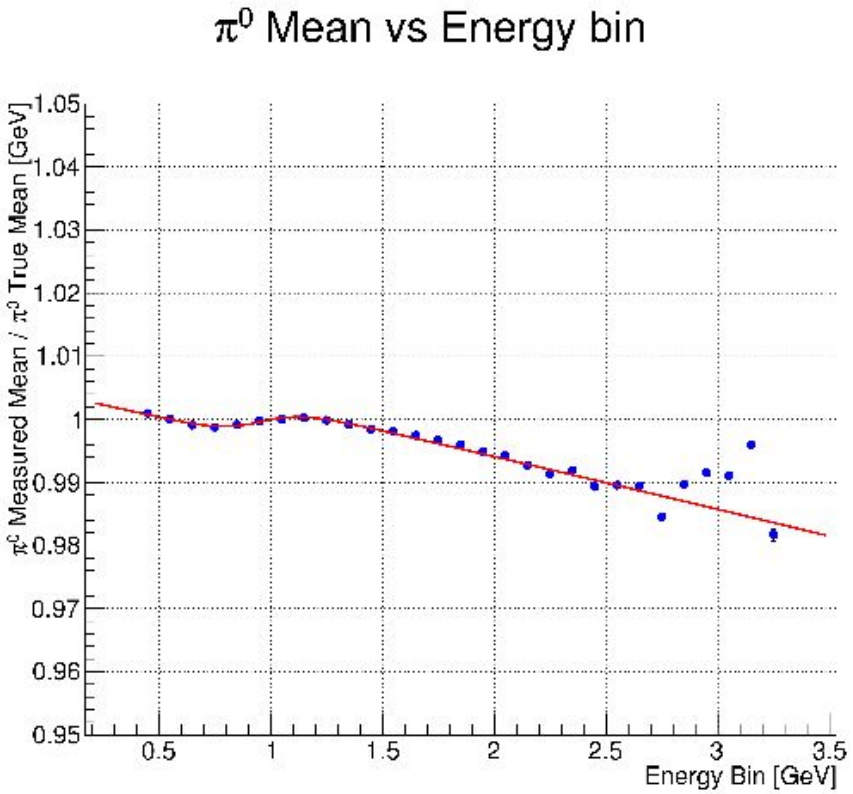
Summary on BCAL pi0 Calibration using SiPM Corrections

Date : 13 December 2018

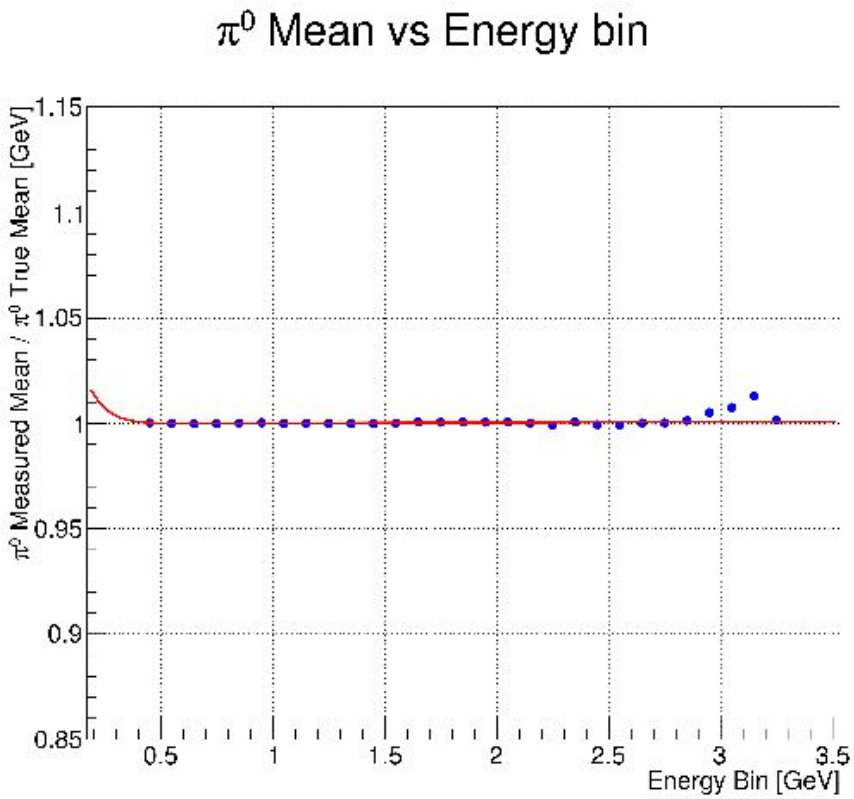
- Until recently, Empirical nonlinear corrections were made to showers to account for the nonlinearity in the calibration
- One of the reason for this nonlinearity is due to SiPM saturation, (Refer Elton_Saturation)
- The new SiPM corrections are done on a hit level basis, It is expected to correct for most of the nonlinearity.

