

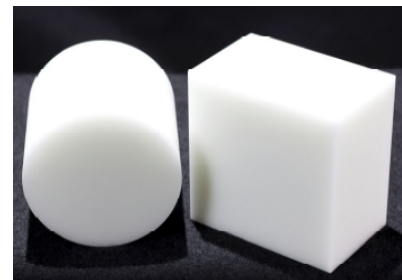


Reunion hebdomadaire IMNC/SHFJ

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Validation of the Optical Module using a Reference Optical Phantom

Available at IMNC



(National Optics Institute)

Preliminary benchmark

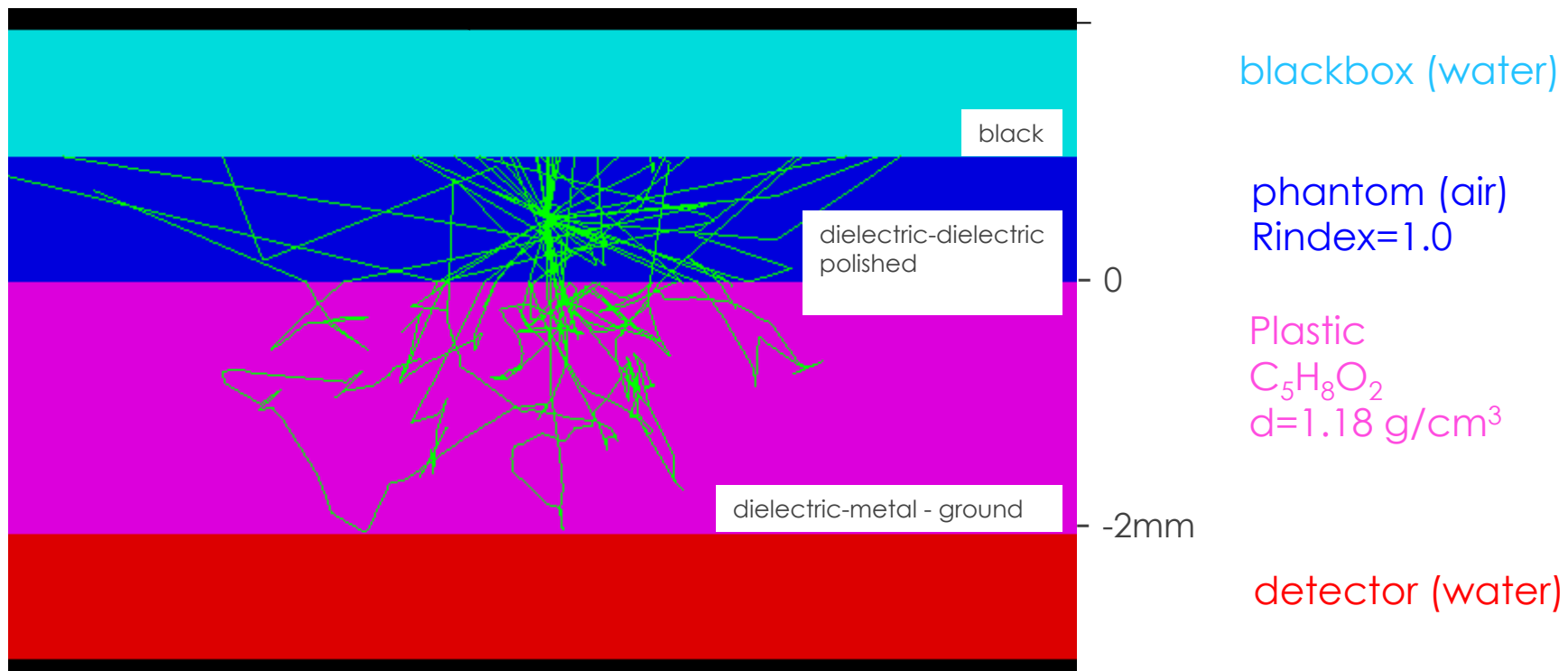
(was discussed last week at IMNC)

Biomimic phantom characterization:

