

Efficiency comparison for Arapuca-Açu sizes.

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Overview

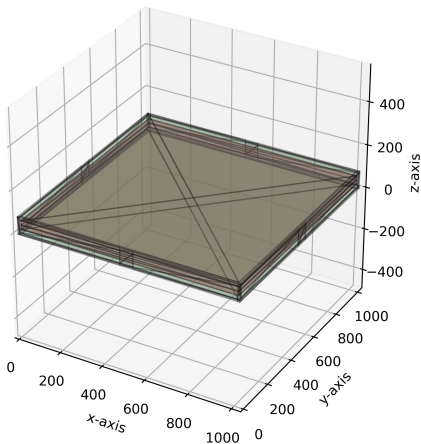
Arapuca-Açu sizes and efficiencies

Photon path distribution

The setting

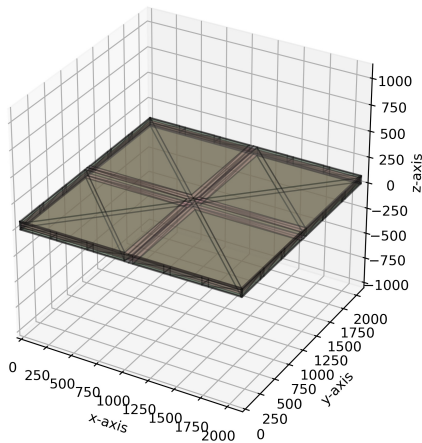
- ▶ The Dichroic Filter are counted in pairs (top and bottom).
- ▶ Each Dichroic Filter is $10\text{cm} \times 10\text{cm}$.
- ▶ There is a 4mm thick light-guide spanning the whole internal area.
- ▶ There are SiPMs only on the external lateral walls. There are 4 SiPMs per Filter, evenly distributed.

Single Filter with 4 SiPMs.



