

WP RFI Mitigation at MPIfR

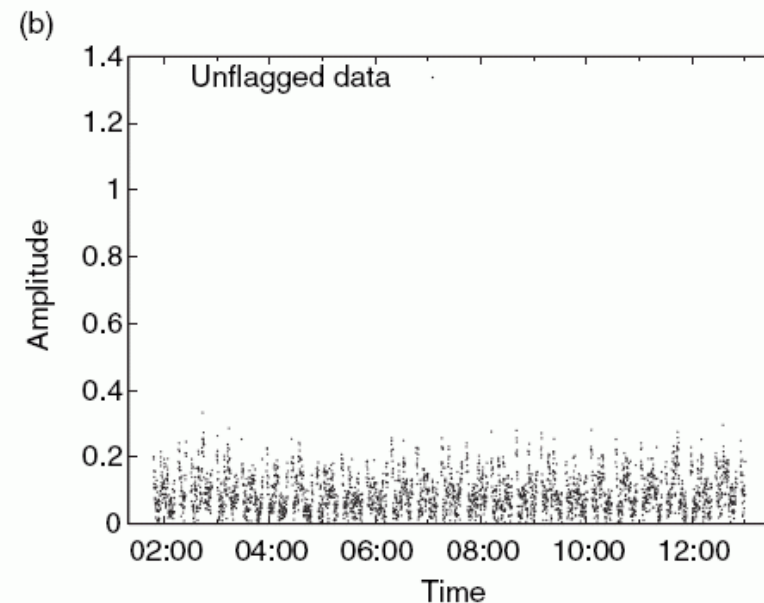
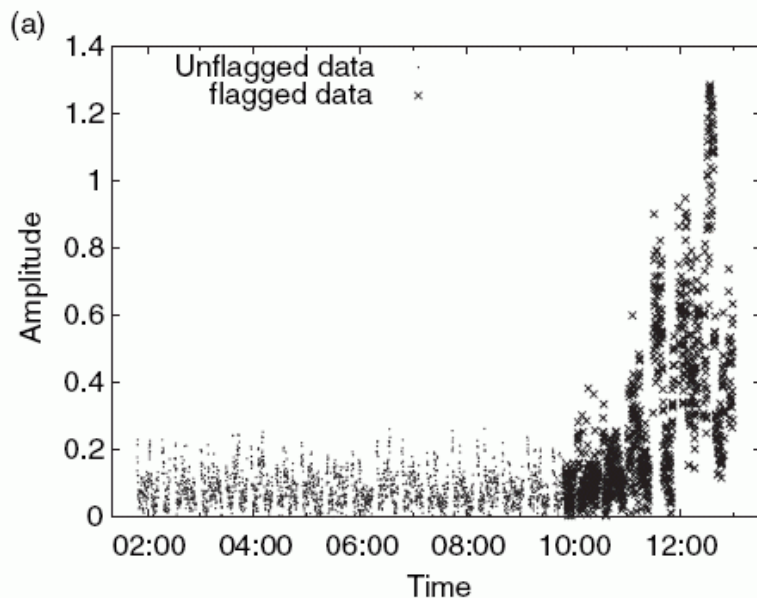
- People: Helge Rottmann(?) Programmer - does the real work
Alan Roy PI - matching
- Time: 6 months total (4.5 months from EU, 1.5 months matching)
- Background: Relatively small effort, but want sizeable impact, so:
- implement existing algorithms,
 - keep it simple and effective,
 - easy accessibility for users.
- (excludes, for example, subspace methods - sexy but hard)

- Intention:
1. Port pieflag to ParselTongue (Middelberg 2006, PASA, 23, 64)
 2. Multi-rate filtering in DiFX
(Roshi & Perley 2003, ASP Conf Ser 306, 109)

1. Port pieflag to ParselTongue

What is pieflag:

- Middelberg (2006, *PASA*, 23, 64) for ATCA deep fields with miriad
- Automated spectral flagging based on amplitude and rms using medians and reference channel
- Interactive GUI
- Leverages Enno Middelberg's effort
- Documented
- Written in python (eases porting to ParselTongue)



1. Port pieflag to ParselTongue

- Interoperability:

Write ParselTongue script for AIPS but with data access layer confined to few subroutines to be adapted for working with CASA

Prepare flag table in AIPS for transfer to CASA

(but time-scale mismatch with interoperability? -> can't transfer tables early in project?)