RINDEX = 1.521 and anisotropie = 0.62

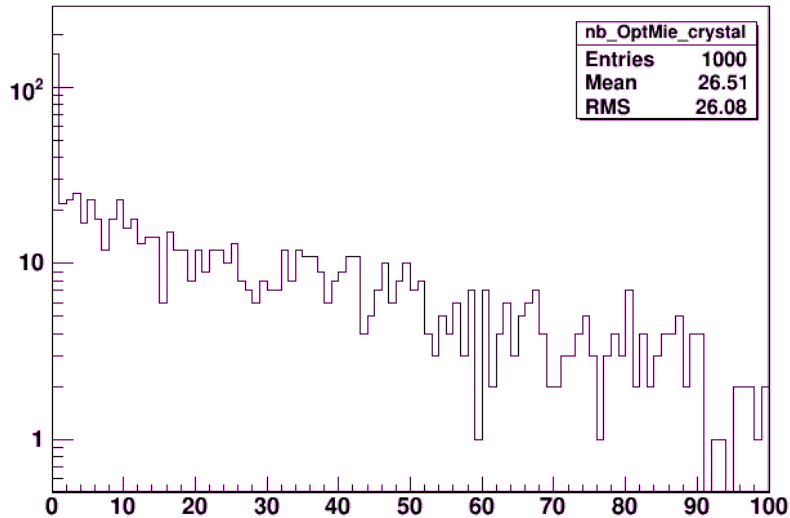
$\lambda = 530 \text{ nm}$ ($E_\gamma = 2.34 \text{ eV}$) $L_A = 0.847 \text{ cm}$ $L_S = 0.0113 \text{ cm}$

$\lambda = 630 \text{ nm}$ ($E_\gamma = 1.97 \text{ eV}$) $L_A = 0.926 \text{ cm}$ $L_S = 0.0104 \text{ cm}$

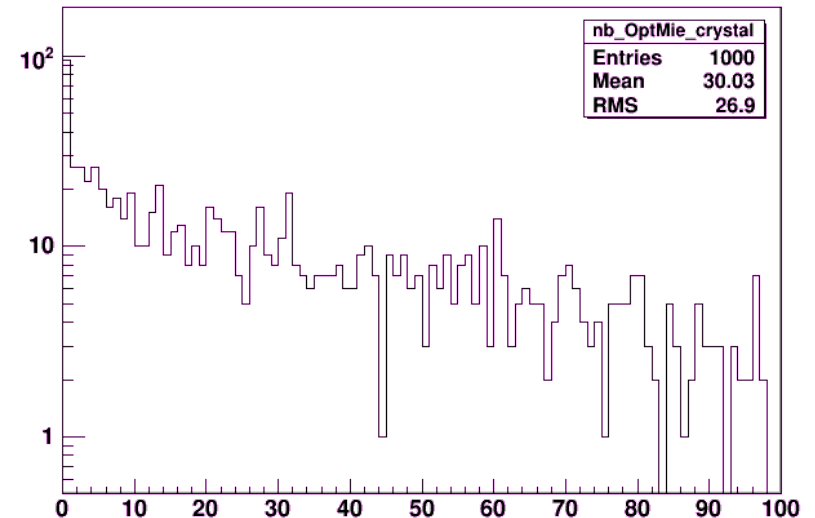


« Very » Preliminary Results

Number of Mie scatter (530nm)



Number of Mie scatter (630nm)



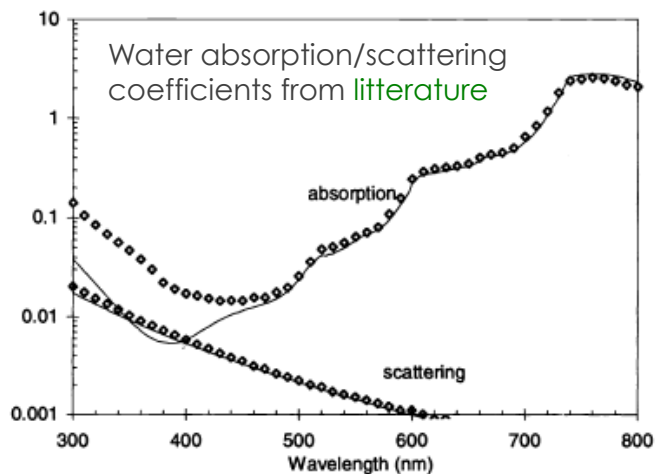
	Optical photon wavelength	Number of generated optical photons	Number of detected photons
plastic	530 nm	1000	498
plastic	630 nm	1000	487

Some information are *still needed* from vendor:

- *chemical formula of the biomimic phantom*

Next Step

- * Update previous table with more basic materials (Water, Blood...)
 - * Inputs: density, chemical formula, Absorption/Scattering lengths, material anisotropy, Reflectivity...



