Update on U/V strip GEMs @ UVa

SBS Weekly Meeting, Mar 29, 2020

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Outline

- **Cosmic tests of U/V GEM #1**
- **Status of U/V GEM #2 & #3**
- **Plans for installation in BB & SBS**

Main team at work on U/V GEMs @ Uva

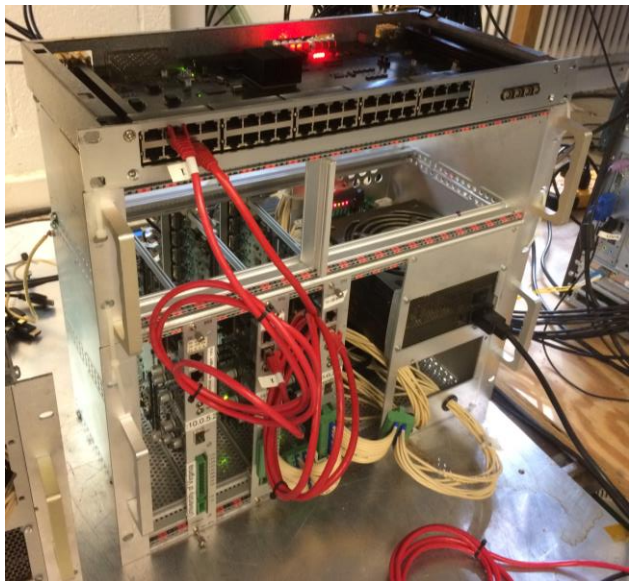
Nilanga, Huong, John B., Salina, Kondo

Weekly meeting for the commissioning of GEM every Wednesday at 10:00 am

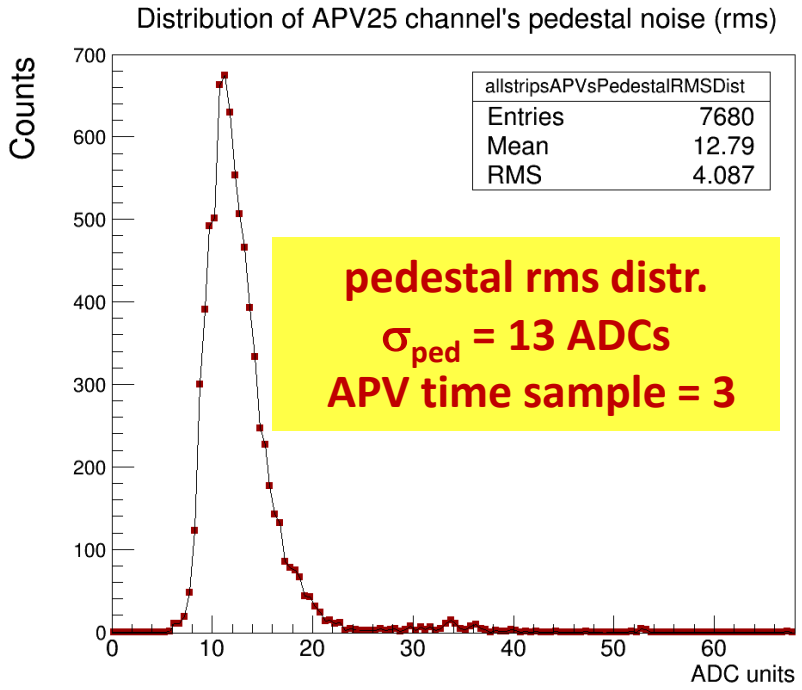
Wiki: https://hallaweb.jlab.org/wiki/index.php/GMn_GEM_Commissioning_Meeting

