Analysis of calorimeter data in TB2020

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Goal:

Analysis of signal distribution and their longitudinal and transvers position in LumiCal

Requirements:

- Run: # 74
- No FLAME (LumiCal takes 1-8 layers)
- 5 GeV beam
- Beam position 10th pad area
- LumiCal tilted at 2 degrees

Current TODOs:

- Get acquainted with calorimeter data and check for bugs, etc

Signal selection

$S(t) = A \frac{t-t_0}{\tau} e^{-\frac{t-t_0}{\tau}} \theta(t - t_0)$

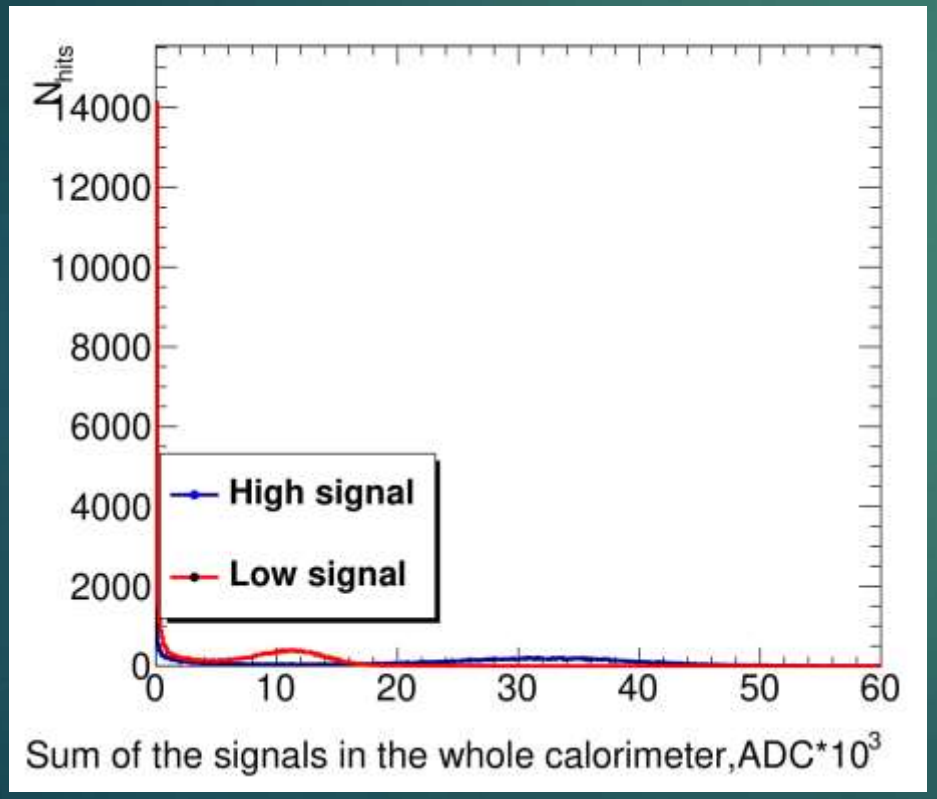
Signal selection:

1. $1 < \tau_{fit} < 3$
2. $S_{max} < 2000$ ADC
3. $t_{1,bin} - 2{,}7 < t_{0,fit} < t_{1,bin} - 0{,}5$
4. $NN_{output} > 0{,}5$

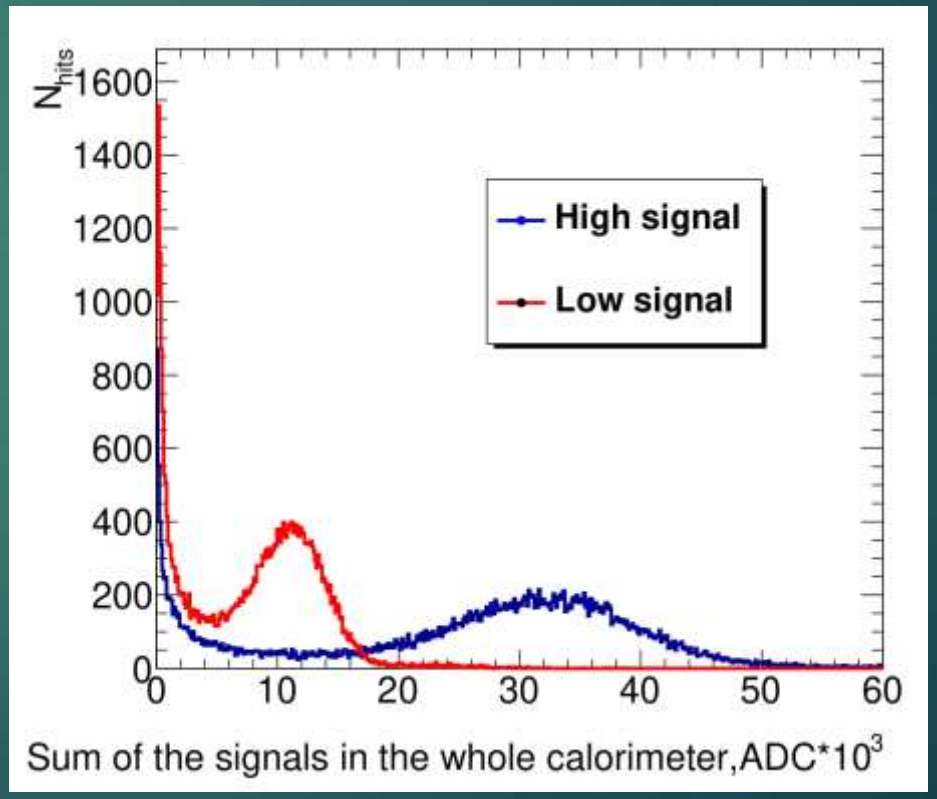
Signal in calorimeter

Number of empty events for the whole calorimeter for High gain: 18,77% and Low gain: 25,89%

With empty events



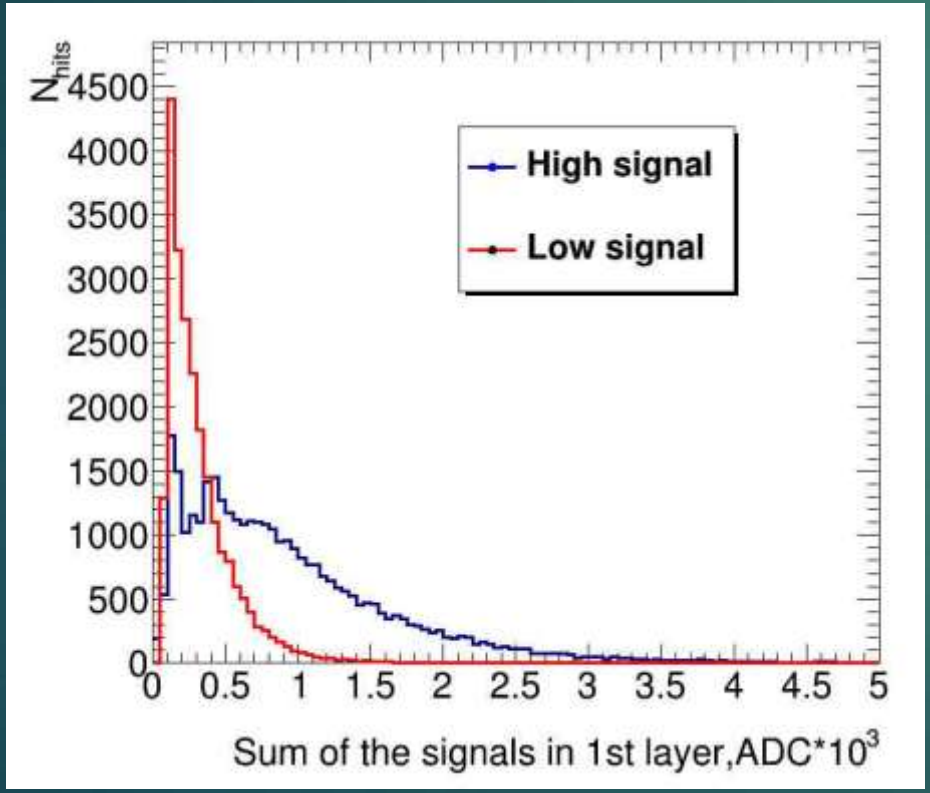
Without empty events



Signal in each layer and number of empty events

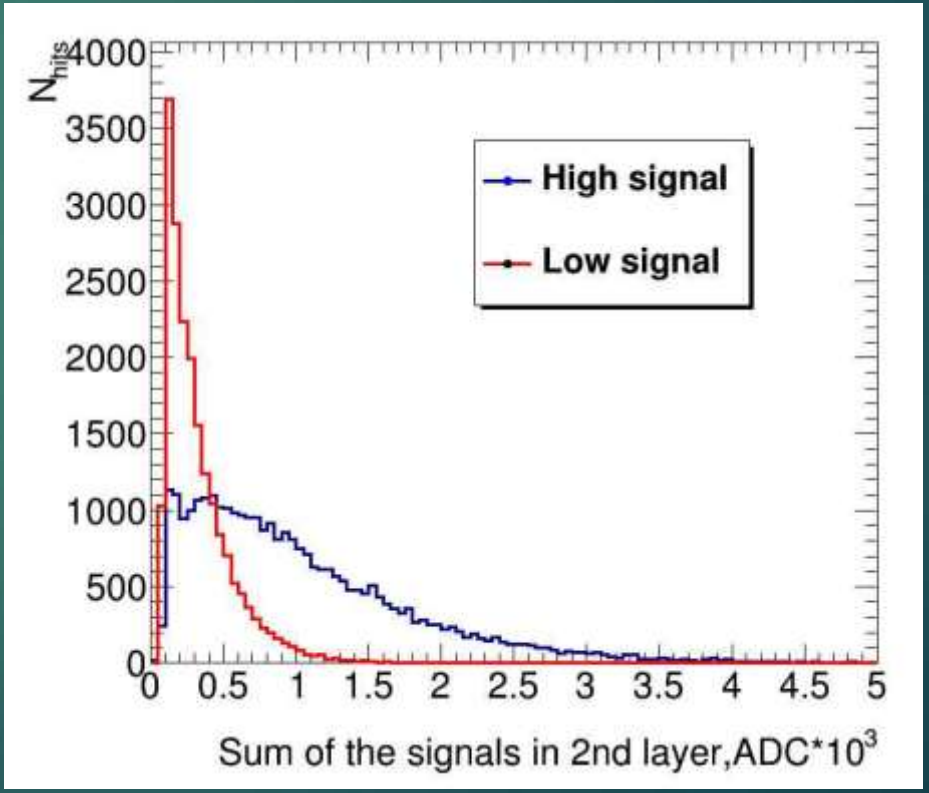
High gain = 31,66%

Low gain = 54,59%



High gain = 39,17%

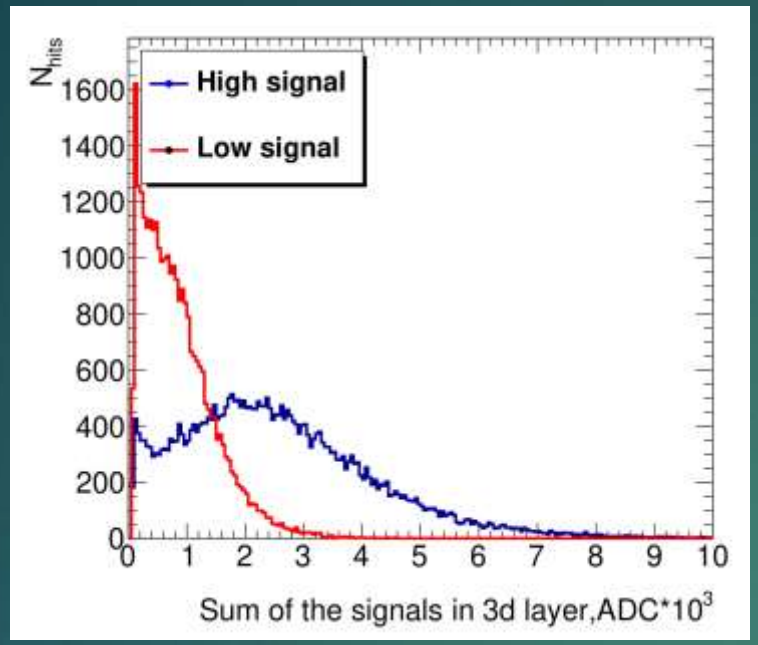
Low gain = 60,26%

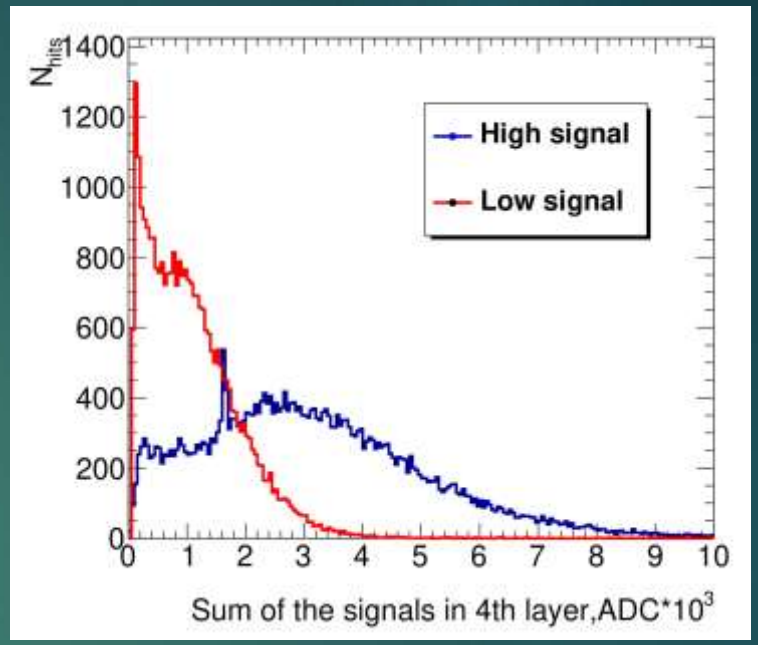


ATTENTION! All plots have been drawn without empty events.

