# 100MeV Proton irradiation update

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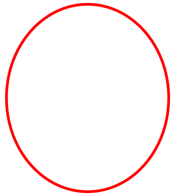
# Review: three issues

- Temperature needs to be kept below 0C
- Position uniform:  irradiation area: 2cm×2cm
- Irradiation attenuation: 5 layers

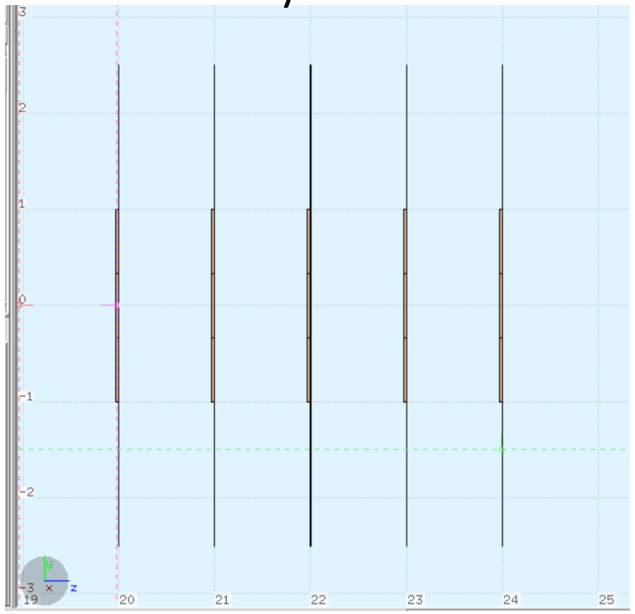
# Irradiation Simulation：

- Beam shape: 2cm×1.5cm
- Beam current of both the long axis and the short axis are Gaussian distribution

