TaichuPix Laser test status

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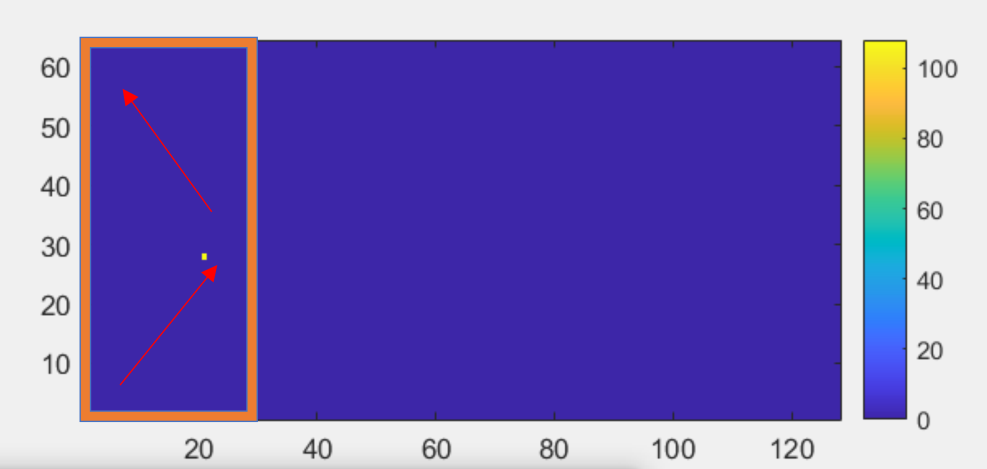
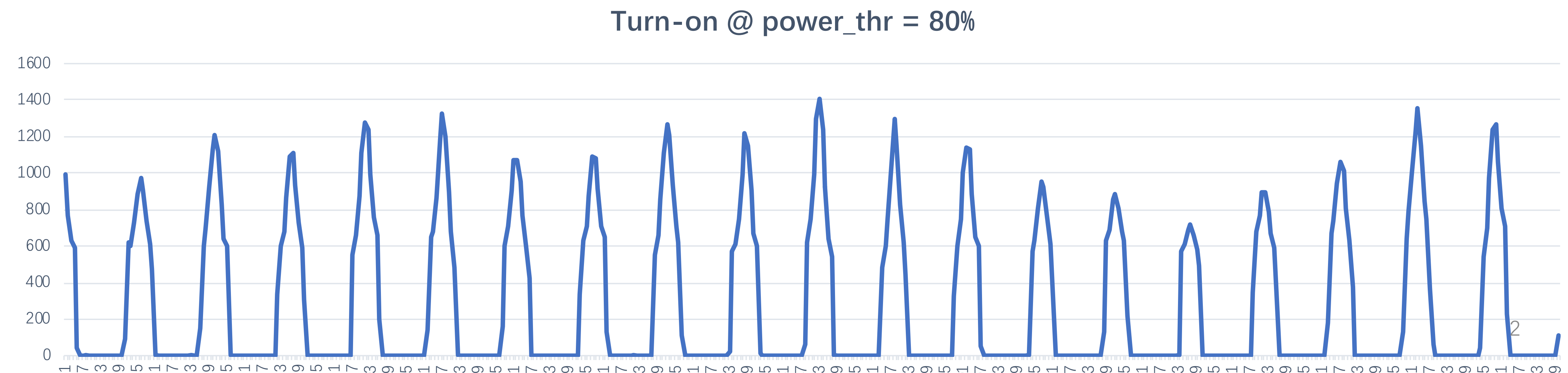
Set up

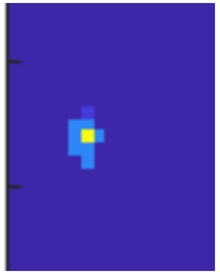


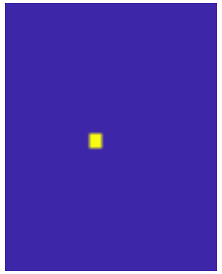
- Laser diode with 1064nm
- Efficient laser spot size ~ 1.6um
  - turn-on width = mask window size(8.4um) + spot size ~ 10um
- Test area: Sector 1 (32x64 Pixels)
- Linear scan with 2 * 500 step * 1um/step movement (~20 Pixels/line)
- TaichuPix threshold fixed to ITHR:1000

