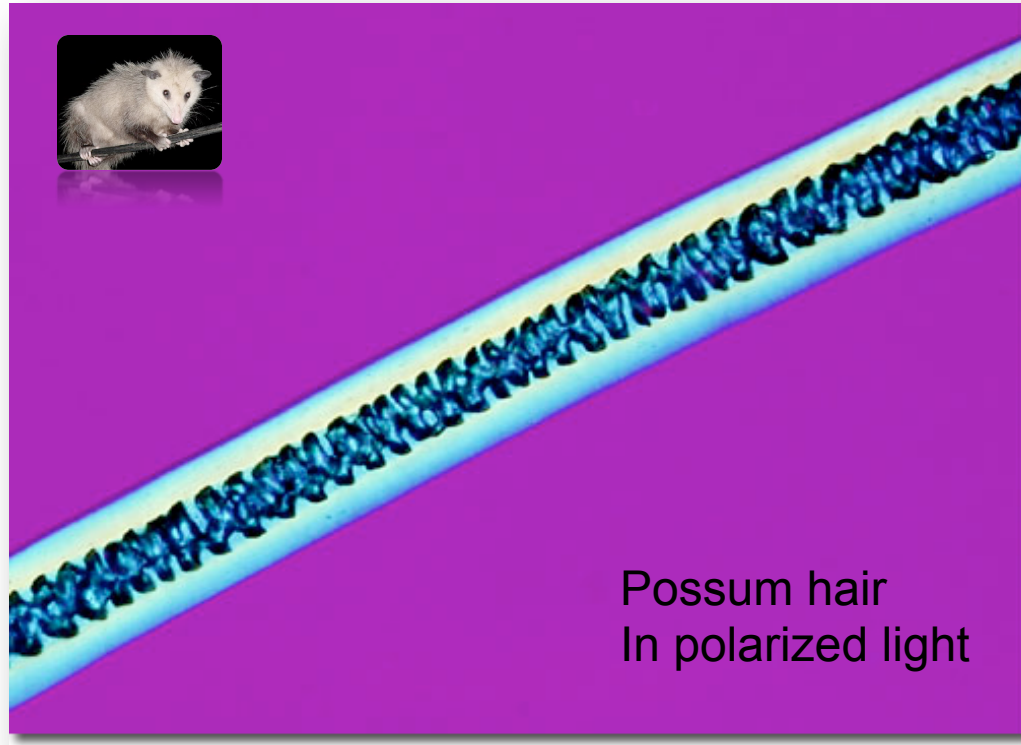


(Mis-)Adventures in RM Synthesis Land



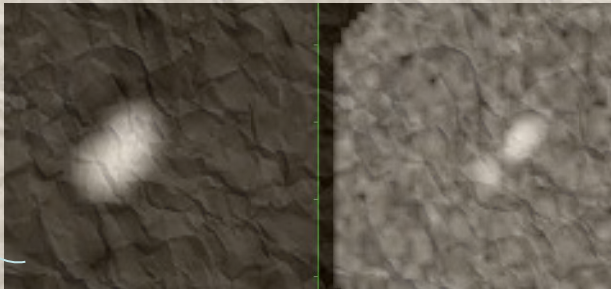
Lawrence Rudnick
Minnesota Institute for Astrophysics

Experiments with

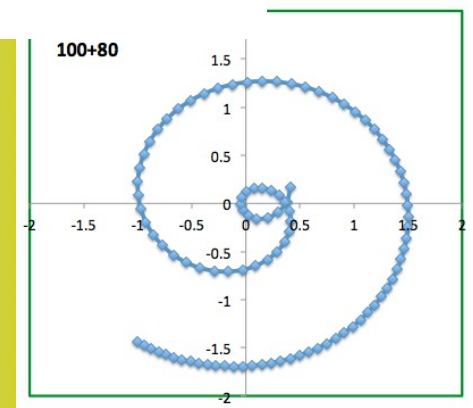
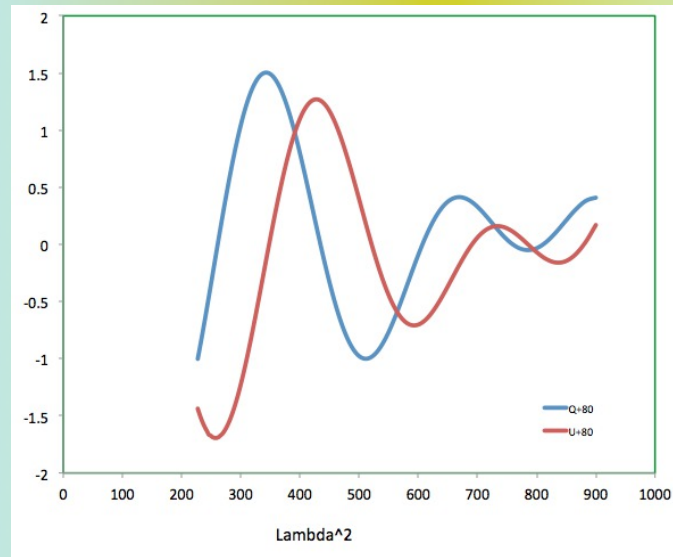
REAL WORLD +

J-VLA:

- GOODSN field, (F. Owen)

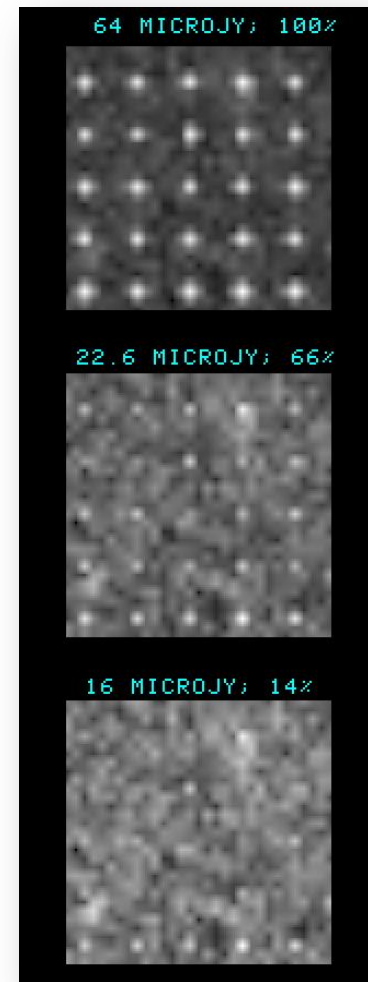


Perfect World



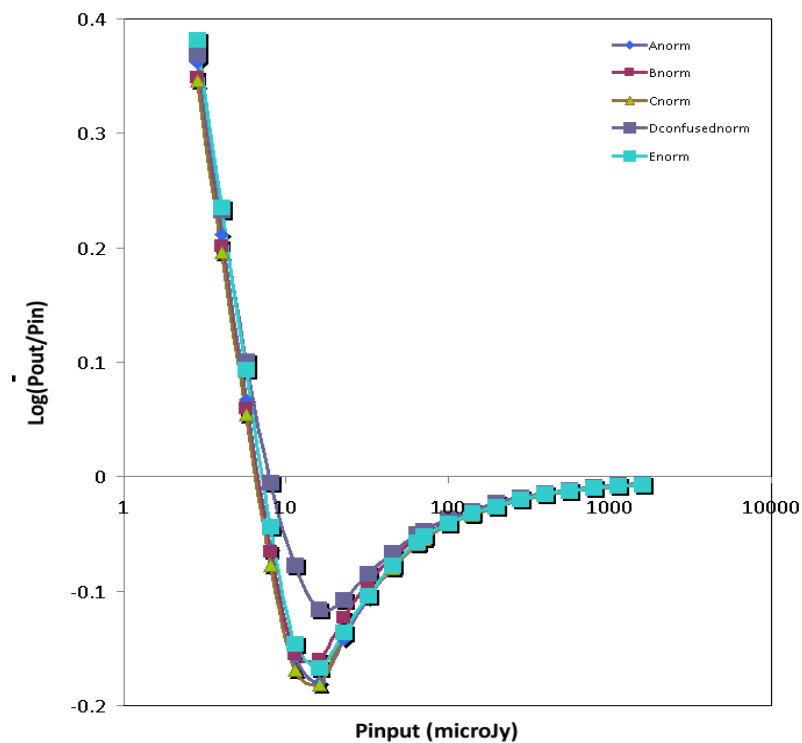
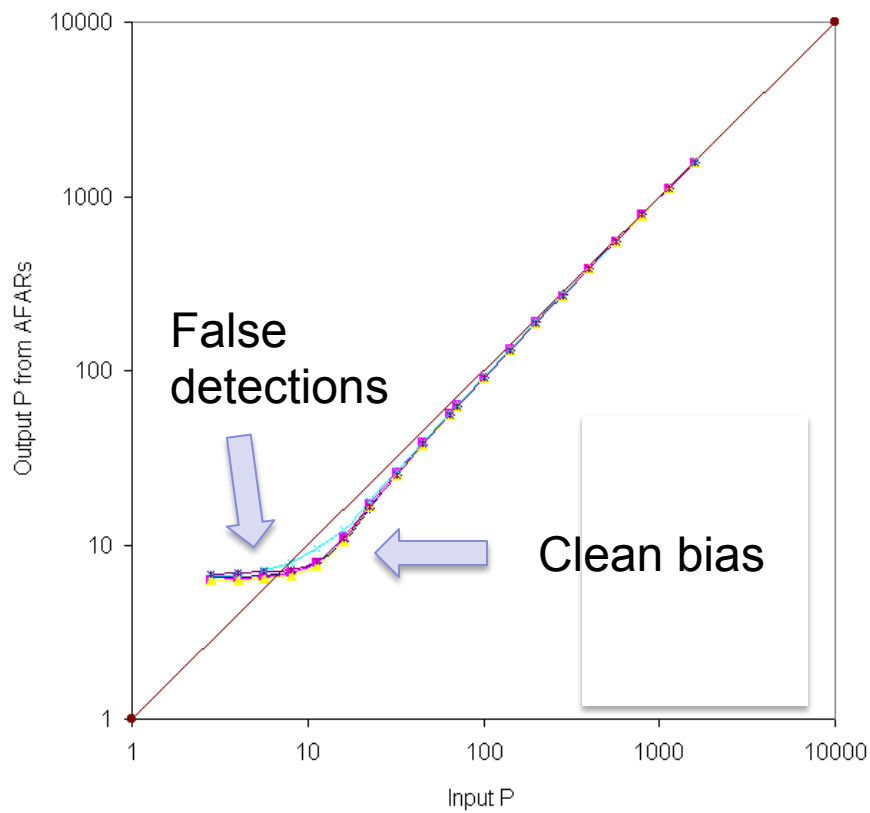
Identifying Real World Problems inserted 125 sources @ 20 different fluxes

