RFI Monitoring and Mitigation

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- Despite Quiet Zone protections, interference from satellite and mobile ground-based sources is increasing.
- Frequencies historically free of RFI will see increasing use from 5G, satellite internet, car radar, etc.

Current Mitigation Strategies

- Quiet zones and on-site mitigation efforts
  - National Radio Quiet Zone coordination and enforcement
    - Applies to permanent, fixed, licensed transmitters in a 13,000 sq-mile area
  - West Virginia Radio Quiet Zone coordination and enforcement
    - Applies to interference-causing equipment in a 10-mile radius
  - On-site policies against intentional emissions and suppression of unintentional emissions

- GBT RFI scans
  - Bandpass plots available online
  - [https://science.nrao.edu/facilities/gbt/interference-protection/ipg/rfi-scans](https://science.nrao.edu/facilities/gbt/interference-protection/ipg/rfi-scans)

- Offline flagging and excision of affected data
  - Manual or automated statistical identification
  - Typically results in loss of a full integration
Possible New Strategies

- Dedicated RFI monitoring station
  - DRAO has developed an antenna + backend that makes use of machine learning to identify RFI
  - This would be an independent source of information about strong RFI
  - DRAO system is frequency swept up to 2 GHz
- GBO system could use DRAO backend but expand coverage to 40 GHz
  - Potential to expand to even higher frequencies in a second phase
- 24/7 monitoring
- User accessible data products
Possible New Strategies

- Active identification and excision in GBT data
  - NSF-funded project is underway to explore techniques for identifying RFI in digitized baseband voltage samples
  - All techniques will undergo rigorous astronomical verification
  - Excision would occur before accumulation and averaging
    - Has potential to excise less data, but in a non-recoverable way
    - Alternatively, both mitigated and unmitigated copies could be saved at the expense of larger data volumes
  - User-selected options
  - Currently in R&D stage; if successful, additional backend computing resources will be required

See posters #109.30 & #175.18
Potential Discussion Questions

• What modes of operation would be most useful for an RFI monitoring station?
  – E.g. continuously sweep over all frequencies or focus on those being observed

• What RFI monitoring station data products would be most useful?

• Are existing methods for RFI identification and flagging/excision adequate?
  – GBTIDL allows integrations and individual channels to be flagged and ignored in later processing
  – Automatic identification and flagging is not included in the default GBTIDL release
  – Several routines are available in pulsar data reduction packages

• Would you accept excised data in lieu of “raw” data?
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