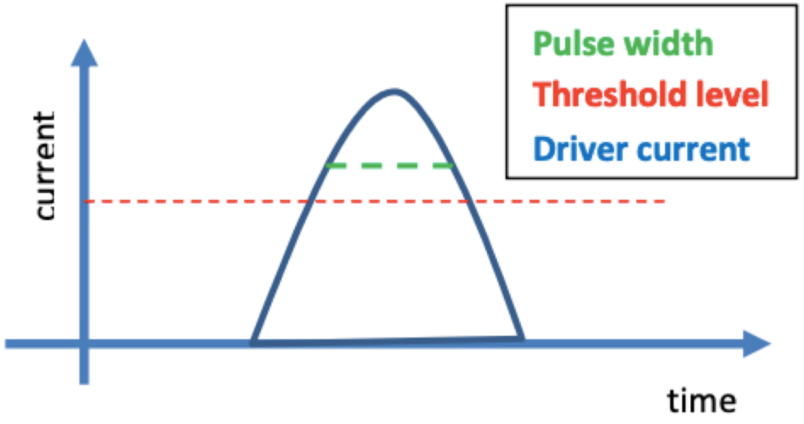


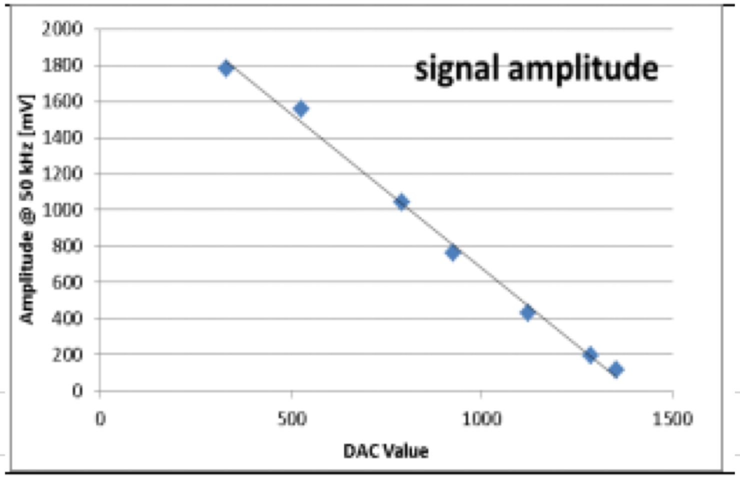
Laster power threshold

- Change the laser power(also width) with threshold 65% to 80%

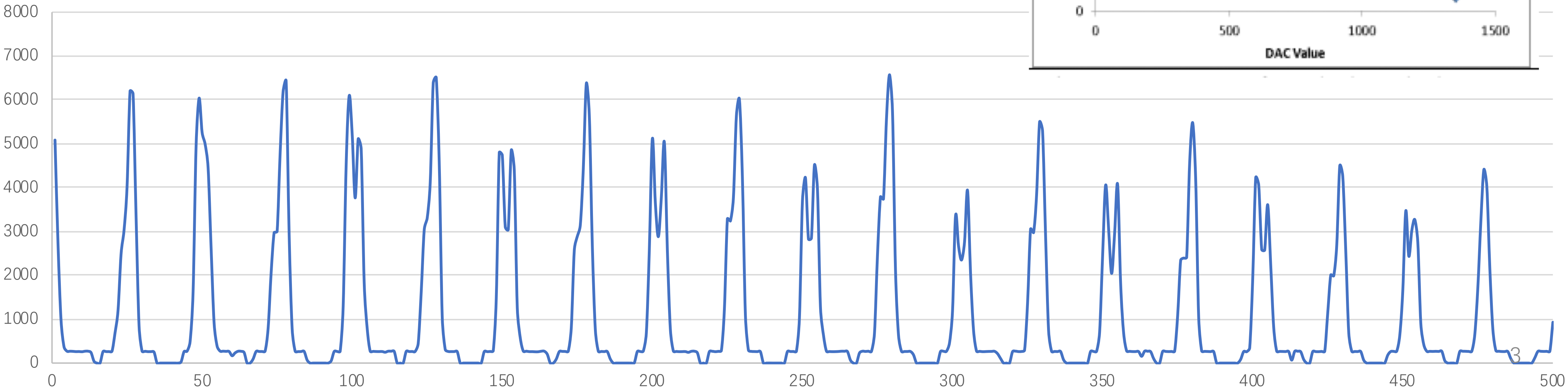






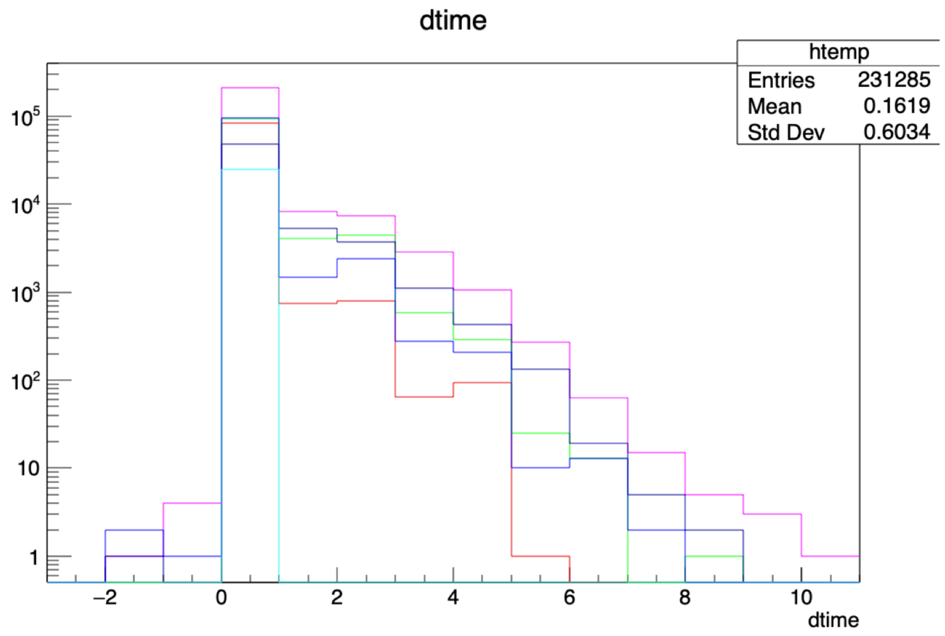


