PLATH SIGNAL PRODUCTS

INTERCEPTION CONFIDENCE · DIRECTION FINDING ASSURANCE

INTRODUCING INTERCEPTION AUTOMATION

Automation at the Front End of COMINT

AGENDA

Introducing Interception Automation

1. Interception Automation
2. The Need for Interception Automation
3. Implementation: Signal Processing and Mass Data Handling
4. Application Example: Hopper Detection using a block-wise Scan
5. Summary

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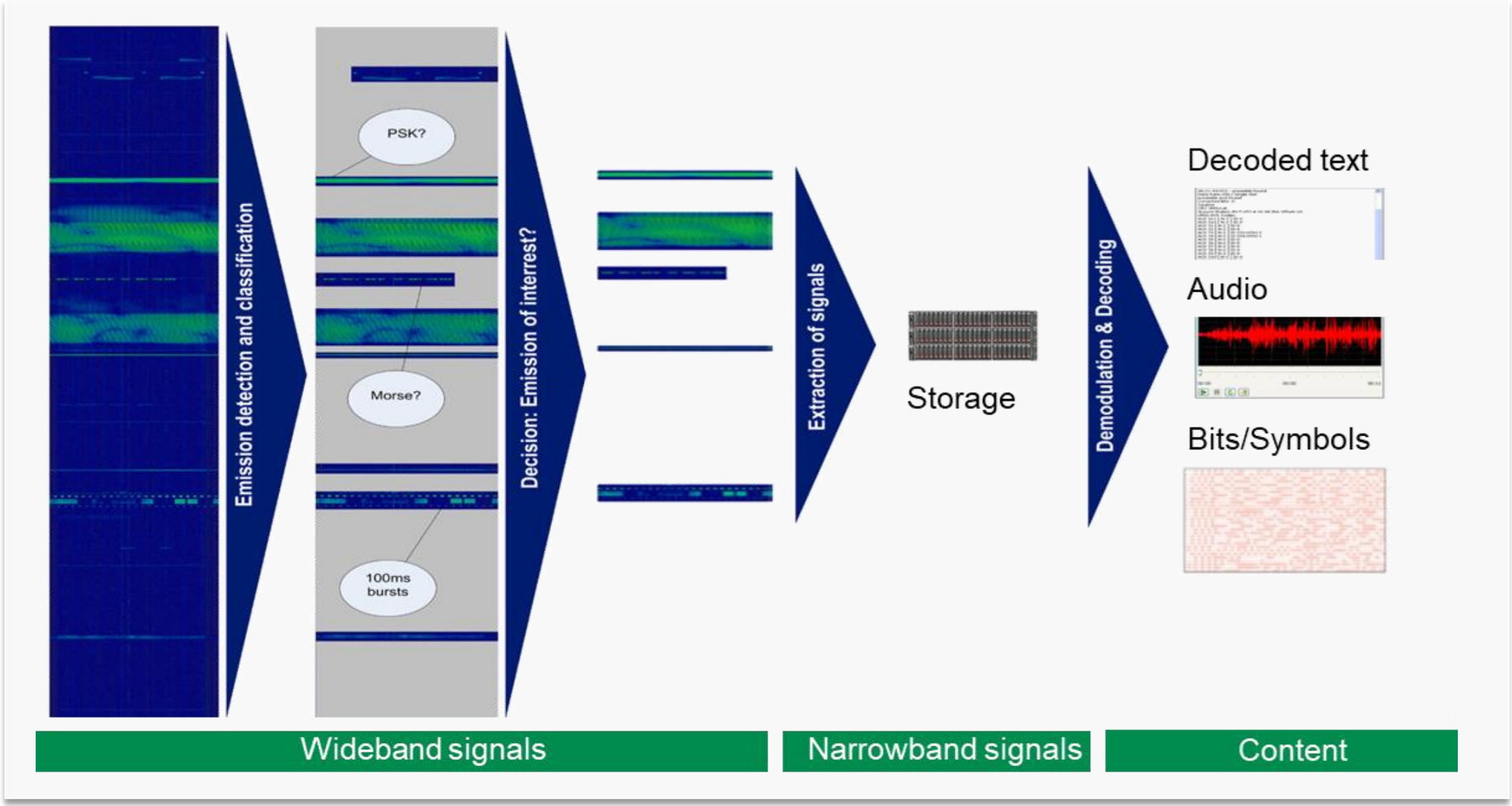
INTERCEPTION AUTOMATION

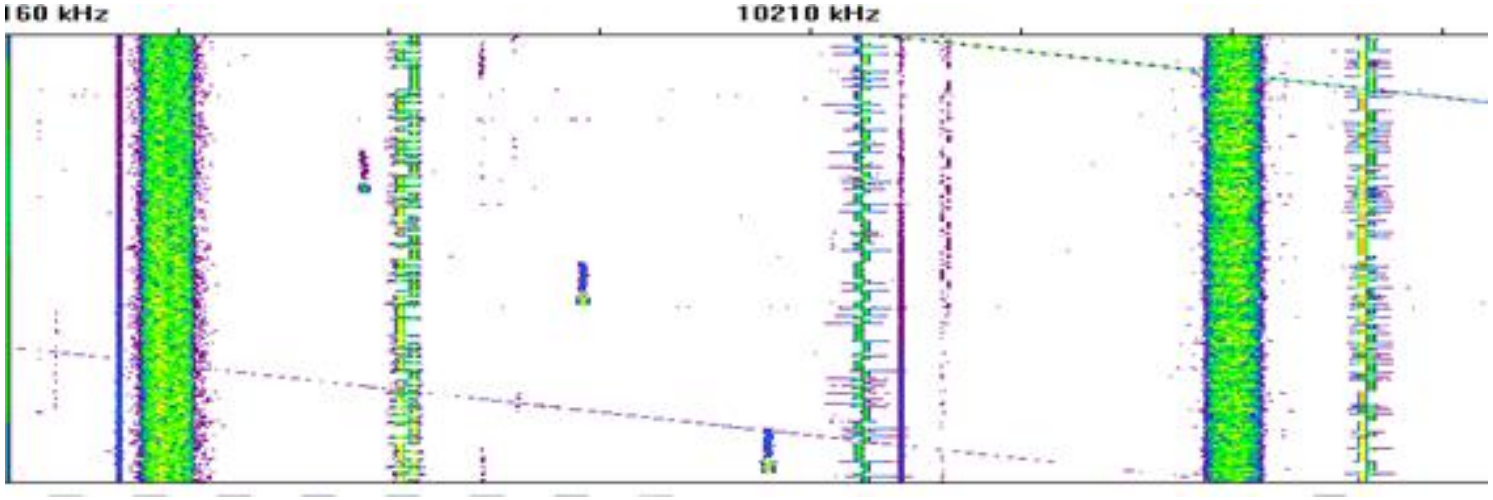
AUTOMATION HAS FOCUSED ON BACKEND…



… AUTOMATION AT THE FRONT END

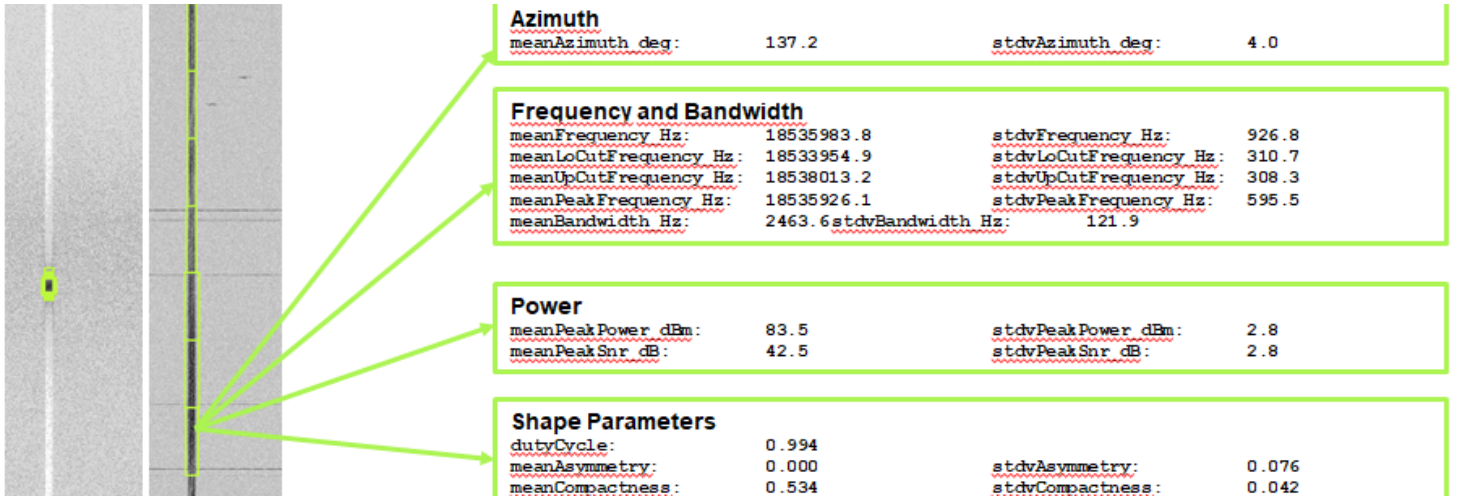
PRE-PROCESSING

- De-Noising
- Masking of Interfering Signals
- Detection of weak Signals
- Segmentation
- (Signal Enhancement)



