VHF software radar
based on P-18 antenna system

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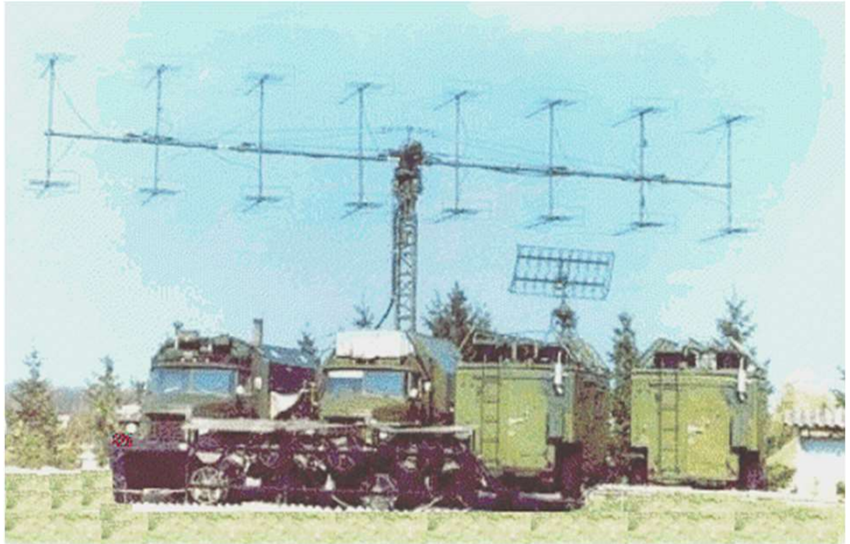
The goals of the project

- Experimental search radar equipment for air targets:
  - low-cross section
  - low-heigth
  - unexpectedly occur

- Experimental test system for measurements

- Using existing antenna system and platform of P-18



Technological goals

- Sub-impulse modulated transmitter
- Pulse compressed receiver
- Semiconductor based
- Computer controllable
- System integration ready

Complete radar equipment which can be used with an external antenna

Radio electronic equipment

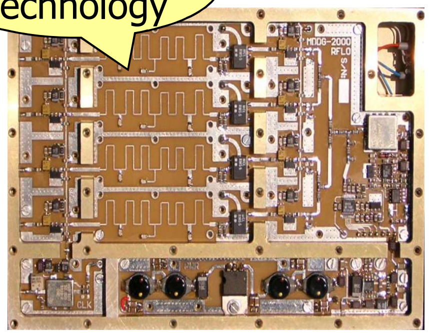
Traditional implementation

RF → **IF Down Conversion** ⟷ IF ⟷ **Baseband Down Conversion** ⟷ BB ⟷ **Baseband Demodulation and Processing**

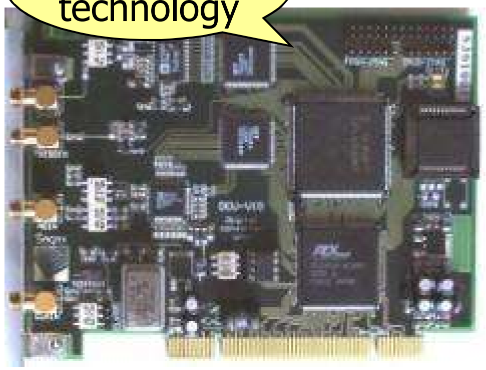
Implementation based on Software Defind Radio Technology

