

# PEGASUS: Building an intense spin-polarized electron gun

## – status report –

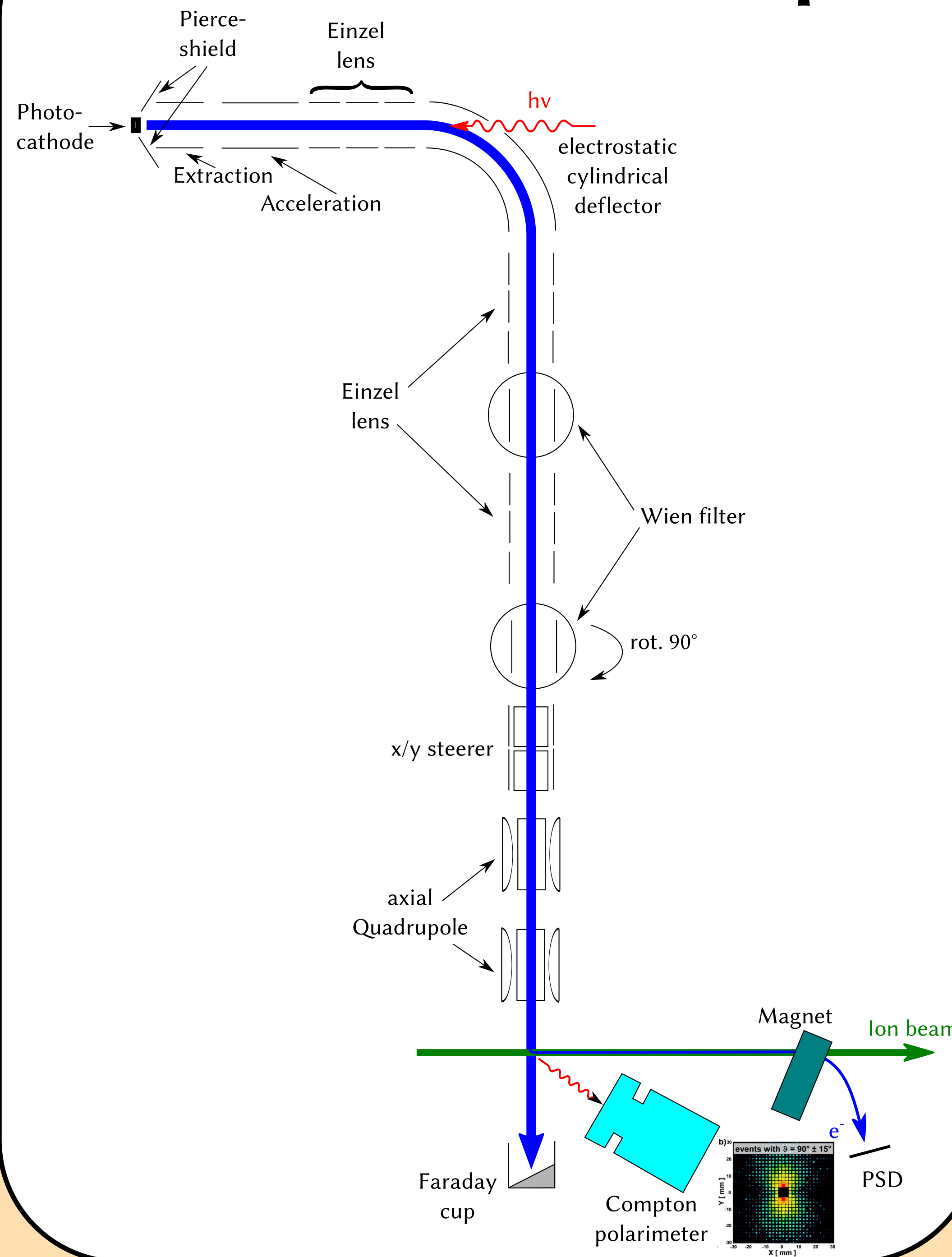
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### Abstract

The PEGASUS project aims at building an intense and portable spin-polarized electron gun for experiments in crossed and merged beams arrangements at various ion beam facilities. The electron beam will cover energies between 1 and 10 keV at electron currents up to 100  $\mu$ A. As source material we will utilize laser induced electron emission from GaAs photocathodes which will be prepared in a state of negative electron affinity. With a set of electrostatic lenses and benders, the electrons will be transported to the interaction zone and Wien-filters will be used for controlling the spin orientation. We give a status report on our progress for building the setup and discuss foreseen experiments.

