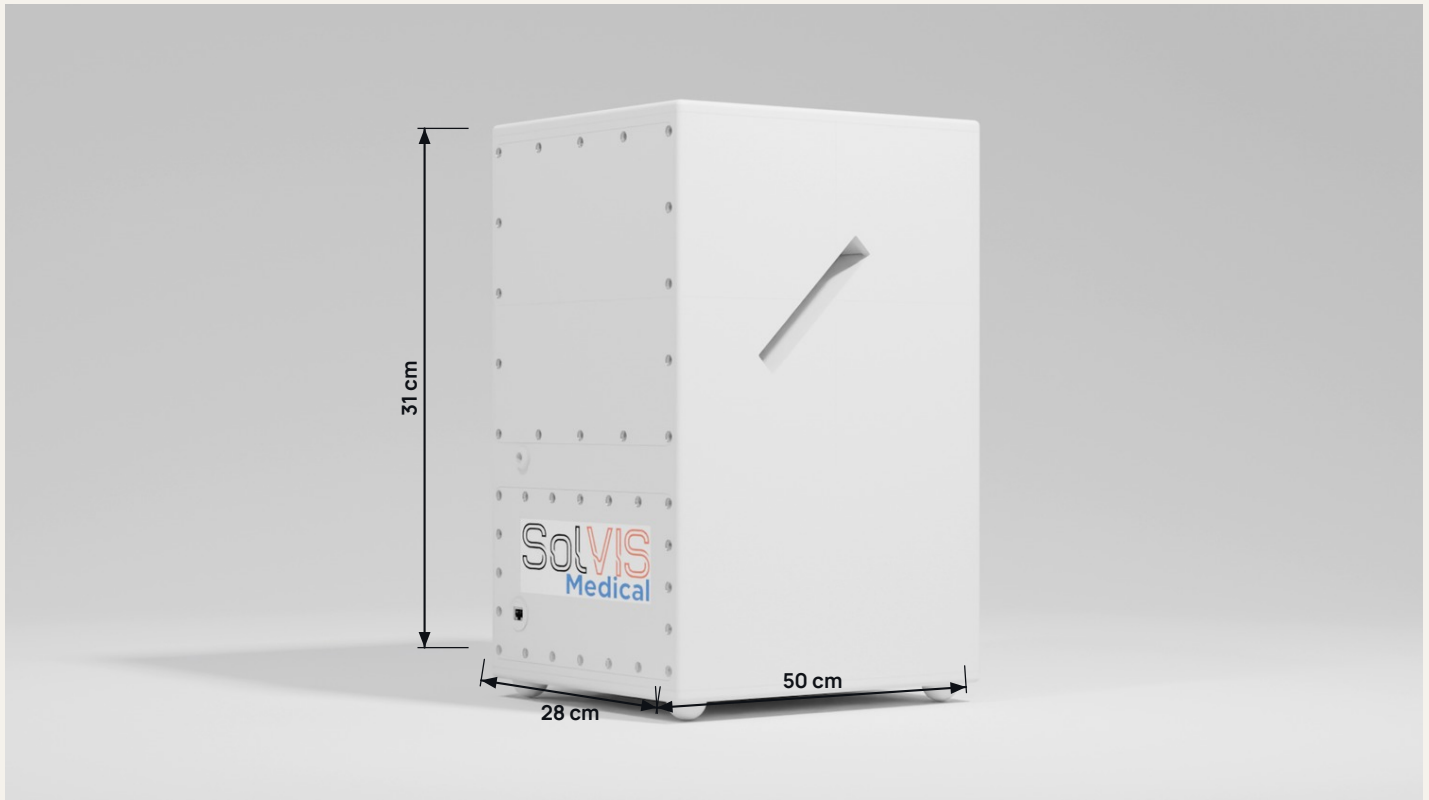


# QA Tron

## Multi-Purpose Daily QA Device



**QA Tron** is a sealed optical instrument that consolidates the full daily quality-assurance chain – CT image quality, IGRT and surface-guidance registration, beam spot position and size, multi-energy range, and output constancy – into one radio-translucent device. A  $21 \times 21$  cm<sup>2</sup> scintillator screen is viewed through a two-mirror periscope by a calibrated monochrome 5 MP PoE camera, turning each daily check into a single review screen. The device mounts on the Leo Cancer Care upright positioning system and connects through a single CAT-6 cable for both power and data.

