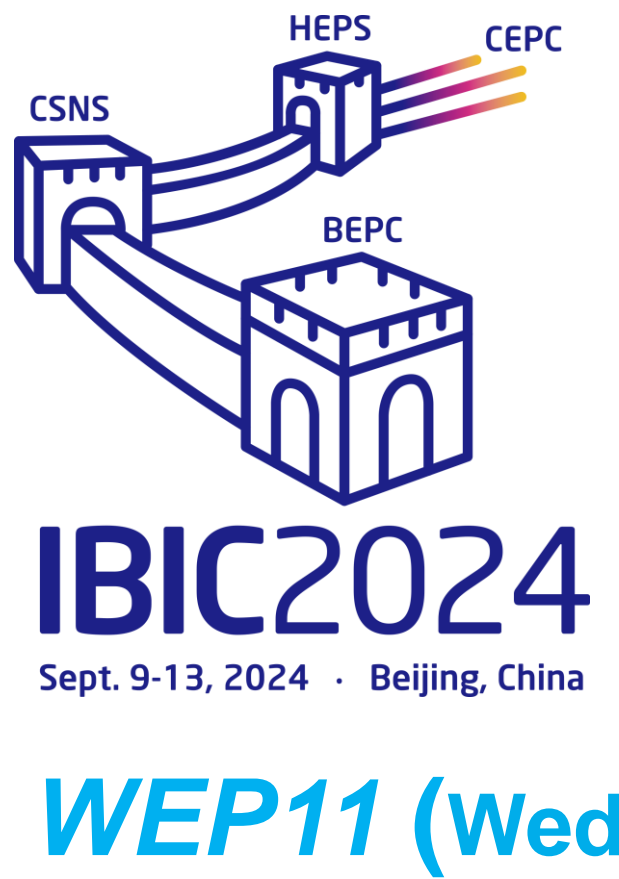


THE UPGRADE OF THE TARGET MULTIWIRE PROFILE MONITOR FOR THE CSNS-II PROJECT*

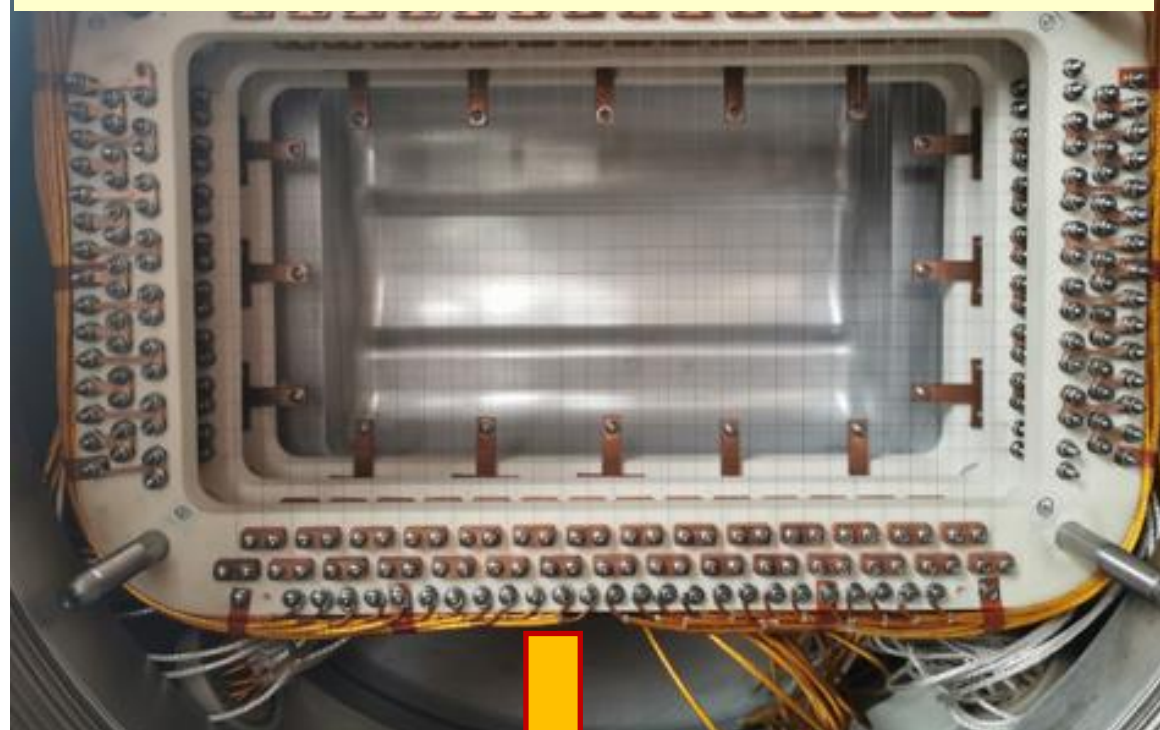
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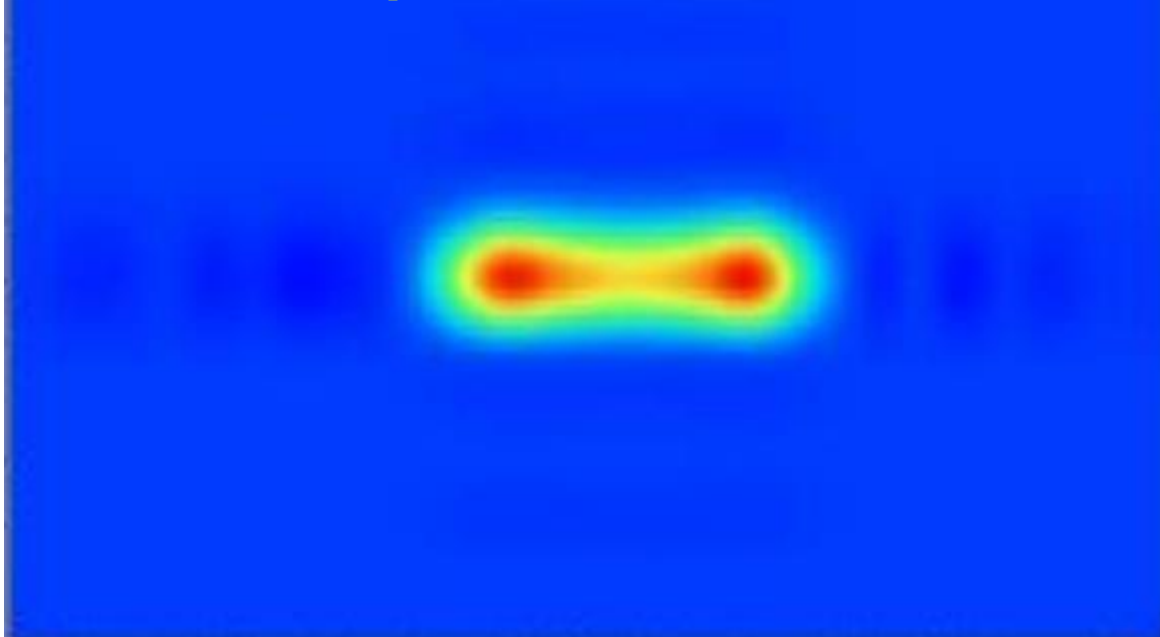
I. Introduction

