Proton Therapy Questionnaire

This questionnaire requests data specific to the beam lines and conditions you will use for patients on NCI sponsored clinical trials. Do not try to be comprehensive for your entire facility; replies should be pertinent to patients on pediatric and adult clinical trial group protocols sponsored by the NCI. Recognizing the rapid development of proton techniques, this questionnaire shall be completed each year concurrent with the TLD irradiations from the RPC. (Please number attachments that are needed to clarify specific procedures.)

Institution: _____

Address: _____

_____

RTF No. (from TLD report): _____

Person completing this questionnaire (please provide your contact information)

Name: _____ Phone: _____
Email: _____

Radiation Oncologist (Please provide the information for one key contact person)

Name: _____ Phone: _____
Email: _____

Physicist (Please provide the information for one key contact person)

Name: _____ Phone: _____
Email: _____

Dosimetrist (Please provide the information for one key contact person)

Name: _____ Phone: _____
Email: _____

Maintenance (Please provide the information for one key contact person – in-house or contract)

Name: _____ Phone: _____
Email: _____

Date Completed: _____

A. Experience

A1. For the following sites, approximately how many adult patients have you treated in the last 12 months?

Brain	_____	Head & Neck	_____	Pelvis	_____
Thorax	_____	Abdomen	_____	Other	_____

A2. Do you treat pediatric cases with protons? ☐ yes, ☐ no

If yes, how many have you treated in the last 12 months? _____

What is the age limit for "pediatric" cases? _____

A3. If you treat pediatric cases, are you capable of providing anesthesia? ☐ yes, ☐ no

If yes, what percentage of the pediatric caseload is treated under anesthesia? _____ %

B. Dose Calibration and Verification:

B1. What calibration protocol is followed for proton beam calibrations?

☐ TRS-398 N_w, ☐ ICRU-59 N_x, ☐ other (describe) _____

B2. Dose is specified in: ☐ water, ☐ other (describe) _____

B3. What devices are used for the absolute dose calibrations? (specify make, model and serial number)

Device	Manufacturer	Model	Serial Number
Ion Chamber			
Electrometer			
Thermometer			
Barometer			

NOTE: Attach a copy of the most recent ADCL calibration report for the chamber and electrometer.

B4. What is the date of your most recent TLD report from the RPC? _____

B5. What are the methods of determining the dose per monitor unit for patient proton treatment fields (examples: TPS, stand-alone program, hand calculation, physical measurement)?

a) primary used for treatment _____

b) first check _____

c) second check _____

B6. For what percentage of patient proton treatment fields is the dose per monitor unit checked by physically measuring dose in the beam? _____

B7. For what percentage of patient proton treatment fields are the depth dose and/or lateral profile distributions physically measured in the beam? _____

B8. When the dose per monitor unit is checked with a physical measurement is:

a) the patient aperture used?	☐ always	☐ sometimes	☐ never
b) a standard aperture used?	☐ always	☐ sometimes	☐ never
c) no aperture used?	☐ always	☐ sometimes	☐ never
d) the patient bolus used?	☐ always	☐ sometimes	☐ never
e) a substitute flat bolus used?	☐ always	☐ sometimes	☐ never
f) no bolus used?	☐ always	☐ sometimes	☐ never

g) additional explanations _____

_____

B9. When the depth dose and/or lateral dose profiles are checked with a physical measurement is:

a) the patient aperture used?	☐ always	☐ sometimes	☐ never
b) a standard aperture used?	☐ always	☐ sometimes	☐ never
c) no aperture used?	☐ always	☐ sometimes	☐ never
d) the patient range compensator/bolus used?	☐ always	☐ sometimes	☐ never
e) a substitute flat range compensator/bolus used?	☐ always	☐ sometimes	☐ never
f) no range compensator/bolus used?	☐ always	☐ sometimes	☐ never

g) additional explanations _____

_____

B10. What dose parameter is used for patient treatments?

☐ Dose to water (Gy), ☐ Dose multiplied by RBE (Gy*RBE)

B11. If dose*RBE is used, what value for RBE is applied?

