

Executive Summary

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1 About the contribution

This contribution focuses on the calibration of the Askaryan Radio Array (ARA) antenna position in the ice with a precision of < 10 cm, and also describes the methodology applied to calibrate the ARA station 4 and 5 Digitization system with < 0.1 ns timing precision.

2 What is interesting

The Data Acquisition System in all ARA stations is equipped with the Ice Ray Sampler second-generation (IRS2) chip, an excellent choice for high-speed sampling (~ 3.2 GS/s) and digitization at low power consumption. In this contribution, we describe the calibration methodology applied to all the IRS2 chips in ARA station 4 and station 5. For accurate data analysis, proper calibration of the digitization system is critical.

3 What has been done

The IRS2 digitizer chip has finely tuned sampling capacitors with timing offsets which is due to the variation in chip fabrication. We determine these individual timing offsets and correct them. We also find the ADC-to-voltage conversion gain for each of the 32,768 storage capacitors in all digitizers in two ARA stations (ARA station 4 and ARA station 5).

4 Results

Our calibration methodology allows for proper timing correlations between incoming radio signals, which is crucial for radio vertex reconstruction and thus detection of ultrahigh-energy neutrinos. We achieve a signal timing precision of ~ 100 ps and an antenna position precision within 10 cm.