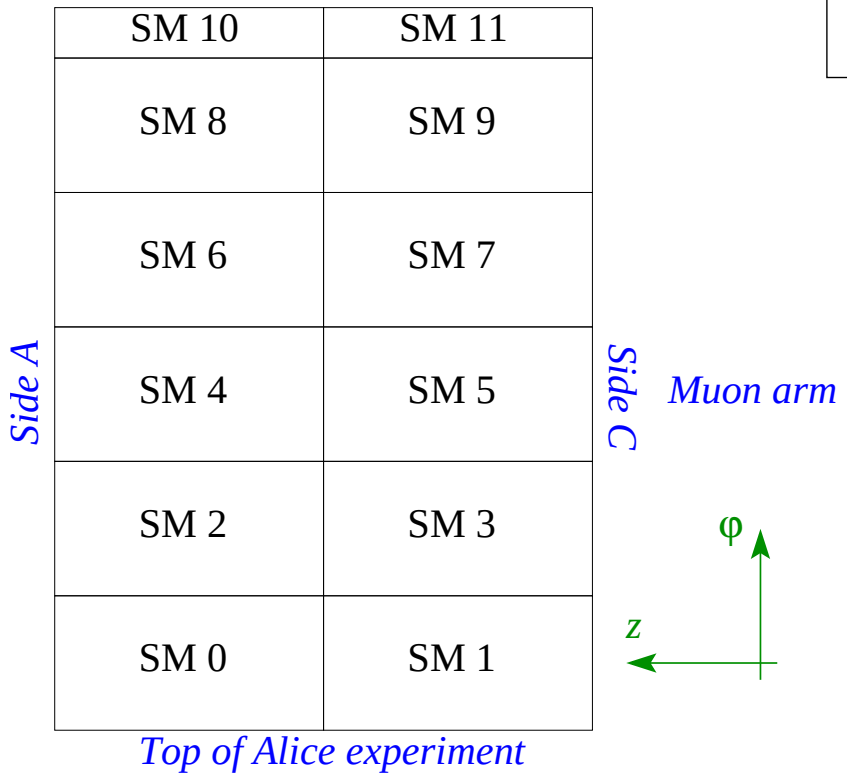
# EMCAL/DCAL $\pi^0$ calibration and HV settings :

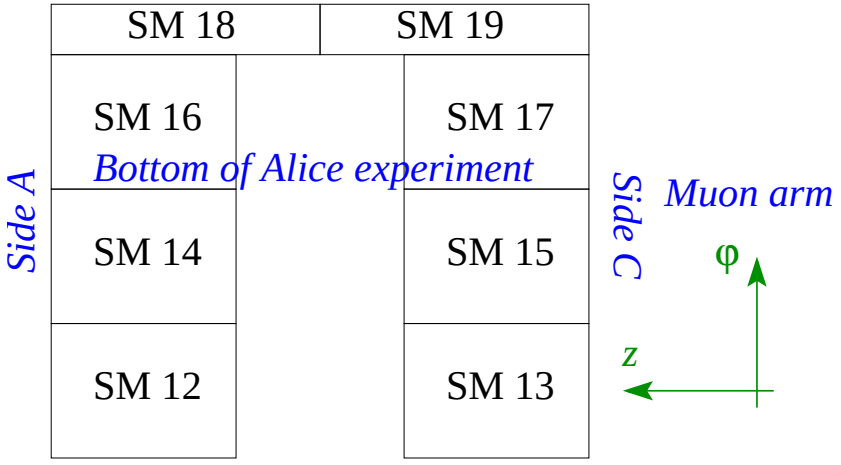
(J.F. + Astrid V.)

Supermodules (SM :)
- identical technology,
- various situations wrt calib : EMCAL, EMCALthirds, DCAL, DCALthirds.
- 1 tower = 1 channel.

## EMCAL + EMCALthirds :




## DCAL + DCALthirds :



# Procedure :

- Tower gain = $f$(High voltage),
  $\Rightarrow$ HV change induces modification of reconstructed cluster energy.

