

DOSIMETRIC ANALYSIS WITH A LINEAR ACCELERATOR FOR SMALL FIELDS

Jornada de Doctorado
Sesión primavera, March 2022

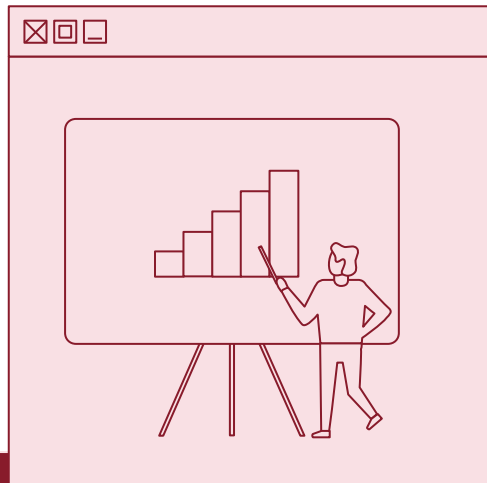
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Térmica y Electrónica



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01



INTRODUCTION

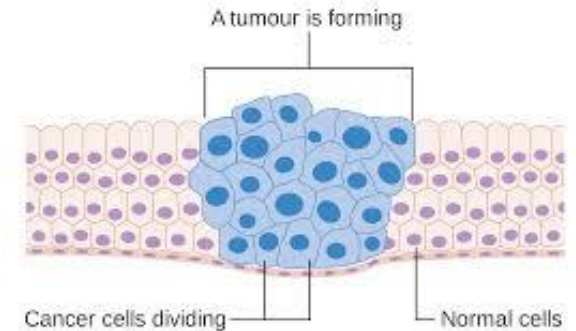
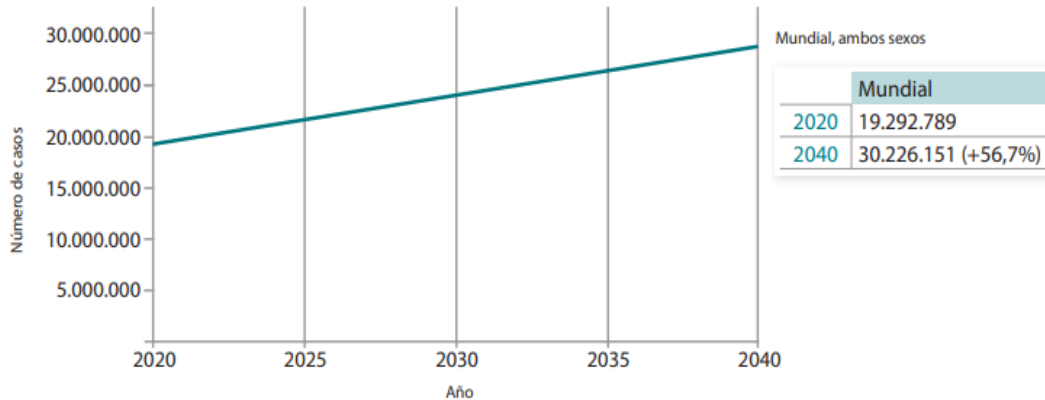


- Motivation
- Methodology
- Results and Discussion





Radiotherapy is a cancer treatment that uses high doses of radiation to kill cancer cells and shrink tumors.



Sociedad Española de oncología médica, S. (2021, 17 de Noviembre)

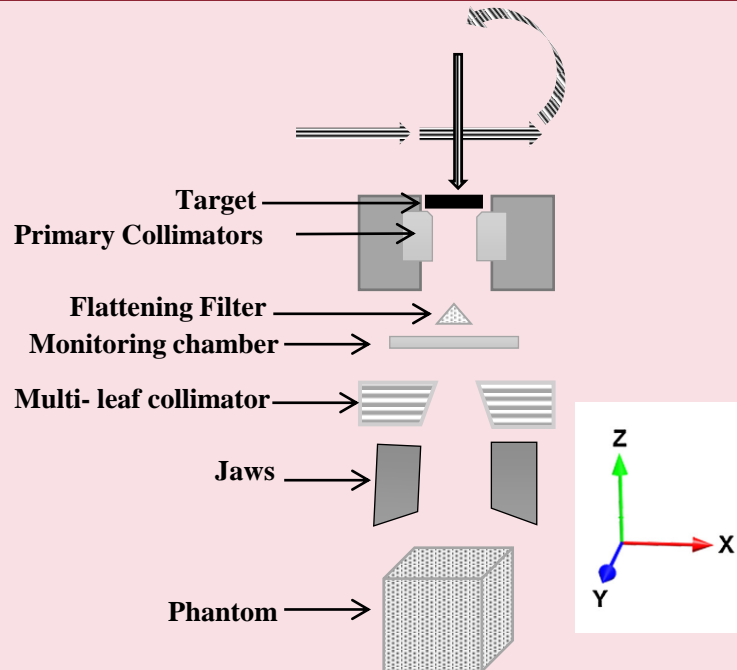
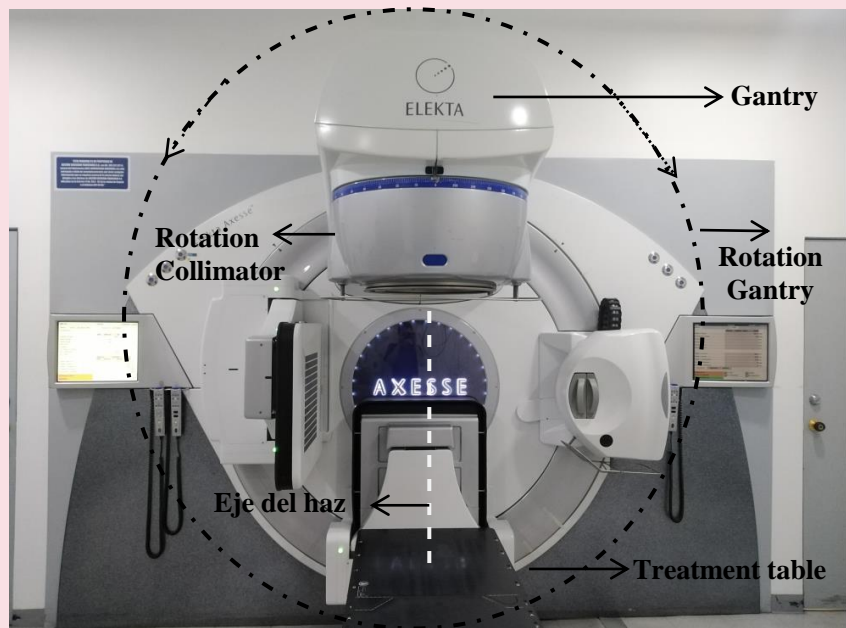


SMALL FIELD RADIOTHERAPY

Small-field radiotherapy was proposed in 1951 by the Swedish neurosurgeon Leksell