### HIGHLIGHTS

CLASS  
I

21 CFR  
892.1940

CODE  
LHO

CONNECT  
CAT-6 PoE

ORIGIN  
USA

- ✓ One radio-translucent instrument verifies CT image quality, IGRT and surface-guidance registration, beam spot position and size, multi-energy range, and output – all in a single daily setup and one coordinate frame.
- ✓ Three integrated polyethylene wedges capture three proton energies, and their Bragg peaks, in a single beam delivery.
- ✓ Mounts to the Leo Cancer Care UPPS through a backrest QA bracket and runs on a single CAT-6 PoE cable; a Triax line is pre-provisioned for a future in-beam ion chamber.

## SPECIFICATIONS

REGULATORY & IDENTIFICATION	
Device classification	Class I · 21 CFR 892.1940
Product code	LHO
Catalog reference (REF)	ASM01302502-0100AAAA
GTIN / UDI-DI	00860015949806
Serial number format	CCC-PP-YYMMDD-NN
Country of origin	United States
OPTICAL & IMAGING	
Scintillator screen	21 × 21 cm <sup>2</sup> Rare Earth Blue 200
Optical path	Precision two-mirror periscope
Camera	Monochrome 5 MP SVS-Vistek PoE, 12-bit depth
Image correction	5-pixel median filter · lens-distortion correction · affine mirror-path alignment
Spatial calibration	Scaled to millimeters at the scintillator plane
BEAM ANALYSIS	
Spot analysis	Per-spot 2D Gaussian: centroid, $\sigma_x$ , $\sigma_y$ , rotation, amplitude
Energy / range	Three simultaneous Bragg-peak curves via three polyethylene wedges; distal $R_{50}\%$
Output / MU	Volume-under-Gaussian ( $2\pi \cdot a \cdot \sigma_x \cdot \sigma_y$ ); linear in MU, energy-independent
Tolerances	User-configurable per metric; go / no-go color coding
CONSTRUCTION	
Upper region	Low-Z, radio-translucent: Delrin, carbon fiber, acrylic mirrors
Energy degraders	Three integrated polyethylene wedges
Enclosure	Sealed optical instrument
ELECTRICAL & MECHANICAL — PRELIMINARY	
Power	≈ 44 VDC / 275 mA via PoE †
Weight	< 15 kg †
Dimensions (L × W × H)	50 × 28 × 31 cm †
Connection	Single CAT-6 PoE (power + data); pre-provisioned Triax line for future in-beam ion chamber
SOFTWARE	
Operating modes	Daily QA (vs. golden reference) · Precision (raw capture)
Data export	CSV / text; raw images retained for audit
Outputs	Per-spot centroid and width, live-vs-reference deltas, three-energy $R_{50}\%$

† Preliminary – pending final engineering release. All specifications subject to change without notice.

## VALIDATED PERFORMANCE

**0.28 mm**

Baseline-return residual (X) after PPS translations

**$R^2 \approx 1.0$**

Bragg-peak linearity across energies

**0.32 mm**

QA-mode spot-size offset vs. reference

**< 0.5 mm**

Residual after IGRT correction (0.2°)

**< 2%**

SAD recovery vs. commissioned values

**Linear**

MU response, energy-independent



ACTUAL MEASUREMENT · 100 / 150 / 180 MEV

Validated on an IBA ProTeus Plus pencil-beam scanning proton system at the Thompson Proton Therapy Center, benchmarked against the RayStation treatment planning system.

## COMPATIBILITY & INTEGRATION

### Patient positioner

Leo Cancer Care MARIE / UPPS (backrest QA bracket); couch-based PPS via seat-column platform

### Treatment planning

RayStation (validated); platform-neutral output

### Surface guidance

OGTS · C-RAD · Vision RT (external 1 mm fiducials)

### Imaging

Vertical / horizontal CT · CBCT · planar kV

### Beam delivery

PBS proton (validated on IBA ProTeus Plus); platform-neutral

### Connectivity

Single CAT-6 PoE; pre-provisioned Triax line

## SCIENTIFIC BASIS

JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS

### Design and specifications of a multi-purpose radio-translucent daily quality assurance device for integrated upright proton therapy

Schreuder N, et al. · Thompson Proton Therapy Center, Knoxville, Tennessee

MANUSCRIPT IN PREPARATION

### Sensitivity testing of a novel multi-purpose proton commissioning and quality assurance device

Shanks R, et al. · University of Tennessee, Knoxville

M.S. THESIS · OCTOBER 2025

### Sensitivity Testing of a Novel Multi-Purpose Proton Commissioning and Quality Assurance Device

Shanks R. · Department of Physics, University of Tennessee, Knoxville