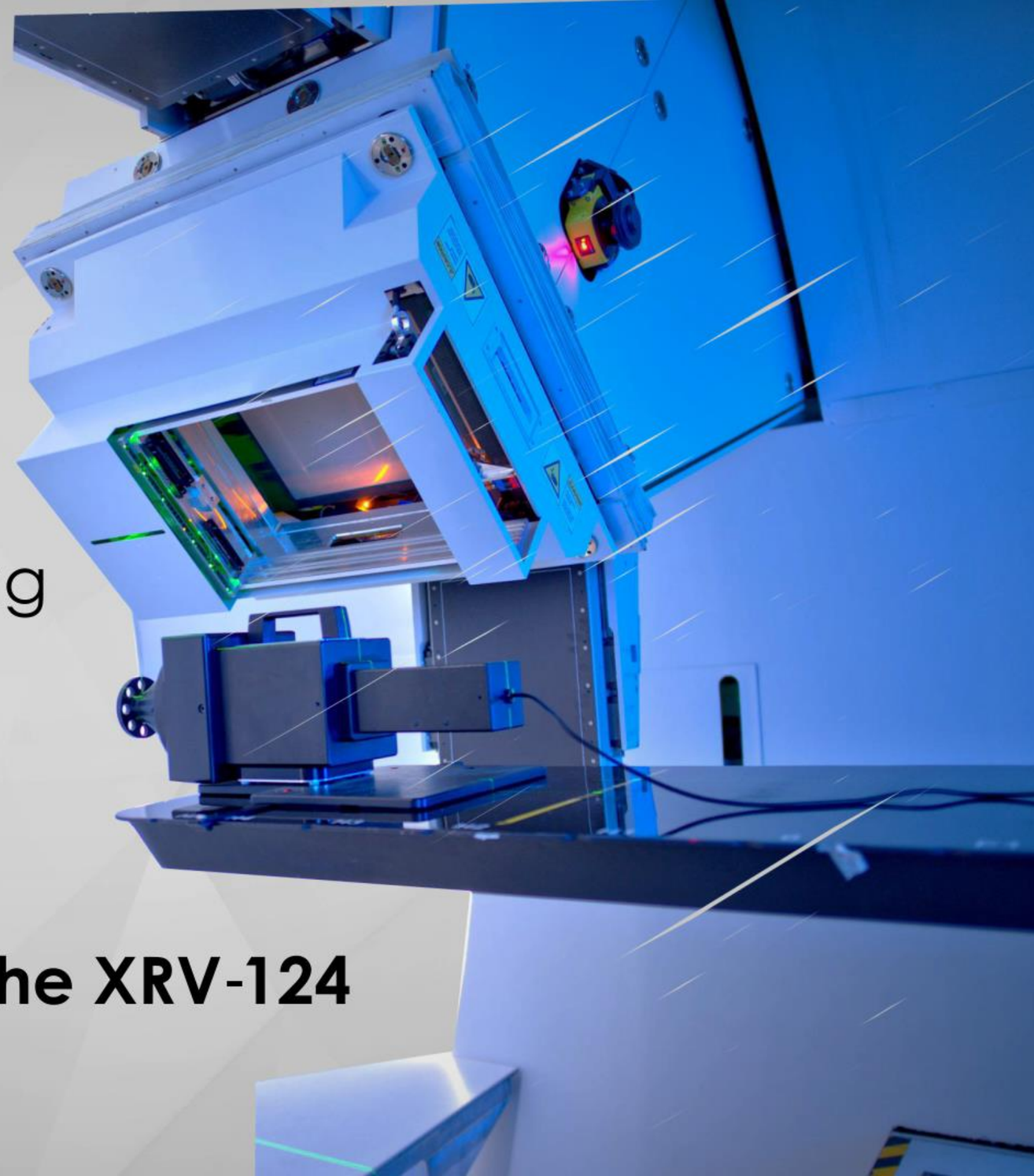
Logos Systems

Proton Beam Gantry Isocenter Optimization using BeamWorks Client Server



Closing the QA Loop with the XRV-124

Size.

