

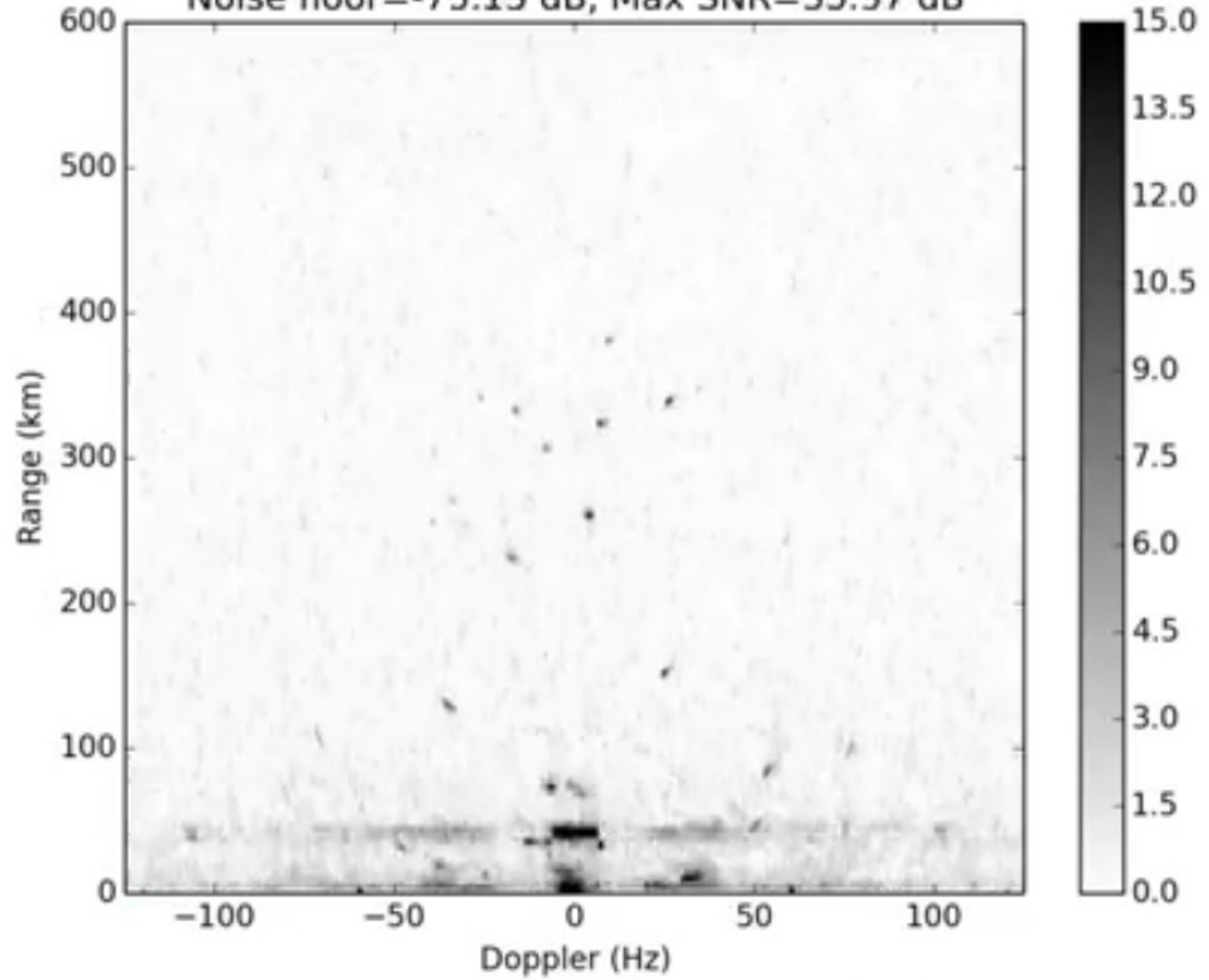


Amatöörradarite võimalustest

Elmer Joandi 2025

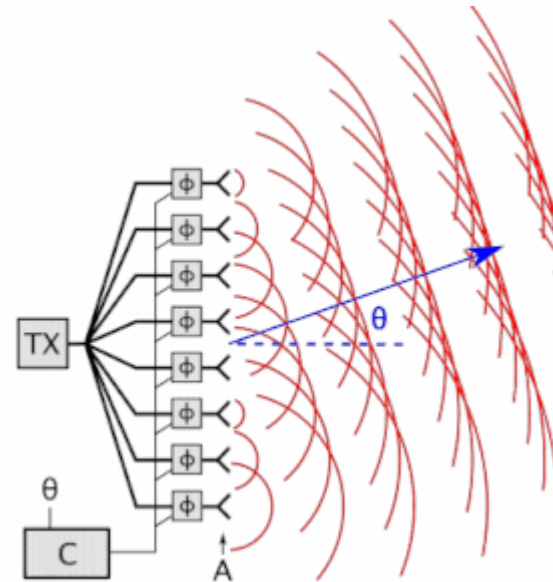
