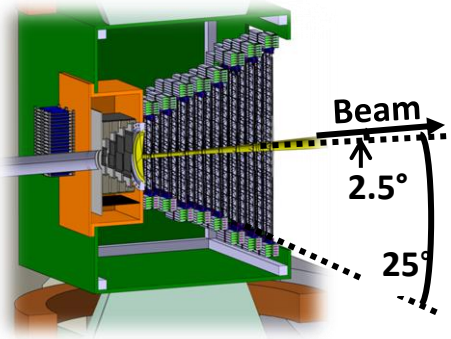
Radiation tolerance studies of neutron irradiated double sided silicon microstirp sensors

Minni Singla, for CBM collaboration - GSI, Darmstadt

Objective

CBM experiment at FAIR, Darmstadt, Germany: 2-45 AGeV nucleus-nucleus collisions with up to 10 MHz interaction rate

- test radiation tolerance (2×10^{14} $n_{eq}cm^{-2}$, max. lifetime for STS) of sensor prototypes for CBM-STS
- compare interstrip connection schemes for strips with stereo angle
  - double metallization (DM) or single metal with external cables (SMwC)
- annealing studies

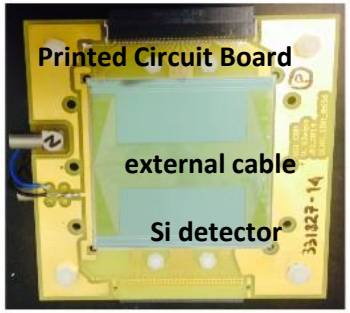


Silicon Tracking System (STS) @CBM

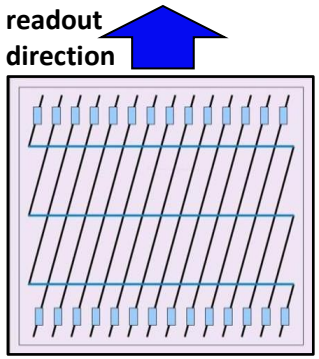
Device under test

- double-sided sensors, p-n-n structure
- 1024 strips per side with 58 µm pitch, stereo angle front-back sides 7.5°
- SMwC or DM on the stereo angle side
- integrated AC-coupled read-out

External routing line "SMwC"

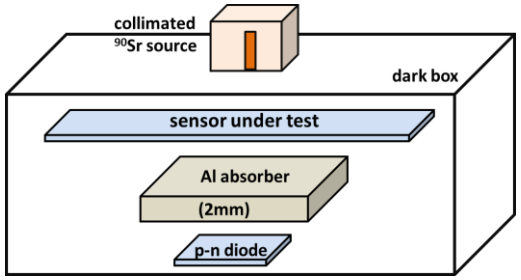


Vs.



Integrated routing line "DM"

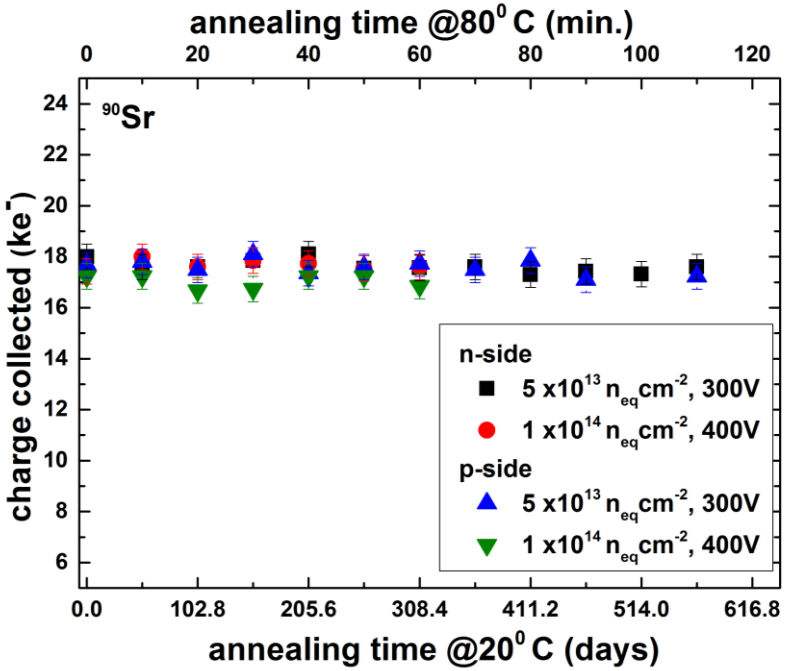
Experimental set-up



Tests performed

- leakage current vs. bias
- long term stability
- capacitance vs. bias voltage
- charge collection with ^{90}Sr source
- measurement temperature -5 ± 3^{0}C

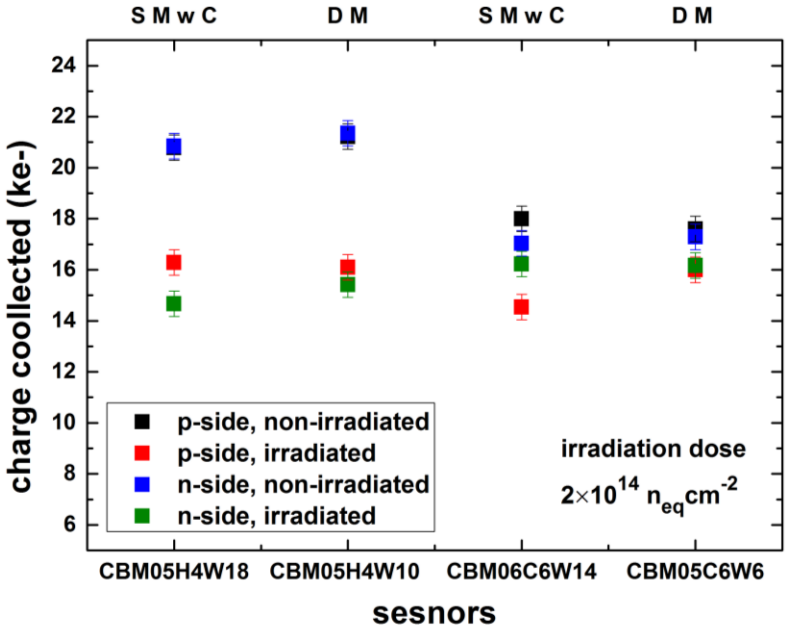
Annealing studies



annealing studies performed on small sensors (1×1 cm^2)

- no charge collection losses seen till 1 year at 20^{0}C because of high operating voltage

Results



- DM and SMwC sensors shows **similar charge collection** both before and after irradiation
- after irradiation ~25% and ~10% charge collection losses seen for Hamamatsu & CiS sensors resp.