Sphere diameter	<input type="text"/>	microns
Wavelength in Vacuum	<input type="text"/>	microns
Index of Refraction in Medium	<input type="text"/>	
Real Index of Sphere	<input type="text"/>	
Imag Index of Refraction (negative!)	<input type="text"/>	
Number of angles	<input type="text"/>	
Concentration	<input type="text"/>	spheres per cubic micron
<input type="button" value="Calculate"/>		

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Mie Scattering calculator
(by Prahl)

Water molecule diameter
0.000275 μm
Hemoglobin diameter
0.0055 μm

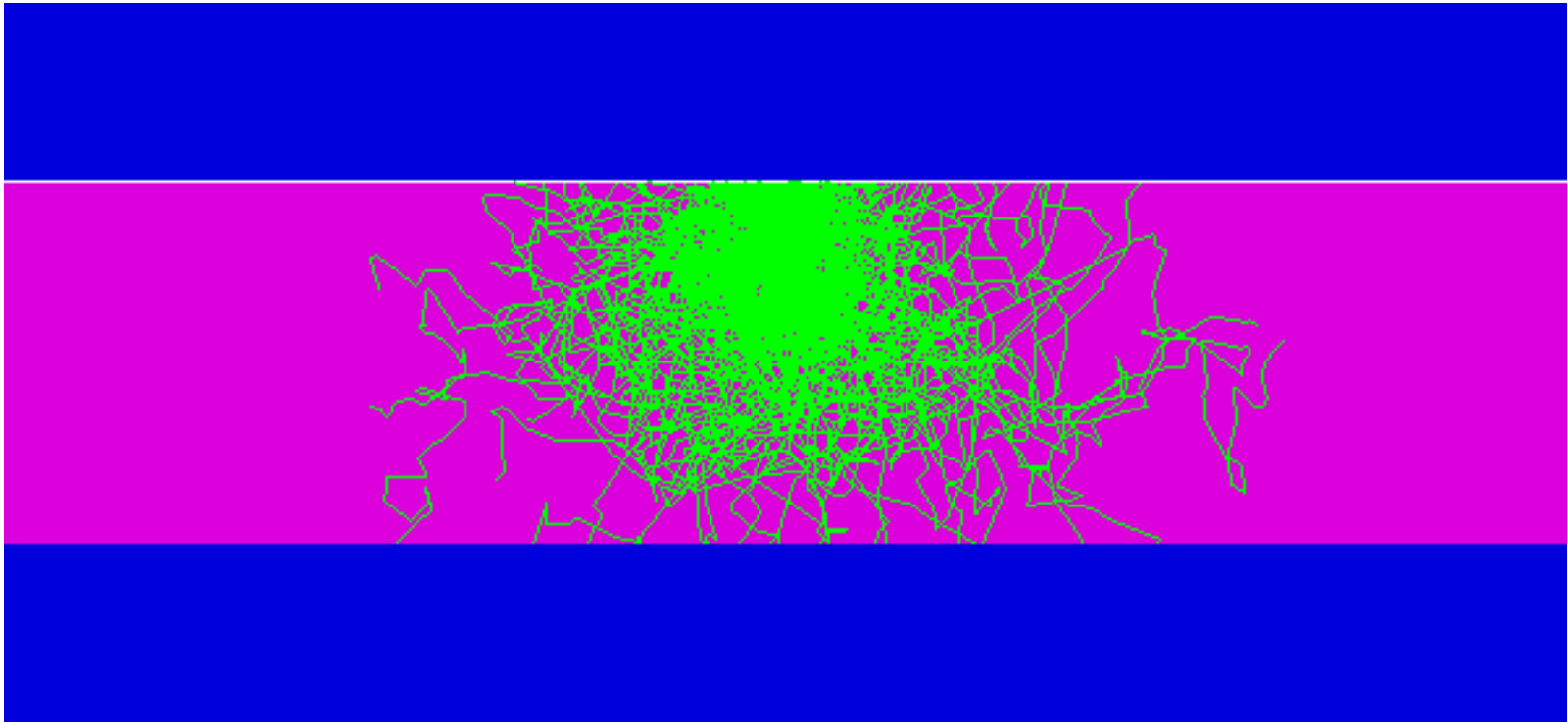
- * Update output Root file with Boundary status and scattering angle.

