Region between pad - charge sharing/effect of traces

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Plan of the presentation

1. Motivation
2. Online vs offline data analysis
3. Amplitude analysis

Motivation

For better understanding of charge sharing and effect of traces (GaAs) on the signal amplitude we were focused on region between two pads using offline reconstruction for raw data and online reconstruction for FPGA data.

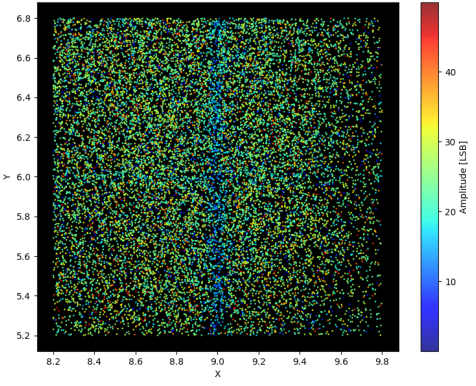


Fig. 1: Yan 1 run 4495 map of tracks with colour as an amplitude of sensor signal

Online vs Offline beam profile

There is a visible notch in observed beam profile which matches with region between pad, if we are focused only on online sensor data.

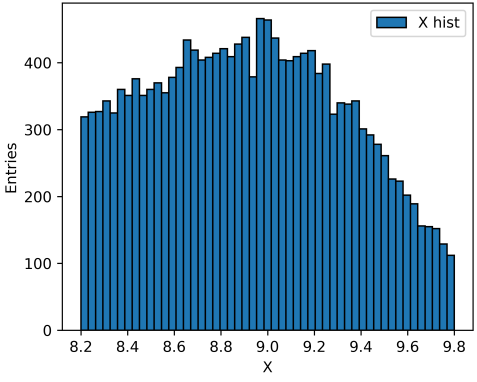


Fig. 2: run 4495 telescope matched with offline sensor data

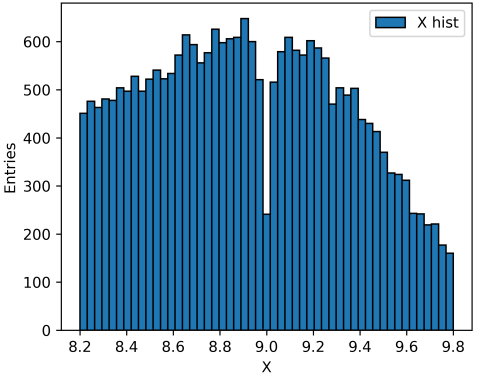


Fig. 3: run 4495 telescope matched with online sensor data

Online vs Offline beam profile

Also visible in different pair of pads

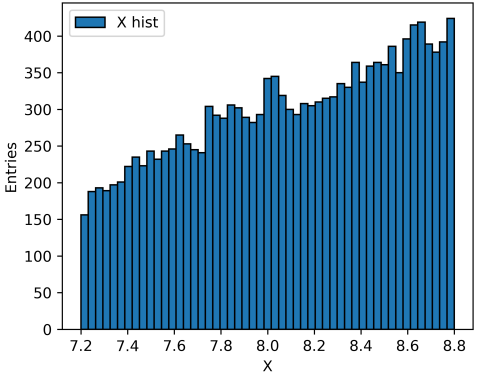


Fig. 4: run 4495 telescope matched with offline sensor data

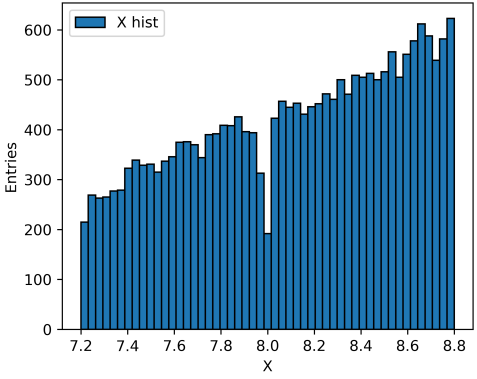


Fig. 5: run 4495 telescope matched with online sensor data

GaAS efficiency - Online vs Offline - X scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 3 LSB in raw data offline reconstruction.

