# Charge collection measurements with large passive array on CHESS-1 chip irradiated with neutrons

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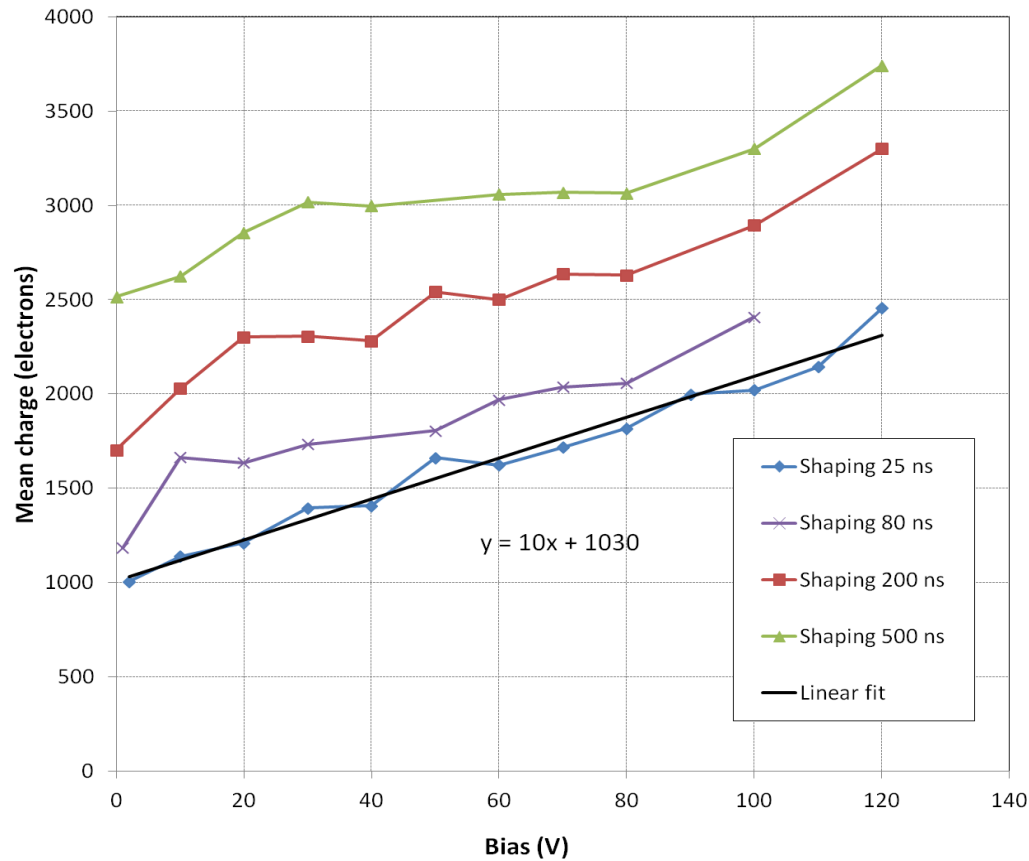• experimental setup and  first results shown at the last meeting
https://indico.desy.de/getFile.py/access?contribId=4&sessionId=0&resId=0&materialId=slides&confId=11374

→ measure collected charge with large passive array with Sr90
→  measure with charge sensitive amplifier and custom made shaper with selectable shaping times

• in this presentation:

  • measurements before irradiation up to 120 V

  • first results with device irradiated in reactor with neutrons to $\Phi_{eq}$ = 2e14 n/cm$^2$

## Before irradiation



$y = 10x + 1030$

Legend:
- Shaping 25 ns
- Shaping 80 ns
- Shaping 200 ns
- Shaping 500 ns
- Linear fit

- measurements extended up to bias of 120 V
- relation at 25 ns: **Mean charge = 1030 el + 10 el/V**

