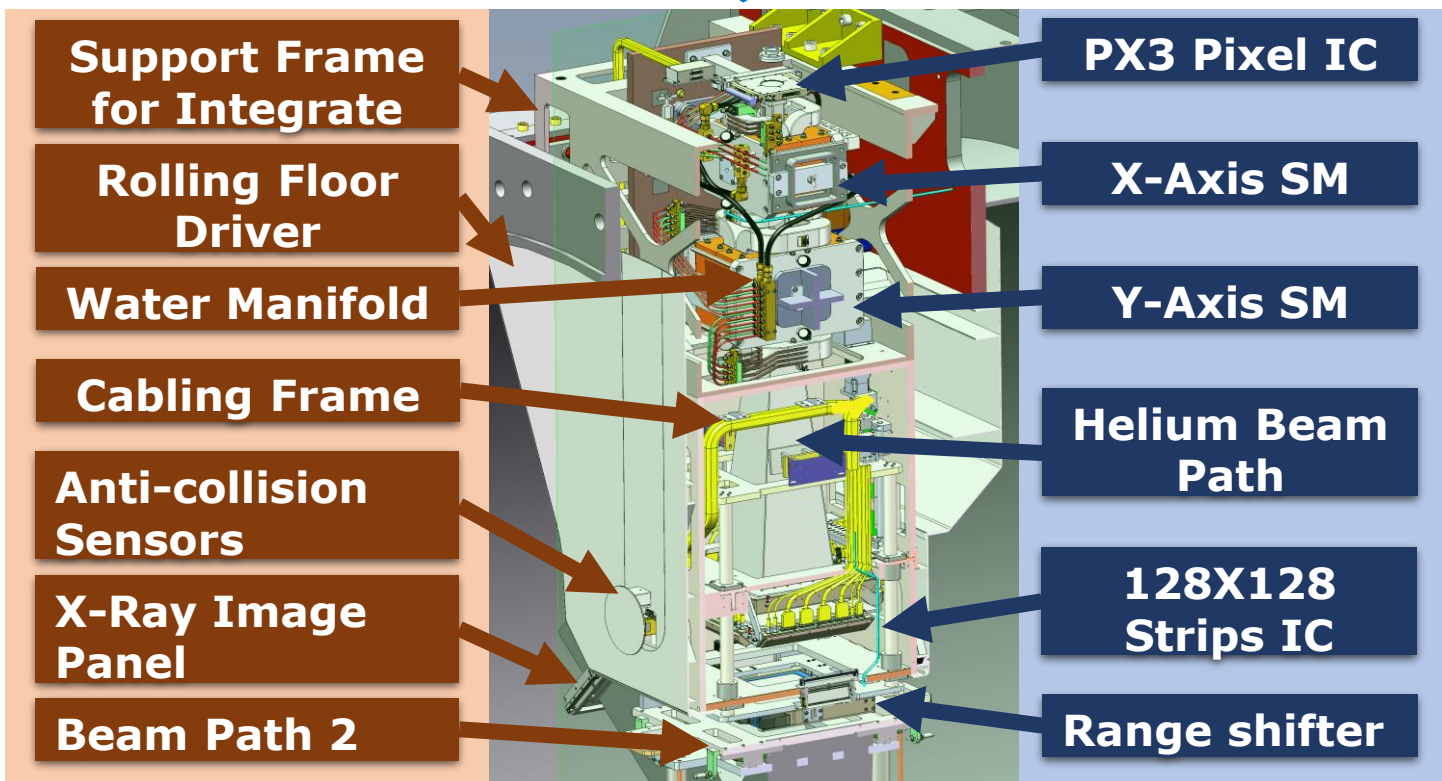


Online parameter identification and control in the commissioning of nozzle for CIAE proton therapy system

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Layout of the nozzle



| PARAMETER | VALUE |
|--|--------------------------------------|
| Beam Energy | 70 MeV ~ 242 MeV |
| Beam Current | 0.1 nA~ 10 nA (max 200nA) |
| Irradiation Field | 300 mm×400 mm |
| Max Range | 35.9 g/cm ² |
| Linear Scan Velocity (at maximum Energy) | 36.5 m/s (ScanX) 11.1 m/s (ScanY) |
| Dose Rate | 2 Gy/L/min |
| Max Position err | ±1 mm |
| Max Dose err | < ±2 % (2σ) |

