

Measurement of Charge Collection in Active Pixels in irradiated AMS Chess 1 HVCMOS prototype

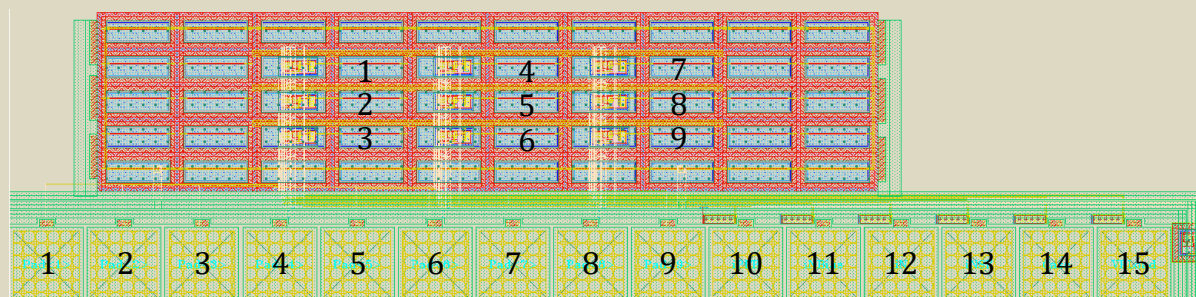
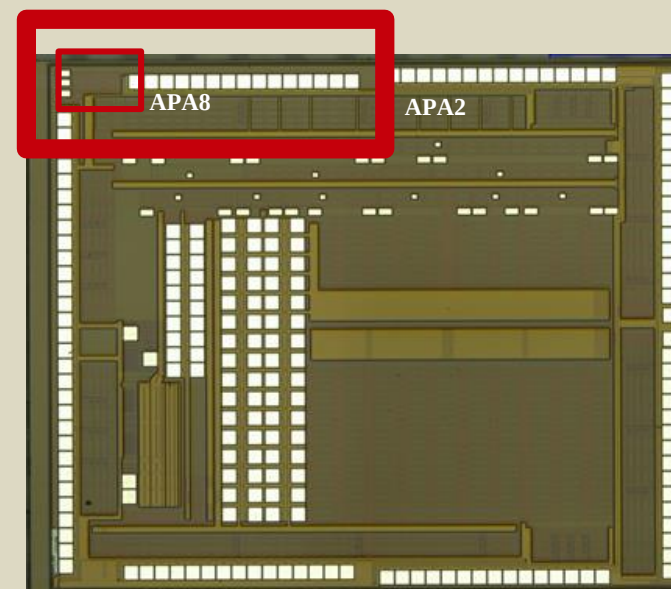
ATLAS Strip CMOS Regular Meeting, 29 March 2016

