InP Detector - HeavyIon Simulation, Comparison and Electric Field Distribution

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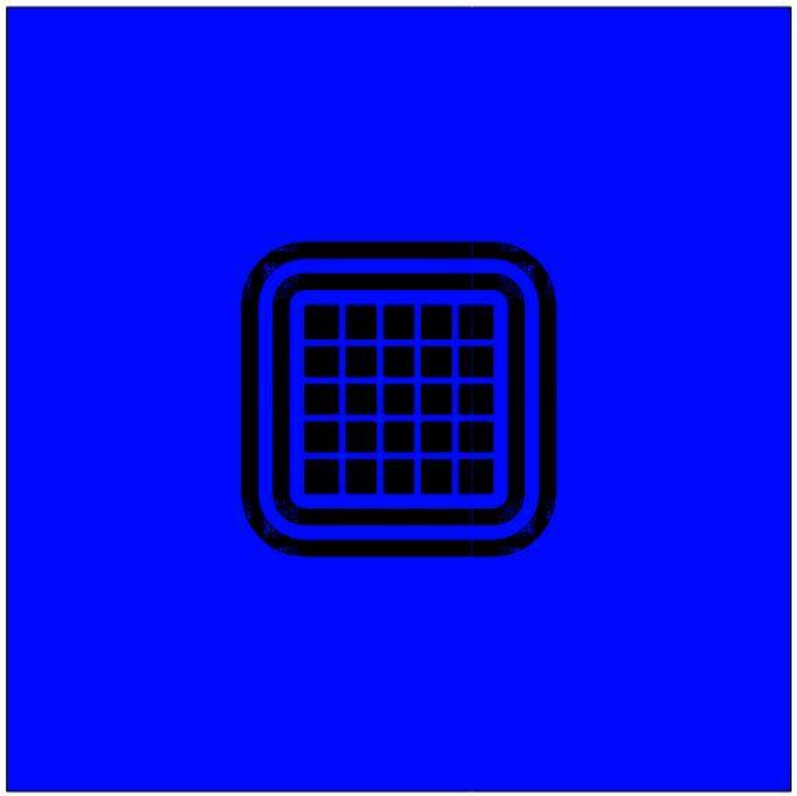
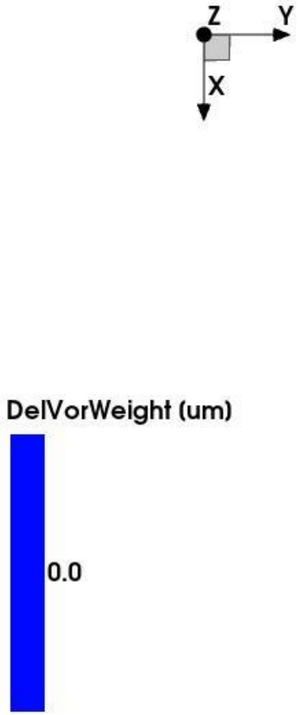
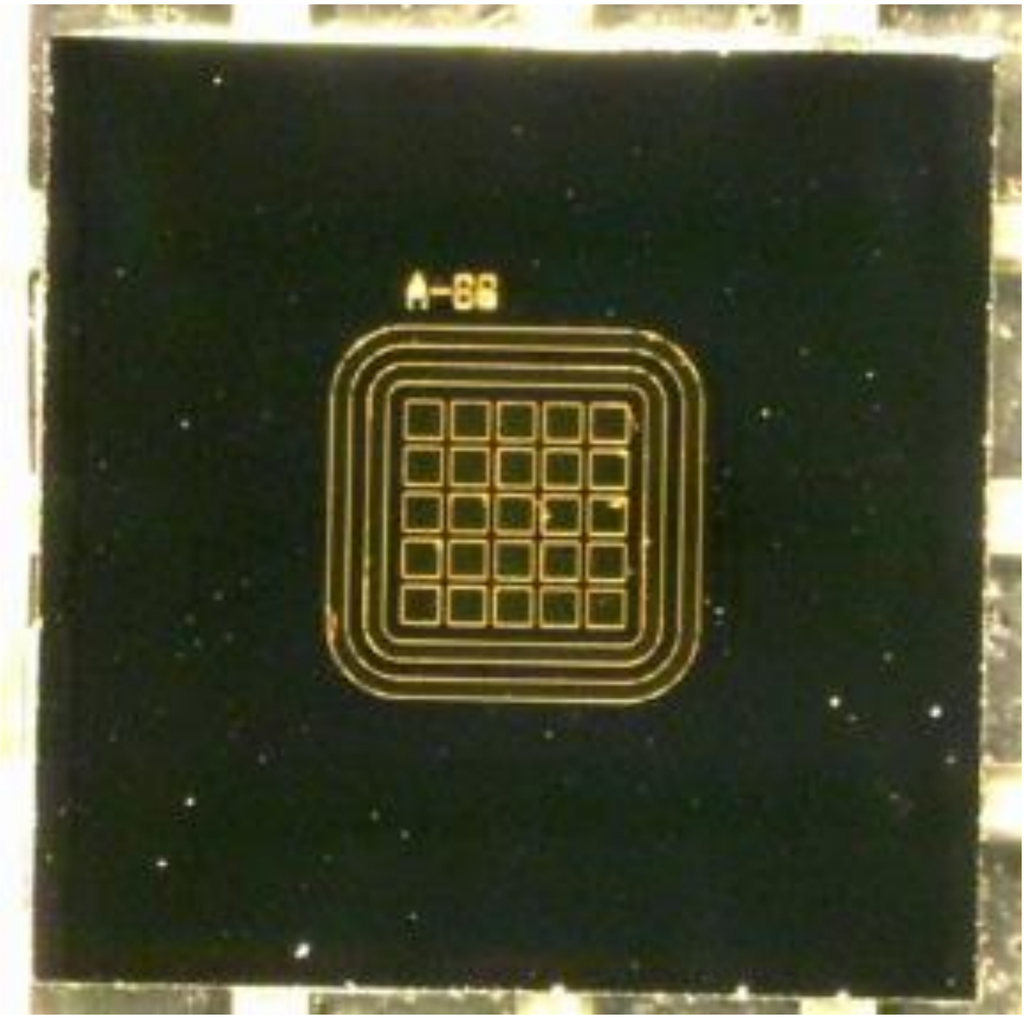
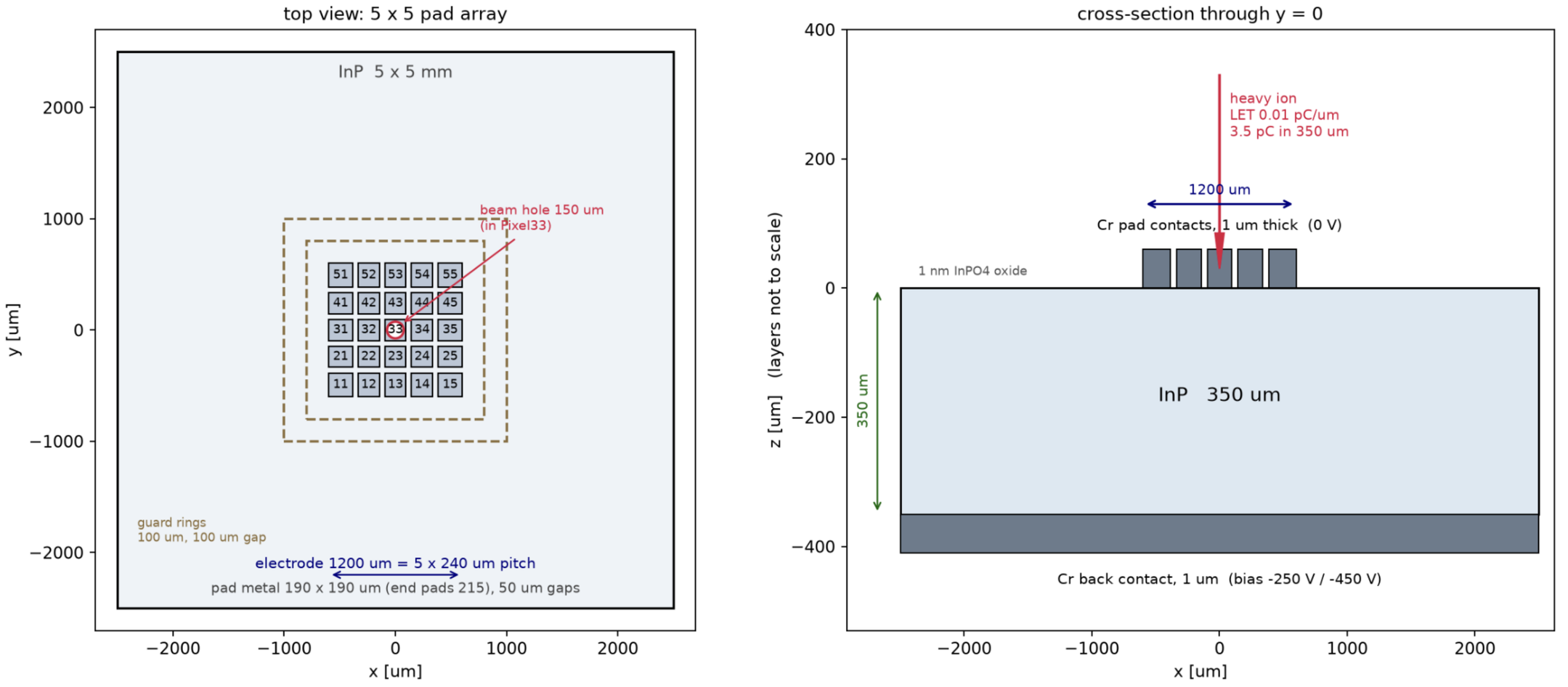
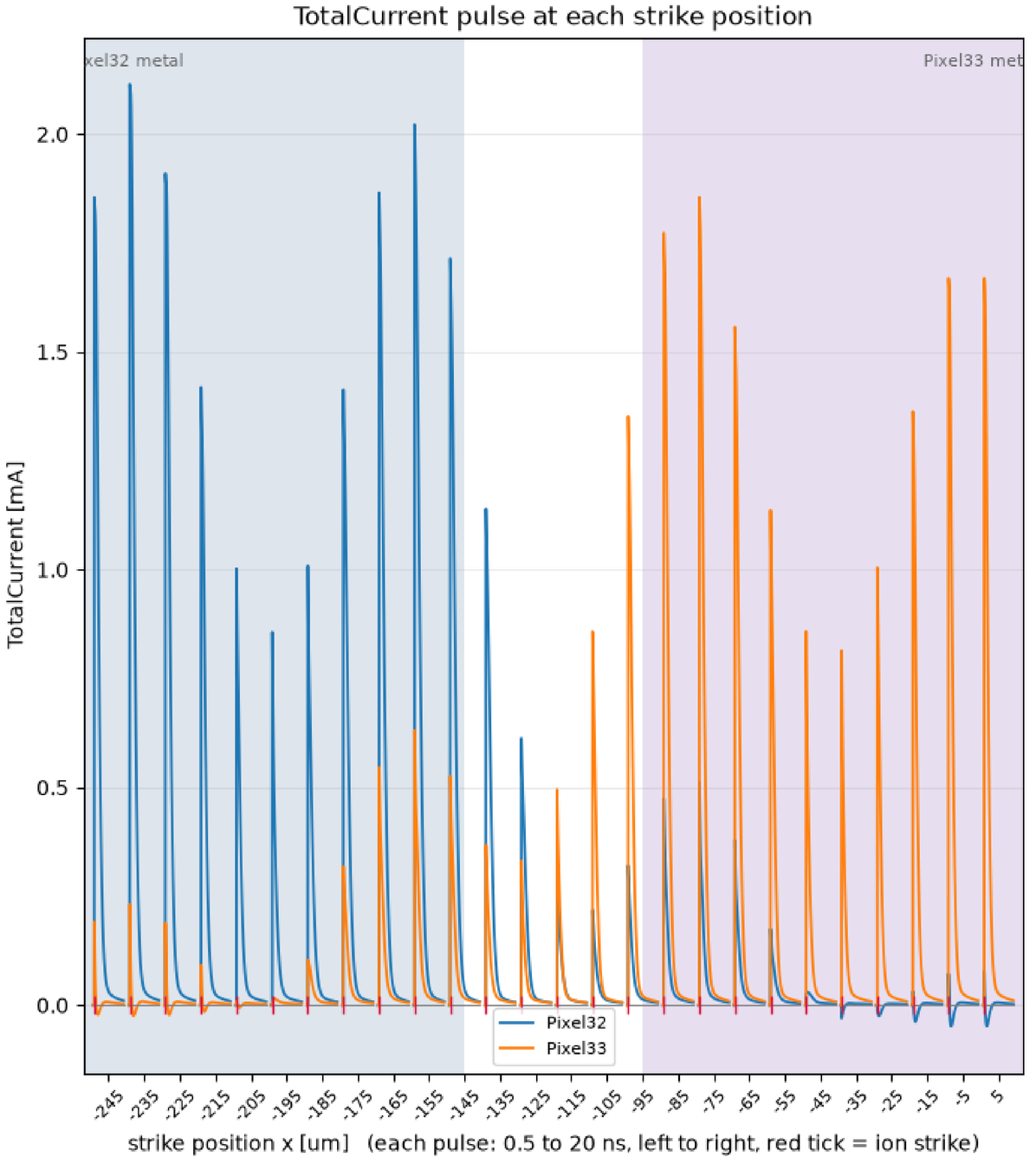
InP Detector