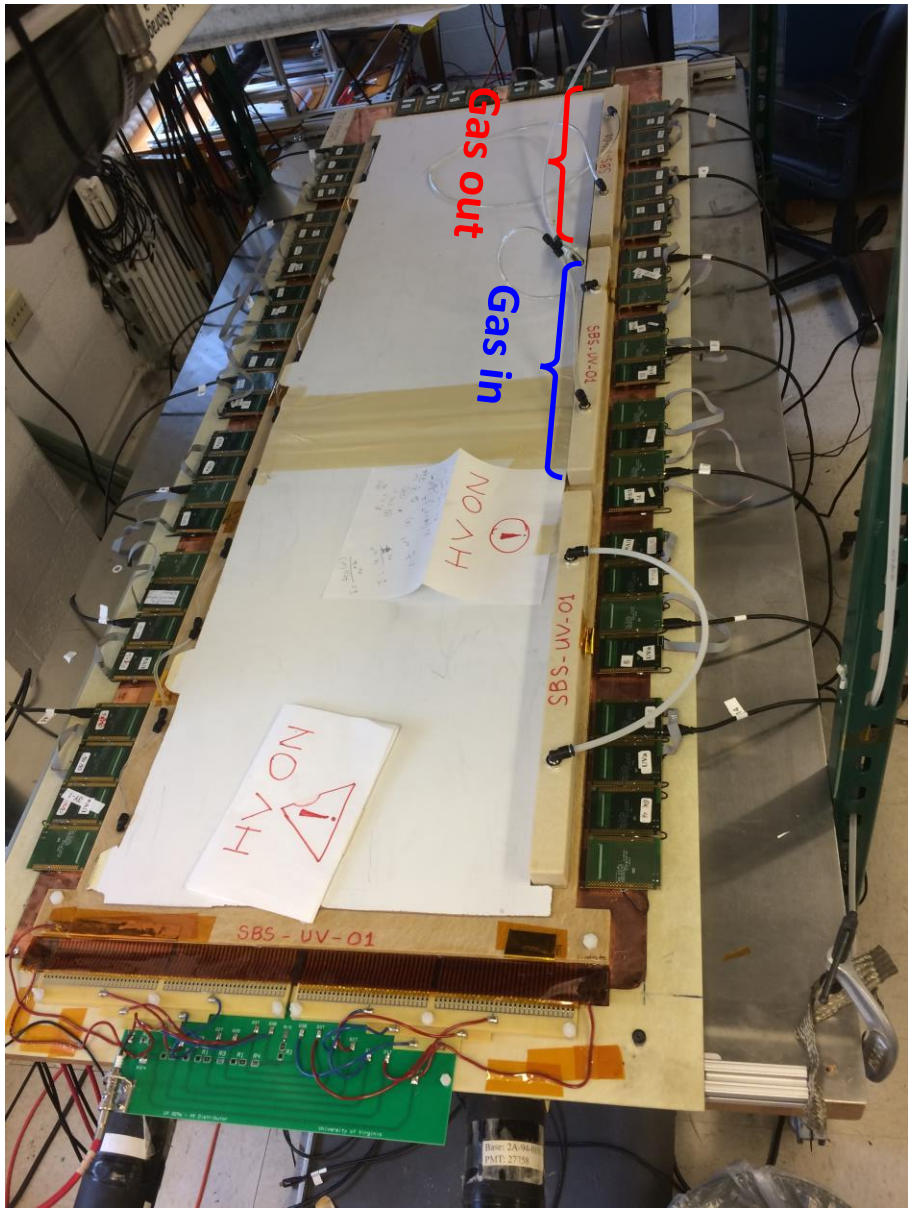
Preliminary test of U/V GEM #1 with cosmic: setup

- **Cosmic setup**
  - Cosmic stand in det lab at UVa ⇨ large plastic trigger counters (top and bottom)
  - APV25-SRS readout ⇨ enough to readout 32 APV25 cards (only half detector area)
- **Test detector response uniformity with new gas flow design (this is fix)**
  - Stable behavior in HV for 6 weeks
  - New gas flow scheme (presented by Nilanga last a few weeks ago)
  - Gas flow 3.5 units (> 4 volume change / hours)
  - HV = 3725V with the new divider ⇨ equivalent ~4175 V with standard divider