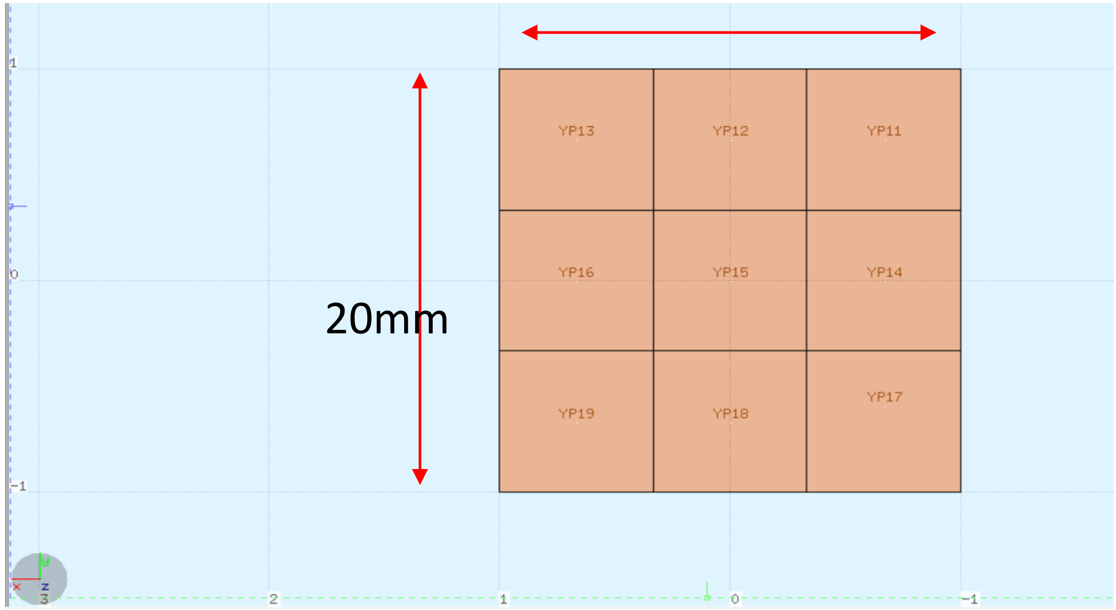
beam



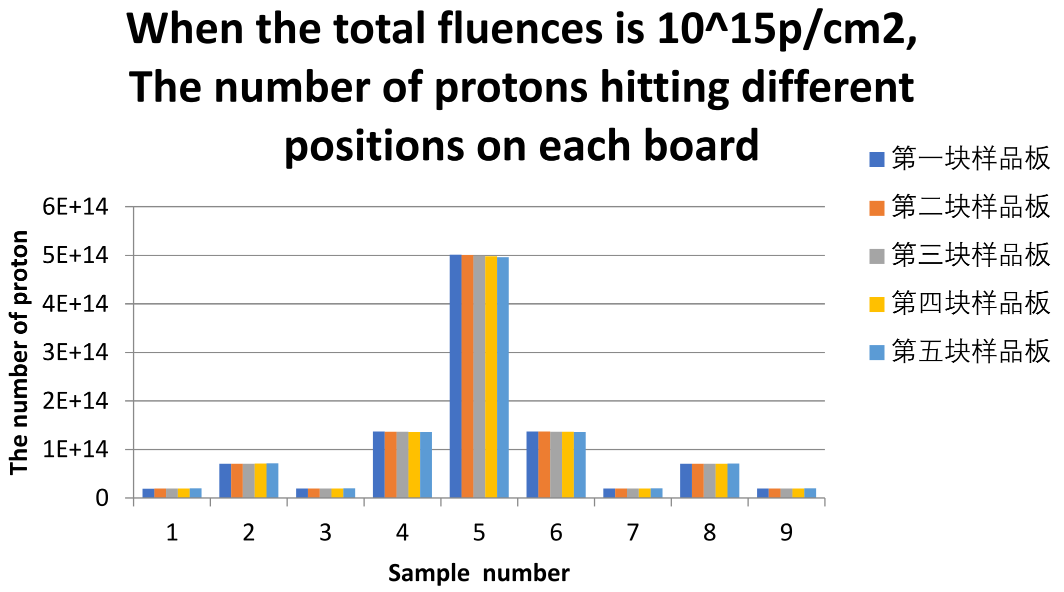
5 layers



20mm



# Simulation result about the number of proton：




layer 1 → 5

| | 1 layer | 2 layer | 3 layer | 4 layer | 5 layer |
|---|---|---|---|---|---|
| Sample number | Number of p | Number of p | Number of p | Number of p | Number of p |
| 1 | 1.92995E+13 | 1.9331E+13 | 1.93964E+13 | 1.9506E+13 | 1.96908E+13 |
| 2 | 7.06304E+13 | 7.06226E+13 | 7.07207E+13 | 7.08994E+13 | 7.1131E+13 |
| 3 | 1.93107E+13 | 1.93439E+13 | 1.9404E+13 | 1.95174E+13 | 1.96643E+13 |
| 4 | 1.36823E+14 | 1.36714E+14 | 1.36557E+14 | 1.36387E+14 | 1.36215E+14 |
| 5 | 5.01341E+14 | 5.0064E+14 | 4.99569E+14 | 4.9802E+14 | 4.95957E+14 |
| 6 | 1.36897E+14 | 1.36789E+14 | 1.36661E+14 | 1.36552E+14 | 1.36416E+14 |
| 7 | 1.93126E+13 | 1.93364E+13 | 1.9399E+13 | 1.94961E+13 | 1.96641E+13 |
| 8 | 7.04925E+13 | 7.04865E+13 | 7.05836E+13 | 7.075E+13 | 7.09868E+13 |
| 9 | 1.93203E+13 | 1.9329E+13 | 1.93767E+13 | 1.94796E+13 | 1.96517E+13 |

| | | |
|---|---|---|
| 3 | 2 | 1 |
| 6 | 5 | 4 |
| 9 | 8 | 7 |

- The number of protons between different layers does not change much, so it can be ignored.
- Irradiation fluences at different locations vary greatly in the same layer.

# Simulation result about the energy of proton：

| | 1 layer | 2 layer | 3 layer | 4 layer | 5 layer |
|---|---|---|---|---|---|
| Sample number | Energy(MeV) | Energy(MeV) | Energy(MeV) | Energy(MeV) | Energy(MeV) |
| 1 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 2 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 3 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 4 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 5 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 6 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 7 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 8 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |
| 9 | 100 | 99.5 | 99.1 | 98.7 | 98.2 |

- The energy of protons between different layers and position does not change much, so it can be ignored.
- So we only need solve the problem of position uniform.
- Irradiation attenuation can be ignored

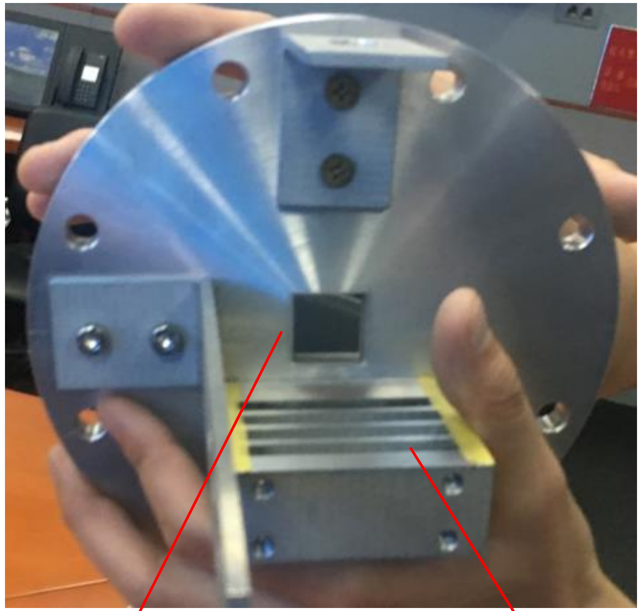
# Temperature: Liquid nitrogen

Need 6 meters long pipe through liquid nitrogen for cooling.
About 1200RMB.

