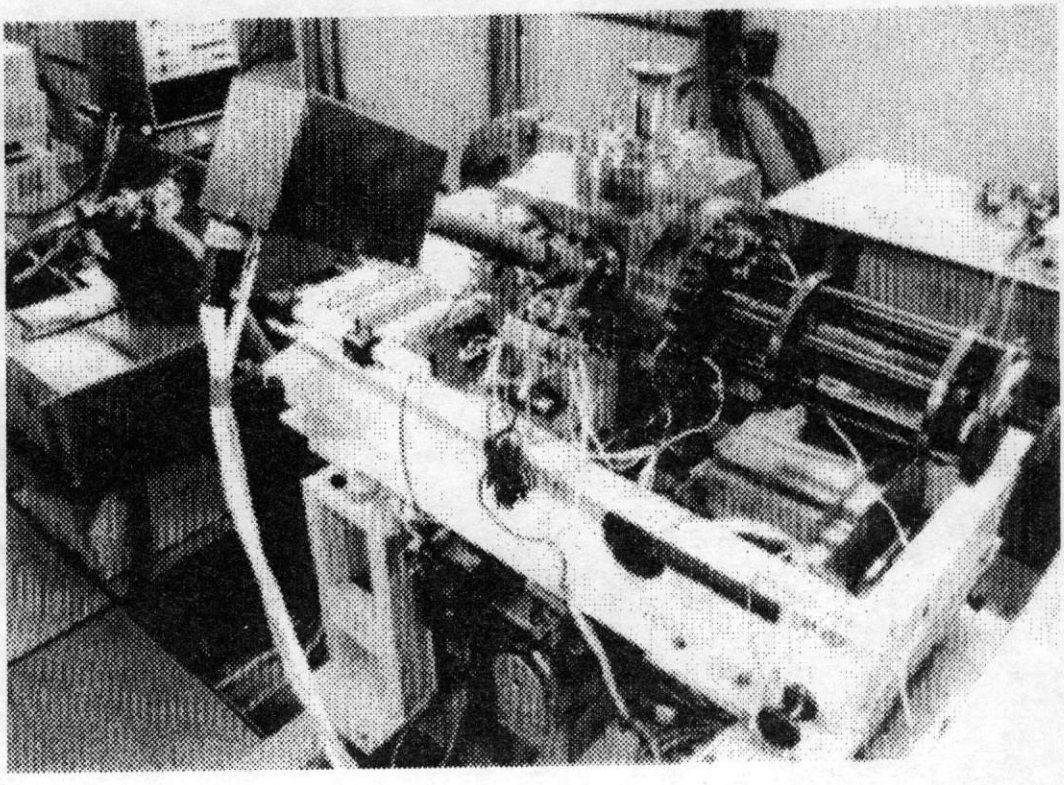

High Power Test of RF GUN Prototype with GaAs Photocathode.