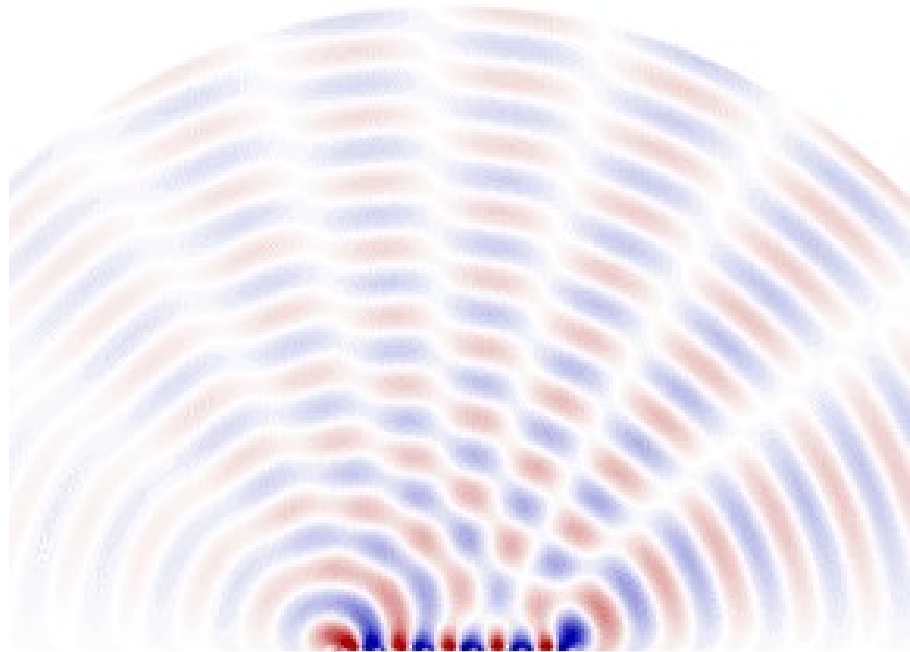


FM 105.1 MHz, Passive Radar, 2013-08-27 15:30:03
Noise floor=-75.13 dB, Max SNR=33.57 dB