Analog front-end ⟷ Domain conversion A/D és D/A ⟷ Digital processing

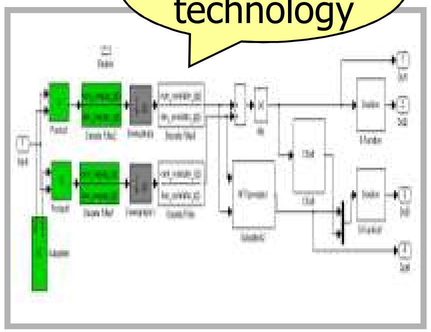
RF technology



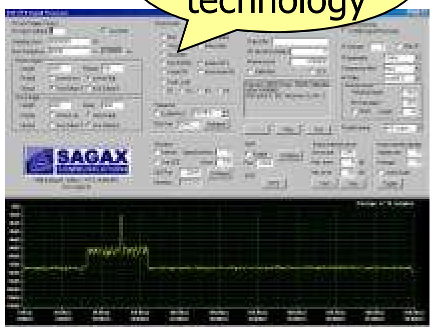
Conversion technology



DSP technology



MMI/GUI technology



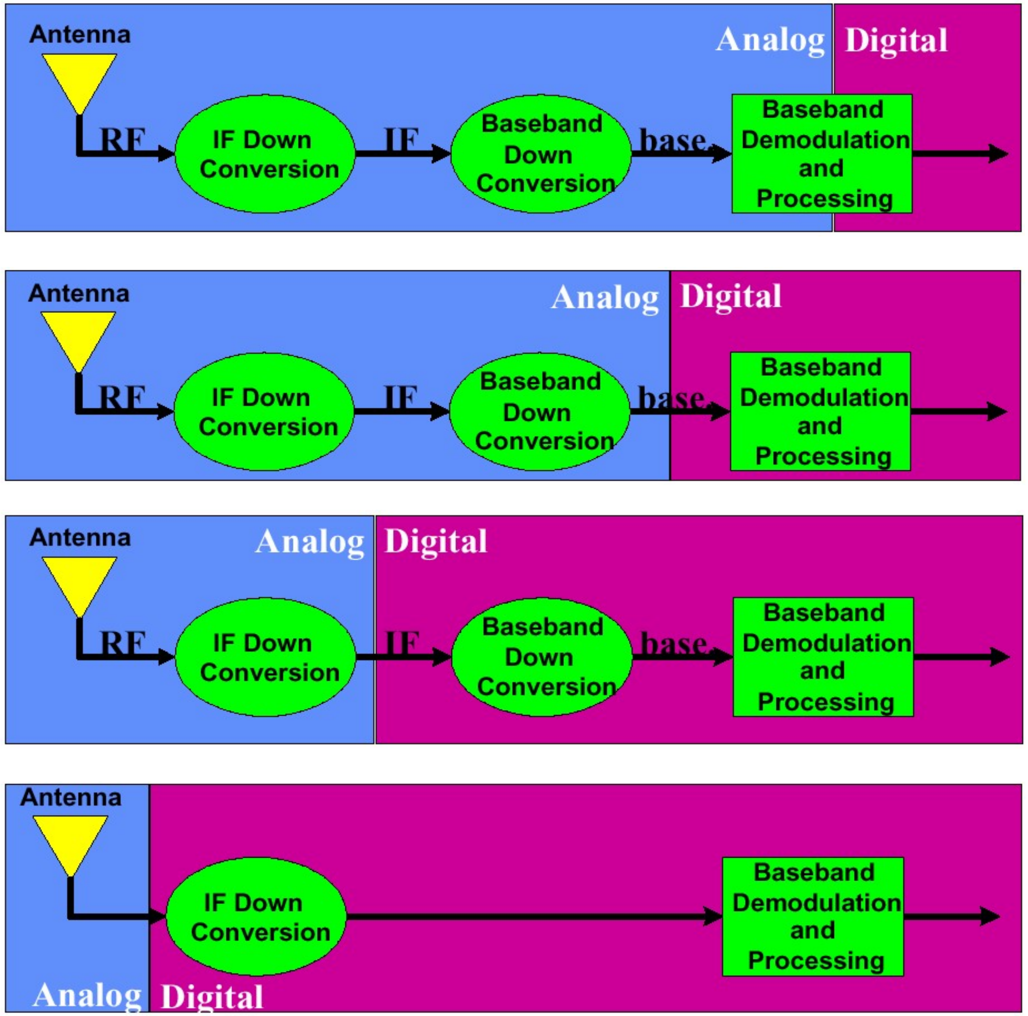
Implementation levels

Digital signal handling

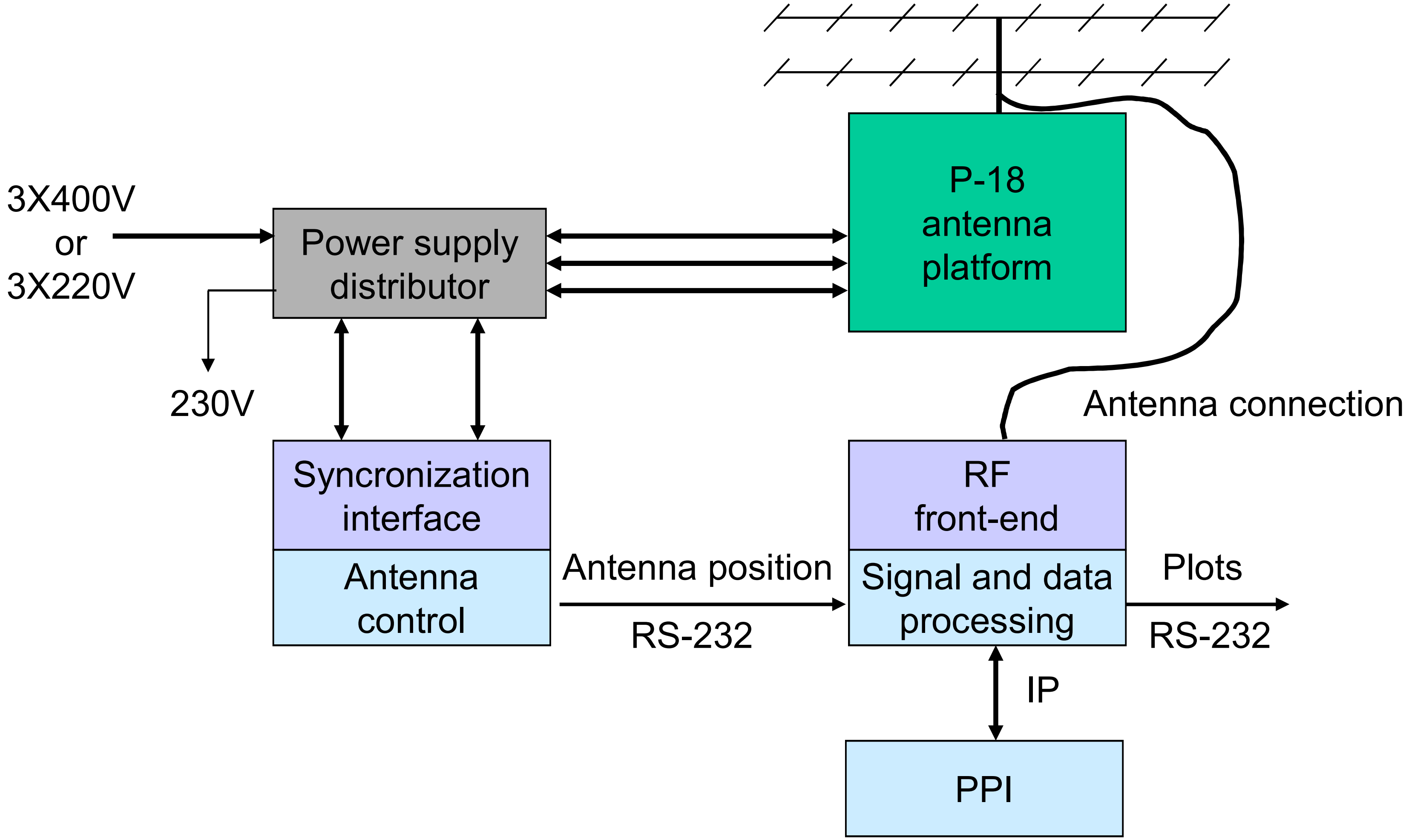
Digital BB

Digital IF

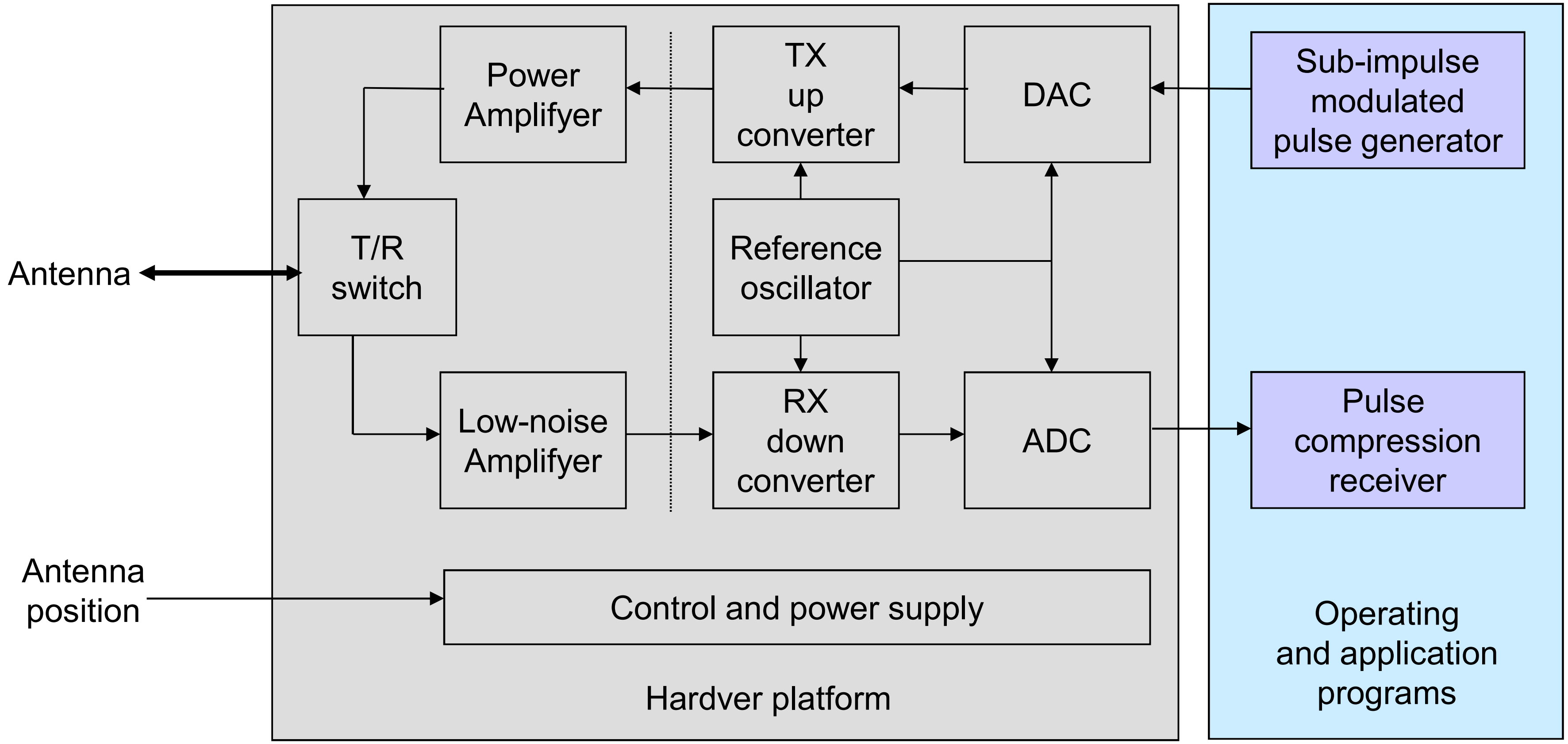
Digital RF



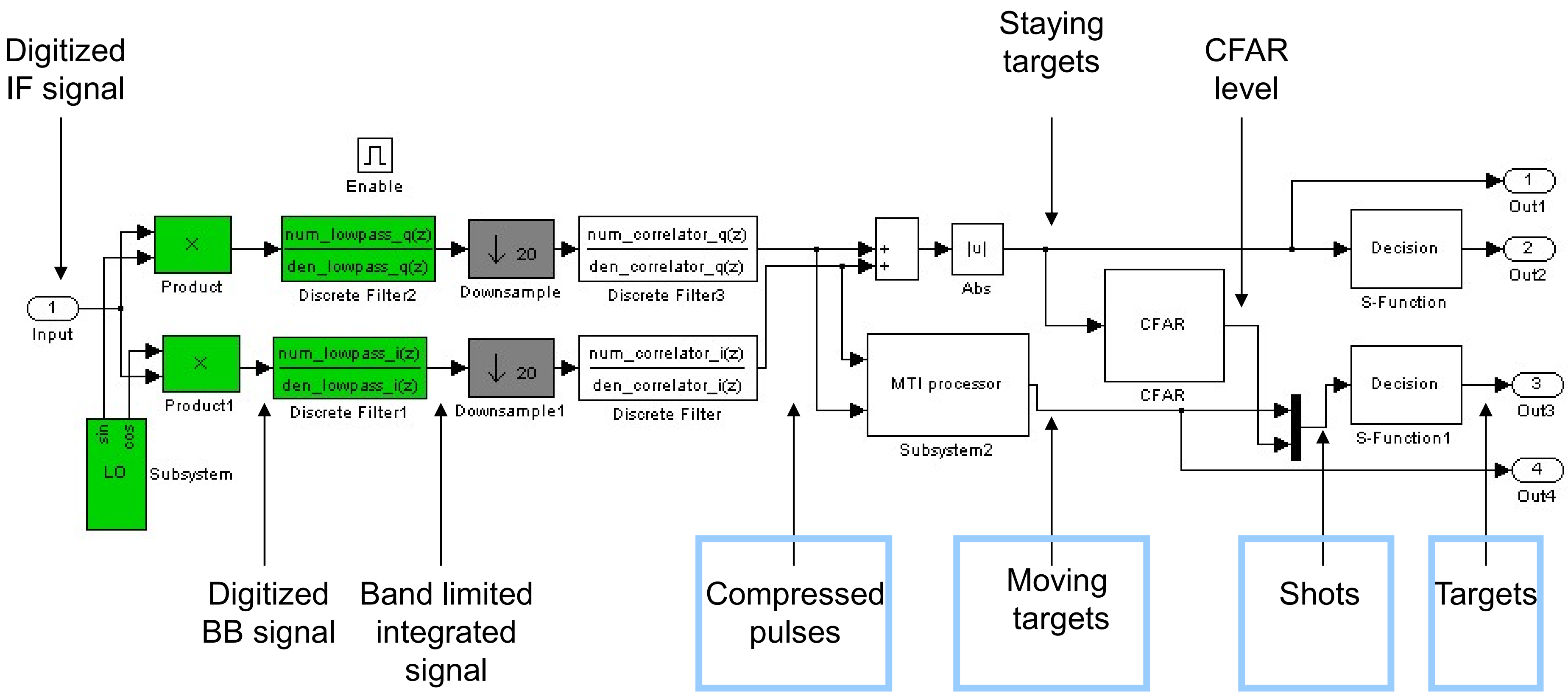
System configuration



Experimental transceiver

