

**Polar Geophysical Institute.
Heliophysical research in the Arctic.
Second all-Russian conference.**

**Technical approaches in performing biophysical experiments
at the Vostok station (energy supply, Wi-Fi, electronics)
Mobile astronomic sun-fed station for collecting cosmic dust by
aerosol filtering**

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**Murmansk
24-26 September 2018**

Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filterin. Station Vostok.



Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filterin. Station Vostok.

**Collect pure snow.
Very Cool! Old traditions.
Station Vostok.**



Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Ethernet Radio bridge

Distance up to 10km



AM-5G19-120
(5 GHz, 19 dBi)



TightVNC server



eTracer ET-6415N



DC/AC HC-12-3000



Delta GX 12-200



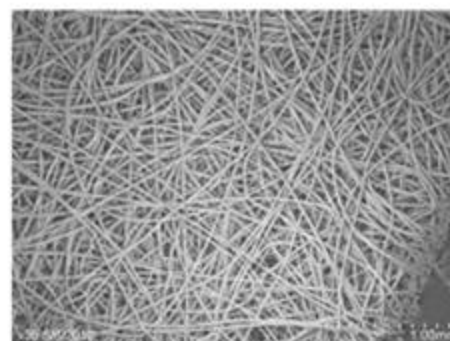
Solar Battery

HH-MONO230W



Radial fan

ROSENBERG EHAE 225-2

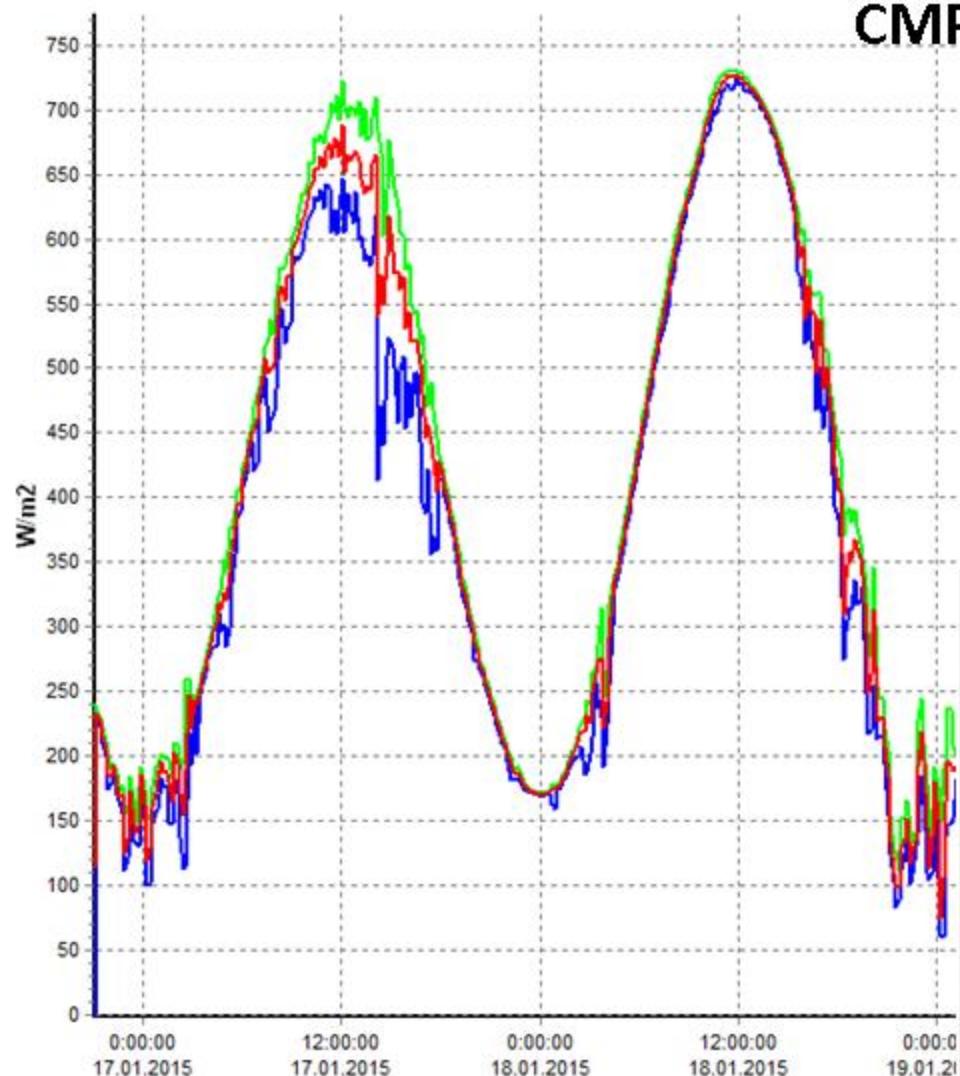


Bekipore (Tm) Sintered
metal fiber filtration media
3mkm from Bekaert

1200 m³ in an hour

Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Solar power at 24 hour $\sim 15 \text{ kBT/m}^2$. Logger Meteon with sensor CMP22



Calculated data

Declination	-23.0452°
Solar zenith angle (no refraction)	55.6963°
Solar zenith angle (with refraction)	55.6843°
Julian day	55562.5000
Equation of time	1436.8048 min
Hour angle	19.2012°
Extraterrestrial global horizontal solar irradiance	797.42 W/m ²
Extraterrestrial direct normal solar irradiance	1414.91 W/m ²

Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Solar battery HH-MONO230W



Day development of electricity of one solar HH-MONO230W battery at its orientation to the north.
4 years in a snowy field, **temperature down to -80 C**



Power W - 230

Voltage nominal V - 27,6

Current A - 8,34

Photo cells - 54/single-crystal

Size of single-crystal cells, mm - 156x156

Extent of protection of the case, IP - 65

Overall dimensions, mm - 1480x982x40

Weight of the module, kg - 17

Total area, m² - 1,45

Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Solar battery controller eTracer ET-6415N, Internal Web server control of work through Ethernet

ELECTRIC CHARACTERISTICS:

Voltage of system, Volt (autochoice) -

12/24/36/48 Maximum current of a

charge of AB, Ampere - 60

Maximum power of SB, Watt - 3200

Maximum voltage on an entrance, Volt - 150

The controler has the Ethernet interface, the external and internal sensor of temperature

MECHANICAL CHARACTERISTICS:

Overall dimensions, mm - 285x203x105

Weight, kg - 5

TEMPERATURE

CHARACTERISTICS: Temperature of operation, °C-20 ~ +55

It is placed in the heat-insulating box



Date	Batt. Voltage (V)	PV Voltage (V)	Batt. Current (A)	Charge Power (W)	Energy Gen. (kWh)	RS Temp. (°C)	Local Temp. (°C)	SOC (%)
2015-01-22	14.0	70.7	16.1	227	3.0	-25.5	26.9	99
16-02-00								
2015-01-22	14.0	70.5	17.1	241	3.1	-25.4	25.7	99
16-22-00								

Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Gel accumulator Delta GX 12-200



TECHNICAL CHARACTERISTICS:

Rated voltage, Volt - 12

Number of elements - 6

Nominal capacity (25 °C), Ach - 200

Internal resistance of completely infected battery (25 °C), megohm - 3,6

TEMPERATURE CHARACTERISTICS:

The category, °C-20 ~ +60 C

Charge, °C-10 ~ +60

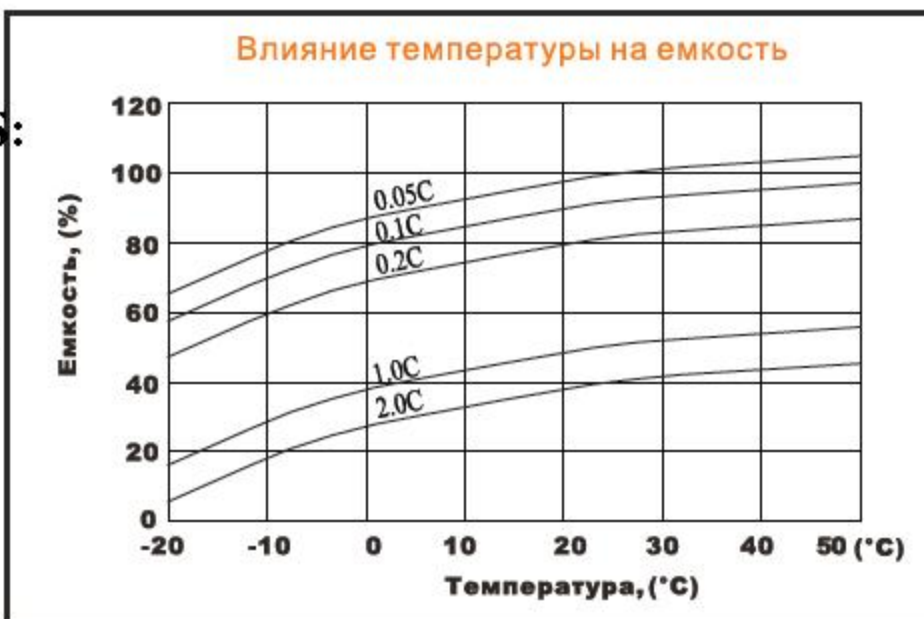
Max. current (25 °C), Ampere - 1000 (5c)

DIMENSIONS AND WEIGHT:

Overall dimensions, mm

- 552x238x240 Weight, kg – 65

It is placed in the heat-insulating box



**Mobile astronomic sun-fed station for collecting cosmic dust by
aerosol filtering**

DC/AC inverter ИС-12-3000

ELECTRIC CHARACTERISTICS:

An output signal - a pure sine Output,

Volt - 220

Rated power, Watt – 3000

Starting power, Watt - to 6600

Product efficiency not less than 92%.

Entrance tension, Volt - 10,5 ~ 14,5

MECHANICAL

CHARACTERISTICS:

Overall dimensions, mm - 165x245x198

Weight, kg - 5

TEMPERATURE

CHARACTERISTICS: Temperature of

storage, °C-40 ~ +70 Temperature of

operation, °C-40 ~ +40

It is placed in the heat-insulating box



Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

The AirMax Sector 5G-19-120 antenna with point of access of Rocket M5 – range of communication to 10km
Ethernet transparent radio bridge

AM-5AC22-45 Antenna Characteristics

Dimensions*	750 x 215 x 94 mm (29.53 x 8.47 x 3.70")
Weight*	6 kg (13.23 lbs)
Frequency Range	5.10 - 5.85 GHz
Gain	22 dBi
HPOL Beamwidth	45° (6 dBi)
VPOL Beamwidth	45° (6 dBi)
Electrical Beamwidth	4°
Electrical Downtilt	2°
Max. VSWR	1.5:1
Wind Survivability	200 km/h (125 mph)
Wind Loading	347 N @ 200 km/h (78 lbf @ 125 mph)
Polarization	Dual-Linear
Cross-Polarization Isolation	30 dB Min.
ETSI Specification	EN 302 326 DN2
Mounting	Universal Pole Mount, Rocket Bracket, and Weatherproof RF Jumpers Included



Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

The AirMax Sector 5G-19-120 antenna with the point of access of Rocket M5 – range of communication to 10km
Ethernet transparent radio bridge

M5 Software Information

Modes	Access Point, Station
Services	Web Server, SNMP, SSH Server, Telnet, Ping Watchdog, DHCP, NAT, Bridging, Routing
Utilities	Antenna Alignment Tool, Discovery Utility, Site Survey, Ping, Traceroute, Speed Test
Distance Adjustment	Dynamic Ack and Ackless Mode
Power Adjustment	Software Adjustable UI or CLI
Security	WPA2 AES Only
QoS	Supports Packet Level Classification WMM and User Customer Level: High/Medium/Low
Statistical Reporting	Up Time, Packet Errors, Data Rates, Wireless Distance, Ethernet Link Rate
Other	Remote Reset Support, Software Enabled/Disabled, VLAN Support, 64QAM, 5/8/10/20/30/40 MHz Channel Width Support
Ubiquiti Specific Features	airMAX Mode, Traffic Shaping with Burst Support, Discovery Protocol, Frequency Band Offset, Ackless Mode

Device Name: Rocket M5

Network Mode: Bridge

Wireless Mode: Access Point WDS

SSID: ubnt

Security: WPA-AES

Version: v5.5.3

Uptime: 05:23:47

Date: 2012-10-12 22:39:41

Channel/Frequency: 60 / 5300 MHz

Channel Width: 20 MHz

Distance: 0.1 miles (0.2 km)

TX/RX Chain: RX

AP MAC: DC:9F:DB:56:1F:27

Signal Strength:  -33

Chain 0 / Chain 1: -24 / -44 dBm

Noise Floor: -91 dBm

Transmit CCQ: 99.2 %

TX/RX Rate: 130 Mbps / 130 Mbps

airMAX: Enabled

airMAX Priority: None

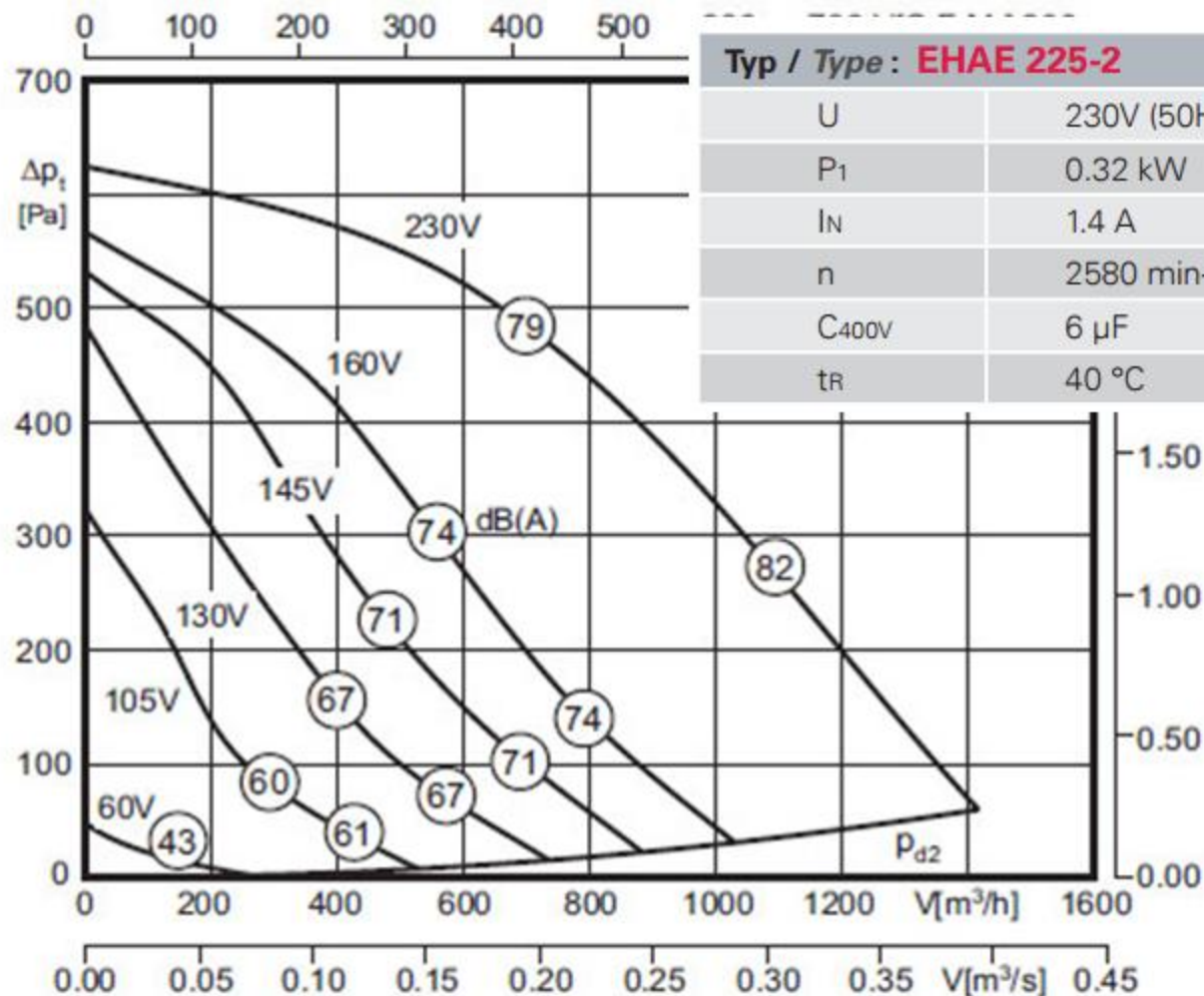
airMAX Quality:  99 %

airMAX Capacity:  98 %

Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Radial fan ROSENBERG EHAE 225-2