GOODSN EVLA: $3.5\mu\text{Jy}$ rms



How far to ...

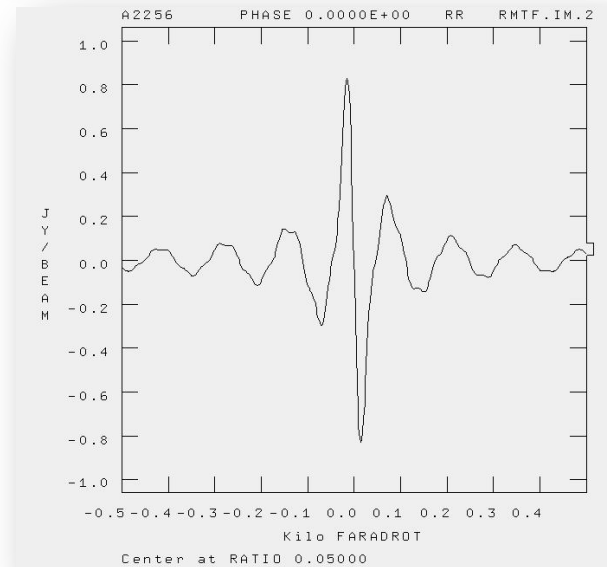
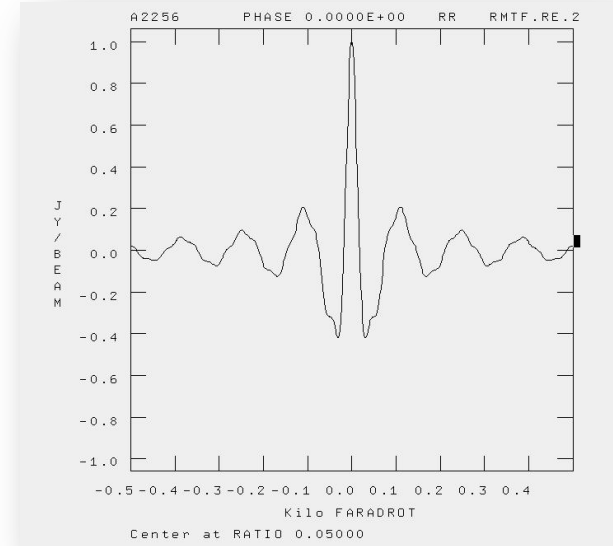
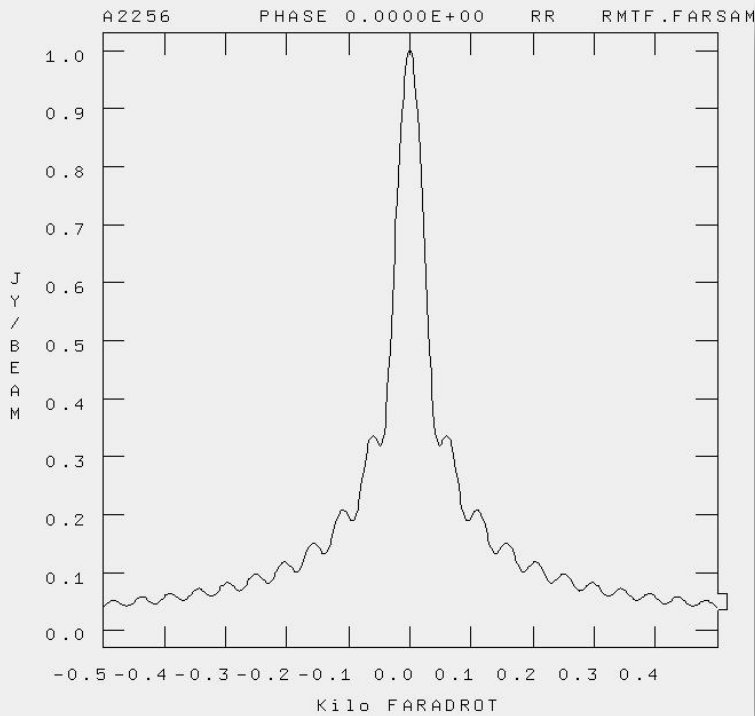
RM clean (AIPS FARS, L. Kogan)



Polarized fluxes are biased by degree of cleaning

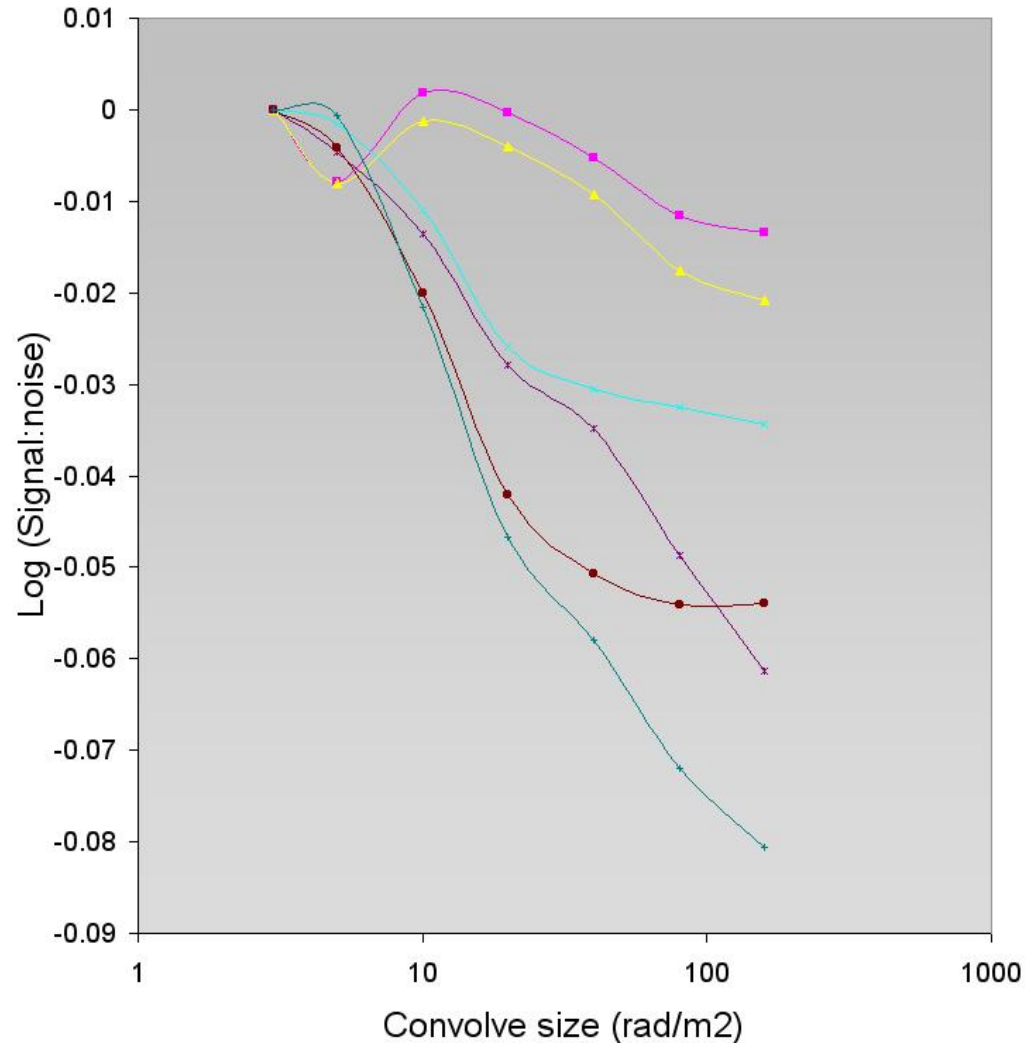
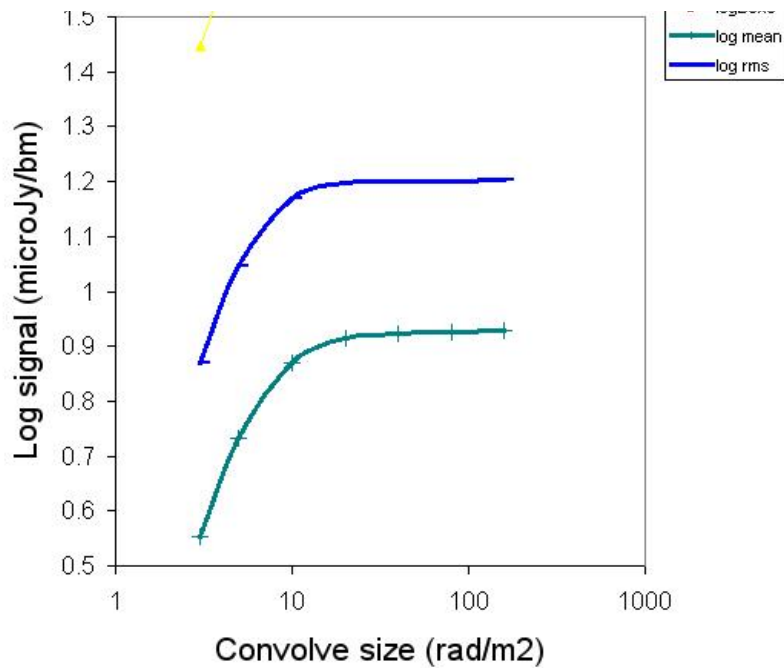
How far to convolve RM spectrum?

