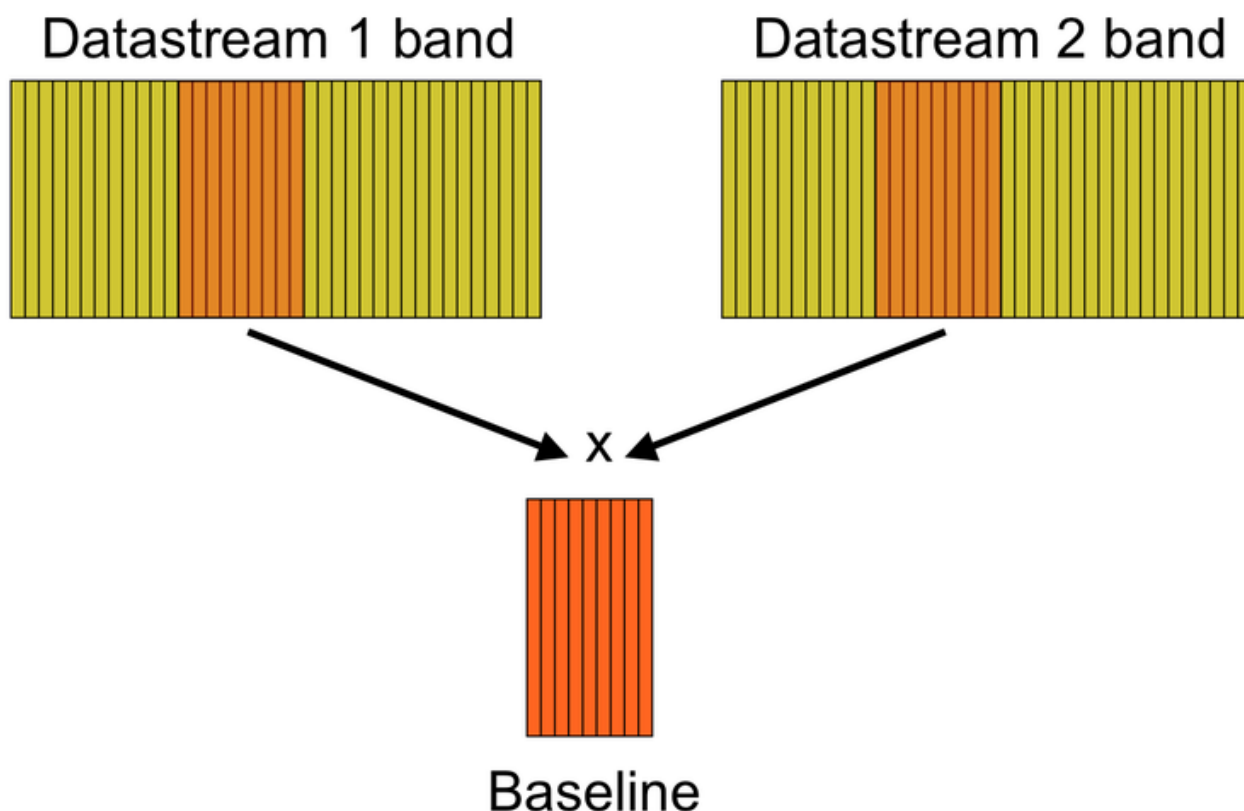


# Spectral selection and spectral averaging in DiFX2.0

DiFX2.0 has introduced a lot more flexibility in the way you can treat spectral points inside the correlator. In DiFX1.5, whatever came out of the FFT was fixed - you cross-multiplied it and wrote it out to disk. Any fiddling was deferred to FITS-building time. DiFX2.0 lets you both select and average channels, or both, inside the correlator.

