INTRODUCTION
For practical SRS commissioning it is essential to precisely measure output factors of small SRS cones. A recent joint working group of AAPM-IAEA publication1 calculates correction factors for each particular detector and cone. Use of these factors significantly improves agreement between different detectors and slightly changes the output measured, as demonstrated by our measurements in Fig. 1.

It is also very important to accurately measure PDD of narrow fields, as the detector can “walk away” from the beam center with increasing depth if the scanning line does not coincide with the beam axis. We came up with a simple practical method presented below.

AIM
Accurate measurement of output factors of small SRS cones using two independent detectors with corrections from an IAEA report #483.

Measurement of PDD for small SRS cones using several parallel auxiliary scans with a diode in a scanning water tank.

RESULTS
Use of the new correction factors allowed to reduce the discrepancy between the output factors measured by the two detectors from 1%-6% to 0.4%-1.2% (depending on the cone size) and changed the output factor measured by the diode by 1%-5%.

For the PDD measurements, all the peripheral PDD curves were lying below the main curve thus validating the measurement.

CONCLUSIONS
The practical methods described can be used for commissioning an SRS system with small cones.

New correction factors significantly improve agreement between different detectors. Using the corrections published in1, the acceptable agreement has been achieved for all cone sizes larger than 4 mm (Fig. 1).

For the PDD measurements, all the peripheral PDD curves were lying below the main curve thus validating the measurement. If one of the peripheral scan PDD curves becomes slightly higher than the curve of the main scan, sometimes it is possible to construct the corrected PDD curve combining both measurements.

METHOD
For cone output measurements, we used a PTW microdiamond detector and Sun Nuclear “Edge” diode. New correction factors were from the AAPM-IAEA joint working group. A scanning IBA water tank Blue Phantom allowed optimum positioning of the microdiamond diode detector to maximize the dose reading in a 1D water tank Norgren from IBA, using the light field guidance and small table adjustments.

PDDs were measured using Edge diode in a scanning water tank. For small cone sizes, it is imperative that the scanning direction is parallel to the cone axis. To verify that, we performed four additional parallel scans, surrounding the main one with the distance of 1 mm from the beam axis (see BEV in Fig. 2). We used small distances between the scans to prevent the detector at depth to unnoticeably deviate from the beam axis due to misalignment. If all of the peripheral scans measured PDD curves lying lower than the main scan curve, the latter was considered validated.

REFERENCES
1 “Dosimetry of Small Static Fields Used in External Beam Radiotherapy”. IAEA report #483, 2017

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