

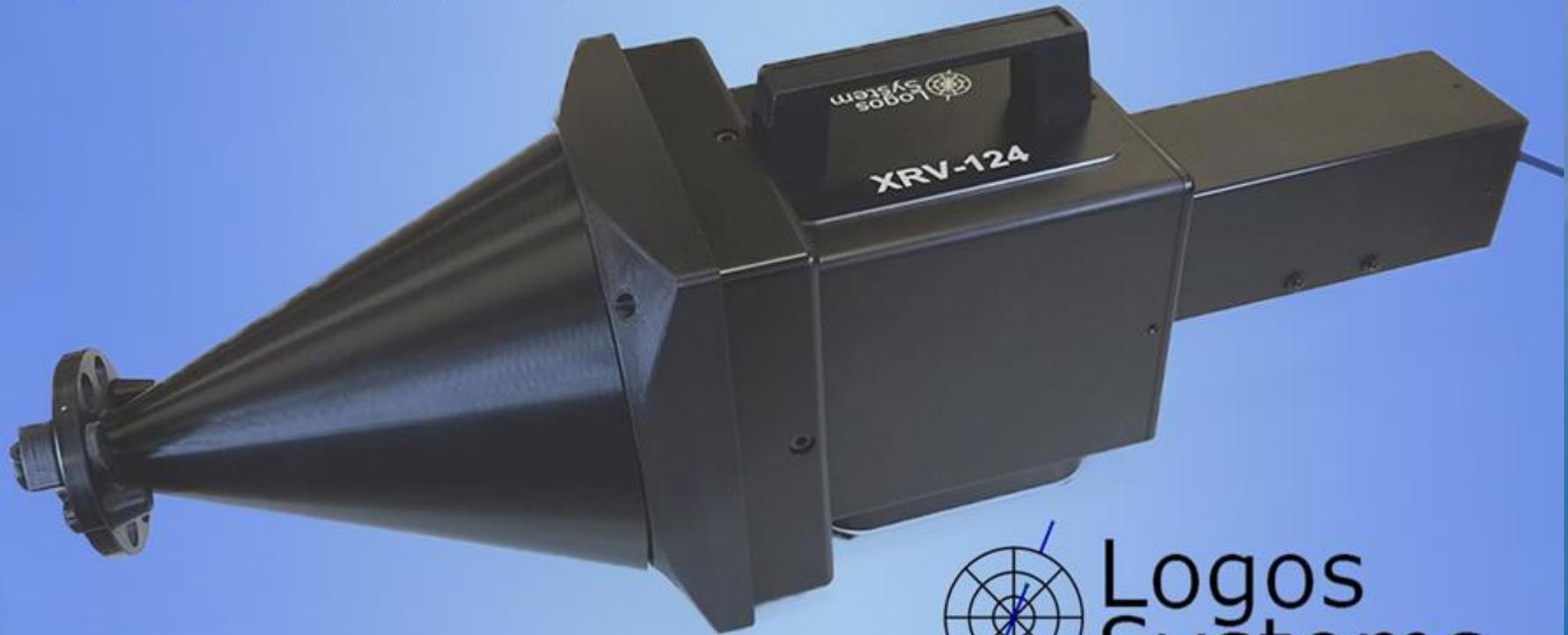
Logos
Systems

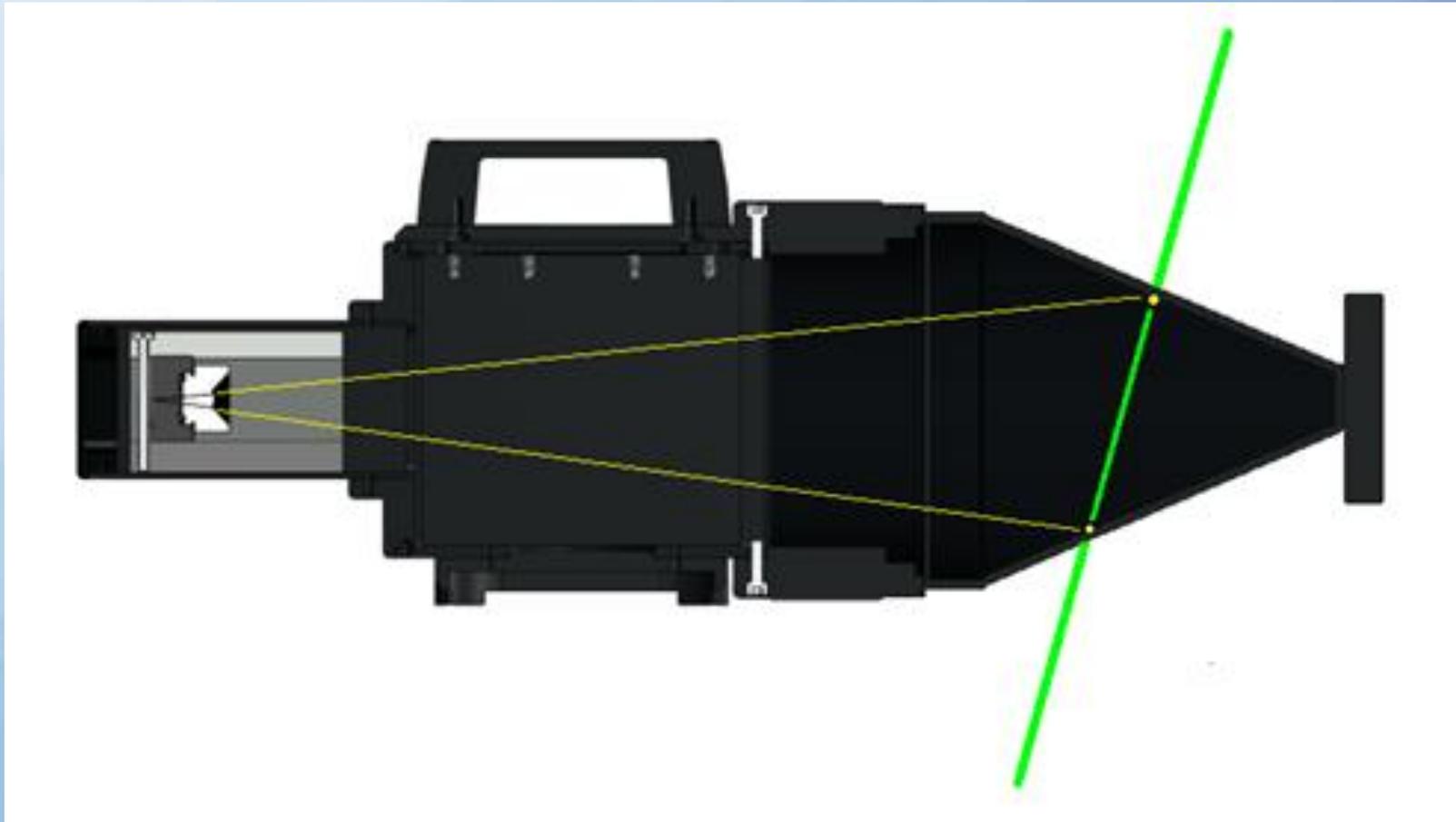
XRV-124 and XRV-3000 Eagle Proton and X-Ray Beam Quality Assurance

LogosVisionSystem.com

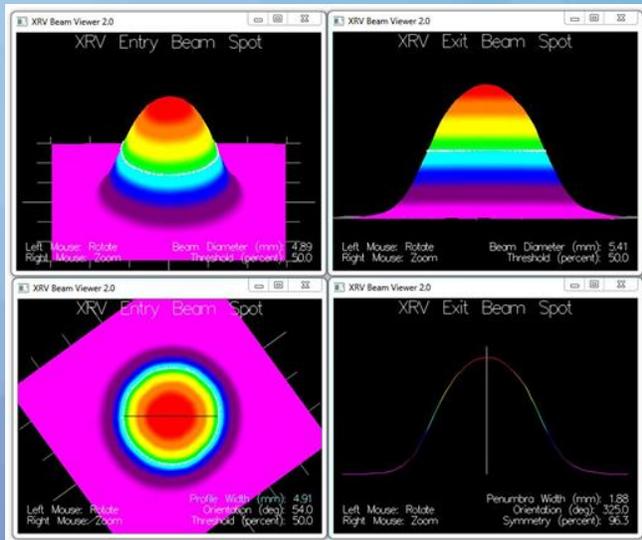
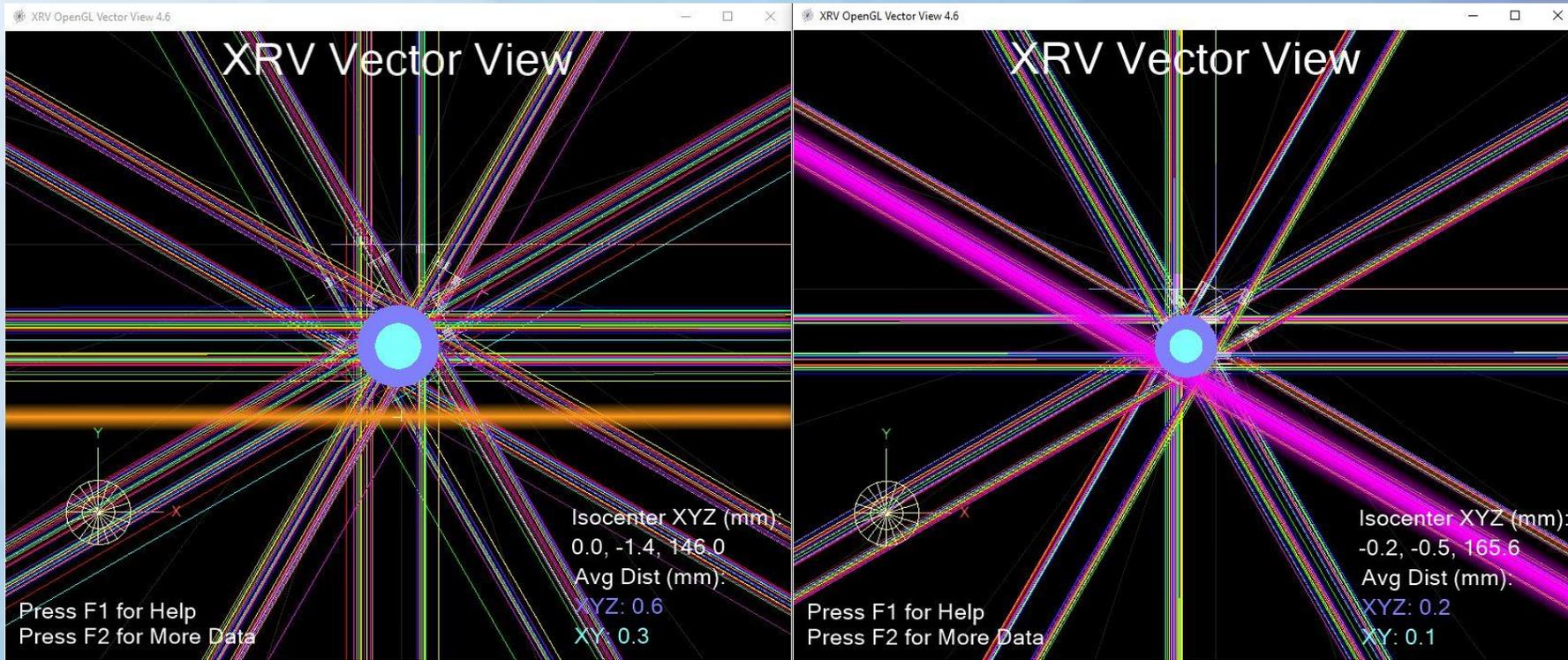
Digital Camera 4D Imaging Cone Phantom