- 1: Fresnel refraction
- 2: Fresnel reflection
- 3: Total internal reflection
- 4: Lambertian reflection
- 5: Lobe reflection
- 6: Spike reflection
- 7: Backscattering
- 8: Absorption

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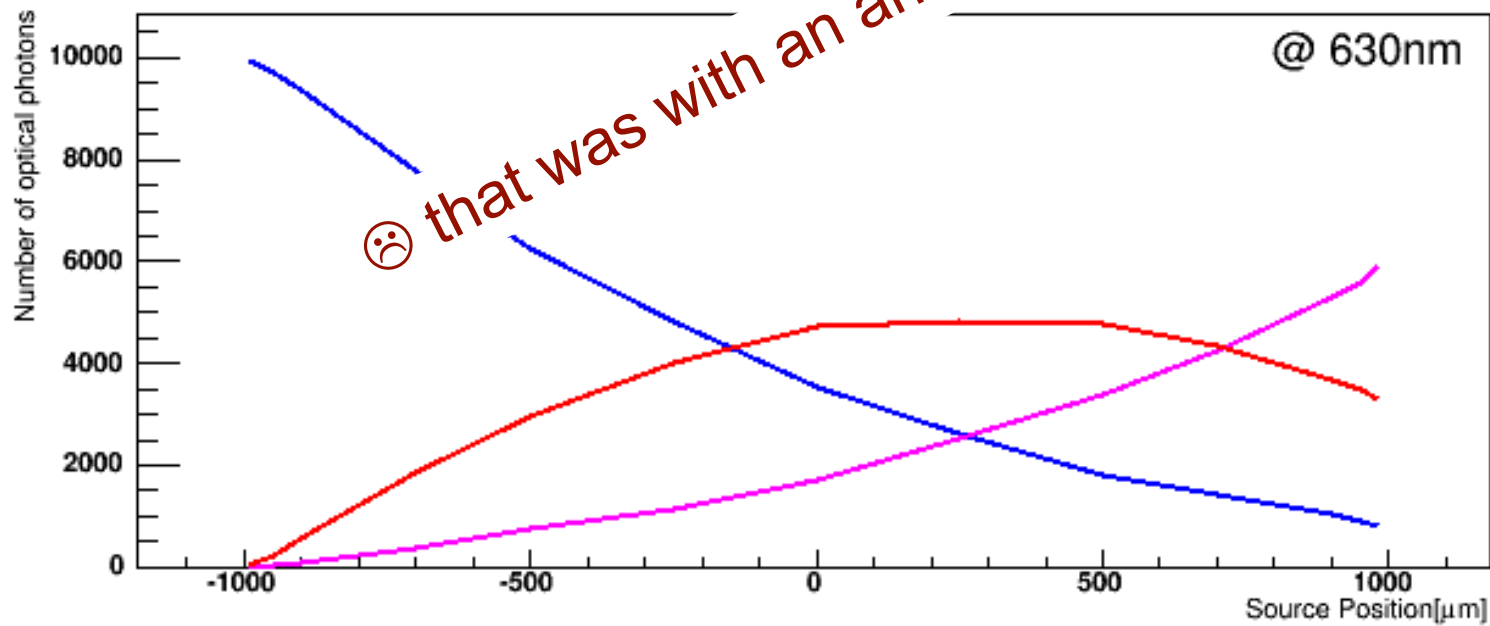
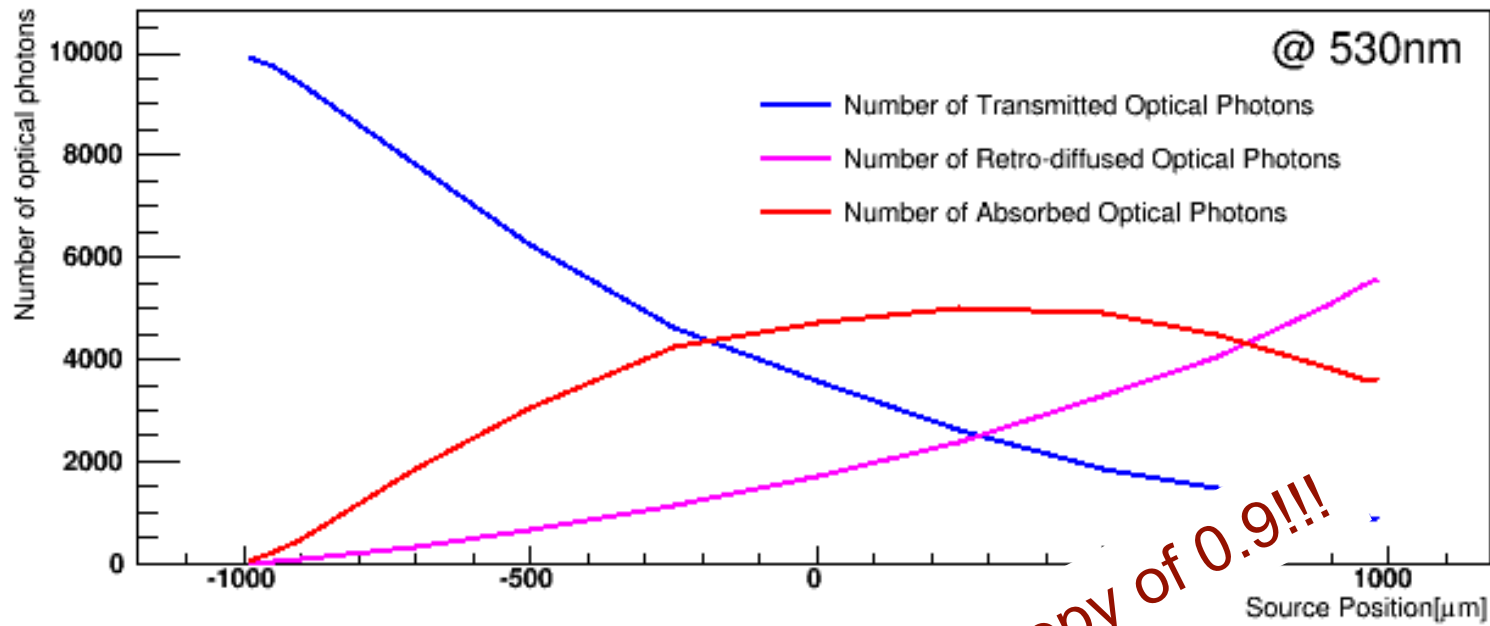
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Common IMNC/SHFJ benchmark



