**Abstract:** To optimize the performance of Super Heavy Elements (SHE), the key challenge is to understand the dynamics of the fission-fission reactions through the measurements of mass and angular distributions of the fission fragments. For the detection of fission fragments, position-sensitive Multi-Wire Proportional Counters are typically used due to their high gas, good temporal and position resolution. However, these detectors are fragile anode wires having a diameter of only 10 μm and therefore they are vulnerable. In the present work, a detector based on robust Thick Gaseous Electron Multiplier (THGEM) has been proposed. A numerical demonstration of THGEM-Multi Wire hybrid detector technology as a possible candidate for the next generation low-energy fission studies and their evaluation as a function of different possible geometric and electric configuration in low-pressure gas is discussed below.

**Fission study being pursued at VECC…**

- Shell effects in nuclei
- Quasi-fission
- Physics related to Super Heavy Elements (SHE)
- Mass distribution as probe to explore these two counter effective process
- Our experiments validate predictive models of HE and SHE production, for guiding future experimental searches of SHE. Things we need to measure:
  1. Z, A of emitted particles — Information about the reaction, fission fragments
  2. Detection — E, R, time-of-flight
  3. Excitation energies of the residual nuclei
  4. Shapes of angular distributions tell about fission mechanism, properties of residual nuclei
  5. Detection by direct energy measurement and position
  6. Using cross-sections, A, 9/10, or 1/9, for new data

**Simulation Tool to Study Response of Low-Pressure Gas Detectors**

We are exploring the possibility for the replacement of fragile anode plane by THGEM plane:

- Thickness GEM plane
- SIMPLE, ROBOT, LARGE-AREA Preamplifier technology
- THGEM cathode plane
- Primary electron and cluster detection
- Thin wire anode drift
- Lower position sensitivity
- Higher ionization density
- Compact and robust pressure
- Field map, geometrical conditions, physical states

**Multi-Wire Proportional Counter (MWPC)**

<table>
<thead>
<tr>
<th>Effective area: 20 cm x 6 cm</th>
<th>Focused energy loss</th>
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<td>(+)</td>
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<tr>
<td>Position (-)</td>
<td>(-)</td>
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</tbody>
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**Breakin type detector**

- Produces a secondary multiplication of primary electrons in the region between Cathode and sense wires
- The very large electric field near the sense wires causes the accelerated e−•B electrons and ions to the majority of the Anode
- Fast rise time pulse at the anode and wire signals at the sense wires
- The position signals read by tapped delay lines (Rhombus industries, TZB-360x10g)

**Simulation Model**

- Cathode wire diameter 20 μ, pitch 1 mm
- X and Y position wire diameter 0.1 mm, pitch 1 mm
- Gas: Nanobuster 6.1 mm
- THGEM thickness 0.1 mm
- Delay: X Wire 12 nSec

**Simulation Model**

- Cathode wire diameter 20 μ, pitch 1 mm
- THGEM thickness 0.1 mm
- Gas: Nanobuster 6.1 mm
- THGEM: Copper 100 μm, diameter 1 mm, pitch 3 mm, gas pressure 2 bar

**Conclusion and Future Plan:**

a) The aim of this study is to build a THGEM-based (or similar MPG-based) device in low pressure environment for the measurement of charged particles and fission fragments.

b) Simulation toolkit has been validated at first by the good agreement reached between the simulation and experimental data for MWPC-based Breakin type detector.

c) Fabrication, experiment and simulation of THGEM-based detector is ongoing. Initial focus is to find suitable electrical and geometrical configuration for sufficiently strong signals from all the electrodes.

d) Simulation of the detector response of several new detector configurations is ongoing. This will be carried out to help the design optimization and data interpretation of the prototypes and understanding detector physics. Intrinsic detector properties will be investigated and related physics issues, such as discharge studies, aging properties will be carried out. Atmospheric pressure characterization for locally fabricated THGEMs and Micromegas is ongoing.

e) Use of the new detector in different Indian accelerator facilities.

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