The measurements of irradiation sensors

Yuhang,Ryuta,Liaoshan

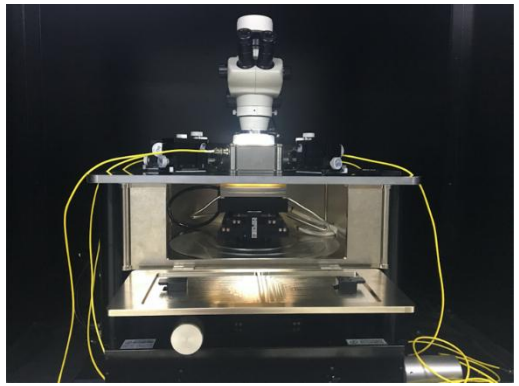
Contents

-- Using probe station which has cold chuck

-- This time, we only show preliminary results without cold temperature setting. All measure at room temperature:20-22°C and GRfloating.

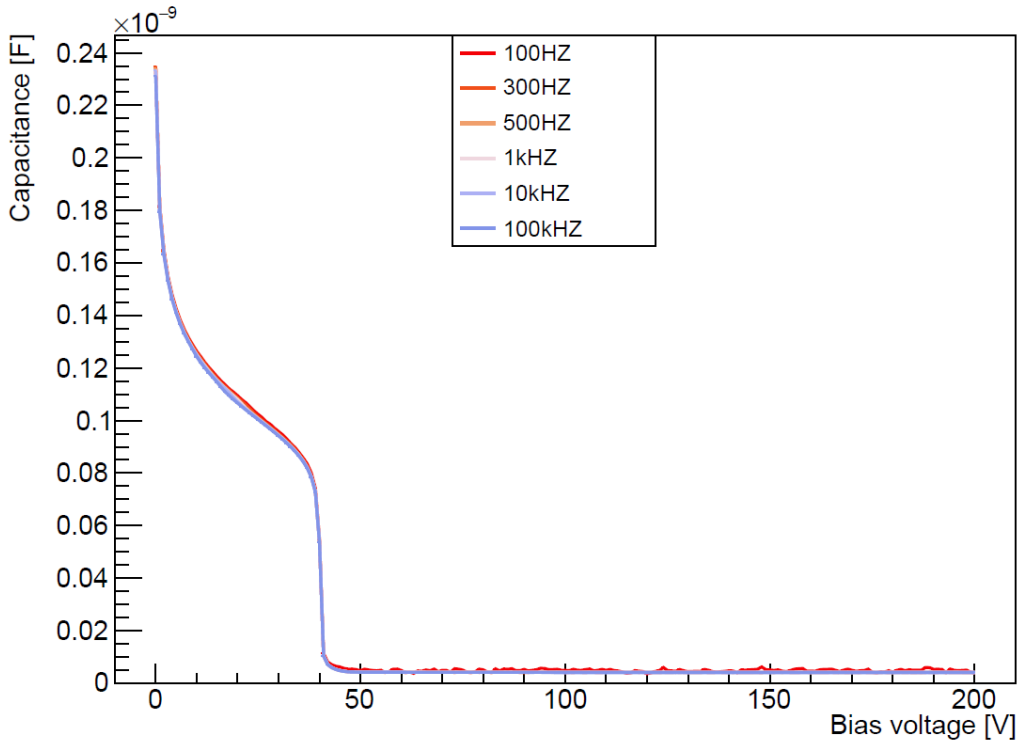
-- C-V scan

-- Different frequencies
-- Different irradiation

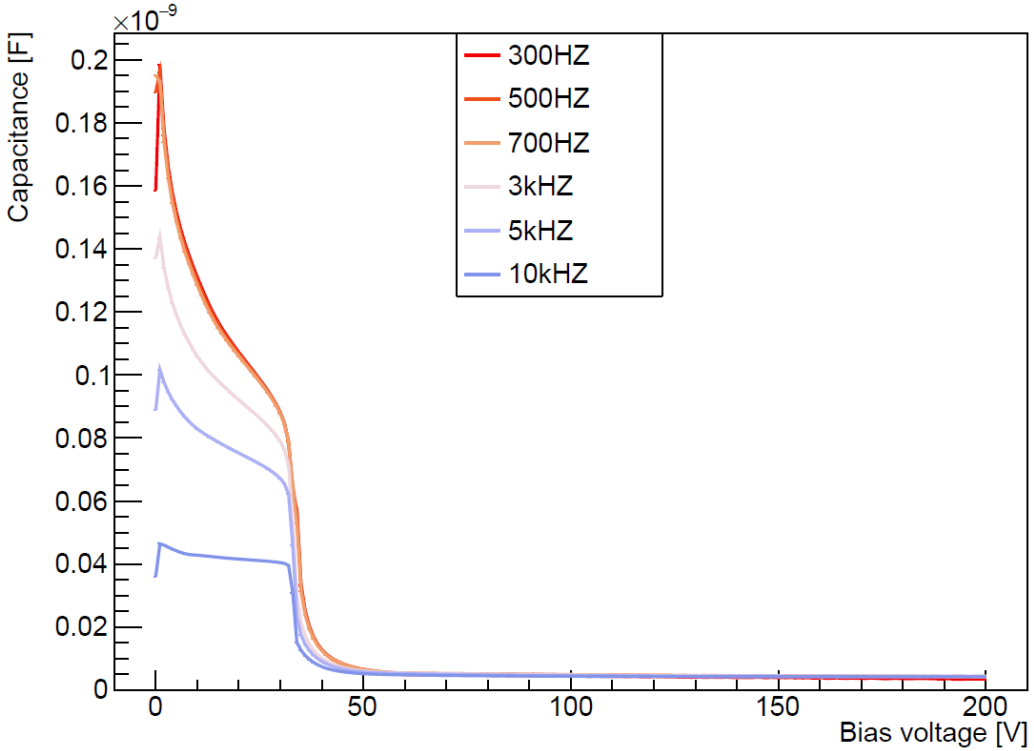


Effect of frequency:

Effect of frequency on W8 capacitance before irradiation :

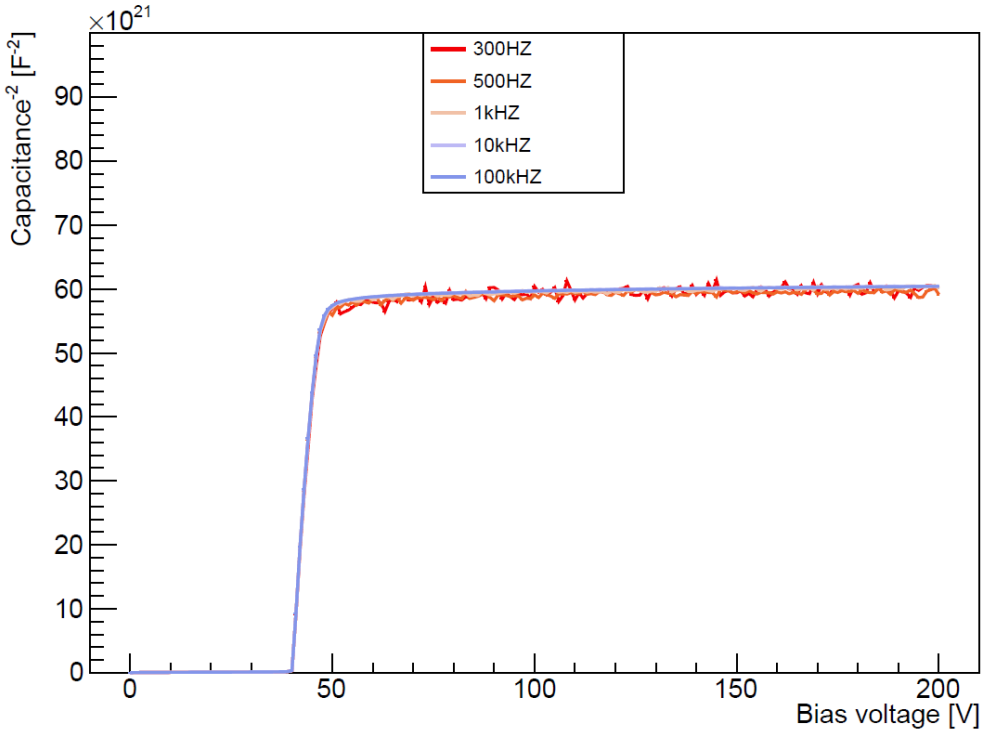


Effect of frequency on W8 capacitance after 4E14 irradiation:

