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Abstract Title: Acceptance Testing of Beam Quality and Mechanical & Imaging Performance for a Pencil Beam Scanning Proton Therapy System

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Background / Aims:

- In accordance with the specification requirements of "WS 816-2023 Standard for testing of quality control in medical proton/heavy ion radiotherapy equipment", acceptance tests were conducted on the beam quality and the mechanical & imaging properties of the Varian ProBeam proton therapy system, and the overall performance of the proton therapy system was evaluated to ensure that the system could be safely applied to clinical treatment.

Subjects and Methods:

- Based on the quality control testing items and technical requirements specified in the standard, this test primarily includes pencil beam proton beam performance testing, mechanical and imaging performance testing.

Result:

Acceptance testing results of beam quality and mechanical & imaging performance

No.	Testing Category	Test Items	Technical requirements	Measurement results
1	Dosimetry	Output constancy	±3%	1.18 %
2		Dose reproducibility	±2%	0.40%
3		Monitor unit Linearity	±2%	0.81%
4		Range verification	±1mm	0.2mm
5		Spot position	±1.5mm	0.57mm
6		Spot size	±15%	2.92%-X; 3.02%-Y
7		Uniformity of spot shapes	±2mm	0.1mm-X; 0.1mm-Y
8		Field flatness	±2%	1.49%-X; 1.64%-Y
9		Field symmetry	±2%	1.28%-X; 1.45%-Y
10		Lateral profile penumbra	±2mm	1.08mm
11		SOBP width	±2%/2mm	0.30mm
12		Virtual SAD	±1%	0.29%-X; 0.43%-Y
13	Mechanical	Beam isocentricity	±1mm	0.4mm
14		Image isocentricity	±1mm	0.8mm
15		Couch isocentricity	±1mm	0.5mm
16		Couch translational accuracy	±1mm	0.1mm
17		Couch rotational accuracy	±1º	0.3º
18	Imaging	Image-guided correcting eviations	±1.5mm	0.8mm
19		Image quality	TG-179 and TG-142	Pass

- The acceptance test results of the ProBeam proton therapy system in terms of beam quality and mechanical and imaging performance meet the standardized parameters. The system exhibits excellent stability and accuracy, ensuring its safe and reliable application in clinical radiotherapy.