XRV-124



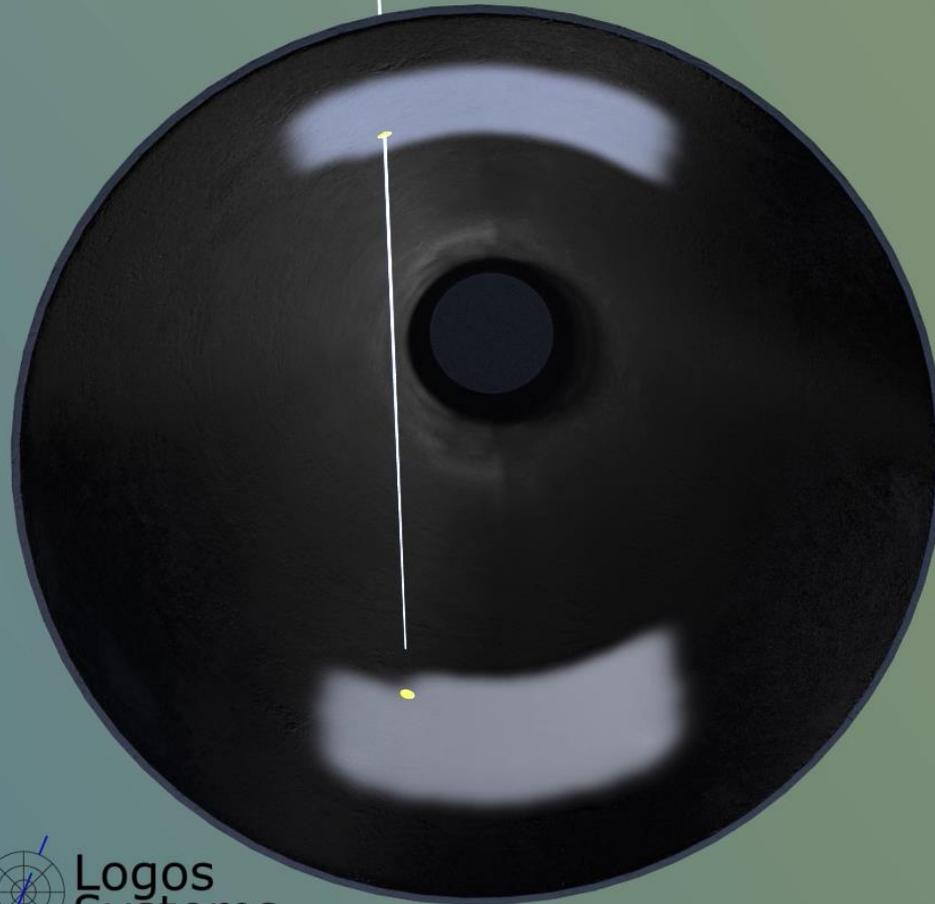


Real-time capture of the Proton or X-ray beams using the scintillator imaging cone creates 3D mathematical models of the delivery sequence for later analysis.

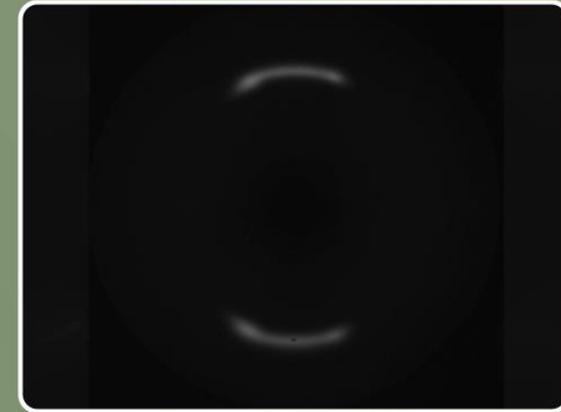


Perform fast TG-142 isocenter verification with the added benefit of beam metrics using a Proton or Linac star-shot.

Real-Time Proton Energy Layer QA

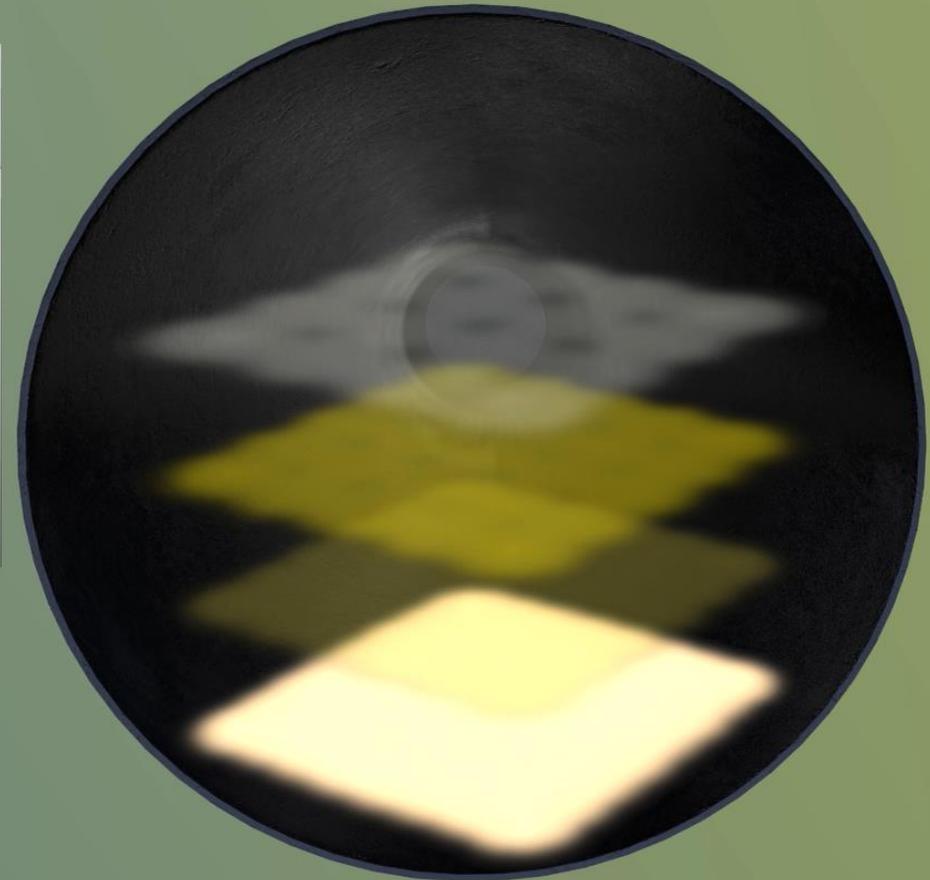
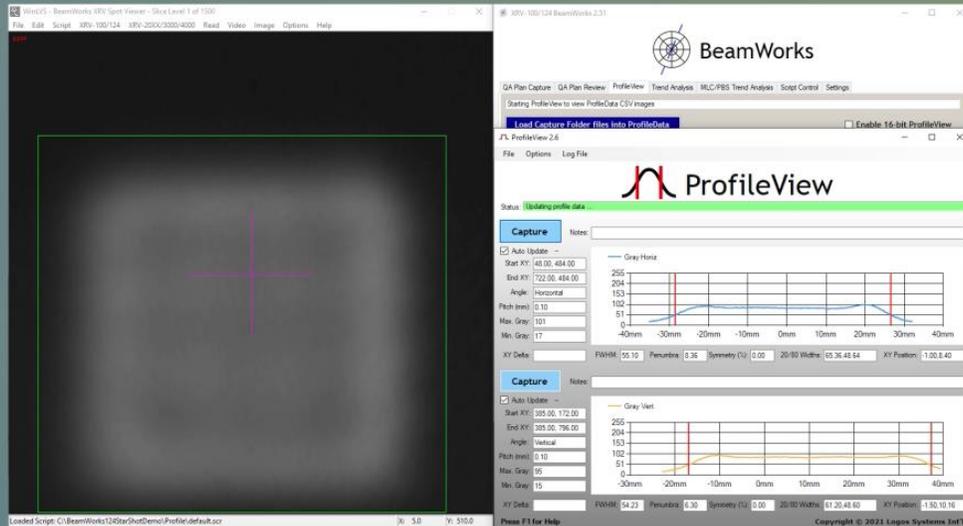


