

PSI

Invitation

Proton Therapy Symposium @SASRO 2025



SpotOn+

Dear Reader

Welcome to the second 2025 edition of our *SpotOn+* Newsletter.

A key highlight for your calendars: on September 11th, during the SASRO Annual Meeting in Davos, a dedicated Proton Therapy Symposium will take place. This year's focus is on head and neck cancers treated with proton therapy - a topic currently under intense investigation in several randomized prospective trials, including but not limited to the TORPEDO (ISRCTN 16424014), DAHANCA 35 (NCT04607694) and the Swedish trial (NCT03829033). The results from these studies are eagerly awaited. Early data from the MD Anderson trial (NCT01893307) has already generated excitement, reporting a significant improvement in five-year overall survival - 91% compared with 81% - for IMPT over IMRT, with a p-value of 0.045. However, the full results are not yet published and await confirmation.

The symposium will provide a detailed review of these trials, along with two clinical case presentations, showcasing IMRT, IMPT, and static proton arc therapy with NTCP calculations. We expect to share more about the latter in a future edition of this newsletter.

In this edition, we also present the outcomes of 119 children with supra- and infratentorial ependymoma treated with pencil beam scanning proton therapy to a median dose of 59.4 GyRBE. This analysis is notable for including a quality of life (QoL) component - still rare in proton therapy research - and for its substantial follow-up of over 60 months. The findings are encouraging: five-year

overall survival exceeded 80%, while local tumor control approached 70%, with most patients experiencing no high-grade late toxicities. Outcomes were better when treatment was given upfront rather than at relapse, and complete resection improved both local control and progress-free survival compared with subtotal resection. Notably, in older patients, QoL at five years remained good, and in some domains self-reported scores even surpassed those of the normative group.

Finally, we introduce a new calibration method that enables accurate patient positioning directly from in-room CT imaging. This feature, part of our second-generation in-house Gantry 2, removes the need for additional isocenter verification, streamlining workflows and bringing us closer to daily adaptive treatment - a development we look forward to reporting on in the near future.

I hope to see many of you at the Proton Therapy Symposium in Davos. Stay tuned for the next edition in about four months' time.

Sincerely,
Prof. Damien C. Weber,
Chairman Center for Proton Therapy,
Paul Scherrer Institute



Radio-Oncology News

Long-term outcomes and quality of life of children with intracranial ependymoma treated with pencil-beam scanning proton therapy

Background

Ependymoma is a common brain tumor in children and adolescents. The standard of care includes surgery, chemotherapy, and adjuvant radiation therapy (RT). RT improves prognosis but carries potential toxicity risks, particularly for young patients. Proton therapy (PT) offers better conformal treatments and reduces dose exposure compared to traditional photon RT. Therefore, PT is particularly indicated for children with a long-life expectancy.

Materials and Methods

This study retrospectively analyzed long-term outcomes of children treated with pencil beam scanning proton therapy (PBS-PT) for intracranial ependymomas at the Paul Scherrer Institute between 2004 and 2022. Re-irradiation and mixed proton-photon treatment were excluded. Finally, 119 children were included in the analyses.

Results

Median age at PT was 36.3 months and 35% of patients were female. Most of the patients had infra-tentorial tumors (70.6%) and anaplastic ependymomas (82.4%). The median PT dose was 59.4 Gy_{RBE} delivered in 1.8 Gy_{RBE}/fraction. The median follow-up time was 63.3 months. Follow-up at 5 years showed 70.4% local control (LC), 63.5% progression-free survival (PFS), and 82.2% overall survival (OS). OS was better with upfront than relapse treatment (83% vs. 69.8%; $p = 0.02$), and complete resection improved both LC (74% vs. 65.1%; $p = 0.03$) and PFS (67.5% vs. 57.1%; $p = 0.049$) compared to subtotal resection. No hearing loss was observed with cochlea D_{\max} not exceeding 48 Gy_{RBE} (10.5% vs. 0%; $p = 0.01$), whereas the risk of hormone deficiency was significantly increased with pituitary D_{mean} above 38 Gy_{RBE} (33.3% vs. 6.0%; $p < 0.01$). Most patients (72.3%) had no late toxicity. Four secondary brain malignancies (3.4%) occurred within a median of 9.3 years after PT (range: 3.7-15). Quality of life 5 years after PBS-PT was good in older (>4 years-old) patients, self-rated autonomy and body image were even better than the norm group.