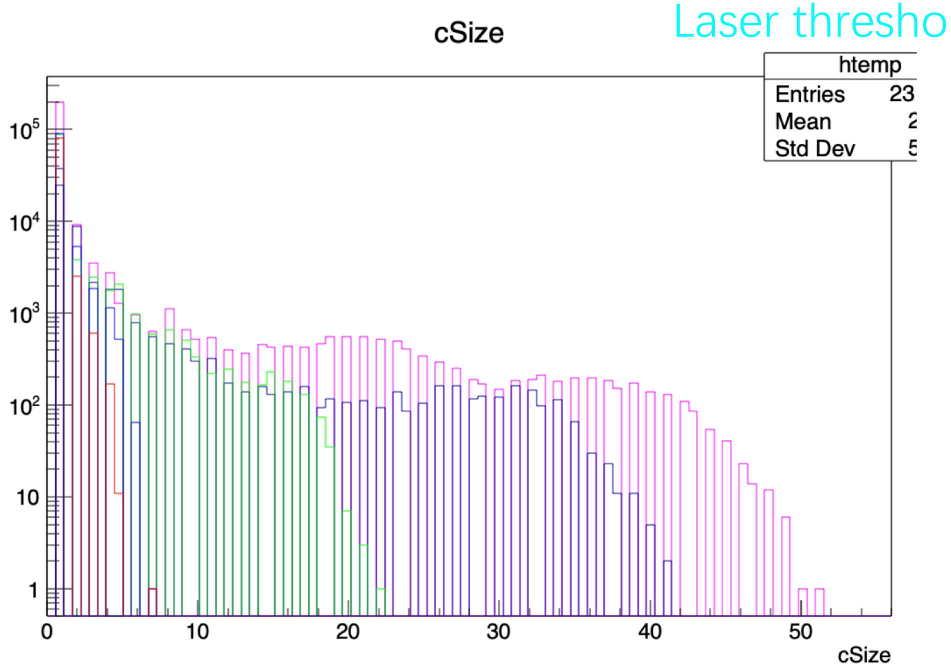
Turn-on @ power_thr = 65%



Cluster size compute

- Continuous timestamp(neighbor pixels) = in one cluster
- Mostly within one timestamp, maximum 10
- Average cluster size: 1~3.38
  - Mostly 1, maximum 50

