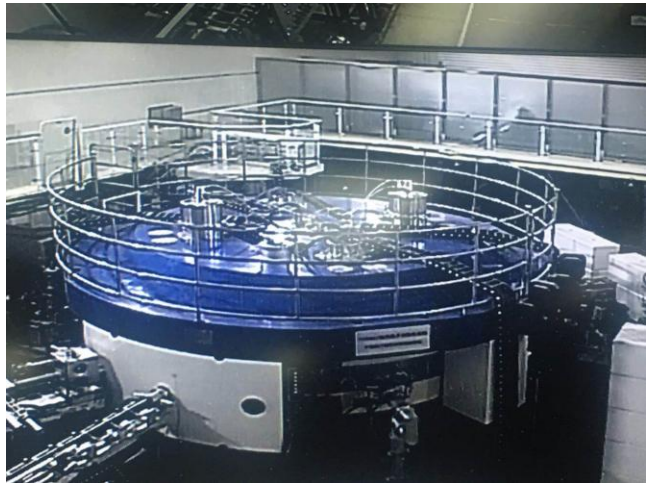
100MeV Proton and neutron irradiation Plan

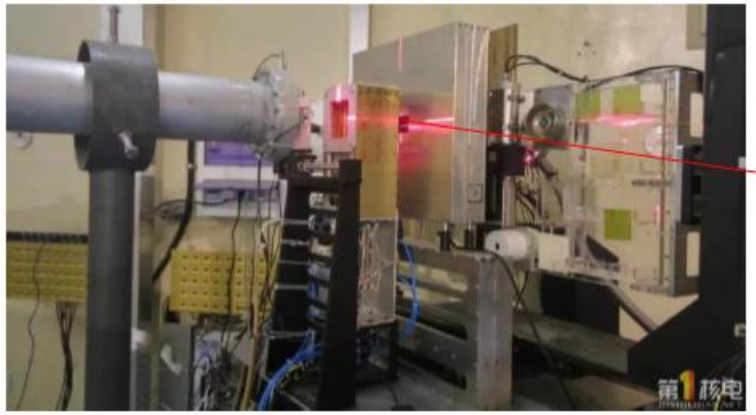
Tanyh

2019.4.18

100MeV Proton irradiation in China institute of atomic energy



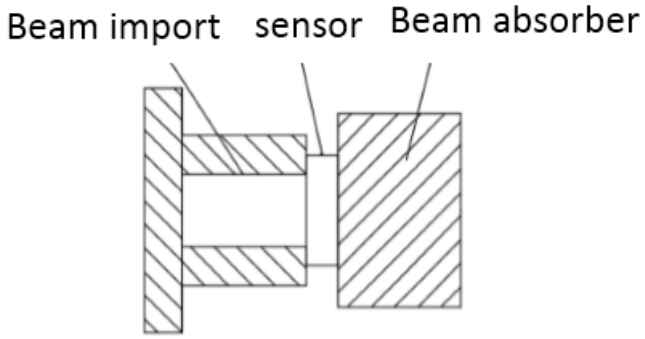
Station for irradiation in CIAE



Beam Size: 20mm×20mm

Beam current: 40nA -> 6E15: 24h

1mA -> 6E15: 1h



Designed by NanJing University

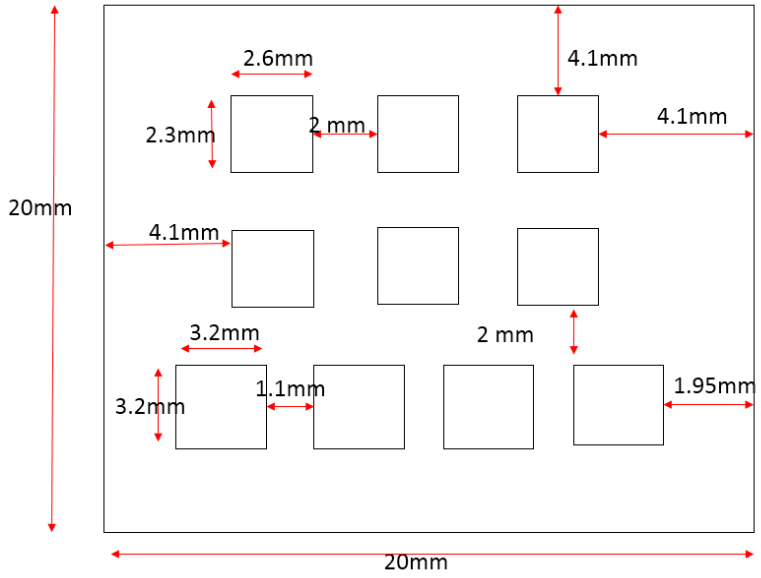
100MeV Proton irradiation in China institute of atomic energy：