High gain = 27,16%

Low gain = 41,46%



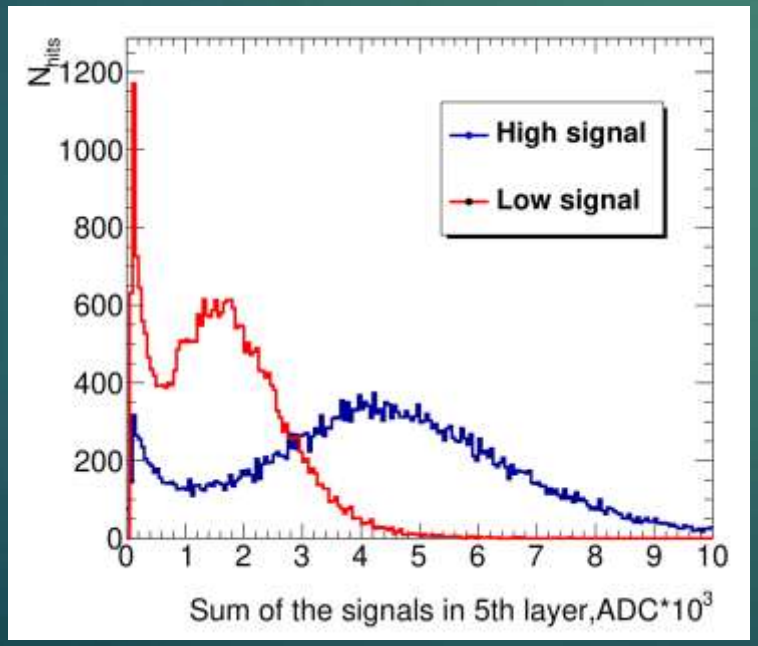


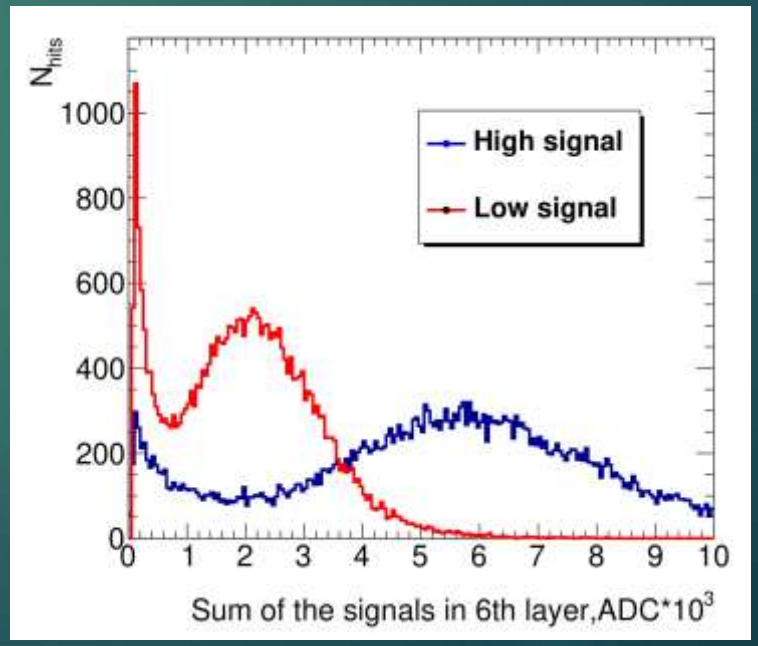
High gain = 27,16%

Low gain = 40,94%

High gain = 27,39%

Low gain = 37,91%



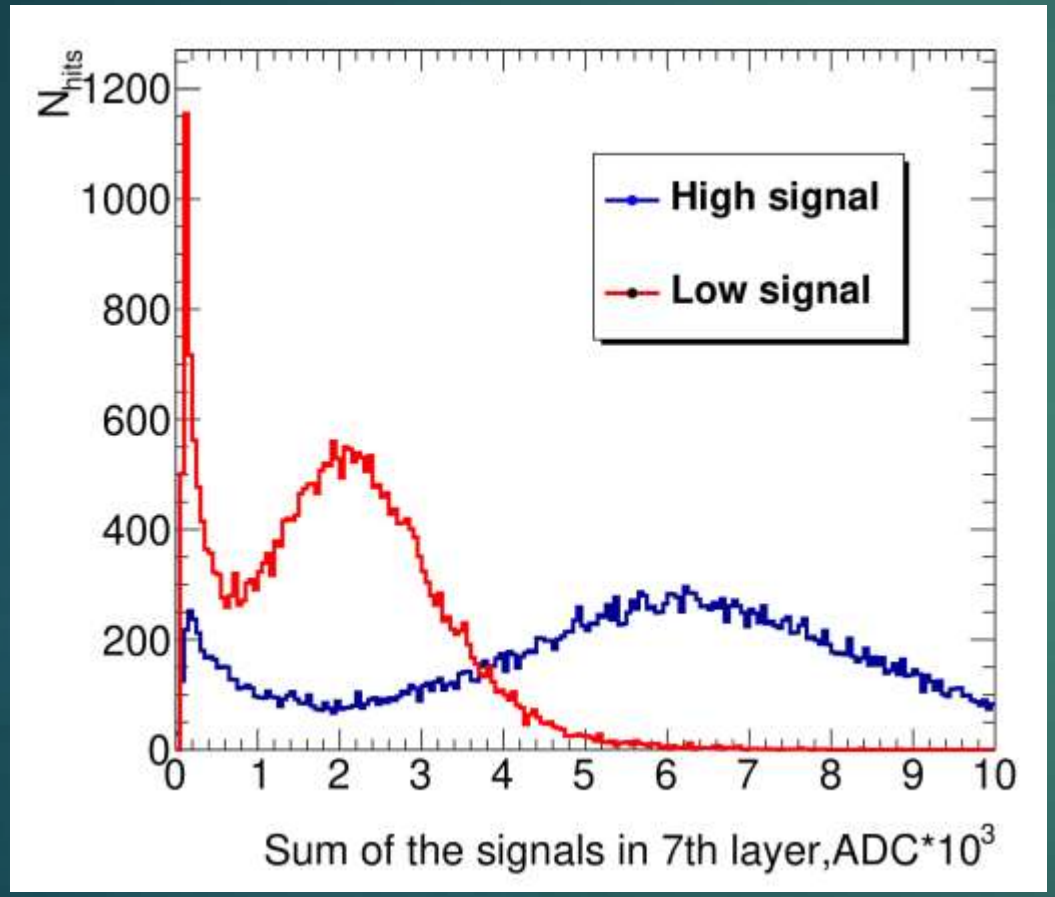


High gain = 27,26%

Low gain = 37,64%

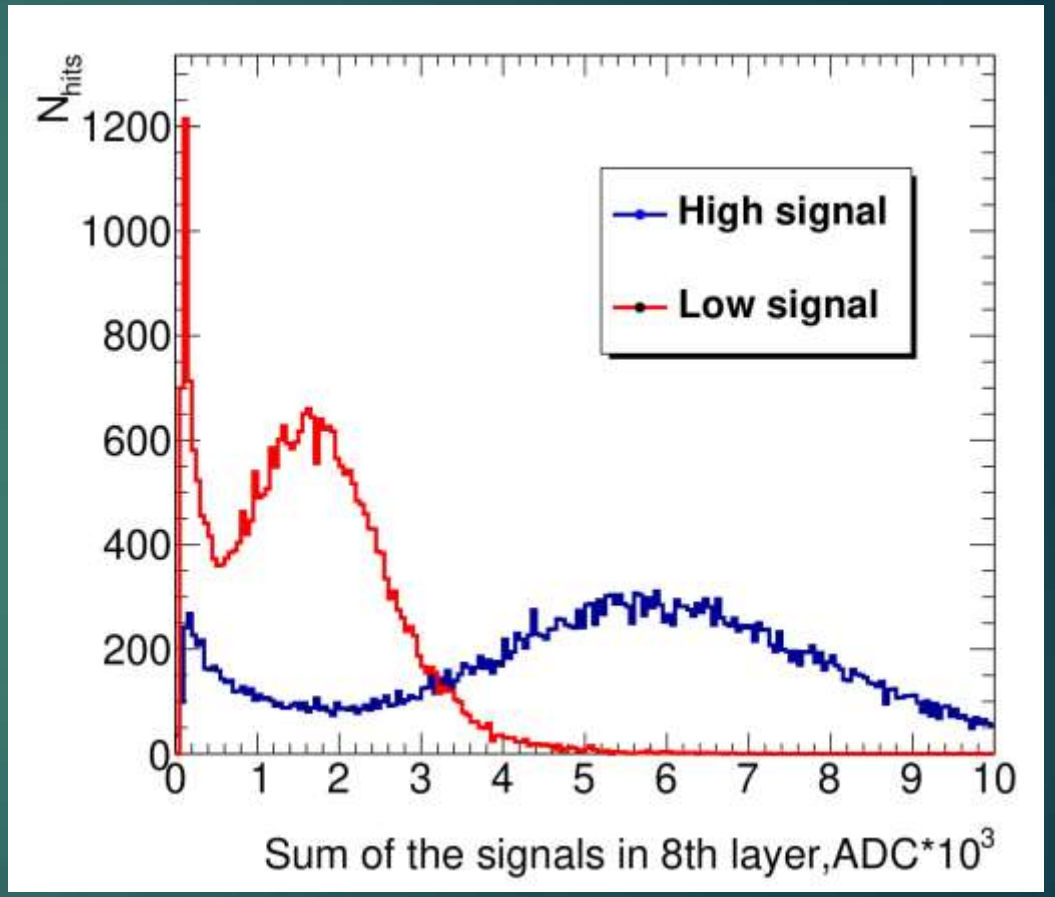
High gain = 28,39%

Low gain = 37,95%



High gain = 29,30%

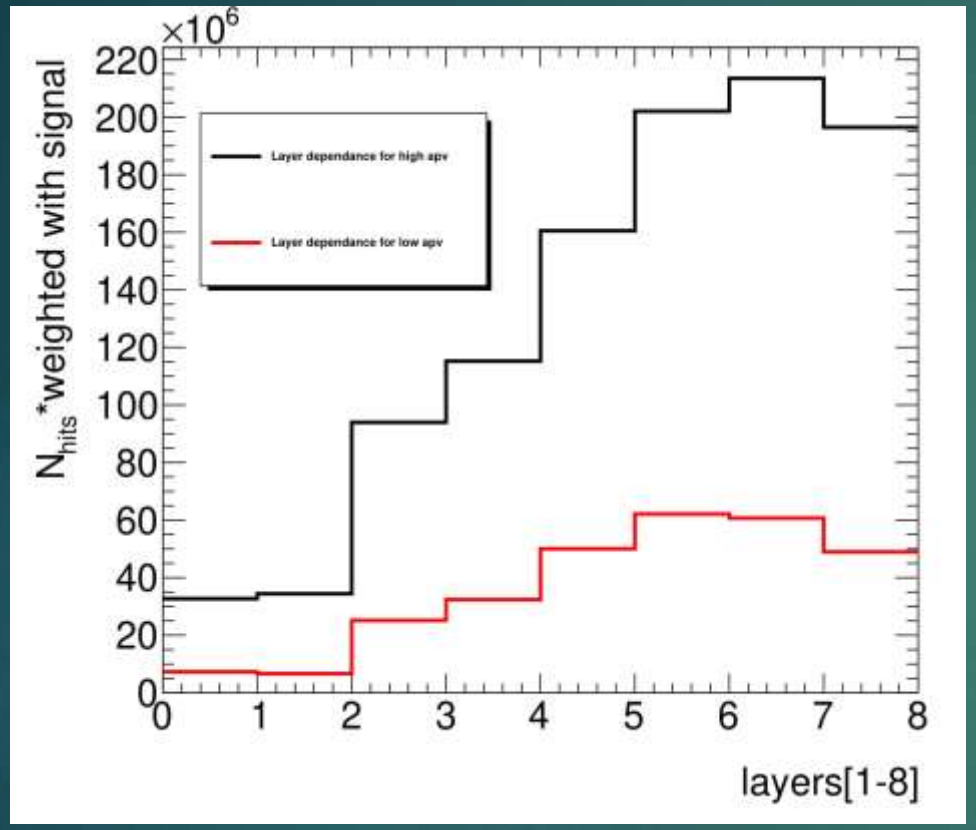
Low gain = 38,24%

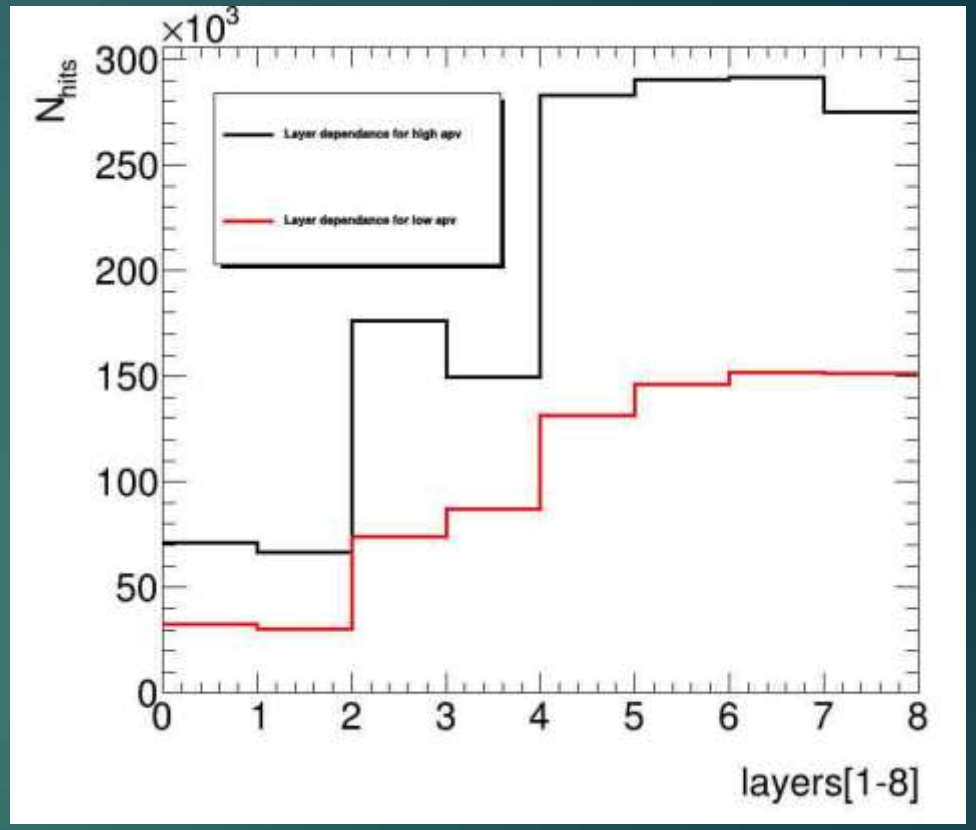