SIGNAL AGGREGATION

- Stationary Signals
- Signal Envelopes
- Chirp Sounders
- Bursts
- Hopper



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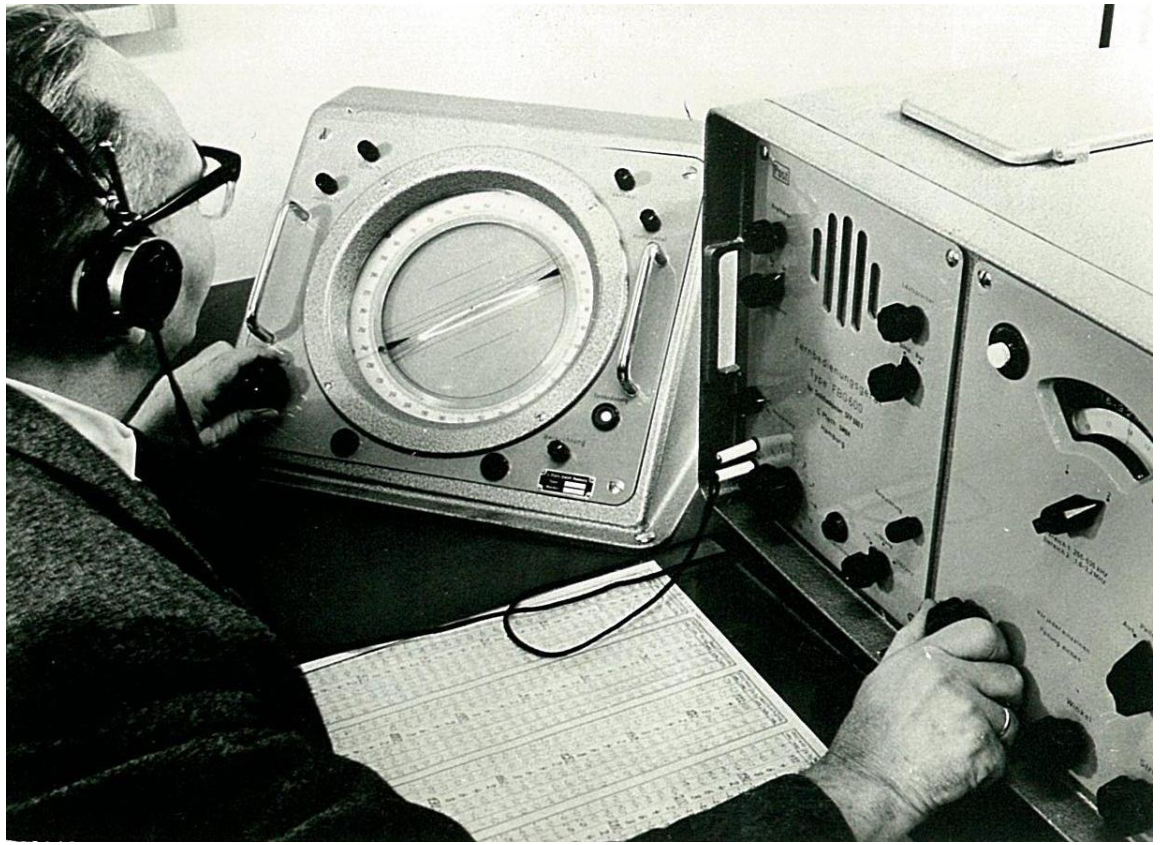
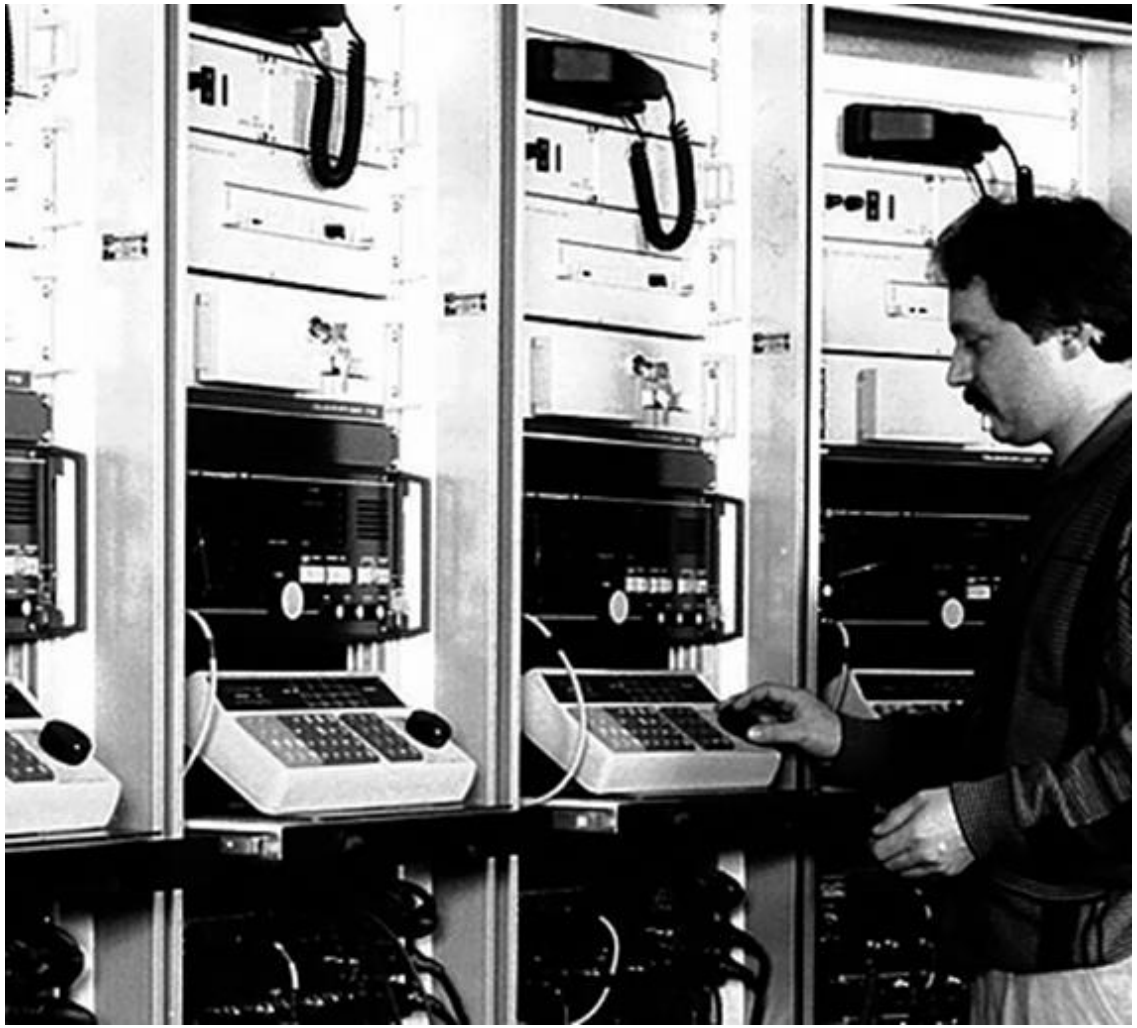
THE NEED FOR INTERCEPTION AUTOMATION

EVOLUTION OF COMMUNICATION INTELLIGENCE

…TRACKING OF SIGNAL ACTIVITY NOW AND THEN



THE NEED FOR INTERCEPTION AUTOMATION



- automatic tracking of signal activity
- reduced required skills
- less training and specialization needed
- reduced costs