Рабочая кривая производительности



Typ / Type: **EHAE 225-2**

Art.-Nr. / Art.-No.: **B30-22500**

U 230V (50Hz)

$\Delta p_{fa \min}$ – Pa

P₁ 0.32 kW

ΔI 6 %

I_N 1.4 A

I_A / I_N 1.7

n 2580 min⁻¹

⚠ IP54

C_{400V} 6 μF

★ 01.024

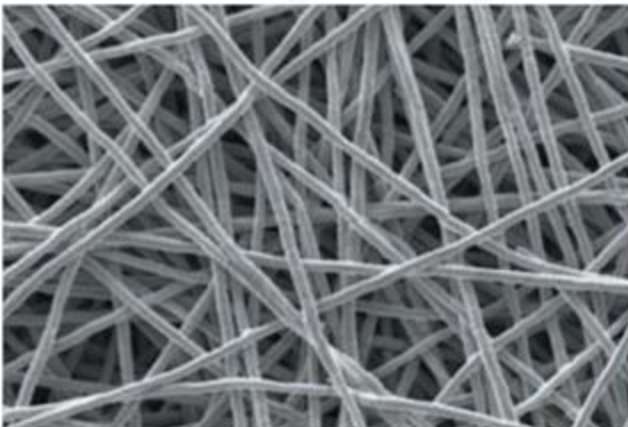
t_R 40 °C

🔋 11 kg

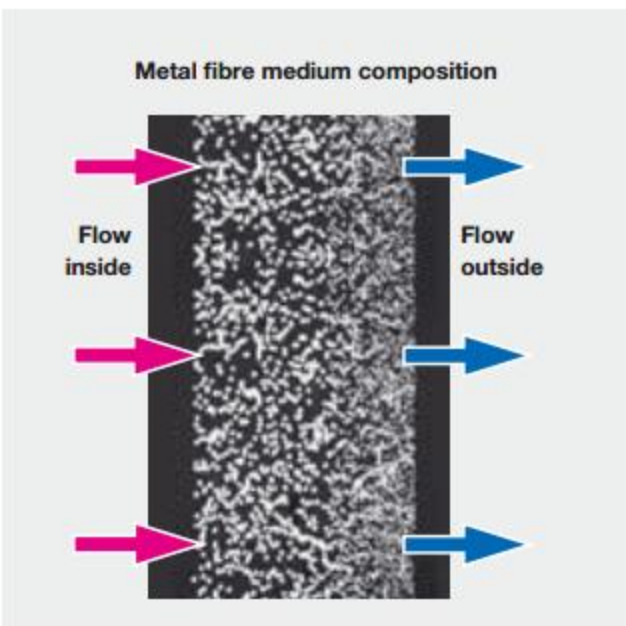


Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Bekipore (Tm) Sintered metal fiber filtration media 3mkm from Bekaert



Depth filtration

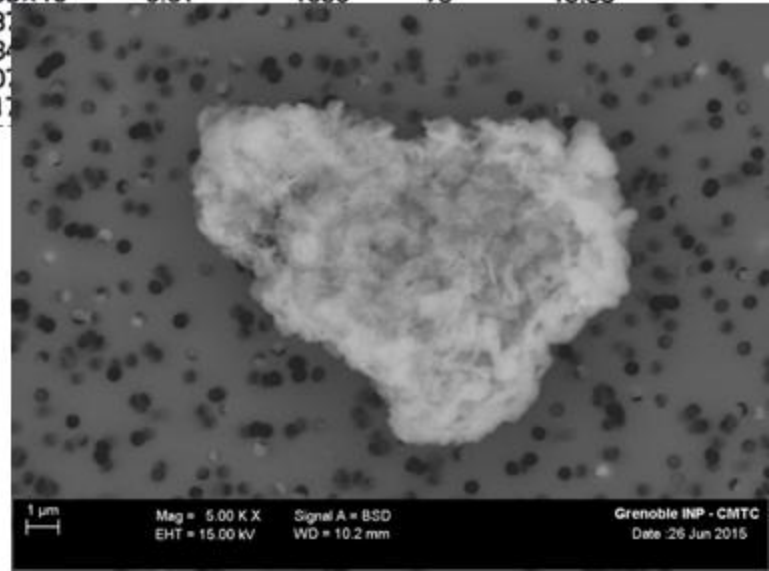


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Filtration: equipment selection, modelling and process simulation

Table 8.18 Example characteristics of Bekipor ST sintered metal fibre media (Bekaert)

