# *Proton Spine Phantom*

Guidelines for ***Planning and Treating*** the Proton Spine Phantom.
Revised September 2024

The study groups are requesting that each institution keep the phantom for no more than 2 weeks. During this two-week period, the institution is expected to image, plan, and treat the phantom and return it to our office. Thank you for your cooperation.

The phantom contains TLDs at 2 locations and perpendicular sheets of film in order to evaluate the field matching at the field junction.

If you have any questions, please contact the Radiation Quality Assurance Laboratory at:

Phone: (713)-745-8989
Email: RQLAB@mdanderson.org

## DOSIMETRY INFORMATION TO BE SUBMITTED:

The following information is to be submitted when returning the phantom (include it in the shipping box):

- A completed **Proton Spine Phantom Institution Information** form.
- Original hard copy of the plans and isodose distributions in the axial and sagittal plane through the target center.
- Please upload the Proton Spine phantom digital data. A folder had been created with your institution name on OneDrive and it will be shared with you. The files to upload are the digital data for your Proton Head and Neck phantom irradiation in DICOM format, and include all CT slices, 3D composite dose file, structure file and plan file.

**Spine Phantom:**
The white shipping case labeled "proton spine" contains a solid phantom simulating the thoracic spinal column to test accurate matching of adjacent fields. The phantom is already loaded with Gafchromic® EBT2 film. The phantom is secured with 2 plastic dowels in the left-right directions and 2 plastic screws in the superior-inferior direction. **Do not open the phantom.**
The phantom consists of three parts:

1. **Bottom** that contains the posterior portion (including spinous processes) of the spine,
2. **Right** which is the patient's right (that contains patient's Rt transverse process), and
3. **Left** which is patient's left

The phantom simulates a supine patient when placed on the table with the Bottom section on the bottom. The inferior end of the phantom is marked on the Bottom section.

**CT Scanning Instructions:**

1) Treat the phantom as you would a patient. The phantom is fragile; please treat it gently. Please do not remove any tape with markings on it. If you are going to mark on the phantom, please use your own tape and mark on it and if you think we need your mark for dosimetry analysis leave the tape on.
2) Scan the phantom with a CT scanner as you would for a spinal or cranio-spinal patient treatment.
3) Scan the entire phantom using the regular slice thickness you use for spine patients.

**Planning Instructions:**

1) The purpose is to simulate the beam divergence that would occur if you were to treat a full spine. Please make sure that each white polystyrene block is attached securely to both ends of the phantom. For this test case **two fields** shall be used. The radiation fields can extend out into the white blocks. Each field should cover the lateral extent of the vertebral bodies. Match the fields in the middle of the phantom, at approximately the middle of the phantom at the $6^{th}$ vertebral body from the superior edge.
2) Deliver a biologically weighted dose of 6.00 Gy (RBE) at each isocenter. The 6 Gy(RBE) isodose lines should cover ≥95% of the CTV, and all hot spots must be ≤107%.
3) Please contour the TLD powder and report the mean calculated TPS dose to the TLD, ensuring uniform coverage. Even if it is not your typical clinical practice to cover the entire vertebral body, the 6 Gy(RBE) isodose line should cover the entire TLD.

**Treatment Instructions:**

1) Perform your customary QA of the proton plan prior to irradiating the phantom.
2) Treat the phantom with the developed plan as you would a protocol patient. You may want to place a towel under the phantom so it doesn't slide on the treatment couch.
3) Put the phantom back into the box.
4) Include all the dosimetry data discussed above. Be sure to include the magnification factor used on the images coming from your TPS.
5) Return the complete package to our office.

## *Proton Spine Phantom Institution Information*

Institution:_____

Address: _____

_____

Person performing irradiation: _____

Physicist to receive report: _____

Email address: _____ Phone Number: _____

Person to call in case of questions:_____

Phone Number:_____ Fax Number: _____

Email address: _____

**Treatment Unit:**

Manufacturer: _____ Model: _____

Proton beam line used: _____

1. For the phantom irradiation, technique used was (check one)

- ☐ Pencil Beam Scanning (PBS) / IMPT (variable intensity pencil beam scanning).
- ☐ Uniform Scanning.
- ☐ Passive Scattering.

2. Collimation technique:

- ☐ Multileaf
- ☐ Solid Aperture

3. Range modulation technique:

- ☐ Range modulator wheel
- ☐ Range shifters
- ☐ Both RMW and shifters
- ☐ Other, please describe _____

4. Compensator technique:

- ☐ Solid compensator / bolus
- ☐ Other, please describe_____

**Please enclose original copies of your treatment plans, isodose distribution of the coronal and sagittal planes through the target center. Include scaling factors for each plane.**

**Treatment Planning System:**

Manufacturer: _____ Model: _____

Software: _____ Algorithm:_____ TPS Version: _____

**Treatment of Phantom:**

Date of Irradiation: _____

Indicate dose delivered to these specific points as determined by your treatment planning computer

| Position | Mean Dose (cGy(RBE)) |
|---|---|
| Superior TLD position* | |
| Inferior TLD position* | |

