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SU-E-T-191

PITSTOP: Process Improvement Techniques, Software Tools, and Operating Principles for a Quality Initiative Discovery Framework

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Purpose: To develop a quality initiative discovery framework using process improvement techniques, software tools and operating principles. **Methods:** Process deviations are entered into a radiotherapy incident reporting database. Supervisors use an in-house Event Analysis System (EASy) to discuss incidents with staff. Major incidents are analyzed with an in-house Fault Tree Analysis (FTA). A meta-Analysis is performed using association, text mining, key word clustering, and differential frequency analysis. A key operating principle encourages the creation of forcing functions via rapid application development. **Results:** 504 events have been logged this past year. The results for the key word analysis indicate that the root cause for the top ranked key words was miscommunication. This was also the root cause found from association analysis, where 24% of the time that an event involved a physician it also involved a nurse. Differential frequency analysis revealed that sharp peaks at week 27 were followed by 3 major incidents, two of which were dose related. The peak was largely due to the front desk which caused distractions in other areas. The analysis led to many PI projects but there is still a major systematic issue with the use of forms. The solution we identified is to implement Smart Forms to perform error checking and interlocking. Our first initiative replaced our daily QA checklist with a form that uses custom validation routines, preventing therapists from proceeding with treatments until out of tolerance conditions are corrected. **Conclusions:** PITSTOP has increased the number of quality initiatives in our department, and we have discovered or confirmed common underlying causes of a variety of seemingly unrelated errors. It has motivated the replacement of all forms with smart forms.

SU-E-T-192

Computer Vision for Final Online Treatment Parameter Verification

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Purpose: In a typical model of Radiation Oncology data flow, treatment plan is designed on treatment planning station (TPS) under the supervision of physician and physicist, and machine specific parameters are pushed to Record and Verify system (RV) for treatment data storage, where it stays available for daily uploads to treatment station. While various QA programs could be established to verify uncorrupted planning data storage and transfer, the ultimate goal is a daily confirmation of patient treatment parameters versus original treatment plan. **Methods:** A new computer vision approach, RTcheck, is used to digitize loaded machine parameters directly from the screen of Varian Clinical Console every time before the beam is turned on by a therapist. The verification engine runs a check against the parameters automatically extracted from the printed postscript planning report (Pinnacle, Philips) prepared during planning stage and approved by physician. All important beam data, MUs, jaws position, beam energy, couch angle, and wedge specifiers are displayed side by side on the screen of RTcheck station. All field verifications are recorded to a log file, periodically reviewed by a physicist. **Results:** In our clinical tests, the electronic verification of machine treatment parameters shortened patient 'on the table' time, as the manual therapist's 'time out' check before every beam on may take up to several minutes for patient treatments with multiple beams (more than 10). Our analysis of verification logs revealed several instances of a small X1 jaw position discrepancy of 0.1cm for jaw position range of 0 to -2cm. After jaw recalibration, the problem was eliminated. **Conclusions:** RTcheck is the end-to-end quality assurance approach to verify data flow from TPS to treatment machine for every patient treatment. Computer vision approach may help reduce human error factor, and shorten patient treatment time. Conflict of interest: S. Kriminski and I. Lysiuk: provisional patent application is submitted to United States Patent and Trademark Office

SU-E-T-193

Using Truebeam's Research Mode to Automate Mechanical Quality Assurance

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Purpose: To determine the feasibility of automating mechanical quality assurance measurements on the Varian Truebeam LINAC. **Methods:** Using the XML coding capability of the Varian Truebeam Research Mode, the LINAC was programmed to mimic the beams delivered for the following mechanical tests. These tests included: Field size accuracy, jaw positions for asymmetric fields, collimator rotation isocenter, and MLC positional-accuracy. Images for these beams were acquired with the EPID. The images were analyzed using an analysis code written in MATLAB. Tests for gantry and couch rotation isocenters and radiation and mechanical isocenter coincidence are being developed. **Results:** For field-sizes ranging from 4x4cm² to 15x15cm², the measured matched the nominal field sizes to within 1mm. The collimator rotation isocenter and the overall accuracy for asymmetric field matched to within 1mm. No positional error >1mm was seen in the 33 MLC pairs visible in the MLC positional-accuracy images. **Conclusions:** A large portion of the time required to make mechanical QA measurements using film is spent placing, processing, and scanning the film. Complete automation in performing these mechanical tests results in a significant time gain compared to film. A majority of the mechanical tests suggested by TG-142 have been performed using this technique, and an automated mechanical QA process has been established in our clinic.

SU-E-T-194

Evaluation and Simulation of Shallow Depth Skin Dose From Couch Top in Radiotherapy

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Purpose: When the treatment couch-top contacts the patient, the skin dose to the patient also generates clinical significance as the radiation beam passes through the couch. In this study, the effect on entrance shallow depth dose was investigated for the carbon fiber exact couch-top from Varian Medical System. **Methods:** An Accredited Dosimetry Calibration Laboratory (ADCL) calibrated PTW parallel-plate thin-window chamber was used to measure the doses in the build-up region. Firstly, the shallow depth doses at different field sizes, depths and incident angle beams were measured for 6MV and 18MV photon beams. To test the couch top contribution to the dose distribution, the depth of measurement went down to 10cm. The couch was simulated in the Eclipse treatment planning system and the related point dose was calculated with different depths. The CT number of the couch top was adjusted to generate agreement between measurement and simulation. **Results:** At a 2mm depth, the surface dose increased with the decrease of the field size. Comparing with and without the couch top, as field sizes vary from 20cmx20cm to 2cmx2cm, the dose increased from 35% to 53% of for 6MV, and from 50% to 113% for 18MV. At 0mm depth, the dose difference was most significant and is at the level of 300%. Angle incident beam dose increase due to couch top varied with complicated dose distribution. Extended Depth Dose measurement shows that couch top effect on dose in build-up region extends to depths of 1cm for 6MV and 2cm for 18MV. An appropriate CT number setting of the couch top is between -200HU to -300HU. **Conclusions:** The couch simulation in Eclipse displays better dosimetric accuracy in couch contacted skin dose. However, calculation factors such as surface definition, heterogeneity, calculation resolution and algorithm also need extra consideration.

SU-E-T-195

Experience in Implementing Intraoperative Radiation Therapy for Accelerated Partial Breast Irradiation Using Low-Energy X-Ray Source

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Purpose: To present our preliminary experience and quality-assurance (QA) procedures in implementing intraoperative-radiation therapy (IORT) for accelerated-partial-breast irradiation (APBI) using the Axxent-system controller (Xoft Inc.) **Methods:** IORT was implemented in our institution utilizing a 50-keV x-ray source. APBI allows breast conserving in patients with early-stage-breast cancer by delivering radiation to the lumpectomy