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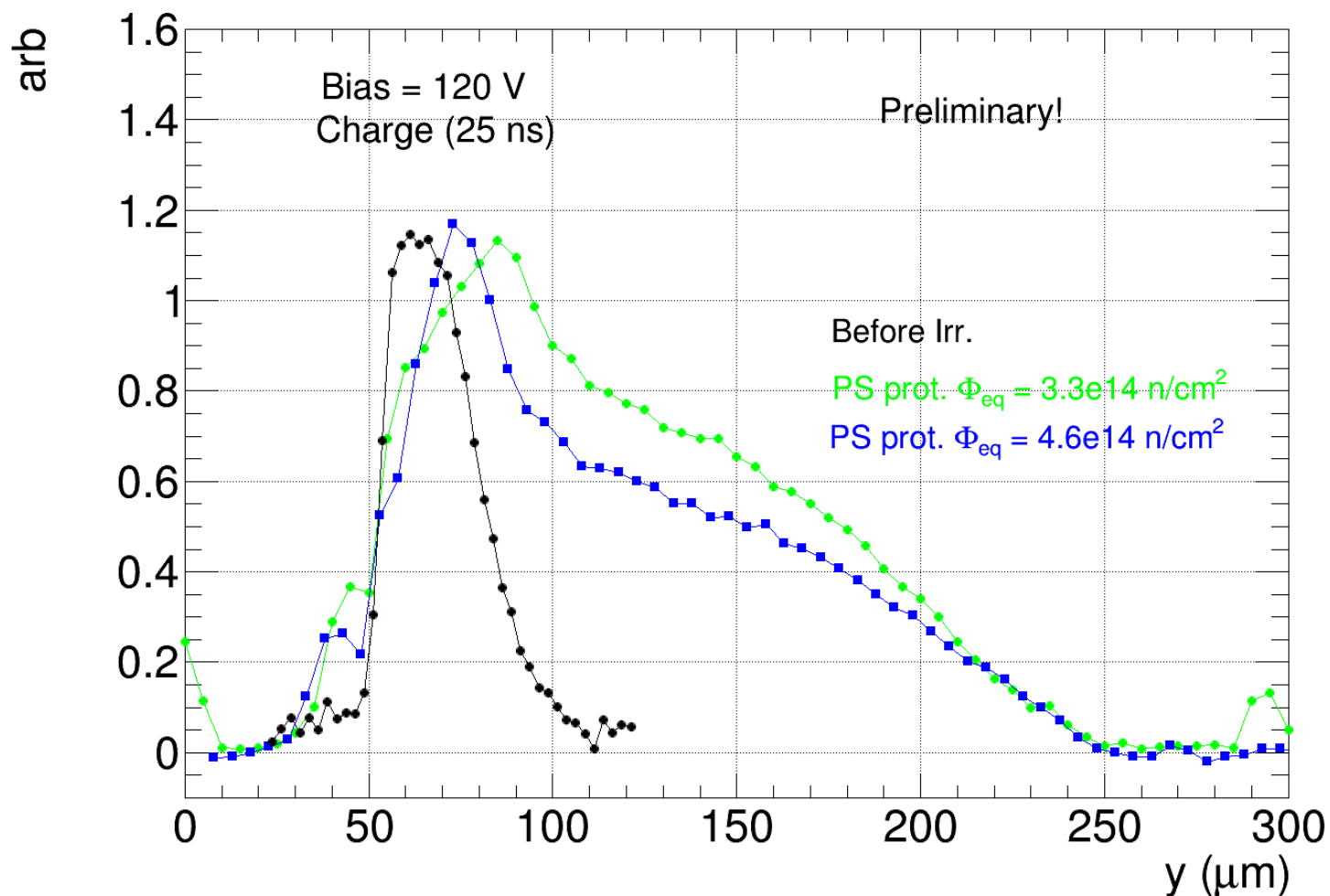
AMS CHESS 1 Sample

- 350 nm, 20 Ω , max. bias voltage 120 V, active pixels
- passive pixel array for e-TCT:
 - 3x3 pixels, 100 x 45 μm^2
- active pixel arrays (APAs) for edge TCT:
 - APA02: 3x3 pixels, 100 x 45 μm^2
 - APA08: 3x3 pixels, 800 x 45 μm^2 ←
- Irradiated at CERN PS in November 2015
 - low fluence (1 sample) – 3.5e14 neq cm^{-2}
 - high fluence (1 sample) – 4.8e14 neq cm^{-2}
 - not annealed



layout of a 3x3 APA (200 x 45 μm^2)

Passive Pixel Array – Depletion Depth



Depleted region increases after irradiation

Global DAC Settings

- Chip DACs need tuning to see the signal
 - For VPFB > 2500 amplifier output disappears
 - For VPFB > 2700 very small negative pulse observed
- Greater laser power compared to unirradiated sample needed

CONFIG 7

VPLOAD	2100
VCASC	2600
VNSF	570
VN	1000
VBIAS	340
VPFB	2664

CONFIG 8 (standard)

