

# Preliminary Results on INFN GEM efficiency

**SBS Weekly Meeting, Oct. 09, 2018**

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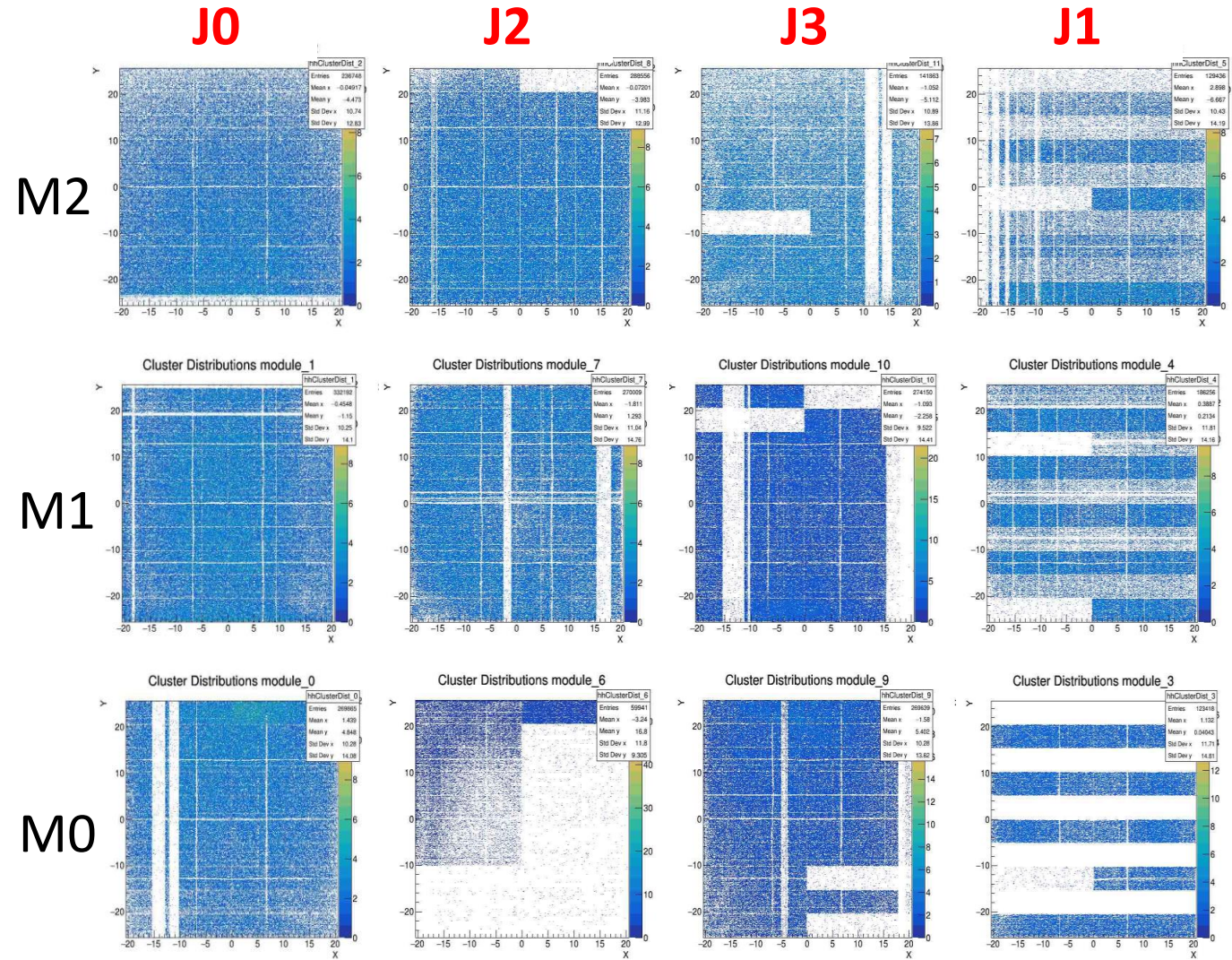
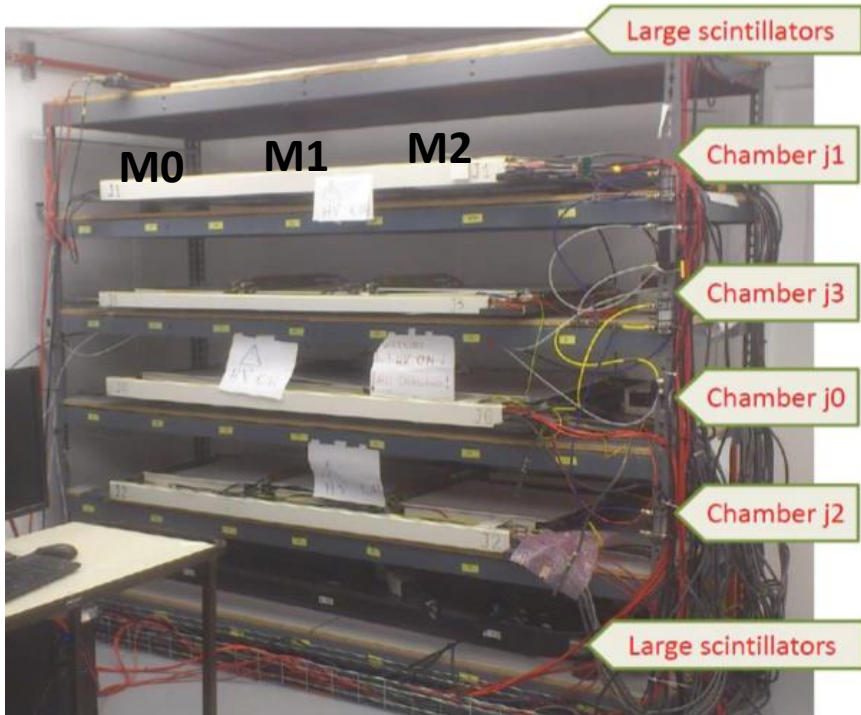
**H.U:** T. Cao, M. Kohl.

