CONSTRUCTION OF A GEM DETECTOR



17th Terascale Detector Workshop 2025 - Bonn Max Beckers, YungWei Chang, Matthias Ludwig, Vanessa Oppenländer

STEP I: PRODUCTION OF THE GEM FOILS

- Creating a GEM foil
 - I. GEM foil consist of polyimide with copper layer on both sides
 - 2. Preparation: applying photo resist layer, mask alignment and exposure to UV light
 - 3. Copper etching
 - 4. Removal of the photoresist layer
 - 5. Polyimide etching
 - 6. Cleaning









STEP 2: QUALITY ASSURANCE

- Use of QA setup in ISO 6 cleanroom
- Idea: stress test of GEM foil with high-voltage
- Box with pins to supply HV and camera to record sparks
- HV is directly applied to GEM foil without ramp-up
- Camera records sparks and software determines location on foil
- Measurement of leakage current and HV stability
- Performed measurement of two GEM foils for comparison
- One GEM foil showed several sparks in the same area

___ Sign of contamination and/or defects

• Second GEM worked fine without sparks



STEP 3: ASSEMBLY OF GEM DETECTOR

GEM Detector

- Readout board with HV and signal traces to route them outside the gas container
- Stacking of the three GEM layers with predefined spacing
- Two powering possibilities
 - One HV channel for all three GEMs with resistors in between
 - One HV channel per GEM
- Gas tight container
- Screwing of the box and gas-tightening







STEP 4: LEAK TEST

- Using a leak-tester
 - Flow measurement
 - Pressure measurement



- Localization of leak
 - Soap-water
 - Detection of test gas
 - Submerging into water