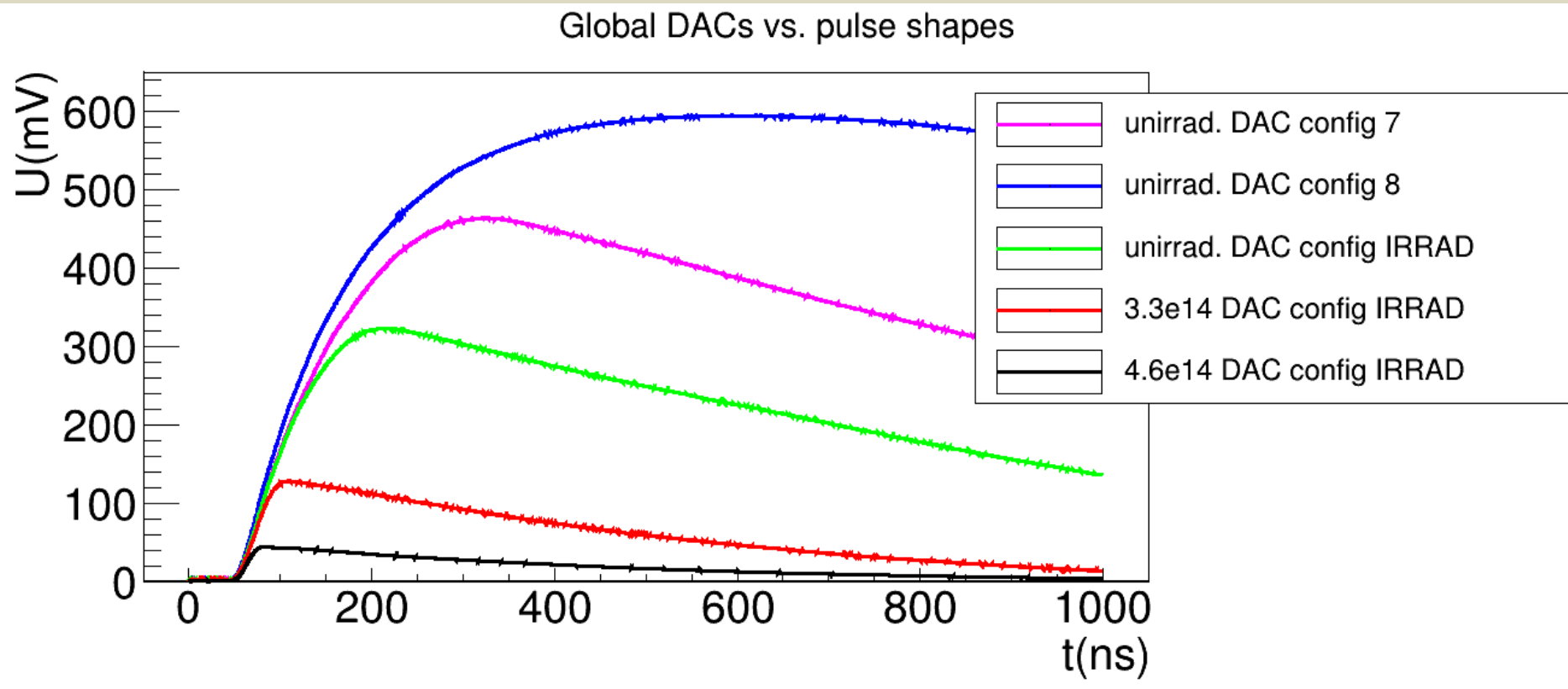
VPLOAD	2100
VCASC	2600
VNSF	750
VN	1000
VBIAS	150
VPFB	2700

