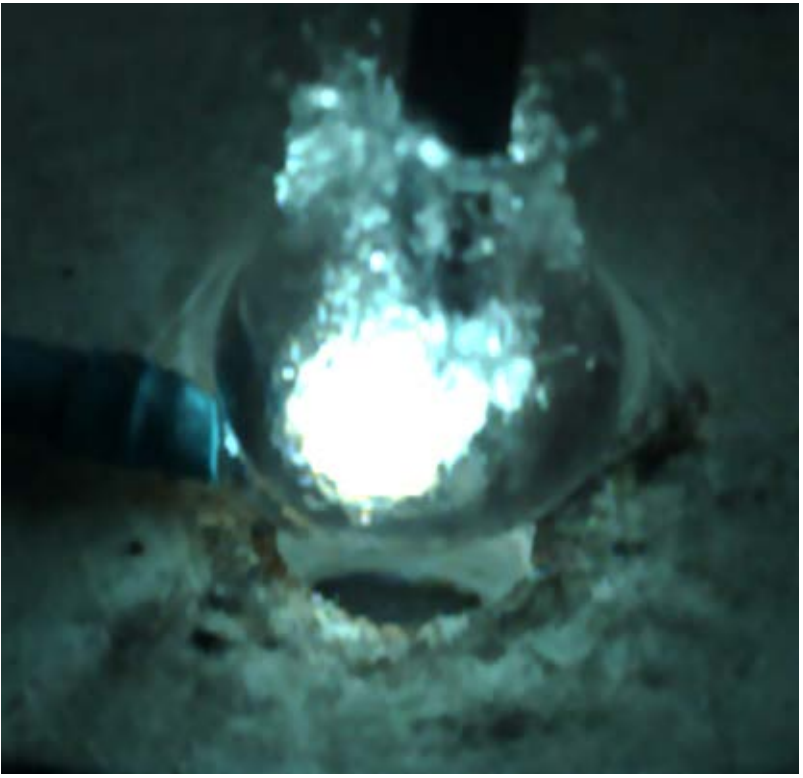

Water Plasma Vortex Reactor for Obtaining Extra- Thermal Energy and Transmuted Chemical Elements

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ICCF-24

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Outline

- Introduction
- Experimental set up
- Experimental results
- Discussion and conclusion

Part 1

INTRODUCTION

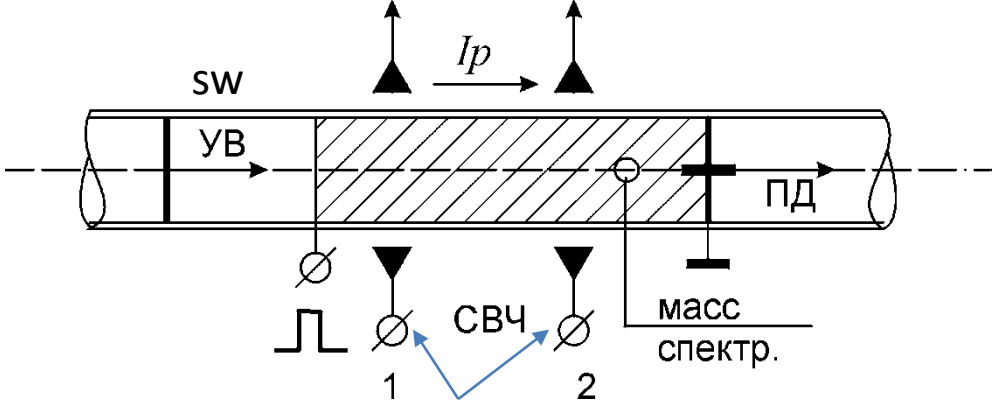
Main Principals of Designing of Plasma Vortex Reactor (PVR). “Key Steps”

- **The first step. Charged heterogeneous plasmoid.** Necessary to create *a electric charged heterogeneous plasmoid with metal nano-clusters + hydrogen ions* by a pulsed repetitive electric discharge in swirl testing mixture: *water steam + argon flow*.

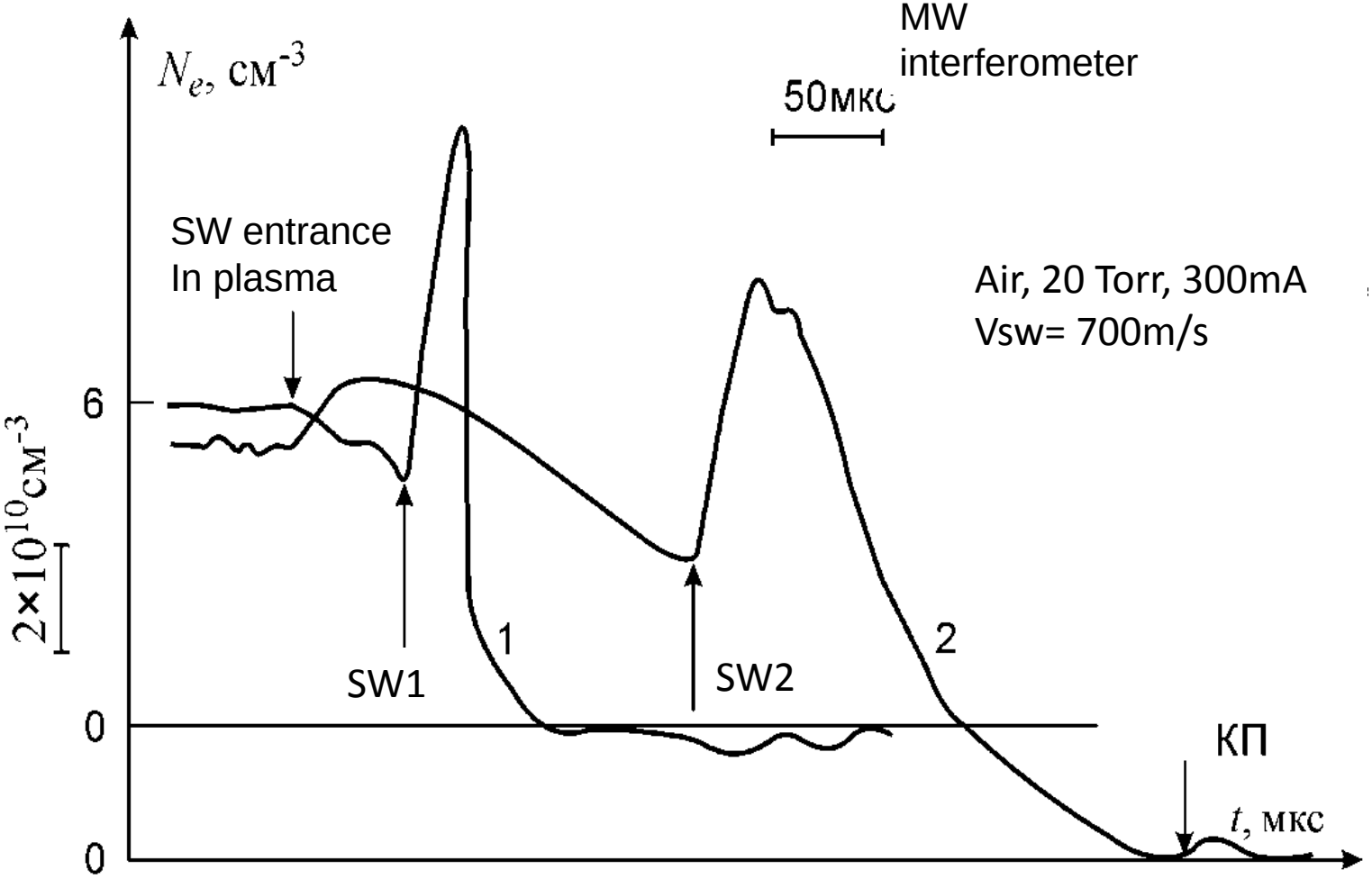
- **The second step. Plasma- bow shock wave accelerator.** *Acceleration of metal cluster ions and electrons by strong electric field.* Creation of a strong electric field (up to 10 KeV) on the bow shock wave front near cathode electrode in supersonic heterogeneous plasma flow.

- **The third step.** Realization of ***interaction*** *of accelerated hydrogen ions with metal nano-clusters in heterogeneous plasma.* Realization of LENR. Screening of protons. Creation of neutron- like particles. Creation of bi-nuclear atoms (molecule Me - H with excited internal electrons). “False- transmutation” of initial chemical elements.

Plasma- Bow Shock Wave
E-beam accelerator.



MW
interferometer



Important Results Obtained in Plasma Aerodynamics and Needed for the Heterogeneous Plasma LENR Reactor Design

1. Stable heterogeneous *metal nono-cluster + hydrogen ion plasmoid* in *swirl flow* in PVR reactor was studied in our works [1-5]

2. Study of gas dynamics of heterogeneous plasma flow. Possibility and importance of *creation of supersonic regime M > 1* in PVR ***at low heterogeneous plasma flow velocity ~10 m/sec*** (with nano-clusters or water microbubbles) [1,4]

3. Possibility of extra heat power extraction and *direct electric power extraction* in the heterogeneous flow by electric charge separation on bow shock wave front near cathode electrode in the PVR [1]

4. *High concentration of transmuted chemical elements created* in a heterogeneous plasma vortex reactor (PVR) [5]

References

[1] A. Klimov, Vortex Plasmoids Created by High_Frequency Discharges, Atmosphere and Ionosphere: Dynamics, Processes, Monitoring (Springer, Berlin, 2013)

[2] Klimov A., Bityurin V., et.al., Study of a Longitudinal Plasmoid Created by Capacity Coupled HF Discharge in Vortex Airflow, AIAA Paper 2009-1046, 47th AIAA Aerospace Sciences Meeting, 5 - 8 January 2009, Orlando, Florida, 2009, P.12

[3] Bychkov V., Zaveshiskii I., Klimov A., et. all, Swirl flow structure in water steam, High Temperature, TBT, V.59, No.4. P. 62-68

[4] Klimov A., , Belov N., Tolkuniv.B., Heat energy release in plasma water flow reactor at pulse-repetitive regime of energy input , Proc. RCCTN and BL, 2018, P. 65-72

[5] Klimov A., Energy Release and Transmutation of Chemical Elements in Cold Heterogeneous Plasmoid, Proc. ICCF-19, Padua, Italy, 2015

Part 2

THEORETICAL CHAPTER

SUPERSONIC REGIME M > 1 AT HETEROGENEOUS PLASMA FLOW VELOCITY VFL~10M/S. **IT IS POSSIBLE!!!**

Main Results from Plasma Aerodynamics (PA)

- It is well-known that ion-sound velocity $C_{i,s}$ is determined to the following formula:

$$C_{i,s} \sim \sqrt{\gamma}\, Te/Mc \quad \text{at } \rho c \sim \rho 0, \qquad (1)$$

where $\gamma = Cp/Cv$, Mc- cluster ion mass, ρc- cluster density, $\rho 0$ – gas density, Te- electron temperature

Important result #1:

$C_{i,s} < V_{fl}$ and Much number is about of **$M = V_{fl}/C_{i,3B} > 1$**

at the flow velocity V_{fl} ~1-10 m/s and $Mc = 10^4$ Ma, (2),

where Ma- atom mass

Important result #2:

Value $\gamma \sim 1$. It is well known that $\gamma = N + 2/N$.