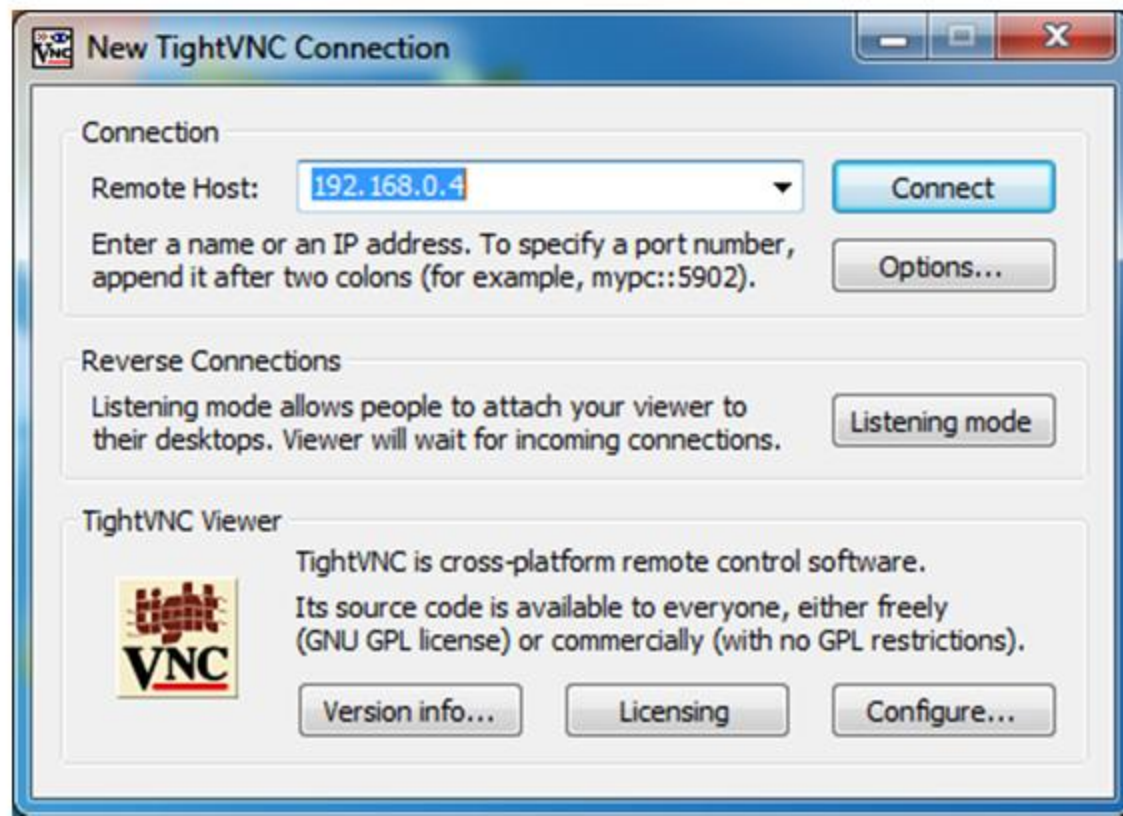
Grade	Absolute filter rating (μm)	Bubble point pressure (Pa)	Permeability (m^2)	Thickness (mm)	Weight (g cm^{-2})	Porosity	Dirt holding capacity (mg cm^{-2})
3AL3	3	12,300	4.80×10^{-13}	0.35	975	65	6.40
5AL3	5	7600	1.76×10^{-12}	0.34	600	78	6.47
7AL3	7	5045	2.35×10^{-12}	0.27	600	72	6.47
10AL3	10	3700	4.88×10^{-12}	0.32	600	77	7.56
15AL3	15	2470	9.87×10^{-12}	0.37	600	80	7.92
20AL3	20	1850	1.91×10^{-11}	0.49	750	81	12.44
25AL3	25	1480	2.98×10^{-11}	0.61	1050	79	19.38
30AL3	30	1235	4.37				
40AL3	40	925	5.84				
60AL3	59	630	1.07				
58L3	5	7000	1.17				



Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

TightVNC Software (<http://www.tightvnc.com/>)

Important note: If all you need is to use TightVNC AS IS, then it's 100% free! Yes, TightVNC is freely available under the terms of the GNU GPL license.



