
INSTITUTE of RADIOPHYSICS
and ELECTRONICS
NAS of UKRAINE
Radiospectroscopy
Department
2016

General Information

Head of Department:
Corresponding member of Nat.Ac.Sci.Ukraine, Prof., Dr.Sc. Sergey TARAPOV

- **e-mail: tarapov@ire.kharkov.ua**
- **tel : 38-057-7203-463**
- **fax : 38-057-3152-105**

Department includes now 25 scientists. Among them there are 3 Doctors of Sciences (Highest Ukraine Sc. degree), 7 Candidates of sciences (corresponds to the Ph.D. in Math and Phys.). All dissertations (both Ph.D. and Dr.Sc.) had been performed on the basis of Department results.

History of Department:

*Department of Radiospectroscopy of Institute of Radiophysics and Electronics NAS of Ukraine had been founded at 1994 on the basis of the research team which was managed by **Professor, Dr.Sc. Alex A.Vertiy**. The team had been extracted from the Diffraction Electronic Department (guided by **Academician NASU Victor P.Shestopalov**). The team developed successfully its research activity from the beginning of 70th. In the initial stages the basic directions were concentrated on the studying of characteristics of electromagnetic field of millimeter (mm) wavelength band in various principal open electrodynamic structures (resonators, diffraction gratings etc.).*

Since 80th the researches of fundamental problems for radiophysics (Extra High Frequency (EHF) -physics, antenna technique, dielectrometry and remote control etc.) as well as the solid state physics tasks (Electron Spin/Magnetic Resonance researches, low temperature physics of disordered magnets, nonlinear dynamics), low temperature physics were joined into the single direction – Radiospectroscopy of high and extra-high frequencies.

Since 2007 – the area of metamaterials and composite nanomagnets are under research.

Experimental Base of the Department involves:

1. Cryomagnetic radiospectroscopy complex of the millimeter waveband for ESR researches.
It consists from:

- **1.1. Experimental radiophysical complex "BURAN" intended for the carrying out experiments at very low T=0.3K<T<150K temperatures, EHF frequency f=60-150GHz, static magnetic field H=7T;**
- **1.2. Magnetic radiospectrometer "KVARK" for ESR researches at T=4.2K<T<300K, f=30-150GHz, H<1.9T;**
- **1.3. Magnetic radiospectrometer for ESR researches at T=300K, f=7.5-12, 21-31GHz, H<1.9T; T=300K (field and frequency scanning)**
- **1.4. Cryodielectrometer "TORNADO" for EHF spectroscopy at f=60-150GHz,T=0.5K<T<300K,**

2. VNA magentoresonance spectormeter based on Vector Network Analyzer Agilent NA 5230A f=50MHz- 40GHz
3. Experimental 3-D test benches for investigation of the near-field characteristics of electromagnetic field;
4. Millimeter waveband circuits technology

By the Directive of the Cabinet of Ministry of Ukraine on 27.12. 2006. N 665-p

Cryomagnetic radiospectroscopy complex of the millimeter waveband

has obtained the status of

NATIONAL SCIENTIFIC-RELATED PATRIMONY of UKRAINE

Cryomagnetic radiospectroscopy complex of the millimeter waveband

consists from 3 experimental units:

1. Experimental radiophysical complex **"BURAN"** intended for the carrying out experiments at very low T=0.3K<T<150K temperatures, EHF frequency f=60-150GHz, static magnetic field H=7T;
2. Magnetic radiospectrometer **"KVARK"** for ESR research at T=4.2K<T<300K, f=30-150GHz, H<1.9T;
3. Cryodielectrometer **"TORNADO"** for EHF spectroscopy at f=60-150GHz,T=0.5K<T<300K.

Detailed descriptions of each unit are given below

Кабінет Міністрів України;
Розпорядження від 27.12.2006
№ 665-р

КАБІНЕТ МІНІСТРІВ УКРАЇНИ

РОЗПОРЯДЖЕННЯ
від 27 грудня 2006 р. N 665-р
Київ

Про віднесення наукових об'єктів до таких, що становлять національне надбання

Віднести до таких, що становлять національне надбання, наукові об'єкти згідно з додатком.

МОН включити зазначені наукові об'єкти до Державного реєстру наукових об'єктів, що становлять національне надбання.