So, *BSW- isothermal one*

Present Status of Water Swirl Flow- Heterogeneous Plasmoid Reactor (PVR-W) in Russia

- *Problem of creation of a new ecological clean and cheap power generator is solved today.*

- *We succeeded in obtaining the following results in the PVR-W* at the first time

- COP = 3 ÷ 10

- Output thermal power Q about of **Q~10 kW**.

- Very cheap hydrogen. Specific hydrogen mass flow rate
  M_{H2}= 10-100 mG/sec • kW

- Large mass rate Mel of transmuted elements. Mel - about of 10-100 mG/sec

- The first successful result on direct extraction of electric energy from heterogeneous plasmoid. Mean power is about of 20-200W

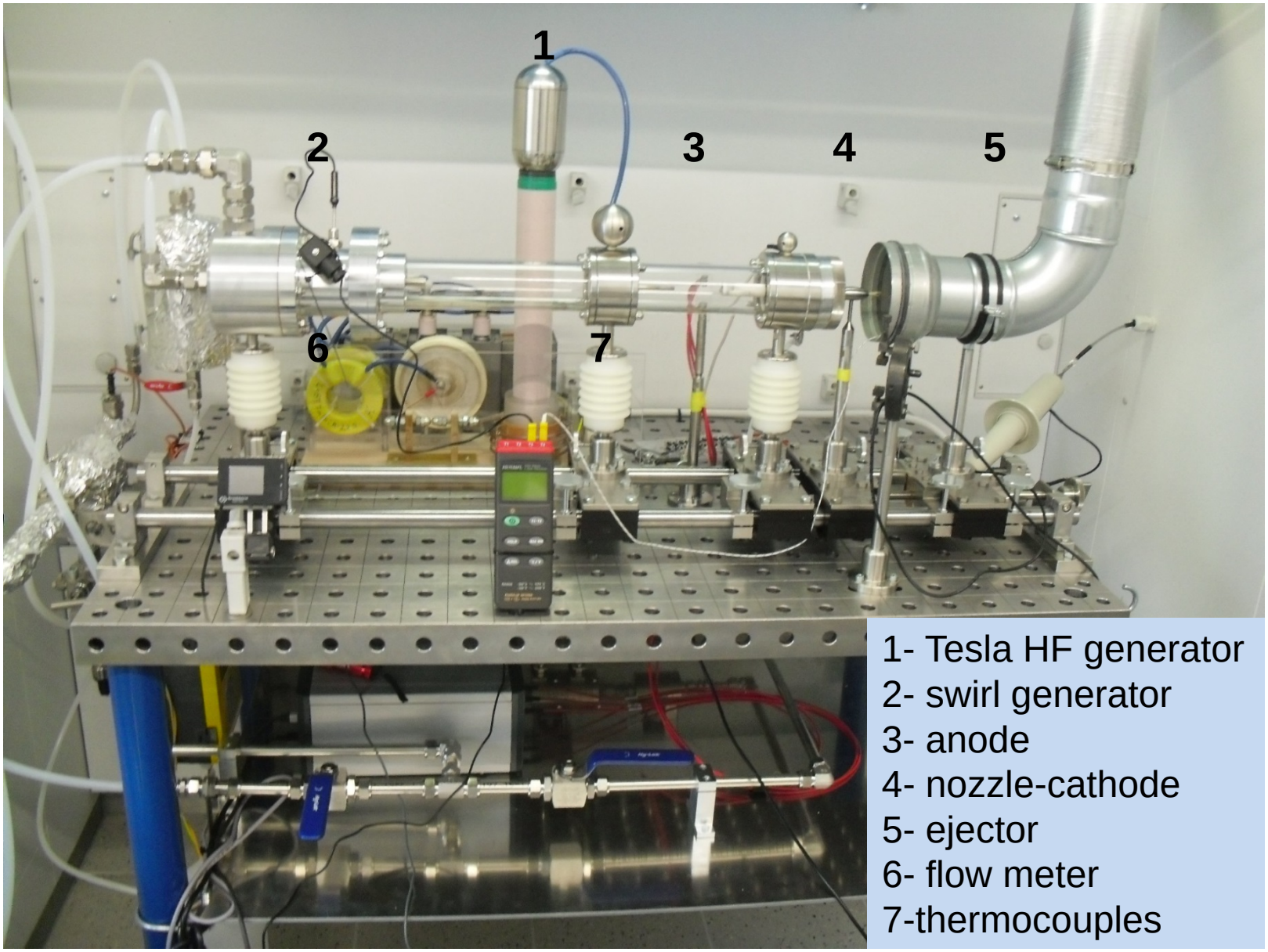
- **Trinity**: - very simple power supply + water heat exchanger near plasma formation + very simple direct electric power extraction from the PVR

Part 3

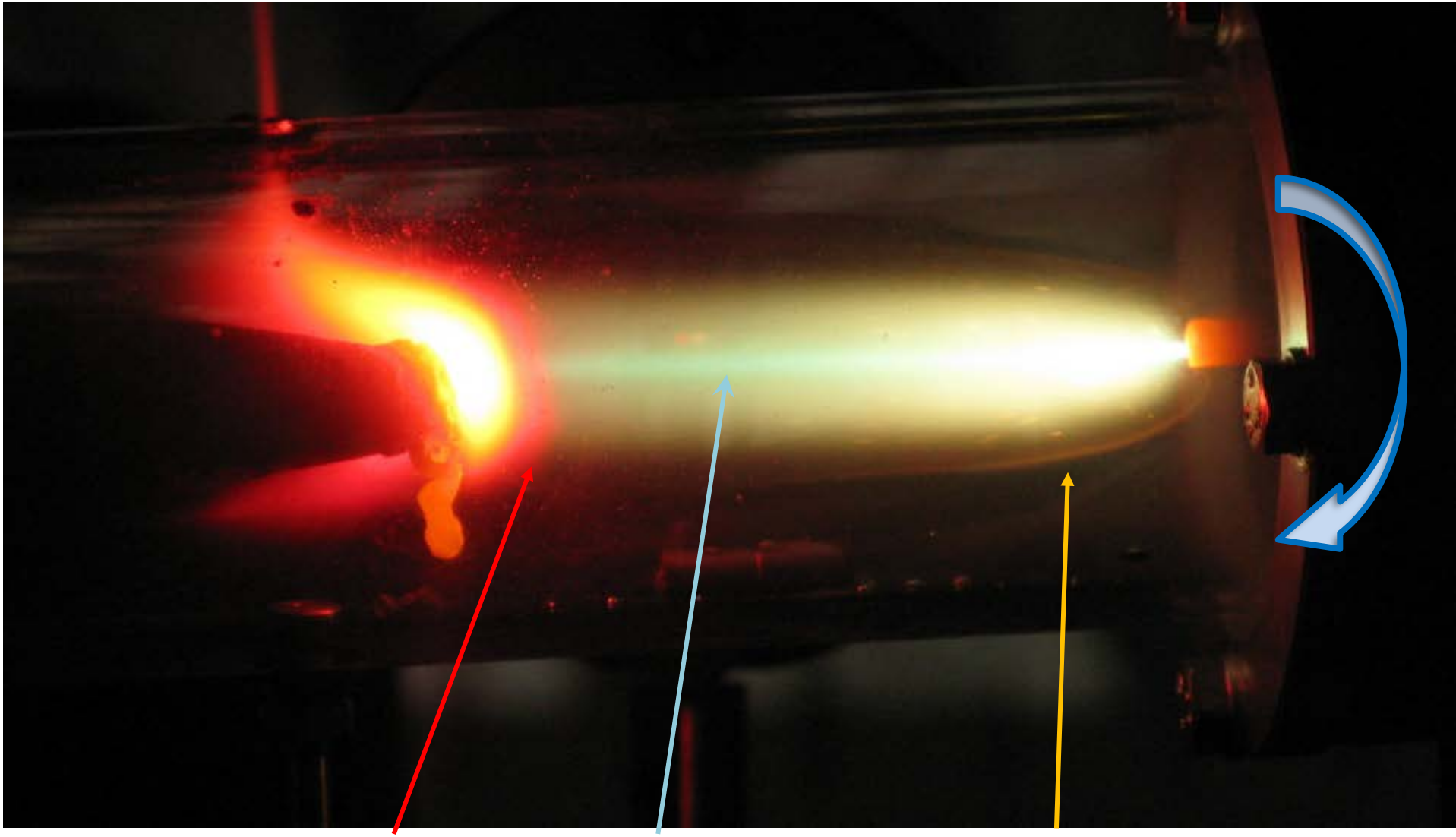
SHORT HISTORY OF PVR'S DESIGN

Experimental set up Plasmoid Vortex Reactor (PVR).