- * 2013
- * !suund
- * ADC-8

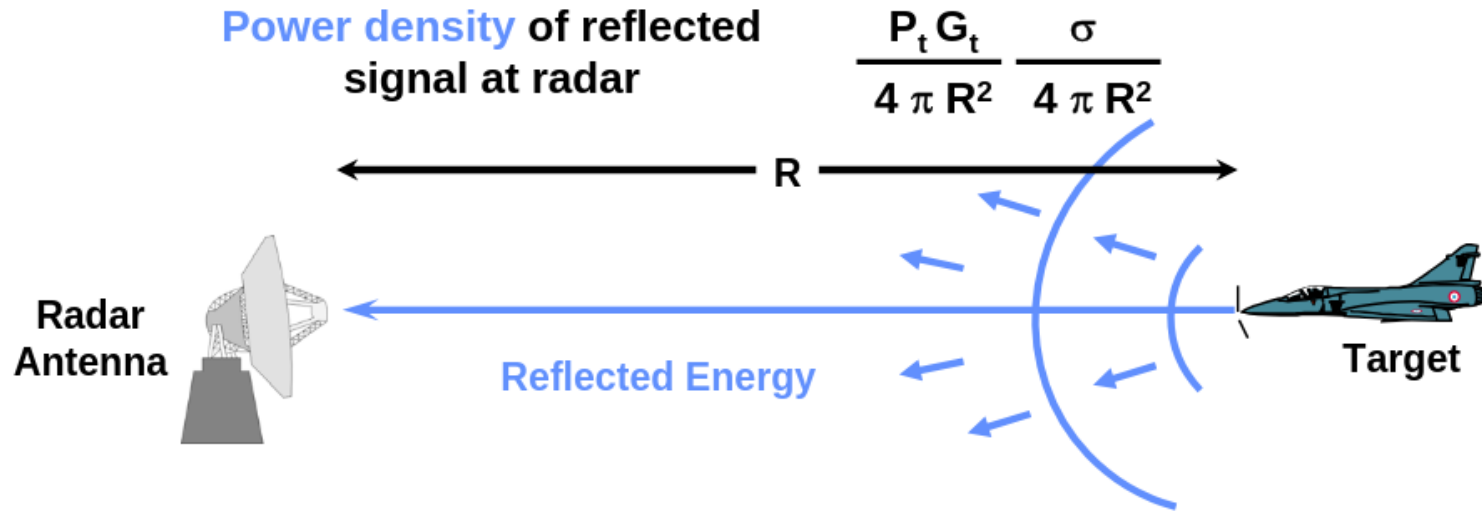
Radari faasinihe



RADAR – RAdio Detection And Ranging

Suuna juhtimine	Aktiivradar	Passiivradar	R, T
Elektriline-pöörlev	pöörlevad radarid	Esimesed radarid	+ , +
Elektrooniline-viivitav	Sõjandus-lennunduslikud	Vene rähn	+ , +
Signaalitöötluslik	MIMO, 5G, WiFi6, Starlink	Vera-M	* , *
Tarkvaraline	Sentinel 1, HAARP, Sonar	SDR põhine amatööradar	! , *
Trianguleeriv tarkvaraline	-	Äiksekaart	! , -

Passiiv vs. aktiiv



The received power = the power density at the radar times the area of the receiving antenna

Power of reflected signal from target and received by radar

$$P_r = \frac{P_t G_t}{4 \pi R^2} \frac{\sigma A_e}{4 \pi R^2}$$

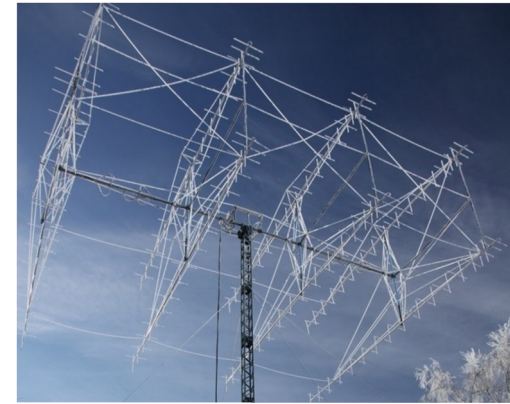
P_r = power received
 A_e = effective area of receiving antenna

