Update on ALPIDE telescope data analysis

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LUXE meeting
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Outline

- Hits reconstruction in Alpide telescope planes;
- Matching position with magnet on.

Data processing

- Data converter from raw format to LCIO
- Eutelescope software. It uses ILC software:
  - for geometry settings (GEAR)
  - Marlin (Modular Analysis and Reconstruction for the LINear Collider) for data processing;
  - LCIO for input/output.

Noisy pixels (default settings for threshold)

Run 49

```
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Noisy Pixel Finder summary:
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 0 noisy pixels on sensor: 0
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 0 noisy pixels on sensor: 1
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 0 noisy pixels on sensor: 2
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 1 noisy pixels on sensor: 3
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 0 noisy pixels on sensor: 4
```

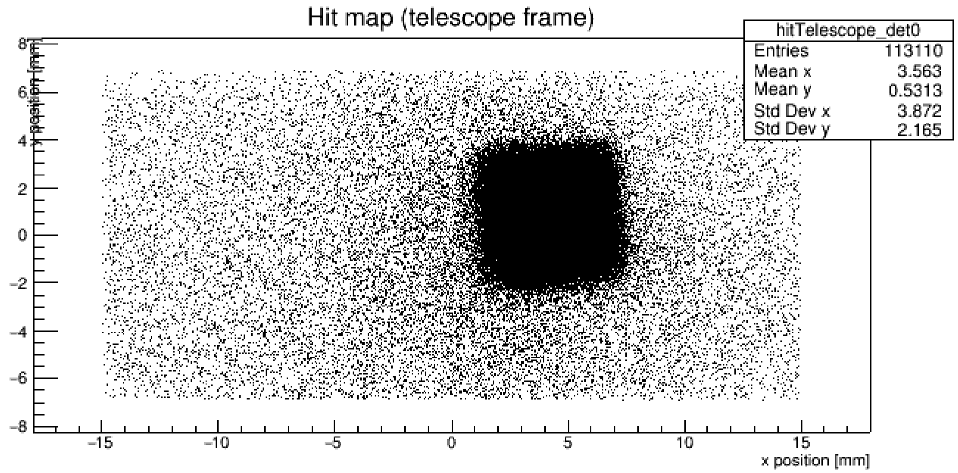
Run 60

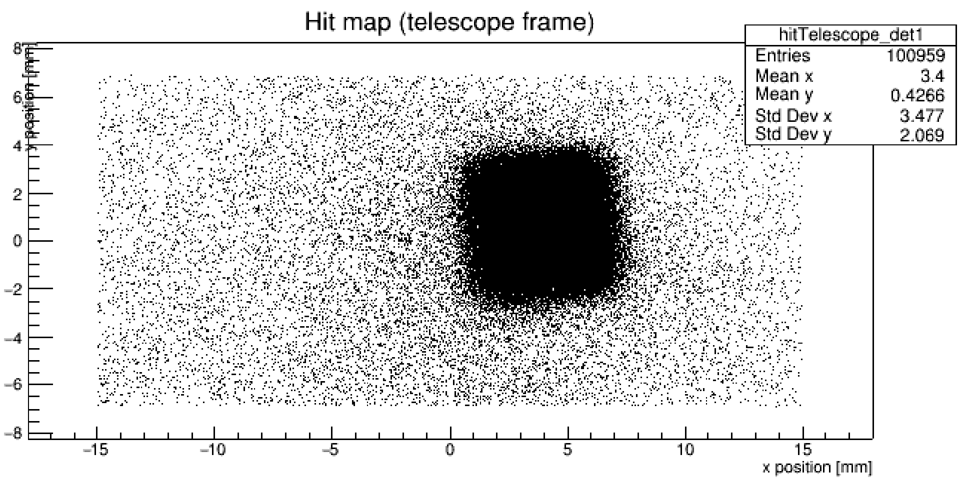
```
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Noisy Pixel Finder summary:
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 1 noisy pixels on sensor: 0
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 0 noisy pixels on sensor: 1
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 0 noisy pixels on sensor: 2
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 1 noisy pixels on sensor: 3
jobsub.noisypixel(INFO): [ MESSAGE5 "HotPixelMasker"] Found 0 noisy pixels on sensor: 4
```