70 rad/m² ?



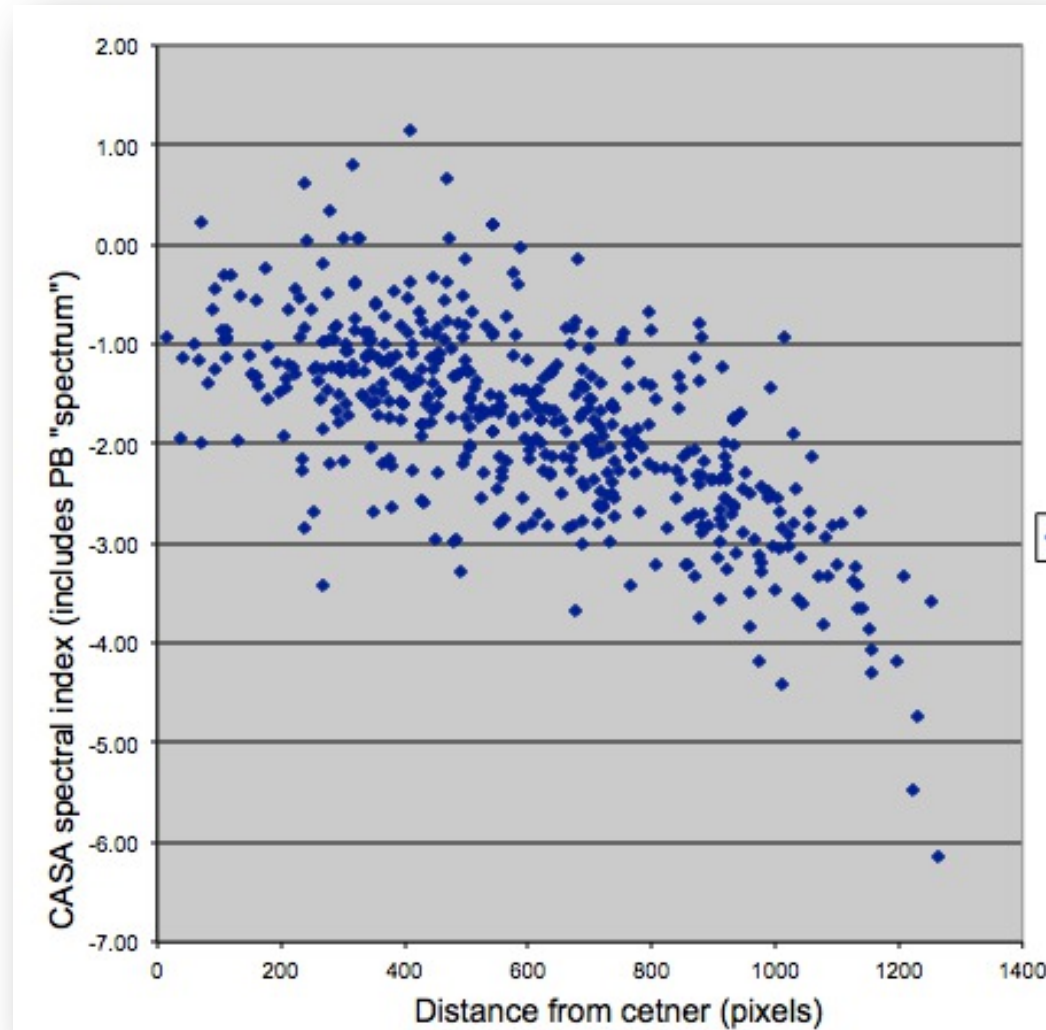
20 rad/m² ?

How far to convolve RM spectrum?

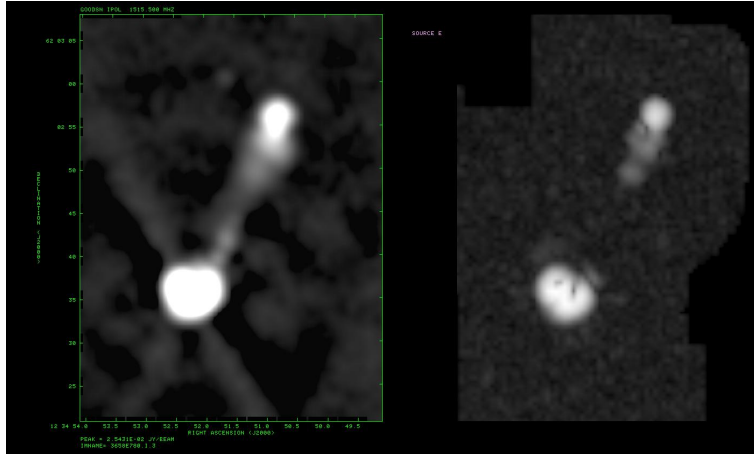


Signal strength and
S:N are a function
of RM convolution

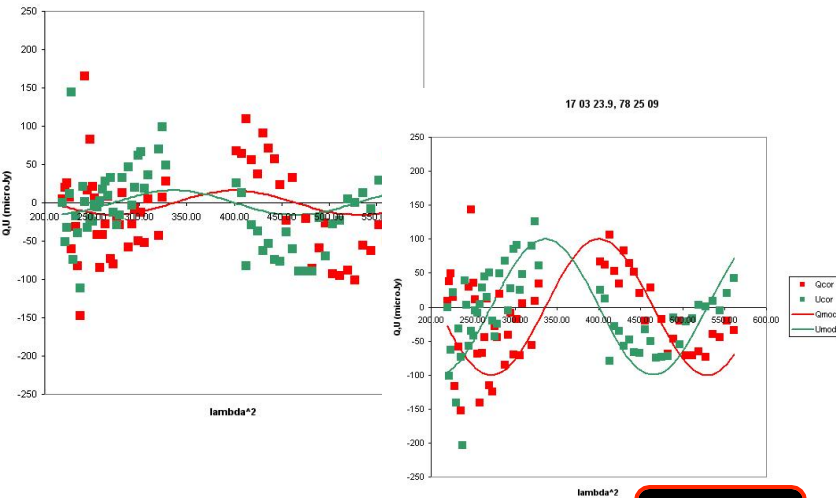
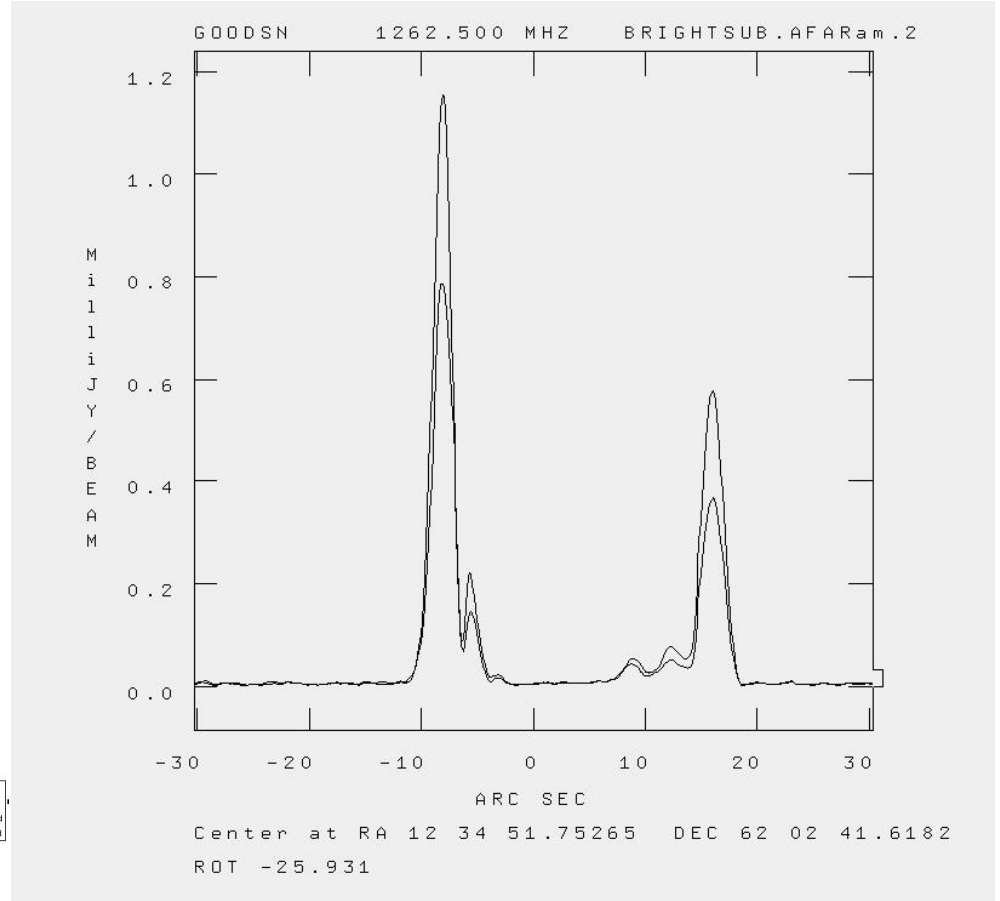
“Alpha” = α + primary beam vs. distance



