Isolation of RFI from Science

• Frequency
  – Resolution
  – Spectral Isolation
    • “Window” taper $10^{-2}$
    • Polyphase Filter $<10^{-4}$

• Time
  – Editing
  – Blanking
    • Sub-second
    • Radar, Aircraft distance measuring, etc.

• Direction of Arrival
  – Low Sidelobes – GBT $\leq 10^{-1}$
  – Adaptive Cancellation
Radar
Aircraft Distance Measuring Equipment

Pulse Power as a Function of Time

Time in microseconds

Log Pulse Power

Time in seconds
DME pulse removal

0952+176 Difference Spectra

Frequency in MHz
Adaptive Cancelling
Adaptive Cancelling Challenges

- High interference-to-noise ratio in reference channel
  - Reference antenna gain, $G_{\text{ref}} \gg \left( \frac{T_{\text{ref}}}{T_{\text{GBT}}} \right) \times G_{\text{GBT}}$ sidelobes
- Rapid frequency dependence due to multi-path delays
  - $\Delta f \approx \frac{c}{\Delta t}$ 50 µs $\rightarrow$ 20 kHz
- Radio astronomy suppression requirements ($T_{\text{sys}} \times 10^{-4}$)
  - Signal-to-Noise Ratio (SNR) $\geq 10^{-4}$
RFI Excision Successes

- Radar pulse blanker at Arecibo
- Adaptive cancellation of TV repeater at the ATNF
- Real-time frequency channel suppression within pulsar passband
- Off-line DME and Radar pulse blanking near redshifted OH lines on GBT

- Well-defined combination science objective and RFI problem
- Sustained long-term effort (science pay-off vs extra effort required)
RFI suppression we get “for free”

- RFI coherence loss on longer interferometer baselines
- On-off differencing in single-dish total power observations
- Asynchronous RFI in pulsar observations