CONFIG IRRAD

VPLOAD	2100
VCASC	2600
VNSF	570
VN	1000
VBIAS	300
VPFB	2500

Gain after Irradiation

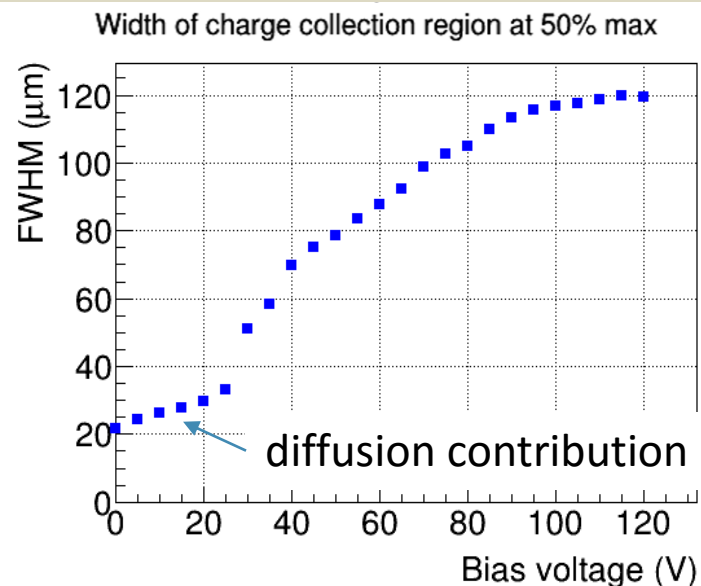
- Pulse shape on 3 different samples measured (unirrad., low fl., high fl.)
- Same amount of light injected
- 120 V bias



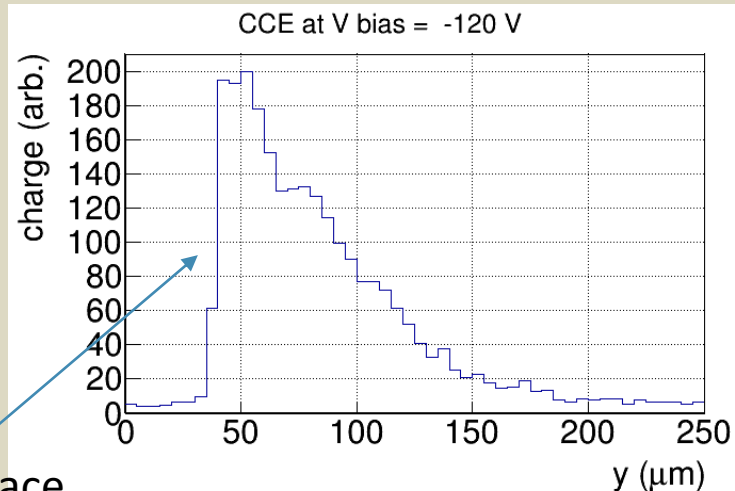
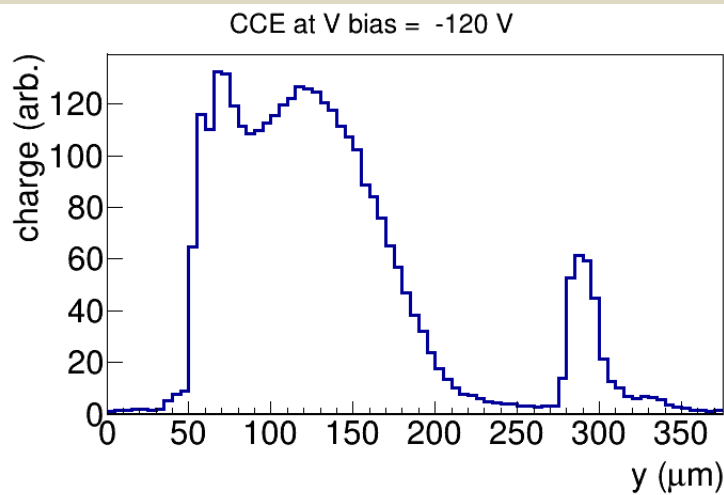
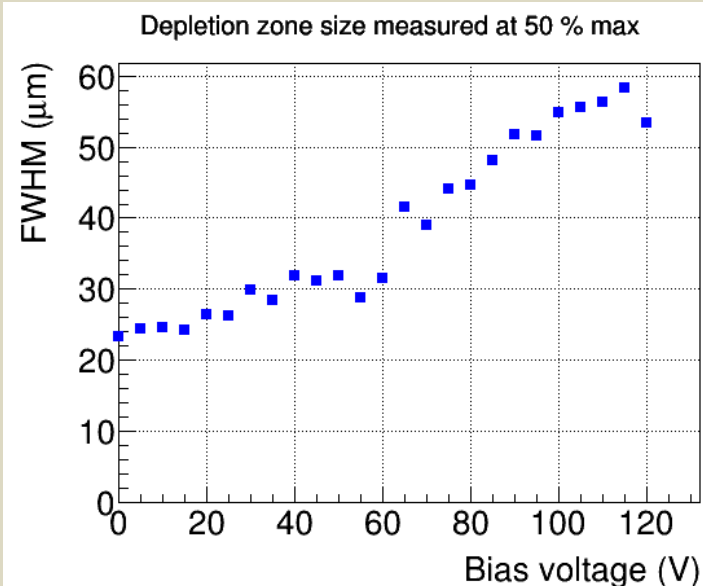
Gain reduces drastically with irradiation (amplifier degradation)