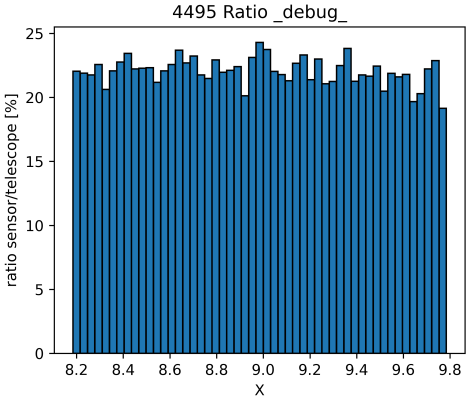


Fig. 6: run 4495 offline efficiency ratio

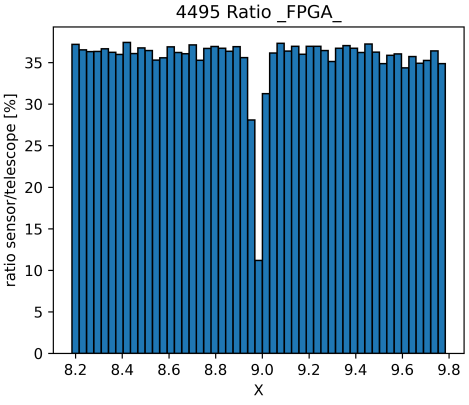


Fig. 7: run 4495 online efficiency ratio

GaAs efficiency - Online vs Offline - X scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 8 LSB in raw data offline reconstruction.

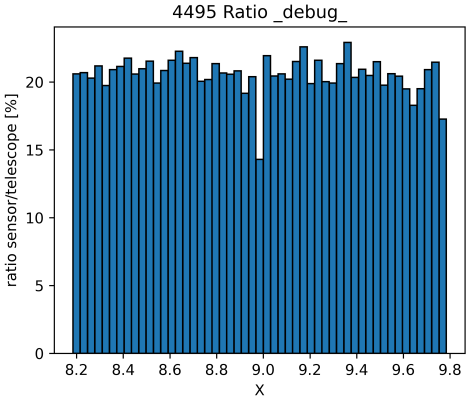


Fig. 8: run 4495 offline efficiency ratio

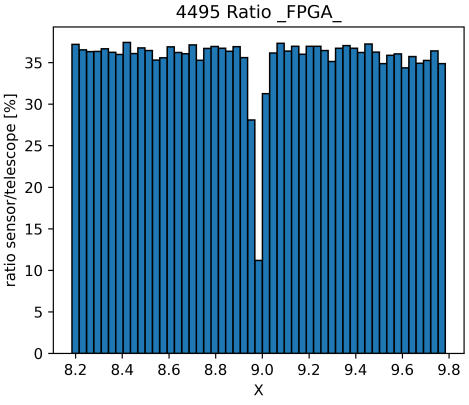


Fig. 9: run 4495 online efficiency ratio

GaAs efficiency - Online vs Offline - Y scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 3 LSB in raw data offline reconstruction.

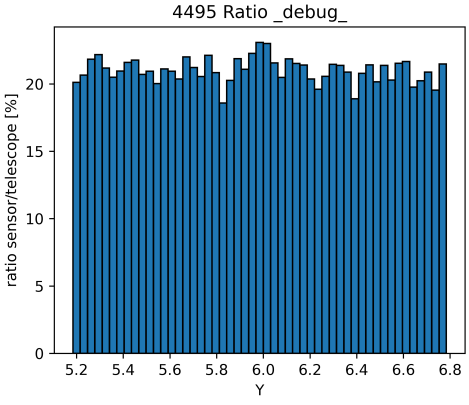


Fig. 10: run 4495 offline efficiency ratio

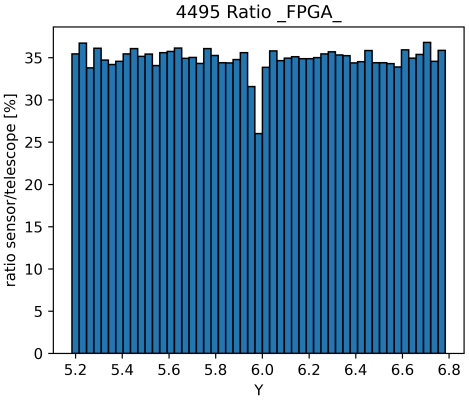


Fig. 11: run 4495 online efficiency ratio

GaAs efficiency - Online vs Offline - Y scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 8 LSB in raw data offline reconstruction.