- while increasing probability of intercept
- and location determination

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IMPLEMENTATION: SIGNAL PROCESSING AND MASS DATA HANDLING

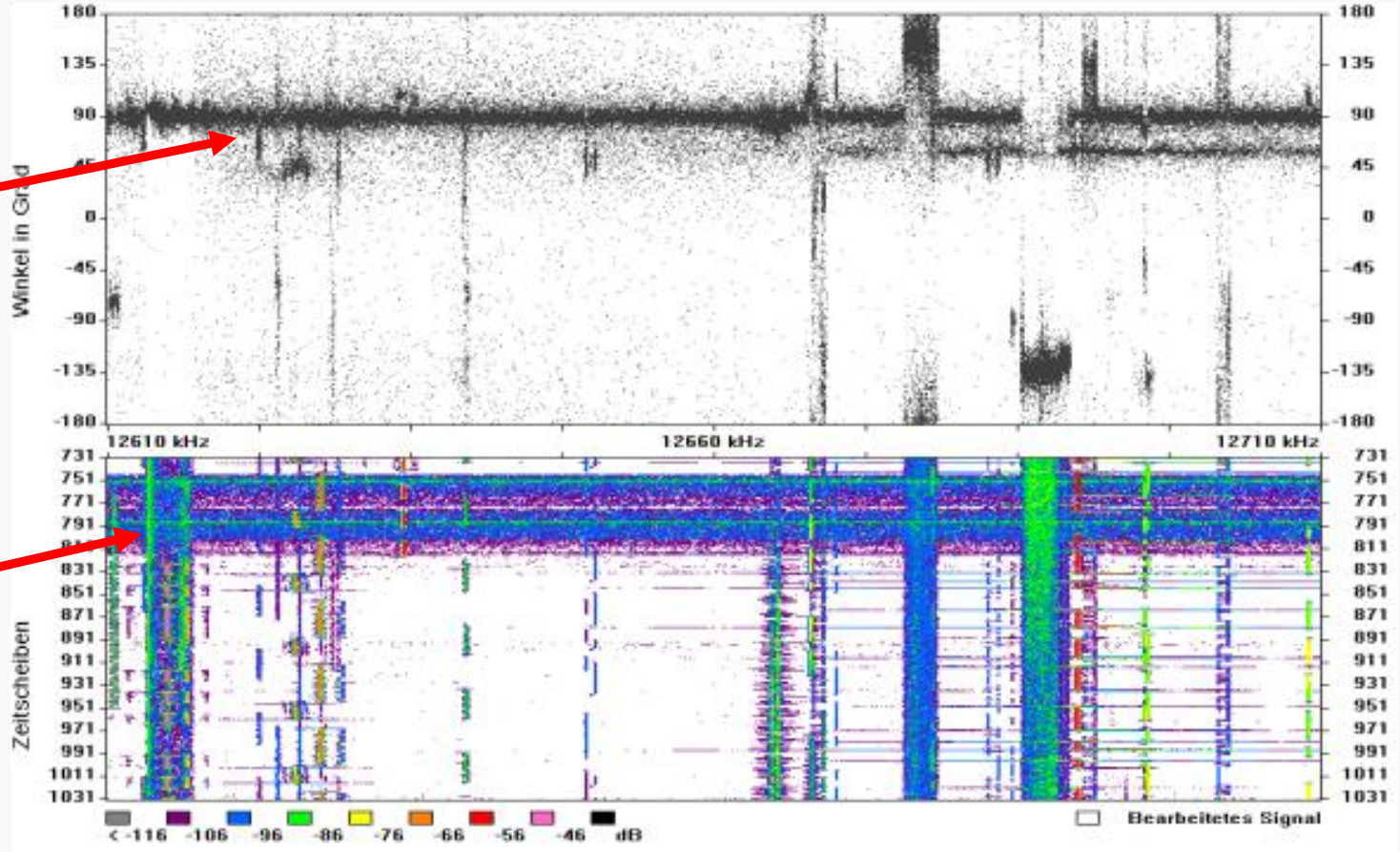
RESULT DATA OF WIDEBAND DIRECTION FINDER

Detection of Broadband Interferences

general increase in the noise level limited in time and space

<u>histogram display</u>
spatially limited interference from + 90°

<u>waterfall display</u>
time-limited frames

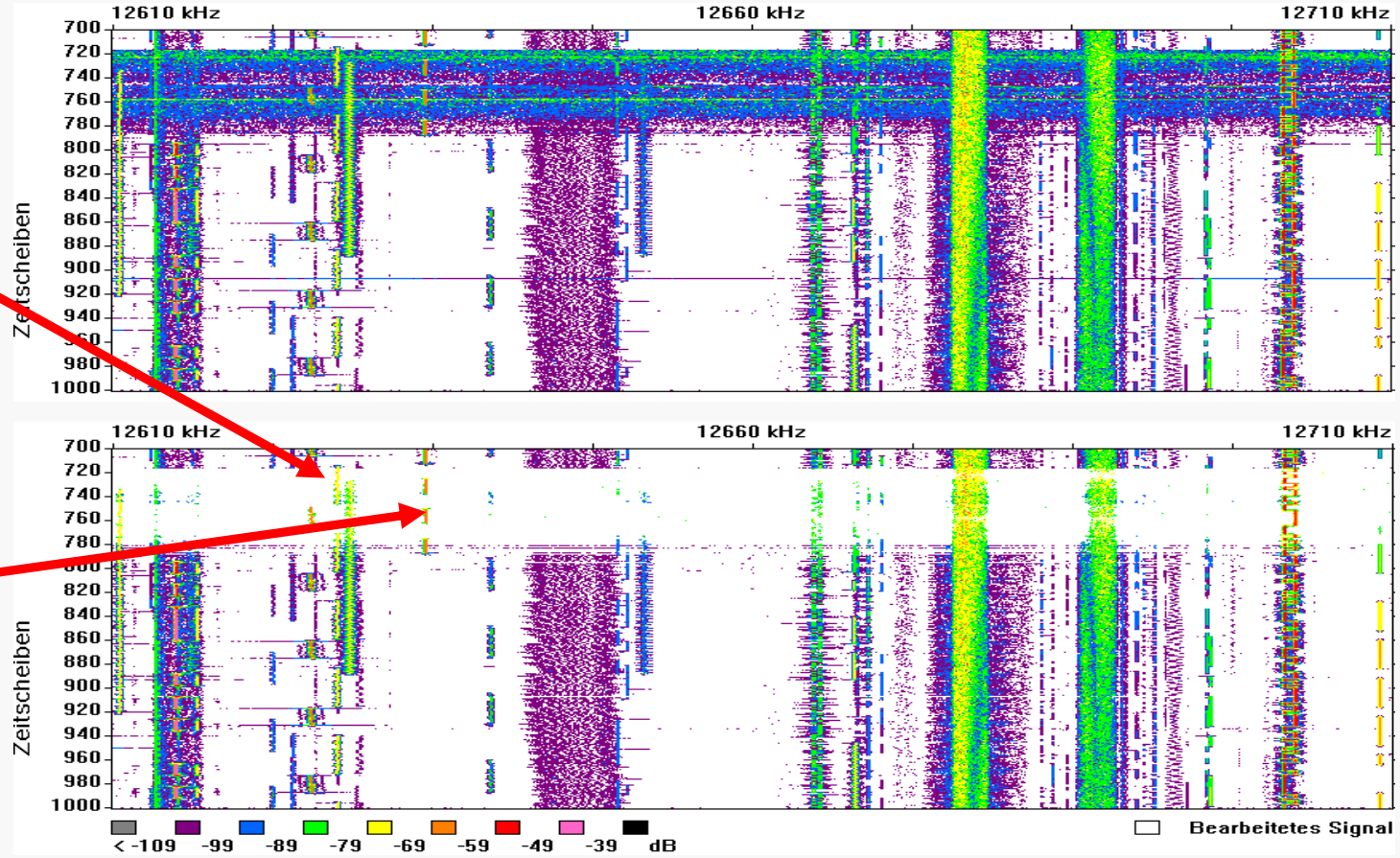


MASKING OF THE INTERFERING SIGNALS

Removal of Wideband Noise

important information is retained (e.g. keying of the transmitter)

individual channels become "visible"