Design parameter of nozzle

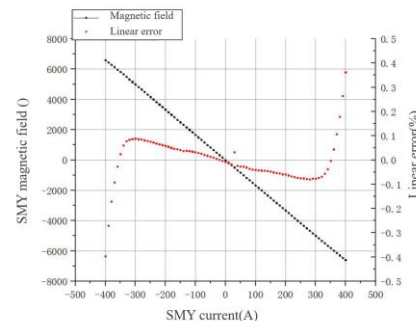
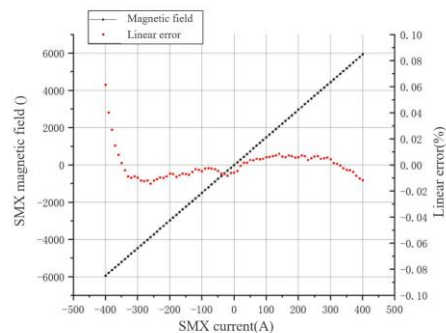
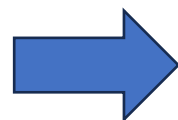
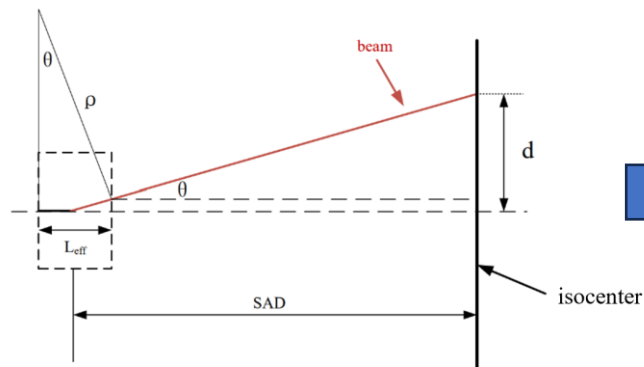
Our commissioning of the nozzle scanning system is focusing primarily on the **position accuracy**

The nozzle system was installed on gantry and has been integrated with the rolling floor and the X-ray panel

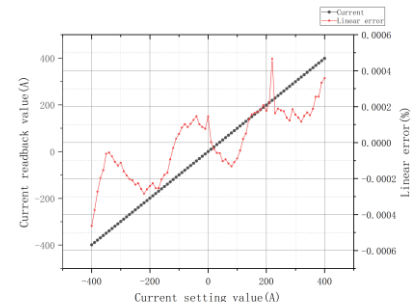
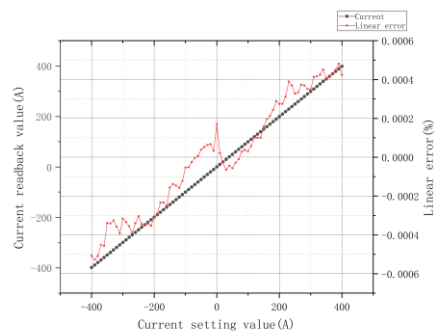
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Online calibration of the scanning control

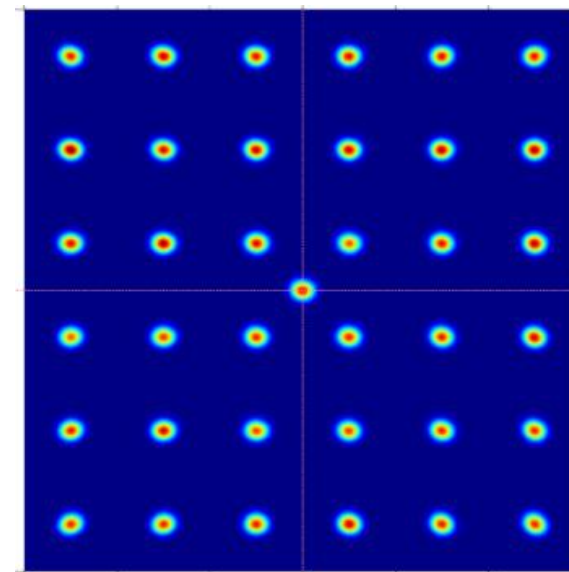


B-I Curve identification for the scanning magnets PS



SM current online correction for the accuracy irradiation

Result of Test

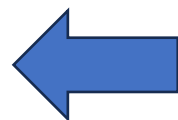
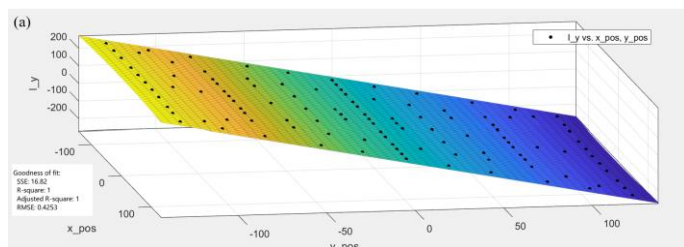


Three times of the accuracy test with beam

The max irradiation deflection was **-0.55 mm**

Our commissioning achieved sub-millimeter level accuracy in open-loop real-time control

Physical analysis for the scanning system simulate the proton beam trajectory



Online calibration of nozzle with beam
Use fifth-order polynomial surface fitting algorithm mapping relationship