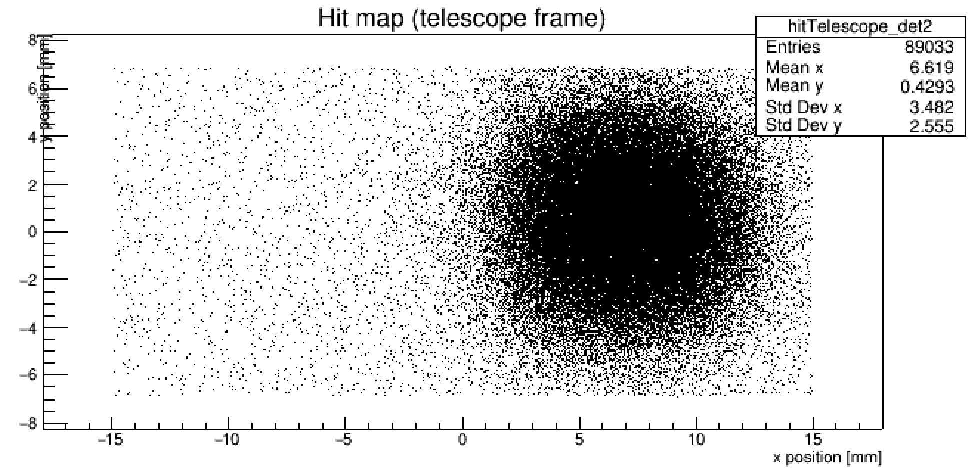
Geometry description

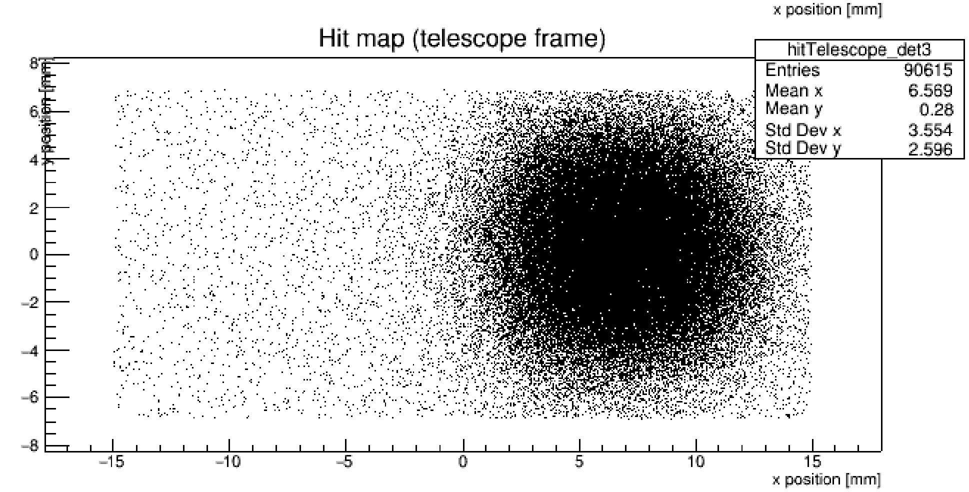
```xml
<gear>
  <!--GEAR file for DATURA Telescope in DESY TB 21 - Nov. 2012 -->
  <global detectorName="EUTelescope"/>
  <BField type="ConstantBField" x="0.0" y="0.0" z="0.0"/>
  <detectors>
    <detector name="SiPlanes" geartype="SiPlanesParameters">
      <siplanesID ID="0"/>
      <siplanesType type="TelescopeWithoutDUT"/>
      <siplanesNumber number="5"/>
      <layers>
    <!--Telescope Plane 0 -->
    <layer>
      <ladder   ID="0"
            positionX="0.00"   positionY="0.00"   positionZ="0.00"
            rotationZY="0.00"  rotationZX="0.0"   rotationXY="0.0"
            sizeX="29.94176"   sizeY="13.76256"   thickness="0.05"
            radLength="93.660734"
            />
      <sensitive   ID="0"
            positionX="0.00"   positionY="0.00"   positionZ="0.00"
            sizeX="29.94176"   sizeY="13.76256"   thickness="0.025"
            npixelX="1024"     npixelY="512"
            pitchX="0.02924"   pitchY="0.02688"   resolution="0.005"
            rotation1="1.0"    rotation2="0.0"
            rotation3="0.0"    rotation4="1.0"
            radLength="93.660734"
            />
    </layer>
    <!--Telescope Plane 1 -->
    <layer>
      <ladder   ID="1"
            positionX="0.00"   positionY="0.00"   positionZ="20.0"
            rotationZY="0.0"   rotationZX="0.0"   rotationXY="0.0"
            sizeX="29.94176"   sizeY="13.76256"   thickness="0.05"
            radLength="93.660734"
            />
      <sensitive   ID="1"
            positionX="0.00"   positionY="0.00"   positionZ="18.7"
            sizeX="29.94176"   sizeY="13.76256"   thickness="0.025"
            npixelX="1024"     npixelY="512"
            pitchX="0.02924"   pitchY="0.02688"   resolution="0.005"
            rotation1="1.0"    rotation2="0.0"
            rotation3="0.0"    rotation4="1.0"
            radLength="93.660734"
            />
    </layer>
    <!--Telescope Plane 2 -->
```