Прем'єр-міністр України **В.ЯНУКОВИЧ**

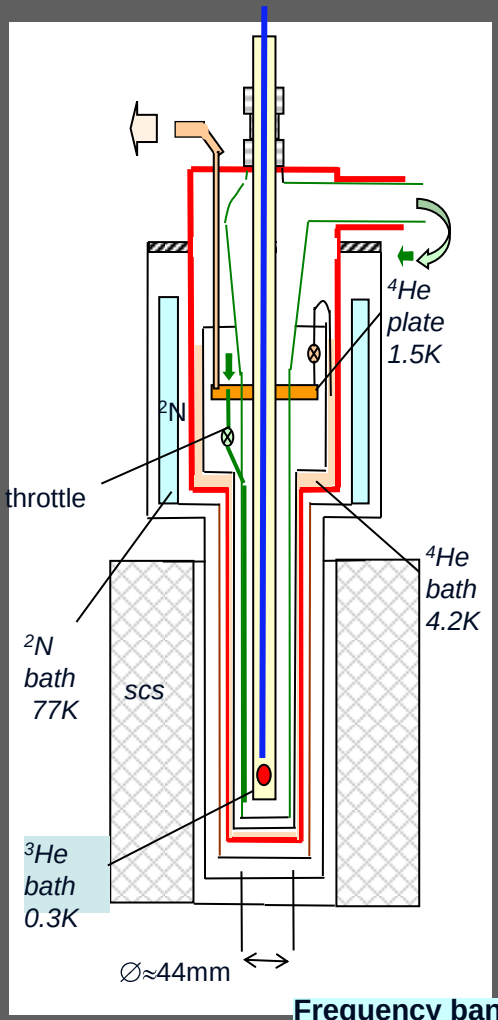
Інд. 28

Додаток
до розпорядження Кабінету Міністрів України
від 27 грудня 2006 р. N 665-р

НАУКОВІ ОБ'ЄКТИ,
що становлять національне надбання

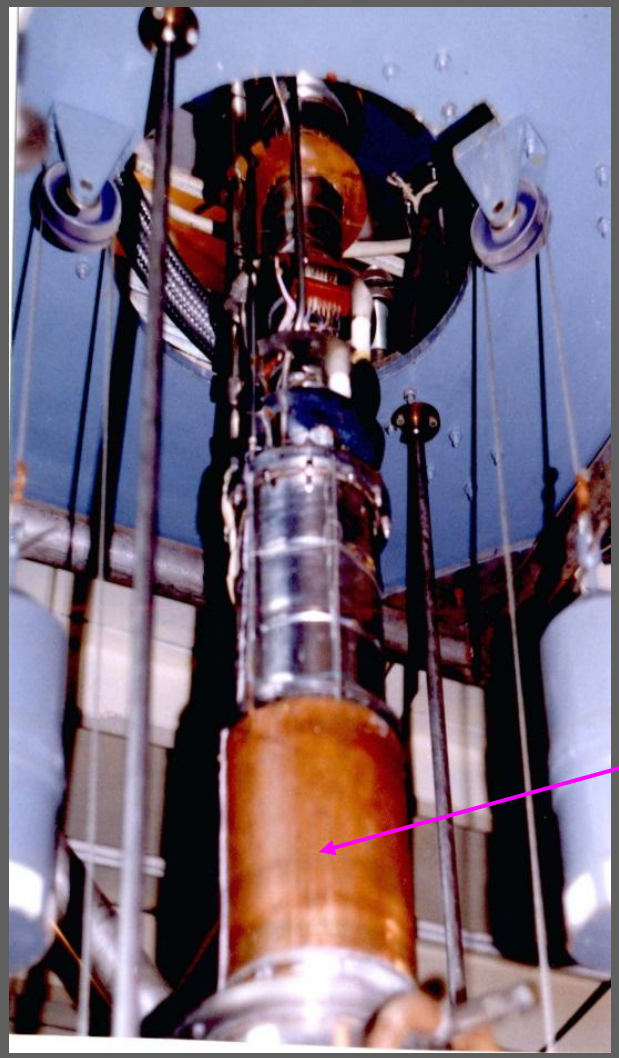
Найменування наукового об'єкта	*Найменування органу, до сфери управління або до відання якого належить науковий об'єкт*
6. Кріомагнітний радіоспектроскопічний комплекс міліметрового діапазону довжин хвиль Інституту радіофізики та електроніки імені О.Я. Усикова (м. Харків)	Національна академія наук