Calibrations without SiPM corrections (summary 2017)

Plot before the empirical correction



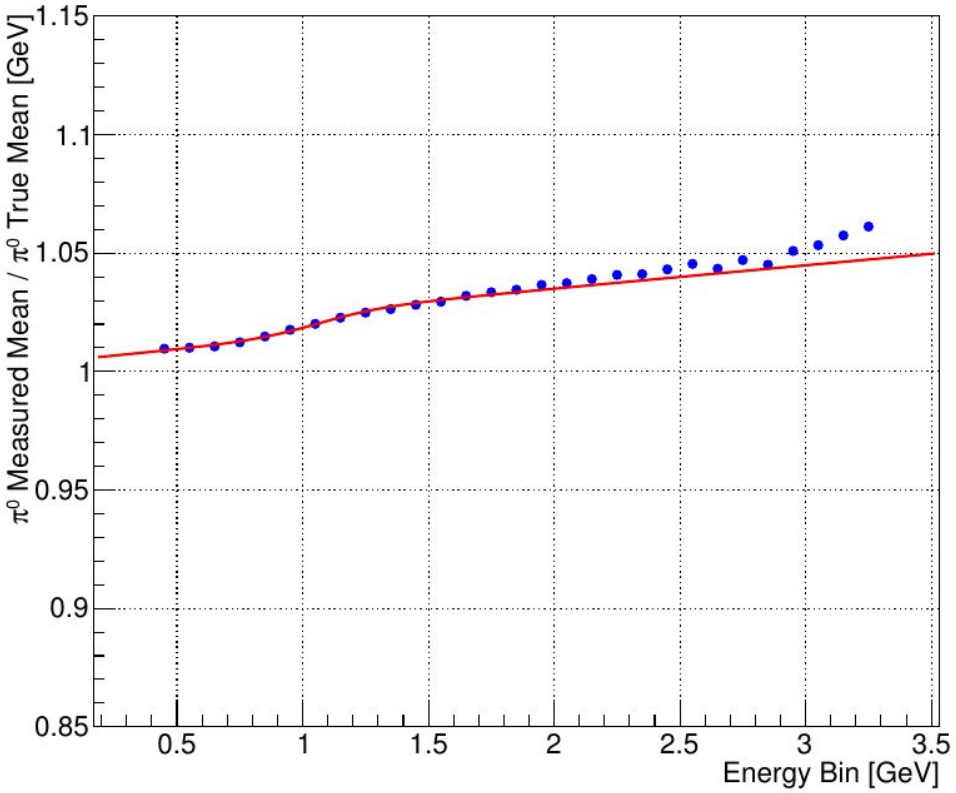
Plot after Empirical correction



Calibration with SiPM Correction

- SiPM saturation corrections are applied in the reconstruction software and were implemented (refer DBCAL_hit).
- The Pixel/count is a constant (Elton_Saturation)with a nominal value of 0.478
- The calibration were done on the same runs that Tegan calibrated (40864 to 41102)
- We found that for a nominal value of Pixel/count = 0.478 we over correct for the non-linearity.
- A systematic study with varying Pixel/count were made.