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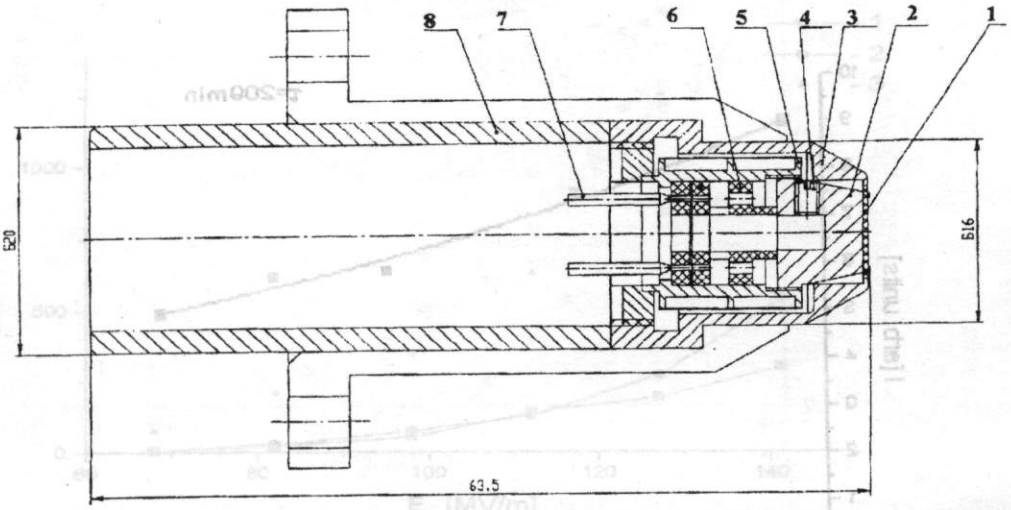
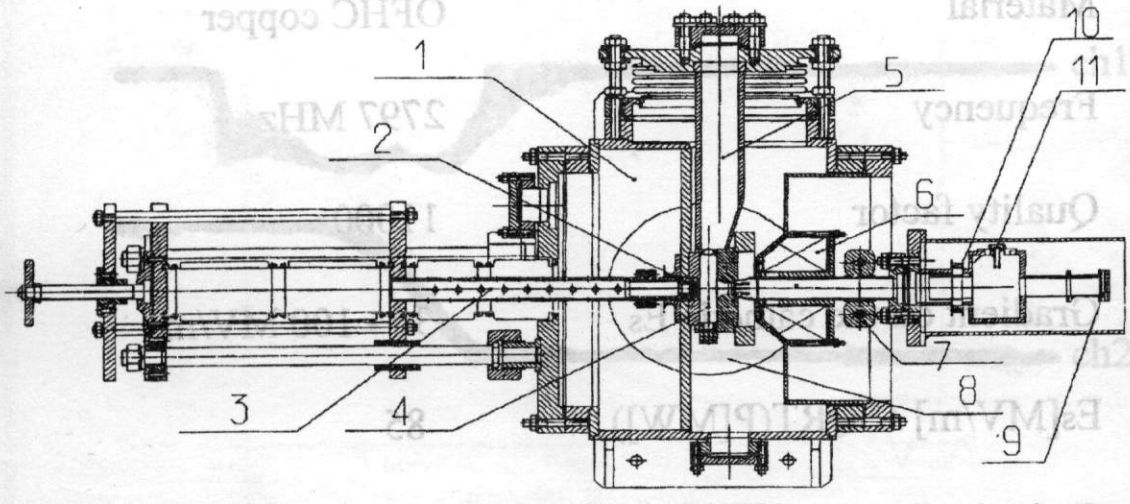
Cathode assembly



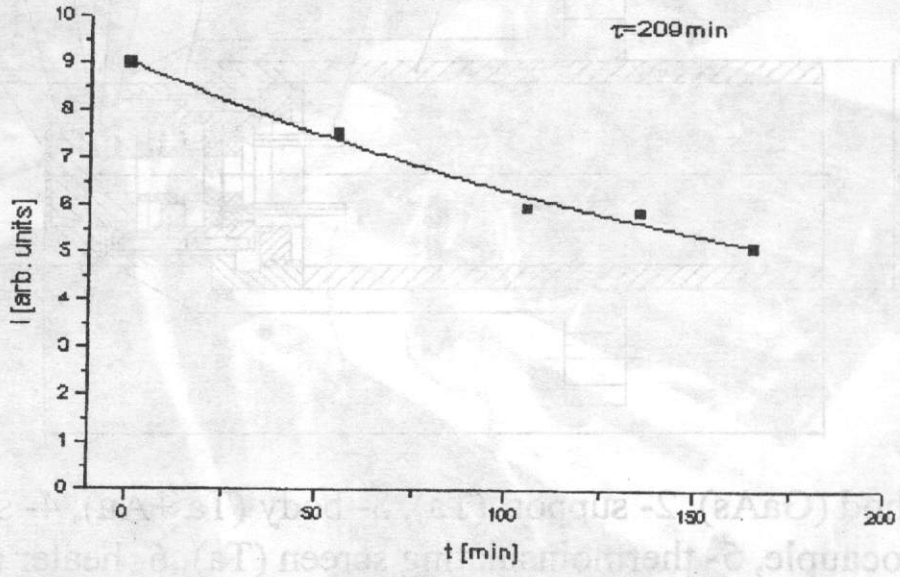
1- cathod (GaAs), 2- support (Ta), 3- body (Ta +Au), 4- scrue for thermocauple, 5- thermoinsulating screen (Ta), 6- heater (W), 7- heater wire, 8- tube (SS).

Scheme of the prototype



1- activation chamber, 2- cathod holder, 3- manipulator, 4- cavity, 5- waveguide, 6- coil, 7- steerer, 8- working chamber, 9- window, 10- Faraday cup, 11- probe loop.

