X-ARAPUCA simulation dimple simulations with dichroic transmittance measured on water.

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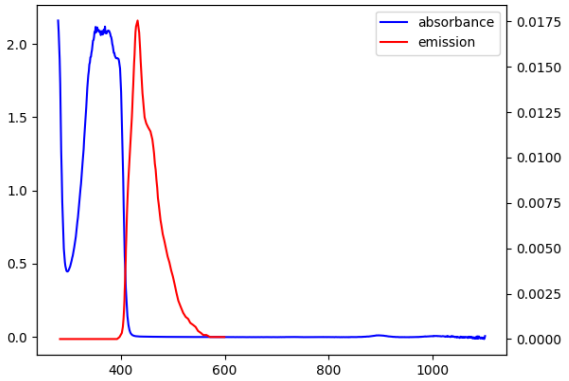
Updates of the group

- New dichroic data measured on water (ZAOT MAY 2022 and OPTO).
- Corrected distance WLS to dichroic filters (now 6.88 mm).
- Changed SiPM thin sides to absorb all photons.

Simulation details - Single Sided

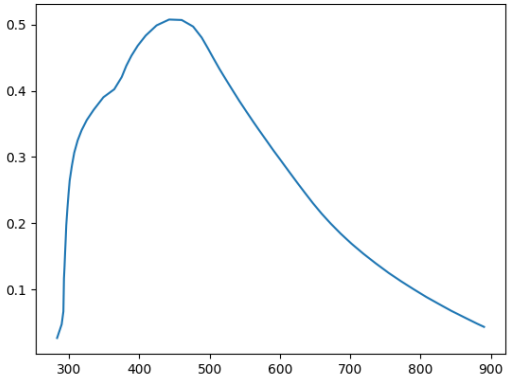
- The pTP layer absorbs and re-emits (by emission spectra) 47.5% of the photons in the direction of the dichroic filters.
- Dichroic filter transmittance of NEW ZAOT filters - experimental data (fitted).
- WSL absorbance and emission spectra by experimental data.
- Refraction index L. Ar. 1.24; WLS 1.5; critical angle - 56º.
- WSL non ideality included as 1% chance that the photon "tunnels" through.
- Inner X-ARAPUCA walls 98% reflectivity (do not change wavelength).
- SiPM detection efficiency spectrum by Hamamatsu data sheet.
- Supercell 6x1 (77mm x 100mm).
- Small distance WLS - SiPM: 0.1 mm (for flat dimple).
- No interactions with L. Ar. inside the X-Arapuca.

Emission / Zeroed WSL absorbance



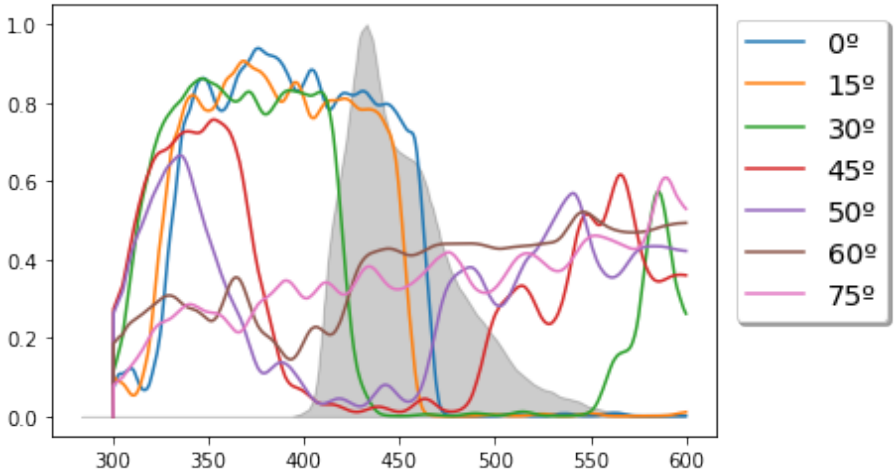
We determined $\epsilon c = A_0/l_0$ using the experimental data A_0 (assuming $l_0 = 4\text{mm}$) an reconstructed for any distance using Beer-Lambert Law $T = 10^{-A} = 10^{-\epsilon c l}$.

