Introduction: Small-fields are becoming increasingly important in intensity modulated radiotherapy. The influence of a simulated air cavity on dose distributions of 6 MV fields was examined to identify increased photon transmission and electronic disequilibrium effects.

Materials and methods: Rectangular fields were collimated by fixing a field length at 10 cm. The field width was varied by adjusting the Y-jaws and the MLC leaves. The SSD was held at 95 cm. A set-up based on an automated water phantom was developed. It comprises two perspex holders and a cylindrical airlike pipe of 2 cm diameter, machined from Styrofoam™. A diamond detector (PTW-Freiburg, type 60003) with a sensitive thickness of 0.21 mm was chosen to measure dose distributions.

Results and main conclusions: The relative CAX dose drops off near the exit interface for a 10x2 cm^2 field ($D_{rel} = 0.92$) and a 10x1 cm^2 field ($D_{rel} = 0.74$), indicating that the electron fluence is significantly reduced and longitudinal electronic disequilibrium effects are becoming important.
Effects of electronic disequilibrium were also assessed in transverse dose profiles. In the case of a 10x2 cm^2 field a dip on the CAX appears compared to the top edges, as it is expected that part of the rebuildup has already been established. Even a profile of a 10x1 cm^2 field reveals a significant underdosing, and the highly convexed shape is no longer present.
Measurements for a 10x2 cm^2 field demonstrate a collimator rotation dependence of the dose. Small axial shifts for 10x1 cm^2 fields complicate accurate dosage.