☐ 1.1 ☐ other (specify) _____

B12. What nomenclature is used to record the dose in the chart?

☐ Gy, ☐ Co-Gy-Eq, ☐ CGE, ☐ Gy_{RBE}, ☐ other (specify)_____

C. Proton Beam Production and Delivery System:

C1. Proton accelerator a: ☐ cyclotron, ☐ synchrotron, ☐ synchrocyclotron, ☐ other _____

Manufacturer: _____

Model: _____

C2. Proton nominal maximum energy (entering radiation head): _____MeV

C3. How many beam lines in clinical operation could be used for treating patients entered on NCI clinical trials? _____ For each please complete below:

Item	*examples*	Beamline 1	Beamline 2	Beamline 3	Beamline 4
What is your facility's name for this beam line	*A3* *Green Room*				
When did/will the beam line begin treating patients?	*Oct. 2011* *Proj. May 2015*				
From what orientations can the beam be directed?	*360° gantry* *horizontal only*				
What is the primary method of laterally spreading the beam? (If scanning beam, please describe available spot sizes.) List all methods commissioned.	*single scattering* *double scattering* *uniform scanning* *modulated scanning*				
What is the maximum field size for each delivery system at the nominal isocenter for the maximum range?	*25 cm x 25 cm (PBS)* *18 cm x 18 cm (US)*				
What is the maximum depth in water that can be treated with a 10 cm x 10 cm field with 10 cm range modulation?	*27.5 cm (Doub Scat)* *30.1 cm (PBS)*				
For the maximum nominal energy, what are the maximum and minimum dose rates for a 10 cm x 10 cm field with 10 cm modulation?	*Max: 1.2 cGy/min* *Min: 0.8 cGy/min*				
Where in the SOBP is dose/MU specified?	*average dose in SOBP* *dose at center of SOBP*				
What method of range modulation is used?	*Enter one or more codes from *note below*				
How is the range modulation width defined?	*proximal 95%*				
	distal 90%				
Where is beam range defined?	R_{90}				
Are there cases where a ripple filter is used?	*yes/no*				
For the 10 cm x 10 cm field above, what is the lateral dose uniformity (with respect to CAX)?	*+/- 3 %*				
Are range compensators used to vary penetration of beam across the field?	*Yes/no*				

If so, what material is used?	*acrylic* *wax*				
What kind of patient specific beam collimation is used?	*apertures* *MLC* *none*				
Is modulated scanning used for patients on NCI supported clinical trials?	*Yes/no*				
If modulated scanning is used, how long does it take to irradiate a 10 cm x 10 cm x 10 cm target volume that has a distal depth of 20 cm of water to 1 Gy?	*minutes*				
For spot scanning and the field described above, what is the average and variation in spot size?	*16 mm ± 1 mm*				
Over all energies, what are the maximum and minimum spot sizes?	*max 30 mm*				
	min 10 mm				

*Note: Use these codes to describe methods of range modulation that might be used for protocol patients (may combine codes for accurate description, for example 1 & 2, or 3 & 4):

1. rotating stepped rangeshifter (modulator wheel or propeller)
2. beam current modulation
3. ridge filter
4. energy stacking
5. spot scanning
6. upstream rangeshifter
7. Other (describe) _____

C4. How is dose uniformity over SOBP specified? (e.g. relative to nominal center of modulation, relative to measured center of modulation, relative to average dose within modulated region, etc.)

_____

C5. For each beam applicator (cone) available, please supply the shape, maximum field size supported, maximum range, and typical clinical dose rate at maximum field size and maximum range for 6.0 cm of range modulation.

