

Hole-ice simulation in clsim

└ Introduction

└ Motivation and Scope

Motivation and Scope

- No explicit hole-ice simulation included in clsim, yet only angular sensitivity approximation
 - No asymmetries possible, e.g. DOM position relative to hole ice
- Master thesis (ending Aug 2018)

1. clsim approximates hole ice using a convolution function for the angular acceptance.
2. e.g. photons hitting a dom from below are made more unlikely to be detected.
3. but no actual simulation of the changed ice properties.
4. i.e. we can't have asymmetries like shifted DOM positions relative to the hole ice.
5. that's why I'm trying to implement propagation through cylinders with changed ice properties in clsim.

2018-03-02

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1 Introduction

1.1 What has been done

- How does it work
- How does it look like
- How to compare it

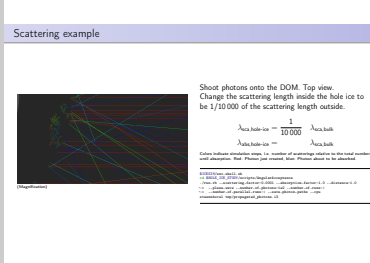
1.2 Examples

- Instant absorption
- Fixed source vs. plane wave source
- Asymmetry: Shift hole ice vs DOM

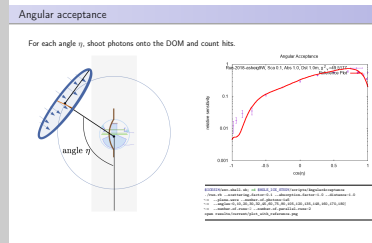
1.3 Outlook

- Separate cylinder positions
- Cable shadows
- Nested cylinders
- Direct detection
- Work to be done

- In this presentation, I'll show you what I've been working on
- some examples with images and plots
- point out some features that will be possible with this tool



- Photon wave length: 340 nm (UV)
 - DOM position: $(-256.02301025390625, -521.281982421875, 500.0)$
 - Scattering length in bulk ice at this DOM: $1.78 \text{ m} \pm 1.79 \text{ m}$
 - Absorption length in bulk ice at this DOM: about 150 m
 - The last example is rather extreme. No sharp border in current understanding of hole ice. But I don't know the correct ice properties of the hole ice.
- Need a way to compare these simulations to other studies.
- e.g. Angular acceptance plots



- One way to compare the new simulation to existing results, is to plot angular-acceptance curves.
- I.e. for each angle η , which is the angle between the starting direction of the photon and the column axis, shoot photons onto the DOM, propagate them in simulation and count hits.
- The current hole-ice approximations are convolutions onto the DOM angular acceptance.
- This is an example using the new hole-ice simulation with arbitrary ice parameters (data points) compared to the old reference curve (red).

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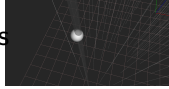
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└ Separate cylinder positions

└ Separate hole-ice cylinder positions

Separate hole-ice cylinder positions



- Each string can have its own hole-ice cylinder configuration
 - cylinder position
 - cylinder radius
 - DOH positions — DOHs may not be perfectly centered relative to the hole ice
- Currently configurable in Geometry frame.
 - Q: Is there a better place to configure this?
- Still work to be done:
 - Not properties need to be configurable for each cylinder: `image / geometry / model / hole-ice / cylinder / radius`

Cylinder configuration needs to be accessible by the steamshovel artist.

Source: <https://github.com/fiedl/hole-ice-study/issues/32> DARD, 2017, Slide 17,
See also: <https://github.com/fiedl/hole-ice-study/issues/32>