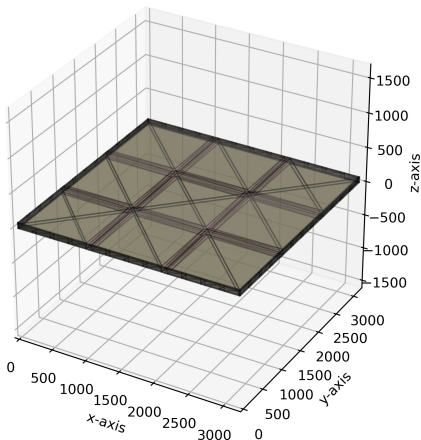
Efficiency: 18,92%

4 Filters with 16 SiPMs.



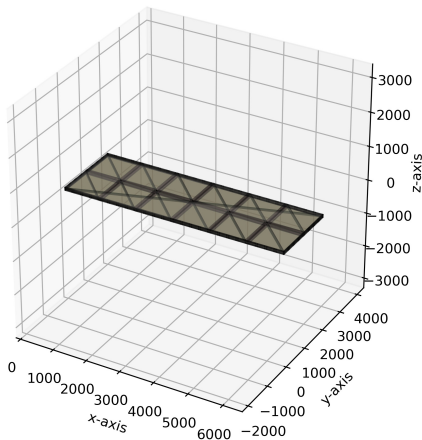
Efficiency: 31,24%

9 Filters with 36 SiPMs.



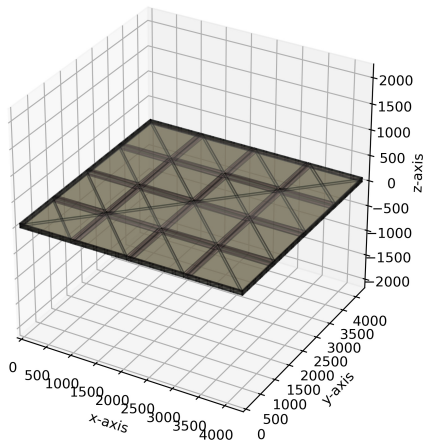
Efficiency: 28,29%

12 Filters with 48 SiPMs.



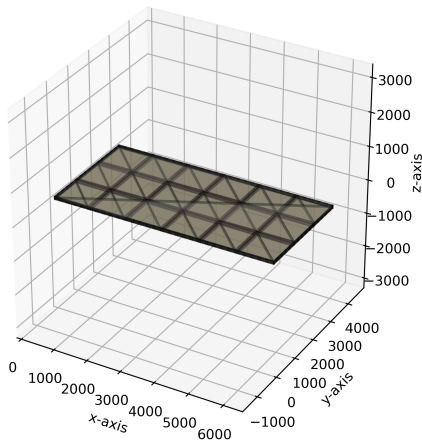
Efficiency: 27,9%

16 Filters with 64 SiPMs.



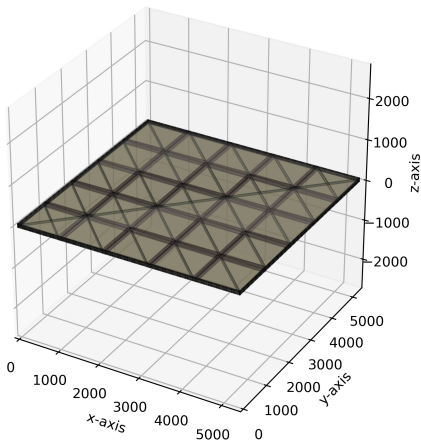
Efficiency: 31,5%

18 Filters with 72 SiPMs.



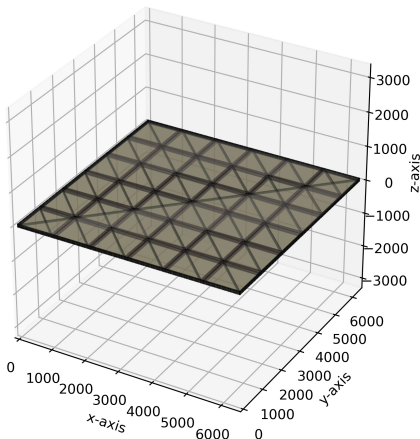
Efficiency: 31,24%

25 Filters with 100 SiPMs.



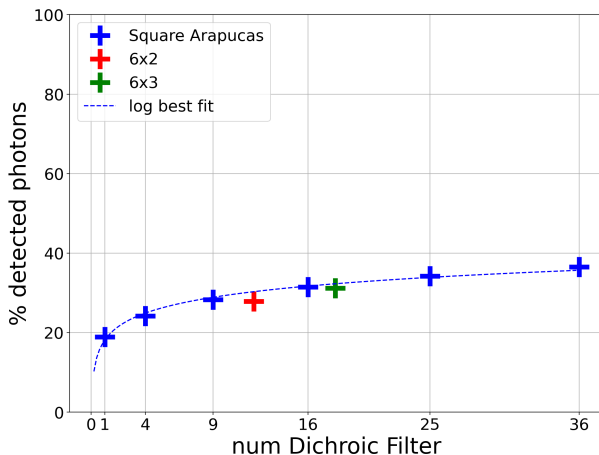
Efficiency: 34,25%

36 Filters with 144 SiPMs.



Efficiency: 36,51%

Efficiency per number of filters on each Arapuca-açu

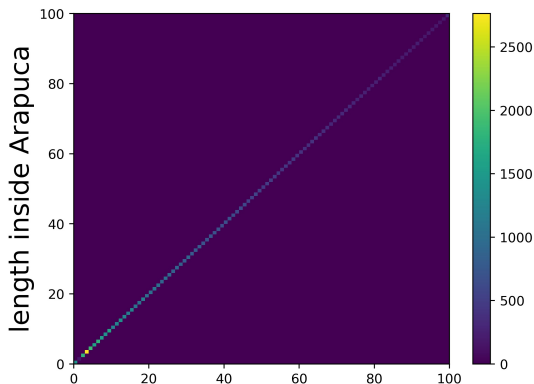


Simulation parameters

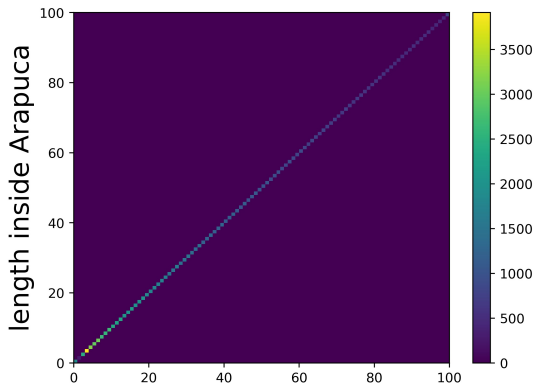
Our simulations used the following parameters

- ▶ Outer box has 8mm height.
