TRD beam test arrangement in 2021

Xiwen Liu, Hongbang Liu, Jiaqi Su, Cong Dai

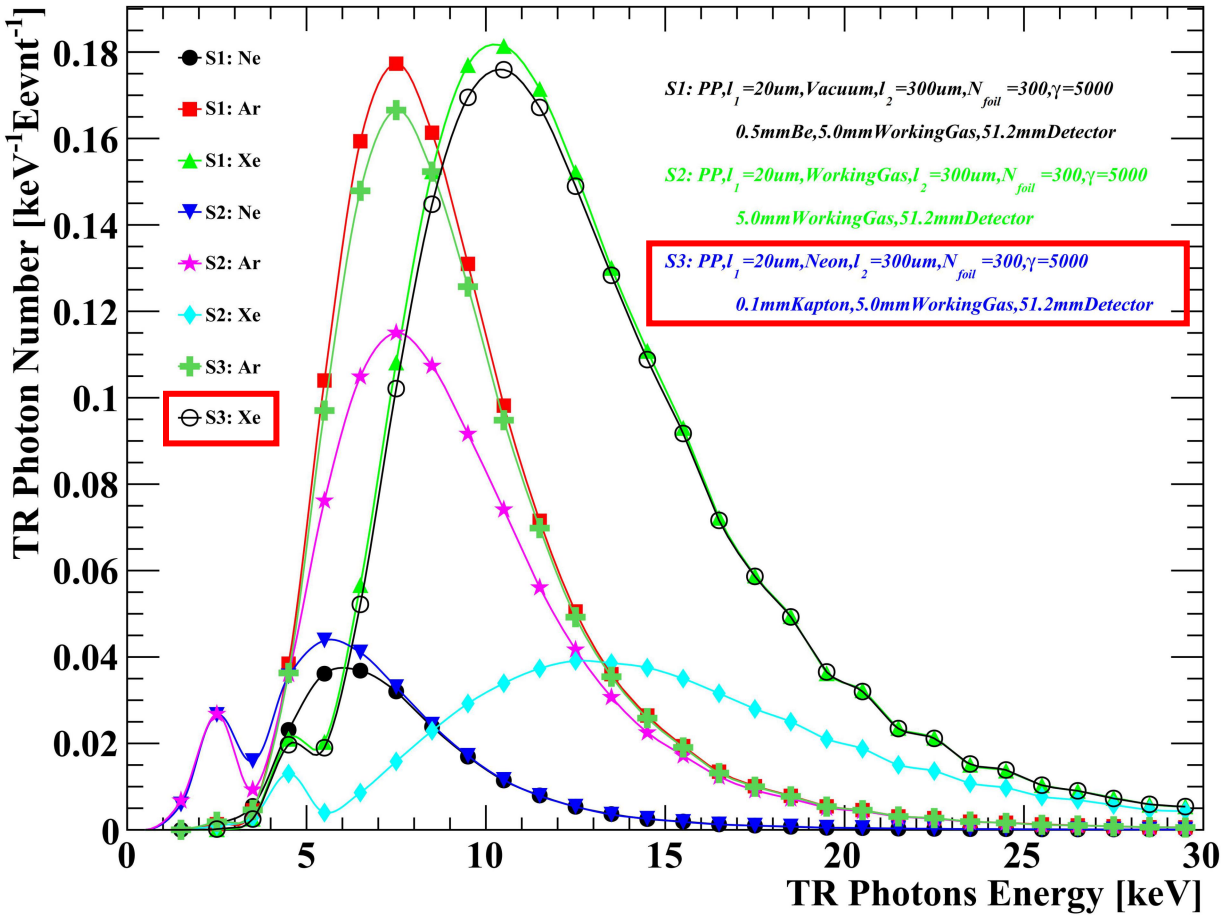
23 February 2021

Motivation

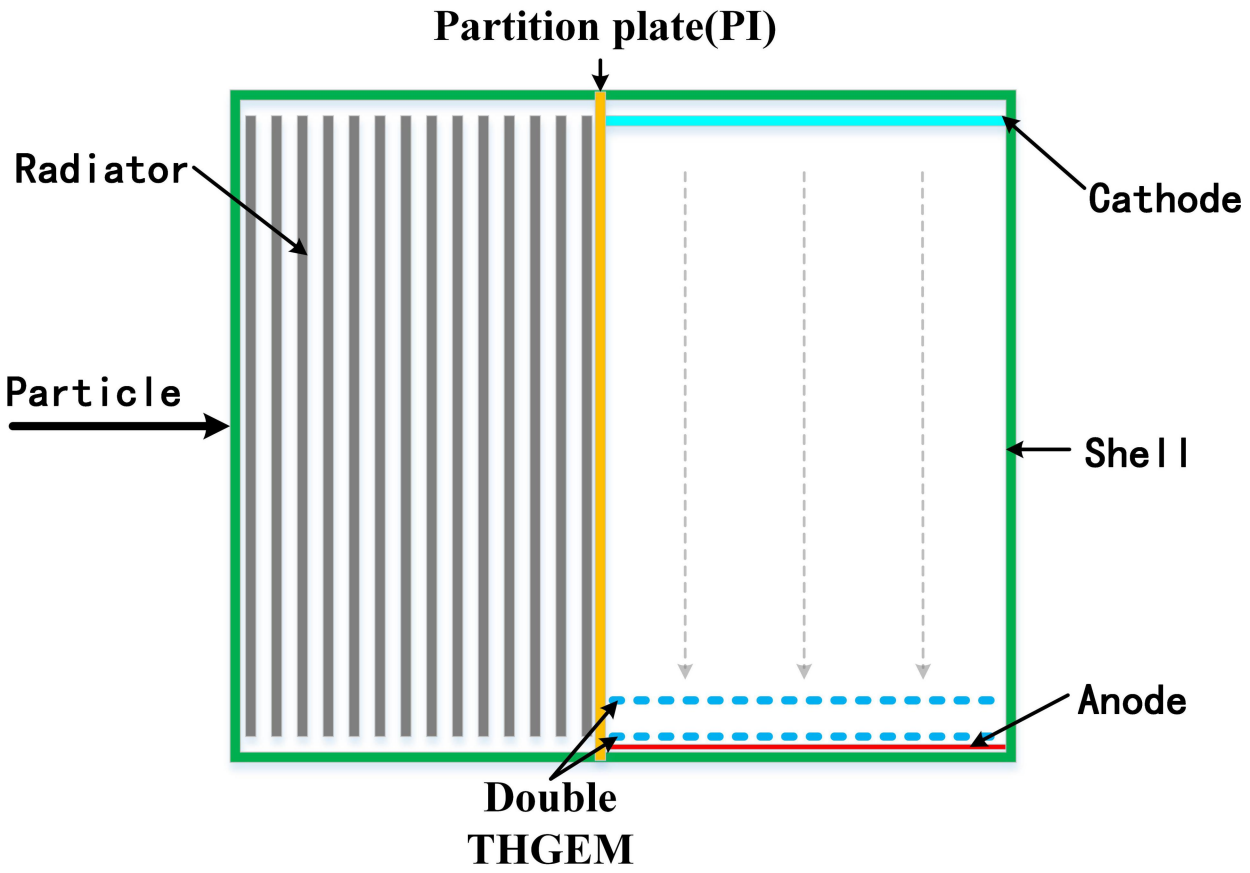
verification of engineering prototype by beam test

- Performance of the radiator
- Uniformity of field cages
- Influence of drift zone length on gain and energy resolution
- Tightness of the detector