Pöörlev amatöörradar



$$7 \times 24 = 168$$

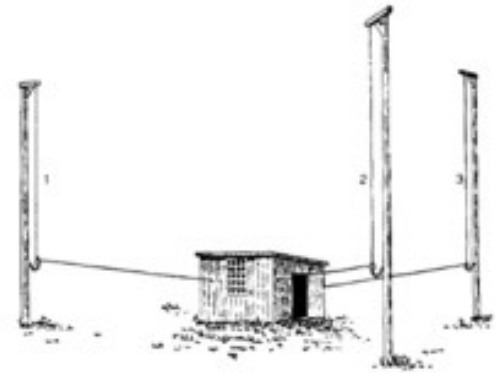
$$4 \times 4 = 16$$



© erau.ee

©Wiki: Nebo-M

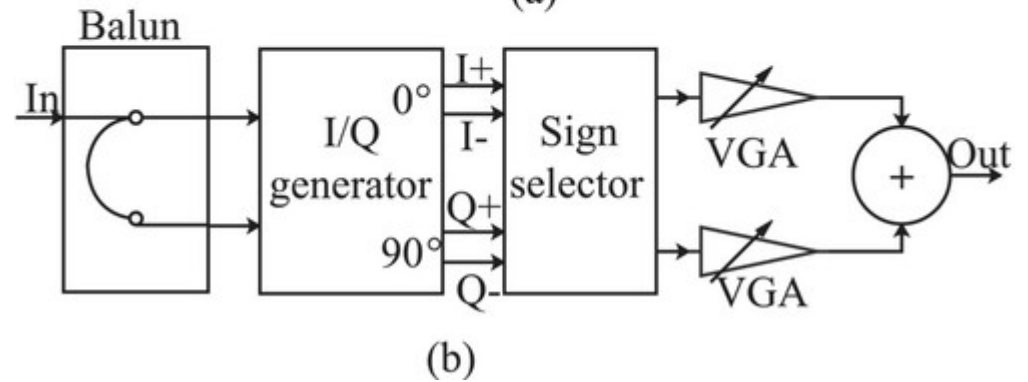
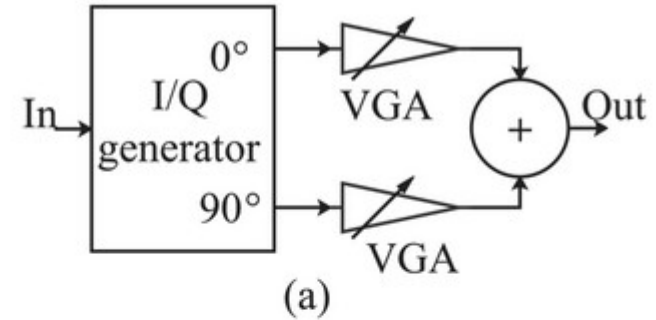
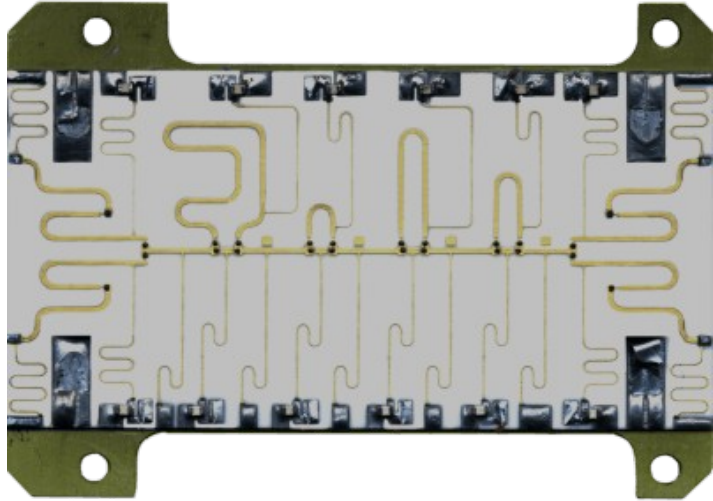
Viiviitav amatööradar