DETECTION OF WEAK SIGNALS

using Direction Finding Histograms

- Frequency

5419.000 kHz

5431.875 kHz

- Bearing

132° ± 10°

39° ± 6°

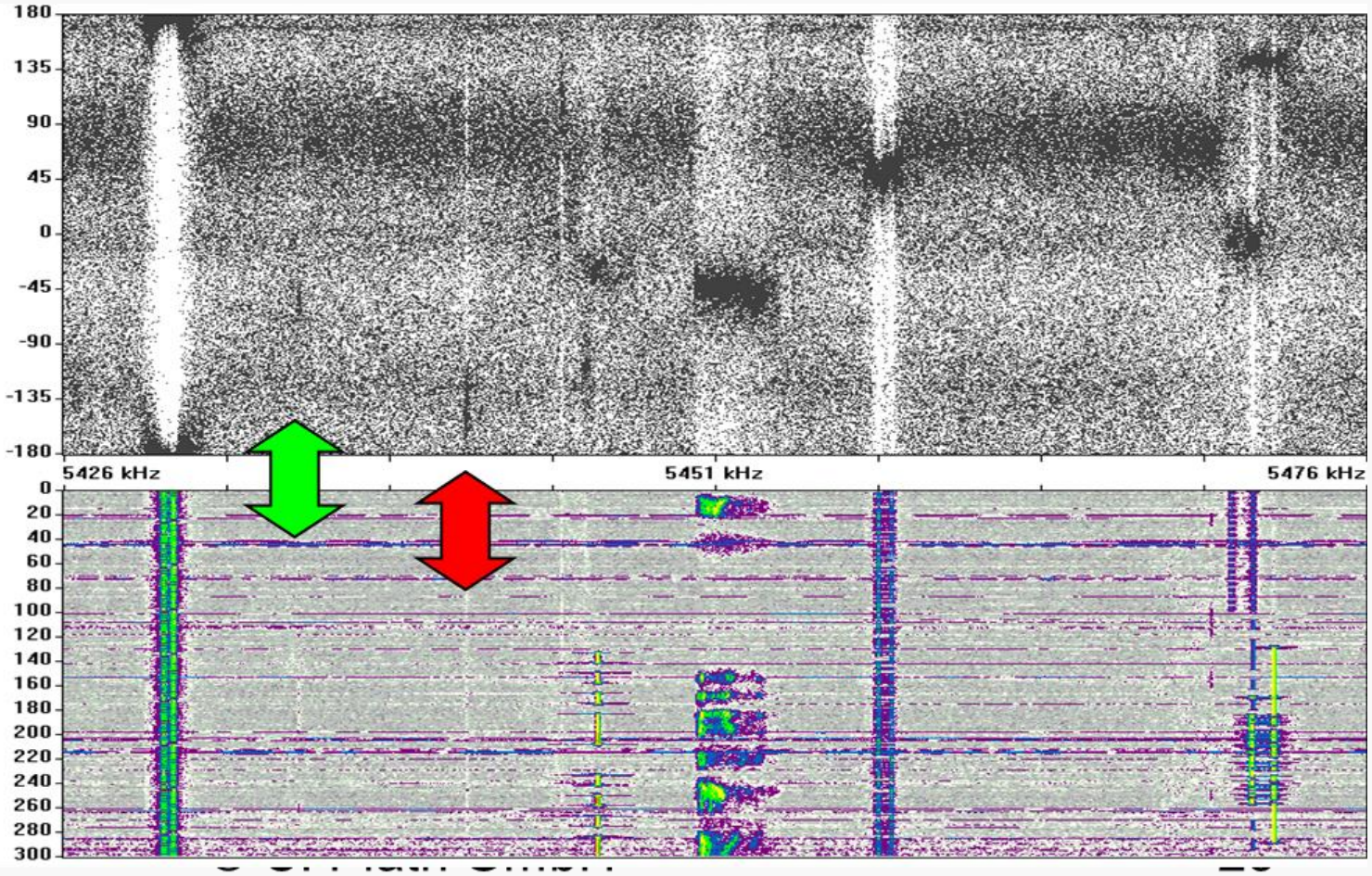
- Amplitude

-121.5 dBm

-118.2 dBm

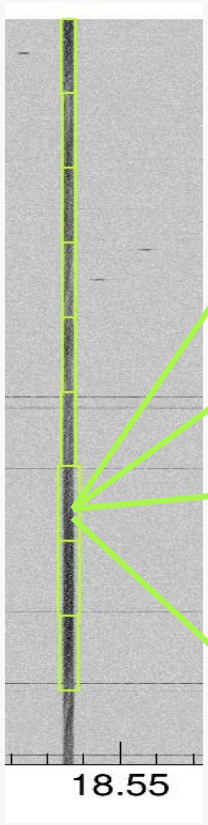
- Threshold

-114.0 dBm



RESULTS OF SIGNAL PRE-PROCCSSING

Extraction of Signal Parameters



Identification and Timing

emissionId:	526469271500010002
emissionStartTime_ms:	001449744956000 (2015-12-10T10:55:56,000)
segmentStartTime_ms:	001449744964000 (2015-12-10T10:56:04,000)
segmentStopTime_ms:	001449744968000 (2015-12-10T10:56:08,000)
nSamples:	14925
nSpectra:	497

Azimuth

meanAzimuth_deg:	137.2	stdvAzimuth_deg:	4.0

Frequency and Bandwidth

meanFrequency_Hz:	18535983.8	stdvFrequency_Hz:	926.8
meanLoCutFrequency_Hz:	18533954.9	stdvLoCutFrequency_Hz:	310.7
meanUpCutFrequency_Hz:	18538013.2	stdvUpCutFrequency_Hz:	308.3
meanPeakFrequency_Hz:	18535926.1	stdvPeakFrequency_Hz:	595.5
meanBandwidth_Hz:	2463.6	stdvBandwidth_Hz:	121.9

Shape Parameters

dutyCycle:	0.994		
meanAsymmetry:	0.000	stdvAsymmetry:	0.076
meanCompactness:	0.534	stdvCompactness:	0.042

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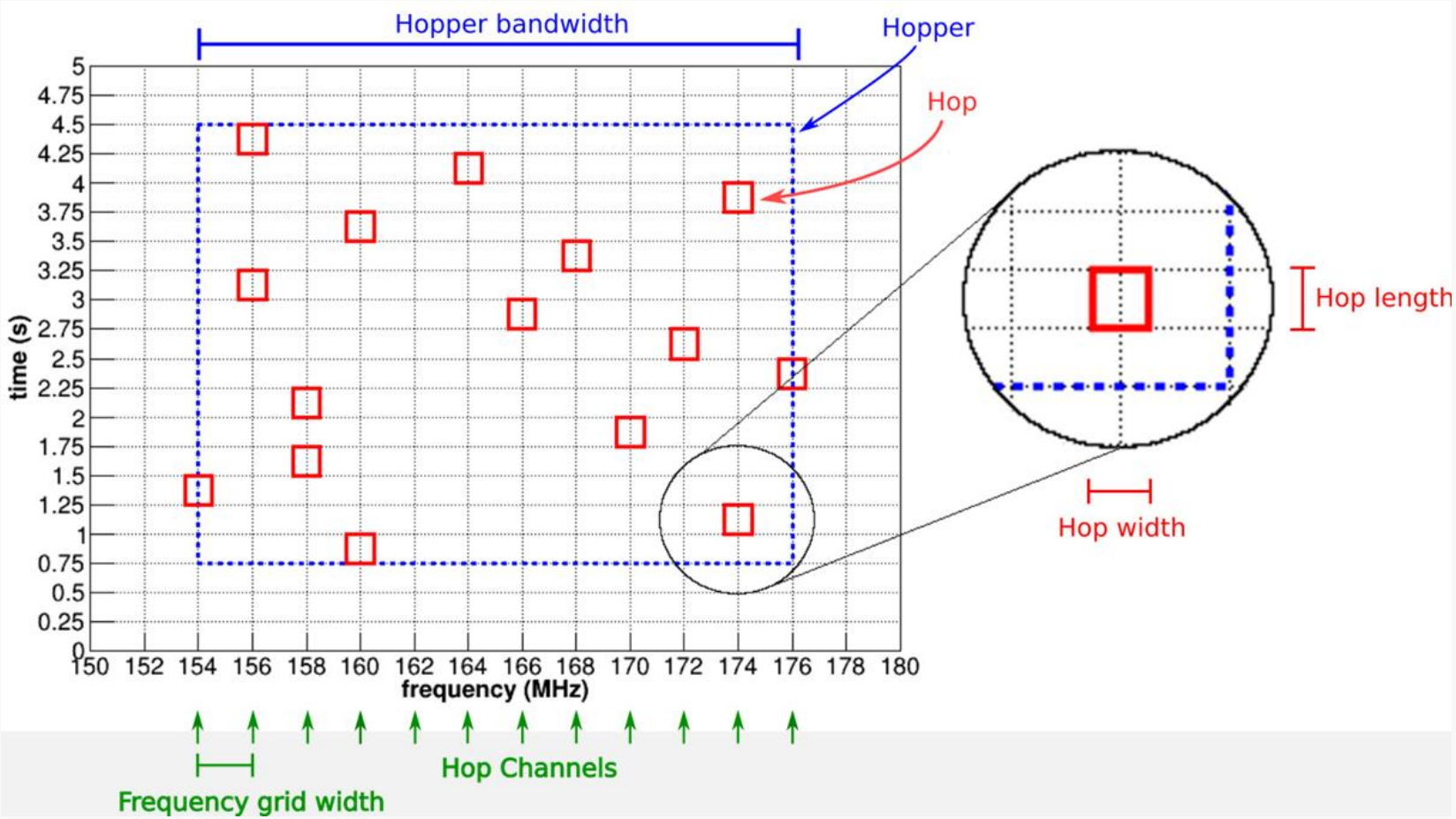
APPLICATION EXAMPLE: HOPPER DETECTION USING A BLOCK-WISE SCAN