Simulation of engineering prototype

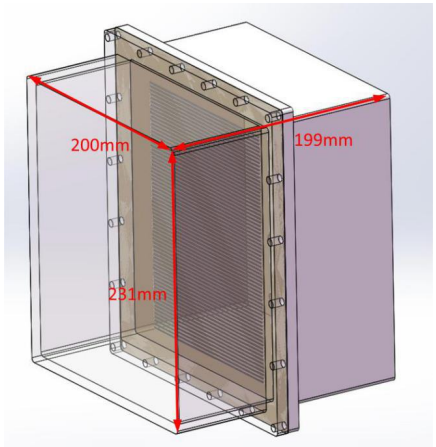


Principle verification of engineering prototype

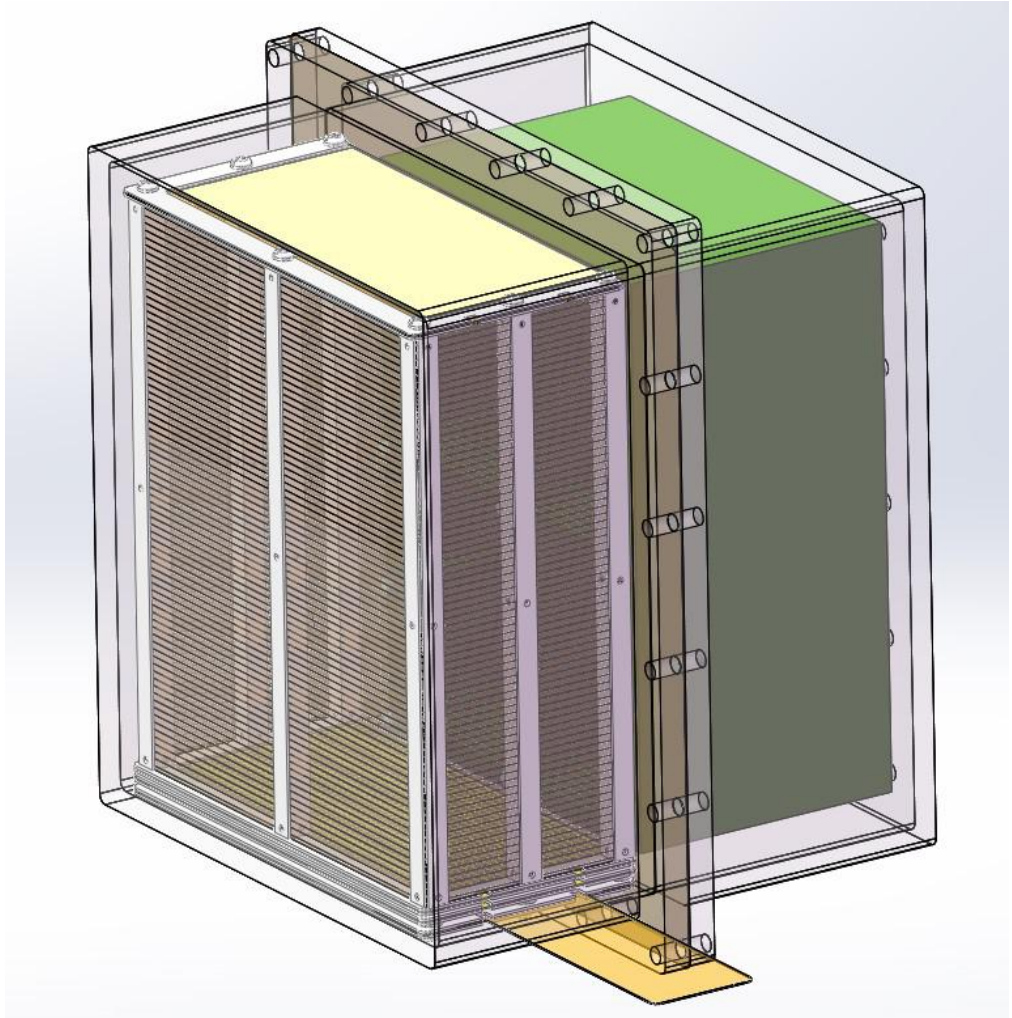


- **TRD engineering prototype**
  - **Radiator placed inside**
    - Reduce ineffective area absorption
    - Conducive to engineering realization
  - **Different working gases**
    - Increase detection efficiency
  - **FPC field cage**
    - Reduce the thickness of the uneven electric field