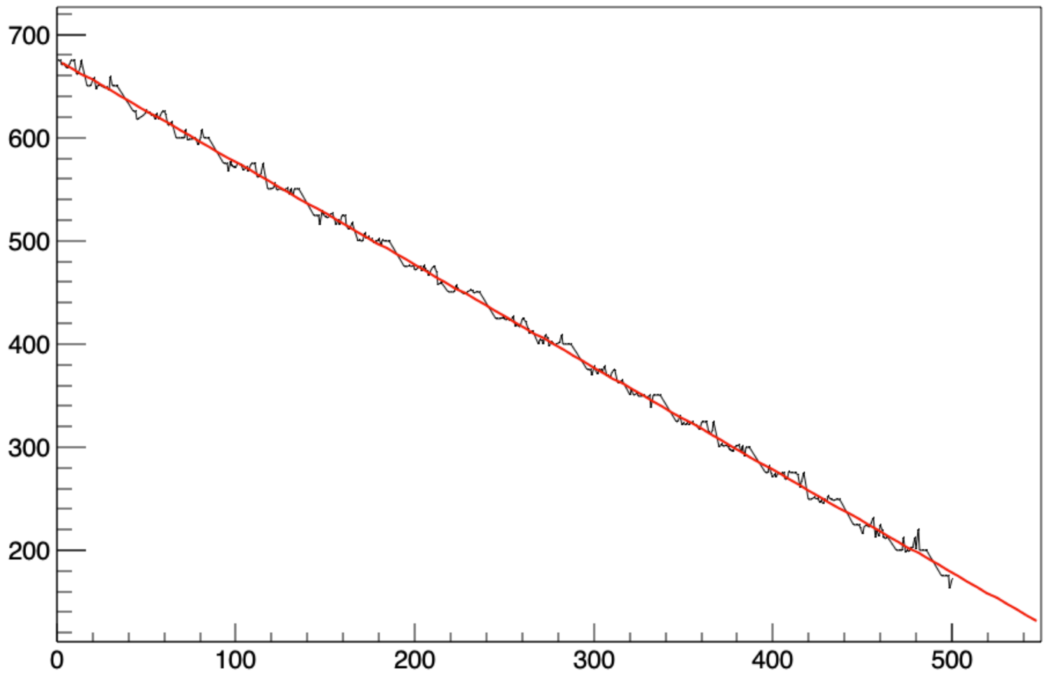


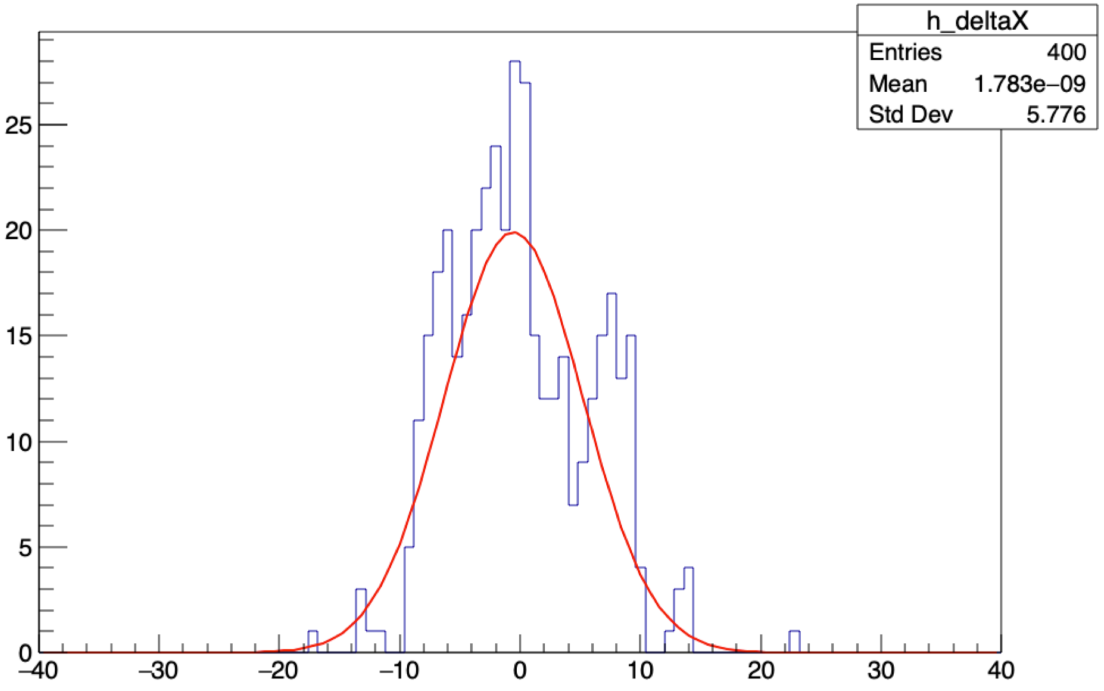


Laser threshold = 80%
Laser threshold = 76%
Laser threshold = 75.5%
Laser threshold = 75%
Laser threshold = 70%
Laser threshold = 65%

Resolution

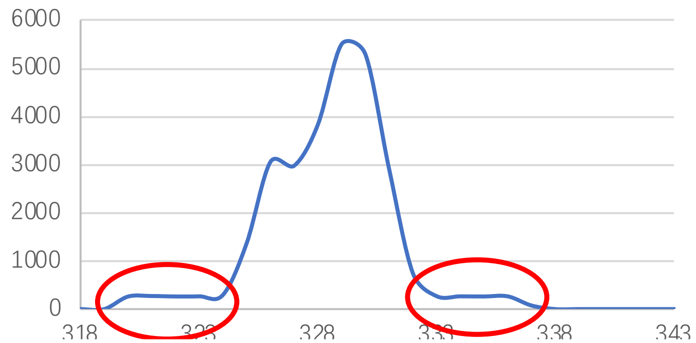