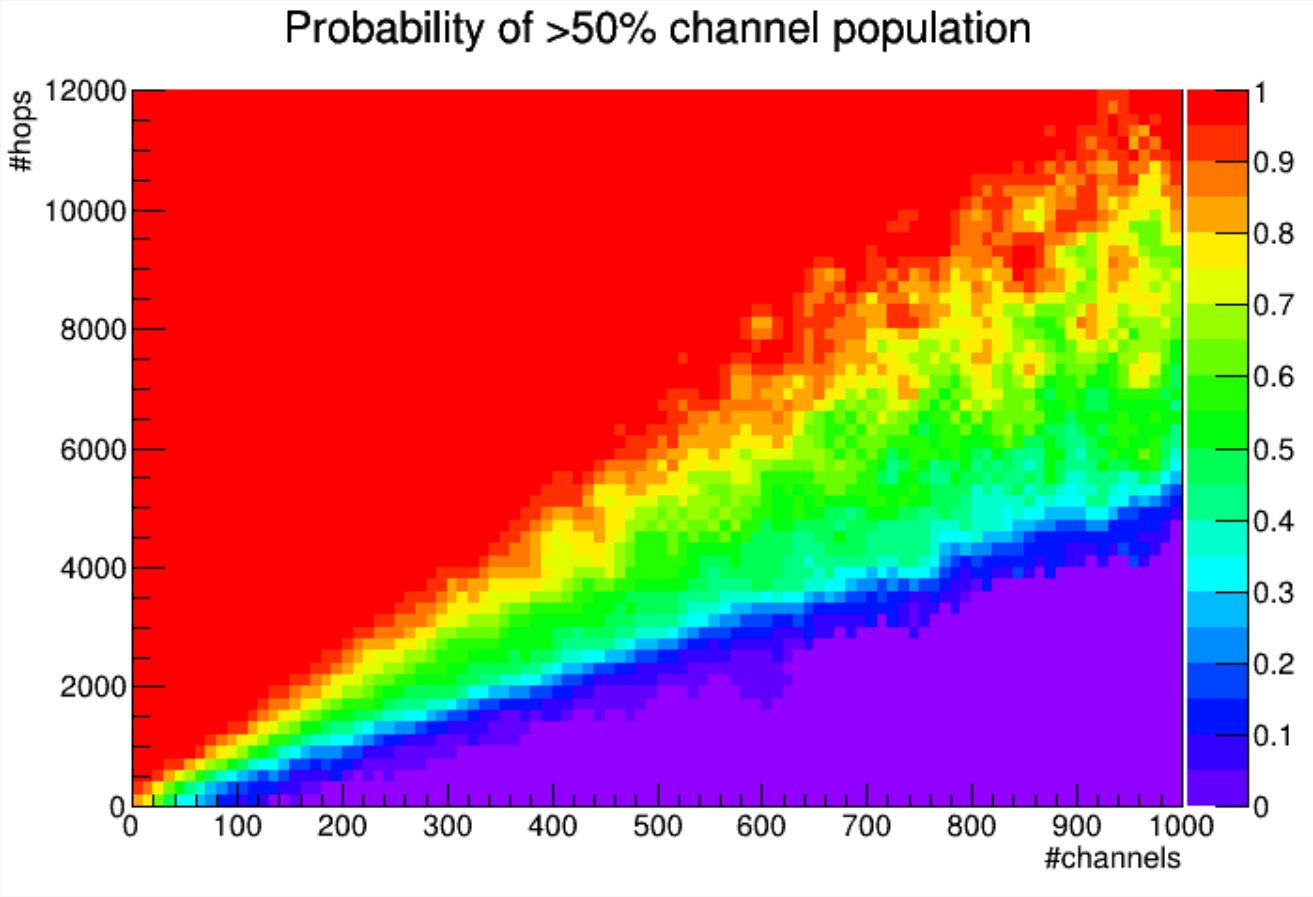
SCHEMATIC HOPPER

- Is it possible to reconstruct the frequency grid from the detected Hops ?
- Even when the hopper BW exceeds the instantaneous BW of the receiver by far?



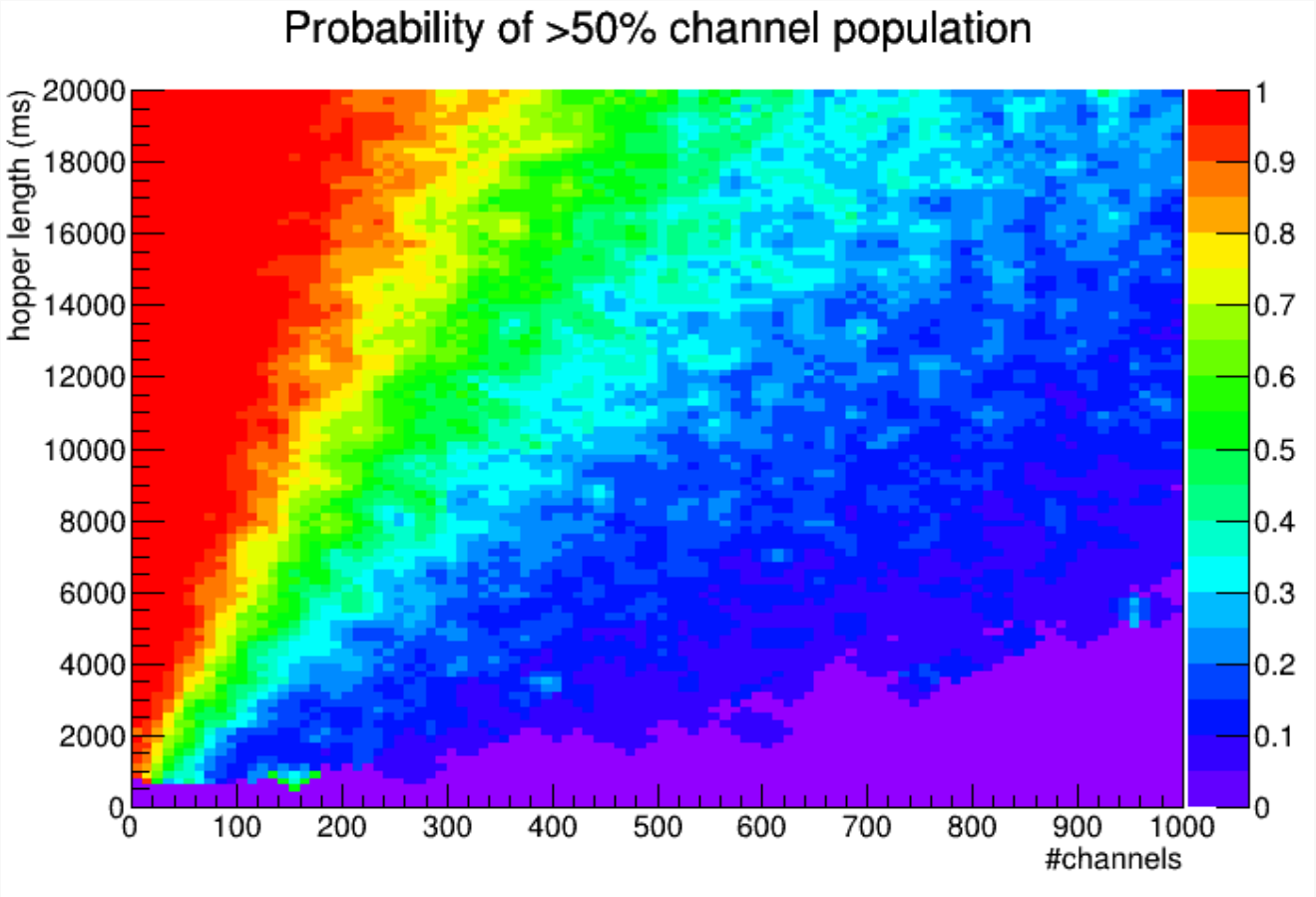
CHANNEL POPULATION (1)

- Probability of detection depends mainly on the number of hopper channels and the number of hops used during the hopper transmission