- Before installation at point-2 : pre-calibration with cosmic muons
  ($\simeq 260\ MeV$-equivalent, $\simeq 2$ % relative accuracy).
- Combine pairs of clusters to reconstruct $\pi^0 \rightarrow \gamma\gamma$ decays :
  if a cluster doesn't have the right energy (i.e. a tower doesn't have the right gain),
  $\pi^0$ inv mass peak not at the right mass.
- Tower-by-tower calibration,
  Iterative procedure.
- After calibration, coeff is known : put it in OCDB for reconstruction.
- End of the run : calculate new tower HV such that tower gain is correct
  next OCDB factors should vanish to "1".

- **Where we are :**
  $\longrightarrow$ partial $\pi^0$ calibration with `p-p`, new HV starting from `p-pRef`.

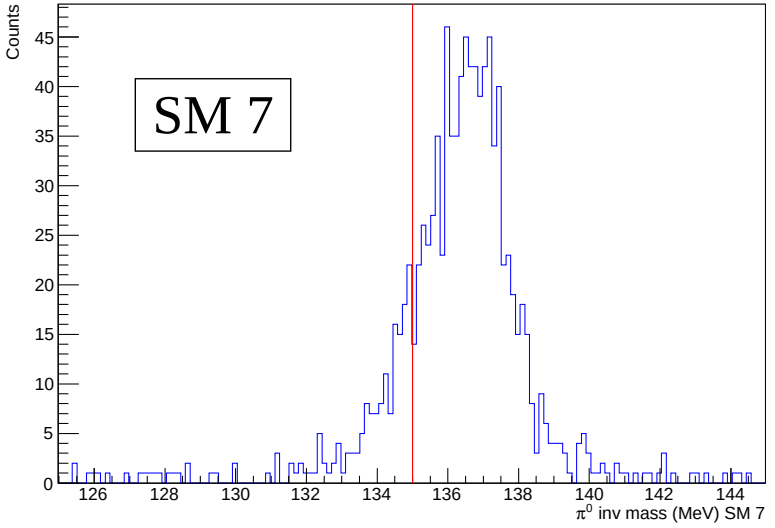
# Situation :

- EMCAL : was calibrated in 2012-2013 ;
  - → new HV calculated in 2013 were not used in 2015,
  - → not recalibrated yet (⇒ no new HV either).
- EMCALthirds + DCAL (1st time in collisions) :
  - → too high gain ($\simeq 15\ \%$),
  - → $\simeq 6\ \%$ because of temperature,
  - → rest is not understood and will not be investigated.
- EMCALthirds :
  - → $\pi^0$ calibration OK,
  - → gain=$f$(HV) function not known for 1/3 of them
    ⇒ slight deviation ($O(3\ \%)$ lower) to be expected with new HV.
- DCAL :
  - → In July : new HV with correction of temperature effect,
  - → $\pi^0$ calibration OK.
- DCALthirds (1st time in collisions) :
  - → Both SM's HV's to be applied have been swapped,
  - → Used the $\pi^0$ information where we could, but we're not magicians
    ⇒ may not be usable yet for Physics.

# EMCAL SM status :

Distribution of the fitted means of the inv mass peaks (1 entry per tower) :

- What we expect (HV didn't change) :
  - → 6 well peaked SM at $m_{PDG}$ with width $< 1\ \%$ (stat uncertainty on $m_{fit}$),
  - → 4 SM with a bit broader distribution and lower mass (TRD material).
- What we have :
  - → Wrongly announced "decalibrated EMCAL"
    (OCDB coeffs were not taken into account).
  - → 10 "broad" distributions (width $\simeq$ 1.0-1.5 %),
  - → average mass in a SM varies by $\pm 1,5\ \%$
    with no apparent logics.
- Situation close to nominal
- Data-taking not endangered.
- Studies needed to quantify better
  what we could really have expected
  (syst uncert on $m_{fit}$, TRD effect,...)
  + what are the queues ?