2005-2015



1- Tesla HF generator
2- swirl generator
3- anode
4- nozzle-cathode
5- ejector
6- flow meter
7-thermocouples



Bow shock wave (BSW) before Ni-cathode with Li – insertion

Hβ cord plasmoid

BSW before Ni- anode

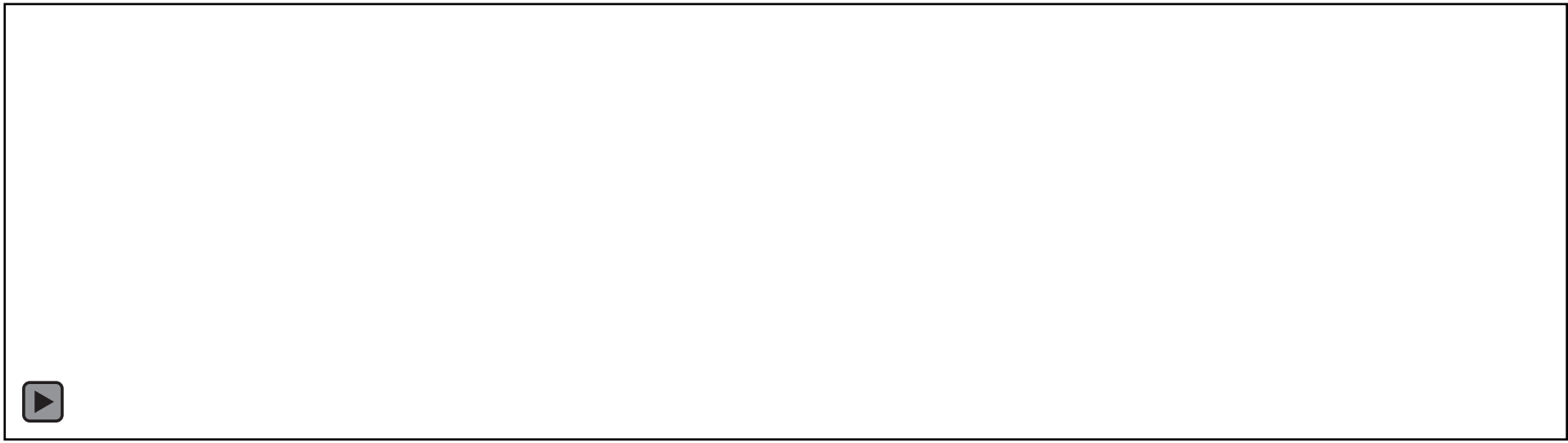
Hetrogeneous Plasma Flow Structure in the setup PVR

Axial flow velocity about 10 m/s and Mach number M>1 ???? Is it possible? **Yes !!!**

Heterogeneous Plasmoid Created in Swirl Flow in the Setup PVR.

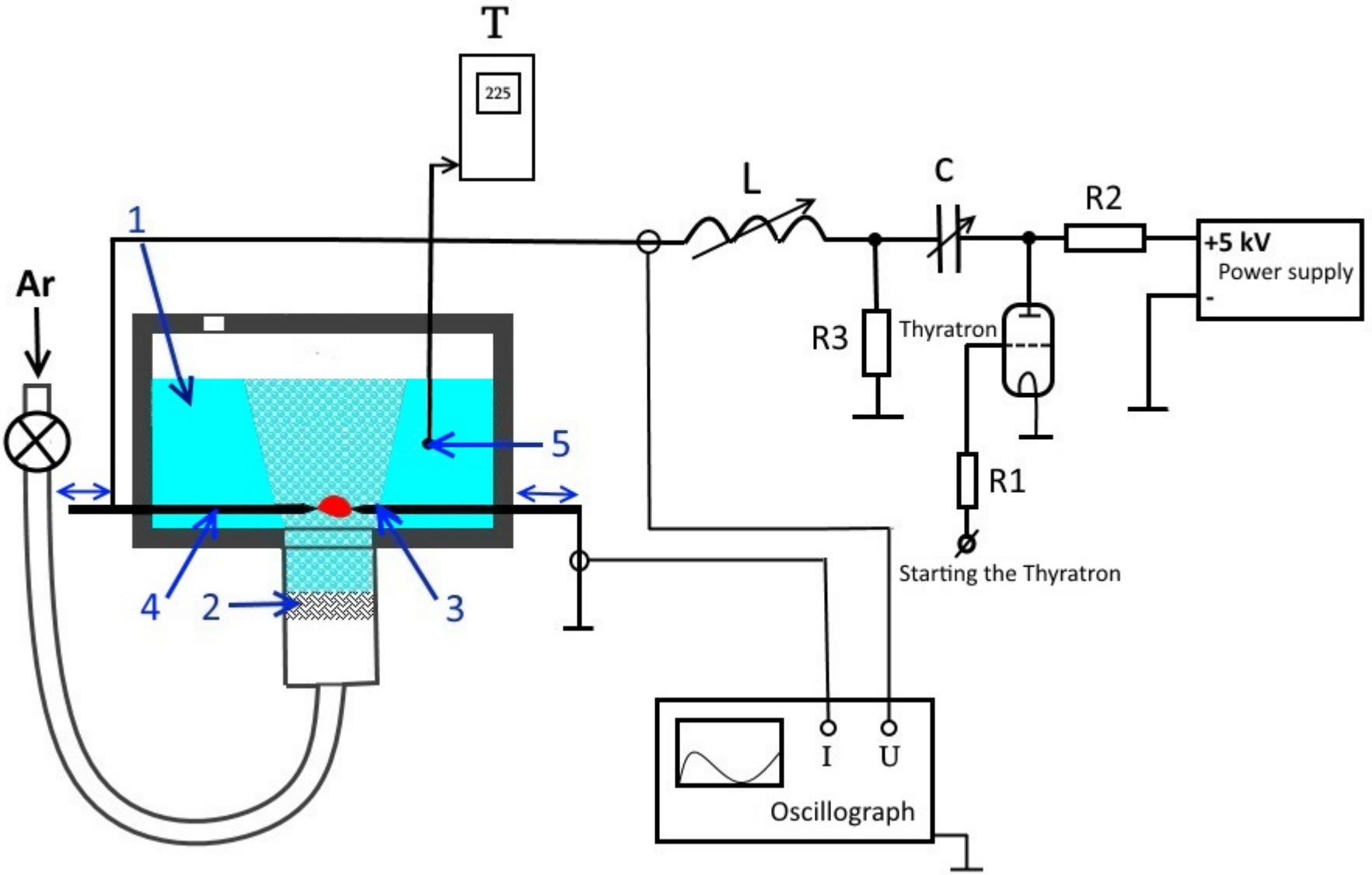
High-speed video. F=9043 Hz, T_{exp}=1μs.

Gas mixture - Ar : H20 = 1 : 1.
Axial velocity Vx is closed tangential velocity Vt: Vx~ Vt ~ 30 m/s, Pst ~ 1.5 Bar.