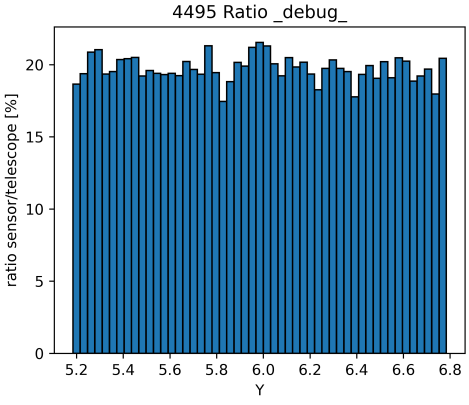


Fig. 12: run 4495 offline efficiency ratio

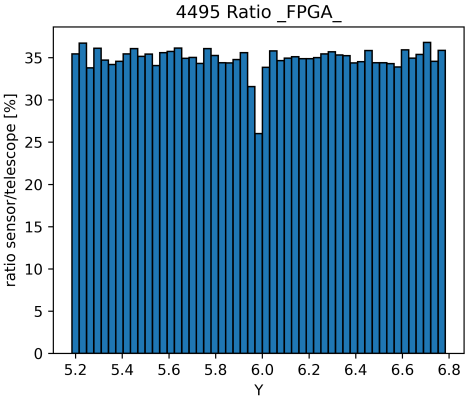


Fig. 13: run 4495 online efficiency ratio

Calice efficiency - Online vs Offline - X scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 3 LSB in raw data offline reconstruction.

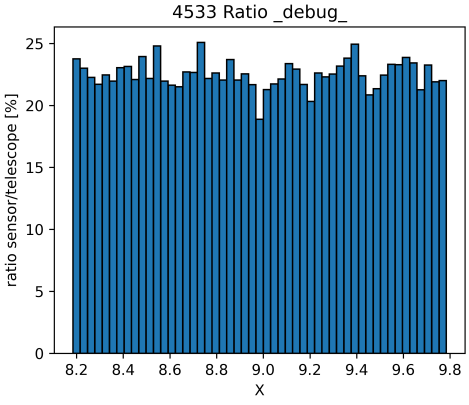


Fig. 14: run 4533 offline efficiency ratio

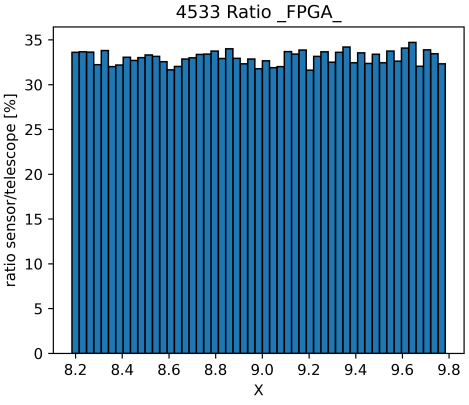


Fig. 15: run 4533 online efficiency ratio

Calice efficiency - Online vs Offline - X scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 8 LSB in raw data offline reconstruction.