Spectral correction

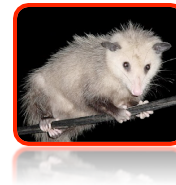
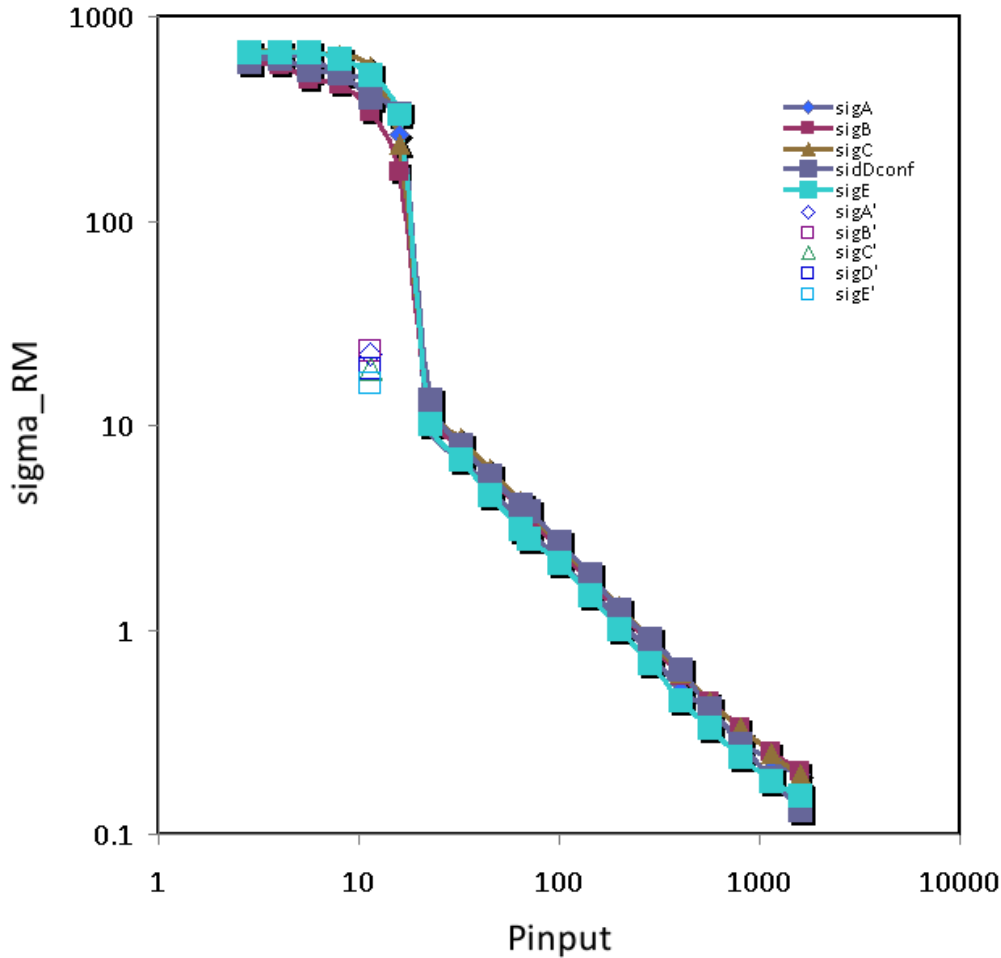


17 03 23.9, 78 25 09 AFARS output



Spectral corrections are important. POSSUM might get away with nominal correction.

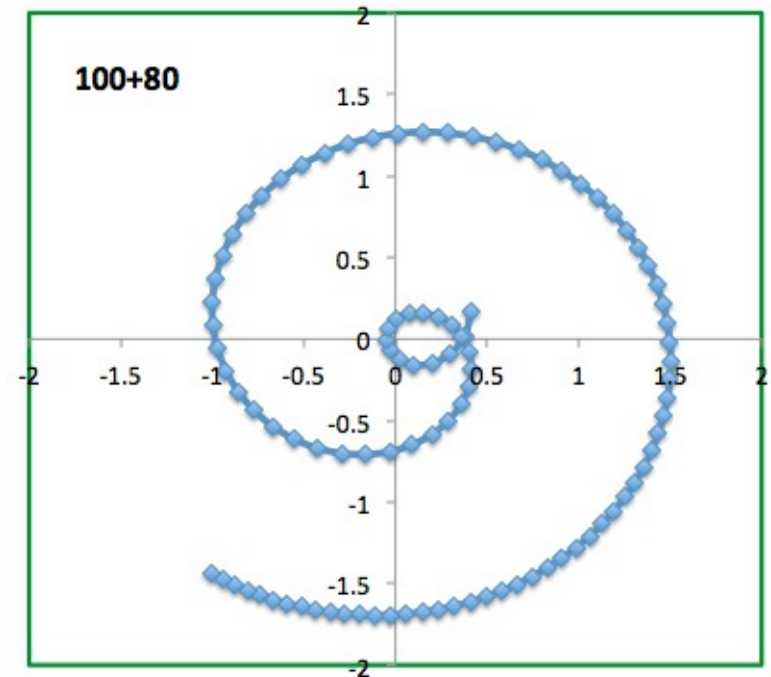
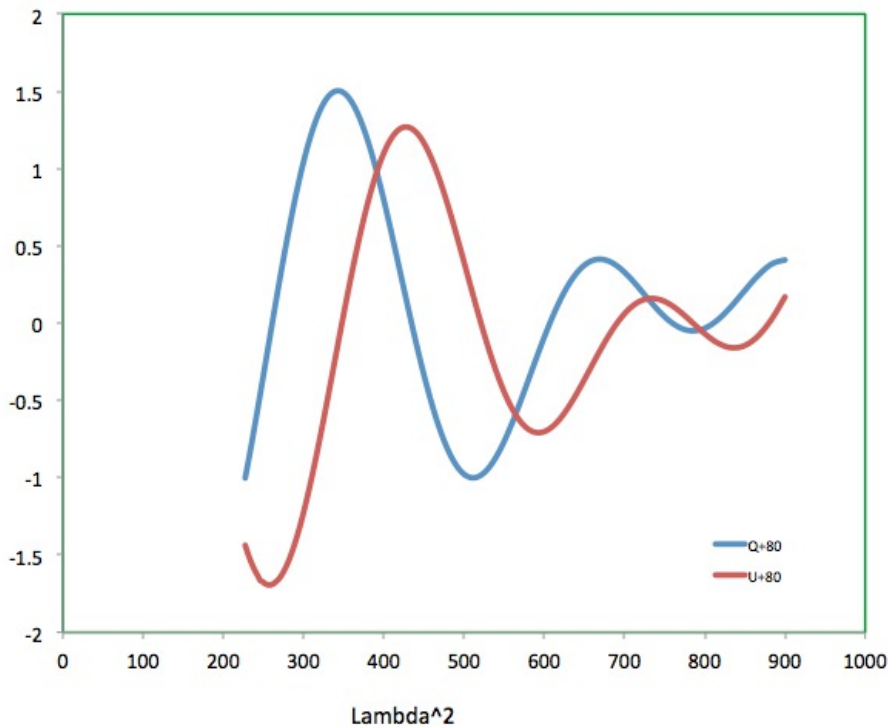
RM scatter