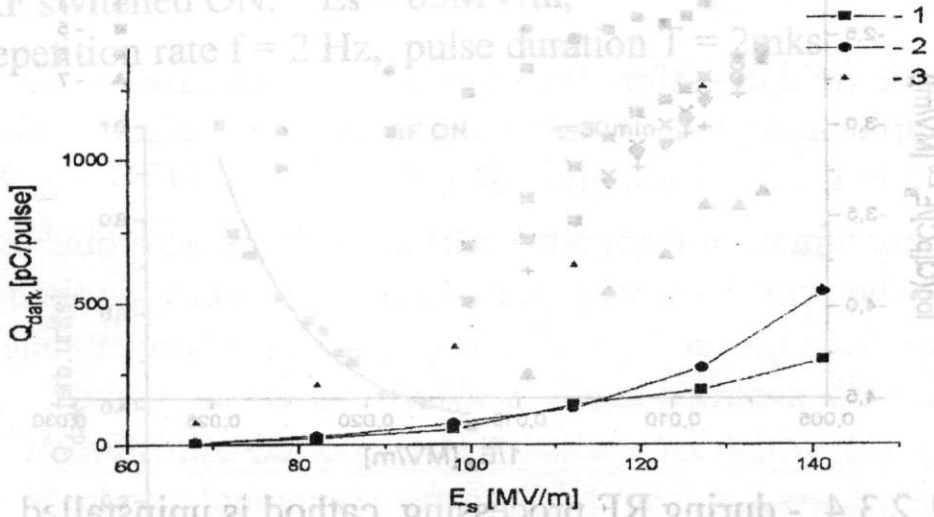
Lifetime measurement in the activation chamber.
HeNe laser, Q.E.max = 5%



Cavity parameters:

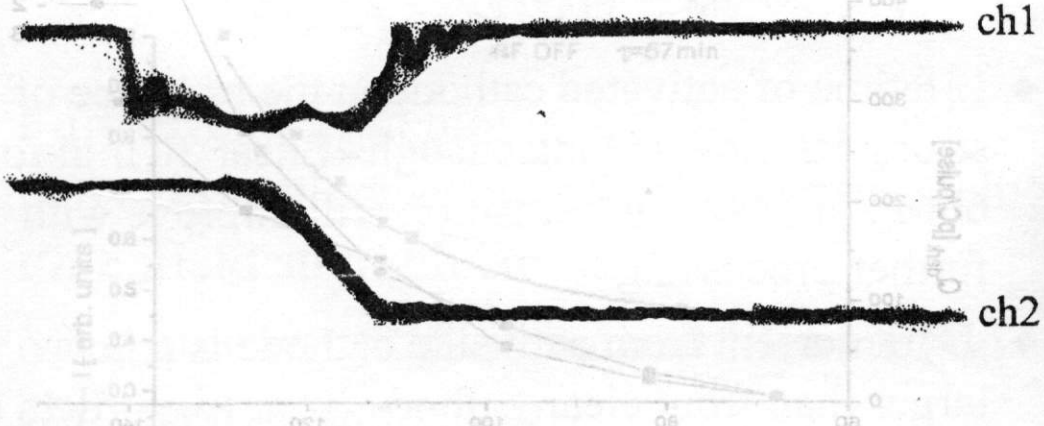
Material	OFHC copper
Frequency	2797 MHz
Quality factor	11000
Gradient on the cathode Es	30 - 100 MV/m
Es[MV/m] / SQRT(P[MW])	85
Cathode diameter	8 mm
Cathod type	bulk GaAs

The dependence of dark current upon field gradient



1 - after processing, cathod is installed
2 - after processing, cathod is uninstalled
3 - before processing, cathod is installed

