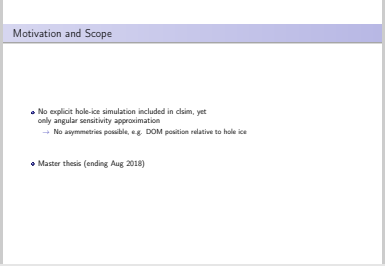
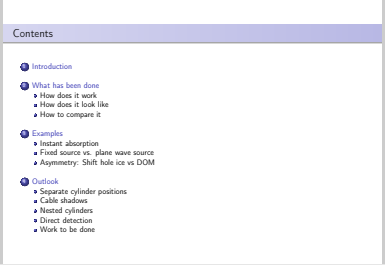
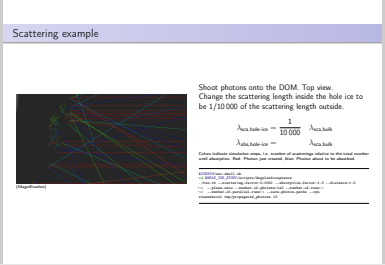


1. clsim approximates hole ice using a convolution function for the angular acception.
2. e.g. photons hitting a dom from below are made more unlikely to be detected.
3. but no actual simulation of the changed ice properties.
4. i.e. we can't have asymmetries like shifted DOM positions relative to the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



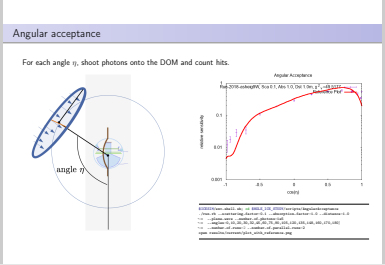
- In this presentation, I'll show you what I've been working on
- some examples with images and plots
- point out some features that will be possible with this tool



- 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.

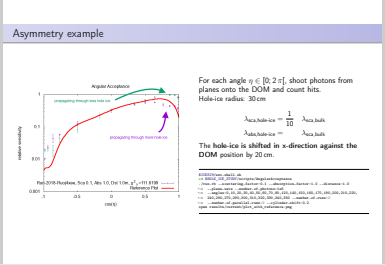
$\rightarrow$ Need a way to compare these simulations to other studies.

$\rightarrow$ e.g. Angular acceptance plots



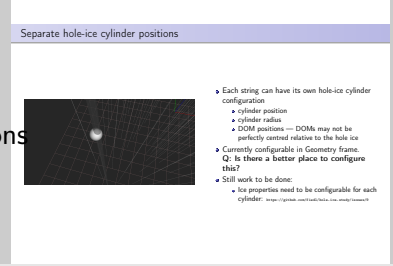
- One way to compare the new simulation to existing results, is to plot angular-acceptance curves.
- I.e. for each angle η, which is the angle between the starting direction of the photon and the column axis, shoot photons onto the DOM, propagate them in simulation and count hits.
- The current hole-ice 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).

Source: Image: Martin Rongen, Calibration Call 2015-11-06, DARD Update, Slide 9
Plot: Measurement of South Pole ice transparency with the IceCube LED calibration system, 2013, figure 7. See also: `https://github.com/fiedl/hole-ice-study/issues/10`



- In data points, one sees upper curve and lower curve.
- Because of the asymmetry, on one way, the distance through the hole ice is smaller, on the other way, larger.

Source: https://github.com/fiedl/hole-ice-study/issues/8 example https://github.com/fiedl/hole-ice-study/issues/8



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