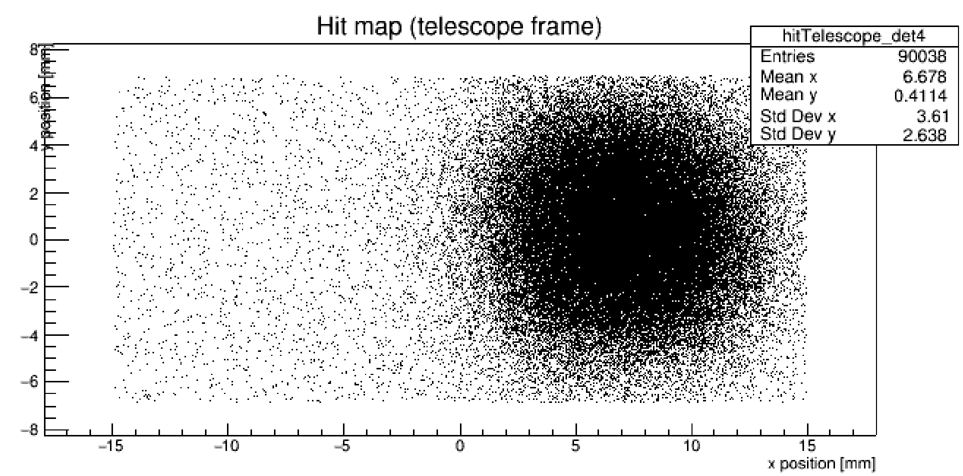
Hits, run 60, magnet off



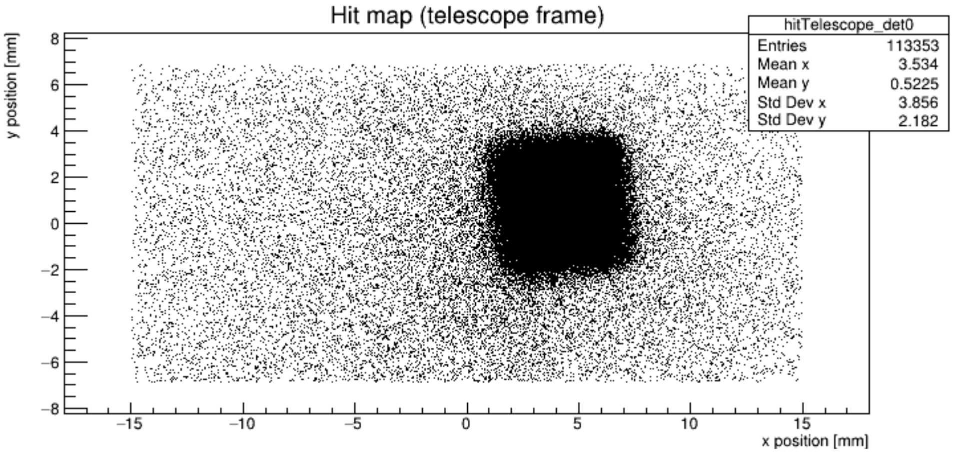


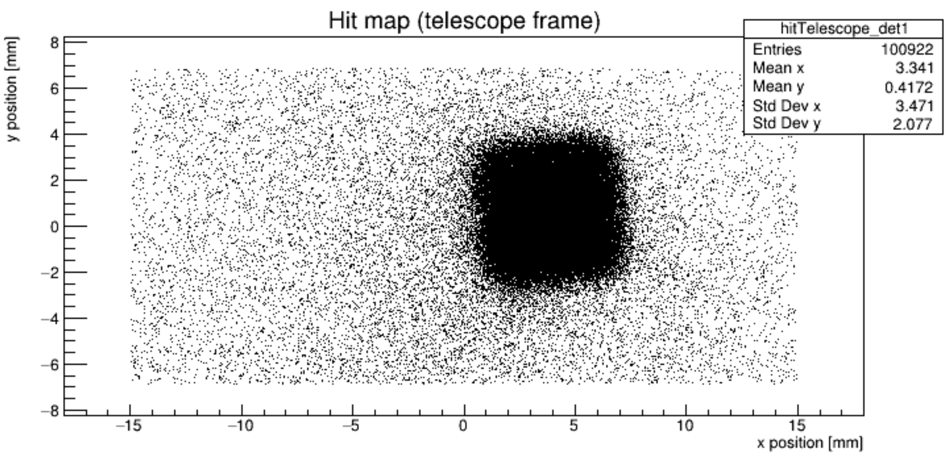




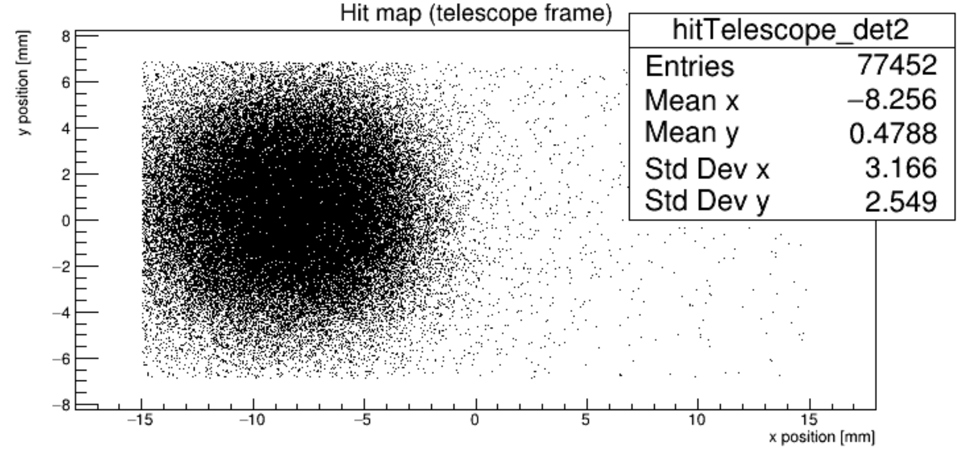