APV25-SRS crate
power 32 APV cards

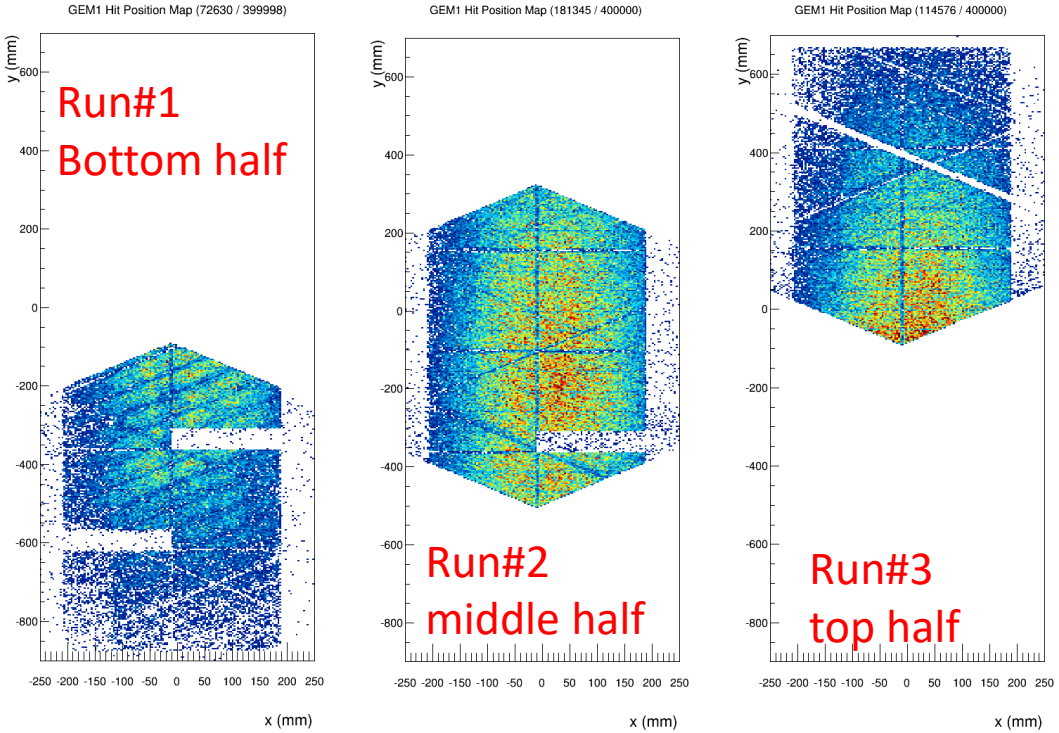


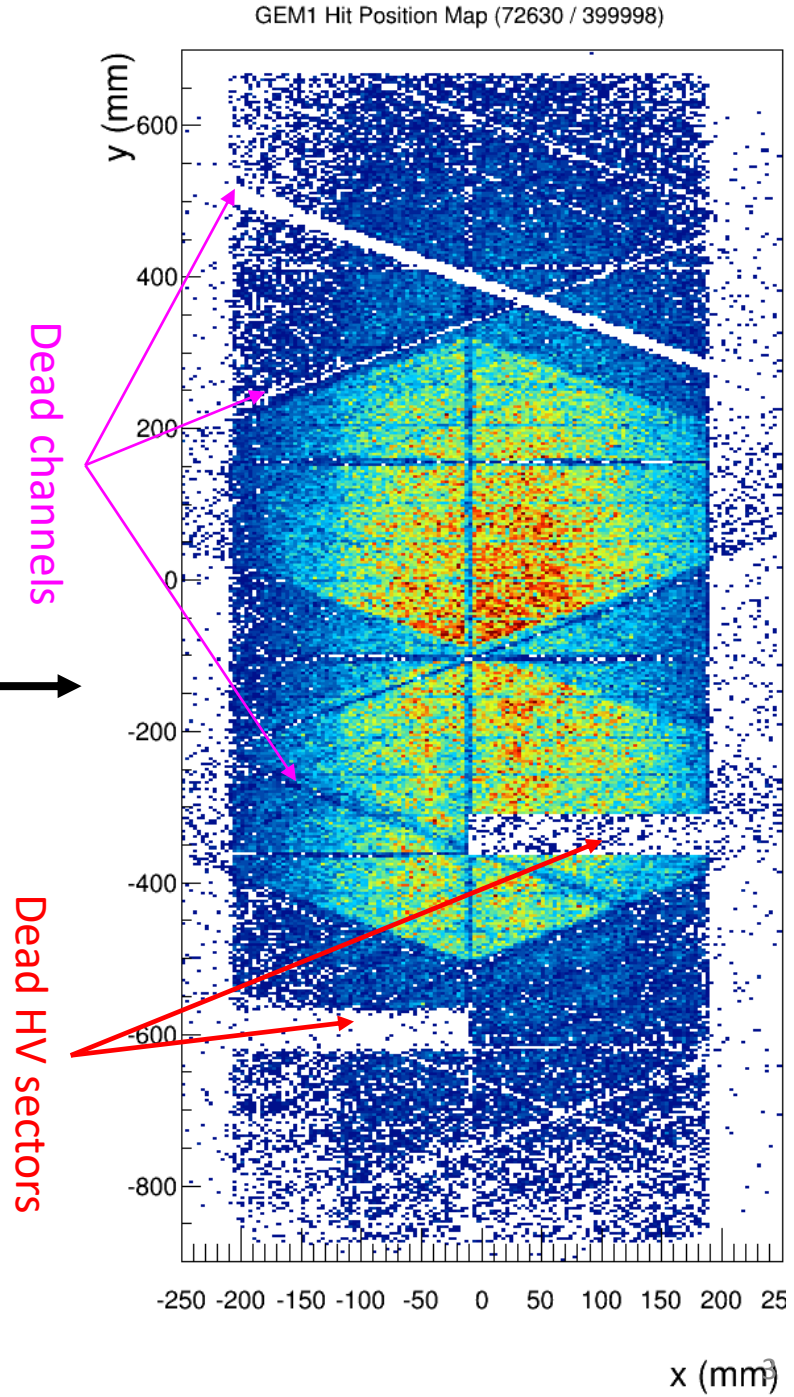


U/V GEM #1 on cosmic stand

2D Hit map: response uniformity

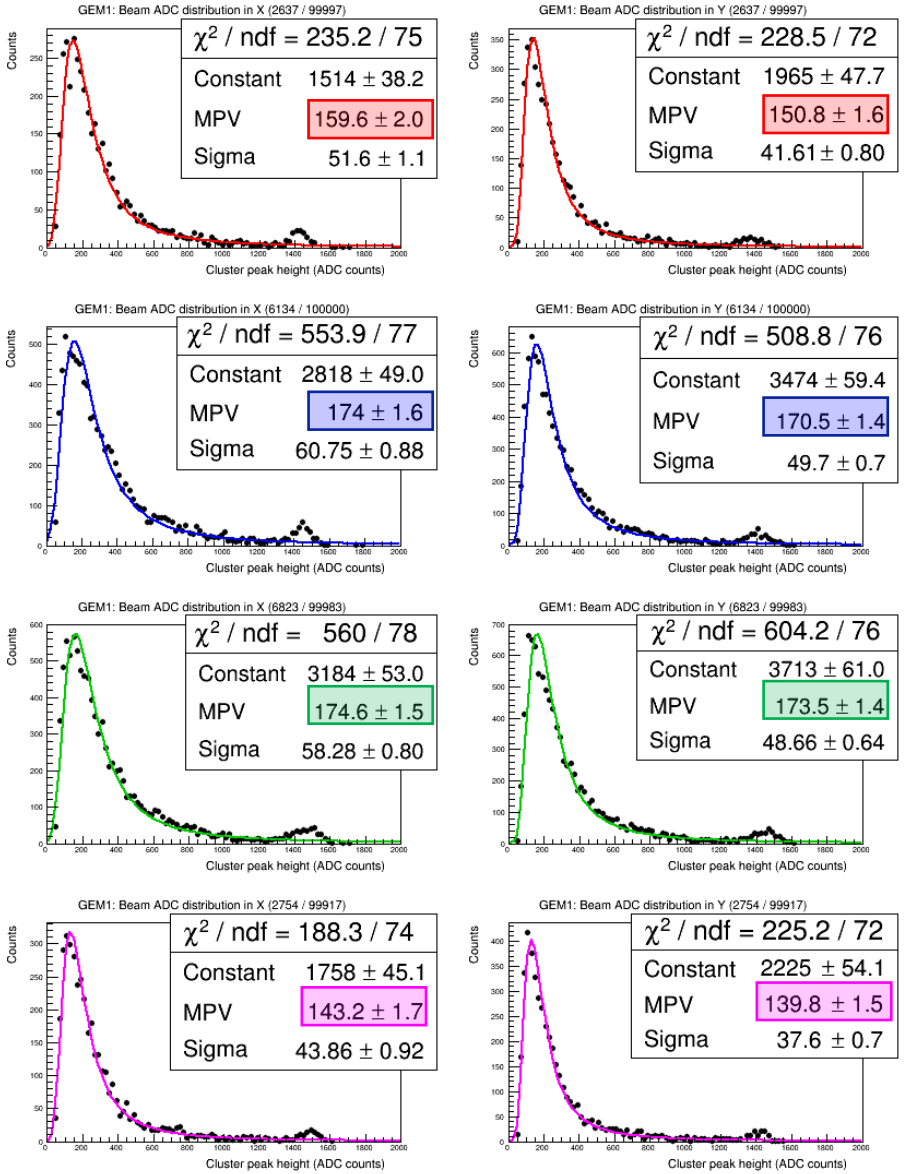
- **Hit map of osmic data**
  - Data splits into 3 runs because of lack of enough readout electronics
  - Each run covers half of the active area (bottom, middle and top) middle half
    - U/V strips into X/Y coordinates ⇨ triangle shape at the edge of the hit map plots
  - A few dead channels ⇨ under investigation (APV25 FE, connectors, strips in the chambers)
  - 2 dead HV sectors (2 out of 180 sectors) ⇨ but represent ~ 3% of active area
    - Caused by some issues with the support frames during assembly in clean room.
    - Issues is understood now and is under control
  - Very good overall detector response in the entire active area

