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# Effects of firn ice models on radio neutrino simulations using a RadioPropa ray tracer

## Executive Summary

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### What is the contribution about?

The contribution relates to the challenges of ray tracing of radio neutrino signals and the influence of different ice features on this signal propagation. Currently mostly exponential models are used, but we are trying to push this forward towards the use of more complex ice models.

### Why is it relevant?

An accurate ray tracing and more realistic ice descriptions result in better radio neutrino simulations. Using these improved simulations, the reconstruction methods can be optimised and uncertainties can more rigorously be estimated.

### What have we done?

1. In the NuRadioMC software, we implemented a new numerical ray tracer based on RadioPropa, which can handle more complex ice models.
2. With this new ray tracer we performed a first examination of a double exponential ice model and its influence on the simulations.

### What is the results?

1. The newly implemented ray tracer is found to be accurate and can be further modified to one's needs to include more complexity in the future.
2. We see that the firn model introduces non-trivial time shifts in the detected radio signal, depending on both depth and ray type. This results in larger uncertainties in the reconstruction methods since they use the time differences between rays.