Beam Applicator ID	Shape (circle, square, other)	Max Field Size [cm]	Max Range [cm water]	Dose Rate [Gy/min]

D. Treatment Planning:

D1. What planning system/software and version is used for proton treatment planning?
Manufacturer: _____ Model: _____ Version: _____

D2. If patients receive both proton and photon beams as part of their treatment, is the photon planning done on the same system as the proton planning? ☐ yes, ☐ no
If yes, are the proton and photon portals part of the same plan? ☐ yes, ☐ no
If no, how are the dose distributions summed and how is RBE accounted? _____
_____
_____

D3. In what format can your proton planning system digitally export CT images, structures, and dose matrix? ☐ DICOM RT format, ☐ RTOG format

D4. Can the planning system export a composite plan of photons and protons?
☐ yes, in DICOM RT format, ☐ yes, in RTOG format, ☐ no

D5. What CT scanner(s) is(are) used for proton therapy patients? For each, complete the table:

Scanner name		
Imaging protocol name		
Helical? (y or n)		
Slice thickness		
kVp		
RFOV for commissioned protocol		

D6. Does the planning system allow CT number scaling for different CT scanners or patients? ☐ yes, ☐ no If no, what procedures are used to account for CT number dependencies on patient size, shape, etc.? _____
_____

D7. How are CT numbers used for penetration calculations?
_____ direct from CT# to RLSP (user input)
_____ CT# to mass density (user input), then mass density to RLSP (pre-programmed)
_____ CT# to tissue group and mass density (user input), then to RLSP (e.g. Monte Carlo)
_____ other (describe)_____

D8. How was the conversion of CT data to proton range verified? _____
_____
_____

D9. Does the planning system allow different conversion functions or curves for CT data to relative stopping power for different CT scanners or scanning techniques? ☐ yes, ☐ no

D10. What is the method and frequency of verification of CT scanner(s) number reproducibility?

_____

_____

_____

D11. Is 4D CT available for proton patients? ☐ yes, ☐ no

If yes, for which sites is 4D CT used? _____

Describe how it is used (e.g. respiratory gating using RPM): _____

_____

_____

D12. Describe the method(s) used to account for lateral alignment uncertainties, motion, and lateral penumbra of the proton beam; i.e. how are lateral treatment margins created around the CTV?

_____

_____

_____

D13. Please give the lateral alignment uncertainties, or PTV margins if used, for the following sites:

Brain _____ mm Head & neck _____ mm Pelvis _____ mm

Thorax _____ mm Abdomen _____ mm

D14. Describe the method(s) used to account for uncertainties in penetration of the proton beam, i.e. how are proximal and distal treatment margins created around the CTV in the direction of the beam? _____

_____

_____

D15. Describe how range compensator/bolus smearing margins are determined:

_____

_____

D16. What are the typical smearing margins used for the following disease sites?

Brain _____ mm Head & neck _____ mm Pelvis _____ mm

Thorax _____ mm Abdomen _____ mm

D17. Describe how range compensator/bolus border smoothing margins are determined:

_____

_____

D18. What are the typical border smoothing margins used for the following disease sites?

Brain _____ mm Head & neck _____ mm Pelvis _____ mm

Thorax _____ mm Abdomen _____ mm

D19. What are typical air gaps (or range of air gaps) used for the following disease sites?

Brain _____ mm Head & neck _____ mm Pelvis _____ mm

Thorax _____ mm Abdomen _____ mm

D20. How is treatment tabletop accounted for in treatment planning?

_____

_____

D21. Are patients with metal implants treated with proton therapy? _____

D21a. If yes to D21, are proton beams allowed to pass through metal implants? _____

D21b. If yes to D21a, describe how beam range is calculated when beam penetrates metal implant materials: _____

_____

D21c. If yes to D21, describe how imaging artifacts are handled near metal implant materials.

_____

_____

D22. How are plans prescribed?

☐ICRU or equivalent Point _____ ☐Isodose Surface _____

D23. If prescribing to isodose surface, what % isodose surfaces are usually prescribed for the following sites?

Brain _____% Head & neck _____% Pelvis _____%

Thorax _____% Abdomen _____% Extremities _____%

E. Immobilization

Please provide a clear description of immobilization techniques for treatments in the:

E1. Head & neck: _____

_____

Is a rigidly attached bite block routinely used for H&N patients? ☐ yes, ☐ no

E2. Thorax: _____

_____

E3. Pelvis: _____

_____

E4. What are procedures for immobilization of pediatric cases? _____

E5. Describe the institution's process of commissioning an immobilization device: _____

E5a. How are immobilization devices accounted for in treatment planning? _____

F. Patient Alignment

F1. Describe your imaging system(s): _____

F2. How is the patient's anatomy localized with respect to the treatment field?