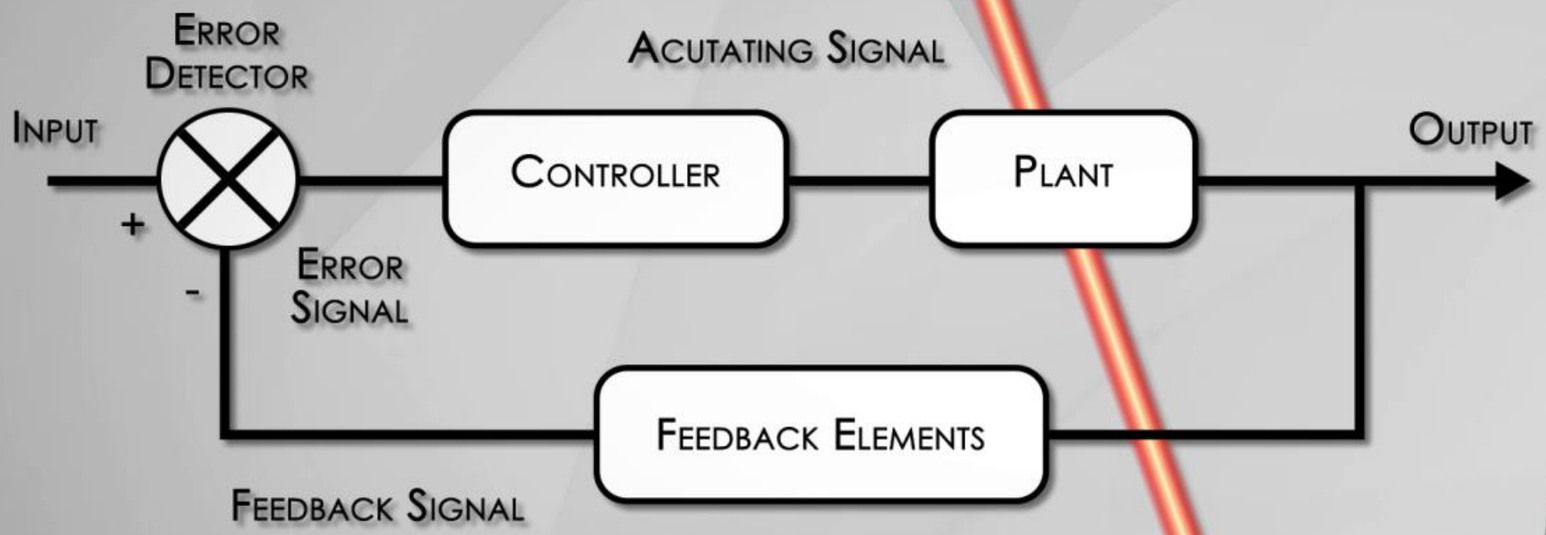
Precision.

Size or Precision ?

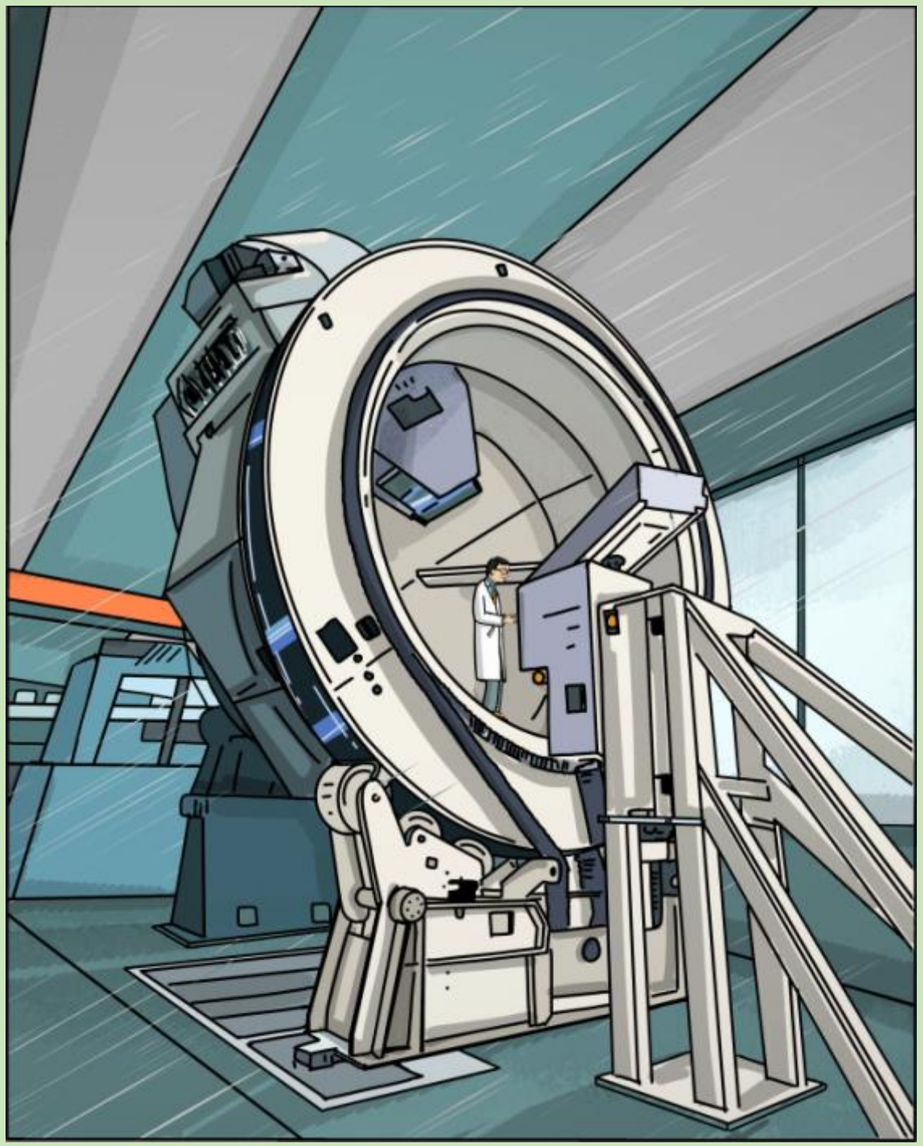
How can we have both?