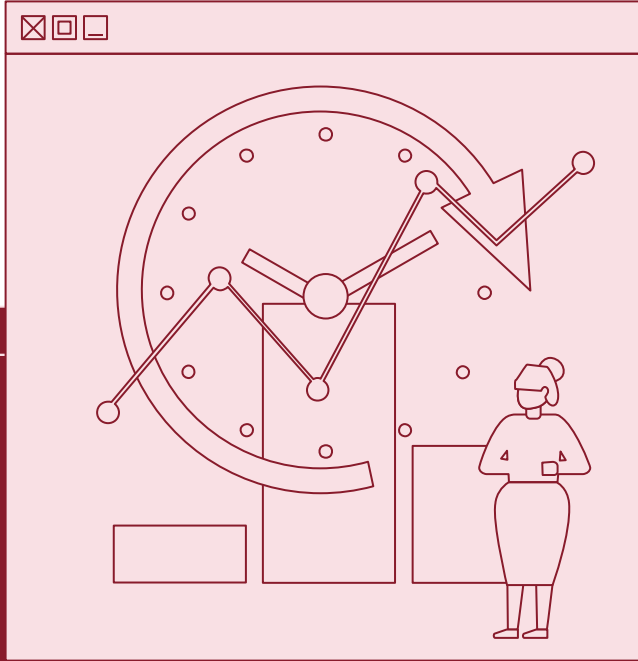
AXESSE ELEKTA LINEAR ACCELERATOR



02



MATERIALS AND METHODS

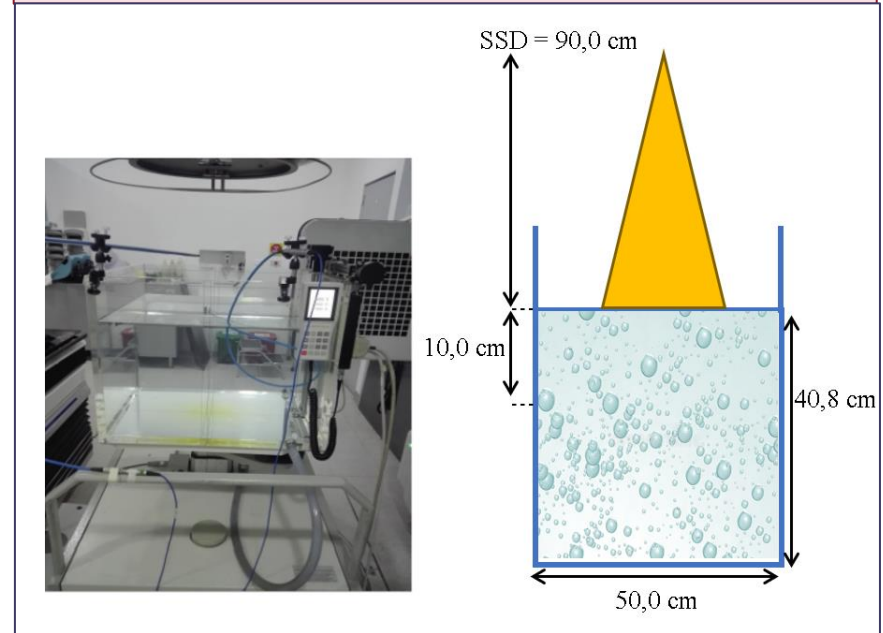
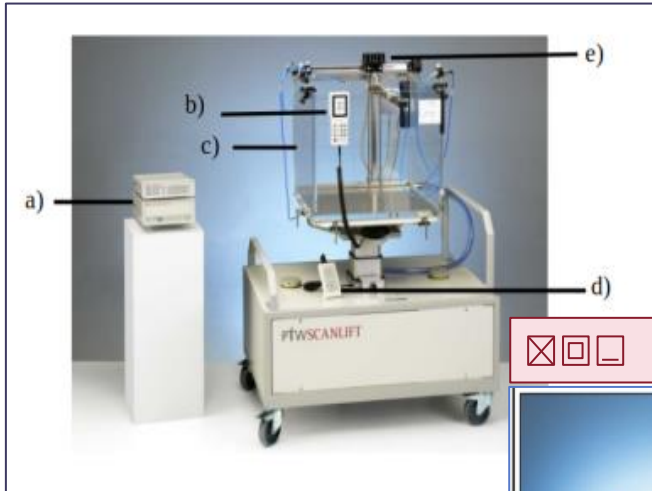




MP3-M SYSTEM AND SEMIFLEX IONIZATION CHAMBER



PTW, type 31010)





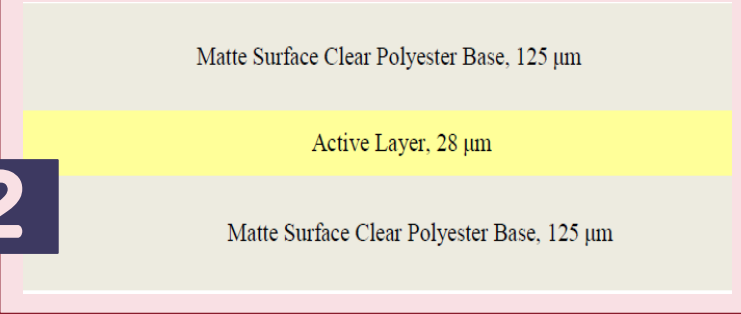
RADIOCHROMIC FILM



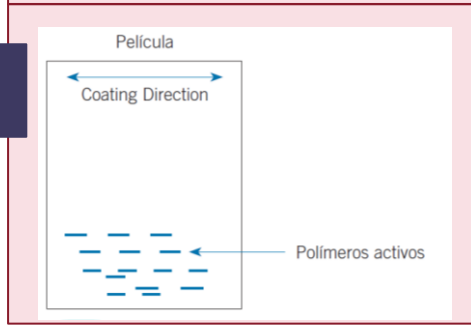
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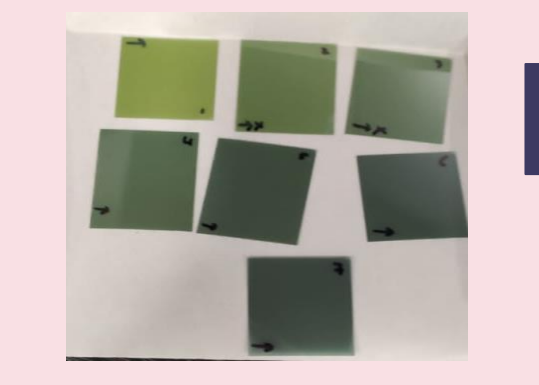
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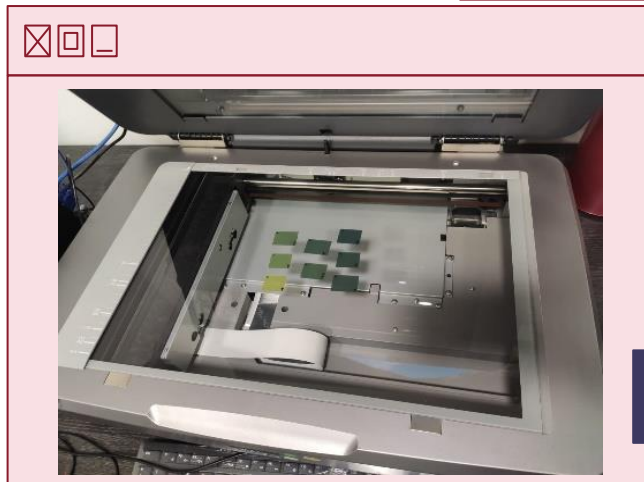
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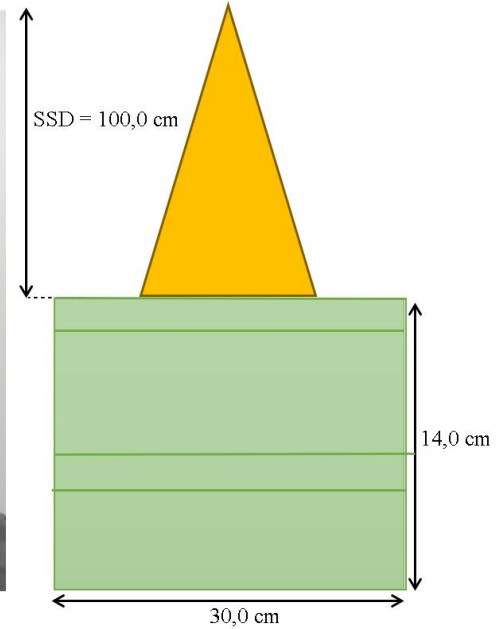
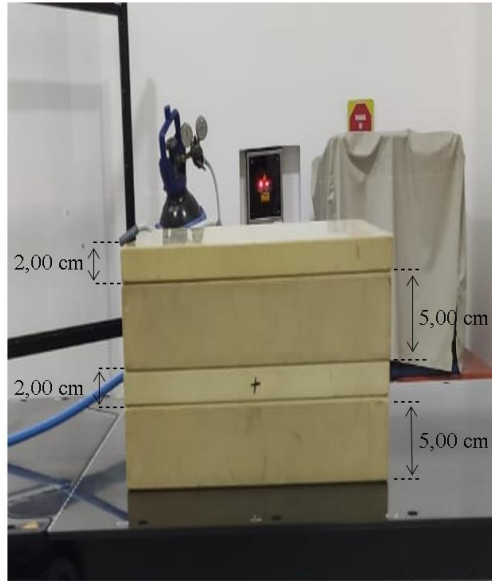