Proton beam

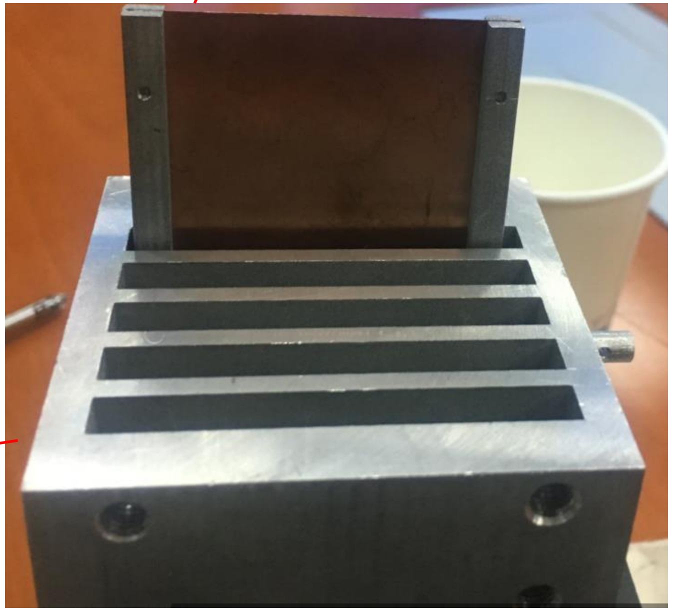
# Irradiation device:

Aluminum plate: Need epoxy glue to stick the sensor on top. Also need a gel remover, so we can easily remove the sensor. I have already bought these, but I am not sure if it can be used. I need to try it.



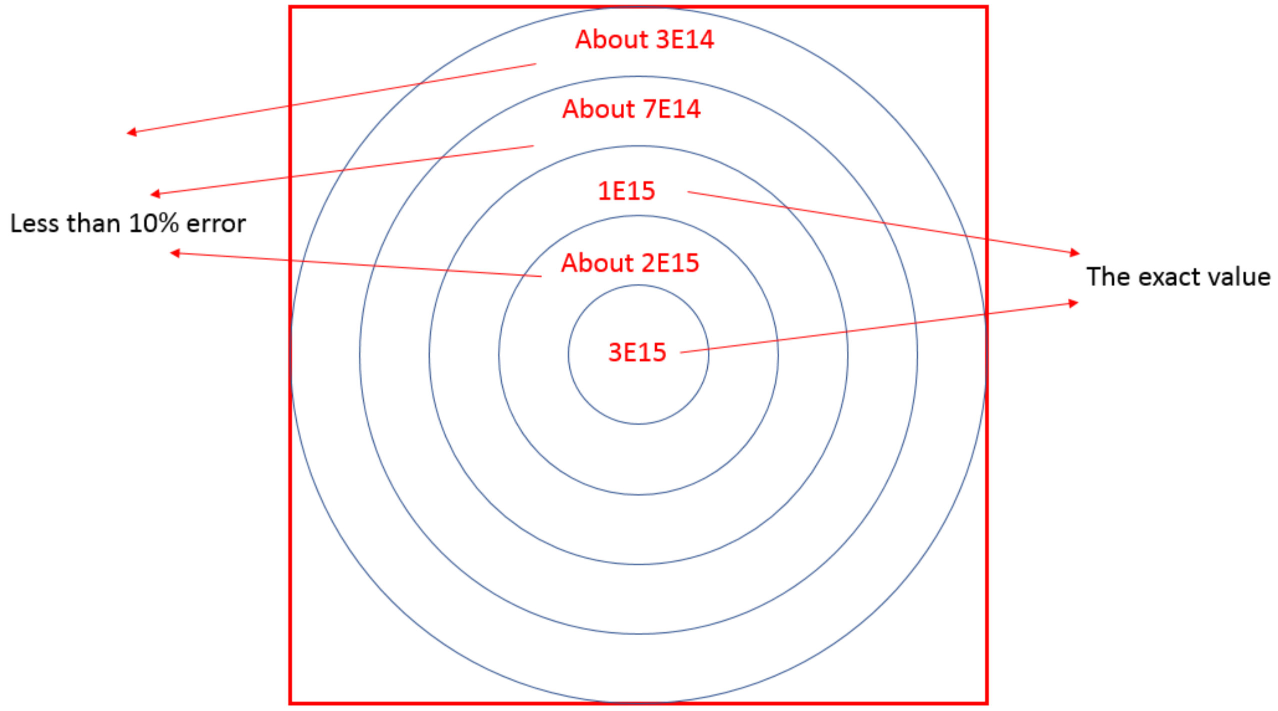
Fixed aluminum plate

Work area



# Ideas about uniformity:

- In one layer, simulate the irradiation fluence at different positions, and strive to get  1E15 and 3E15.
- The values of the other three points may be slightly different.
- The error of irradiation fluence should be less than 10%