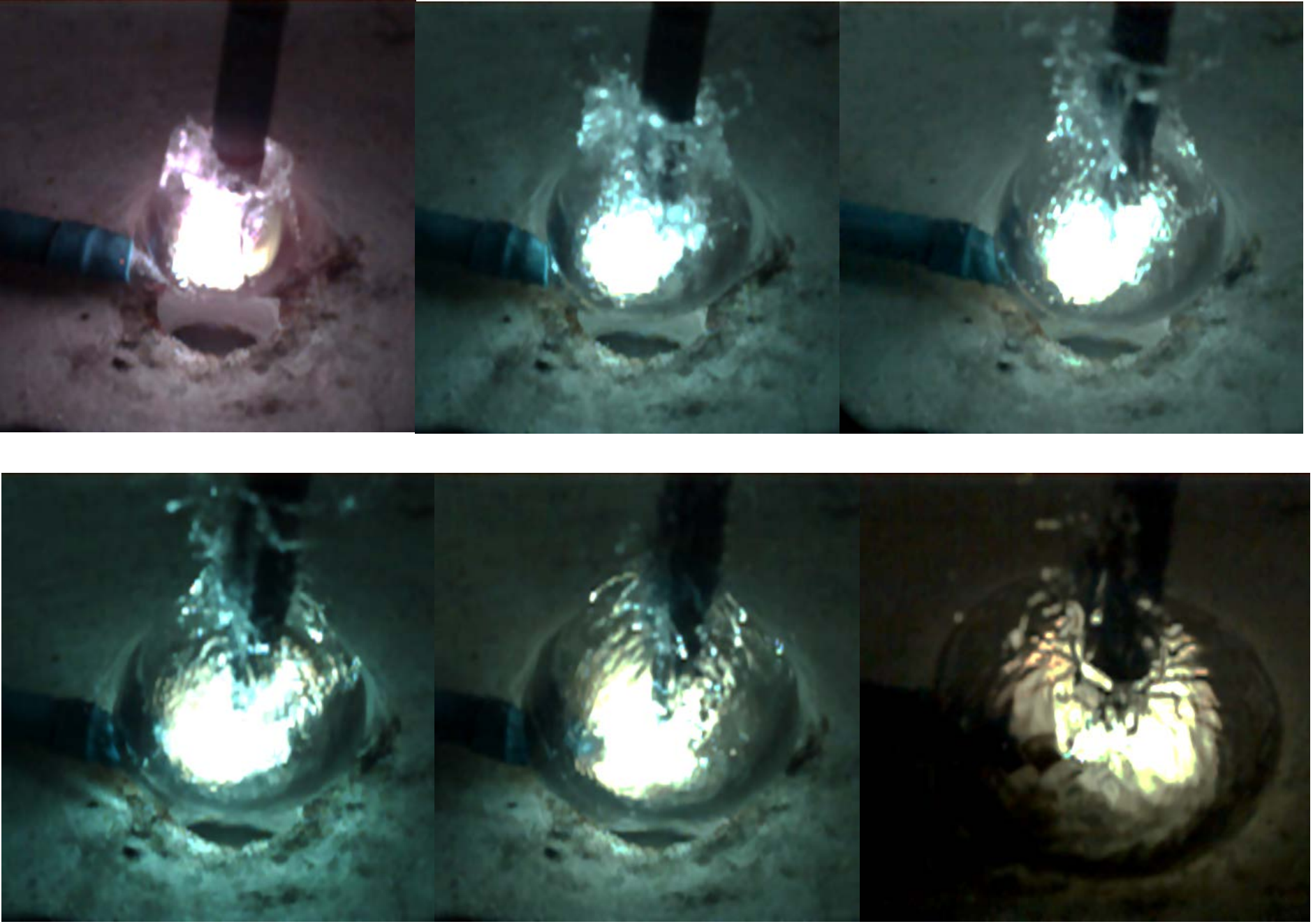
Anode **Cathode**

Scheme of experimental set up PVR_W1with micro-bubles flow

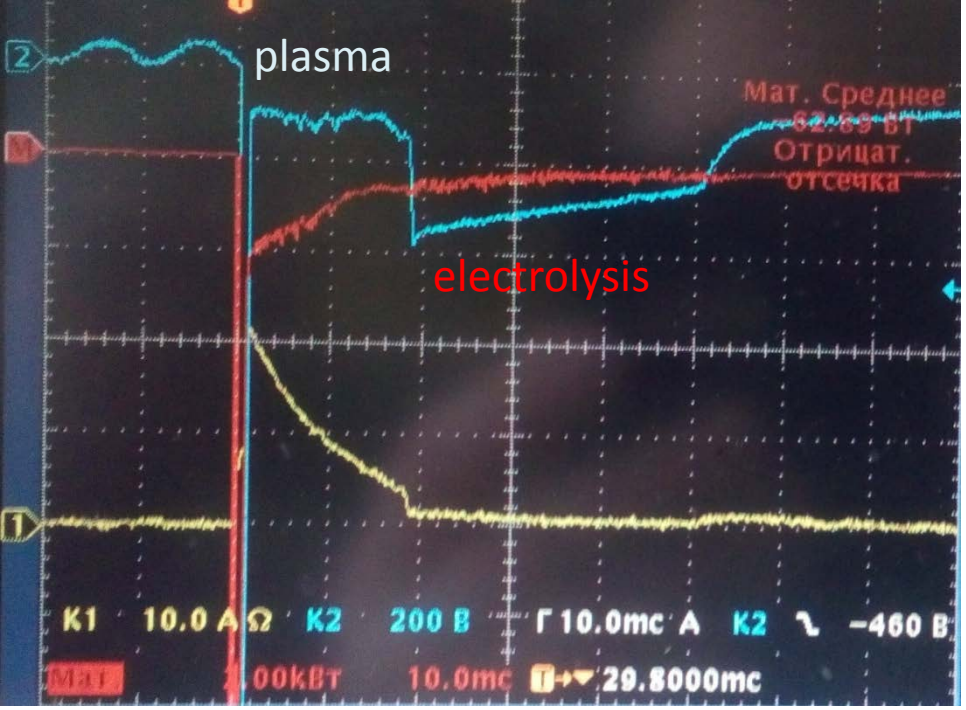


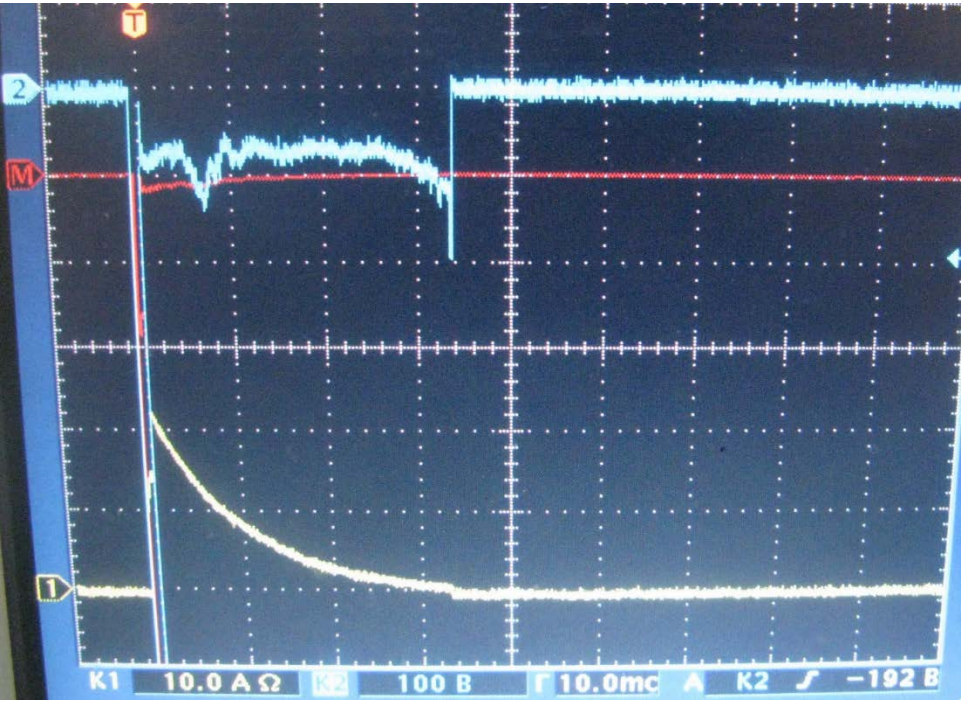
1-LiOH, 2-ceramic porous diaphragm, 3-anode, 4-cathode, 5-thermocauple

Reactor PVR_W1



Heterogeneous Plasmoid inside Argon Bubble. PVR-W1





Reactor PVR-W1

Main Signals:

- Voltage (blue)
- Current (yellow)
- Power (red)

Pulse duration- 21.6 ms
Eт=36.2 J
Ee= 17.3 J

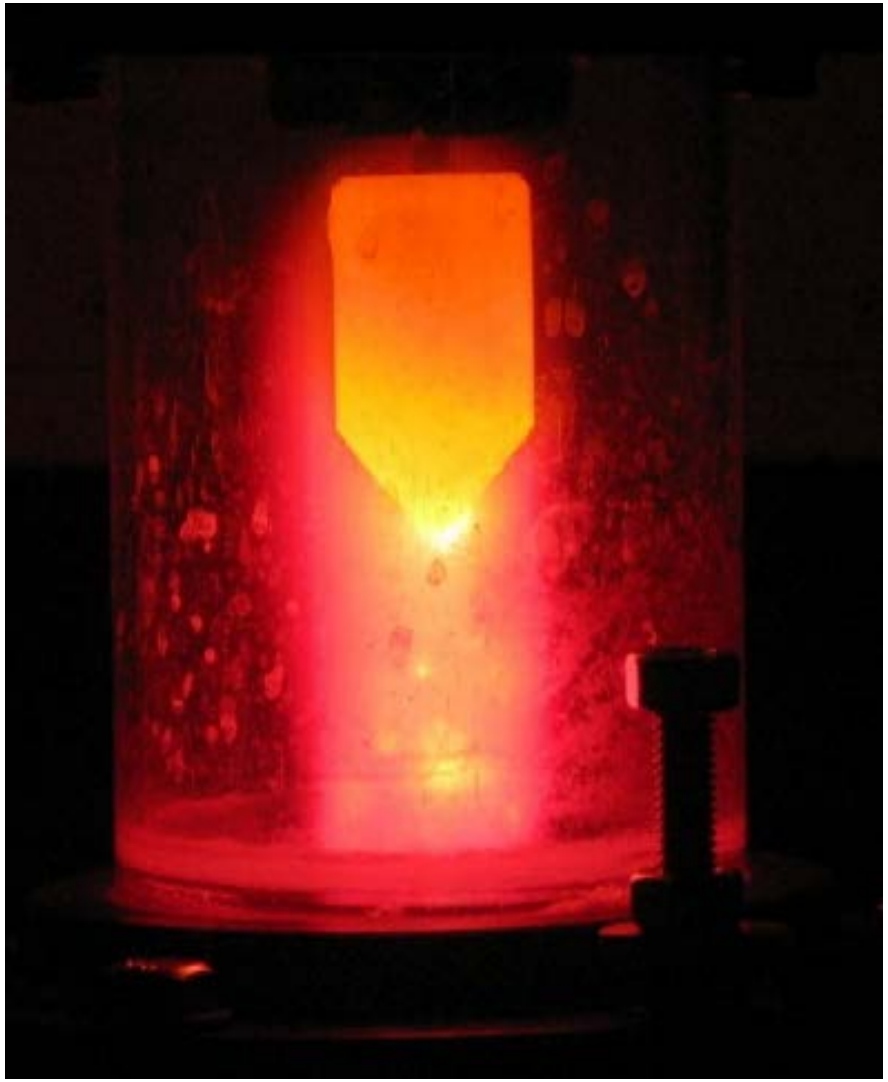
K= ***COP***= Eт/ Ee= **2.1**

PVR-W2 and Cheap Hydrogen Production

Regime:
Under Water Plasmoid
COP~2
Hydrogen Extraction Regime. M=0.1 G/sec
Commercial coast about zero if consider extra heat power extraction coast

Reverse Plasma Vortex Reactor PVR-W4 with Heterogeneous Testing Mixture:

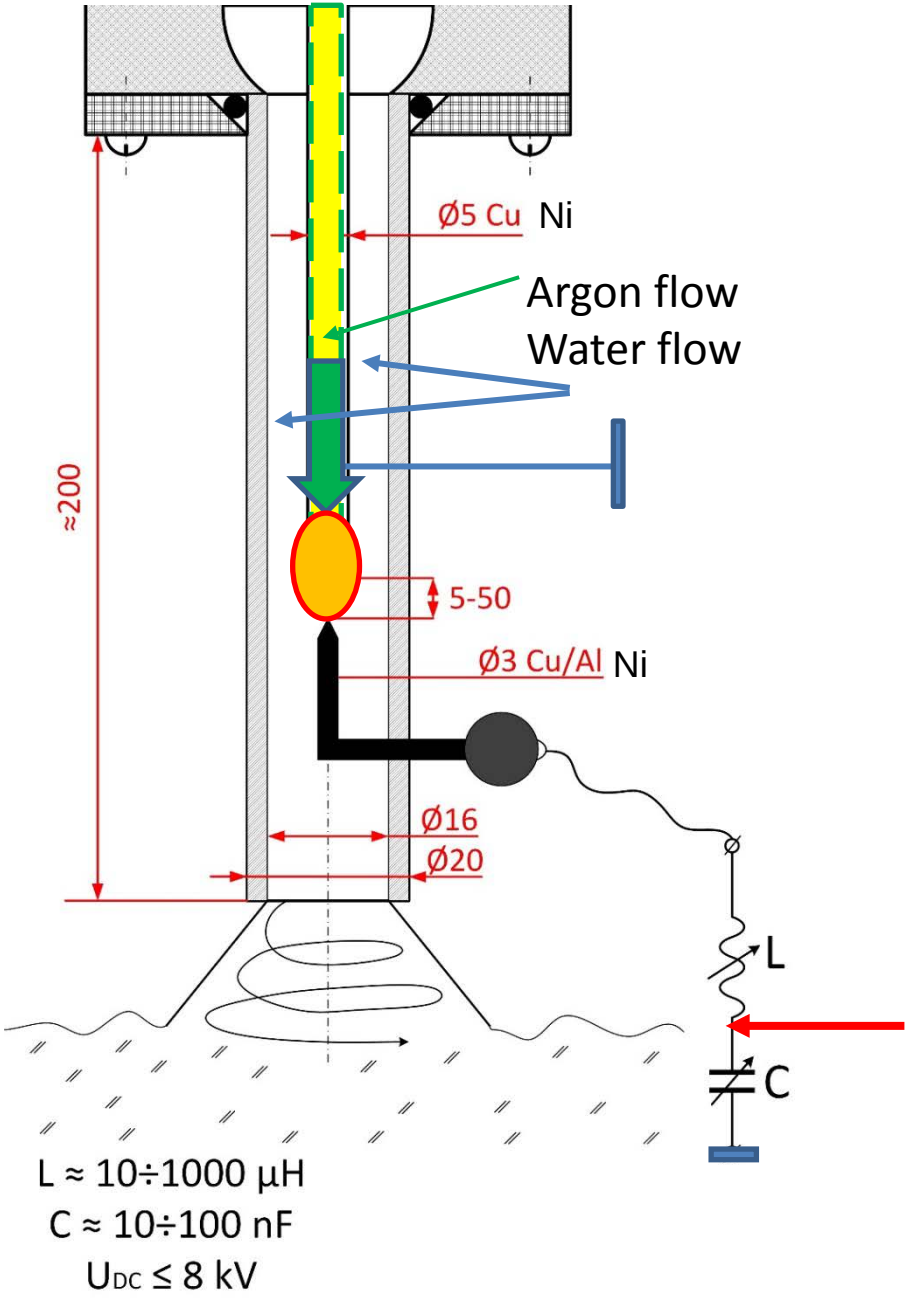
Water Steam +Argon. Ni-electrodes [99.99%]

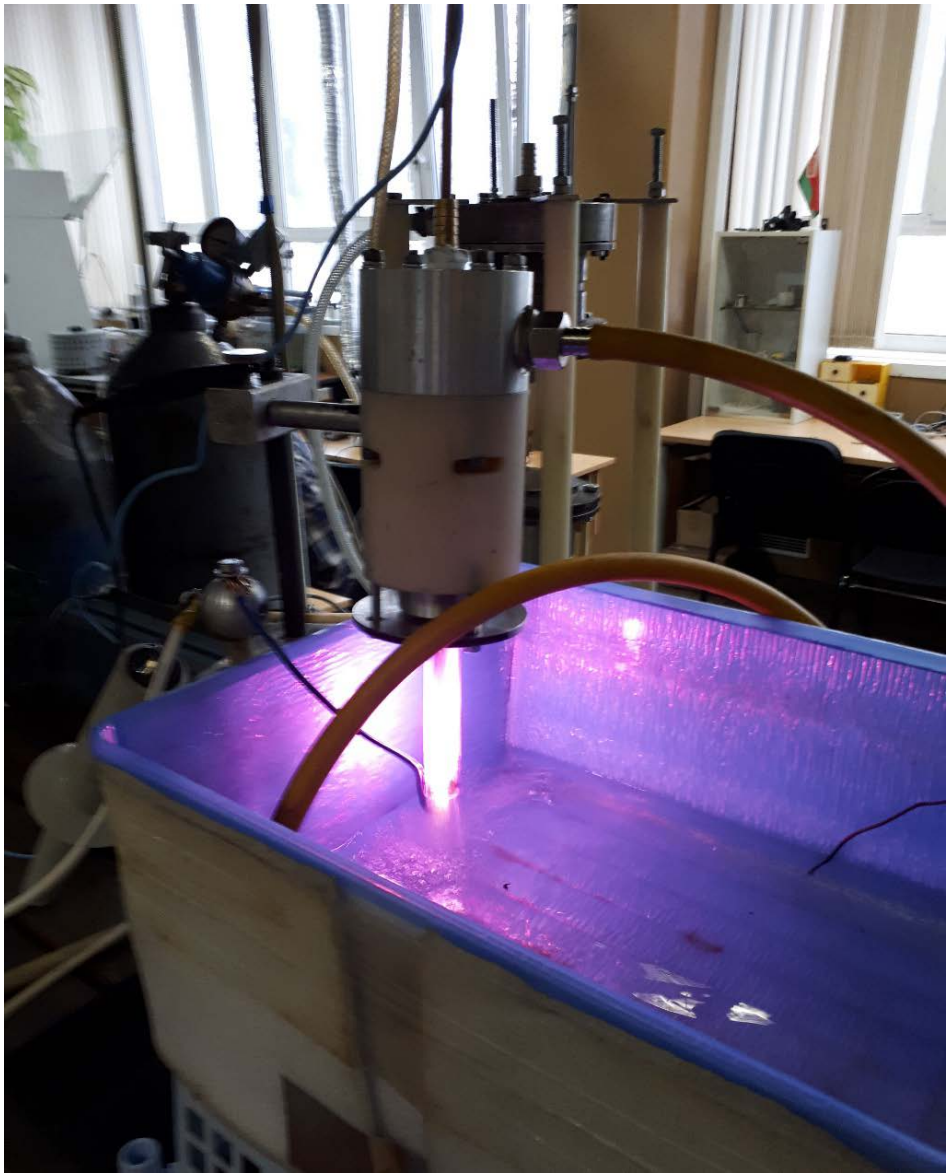


Part 4

NEW EXPERIMENTAL SET UP PVR-WX

New design of PVR-WX
Closed water flow counter





Tabl.1. Calorimetric measurements in the PVR-W

Exp	M_{H2O}, G	Тн,С	Тк,С	ΔТ	t, sec	Nel, W	Q_{H2O}, kJ	Qel, kJ	COP	
1	4000	18,0	25,2	7,2	218	690	150	150,4	**0,99**	BSW off
2	4000	23,6	29,6	6	174	790	125	137,5	**0,9**	
3	5000	26,7	33,6	6,9	90	970	214	87,3	**2.45**	BSW on
4	5000	32,2	40,4	8,2	90	700	213.7	63,0	**3.4**	
5	6000	17,5	22,4	4,9	60	727	153.7	43,6	**3.52**	
6	6000	26,8	31,8	5	55	1071	156.7	58,9	**2.7**	
7	8000	28,2	34,9	6,7	90	1540	280	138,6	**2.02**	

Main Experimental Results

1. One can see from table 1 that

- There is correlation between the value COP and design of cathode electrode.

- **COP < 1.** NO BSW - surface ring electrode. Regime without BSW creation;

- **COP > 1**. BSW - axial rod electrode with BSW creation.

2. Mean output thermal power is higher than **N_t > 3 kW**

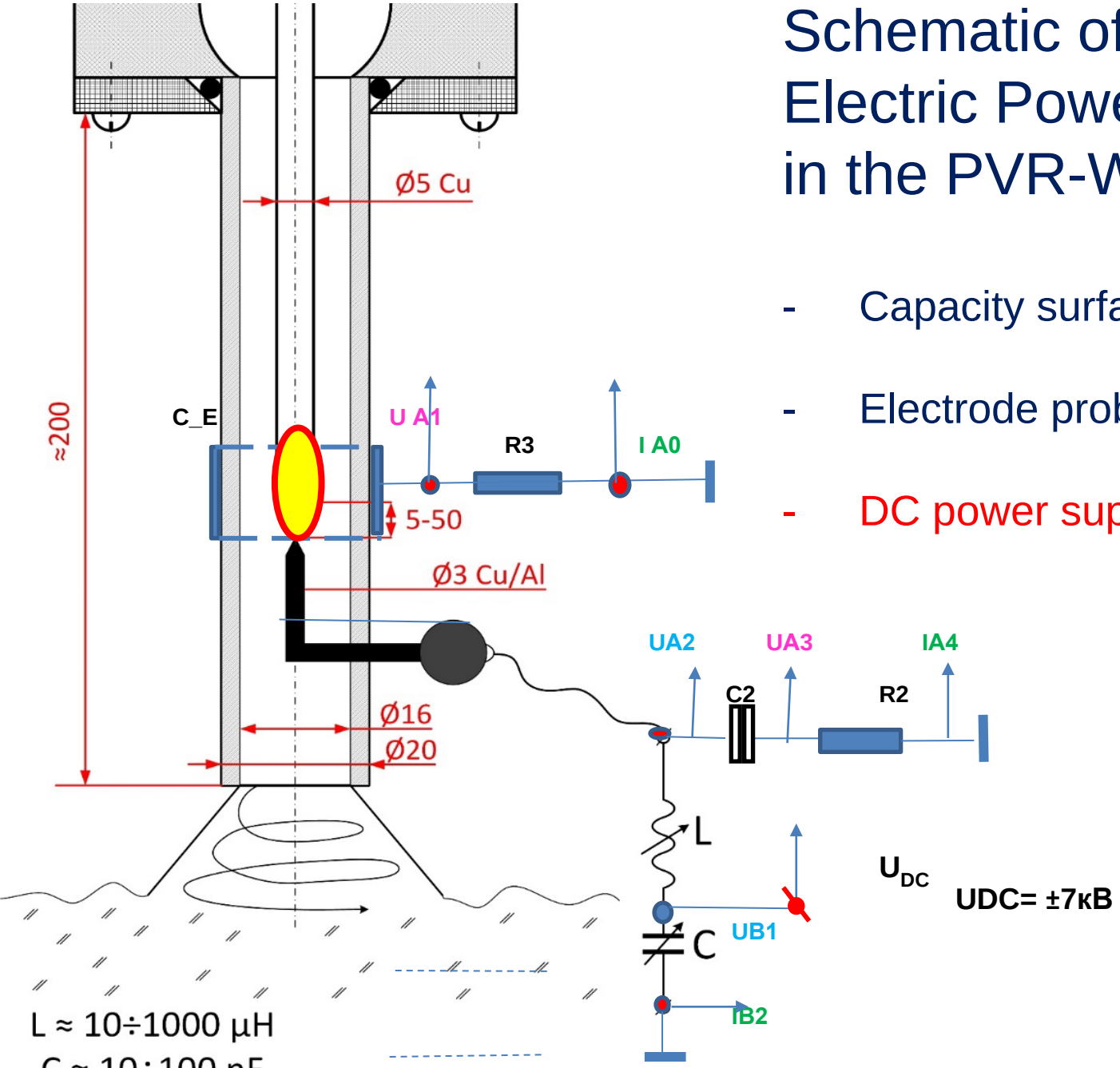
3. Very compact experimental set up with the typical length 200mm and the typical diameter 20 mm