**Weekly meeting for the commissioning of the GEMs every Thursday at 9:00 am**

Wiki: [https://hallaweb.jlab.org/wiki/index.php/GMn\\_GEM\\_Commissioning\\_Meeting](https://hallaweb.jlab.org/wiki/index.php/GMn_GEM_Commissioning_Meeting)

# INFN GEM Cosmic stand & first large run of cosmics

- Cosmic data ~ 1.2M triggered events
- HV on GEMs = 3.9 kV (probably not optimal)
- Gas: Ar-CO<sub>2</sub> (75/25) @ flow rate 0.4 units on flow meter (~70 ccpm per GEM module)



- **Dead area on J0, J2 and J3 modules:**
  - Vertical direction: external to the GEM modules ⇒ APV25 card connection issues to be fixed later
  - Horizontal direction: internal to the GEM module ⇒ dead HV sector of the GEM foil
- **Dead area on J1:** Problem on the set of APV25 back planes to be fixed later

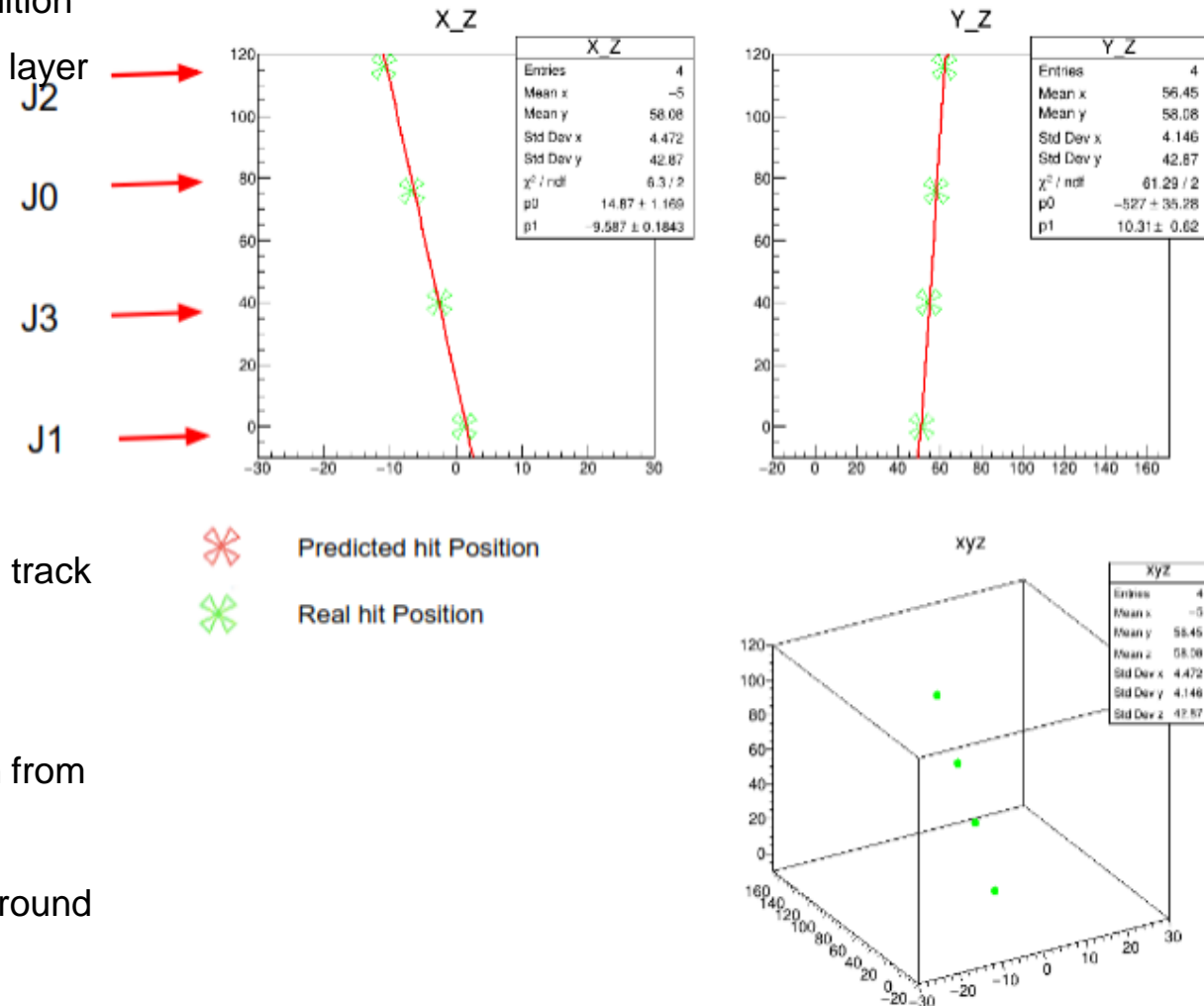
(Siyu Jian)

For the tracking imposed these following conditions:

- Events with only one hit per layer  $\Rightarrow$  most cosmic events satisfied this condition
- The alignment not optimal  $\Rightarrow$  No correction of relative offset in between the layer
- Example of one event with a hit on each of for layer shown here

Efficiency of the modules in one layer

- Select one layer under study  $\Rightarrow$  **J0 in this case**
- The three other layers (J1, J2, J3) are used as reference for the tracking
- Straight line fit of the tracks from the hits in these reference layers
- Plot the predicted hit 2D position (x,y) from the projection on J0 layer of the track on 2D histogram
  - Fit Chisquare cut  $< 1$  ( $p > 97\%$ )
- Plot the real hit 2D position (x,y) in J0 layer based on the expected position from the track in a 2D histogram
  - Expected hit position is obtained within a region of radius  $< 2.5$  cm around the predicted hit