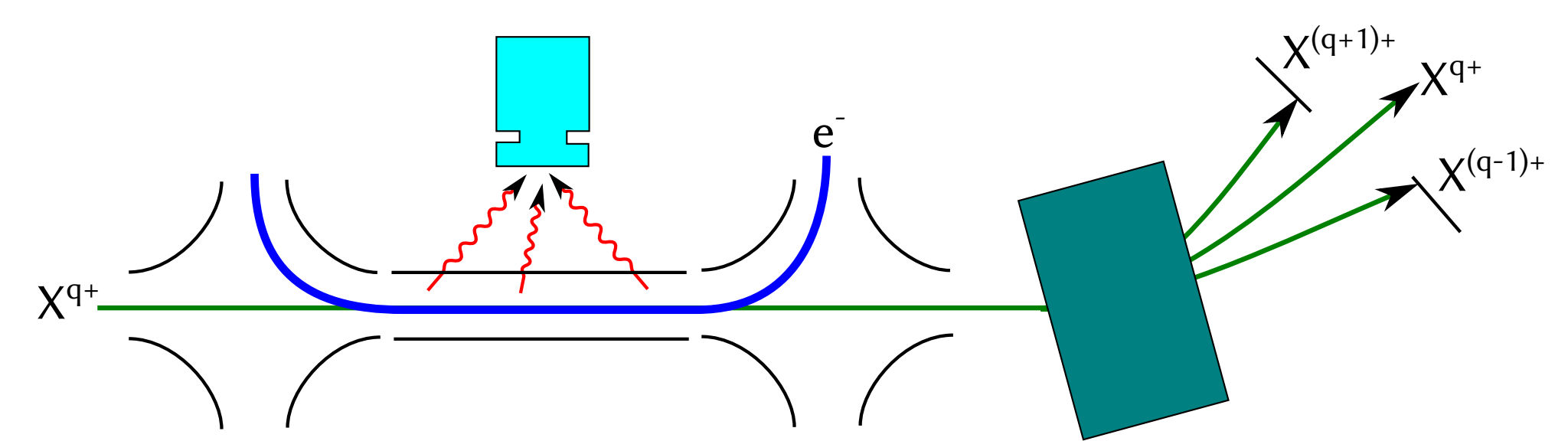
### Crossed Beams Setup



### Performance

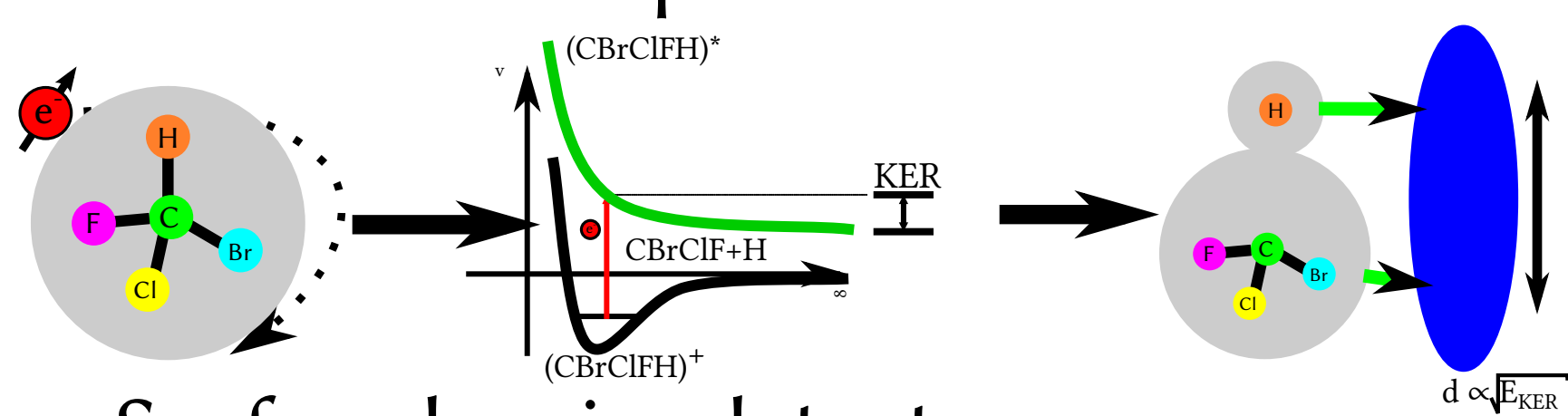
- closed cycle activation of GaAs cathode samples
- cold electron source
- only electrostatic beam guiding
- freely adjustable spin orientation
- $\sim 100 \mu$ A electron beam ( $\sim 10^7/\text{cm}^3$ )
- $>85\%$  polarization degree
- transverse or parallel ion beam overlap
- transverse: small interaction volume, simple doppler correction
- parallel: low relative energy, increased area density (luminosity)
- Ultra High Vacuum ( $\sim 10^{-11}$  mbar)
- portable design

