

Abstract ID: 9828 Title: IM RT Commissioning: A multi-center evaluation of a standardized test protocol

There is evidence that IMRT treatments may not always be as accurate as practitioners believe. In 2006, the Radiological Physics Center (RPC) reported that of the 155 institutions that had irradiated the head and neck phantom as part of an IMRT credentialing process, 54 (35%) had failed to meet accuracy criteria of 7% for dose in a low gradient region and/or 4mm distance to agreement in a high gradient region. This experience strongly suggests that some clinics have not adequately commissioned their planning and delivery systems for IMRT. By "commissioning", we mean beam mode linking in the treatment planning system and initial verification by phantom studies that treatments can be planned, prepared, and delivered with sufficient accuracy.

Task Group 119 of the American Association of Physicists in Medicine (AAPM) has developed a specific set of tests for IMRT commissioning that are representative of common clinical treatments and pose a range of optimization problems requiring simple to complex modulation patterns. The tests include mock prostate, head and neck, and peri-spinal geometries. Members of the group have planned and delivered the treatments using their local planning and delivery systems, and then assessed the resulting doses using broadly available dosimetry tools following a specified protocol. Measurements included ion chamber point doses and film dosimetry on selected planes for all fields irradiating the phantom. Institutions also evaluated dose distributions produced by individual fields using detector arrays, film, or EPID.

Eight institutions have reported their results with nine different combinations of planning systems and accelerators. All have passed the RPC IMRT phantom test. The summary of the preliminary data shows:

Measurement type	Location	(Meas.-Plan)/Plan Average	(Meas.-Plan)/Plan Standard Deviation
Ion chamber	High dose target	- 0.1%	2.1%
Ion chamber	Low dose organ	0.9%	2.8%
% Points Passing Gamma Criteria of 3% dose, 3mm distance to agreement			
Composite film	High dose target	96.3%	3.4%
Composite film	Low dose organ	95.9%	4.9%
Average per field	-	95.8%	4.5%

One institution identified the need to improve the beam mode linking using the sets for better agreement between planned and delivered doses for IMRT.

The presentation will illustrate (1) that the percent of points passing the gamma criteria is highly dependent on the details of the implementation of the test and (2) that testing the individual field with a gamma test can be insensitive to problems and is not sufficient for commissioning. (3) The tolerance limits based on Dose -difference distribution, distance-to-agreement (DTA), and a numerical gamma index for IMRT QA are often not adequate because all these methodologies do not account for space -specific dose uncertainty information. (4) Beam modeling affects the planned and delivered dose agreement.

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Learning objectives:

1. To describe the uncertainties in IMRT planning and delivery - describe the impact of spatial and dosimetric uncertainties on the IMRT dose distribution
2. Obtain examples of commissioning results for standardized IMRT studies that can be used for comparison with a clinic's IMRT system.
3. See how these standardized tests can be used for local testing purposes.
4. See examples of how the gamma criterion can vary depending on details of its implementation.
5. See examples of limitations of gamma criterion testing for identifying problems with individual IMRT fields.