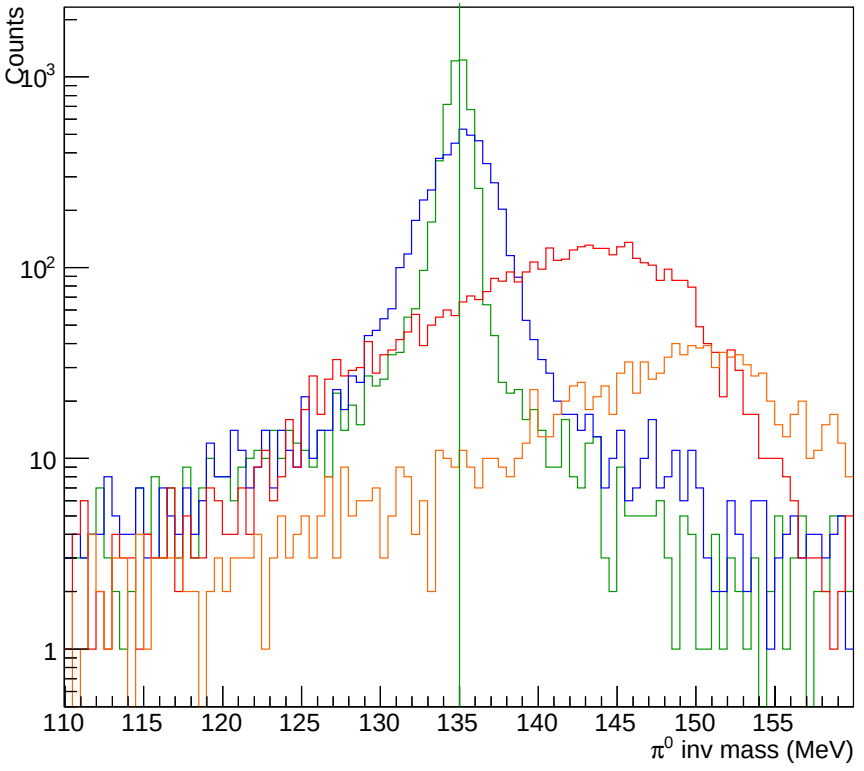


# Status of the new SMs :

Distribution of the fitted means of the inv mass peaks (1 entry per tower) :

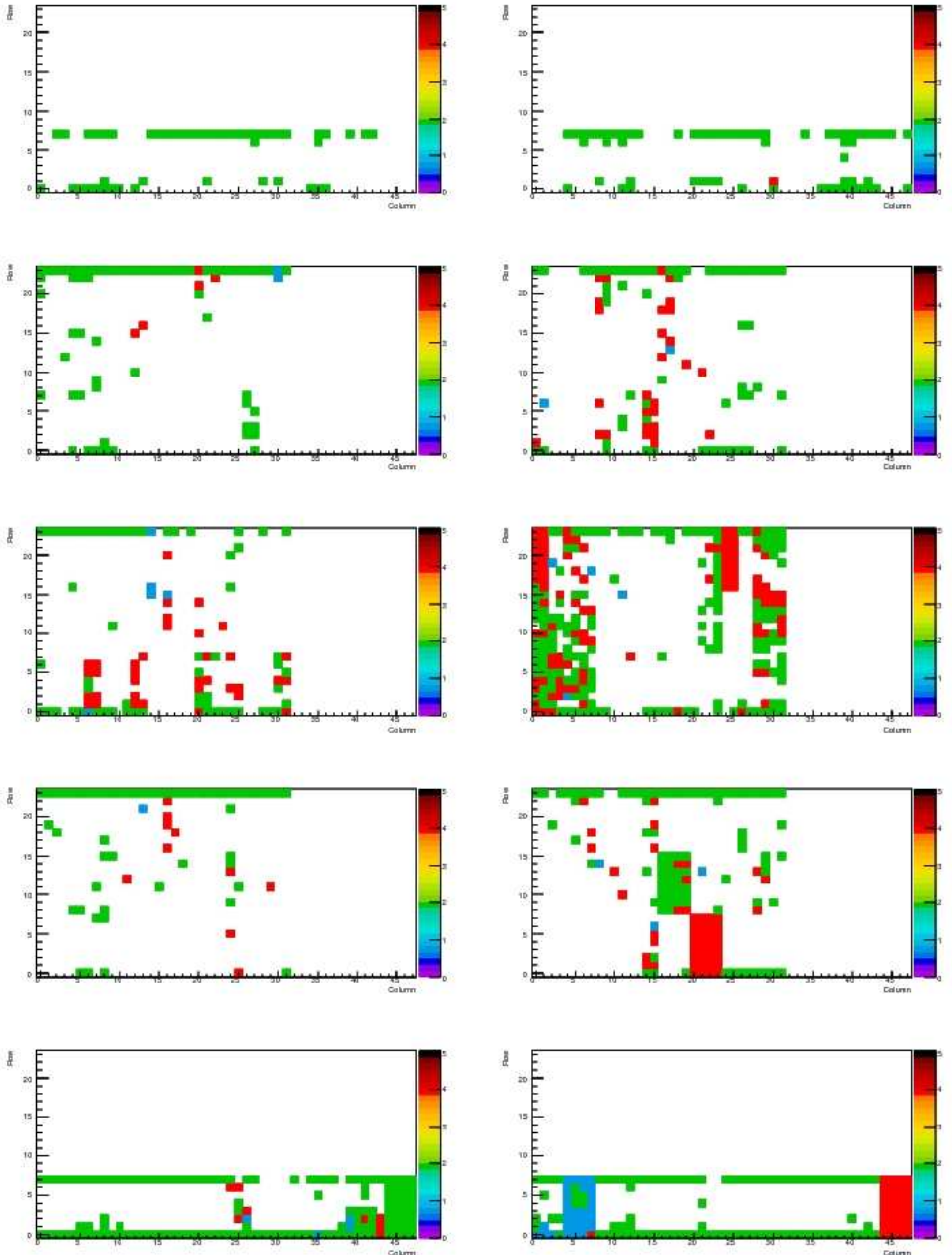
- 3 iterations enough to calculate reliable new voltages...
- ...but not enough for Physics
  $\Rightarrow$ to be continued.