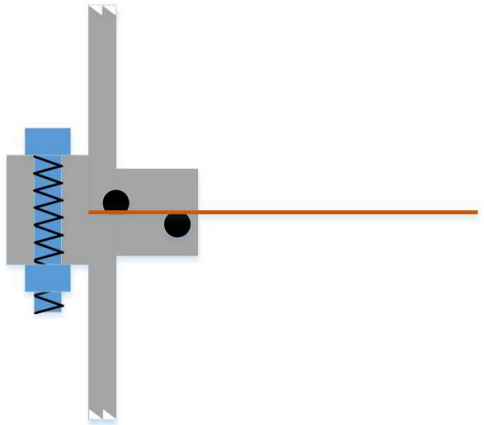
Principle verification of engineering prototype



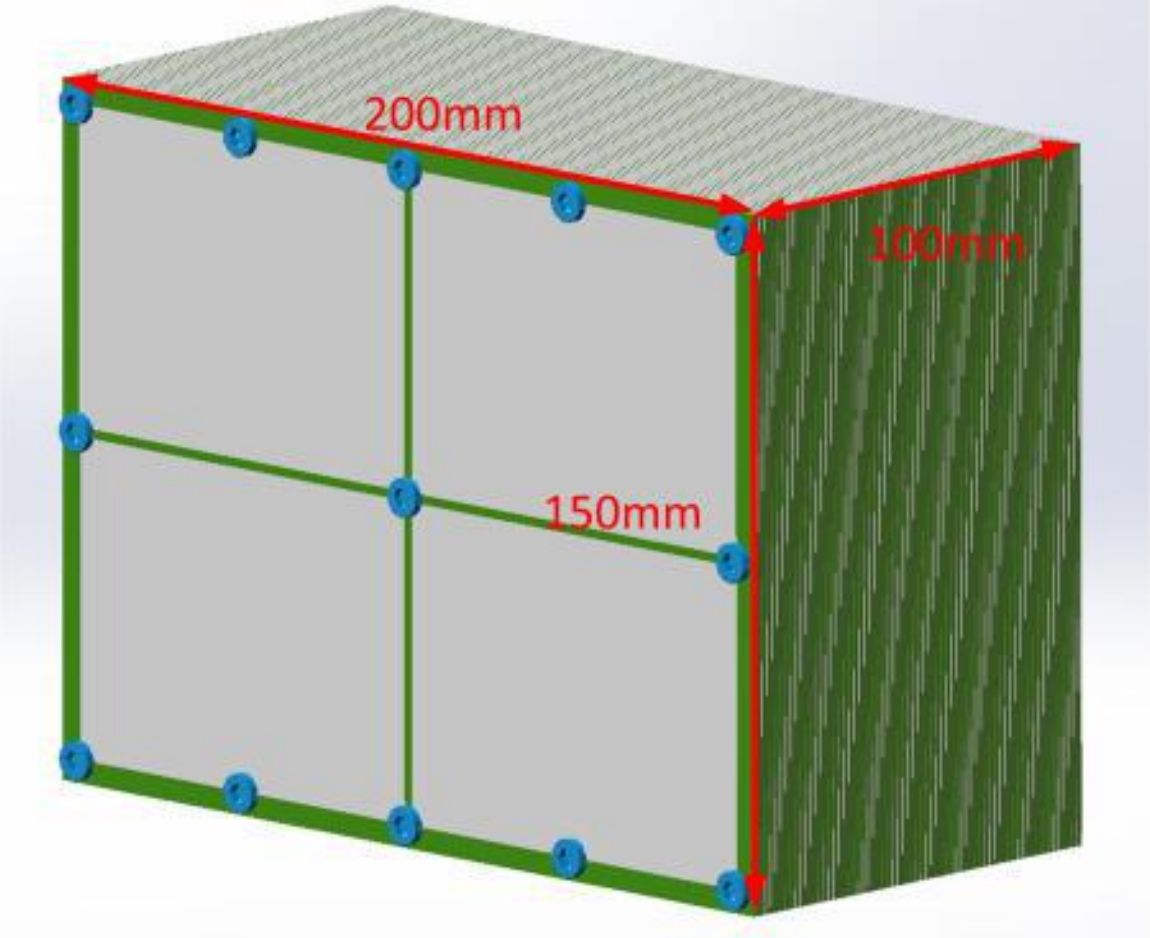
- Closed chamber



- Double O-ring

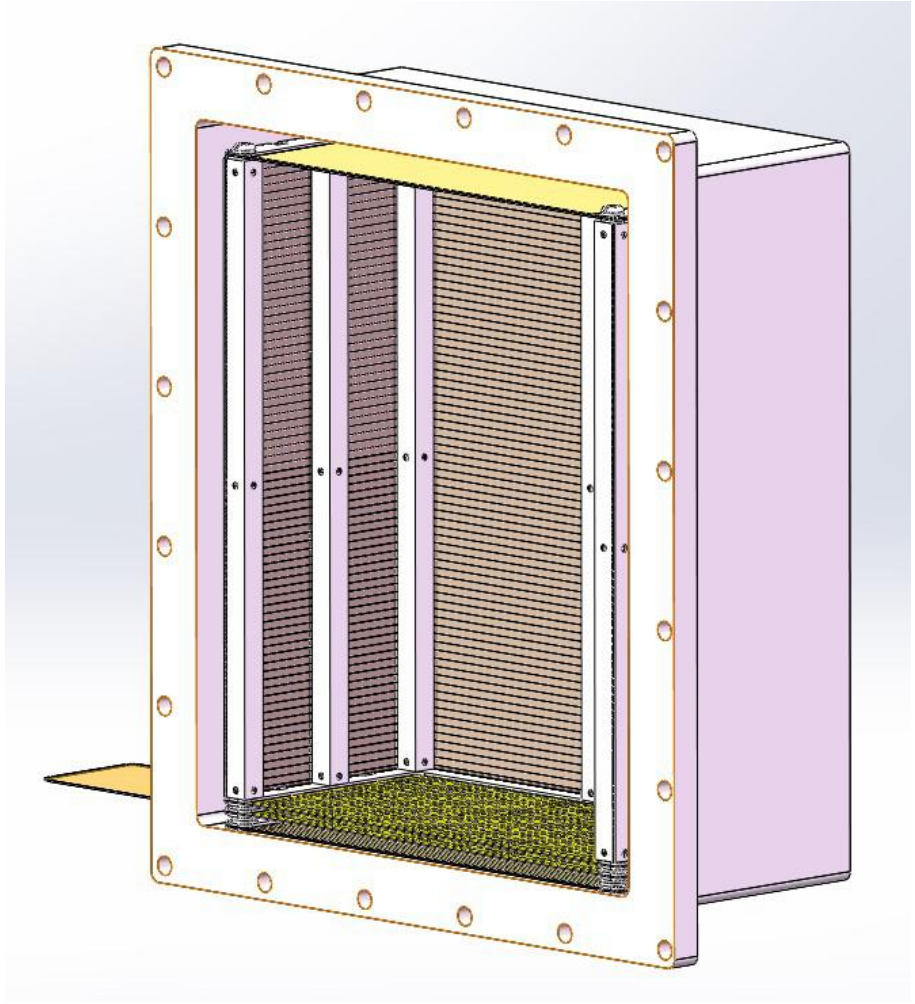


