

# GR-INSPECTOR

A SIGNAL ANALYSIS TOOLBOX FOR GNU RADIO



# MOTIVATION OF AUTOMATED SIGNAL ANALYSIS

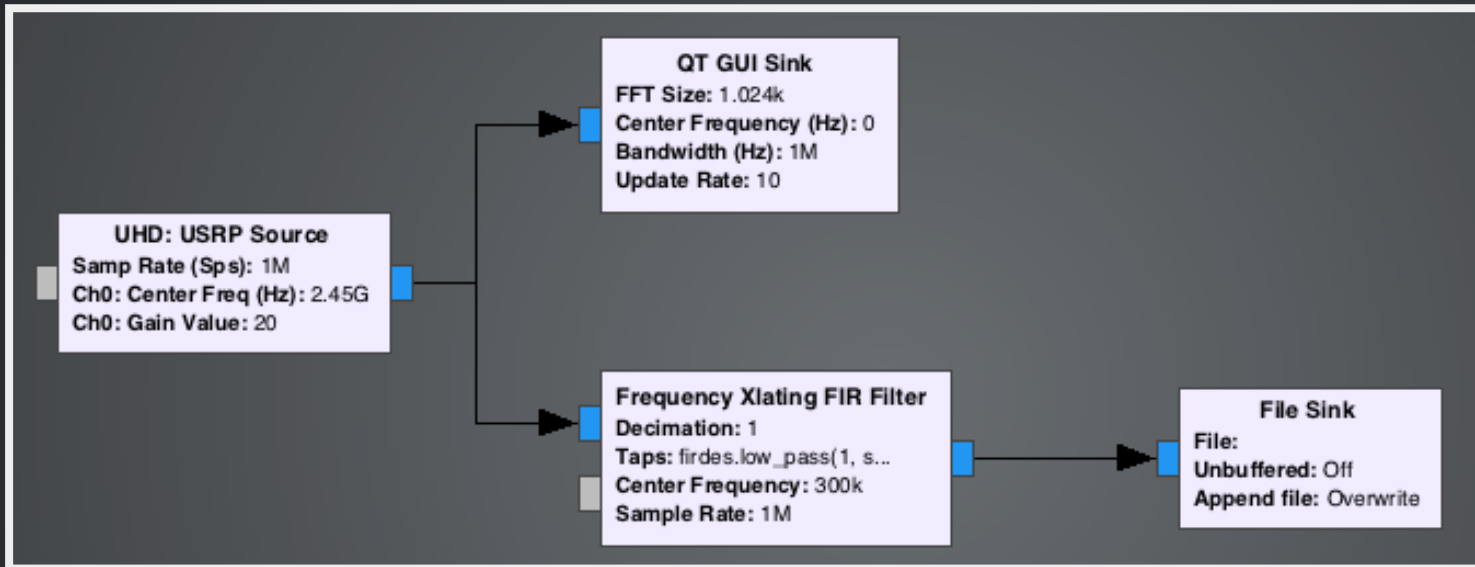
- Spectrum Monitoring
- Explore real-world signals
- Easy access for beginners
- Live demodulation
- Batch processing of signals

# TASKS OF RECEIVING UNKNOWN SIGNALS

- Detect
- Mix down
- Filter
- Analyse
- Demodulate
- Decrypt

# TYPICAL WORKFLOW BEFORE

- Use GNU Radio to receive signal



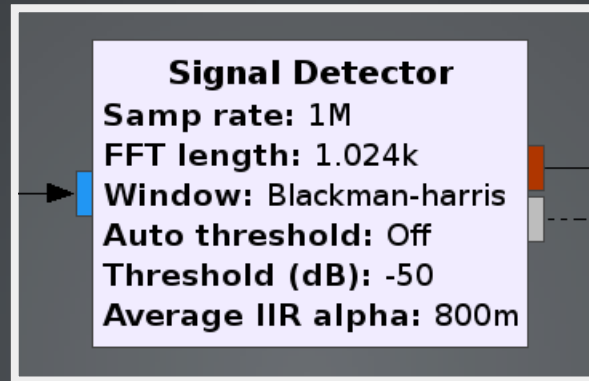
- Analyse signal with signal processing tools (Scipy/Inspectrum/MATLAB)
- Estimate necessary parameters for demodulation
- Demodulate with GNU Radio or other tools

# WORKFLOW CHARACTERIZED BY

- Stop and adjust flowgraph several times
- Rule-of-thumb estimate of parameters
- Real-time analysis hardly possible
- User needs much expertise to perform steps