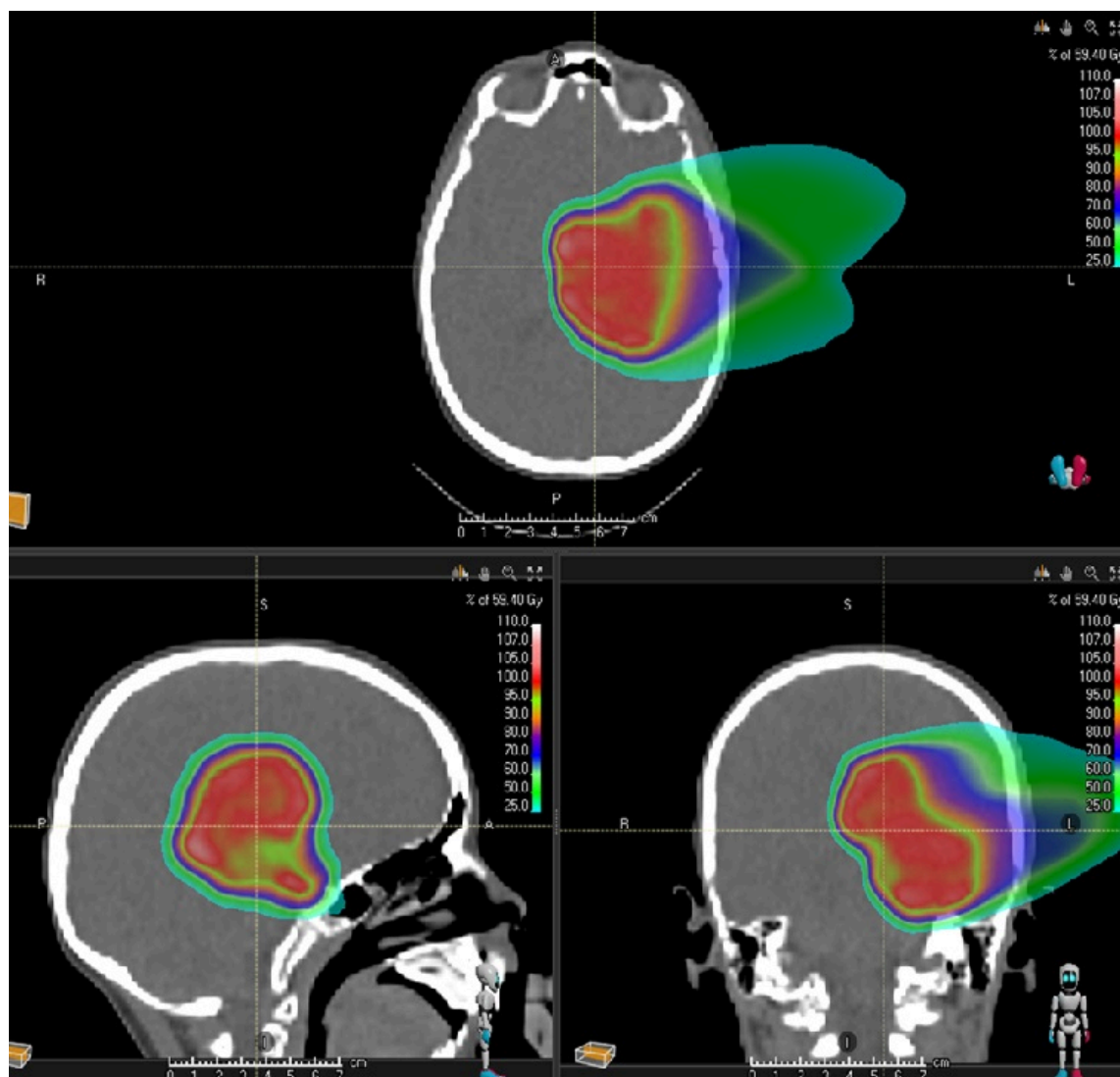


Figure: Dose distribution for a 3-field proton therapy plan in an 8-year-old female patient diagnosed with a partially resected grade II ependymoma in the left thalamus. The patient received 59.4 Gy_{RBE} in 33 fractions, delivered in supine position using a bite block for head immobilization. Treatment was well tolerated, and at 5-year follow-up, the patient remains recurrence-free and in good clinical condition.

Conclusion

Intracranial PBS-PT offers excellent tumor control and low late toxicity, and revealed good overall quality of life in children with ependymoma, both by proxy- and self-assessment.

This work has been recently published ([Le Reun and Kotov et al. 2025](#)).