- Expected X, Y computed from linear fit of the observed X, Y
  - delta_x, delta_y have double-peaks ?

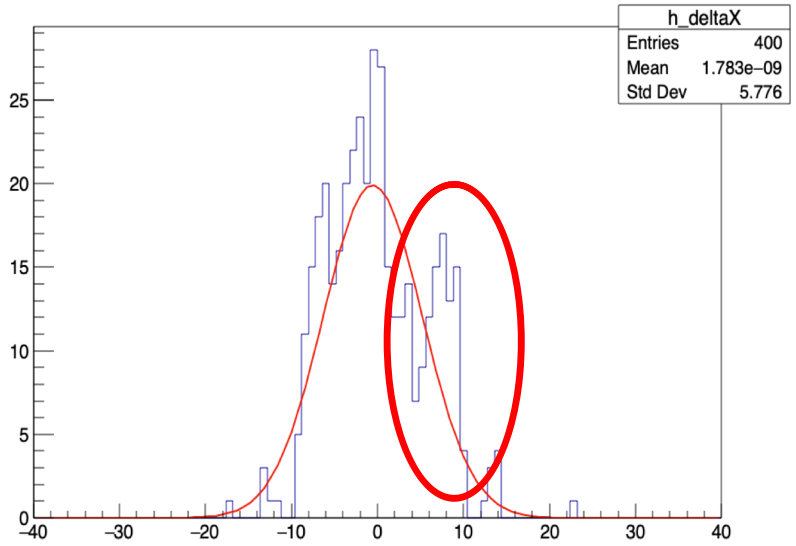




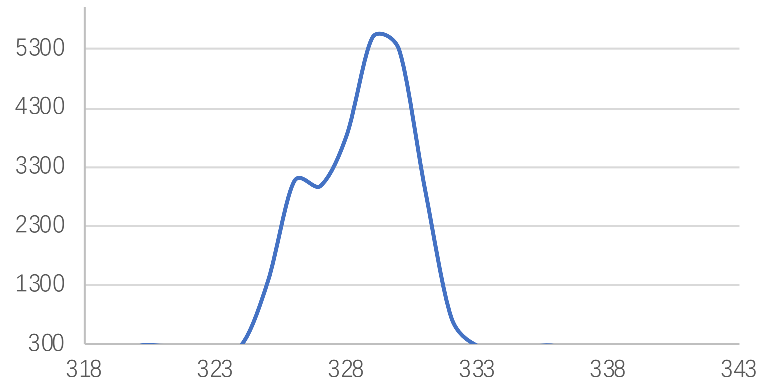
Check removing laser outer region fired points