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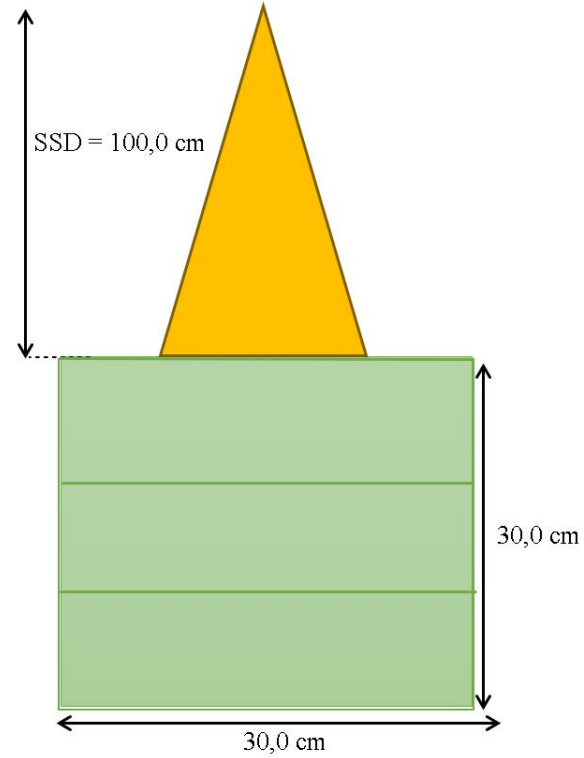


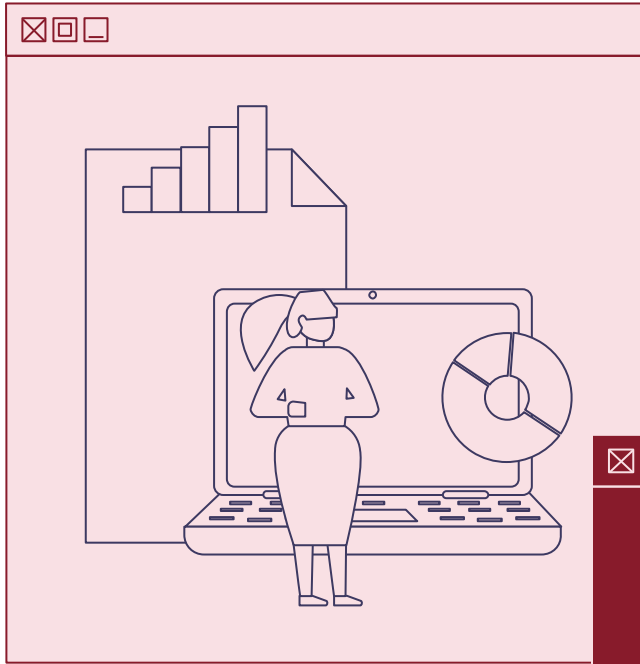
CONDITIONS EXPERIMENTAL DATA





MEASUREMENTS WITH EBT3 RADIOCHROMIC FILMS

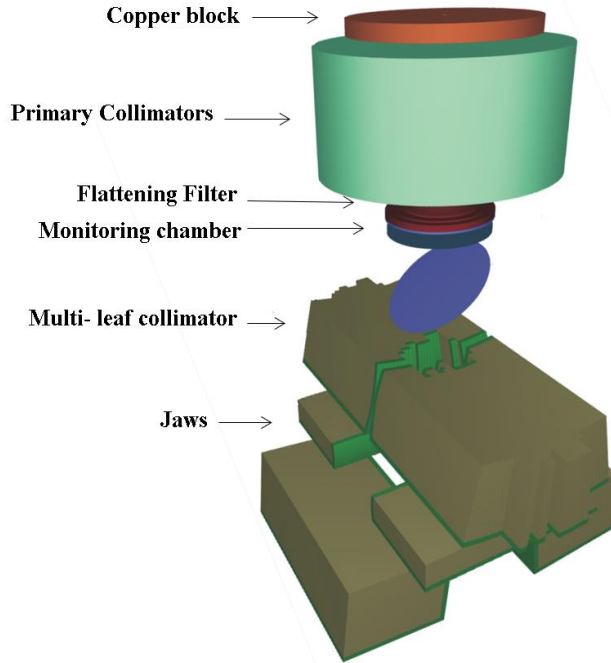


A dark red rectangular box with a thin white border and three small window control icons (close, maximize, minimize) in the top-left corner. Inside the box, the text 'MONTE CARLO SIMULATION' is written in a large, white, serif font, centered vertically and horizontally.