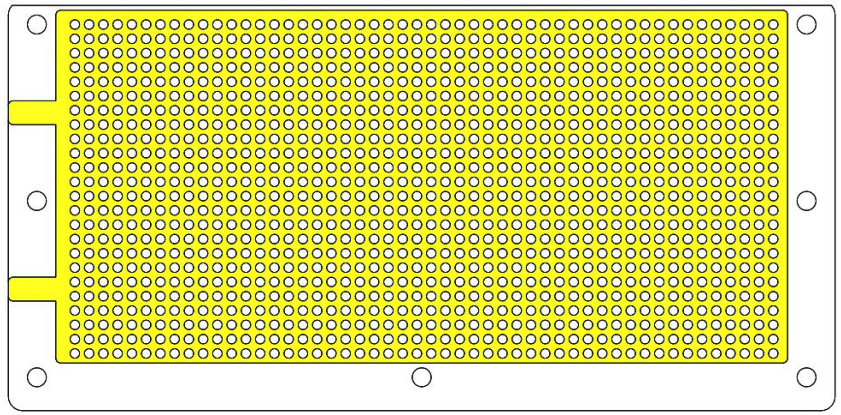
Radiaror



- Foil materials：Polypropylene (PP)
- Foil thickness：20 μm
- Gap materials：Neon
- Gap thickness：300 μm
- Number of foils：300