XRV-124 Camera Data

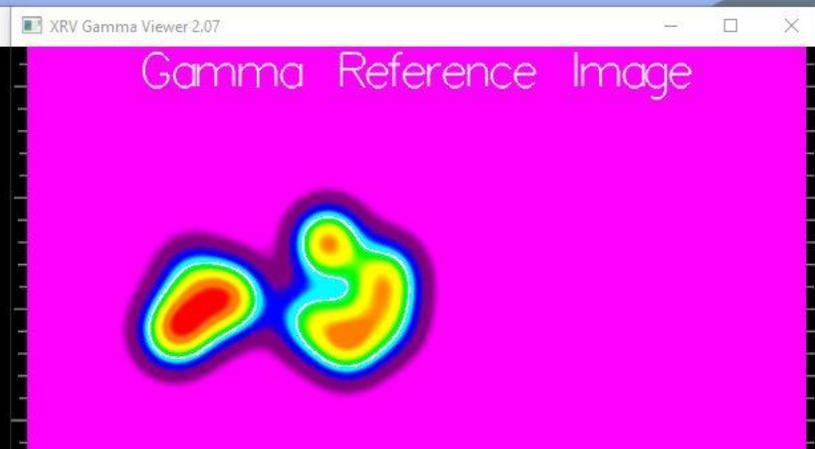
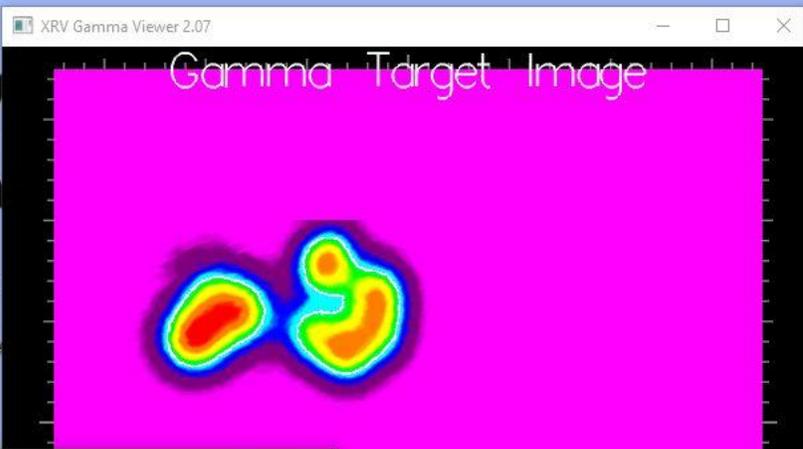


Pencil Beam Scanning
paints the proton beam energy layers
using fiducials for image guidance
while the XRV-124 captures images
to memory in real-time

Real-Time Proton Energy Layer QA



The horizontal and vertical dimensions of each energy layer can then be precisely measured



WinLVS - BeamWorksGamma - Slice Level 5 of 200

File Edit Script XRV100/124 XRV2000-4000 Read Video Image Options Help

Processing Gamma Images
Use X to Stop

Gamma-Target/Reference Analysis

Gamma 2D Results:
3x3 - 97.66 percent
2x2 - 91.04 percent
1x1 - 78.97 percent

OK

BeamWorksGamma 1.92

BeamWorks Gamma

Select Input Files | Gamma Analysis | Settings

Target and Reference files have been converted. Ready for Gamma Analysis.

Select Target Image and Resolution

Browse Images C:\StJude_C3Data_Oct2024\20241001\CapturedNomMirrorRotCW90Images_1010_2024b\00000020.tif **View**

Select Scaling C:\BeamWorksGamma\SourceExampleFolders\FlatFieldSamples\StandardScint_Assembled_Bright\active: AutoSelect

Horiz. Scaling (pixels/mm): 10.0 Vert. Scaling (pixels/mm): 10.0 Calibration Center X: 1030 Center Y: 802.4

Select Reference Image and Resolution

Browse Images C:\StJude_C3Data_Oct2024\20241001\TPS_Logos_Normalized_Sequence\00000035.tif **View**

Select Scaling C:\BeamWorksGamma\SourceExampleFolders\BeamSpotSamples\activescript.txt AutoSelect

Horiz. Scaling (pixels/mm): 10 Vert. Scaling (pixels/mm): 10 Calibration Center X: 800 Center Y: 800

Create Gamma Target and Reference Files

Normalization Preferences
 Use brighter of Target or Reference
 None - shapes only

Size Preferences
 Beam spot (under 8 cm) Large field (20 cm)
 Medium field (10 cm) ArcWorks