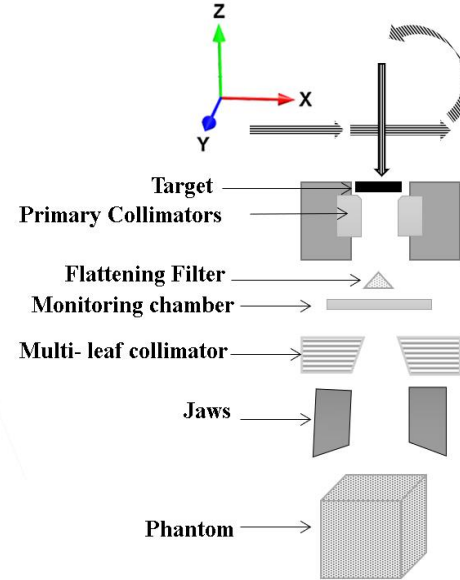
MONTE CARLO SIMULATION



LINEAR ACCELERATOR SIMULATION



a)



b)



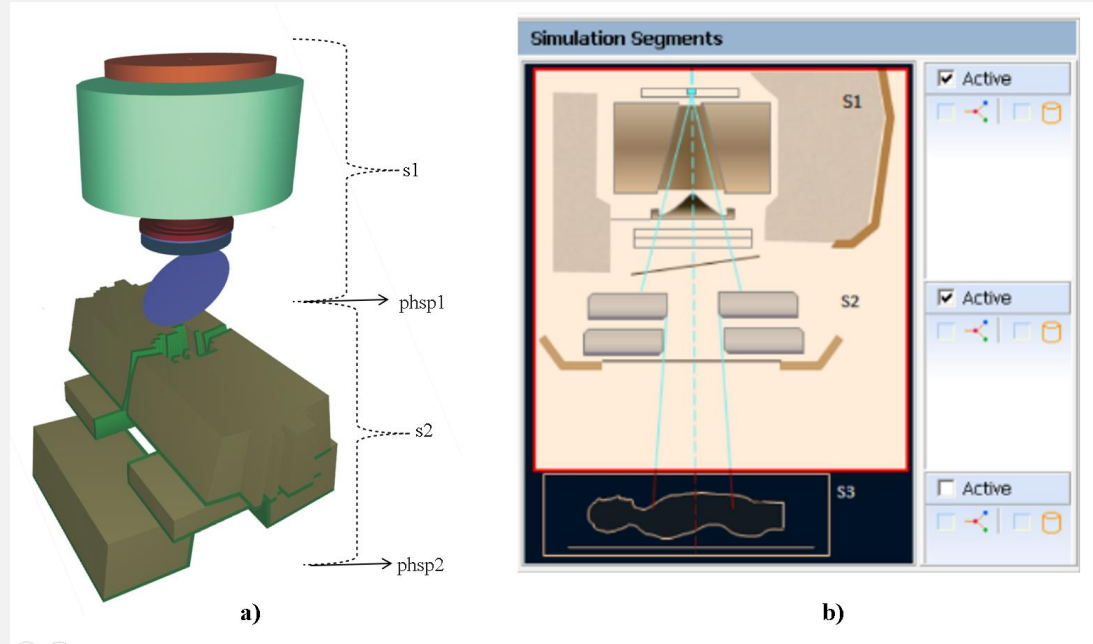
PHASE SPACE IN PRIMO

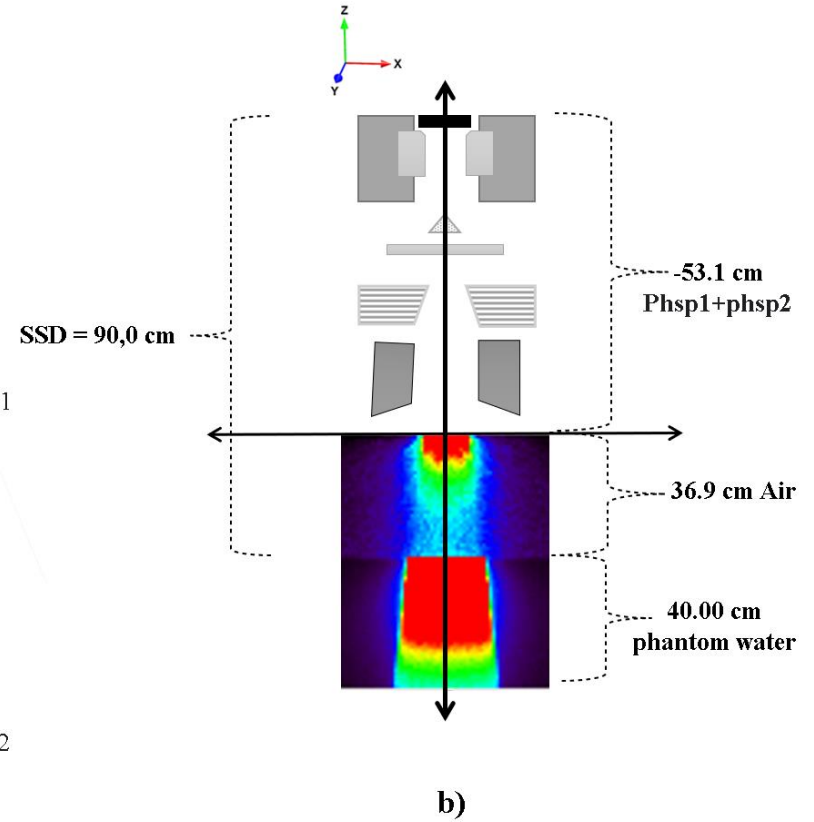
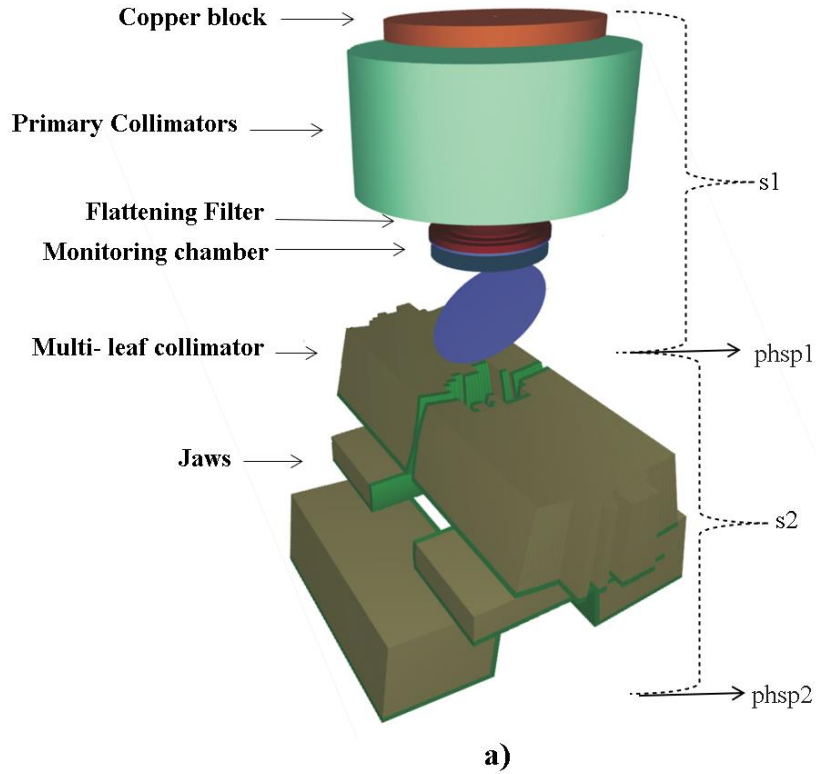


phase space contains information charge, energy, position of each particle.