Experimental Radiospectroscopy Complex for Study of Magnetoresonance Phenomena (BURAN)

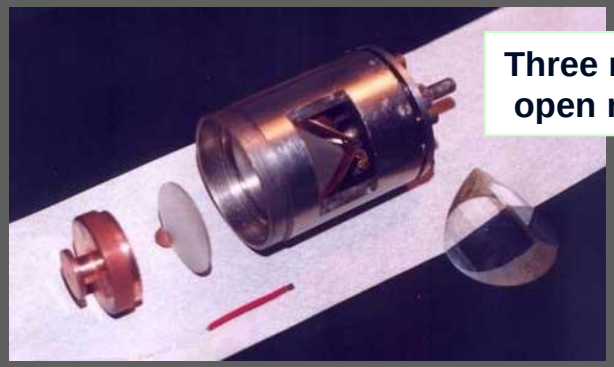


Frequency band - 60GHz -150GHz
Temperature band - 0.3K-150K
Magnetic field - up to 7T
Cooling system - Top-loading closed-cycle ^{3}He refrigerator with the working chamber volume - 200cm^3.

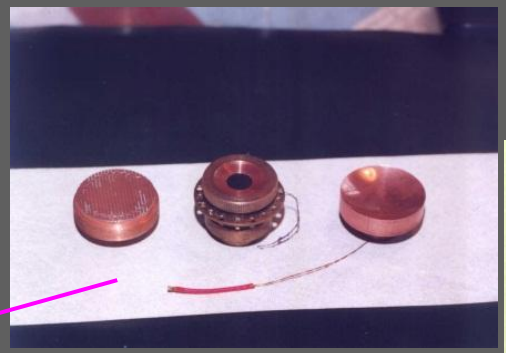
BURAN - Radiospectrometer Elements



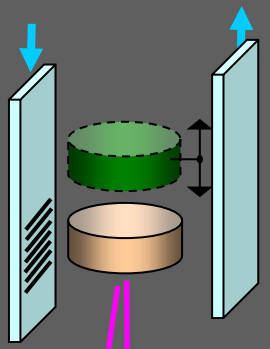
Cryogenic stage

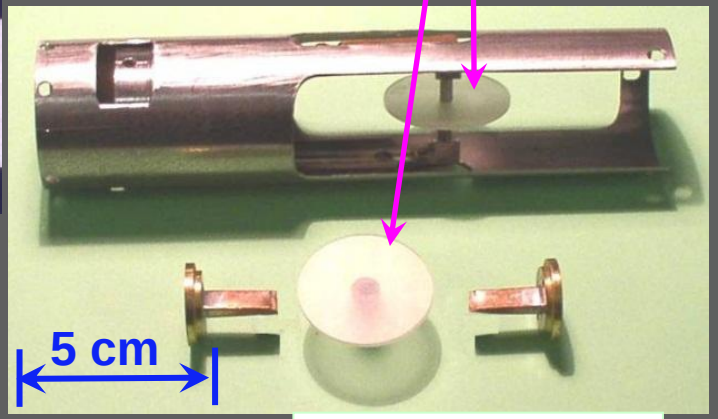


Three mirror open resonator



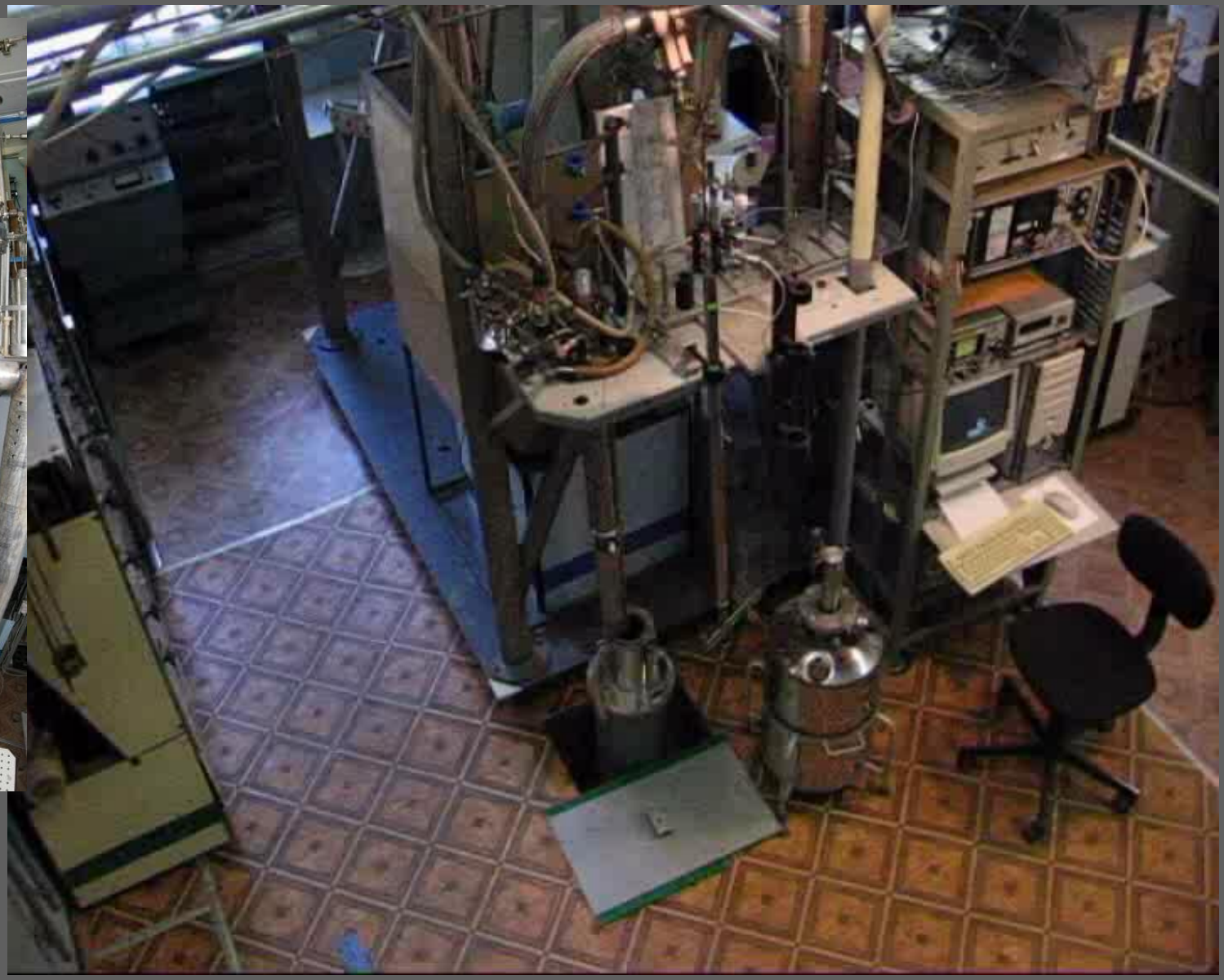
2 mirror Open Resonators for study bulk metals and liquids



