Conclusions: EPID-based in vivo dosimetry was successfully implemented across 4 cancer centres. Results were comparable with those of alternative approaches but without increasing the time required for the treatment appointment. Detailed understanding of the equipment involved is important when relying on EPIDs for dosimetry. A dedicated team of champions is essential for driving forward changes to existing workflows. EPIDs can successfully be utilised for photon output checks.

EP-1144
An empirical model of transmitted dose for pretreatment verification of IMRT plan using an amorphous silicon EPID
K. S. Saboori1, M. Schmidt2, R. Müller3, M. Mohammadi4
1University Hospitals of Erlangen, Radiation Oncology, Erlangen, Germany
2Royal Adelaide Hospital, Dept. of Medical Physics, Adelaide, Australia

Purpose/Objective: The main objective of this work was to model an electronic portal imaging devices (EPID) in a commercial Treatment Planning System (TPS). An EPID based transmitted dose verification model was developed to predict transmitted doses. This model enables the verification of two dimensional dose distribution in EPID level for a step and shoot intensity modulated radiation therapy (IMRT) technique using a SIEMENS Optivue 1000ST amorphous silicon portal imaging device. The model is user-friendly and does not involve complicated and time consuming analytical methods.

Materials and Methods: A homogeneous PMMA phantom was scanned using a CT scanner. The CT scan of this phantom was transferred via DICOM files to the planning system. The central pixel response and profile characteristics were investigated to find the best EPID model in the TPS. To remove the effect of different sensitivity of EPID pixels, the flood field images have been obtained and used for correcting images. Portal images for several rectangular fields at different phantom thicknesses were measured using the field size dependency of the EPID detector. A two dimensional array of ionization chambers were used as reference for dose calibration of EPID portal images at a specific depth; dref which the EPID dose profiles were best matched with the corresponding dose profiles measured in water in the TPS.

Results: Predicted transmitted dose maps of 7 IMRT pelvic cases in a Phantom in EPID model were generated in the treatment planning system using collapsed cone algorithm. Predicted transmitted dose maps were compared with the corresponding two dimensional measured calibrated dose map using a calibrated EPID. Gamma analysis was used for comparison of predicted and measured dose maps. Results showed that approximately more than 95% of points in the dose maps of IMRT fields were in agreement with a 4% dose and 4 mm distance criteria.

Conclusions: The current technique can be applied for clinical dose verification as a simple and fast assessment method to verify IMRT treatments.

EP-1145
Development and assessment of an in-house program for calculating the monitor unit in proton therapy.
N. Hayashi1, Y. Watanae1, Y. Adachi2, M. Manabe2, S. Yoshimura2, I. Eharal, H. Katz3
1Fujita Health University School of Medicine, Academic Physics, Toyoake, Japan
2Fujita Health University School of Health Sciences, Radiological Technology, Toyoake, Japan

Purpose/Objective: The purpose of this research is to develop and verify an in-house program to calculate the monitor unit (MU) for proton therapy system equipped with the range modulation wheel (RMW).

Materials and Methods: The MU calculation for the proton beam was suggested by Sahoo et al. in 2008 and given by the formalism using the multiplication of several factors with regard to the structure of the proton beam system. We adopted their theory and used eight factors in the equation for creating the program as follows: Relative output factor (ROF), Spread-out Bragg peak factor (SOBP), Range shifter factor (RSF), SOBP off-center factor(SOBPoffC), Off-center ratio (OCR), Field size factor (FSF), Inverse square factor (ISF), and Compensator and patient scatter factor (CPSF). The program was built by Microsoft Visual Basic on Windows personal computer. After building the program, the calculated doses were compared with the measured dose. The referential dose was calculated with an ionization chamber placed at the isocenter with a fixed source-to-detector distance (SDD) of 270 cm.

Results: The program was created by Visual Basic ver.6.0 and verified under the environment of Windows 7 OS, 4 GB memory, 2.5GHz CPU. It was simply and satisfactory fast for the user to complete calculating (dose/MU). The graphical user interface (GUI) of our program is shown in Figure 1. The dose/MU was calculated by the equation with the multiplication using eight factors. The equation was given by: (dose/MU)=ROF*SOBPF*RSF*OCR*FSF*ISF*CPSF. Once the energy and the radiation field settings were input to the program, these factors were estimated from the referential measured data. Then MU calculation was done immediately. As the results of the comparison between the measured and calculated doses, the errors between the calculated and measured doses in all referential settings were within 2%. Our program was able to calculate MU accurately in simple field settings. However, the errors in complicated radiation fields were larger than those of simple fields. In particular, ROF and SOBPF were common factors leading to large changes in d/MU.

Figure 1. The main menu in our in-house program.

