

e-MERLIN pre-processing

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Pre-processed data

- Original FITS-IDI format cannot be managed by data reduction tools
- There are certain straight-forward transformations
- There are time-consuming steps that need to be done only once
- The observatory provides pre-processed data to reduce data volume

Import data

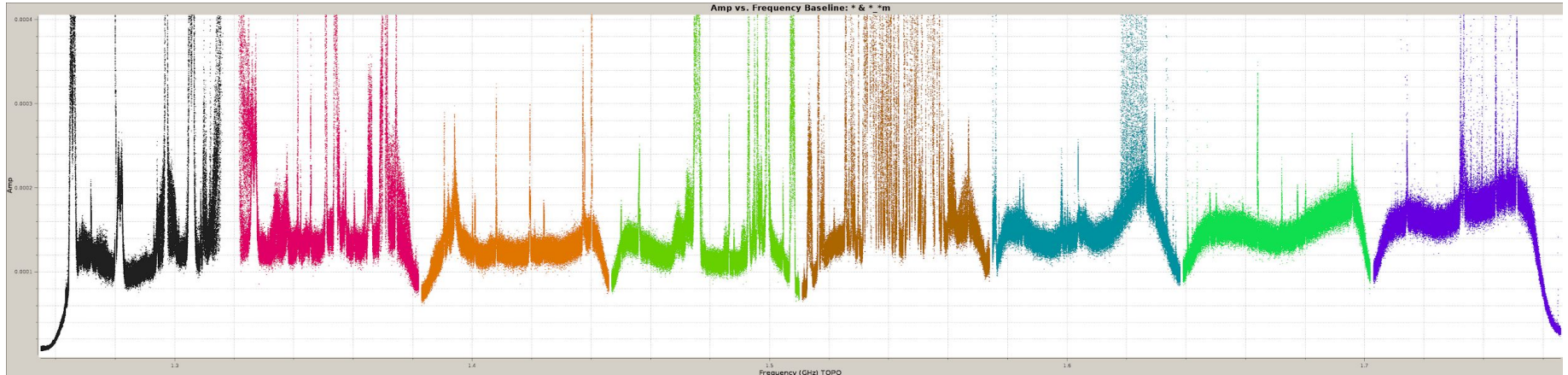
- Importfitsidi (FITS-IDI to MS)
- Remove autocorrelations (not used generally)
- Separate continuum from spectral data (produce different data sets)
- Convert to MMS (optional), can speed up large processes
- FIXVIS (correct possible correlator UVW mismatches)