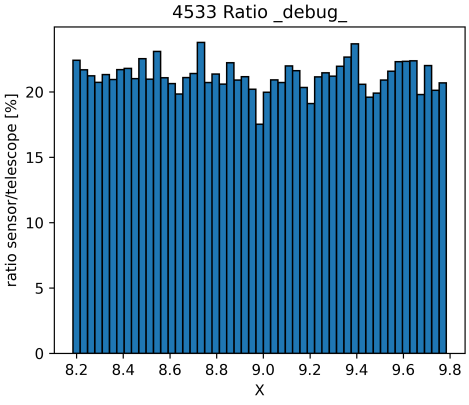


Fig. 16: run 4533 offline efficiency ratio

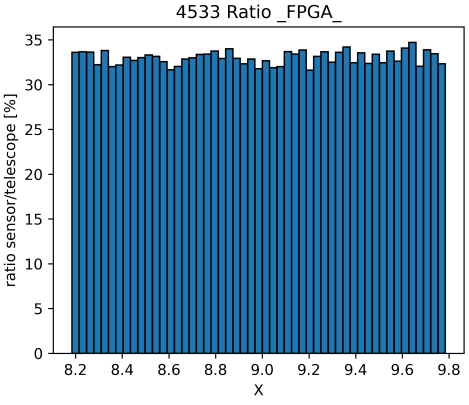


Fig. 17: run 4533 online efficiency ratio

Calice efficiency - Online vs Offline - Y scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 3 LSB in raw data offline reconstruction.

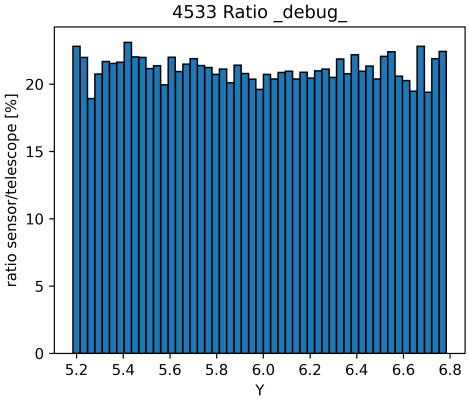


Fig. 18: run 4533 offline efficiency ratio

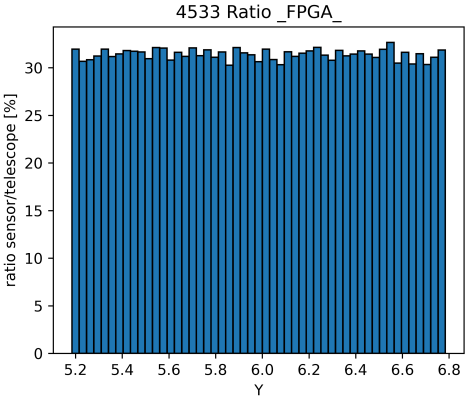


Fig. 19: run 4533 online efficiency ratio

Calice efficiency - Online vs Offline - Y scan

Efficiency comparison between online and offline reconstruction, minimal signal amplitude 8 LSB in raw data offline reconstruction.

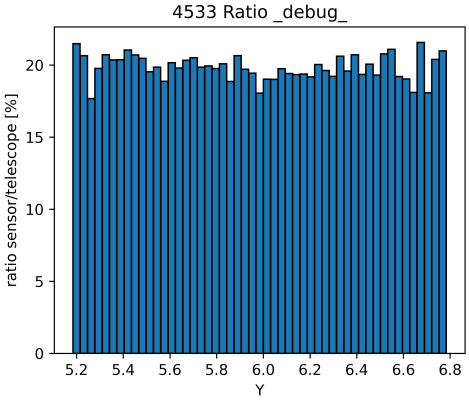


Fig. 20: run 4533 offline efficiency ratio

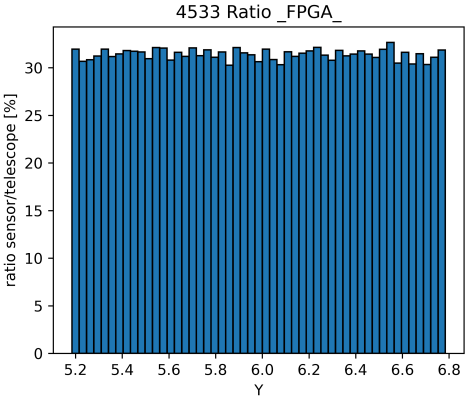


Fig. 21: run 4533 online efficiency ratio

Amplitude reconstruction - Online vs Offline - GaAs

Online analysis has stricter criterion for noise treatment. In the region between pads there is risk of rejecting signal of lower amplitude.