Fluence[1 MeV n_{eq}/cm^{-2}]	LGADS	PiN diodes
3×10^{15}	W2,W8,W18,BV170,BV60	5
4×10^{15}	W2,W8,W18,BV170,BV60	5
5×10^{15}	W2,W8,W18,BV170,BV60	5
6×10^{15}	W2,W8,W18,BV170,BV60	5

W2,W8,W18 size: 2.3mm×2.6mm
BV160,BV60 size: 3.2mm×3.2mm
Beam size: 20mm×20mm

More sensors: we can add 14 more

The sensors may not be enough.

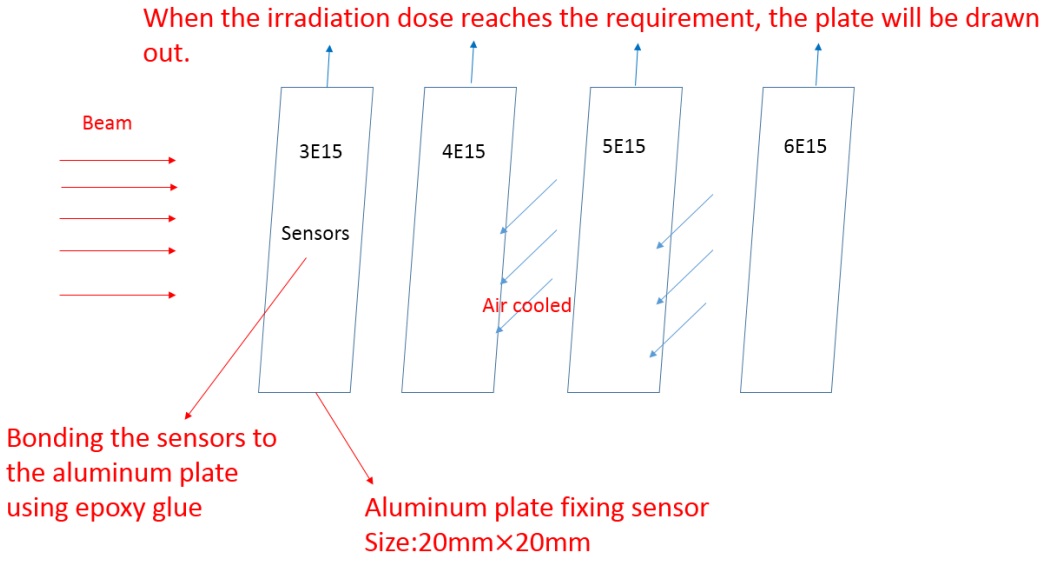


Discussed at the China Atomic Energy Institute on Tuesday:

- Beam current: 0.7pA-10mA If choose 40nA->2% uncertain
- Irradiation at room temperature:

  we need to calculate the temperature of the sensor to prevent burnout
- If choose 4 different groups irradiation doses, may take a week.

  When one group is irradiated, it takes more than 24 hours to continue to the next group.
- Fee: 1,0000/h a week->168,0000 RMB
- Structure:



Neutron irradiation in china academy of engineering physics

CAEP

CAEP has CFBR-II fast neutron pulse reactor. The fast neutron pulse reactor is a large nuclear facility that produces strong neutron and γ-helium nucleus radiation pulses in a very short time (a few microseconds).

Neutron irradiation in china academy of engineering physics:

- Neutron fluence: $2\times 10^{14} n_{eq}/cm^{-2}$-> 4 Groups : 90h
- Neutron energy: 1.38MeV
- Only need us to provide sensors
- Beam size: 20mm×20mm -> uncertain < 5%
- After irradiation, within one week, sensors can work
- Fee: 80,0000RMB
- If we choose online measurement :

  They can provide on-line measuring equipment.

