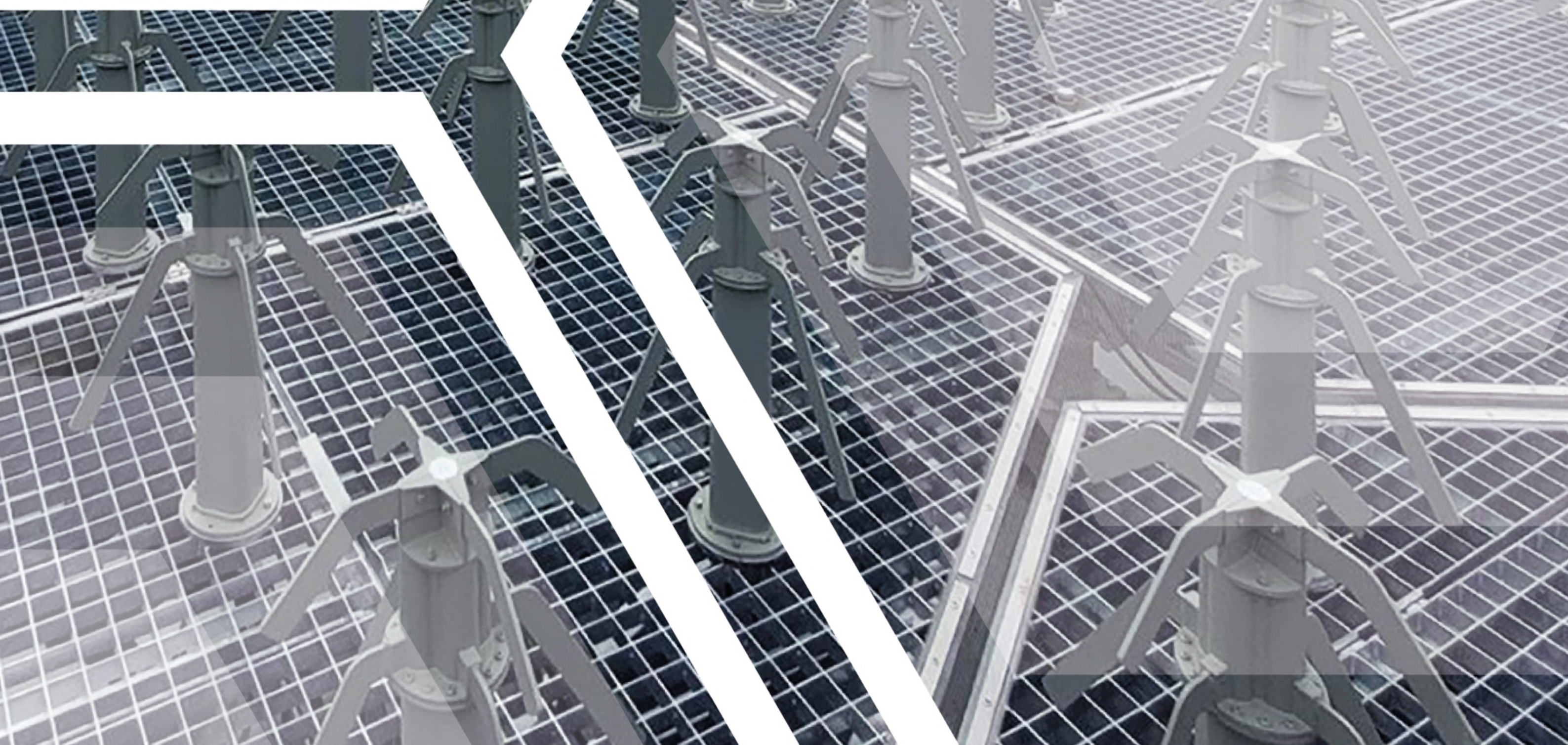
EISCAT

DIGITAL PROCESSING



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Digital processing

1. Smart filtering

In standard EISCAT applications, we want to recover the *ion line* component of the incoherent scatter spectrum. At 930 MHz, an ion line is typically less than 25 kHz wide. The power spectral distribution of this line contains the wanted information about the the ionospheric plasma. After allowing for Doppler shifts, unusual ionospheric conditions and the fact that the scattered spectrum is convolved with the transmitted spectrum, the received signal still fits comfortably in a 100 – 150 kHz spectral window.

Even in a multi-frequency experiment, the total bandwidth covered by all the ion lines is much less than the 2nd i.f. bandwidth. For example, in the CP-1-L-T experiment, RF pulses are transmitted on four different frequencies in each cycle. In the 2nd i.f. passband, there are therefore four ion line signals present simultaneously, which altogether occupy about 600 kHz, or less than 10 % of the 2nd i.f. bandwidth.

It is therefore a smart move to first of all *bandpass filter* the digital 2nd i.f. signal, keeping only the ion-line spectral windows and discarding the rest of the spectral power. Since the signal bandwidth after filtering is in the order of 100 kHz per ion line, one can also *decimate* the post-filtering sample rate from 15 Msamples/s to something less than, say, 200 ksamples/s, making for greater economy in the following processing stages.