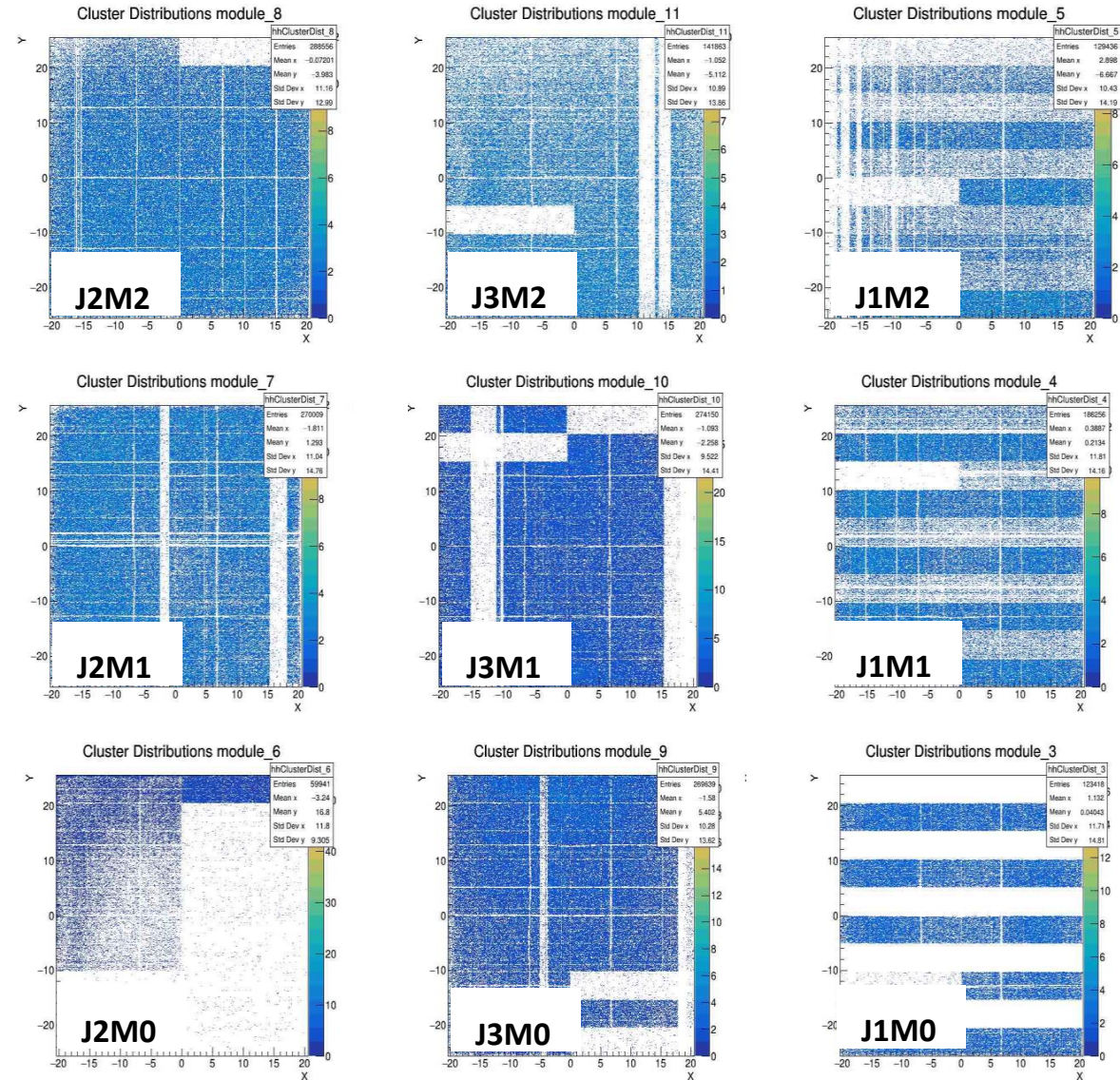


# Acceptance of the J0 layer from the tracking

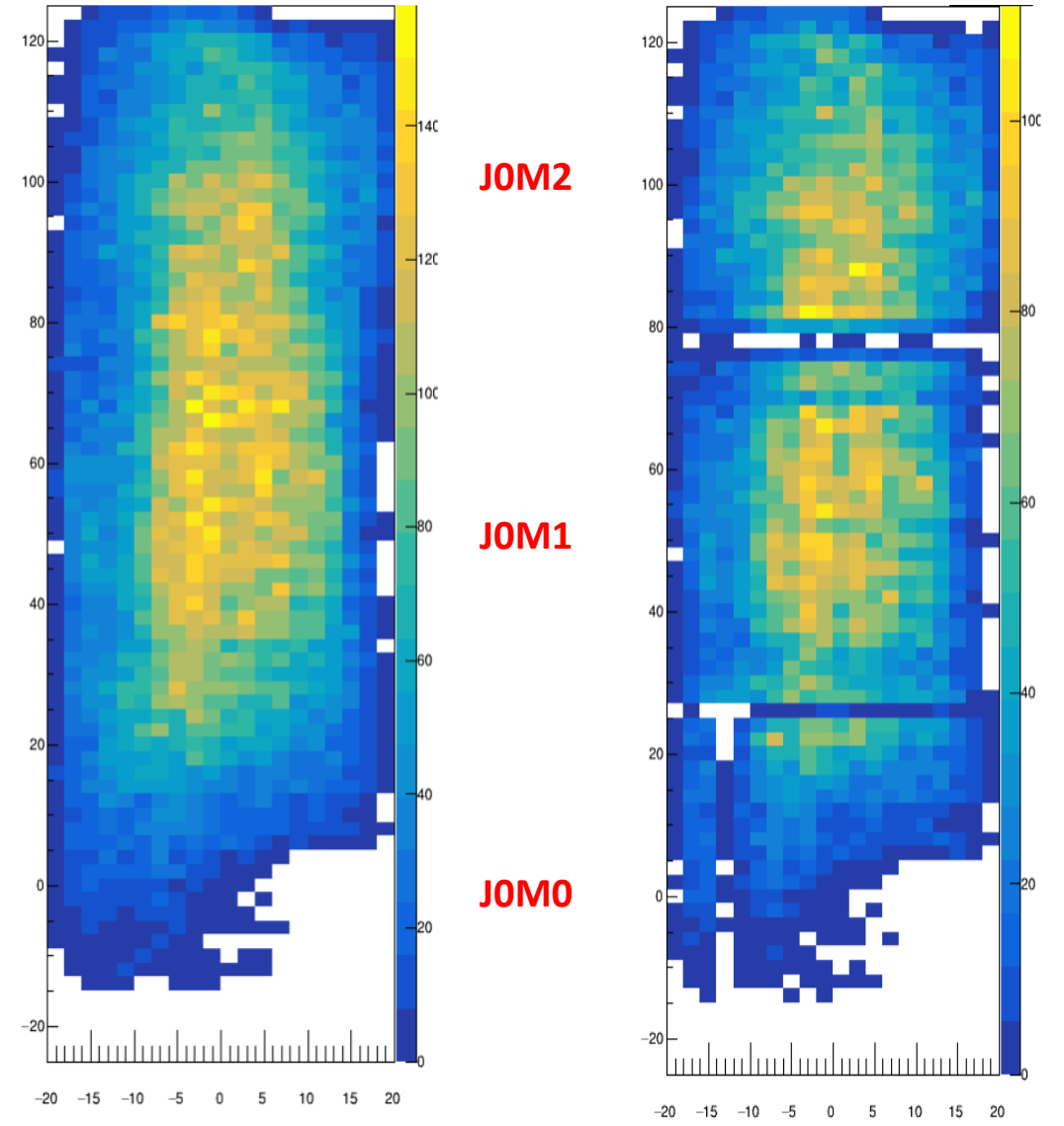
Reference trackers J1, J2, J3