Hanning smoothing

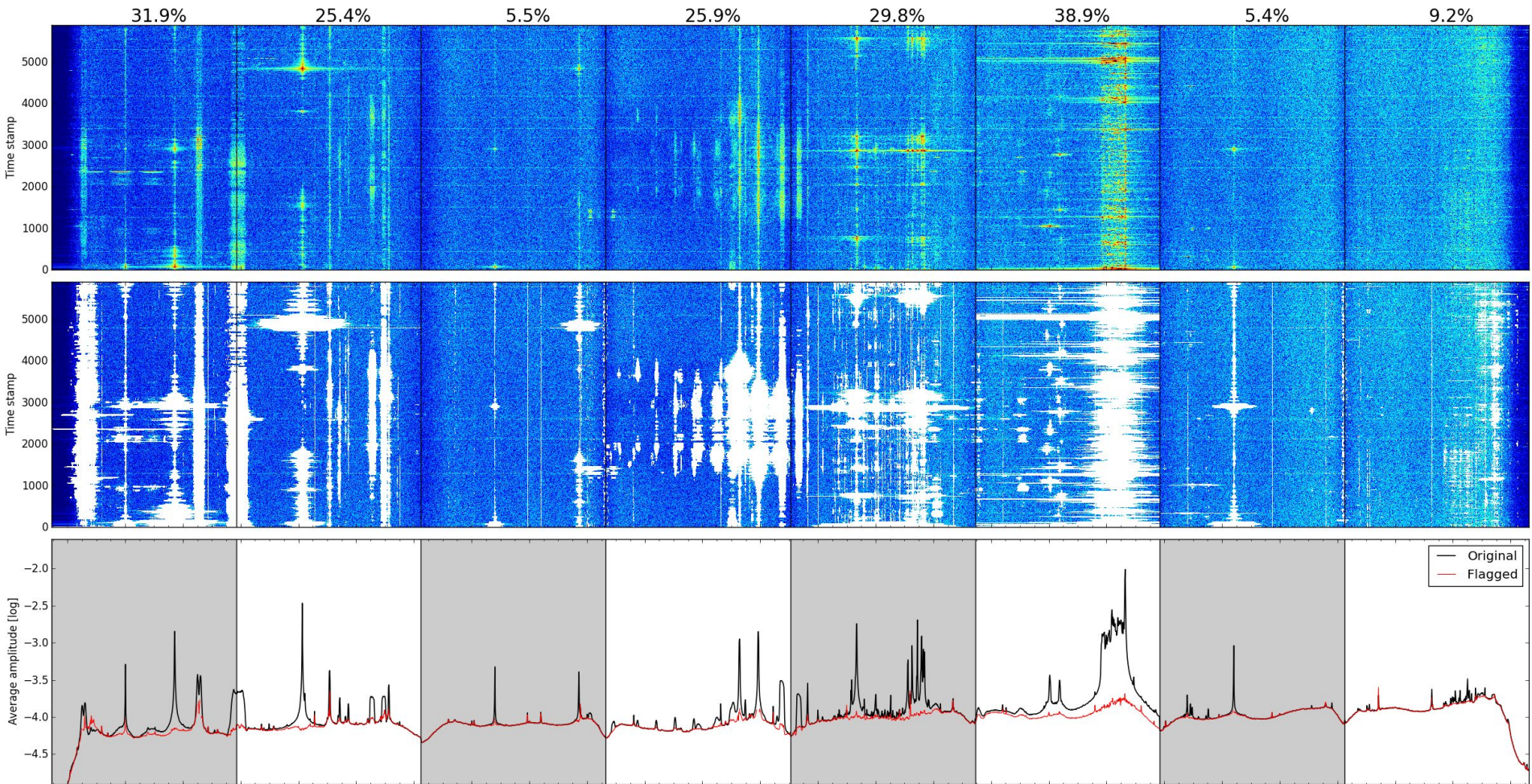
- To reduce effect of strong RFI
 - They produce ringing across frequency channels (Gibbs phenomenon)
 - Running mean across spectral axis with a triangle as a smoothing kernel.
 - Loss of a factor of two in spectral resolution
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- Recommendations:
 - Never run for C band
 - Always run for continuum L band
 - Never run for spectral line spw at L band

AOFlagger (optional)