The present target MWPM at the CSNS had played an important role for the accelerator stable operation. The signal wire of CSNS-I target MWPM is made of tungsten ($\phi 100\mu\text{m}$), and the wire interval is 7 mm. To meet **more precisely monitoring requirements**, an upgrade scheme with **a smaller wire interval is necessary** for the CSNS-II project. We have developed a PCB-based profile monitor to achieve a wire interval of **2 mm**, and we also add several biased-voltage planes to mitigate the crosstalk effect due to the stray electrons.

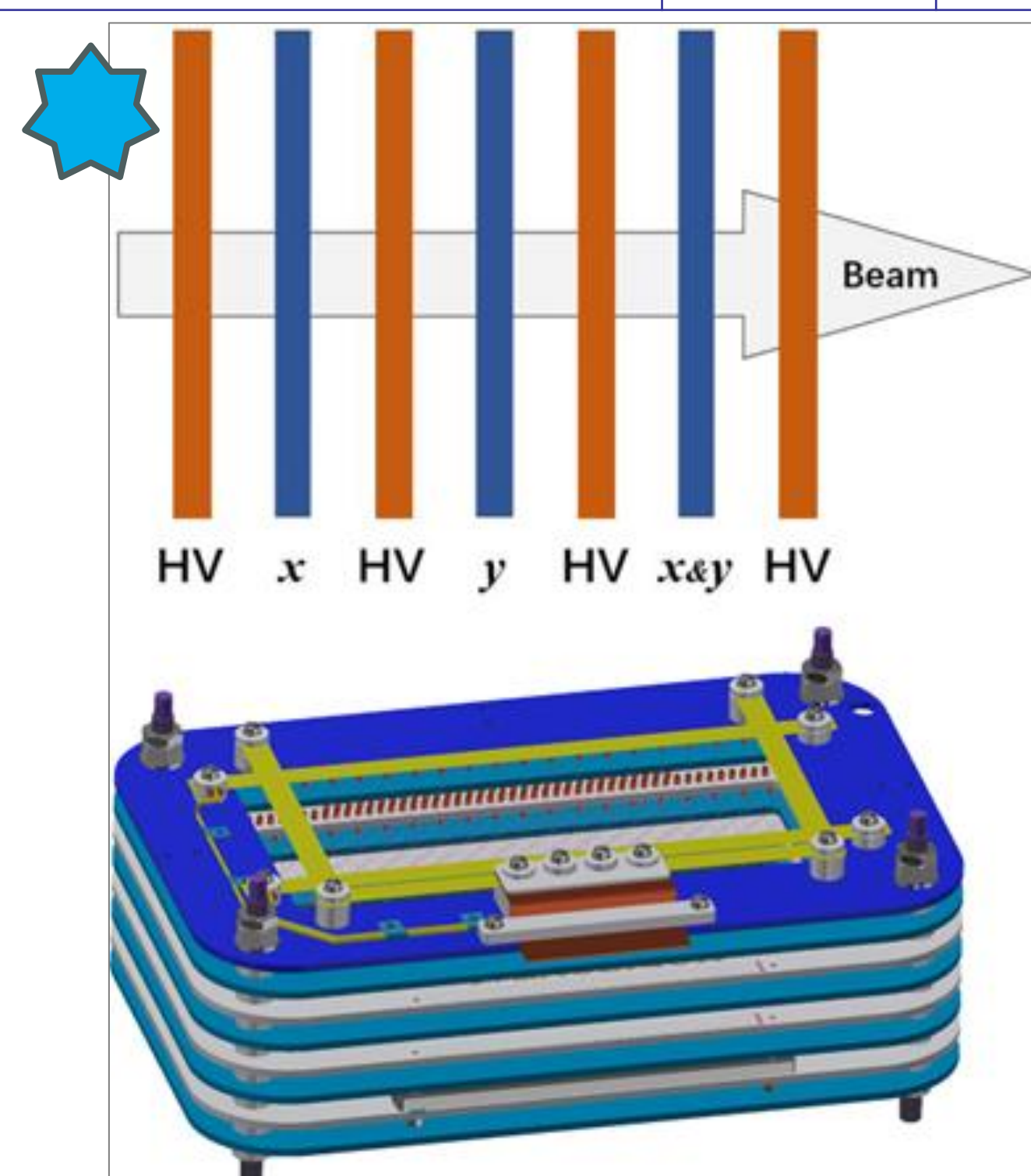
The target MWPM of CSNS-I



Reconstructed 2D distribution by linear interpolation

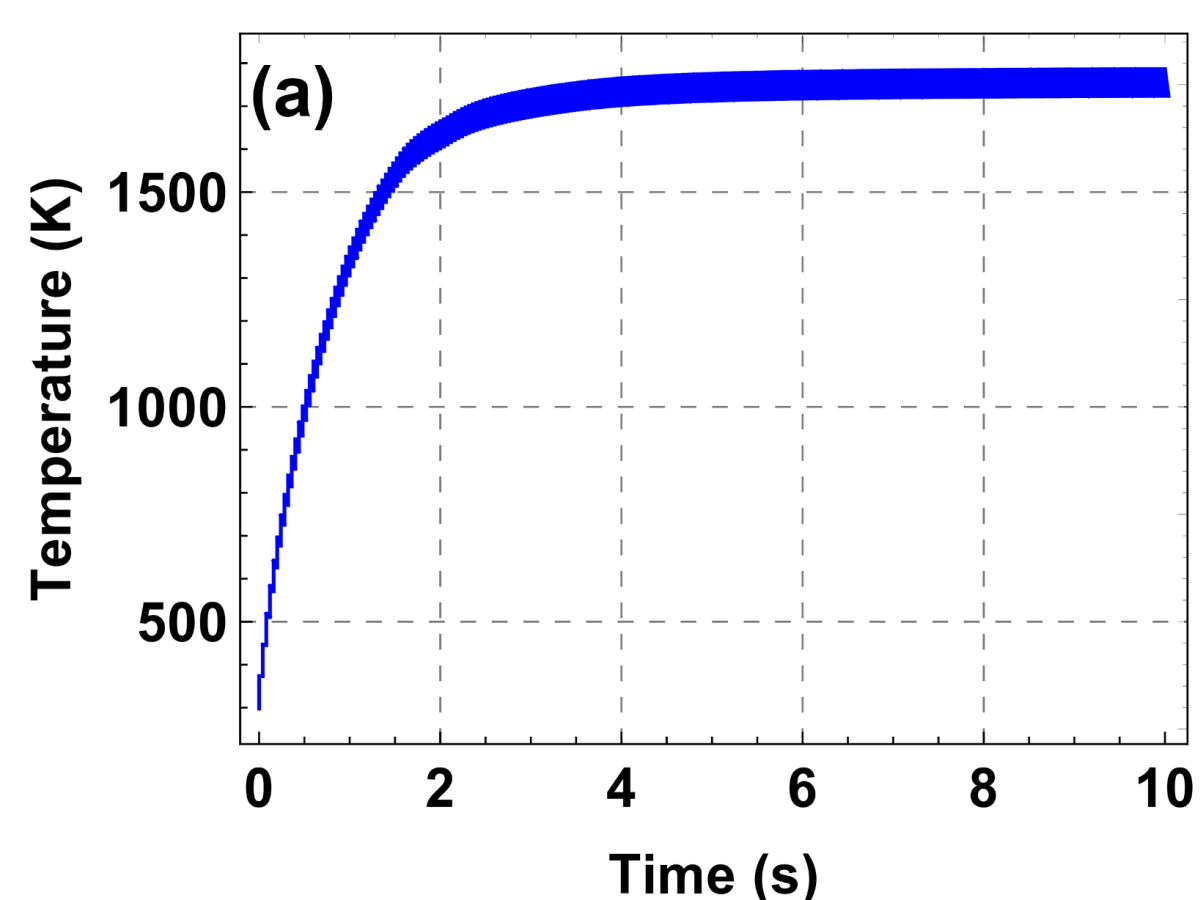


Parameters	CSNS-I	CSNS-II
Beam Power (kW)	100	500
Beam Energy (GeV)	1.6	1.6
Average Beam current (μA)	62.5	315
Beam repetition rate (Hz)	25	25
Protons per pulse (10^{13})	1.56	7.8