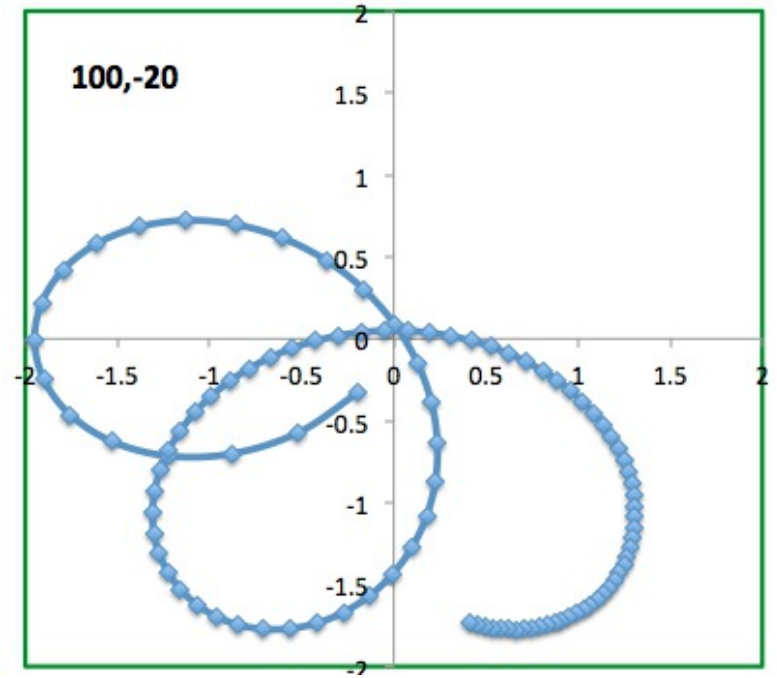
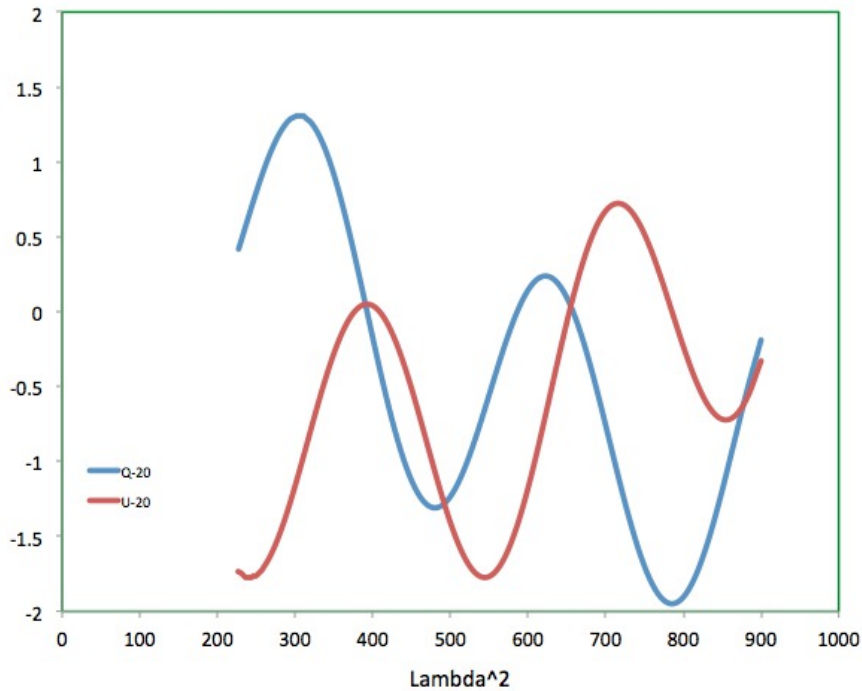
RM errors follow $\sqrt{S:N}$ down to ~ 5 , then blow up.

Below that, may still be useful statistically – need to identify possible POSSUM uses..

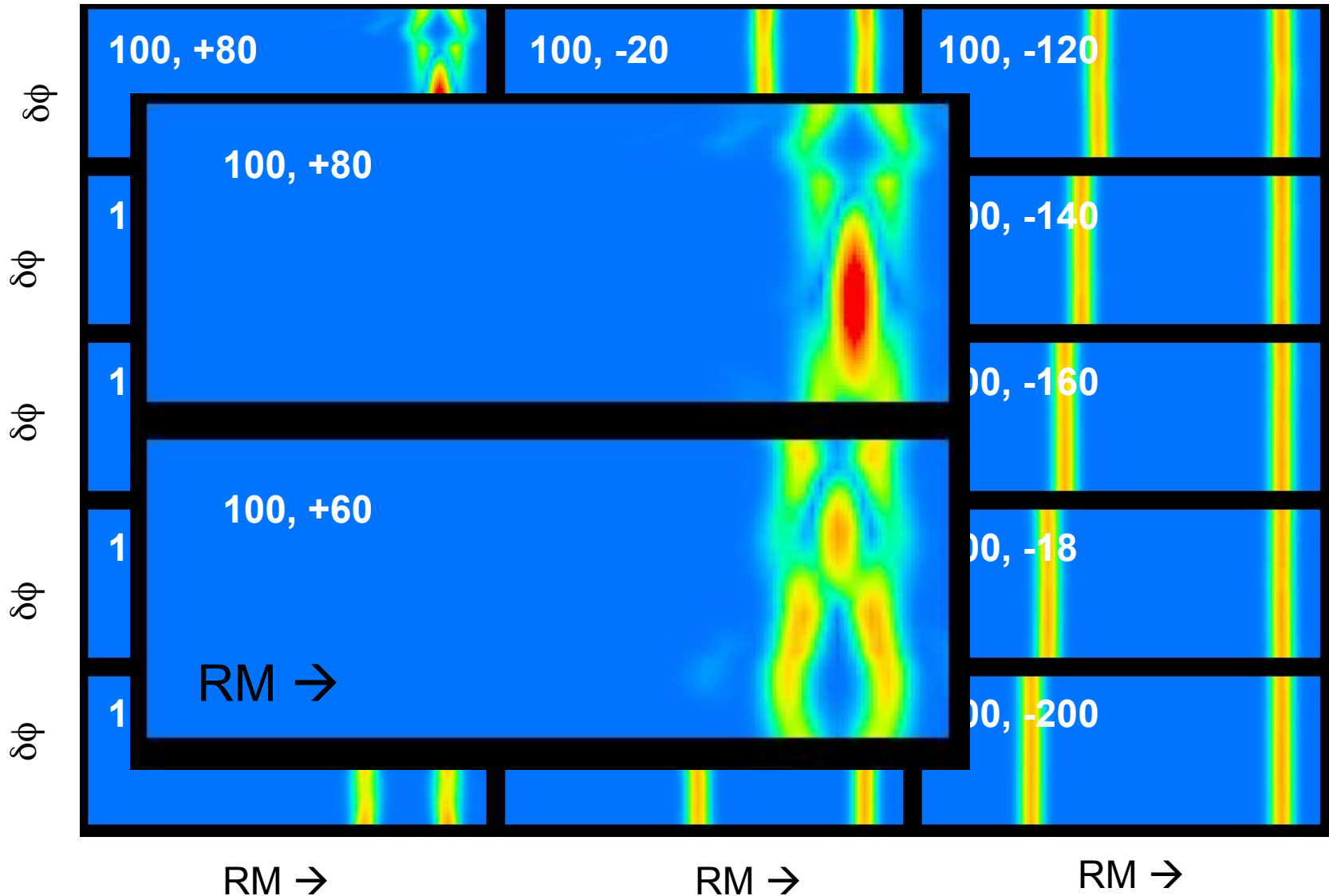
Ideal World: experiments with 2 components, *no noise!*