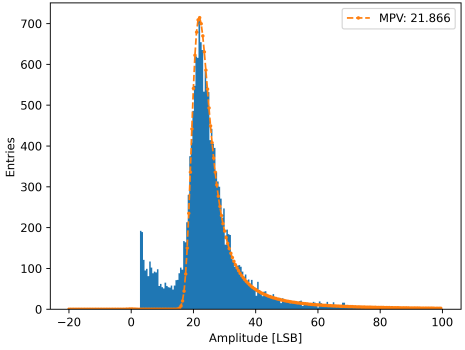


Fig. 22: run 4495 offline sensor data

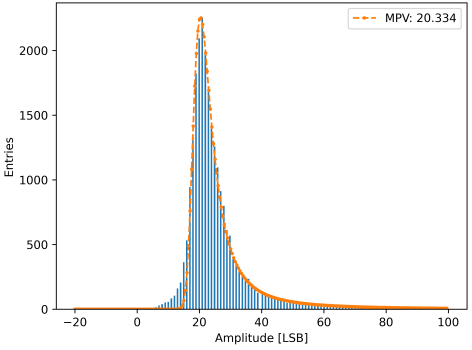


Fig. 23: run 4495 online sensor data

Amplitude reconstruction - Online vs Offline - Calice

Online analysis has stricter criterion for noise treatment. In the region between pads there is risk of rejecting signal of lower amplitude.

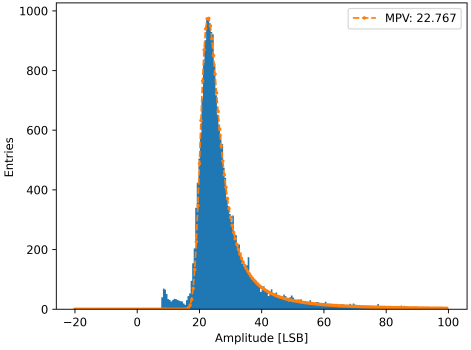


Fig. 24: run 4533 offline sensor data

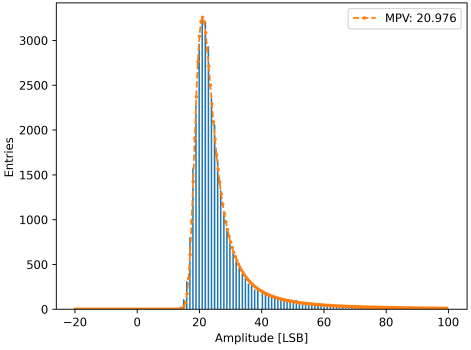


Fig. 25: run 4533 online sensor data

Amplitude X scan and Y scan explanation

Selected region which contains 4 pads is divided into many bins in X or Y orientation.

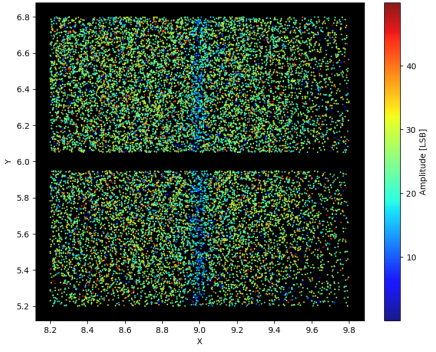


Fig. 26: run 4495 offline sensor data prepared for X scan

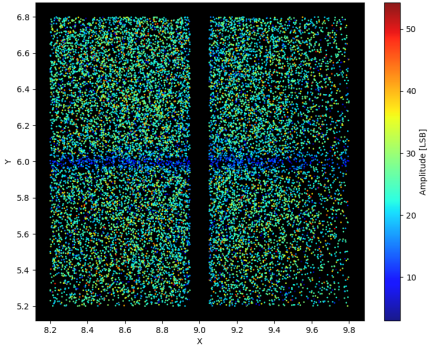


Fig. 27: run 4495 offline sensor data prepared for Y scan

GaAs - amplitude X scan

Comparison of fitted MPV in function of position in sensor. The **X** scan includes region between pads with traces in GaAs sensor.