- Overlap with CASA / Oxford / Cambridge / UMAN:

Cambridge (data excision): plans unclear

Oxford (data visualization):

Lead user with RFI-contaminated data

Could provide source-subtracted uv data for RFI mitigation

RFI mitigation could return FG table and statistics (median, rms vs time)

UMAN: ?

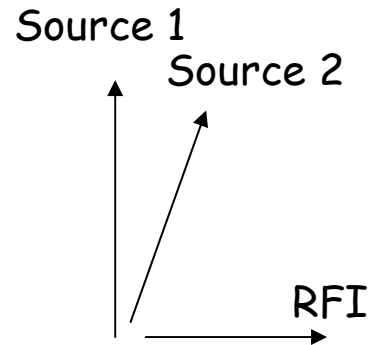
CASA: Re-use ALMA heuristics python code?

If ALMA heuristics code already does everything, then:

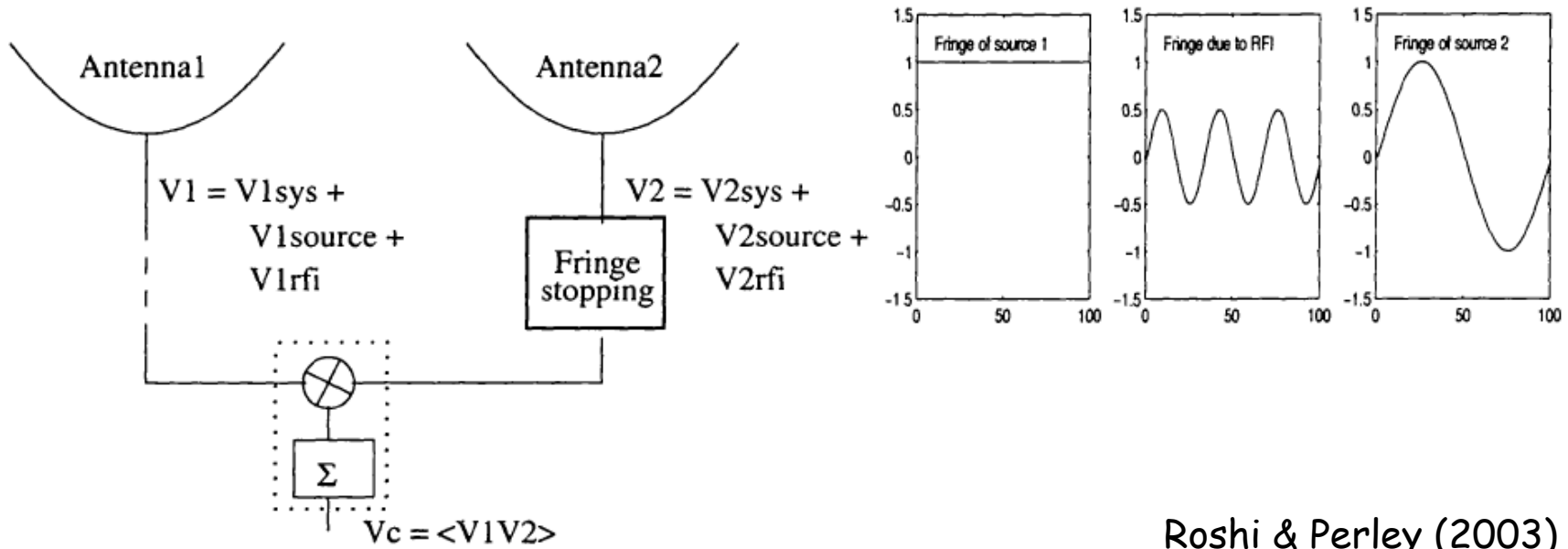
- do we do nothing and rely on interoperability WP?
- or do we port ALMA heuristics to ParselTongue?

