

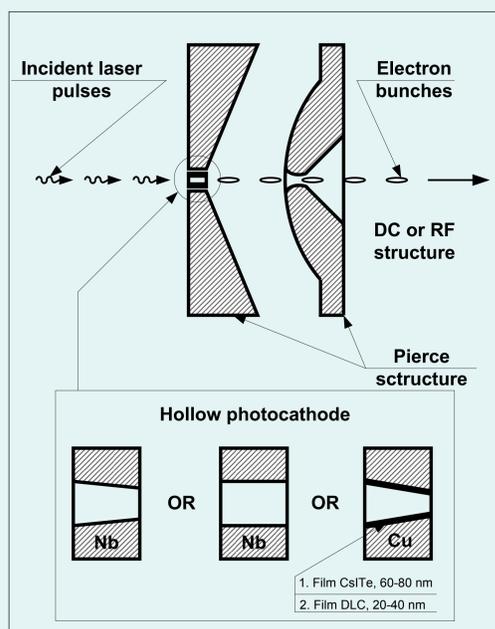
# Hollow photocathode prototype for e-gun

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## Introduction

The new photocathode conception is proposed in Laboratory of High Energy Physics of Joint Institute for Nuclear Research. Hollow photocathode is a 4-6 mm width washer with a cone or cylinder aperture in the middle.

Such cathode geometry allows quantum efficiency rising due to surface photoelectric effect, which is concerned to normal to material surface wave electric field component. Backside irradiation also simplifies laser beam targeting on emitting surface, accelerator equipment alignment and photocathode working surface laser cleaning.



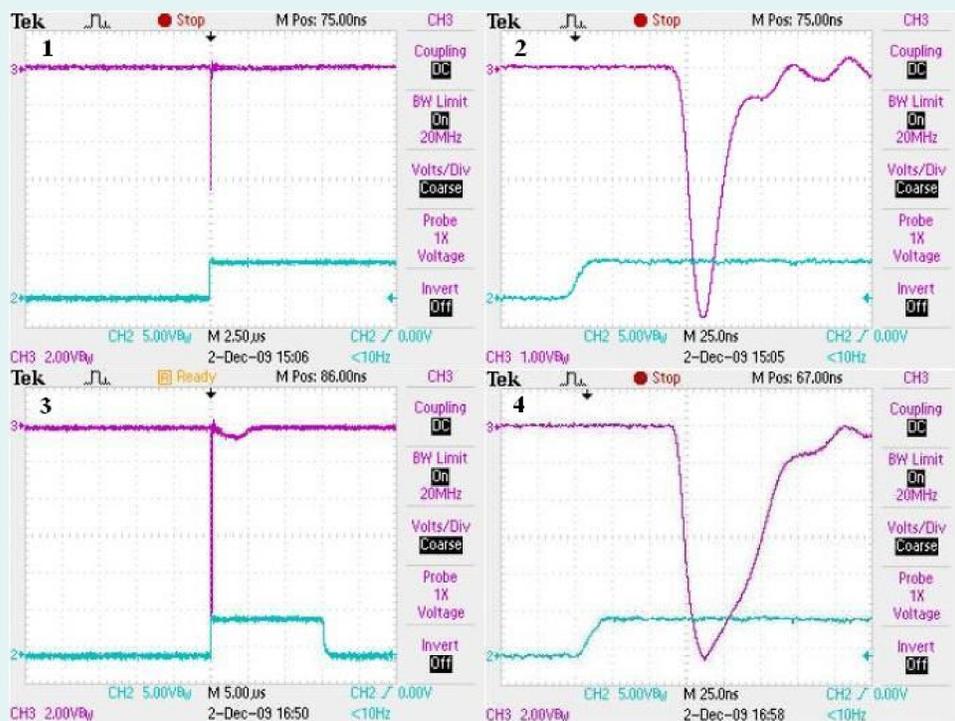
## Stand setup



Cathode investigations were done at a stand with a monopulse YAG:Nd<sup>3+</sup> laser. Generated radiation had wavelength of 266 nm, pulse length of 15 ns and maximum energy of 15 mJ.

## Common photocathode investigations

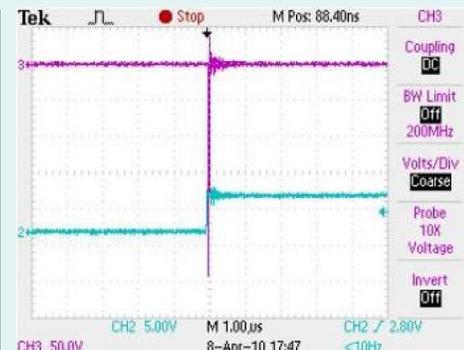
Preliminary emission characteristics of common solid photocathode (Ø10 mm Nb disk with thickness of 1) were done. Cathode was irradiated by unfocused and focused to Ø3 mm laser beam with normal angle of incidence. Radiant flux density was changed from 0.8 to 4.1 MW/cm<sup>2</sup> for unfocused and from 3.2 to 16.4 MW/cm<sup>2</sup> for focused beam. For unfocused beam thermoemission was absent. For focused – appeared from intensity of 4.8 MW/cm<sup>2</sup> – photocurrent pulse duration increases.



1, 2 – 4.2 MW/cm<sup>2</sup>, unfocused beam  
3, 4 – 4.8 MW/cm<sup>2</sup>, focused beam

## Quantum efficiency measurements

| Cathode type    | QE, %              |
|-----------------|--------------------|
| Solid Nb        | $2 \times 10^{-4}$ |
| Hollow Nb       | $6 \times 10^{-3}$ |
| CsTe 80 nm film | $7 \times 10^{-3}$ |
| DLC 40 nm film  | $1 \times 10^{-3}$ |



## New stand setup

The new picosecond laser was installed in December 2010. Preliminary investigations have shown electron beam current of 15-20 A