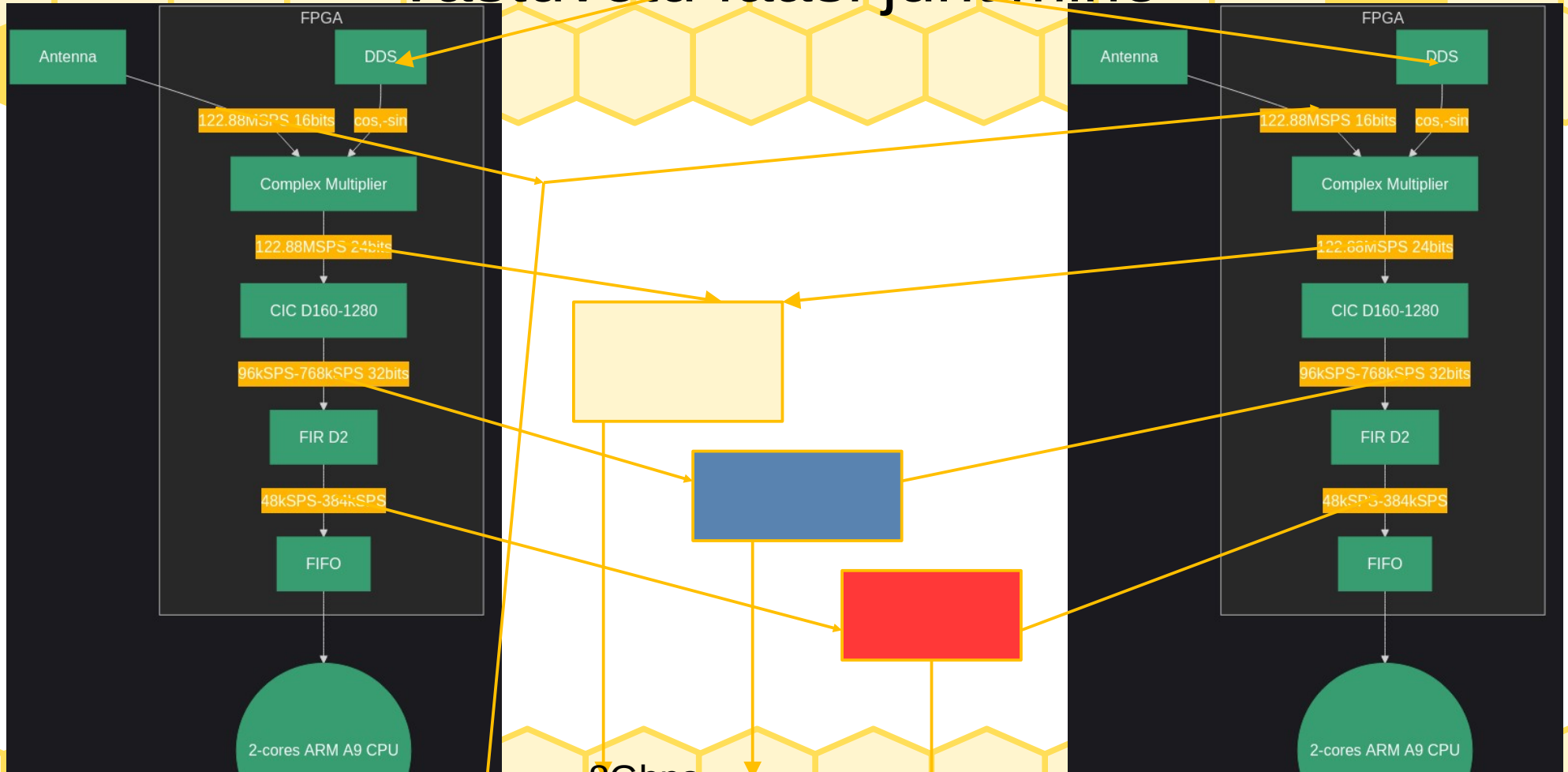
© HAARP

Wiki: Braun 1905

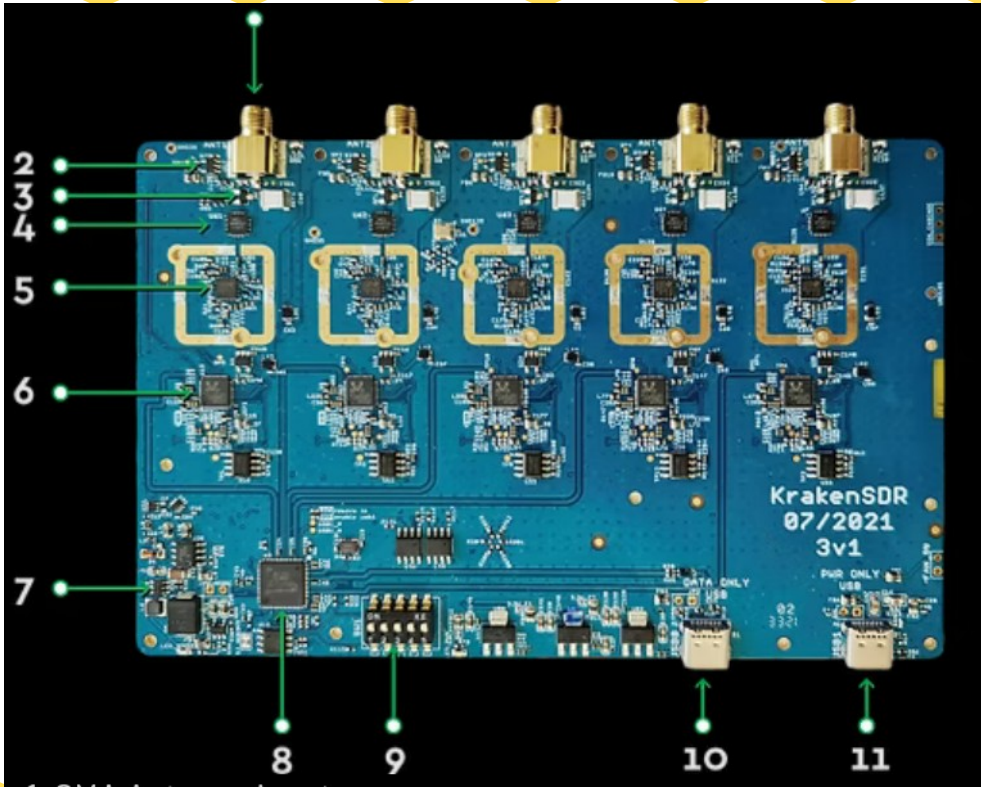
Saatefaasi juhtimine



Vastuvõtu faasi juhtimine



RTL 7-bit ADC



1. SMA Antenna inputs
2. Bias Tee
3. ESD protection
4. Noise calibration switches