- third-SMs, start,
- DCAL, start,
- both, 1st iteration,
- both, 3rd iteration.



# New SMs : what cannot be calibrated :

- Masked/dead towers,
- Not enough stat (don't even try),
- Tried but no success
  despite human intervention.

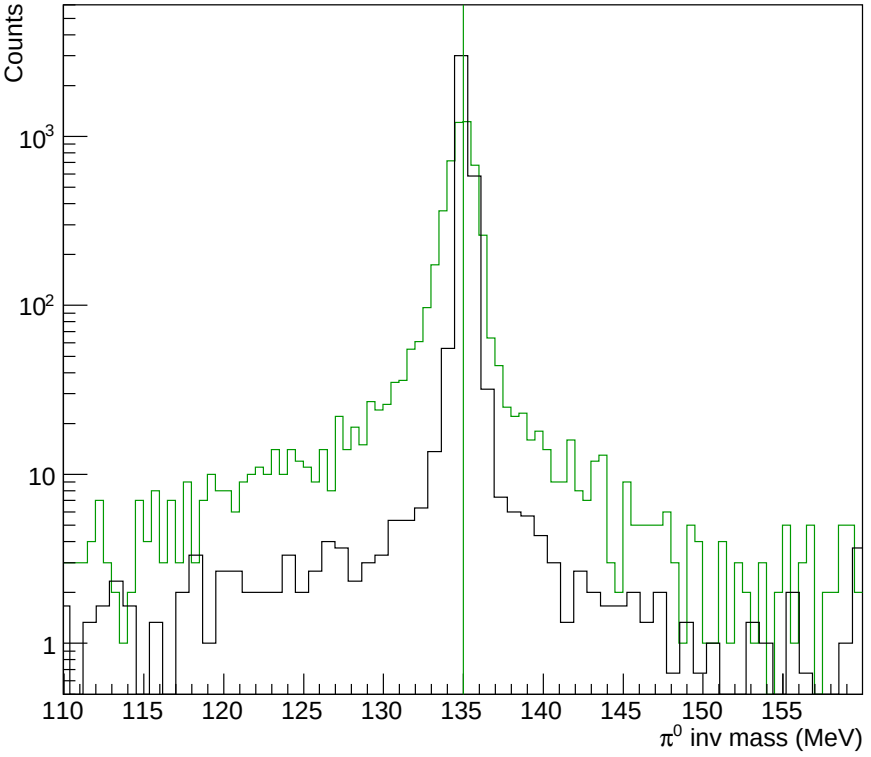


# What remains to be done :

**For most of the towers :** ⟶

- Green = where we are,
- Black = EMCAL-2012

  (note that it's year n+2 for EMCAL !)