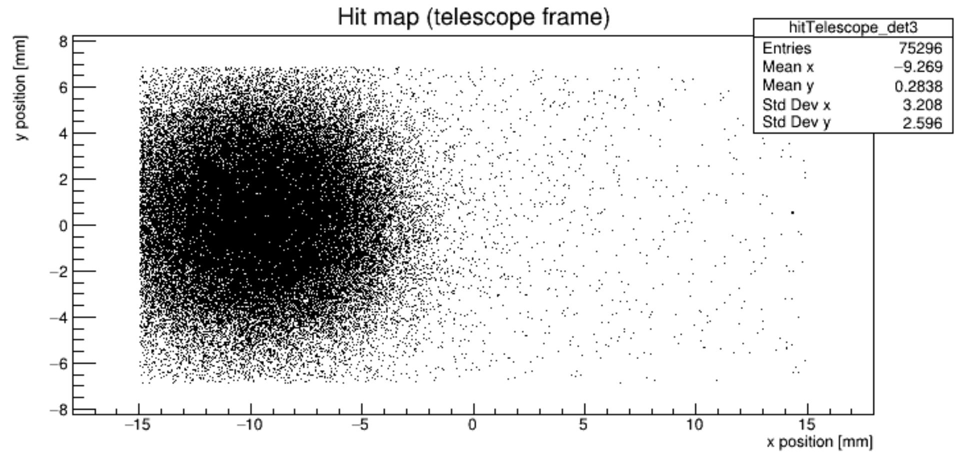
Hits, run 49, magnet current 200A

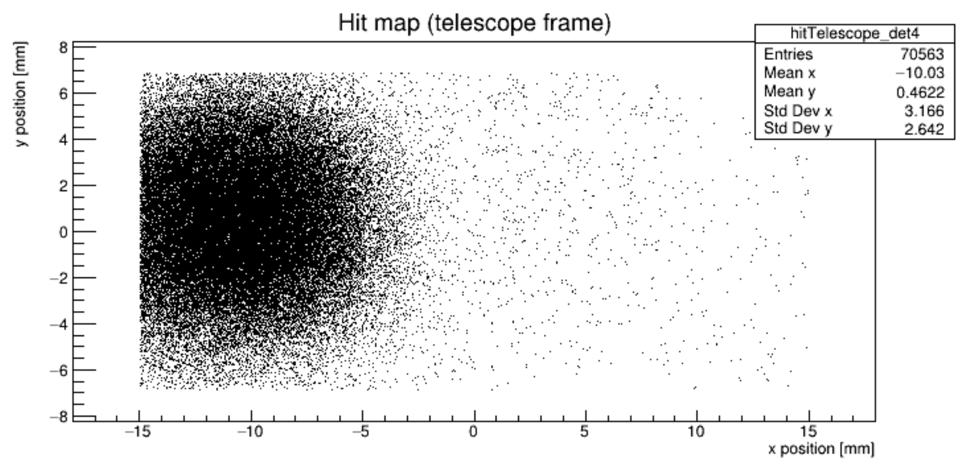




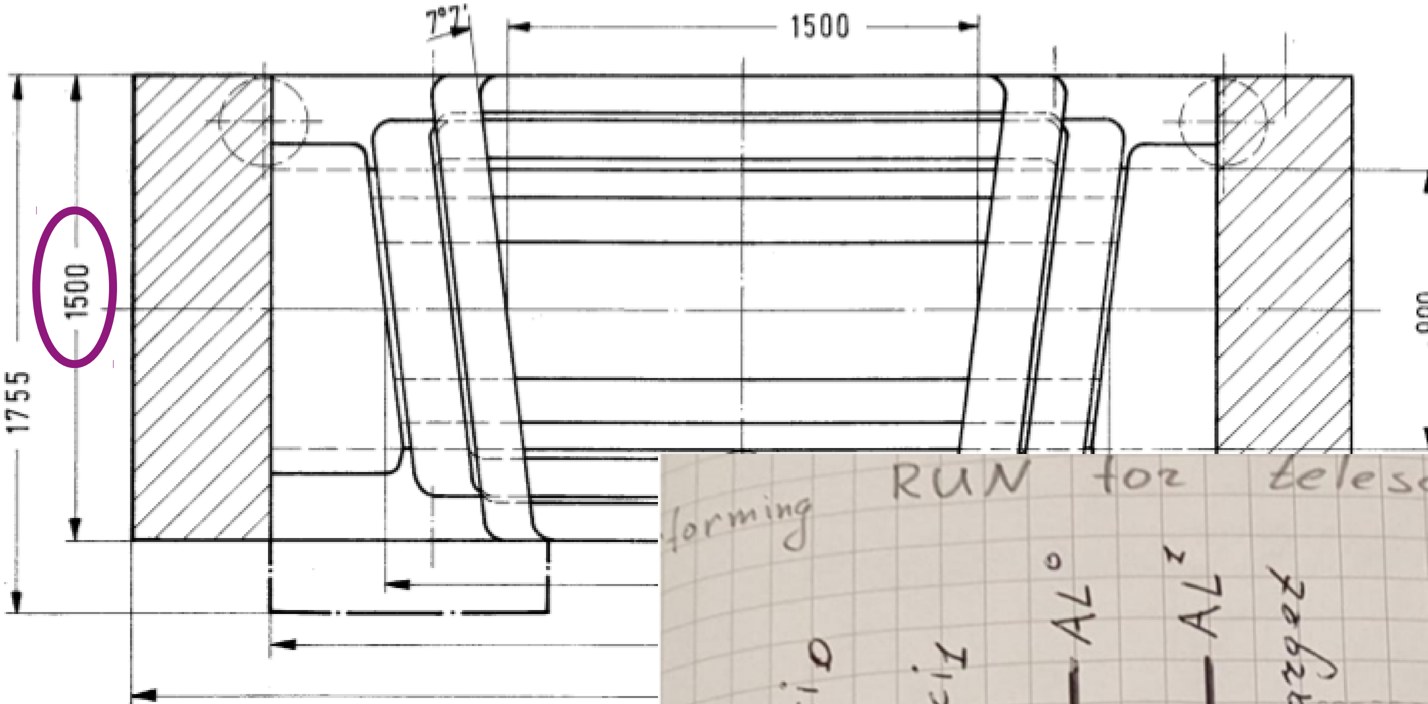
Displacement in first plane after the magnet:
6.619 + 8.256 = 14.875 mm

