Purpose: Fabrication of electron beam cutouts not only is a time consuming process but also involves the handling of cerrobend which is a toxic material. Hospital workers involved in cutout construction can actually be exposed to toxic fumes that are usually generated during the process. The aim of this work is to study the feasibility of replacing electron cutouts with our prototype motorized electron multileaf collimator (eMLC).

Methods: Electron beams collimated by an eMLC have very similar penumbra to those collimated by applicators and cutouts as we already demonstrated in a previous study. However undulation of the isodose curves is expected due to the finite size of the eMLC. This may be a problem when the field edge is close to critical structure. Thus ten different breast cases that were previously treated with an electron boost were selected from our database. An inhouse Monte Carlo based treatment planning system were used for dose calculation using the patients CTs. For each patient two plans were generated one with electron beams collimated using the applicator/cutout combination and the other plan with beams collimated only by the eMLC. Treatment plan quality was compared for each patient based on dose distribution and dose volume histogram. In order to determine the optimal position of the leaves, the impact of the different leaf positioning strategies were investigated.

Results: Results have shown that target coverage and critical structure sparing can be effectively achieved by electron beams collimated by eMLC. Preliminary results have shown that the out-of-field strategy is most conservative and would be the recommended method to define the actual leaf position for the eMLC defined field.

Conclusion: The eMLC represents an effective time saving and pollution free device that can completely eliminate the need for patient specific cutouts.

Funding Support, Disclosures, and Conflict of Interest:

This work has been supported by a UICC American Cancer Society Beginning Investigators Fellowship funded by the American Cancer Society