### Merged Beam Setup



### Experiments

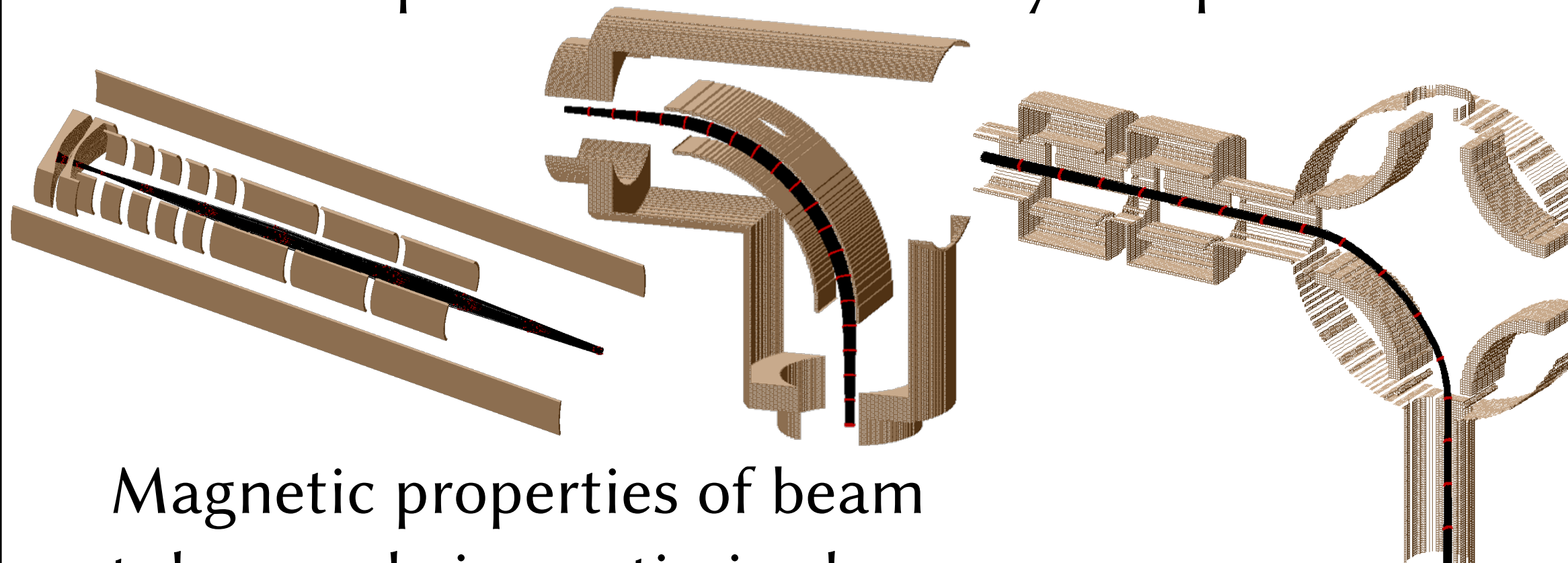
- Bremsstrahlung emission of spin-polarized electron-nucleus-scattering in inverse kinematic
- identification of all products
- angular correlation with X-rays and X-ray polarization
- polarization transfer
- circular dichroism in dissociative recombination processes



