Results: For diode detector, correction factors were 0.993 and 1.000 for 3x3, 4x4 cm² at 6-X respectively and correction factors of 0.999 and 1.000 were found for 6-X FFF. For smaller field sizes, obtained correction factors were below 0.98 for both energies. For ion chamber, at the smallest field size, the respective correction factors were 1.046 and 1.079 for 6-X and 6-X FFF. At 2x2 cm², it was 0.971 and 0.967 for 6-X and 6-X FFF respectively. However, with increase of field size, the value of correction factors for ion chamber became close to 1.0.

Conclusion: For ion chamber, at 1x1 and 2x2 field sizes, correction factors were up to 3% more or less than of optimum value of 1.0. Our MC calculations showed that Pinpoint detector required output correction factor for field sizes below 2x2 cm². For diode detector this requirement was for field sizes below 2x2 cm².

EP-1504
Evaluation of transmission detector model using Monte Carlo simulation of VMAT delivery
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Purpose or Objective: The Device for Advanced Verification of IMRT Deliveries (DAVID) is a novel, transparent transmission detector. It is designed for in-vivo verification by measuring the radiation fluence from the linac head during treatment. In order to investigate its properties and sensitivity to standard errors it was desirable to build an accurate Monte Carlo model of the device. In this study a working Monte Carlo model of the detector was built and verified by comparing simulation and measured signals from simple square fields as well as complex IMRT and VMAT fields.

Material and Methods: All results were collected on an Synergy linear accelerator (Elekta AB, Stockholm, Sweden) equipped with an MLCI2 collimator. All treatment plans have been delivered as clinical treatments in the department and were generated by the Monaco 3.3 TPS (Elekta AB, Stockholm, Sweden). The Monte Carlo simulation of the linac and DAVID used BEAMnrc and DOSXYZnrc.

The DAVID is a transmission style detector, specific to the linac (MLC) model. As the MLC220 collimator has an 80 leaf (40 leaf pairs) MLC; the DAVID used in this work had 40 wires. These collection wires are held in a 2mm thick vented air gap that is encased by two polymethyl methacrylate (PMMA) plates, each 4mm thick. On the inside of the PMMA a thin layer of aluminium is been evaporated on to the inner surfaces; this layer is thin enough so that the device remains optically transparent, but thick enough to maintain a potential of 400V between the plates and the collection wires. Ionisation charge in the air gap, as a consequence of primary and scattered radiation, migrates towards the collection wires under the influence of the potential, each wire having a collection area of 0.03 cm² per centimeter of length.

It was shown that the collection wires had a negligible effect on the dose deposited in the collection volume allowing the DAVID to be modeled as two 4mm slabs of Perspex separated by a 2mm air gap.

Results: The DAVID signal measured on the linac was shown to be repeatable and stable. All simulated results were shown to agree with measured results to within 3% of the maximum signal.

Conclusion: The Monte Carlo model of the DAVID works well for both simple and complex deliveries. The model will provide a useful tool for investigating the sensitivity of the DAVID to linac faults. These can easily be simulated for a variety of cases in the Monte Carlo model.

EP-1505
Comparison of two unshielded diodes for commissioning of Cyberknife
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Purpose or Objective: The aim of this study was to evaluate the suitability of two recently launched unshielded diodes for commissioning of CyberKnife (Accuray Inc., Sunnyvale, CA) system.

Material and Methods: IBA Razor (IBA dosimetry GmbH, Schwarzenbruck) and PTW SRS 60018 (PTW Freiburg, Freiburg) diodes were used to commission CyberKnife M6 unit. TPR/PDD, OCR and output factors for 12 stereotactic cones (range 5-60mm) were measured with both detectors using PTW MP3-M water tank. The measurement results were compared between each other and with the composite data from the manufacturer.

Results: Output factors measured with both diodes agreed within 1% to the manufacturer supplied uncorrected data for all cones except 5 mm. For 5 mm cone differences of up to 2.3% were observed. Output factors for 5 mm cone were also compared with published Monte Carlo data and correction factors for PTW SRS 60018 and IBA Razor diodes are 0.95 and 0.94, respectively were noted. The difference is being larger for IBA Razor diode. For all other cones the correction for IBA
Razor diode is being smaller than for PTW SRS 60018 diode. PDDs agreed well for both diodes for the measured cones. The tale of the profile for 60 mm cone at 30 cm depth is being overstated by approximately 10% for both detectors compared to the profiles measured with PTW 31010 ionization chamber. The dose per pulse dependence for IBA Razor diode is larger than for PTW SRS 60018 diode.

