A mechanical Multileaf Collimator for use in Cobalt-60 teletherapy

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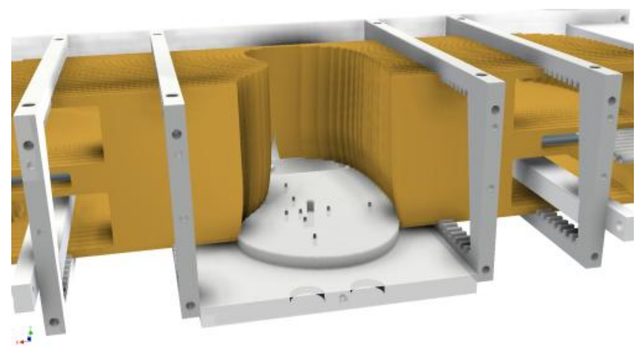
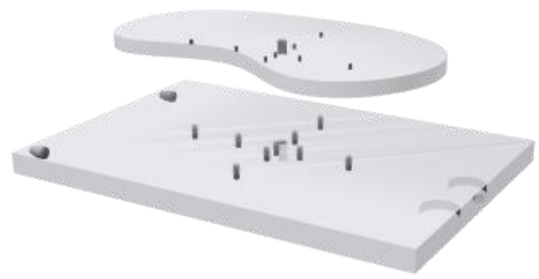
Motivation: Multileaf Collimators (MLC) for conforming radiation fields to a target shape have been in use for more than 20 years. [1,2] The quest for the application of modern technological advances in Co-60 radiotherapy that are standard in Linac radiotherapy - as, for instance, a MLC - has been mentioned frequently. [3,4,5,6].

Material & Methods: A manual MLC was developed to be used with a Co-60 teletherapy machine. The main requirements for this collimator were defined to be a low costs, highly reliable, low maintenance, independent of electric power and versatile in its applicability. The maximum field size is 20*30cm^2 in the isocentre.
A novel drive mechanism for the individual leafs has been implemented by using a passive closed-loop, semi-automatically pneumatic system. The measurements were performed with both a 1.5cm and a 2.0cm source diameter with SSD of 80cm/85cm/100cm with varying field sizes for PDD, Penumbra and Leakage evaluation.

Results: The results yield leakage properties conforming with present international requirements. The penumbra for a field of 10x10cm^2 and a 2.0cm source diameter is 0.85cm for a 80%/20% Penumbra definition. Intraleaf and Interleaf-Leakage is at 1.5% and below 3%, respectively. End-to-end gap leakage has a maximum of 5%.

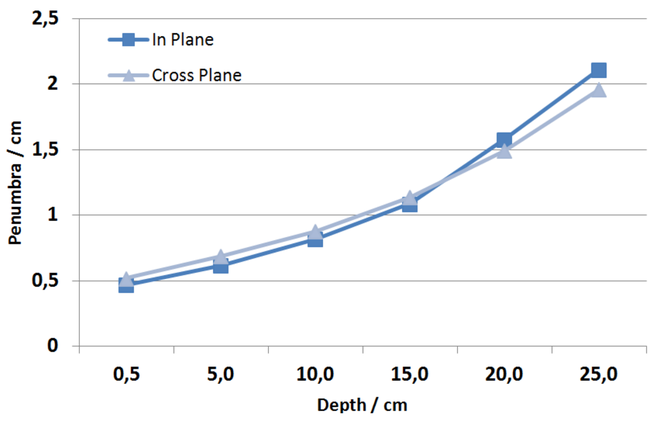




Discussion: The leakage properties for the tested prototype (further improvements are work in progress according to the manufacturer) are well within the 2% limit and the end-to-end gap leakage is comparable to common LINACs.

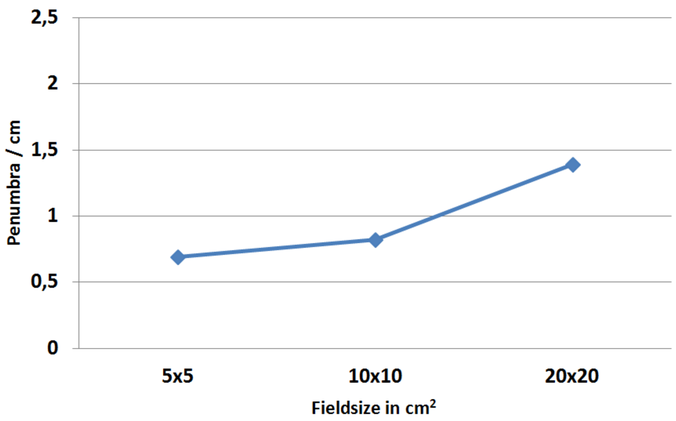
Conclusion: The present prototype shows high usability and with some minor mechanical adjustments in terms of ergonomics it can be a useful tool to perform conformal radiotherapy with Co-60 teletherapy machines.