beam characteristics such as energy distribution, particle fluence and energy fluence

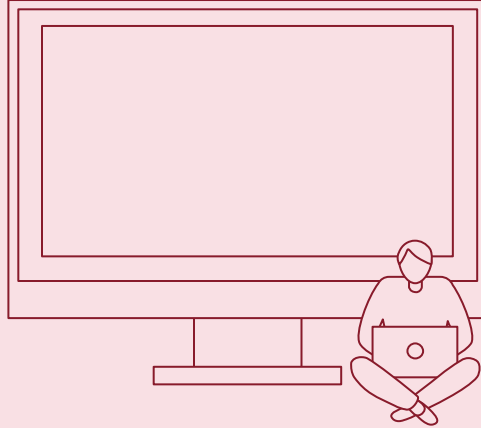


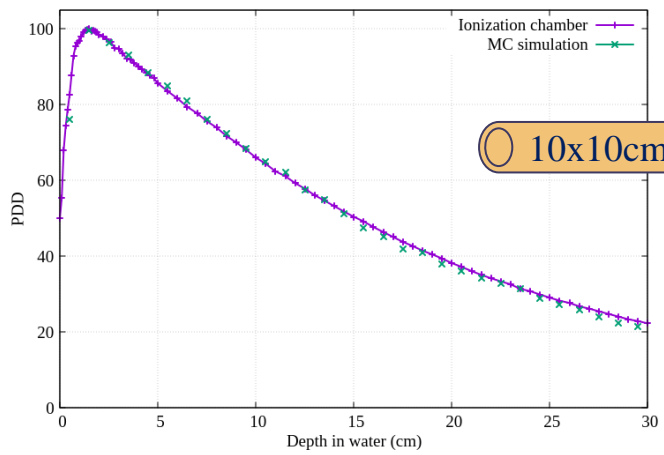
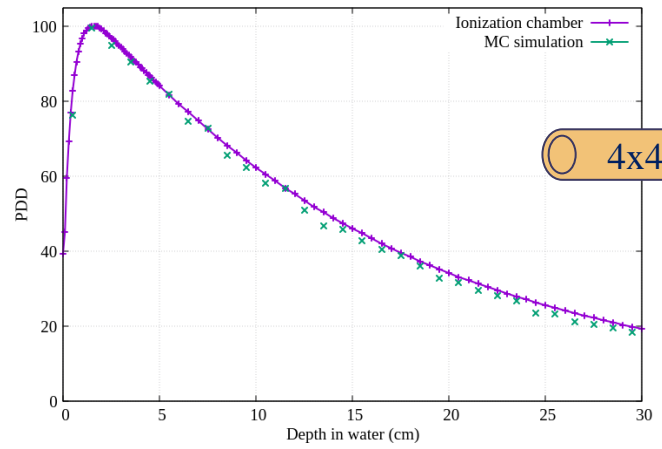
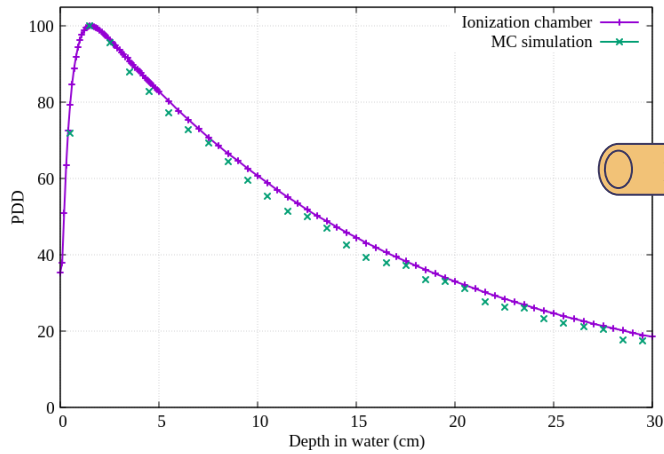


04



RESULTS

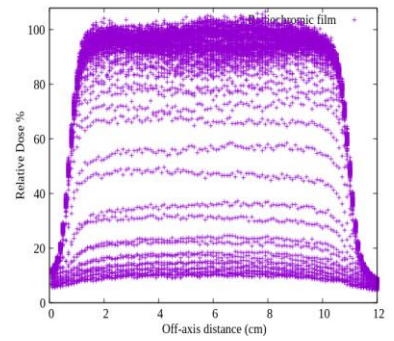
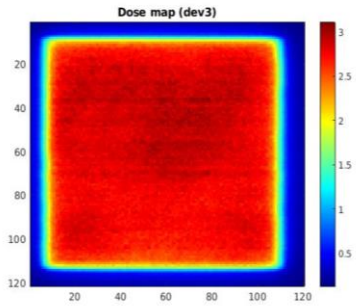
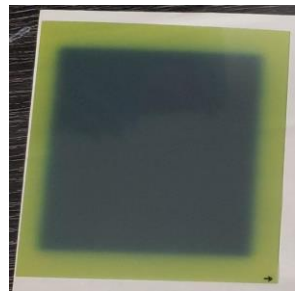




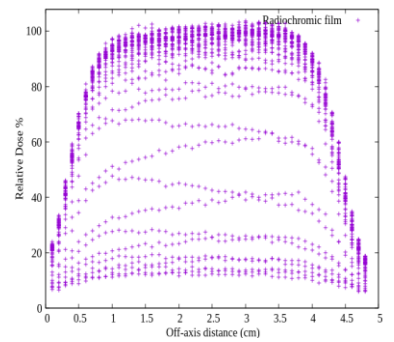
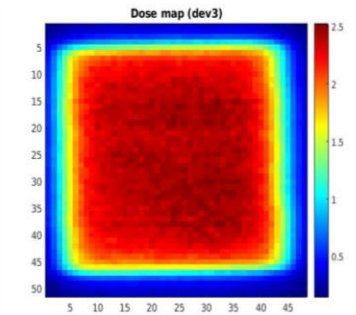
Field	PDD		
$\Delta d(p) = \frac{d_e(p) - d_c(p)}{d_e^{max}} 100$	(10 cm depth)	(20 cm depth)	(30 cm depth)
10x10	0.17%	0.66%	0.06%
4x4	0.11%	0.70%	0.03%
2x2	0.21%	0.93%	0.12%

After irradiation, radiochromic films need to be scanned and converted to dose. A multichannel is the best option, as it offers the selection of the red color channel for greater sensitivity at lower doses and the blue and green color channel for higher doses.