SiPM detection efficiency



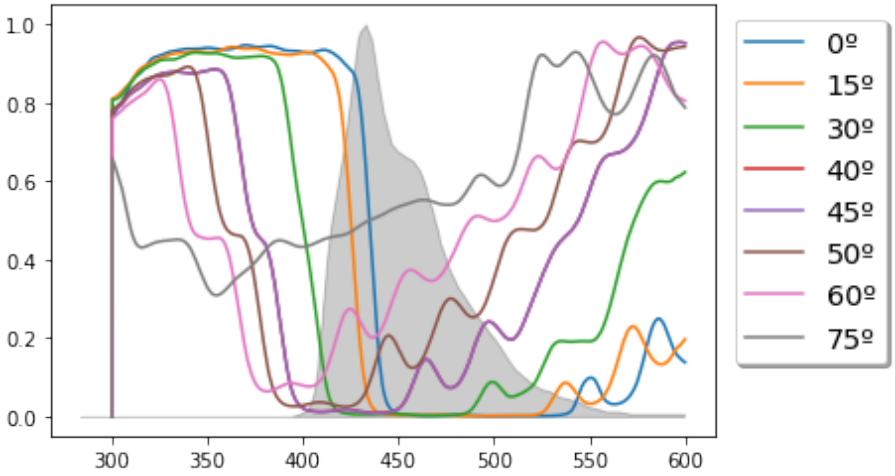
Data from Hamamatsu S13360 (Data sheet).

OPTO measurements on Water(CARLA CATTADORI)



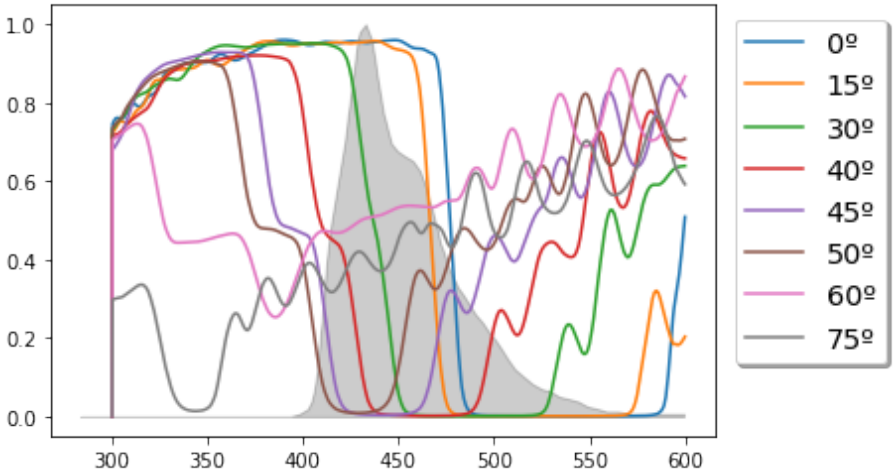
The gray area shows WLS emission (rescaled).

ZAOT MAY 2022 measurements on Water(CARLA CATTADORI)



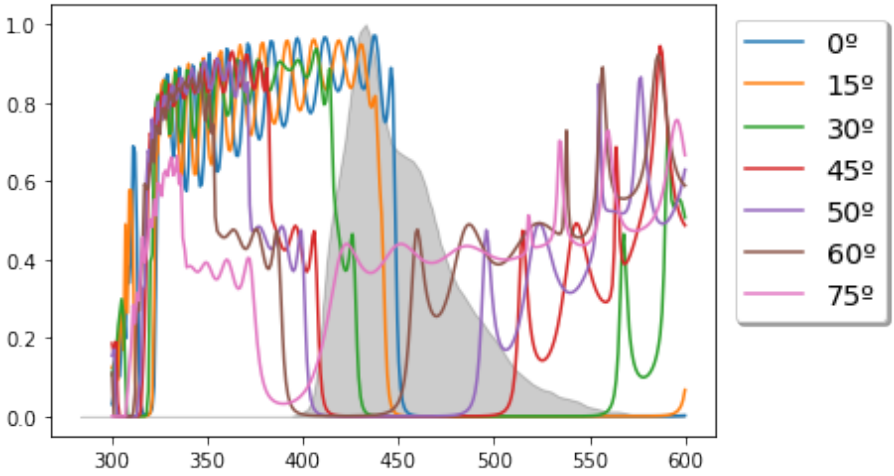
The gray area shows WLS emission (rescaled).