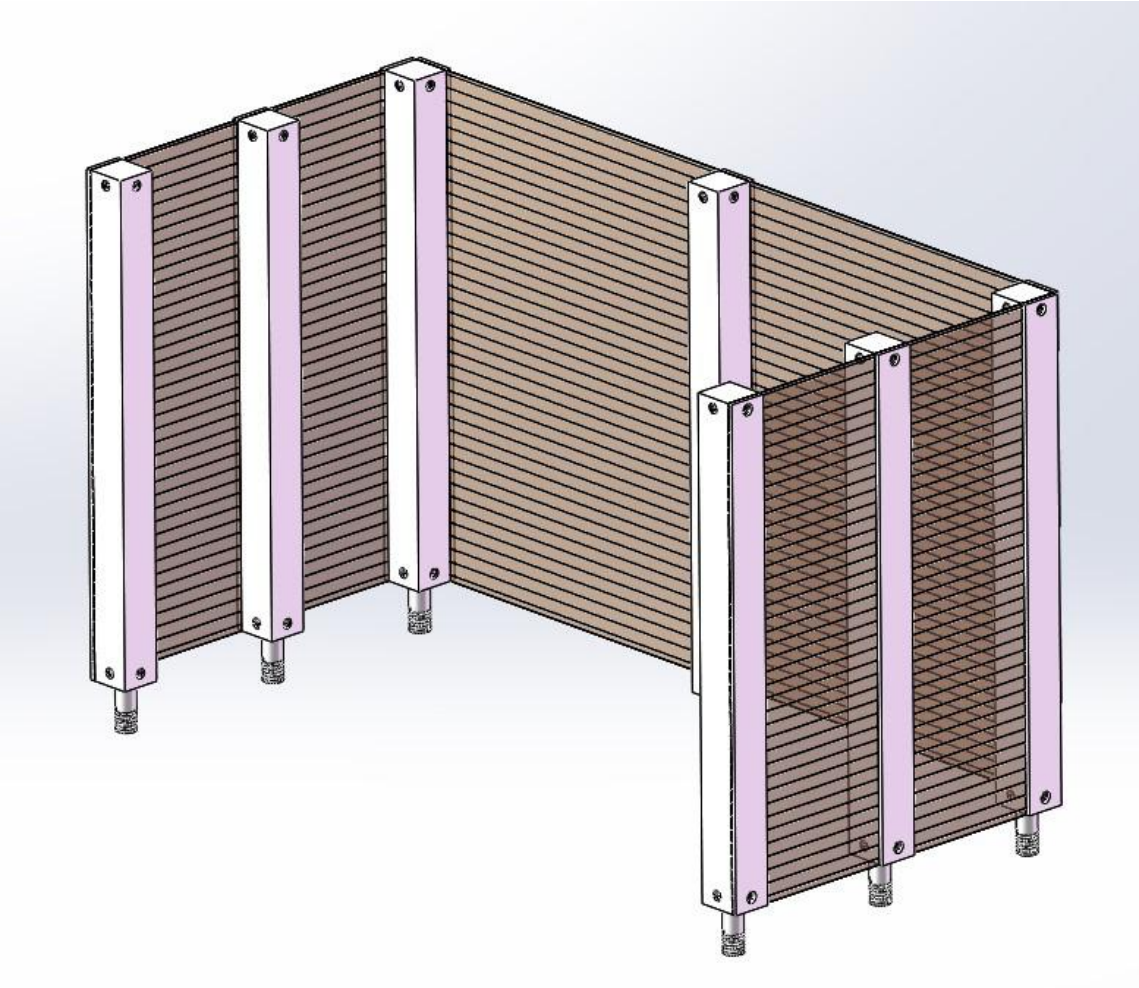
X-Ray Detector based on THGEM





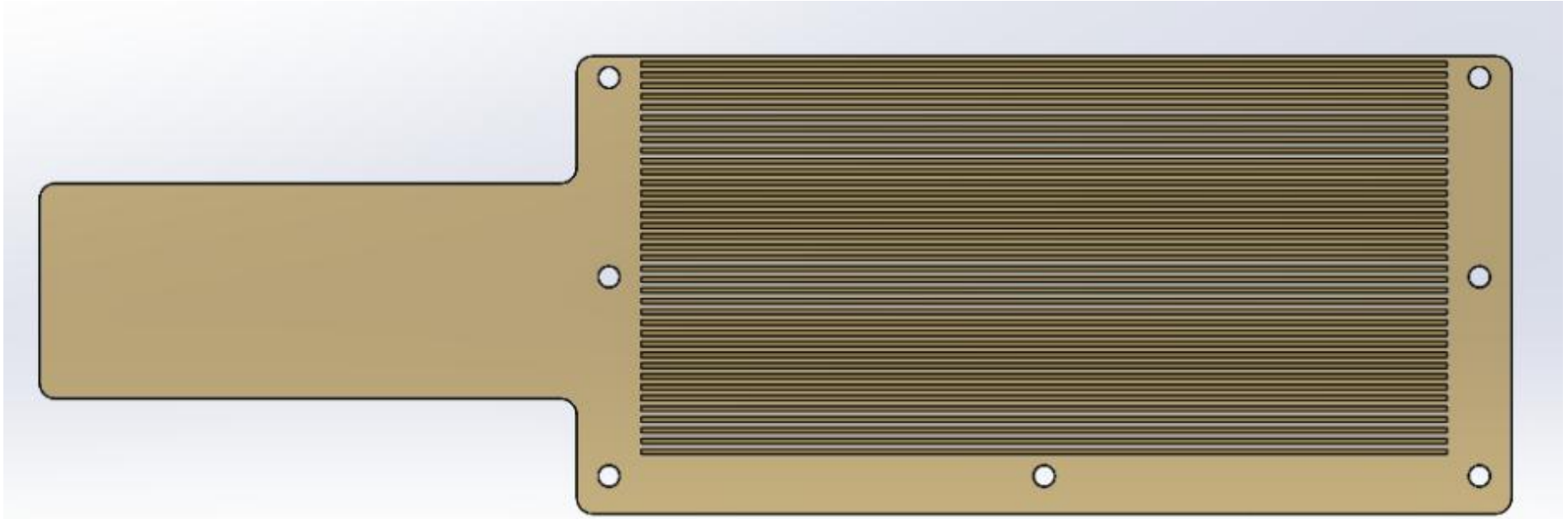
- **X-Ray Detector**
  - **Double THGEM**
  - **Allotype THGEM**
    - Asymmetry
    - Low invalid area