Medical-Physics News

Achieving precision positioning using in-room CT-on-rails imaging

Background and Purpose

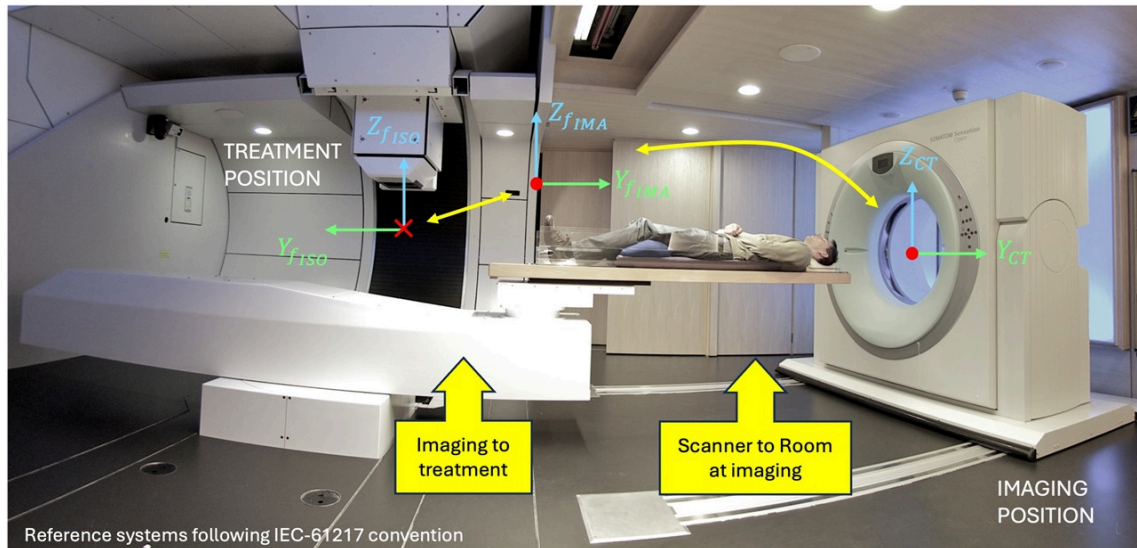
Over the past decade, several proton therapy facilities have installed in-room CT-on-rails scanners to image patients in treatment position and assist with positioning. However, due to workflow complexity and limited system integration, these scanners are often restricted to control imaging, while treatment verification relies on on-board imagers at isocenter. A key challenge is the harmonization of coordinate systems between the scanner and robotic treatment table, further complicated by geometric distortions that impact accuracy. In this study, we introduce a calibration method that enables accurate patient positioning directly from in-room CT imaging, eliminating the need for additional isocenter verification.

Materials and Methods

We presented a geometry calibration approach to correct distortions, primarily compression in the longitudinal direction, by comparing image data to high-accuracy laser tracker measurements. For 3DCT imaging, distortion was modeled as a function of scan range and corrected using affine transformations. Topogram (localizer) images were calibrated similarly, and combined with a novel algorithm for generating digitally reconstructed topograms, enabled 2D/3D radiograph-based patient positioning. This approach is particularly suitable for verifying extremities and the craniospinal axis while keeping imaging dose low.

Results

Accuracy and feasibility were assessed in phantom studies simulating clinical conditions. With proper calibration, CT-on-rails met sub-millimeter positioning requirements. Residual errors in 3DCT-based workflows were under 0.2 mm in all directions, while topogram-based 2D/3D registration showed discrepancies between 0.3 and 0.55 mm, depending on resolution and field-of-view.



Annotated view of Gantry 2 at PSI, showing the frames of reference used in scanner calibration, from the CT coordinate system to the imaging position (IMA) and treatment isocenter (ISO).

Conclusions

This study demonstrates that, when properly calibrated, in-room CT-on-rails can support high-precision patient positioning compatible with proton therapy requirements. The method integrates with existing clinical systems, including robotic tables, and provides a practical alternative to isocenter-based verification. It also facilitates workflows that combine positioning and treatment adaption.

This work has been recently published: [Fattori et al. 2025](#).

Announcement

Proton Therapy Symposium at SASRO 2025 in Davos

A Symposium dedicated to proton therapy will take place on the opening day of the SASRO conference, **Thursday, 11th September, from 09:15 to 10:45**. The session will feature presentations on the clinical and technical aspects of proton therapy for head and neck cancer patients. Please find the detailed program below:

09:15	Welcome	DC Weber, B Baumert
09:20	Integrating Proton Therapy into Comprehensive Cancer Care	DC Weber
09:35	Proton Therapy in H&N Cancers: A Review of Ongoing and Completed Studies	B Bachtary
09:50	Case-Based Approach to Proton Therapy in H&N Cancer	A Cherchik
10:00	<i>Questions and Answers</i>	
10:05	Integrated Approaches in H&N Proton Therapy: Robust Planning, Proton Arc Therapy, and NTCP-Guided Patient Selection	A Meijers
10:30	<i>Questions and Answers</i>	
10:35	Conclusion and Summary	DC Weber

For further information and registration, kindly refer to the official website of this year's [SASRO congress](#). The Proton Symposium will be free of charge for SASRO participants.

Imprint

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