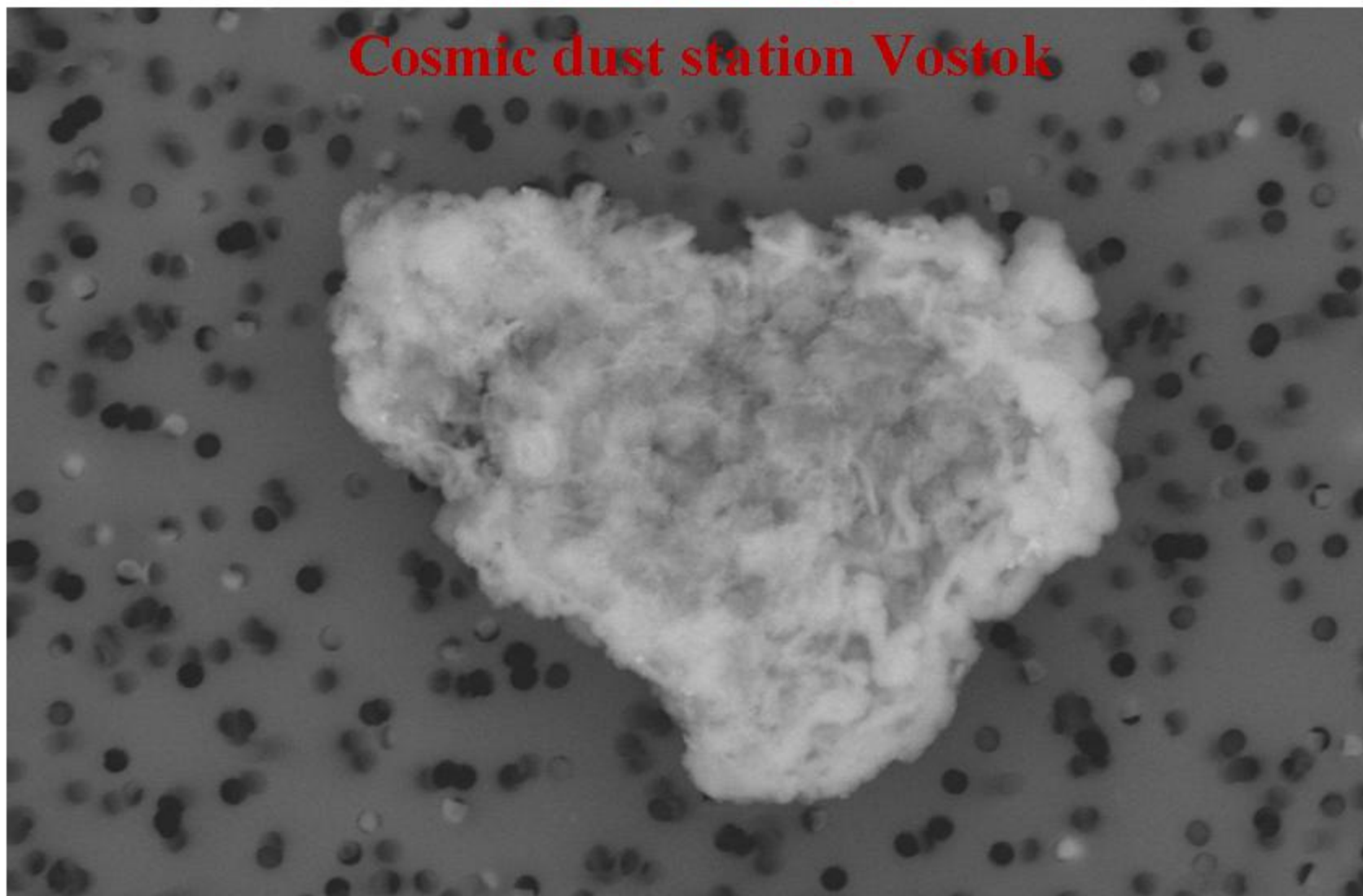
Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Main characteristics :

- Electricity Power of the up to 500W (300W)**
- 150W (500W without fan) the scientific equipment (15 W)**
- Control of operation of Solar batteries and power supply system through Ethernet transparent radio the bridge**
- Control and management of work of the scientific equipment through Ethernet transparent radio the bridge**
- Connection of the scientific equipment by Wi-Fi, Ethernet, USB add RS-232, RS-485, Bluetooth.**
- Range of communication options: a) 10km; b) up to 30km**
- To install the monitoring system of operation of the fan**
- To establish Blok of automatic change of filters for collecting cosmic dust by aerosol filtering**
- Industrial computer**
- Mechanical set for transportation and new "a warm box" with comfort temperature for scientific equipment**

Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering

Cosmic dust station Vostok



1 μm

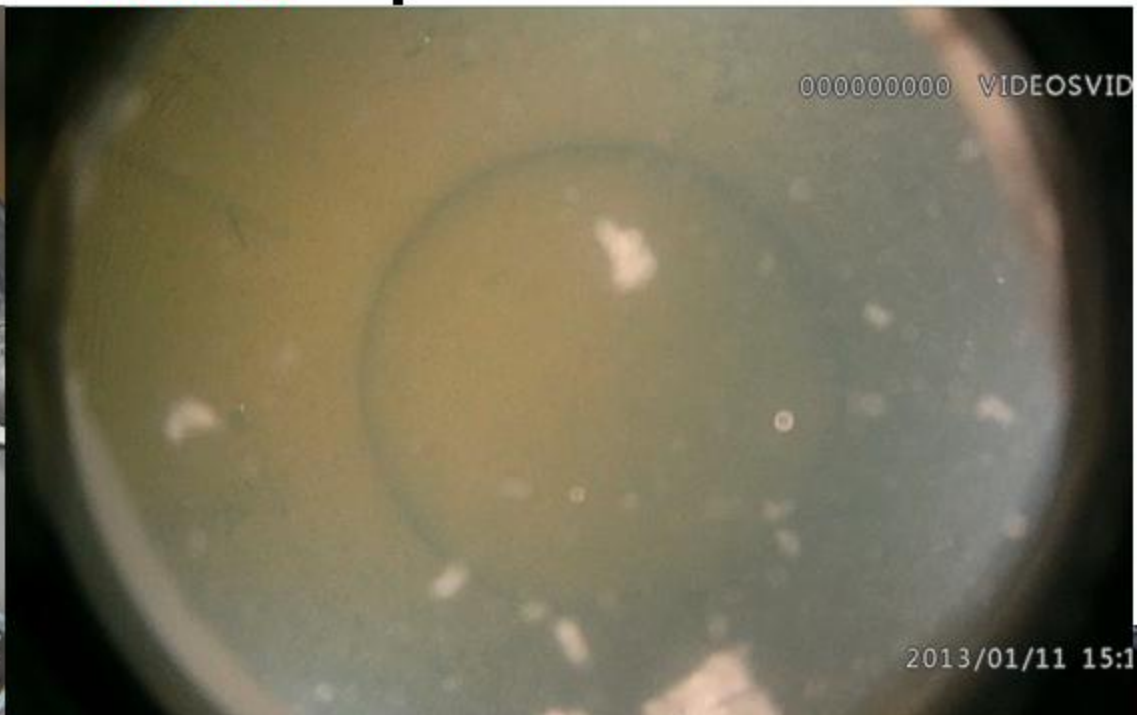
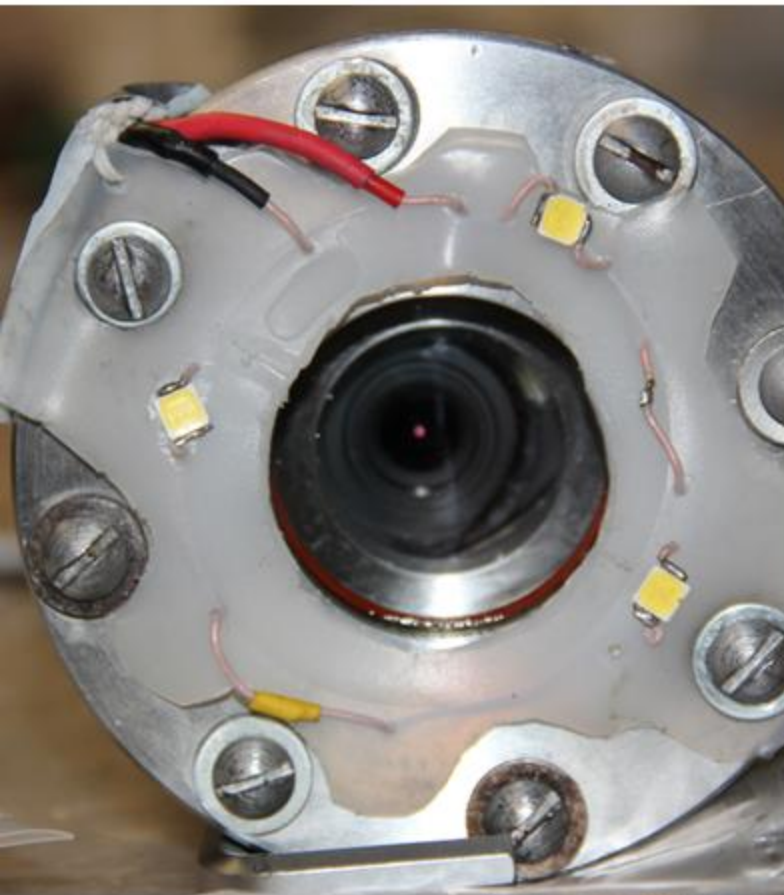
Mag = 5.00 K X
EHT = 15.00 kV

Signal A = BSD
WD = 10.2 mm

Grenoble INP - CMTC

Date :26 Jun 2015

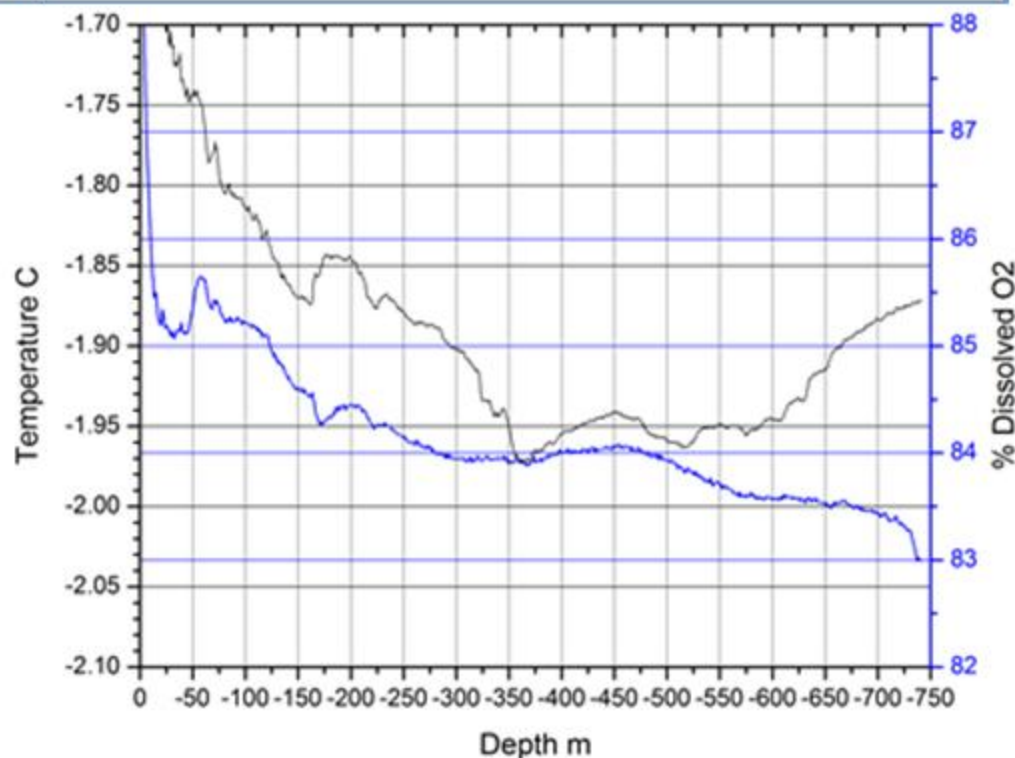
HDTV Video Camera successfully testing in 5G-3 borehole – until **3765m** depth