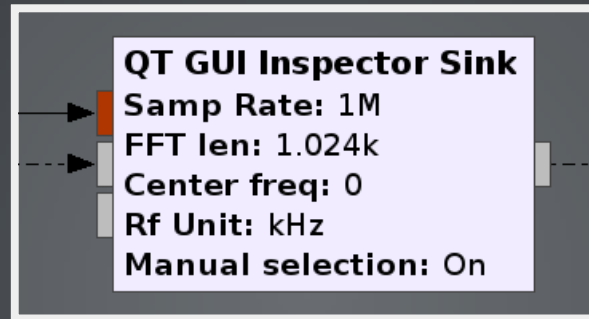
This is where the inspector comes in!

# SIGNAL DETECTION



- Performs energy detection on one or more signals
- Set threshold or use auto threshold
- Suppress narrow signals (false detections)
- Outputs estimated PSD and map of signal frequencies/bandwidths

# VISUALISAZIONE

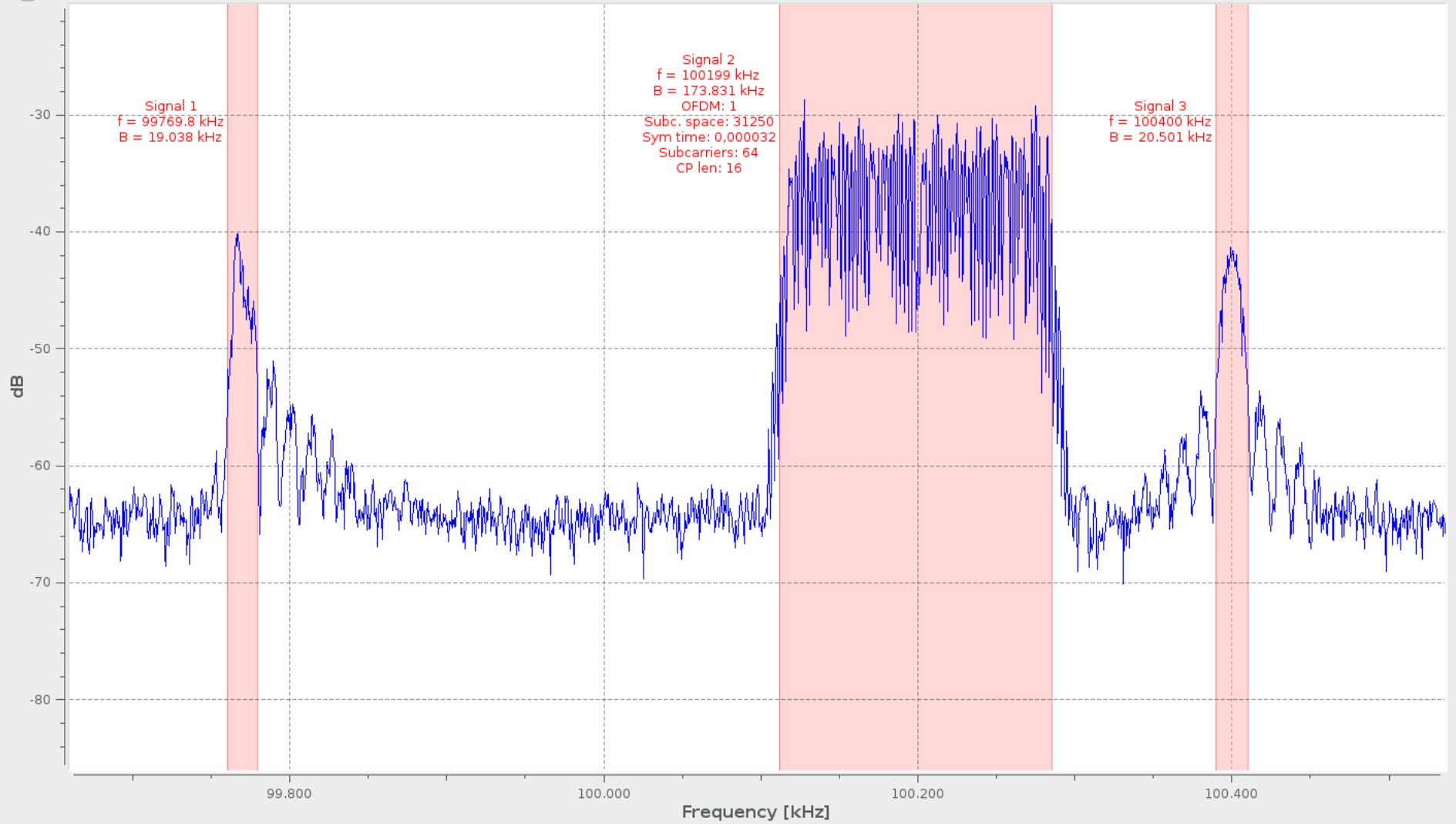


- Plots PSD estimate from signal detector
- Shows signal boundaries
- Prints signal properties and analysis results
- Enables manual selection of signals