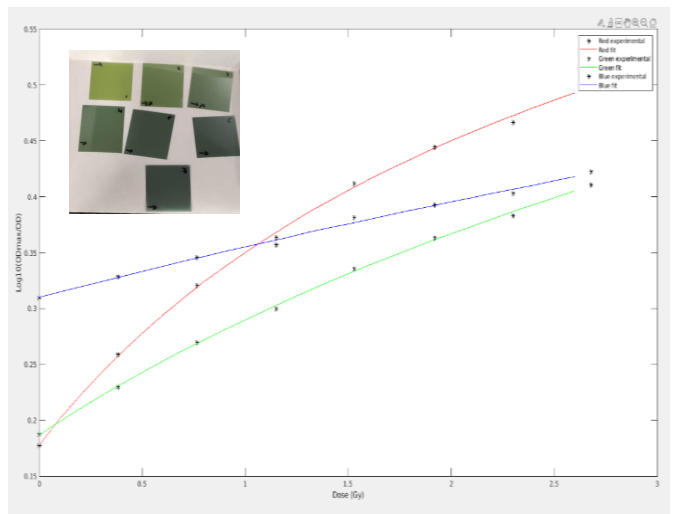
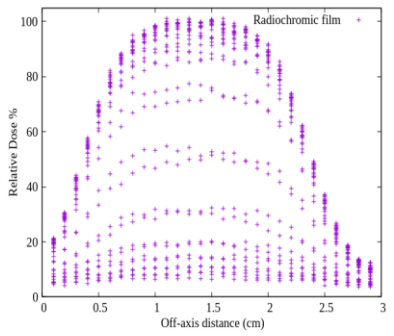
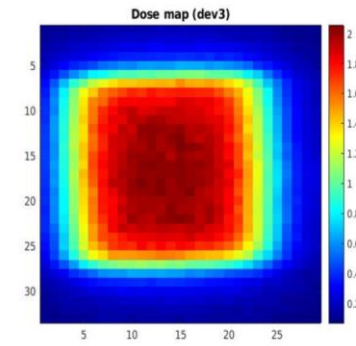
10x10cm²



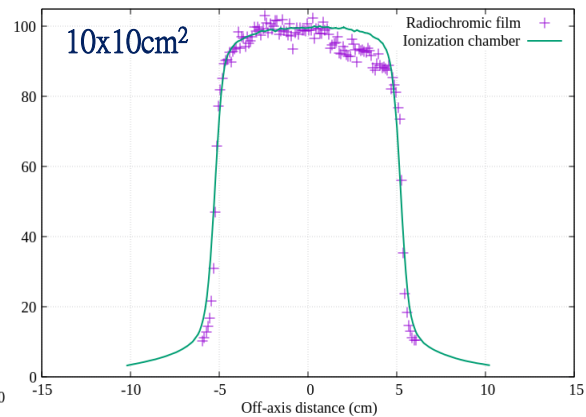
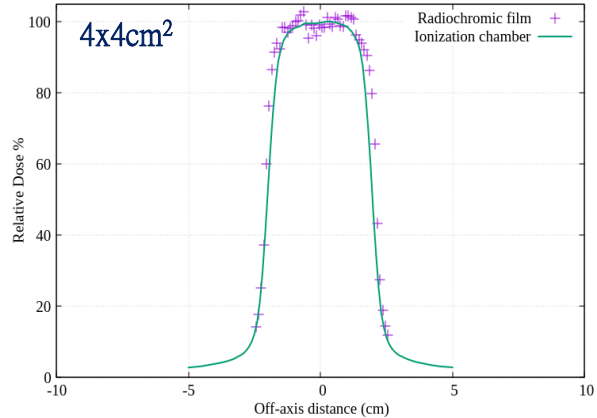
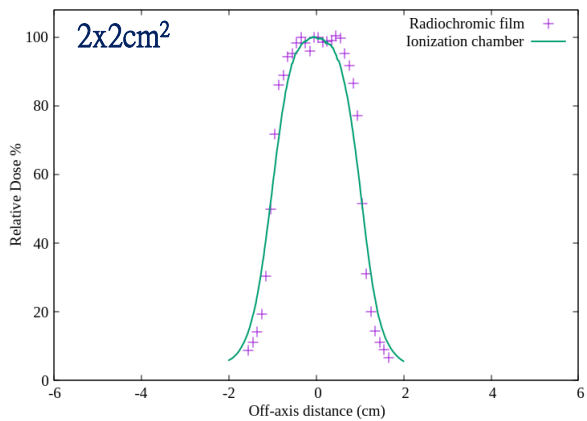
4x4cm²



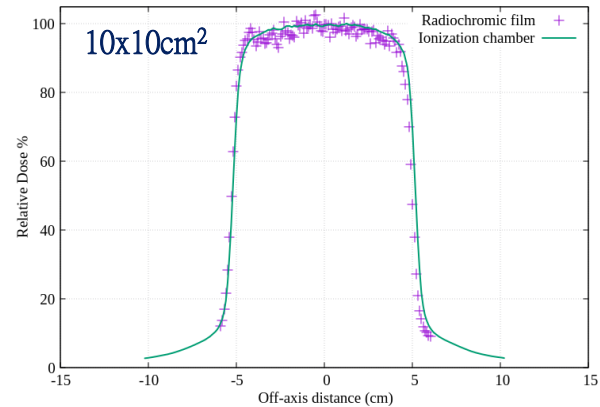
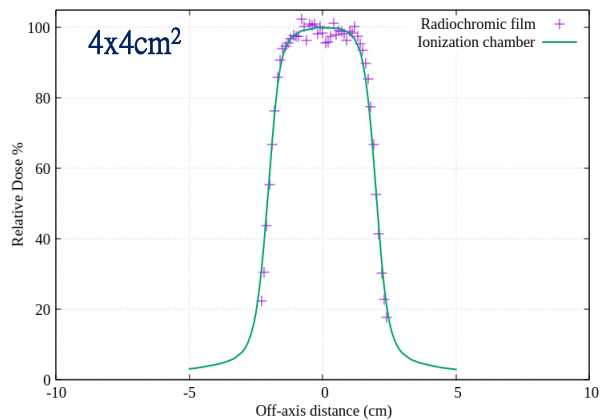
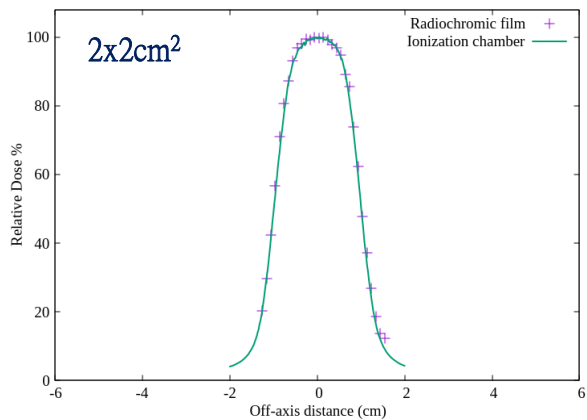
2x2cm²