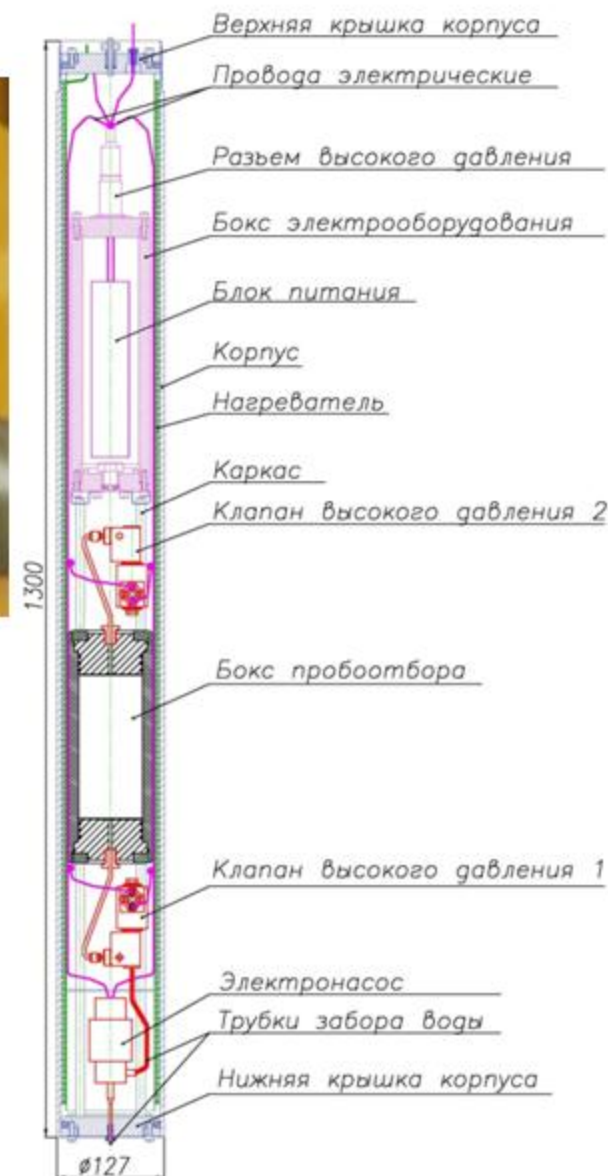
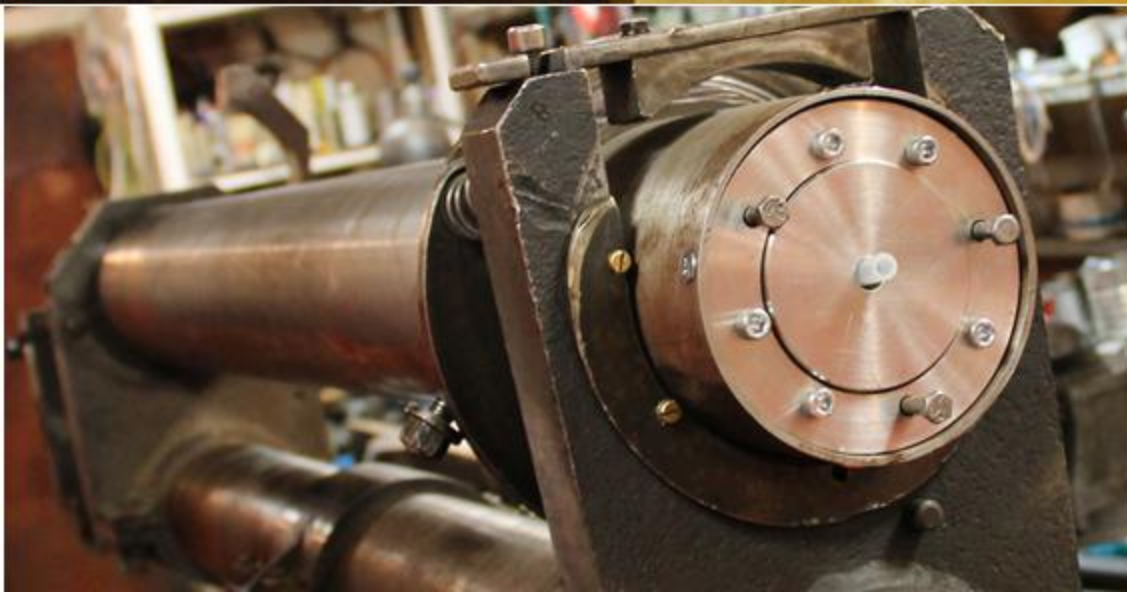
Open sea test dissolved oxygen data logger

Rinko-I near station Progress

Parameter	Dissolved Oxygen Sensor	Temperature Sensor
Measurement principle	Phosphorescence lifetime (optode)	Thermistor
Response time ¹⁾	0.4 sec (63%) 0.9 sec (90%)	0.2 sec
Range	0 to 200% (0 to 20 mg/L)	-5 to 45 °C
Resolution ²⁾	0.01 to 0.4% (2 to 8 µg/L)	0.001 °C
Accuracy ^{3), 4)}	± 2% (at 1 atmosphere, 25 °C)	± 0.02 °C
Stability ⁵⁾	±1% (24 hours) ±5% (1 month)	



PNPI-made water sampler – successfully tested in borehole until



Mobile astronomic sun-fed station for collecting cosmic dust by aerosol filtering. Station Vostok.

Thank you for your attention!