ZAOT NOV 2022 measurements on Water(CARLA CATTADORI)



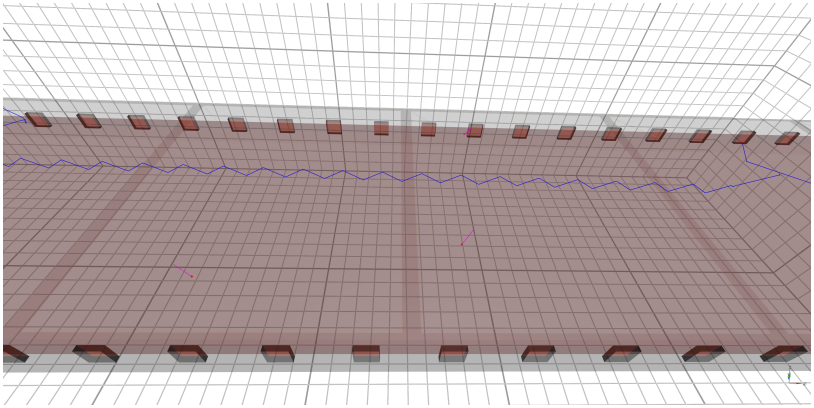
The gray area shows WLS emission (rescaled).

ZAOT DEZ 2022 simulation on Water(CARLA CATTADORI)

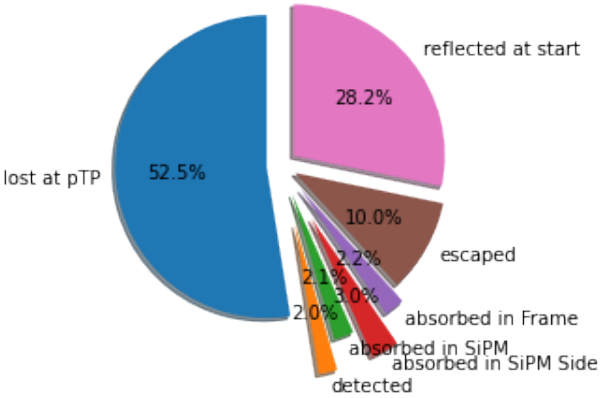


The gray area shows WLS emission (rescaled).

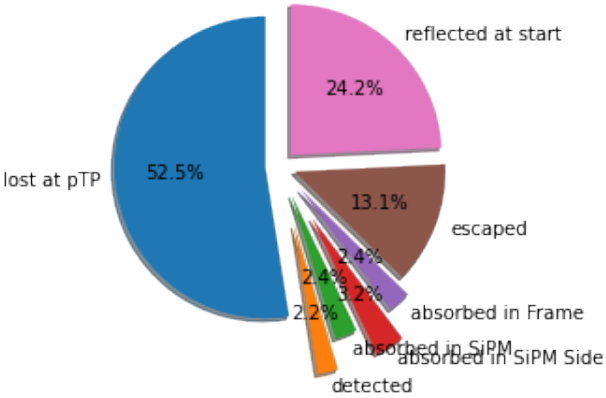
X-ARAPUCA control case (no roughness, no dimple, 48 SiPMs, 77 x 100).



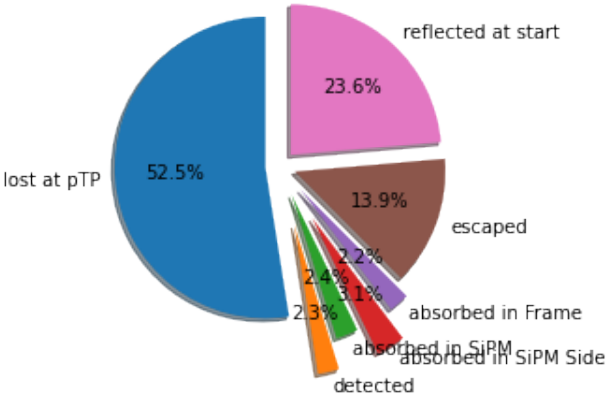
X-ARAPUCA control case (no roughness, no dimple, 48 SiPMs, 77 x 100). OPTO WATER 2022 filters. Pie chart.