Number of empty events

Layer	Low gain	High gain
1	54,59 %	31,66 %
2	60,26 %	39,17 %
3	41,16 %	27,16 %
4	40,94 %	27,16 %
5	37,91 %	27,39 %
6	37,64 %	27,26 %
7	37,95 %	28,39 %
8	38,24 %	29,30 %
Whole LumiCal	25,89 %	18,77 %

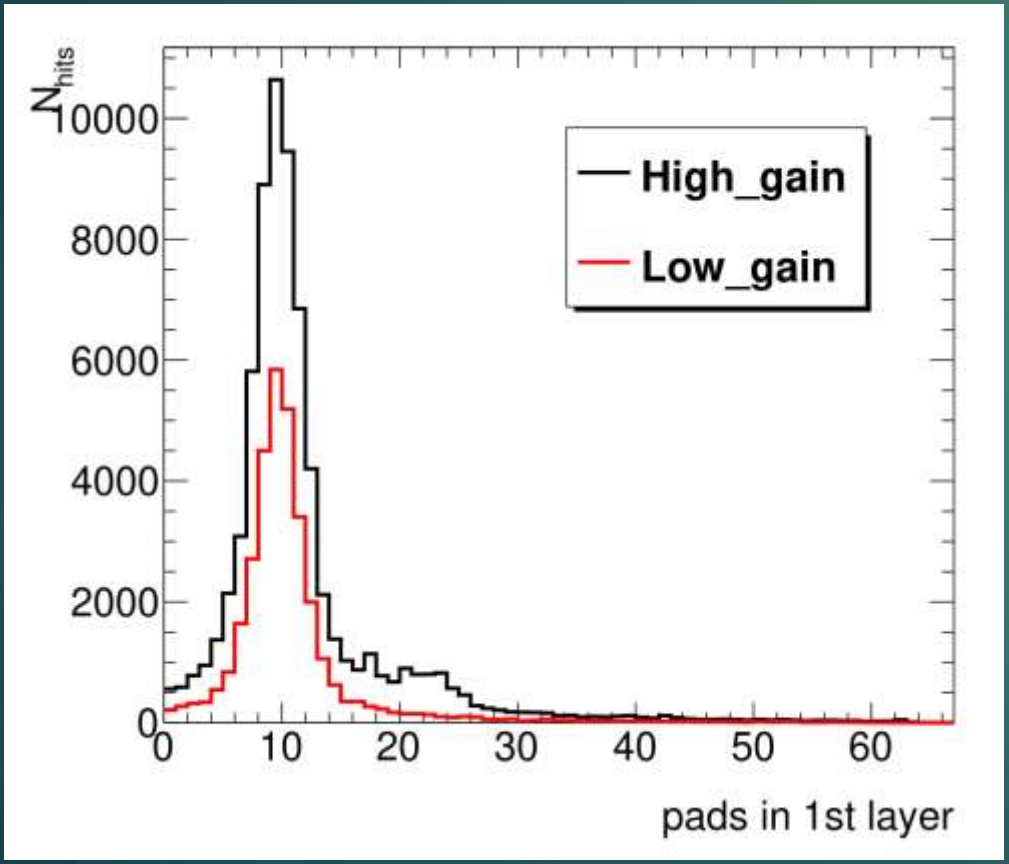
Signal in layers

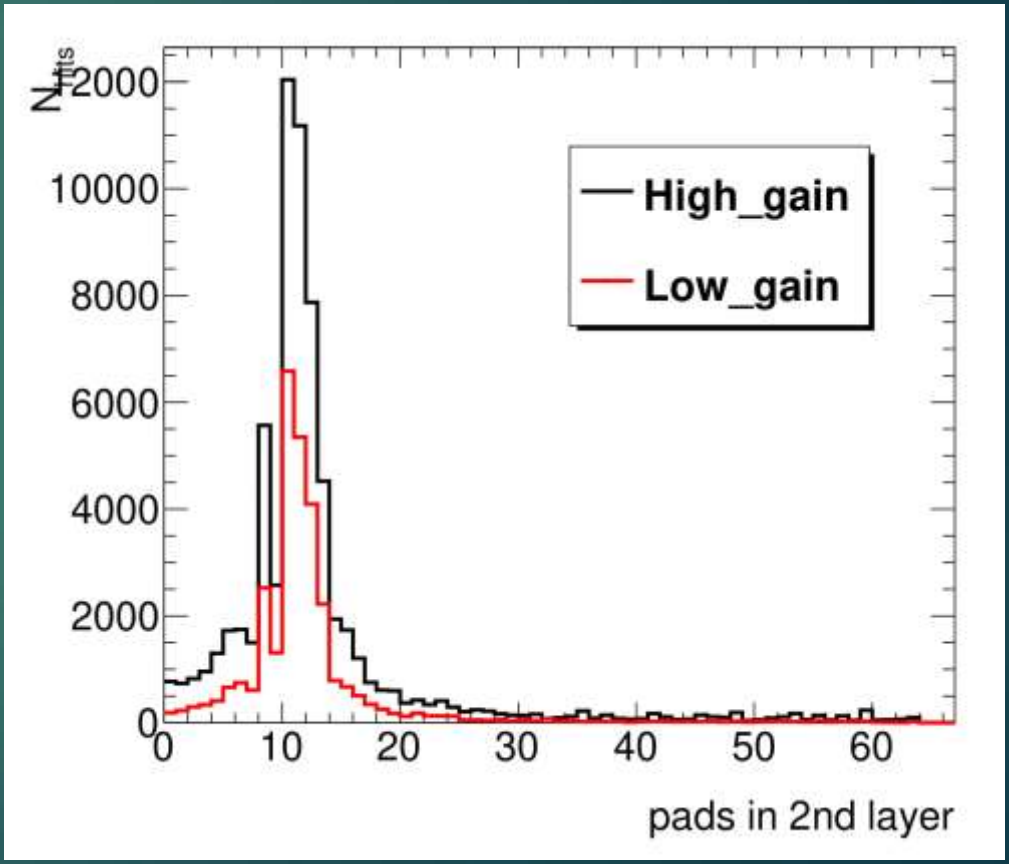


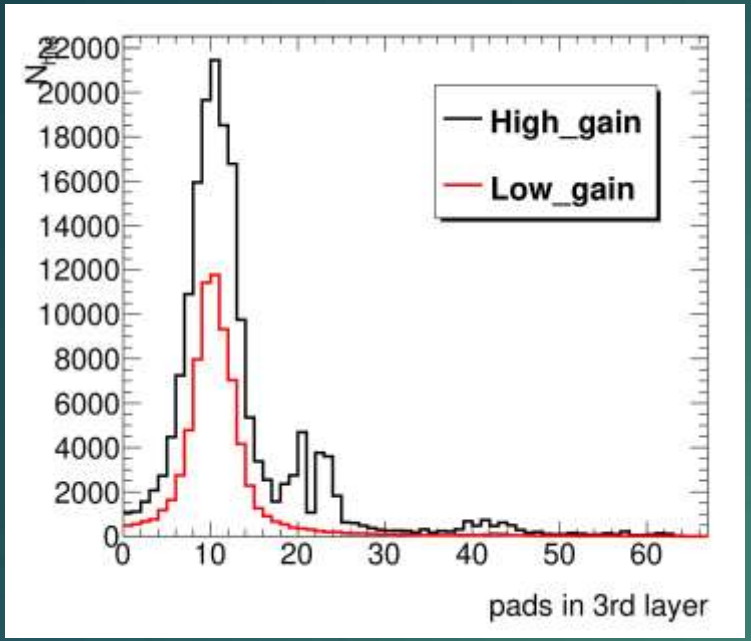


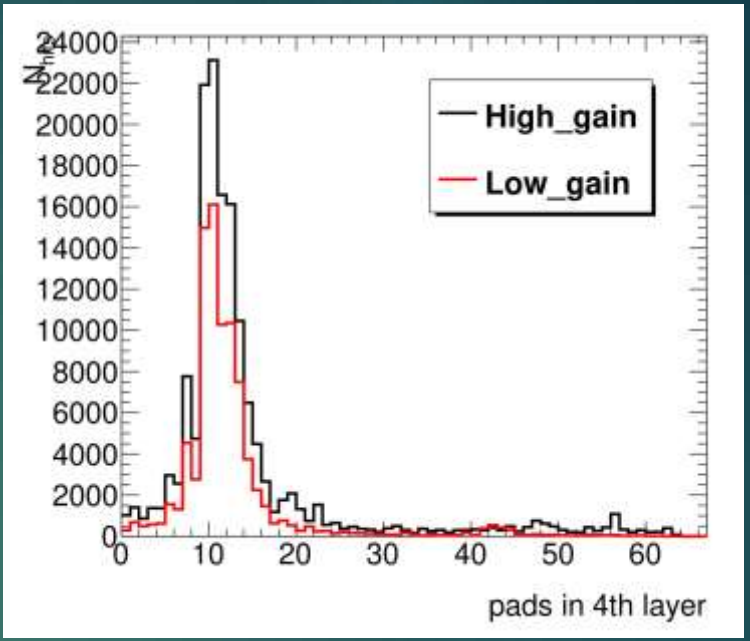
4th layer has dip but after weighting it with a signal this dip disappear