Conclusions: The in-house program provides the fast MU calculation for proton beams as an independent check. The accuracy of the dose calculation is good in the referential settings at SDD of 270 cm. However, further improvement is required for the complicated settings.

EP-1146
Initial experience with portal dosimetry patient-specific pretreatment verifications of IMRT plans
F. Lillo1, M. C. Pujades1, T. Garcia2, J. Gimeno1, V. Carmona1, F. Ballester1, J. Perez-Calatayud1
1Hospital Universitario La Fe, Radiotherapy Department, Valencia, Spain
2University of Valencia, Department of Atomic Molecular and Nuclear Physics, Valencia, Spain
3Hospital Universitar, Radiotherapy Department, Valencia, Spain

Purpose/Objective: At the present, IMRT is a standard treatment modality and VMAT is becoming an increasingly common delivery technique; the complexity of these techniques makes patient-specific verification to be considered a prerequisite to patient treatment. Characteristics of modern EPIDs along with specific developed algorithms to process EPD response make these devices promising candidates for such dosimetry. The purpose of this work is to describe our initial experience using Varian® Portal Dosimetry in patient-specific pretreatment verifications of RapidArc (RA) treatments.

Materials and Methods: Our department has recently (February 2012) been equipped with 3 Varian linac’s (2 Clinac’s, 1 TrueBeam), in which a large part of the treatments are delivered with IMRT, mostly RA; dose distribution calculations are performed with Eclipse® treatment planning system (10.0). The three linacs come with EPID systems and Portal Dosimetry software (10.0) that allows for comparison between predicted images and acquired ones. The software is based on the EPID response calibration and a pencil beam-based algorithm (PDIP) that predicts the system response. Our IMRT verification protocol includes Portal Dosimetry as one of the patient-specific verification tools; one predicted image is generated for each of the arcs used; a calibration 10x10 static field is acquired prior to the verification in order to account for eventual minor changes in the detector response or linac output; for comparison, local gamma index (3%/3mm) is used discarding doses below a 10% threshold. The points passing rate is evaluated to assess the acceptability of the plan.
Results: A total of 325 IMRT treatment verifications have been performed (315 RA), with more than 700 portal images analyzed. Although we use a quite restrictive protocol (local gamma index) the average number of points that passed the mentioned criterion has been 95.1% (range: 83.5 – 99.9, std dev: 4%). The worse cases results (mean -1.8%, except for one film (6.5%). Difference between EBT2 films readings were compared to a reference point. This process was repeated several times to evaluate the reproducibility and accuracy of MOSFET measurements during whole breast treatment plans. Discrepancies between calculated and measured values for TD treatments have been evaluated.

Results: The reproducibility of the MOSFET response is found to be better than 2.5% for the doses normally delivered to the patients. The difference between the MOSFET measured dose on Rando phantom and the planned dose at each point was less than 4%, with an average difference between the MOSFET measured dose and the planned dose of -0.8%± 1.7%. In vivo dose measurements show that the dose difference between MOSFET results and the TPS calculations was on average 0.5%, ranging from -4.7% to 4.8%. In conclusion, MOSFET detectors are suitable for routine TD dose verification.

EP-1149
A proposal for a novel dose-verification method for IMRT: Extended distance to agreement
A. Nakata1, K. Tateoka1, Y. Yaegashi1, K. Fujimoto1, Y. Saito1, T. Nakazawa1, T. Abe1, M. Yano1, M. Kikuchi1, K. Sakata1
1Sapporo Medical University School of Medicine, Department of Radiation Oncology and Medical Physics, Sapporo, Japan

Purpose/Objective: The aim of this study is to develop a novel dose-verification method for IMRT that expands upon the traditional DTA (extended DTA) by adding displacement directions to the distance difference.

Materials and Methods: The extended DTA was measured by acquiring the distance between the isodose lines obtained from the Treatment Planning System (reference isodose line) and the film dosimetry (evaluation isodose line) (EDR2 Films: EastmanKodak Company) of the prostate IMRT case. The extended DTA is the difference between the points at which the reference and evaluation isodose line intersect with a straight line after every 10° with respect to the origin. Furthermore, the distance of the difference was determined as both ‘negative’ and ‘positive’ if the evaluation isodose lines were both inside and outside the reference isodose lines, respectively. This latter assessment is useful because some reference isodose lines show low and high doses. The extended DTA was represented by 2D difference maps that use cylindrical projection. These maps show the angle in the horizontal axis, the dose in the vertical axis and the distance of difference (in millimeters) with the color scale. The criterion value used for the gamma analysis and the DTA was 2mm3, 2mm. The extended DTA was calculated using max dose and 100%, 97%, 95%, 93%, 90% and 80% of the isodose lines.

Results: The extended DTA in the 2D difference map showed a value