This week we received some HPK non-irradiated sensors:

HPK Sensor received at 2019/4/15, 35µm with UBM

Type1-1

Single pad (11 sensors per set: 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)

- EXX30327-WNo1 LG Single-SET-P3
- EXX30327-WNo3 LG Single-SET-P3
- EXX30327-WNo4 LG Single-SET-P3
- EXX30327-WNo5 LG Single-SET-P3
- EXX30327-WNo6 LG Single-SET-P3

2x2 sensors

- EXX30327-WNo5 LG 2x2-SET-P1
- EXX30327-WNo6 LG 2x2-SET-P1

5x5 sensors

- EXX30327-WNo1 LG 5x5-SE5-IP9-P4
- EXX30327-WNo3 LG 5x5-SE5-IP9-P4
- EXX30327-WNo4 LG 5x5-SE5-IP9-P4
- EXX30327-WNo5 LG 5x5-SE5-IP9-P4
- EXX30327-WNo6 LG 5x5-SE5-IP9-P4

15x15 sensors

- EXX30327-WNo1 LG 15x15-SE5-IP9-P2
- EXX30327-WNo3 LG 15x15-SE5-IP9-P1
- EXX30327-WNo4 LG 15x15-SE5-IP9-P2
- EXX30327-WNo5 LG 15x15-SE5-IP9-P2
- EXX30327-WNo6 LG 15x15-SE5-IP9-P2

Type1-2 float zone bulk (11 sensors per set: 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)

Single pad

- EXX30328-WNo1 LG Single-SET-P2
- EXX30328-WNo2 LG Single-SET-P2
- EXX30328-WNo3 LG Single-SET-P2
- EXX30328-WNo4 LG Single-SET-P2
- EXX30328-WNo5 LG Single-SET-P2

2x2 sensors

- EXX30328-WNo4 LG 2x2-SET-P2
- EXX30328-WNo5 LG 2x2-SET-P2

5x5 sensors

- EXX30328-WNo1 LG 5x5-SE5-IP9-P2
- EXX30328-WNo2 LG 5x5-SE5-IP9-P2
- EXX30328-WNo3 LG 5x5-SE5-IP9-P2
- EXX30328-WNo4 LG 5x5-SE5-IP9-P2
- EXX30328-WNo5 LG 5x5-SE5-IP9-P2

15x15 sensors

- EXX30328-WNo1 LG 15x15-SE5-IP9-P2
- EXX30328-WNo2 LG 15x15-SE5-IP9-P2
- EXX30328-WNo3 LG 15x15-SE5-IP9-P2
- EXX30328-WNo4 LG 15x15-SE5-IP9-P2
- EXX30328-WNo5 LG 15x15-SE5-IP9-P2

Type2 different gain layer (11 sensors per set: 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)

Single pad

- EDX30329-WNo9 LG Single-SET-P9
- EDX30329-WNo10 LG Single-SET-P6
- EDX30329-WNo11 LG Single-SET-P7
- EDX30329-WNo12 LG Single-SET-P7

2x2 sensors

- EDX30329-WNo12 LG 2x2-SET-P3

5x5 sensors

- EDX30329-WNo9 LG 5x5-SE5-IP9-P9
- EDX30329-WNo10 LG 5x5-SE5-IP9-P8
- EDX30329-WNo11 LG 5x5-SE5-IP9-P7

15x15 sensors

- EDX30329-WNo9 LG 15x15-SE5-IP9-P4
- EDX30329-WNo10 LG 15x15-SE5-IP9-P4
- EDX30329-WNo11 LG 15x15-SE5-IP9-P4

HPK Sensor received at 2019/4/15, 35µm with UBM.

There are three different types of sensors.

Details can be found in OneNote

Measurement Status

Sensor without measurement:

- HPK (35 μm no UBM) W10
- HPK(50 μm with UBM) W1,W2,W3,W4,W7,W17

  (5×5)W1,W2,W17 have been measured
- CNM (2×2) W7,W14
- BNU with wire bonding (2×2) BV60-50-S,BV170-30-S
- HPK irradiation sensor
- New HPK (35 μm with UBM)

Measurement Plan

- Sensor without irradiation
  - 50μm W2: may send radiation
  - New 35μm W2,W8,W18: Comparison with 50μm
- Sensor with irradiation
  - Cold temperature setting
  - W8 I-V and C-V (GR floating and grounded)

Thank you