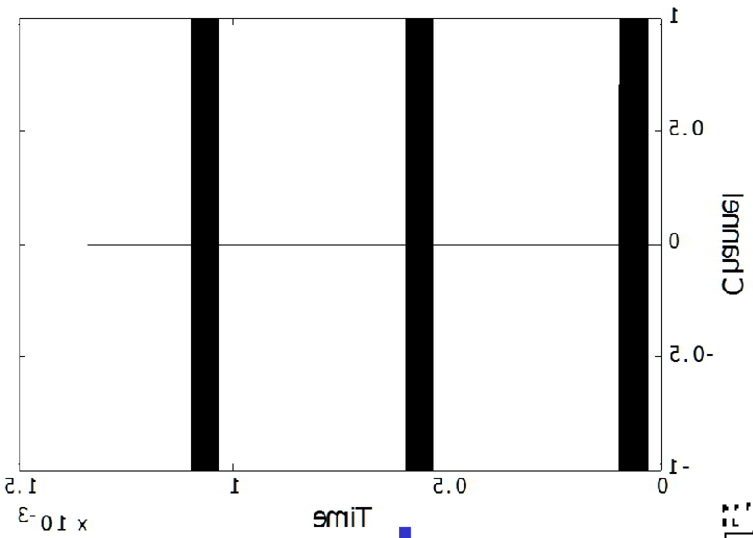


Digital signal processing

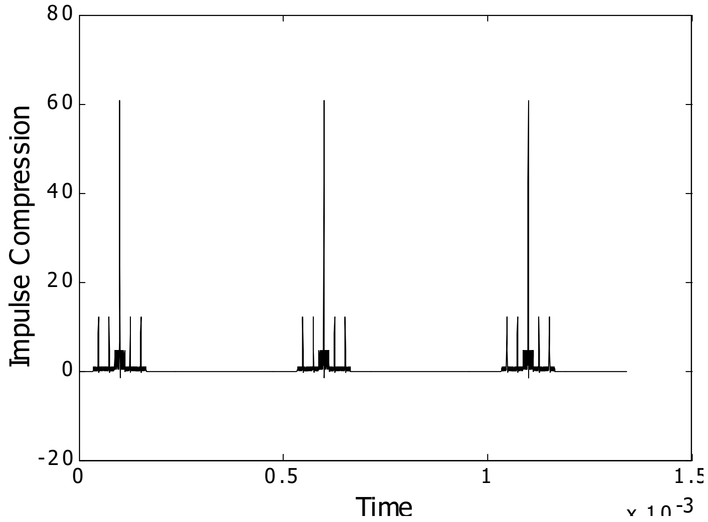


Sub-impulse modulation

64us radiated pulse

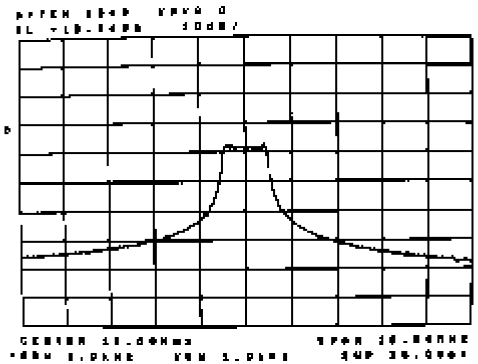


1us compressed received pulse



Sub-impuls modulated search signal

DSP technolgy



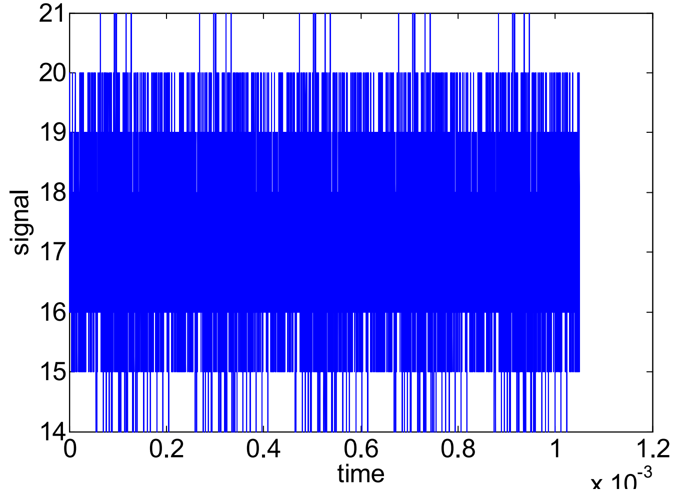
1MHz bandwidth

Matched-filter pulse compressor

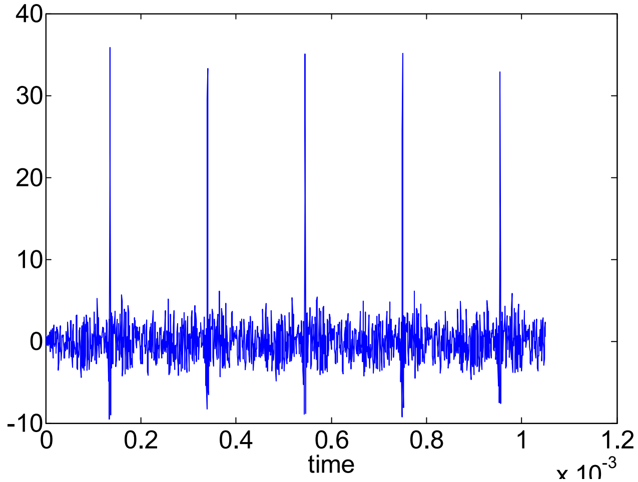
DSP technology

Compression gain

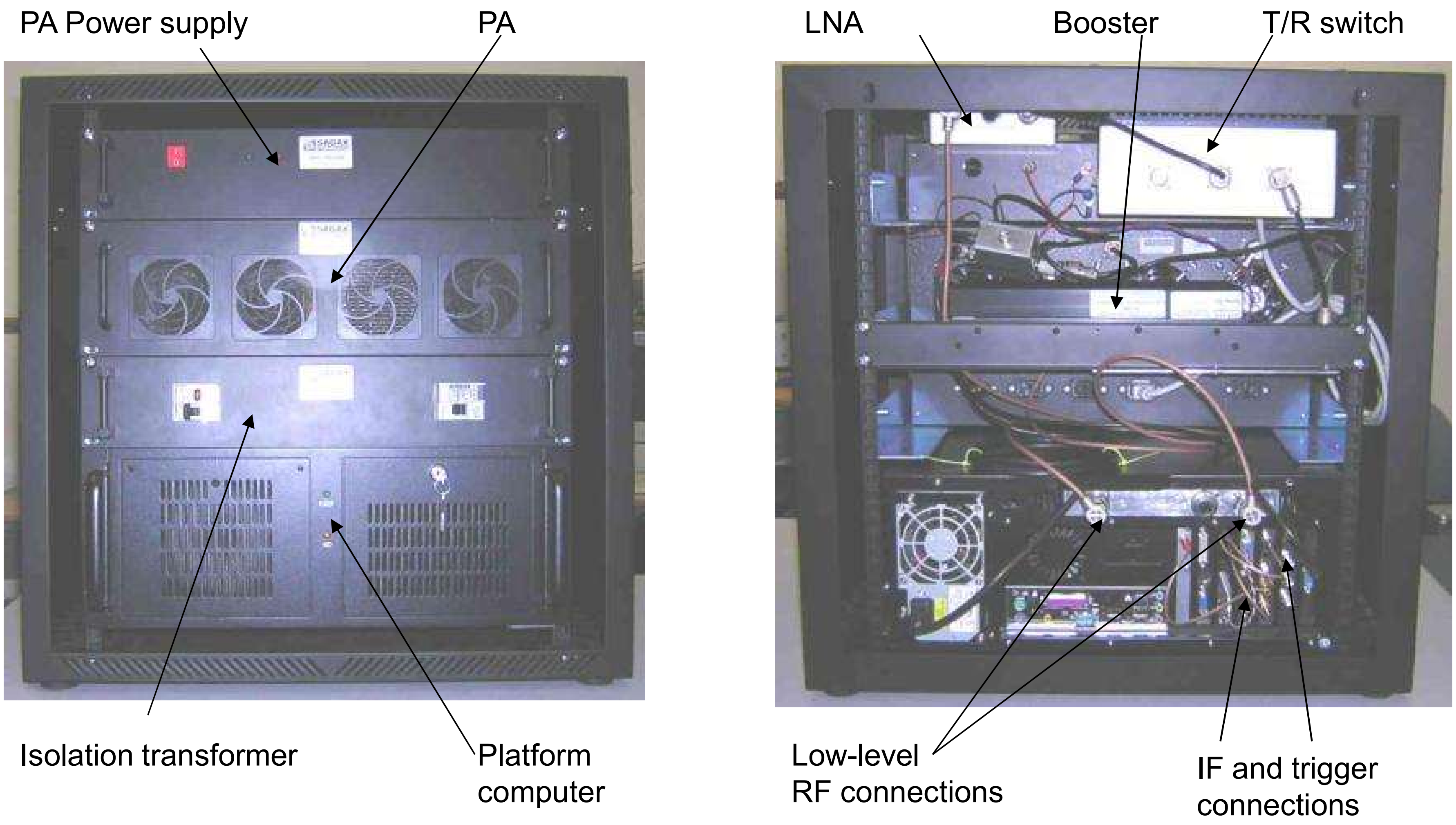
Receiver IF output:
signal+noise



Output of the matched filter:
SNR improoved



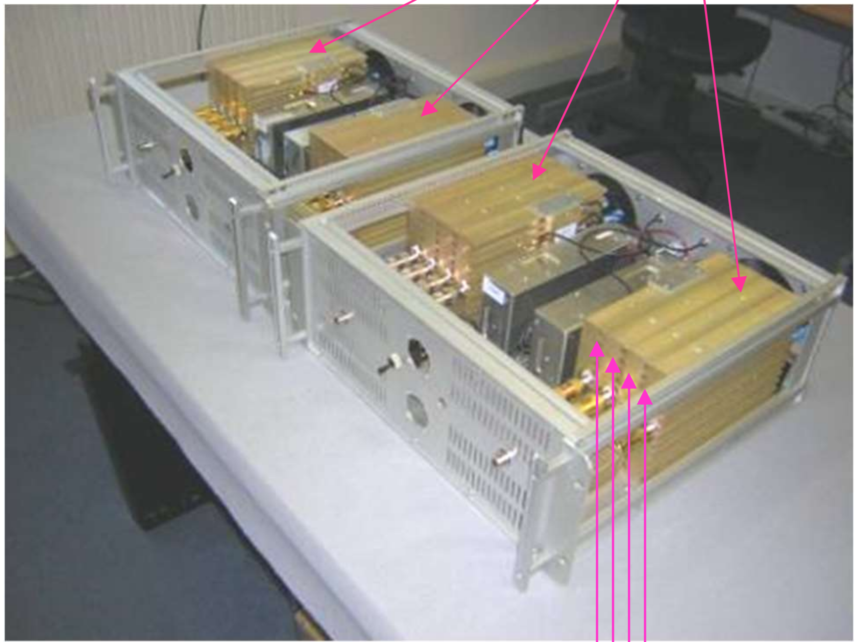
Hardware implementation



Solid-state power amplifier

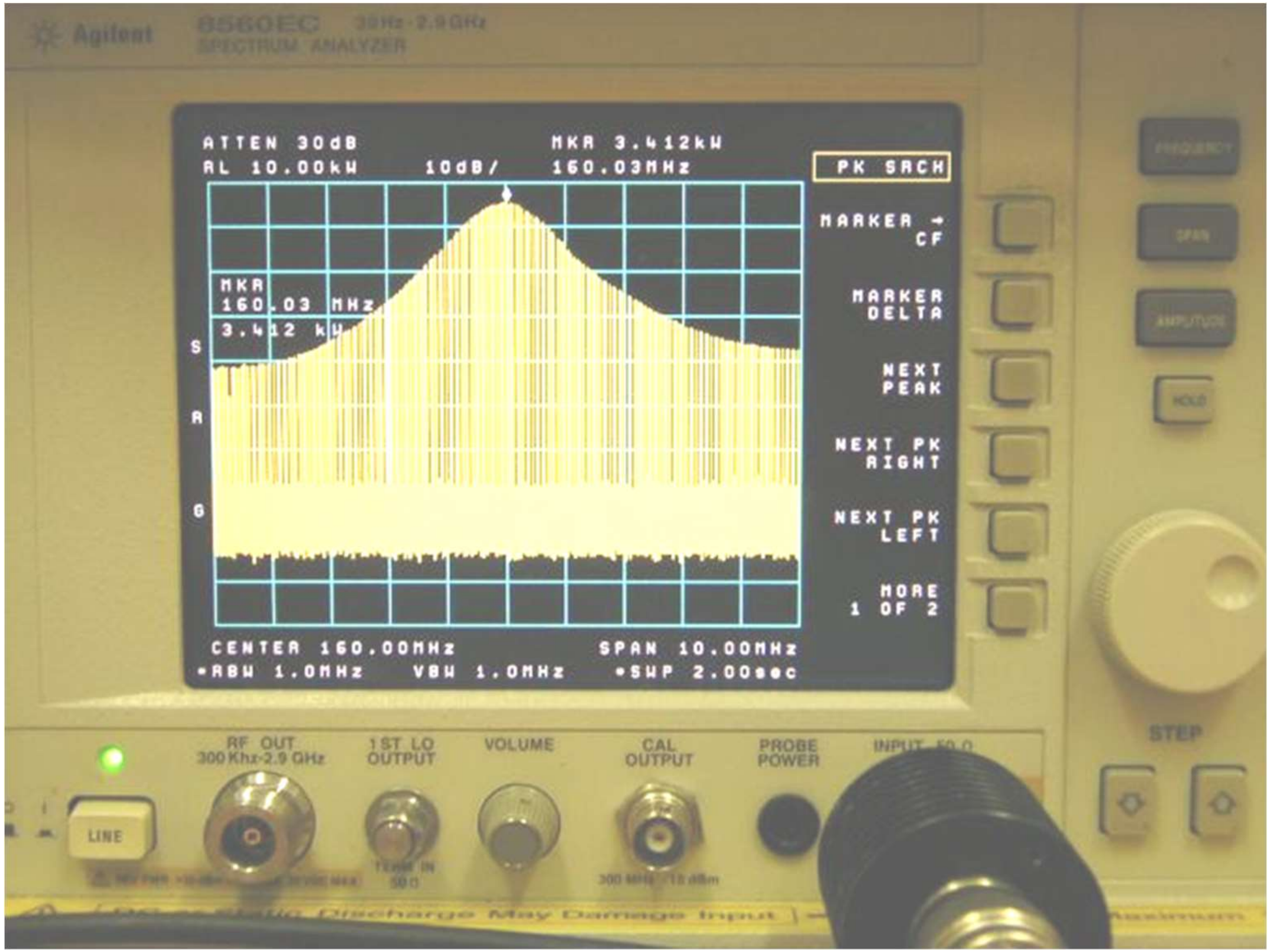
4X 800W

3200W



4X 200W

Output power measurement



PP indicator

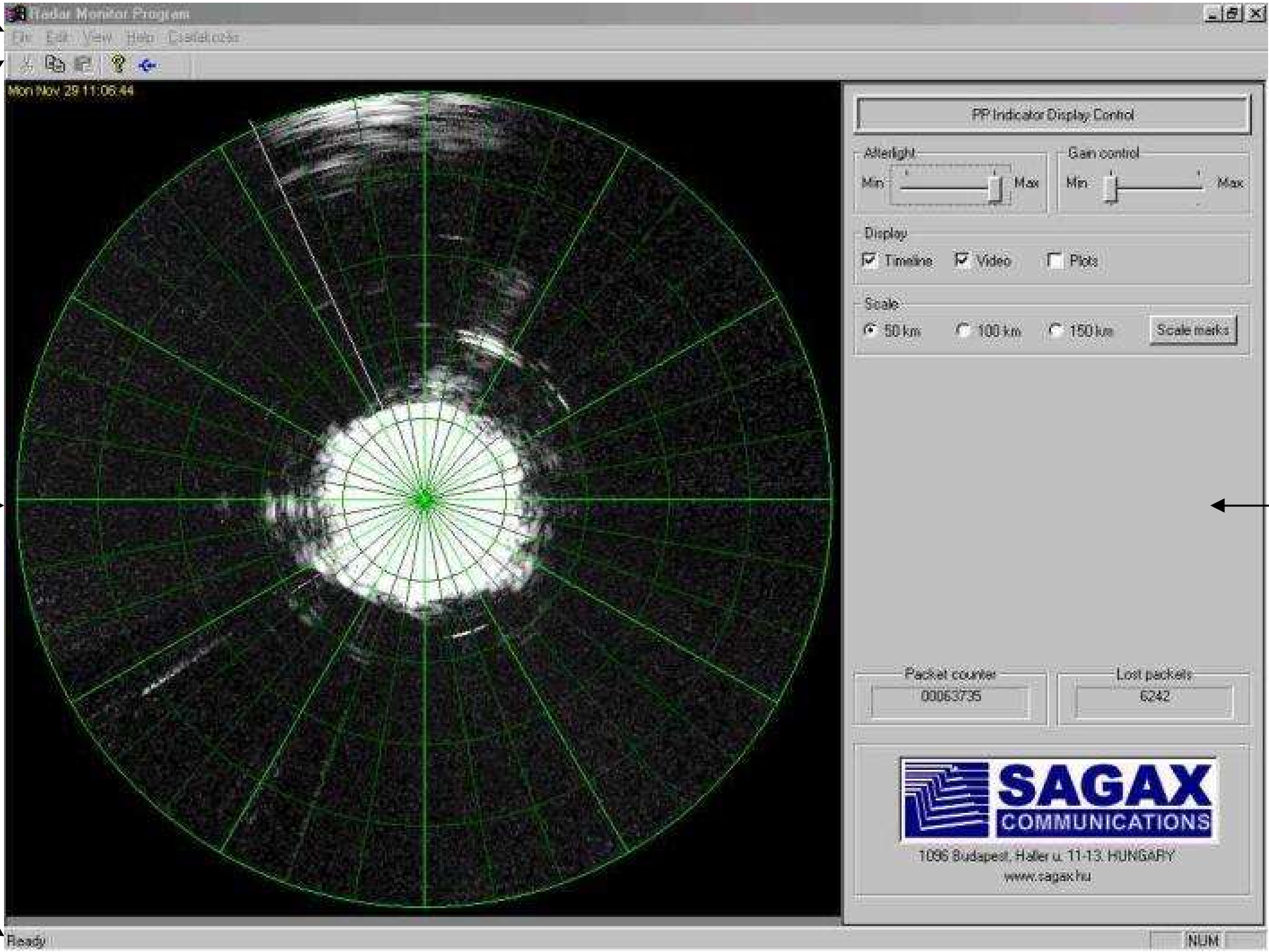
Menu

Icons

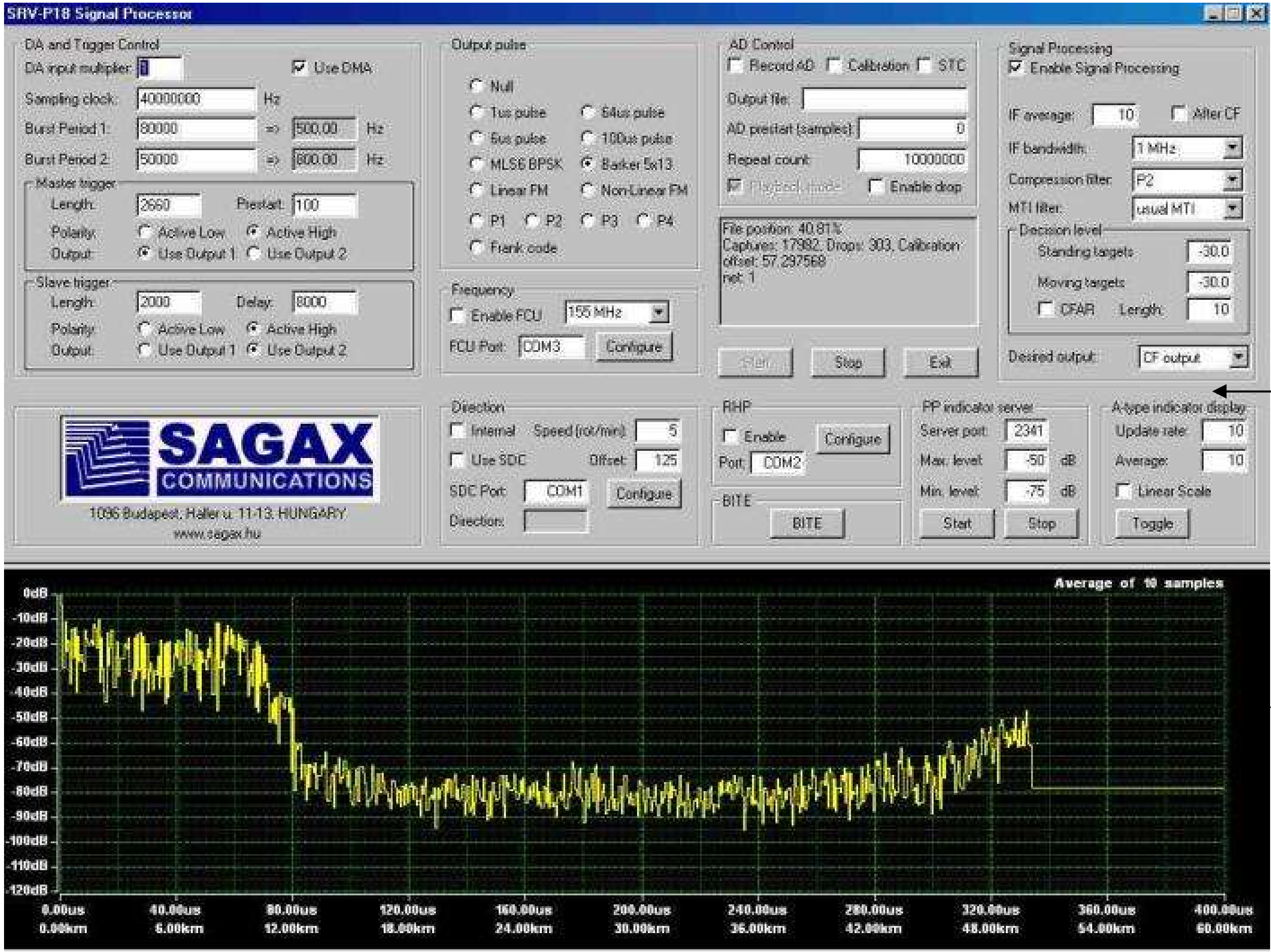
Display area

Status

Control area



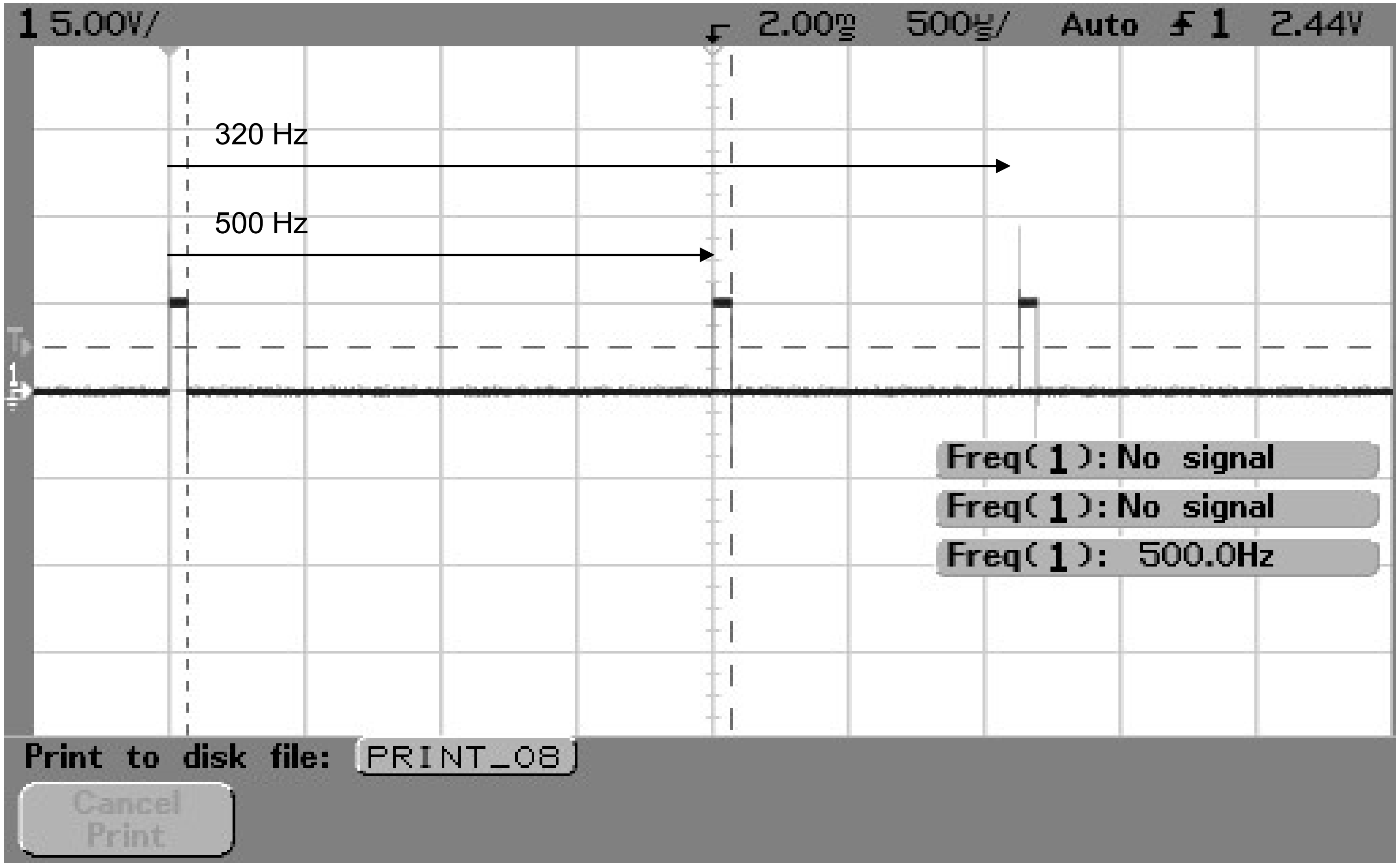
Control panel



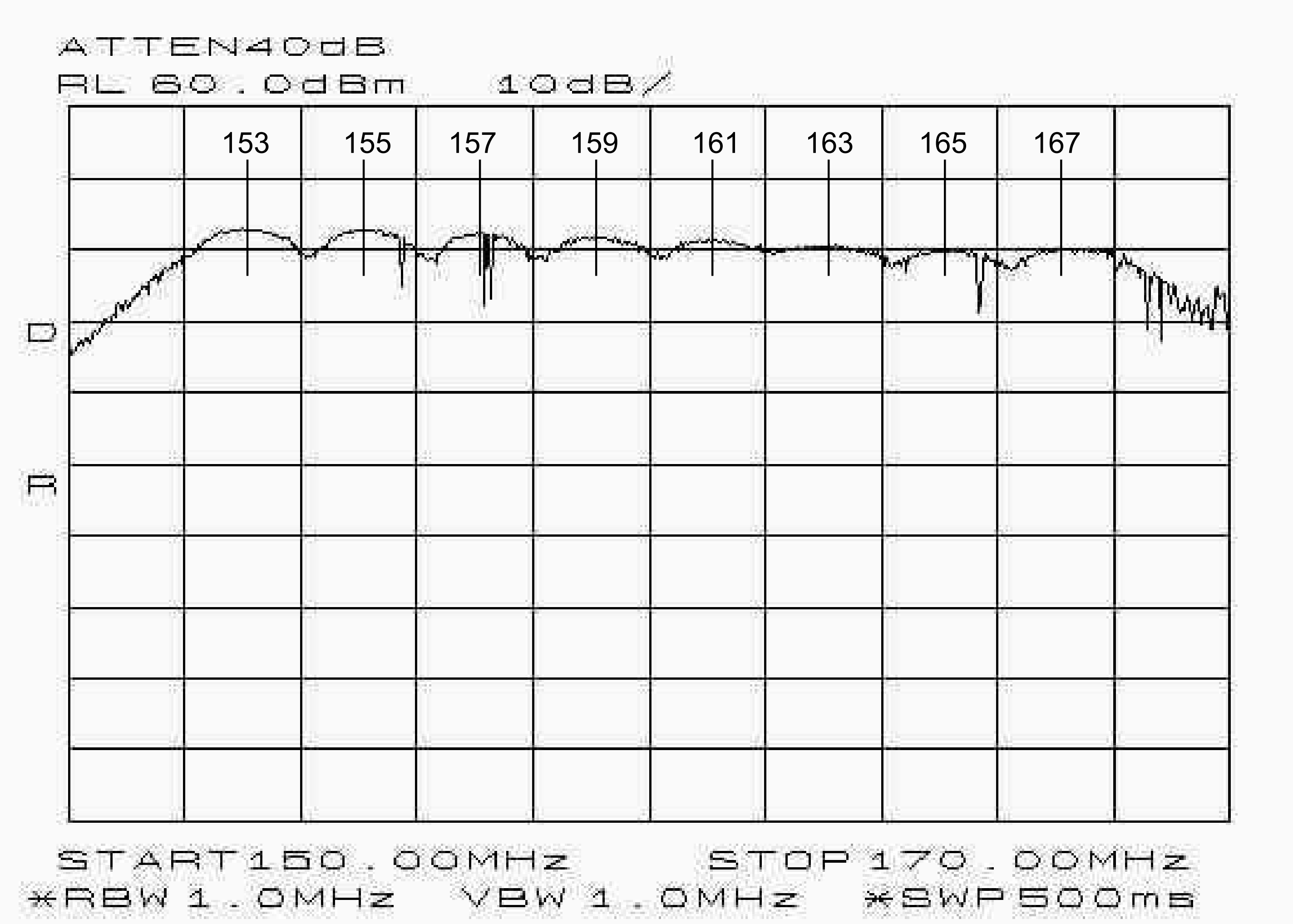
Control area

A-type indicator

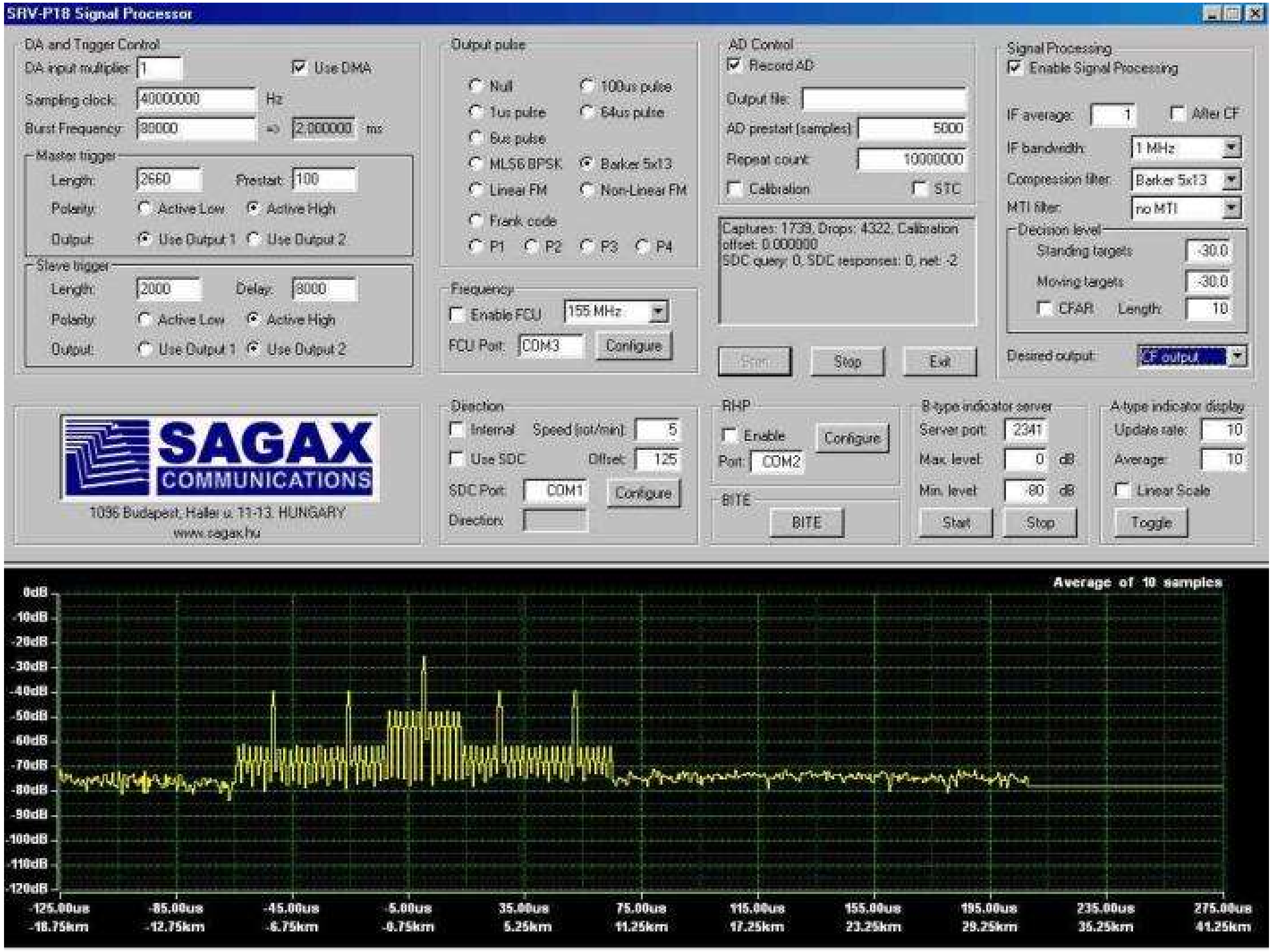
Automatic trigger changing



