



LINEAR ACCELERATOR

for SSRS-4 Facility

Michael LALAYAN

PhD, Associate Prof.

National Research Center «Kurchatov Institute»

National Research Nuclear University «MEPhI»

MVLalayan@mephi.ru



SSRS-4 Linac general concept

Linear accelerator for SSRS-4 facility

parameters listed could be subject to alterations – depending on facility layout and parameters

	injection in booster ring	injection in storage ring
Energy	~200 MeV	6 GeV
RF gun (s)	Thermionic+RF SW buncher 10 MeV	Thermionic+RF SW buncher Photo 10 MeV
Current	~ 400 mA	~ 400 mA
Linac operation mode	injector in booster ring	injector in booster ring provide beam for X-FEL

*Compact, cheaper and
more safe in construction*

Promising but challenging



Research Team



Joined research group of scientists was created for SSRS-4 project. It has an extensive experience in different systems of linear particle accelerators development.

We have an experience, soft- and hardware for R&D in linear accelerators: accelerators theory and simulation of high intensity beam dynamics, RF and microwave systems – accelerating structures and RF power distribution systems, vacuum technology.

Team is ready to meet RF components development challenge:
simulation – design – low-power tests

"INFRASTRUCTURE"

Simulation codes:

self - developed:

BEMADULAC (dynamics simulation taking into account both Coulomb field and beam loading);

MULTP-M (multipactor simulation);

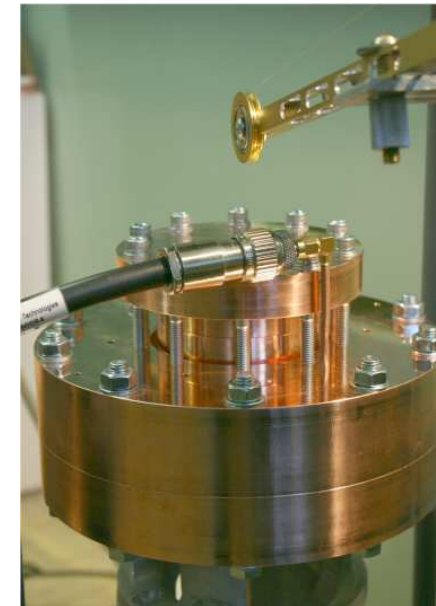
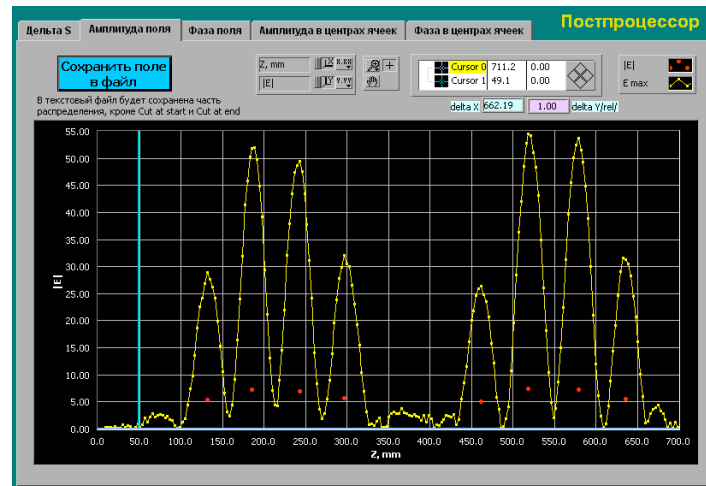
experience with commercial codes:

CST Microwave studio, ANSYS.

Hardware:

IT for numeric simulations

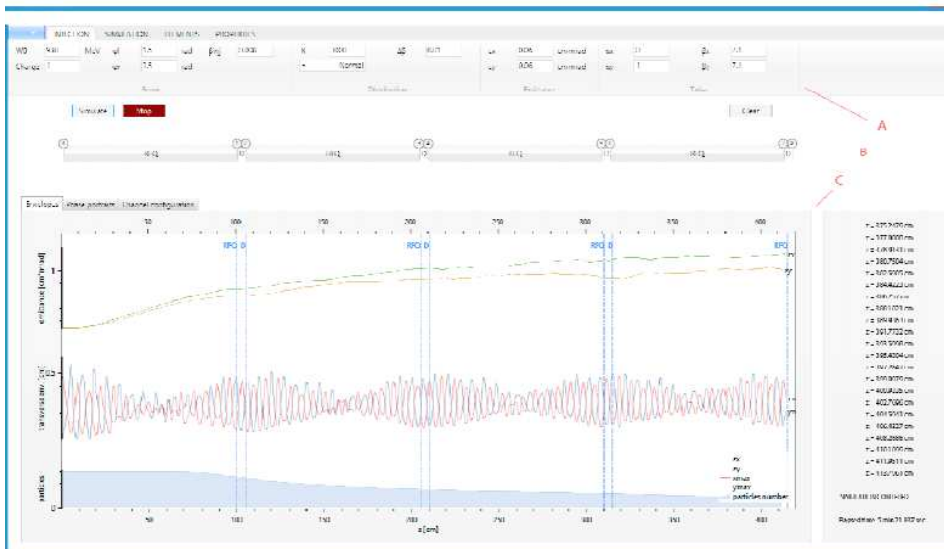
Microwave test equipment and techniques for low-power tests