5. R820T2 tuner
6. RTL2832U ADC
7. Noise source
8. USB Hub
9. Individual tuner on/off DIP switched
10. USB Type-C DATA
11. USB Type-C PWR



©xilinx.com : Raptor SDR devkit

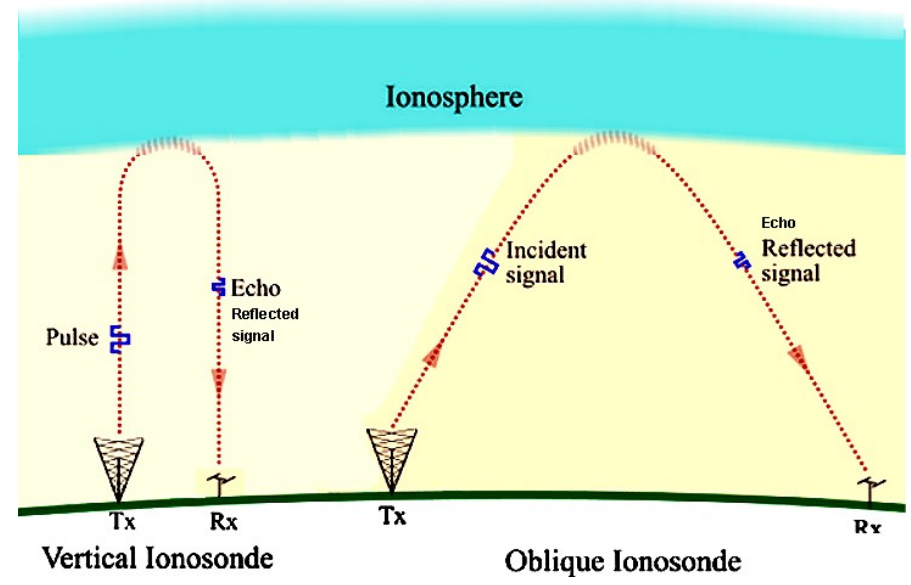
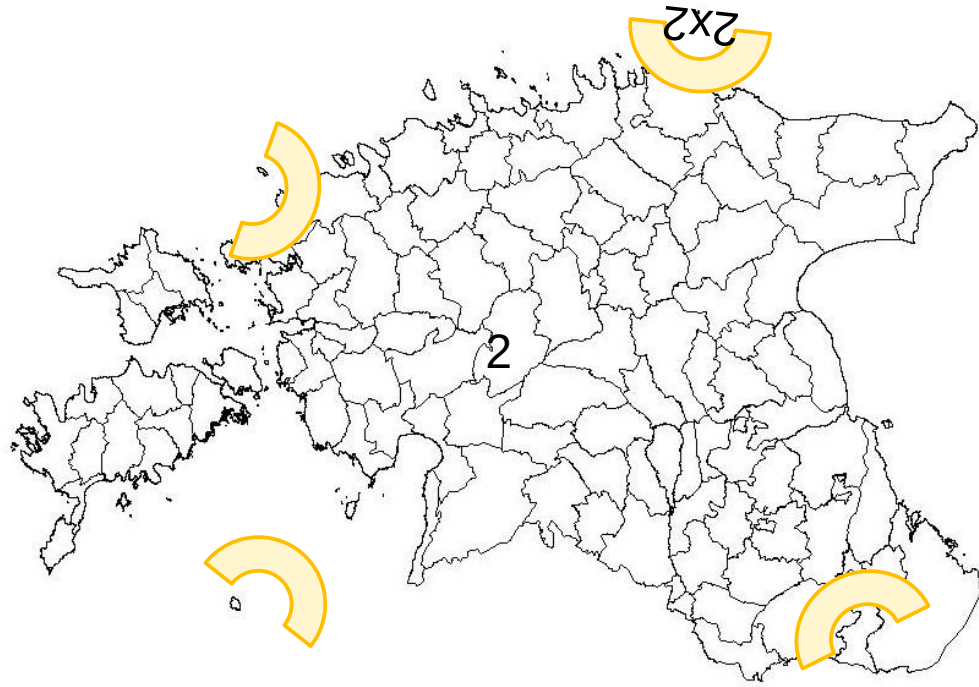
Nvidia/AMD GPU