Depletion depth in APA 08

low fluence



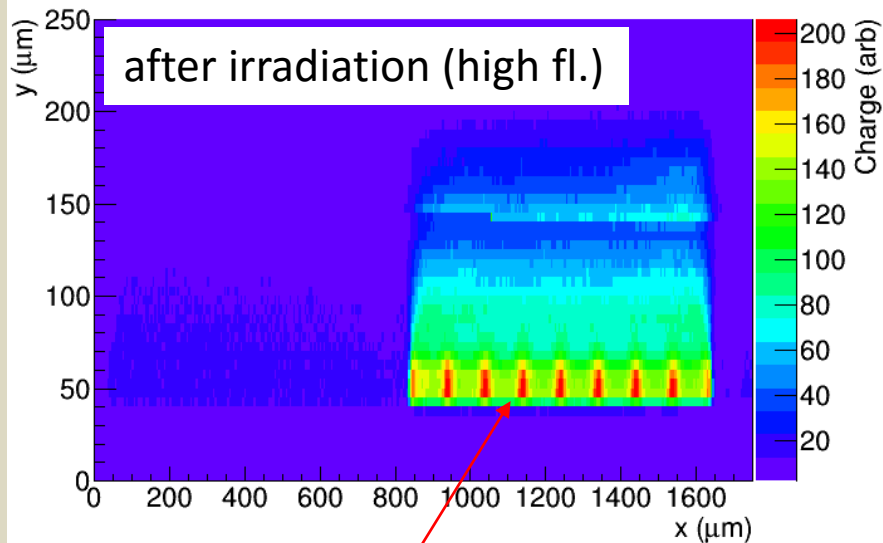
high fluence



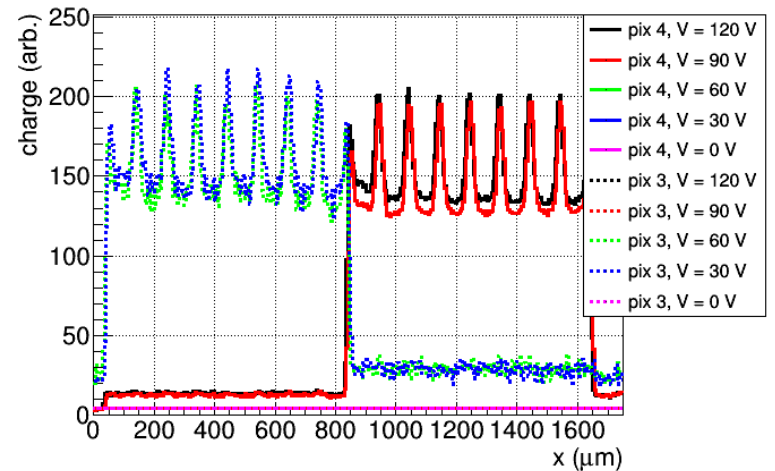