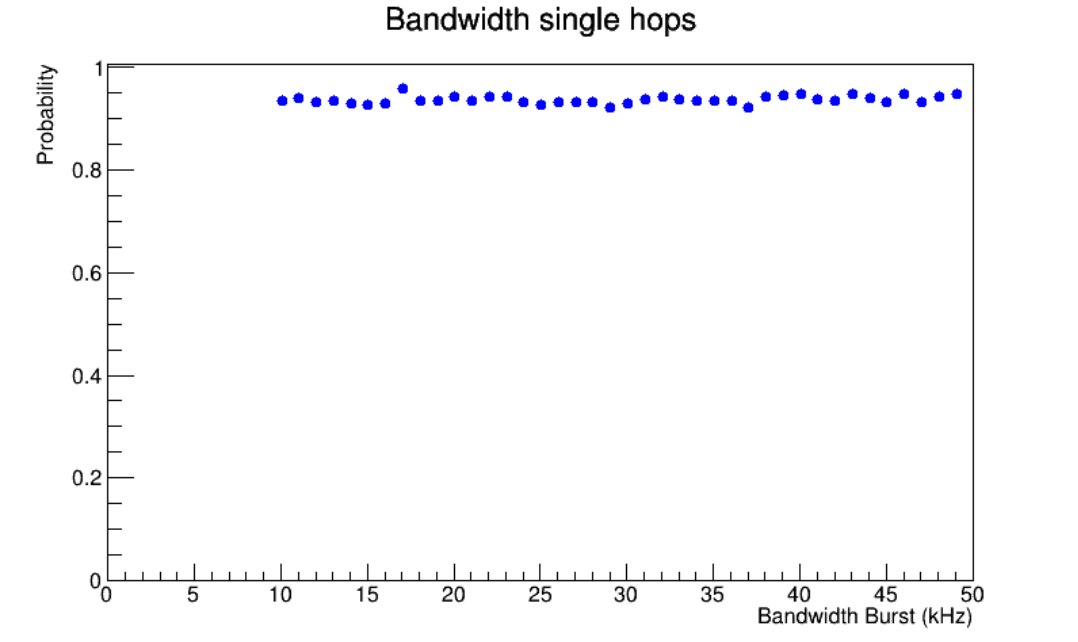


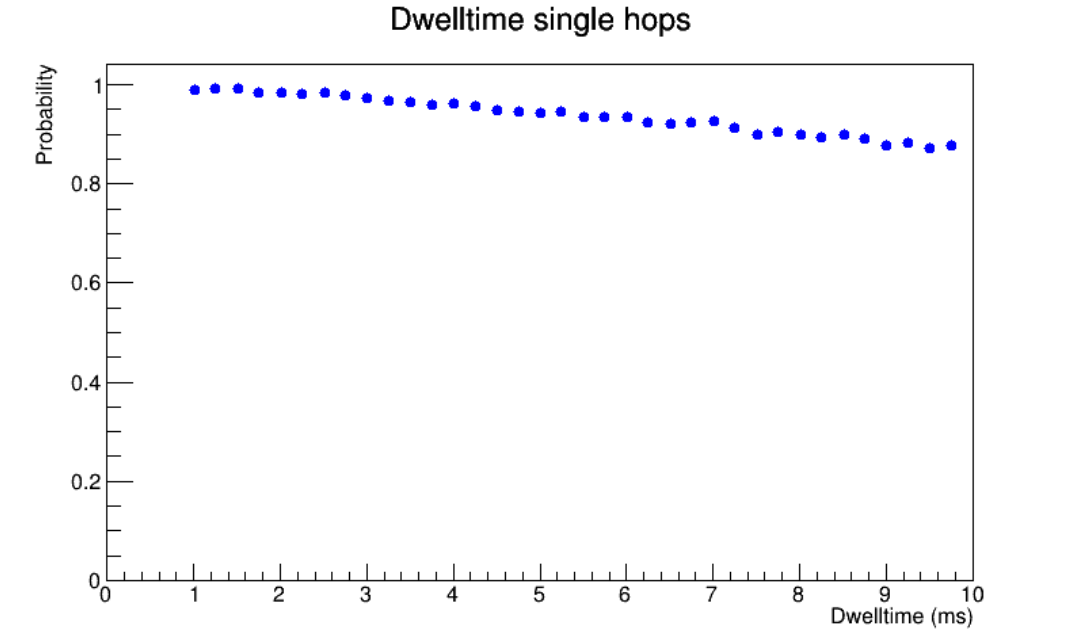
CHANNEL POPULATION (2)

- Probability as a function of channel number and length of the hopper emission.

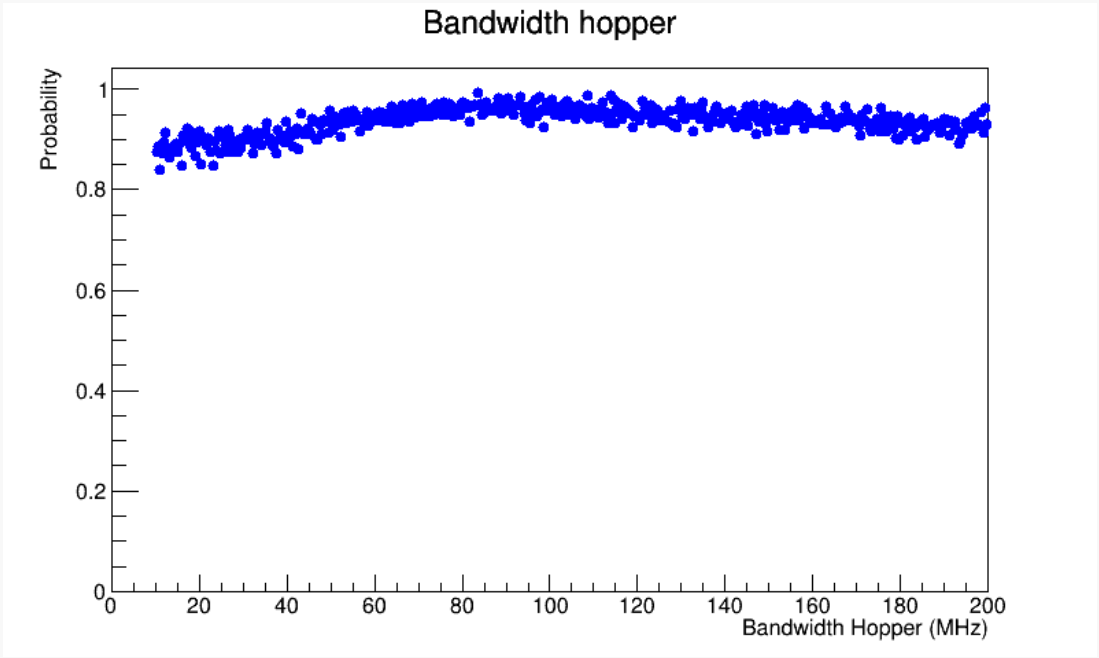


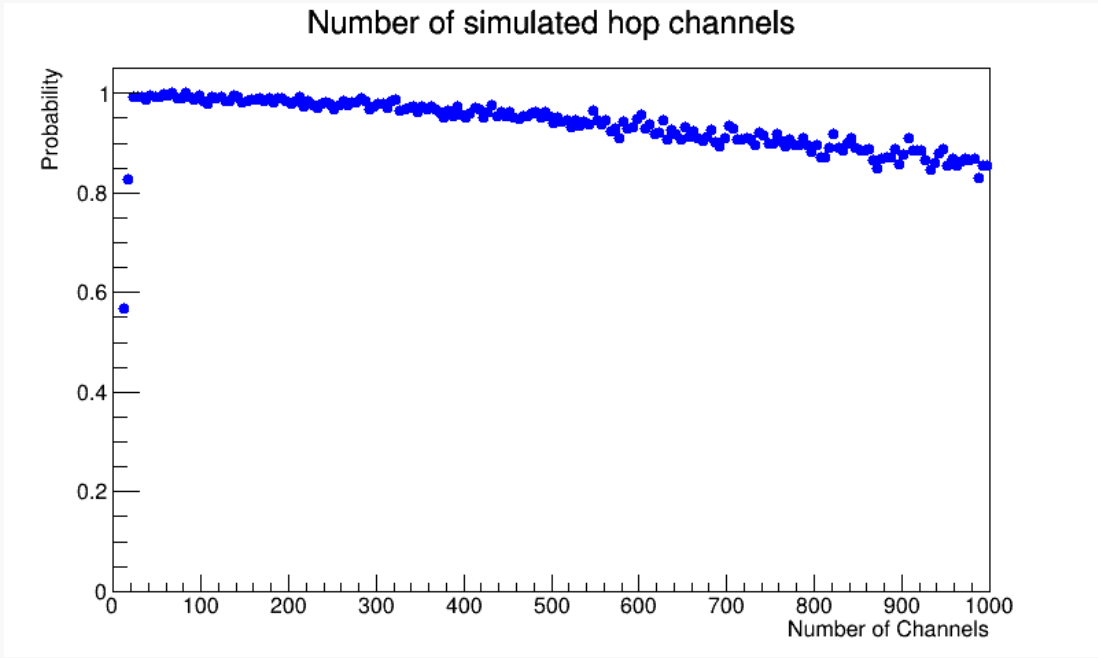
CHANNEL DETECTION PROBABILITY (1)