Compare High to Low gain signal in pads by layers

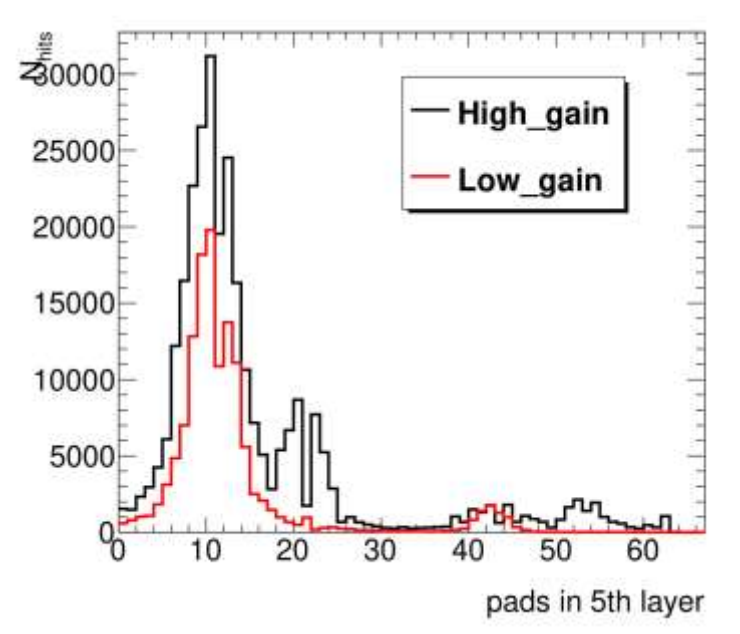


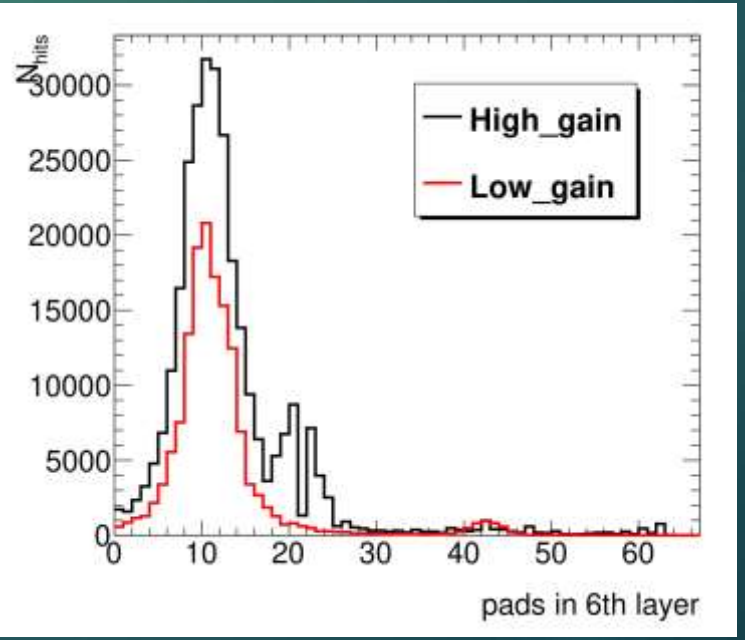


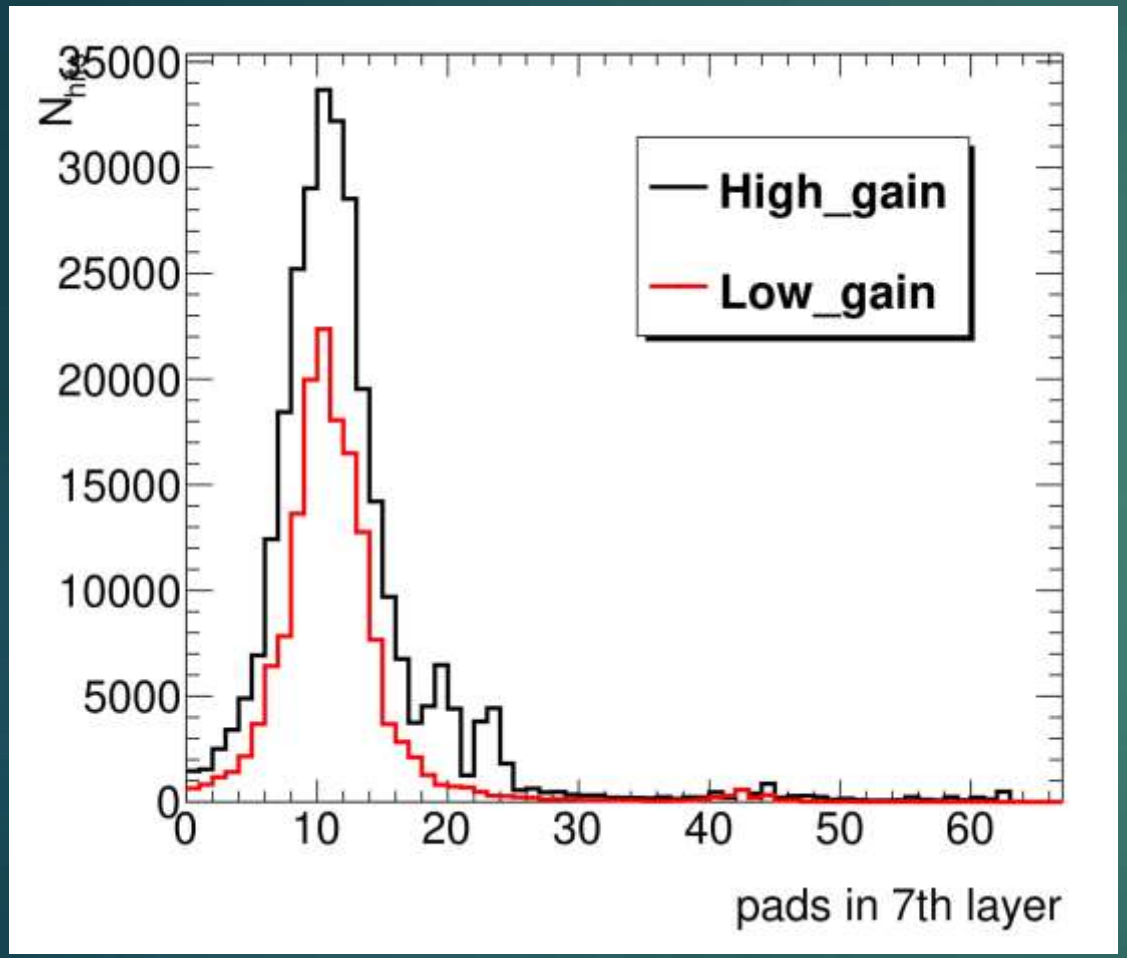


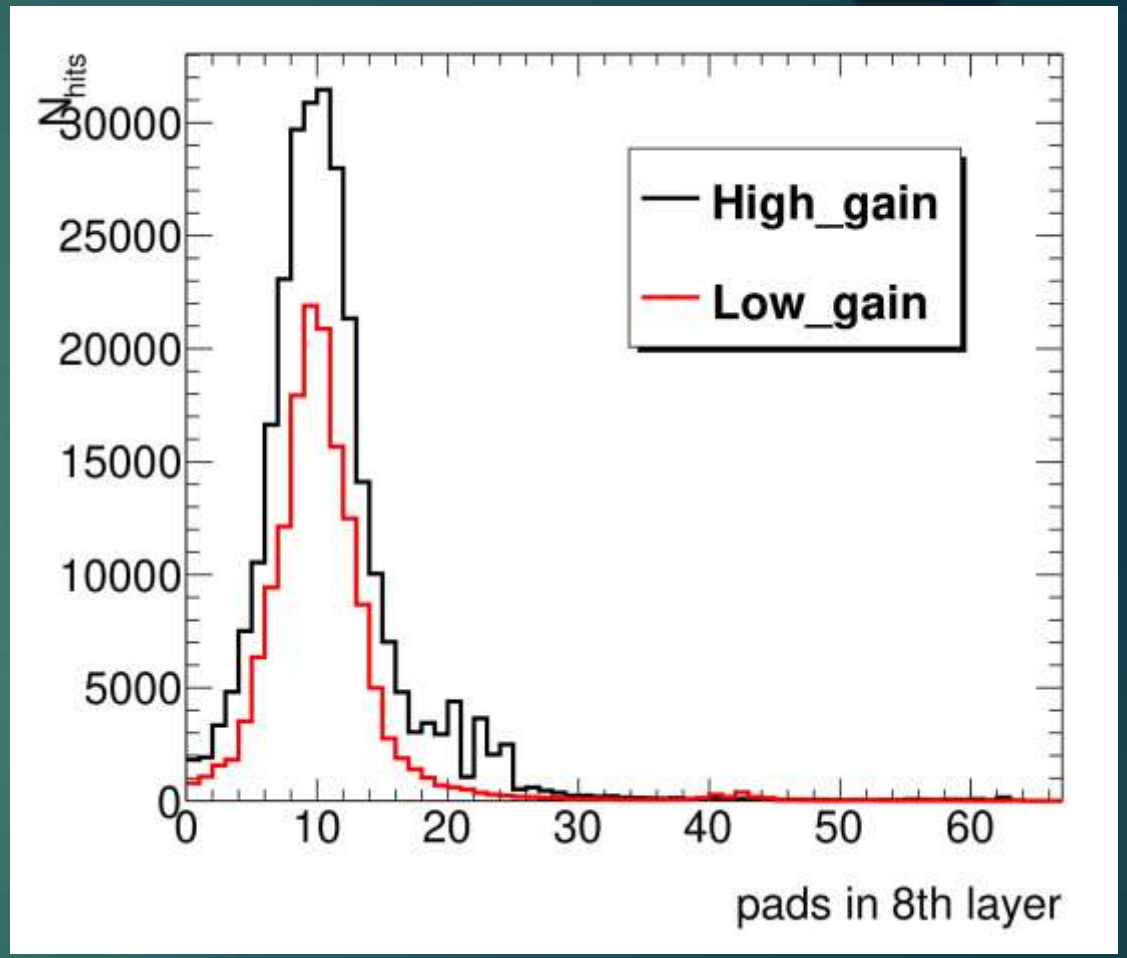


layers have peak near to 20th pad which is unknown and about 43rd it is probably cross-talk

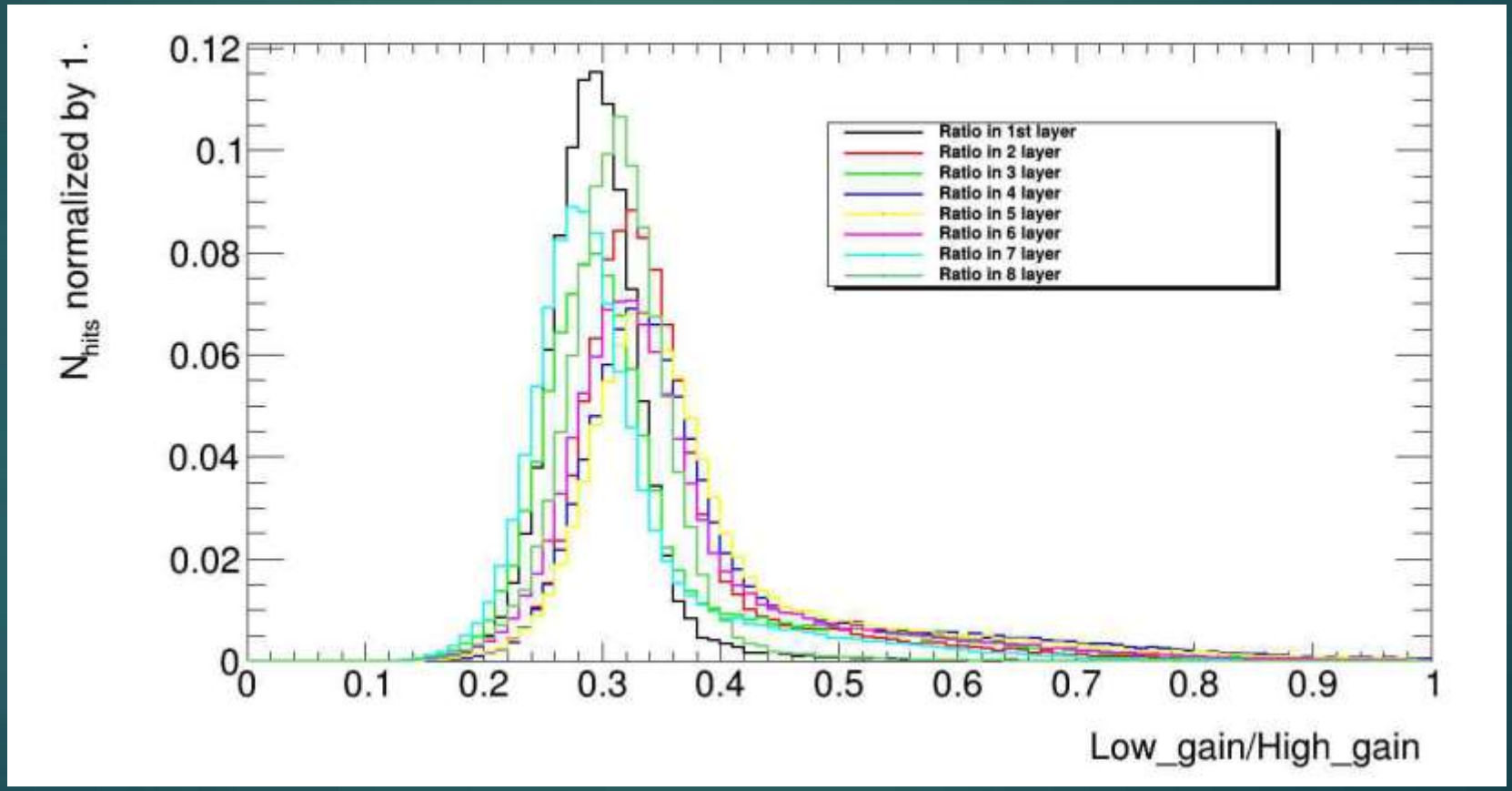





N_{hits}
35000
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60
High_gain
Low_gain
pads in 7th layer