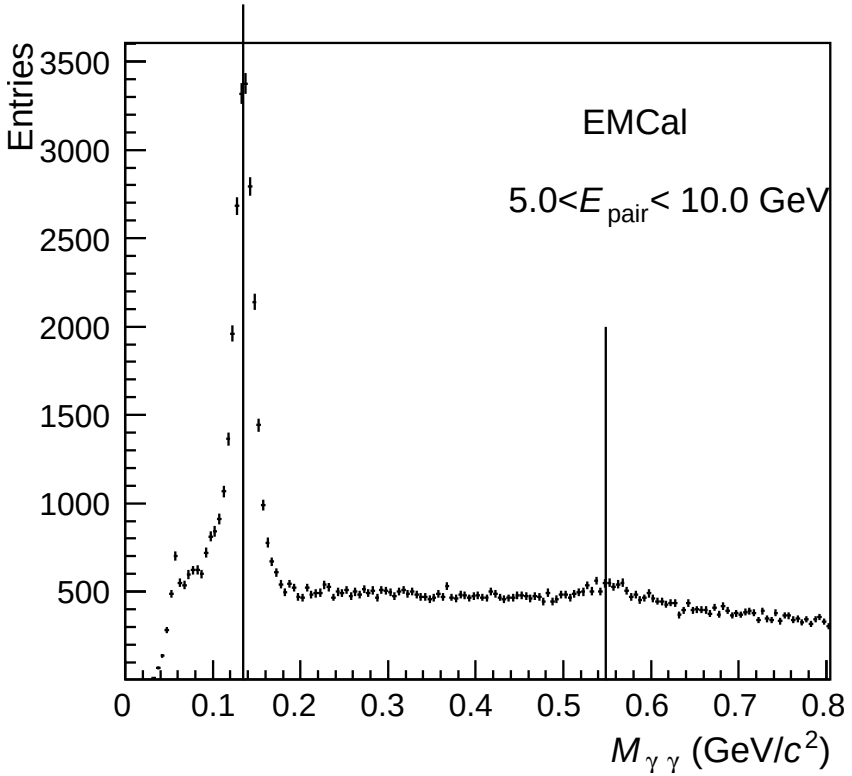

**For many other others :**

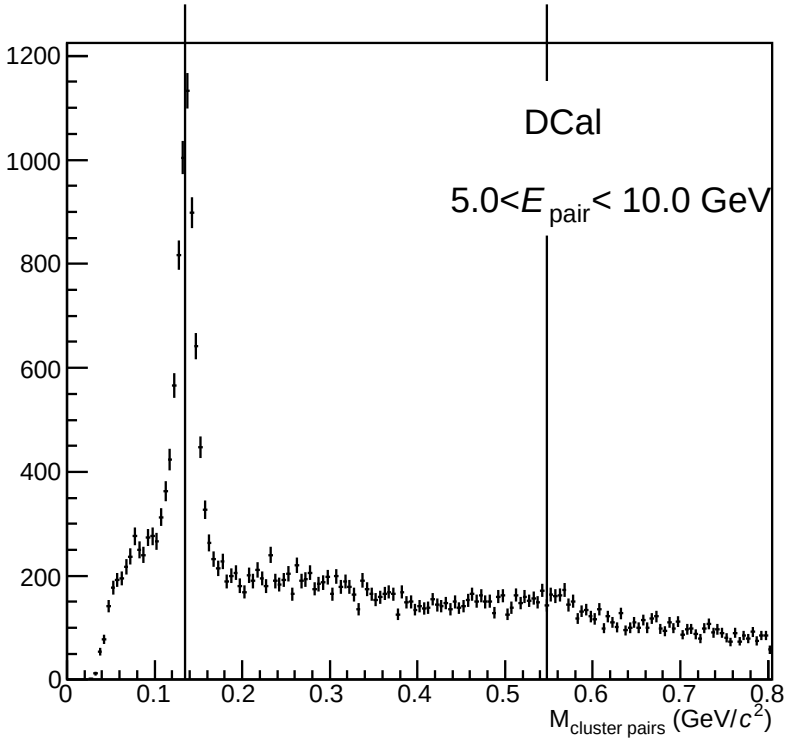
- electronic noise,
- background shape not understood,
- towers on the edges,
- towers with low statistics,
- peak distortion where there is material,
- fit stability/reproducability,
- ...