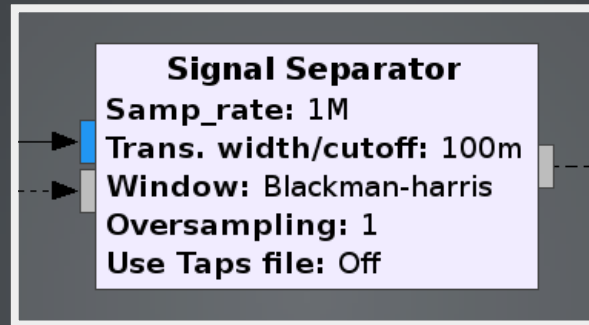


# Inspector GUI

☐ Manual

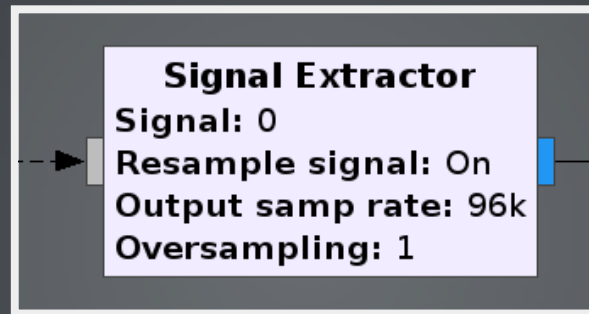


# SEPARATION OF SIGNALS



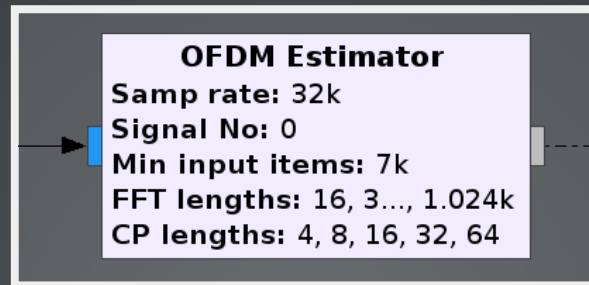
- Mixing, Filtering, Decimating
- FIR filter for every detected signal
- Calculates filter taps or uses precalculated JSON file
- Outputs lists of signal parameters and samples

# CUSTOM PROCESSING OF SIGNALS



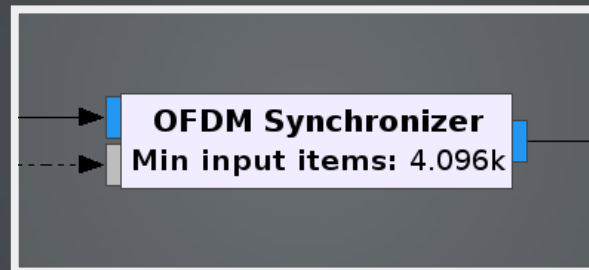
- Picks one signal from separator list
- Passes it as complex stream for most GR blocks
- Resampling possible

# OFDM PARAMETER ESTIMATION



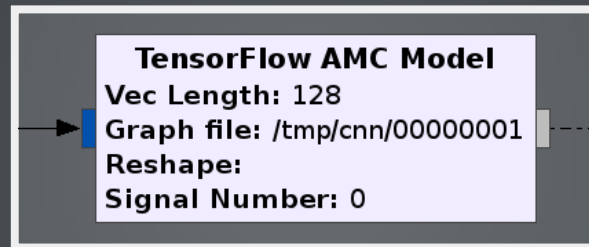
- Estimation of
  - Subcarrier spacing
  - Symbol time
  - Subcarrier number
  - Cyclic prefix length
- Can be fed back to QT GUI Inspector Sink

# OFDM SYNCHRONIZATION



- Performs frequency and timing synchronization

# MODULATION CLASSIFICATION



- Estimates modulation type of single carrier signals
- Developed by Christopher Richardson

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# THANK YOU!