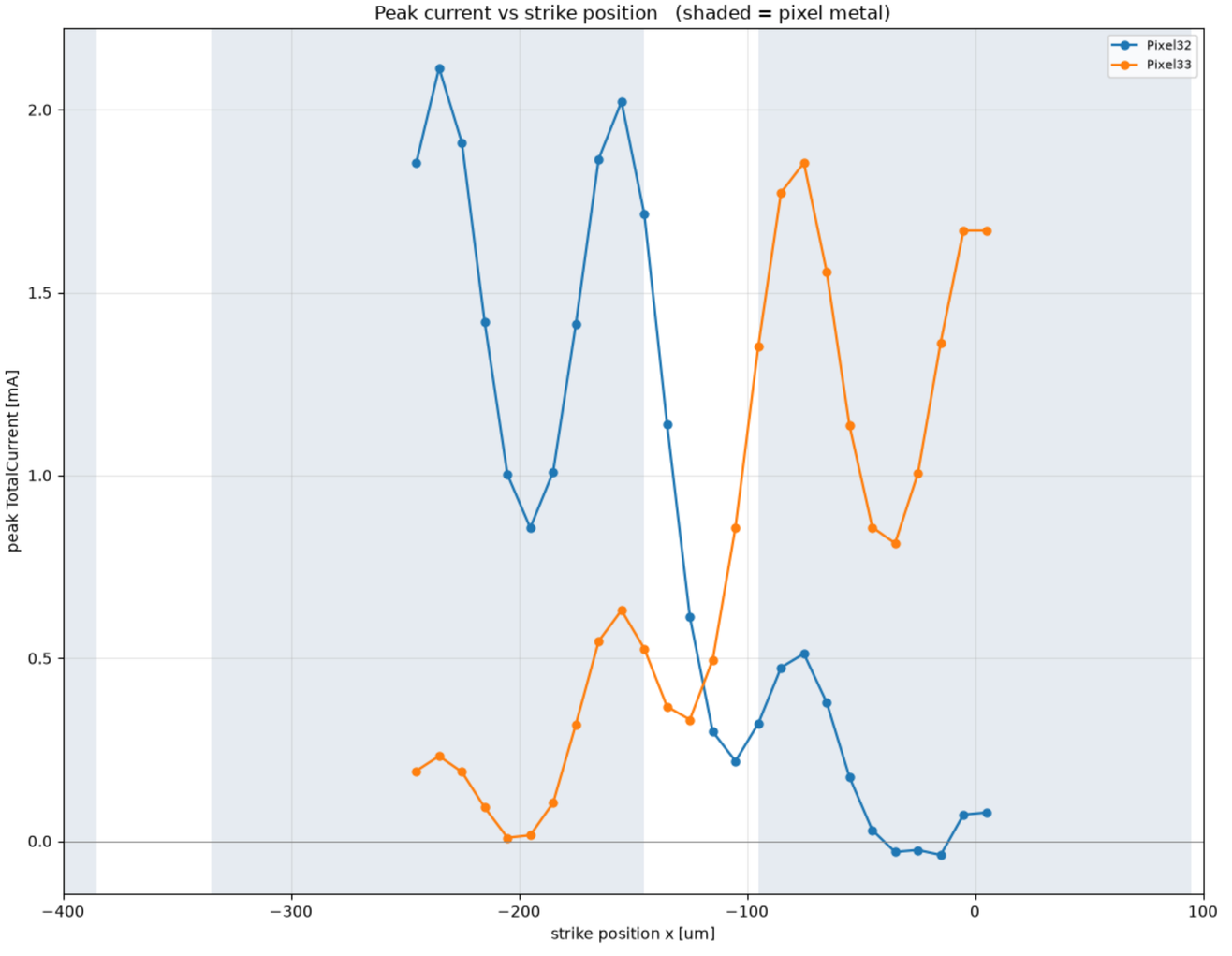




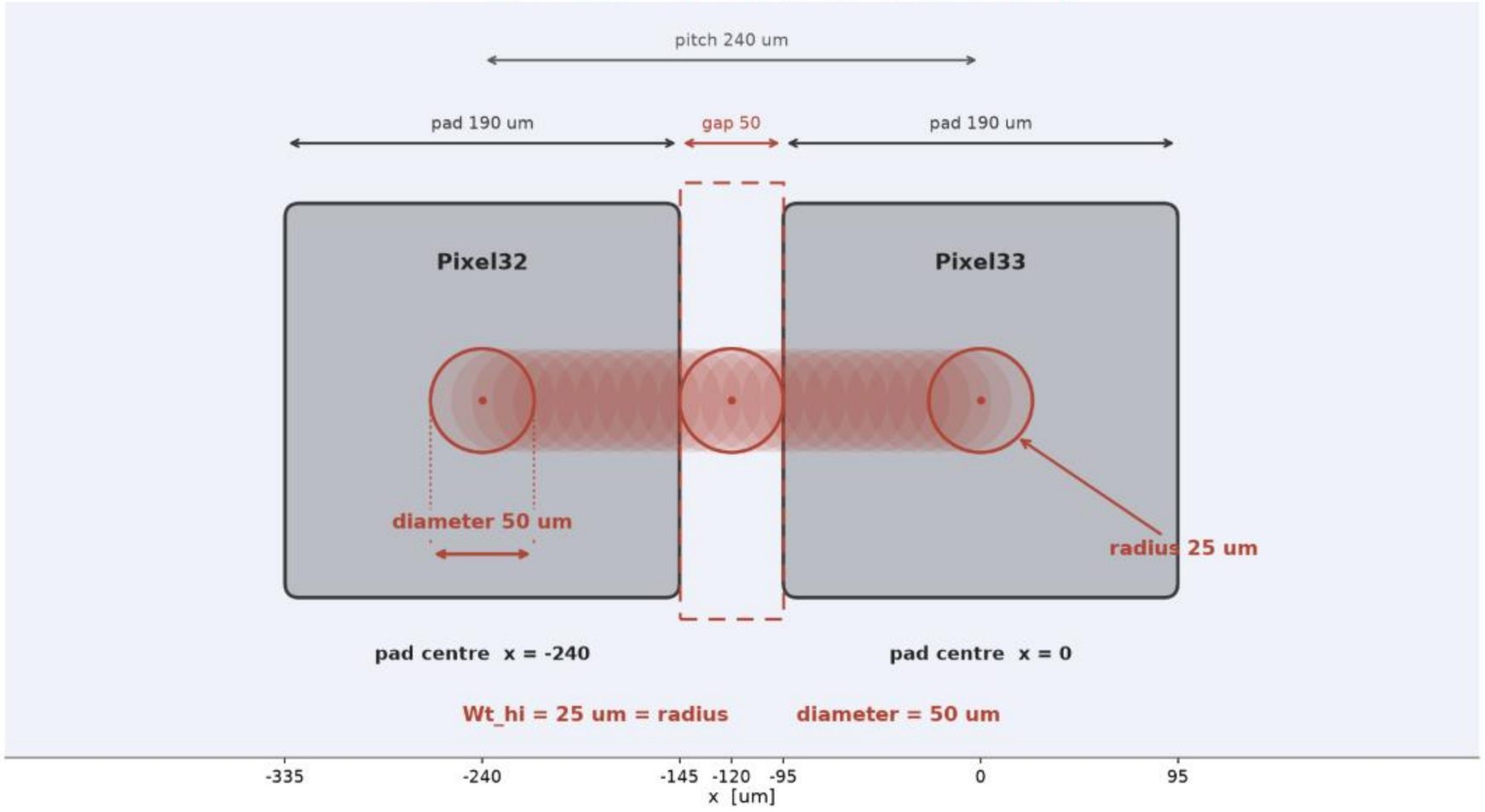



InP pad detector, 3D Sentaurus model - verified dimensions
top view: 5 x 5 pad array
InP 5 x 5 mm
beam hole 150 um
(in Pixel33)
51 52 53 54 55
41 42 43 44 45
31 32 33 34 35
21 22 23 24 25
11 12 13 14 15
guard rings
100 um, 100 um gap
electrode 1200 um = 5 x 240 um pitch
pad metal 190 x 190 um (end pads 215), 50 um gaps
y [um]
x [um]
cross-section through y = 0
heavy ion
LET 0.01 pC/um
3.5 pC in 350 um
1200 um
Cr pad contacts, 1 um thick (0 V)
1 nm InPO4 oxide
InP 350 um
350 um
Cr back contact, 1 um (bias -250 V / -450 V)
z [um] (layers not to scale)
x [um]