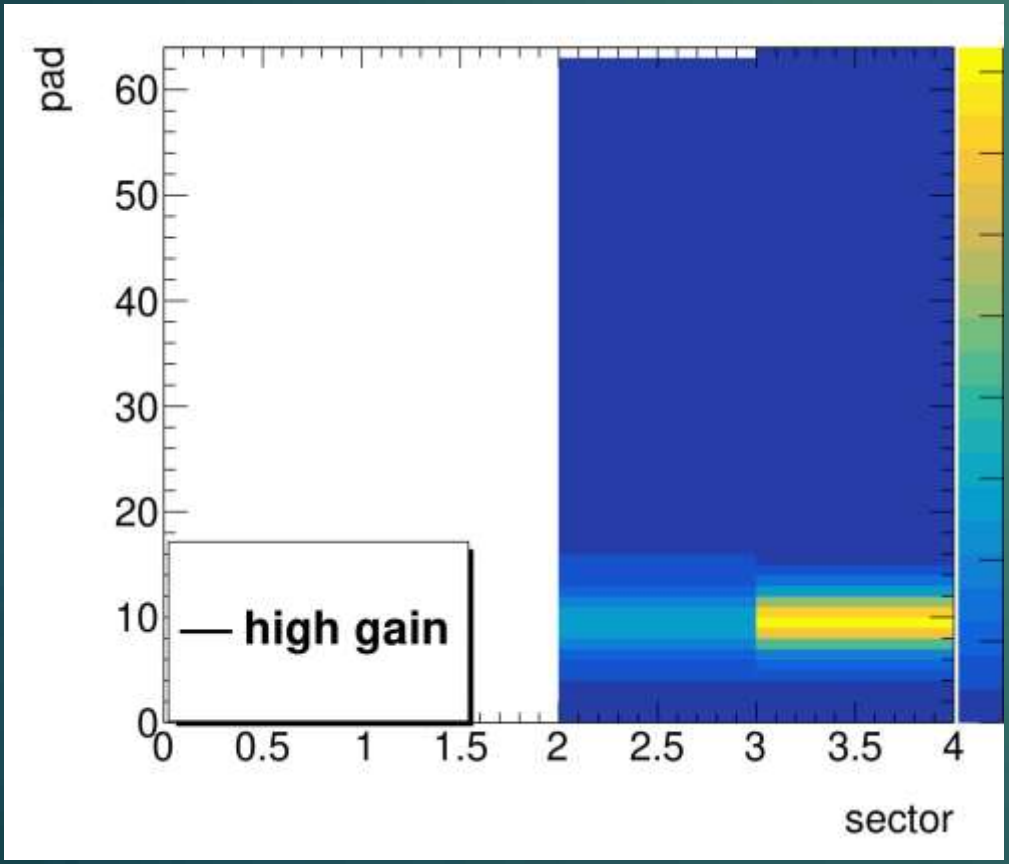

N_{hits}
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60
High_gain
Low_gain
pads in 8th layer