## Irradiated device
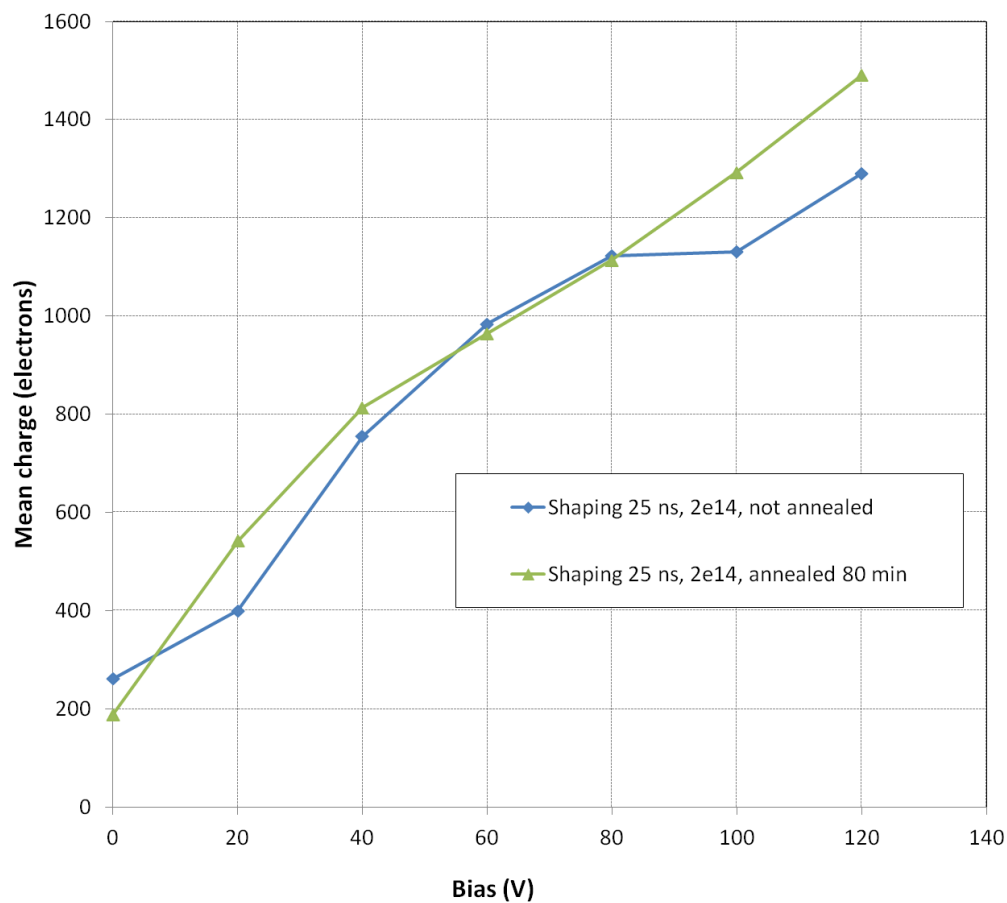
- sample irradiated in TRIGA reactor in Ljubljana to equivalent fluence $\Phi_{eq}$ = 2e14 n/cm$^2$
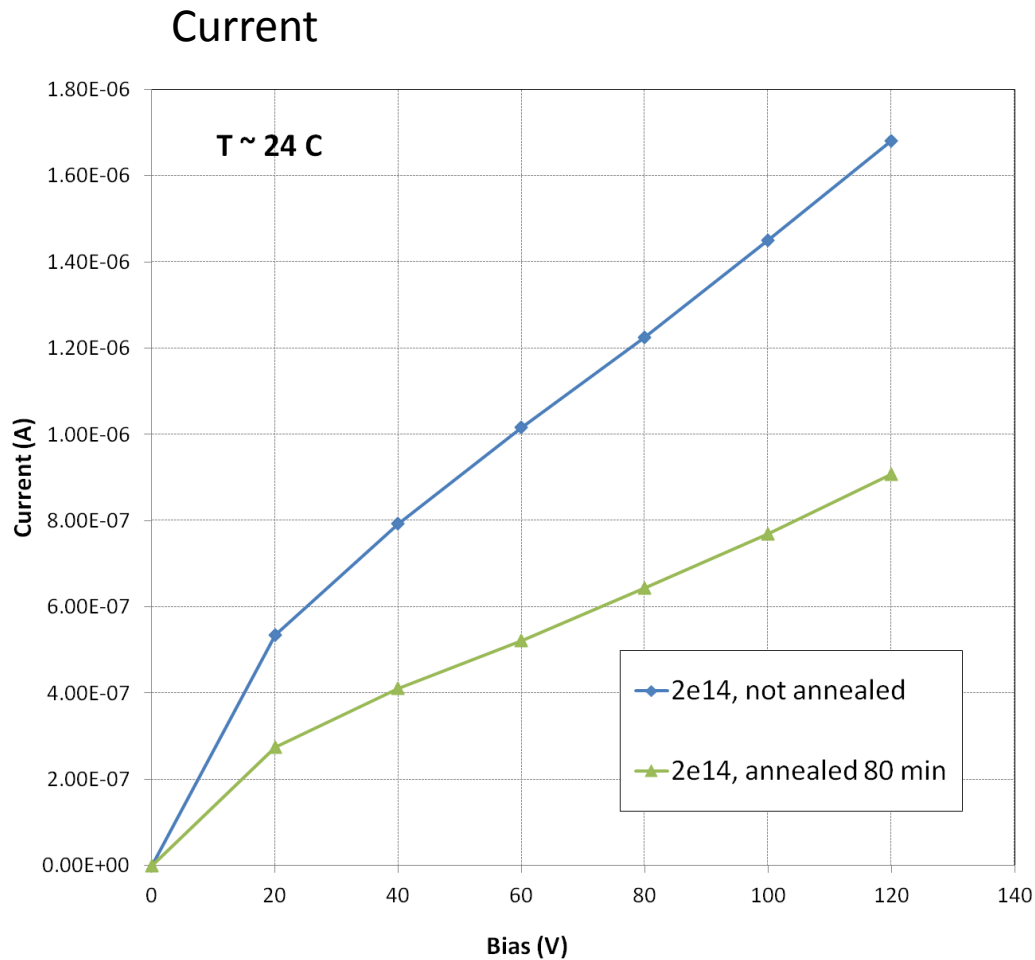- annealed at 60 C for 80 minutes
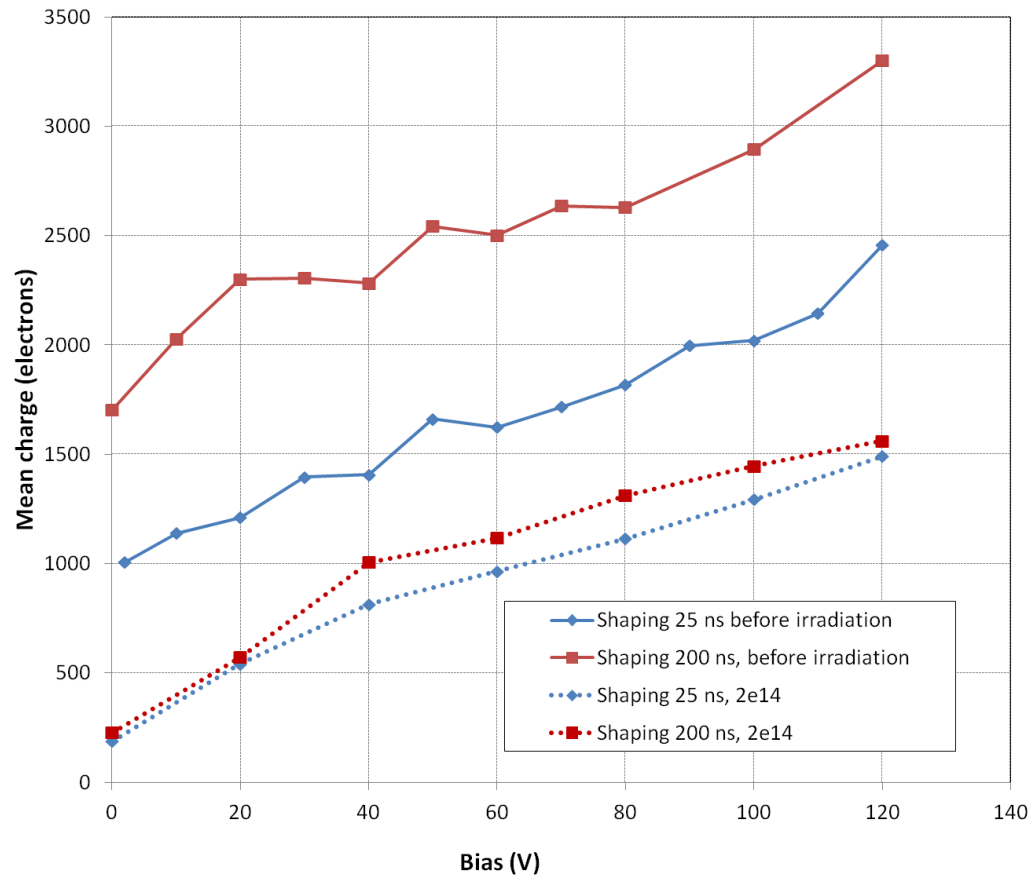