Predicted ht map in J0:  
projection from tracks

Real data hit map in J0:  
based on tracks cut



Hits from the tracks



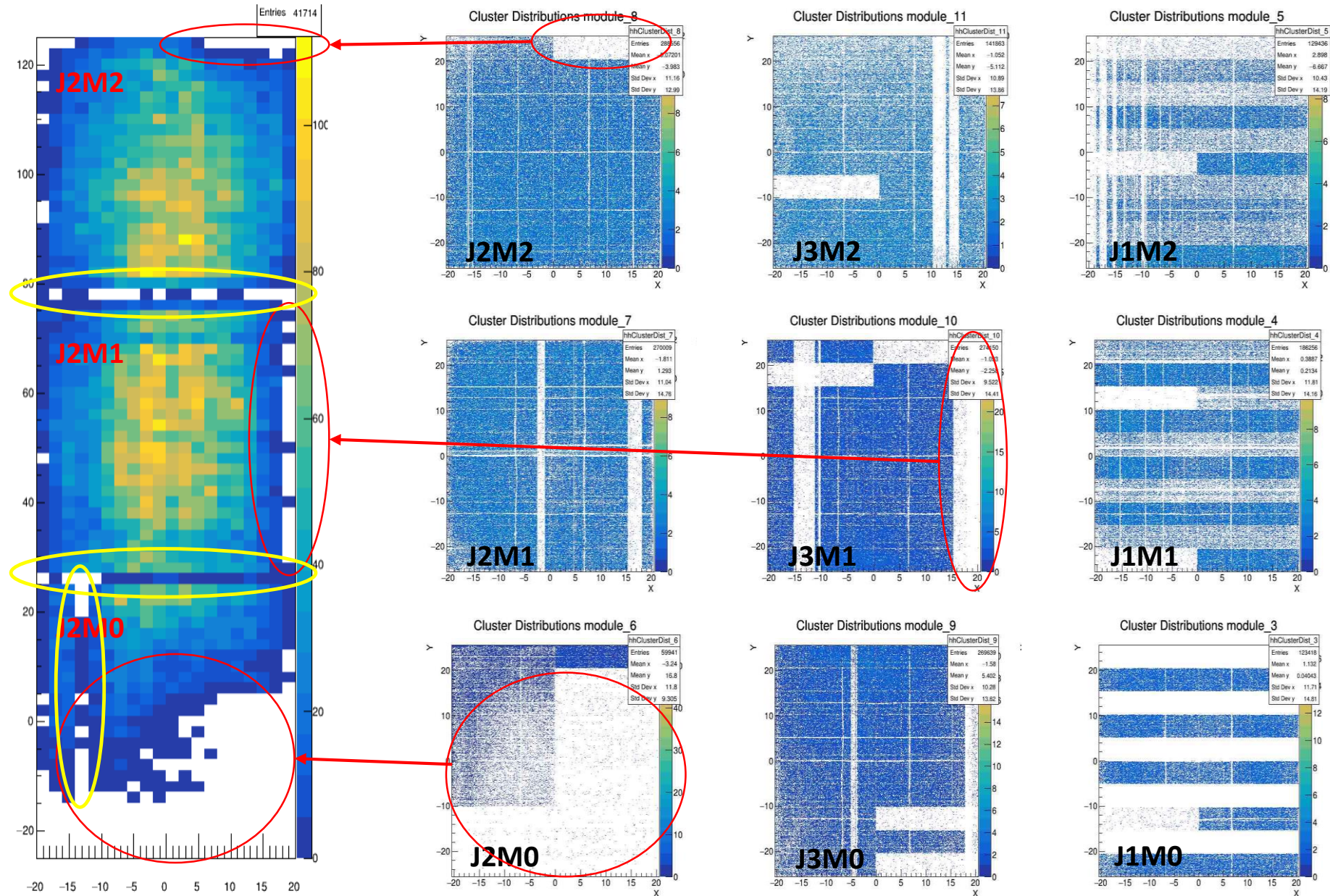
# Limitations on the acceptance of layer J0

## Red circle

- Dead region in the different reference layer affect the acceptance of J0
- Especially when it superimposed from 2 layers