The schematic diagram of target MWPM for the CSNS-II

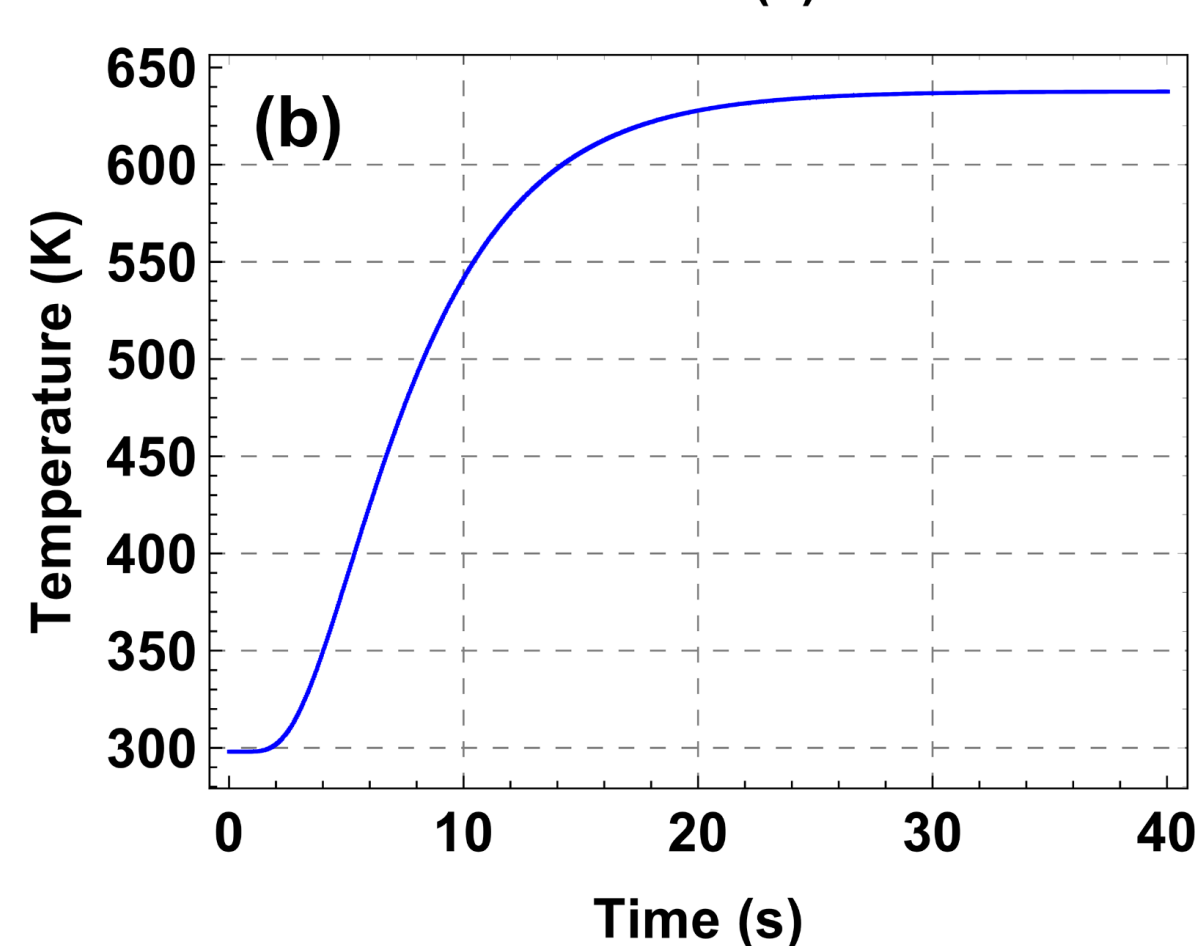
II. Design Considerations



□ The main design considerations of the MWPM are the beam induced thermal effects and the wire material selection.

□ Carbon, tungsten and SiC are the main material types for the beam profile measurements based on the secondary emission mechanism of wires.