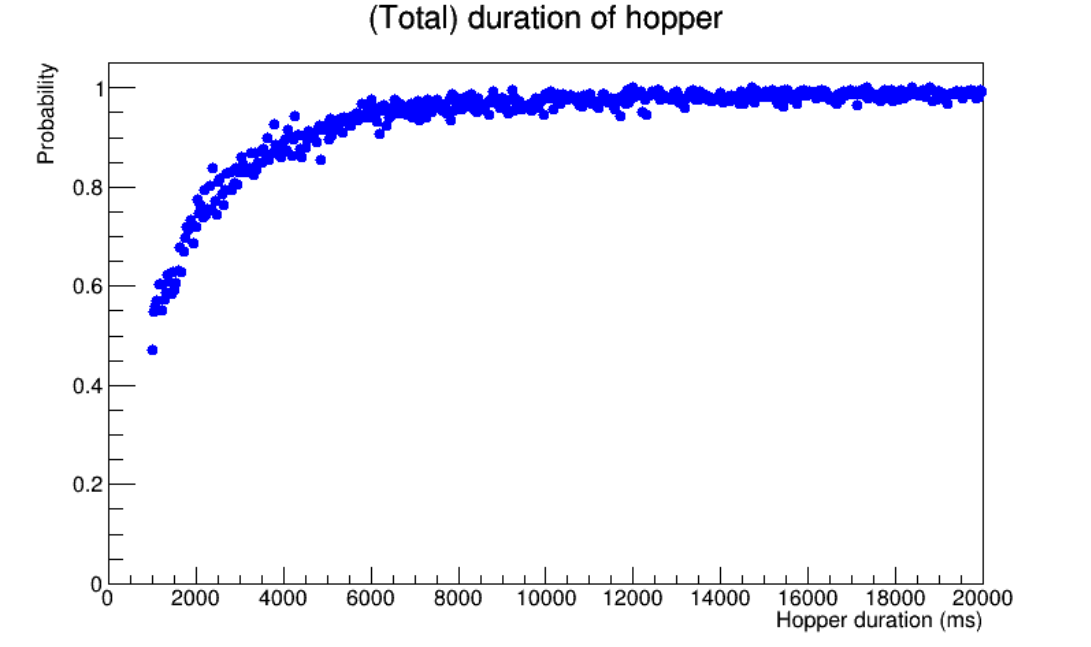


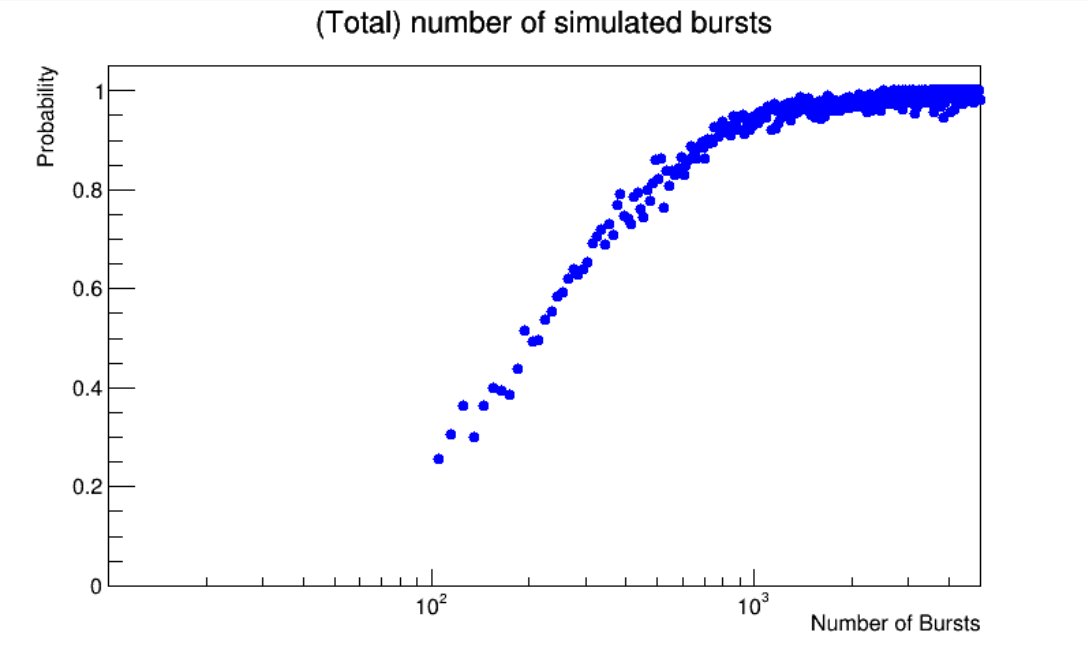
CHANNEL DETECTION PROBABILITY (2)



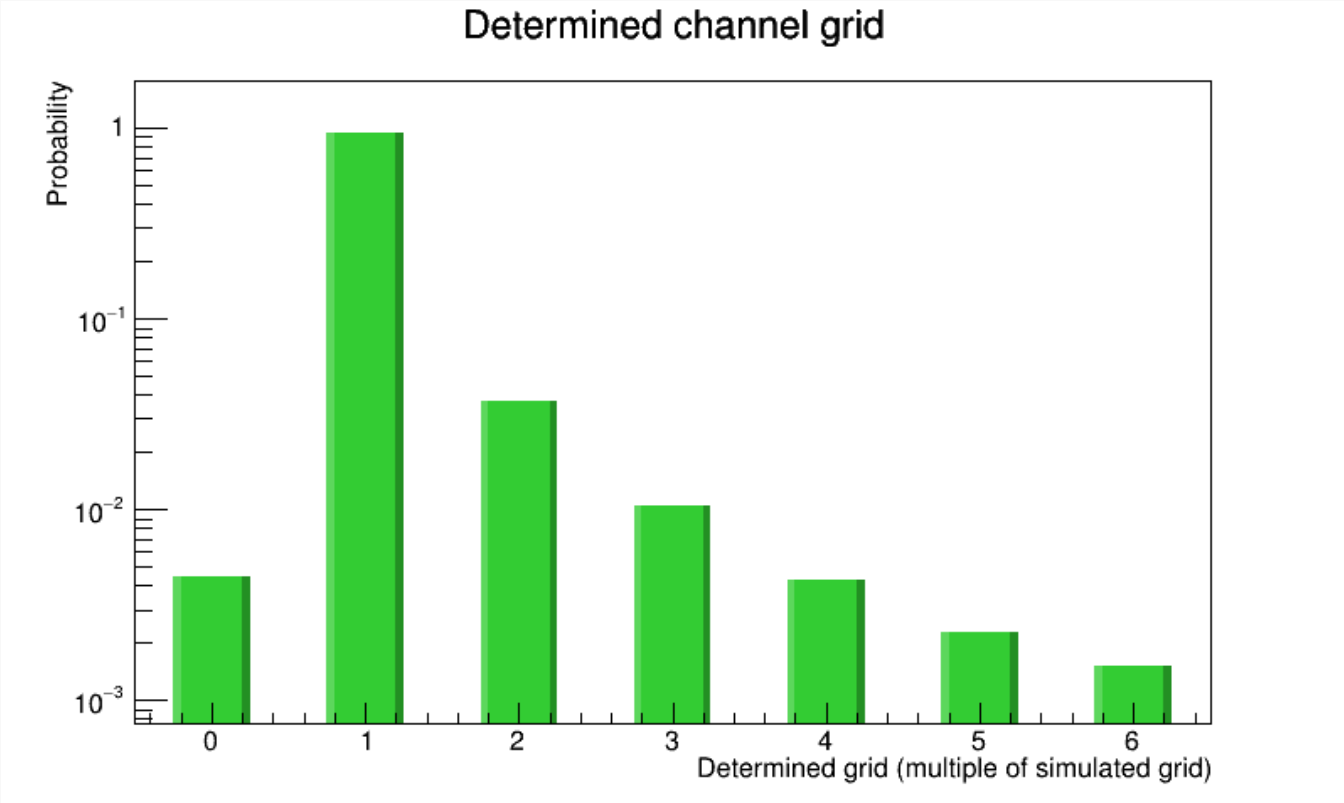


CHANNEL DETECTION PROBABILITY (3)