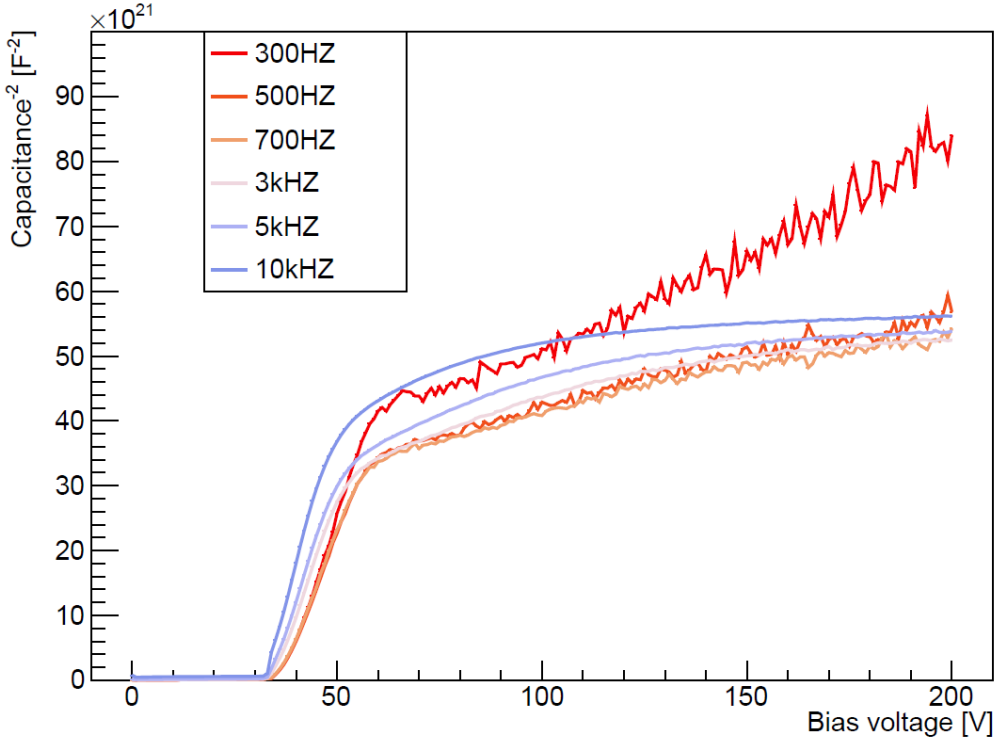


Effect of frequency:

Effect of irradiation on capacitance^{-2}
W8 before irradiation:

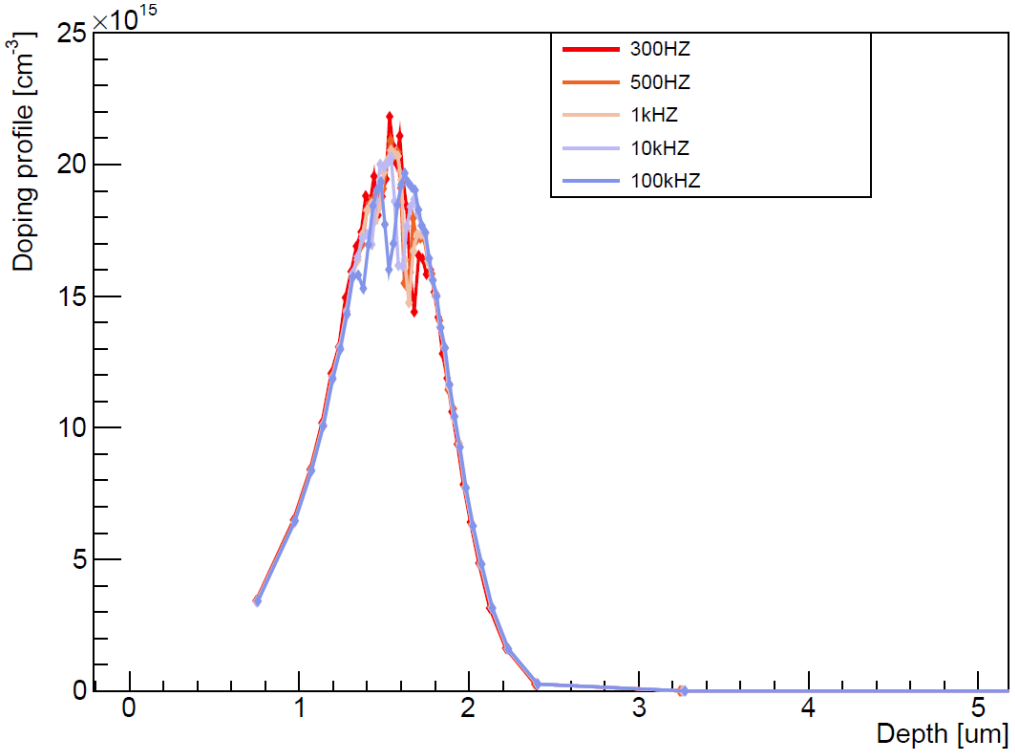


Effect of irradiation on capacitance^{-2}
W8 after 4E14 irradiation:

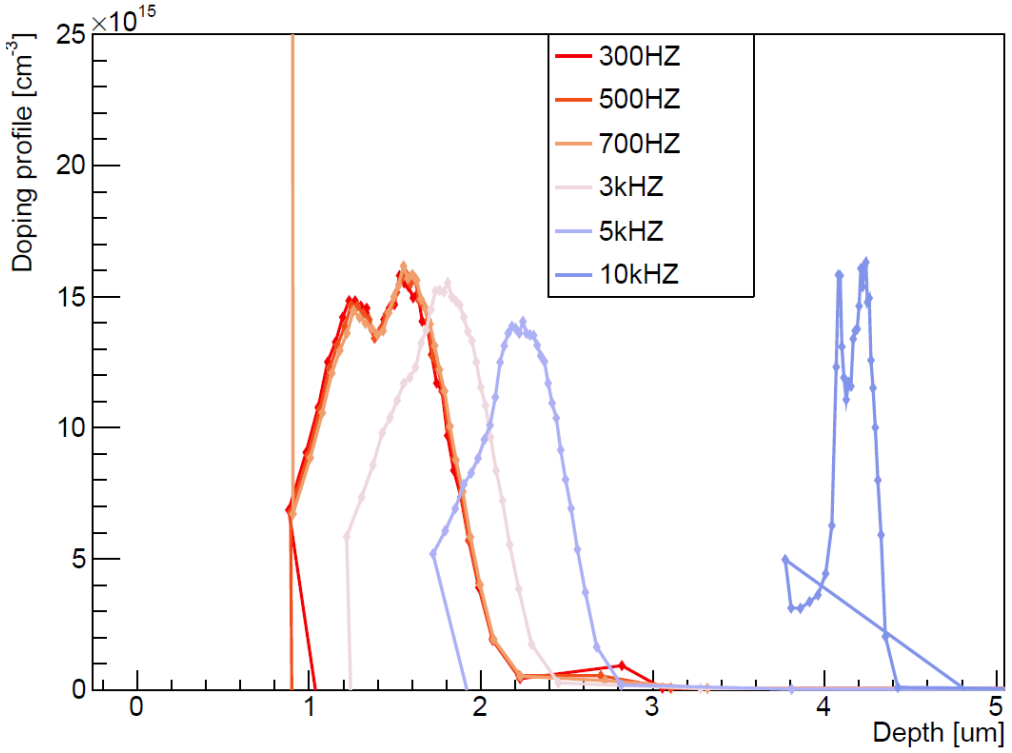


Effect of frequency:

Effect of frequency on W8 doping profile before irradiation:



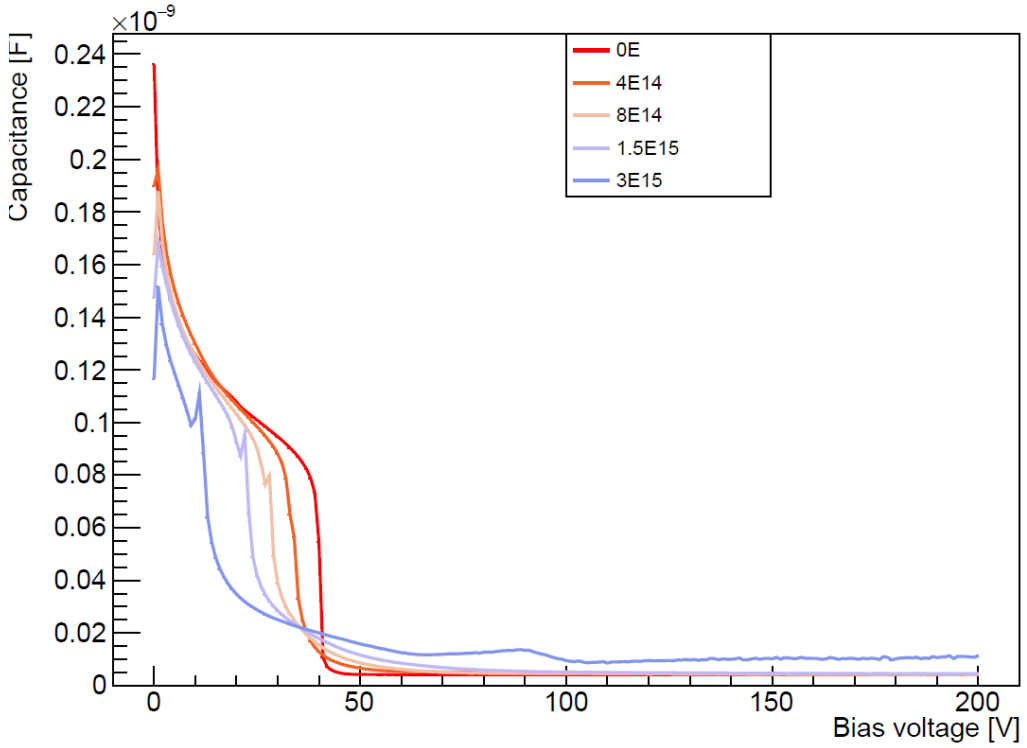
Effect of frequency on W8 doping profile after 4E14 irradiation :