- ☐ orthogonal kV x-ray images compared to DRRs
- ☐ kV x-ray BEV portals compared to DRRs
- ☐ kV cone-beam CT images compared to planning CT
- ☐ kV CT images compared to planning CT
- ☐ other (please be specific) _____

F3. After initial daily localization and repositioning of the patient, is alignment verified with repeat imaging? Adults: ☐ yes, ☐ no Pediatrics: ☐ yes, ☐ no
If yes, how frequently:

- ☐ before every treatment
- ☐ before every treatment field
- ☐ first treatment and then weekly
- ☐ if repositioning shift exceeds _____ mm
- ☐ never
- ☐ other _____

F4. What are setup tolerances? That is, what are the acceptable disagreements between the verification imaging and the planning imaging before treating?

Brain _____ mm Head & neck _____ mm Pelvis _____ mm
Thorax _____ mm Abdomen _____ mm

F5. Are patch fields alternated? ☐ yes, ☐ no, ☐ N/A

F6. For matched fields, is the patient's anatomy relocalized with respect to the second treatment field after making the specified move between fields? ☐ yes, ☐ no
If yes, what is the tolerance for changing the alignment? _____ mm

F7. Are implanted fiducial markers used for patient alignment? ☐ yes, ☐ no
If yes, for which sites? _____
What are the composition and size of the markers? _____

F8. Is the correlation of agreement between the verification imaging and image information from the planning CT handled as a computerized process that generates shifts of the patient support system? ☐ yes, ☐ no If yes, what software? _____

G. QA Procedures

G1. Describe the equipment used for daily dose/monitor unit (dose/MU, dose/Gp) checks.
Equipment: _____
What is the acceptable variation? ± _____ %

G2. Describe QA (in addition to daily) used for physics dose/monitor unit checks.
Frequency: ☐ weekly, ☐ monthly, ☐ annually, ☐ other (describe) _____
Equipment: _____
What is the acceptable variation? ± _____ %

G3. Describe QA used to verify the transverse beam profile uniformity.
Equipment: _____
Frequency: ☐ daily, ☐ weekly, ☐ monthly, ☐ annually, ☐ other _____
What is the acceptable variation within the uniform dose region? ± _____ %

G4. Describe QA used to verify the transverse beam profile penumbra width.
Equipment: _____
Frequency: ☐ daily, ☐ weekly, ☐ monthly, ☐ annually, ☐ other _____
What penumbra definition is used for QA? ___ % to ___ %
What is the acceptable deviation from the standard penumbra width? _____ mm

G5. Describe QA used to verify beam depth dose profiles.
Equipment: _____
Frequency: ☐ daily, ☐ weekly, ☐ monthly, ☐ annually, ☐ other _____

G6. For the definition of modulation width in question C4 above, what is the acceptable variation in the depth of the specified dose proximal to the center of modulation? _____ mm
In the depth of the specified dose distal to the center of modulation? _____ mm
What distal penumbra definition is used for QA? _____ % to _____ %
What is acceptable deviation from the standard distal penumbra width? _____ mm

G7. For modulated scanning, describe QA used to check spot size.

Equipment: _____

Frequency: ☐ daily, ☐ weekly, ☐ monthly, ☐ annually, ☐ other _____

What is the maximum variation in spot size away from CAX? _____ mm

At various gantry angles? _____ mm

G8. Describe the method of verifying coincidence between the therapy beam and imaging isocenter.

_____

_____

_____

G9. Please provide a clear description of the QA procedures used for patient specific collimation devices, including the acceptability criteria: _____

_____

_____

G10. Please provide a clear description of the QA procedures used for patient specific range compensator devices, including the acceptability criteria: _____

_____

_____

Return completed questionnaire to:

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