- ADC: $16 \times 8 \text{ Gbps} = 13 \text{ GB/sec} = 128 \text{ Gbps}$
- Ethernet – $4 \text{ GB/s} - 40 \text{ Gbps}$
- PCI-E siin - 7 GB/s
- GPU põhimälu - $300..1000 \text{ GB/sec}$
- Mäluaken tiiruga ümber ilma – 0.15 sec
- 1000 km impulsi otsing – 0.01 sec , $10 \text{ imp/sec} - 1 \text{ Gbps/antenn}$

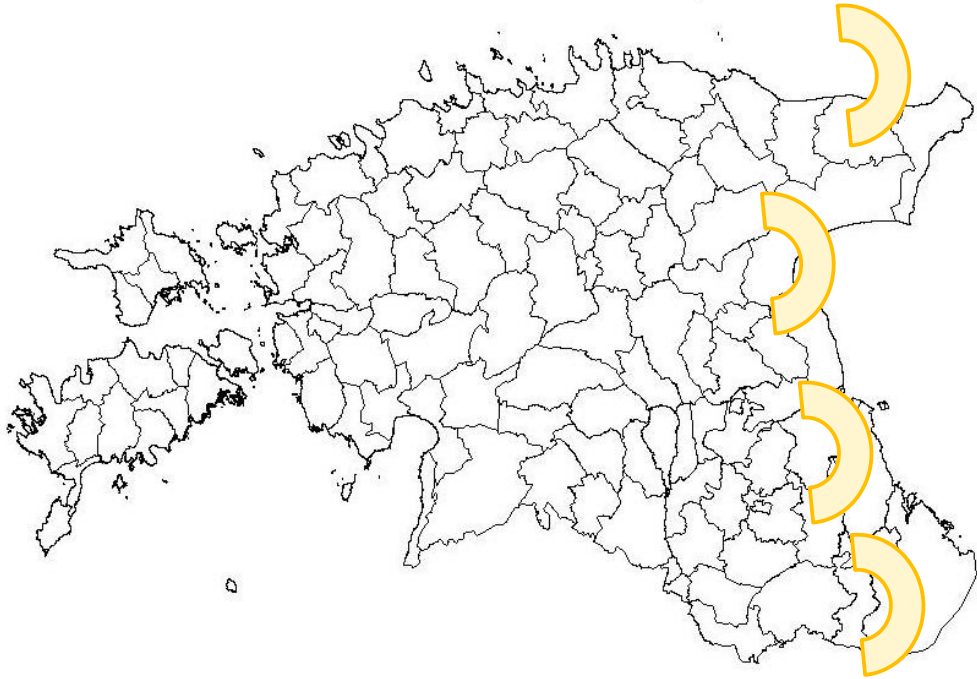
Pildi koostamine

	1D FFT	2..4D FFT-d ja nende summa	Tarkvaraline mustri otsing
Teadaolev signaal kitsas ribas	Kauguse määramine, Dopler kaugus-kiirus.	Suuna filtreerimine	Passiivradar
Tundmatu signaal kitsas ribas	SDR vastuvõtu filtreerimine	Suuna otsing	trianguleerimine Äiksedetektor
Teadaolevad signaalid laias ribas		Samaaegne vastuvõtt	Paljude saatjate eristamine
Laia spektri vastuvõtt laial pildid	-	Ionosfääri omadused Raadioastronoomia	Impulssaatjate tuvastamine, logi

Kasutused, lühilaine raadioside



100Mhz FM mobiilne passiivradar



- 2x2 antennid
- 100Mbps võrk
- 4 kõrgemat punkti
- Tuulikud





© Wiki: EISCAT

Filter Layers Profile

Mode: Pair

File 1: 2018-01-08 (7_10) | VH

File 2: 2018-01-08 (7_10) | VV

Map

Group by: None [View legend](#)