Work area 2cm× 2cm

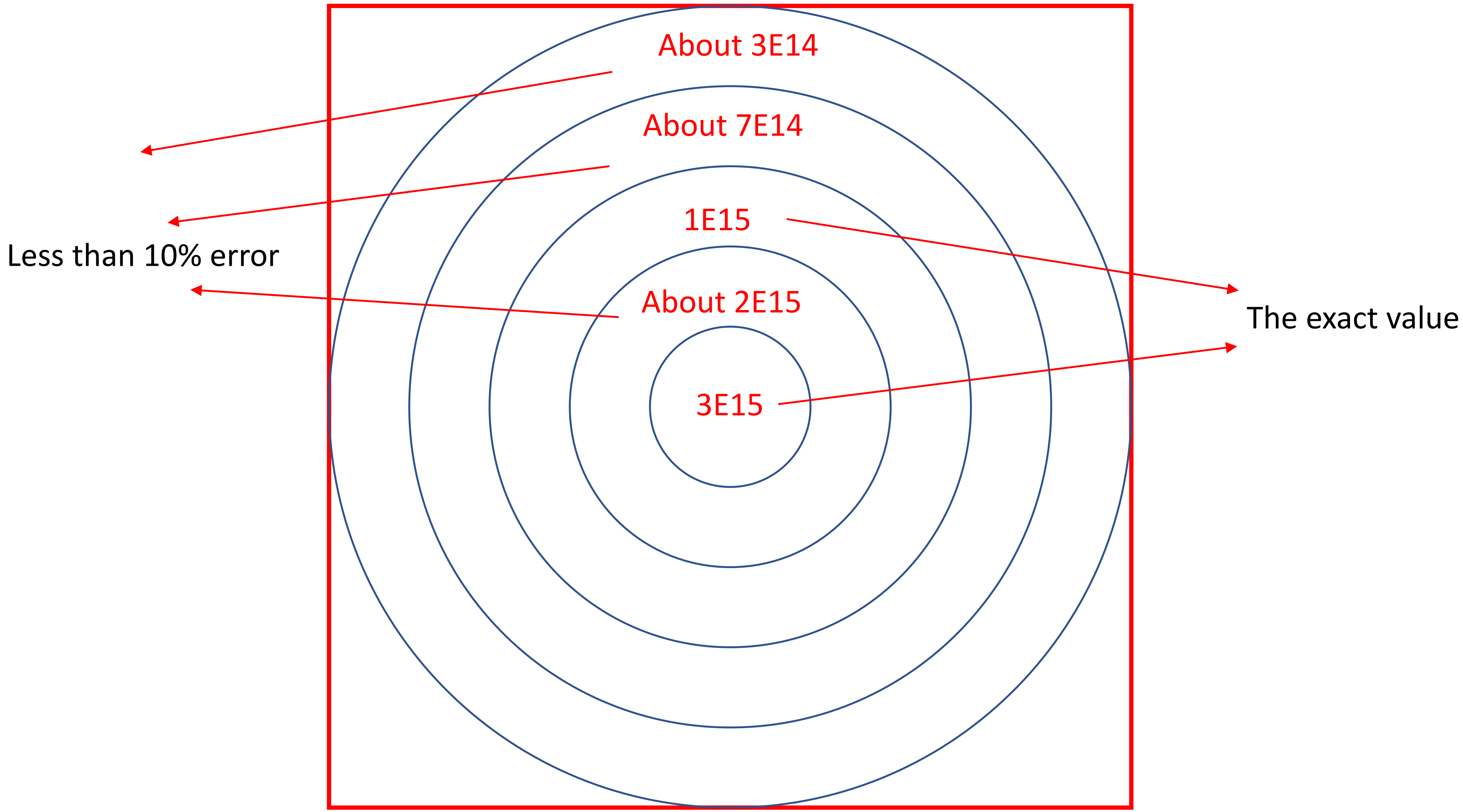
# Plan

1. Test NDL and CNM sensors which will be irradiated

2. Try glue and gel remover

3. Discussing the issue of uniformity with the Atomic Energy Institute and design how to position the sensors

# Backup


About 3E14
About 7E14
1E15
About 2E15
3E15
Less than 10% error
The exact value