GEM R&D PLAN

2012.07 – 2013.04 and outlook

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Research of GEM detector

• **Aim**: participate the upgrade project for forward muon system in CMS detector

• **Subject & Duty**: Simulation of GEM detector
  Acquisition of detection technics using GEM

• **Anticipation**: Application using GEM detector
  (medical, industrial, security, etc)

• **Ultimate object**: training a detector expert
Main Subjects

- Simulation
  - 1 GEM and 3 GEMs
  - Prototype detector (charged particle, and then X-ray)

Fabrication of prototype detector (NewFlex, RD51, Texas Univ., etc)
- GEM size: 100 x 100 mm²
- Pre-amplification: 3 GEM layers
- Signal readout: pad, strip or wire for anode
- Current monitor: each 3 GEM layers and anode

Setup for Fabrication & Test System (PC 2 ea, DAQPC 1ea)
- Fabrication System: optical table 1800x1200 mm², tools, clean room, air-conditioner,
- Detector Test System: lack, GAS system, NIM bin, 4ch HV supply (current monitor), preamp, Disc., 4 fold logic, NIM pulse counter, CAMAC crate, ADC, TDC,
- Oscilloscope - (KU: 4ch Tektronix - 5 Gsa/s, 500 MHz Bandwidth), Agilent, LeCroy, etc.
- Gate generator – (KU: ? for RPC)
- HV & LEMO & BNC Cables: 6 EA in each
  - Purchase at CERN: LEMO short cables in summer and long cables in winter
## Simulation

<table>
<thead>
<tr>
<th>Task</th>
<th>2012</th>
<th>2013</th>
<th>2014 - future</th>
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<tbody>
<tr>
<td>E-field</td>
<td>7-8</td>
<td>9-10</td>
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<tr>
<td>Poisson</td>
<td>11-12</td>
<td>1-2</td>
<td>5-7</td>
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<tr>
<td>Superfish</td>
<td>3-4</td>
<td>8-10</td>
<td>11-12</td>
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<td>CST studio*</td>
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<td>GEM small*</td>
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<td>G4 Geometry</td>
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<td>G4 Physicslist</td>
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<tr>
<td>1 GEM layer</td>
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<td>GEM small</td>
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<tr>
<td>GEM large</td>
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<tr>
<td>3 GEM layers</td>
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<tr>
<td>3 layers</td>
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<td>Full Det. (charged &amp; X-ray)</td>
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* Small: 2 or 3 GEM holes

* CST studio: co-work with KIRAMS
## Setup of Fabrication & Test at UoS

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<th>Task</th>
<th>2012</th>
<th>2013</th>
<th>2014 - future</th>
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<tr>
<td></td>
<td>7-8</td>
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<td>11-12</td>
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<tr>
<td>GE1/1 Beam Test</td>
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<tr>
<td>Data analysis</td>
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<tr>
<td>GEM Det. purchase GEM</td>
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<tr>
<td>design &amp; fabrication</td>
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<td>2nd prototype GEM detector</td>
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<td>TEST lab purchase device</td>
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<tr>
<td>Fab. lab</td>
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<td>Test lab</td>
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<tr>
<td>GAS system gas mixter</td>
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<tr>
<td>Ar, CO₂, C₄H₁₀, etc</td>
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Fabrication lab in UoS

- Lab size:
- Clean room size (4x4 m^2)(> optical table):
- Air-conditioner:

- Tools:
  - Electrical drill:
  - Compressor:
  - Soldering system:
Test lab in UoS

- Lab size:
- Table for Test:
- Tools:

- Lack:
- NIM bin:
  - 4ch HV supply (current monitor):
  - preamp:
  - Disc.:
  - 4 fold logic:
  - logic counter:

- CAMAC crate:
  - ADC
  - TDC

- Oscilloscope - (KU: 4ch Tektronix - 5 Gsa/s, 500 MHz BW), Agilent, LeCroy, etc.
- Gate generator – (KU: ? for RPC)

- HV cables: CERN and Domestic
- LEMO cables: CERN and Domestic
- BNC Cables: Domestic
Gas system in UoS

- Lab size:
- Gas mixer:
- Gas: Ar, CO$_2$, C$_4$H$_{10}$, or mixed gas, etc
- Air duct from lab:
  - gas pipe (Φ4, etc):
  - gas connector (Φ4, etc):
  - gas leak detector (?? from UoS):
Summary & Outlook

• Beam test at CERN in this summer
  • M. S. Ryu & M. Choi will join the test from Aug. 6 to Aug. 27.
  • We don’t know the test schedule.
  • We will visit the DAQ lab in KU before Aug. 6.

• We will check the experimental setup of prototype GE1/1.
  • Gas system, FEE, Detector structure, DAQ, etc
  • Data analysis of beam test

• We should consider Beam Test Setup and our availability.

• SIMULATION is consistent with LAB SETUP.
  ➔ Detector fabrication.