Source position (μm)	Transmitted		Retro-Diffused		Absorbed	
	530nm	630nm	530nm	630nm	530nm	630nm
990	8.53%	8.08%	56.98%	59.52%	34.49%	32.40%
980	8.53%	8.09%	55.94%	59.11%	35.53%	32.79%
950	9.24%	8.89%	54.33%	56.08%	36.43%	35.03%
900	10.51%	10.22%	51.11%	53.00%	38.38%	36.78%
700	14.80%	14.12%	40.39%	42.57%	44.81%	43.31%
500	18.36%	17.99%	32.65%	34.12%	48.99%	47.96%
250	26.31%	26.40%	23.75%	24.12%	49.94%	48.48%
0	35.55%	35.30%	17.36%	17.36%	47.32%	47.34%
-250	46.48%	46.70%	11.18%	11.55%	42.33%	40.30%
-500	62.22%	62.70%	6.60%	7.51%	30.67%	29.79%
-700	77.22%	77.83%	3.40%	3.66%	18.38%	18.51%
-900	94.25%	93.49%	0.87%	1.02%	4.88%	5.49%
-950	97.19%	97.21%	0.28%	0.47%	2.53%	2.32%
-980	99.02%	98.97%	0.09%	0.12%	0.89%	0.91%
-990	99.37%	99.48%	0.06%	0.08%	0.57%	0.44%

☹️ that was with an anisotropy of 0.9!!!



☹ that was with an anisotropy of 0.9!!!