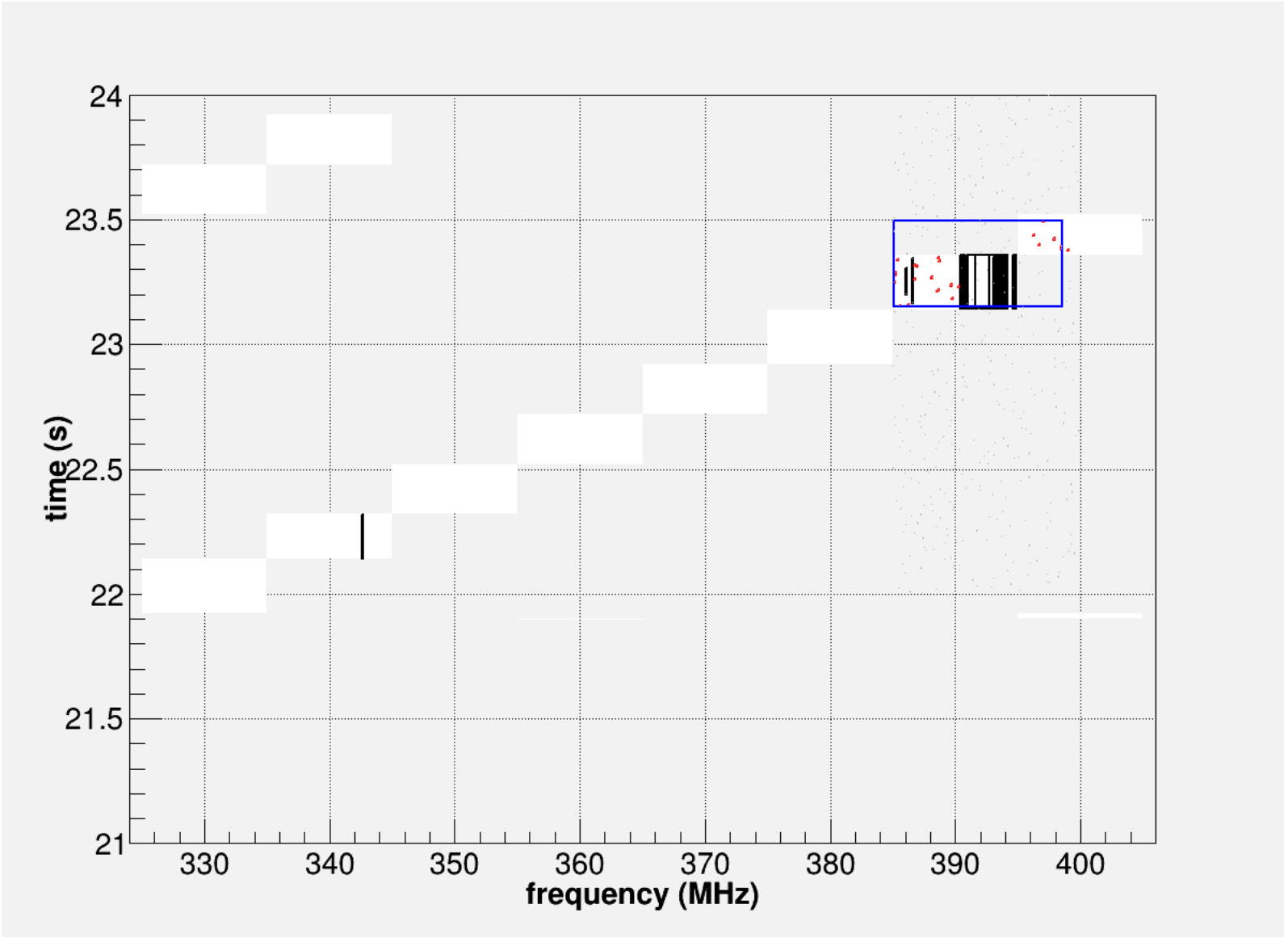




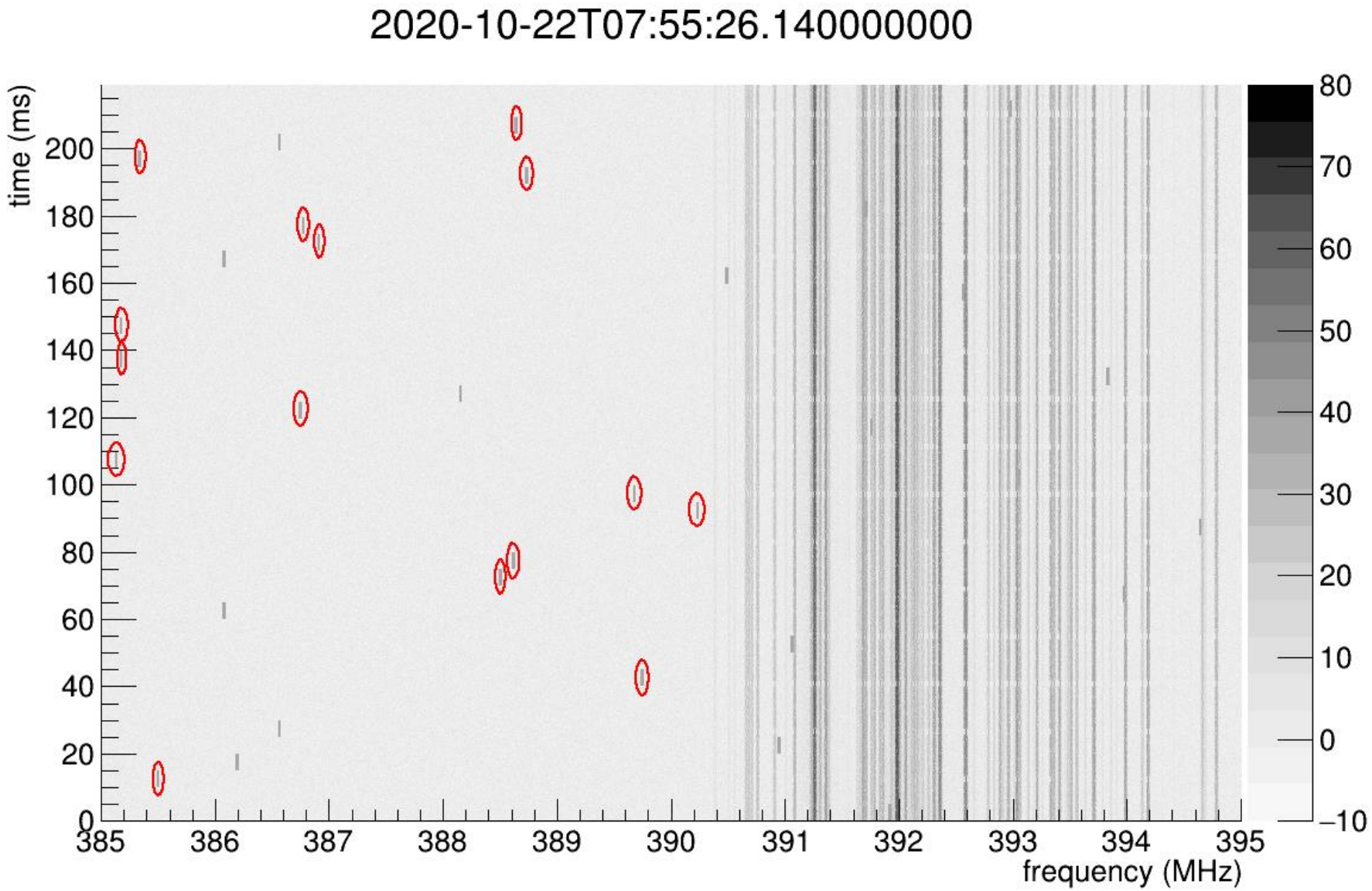
- Successful in 94% of the cases
- In about 4% of the cases every second hop frequency is found



OVERVIEW RESULTS



DETAILS - STEP 2



RESULTS

NUMBER OF HOP CHANNELS RECONSTRUCTED

Parameter	Value
Simulated Grid	23076 Hz
Determined Grid	22030 Hz
Hops simulated	400
Hops found (within boundaries)	361
Hops found (outside boundaries)	39
Missed Hops	0

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SUMMARY

SUMMARY INTERCEPT AUTOMATION

- Load relief for operators through automation of the COMINT process, by automatic sorting relevant from non-relevant signals
- Handling mass data in automatic (automated) systems/reduced complexity
- Data reduction since only relevant (or non-redundant) information will be transmitted (up to 1:10,000)
- Probability of Detection and Exploitation enhanced and supports the COMINT value chain
- Supports Cognitive EW by distilling the quality out of mass data

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PLATH Signal Products GmbH & Co. KG
Gotenstraße 18
20097 Hamburg
Germany

Phone +49 40 237 34-0
Fax +49 40 237 34-222

www.plath-signalproducts.com