Field cage



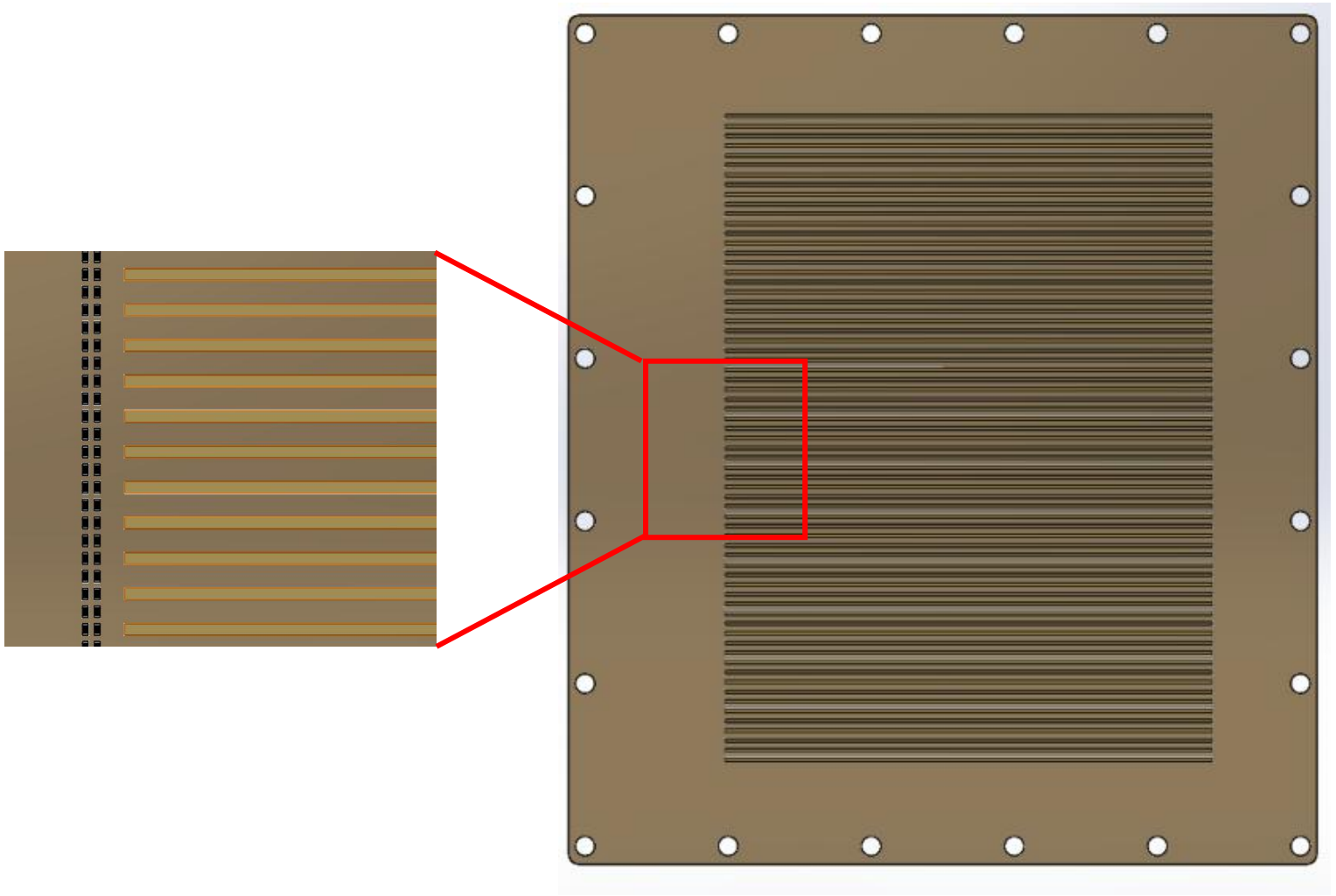
- **Craftsmanship:** Flexible Printed Circuit（FPC）
- **Material:** Polyimide（PI）
- **Parameter:** (Simulation by COMSOL)
  - Thickness（PI）: 0.1 mm
  - Width（Cu）: 0.08 mm
  - Interval(Cu): 2.5 mm
- **Advantage:**
  - Low outgas
  - Low absorb
  - Uniform electric field
  - Low invalid area

Anode



- **FPC Anode**
- **Allotype Anode**
  - Low invalid area
  - Signal output
- **Parameter**
  - Thickness（PI）：0.1 mm
  - Width（Cu）：0.45 mm
  - Interval(Cu)： 0.54 mm
  - Number of strip：128

Partition Plate



- **Material**: Polyimide（PI）
- **Function**:
  - Different working gases
  - Filed cage
- **Asymmetry**
  - Field cage area
  - Electric circuit
- **Electric circuit**
  - Distribution voltage
  - Double line

Before the beam test

- Verify the sealing effect of the detector (double O-ring)
- Test the performance of THGEM on different substrates (ceramic, polyimide, polytetrafluoroethylene, etc.)
- Test the outgassing rate of the materials used inside the detector respectively
- Degas the material in the detector
- Radiator and detector production

During the beam test

- Location scan（XY）
  - Effect of the flatness of the radiator on the production of TR photons
  - Influence of drift zone length on gain and energy resolution
  - Uniformity of the electric field of the new field cage
- Energy scan（0.5-10 GeV @ e^-）
  - Draw a calibration curve by electrons of different energy

THANKS !