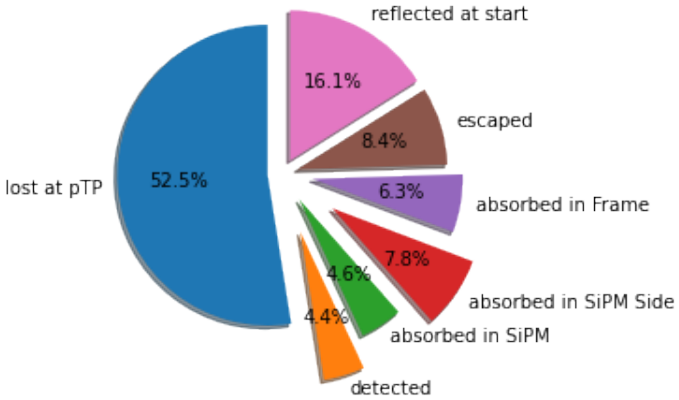
X-ARAPUCA control case (no roughness, no dimple, 48 SiPMs, 77 x 100). ZAOT MAY 2022 filters. Pie chart.



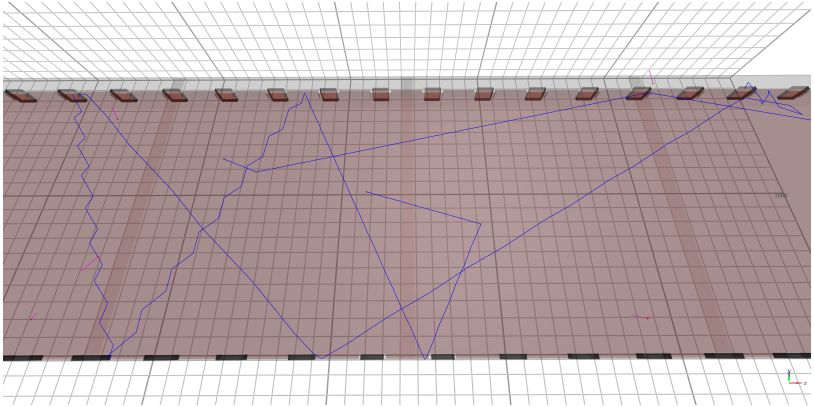
X-ARAPUCA control case (no roughness, no dimple, 48 SiPMs, 77 x 100). ZAOT NOV 2022 filters. Pie chart.



X-ARAPUCA control case (no roughness, no dimple, 48 SiPMs, 77 x 100). ZAOT DEZ 2022 filters. Pie chart.

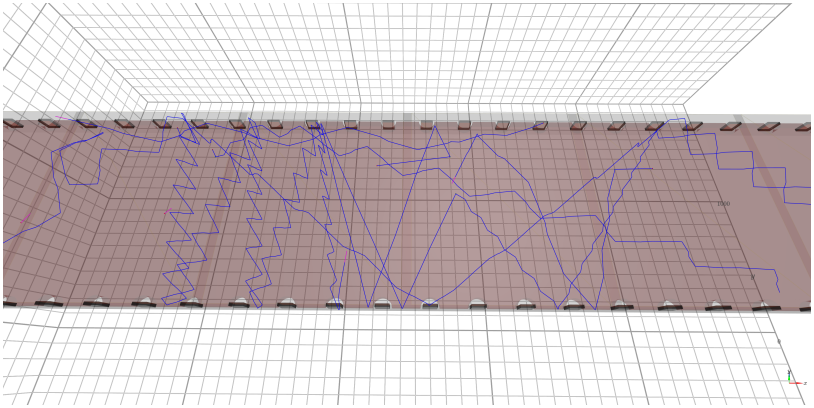


X-ARAPUCA square dimples (no roughness, 1.2mm depth, 80mm width, 48 SiPMs, 77 x 100).



X-ARAPUCA cylindrical dimples (no roughness, 4mm radius, 48 SiPMs, 77 x 100).

Click the image to see the model



Efficiency table 1. X-ARAPUCA (48 SiPMs, 77 x 100).

	OPTO filters	ZAOT MAY	ZAOT NOV	ZAOT DEZ
No dimple	2.0%	2.2%	2.3%	4.4%
Square dimple	2.1%	2.4%	2.4%	4.3%
Cylindrical dimple	2.2%	2.5%	2.6%	4.8%