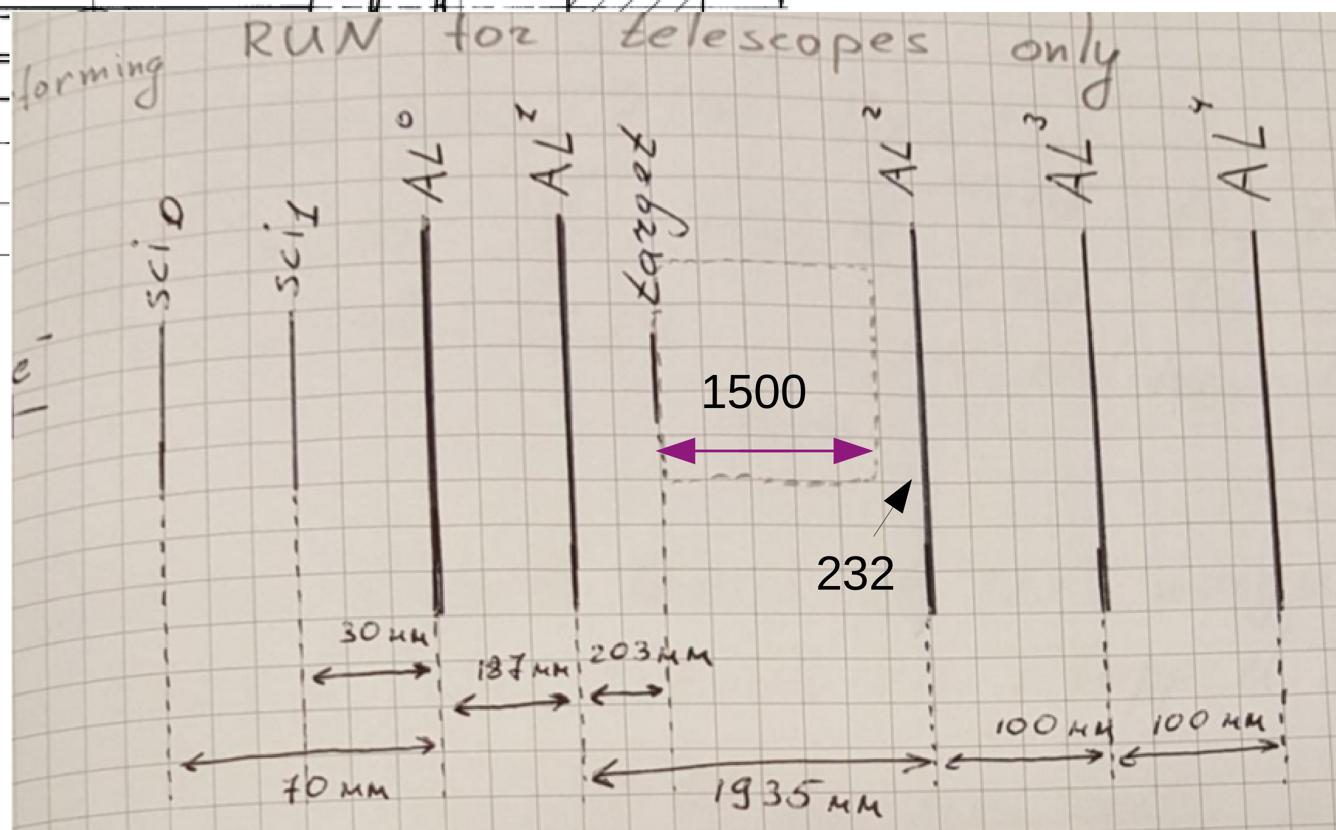






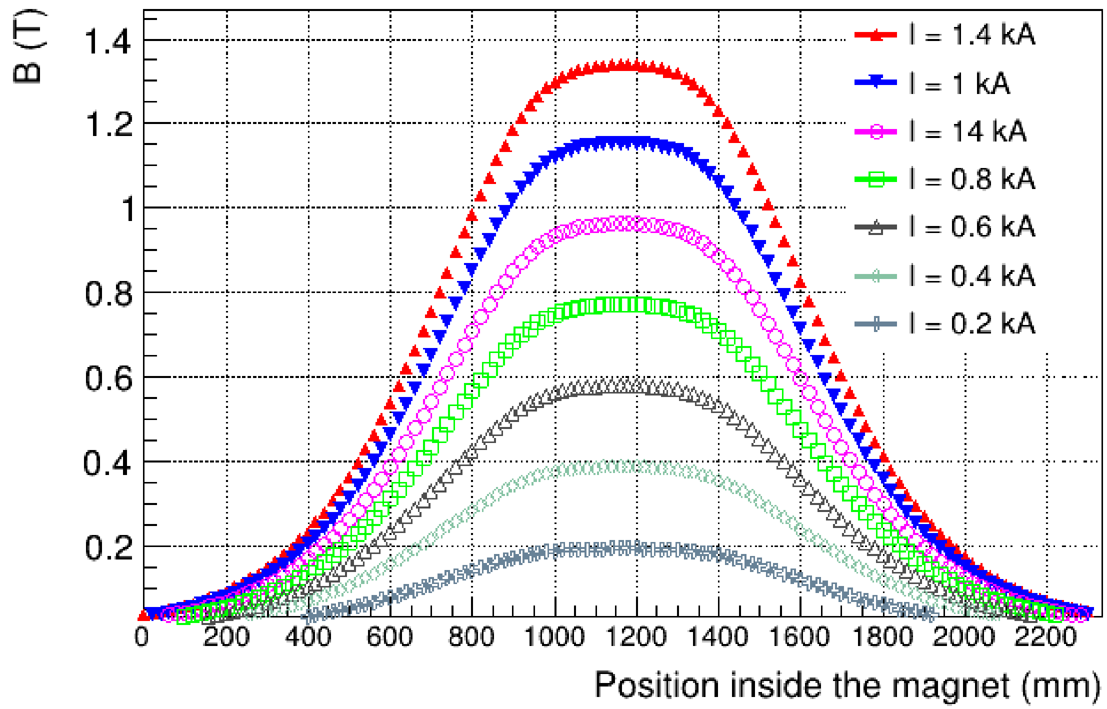
Magnet and TB setup geometry





T21 Magnet

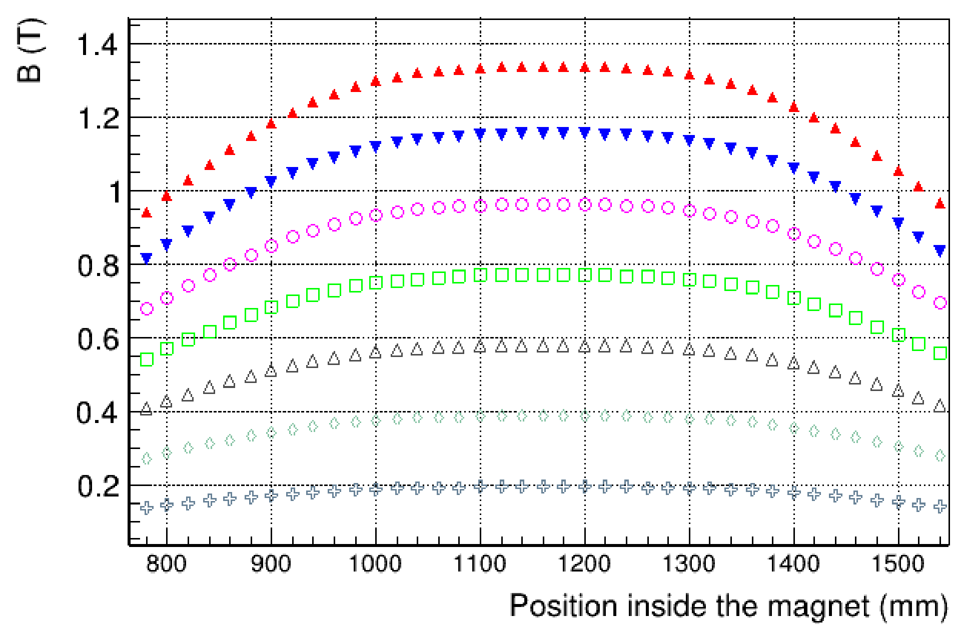
- DESY TB experts shared with the measurements data of T21 dipole magnet field;
- Can be used for accurate planing of the TB setup in simulation;
- Middle position of the magnet corresponds to 1166 mm.



Deflection estimation based on the measurements of the field:

```
./getDeflection  5.0  200.0   982.0

p=5 GeVIb=200 Ax=-12.3364 mm
theta=0.012458 rad (0.713793 deg)
```