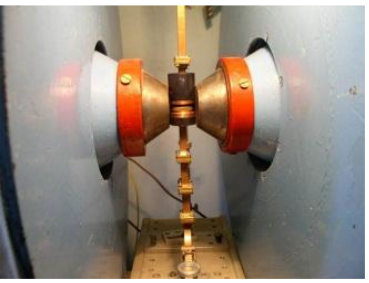


Disk Dielectric Resonator with high Q-factor 10^4-10^5

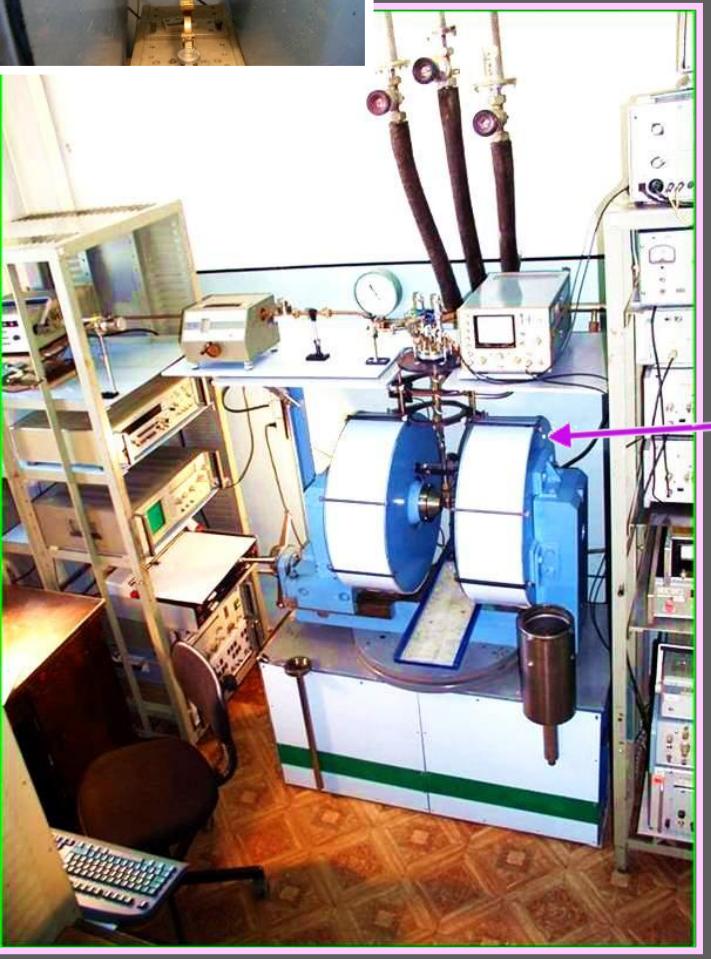
ESR spectrometer BURAN
Specimen changing at temperature T<1K takes less 40 min

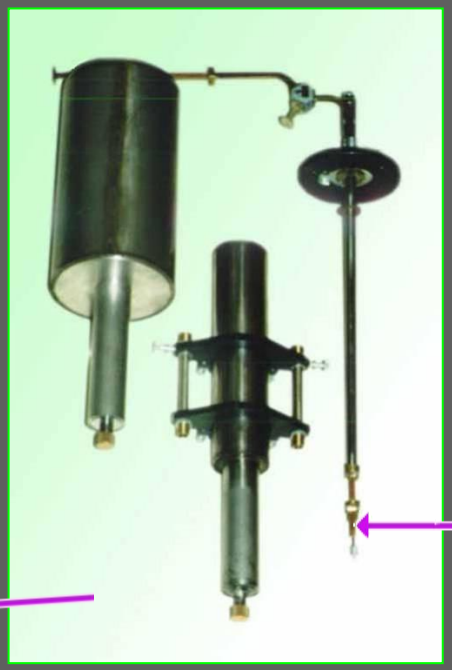


Radiospectrometer KVARK
study of resonance and nonresonance absorption in magnetic materials at f=20-40 GHz; T=4.2- 300K; H<0-1.5T

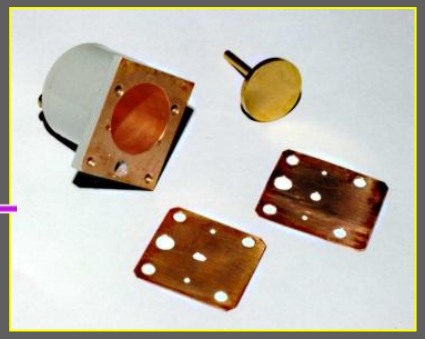


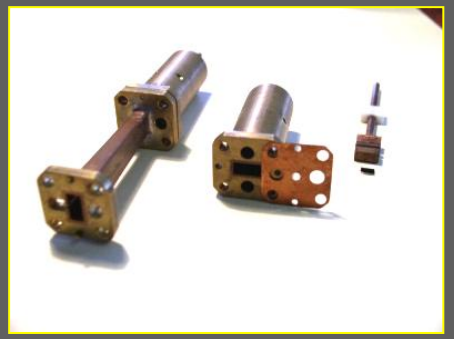
Experimental sample
in resonator
between the magnet tips





Cryogenic modules
for low temperature
experiments





Elements of resonant cells

Radiospectrometer KVARK

Cryogenic units

Open resonator module for 150 GHz

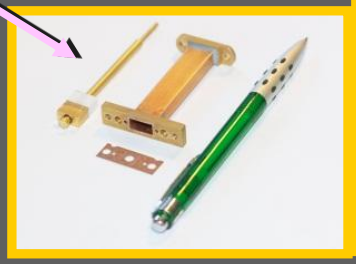
Cavity resonator module for 40 GHz

Cooling systems for resonators modules

VNA-Electron Spin Resonance spectrometer (magnetic field and frequency scanning) for microwave band at H=0-1.9T, T=300K