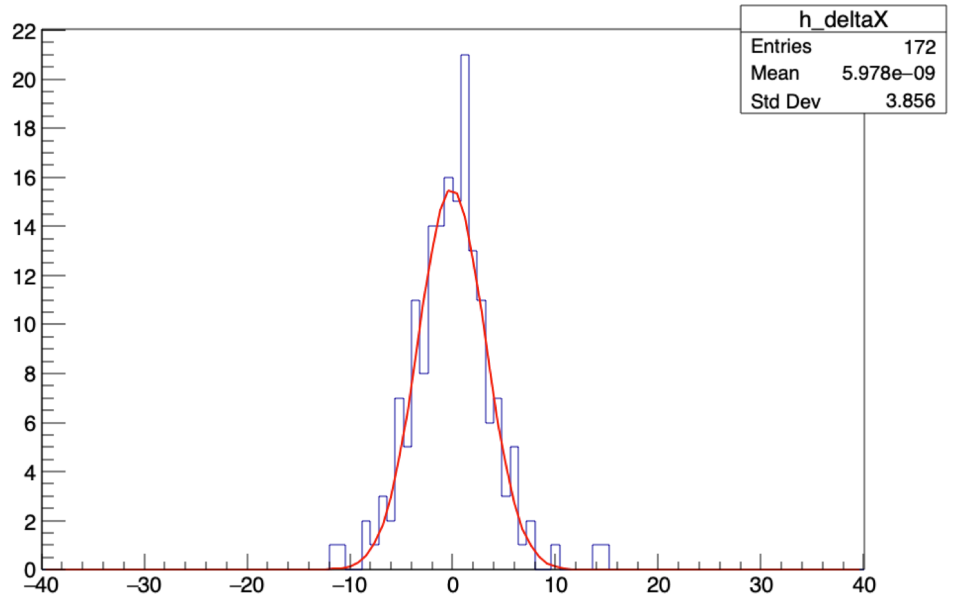
- Turn-on also reflects the laser spot power distribution
- Turn-on threshold set to 300