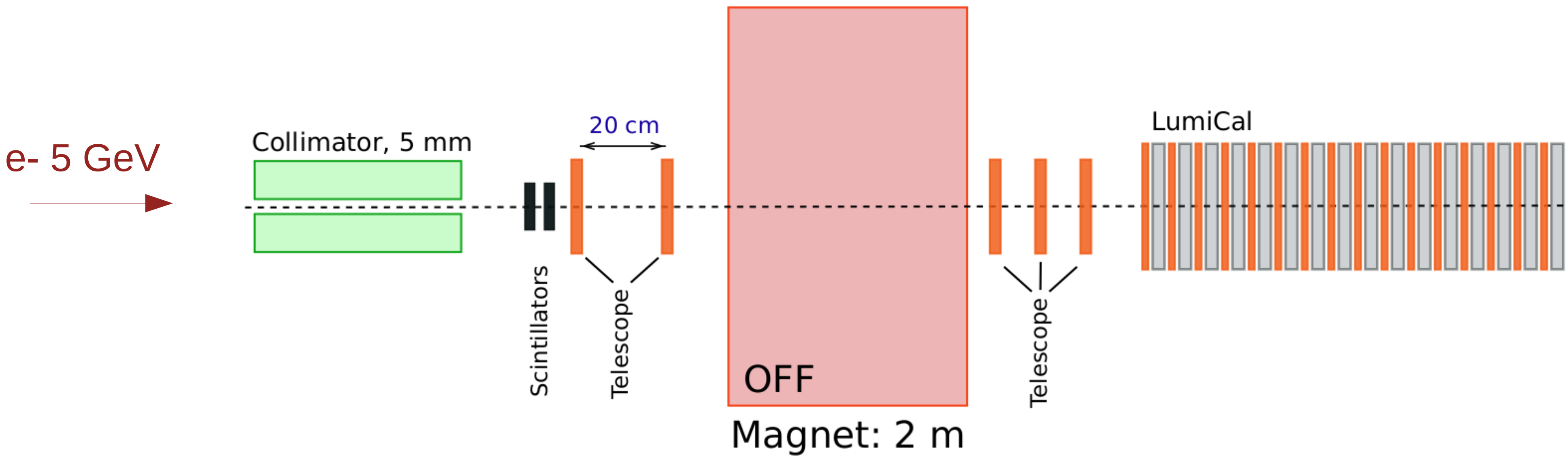


Summary

- Converter for ALPIDE raw data to LCIO works reasonably well.
- Noisy pixel analysis, clustering and hits reconstruction produces reasonable results.
- Default and recommnded alignment algorithm (GBL) implementation in Eutelescope software requires 3 + 3 planes geometry. Does not seem to allow configuration 2+3 as we use in TB.
- Fast workaround could be duplicating first plane and placing new copy close to the original one in geometry; Later exclude it from the tracking.
- Observed position of the beam after the magnet is in agreement with simulation which uses measurements of the magnetic filed. Though the agreement is not perfect. Maybe not the best runs for comparison, could be the detector was moved. Will be discussed with TB experts.

