

Theme: Physics

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Abstract Title: Design and Fabrication of 3D-Printed Variable Density Range Modulators for FLASH Proton Therapy

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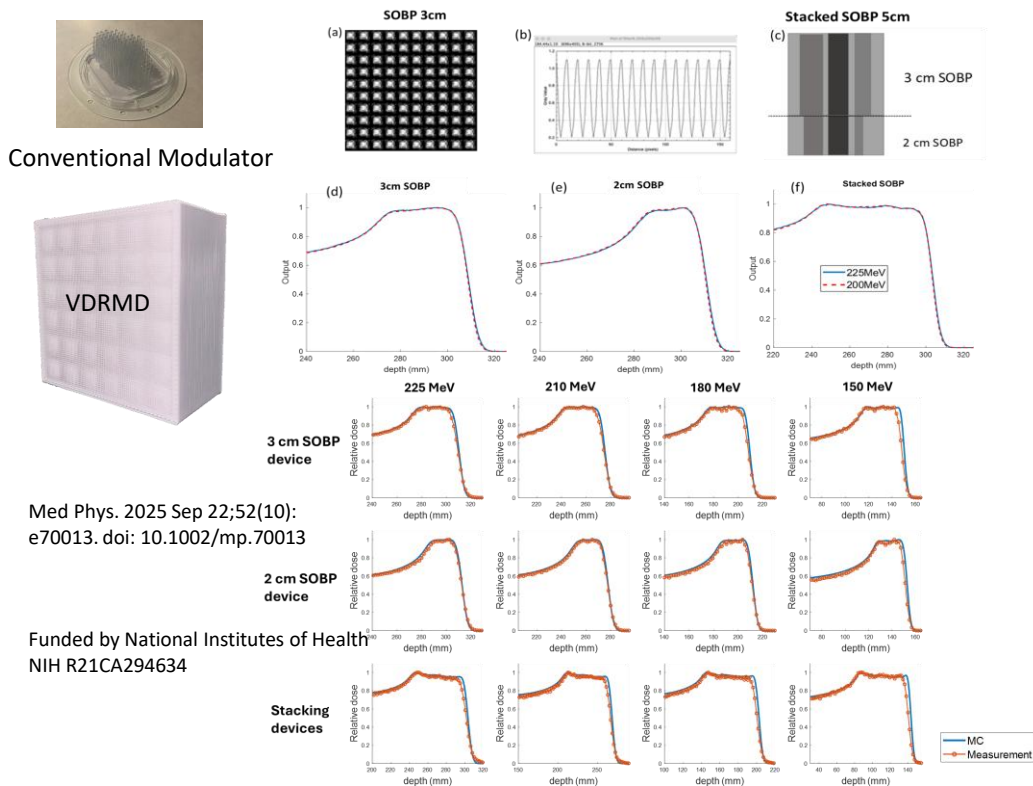
Background / Aims:

- Proton FLASH Therapy requires the use of Range Modulators to create a Spread-Out Bragg Peak (SOBP) from a proton beam without energy layer switching
- PixelPrint technology is a novel solution to 3D printing technology used to create a variable density (0.2 to 1.0 of max density) range-modulating device (VDRMD)
- We demonstrate the flexibility of VDRMDs, compared to conventional uniform-density ridge filters
- We demonstrate that VRMD devices can be stacked to create composite modulators with different SOBPs

Subjects and Methods:

- We designed and 3D printed (PLA) 2 cm and 3 cm SOBP VDRMD devices
- Measurements were performed with proton beam irradiation using a multi-layer ion chamber (MLIC) device to characterize the SOBPs

Result:



- Novel stackable VDRMD designs for proton therapy were fabricated
- High manufacturing fidelity was confirmed by CT imaging, and both simulations and measurements demonstrated the feasibility of creating wider SOBPs by stacking.
- This approach will enable a library of robust, pre-fabricated universal modulators to be assembled for flexible clinical applications