Crossplane profile



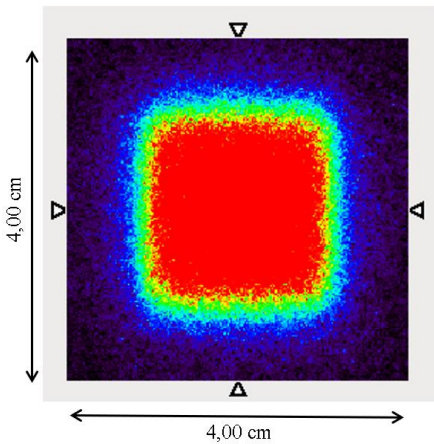
Inplane profile



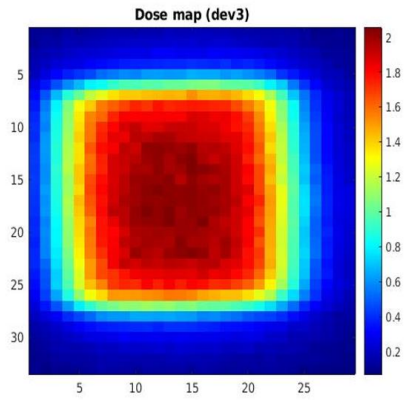
If $\gamma(r_m) > 1$ doesn't pass

If $\gamma(r_m) \leq 1$ pass

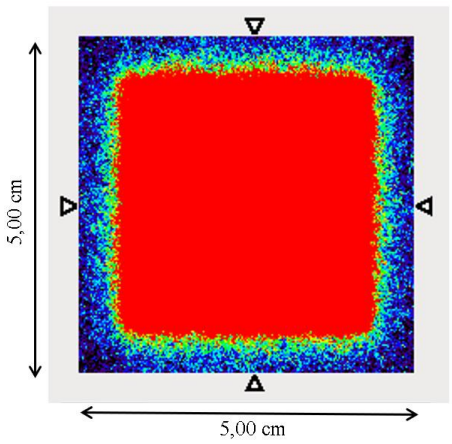
FIELD	Gamma index within the field		Gamma index in the penumbra region		Percentage of points that pass the test (3%, 3mm)	
	Inplane	Crossplane	Inplane	Crossplane	Inplane	Crossplane
MEASURE 2X2	0.33	0.37	0.54	0.64	97.6	96.3
MEASURE 4X4	0.22	0.28	0.36	0.43	97.8	96.4
MEASURE 10X10	0.21	0.24	0.26	0.35	98.7	97.9



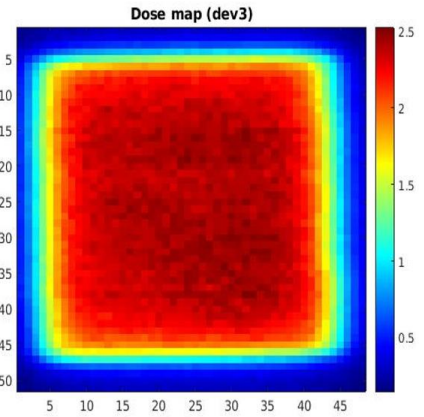
a)



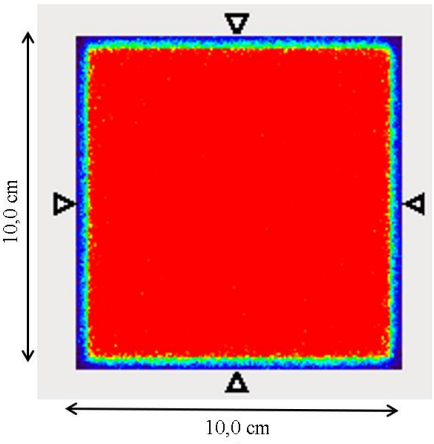
b)



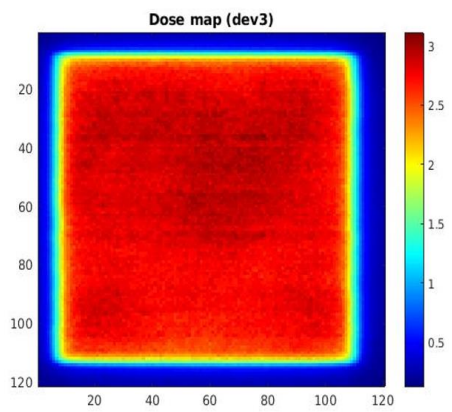
a)



b)



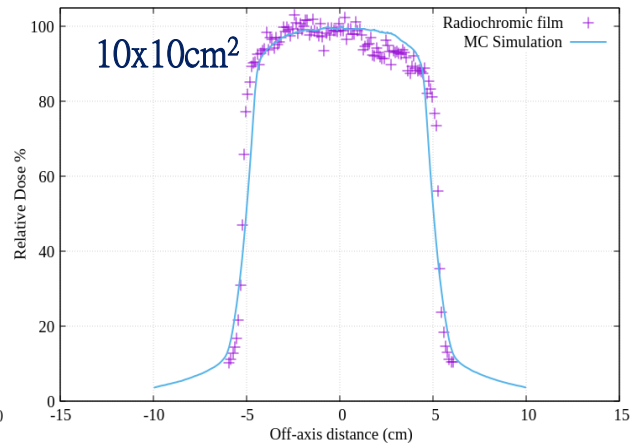
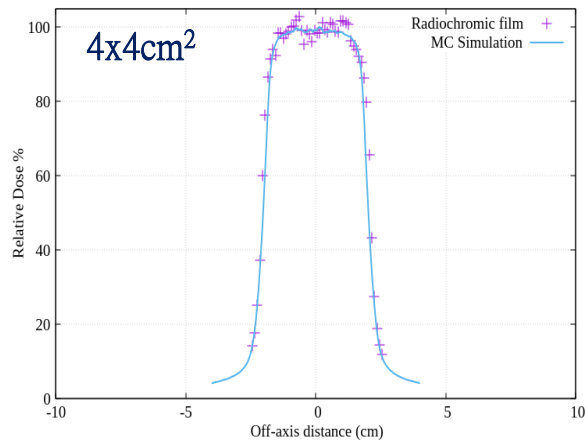
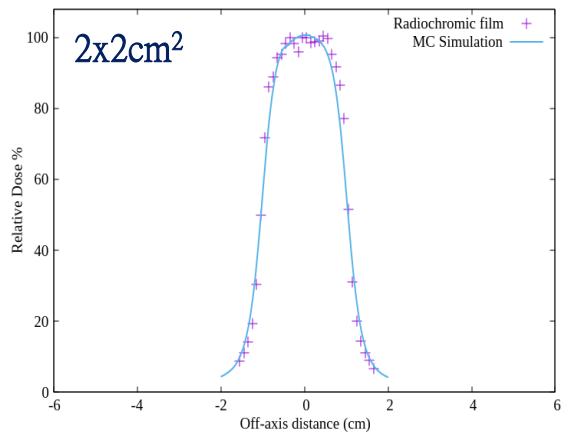
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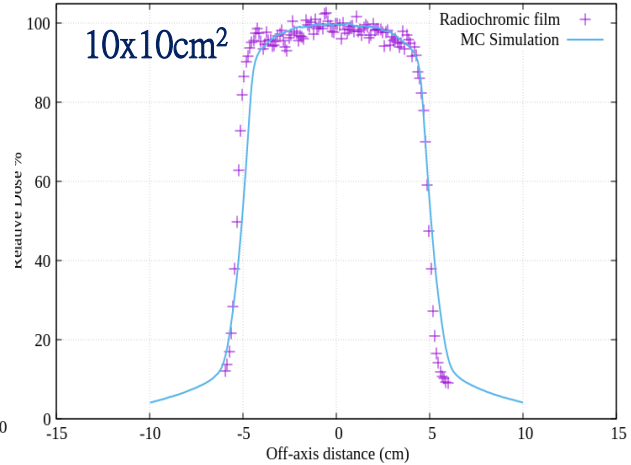
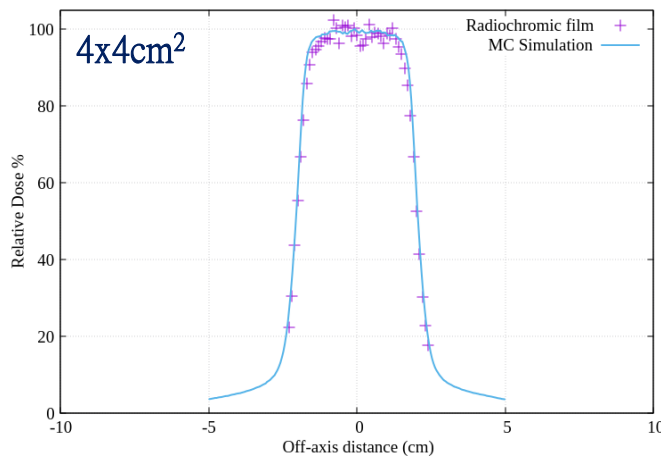
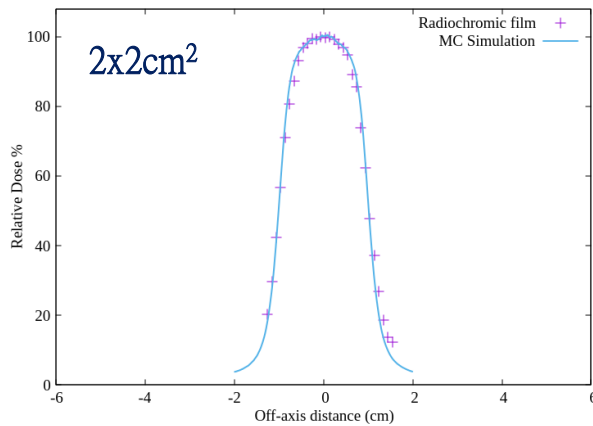
b)