**Plus : many other studies** to understand the detector stability, LED system,...

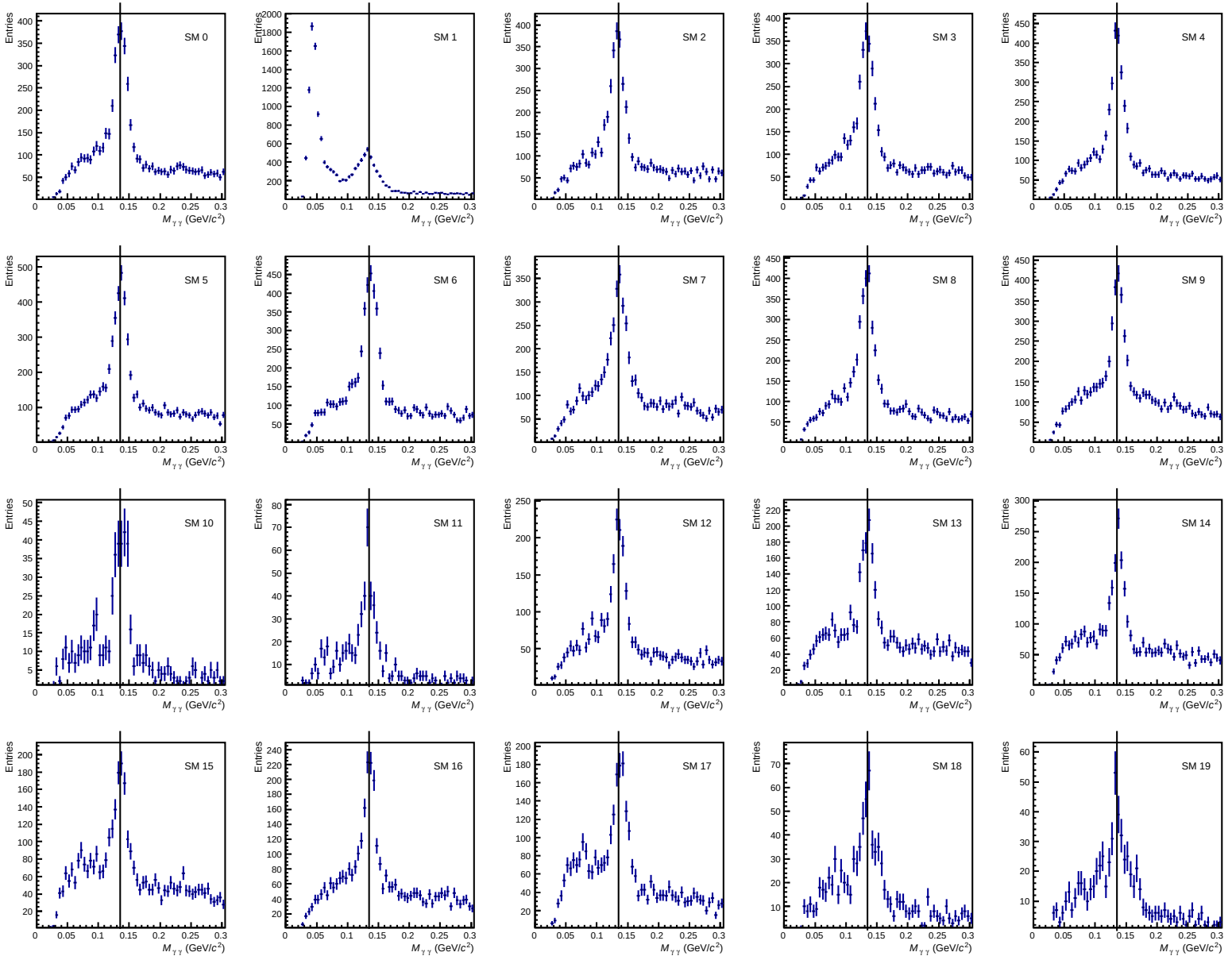
# Raw status in p–pRef :

(Gustavo C.)



# Raw status in p–pRef, per SM : (Gustavo C.)



# Conclusions :

- Raw `p-p`Ref : $\pi^0$ in DCAL mean : $156 \rightarrow 135\ MeV$, (Marie G., width : $15 \rightarrow 10\ MeV$ Lucille R., Alexandre S.).
- pp 2015 data :
  - $\rightarrow$ EMCAL : some studies needed ;
    `if (Physics)` : calibration to be continued ; (months)
  - $\rightarrow$ DCAL + third-SMs : finish calibration.
- `p-p`Ref, `Pb-Pb` and `p-p` 2016 :
  - $\rightarrow$ check and calibrate (months).
- Will begin heavier studies (year).

- More details : next Friday EMCAL-weekly meeting.

# BACKUP