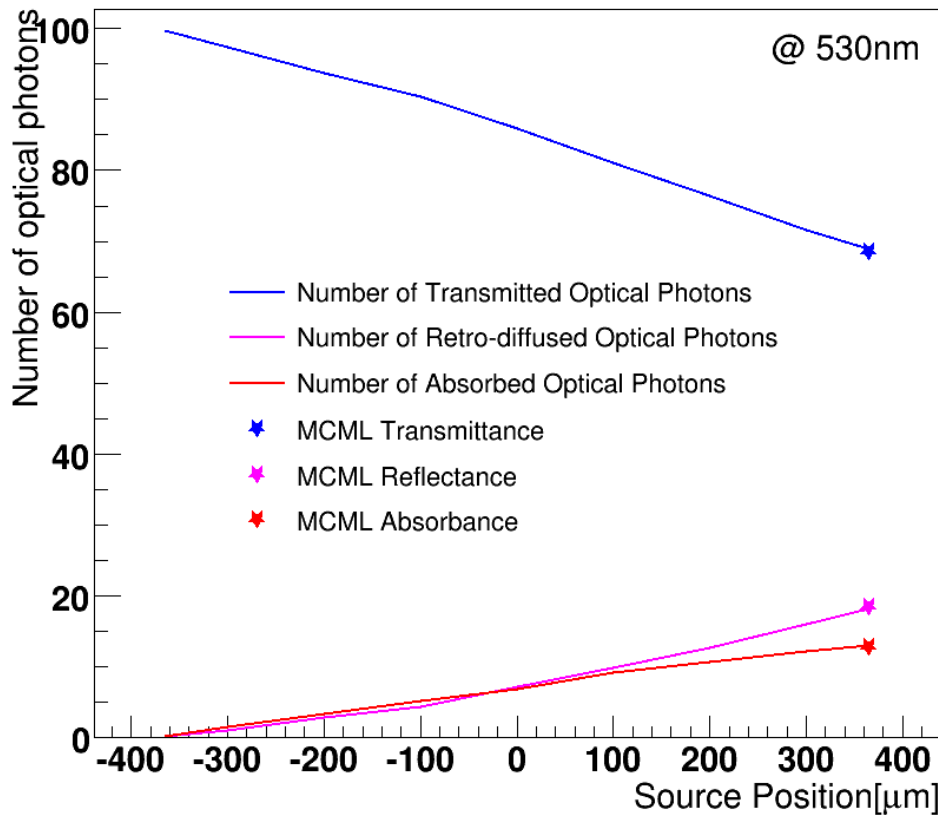
CPU time

Number of Events	Gate CPU time (s)
1000	2.82
3000	8.31
5000	14.50
10000	28.10

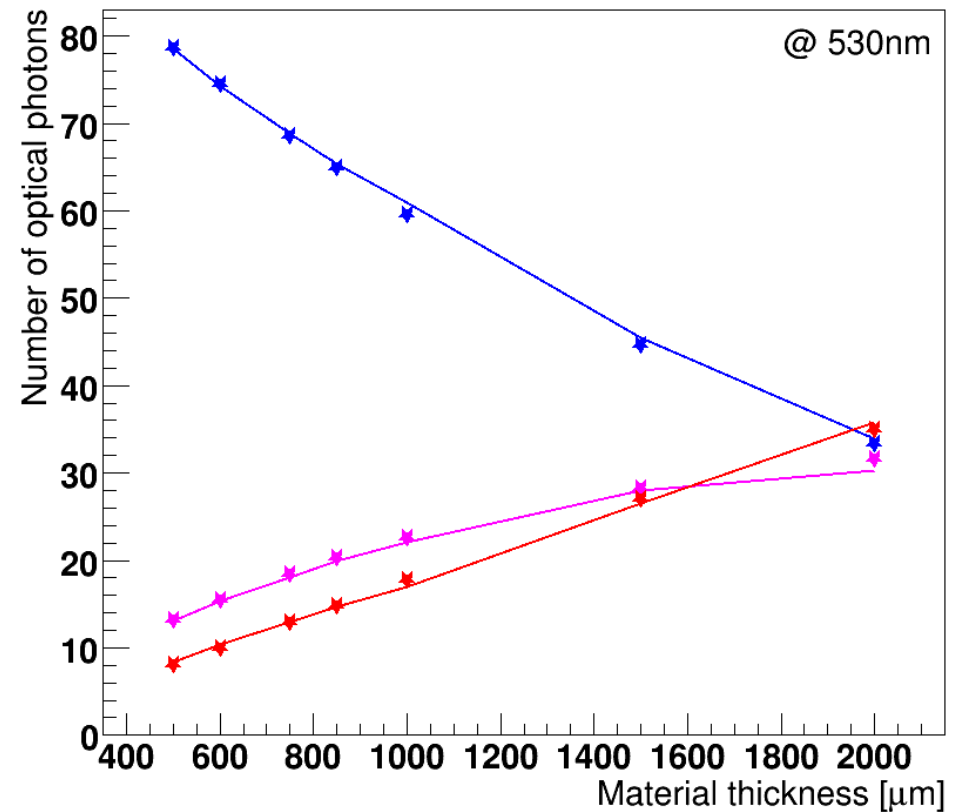