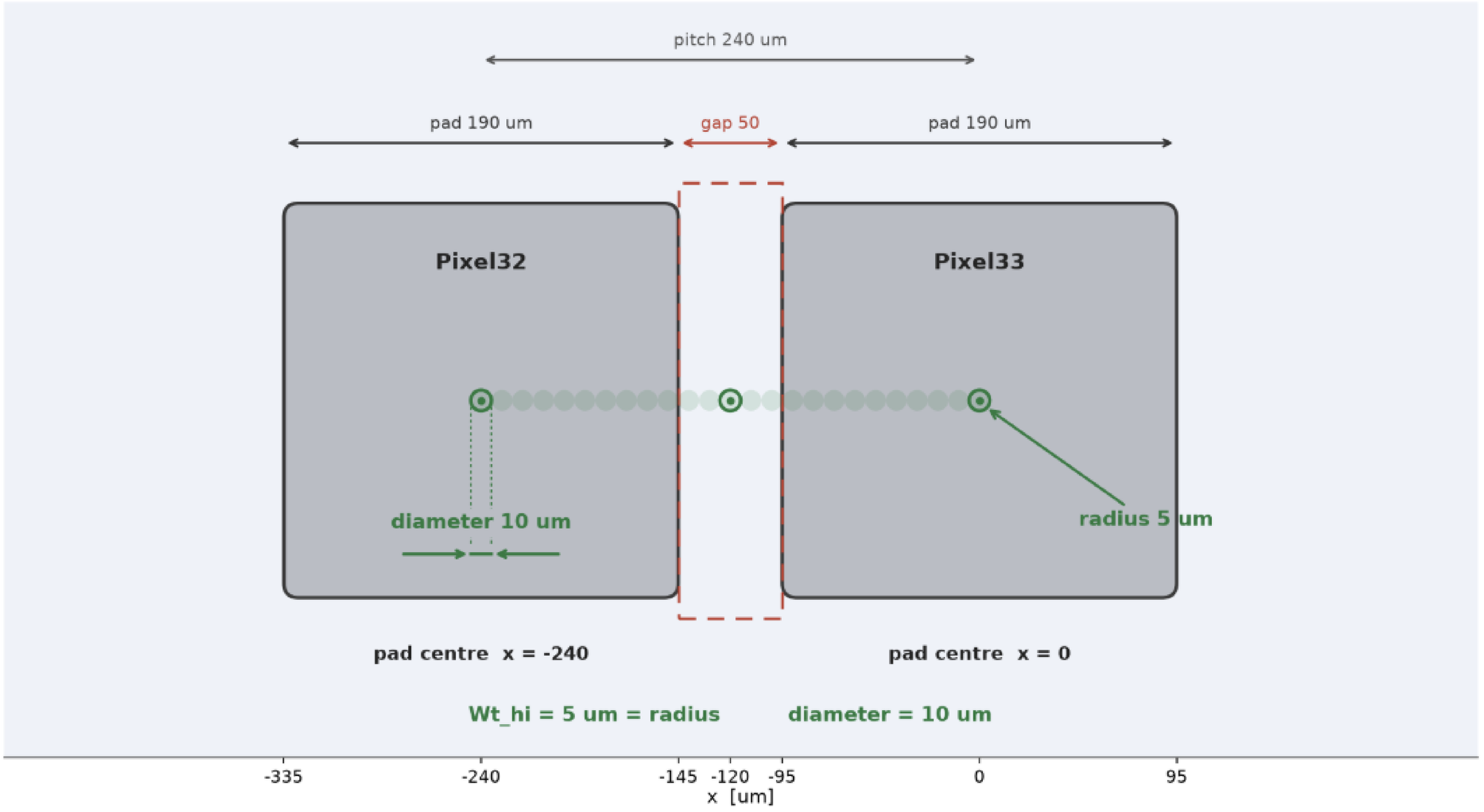

TotalCurrent pulse at each strike position
xel32 metal
Pixel33 met
TotalCurrent [mA]
2.0
1.5
1.0
0.5
0.0
Pixel32
Pixel33
-245 -235 -225 -215 -205 -195 -185 -175 -165 -155 -145 -135 -125 -115 -105 -95 -85 -75 -65 -55 -45 -35 -25 -15 -5 5
strike position x [um] (each pulse: 0.5 to 20 ns, left to right, red tick = ion strike)


Peak current vs strike position (shaded = pixel metal)
Pixel32
Pixel33
peak TotalCurrent [mA]
2.0
1.5
1.0
0.5
0.0
−400
−300
−200
−100
0
100
strike position x [um]

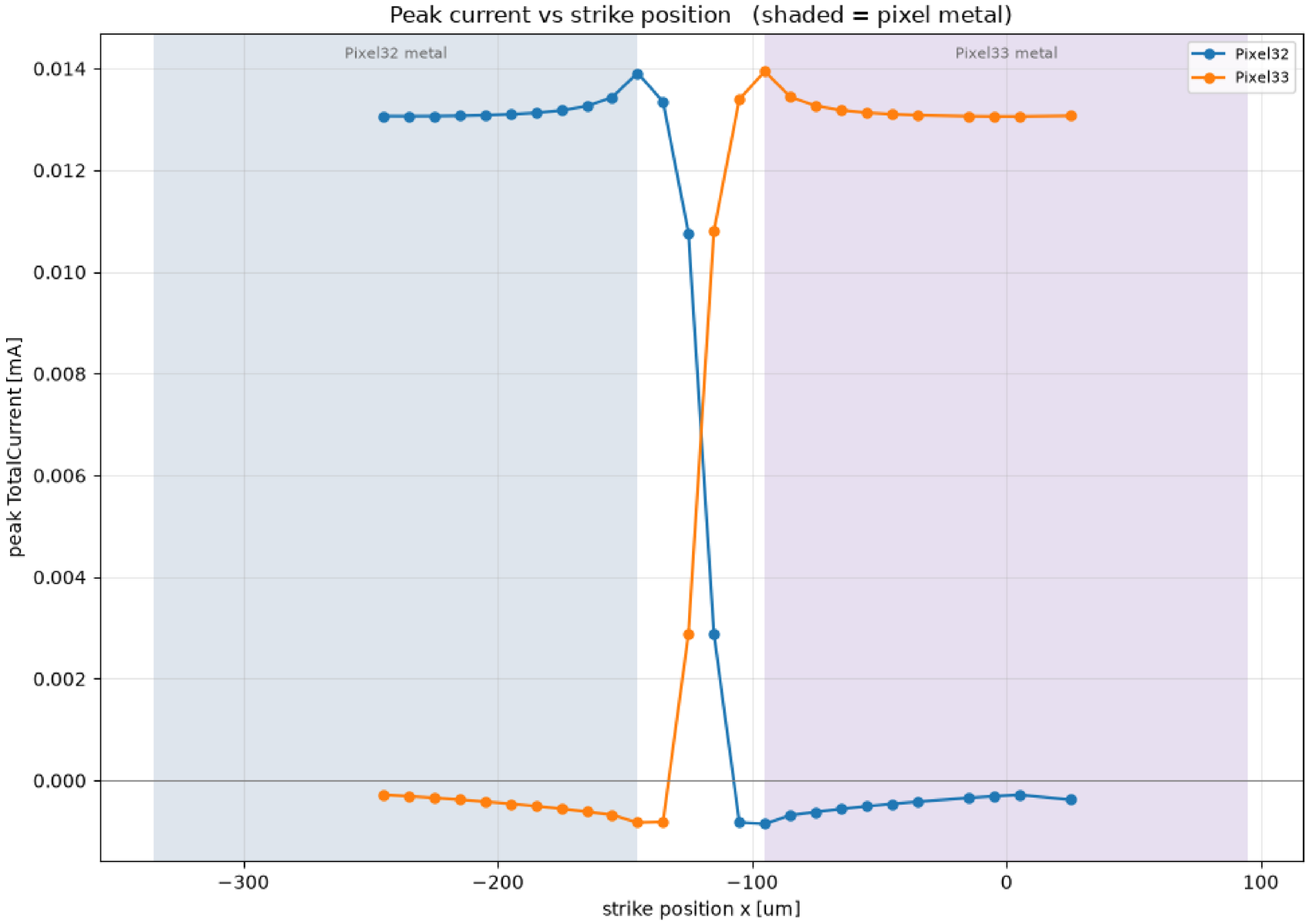
A. Wt_hi = 25 um (the original heavy-ion runs)