The answer is:

To Close the Loop.

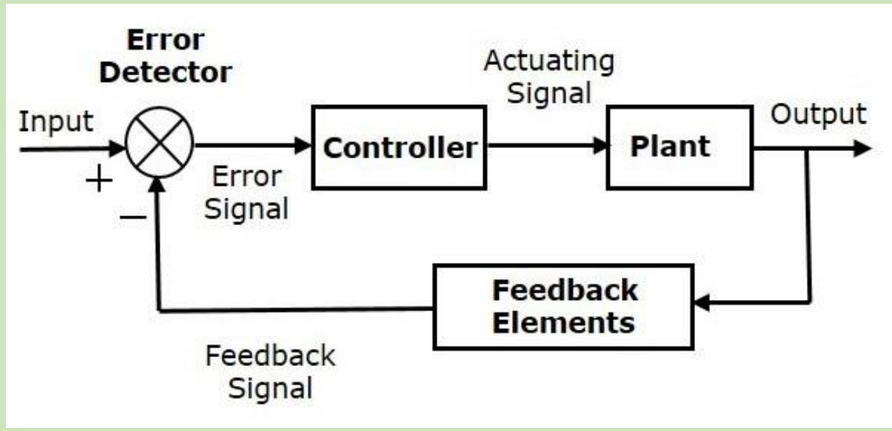


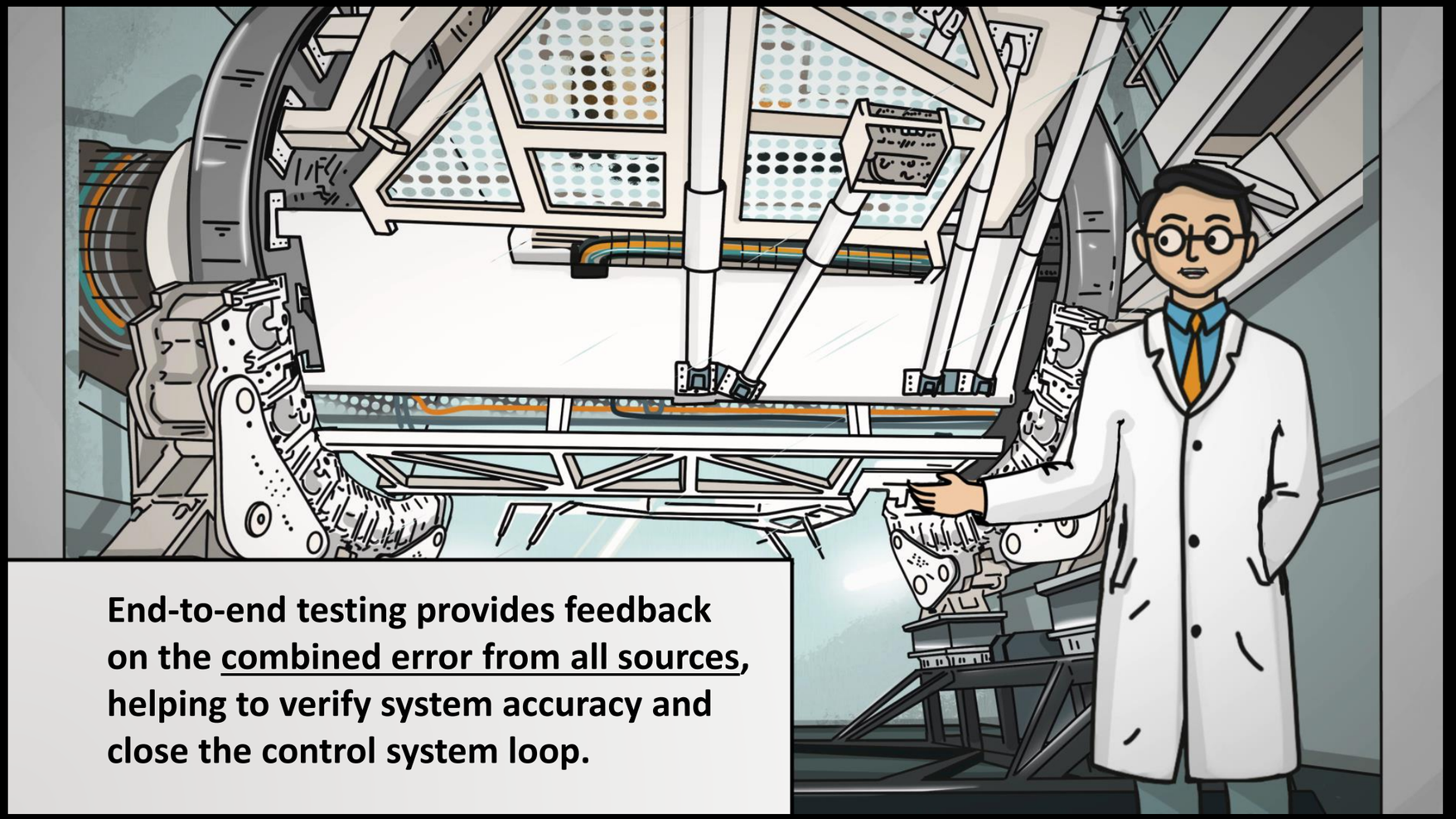
Closing the loop means adding dynamic feedback to increase positioning accuracy.