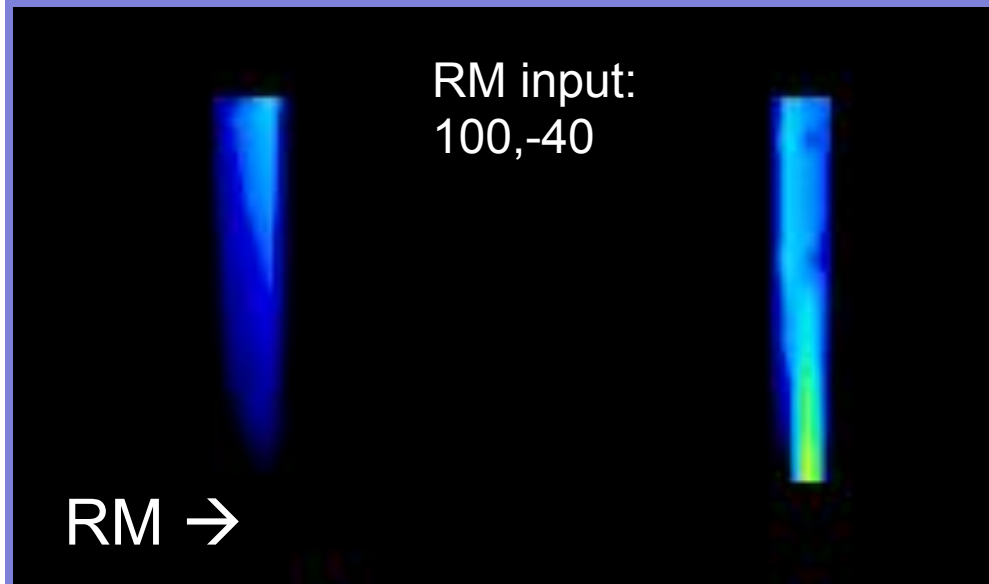
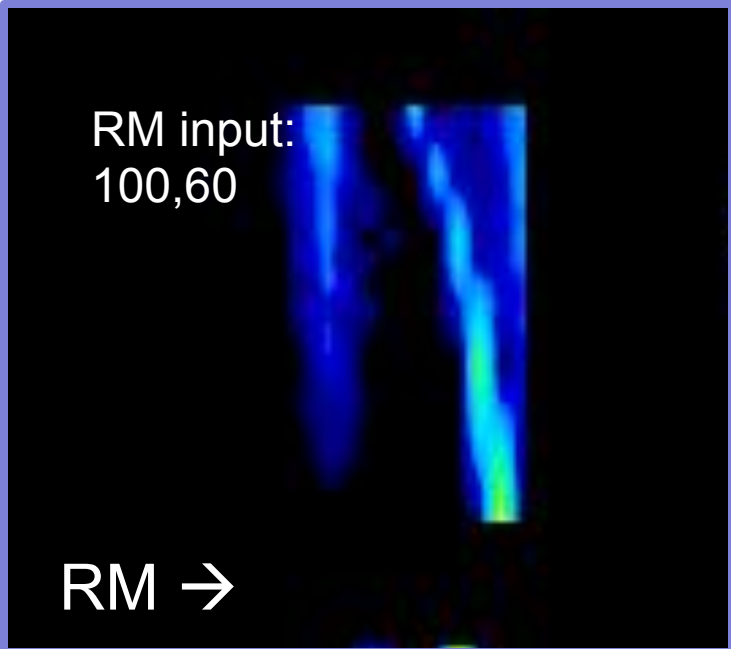
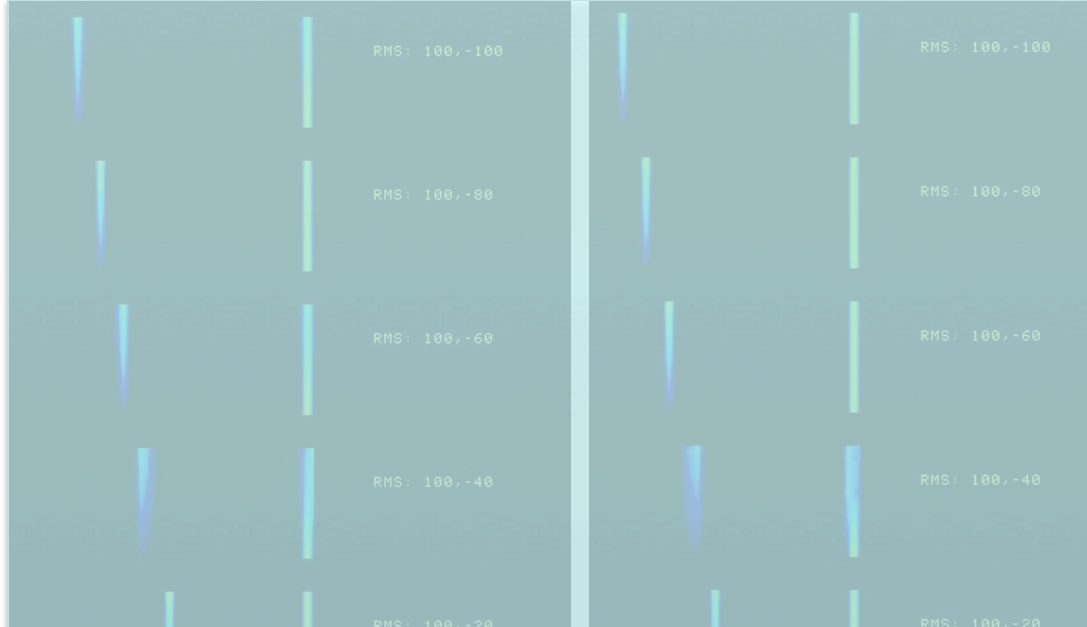
Ideal World: experiments with 2 components, *no noise!*



Faraday spectra (10,800 little experiments)



Varying ampl of
2nd component,
→ errors in
amplitude of 1st



100, 0
100, 20
100, 40
100, 60



Even with 2nd component 2x RMTF away,
Major changes in Amp & RM of 1st

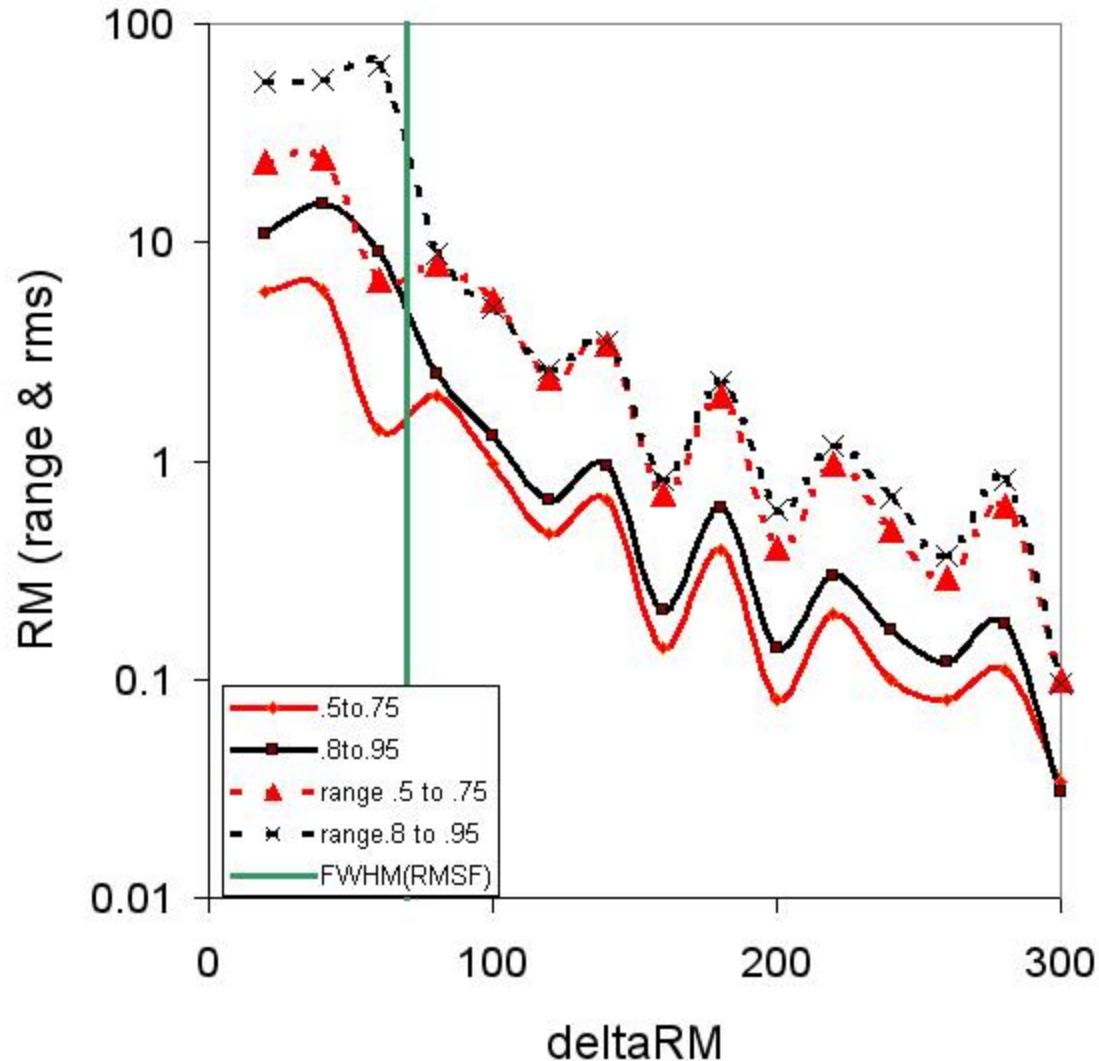


How bad is it? *no noise!*

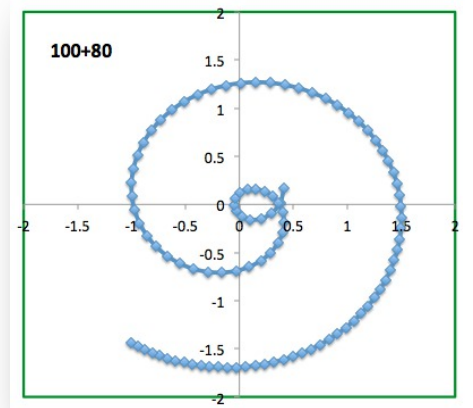
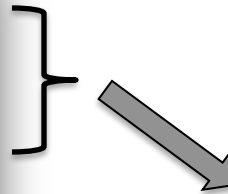
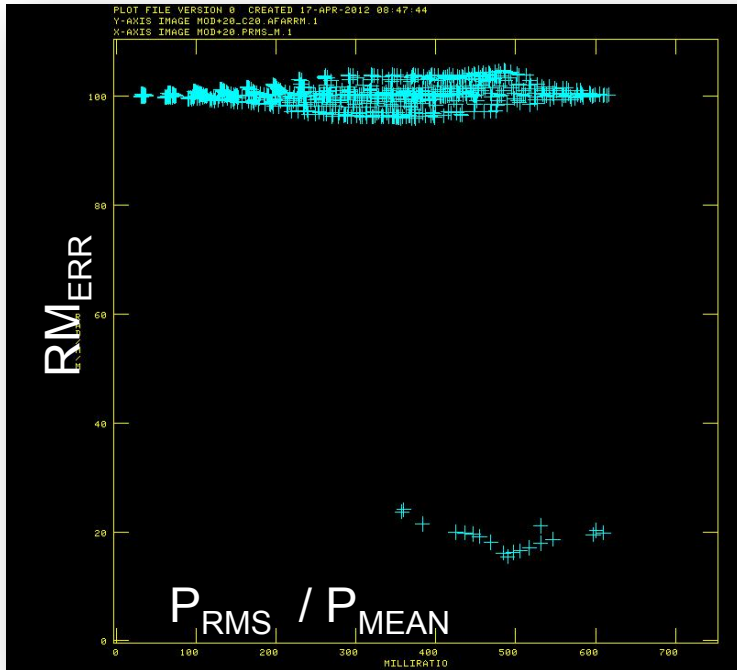


It's bad –
the limiting factor.