Part 5

DIRECT ELECTRIC POWER EXTRACTION IN PVR-WX

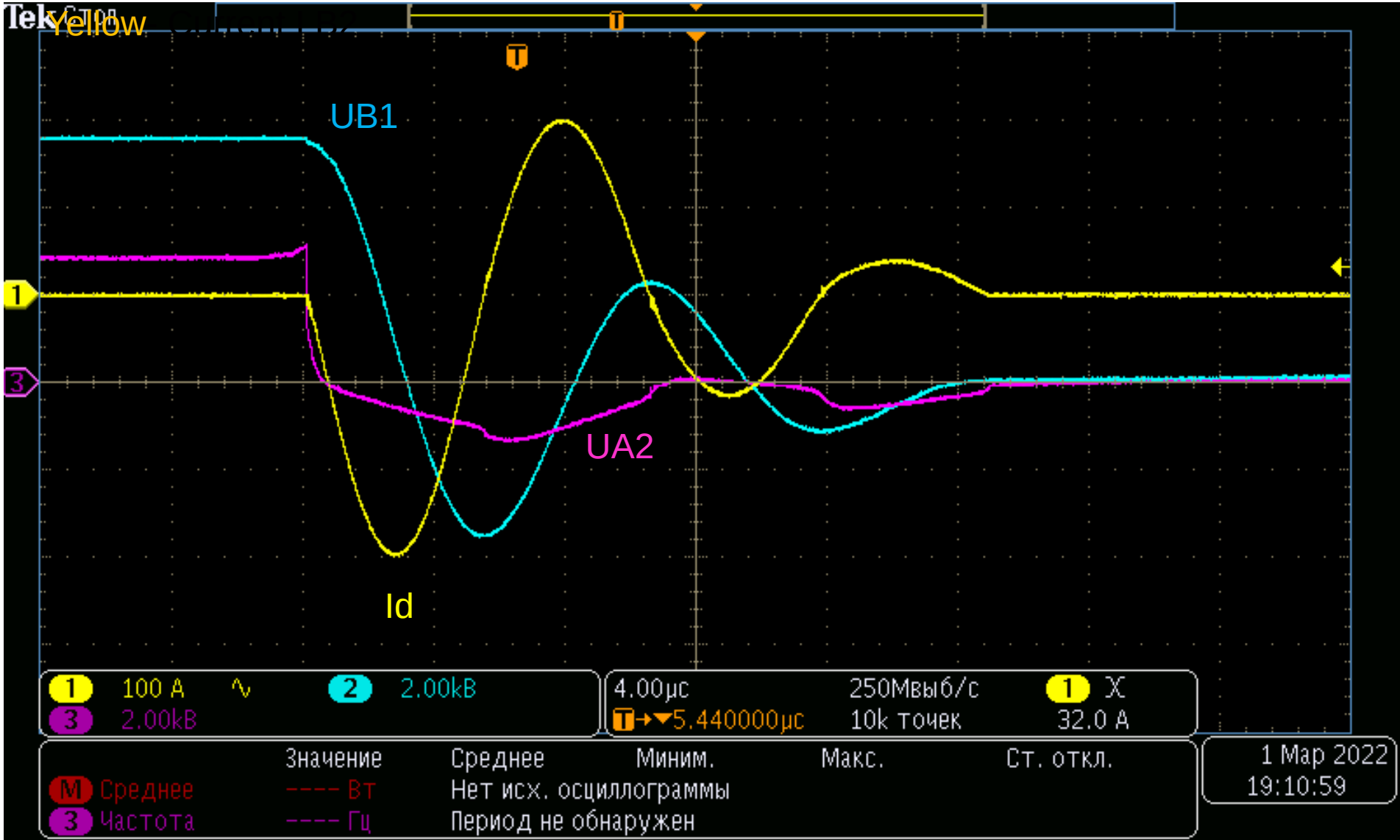
Schematic of Direct Electric Power Extraction in the PVR-WX by

- Capacity surface ring probe (C_E)
- Electrode probe (C2-R2)
- DC power supply (± 7 kV, 2 Amp)



The voltages (UA2 and UB1) measured by HV-probes in the points A2 and B1 (different sides of the L-inductance). Regime:- R2 is connected only (no capacity C2).

Blue- distant L-side near power supply, Violet- L- side near electrode,



Main Results on Direct Electric Power Etraction in the PVR-WX

Analysis of considered pictures shows that

1. Voltage in the point A2 and one in the point B1 (different sides of the inductance L) are differed considerably. The type of oscillations in the point A2 is not sinusoidal one.

2. Pulsed electric power of direct power extraction is about of **2kW**. Mean direct power extraction is about of **20W.** The mean electric power input in plasma is about of **Ne~ 1kW** at repetitive frequency F~ 1.56 kHz.

3. There is DC- voltage in the point A2. The maximal value of this DC-voltage is about of **Ub1= - (0.5-1) kV ????** The physics of this voltage component is not clear up today.

4. According our opinion there is real electric power battery inside heterogeneous plasma flow is created by BSW (realization regime M >1) in this plasma flow. Bow shock wave near cathode electrode can separate electric charges in plasma.

Part 6

PVR. NEW EXPERIMENTAL RESULTS

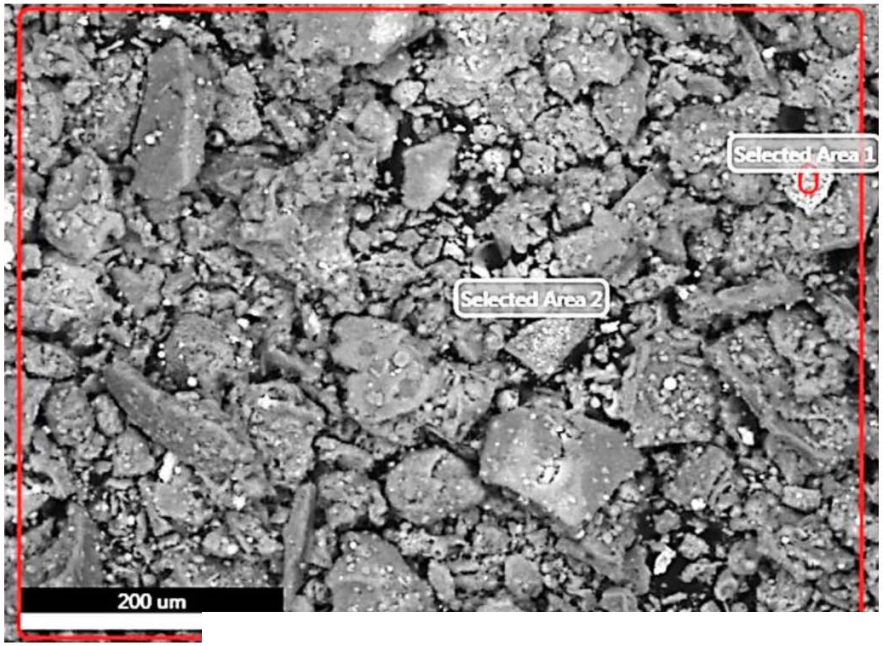
CHEMICAL ELEMENT TRANSMUTATION

Two Methods of Chemical Composition of Sediment Dusty Particles Obtained in the PVR-WX