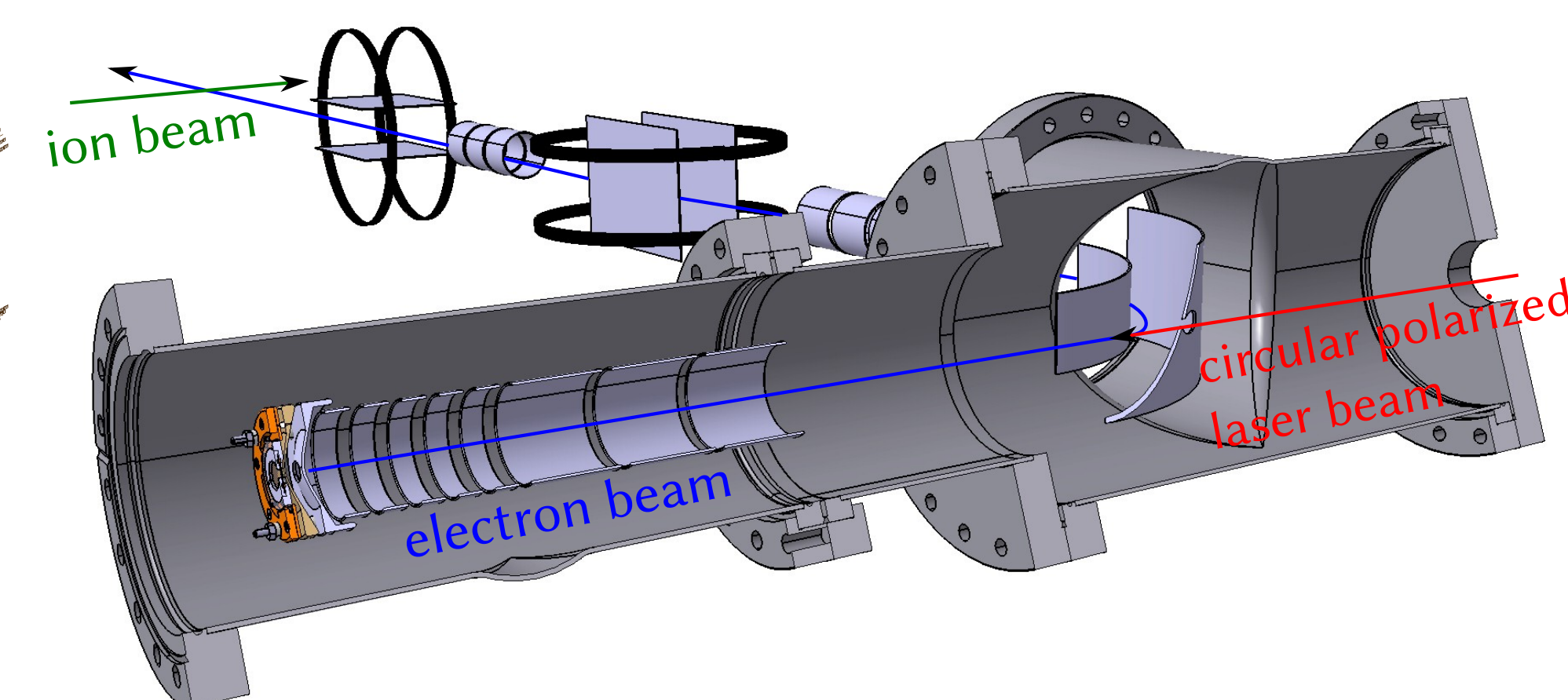
- Surface barrier detector
- mass identification
- 3D reconstruction
- multihit
- development of low energy electron polarimetry