Menu

Demo

- Coherence
- Ice Map B/W

Opacity (50%)

Scale

0 Unit: 0.005

RTM Options

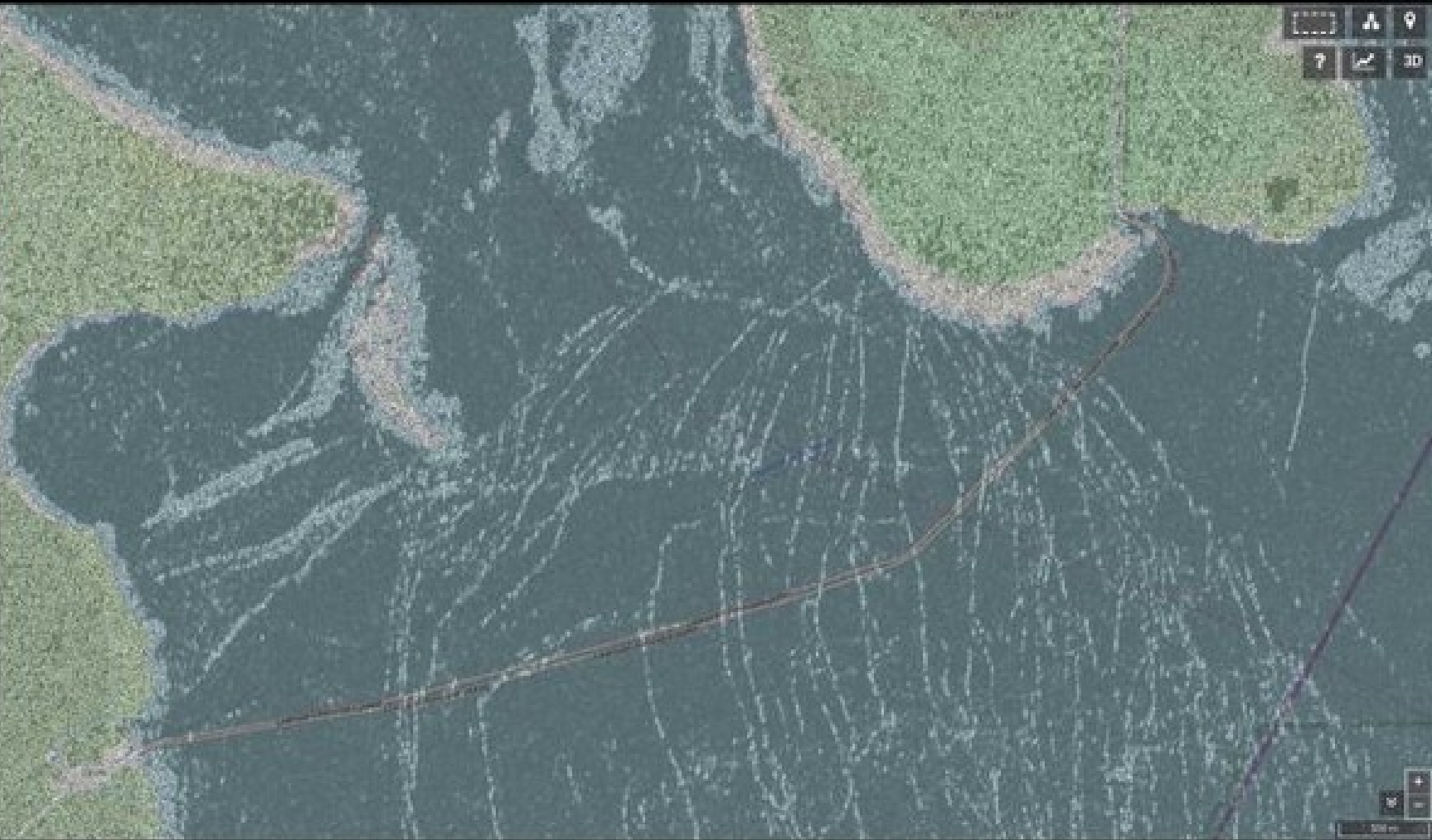
- Interferogram
- Sigma 0
- Sigma 0 +
- Sigma0o (Master)
- Sigma 0 Slave
- Speckle Filter

Development

Other

Restart

Test



Navigation icons: Home, Layers, Location, Zoom In, Zoom Out, 3D