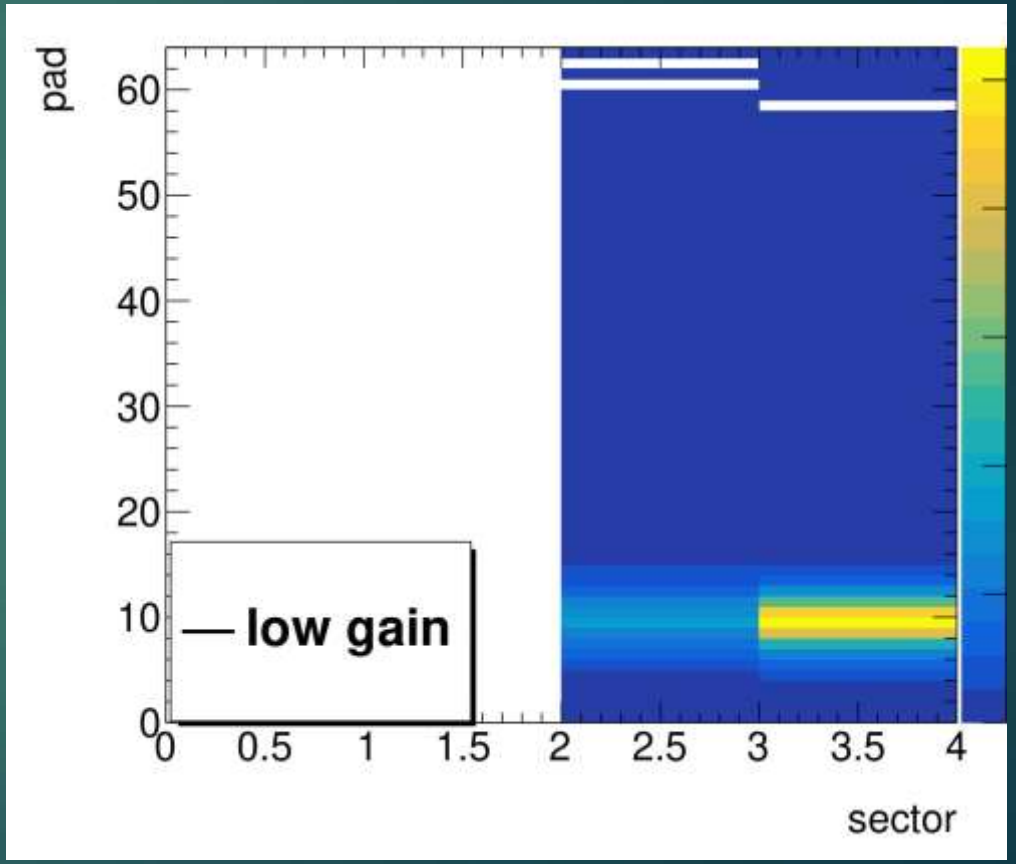
Ratio between low and high gain signals



Occupancy in layers

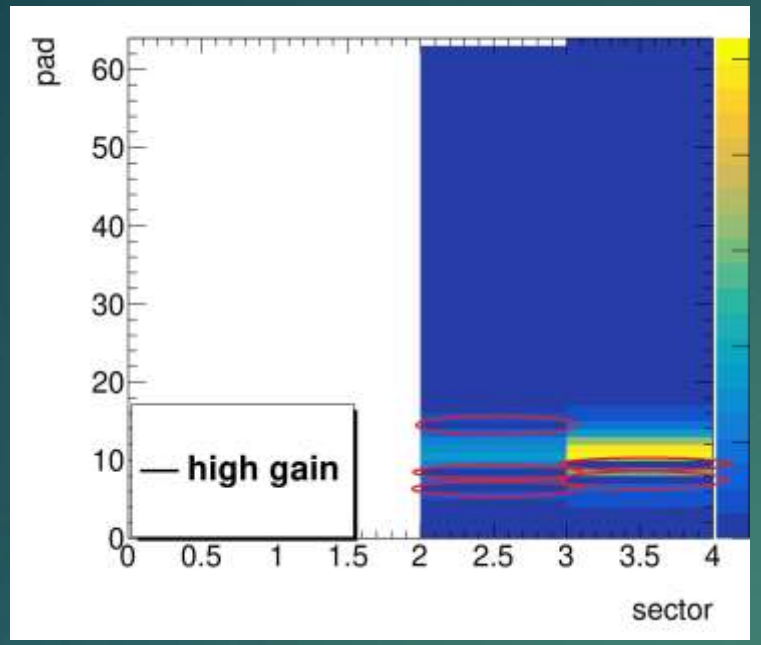
1st layer

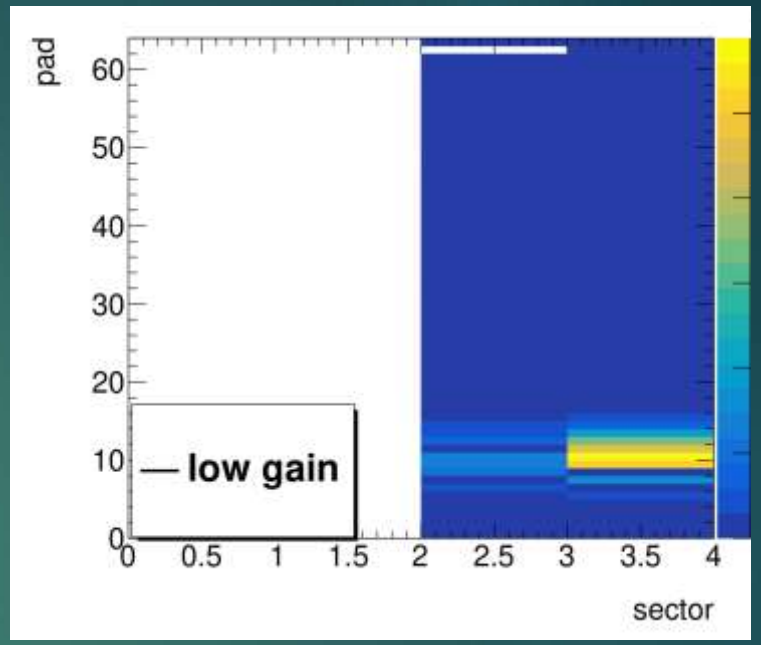




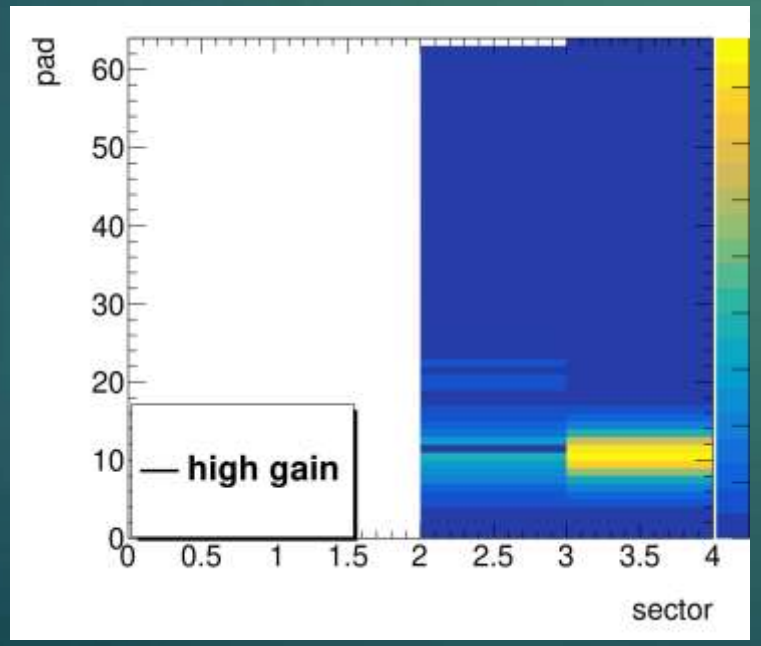
2nd layer

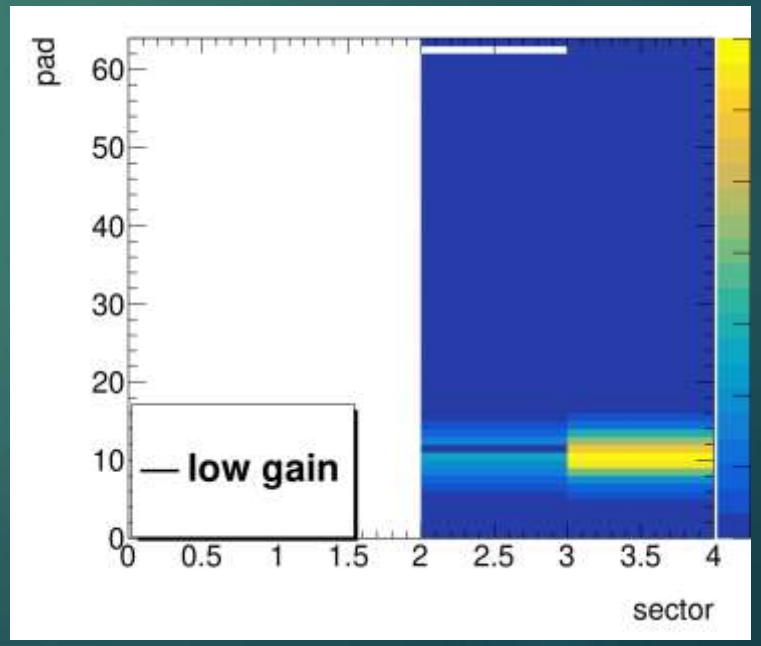
Dark blue pads are bad pads



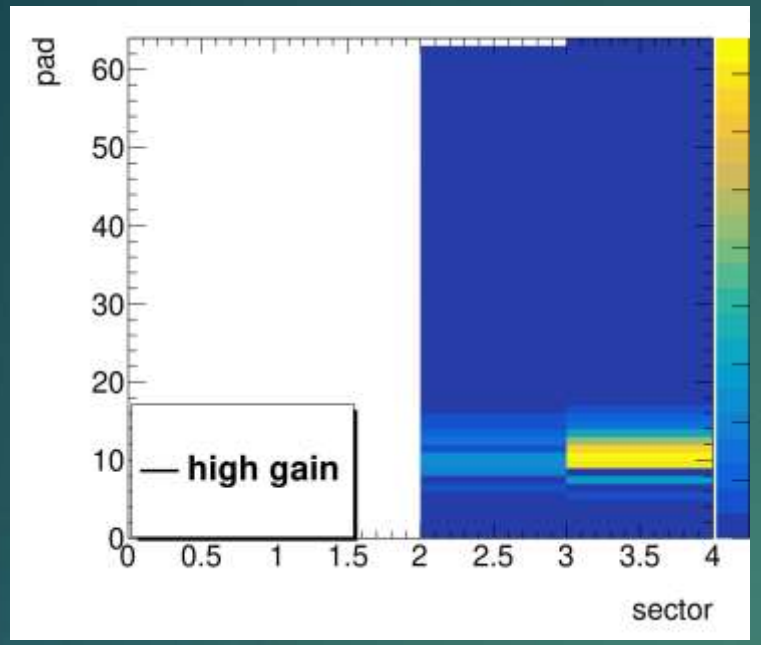


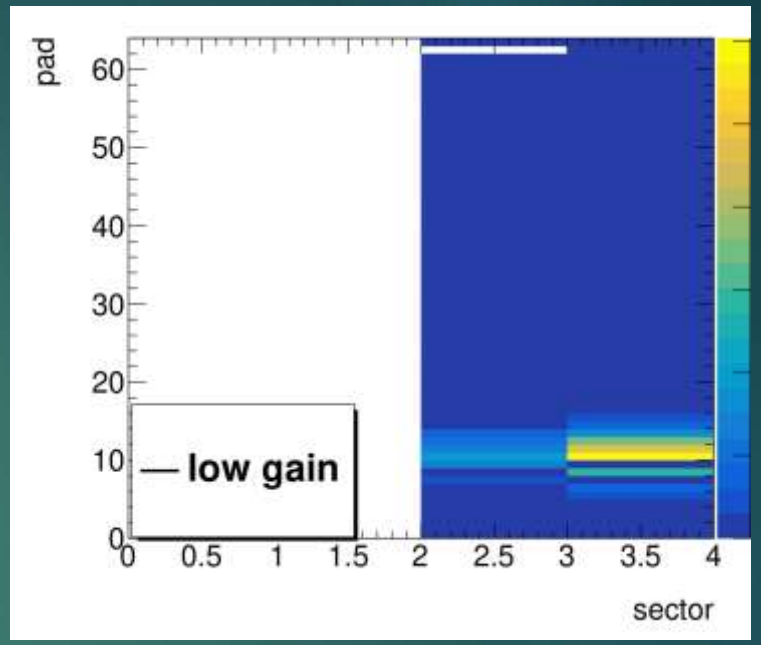
3rd layer



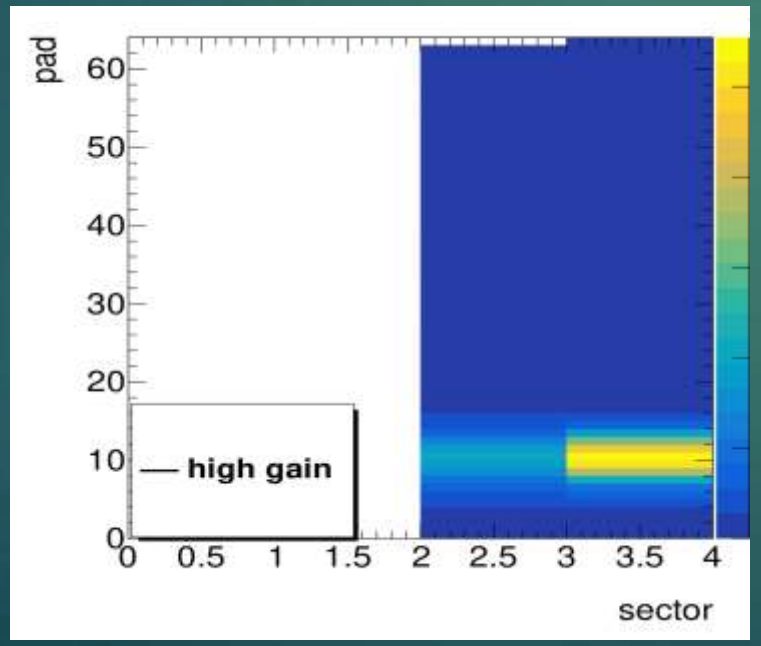


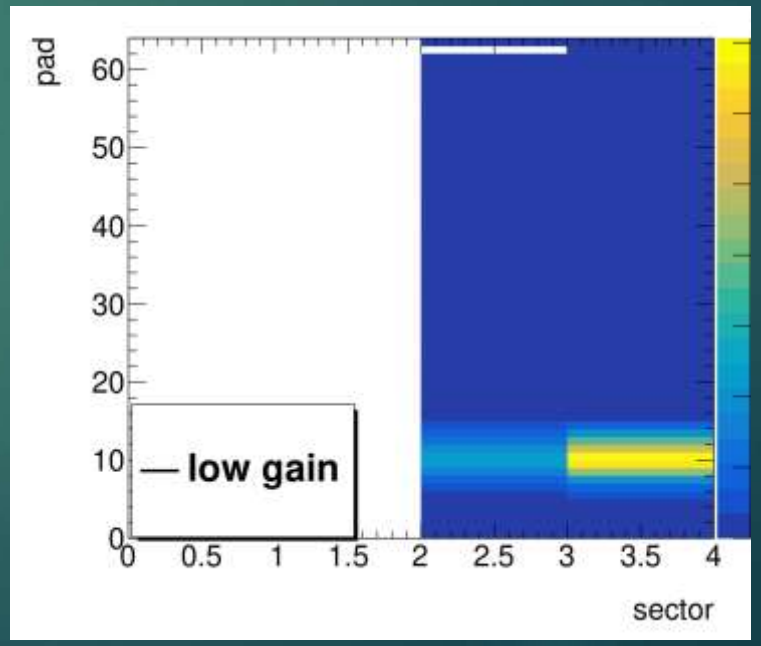
4th layer



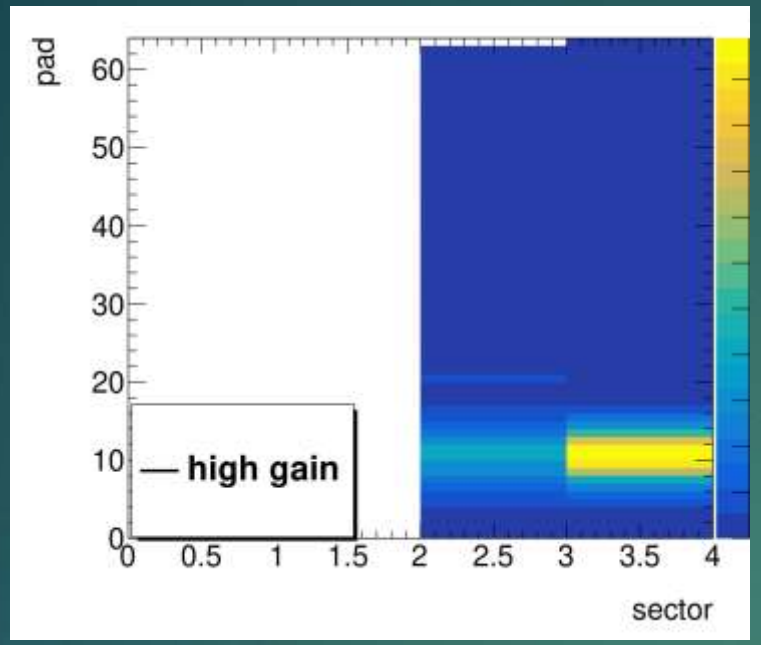