- ▶ Light guide thickness 4.0mm. Distance to the outer box 1.0mm.
- ▶ Dichroic filters: 10cm × 10cm. The skip between two filters is 8mm. 1mm skip to outer box
"relative refraction index": 1.58/1.228,
- ▶ "default threshold": 0.05,
"guide abs threshold": 0.002
Photons start at the Dichroic filters.
Once inside the light guide, they are re-emitted in
- ▶ a random direction once.
Only considered reflection, refraction (Snell's law),
total internal reflection and absorptions.

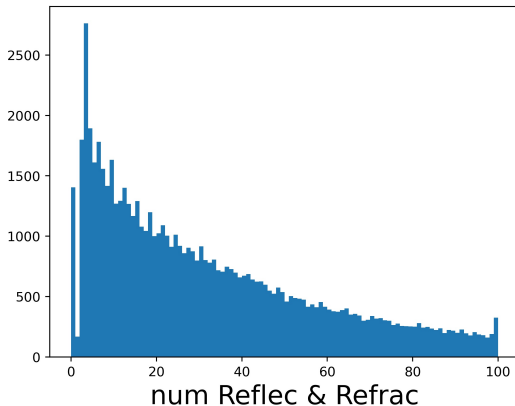
Histogram of the number of reflections-refractions and total distance inside the Arapuca per detected photon - 1 filter



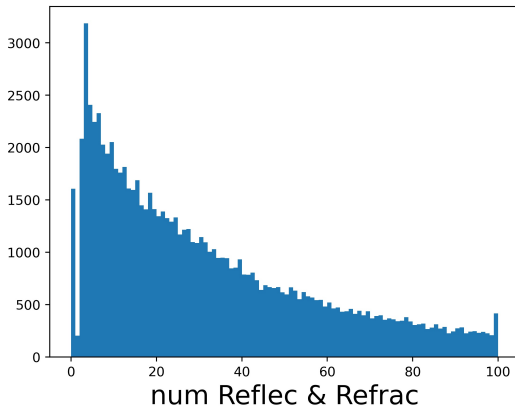
Histogram of the number of reflections-refractions and total distance inside the Arapuca per detected photon - 36 filters



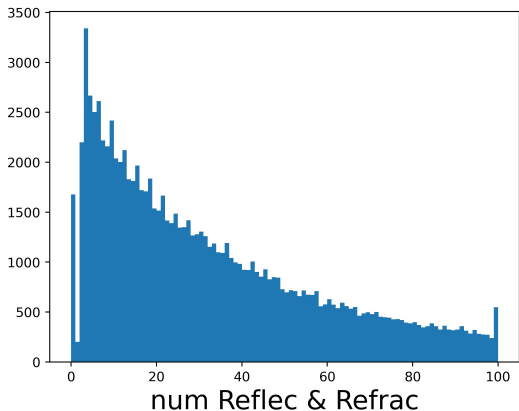
Histogram of the number of reflections - 1 filters