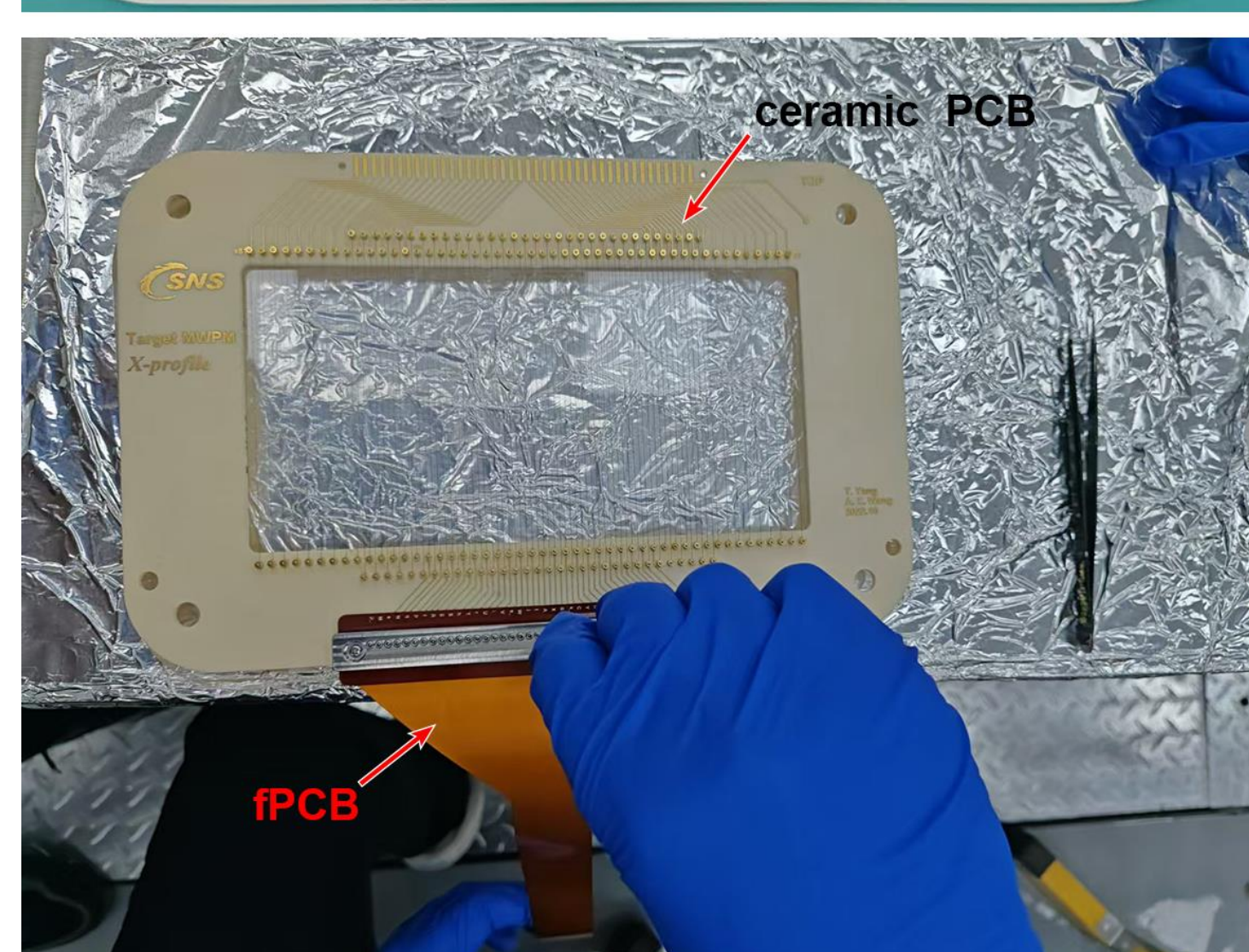
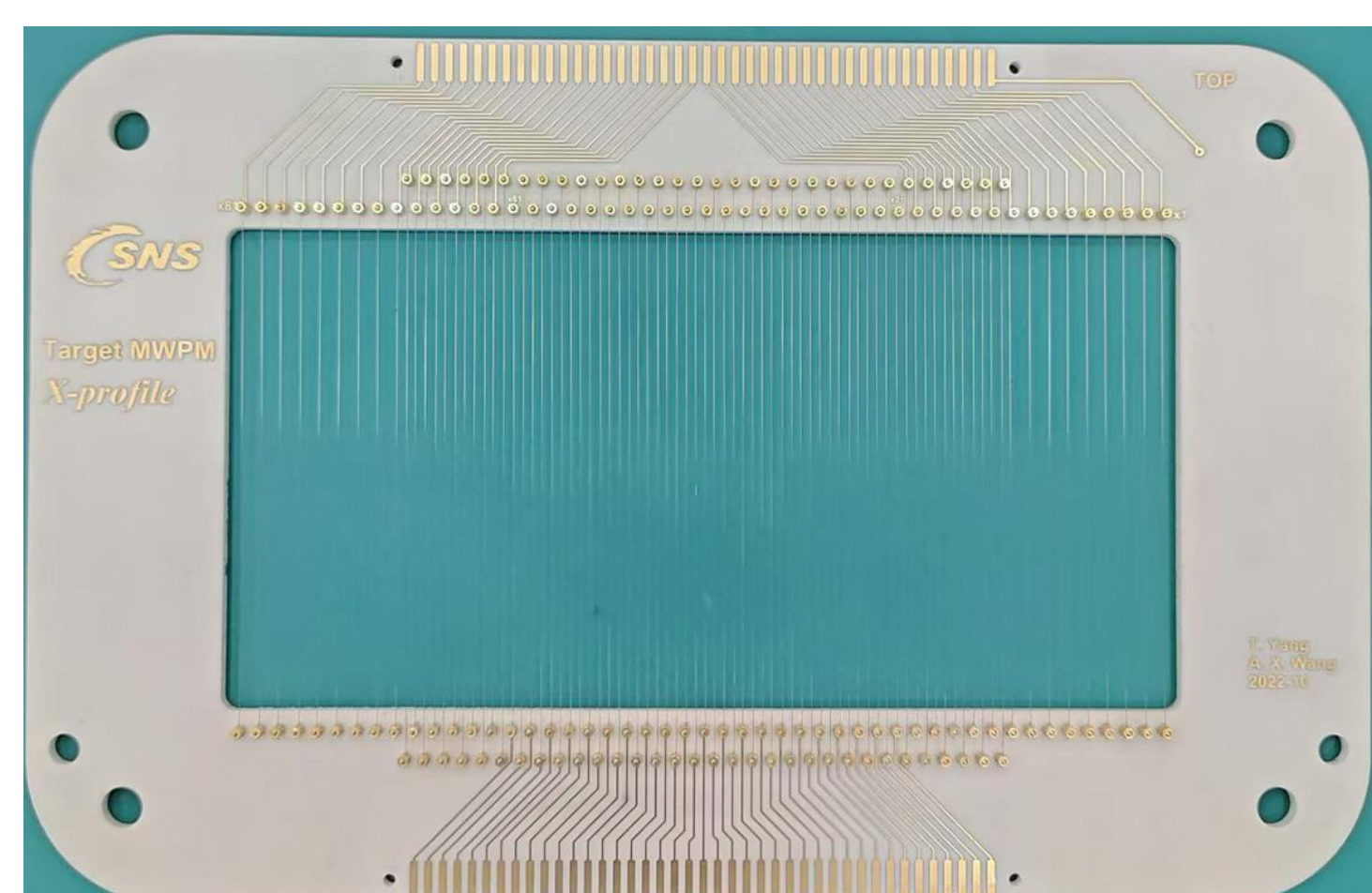
□ Tungsten is selected as the wire material both in the target MWPM designs of CSNS-I&II because of its high melting point, high tensile strength and low cost.