→ at 25 ns shaping about 35 % less charge measured after irradiation at high voltage
→ small dependence on shaping time after irradiation → small contribution from diffusion

# Irradiated device

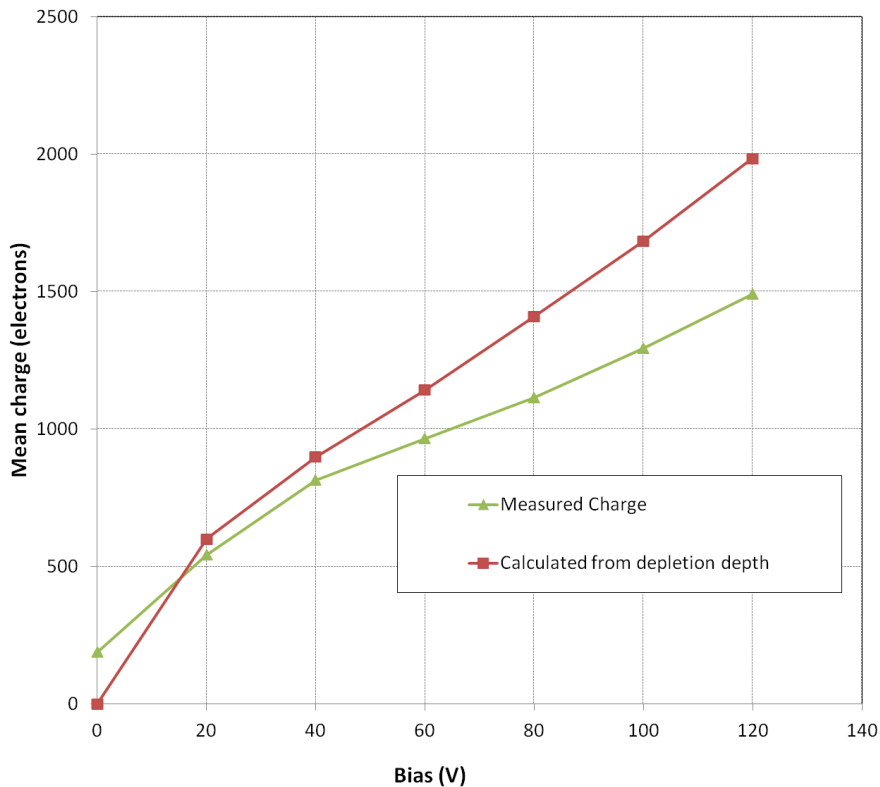- small effect of annealing on measured charge

# Irradiated device

Current

## Irradiated device

- from current after annealing  depleted depth can be estimated:  $w = I/\alpha\Phi S$
  $\alpha$ = 4e-17 A/cm, $S$ = 2 mm², correction factor 0.7 because current measured at T = 24 C

➔ charge can be estimated from depleted depth assuming mean charge  100 el/μm

## Summary :

**Before irradiation**

- at 25 ns shaping:     **Mean charge = 1030 el + 10 el/V**

- collected charge increases with longer shaping  times

**After irradiation with neutrons $\Phi_{eq}$ = 2e14 n/cm²**

- at 25 ns shaping about 35% less charge measured at high bias voltage

- small dependence on shaping  time ➔ small contribution from diffusion

- measured charge agrees with estimation from depleted depth calculated from leakage current