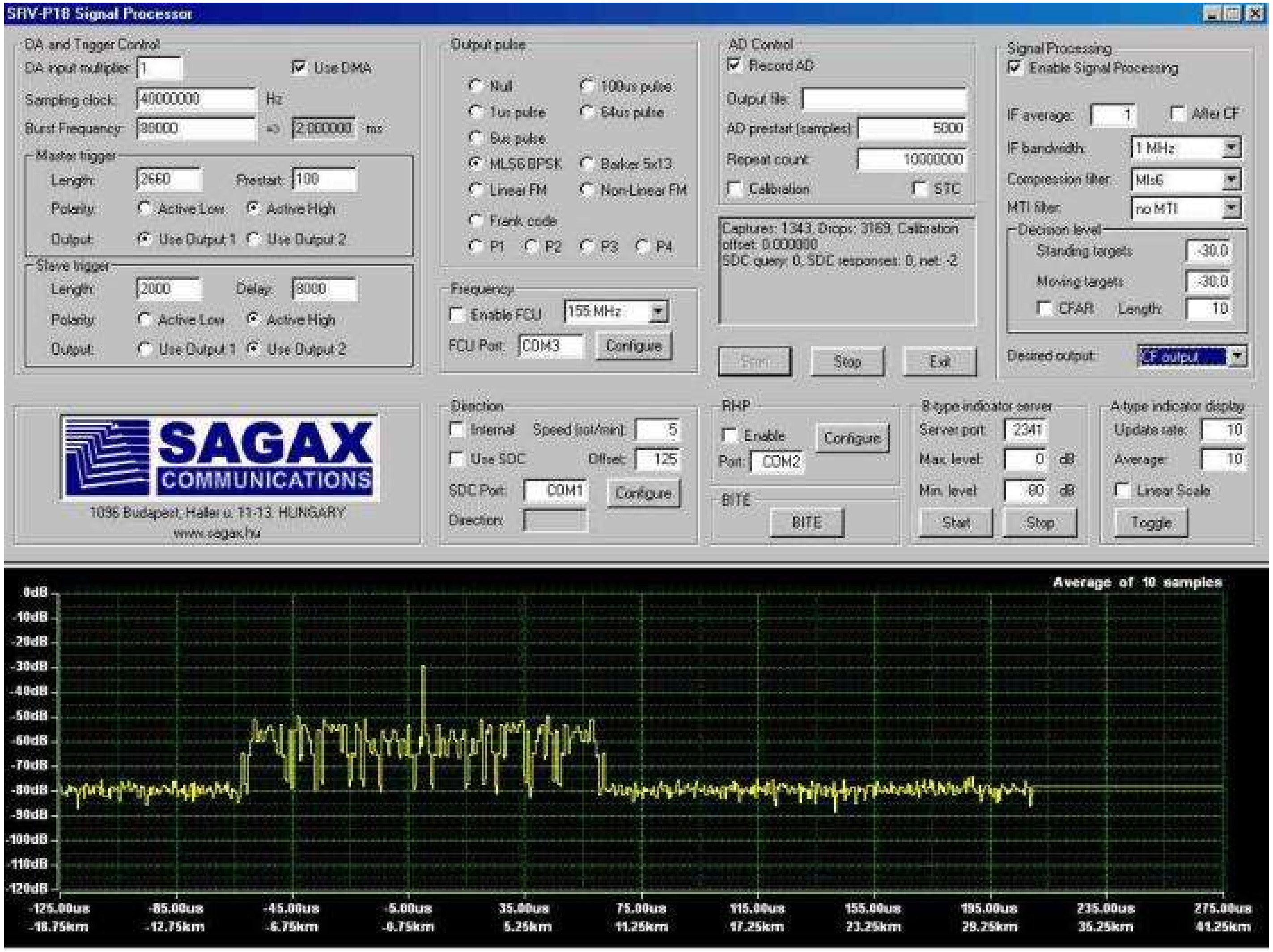
Output frequencies



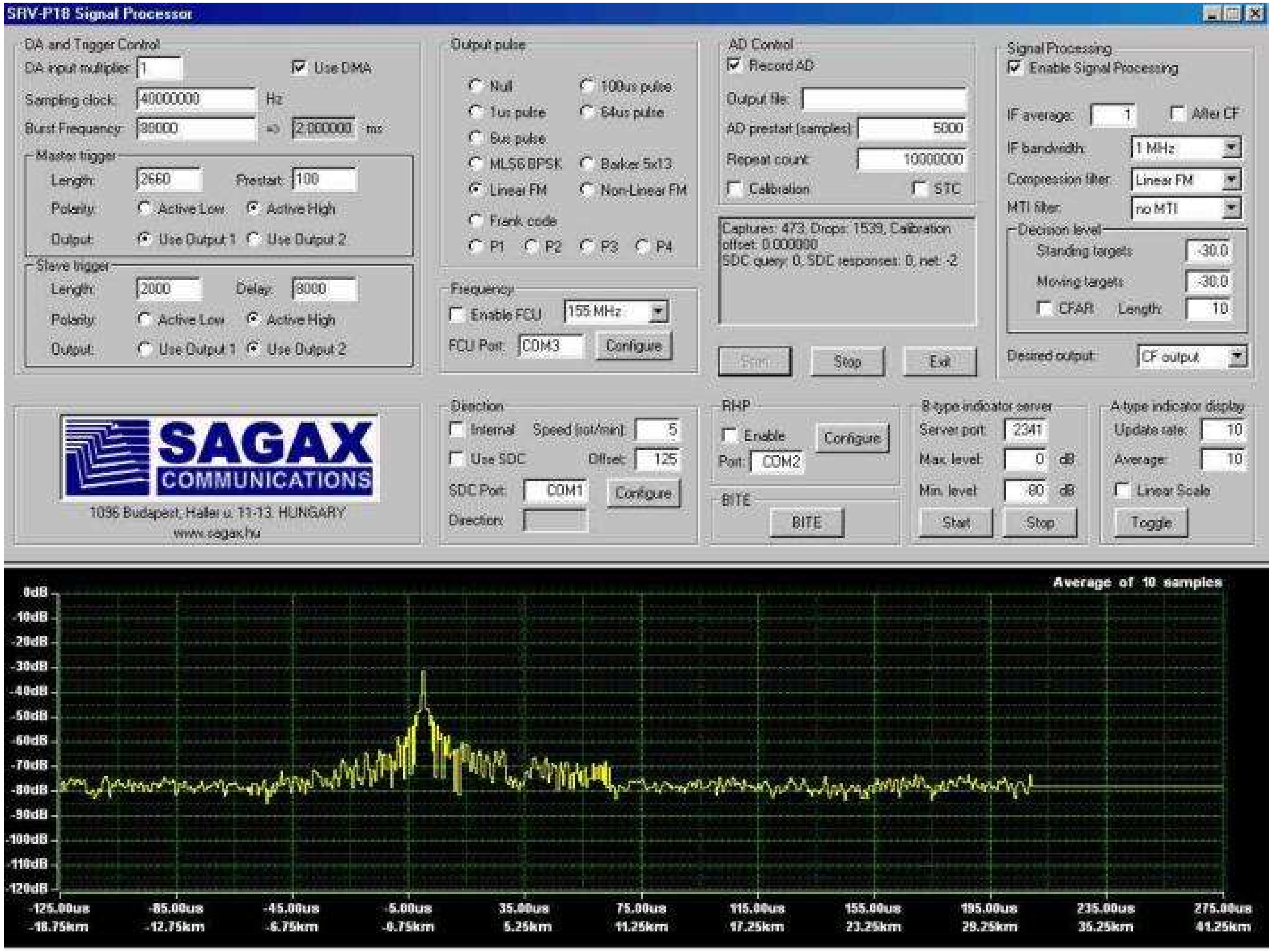
Pulse compression: Barker



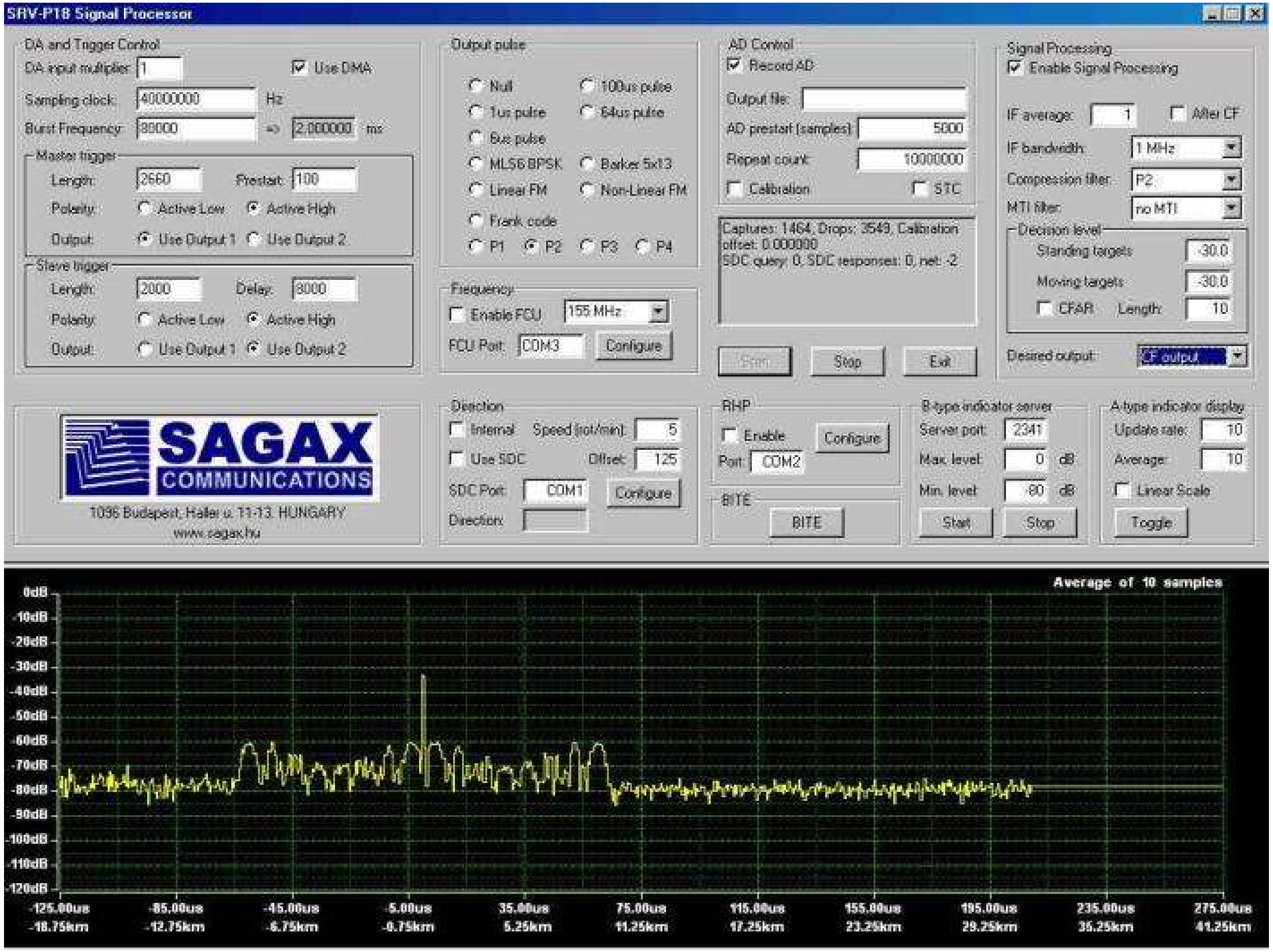
Pulse compression: MLS



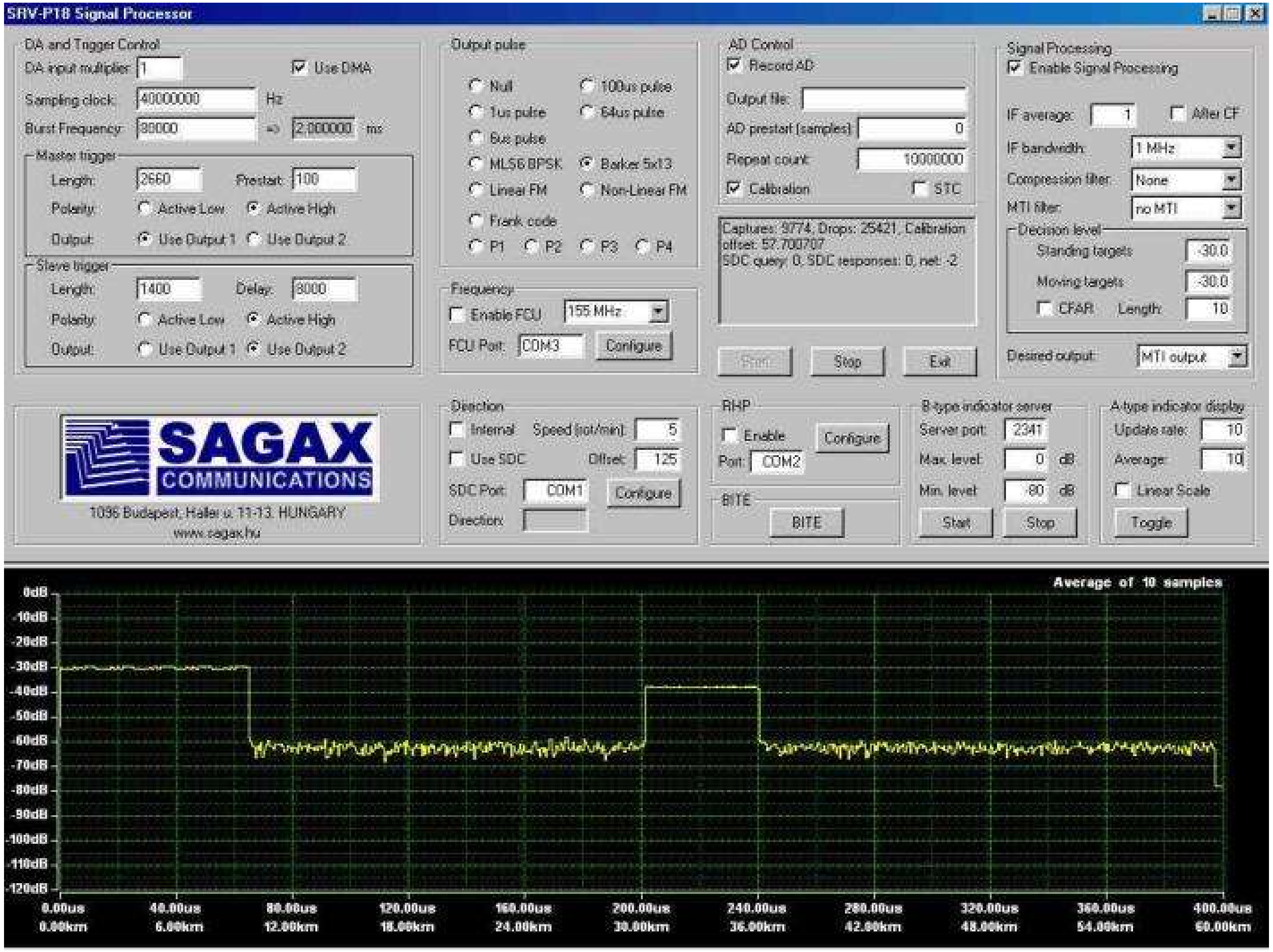
Pulse compression: LFM



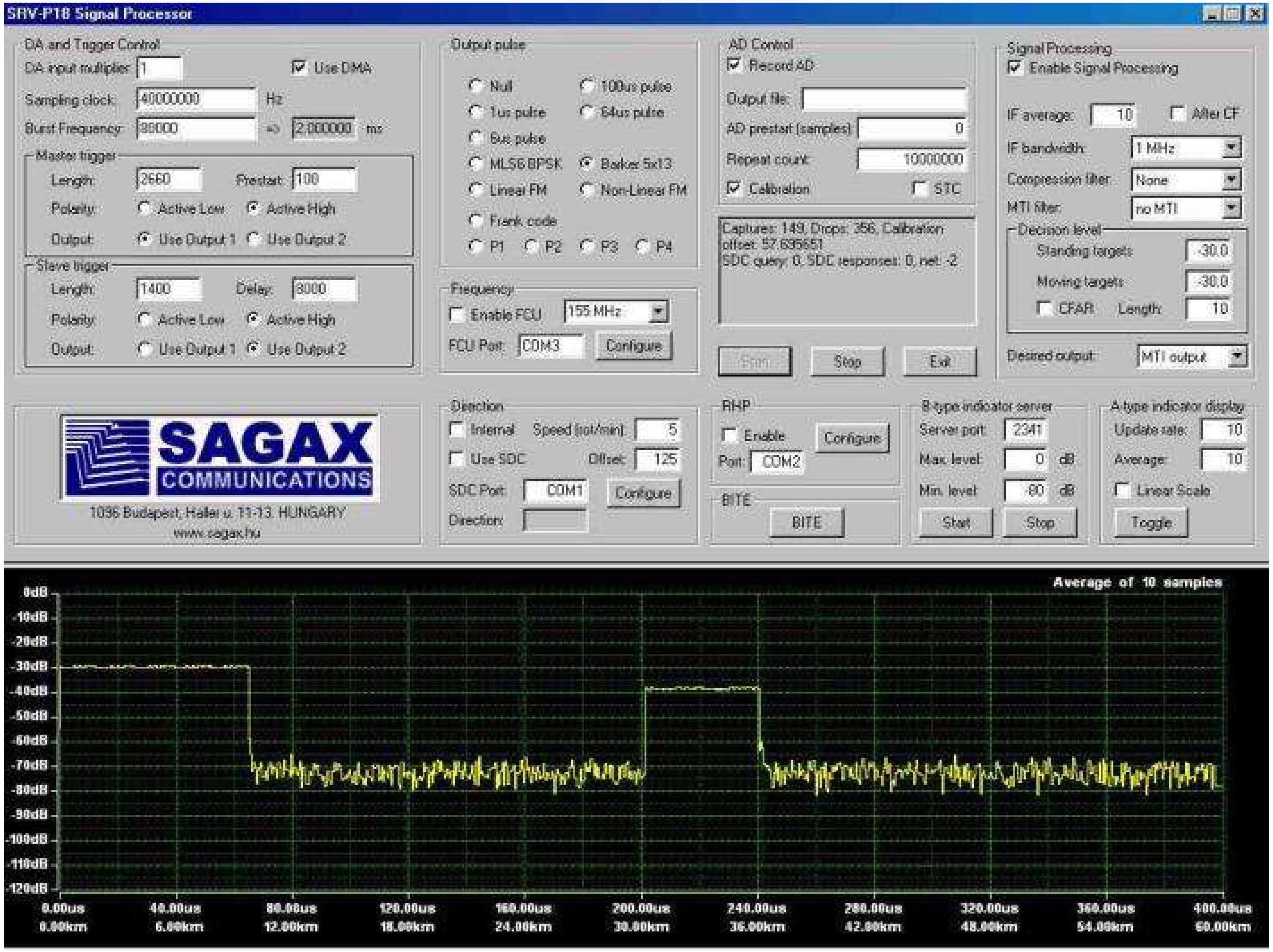
Pulse compression: P2



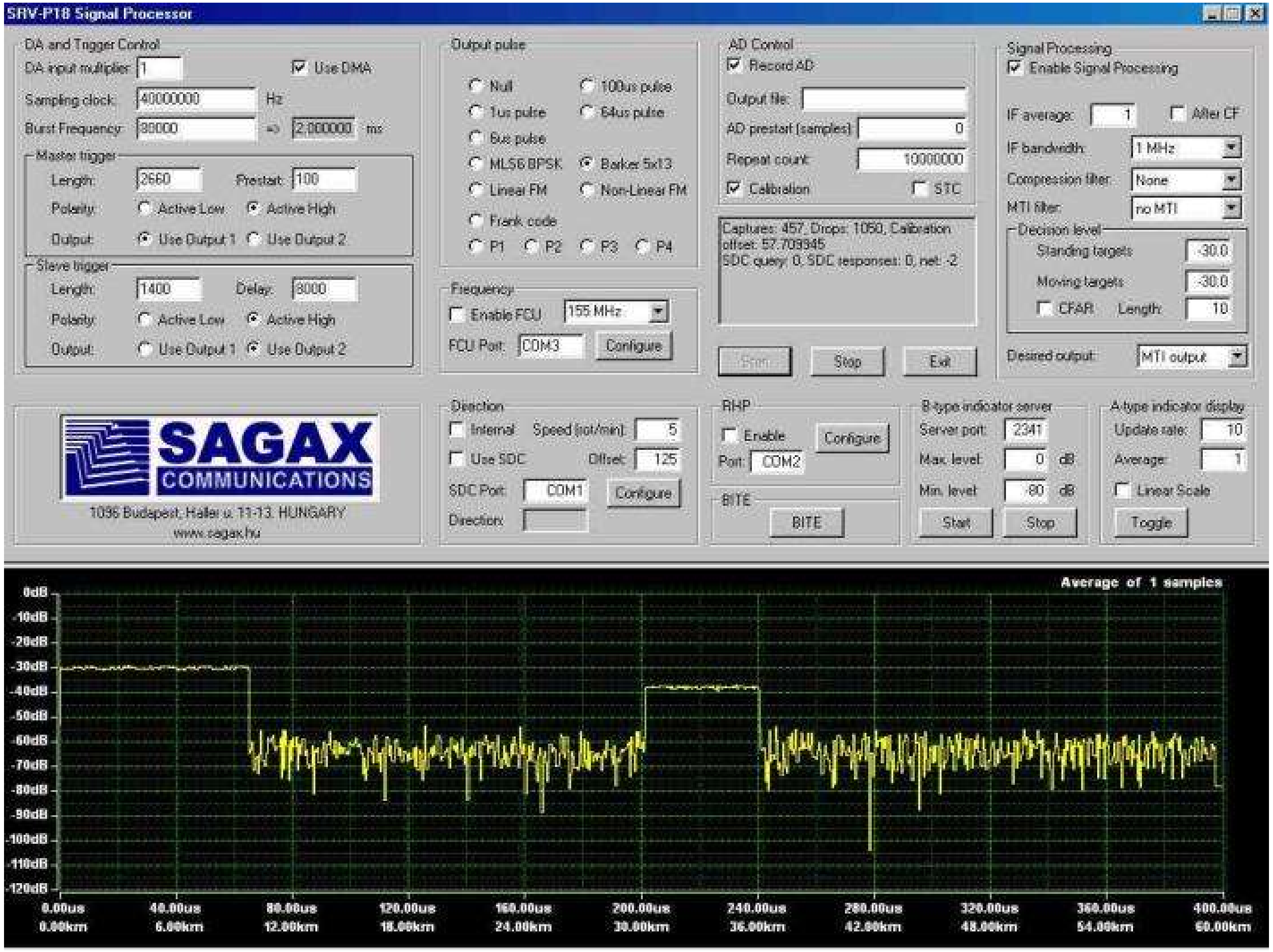
Digital signal processing: CINT=1



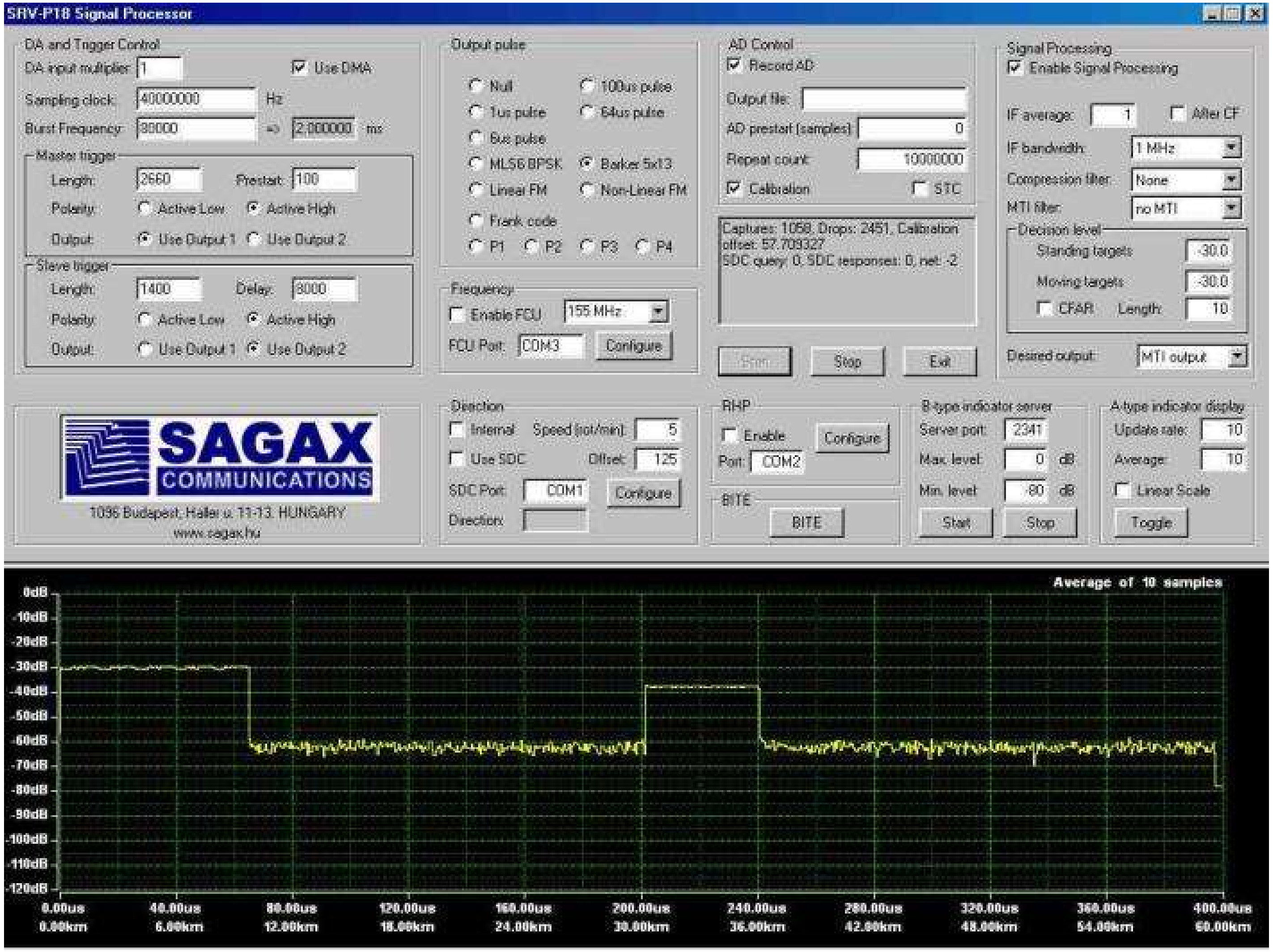
Digital signal processing: CINT=10



Digital signal processing: VINT=1

