

An overview of Analog Receiver System for Detection of Global EoR Signal

SARAS is an ongoing experiment aiming to detect the redshifted global 21-cm signal expected from Cosmic Dawn (CD) and the Epoch of Reionization (EoR). Standard cosmological models predict the signal to be present in the redshift range $z \sim 6-30$ corresponding to a frequency range of 40-200 MHz, and as a spectral distortion of amplitude 20-200 mK to the cosmic microwave background. Design of a radiometer for detection of this weak signal is a challenging task, owing to the fact that this frequency range is dominated by astrophysical foregrounds of Galactic and Extragalactic origin, with several orders of magnitude greater brightness temperature and strong terrestrial Radio Frequency Interference (RFI). It is critical that the instrumental systematics do not preclude the measurement of the weak 21-cm signal via additive or multiplicative confusing structures in the measured sky spectrum.

Here, we present the system design of the SARAS 3 version of the receiver, emphasising on the receiver configuration and the signal flow from the antenna to the digital backend. We touch upon the aspects on the system design and laboratory measurements. New features in the evolved design include Dicke switching, double differencing and implementation of optical isolation and optical switching for improved accuracy in calibration and rejection of additive systematics leave no confusing systematic structures at a level of a few mK. We review the design and engineering challenges involved in the deployment of the system in field for sky observations with future plan of action.