Reuse WSRT flagger in AIPS++? (does similar for WSRT measurement sets)

2. Multi-Rate Filtering



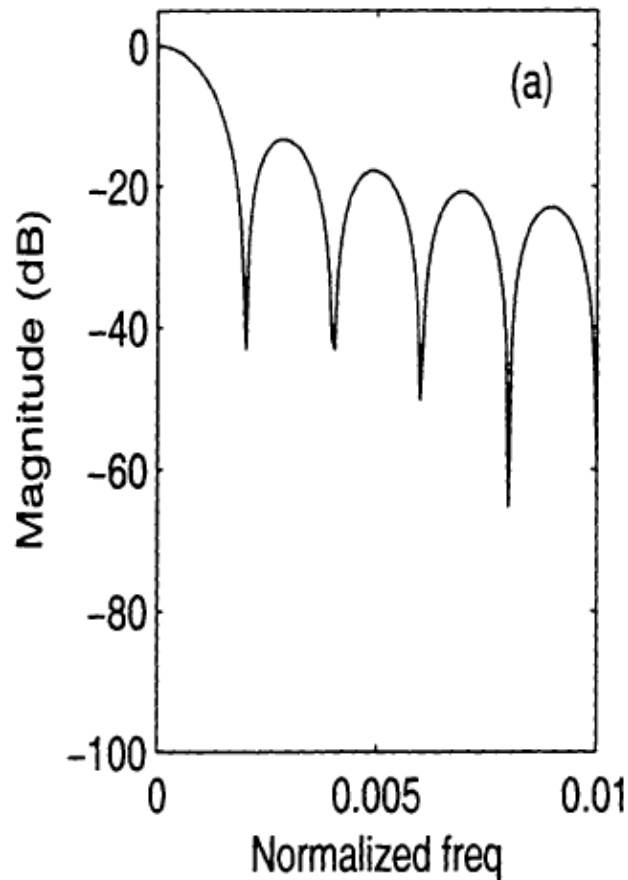
(b) After Fringe stopping



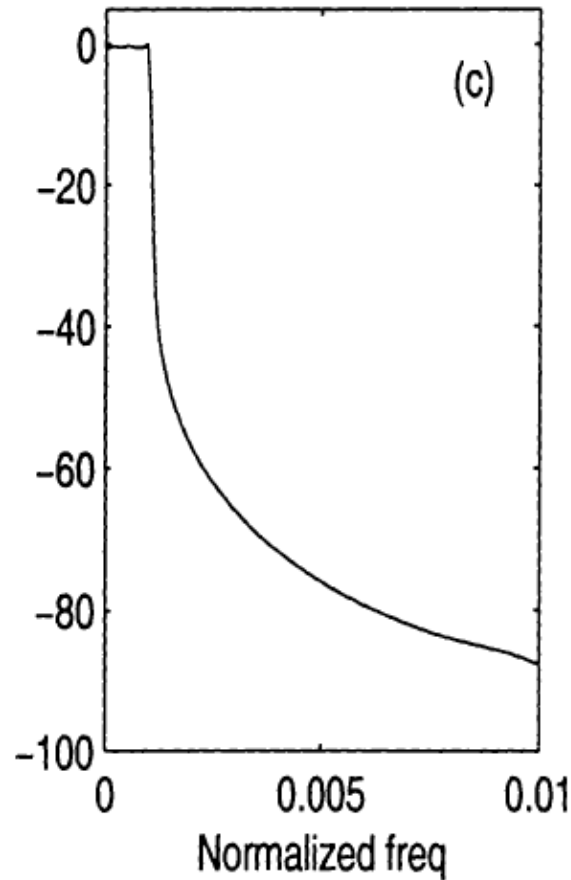
Roshi & Perley (2003)