## Yellow circles

- Dead region between modules
- APV25 cards connection issues as well



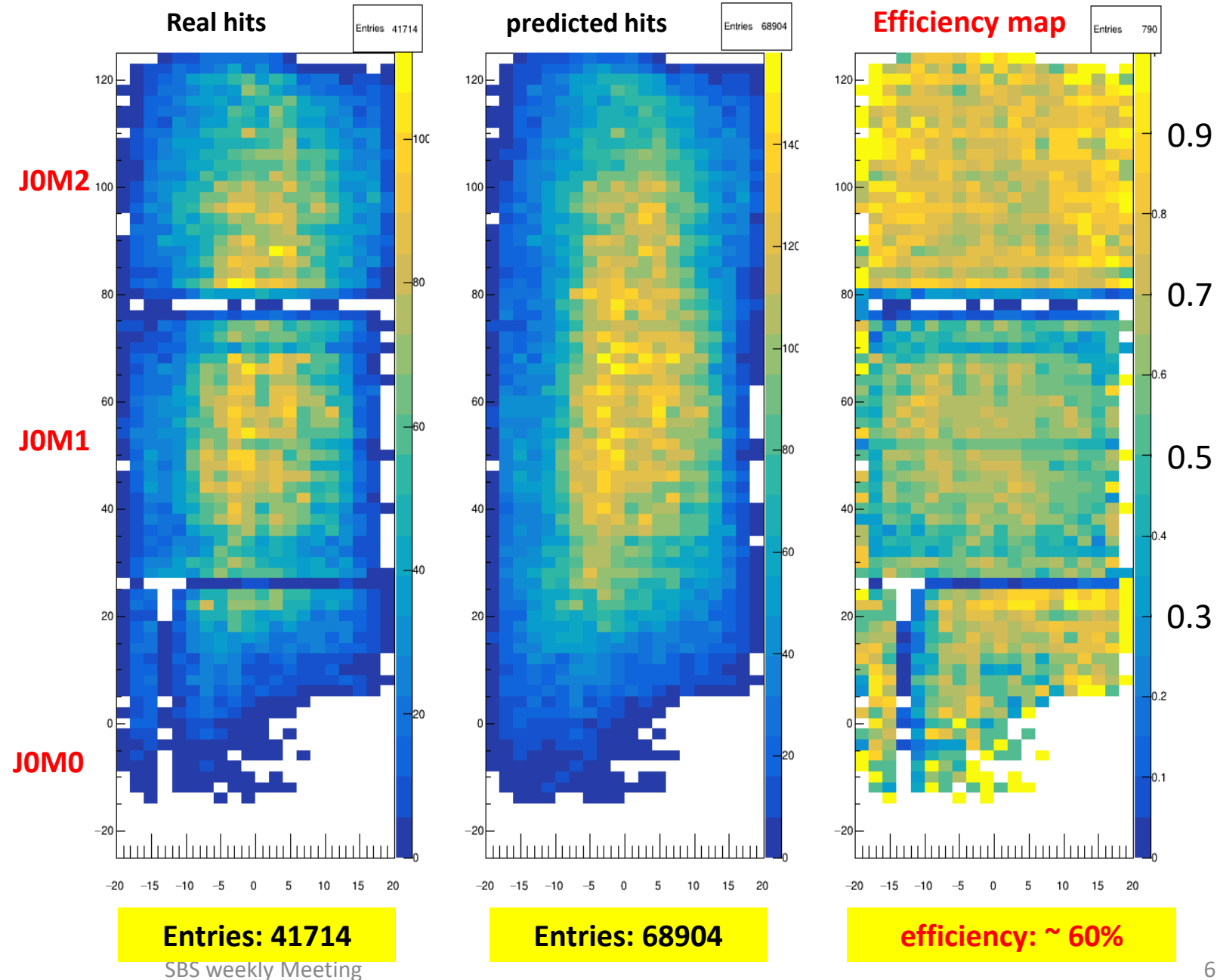
# Overall efficiency of J0

## Preliminary analysis

- **J0M2**: Overall good and uniform efficiency on J0M2 > 80%
- **J0M1**: lower efficiency (50% to 80%) ⇒ might need higher gain (HV)
- J0M0 seems OK but limited acceptance from reference layers dead region prevented a firm conclusion

Data taken at 3.9 kV is not the optimal for efficiency performances of the GEMs

- Need to optimize the gain (HV) for each module to evaluate the ultimate efficiency



## Analysis package for simple tracking and efficiency evaluation

- Work in progress but we can already start producing the efficiency results for each INFN GEM modules
- Still need some fixes and ultimately, integration of multi tracks tracking tool
- J0M0 seems OK but limited acceptance from reference layers dead region prevented a firm conclusion

## Efficiency of INFN GEM layers

- Produced for J0 layer  $\Rightarrow$  Overall good efficiency but we are working at too low gain
- Need to optimize the gain (operating HV) for each module to have a meaning full efficiency evaluation
- We just started HV scan run for the chambers to do so
- Will ultimately produced efficiency map for all 4 layers  $\Rightarrow$  but ideally we need to fix all the fixable dead area before the efficiency run
  - Evaristo's team are coming in  $\sim$  two weeks and will work on that

## UVa GEM status

- First GEM layer assembled but we are still waiting for the safety approval for the gas system to start data taking
  - Should be ready in a week from now: All part needed have been ordered and expect to be delivered soon
- We have a submitted the design of the cosmic stand frame to Whit Seay for approval as well  $\Rightarrow$  No show stopper but still need the final green light to start getting the parts together