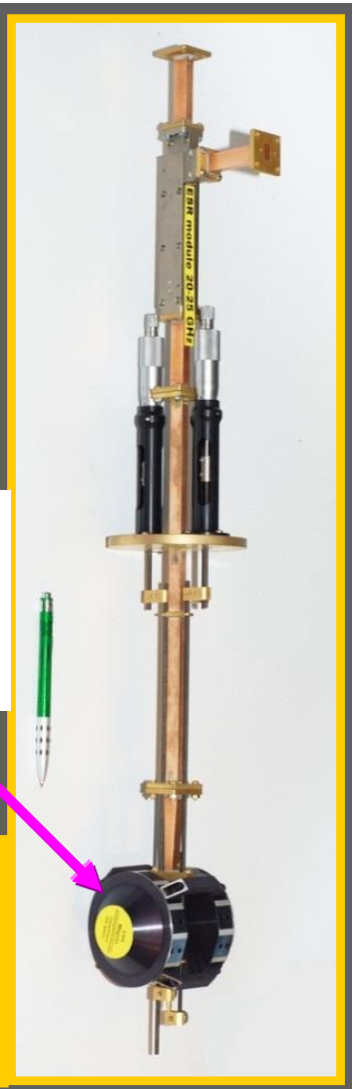
Module for f=7.5-12 GHz

ESR cells:
- length variation
- goniometer

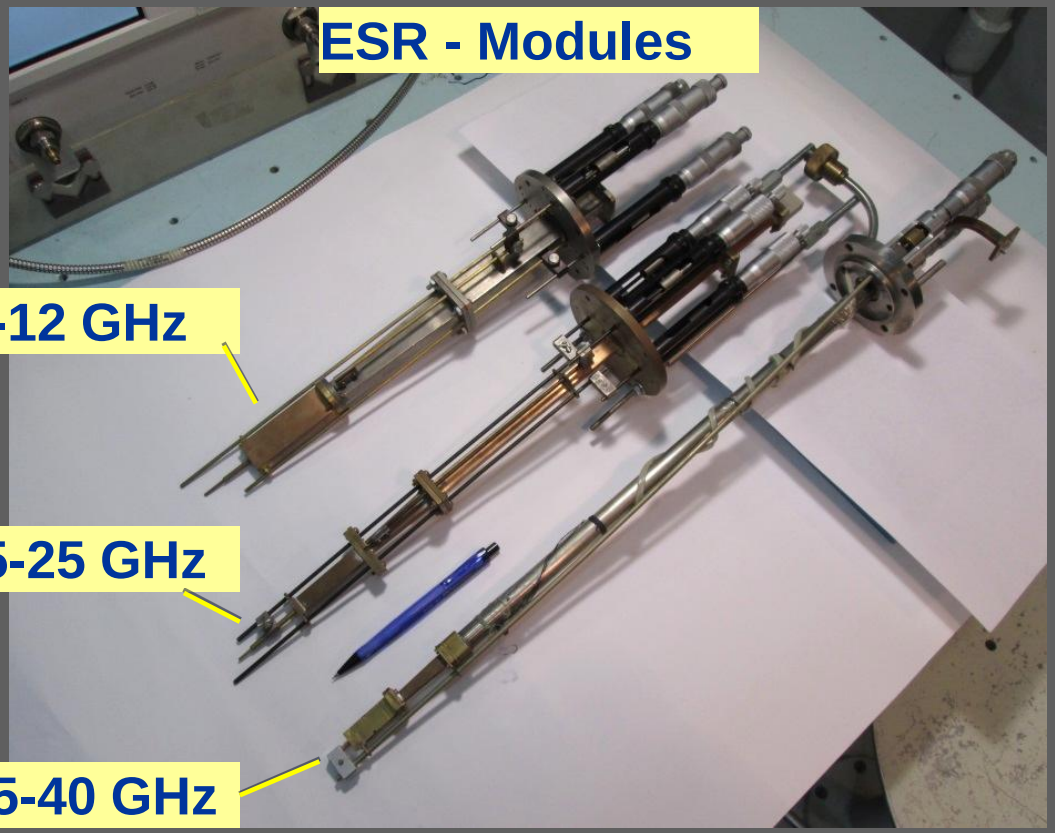


Sm-Co magnet – 0.5-1T

Module for f=21-31 GHz



VNA-Electron Spin Resonance spectrometer (magnetic field and frequency scanning) for microwave band at H=0-1.9T, T=300K