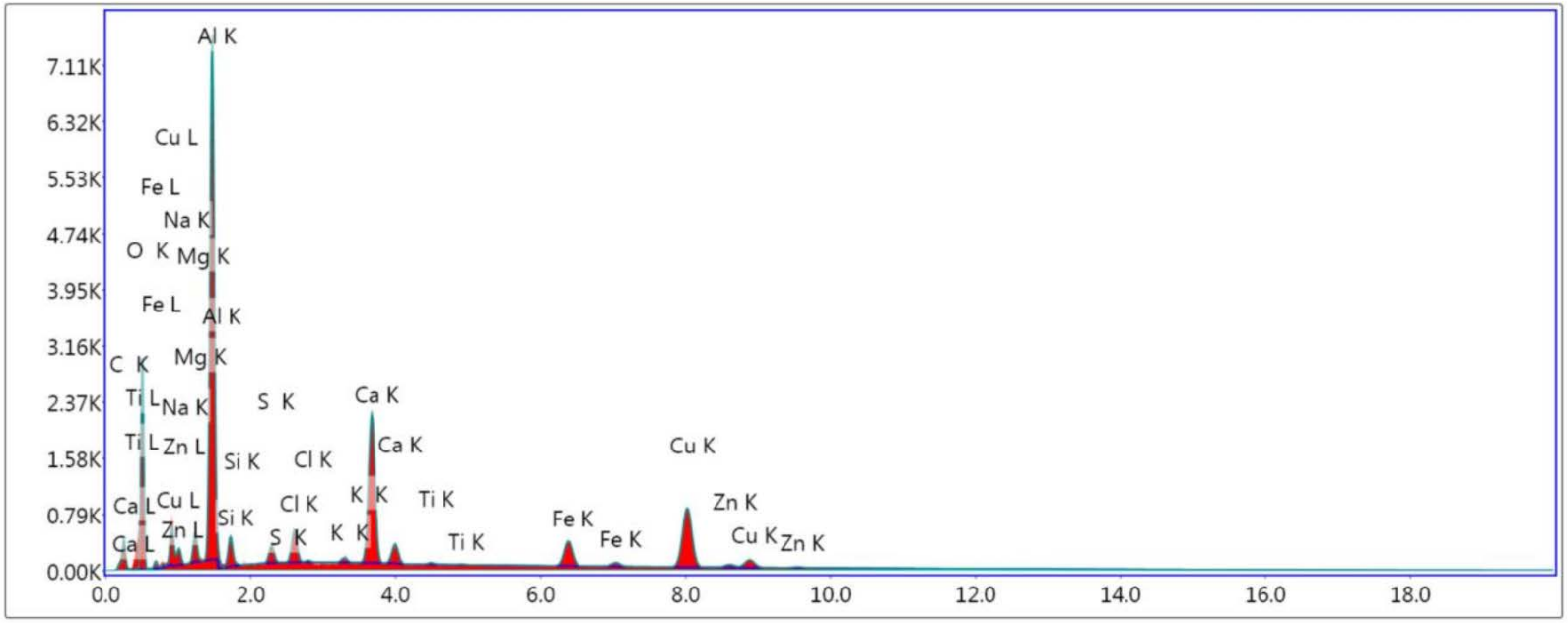
- New transmuted chemical elements created in the PVR-WX are studied both optical spectroscopy method (Spectrometer AvaSpec 2048) and EDS method

Area 1

EDS- Spectra Obtained in PVR-WX

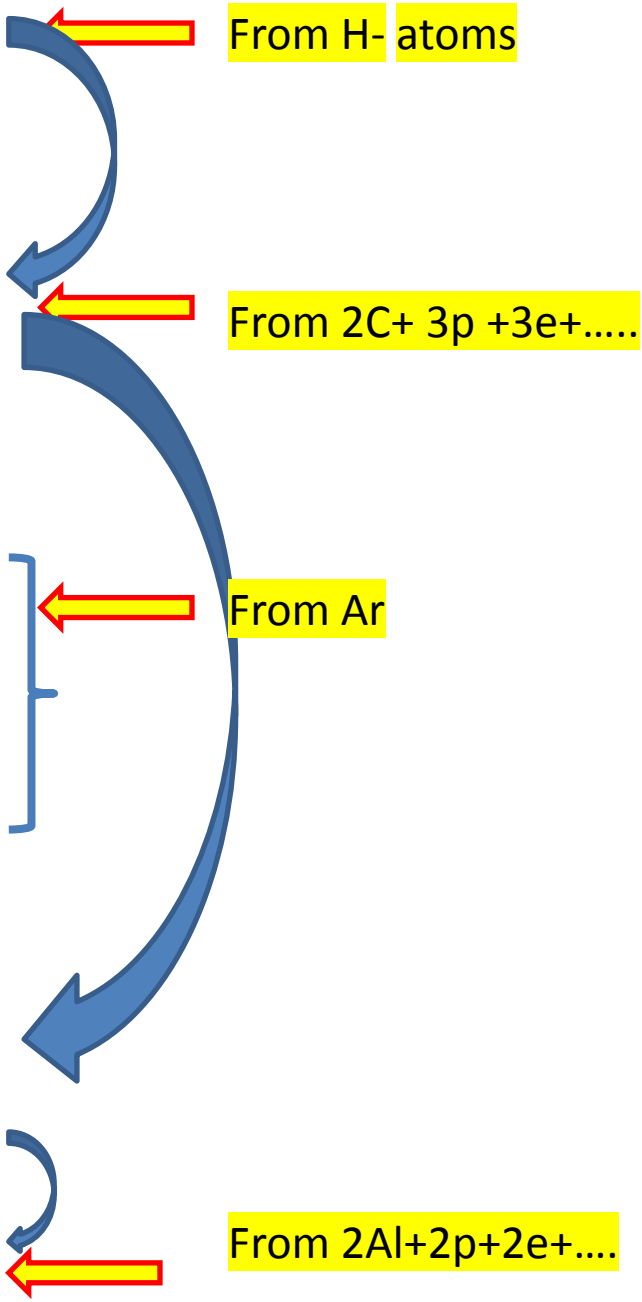


Selected Area 2



Lsec: 200.0 0 Cnts 0.000 keV Det: Octane Pro Det

Element	Weight %	Atomic %	Error %
C K	4.76	10.96	19.44
O K	30.86	53.29	8.02
MgK	0.98	1.11	14.85
AlK	4.67	4.78	9.94
SiK	0.51	0.50	17.29
S K	0.19	0.17	27.89
ClK	1.17	0.91	9.31
K K	0.15	0.11	27.30
CaK	1.24	0.86	6.07
TiK	0.05	0.03	56.83
MnK	0.24	0.12	26.83
FeK	52.96	26.20	1.15
CuK	1.98	0.86	10.45
ZnK	0.24	0.10	56.25

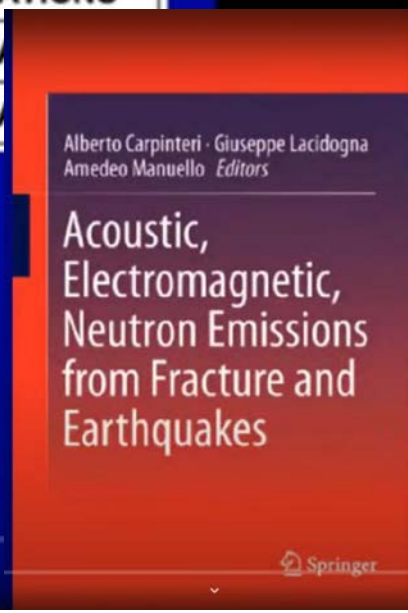


Phengite (Granite)

	External surface mean value (wt%)	Fracture surface mean value (wt%)	Increase/ decrease with respect to Phengite	Increase/ decrease with respect to the same element
Fe	6.2	4.0	– 2.2%	– 35%
Al	12.5	14.5	+ 2.0%	+ 16%
Si	28.0	27.8	NO VARIATIONS	NO VARIATIONS
Mg	0.7	0.8	NO VARIATIONS	NO VARI
K	8.0	7.7	NO VARIATIONS	NO VARI

