

Introduction

The Imaging and Radiation Oncology Core Houston Quality Assurance Center IROC IROC Houston (formerly RPC) perform annual audits for verification of output of external beam. The OSLD system, based on the use of nanoDotTM from Landauer, is used in most of the audits. The MicroStar[®] inLight[®] reader from Landauer with a specific adapter for nanoDotTM is used for the readings of these detectors. The new model of OSLD reader, microSTARiiTM was evaluated by IROC Houston. The reader is designed for only reading nanoDotsTM. The new system (reader and software) allows an automatic reading process avoiding the complications related to the use of the knob as well as the physical mechanics inside the previous model.

The IROC Houston performed tests to look into the performance of this new reader based on the results obtained from the use of the previous model. The expectation was to improve the efficiency of the reading process, minimize changes to the procedure for dose calculation in place and keep or reduce the final uncertainty in the determination of dose.

Methods

IROC Houston currently uses the MicroStar[®] reader for the OSLD program for verification of photon, electron and proton beam machine outputs (Fig. 1).



Figure 1: MicroStar[®] reader. Computer, scanner and adapter for nanoDotTM are shown in picture

Methods (cont'd)

The calculation of dose from the OSLD system is based on a group of factors defined during the commissioning of a batch of OSLD. Factors include system sensitivity (SS), depletion (K_D), element correction factor (ECF), linearity (K_L), energy correction (K_E) (1). The new microSTARiiTM unit presents many hardware and software upgrades that hopefully will enhance our OSLD output verification program. (Fig 2)



Figure 2: microSTARiiTM reader and drawer for nanoDotTM readings

Based on these upgrades and design changes, many factors that were considered reader dependent, are now being measured and analyzed to determine their effect on the new reading process (2).

The first factor needed is the depletion of the signal based on the reading process. The next factor needed for the commissioning process is the determination of the element correction factor ECF per each nanoDotTM. All the other correction factors depend on the ECF of the detectors used for the study.

Results

The determination of the depletion of the signal based on the reading process is studied from a series of consecutive readings taken for 4 different nanoDotsTM. (Fig 3)