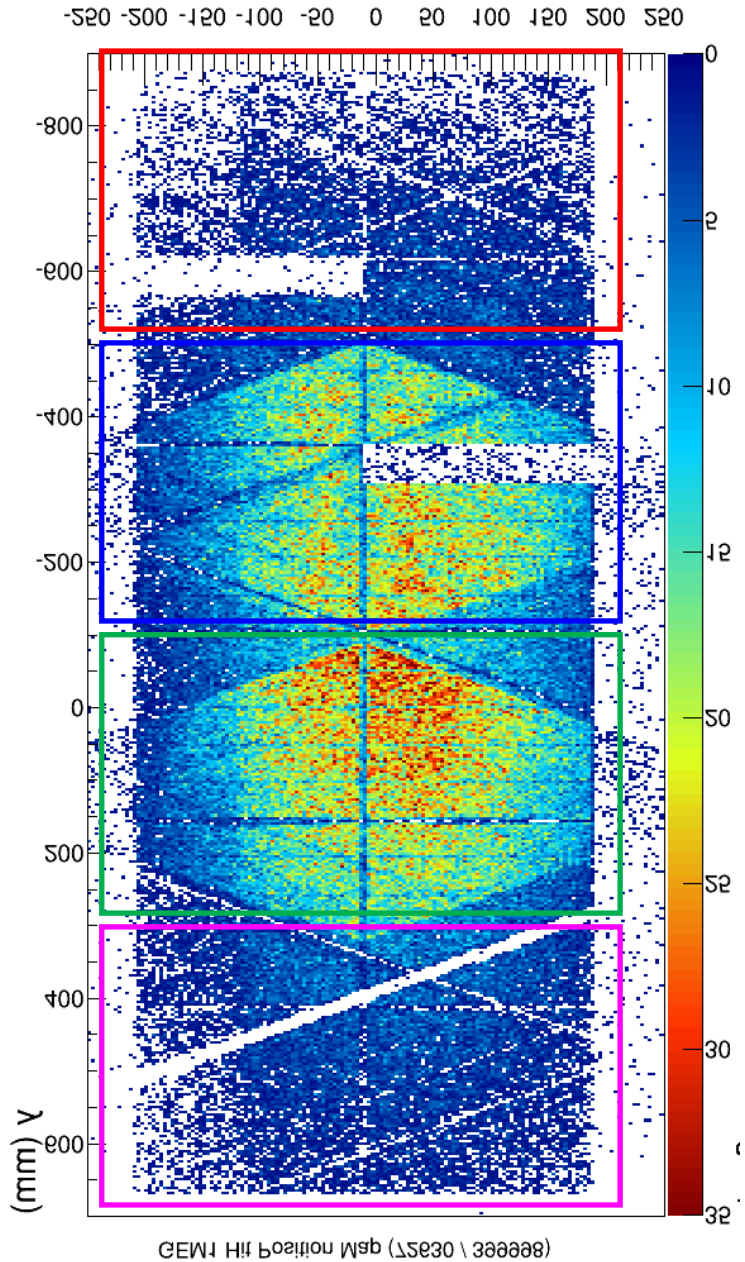




ADC distribution: Gain uniformity across the area

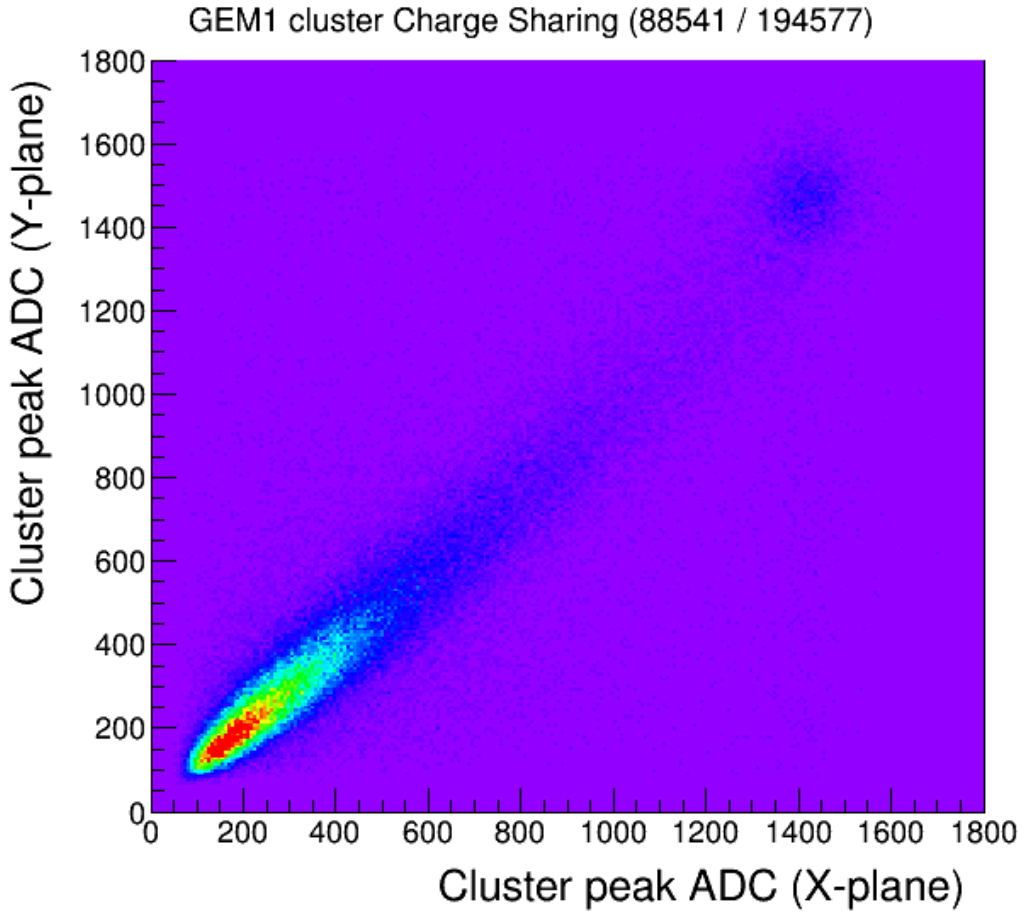
- **Estimate of gain uniformity**
  - Split the active area in 4 regions
  - Look at the ADC distribution on U and V strips for each region
- Landau shape for MIPs
  - MVP proportional to gain
- Variation of MVP from one region to the another ⇨ Gain uniformity
- Here we see a very good uniformity across the full detector area
  - Maximum deviation ~18% is well within the range that we would expect
  - Various effects can cause such variation ⇨ cosmic track acceptance, small overpressure in the chamber ….
- So we conclude that our gas flow scheme works very well and we don't see any impact on detector performances