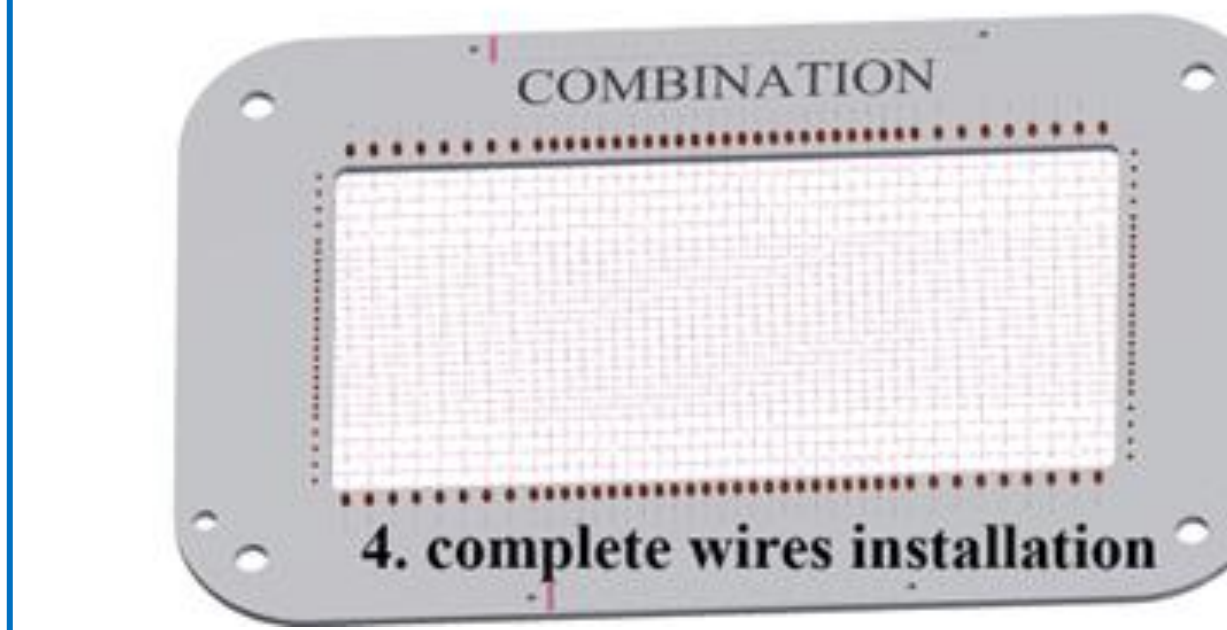
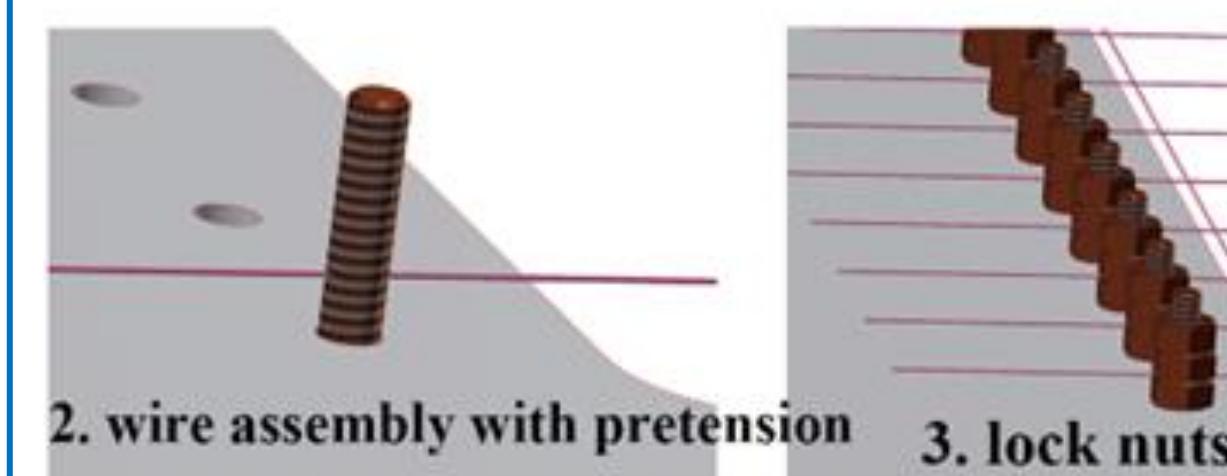
The calculated temperature vs. time (a) at the center and (b) edge of tungsten wire.