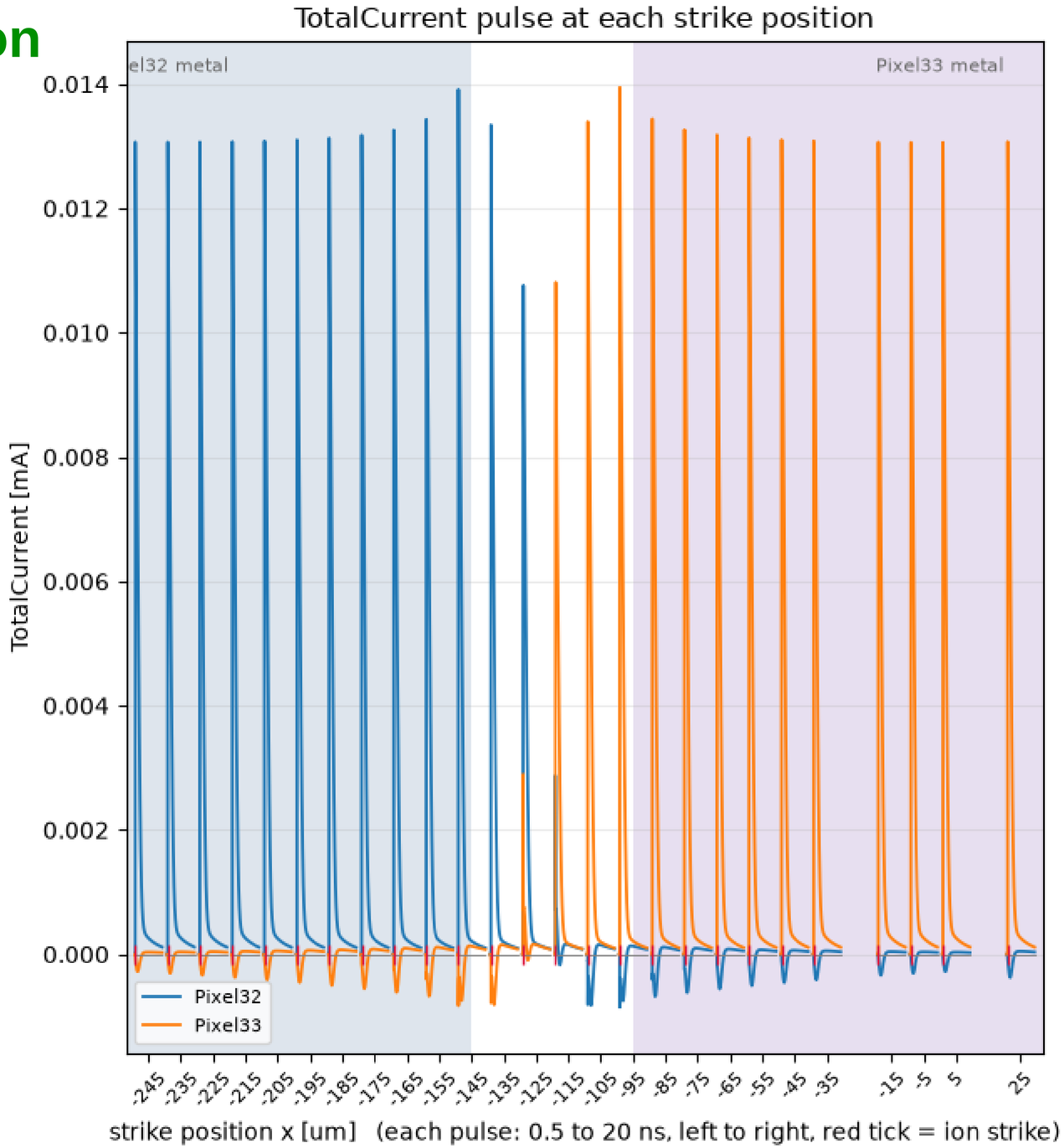
B. Wt_hi = 5 um (what we changed it to)



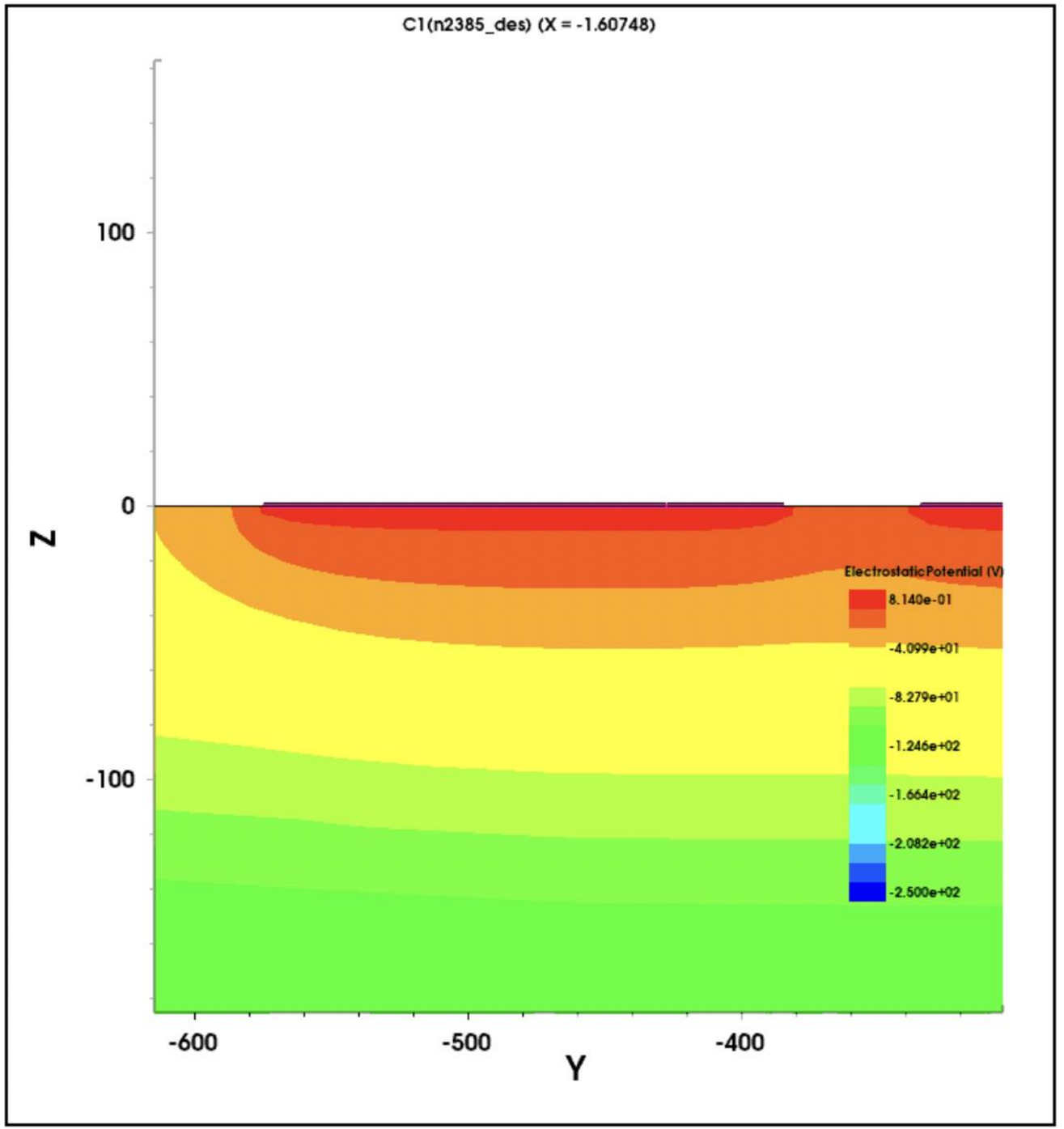
Peak Current vs Position (updated MESH)