chip surface

APA08, 2d Scan

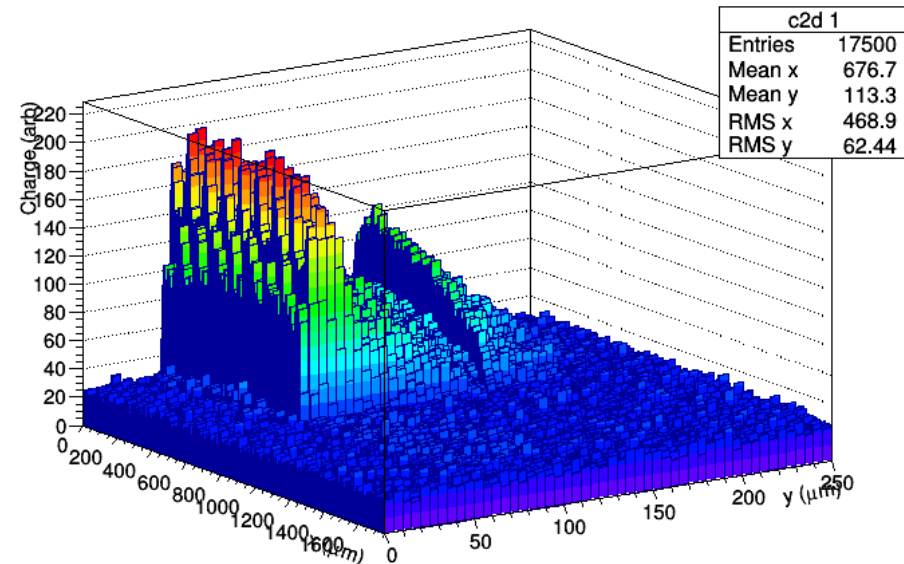
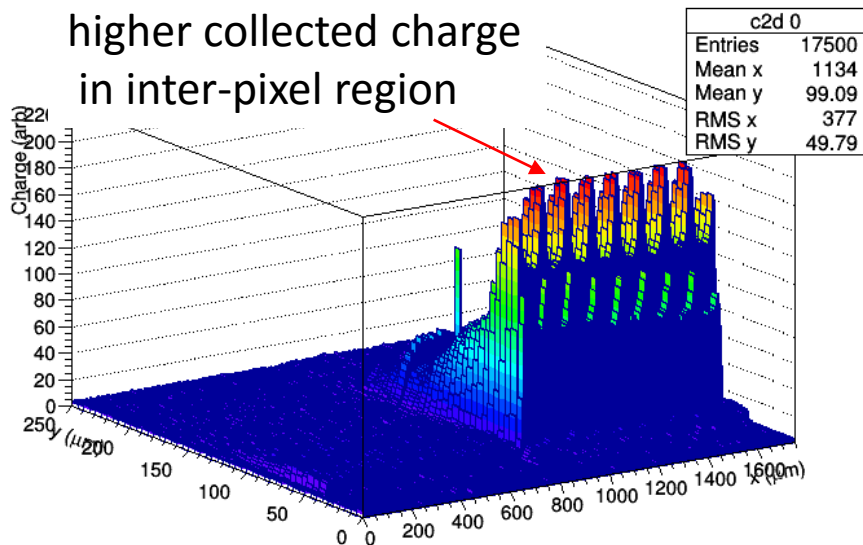
CCE at V bias = 120 V