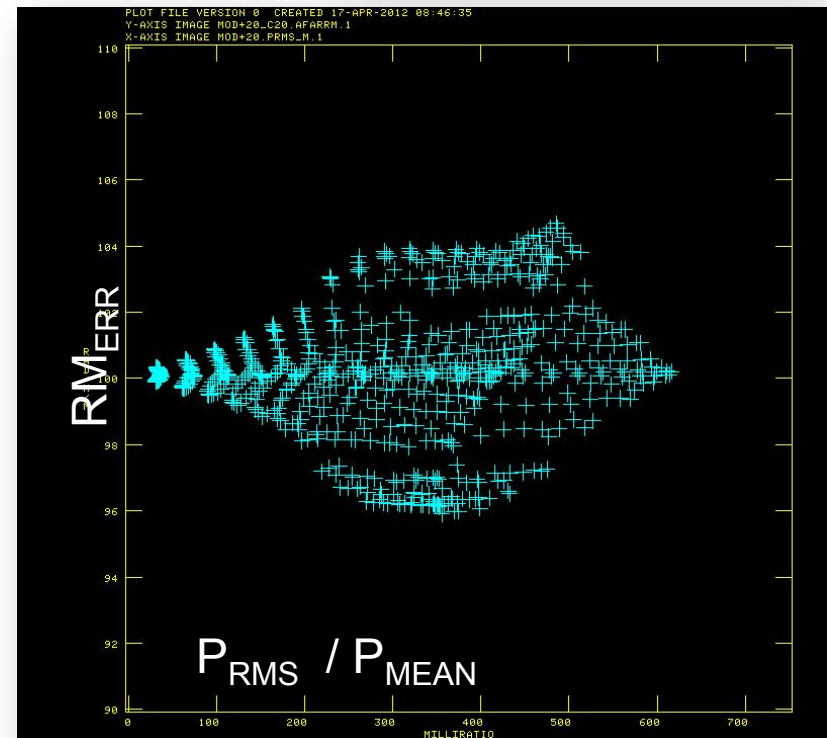
The presence of
a second comp.
within RMTF will
cause rms errors
of 3-10 rad/m².



Can we use $P_{\text{rms}}/P_{\text{mean}}$ to identify problems?



Yes, to some extent
but not at faint end





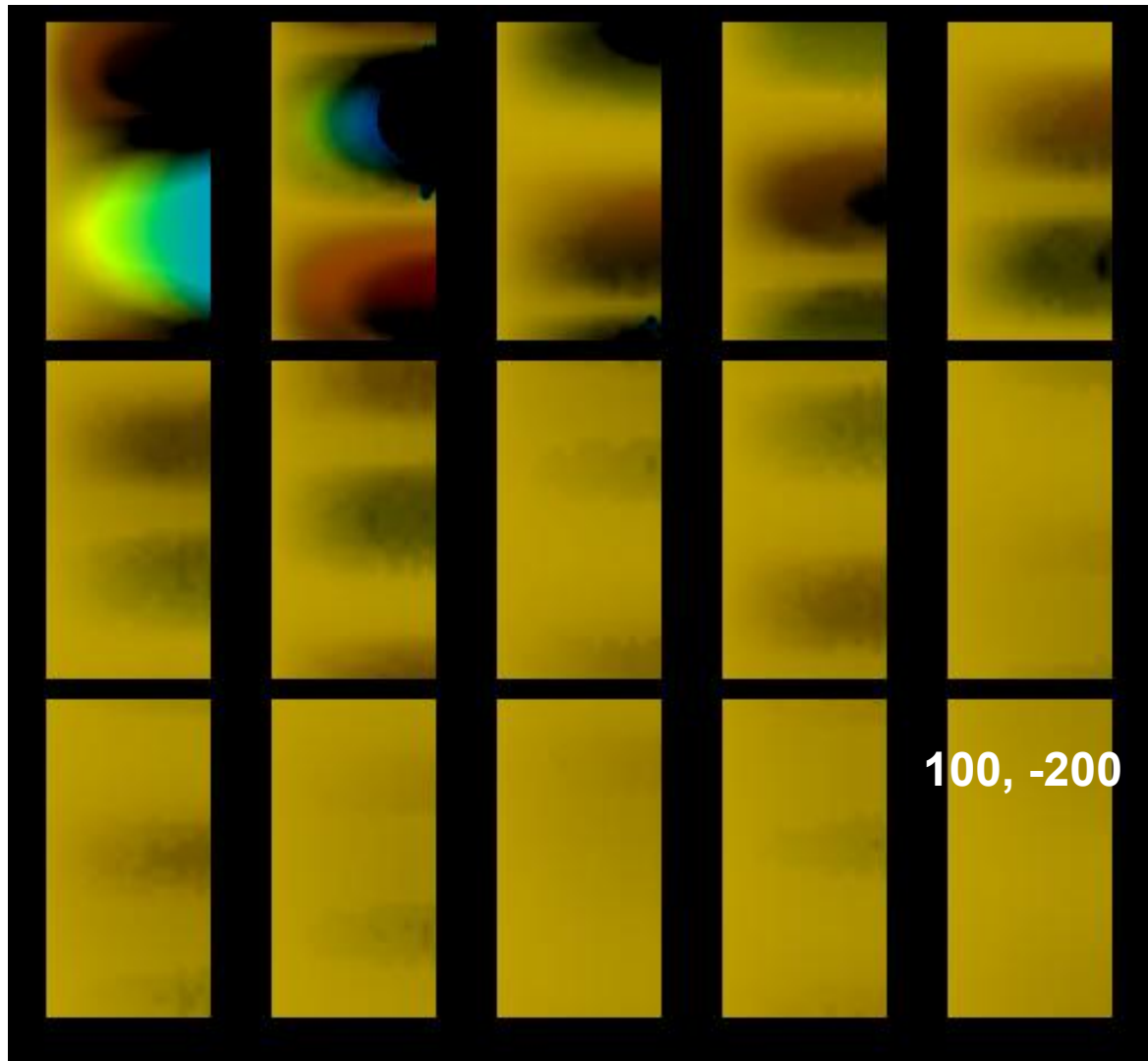
POSSUM lessons

- We have to strategically choose amount of cleaning, amount of RM convolution
- Need to do some level of spectral correction
- Statistical info may be valuable even at low S:N
- Second RM components, even far from first, wreak havoc on RMs and Amplitudes
- Measuring $P_{\text{rms}}/P_{\text{mean}}$ may help a little

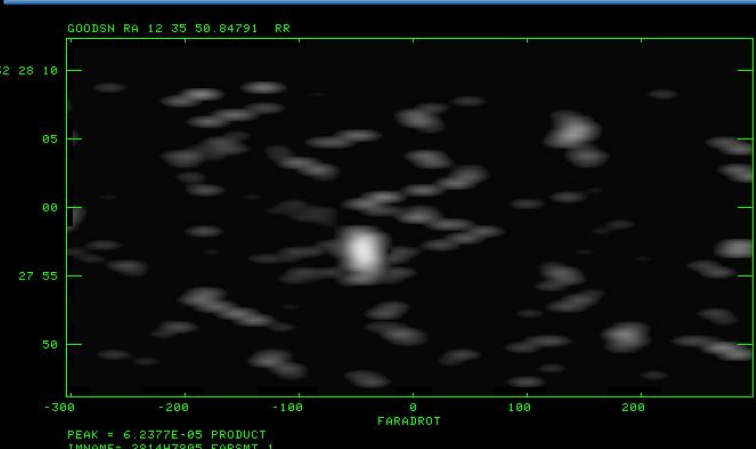
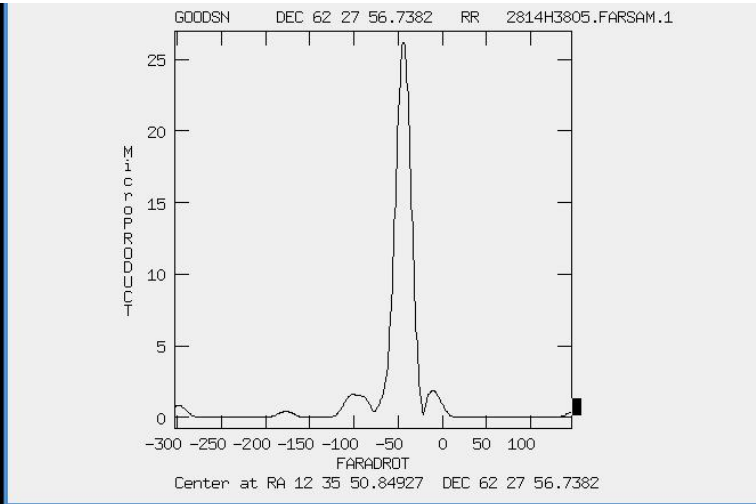
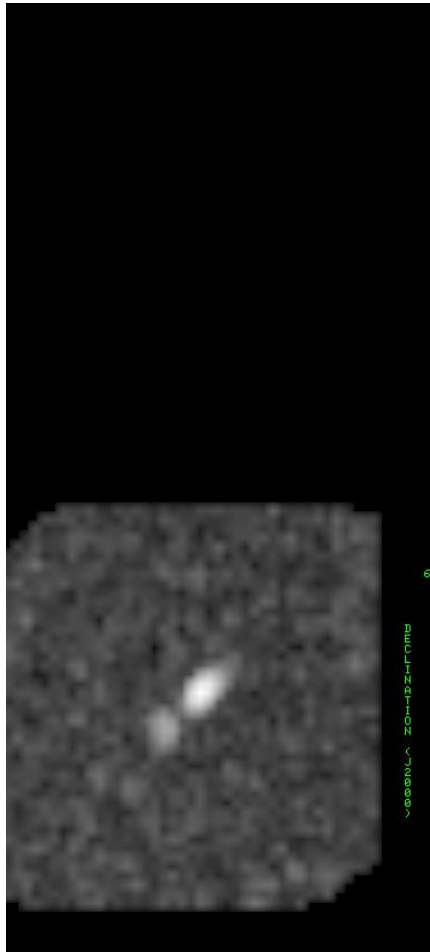
Varying amplitude of 2nd component