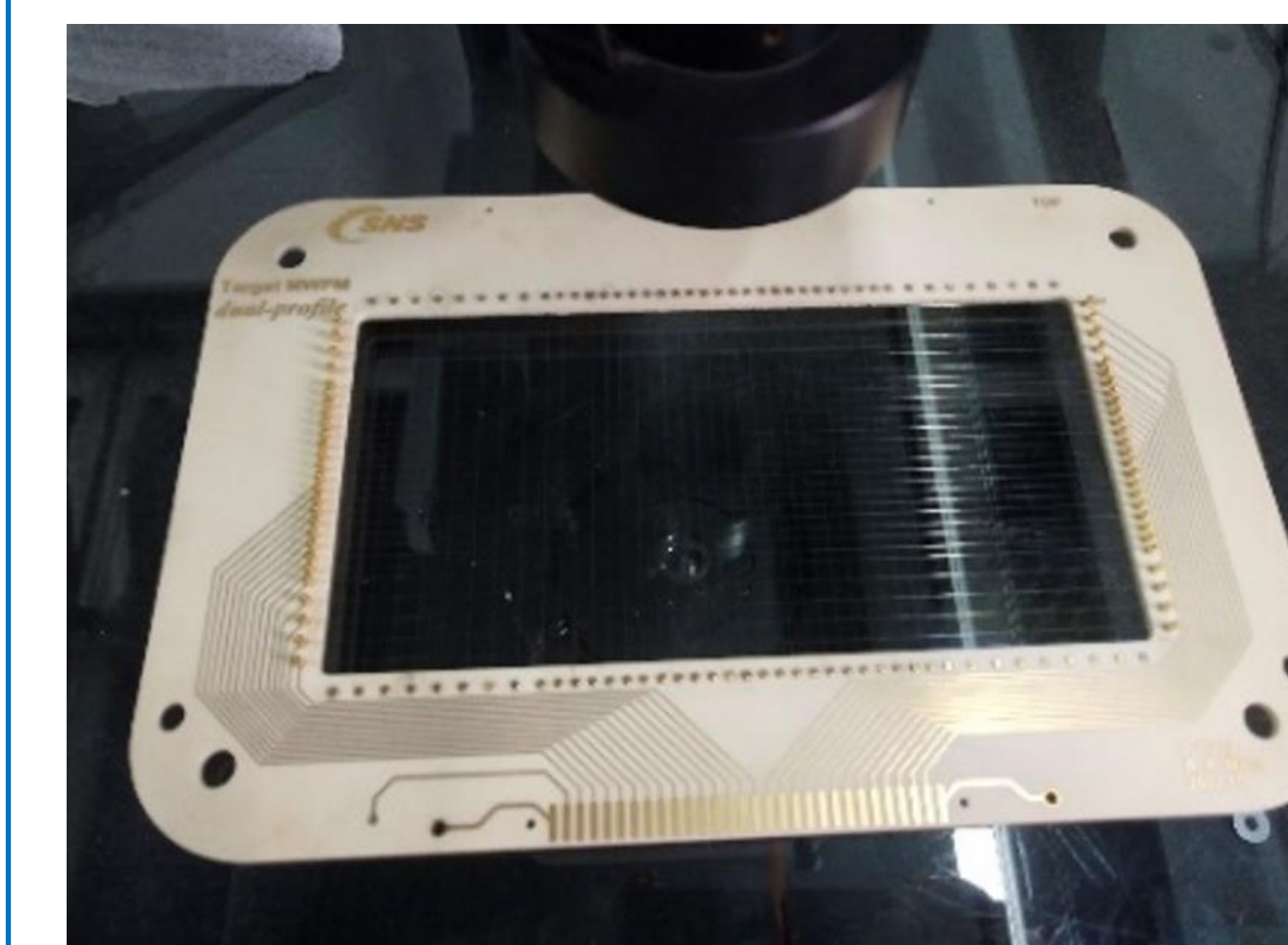
The new MWPM employs a new scheme involving of the **ceramic PCB routing, fPCB connecting and perforated-screw fixing** for wires.