Proton therapy systems are large, heavy, and complex. The gantry, accelerator, degrader, robotic couch, beam-steering magnets, KV imagers, X-ray sources, lasers, and various other elements must be orchestrated precisely to deliver dose to a millimeter-scale target.

Control system feedback elements enable proton therapy systems to operate with precision despite their incredible size and complexity.



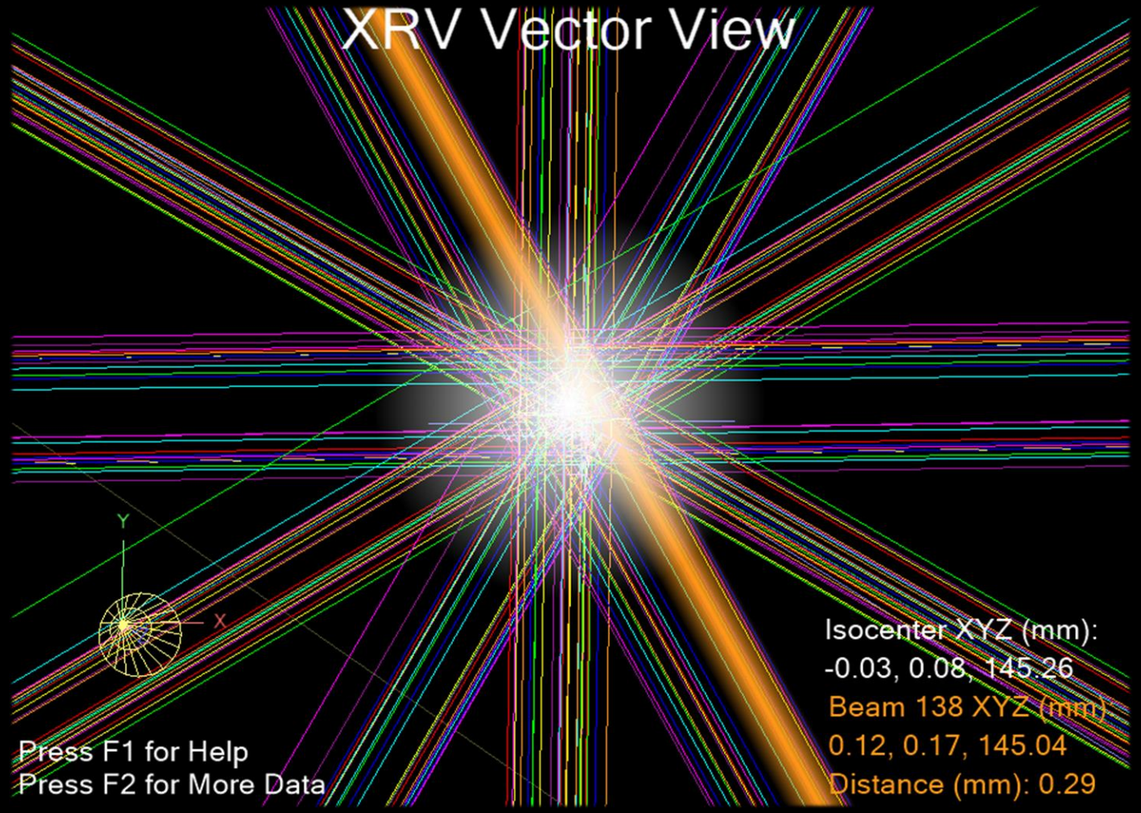


End-to-end testing provides feedback on the <u>combined error from all sources</u>, helping to verify system accuracy and close the control system loop.