Target Gamma File
C:\BeamWorksGamma\Gamma\Source\00000001.csv **View**

Reference Gamma File
C:\BeamWorksGamma\Gamma\Source\00000002.csv **View**

Press F1 for Help

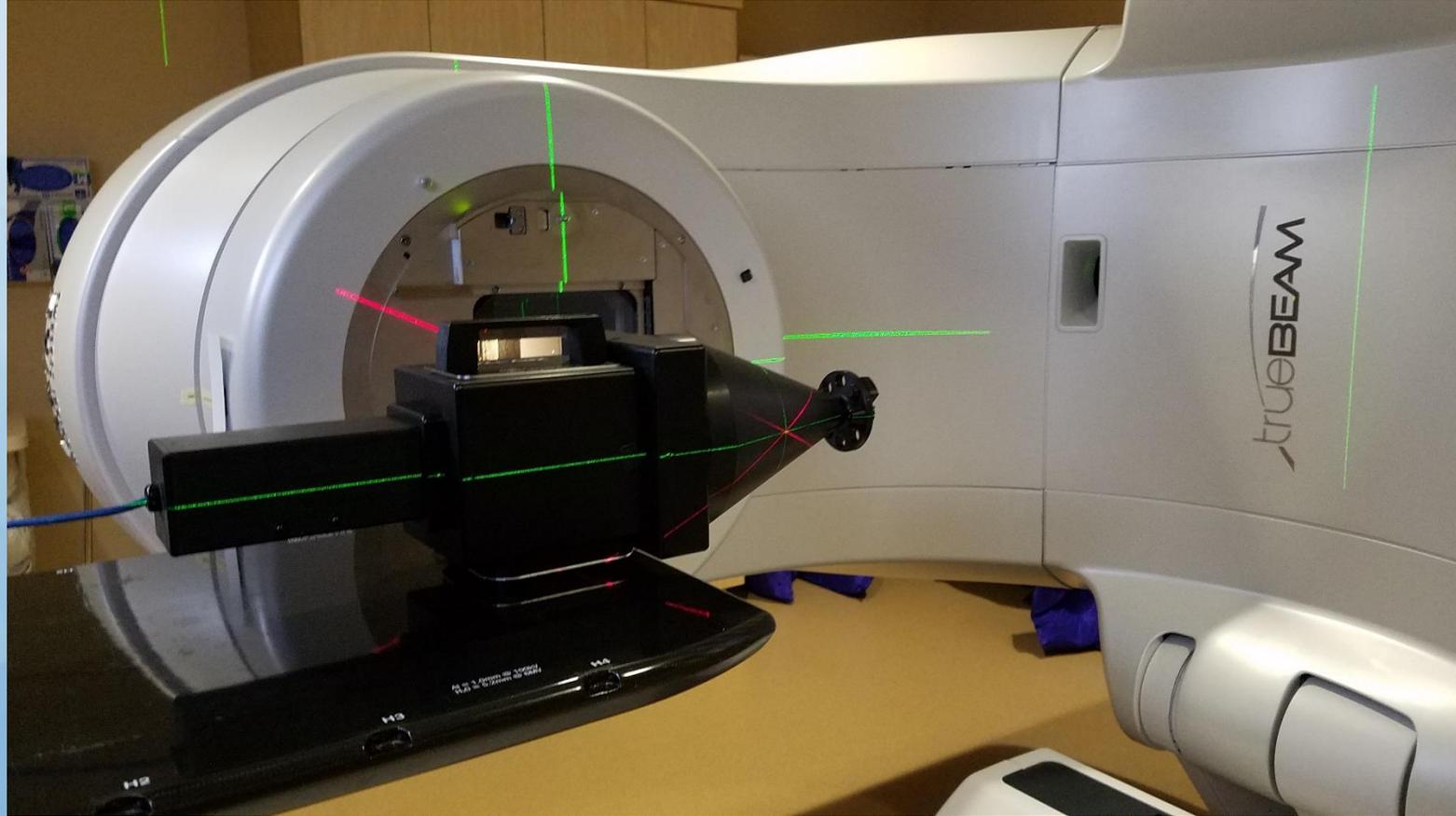
Copyright © 2022 Logos Systems Int'l

**Our new large format imaging cone can capture
fields up to 10 x 10 cm**



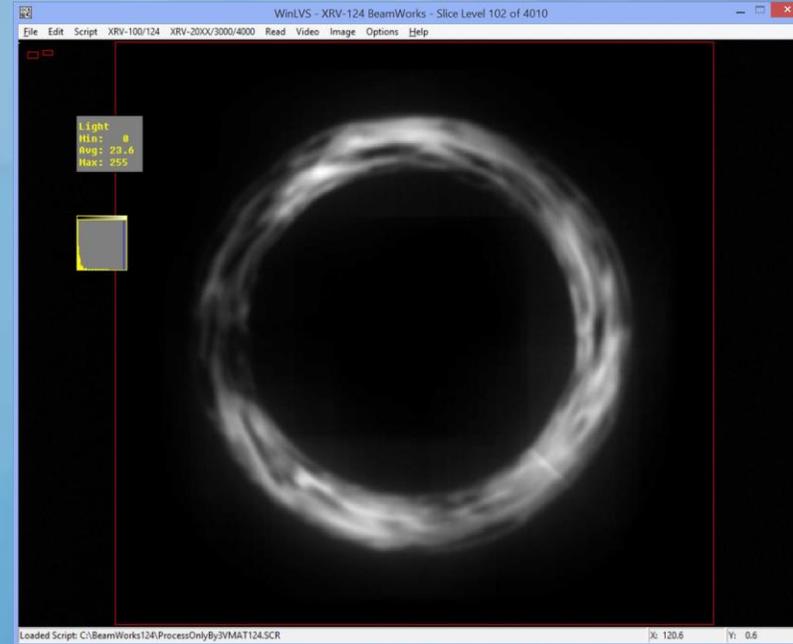
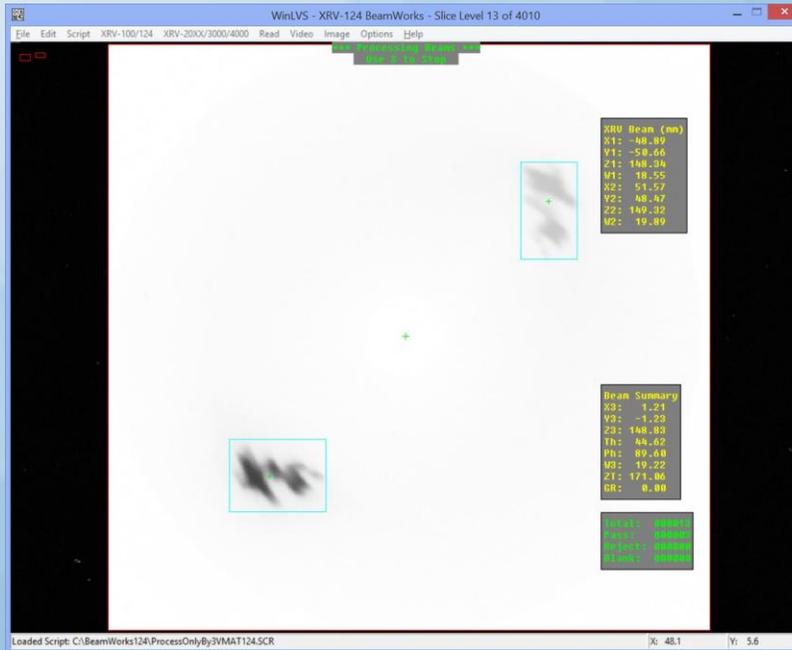
XRV-325 Detector Phantom

Small Field VMAT or Proton-Arc Quality Assurance



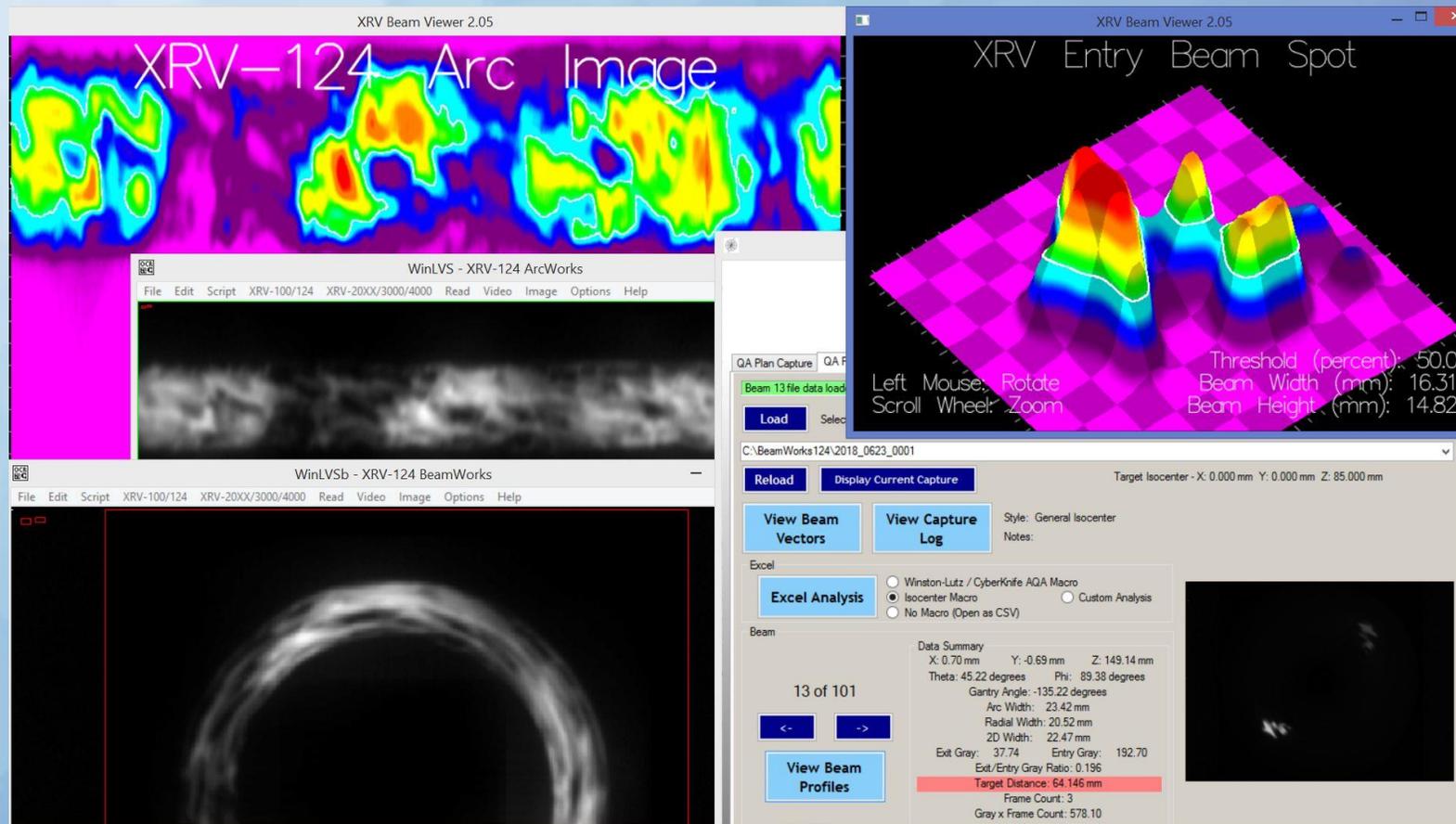
Capture up to 20 minutes of arc-style deliveries in real-time.

Small Field ArcWorks Quality Assurance



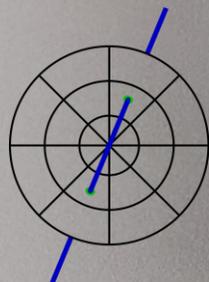
Isolate and measure beam shapes in real-time and create a cylindrical Arc representation of the delivery

Small Field ArcWorks Quality Assurance



Perform 2D gamma-style analysis on the Arc image comparing it to previous deliveries or the TPS-generated reference