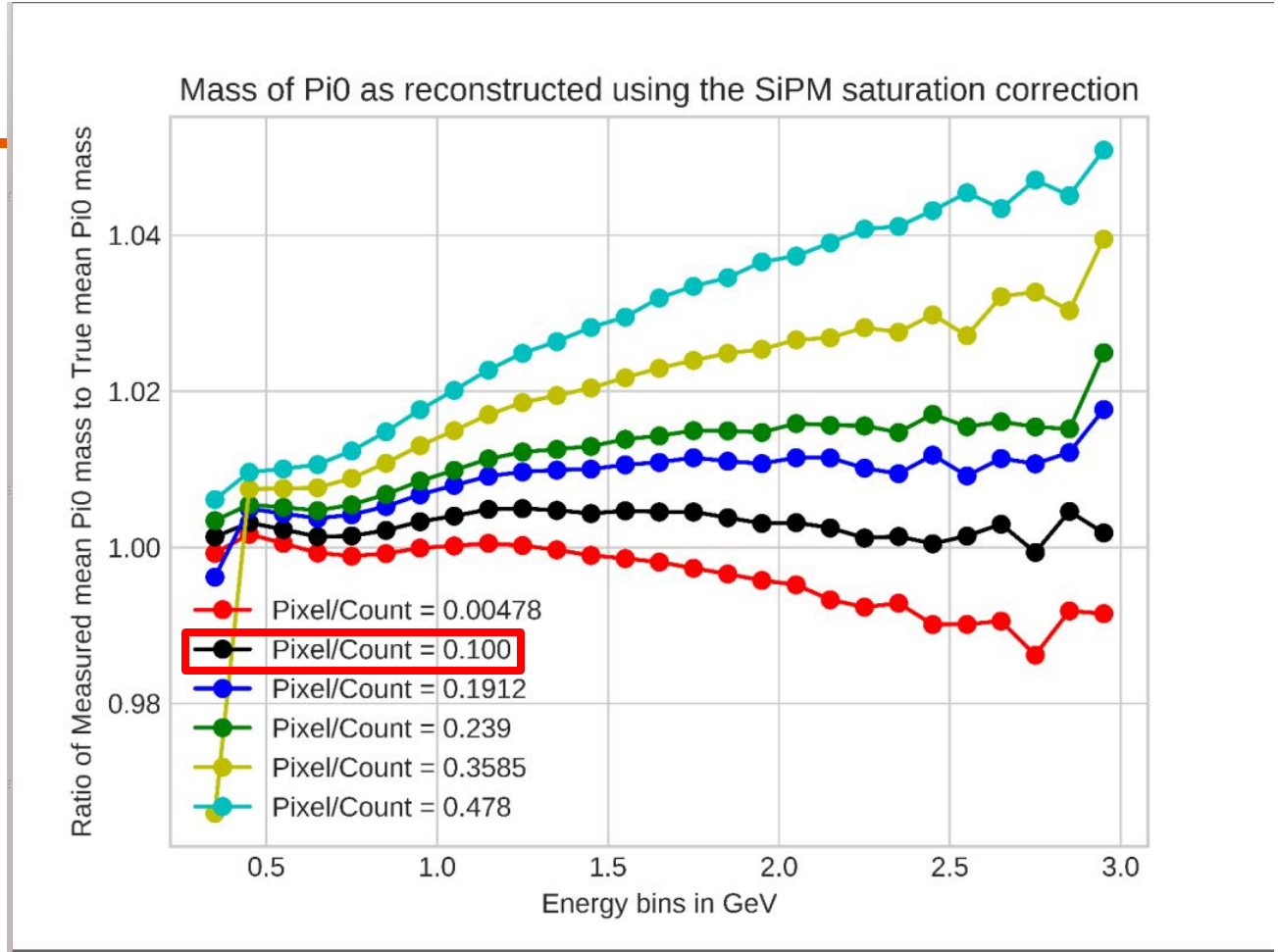
Calibration with SiPM's Pixel/Count = 0.478