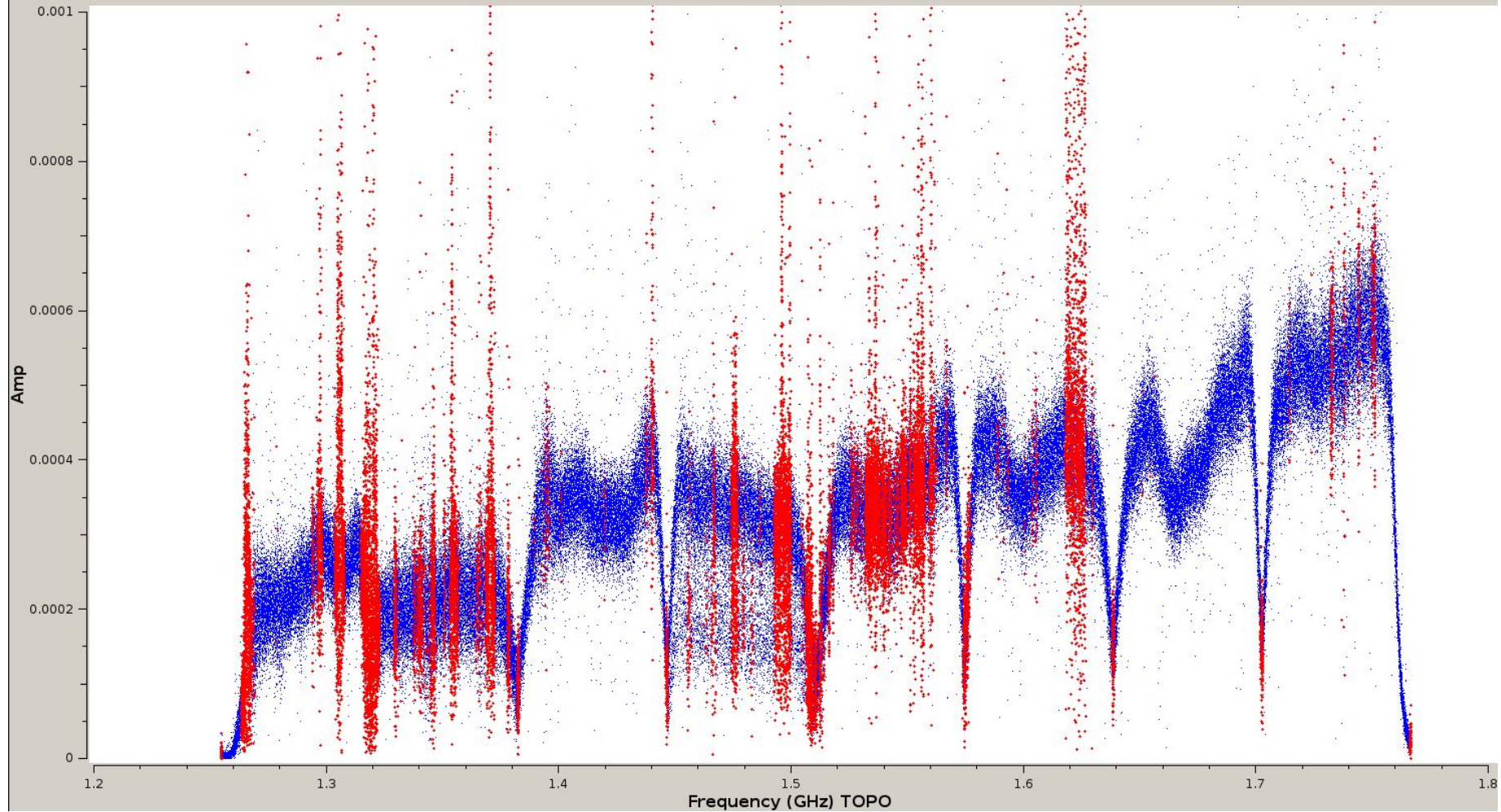
- RFI is a huge problem at L band
- AOFlagger: <https://sourceforge.net/p/aoflagger/wiki/Home/>
- Uses SumThreshold algorithm
- Very efficient to eliminate strong RFI almost blindly
- Specific strategies per source/spw can be defined



RR Kn&Pi 66.7 km field 1229+6335 21.5% flagged



Amp vs. Frequency



A-priori flags

- Automatically remove known bad data
 - Remove Lo-Mk2 baseline
 - Subband edges. Remove 4 channels at the beginning and end of spw
 - Remove antenna slewing (not completely accurate at the moment)
 - Remove Lo dropouts
 - Remove known misbehaving antennas (mechanical or receiver problems)

Phase-shift positions (optional)

- In some cases sources far away from the phase center are interesting
- FoV:
 - L band: 30 arcmin
 - C band: 7 arcmin
- If we average the data, there will be significant frequency/time smearing

Average data

- To reduce the data volume we average the data by default to:
 - 128 channels/spw: Channel width 0.50 MHz
 - 4 seconds integration time
- Data volume reduced by a factor of x16
- Problem: frequency and time smearing
- <http://www.atnf.csiro.au/people/Emil.Lenc/Calculators/wfcalc.php>
- FoV:
 - L band: 30 arcmin \rightarrow \sim 5% loss at 4 arcmin from phase center
 - C band: 7 arcmin \rightarrow \sim 5% loss at 1.5 arcmin from phase center
- Data cannot be average for full FoV observations

Resulting data

Input:

- pure FITS-IDI data (single or multiple files)

Output:

- MS (or MMS), fixed
- A-priori flags applied
- RFI significantly reduced (Hanning smoothing + AOflagger)
- Averaged data set (optional)