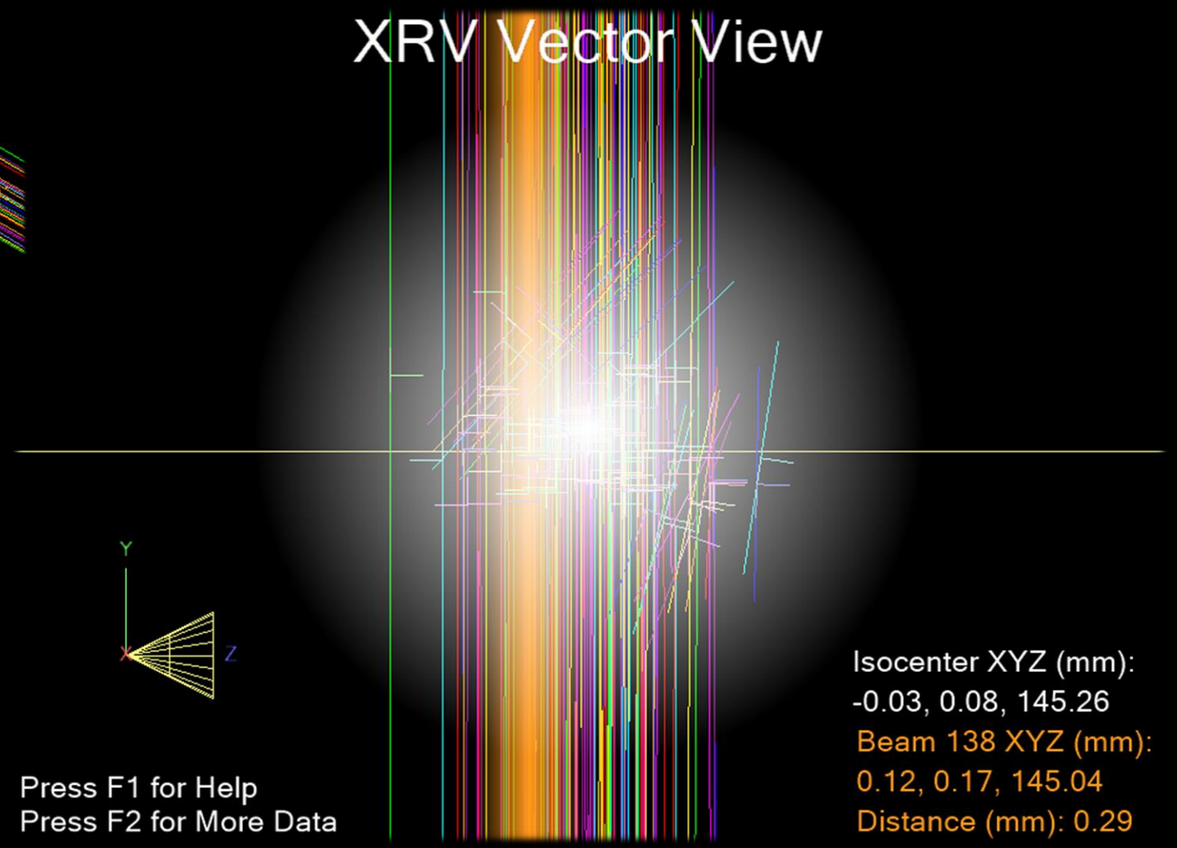
- Gantry Sag
- Metal Fatigue
- Settling and Creep
- Bearing/Drive Gear Wear
- Temperature Cycling
- Friction
- Inertia
- Axial Translation
- Tidal Forces
- Eddy Currents
- Magnetic Fields
- KV Panel Alignment
- KV Panel Sag
- Maintenance Accidents
- Operator Error Damage
- Couch Sag
- Beam Tuning
- Beam Deflection
- Beam Bending Radius
- Beamline Changes
- Power Grid Fluctuations

AAPM Task Group 142 guidelines suggest that the radiation beam isocenter should be verified to a 1-mm accuracy on a daily basis for stereotactic radiation therapy.