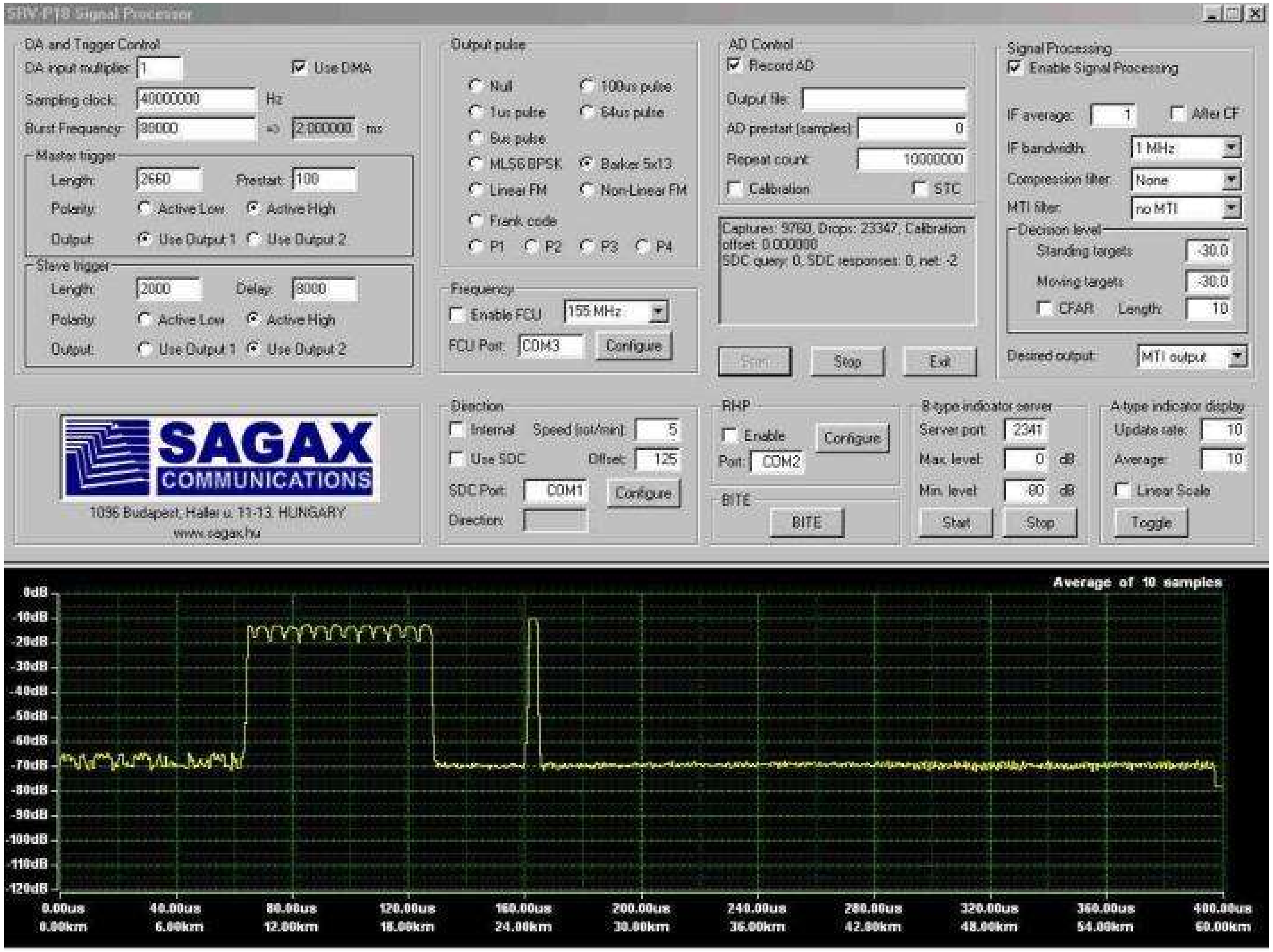


Digital signal processing: VINT=10

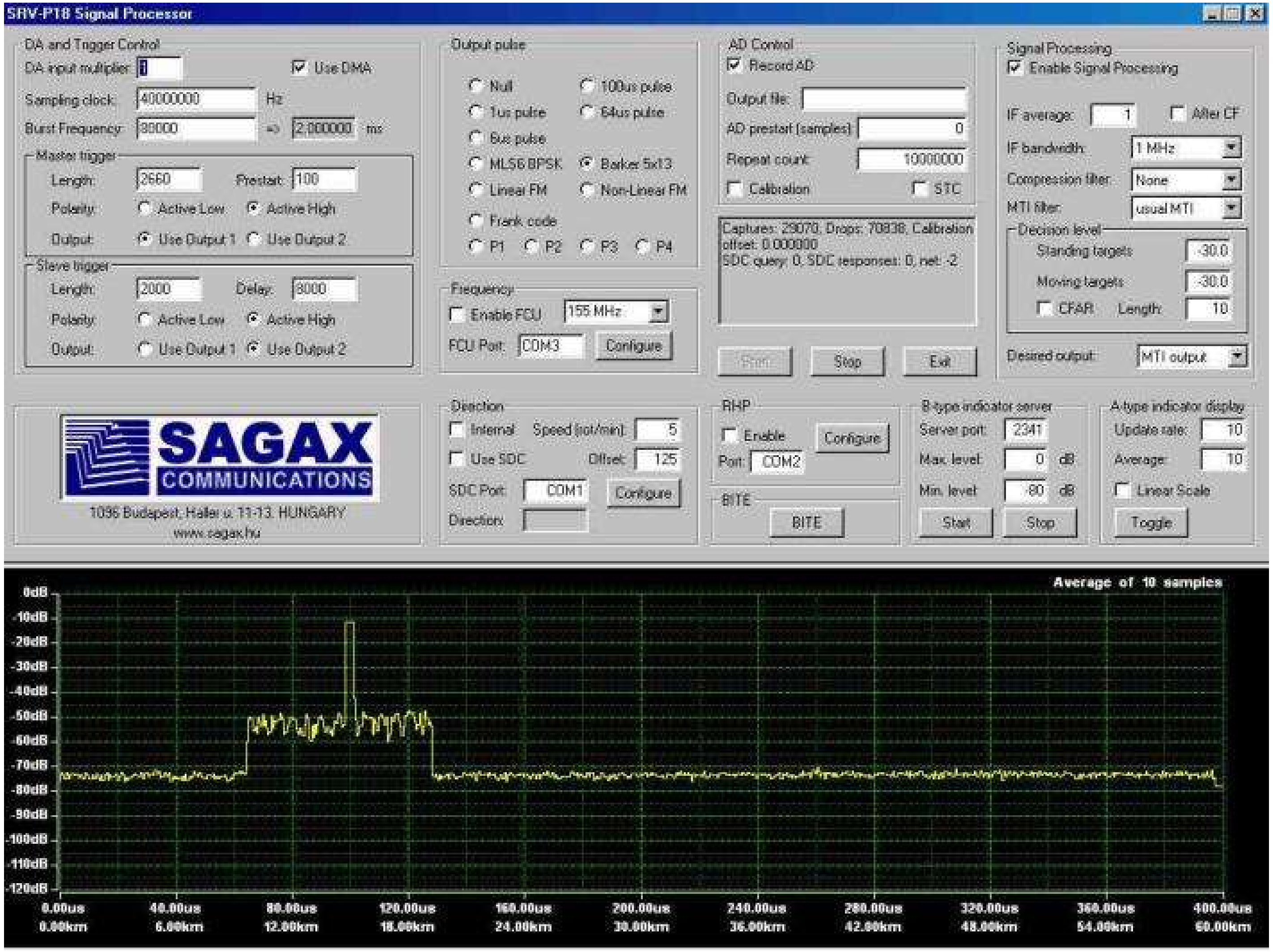


Digital signal processing: DMTI

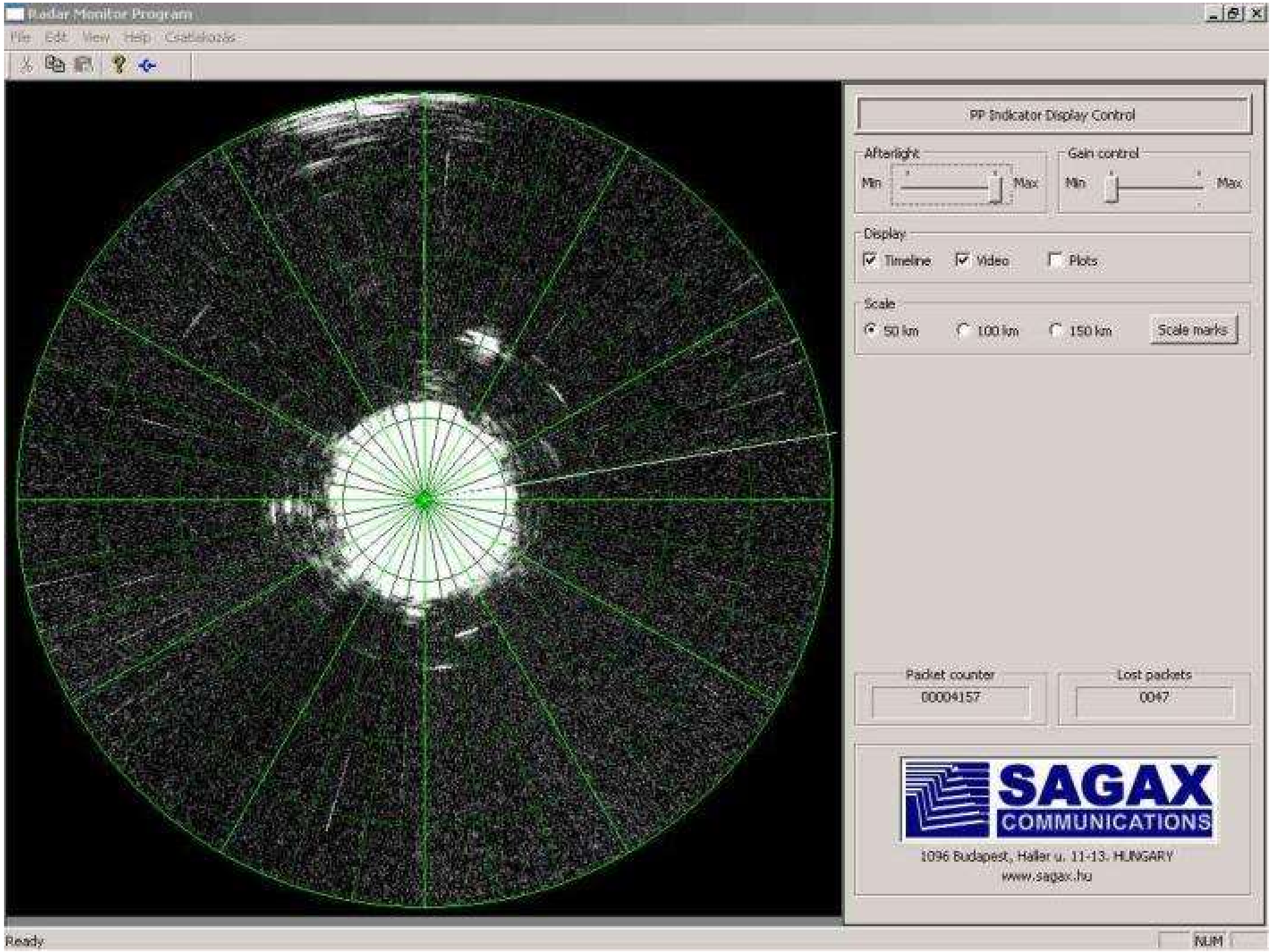
Digital signal processing: DMTI off



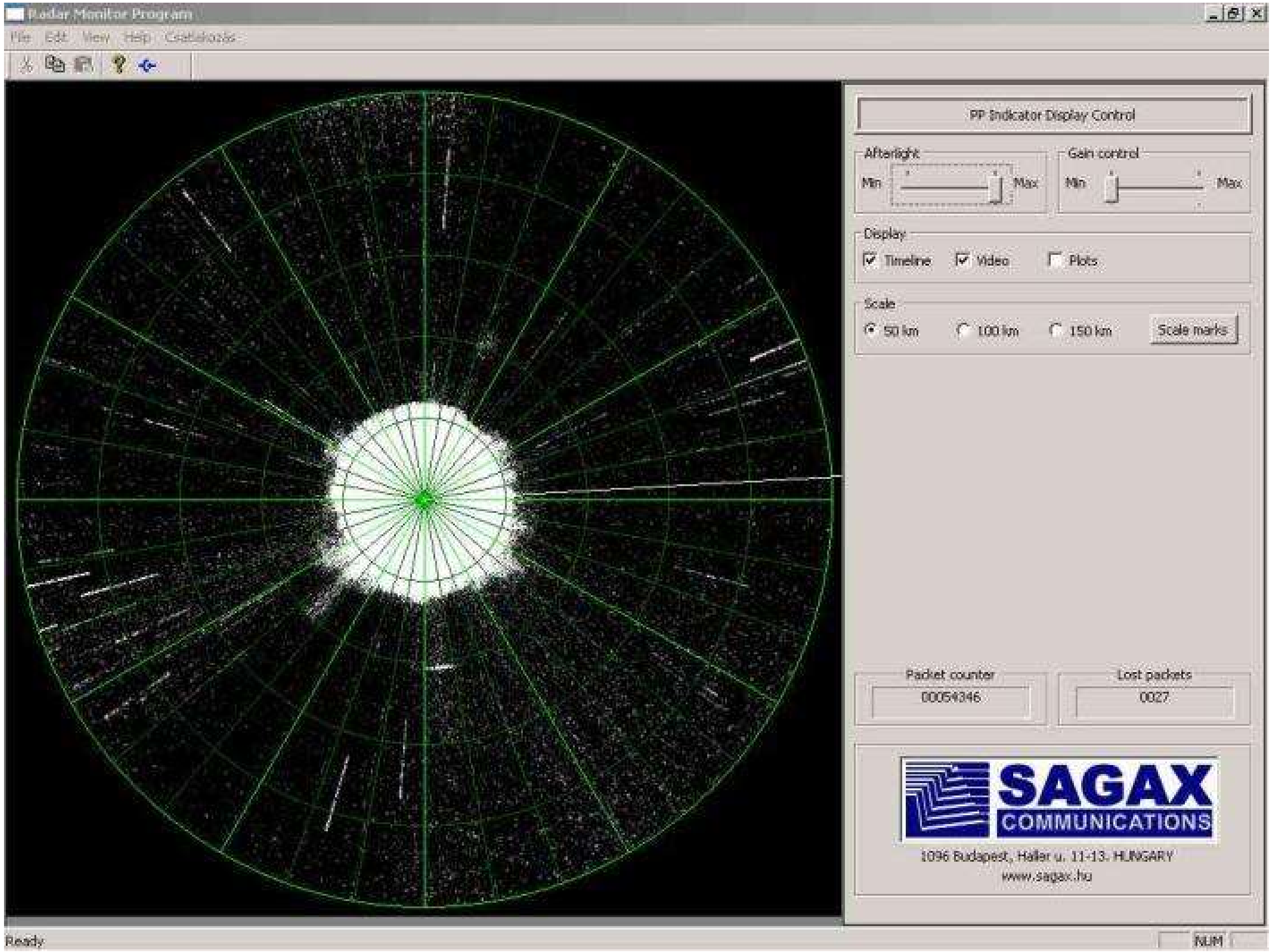
Digital signal processing: DMTI on



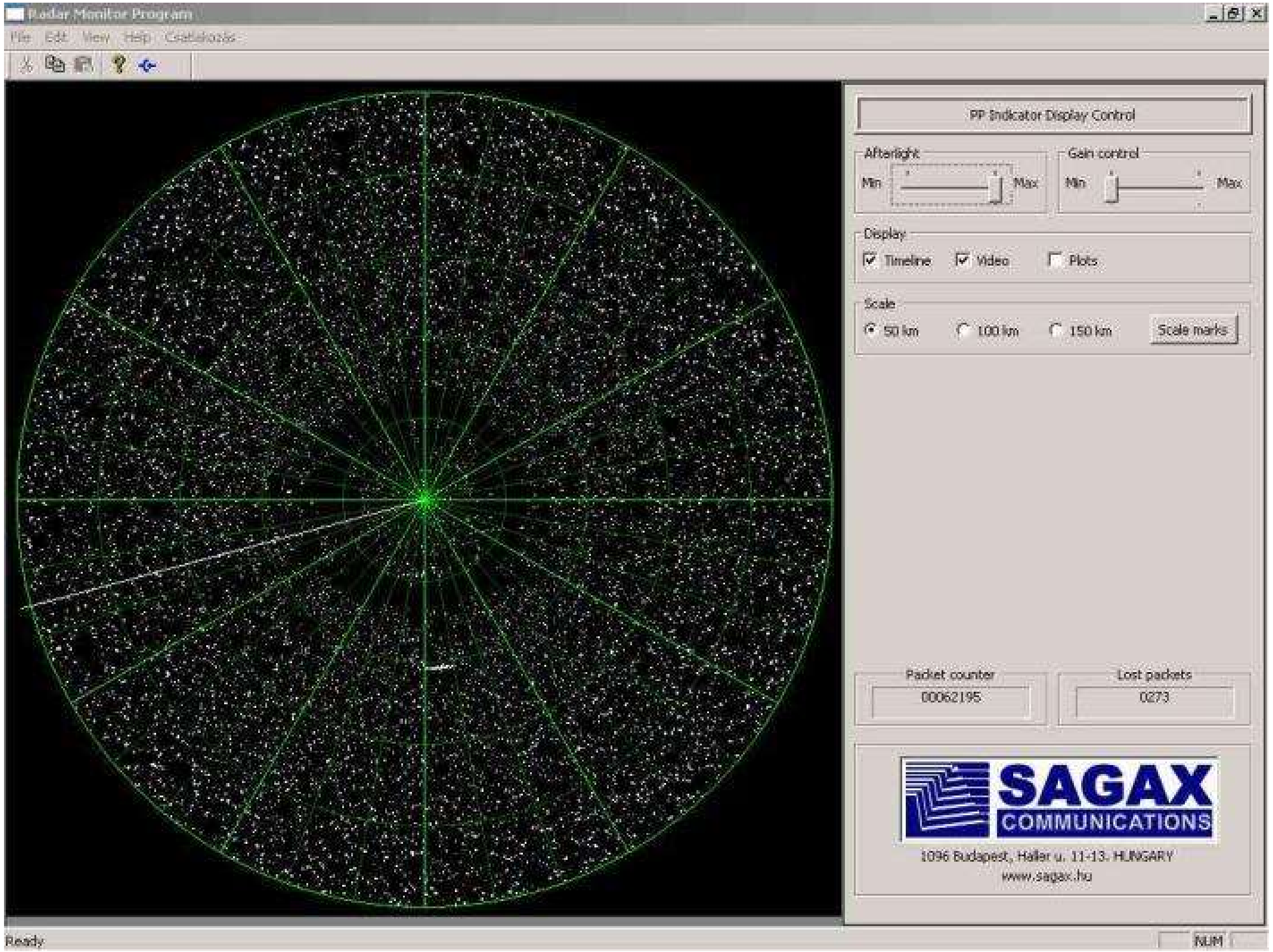
Results: compressed pulses



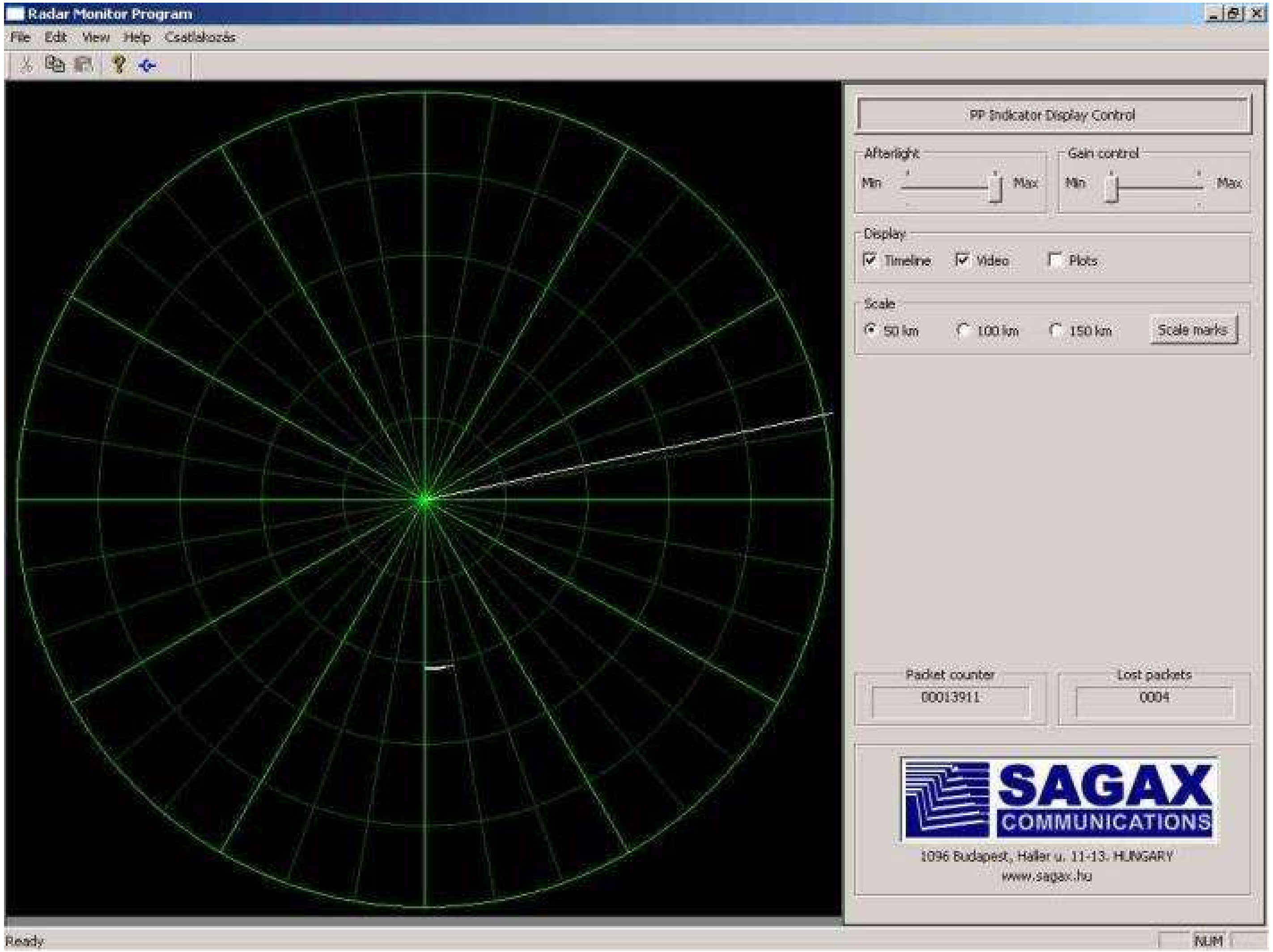
Results: moving targets



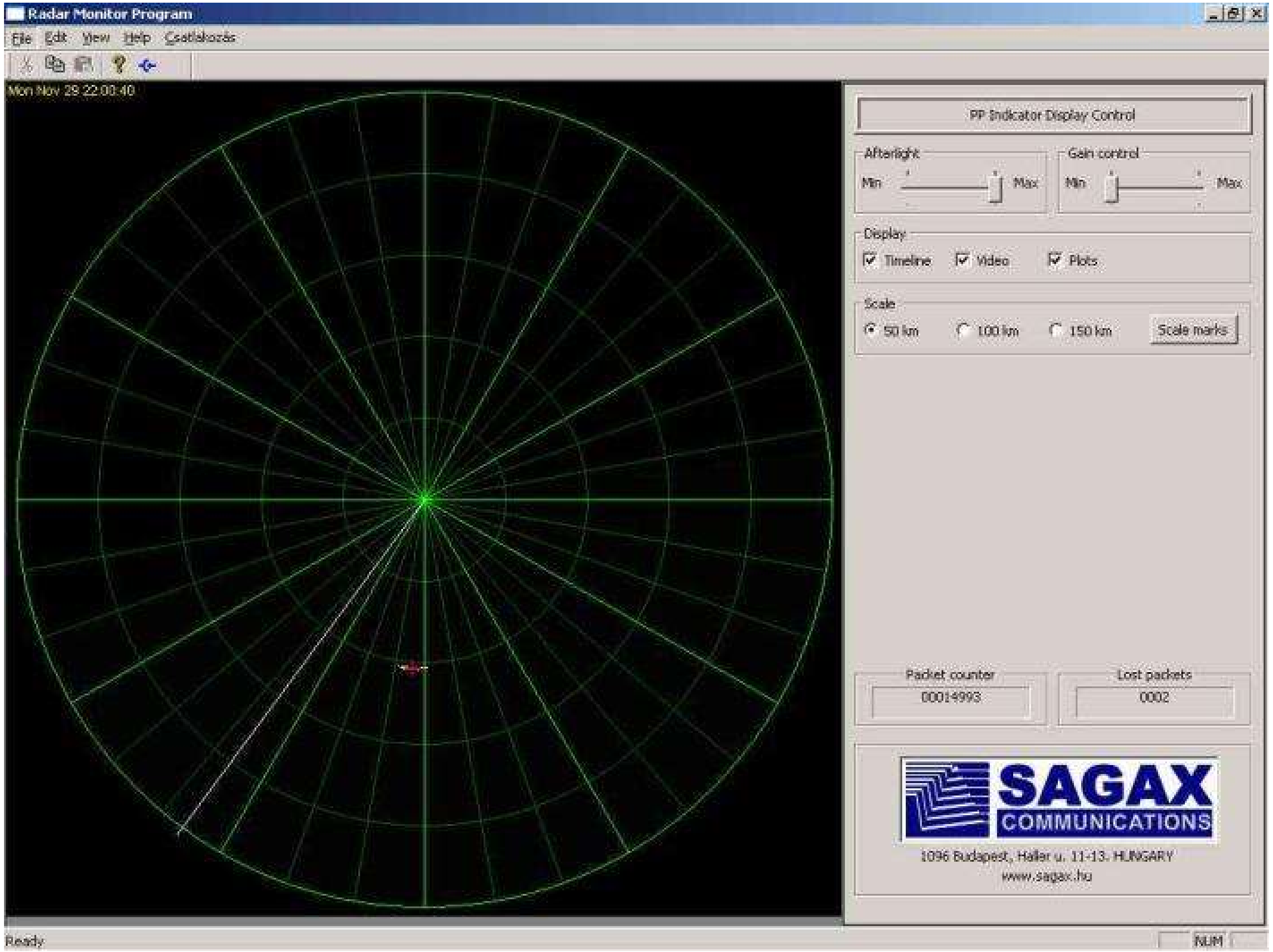
Results: decision hits



Results: target search



Results: plot generation