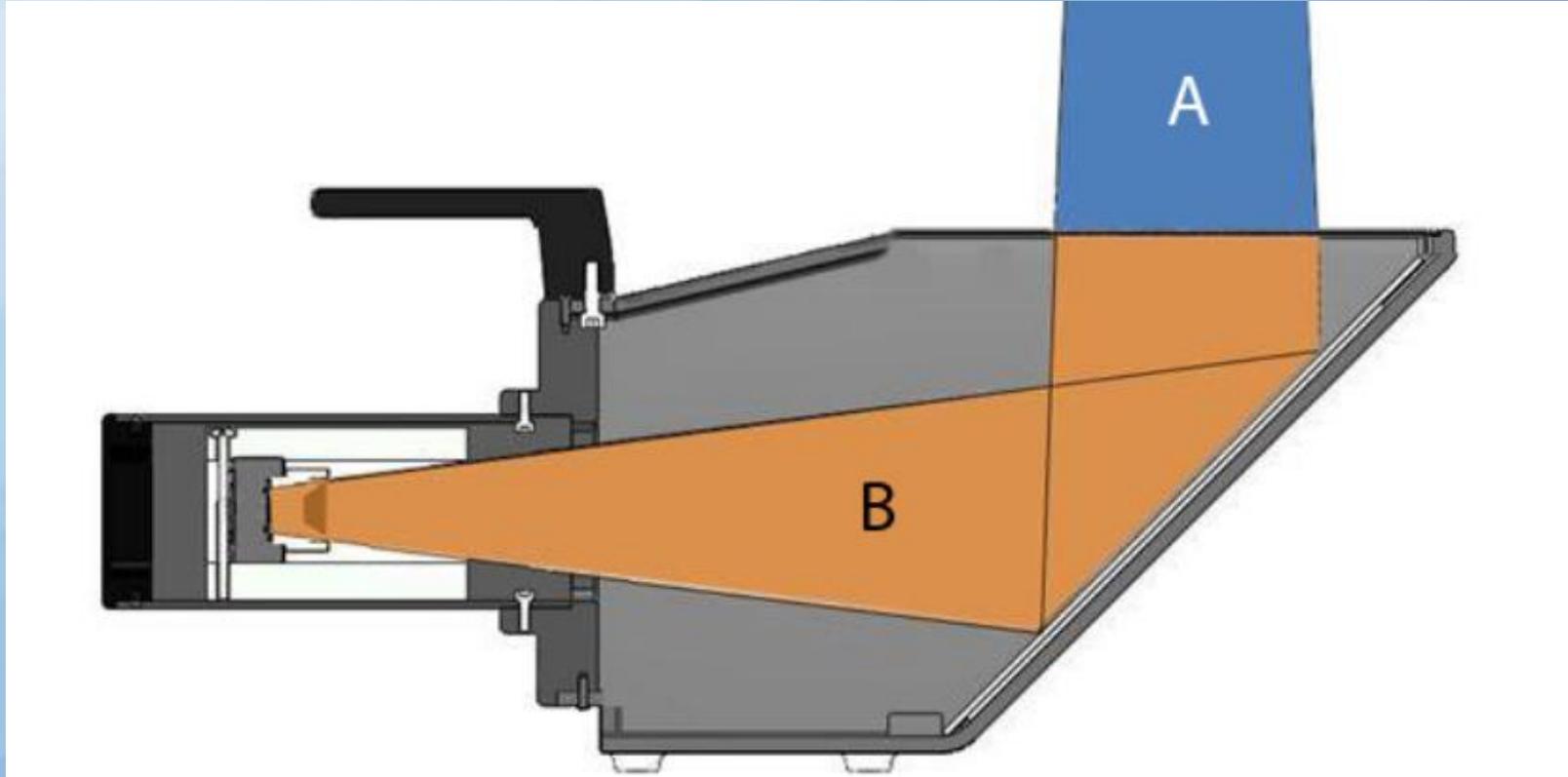
XRV-3000 Eagle QA Phantom



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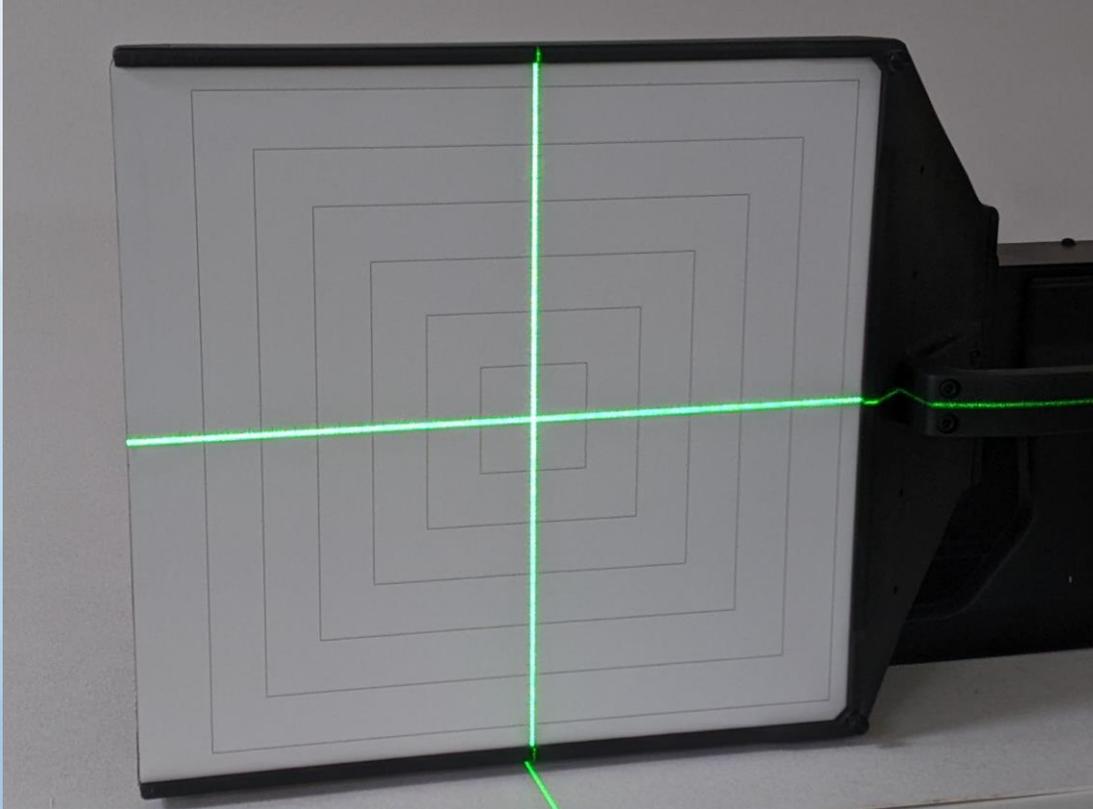
XRV-3000 Eagle

XRV-3000 Eagle Operation



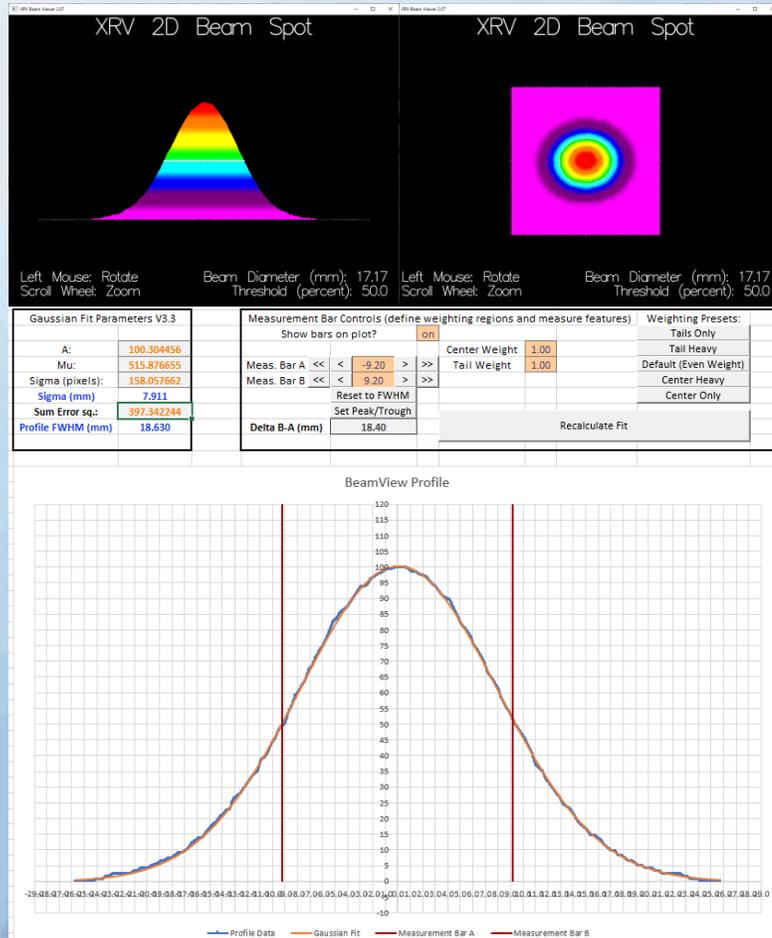
The planar scintillator converts the invisible radiation beam (A) into visible light (B), which reflects off the angled mirror and is captured by the CCD or high speed CMOS camera. Data is then processed in the included software

Easy Setup Process



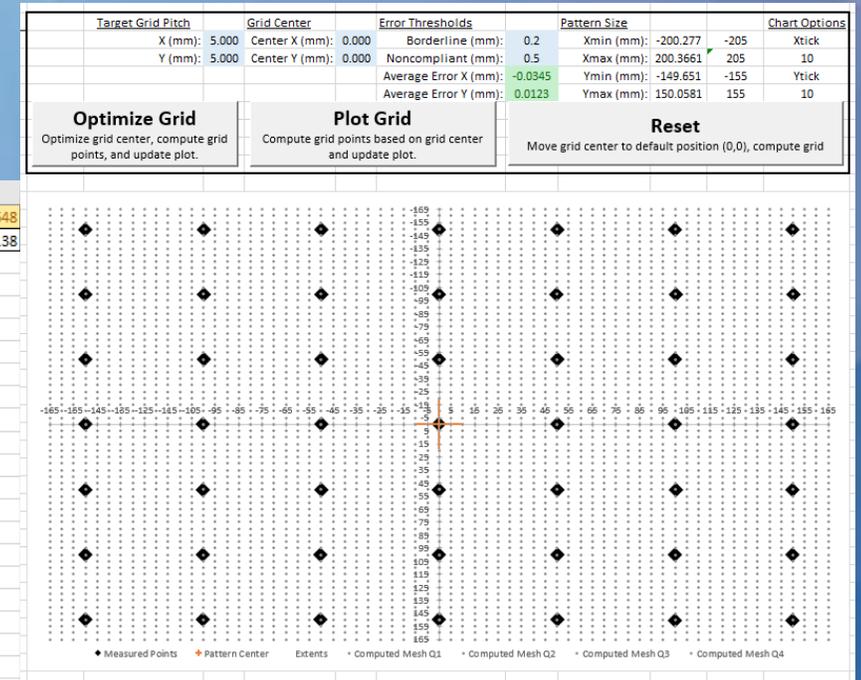
Target and side markings for fast laser setup
Six embedded tungsten fiducials for kV image alignment