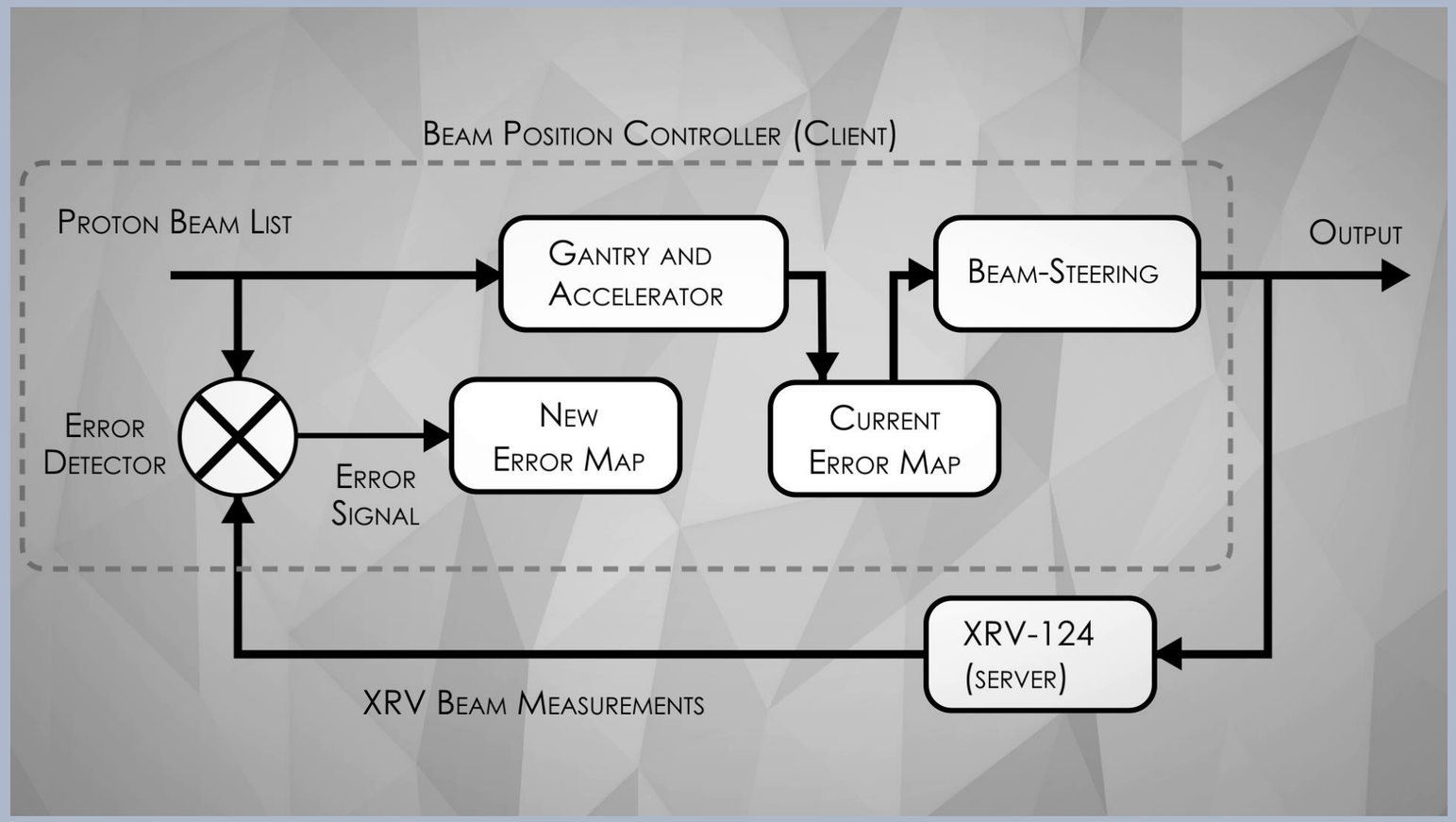
The Logos Systems XRV-124 and XRV-100 camera phantoms are used for daily and weekly isocenter verification as an end-to-end test.



The XRV-124/100 camera phantoms and software automatically map the proton beam isocenter as the gantry rotates.