Field trials

- NATO RTO SET-078 TG-046

  "Multi-Band Radar For Air Defense Systems"
- COSIMA I Trial:
  - 2004 October, Medina, Hungary
- COSIMA II Trial:
  - 2005 September, Livorno, Italy

*Co-located Simultaneous Multi-band-radar Analysis

COSIMA II site in Italy

COSIMA II deployed radars

DIMURA (NO) [5.9GHz]
MELISSA (DE) [238-348MHz]
MMS-300 (IT) [2-18GHz]
SRV-P18 (HU) [150-170MHz]
SzT-68UM (HU) [2.8-3.1GHz]
MEPHIS (DE) [10/35/94GHz]

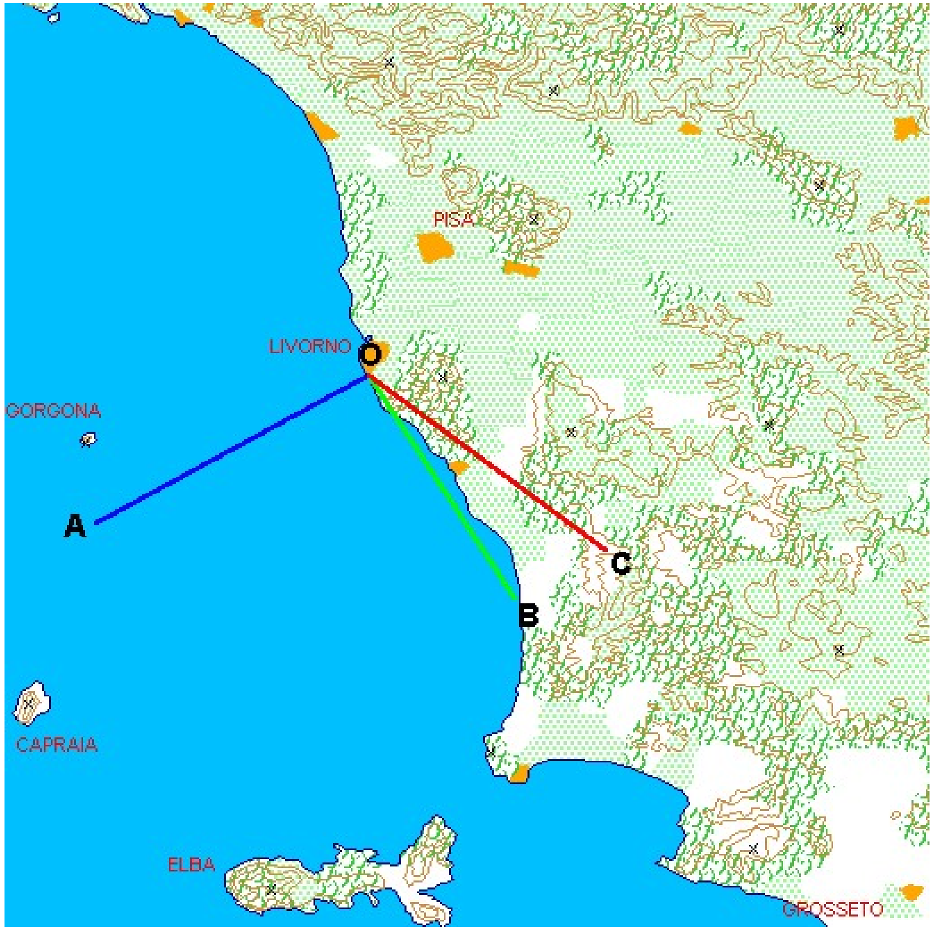
COSIMA II targets and trajectories

Piper:
