37th International Cosmic Ray Conference – ICRC 2021, Berlin PoS(ICRC2021)1069 In-situ calibration device of firn properties

BACKGROUND

- Detection of high-energy neutrinos most cost-efficient with radio technique
- Monitoring of ice properties is required for a precise v direction and energy reconstruction

SNOW ACCUMULATION MEASUREMENT

- 14 month of in-situ data from ARIANNA site analyzed with:
 - Cross correlation (CC)
 - Convolutional Neural network (CNN)
- CC: 5 ps resolution for high-SNR events
- CNN: 34 ps resolution for low-SNR events





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ICE PROPERTIES MEASUREMENT

- Extend setup by an additional emitter
- Allows simultaneous measurement of:
 - snow accumulation h
 - index-of-refraction profile n(z)
- Optimise transmitter positions for minimal reconstruction resolution and correlation

stat. uncertainty	correlation
$\sigma_{\rm h}$ = 5 mm	$\rho_{h,\Delta n} = 24\%$
$\sigma_{\Delta n}/\Delta n = 0.04\%$	$ ho_{h,z0} = -41\%$
$\sigma_{z0}^{2}/z_{0}^{2} = 0.3\%$	$\rho_{\Delta n, z0} = -12\%$

- Factor of ~50 more precise than current density-based borehole calibrations
- Systematic antenna misplacement of 1 cm
 - ~ statistical uncertainty