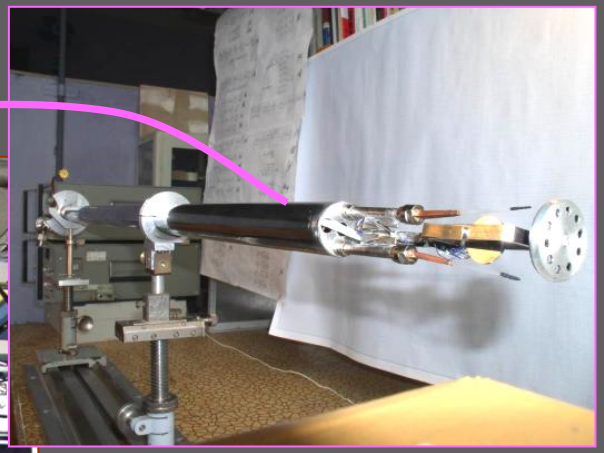


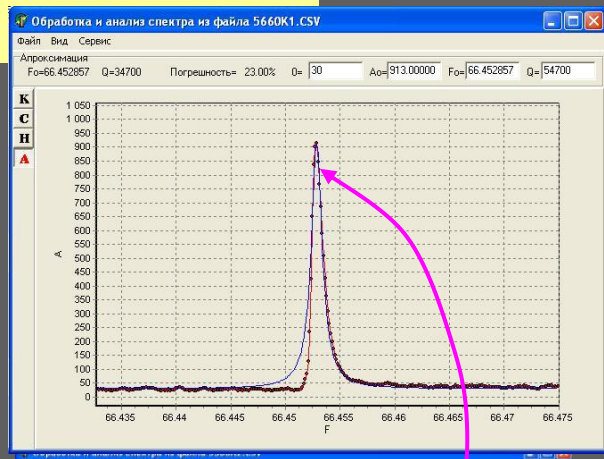
Cryodielectrometer TORNADO

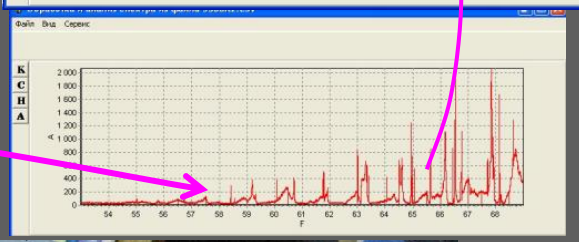
f= 60-150 GHz; T=0.5-300 K

Whispering Gallery Resopnator Technique for : Si-Au, Qartz, diamond, Al_2O_3, Si etc., at T < 0.9K

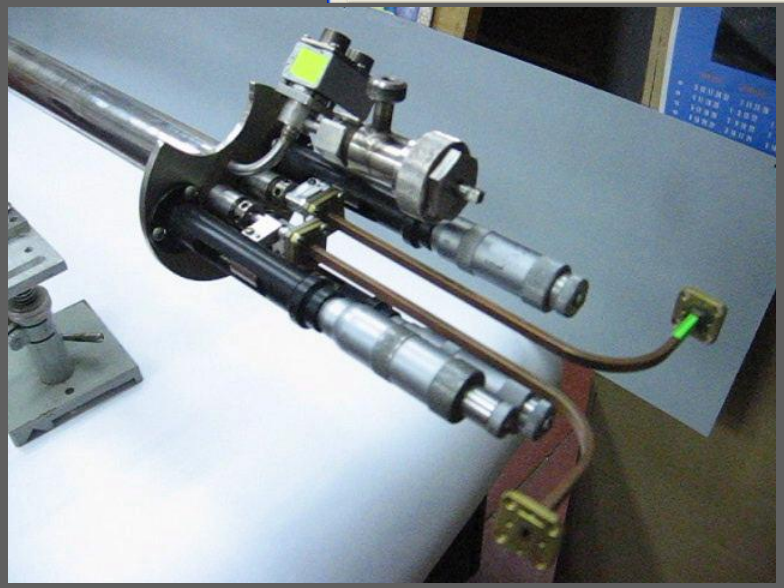
Q_{DDR} = 0.7-2 *10^5







Electrodynamical module



Cryodielectrometer TORNADO

Materials under study shaped as Disk Dielectric Resonators *ν*=60-150 GHz; T=0.5-300 K