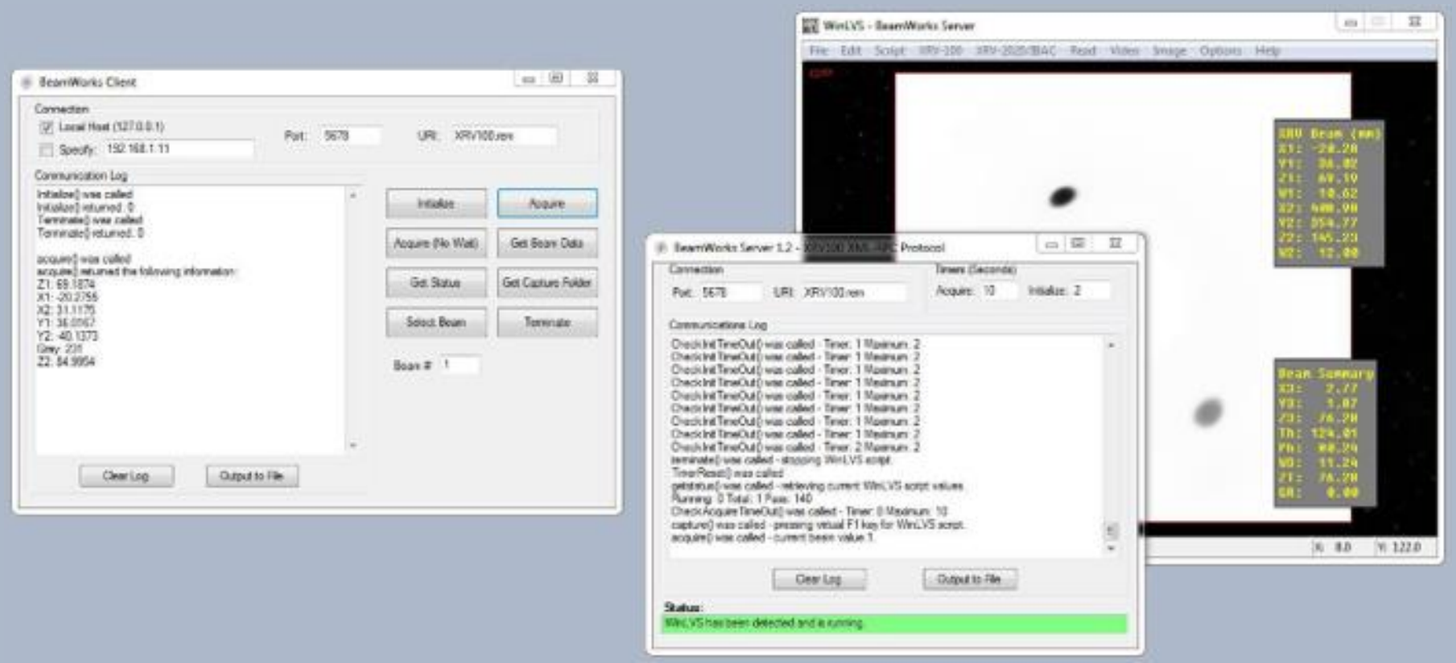
Tightly Integrated QA Loop with BeamWorks Client-Server



Using the BeamWorks Client-Server, measurements can be automatically fed back into the treatment system to iteratively tune the beam with minimal human interference.

Generating an error map in real-time enables the proton Beam Position Controller to close the QA feedback loop and recalibrate the entire system as needed.

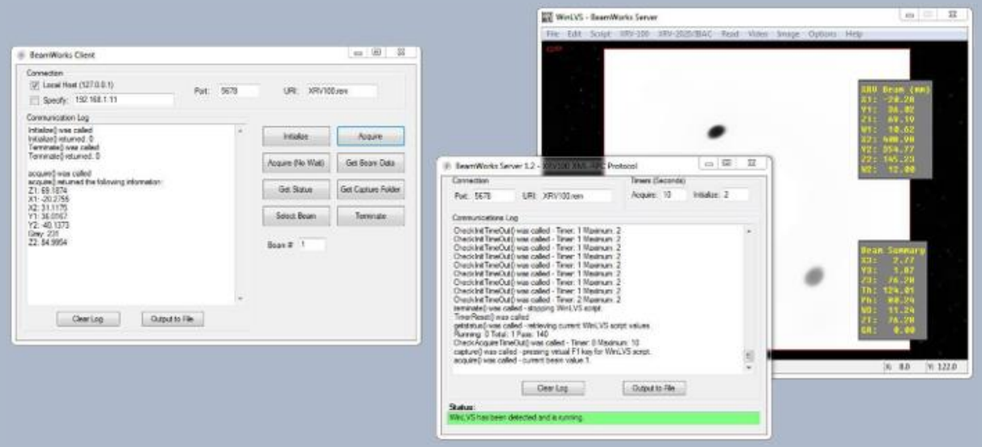
The BeamWorks Client-Server is a Toolkit for System Integration



After integration, the treatment system acts as the Client and queries the XRV-124 Server over the Local Area Network using the XML-RPC protocol.