Conclusion: Both detectors are suitable for commissioning of Cyberknife M6 system. Correction factor required for 5 mm cone for IBA Razor diode is larger than for it predecessor - IBA SFD diode (as based on published data). Both detectors require correction factors in order to account for the overestimation of the signal. Because of lower sensitivity the time required to collect the same quality data with IBA Razor diode is about 3 times greater than for PTW SRS 60018.

EP-1506
Investigation of PTW’s “microDiamond” detector for dosimetry in small animal radiotherapy research
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Purpose or Objective: The recently presented single crystal diamond detector (SCDD) from PTW (PTW-Freiburg, Germany) called microDiamond (µD, type TM60019) is especially meant to be used in small field dosimetry. As irradiation experiments of small animals in preclinical settings often use small fields this µD detector could potentially be the right device in this special field of interest.

Material and Methods: Two different kinds of measurements were performed: a) horizontal and vertical beam profiles, and b) depth dose curves. Both types of measurements were done in solid water slabs for two field sizes: 5x5 mm² and 10x10 mm². Measurement a) was done in 2 cm depth with the detector in the isocenter. The orientation of the detector was perpendicular to the beam axis and in terms of rotation in a suitable position to prevent effects due to unequal sensitivity. Measurement b) was performed with a fixed SSD of 304 mm and in depths in the range from 0 to 51 mm. The detector’s axis was parallel to the beam axis during this measurement. To enable the comparison of our measured depth dose, the µD detector was calibrated for our distinct setup against a standard ionization chamber in a large field. We compared the results of the µD detector to film measurements with radiochromic films (Gafchromic EBT3, Ashland, USA).

Results: The results of the beam profile measurements with the µD detector of the 10x10 mm² field are 10.10 mm in horizontal and 10.16 mm in vertical direction for the field width at half maximum (FWHM). For the 5x5 mm² field the µD results are 5.08 mm in both directions. The measured depth dose curve shows values from 4.05 Gy/min in a depth of 1 mm and 3.71 Gy/min in 5 mm down to 1.14 Gy/min in 51 mm. In comparison, the field size measurements with the film resulted in 10.16 mm (5.19 mm) for horizontal and 10.20 mm (5.20 mm) for vertical direction for the 10x10 mm² (5x5 mm²) field. This means a very good agreement in the 10x10 mm² field (difference less than 0.1 mm or 1%). In the 5x5 mm² field, the differences between film and µD is 0.11 mm and 0.12 mm (less than 2.4%). Depth dose curve measurements show also very good agreement of the two methods. In a depth of 5.3 mm the film measurements produced 3.68 Gy/min, in 51.4 mm depth 1.16 Gy/min (maximum deviation of about 2 %).

Conclusion: We showed measurements with the µD detector of two very important variables of radiation fields and their comparison to reference measurements with radiochromic film. As the discrepancy between both methods is very small, these findings justify the usage of the described µD detector for quality assurance measurements in preclinical research, especially for the SARRP.

EP-1507
Which detector for small photon field measurements?
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Purpose or Objective: Dosimetry in small fields is an open issue, due to several sources of errors, reported in literature. The purpose of this work is to compare the response of different detectors for the measurements of output factors (OF), profiles and percentage depth dose (PDD) curves for Elekta Synergy 5 BM 6MVX beams and field sizes from standard (10.4cmx10.4cm) down to 0.8cmx0.8cm.

Material and Methods: We tested the detectors reported in the first table.

No corrections were made for the difference between detectors and water (fluence perturbation and non water-equivalence) neither for volume averaging effects.

Results: OF were referred to 3.2cm field and deviations calculated respect to W1 as reference detector, both for its smaller dimensions and its better water equivalence.

For large fields all detectors agree within 1% except for µD, which show an over response for large fields, due to low energy scattered radiation. SCDD is in agreement with W1 within 0.6% for all field sizes, also down to 0.8cm, maybe for compensation effects between the over response due to high density and the under response due to volume averaging effects. For 1.6cm and 0.8cm, ion chambers show an under...