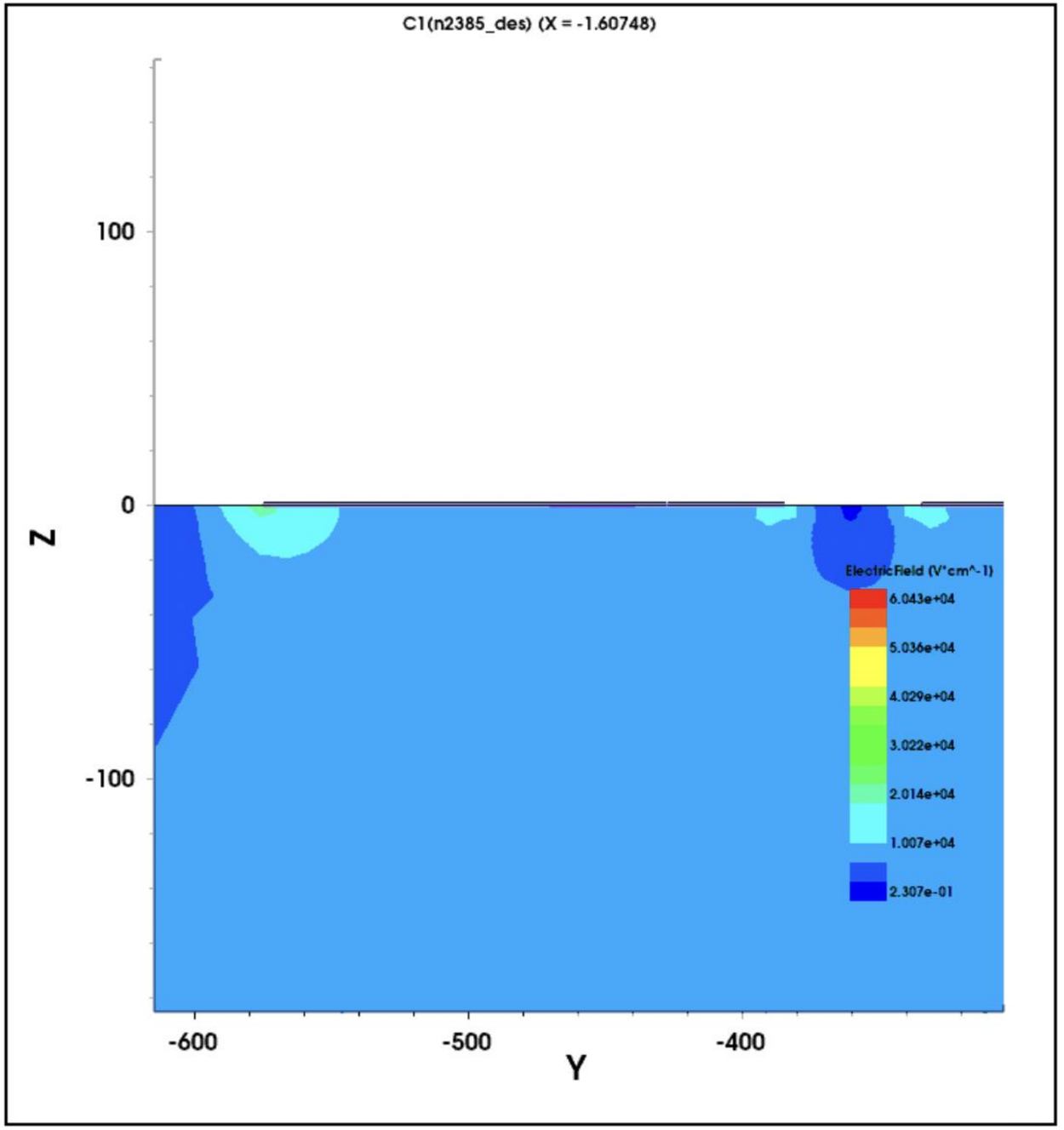
Total Current Pulse vs Position



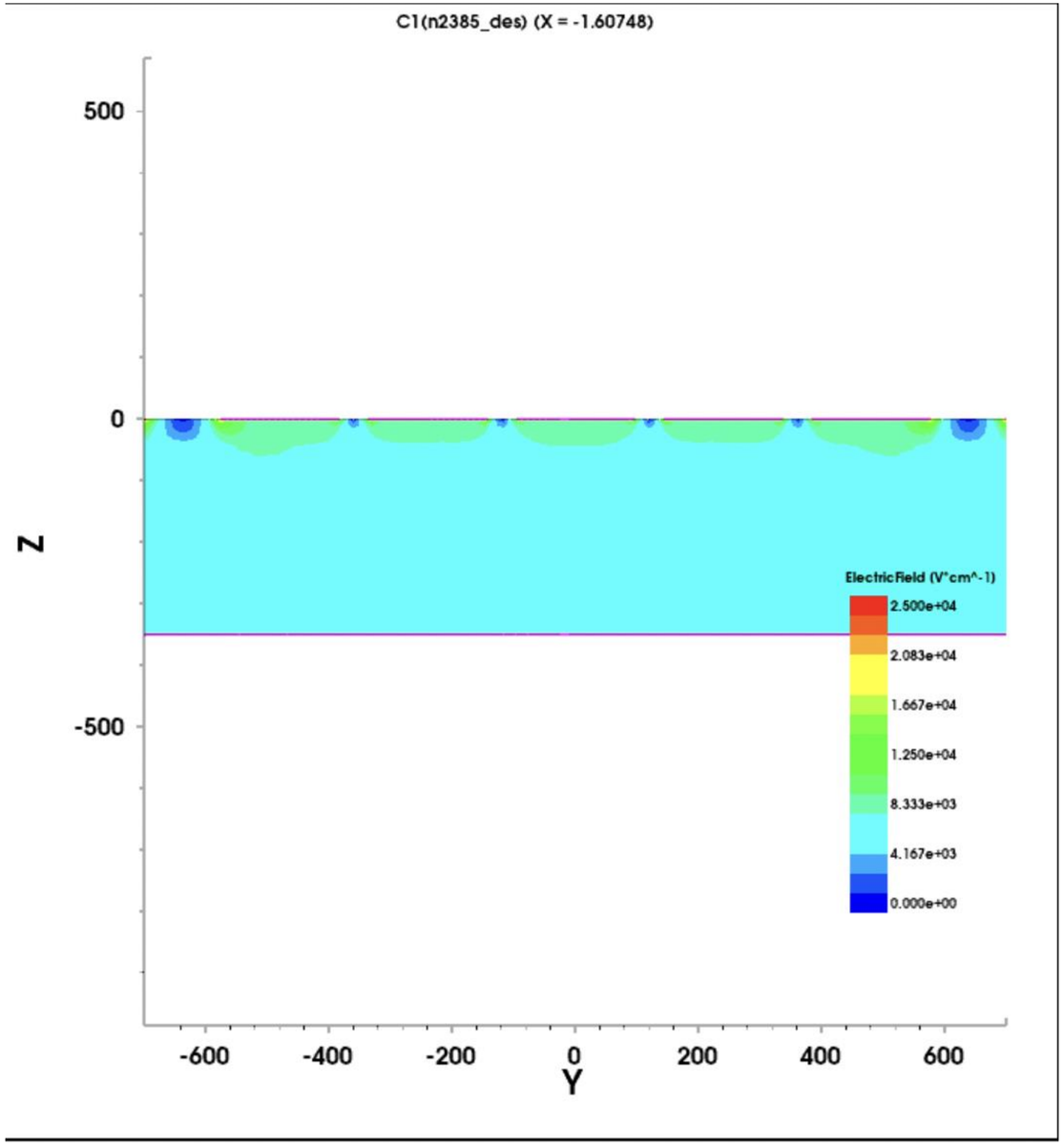
Electrostatic Potential

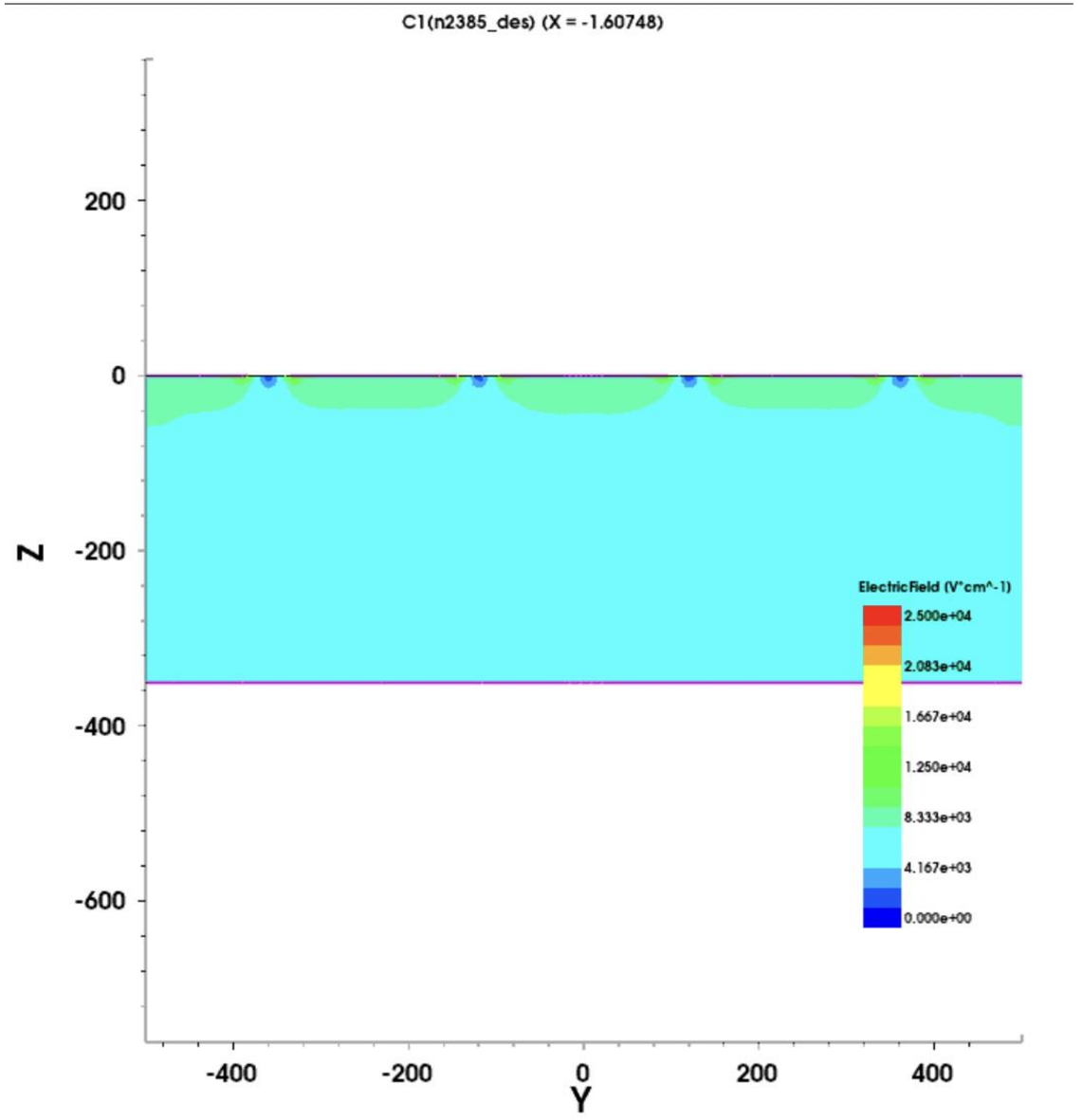


Electric Field

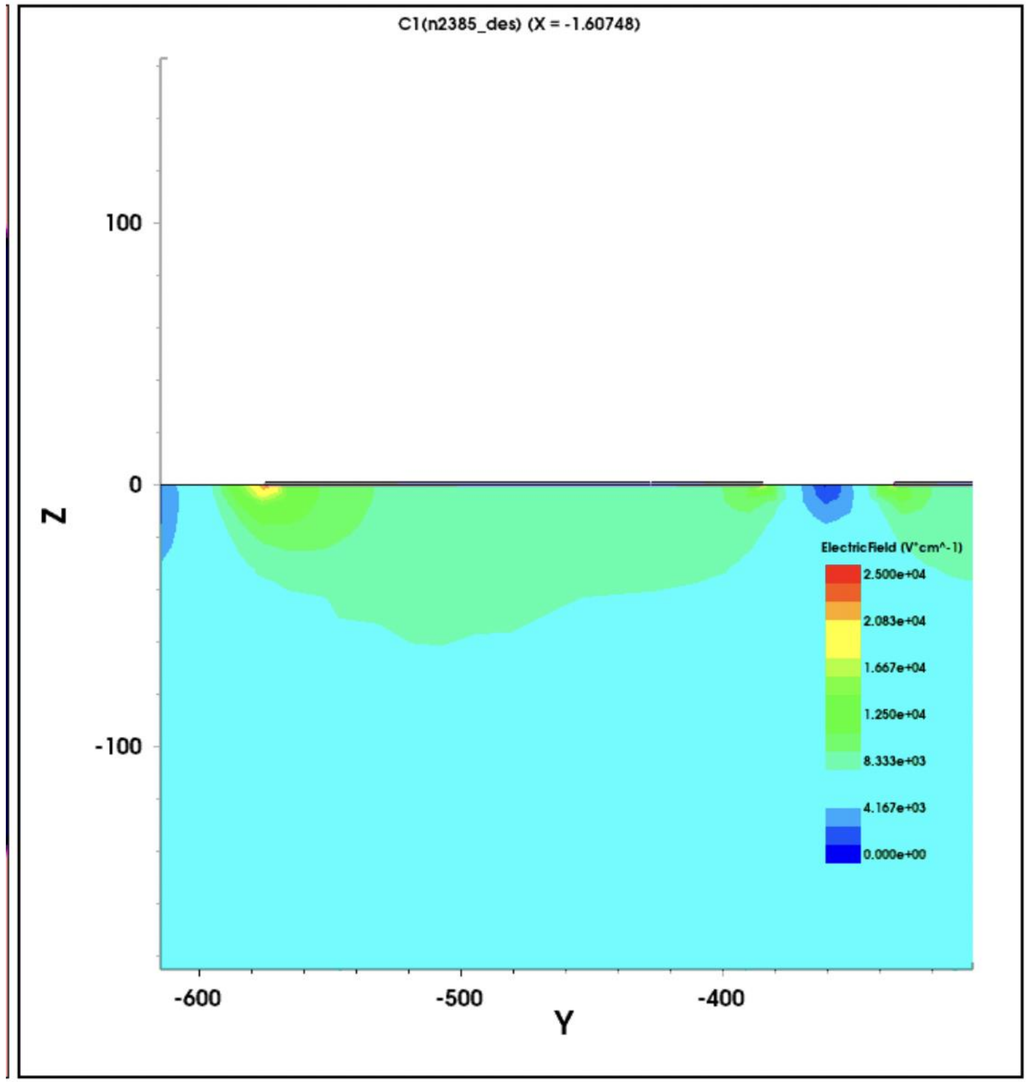


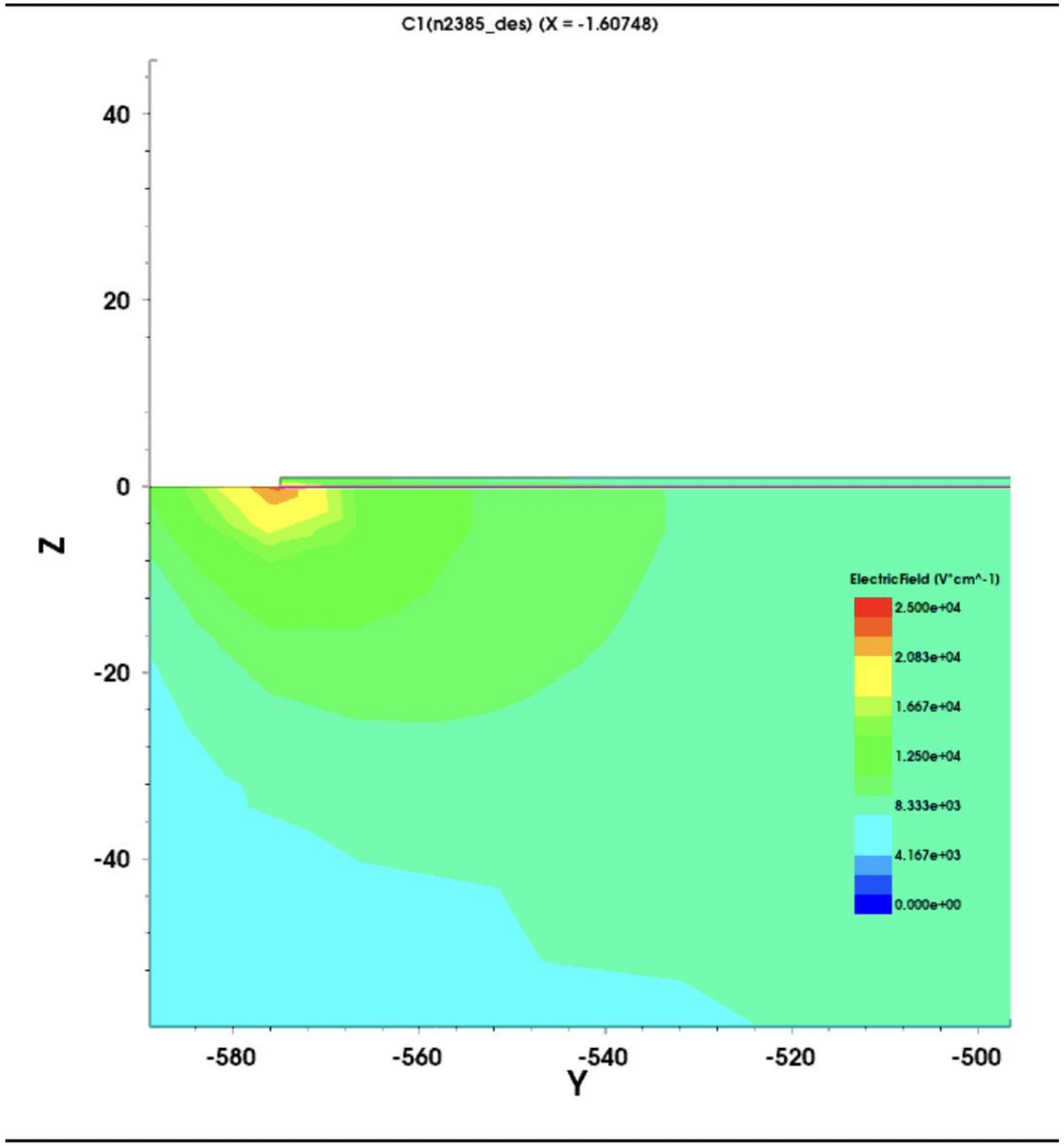
Electric Field



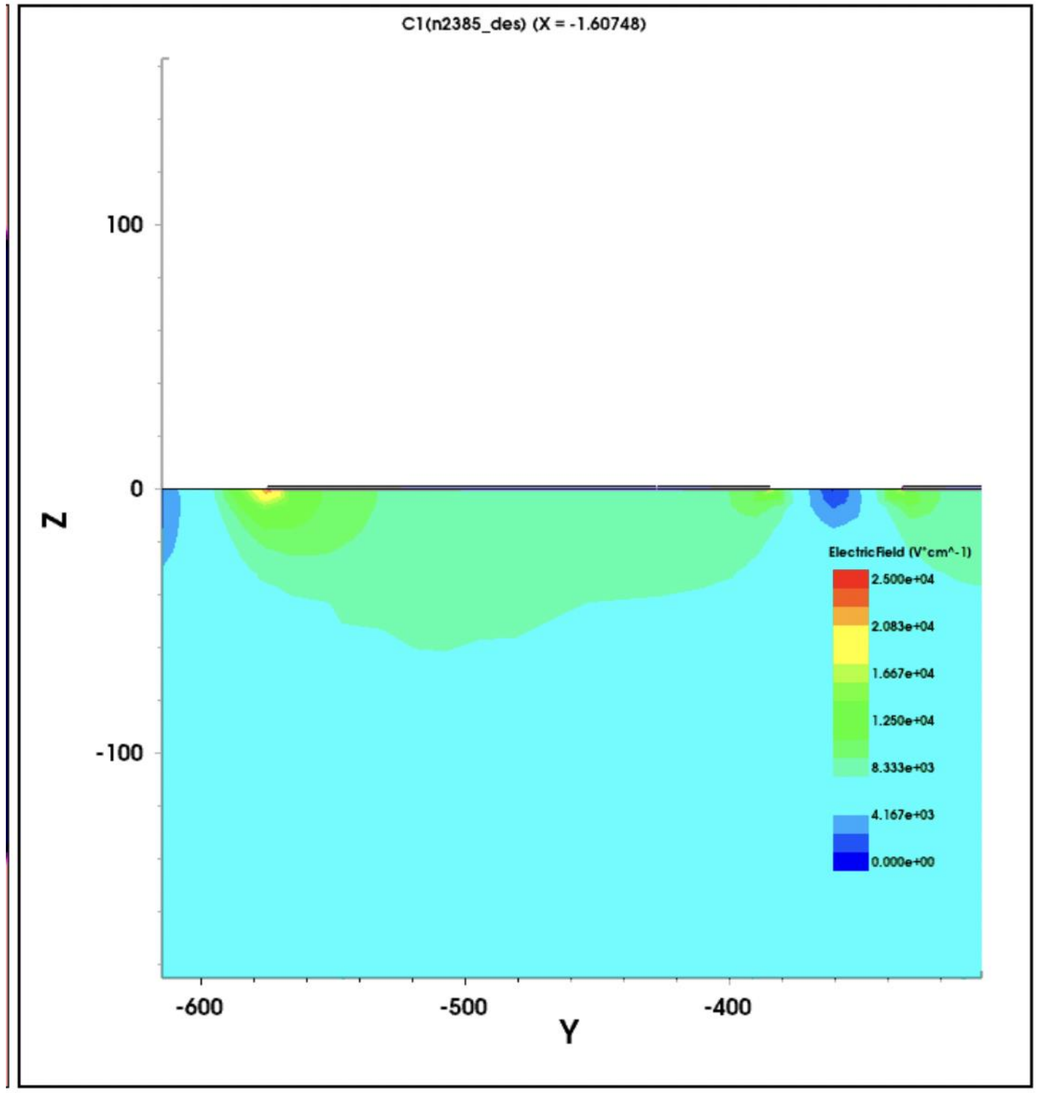


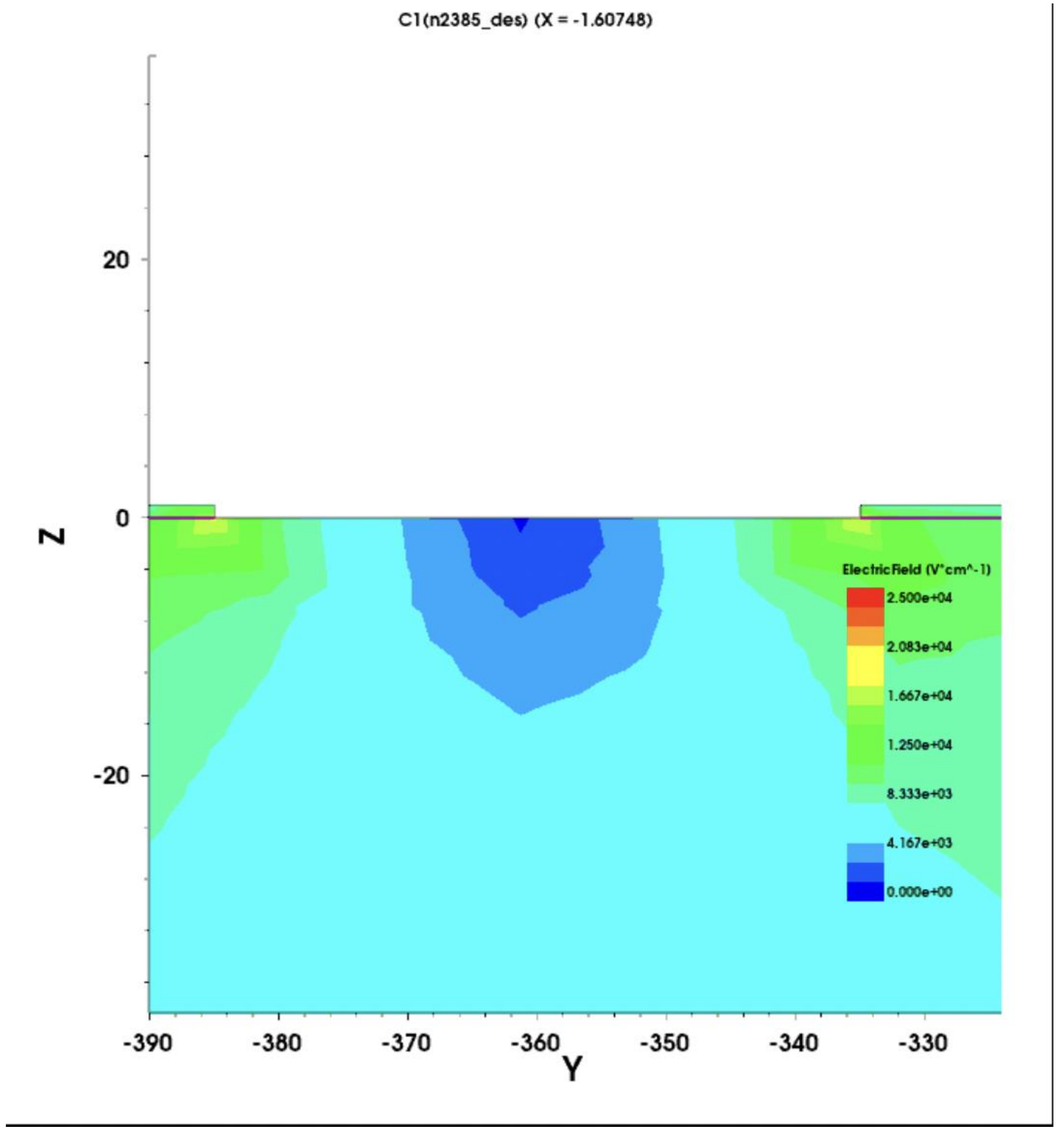
Electric Field

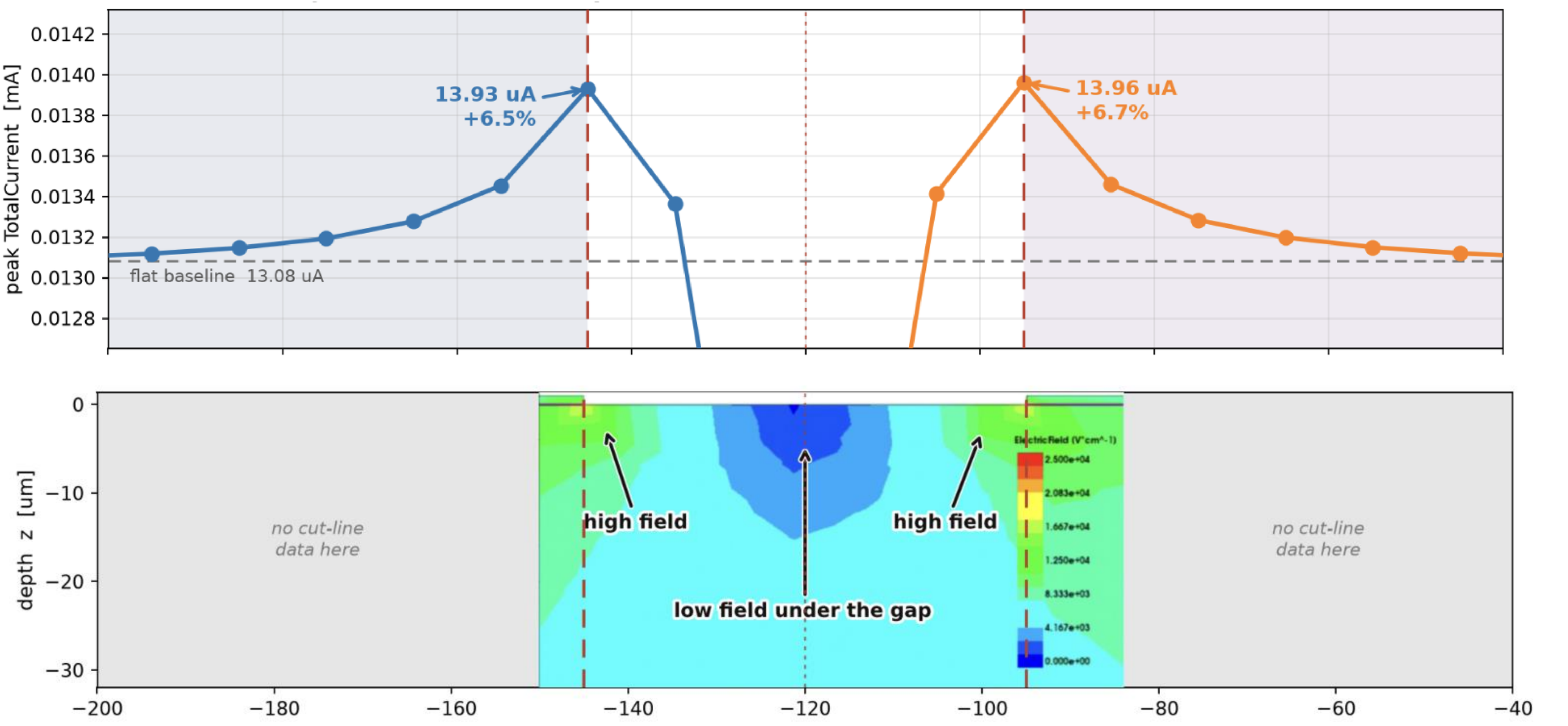