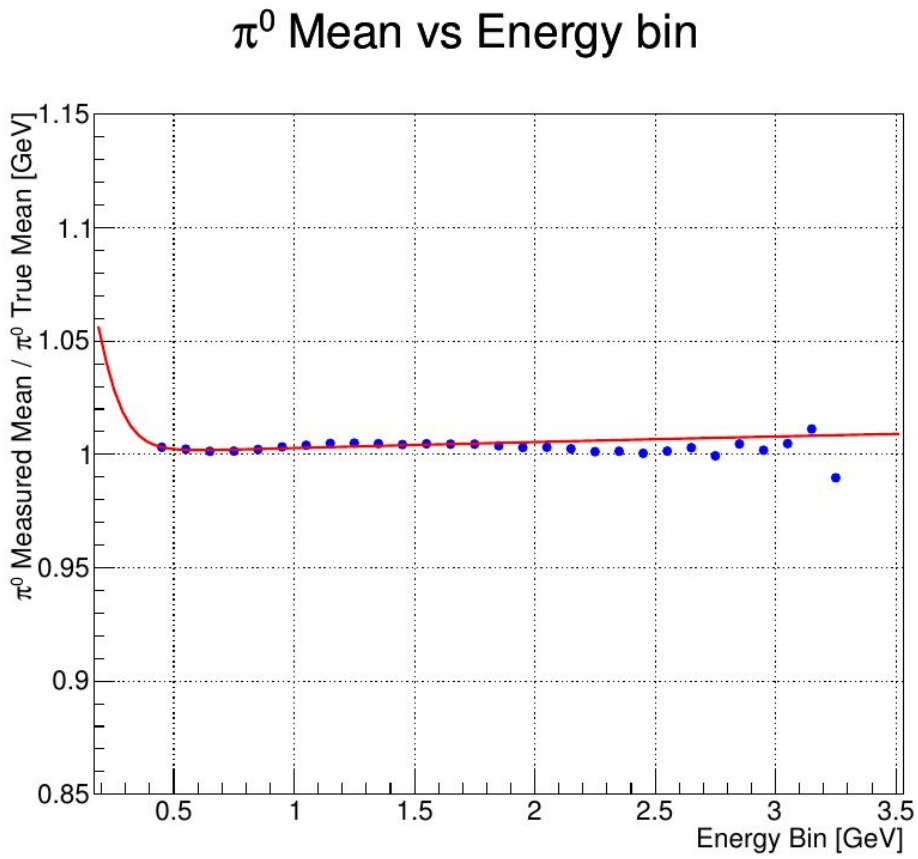
Continued

- Calibrations were done with varying Pixel/Count.
- All the calibrations were done for the runs 40864 to 41102
- Pixel/count varied from 0.00478 to 0.478 with a increase of 25% each time.
- We found that for a value of Pixel/count = 0.1 we almost obtain a linear calibration,
- Refer updates on SiPM saturation correction.

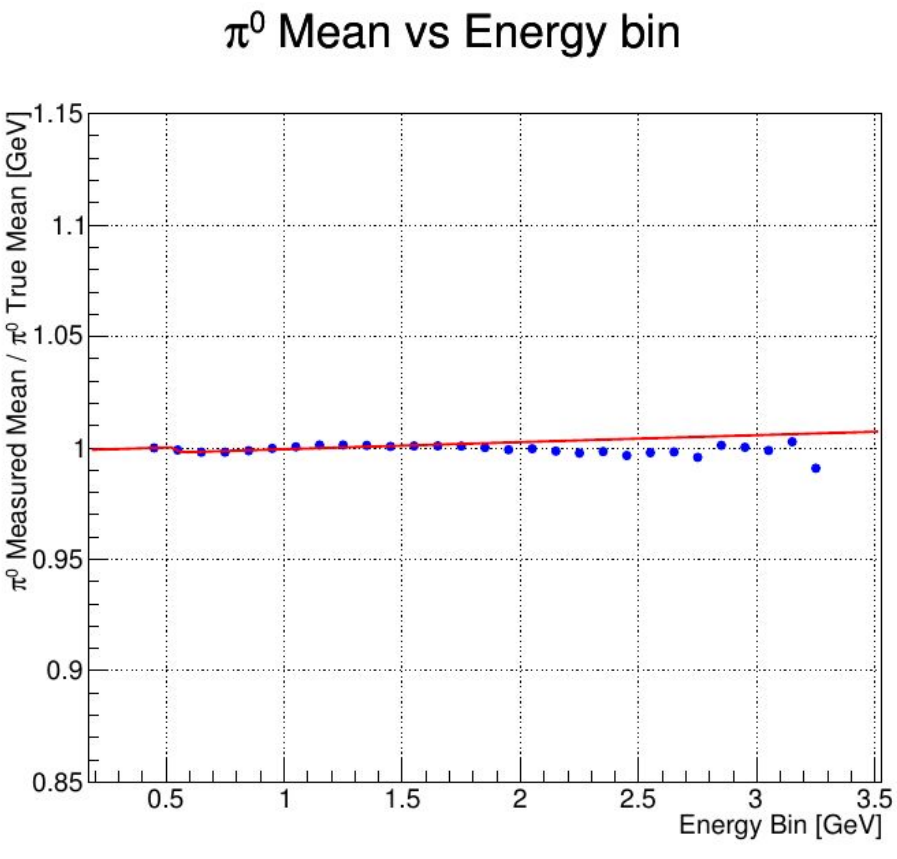
Calibrated energies with varying Pixel/count