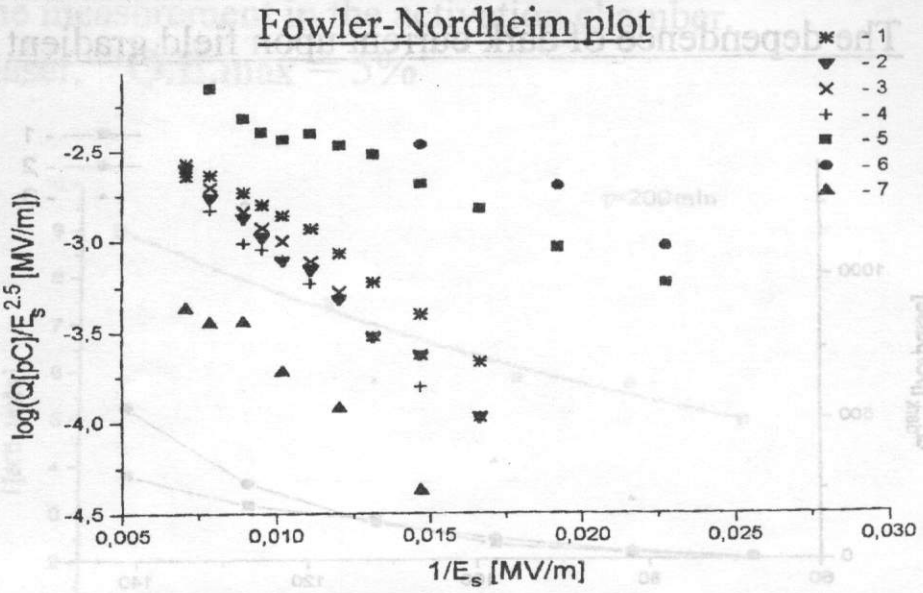
1 mks / div.



ch1 - incoming RF power, P_{max} = 2.5 MW
ch2 - Faraday Cup voltage, 1V/div., RC = 1MOhm*3nF

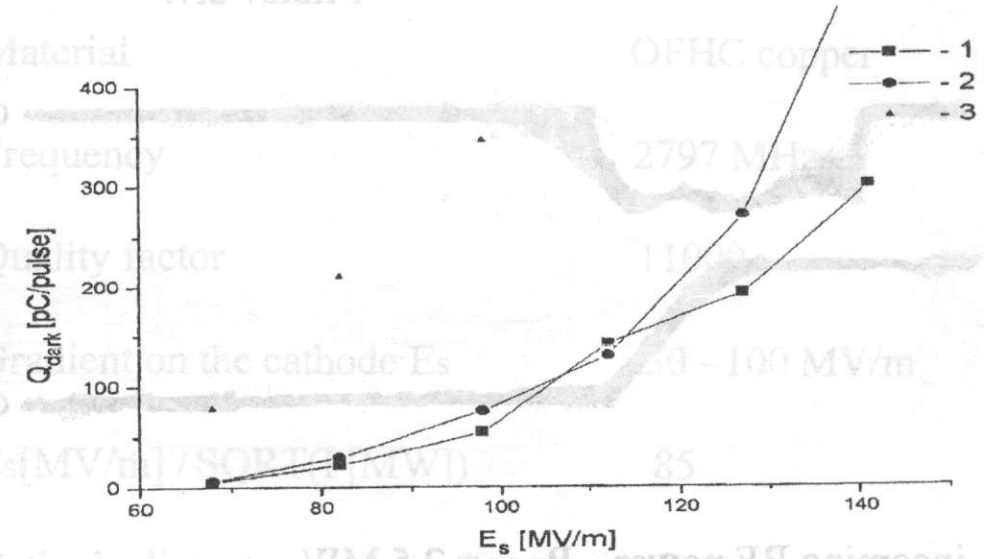
Cathod is installed, beginning of processing

Fowler-Nordheim plot



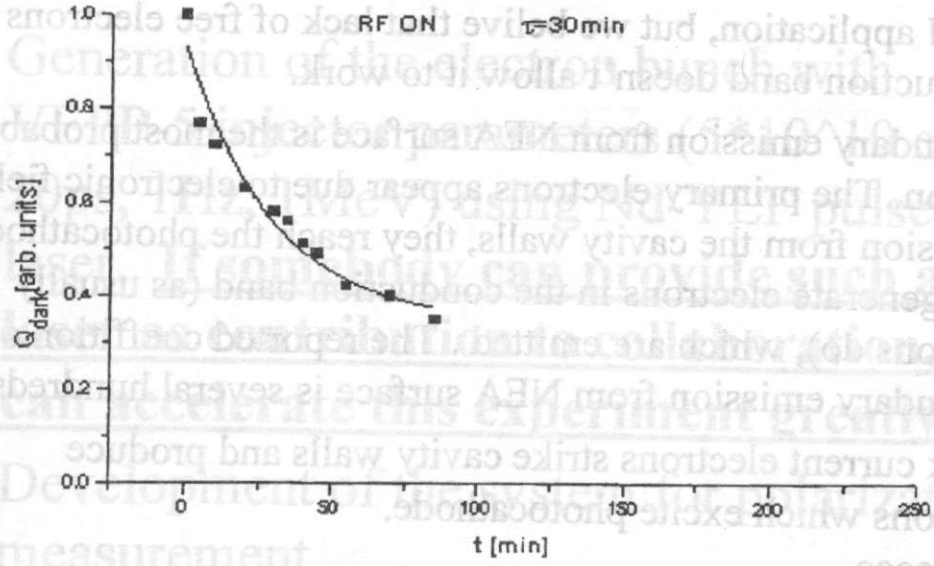
1,2,3,4 - during RF processing, cathod is uninstalled
5 - before processing, cathode is installed
6 - activated cathode (Q.E. = .05%)
7 - after processing, cathode is installed