Crossplane profile



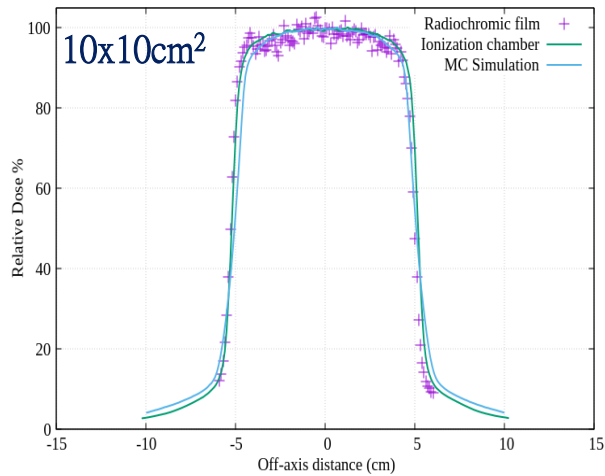
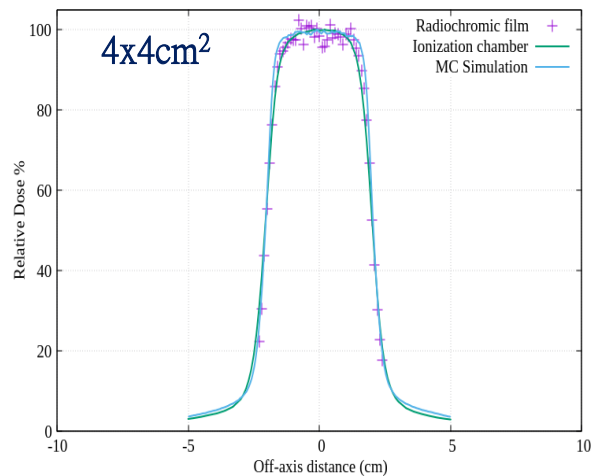
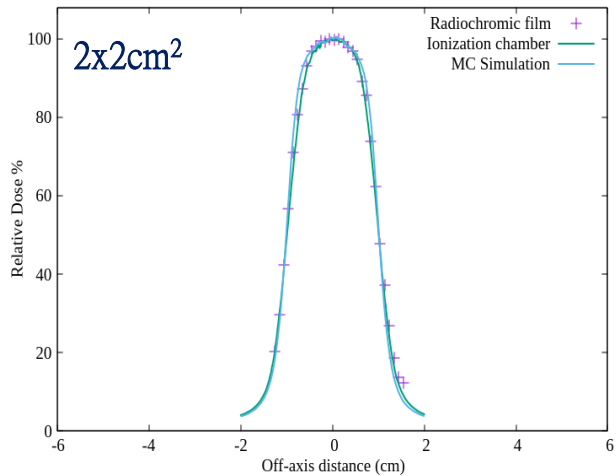
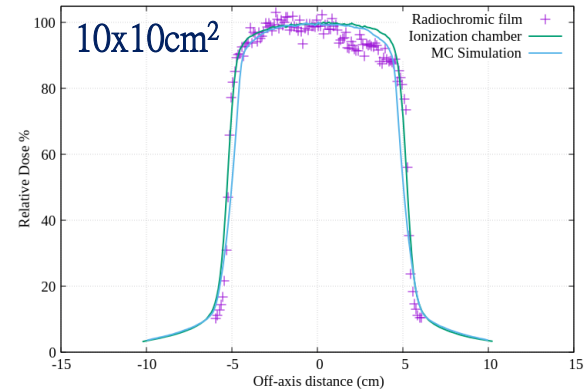
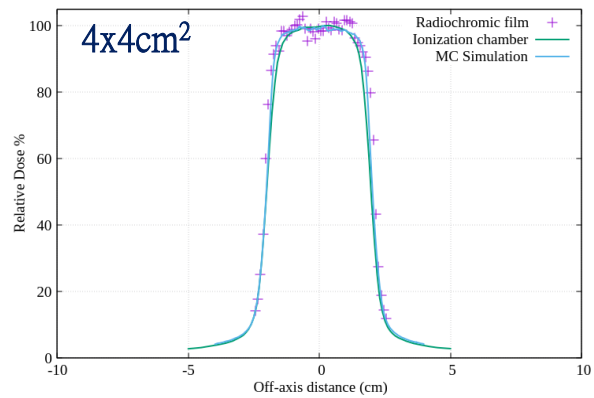
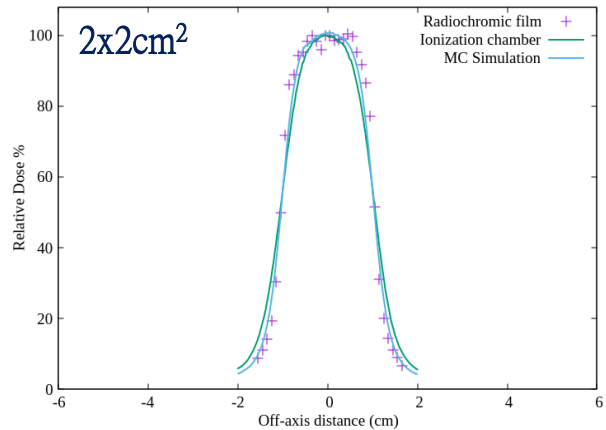
Inplane profile



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THANKS



Do you have any questions?