Beam Profile and XY Grid Analysis



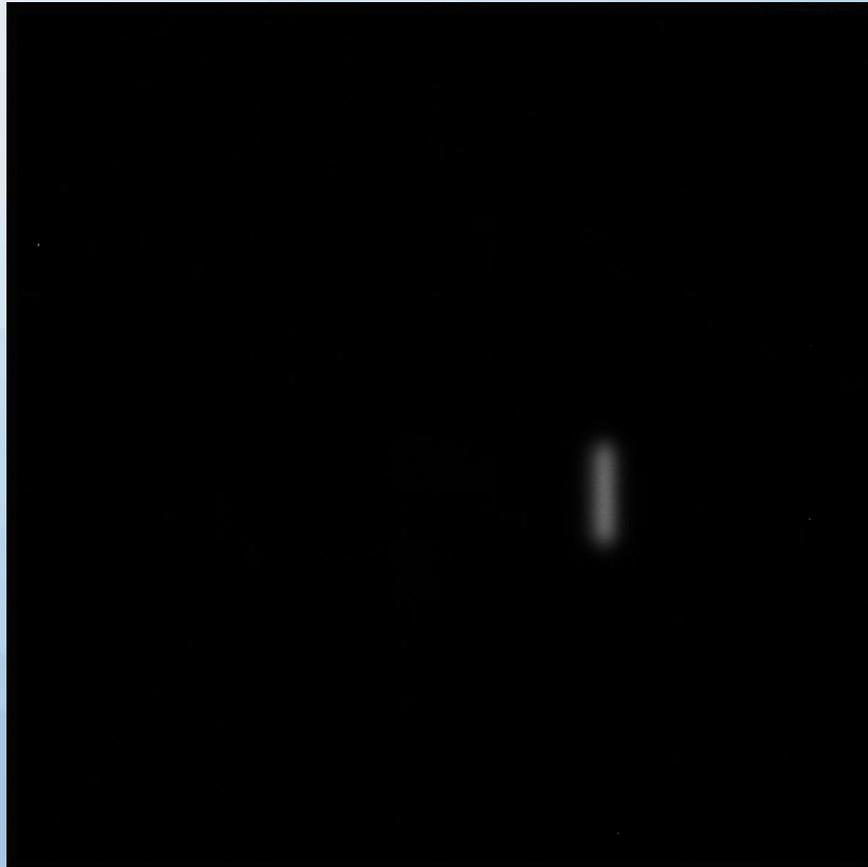
3D viewing of spot profiles and dual orientation Gaussian fitting

Spot Distance from Grid		Average Spot-to-grid distance: 0.271648	
Total Spot-to-grid distance: 17.1138			
X Dist from grid (mm)	Y Dist from grid (mm)	Abs. Dist from grid (mm)	
0.2774	0.3487	0.445581025	
0.1499	0.3487	0.379554607	
0.0225	0.3487	0.349425157	
-0.105	0.3487	0.364165745	
-0.2324	0.3487	0.419048267	
0.1943	0.3487	0.399179383	
0.0668	0.3487	0.355040744	
-0.0606	0.3487	0.353926617	
0.3661	0.3487	0.505589656	
0.0003	-0.1149	0.114900392	
-0.1271	-0.1149	0.171337153	
0.0225	-0.1149	0.117082279	
0.1721	-0.1149	0.206930955	
-0.2324	0.1619	0.283233773	
-0.3599	0.1619	0.394638594	
0.3439	0.1619	0.380103696	
0.2164	0.1619	0.270260189	
0.089	0.1619	0.184750129	

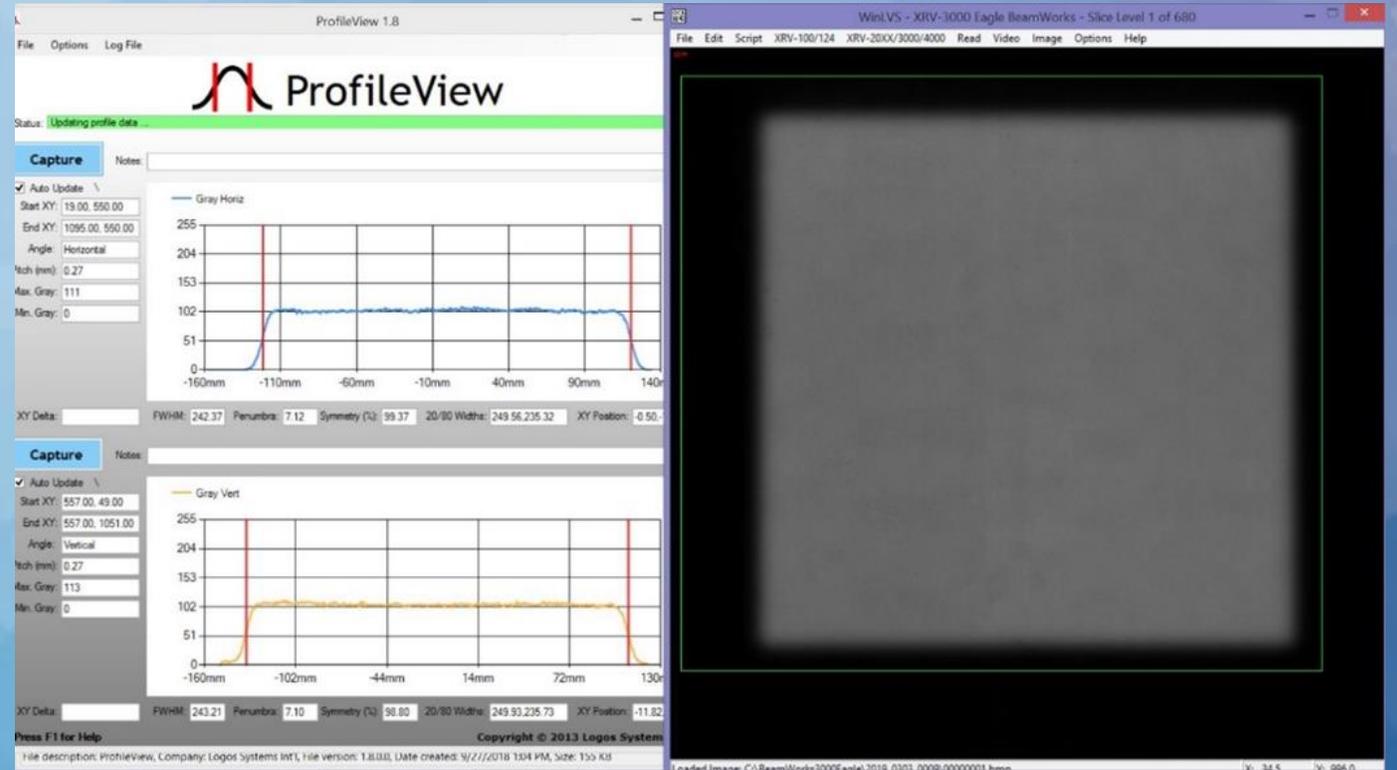


Export captures to Excel with color coded distance thresholds, measurements, and automatic grid plotting

Proton Field Assembly and QA

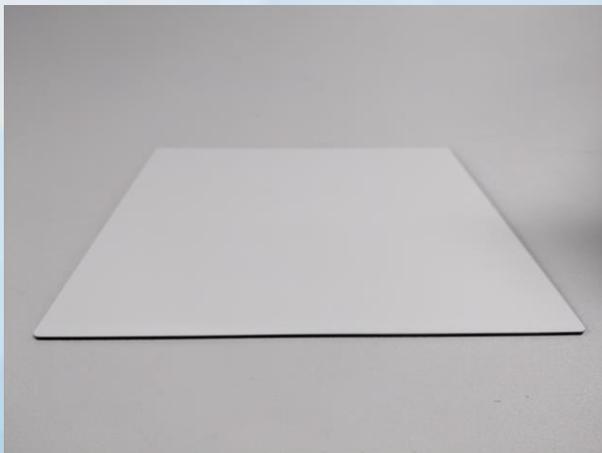


Beam streaks can be assembled into a larger field using software integration



Analysis of a proton field can be done on either an assembled field with any scintillator or a single frame integration with a ClearView scintillator.

