





UNIVERSITY of the WESTERN CAPE

Flagging

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Thanks to Joe Callingham and Andre Offringa



What is flagging?

> Broken Elements



- > Broken Elements
- > Antenna Shadowing



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- Correlator malfunctions



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- > Bandpass issues
- Low elevation for some antennas
- Correlated noise on some baselines



Radio Frequency Interference – a radio astronomers worst enemy (most of the time)

> Discrete bands



EMF Sources



Source: Rezence.com

> Broadband













What if you do not flag?

- Probably will not be able to derive sensible calibration solutions (e.g. delay or phase solutions in particular)
- If you can make an image, it will be noisier and (depending on the brightness of your target), you will not be able to see your target
- Remember RFI is not constant in time. So you have to flag all calibrators and targets separately.



How can we fix this in one slide...

- > Broken elements → remove antennas
- ➤ Correlator malfunctions → remove timesteps
- > Shadowing \rightarrow remove antennas in time range
- > Initial pointing delay \rightarrow remove first timesteps
- > Bandpass issues → remove channels
- Low elevation → remove antennas with low elevation
- Correlated noise on some baselines (e.g. LOFAR split stations) → Flag baselines
- > RFI→ remove antennas, timestep, frequencies or baselines...



You can do this in casa

- > Inspect and find look at antennas, frequency and time, phase and amp.
- > Don't be afraid to flag bad data!
- Corrupted data can reduce the image quality significantly, but the effect of missing data (even 25%) is often minor.
- > A little bit easier in VLBI as you correlate the RFI away



Flagging data does not mean deleting



Modern ways to flag can not be manual

- > For example, MeerKAT has 64 antennas.
- > That means there are N(N-1)/2 = **2016 baselines**



> Far too many to inspect manually

Other more automated/modern ways to flag

- > Two classes of RFI excision methods:
 - Detection: find & throw away affected data
 - Filtering or subtracting: estimate RFI contribution and restore affected data
- > Detection methods ("flagging") commonly used
 - Some specialized pipelines for surveys or instruments
- > Filtering RFI is harder
 - Resulting data quality is not well understood
 - Requires more resources
 - Lack of full (automated) filtering pipelines

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Subtracted "background"

High-frequency components

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> Always flag (first) at highest possible resolution



Flagging is often iterative with calibration



Conclusions

- > First step in data processing is data inspection
- > Then flagging (at highest possible resolution)
- Make use of automatic flagging routines (although flagging in VLBI can be quite manual)
- Remember: Better to have less data that is good than more data that has bad components.