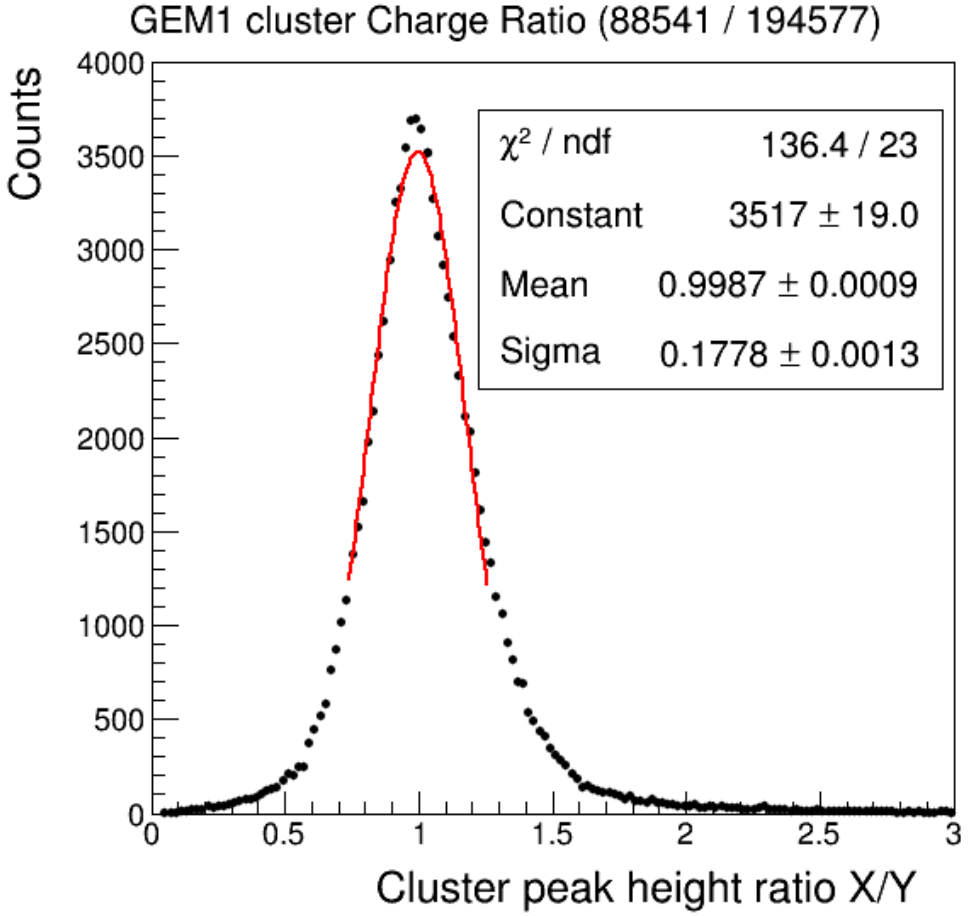




U/V strips charge sharing

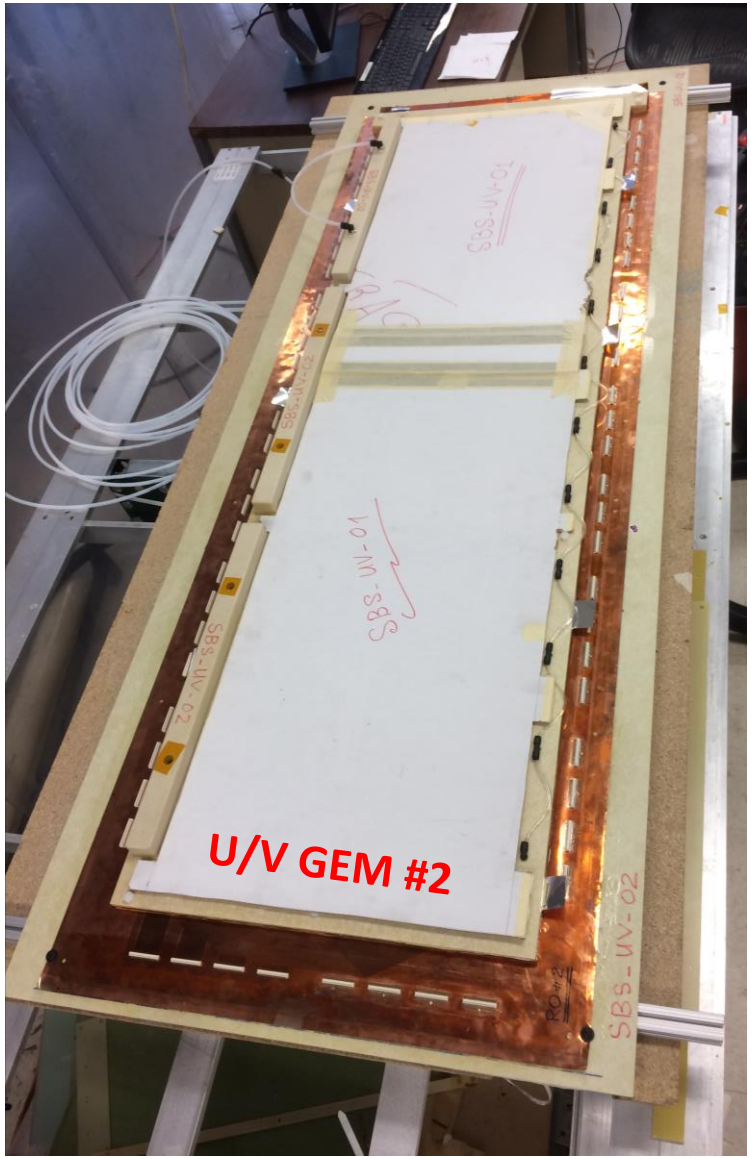
- Very good U/V charge sharing

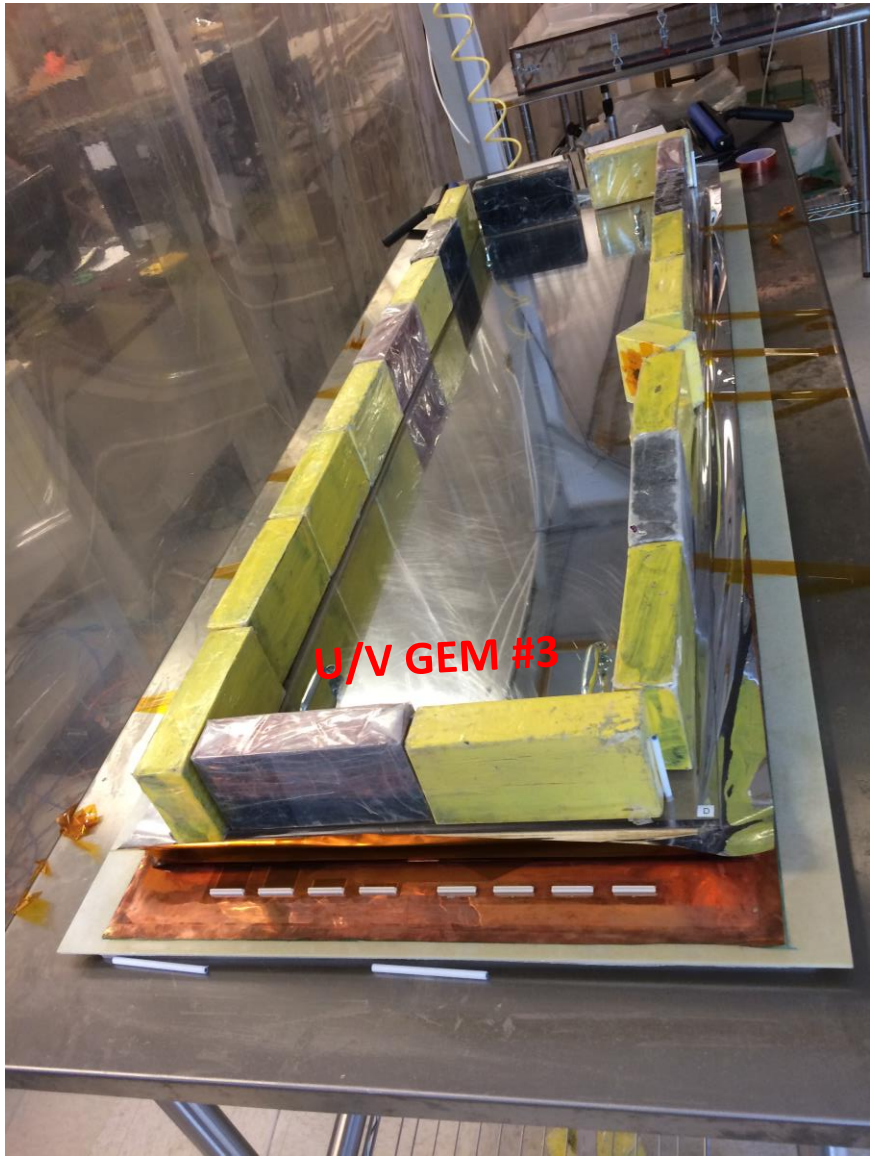




Status of U/V GEM #2 & #3

- **U/V GEM #2 assembly completed**
  - A few out of clean room work still needed to complete the assembly and test it
  - Same issues as U/V strip GEM #1 regarding gas flow scheme
    - So we expect it to work perfectly as well like the first chamber
  - Hopefully, we don't have any dead sector
- **U/V GEM #3 assembly almost completed**
  - Clean room part of the assembly to be completed this week
  - No gas flow issue ⇨ would operate as is was originally designed
- The two chambers will be tested on the cosmic stand at UVa by in about one month scale (by the first week of May)





Plans for moving layers to JLab and installation in BB and SBS

- **U/V strips GEM #1 will be moved to JLab in the next two weeks**
  - We plan to test it in cosmic stand in EEL Clean room to look at efficiency, resolution and gain curve with Andrew's code
  - After that, it will be ready to go to the spectrometer

- **U/V strips GEM #2 #3 will be moved to JLab by mid May**
  - Cosmic test in EEL clean room 124 will be performed the same way (resolution, efficiency etc …)
  - Probably GEM #3 will be the best to go to slot #3 of Bigbite spectrometer
  - The best between GEM #1 and #2 could be installed in slot #3 of Bigbite
  - The other detector can be reserve for SBS Gen-RP spectrometer
  - This choice will be made by early May

- **U/V strips GEM #4**
  - We are still waiting for parts from CERN (GEM foils) and RESARM (frames) for the 4th GEMs
  - Don't expect the chamber to be ready before June at the earliest
  - This chamber will be free from gas flow issue as well

Backup

Raw APV data: Cosmic hit