For each gantry beam angle, the BeamWorks Server returns 3D beam measurement data to the treatment system, answering the question: “Where was beam energy actually delivered?”

Automation Increases Productivity and Keeps the Commissioning Team on Schedule



The XRV-124 is best used to create error maps which correct for variations in the gantry isocenter.

In a similar process, 2D phantoms like the XRV-4000 Hawk can be used to correct for bending magnet nonlinearities in the XY treatment field at each gantry angle.

These error maps provide the added precision needed by the proton delivery system to fine-tune treatment plans for the highest possible accuracy.

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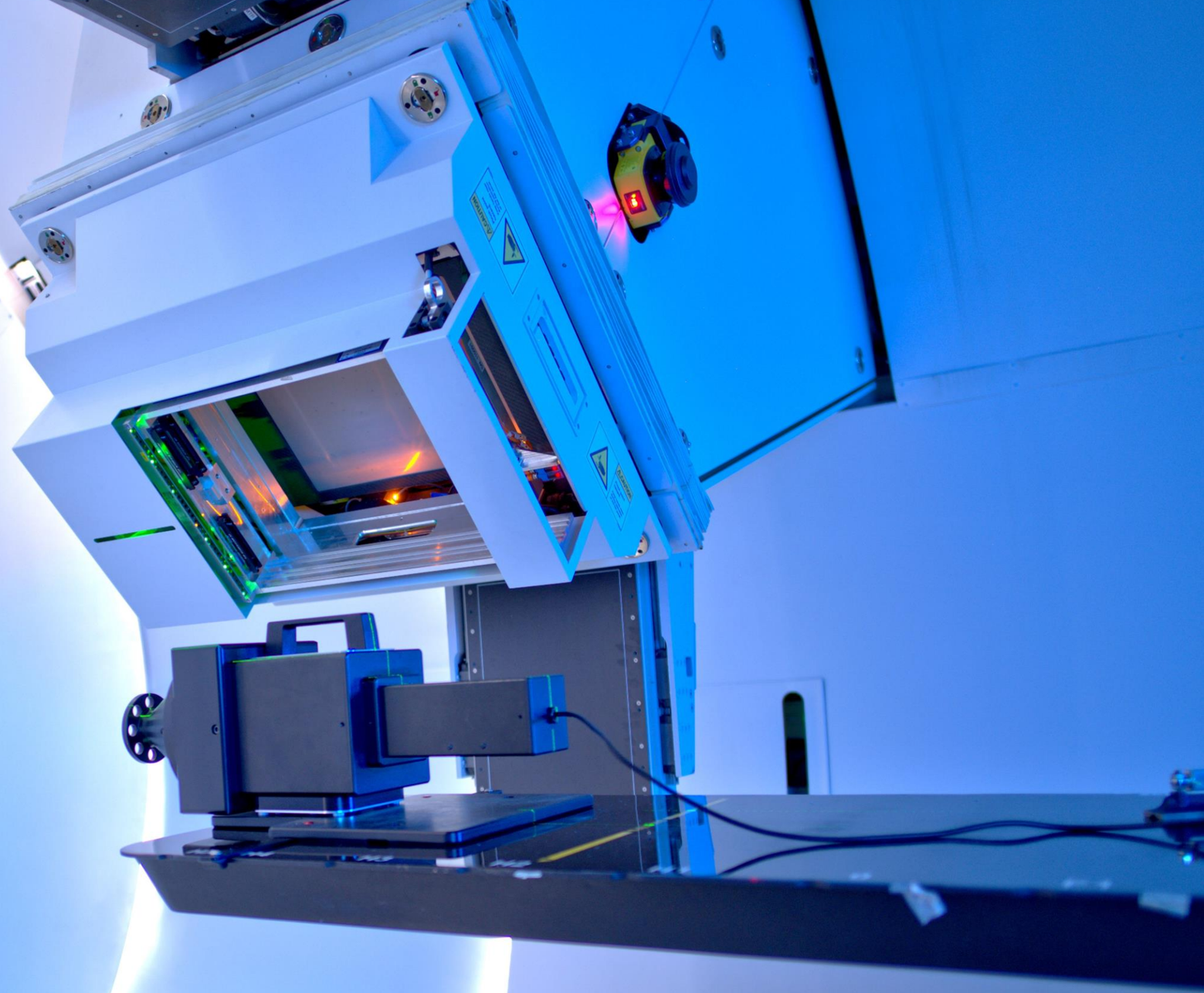

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Closing the QA Loop with the XRV-124 and XRV-100