Electric Field

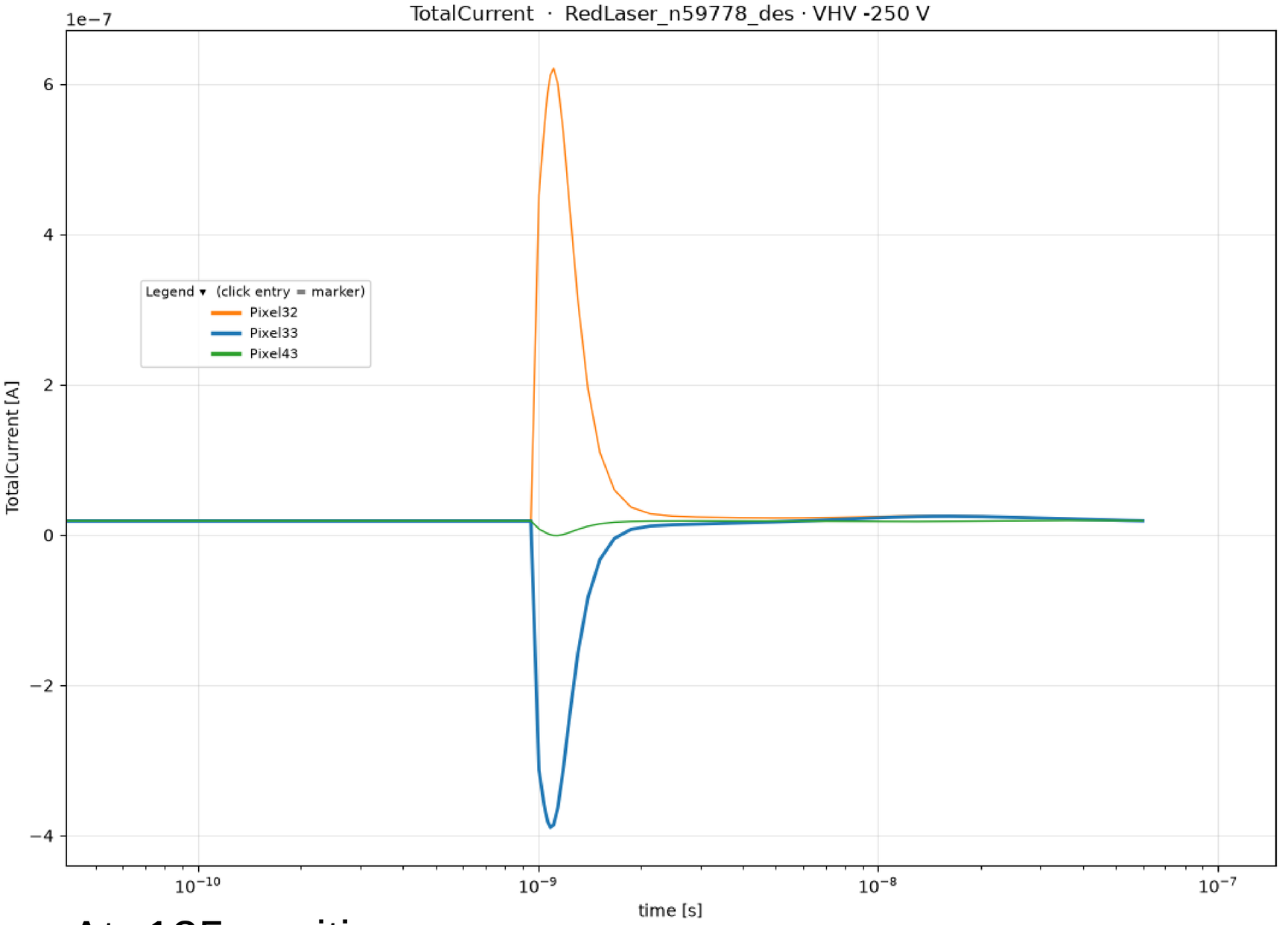




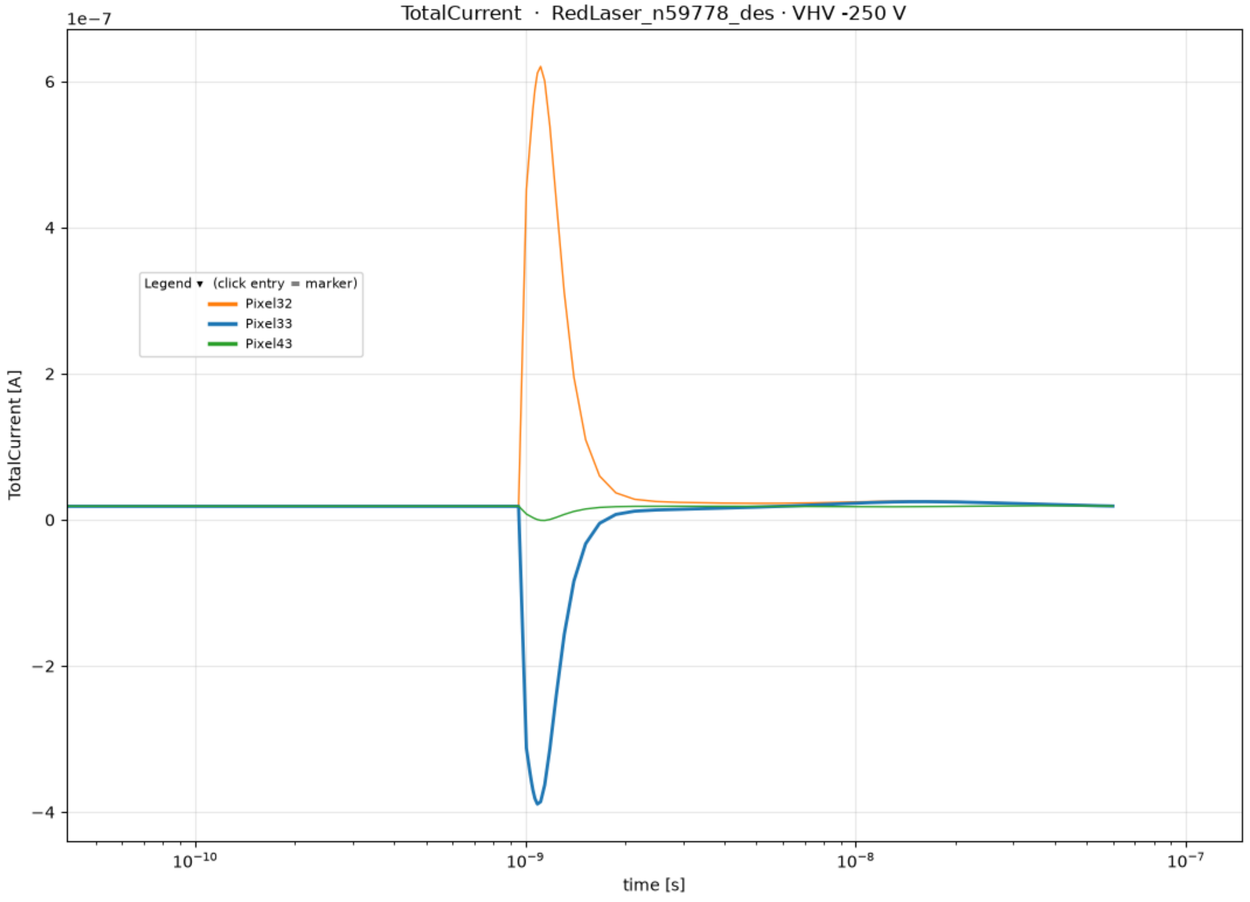

peak TotalCurrent [mA]
0.0142
0.0140
0.0138
0.0136
0.0134
0.0132
0.0130
0.0128
13.93 uA
+6.5%
13.96 uA
+6.7%
flat baseline 13.08 uA
depth z [um]
0
−10
−20
−30
−200
−180
−160
−140
−120
−100
−80
−60
−40
no cut-line
data here
high field
high field
low field under the gap
no cut-line
data here
ElectricField (V*cm^-1)
2.500e+04