SIMULATION CODES

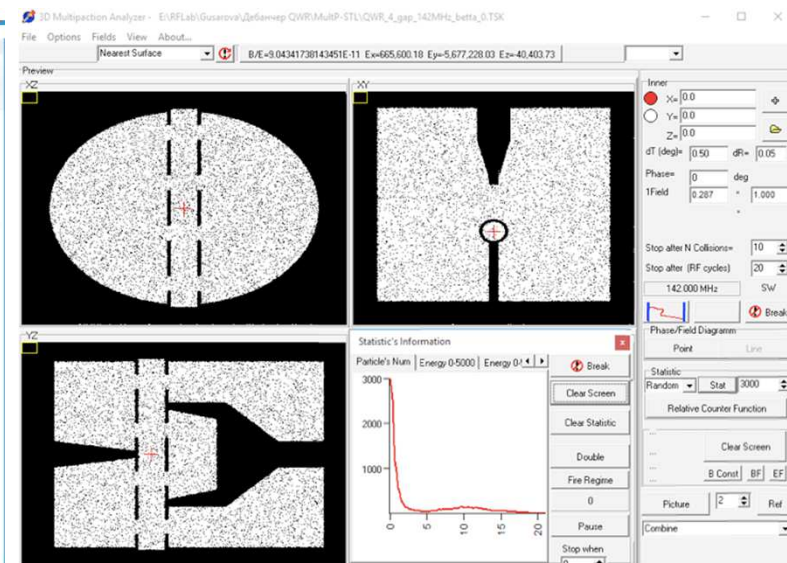
BEAMDULAC

beam dynamics simulation
taking into account Coulomb field and beam loading



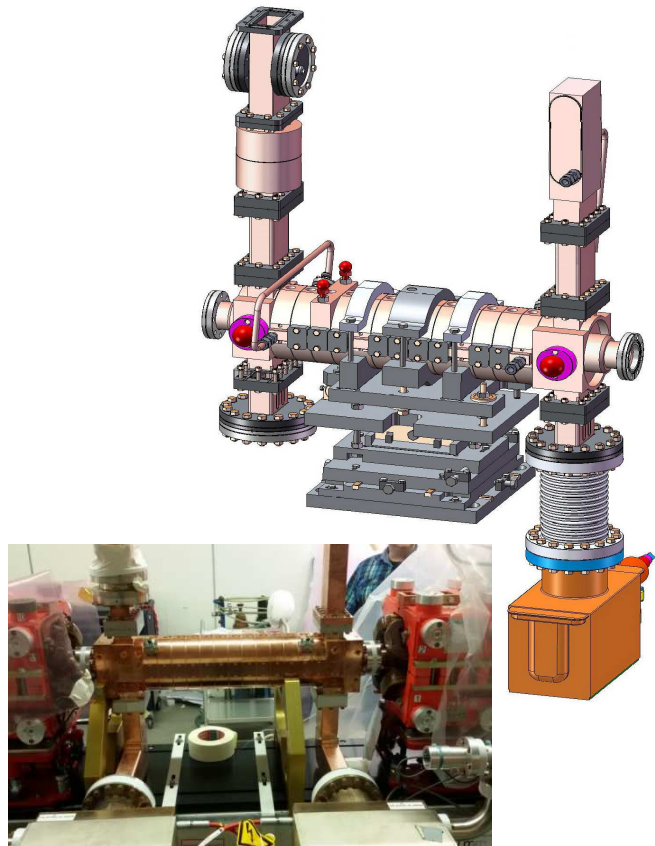
MULTP-M

Multipactor simulation in RF devices

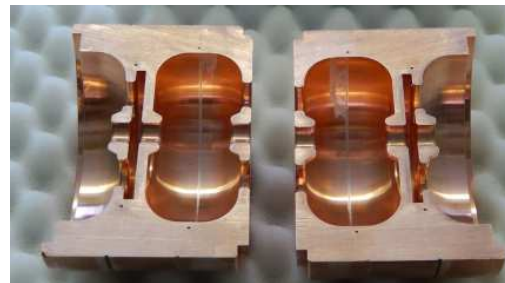


ACCELERATING STRUCTURES DEVELOPMENT – "WARM"

conventional L-, S-, X- bands, and exotic Ku-(17GHz) and K-(27 GHz) bands.