$$Fe_{26}^{56} \rightarrow 2\,Al_{13}^{27} + 2n$$

relatore



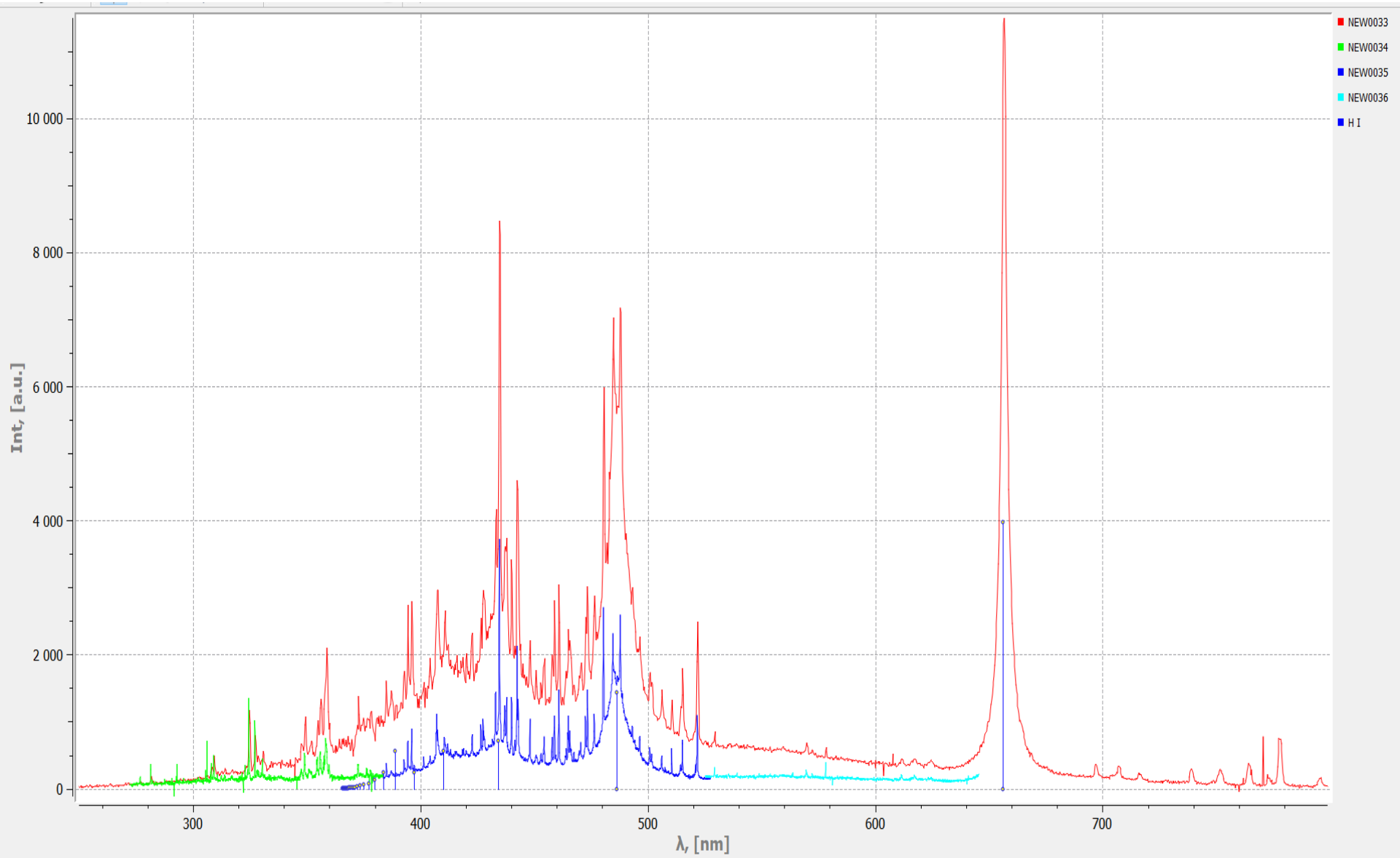
Part 7

OPTICAL SPECTRA FROM HETEROGENEOUS PLASMOID CREATED IN THE PVR-WX

Optical spectra obtained in the PVR-WX

Blue columns- NIST. **H-spectrum**

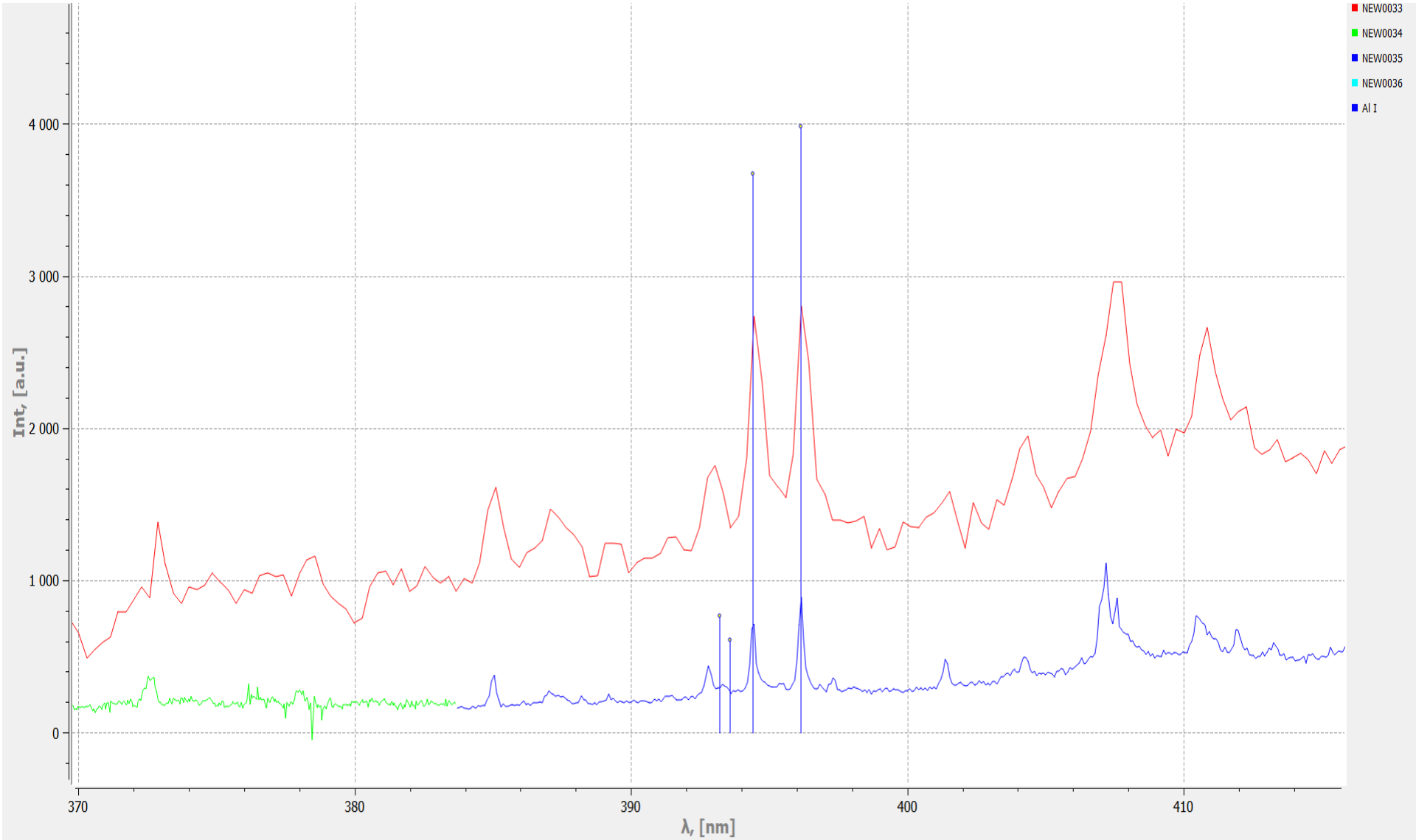
Red, green, blue - measured spectrum



Optical spectra obtained in the PVR-WX

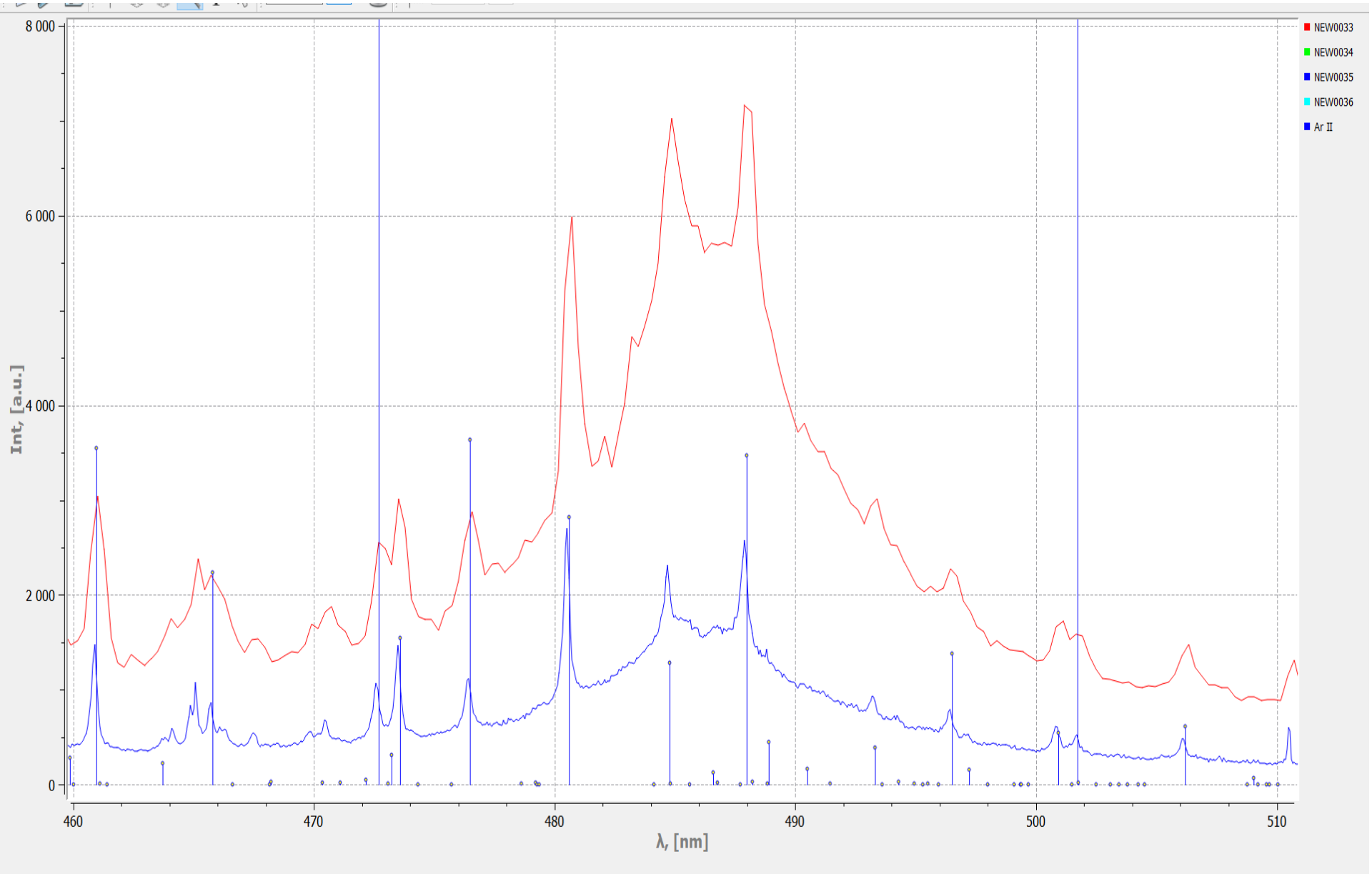
Blue columns- NIST. **Al -spectrum**

Red, blue- measured spectra



Ar II Spectra

E(ArII) = 27,63 эВ; **Tg**= 4000K; **E(ArII)/κTg**~ 100 ⟹ strong non-equilibrium plasma **???!!!!**



Conclusions

Importance:

1. Realization of supersonic regime M > 1 *at low velocity V_{fl}<10m/sec* of heterogeneous plasma flow in the PVR- WX

2. Realization of self-sustained oscillation regime in the PVR-WX. Charged separation on the bow shock wave front near cathode electrode. Direct electric power extraction.

3. High concentrations of new transmuted elements in the PVR-WX are measured both optical spectroscopy method and EDS-method

4. HELP. *Study of multi-charged ion kinetics and soft X-ray radiation* in heterogeneous plasma created in the PVR-WX helps to clear physics of LENR

Thank you for attention !!!!