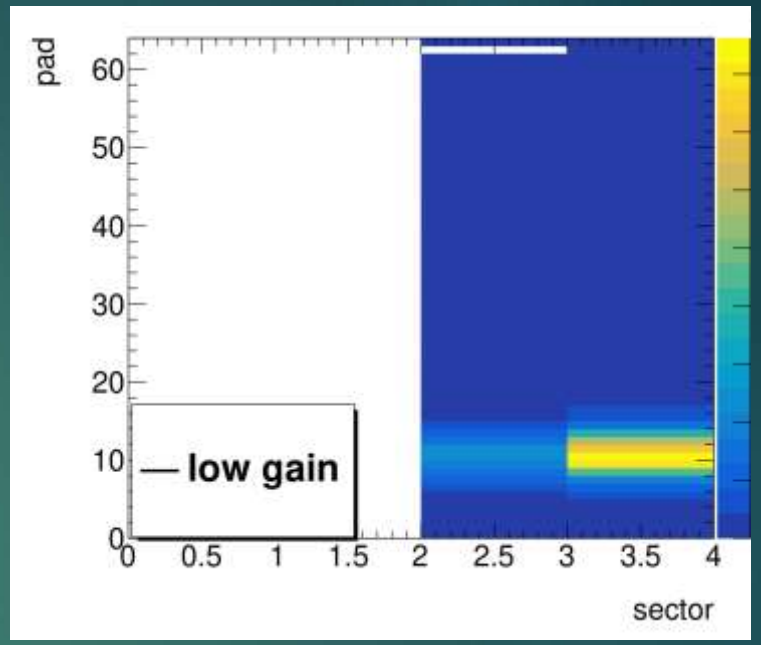
5th layer



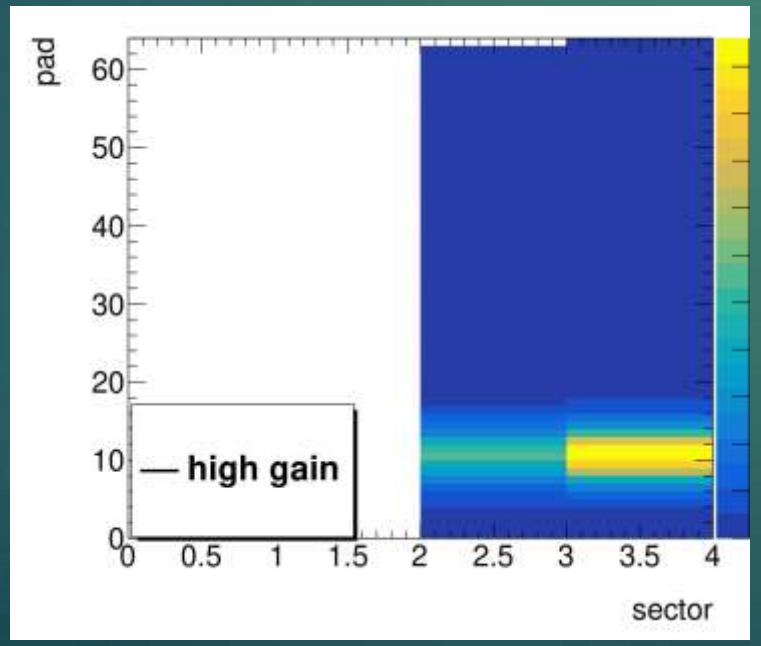


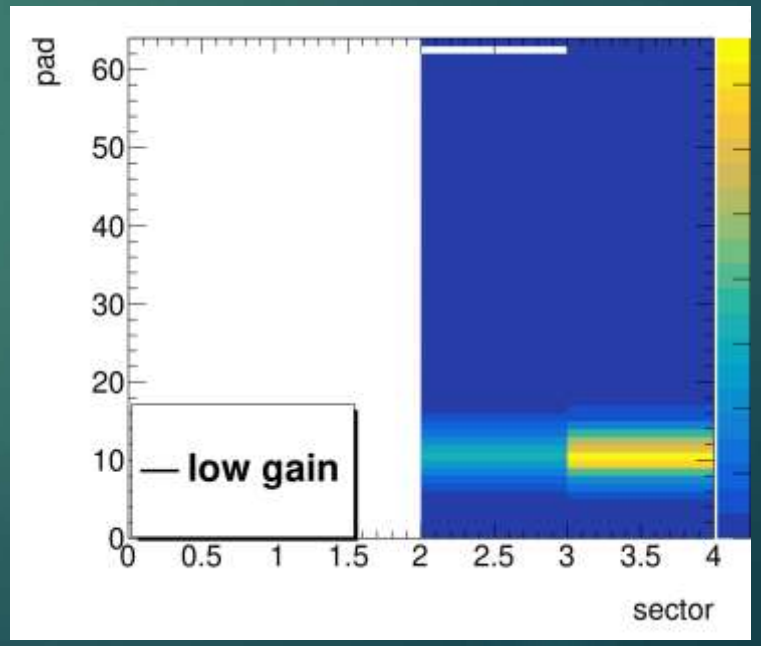
6th layer



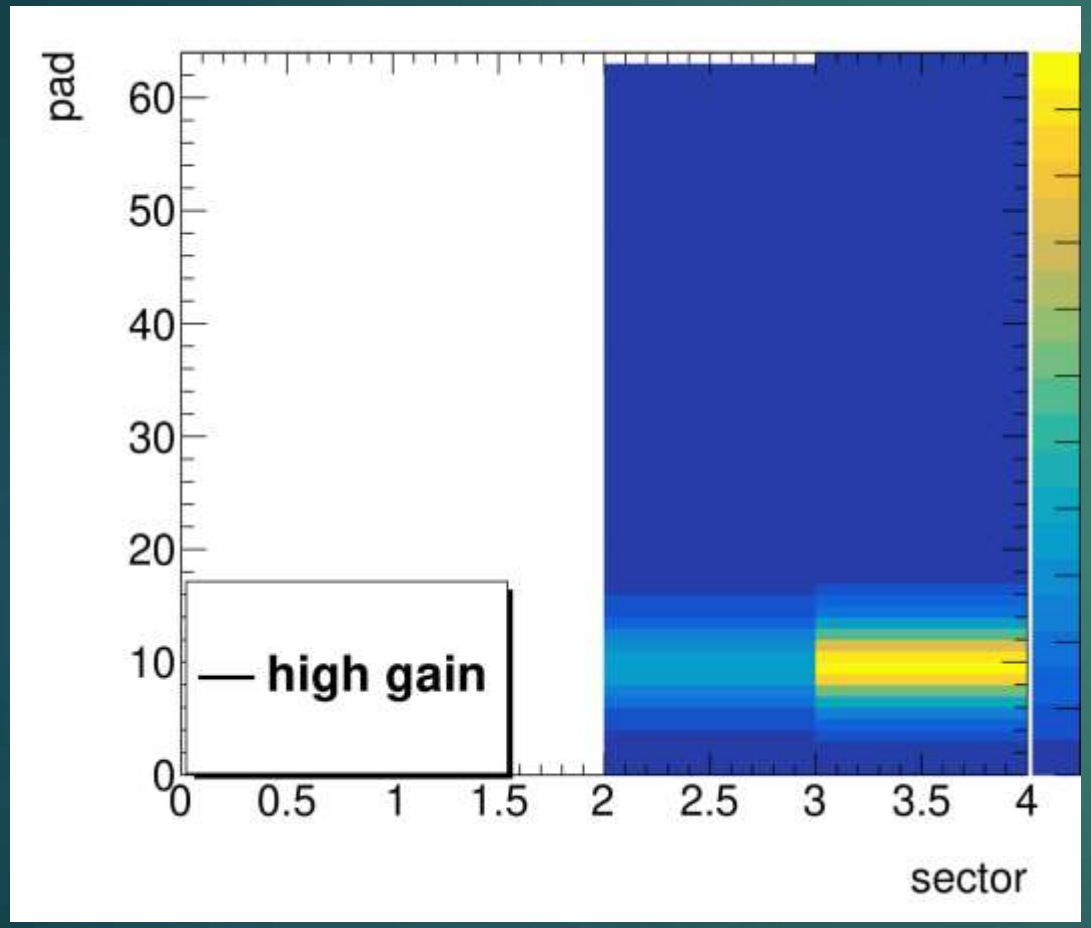


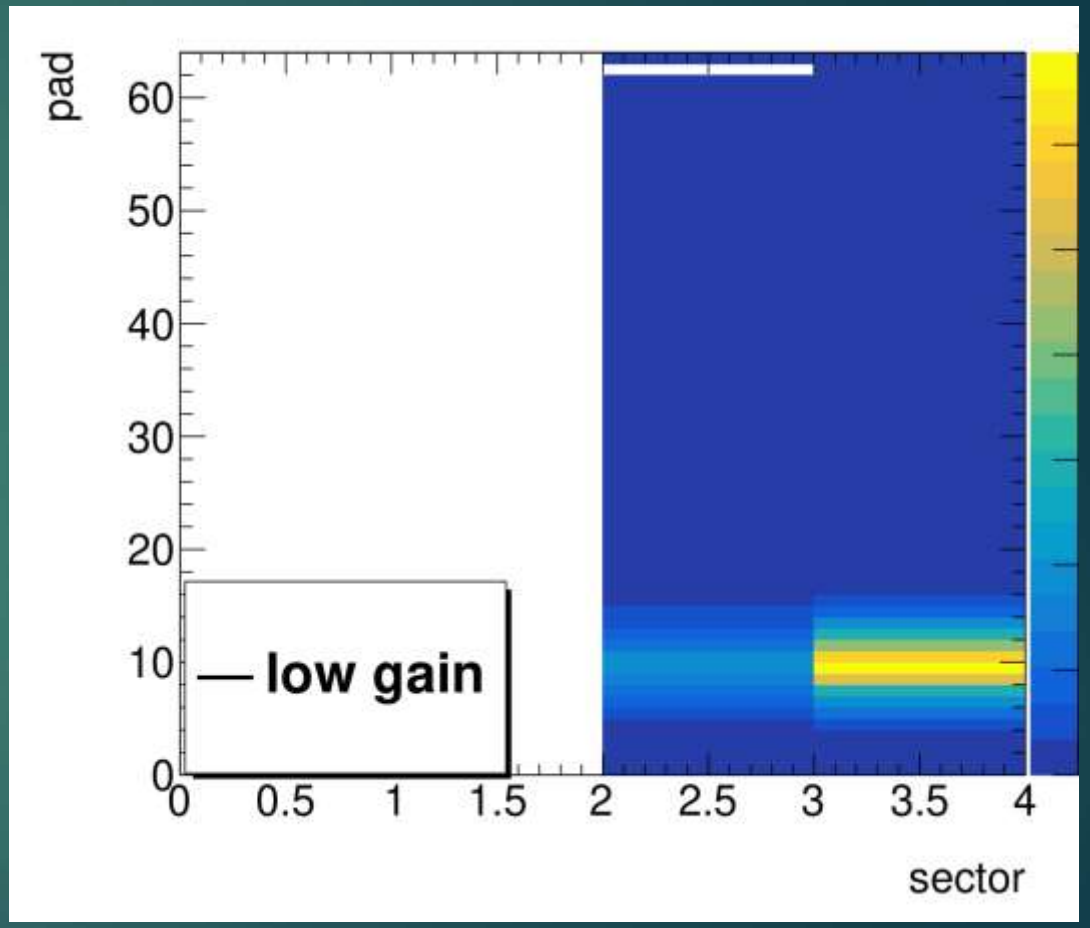
7th layer



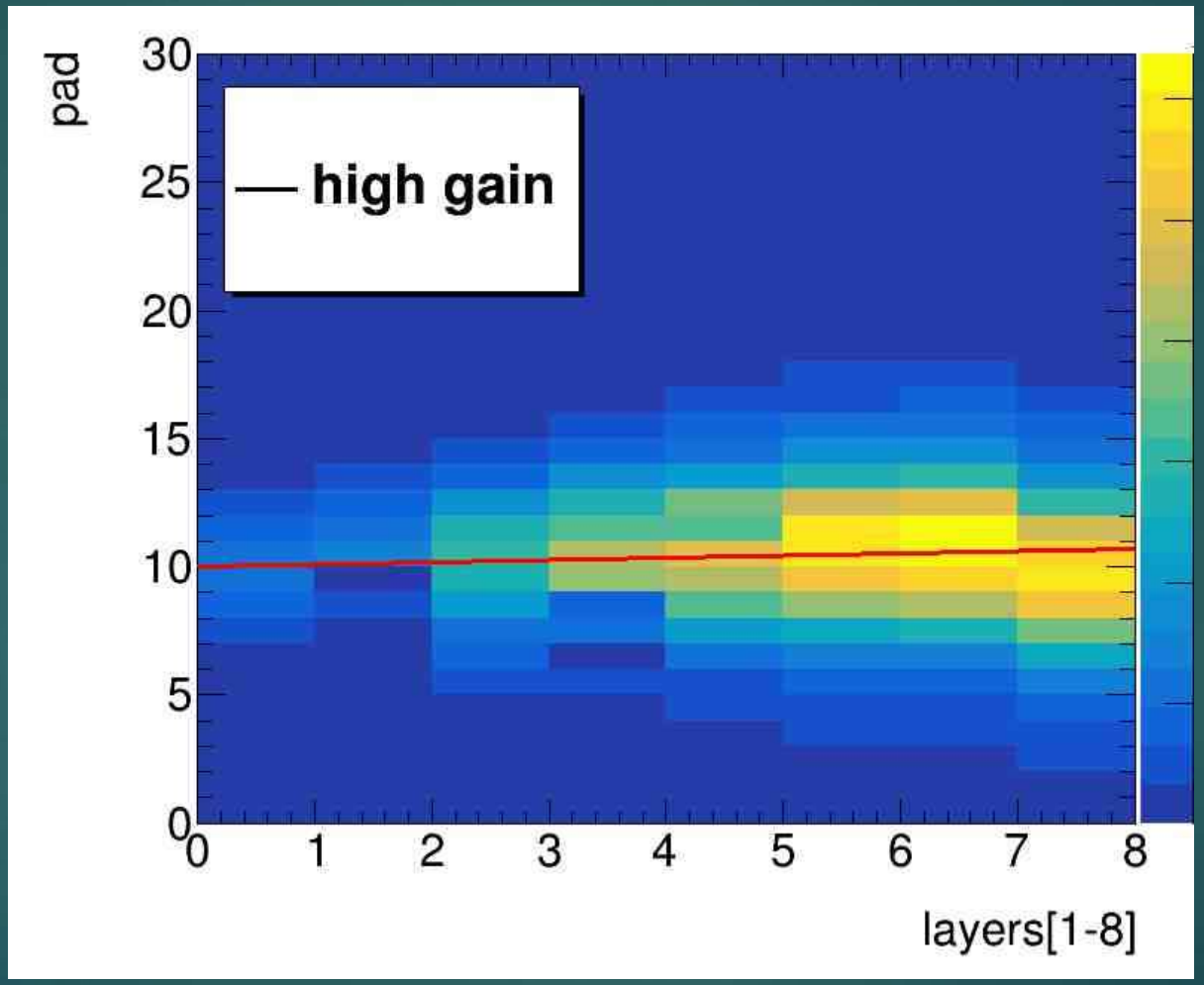


8th layer


pad
60
50
40
30
20
10
0
high gain
0
0.5
1
1.5
2
2.5
3
3.5
4
sector


pad
60
50
40
30
20
10
0
low gain
0
0.5
1
1.5
2
2.5
3
3.5
4
sector

Distribution of deposited energy



Red line shows 2 degree tilt

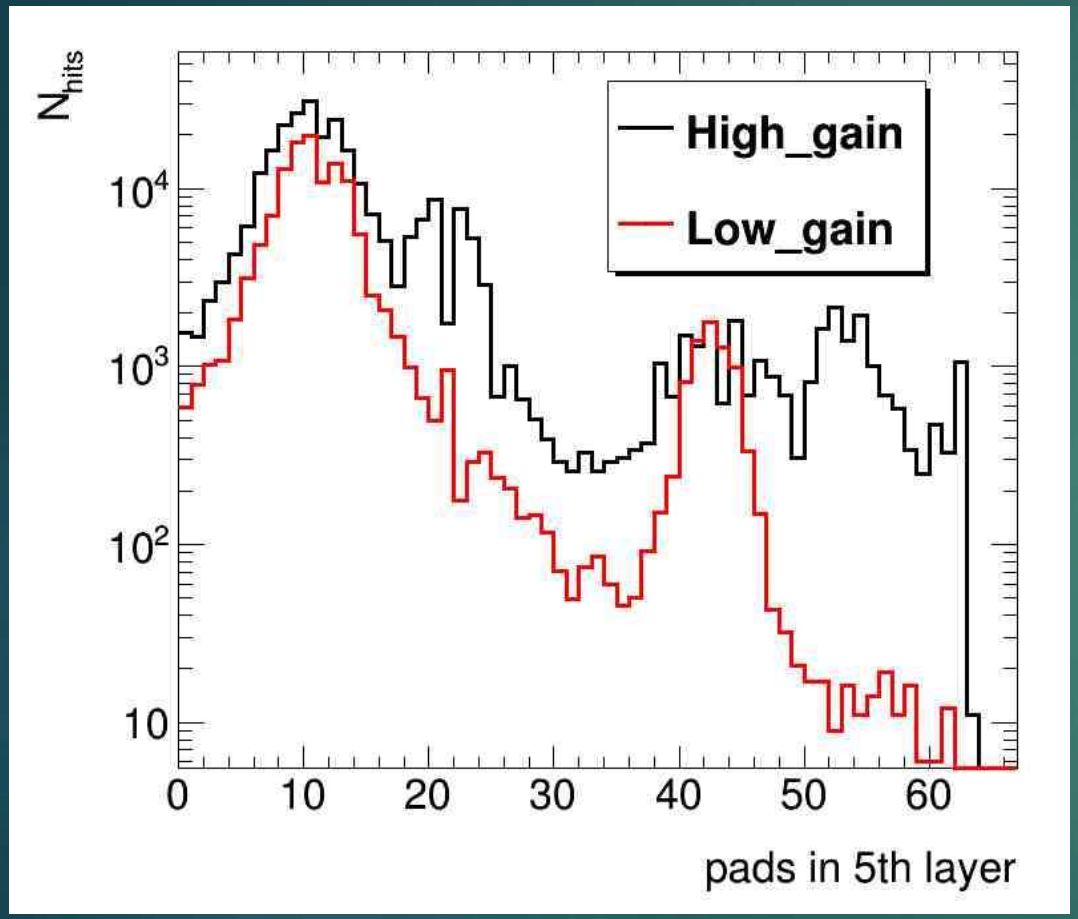
Summary