2.083e+04
1.667e+04
1.250e+04
8.333e+03
4.167e+03
0.000e+00

Red Laser:

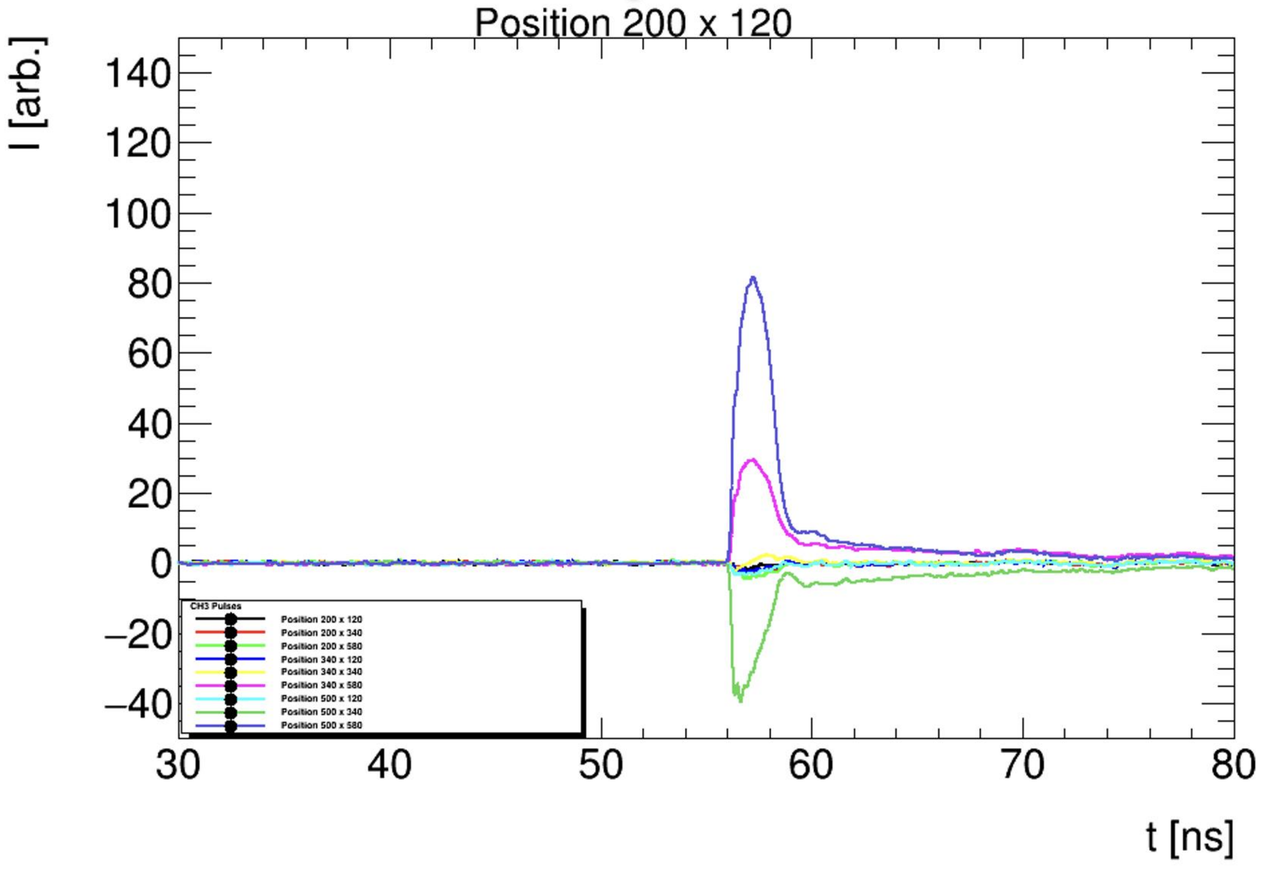
For pixel 32, 33 and 43

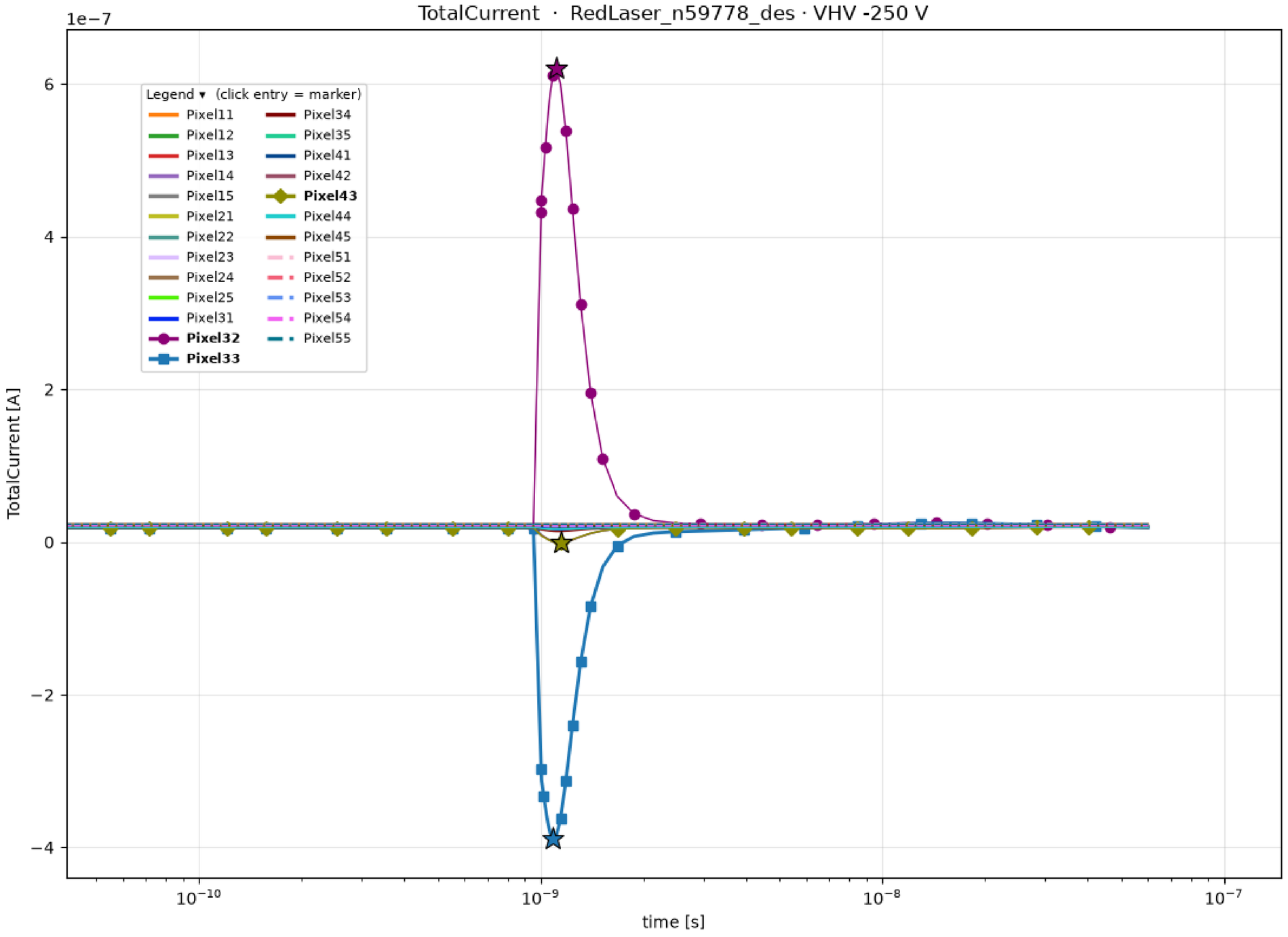


At -125 position


TotalCurrent · RedLaser_n59778_des · VHV -250 V
1e−7
TotalCurrent [A]
time [s]
Legend ▾ (click entry = marker)
Pixel32
Pixel33
Pixel43

At -125


Position 200 x 120
I [arb.]
t [ns]
CH3 Pulses
Position 200 x 120
Position 200 x 340
Position 200 x 580
Position 340 x 120
Position 340 x 340
Position 340 x 580
Position 500 x 120
Position 500 x 340
Position 500 x 580


TotalCurrent · RedLaser_n59778_des · VHV -250 V
1e−7
TotalCurrent [A]
time [s]
Legend ▾ (click entry = marker)
Pixel11
Pixel12
Pixel13
Pixel14
Pixel15
Pixel21
Pixel22
Pixel23
Pixel24
Pixel25
Pixel31
Pixel32
Pixel33
Pixel34
Pixel35
Pixel41
Pixel42
Pixel43
Pixel44
Pixel45
Pixel51
Pixel52
Pixel53
Pixel54
Pixel55