The dependence of dark current upon field gradient

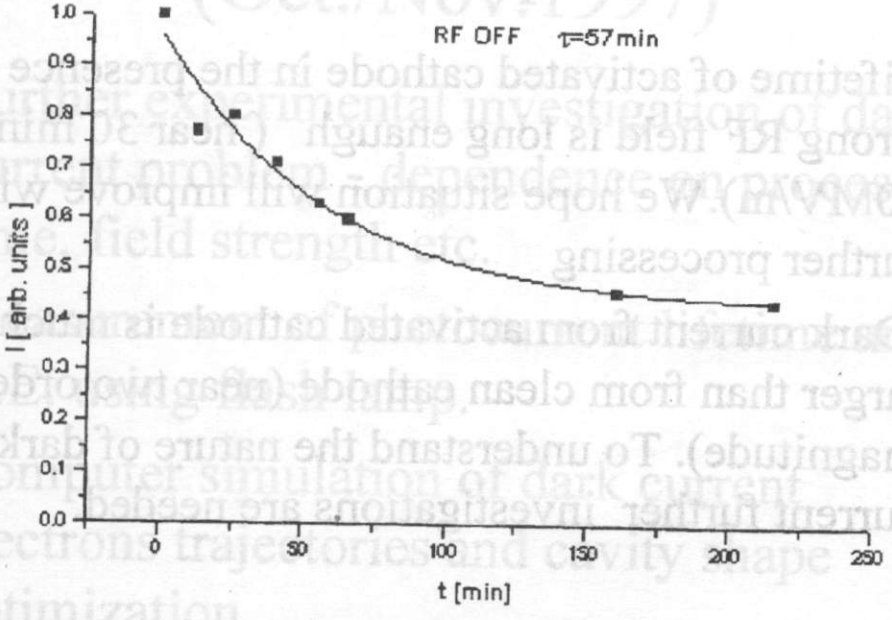


1 - after processing, cathod is installed
2 - after processing, cathod is uninstalled
3 - before processing, cathod is installed

Lifetime measurement in the cavity. Dark current.
RF switched ON. E_s = 65MV/m,
repetition rate f = 2 Hz, pulse duration T = 2mks



Lifetime measurement in the cavity. RF switched OFF .
HeNe laser, Q.E.max = .05%



Possible reasons for large dark current:

- Electronic field emission. It would be very bad case for RF GUN application, but we belive that lack of free electrons in conduction band doesn't allow it to work.
- Secondary emission from NEA surface is the most probable reason. The primary electrons appear due to electronic field emission from the cavity walls, they reach the photocathode and generate electrons in the conduction band (as usually photons do), which are emitted . The reported coeffition of secondary emission from NEA surface is several hundreds.
- Dark current electrons strike cavity walls and produce photons which excite photocathode.
- ????????

The most important results of the first experiments are:

- Lifetime of activated cathode in the presence of strong RF field is long enaugh (near 30 min for 60MV/m).We hope situation will improve with further processing
- Dark current from activated cathode is much larger than from clean cathode (near two orders of magnitude). To understand the nature of dark current further investigations are needed.

The next step (??/1998)

- Generation of the electron bunch with VEPP-5 injector parameters (5*10^10 e-, 20ps, 1Hz, 1MeV) using Nd-YLF pulse laser. **If somebody can provide such a laser as contribution to collaboration, it can accelerate this experiment greatly.**
- Development of the system for polarization measurement.

The nearest plans (Oct./Nov.1997)

- Further experimental investigation of dark current problem - dependence on processing time, field strength etc.
- Measurement of photocurrent lifetime and Q.E. using flash lamp.
- Computer simulation of dark current electrons trajectories and cavity shape optimization.