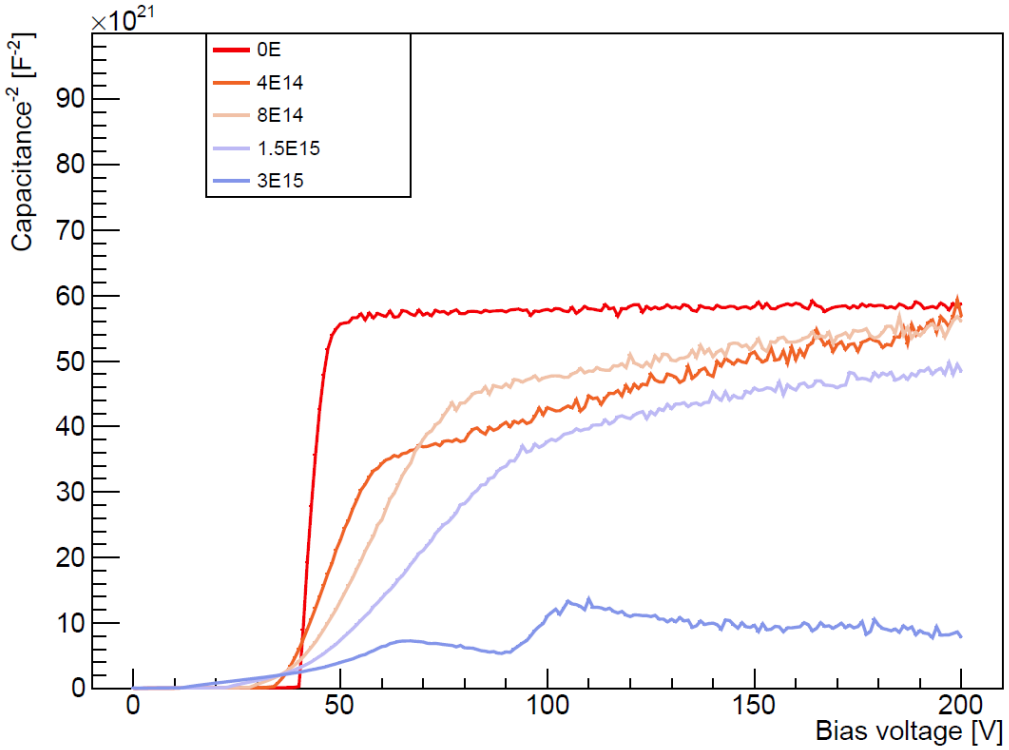
Multiplication layer movement? Around 500 frequencies, depth is almost unchanged. So we made some measurements with 500HZ.

Effect of irradiation:

Effect of irradiation on capacitance W8 at 500HZ:

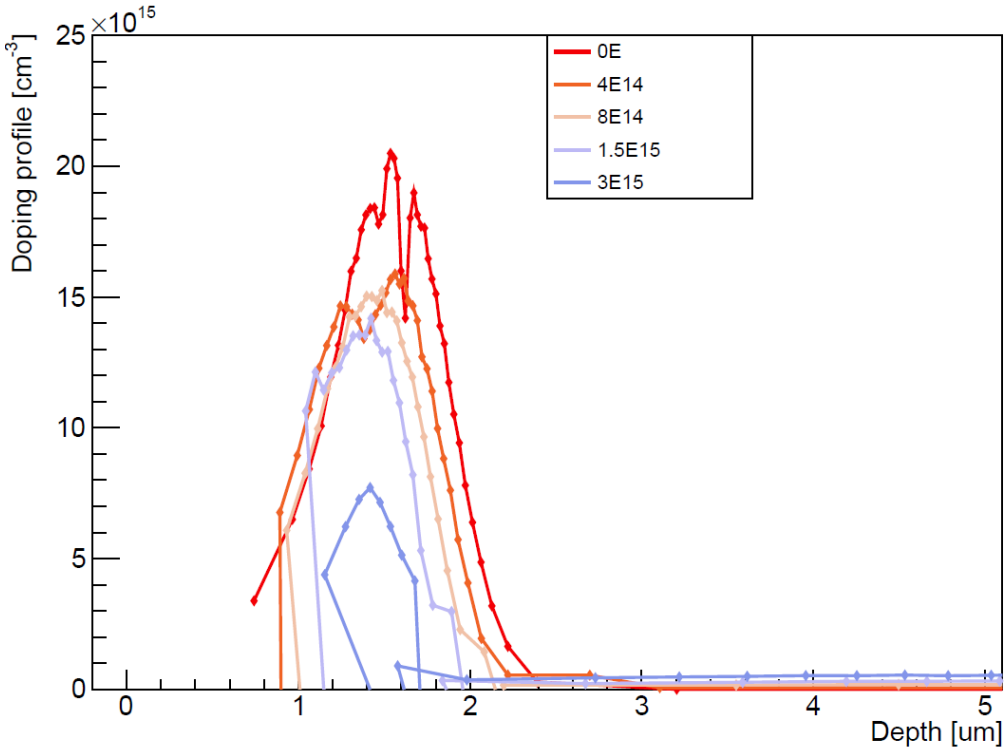


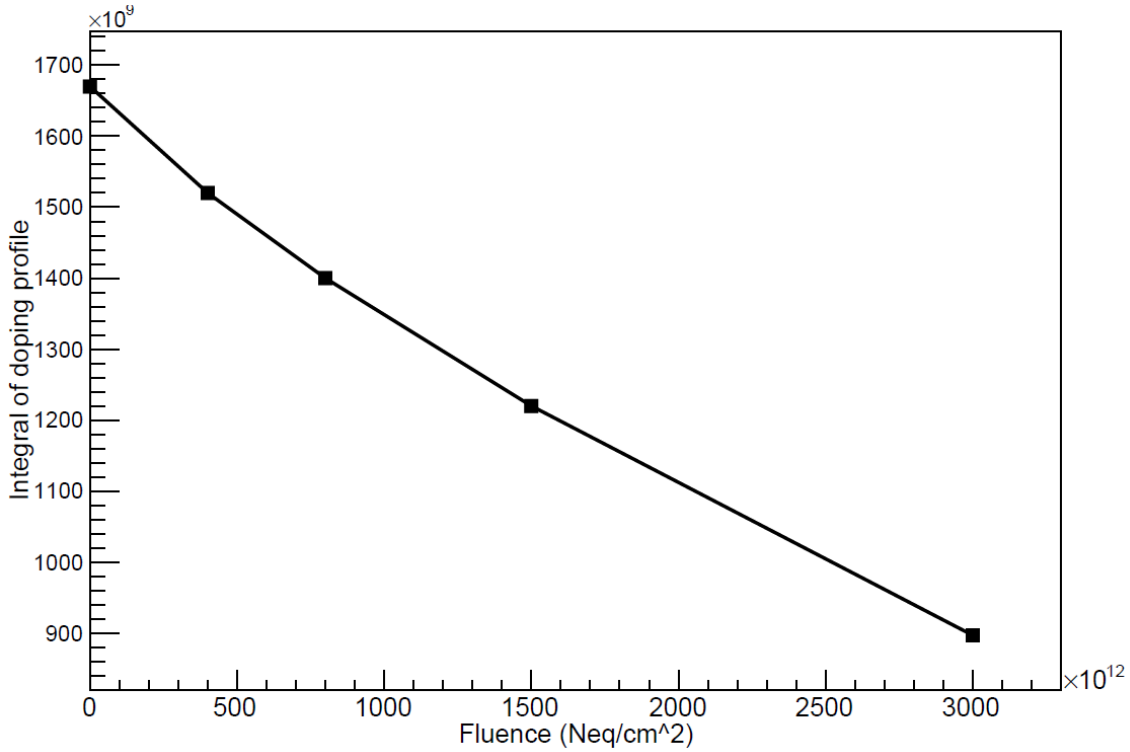
Effect of irradiation on capacitance^{-2} W8 at 500HZ:



Effect of irradiation:

Effect of irradiation on W8 doping profile at 500HZ:





As the irradiation increases, doping profile is decreasing.

Next Plan

- Cold temperature setting
- Measuring I-V and Measuring C-V Again
- GR grounded

100MeV Proton irradiation plan： (China institute of atomic energy)

Irradiation details for LGADs and PiN diodes

one group : 6

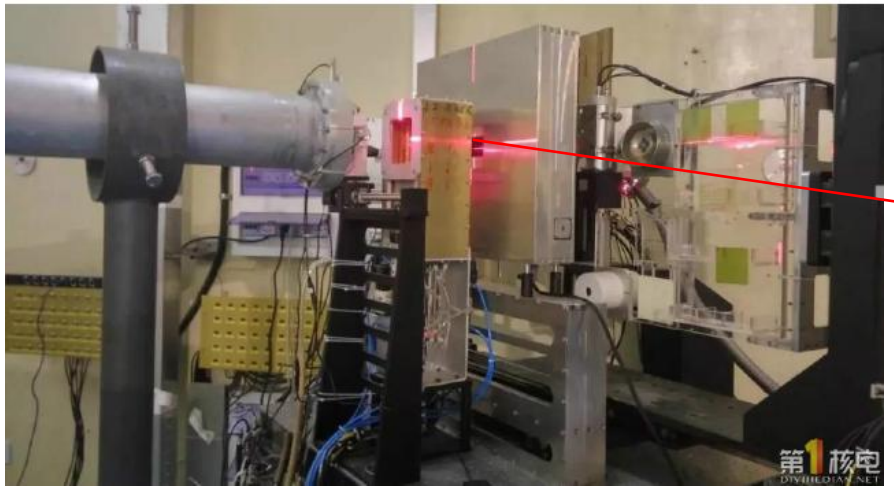
Fluence[1 MeV n_{eq}/cm^{-2}]	LGADS	PiN diodes
4×10^{14}	W2,W8,W18	3
8×10^{14}	W2,W8,W18	3
1.5×10^{15}	W2,W8,W18	3
3×10^{15}	W2,W8,W18	3
6×10^{15}	W2,W8,W18	3

Sensor type:2 x LG1_SE2, 2 x LG1_SE3, 4 x LG1_SE5, 1 x LG1_SE5_NM, 1 x PIN1_SE5, 1 x PIN1_SE5_NM

SE3:2.3mm x2.5mm SE5:2.3mmx2.6mm

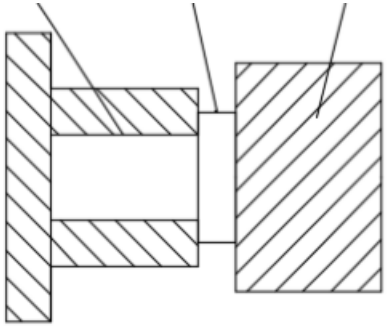
Based on offline measurements.

