

Unbiased All-Sky Search (Michigan)

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Analysis Strategy:

- Measure power in selected bins of averaged periodograms
- Bins defined by source parameters (f , RA, δ)
- Estimate noise level & statistics from neighboring bins
- Set “raw” upper limit on quasi-sinusoidal signal on top of empirically determined noise
- Scale upper limit by antenna pattern correction, Doppler modulation correction, orientation correction
- Refine corrected upper limits further with results from explicit signal simulation

Preliminary Data Pipeline Diagram for Unbiased All-Sky CW Search

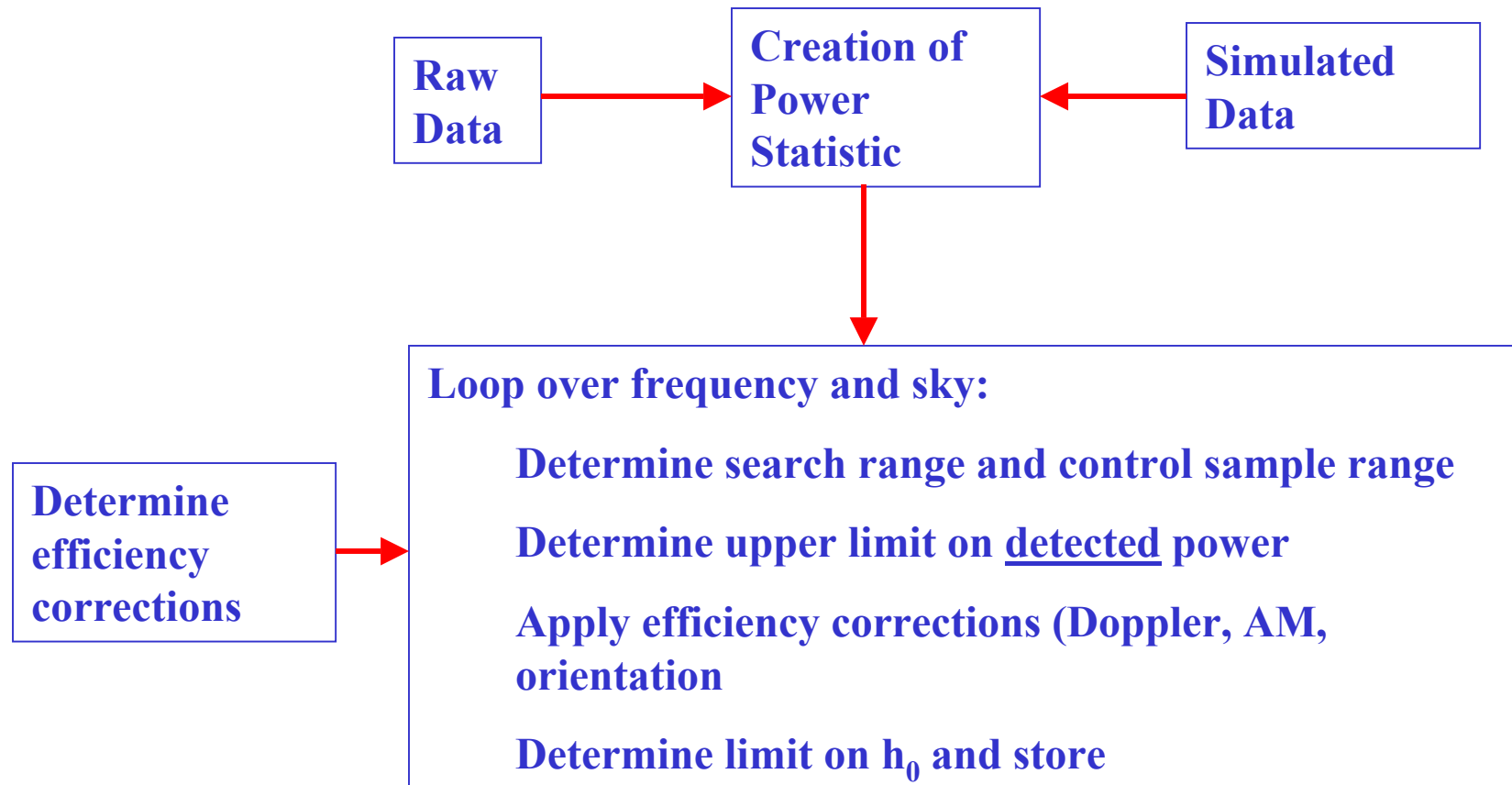
S2 Numbers:

59 days = 1416 hours = 84,960 minutes = 5.1×10^6 seconds \rightarrow Single FFT: 0.2 μ Hz bins

Power sum for 1-minute FFT's: 0-2000 Hz x 60 bins/Hz x 4 Bytes/bin = 480 kB (17mHz bins)

Power sum for 2048-s FFT's: 0-2000 Hz x 2048 bins/Hz x 4 Bytes/bin = 16.4 MB (0.5 mHz bins)

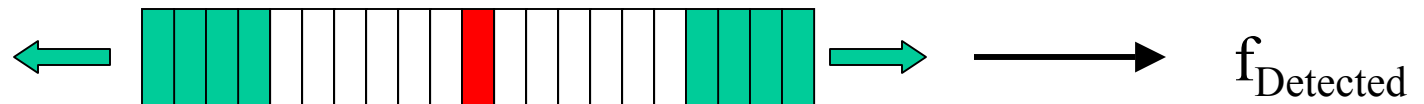
Overview:



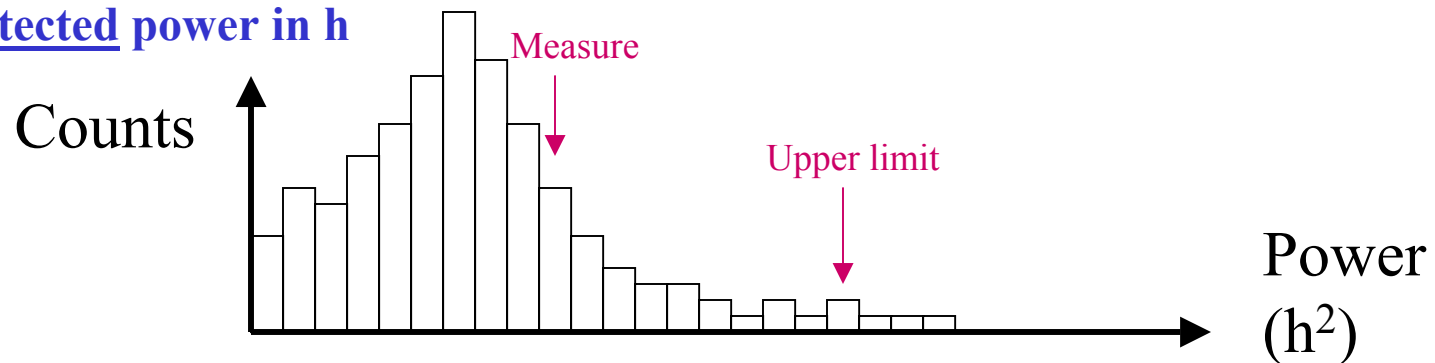
Upper Limits Finder (schematic)

Loop over values of f_0 (SSB frame), RA, $\sin(\delta)$ in steps of $\frac{1}{4}$ (17 mHz, 0.5 mHz):

- Determine the freq bin(s) of **search** and the large **control** range (nearly neighboring)



- Compare total power in bin(s) and compare with histogram to find upper limit ($\sim 2\sigma$) on detected power in h



- Apply efficiency corrections (Doppler modulation, antenna pattern, worst orientation) to find 95% C.L. upper limit on h flux at earth
- Store upper limit

Auxiliary Programs

Program to generate antenna pattern efficiency corrections, sampling over h_+ and h_x in each $(RA, \sin(\delta))$ bin [Dave]

Program to generate Doppler modulation “histograms” for sampling of f_0 values in $(RA, \sin(\delta))$ bins, including efficiency corrections for choice of frequency sampling. (Sample output on next page.) [Keith]

Comments on Simulations

Will use efficiency correction lookup tables in deriving approximate worst-case upper limits

Must refine with full simulation sampling to derive better estimates of limits