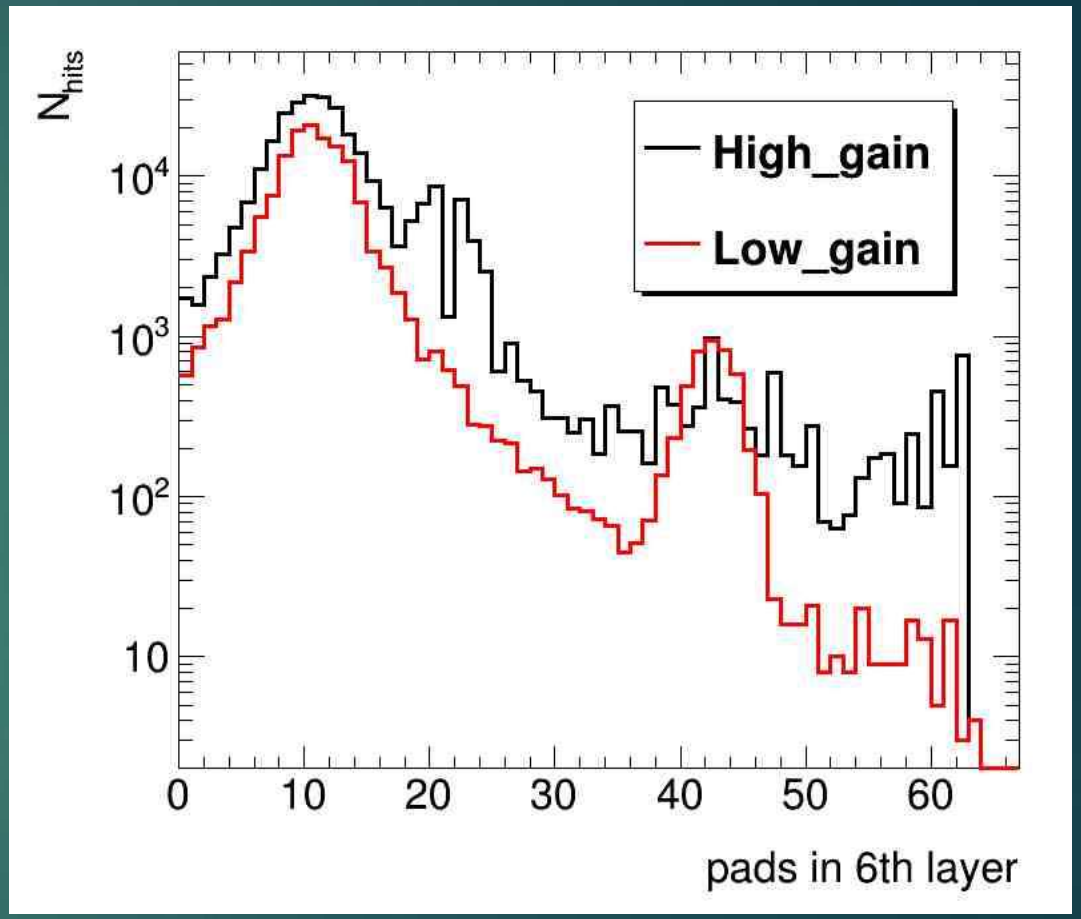
- Empty events in calorimeter 18,77% for high gain and 25,89% for low gain
- Dip in 4th layer maybe because of bad pads
- Strange peak near to 20th pad

TODOs:

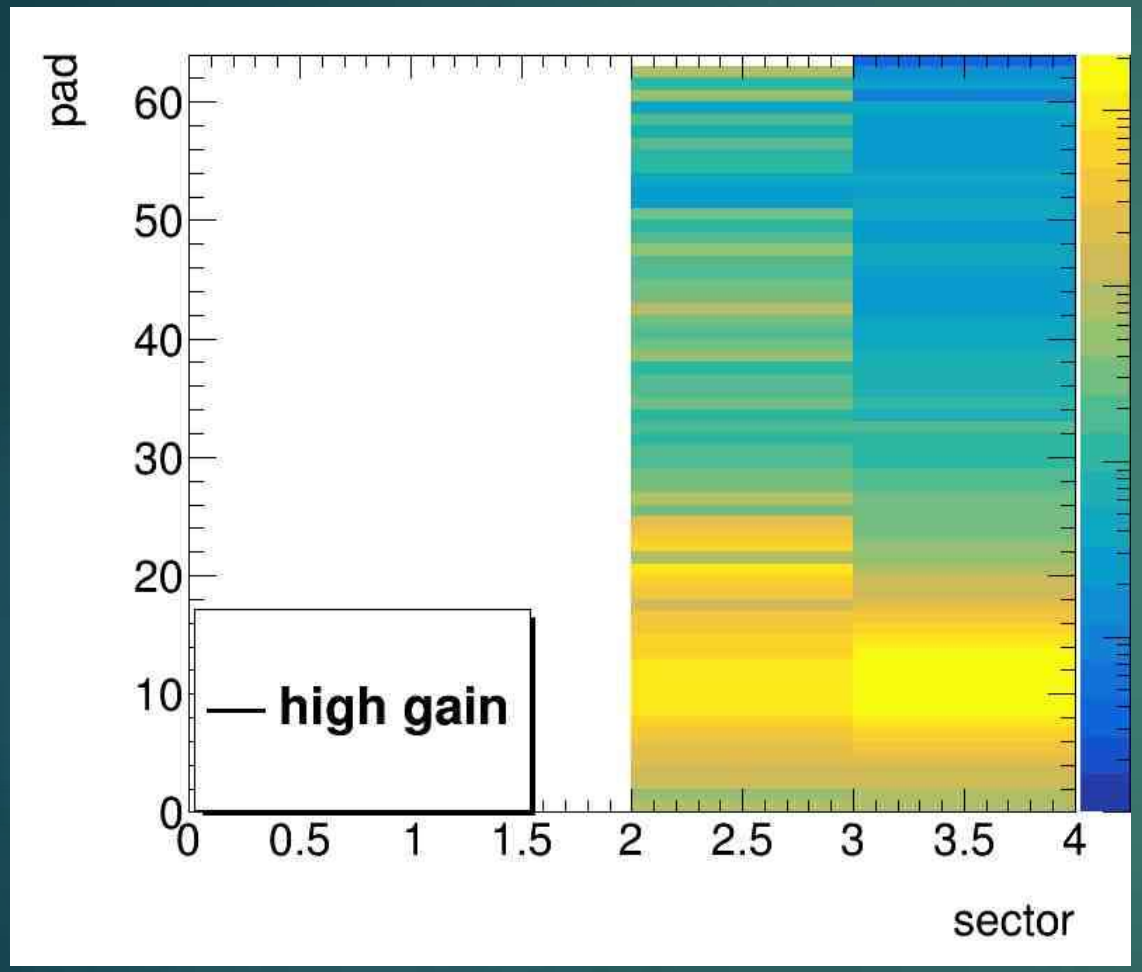
- Ratio high/low for each layer
- Correlation high/low for each layer(cross-check of Bohdan's result from TB19)
- Anything else ? Halina, Wolfgang?

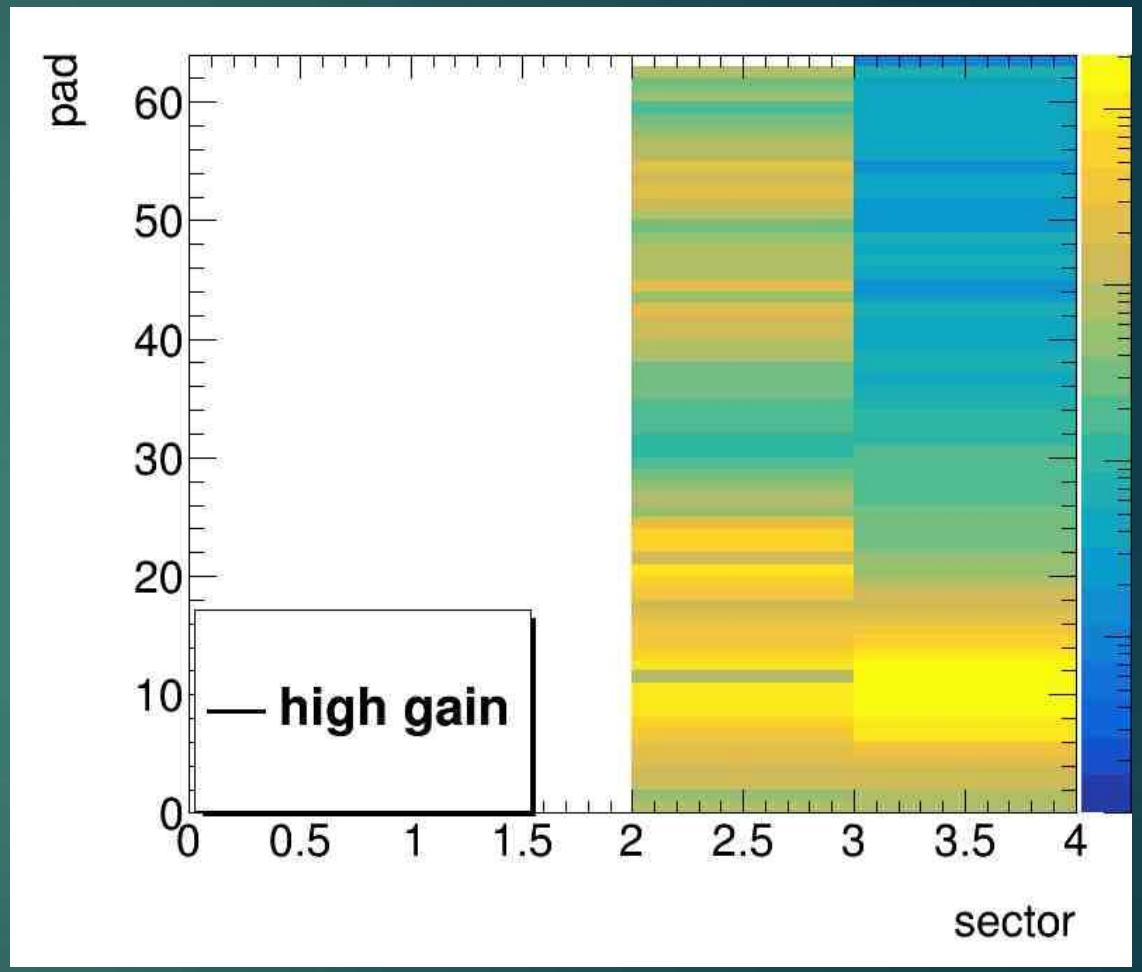
BACKUP





5th and 6th layers with logY scale





5th and 6th layers with logZ scale

Signal with empty events in layers