### Status

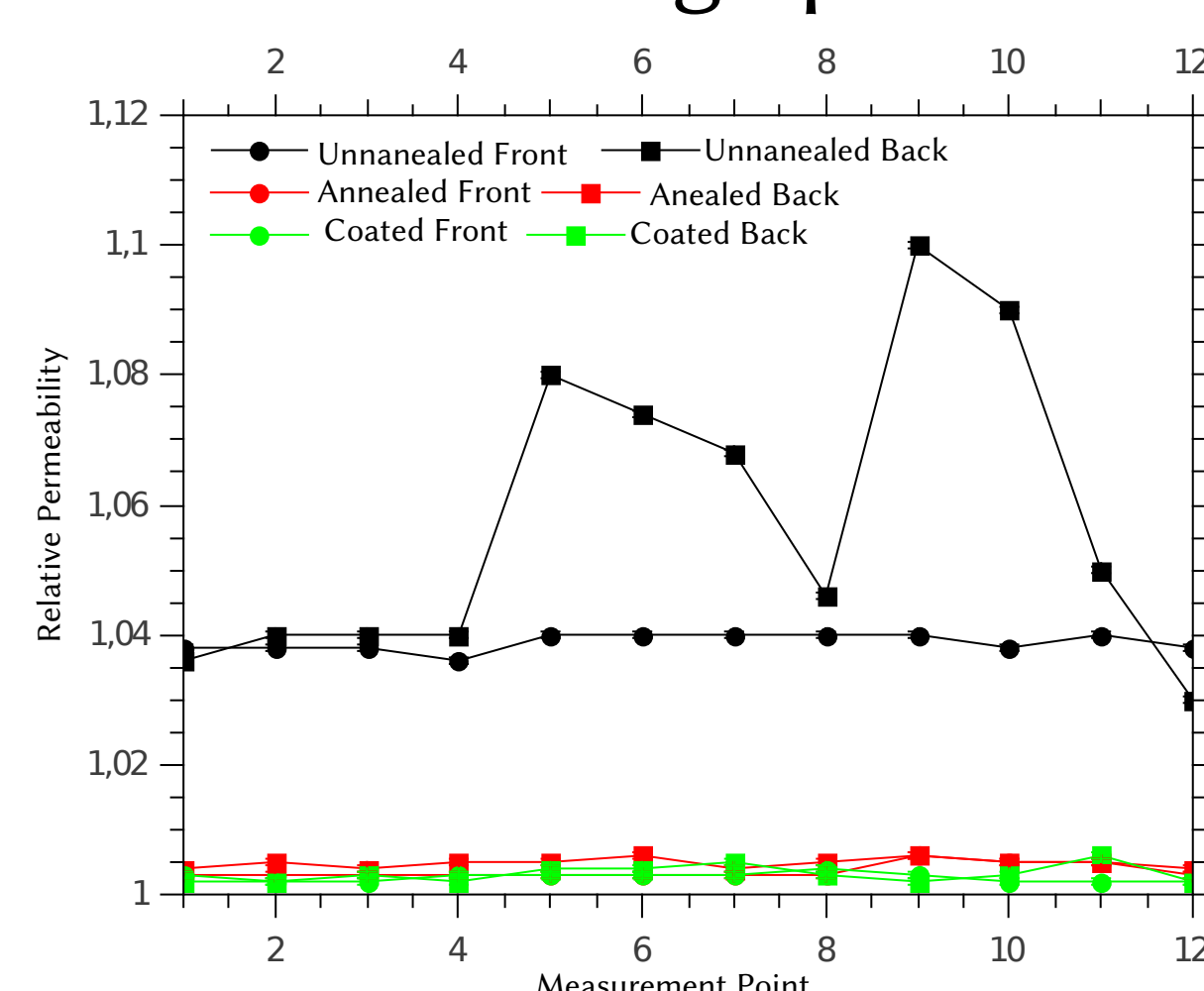
Electron optics simulation mostly completed