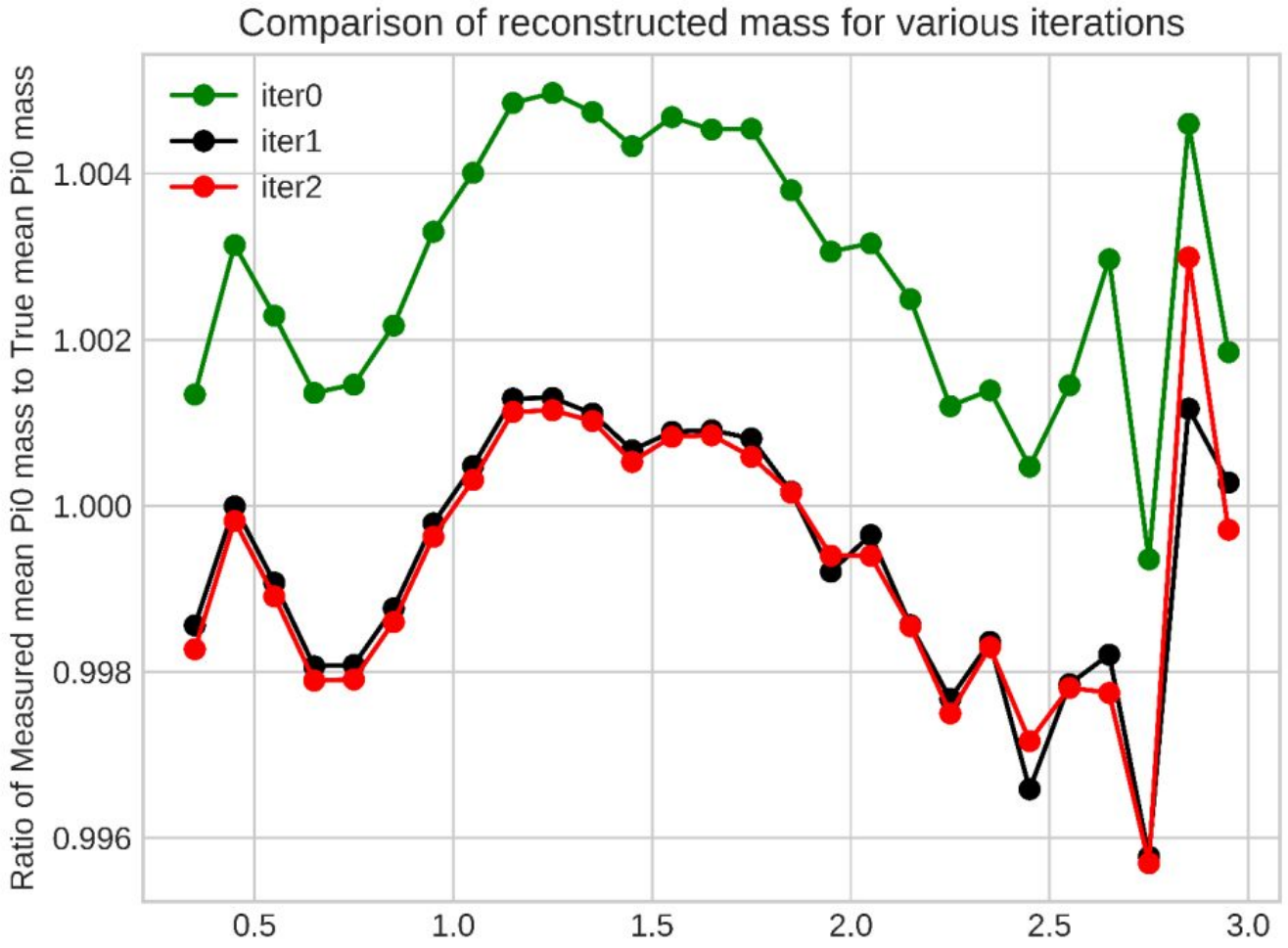


Iteration 0 with Pixel/Count = 0.1



Iteration 1 with Pixel/Count = 0.1




Comparison of reconstructed mass for various iterations
iter0
iter1
iter2
Ratio of Measured mean Pi0 mass to True mean Pi0 mass
1.004
1.002
1.000
0.998
0.996
0.5
1.0
1.5
2.0
2.5
3.0