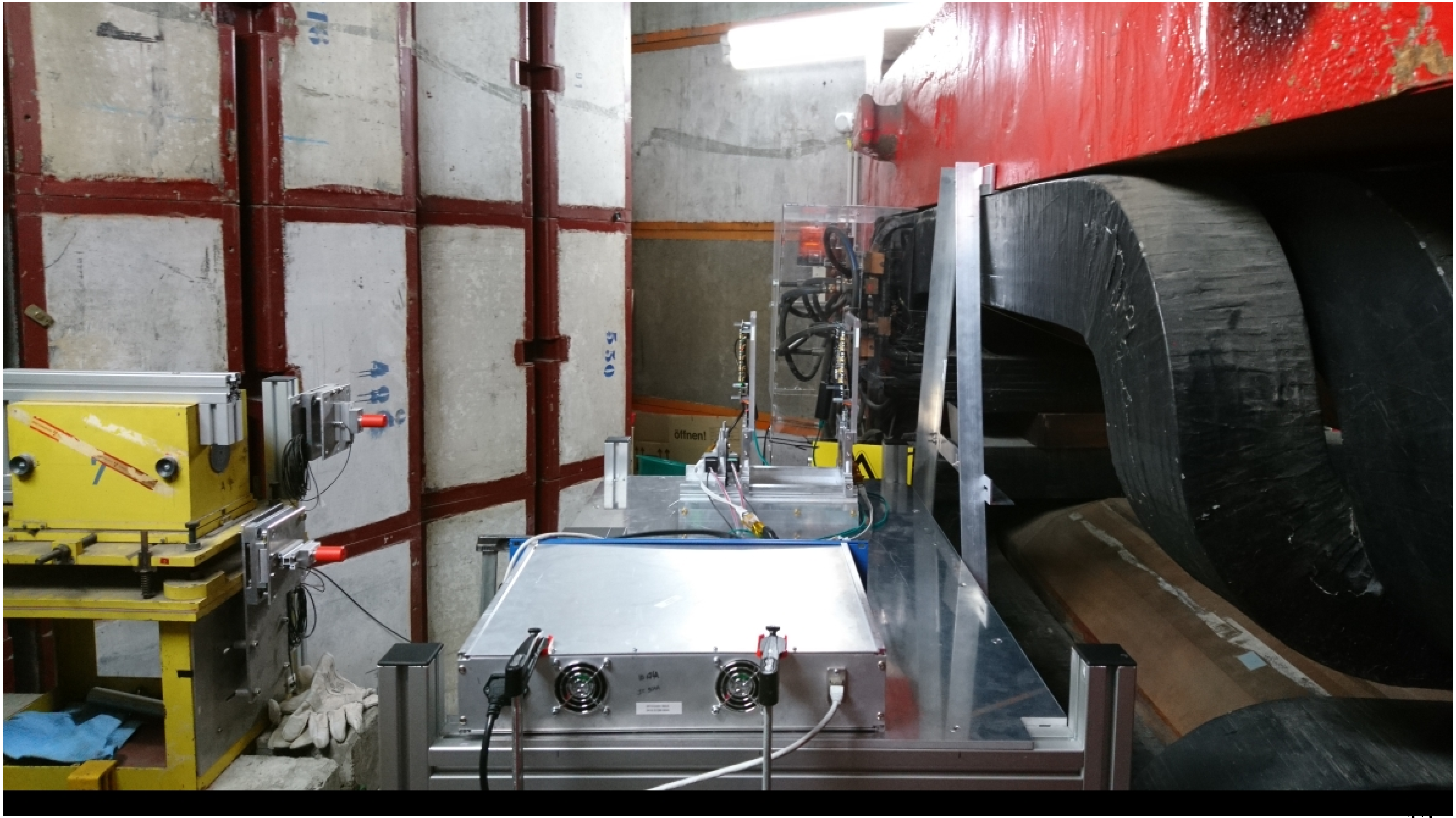
Back up

Setup 1

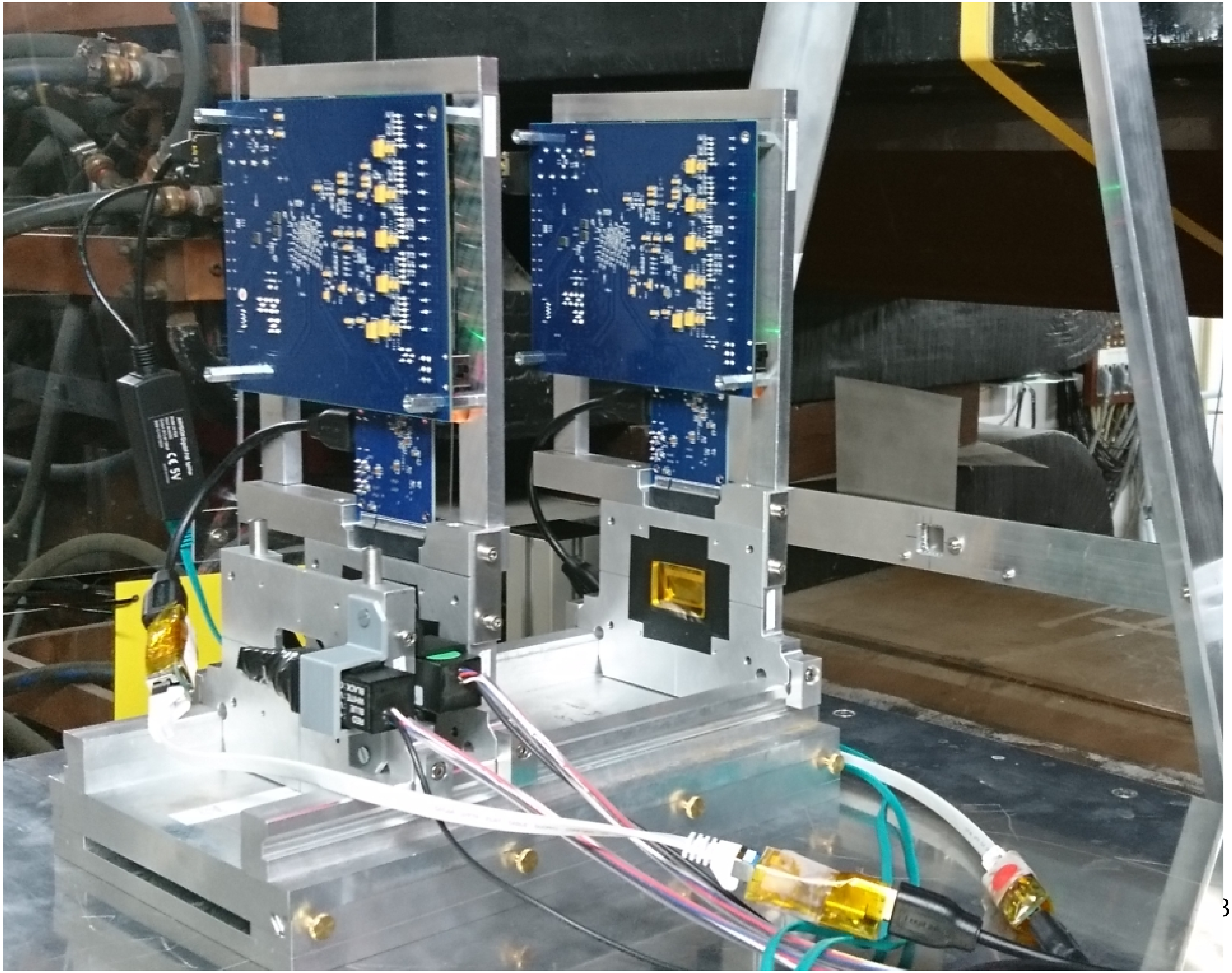


- Measure the effect of the air ~2 m.
- Other beam energies?
- Collimator with 5 mm square cross section?

Upstream of the target



Upstream of the target



Downstream of the target

Downstream of the target