DESY PITZ deflector system
(photo courtesy of JSC Nanoinvest)



industrial S-band linacs



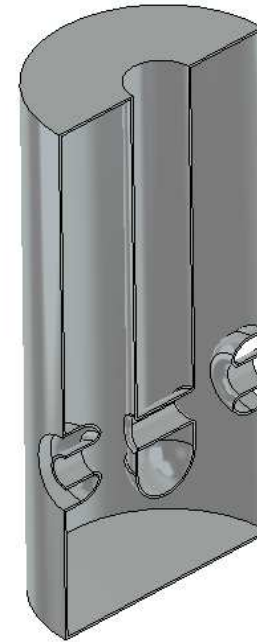
ACCELERATING STRUCTURES FOR *mid-BETTA*

Normal-conducting



Proton linac TW accelerating structure

Superconducting



QWR cavity proposed for NICA
(Joint Inst. of Nuclear Physics, Dubna)

ACCELERATING STRUCTURES DEVELOPMENT – SUPERCONDUCTING

High power input coupler for SC cavities of Cornell ERL injector (100kW CW)

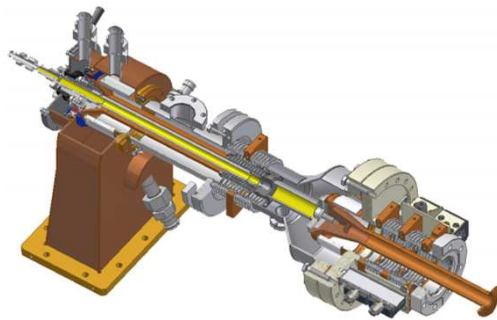
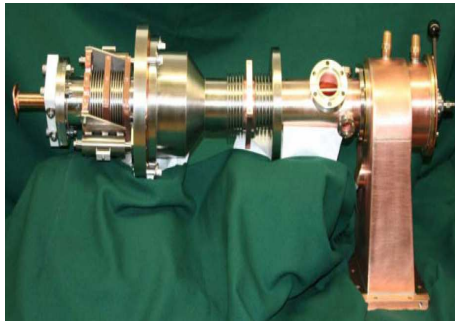
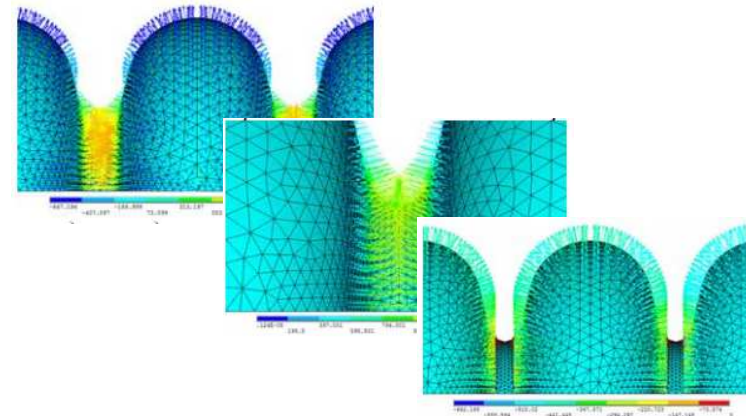
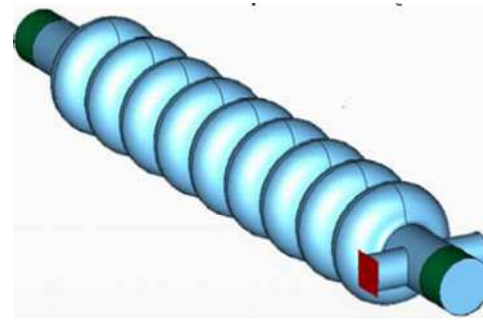


Photo:
courtesy of
Cornell Uni.

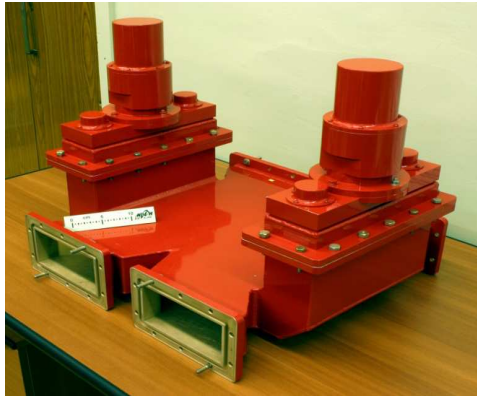


Cavity for e-Linac at TRIUMF

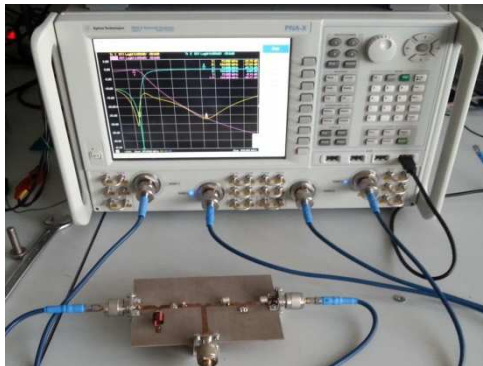


We have only experience in research – neither one in development nor in operation

DEVICES FOR RF HIGH POWER DISTRIBUTION SYSTEMS



Adjustable waveguide directional couplers for TESLA-type accelerators
($C = 3 \dots 12$ dB; adj. range ± 1 dB; D, R better than 30 dB.)



Power combiners and RF hardware for solid state
microwave generator developed by Siemens



AREAS OF COOPERATION



Large-scale linac Research, Development and Engineering expertise

High RF power system

Thermionic gun and Photoinjector (latter: +laser driver) development

RF superconductivity

Thank you for attention