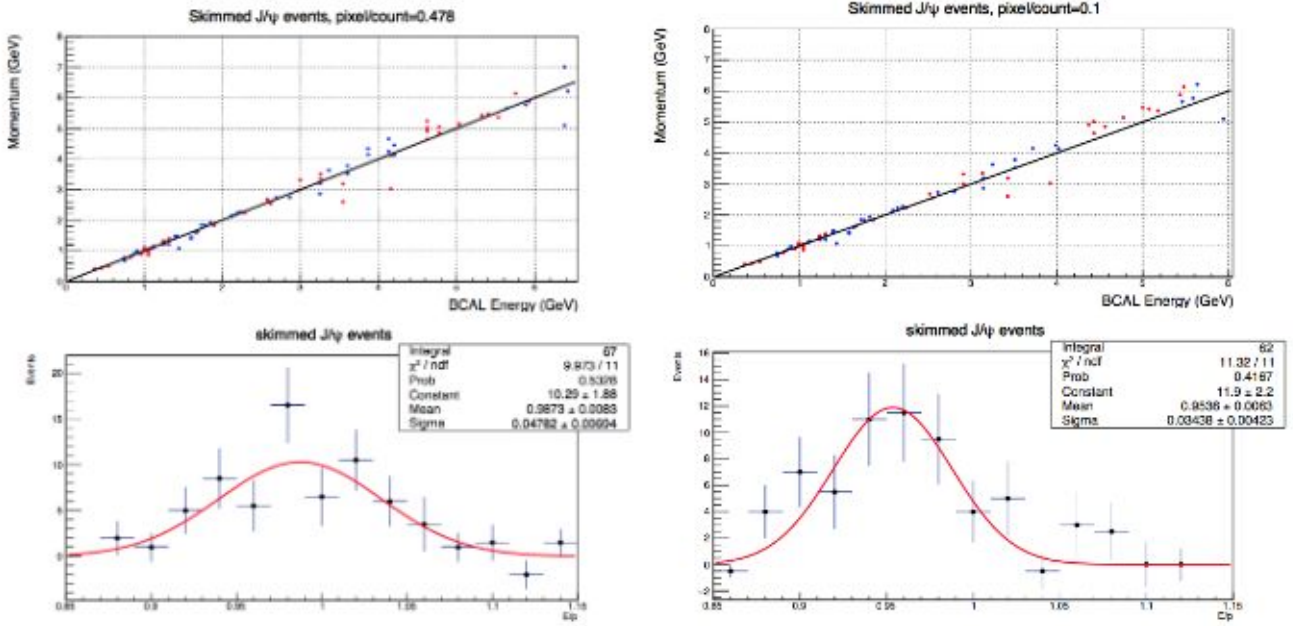
Calibrations with J/Psi

- Elton performed a calibration with Pixel/count =0.1 on the J/Psi events
- A similar calibration was done as a preliminary study before with pixel/count = 0.478 (refer Elton_Saturation)
- The study revealed that with a Pixel/count = 0.1, corrections for J/Psi were not efficient enough as for pixel/count = 0.478
- Refer Elton_summary

SiPM saturation correction J/ψ events

GlueX-doc-3737

https://logbooks.jlab.org/entry/3636995



Pixel/count=0.478, <E/p> = 0.99

Pixel/count=0.1, <E/p> = 0.95

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https://halldweb.jlab.org/DocDB/0038/003841/001/BCAL_gain_calib.pdf

- We are still figuring out the discrepancy on Pixel/count.
- Generating more J/Psi events for better statistical analysis
- However, We can use this model for the calibration (refer Analysis meeting)
- Currently checking the calibrations for the other runs during the spring 2018.
- References
  - Analysis meeting
  - Elton_summary
  - Elton_Saturation
  - SiPM saturation correction
  - DBCAL_hit