GEM Detector R&D at Florida Tech

— “Get to know each other” —

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Florida Tech Overview

• CMS member since 2002
  – Potential muon high-\( \eta \) upgrade with GEMs for tracking & triggering (2009 - present)
  – Muon Endcap Alignment (2002 - present)
  – CMS Tier-3 site on OSG

• PHENIX member since 2004

• RD51 charter member
  – Large-area GEMs (WG1)
  – Electronics (WG5)

• GEM R&D for DHS

• Notable Alumni
  – Klaus Dehmelt (Ph.D. 2006)
  – Georgia Karagiorgi (B.S. 2004, Ph.D. MIT 2010, now Nevis Labs)
Potential CMS high-\(\eta\) upgrade

Potential muon upgrade at \(|\eta| > 1.6\) with GEMs for triggering & tracking

Largest GEM detector built to-date (CERN):

- Frame
- GEM Foils
- Drift plane
- Al frame with gas distrib. grooves
- Openings for VFAT electronics
- Readout (PCB w/ 256 strips)
- Shielding

Spacers
- 3 mm Al base plate

~1m

A. Sharma, S. Colafranceschi

Triple-GEM Prototype (2010)

4/11/2011
Cost-effective GEM foil thermal stretching technique via infrared heating under clean room conditions in our high-bay lab (see RD51 Technical Note: RD51-2011-04)

Plexiglas frame

Infrared lamps

Works well

CMS high-η prototype drift foil (1m long)
GEMs for Homeland Security Application

Triple-GEM detectors for Muon Tomography
(30cm × 30cm active area, 2D readout, 400µm pitch)

mips
8 keV X-rays

Kondo Gnanvo @ CERN
RD51 SRS Readout Electronics & DAQ

RD51 coll. is developing a common **Scalable Readout System** for MPGD’s

- from few 100 to $\sim 10^5$ channels
- full hardware chain tested by now

**Florida Tech SRS application:**

- Commercial production of 160 APV hybrids at Hybrid S.A.
- DAQ software development (DATE system)
- Development of Event monitoring s/w (AMORE suite)
- First demonstration of chain APV+SRS+DATE+AMORE
- Integration of SRS with 30cm×30cm GEM detectors
- Largest use case of SRS to-date (~15k ch.)
Fl. Tech’s SRS currently being commissioned at CERN

- 120 APVs needed for Muon Tomography
  - ~ 40 APVs & 2 ADCs & 2 FECs available for R&D (~ 4k ch.)
Plan:
Follow up on previous BNL R&D & study zigzag-strip readout to reduce # of readout strips & consequently cost of electronics for large tracker

Questions:
• What spatial resolution would be needed for an EIC tracker?
• Can it be different for $\varphi$ and $\eta$?
• What is the expected occupancy?
• What readout cell size would be needed?