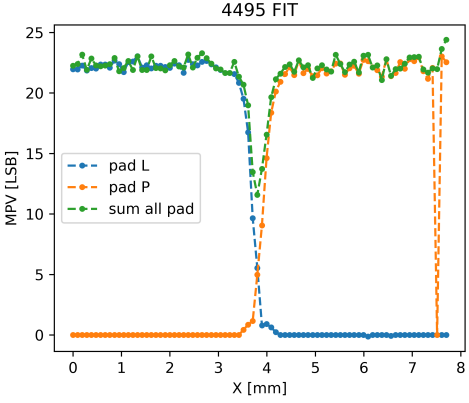


Fig. 28: run 4495 offline sensor data X scan

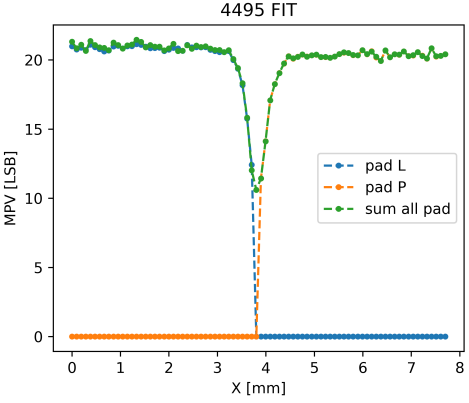


Fig. 29: run 4495 online sensor data X scan

GaAs - amplitude Y scan

Comparison of fitted MPV in function of position in sensor. The **Y** scan includes region between pads but without traces in GaAs sensor.

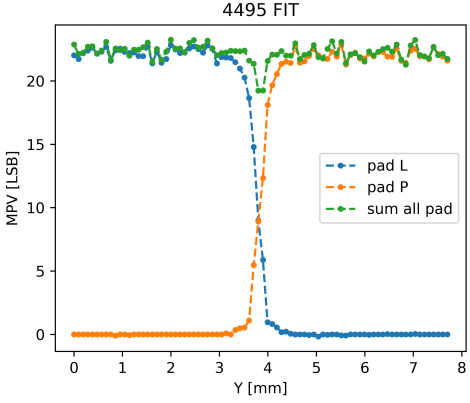


Fig. 30: run 4495 offline sensor data Y scan

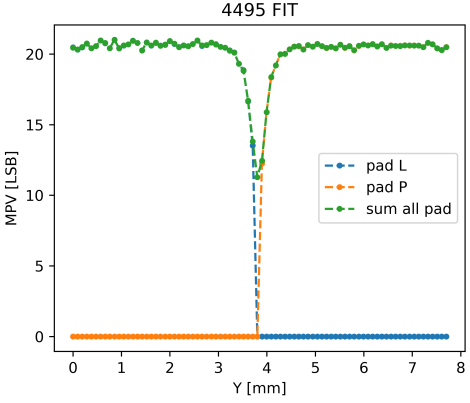


Fig. 31: run 4495 online sensor data Y scan

Calice - amplitude X scan

Comparison of fitted MPV in function of position in sensor.

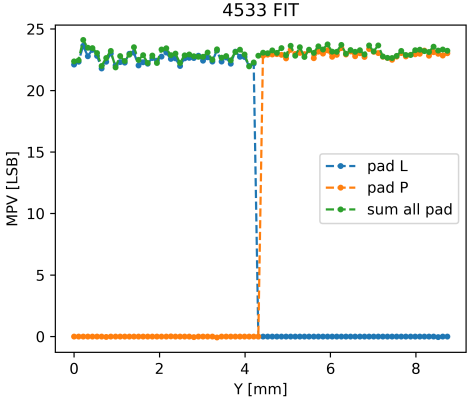


Fig. 32: run 4533 offline sensor data X scan

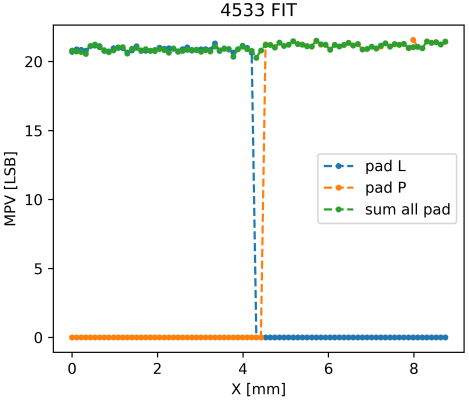


Fig. 33: run 4533 online sensor data X scan

Calice - amplitude Y scan

Comparison of fitted MPV in function of position in sensor.

