

Task: 6.3.1 (RFI mitigation)

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Objective or Use Case:

### 1. Multi-Rate Filtering

Use Case:

An astronomer with a spectral line or continuum VLBI experiment for correlation at any of the correlators with DiFX, when specifying the correlation parameters, will be presented with the additional option to switch on or off multi-rate filtering.

If he selects off, he obtains the standard correlation product.

If he selects on, there will be a taper applied to the long-term accumulator, with the tapering weights calculated as part of this project following Roshi & Perley (2003). The correlation product will then have improved rejection of RFI (and signals) that have high fringe rate, and so the correlator output will be less affected by RFI.

The astronomer will perform post-correlation data reduction in the standard manner - the selection of multi-rate filtering during correlation has no impact on the subsequent steps.

Research and development:

1. Calculate optimized taper function and understand the computing power requirements
2. Implement multi-rate filtering in the DiFX software correlator
3. Demonstrate the effectiveness with a VLBI experiment, showing the degree of suppression of RFI with and without multi-rate filtering switched on, and showing non-toxicity within the field of view.
4. Documentation of use, performance, and software
5. Deliver software for installation at other DiFX correlators.

### 2. RFI Mitigation with Focal Plane Arrays

Use Case:

The user is an astronomer observing with a focal plane array in a single dish (eg the 21 cm 7 beam receiver at Effelsberg) or interferometer (eg APERTIF at Westerbork), and who wishes to suppress RFI.

The user can select RFI mitigation off or on.

If the selection is off, each beam is processed independently, as is the present standard.

If the selection is on, then cross correlations between beams are formed in real time to produce template spectra of the RFI, and this can be subtracted later from the astronomical spectra.

The astronomer will have the option during data reduction to subtract the template spectra from the astronomical spectra to mitigate RFI.