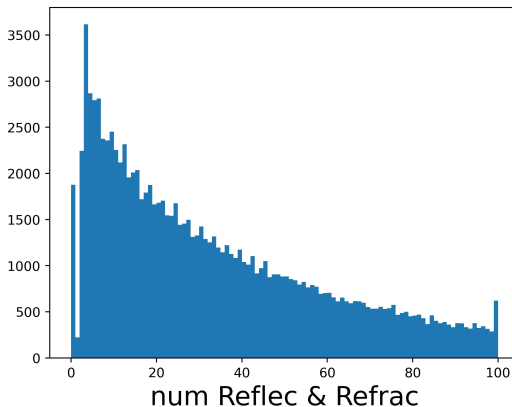
Histogram of the number of reflections - 4 filters



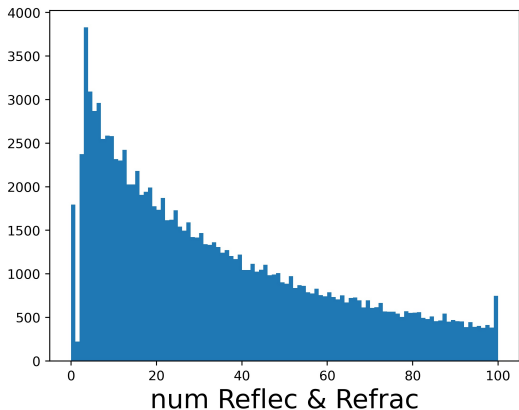
Histogram of the number of reflections - 9 filters



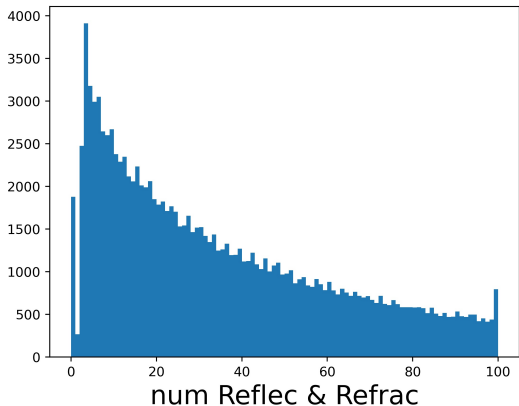
Histogram of the number of reflections - 16 filters



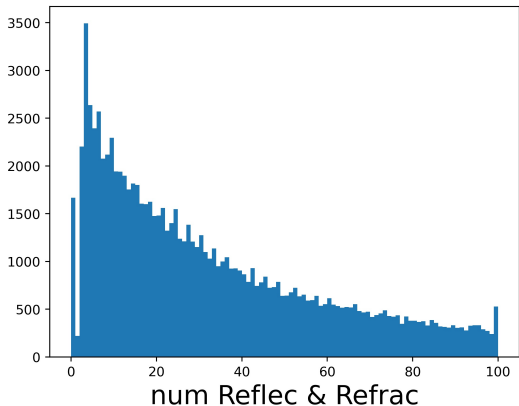
Histogram of the number of reflections - 25 filters



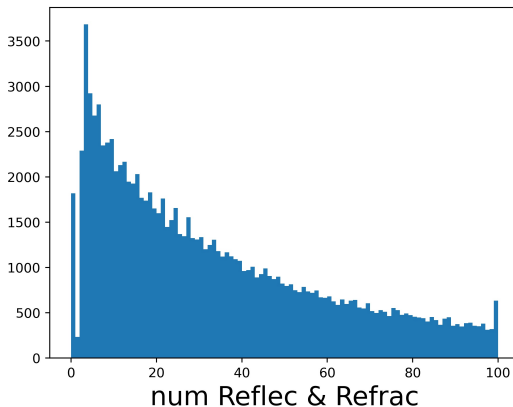
Histogram of the number of reflections - 36 filters



Histogram of the number of reflections - 12 filters (6 x 2)



Histogram of the number of reflections - 18 filters (6 × 3)



Acknowledgement

- ▶ Laura Paulucci
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Thank You