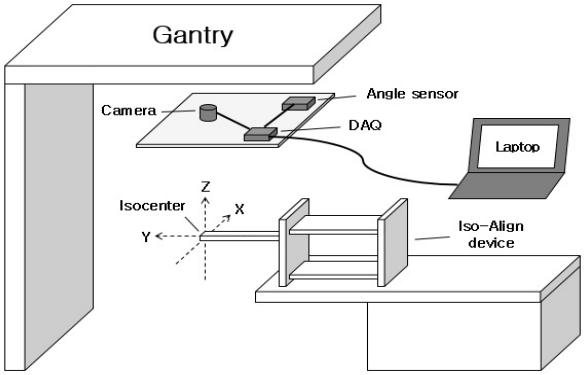

Figure 1. The configuration of the developed QA systems in this study.

Results: In the mechanical isocenter offset check, the mean error is about 0.09 mm for gantry rotation, the maximum error is about 0.28 mm was measured. And the mean error is about 0.11 mm for collimator rotation, the maximum error is about 0.31 mm was measured. In the couch movement check, the mean error in the X-direction is about 0.17 mm, the mean error in the Y-direction is about 0.19 mm, and the mean error in the Z-direction is about 0.24 mm.

Conclusion: In this study, we developed the QA system to improve the inefficient of the mechanical QA using conventional methods. At present, our QA system may measure the mechanical isocenter offset check and the couch movement check. The accuracy of measurement result is sufficient to measure the tolerances recommended in the guidelines.

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The IROC Houston QA Center's international activities outside North America

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Purpose or Objective: Purpose/Objective: To describe the extent of IROC Houston's, formerly the Radiological Physics Center, QA activities and audit results for radiotherapy institutions outside of North America (NA).

Material and Methods: Material/Method: The IROC Houston's QA program components were designed to audit the radiation dose calculation chain from the NIST traceable reference beam calibration, to inclusion of dosimetry parameters used to calculate tumor doses, to the delivery of the radiation dose. The QA program provided to international institutions includes: 1) remote TLD/OSLD audit of machine output, 2) credentialing for advanced technologies, and 3) review of patient treatment records. IROC Houston uses the same standards and acceptance criteria for all of its audits whether for North American or international sites.

Results: Results: IROC Houston's QA program has reached out to radiotherapy sites in 43 different countries since 2013 through their participation in clinical trials. In the past two years, 2,778 international megavoltage beam outputs were audited with OSLD/TLD. While the average IROC/Inst ratio is near unity for all sites monitored, there are international regions whose results are significantly different from the NA region as seen in Table 1. In the past 2 years, 477 and 87 IMRT H&N phantoms were irradiated at NA and international sites, respectively. Regardless of the OSLD beam audit results, the overall pass rate (87 percent) for all international sites (no region separation) is equal to the NA sites. Of the 182 international patient charts reviewed, 10.7 percent of the dose calculation points did not meet our acceptance criterion as compared to 13.6 percent for NA sites. The lower pass rate for NA sites results from a much larger brachytherapy component which has been shown to be more error prone.

	Beam Output Audits (IROC/INST)			
Geographical Region	Sample count	Mean	Std Deviation	P value (α=0.05)
N America	29284	0.999	0.019	control
Australia/New Zealand	544	0.989	0.018	0.000
China/ Hong Kong	187	1.002	0.017	0.053*
Republic of Korea	397	0.997	0.022	0.013
Japan	84	0.991	0.017	0.000
Taiwan	95	0.993	0.029	0.002
E Europe/ Russia	104	1.005	0.038	0.002
W Europe	657	1.000	0.029	0.914*
India/ Sri Lanka	71	1.009	0.042	0.000
Middle East	268	0.995	0.022	0.000
Africa	48	1.006	0.024	0.011
Latin America	37	1.003	0.023	0.272*
SE Asia	104	0.992	0.023	0.000

* not significantly different from N America (one way ANOVA)

Table 1. OSLD/TLD output audit results by geographical region since 2013.

Conclusion: Conclusion: The IROC Houston QA Center has expanded its QA services worldwide and continues a long history of improving radiotherapy dose delivery in many countries.

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Measurements of reactive oxygen species production induced by gold nanoparticles in radiotherapy

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Purpose or Objective: Metallic nanoparticles have shown radiosensitizing properties in cancer radiotherapy, with both conventional and hadron beams. In particular, Gold Nano Particles (GNPs) are emerging as promising enhancers for radiotherapy. However, the exact mechanisms behind the extra damage are yet unknown, although Reactive Oxygen Species (ROS) production, known to be crucial in radiotherapy, is a strong candidate. A direct measurements of ROS production was performed in typical radiotherapy treatment conditions.

Material and Methods: A protocol for measuring the OH* radical production in Phosphate-buffered saline (PBS) solution, based on the fluorimetric properties of oxygen-quenched Terephthalic acid, was designed and validated. Correction factors associated to GNP-induced adsorption, absorption and diffusion at the fluorimetric excitation and emission wavelengths were carefully evaluated. ROS production induced by 6 and 15 MV photon beams was then measured in standard PBS solution, as well as in the presence of GNPs of 5 nm and 20 nm diameters, at 5 μmol and 10 μmol concentrations.

Results: A relevant ROS extra production was observed for 5 nm diameter GNPs, up to about 40% at 10 μmol and 20% at 5 μmol as a function of the delivered dose. Measurements with 20 nm diameter GNPs are consistent with a ROS production increase of the order of 10%, albeit with a large experimental error. The ROS enhancement is consistent with the hypothesis of a linear dependence on the GNP surface to volume ratio, within the experimental errors.

Conclusion: Further measurements with 10 nm and 2 nm GNPs are planned, in order to verify the linear dependence on the inverse GNP radius with higher precision over a wider size range.