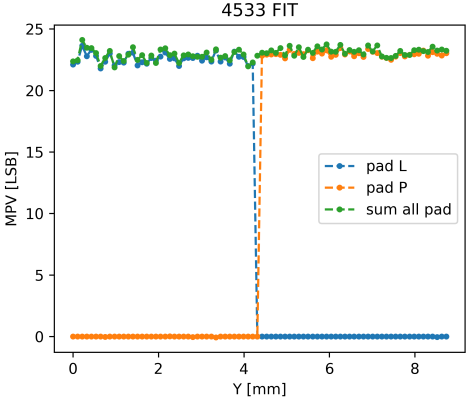


Fig. 34: run 4533 offline sensor data Y scan

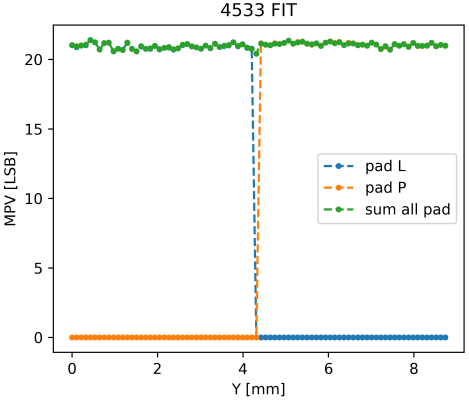


Fig. 35: run 4533 online sensor data Y scan

GaAs - amplitude analysis - X scan vs Y scan

We can observe different behaviour in scan X when we cross region between pads with routes.

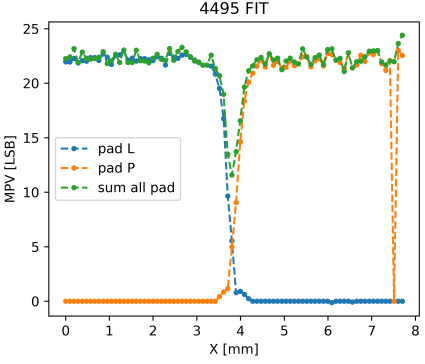


Fig. 36: run 4495 offline sensor data X scan

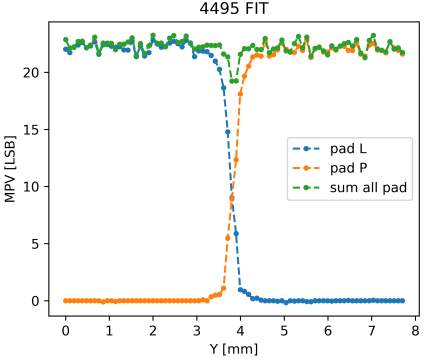


Fig. 37: run 4495 offline sensor data Y scan

GaAs - amplitude analysis - X scan vs Y scan

Another method calculates simple arithmetic mean instead of MPV. The maximum mean value is normalised to MPV for each pad.

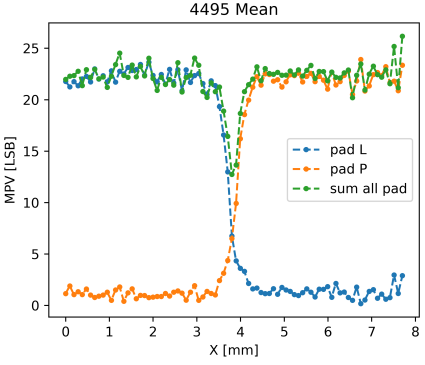


Fig. 38: run 4495 offline sensor data X scan

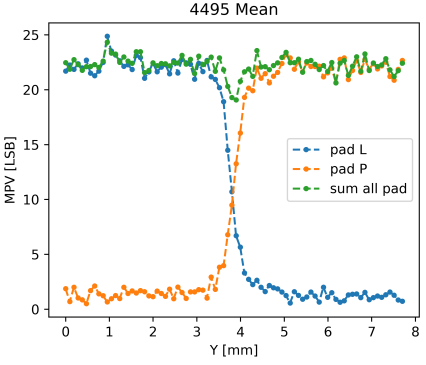


Fig. 39: run 4495 offline sensor data Y scan

Calice - amplitude X scan vs Y scan

In Calice sensor there is no visible difference between X and Y scan.