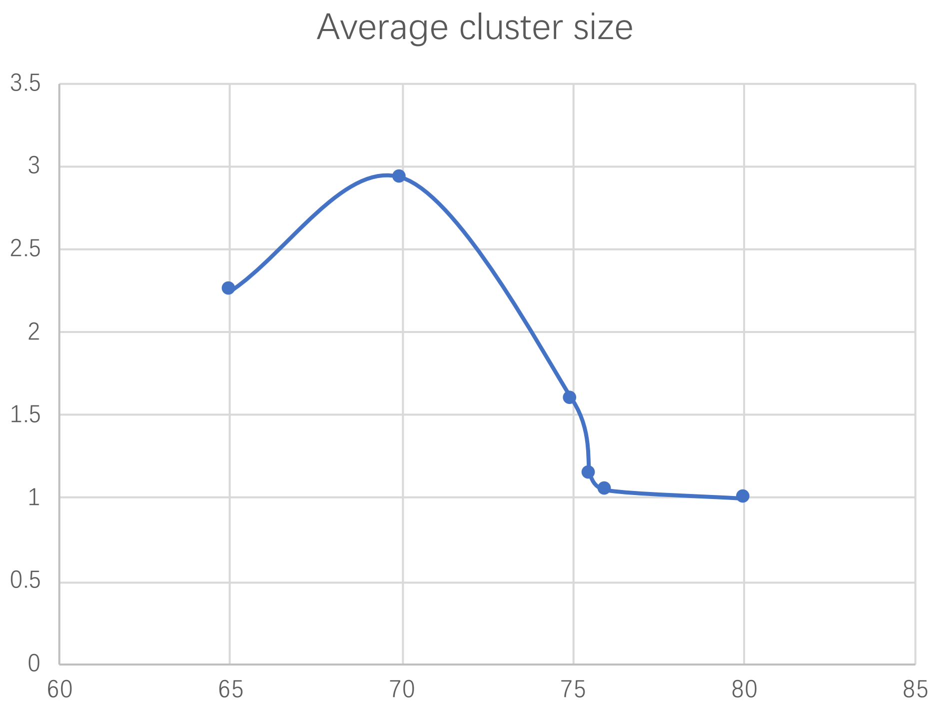
Laser threshold = 65%





After the turn-on cut

- Result not understood yet



Problems & Discussion

- Turn-on threshold cut
  - Would this turn-on cut bring any bias?
  - Is there something we can do to the Pixel trigger/threshold to avoid this?

- Resolution result to be understood
  - Statistics? Threshold difference in each pixel? Unstable working condition?

- Cluster size compute
  - Charge diffusion should happen within one timestamp (25ns)
    - Electron diffusion velocity in silicon ~ 1350 $cm^2V^{-1}s^{-1}$
    - 25*25 um^2 ~ 0.5ns;   50*50 um^2 ~ 18.5ns
  - Minimum laser pause duration 400ns = 16 timestamp
  - Try to compute cluster size within one timestamp?

Back-up

DAC_reg_all_TC2.xlsx

port name		bits				
ENBGR	1	1	1			
REG_BGR_OFFSET	100	3	100			
ENIBG	1	1	0			
REG_CDAC0	00001010	8	1010	IBIAS:7.45uA:11111111,463nA:1010; 255nA:101		
EN_CDAC	1	1	1			
EN_CDAC_T	1	1	1			
REG_CDAC1	101100	8	1000	ITHR:100110		
EN_CDAC	1	1	1			
EN_CDAC_T	1	1	1			
REG_CDAC2	00011000	8	101	IDB:0.79uA:100, 0.977uA:101; 0.61uA:11		
EN_CDAC	1	1	1			
EN_CDAC_T	1	1	1			
REG_VDAC0	0010000001	10	10000001	VCLIP:1.01V:1110000001， 0.183V 10000001		
REG_VDAC0_C	01111	5	10000			
REG_VDAC0_T	11	2	11			
EN_VDAC	1	1	1			
REG_VDAC1	0110000101	10	100	VCASP 0.869V:1001000010 0.6V:110000100; 0.55V:101011111		
REG_VDAC1_C	01111	5	10000			
REG_VDAC1_T	11	2	11			
EN_VDAC	1	1	1			
REG_VDAC2	0101100100	10	100000000	VCASN: 523mV 100000000 838mV:1000000010; 535mV:100000111		
REG_VDAC2_C	01111	5	10000			
REG_VDAC2_T	11	2	11			
EN_VDAC	1	1	1			
REG_VDAC3	0101000100	10	101000100	VCASN2: 630mV: 110000000; 533mV:100111010		
REG_VDAC3_C	01111	5	10000	10010100		
REG_VDAC3_T	11	2	11			
EN_VDAC	1	1	1			
REG_MUX	000	3	1			
REG_MUXO	00	2	1			

Results before turn-on threshold cut

Laser power threshold	20 pixel scan # (500*1um/step)	Average cluster size	Resolution x (count)	Resolution y (count)	Resolution x (fit)	Resolution y (fit)
65%	1 3	2.71 1.79	5.78 5.64	5.30 4.72	5.76 5.73	4.89 4.90
70%	1 2	3.38 2.49	7.43 7.13	5.54 5.34	8.10 6.64	5.03 3.34
75%	1 2	1.77 1.41	5.64 4.08	5.14 4.32	5.38 4.36	5.48 4.13
75.5%	1 2 3	1.00 1.17 1.26	4.66 5.36 5.26	4.61 5.70 5.16	4.95 5.59 4.90	4.59 6.35 3.41
76%	1 2	1.03 1.07	4.30 3.77	4.52 3.81	5.26 4.09	2.24 4.17
80%	1	1	2.92	2.92	3.32	3.32