Ratio: 0.1 1

$\delta\phi$



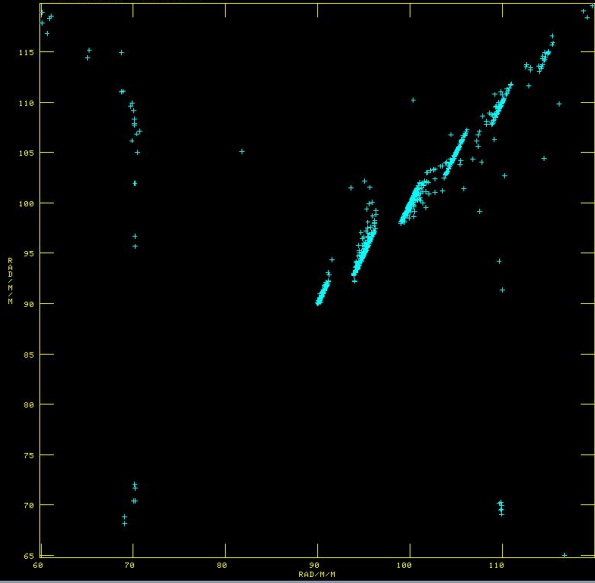
100, -200



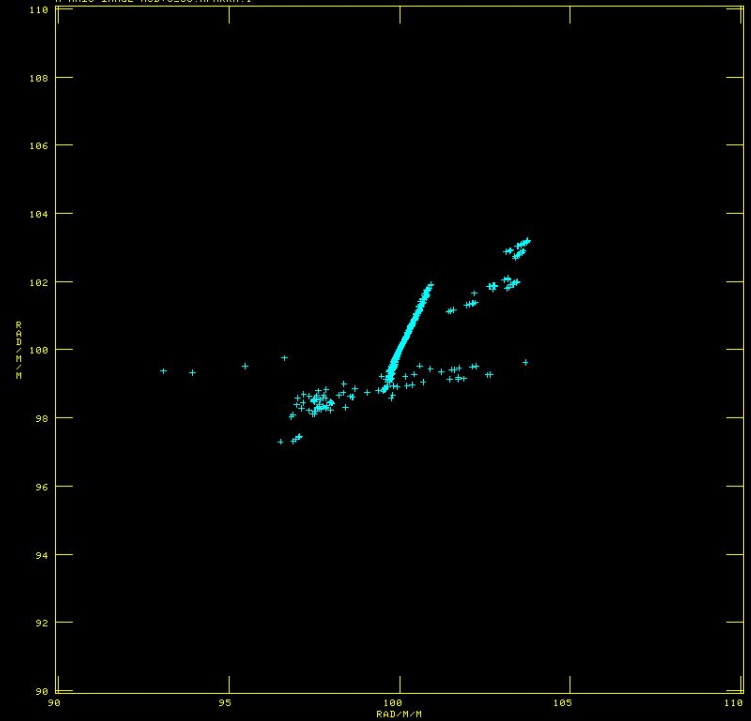
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1000

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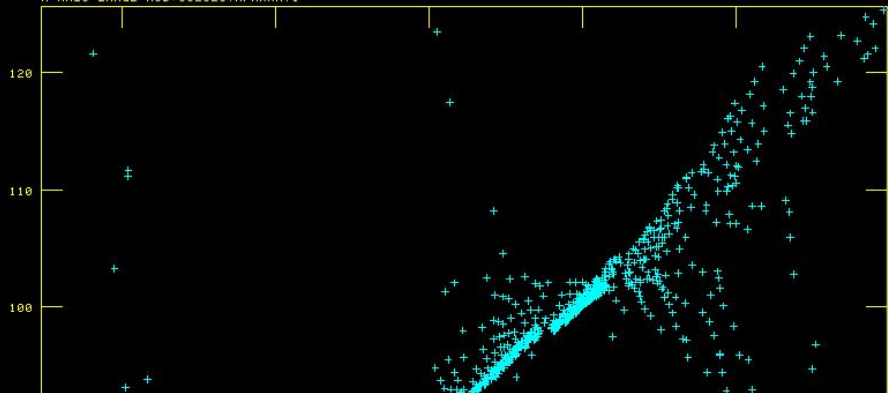
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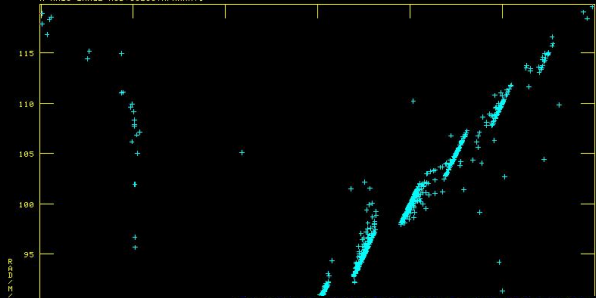
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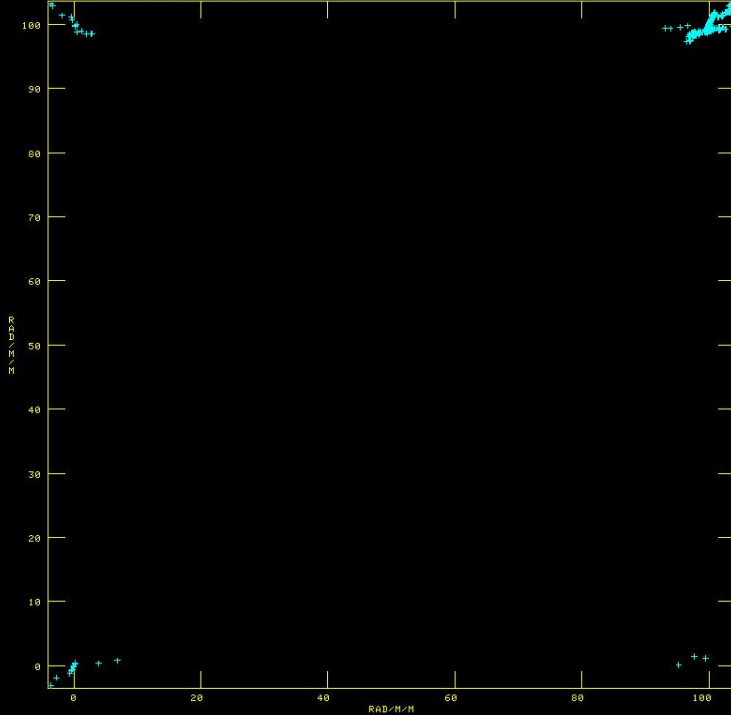
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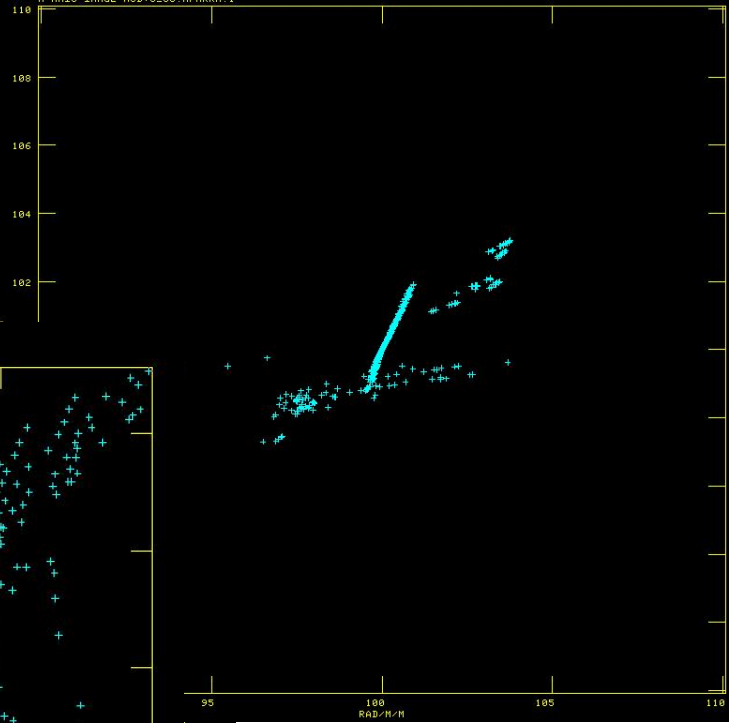
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60

70 80 90 100 110
RAD/M/H

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