2. Multi-Rate Filtering

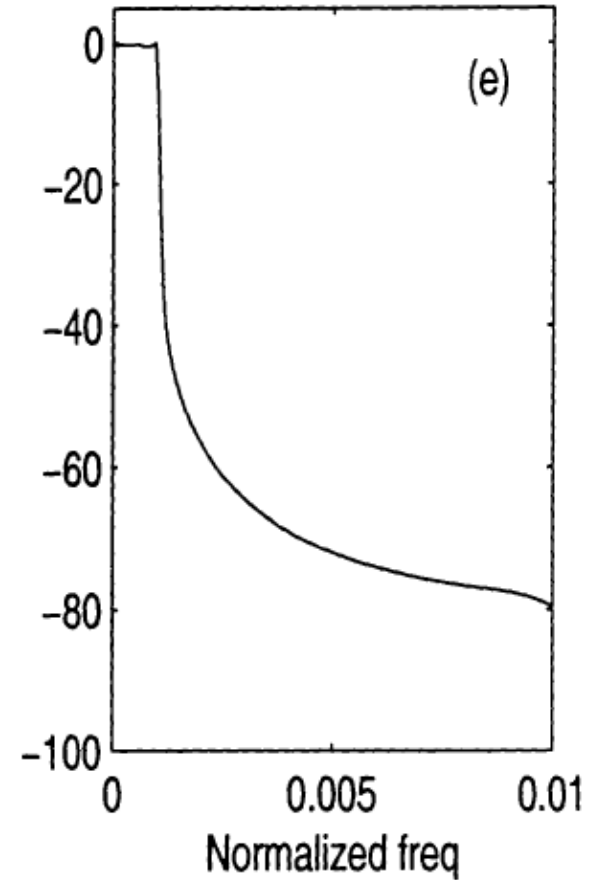
Moving-average filter



Multi-rate filter,
resampled with polyphase
filter then elliptic filter

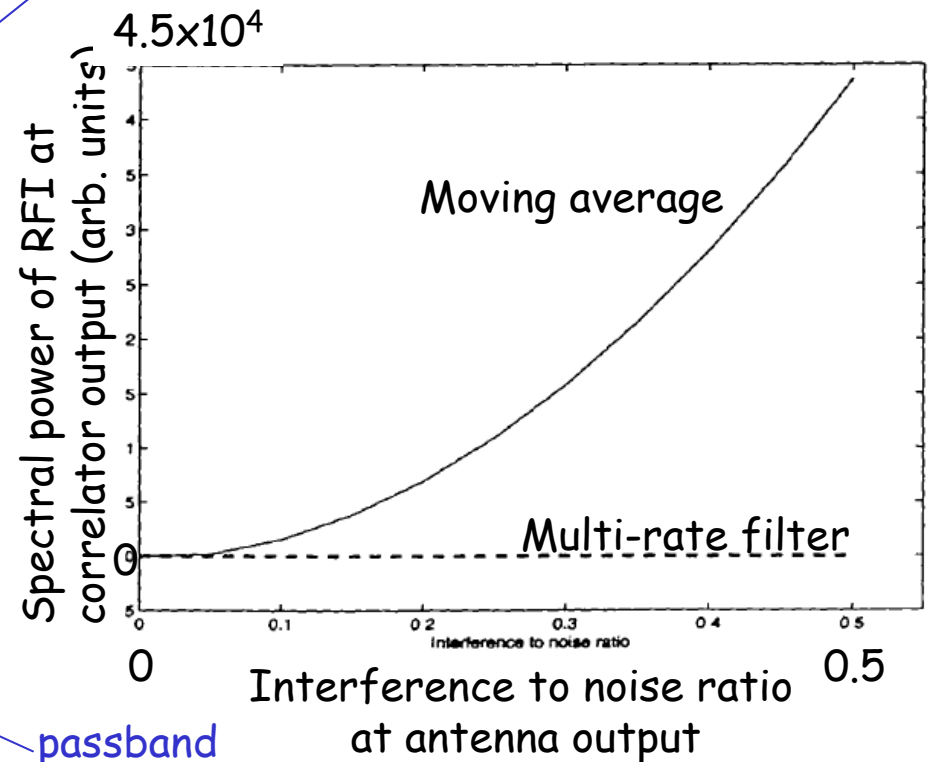
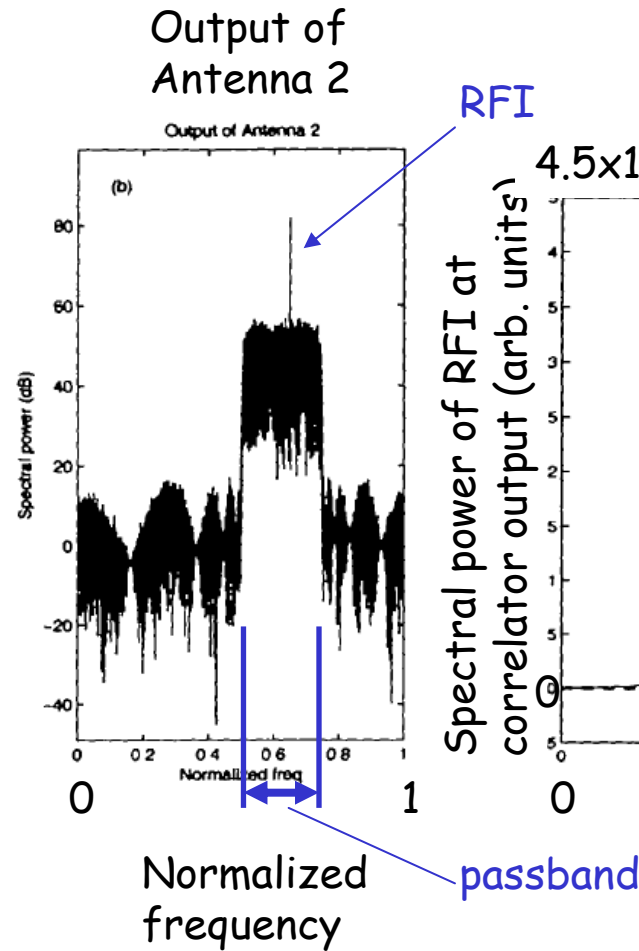
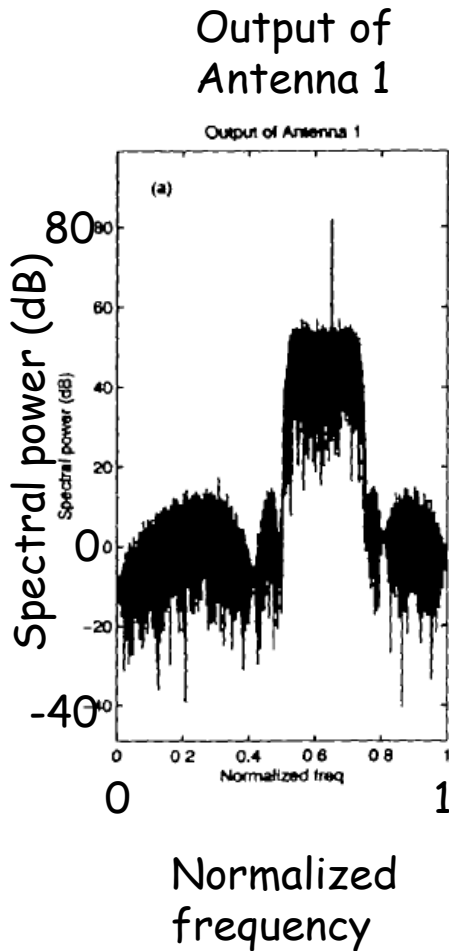