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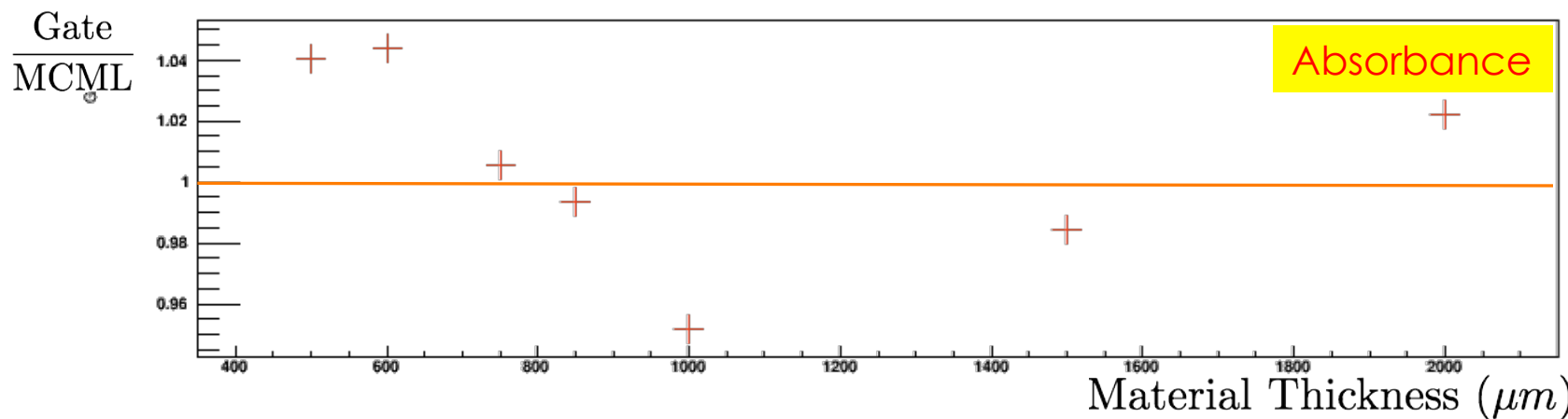
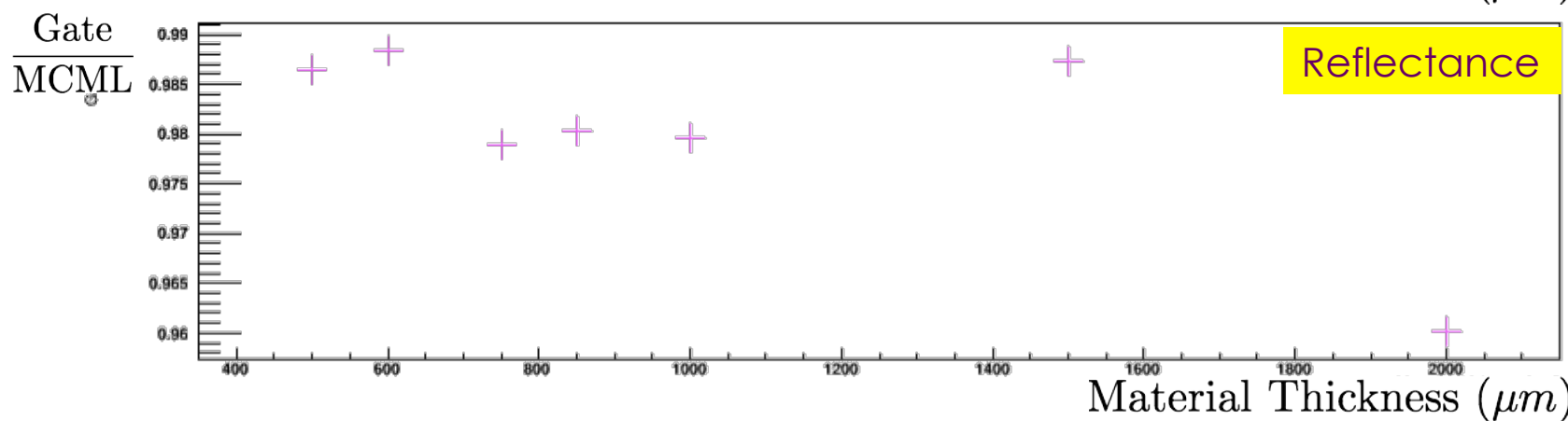
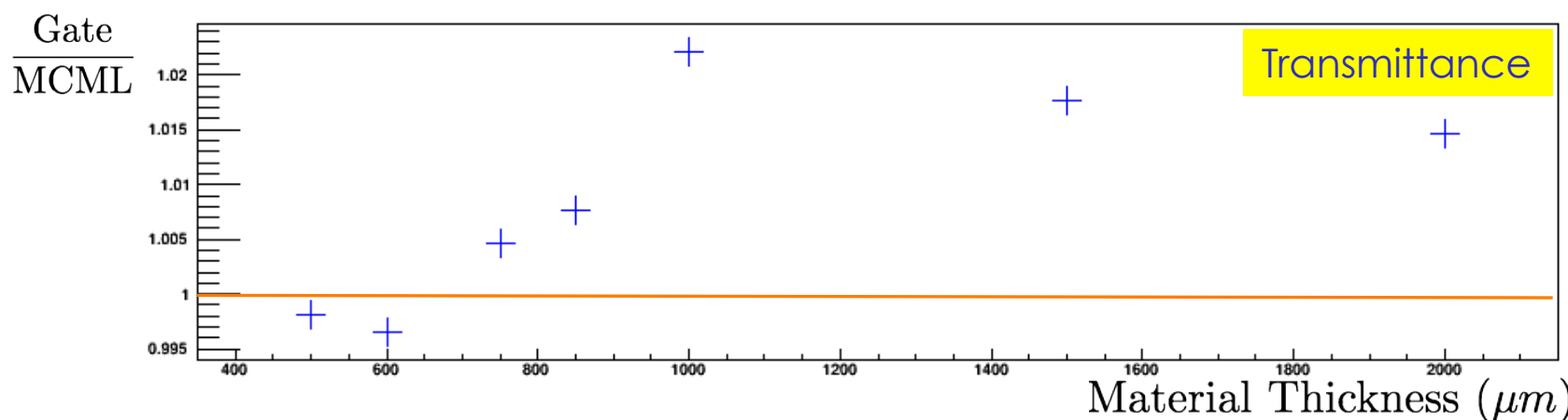
Comparison Gate/MCML