Cesna 172

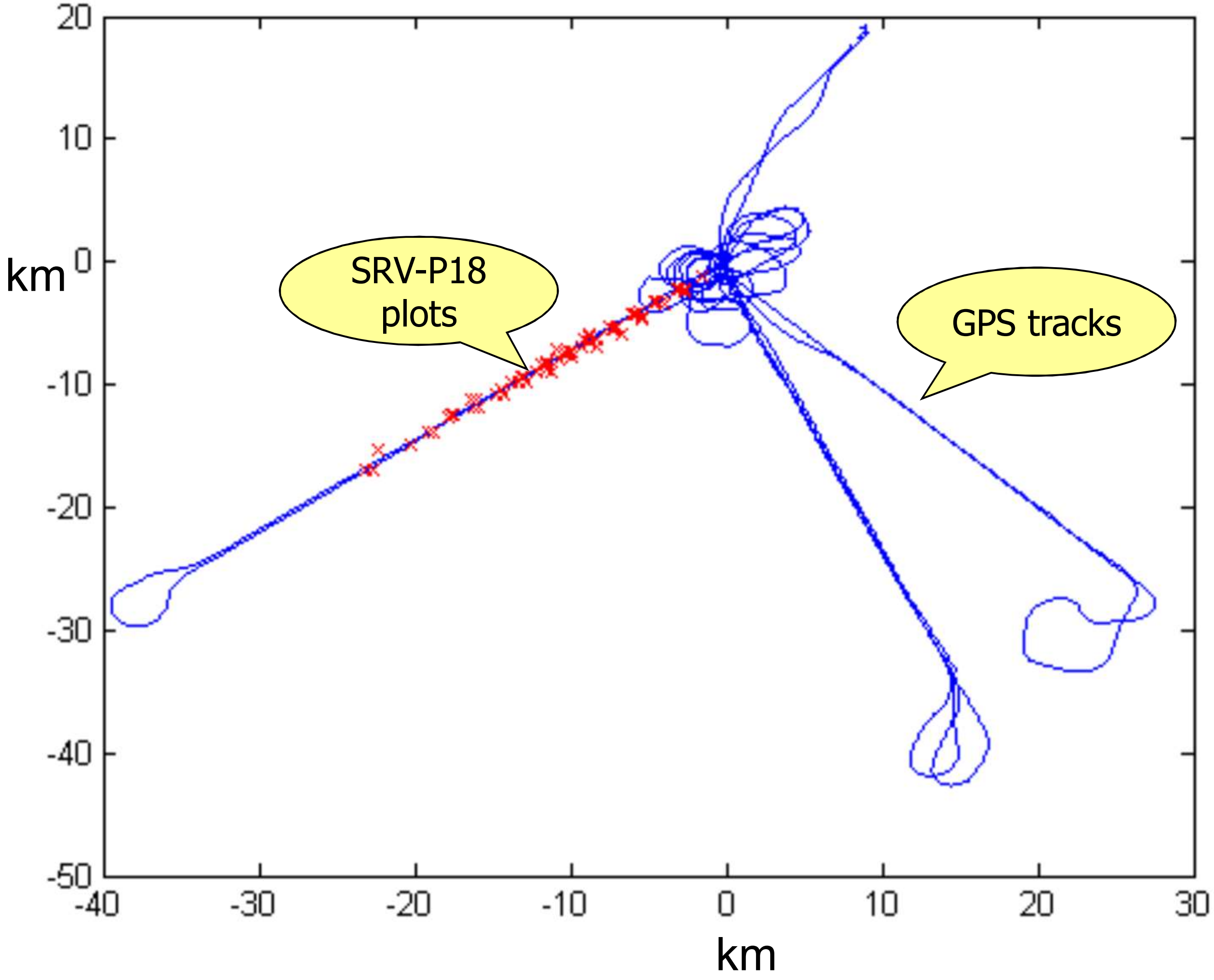
Jet
KingAir 200

Helikopter
B200

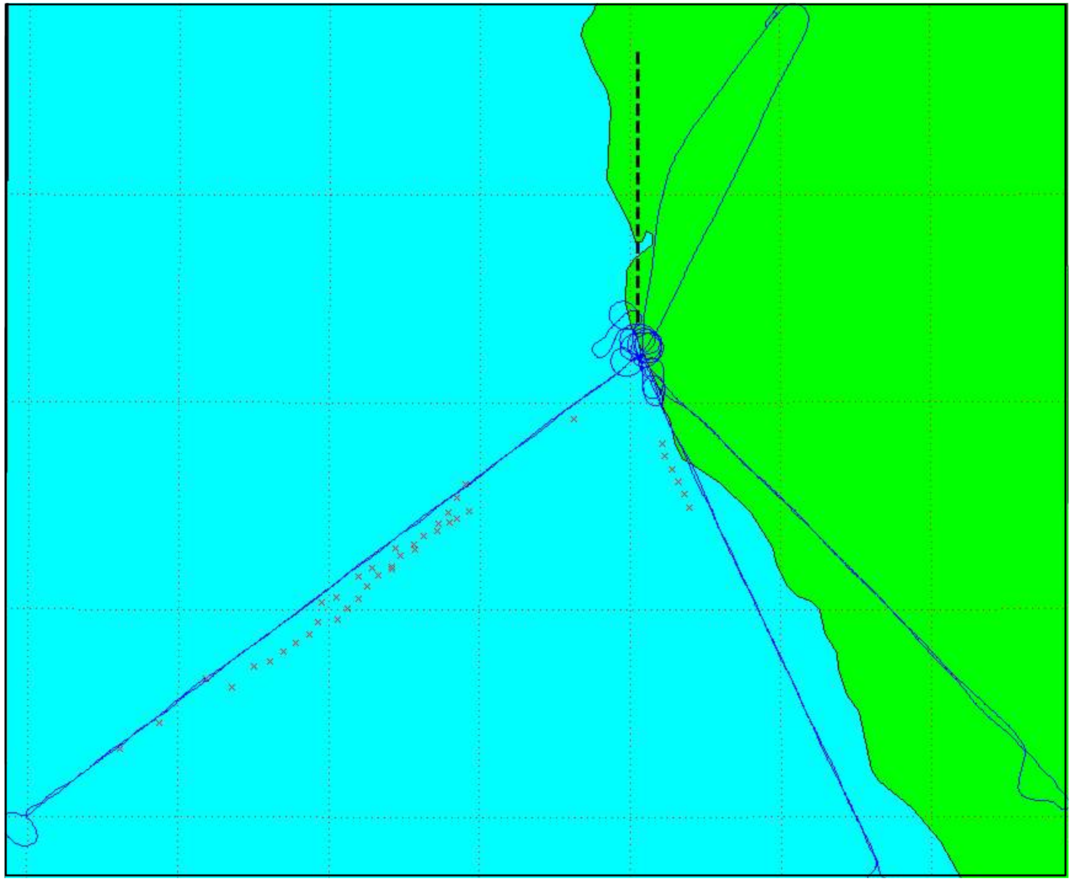
Ship
Rosetti



COSIMA II measured plots vs GPS



COSIMA II: SRV-P18 Toszeg vs. C1



Conclusions

- A complete software based radar system
  - Digital signal and data processing
  - VHF analog front-end with 3KWp solid-state power amplifier
  - Interfacing to the existing P-18 antenna system
- Error-free operation during the field trials
- Capability of available technology and knowledge base in Hungary was demonstrated