Scintillator Modules



**Standard
Gadox Scintillator**

High sensitivity for individual spot profiles and XY pattern QA



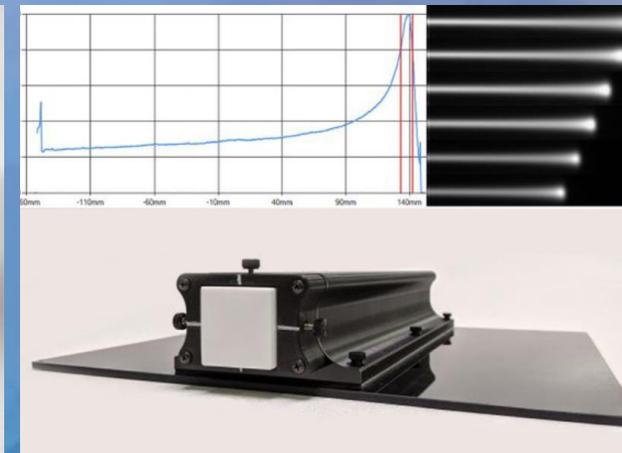
**ClearView
Plastic Scintillator**

Medium sensitivity, designed for even response large field QA



**ClearView UHDR
Glass Scintillator**

Lowest sensitivity for ultra high dose rate captures and FLASH experimentation

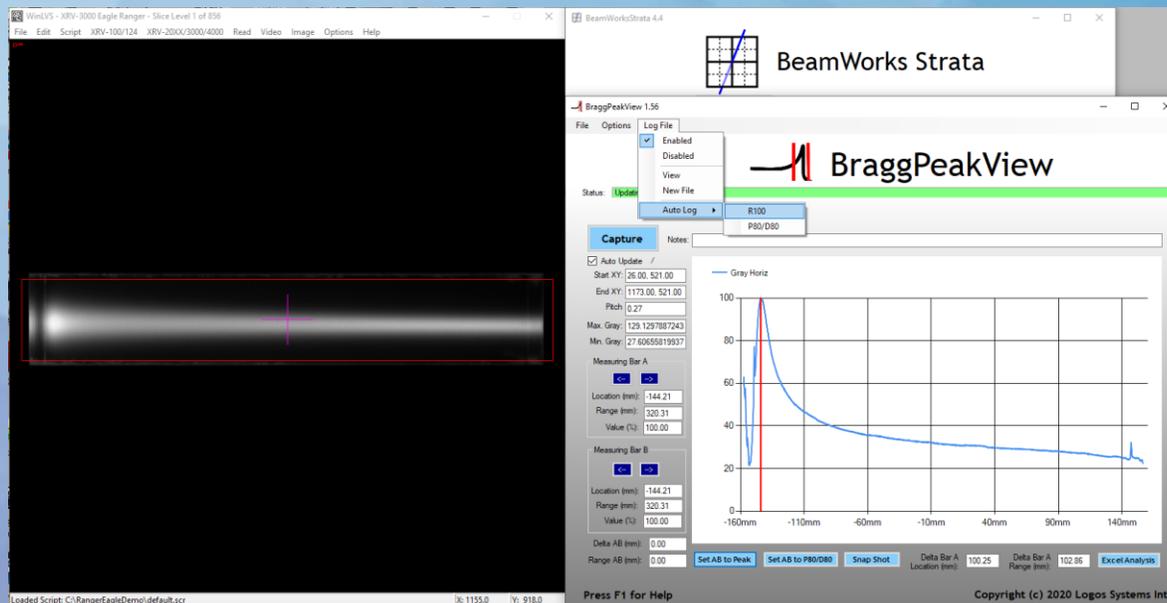
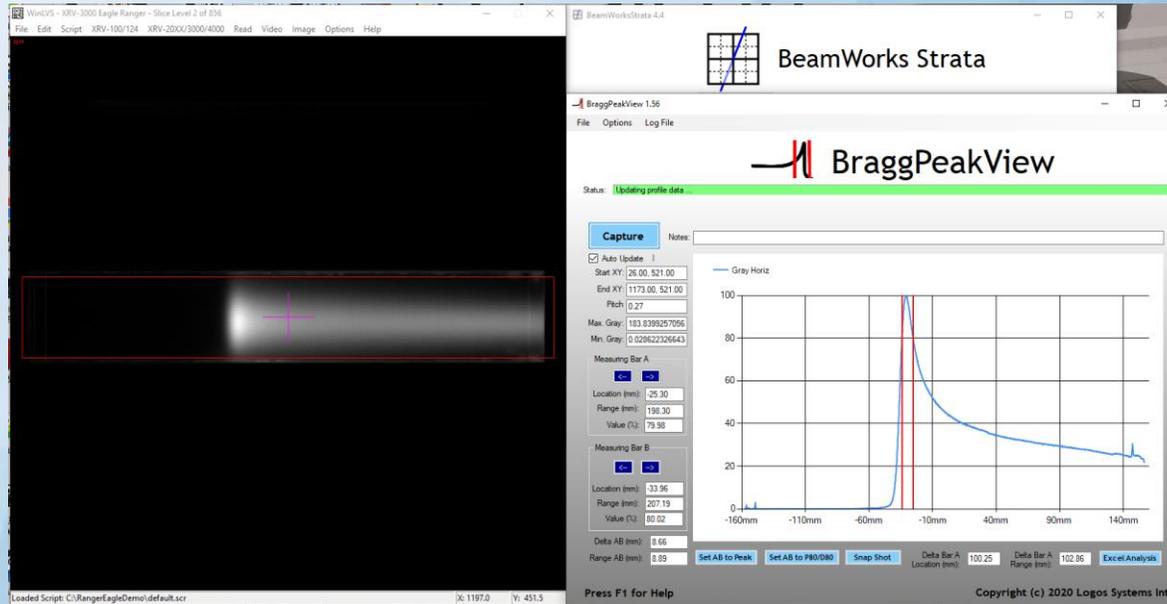


**Ranger-300
Plastic Scintillator**

Medium sensitivity for fast, single beam, any angle Bragg Peak QA

Proton Range Verification with the Ranger-300

BraggPeakView can quickly and automatically record a series of R100 and P80/D80 measurements into a CSV log file.

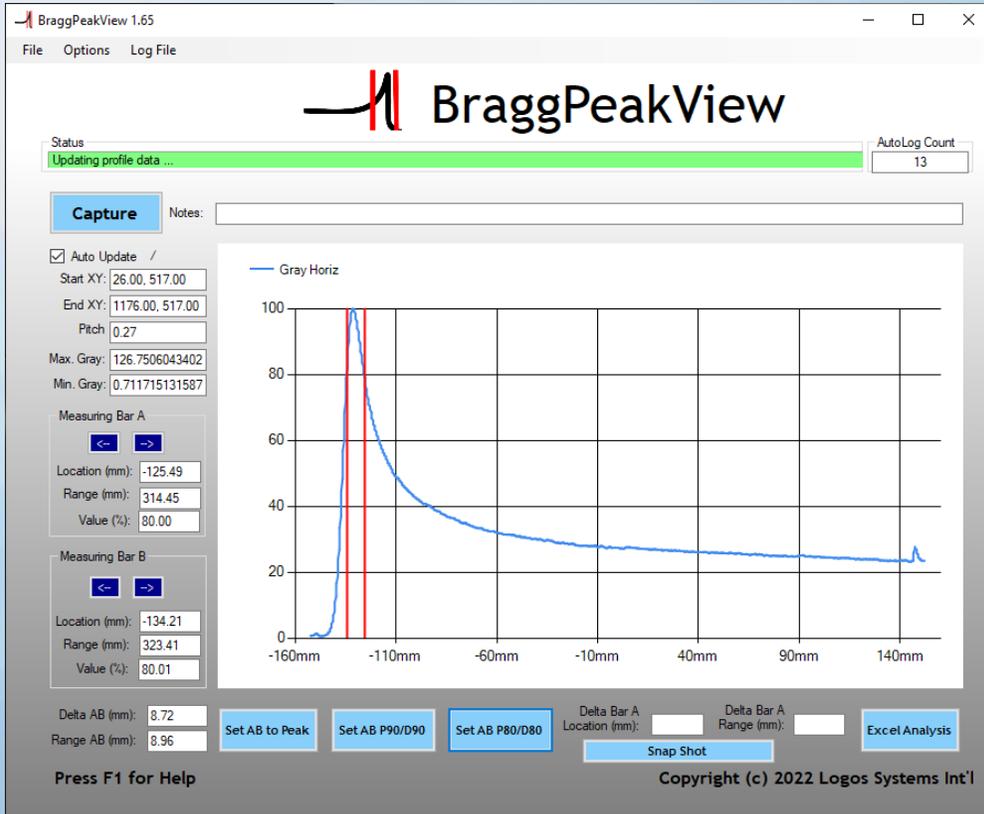


```
Profile_20210113_0001.log - Notepad
File Edit Format View Help

BraggPeakView R100 Autolog
Count: ,7
Date: , 01/13/2021,11:57:04
Notes:

Image , R100 Range
Index , (mm)
1, 320.31
2, 203.91
3, 193.49
4, 173.54
5, 154.71
6, 136.14
7, 33.28
```

Proton Range Verification with the Ranger-300



Ranger_Export.xlsx - Excel

Summary

	P80 (mm)	P90 (mm)	R100 (mm)	D90 (mm)	D80 (mm)	D20 (mm)	Average (mm)	NIST-BPV D80 (mm)
9 Average Delta	0.15	-0.21	-0.12	-0.03	0.00	0.11	-0.02	-0.16
10 Average ABS Delta	0.34	0.28	0.34	0.28	0.15	0.30	0.26	0.30
11 Max. Delta	1.10	1.29	1.00	0.44	0.36	0.65	0.80	0.87
12 Std. Dev.	0.42	0.55	0.39	0.18	0.19	0.32	0.31	0.35
13 Spread (MaxΔ - MinΔ)	1.89	1.54	1.53	0.74	0.69	1.10	1.25	1.23

Alternate vs. Bragg Peak View (A-BPV)

	P80 (mm)	P90 (mm)	R100 (mm)	D90 (mm)	D80 (mm)	D20 (mm)	Average (mm)
17 Average Delta				-0.25	-0.23	0.11	-0.12
18 Average ABS Delta							
19 Max. Delta				0.39	0.38	0.44	0.40
20 Std. Dev.				1.28	1.37	1.43	1.36
21 Spread (MaxΔ - MinΔ)							

Bragg Peak View Data

Count	P80 (mm)	P90 (mm)	R100 (mm)	D90 (mm)	D80 (mm)	D20 (mm)
1	275.99	278.52	281.99	284.99	286.17	291.59
2	263.25	265.77	268.86	272.40	273.50	278.73
3	239.07	241.53	245.09	247.67	248.62	253.58
4	215.24	217.26	220.44	223.61	224.55	229.26
5	214.32	216.25	219.46	221.50	221.50	227.31
6	250.94	253.04	256.25	258.67	259.63	264.22
7	229.01	231.14	234.19	236.87	237.73	242.08
8	208.40	210.37	213.57	215.37	216.35	220.62
9	188.02	190.13	193.26	194.88	195.76	199.91
10	168.99	170.70	172.95	175.10	175.94	179.86
11	150.57	152.27	154.92	156.53	157.34	160.78
12	133.18	134.89	137.14	138.73	139.47	142.67
13	116.98	118.29	120.25	121.68	122.36	125.38
14	101.63	102.75	104.54	105.80	106.42	109.12
15	86.79	87.88	89.65	90.77	91.35	93.84
16	72.96	74.07	75.60	76.77	77.20	79.53
17	60.45	61.37	62.73	63.61	64.02	66.02
18	48.45	49.28	50.69	51.34	51.69	53.40
19	37.65	38.51	39.84	40.58	40.90	42.51