## Spectral selection and matching

DiFX2.0 lets you define additional frequency bands (IFs, if you like) which fall within the recorded frequency bands. I call these “zoom” bands. These zoom bands are obtained by positioning a pointer to somewhere within a recorded band - allowing a subset of the spectral points to be correlated, and the rest thrown away. The following image illustrates the idea:

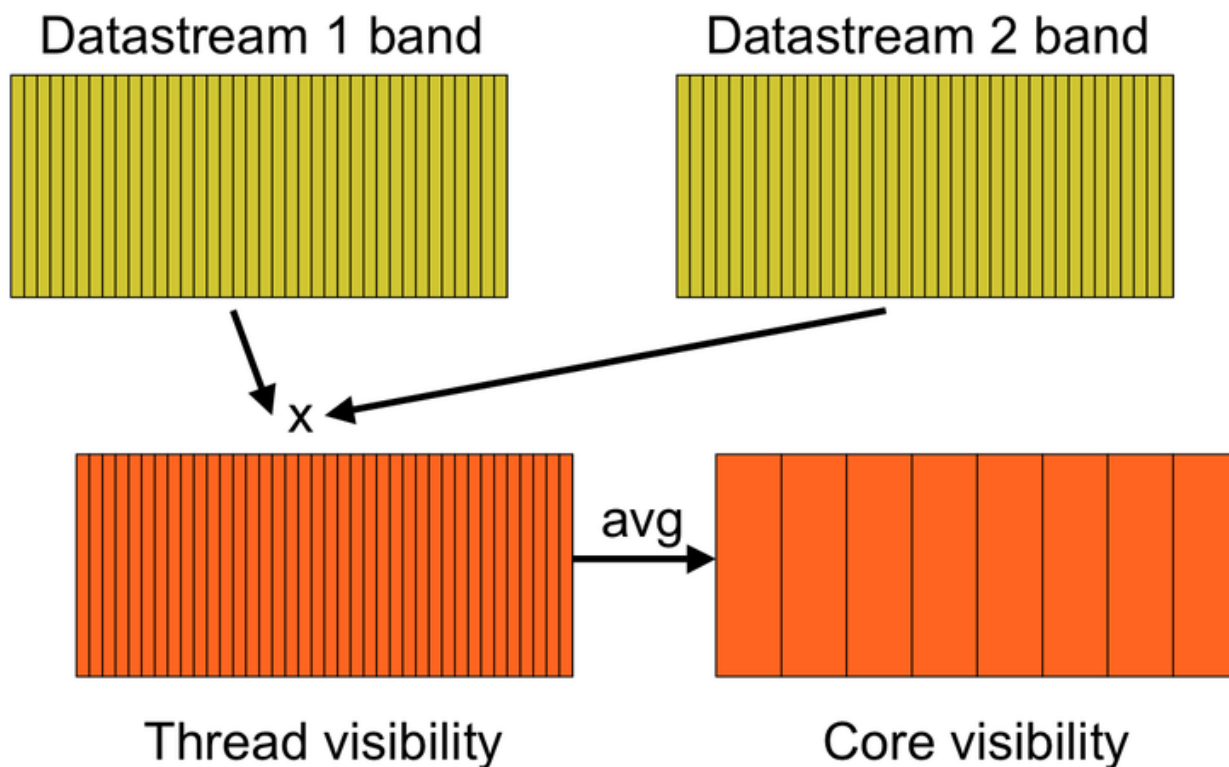


This is obviously useful if the recorded band is much wider than a spectral window of interest - something that frequently comes up for narrow masers, for example. But it gets better. Say you have a 16 MHz band, which encompasses two narrow regions (~50 kHz) of maser emission 10 MHz apart. You want 1 kHz spectral resolution. You could just correlate the lot with 16,000 spectral points. But then you are sending around and writing to disk data which is mostly garbage. (This is what was done in DiFX1.5). With the zoom bands in DiFX2.0, however, you can place one on each area of interest and throw the rest of the junk away.

Another use of spectral selection is correlating mismatched bands. Say one antenna recorded a single 16 MHz band and another antenna covered the same region of spectrum with two 8 MHz bands. By defining two 8 MHz “zoom” bands for the antenna which recorded the 16 MHz band, you can cross-correlate the two antennas, getting two 8MHz bands out as a result. This couldn't be done in any way in DiFX1.5.

## Spectral averaging

Most continuum experiments want a very small number of spectral points per subband. Getting this directly using a very small FFT, though, is rather inefficient. So in DiFX1.5, continuum experiments would typically be correlated with 128 spectral points, and difx2fits would average down to the required number. This is a bit wasteful of disk space and correlator interconnect, however. So in DiFX2.0, in-correlator averaging has been implemented. As described in the [multiple phase centre](#) documentation, this feature is crucial for the efficient implementation of multiple phase centres. An image below illustrates how it works.



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