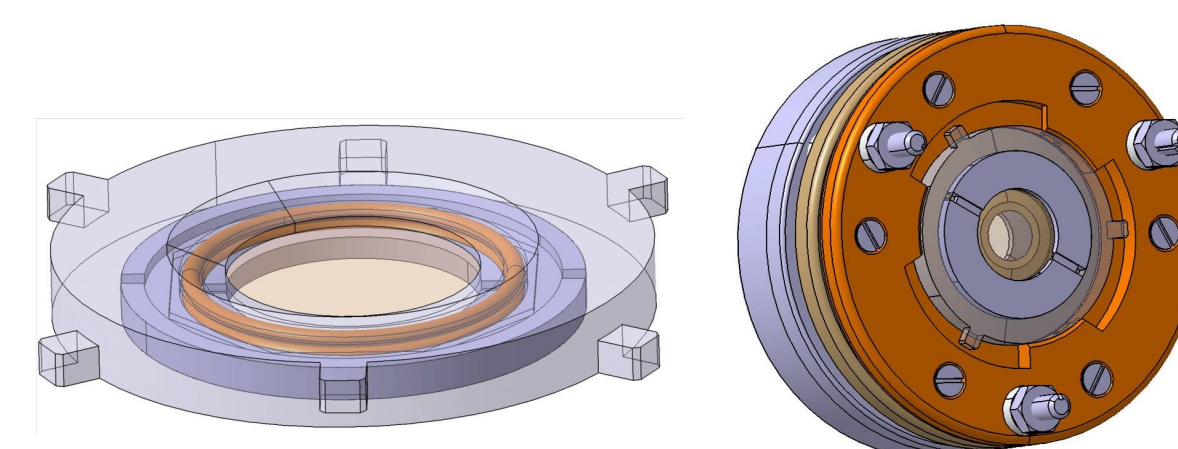
CAD model of apparatus in development



Magnetic properties of beam tubes are being optimized



Changeable GaAs cathode samples



Vacuum system in preparation

Hardware communication established

Photocathode laser system completed

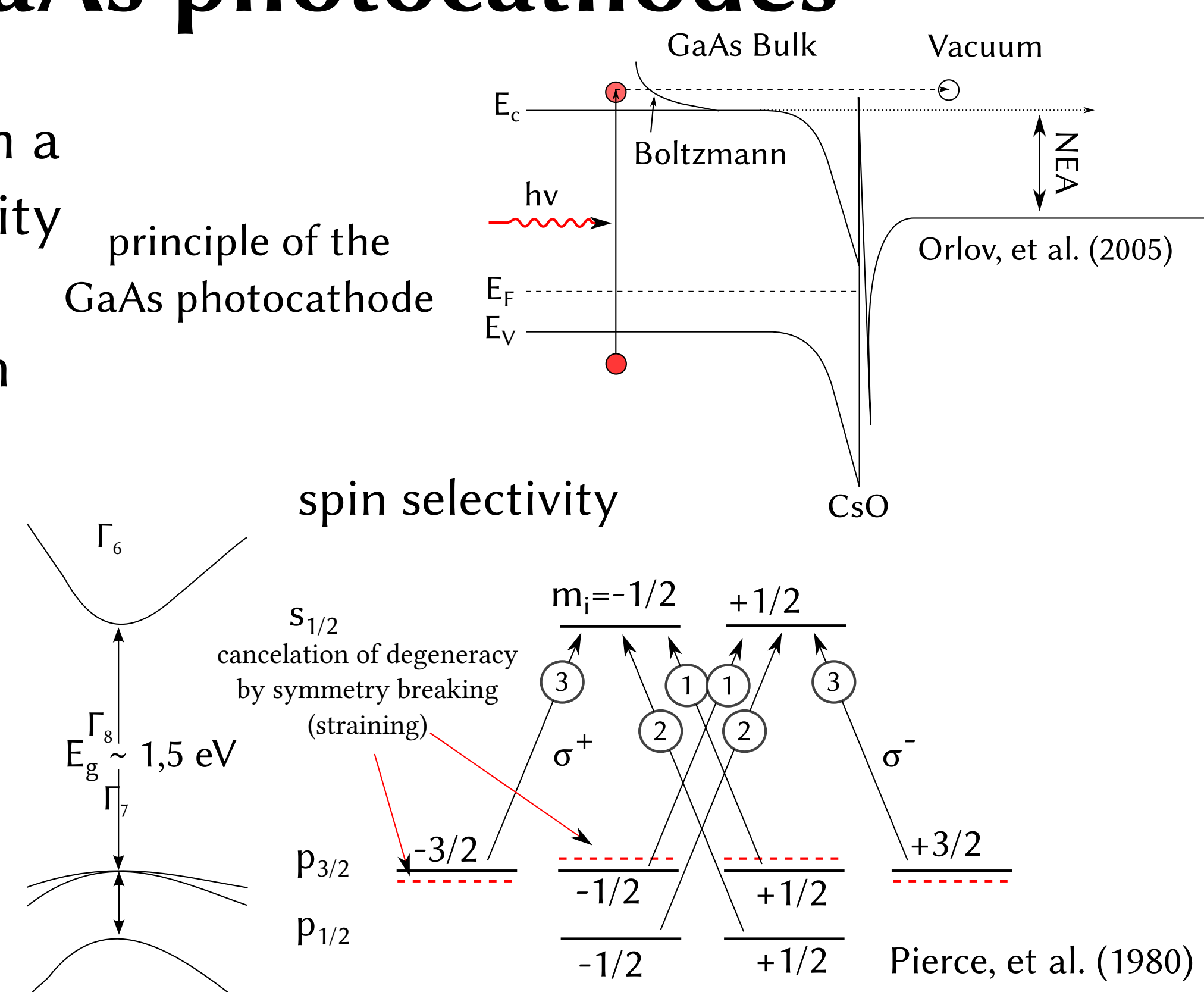
### Polarized e<sup>-</sup> from GaAs photocathodes

- irradiate GaAs cathodes prepared in a state of negative with electron affinity with  $\sigma^{+/-}$  light
- choose wavelength and polarization accordingly to the band gap
- Polarisation

$$P = \frac{P_+ - P_-}{P_+ + P_-} \leq 50\%$$

(GaAs bulk)

- Straining yields  $P > 85\%$  at quantum efficiency  $\sim 1\%$



### References

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### Acknowledgements

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