Station for irradiation in CIAE



Sensor

Beam import sensor Beam absorber

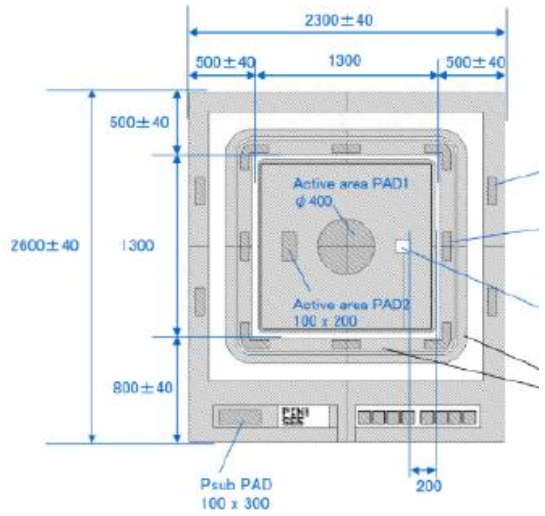


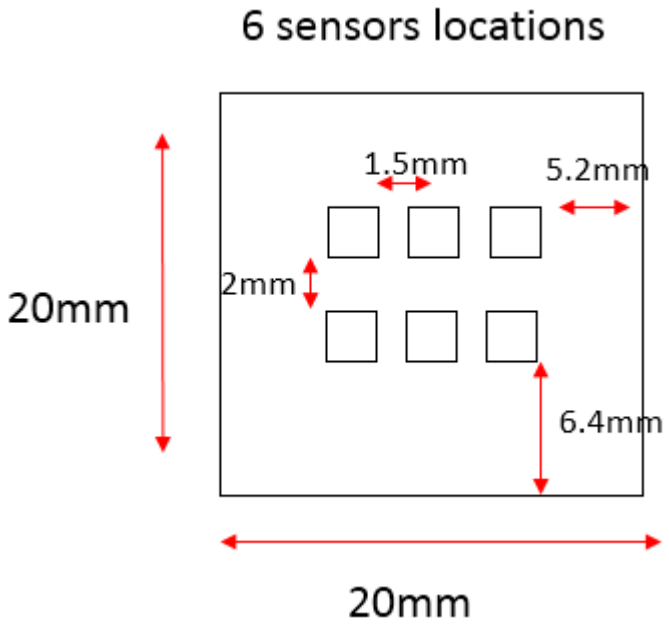
Designed by NanJing University

Sensors placement:

Based on offline measurements

Our Sensor size:
2.3mm×2.6mm or 2.3mm×2.5mm





Multiple sets of simultaneous measurements:
The longer the measurement, the more expensive

Based on offline measurements.

Piezoelectric motor translation stage

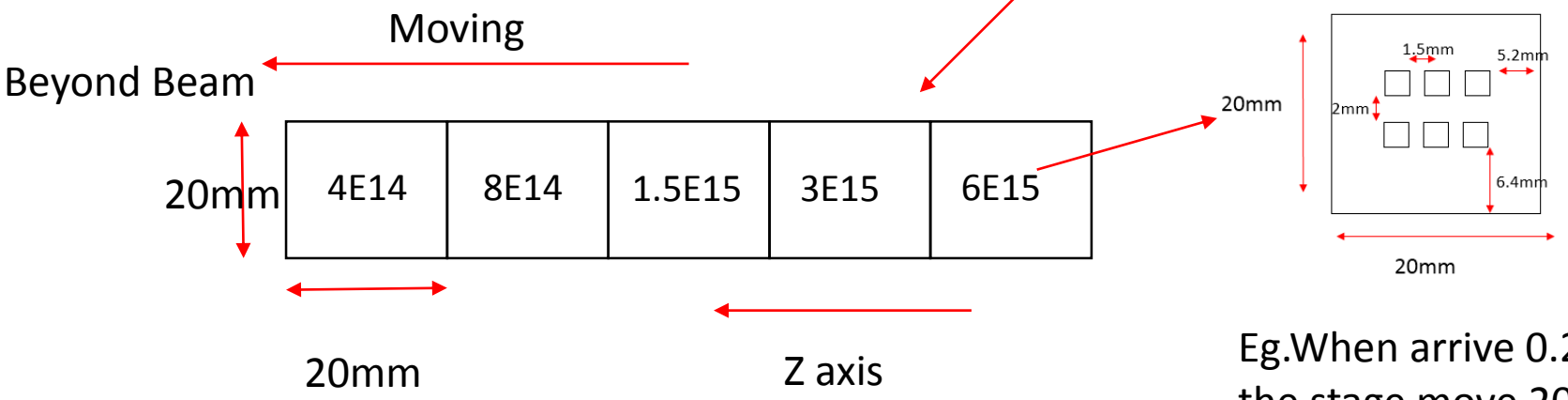
Move back and forth

PC control

Minimum travel range:19mm

Maximum travel range:92mm

Beam size: 20mm×100mm



Time: 4E14: 0.25hours

8E14: 0.5hours

1.5E15: 1hours

3E15: 2hours

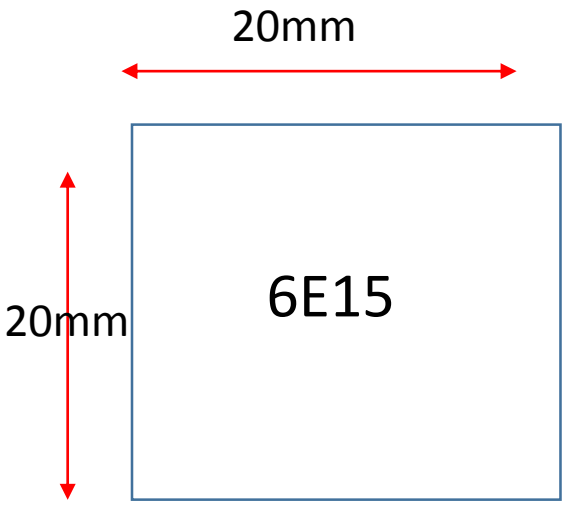
6E15: 4hours

Eg.When arrive 0.25hours, the stage move 20mm.So the sensors leave the beam range.