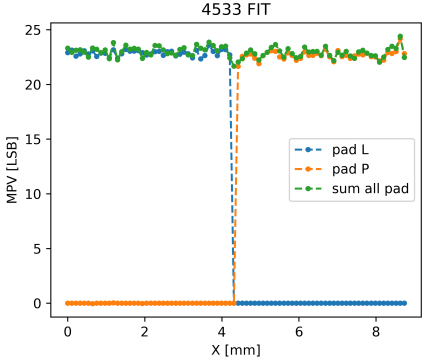


Fig. 40: run 4533 offline sensor data X scan

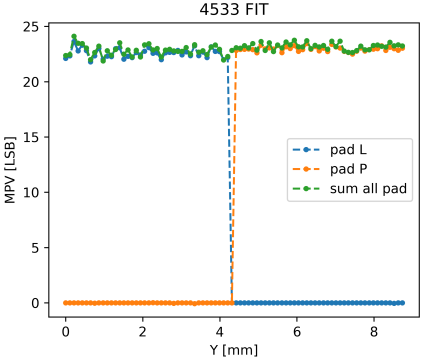


Fig. 41: run 4533 offline sensor data Y scan

Calice - amplitude X scan vs Y scan

In Calice sensor there is no visible difference between X and Y scan, also using mean value method.

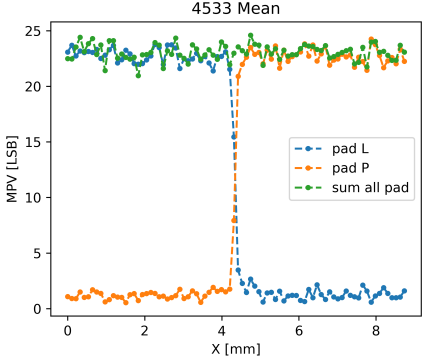


Fig. 42: run 4533 offline sensor data X scan

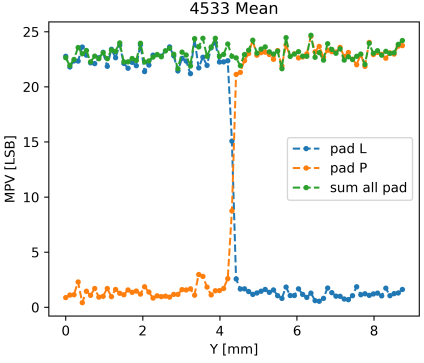
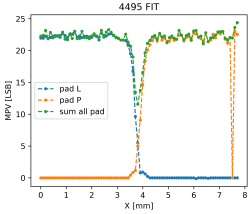


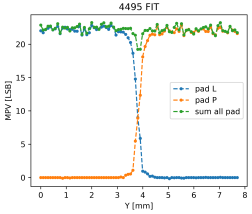
Fig. 43: run 4533 offline sensor data Y scan

Conclusions

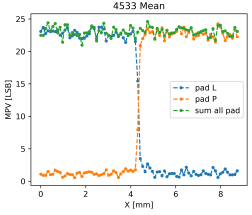
- In GaAs sensor charge sharing is well visible and significantly depends on the traces.
- In data from GaAs sensor the efficiency dip is visible in the region in between pads.
- In Calice sensor charge sharing is barley visible.
- In data from Calice sensor the efficiency if flat in X and Y scan.



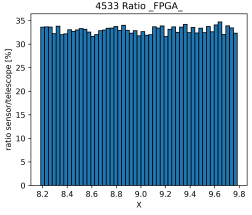
(a) run 4495 Yan1 scan in X offline reconstruction



(b) run 4495 Yan1 scan in Y offline reconstruction



(c) run 4533 Calice74 scan in X offline reconstruction



(d) run 4533 Calice74 scan in X sensor/telescope ratio

Fig. 44: My composed figure

Thank you for attention