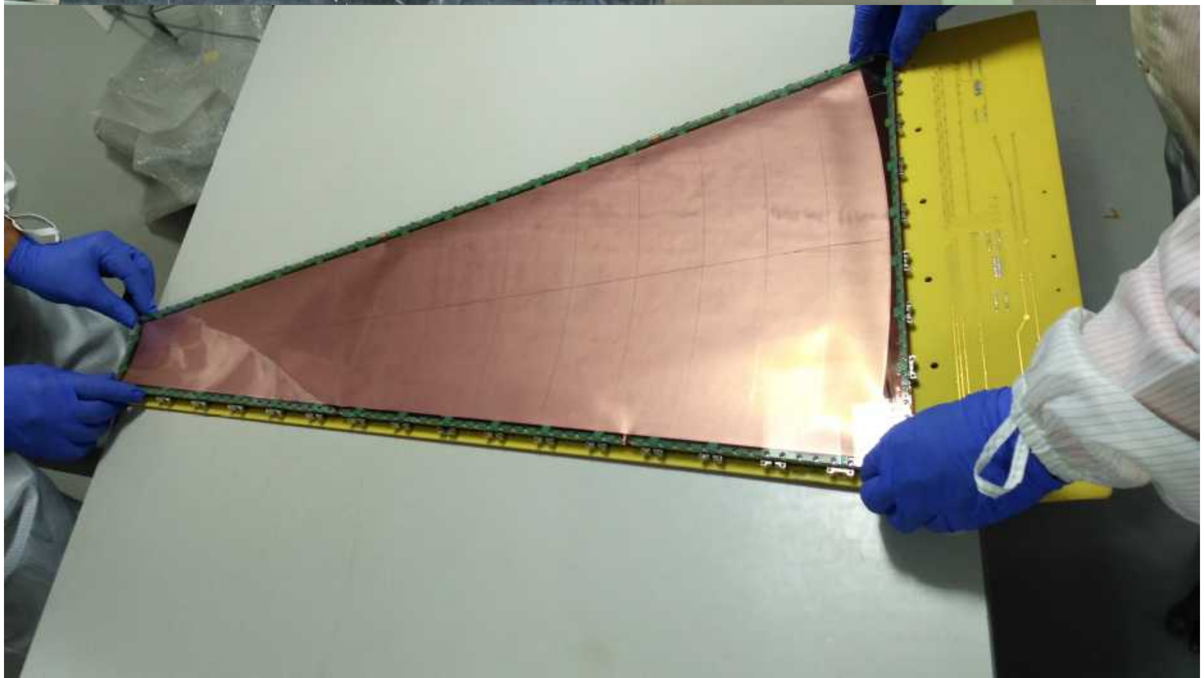


mTOF setup
25 MRPC(3a) counters
(= 5x STAR modules)
150 x 120 cm2 active area
1600 readout channels



Status of mMuch

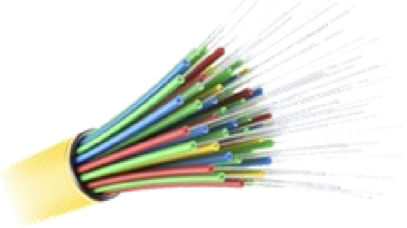




What will provided by DAQ in 2018

The DAQ will provide the backbone for the mCBM readout:

- **Optical fiber connections from HTD to the DAQ container**
- **µTCA crates in the DAQ container, some AFCK boards**
- **Optical fiber connections from DAQ container to the GC**



- **mFLES Input Nodes in the GC and HTG-K700 boards**
- **Infiniband network for time-slice building**
- **mFLES Compute Nodes in the GC**
- **only 4 months are left until DAQ commissioning !!**

Information taken from D. Emschermann

What the detector teams have to provide

The mCBM subsystems must provide the following:

- **a detector including FEE terminated in a GBTx-ROB (the GBTx-ROB is part of your detector system)**
- **the optical patch chord plugged into the ROB-SFP is the interface to the mCBM DAQ system**
- **a GBTx compatible firmware to operate your AFCK**
- **software for online monitoring of your subsystem**

Information taken from D. Emschermann

Status of mFLES

- **Boot environment for compute nodes is available**
- **Compute nodes**
  - Roughly 50 nodes reused from old computing cluster
  - 42 nodes cabled
  - 38 nodes are booting
  - More serious test of these nodes needed
- **Ethernet network**
  - Working since last week
- **Infiniband network**
  - Will be installed once stable nodes are identified

Status of Computing

- **Large problem**
  - Missing manpower
  - Change of framework (FairRoot → FairMQ)
- **Move to FairMQ**
  - Independent processes which communicate sending the data as messages
  - Process Graph can be adjusted to the problem
- **Move to FairMQ needs time for development and testing**
  - Not clear if it will be ready for the mCBM beam time this year
- **Backup solution**
  - Write files and analyze them afterwards using CbmRoot (not online but “near line”)
  - Use CbmRoot to connect to a Fles-Node and analyze the data online
    - If more then one Fles-Node is needed for timeslice building one can’t access the full data
    - Code has to be fast to not block the DAQ
    - Start several CbmRoot sessions for different detector sub systems
    - Scheme was used for several beam times

Conclusion

- **We already made a lot of progress**
- **But still a lot of work is ahead of us and time becomes short**
- **Think about what you can do to make mCBM a success**

Thank you

धन्यवाद्