Multi-rate filter,
resampled with moving
average then elliptic filter



2. Multi-Rate Filtering

Simulation: Fringe freq of RFI = 0.65
Fringe freq at field edge = 0.003



2. Multi-Rate Filtering

What is multi-rate filtering:

- Roshi & Perley (2003 ASP Conf Ser. 306, 109)
- Optimizes the window function in long-term accumulator in correlator
Instead of rectangular use, eg, 10th order elliptic IIR for better suppression of RFI at high fringe rate
- Ingeniously simple and effective-looking algorithm
- Does not depend on good INR
- Performance shown theoretically and in simulation

Some Issues:

- Implement in DiFX for distribution to other correlators
- Exchange with LOFAR for use in LOFAR correlator
- Use also weighted time averaging in UVAVG in AIPS?

Other Algorithms?

Considered not practical within this effort:

- Hardware to implement blanking in time and frequency
- Algorithm development for RFI mitigation in focal-plane arrays
- Implement subspace techniques
- Reference antenna and closure relations (Briggs, Bell & Kesteven 2000, AJ, 120, 3351)
- Pulsed radar excision (Zhang, Zheng, Wilson, Fisher 2003, AJ, 126, 1588)
- Parameter modelling (eg Ellingson, Bunton, Bell 2000, ApJS, 135, 87)