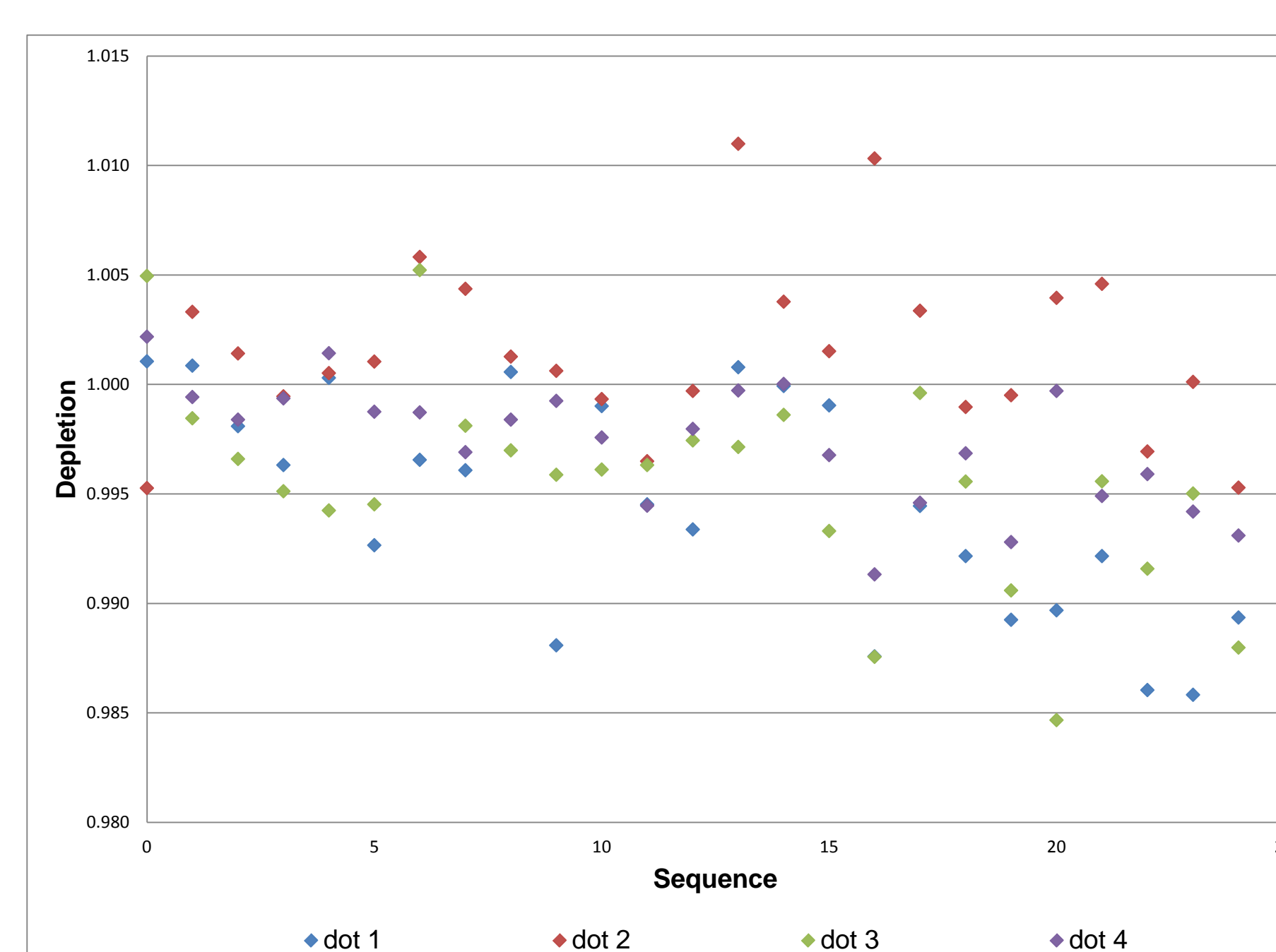


Figure 3: Change in signal based on number of readings (depletion)

Results (cont'd)

These measurements were done based on consecutive readings without removing the drawer. Each of the 4 dots had 5 consecutive readings recorded. In between measurement sets the dot was removed from the drawer and put back. Special results for 2 different detectors are shown on Figure 4.

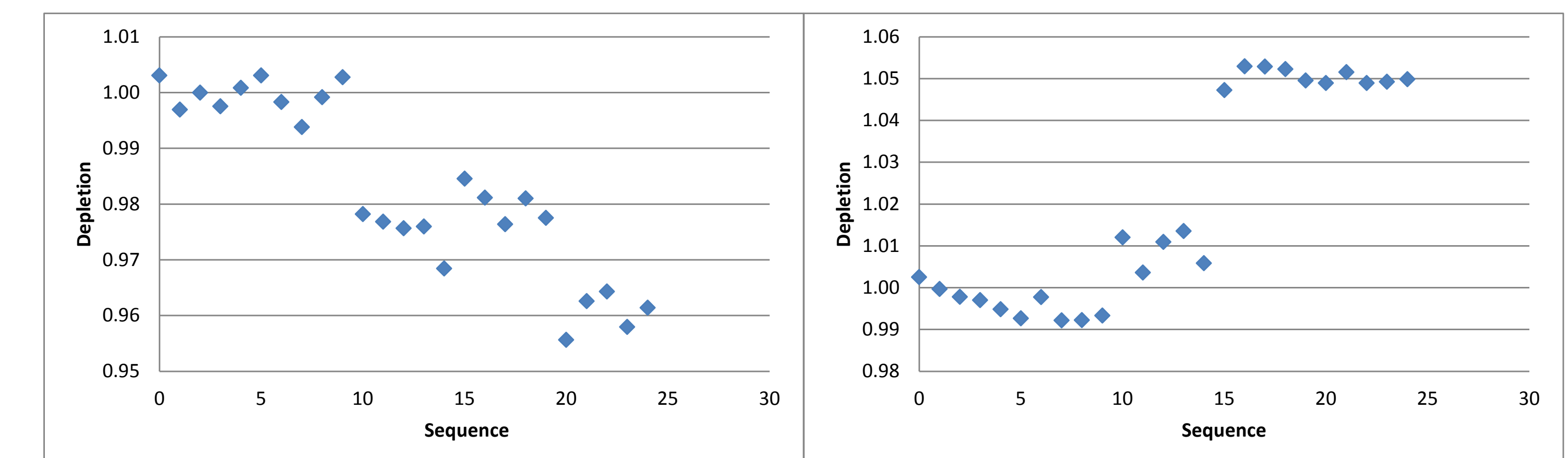


Figure 4: Depletion curves for 2 detectors

The differences observed between groups of readings were up to 5% compare initial readings for certain detectors. These large differences affect the determination of the ECF for each detector as well as every factor under analysis during the commissioning process. No further commissioning was possible. The problem seems to be related to the design of the new readers drawer.

Conclusions

The new microSTARii reader presents new features that may improve the efficiency of the OSLD program at IROC Houston. The acceptance and commissioning of this device had to be is put on hold based on the results shown in Figure 4. The manufacturer is working on an upgrade of the system that will hopefully improve the response of the reader. The acceptance tests will be redone once the upgrade is approved and the reader will be evaluated in order to meet uncertainties at the level of the existing system or better.

References

- (1) Aguirre, et al. Optically Stimulated Light Dosimetry: Commissioning of An Optically Stimulated Luminescence (OSL) System for Remote Dosimetry Audits, the Radiological Physics Center Experience, Med. Phys. **36**, 2591 (2009)
- (2) Thistlethwaite, et al. microSTARiiTM – A new system for medical dosimetry: Part I: Technology & Initial performance – Landauer Technology white paper