Penumbra with depth



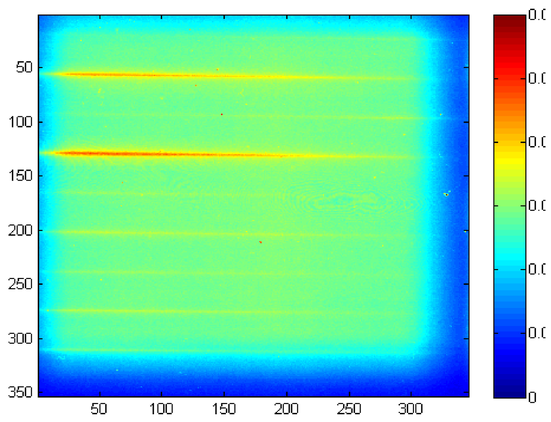
Source Ø 2.0 cm:
Reference Penumbra: **0.85 cm**
Source Ø 1.5 cm:
Reference Penumbra: **0.55 cm**

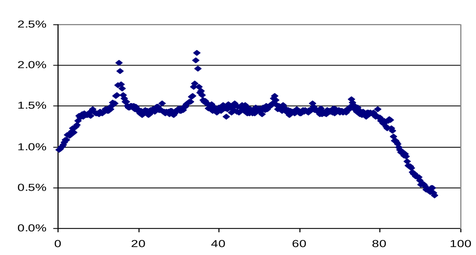
Penumbra with fieldsize



Source Ø 2.0 cm, Depth 10 cm
Penumbra: **0.69 cm – 1.39 cm**

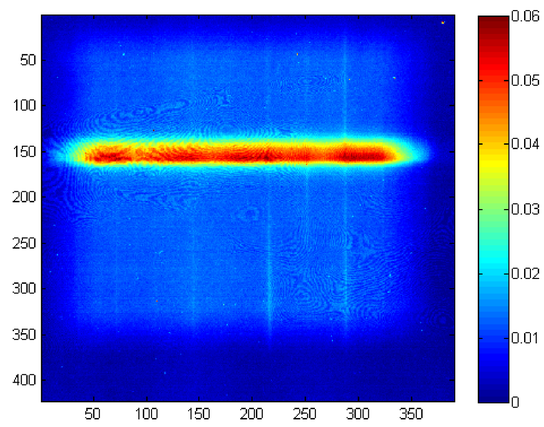
Interleaf Leakage

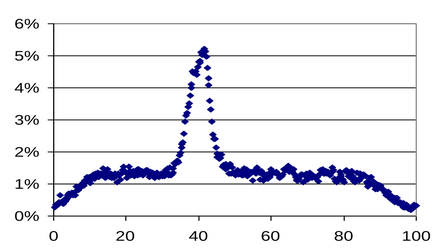




Average Leakage ~1.5%
Max < 3%

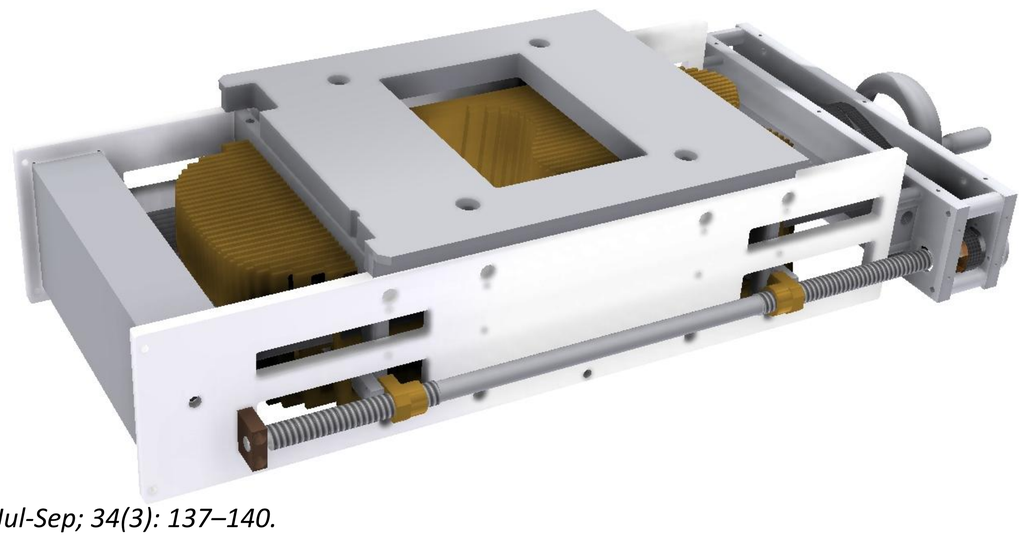
End2End Gap





End2End Gap ~5%
Improvement planned

Outlook: Further mechanical improvements and an enhancement in the clinical workflow are presently being worked on. An electronic interlocking system will be implemented for improved safety. More detailed dosimetric description is scheduled for the final design, which will then be marketed by the project partner (Precisis AG, Heidelberg, Germany) under the name of CobraLeaf®; i.e. the Cobalt Radiation Multileaf-Collimator.



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This poster is a summary of the oral presentation at the AMPICON 2012 conference, Mangalore, India.
Details can be found under AMPICON2012: Abstracts, O-02 12070902: A manual Multileaf Collimator for use in Cobalt-60 Teletherapy