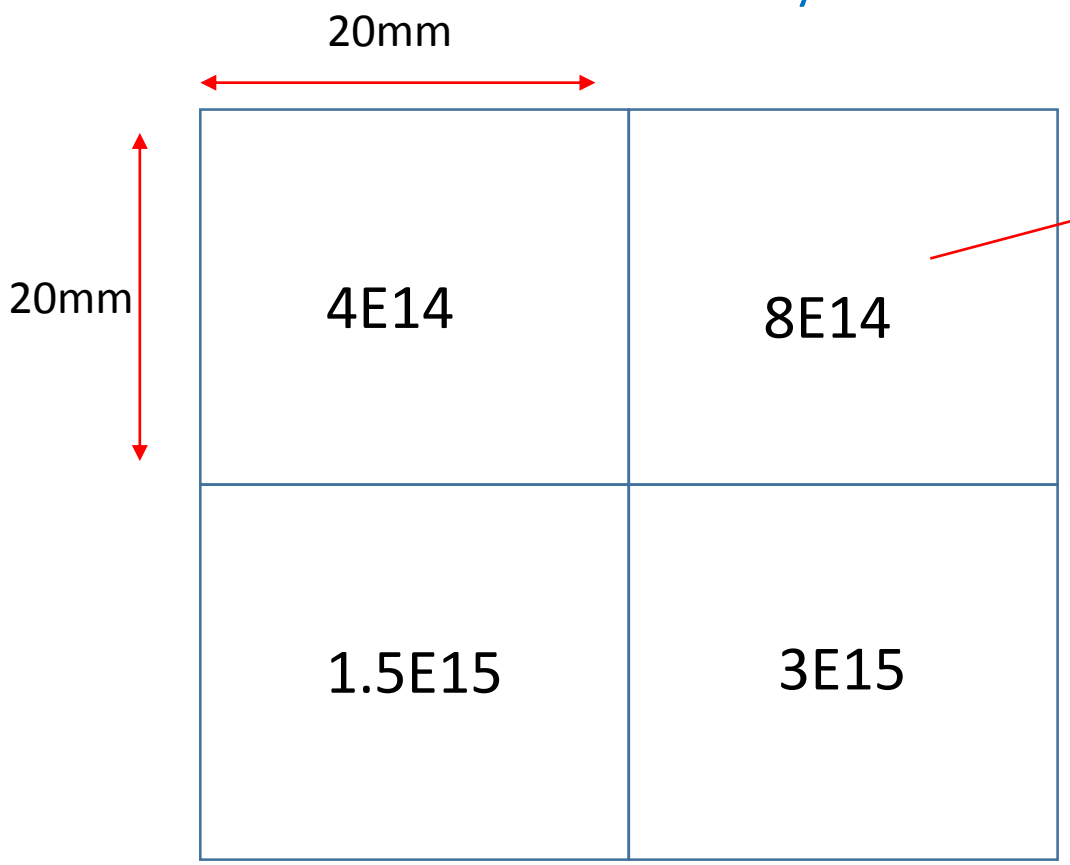
Second option: two layers

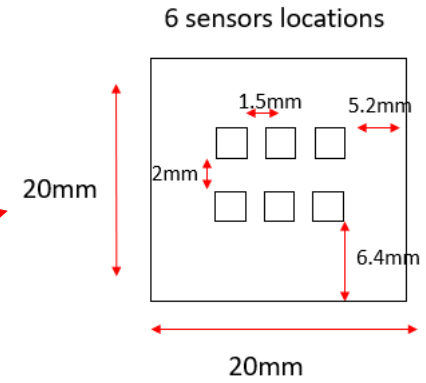
Beam size:
20mm×20mm

First layers



Second layers





XY高速电动位移台

PMS

295mm * 260mm * 32.5mm

- 最高速度达200mm/s
- 重复定位精度1μm
- 结构紧凑，适用性广

Question: (already sent to CIAE)

1. How to calculate the irradiation dose or how much time does 6× $10^{15} n_{eq}/cm^2$ need?
2. Can the beam size reach 20mm×100mm or 20mm×80mm?
3. Is Beam absorber necessary?
4. What materials can be used to take sensors after one week after irradiation? Lead or Steel?
5. When beam size is 20mm×20mm, is the irradiation dose at the center and the edge the same?

Next Plan：

- Go to China institute of atomic energy next Tuesday