*Please see Appendix for screenshots of the TLD locations if you are having difficulty locating them

Results of QA:_____

_____

Did you change the M.U. based on your QA? □No □Yes_____

Attach copies of the treatment plans including slices in the sagittal and coronal film planes. Please include labels for the treatment plan

Comments: _____

_____

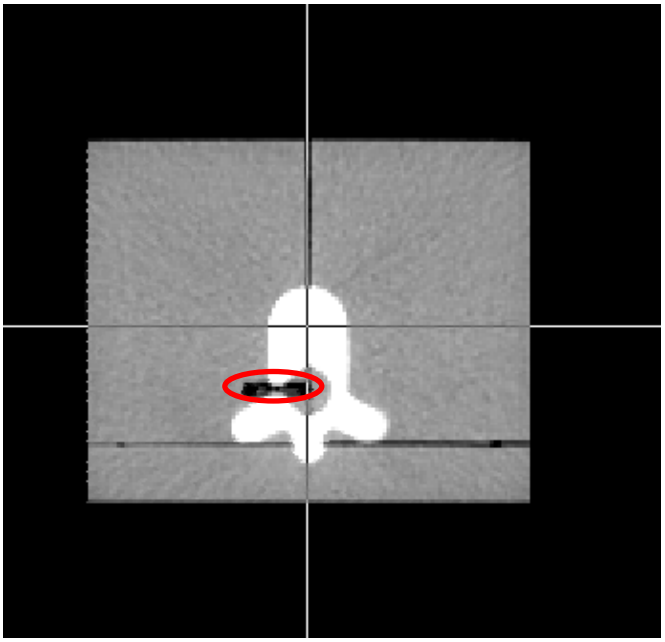
_____

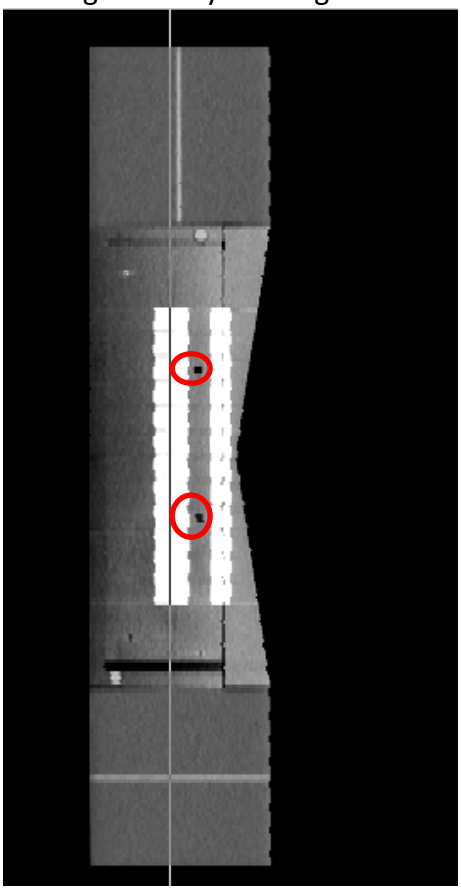
_____

| For Office Use Only | TLD Batch | Film Batch<br>EBT3 LOT # | Phantom ID # | Code | Date Sent<br>NH | Date Rec'd |
|---|---|---|---|---|---|---|
| | | | | | | |

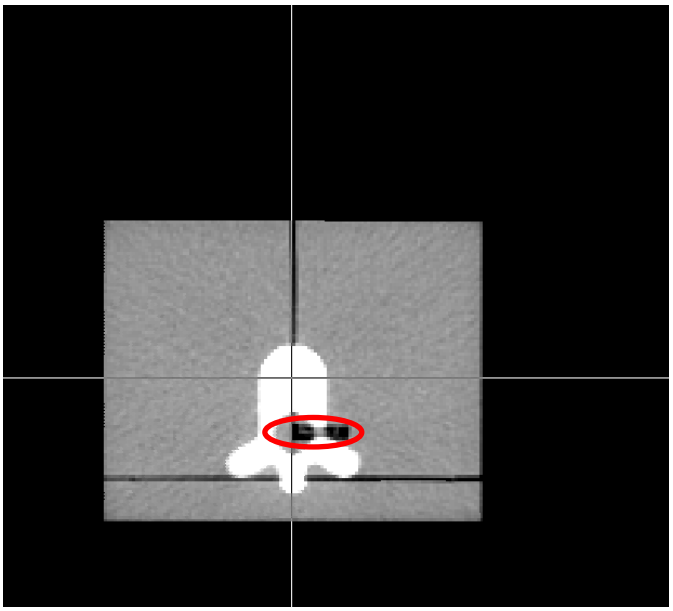
## Appendix

See screen captures below for location of TLD if you are having difficulty locating them.





**Right Superior**



**Left Inferior**