Buildup Compensation (mm)

81	81
81	81
81	81

Buildup Adjusted Bragg Peak View Data

Energy (MeV)	P80 (mm)	P90 (mm)	R100 (mm)	D90 (mm)	D80 (mm)	D20 (mm)
245	356.99	359.52	362.99	365.99	367.17	372.59
240	344.25	346.77	349.86	353.40	354.50	359.73
230	320.07	322.53	326.09	328.67	329.62	334.58
220	296.24	298.26	301.44	304.61	305.55	310.26
210	274.32	276.25	279.46	281.61	282.50	287.31
200	250.94	253.04	256.25	258.67	259.63	264.22
190	229.01	231.14	234.19	236.87	237.73	242.08
180	208.40	210.37	213.57	215.37	216.35	220.62
170	188.02	190.13	193.26	194.88	195.76	199.91
160	168.99	170.70	172.95	175.10	175.94	179.86
150	150.57	152.27	154.92	156.53	157.34	160.78
140	133.18	134.89	137.14	138.73	139.47	142.67
130	116.98	118.29	120.25	121.68	122.36	125.38
120	101.63	102.75	104.54	105.80	106.42	109.12
110	86.79	87.88	89.65	90.77	91.35	93.84
100	72.96	74.07	75.60	76.77	77.20	79.53
90	60.45	61.37	62.73	63.61	64.02	66.02
80	48.45	49.28	50.69	51.34	51.69	53.40
70	37.65	38.51	39.84	40.58	40.90	42.51

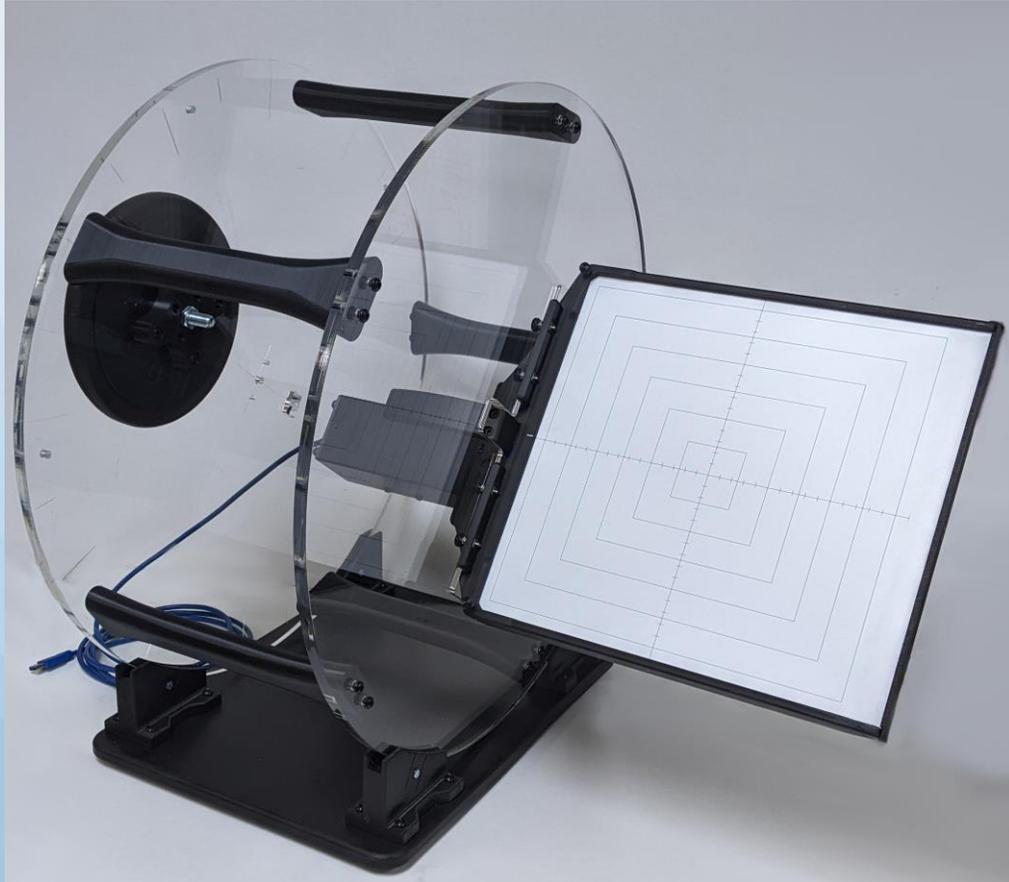
Commissioning Bragg Peak Measurements

Energy (MeV)	P80 (mm)	P90 (mm)	R100 (mm)	D90 (mm)	D80 (mm)	D20 (mm)
245.0	1	357.12	359.39	363.01	365.74	372.59
240.0	2	344.73	346.85	350.55	353.27	359.73
230.0	3	320.69	322.62	326.62	328.67	334.58
220.0	4	296.38	298.35	301.85	304.52	310.26
210.0	5	273.22	274.56	278.46	281.20	287.31
200.0	6	250.75	252.48	255.98	258.64	264.22
190.0	7	229.08	230.83	234.33	236.65	242.08
180.0	8	208.31	209.73	213.23	215.47	220.62
170.0	9	188.39	190.11	193.61	195.04	199.91
160.0	10	169.36	170.55	173.95	175.42	179.86
150.0	11	151.28	152.44	155.84	157.71	160.78
140.0	12	133.75	134.84	137.24	138.84	142.67
130.0	13	117.03	118.15	119.95	121.81	125.38
120.0	14	101.35	102.21	104.31	105.77	109.12
110.0	15	86.68	87.57	89.17	90.69	93.84
100.0	16	73.09	73.83	75.23	76.62	79.53
90.0	17	60.42	61.11	62.31	63.45	66.02
80.0	18	48.65	49.21	50.21	51.23	53.40
70.0	19	38.44	38.76	39.76	40.47	42.51

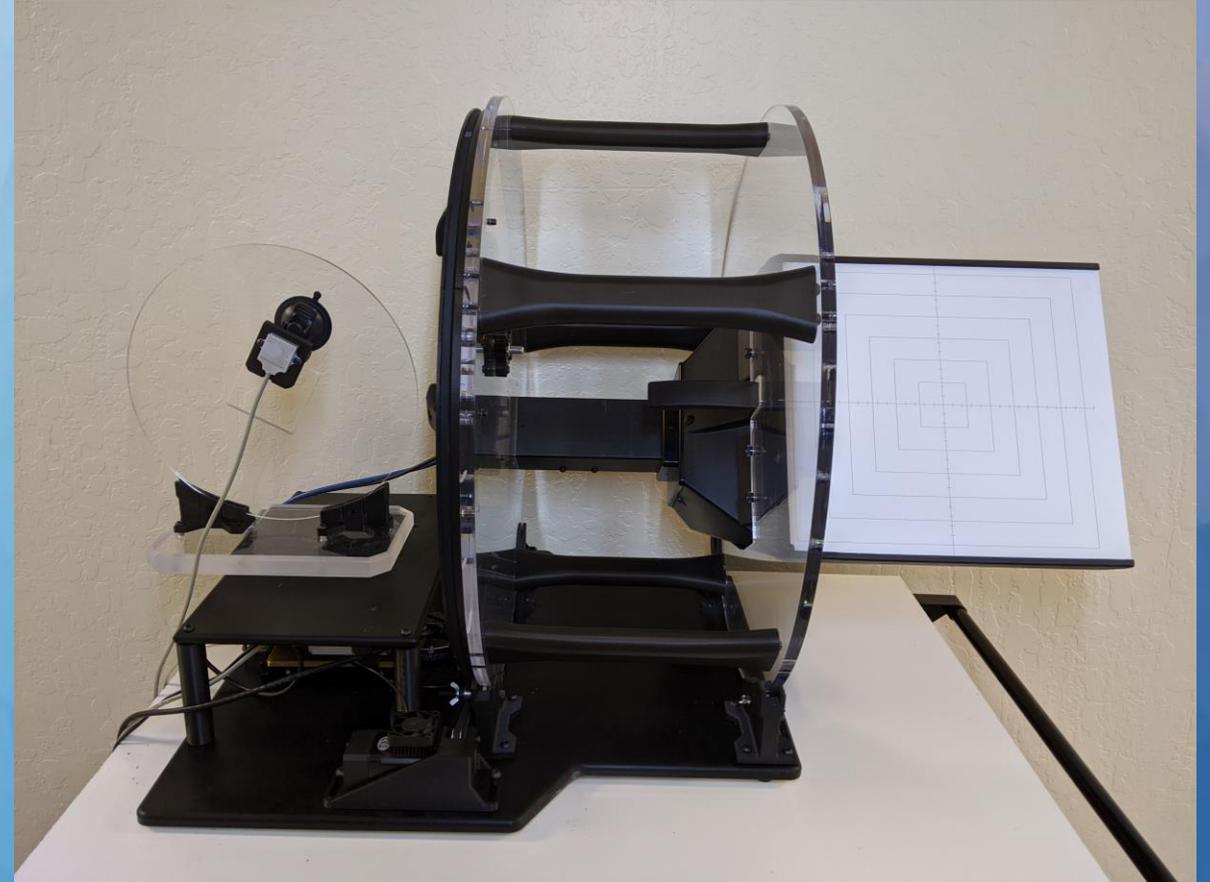
BraggPeakView integrates, corrects for quenching in the scintillator, and performs measurements on each beam

Automatic export into Excel for a summary of P80, P90, R100, D90, D80, and D20 deviations from input values and an in-depth analysis for each beam

Manual and Motorized Gantry Cradle Options



Manual Gantry Cradle
for individual gantry
angle deliveries



Motorized Gantry Cradle for
automatic gantry following,
step/shoot, or programmed motion

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