Phantom thickness set to $750\mu\text{m}$.
We vary the source position.



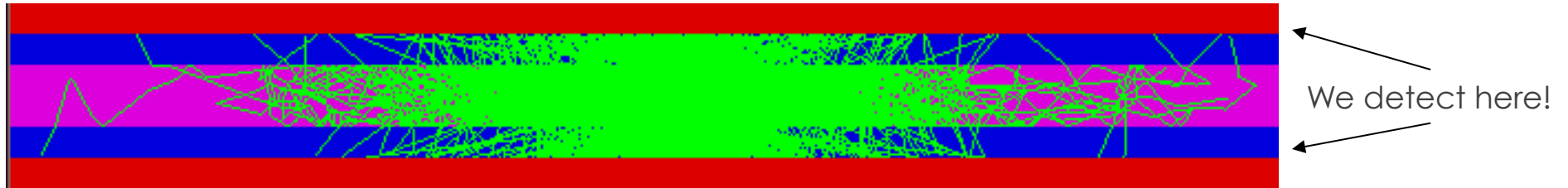
Photon source at $-10\mu\text{m}$ from the
phantom surface.
We vary the phantom thickness.



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Comparison Gate/MCML WITH SURFACE EFFECTS



Surface between the Biomimic phantom and Air is not defined == default smooth surface.

	Gate	MCML
Transmittance (%)	45.1	44
Reflectance (%)	22.9	22.8
Absorbance (%)	32	33.2