III. Physical & Mechanical designs



The wire fixing and installation steps



□ The wire fixing issue cannot be simply solved by usual tin-soldering method because of the relative high edge temp.

□ The perforated screws (M1) with a 100- μm hole diameter are fabricated.

□ The tungsten wire is passed through the hole with a pretension determined by a tension meter ($\sim 1-2\text{ N}$).

□ lock the nuts and finally a wire installation is completed.

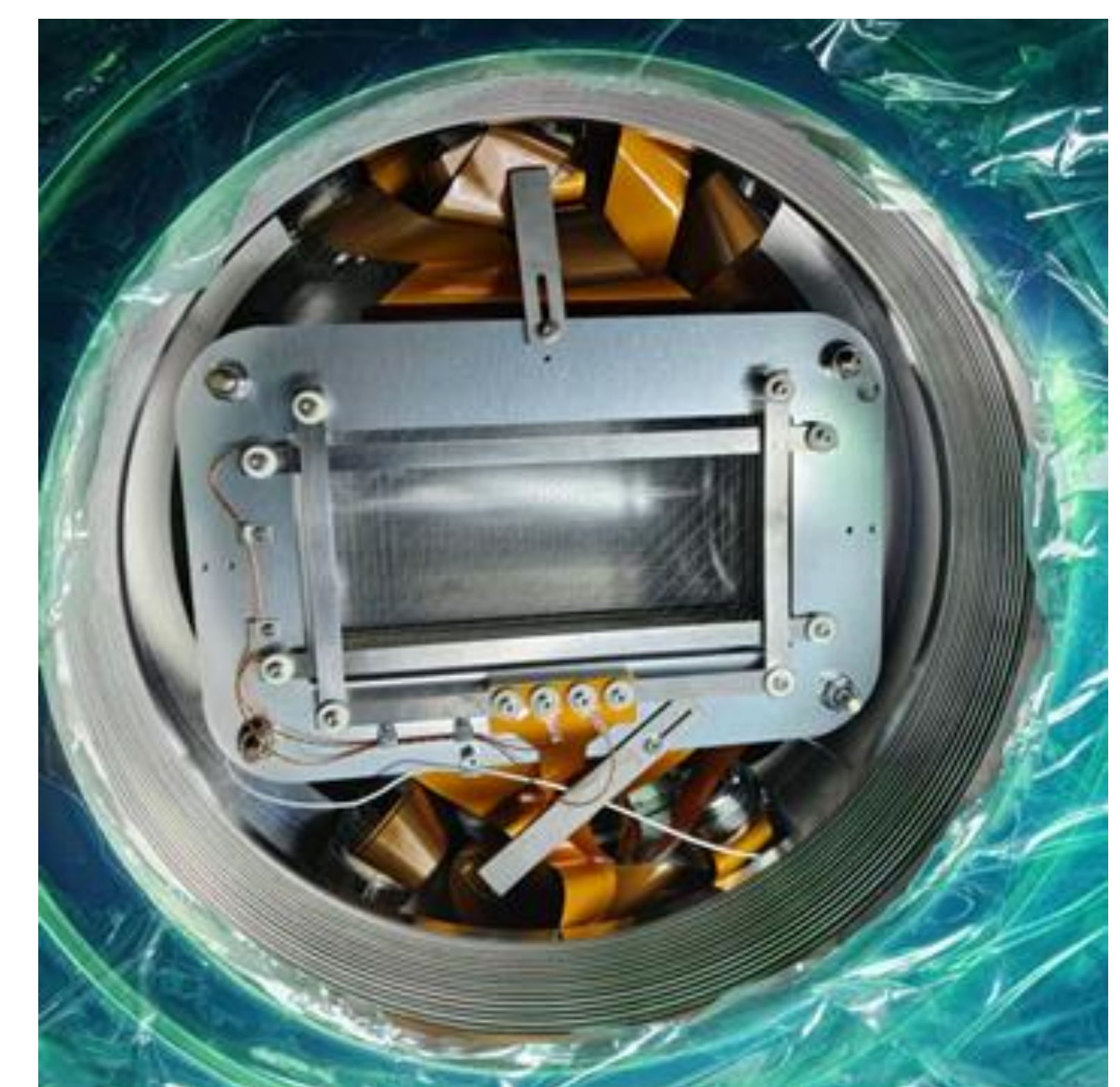
□ The wire interval could be achieved 2 mm by adopting this method.

□ Optical imaging instrument to measure the wire position

□ The average positioning accuracy is about 0.13 mm, which fully meets the design requirements.

□ The MWPM completed the installation in the PBW in June 2024.

□ The entire equipment hoisting will be completed in Sep.



IV. CONCLUSIONS

□ The new target MWPM for CSNS-II project employs a new scheme involving of the ceramic PCB routing, fPCB connecting and perforated-screw fixing for wires.

□ The wire interval could be achieved to be 2 mm, which is expected to attain a finer measurement result.

□ The overall instrument size is also more compact compared with the CSNS-I one.

□ The complete instrument has undergone manufacturing, assembly, and installation, and the beam experiment is scheduled to commence in October this year.

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