CCE at y=50 μm



higher collected charge
in inter-pixel region

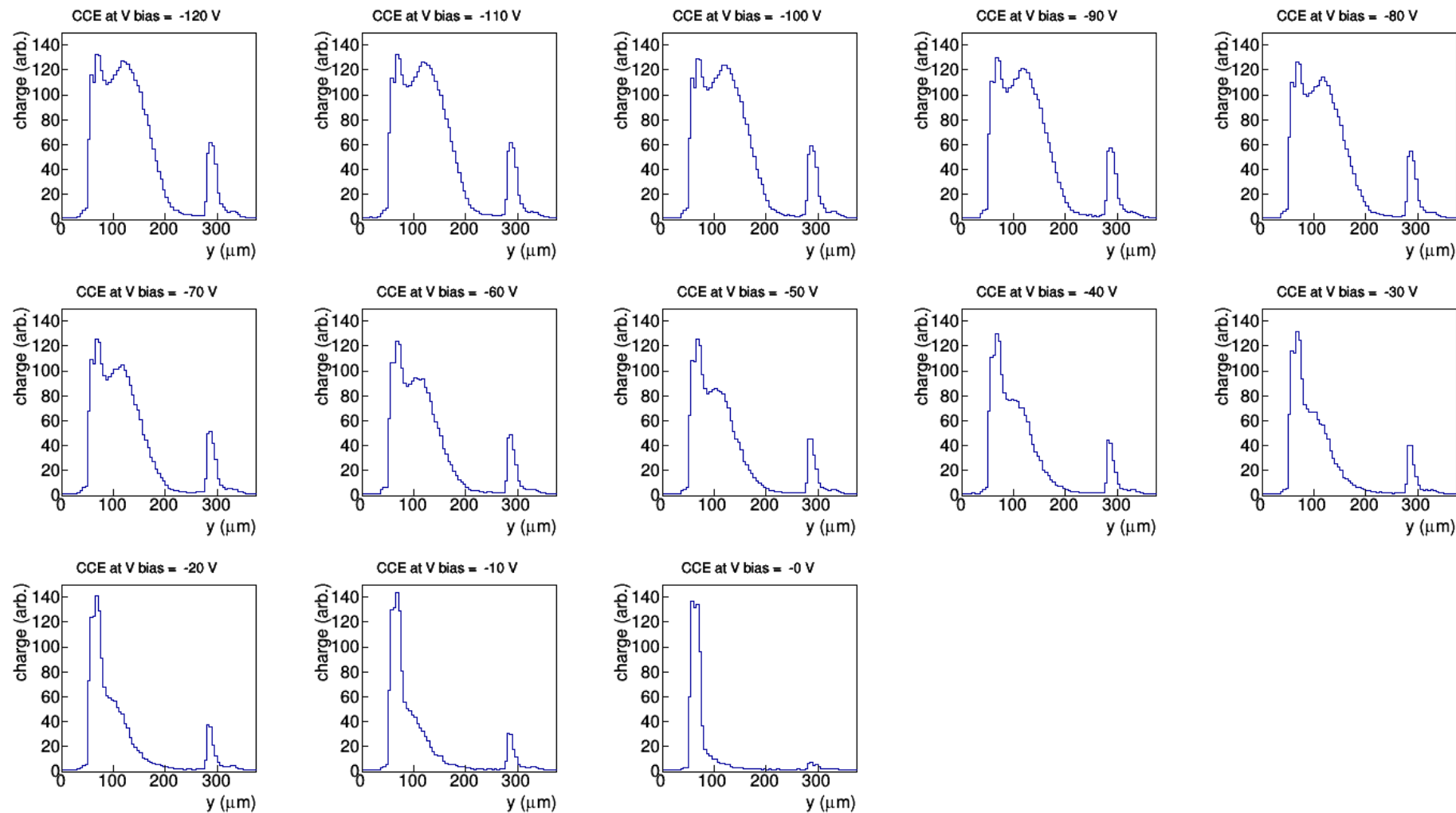


Conclusion



- Signal in irradiated devices found, but require specific DAC settings and high laser power
- Depletion regions grows with irradiation
- Next steps:
 - measure amplifier gain on irradiated samples (isolated amplifier)
 - annealing

Charge collection profiles – low fluence



Charge collection profiles – high fluence

