



การวัดและปรับปรุงคุณสมบัติของ electron beam และการประยุกต์ใช้ electron gun สำหรับการทดลองทางชีววิทยา

น.ส.พิชญากัศ กิติศรี และ ผศ.ดร.สาคร ริมแจ่ม

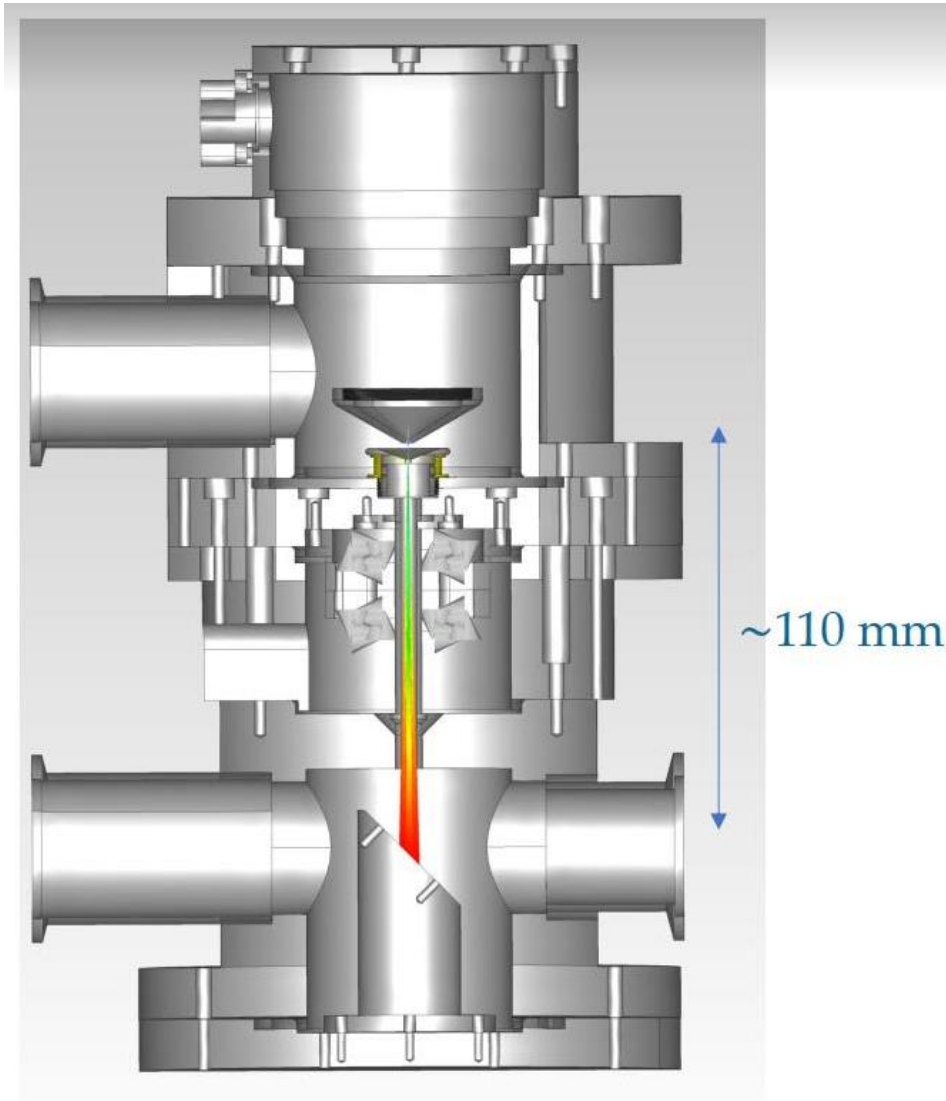
ห้องปฏิบัติการวิจัยเครื่องเร่งอิเล็กตรอนเชิงเส้น

ภาควิชาฟิสิกส์และวัสดุศาสตร์ คณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่



- Beam Dynamic Simulation
- Beam Measurements
 - Beam transverse profile
 - Beam current
- Beam Property Comparison
- DNA Project
- Out Look

Model V1



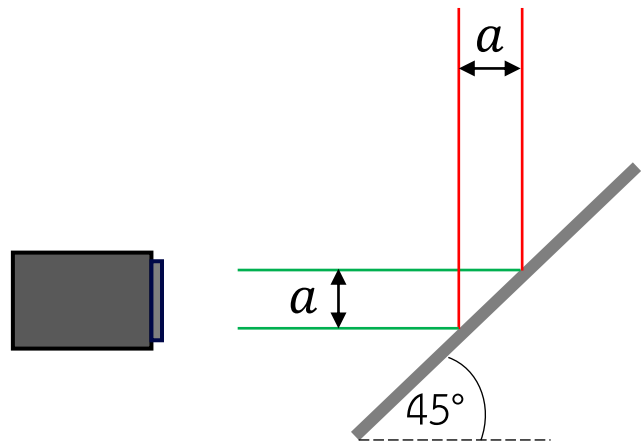
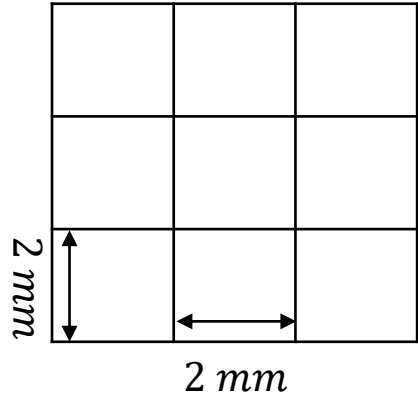
Electron beam properties from simulation.

Parameter	Value
Beam energy	20 keV
Electron current (at screen)	2.22 nA
Beam diameter (at screen)	6.24 mm

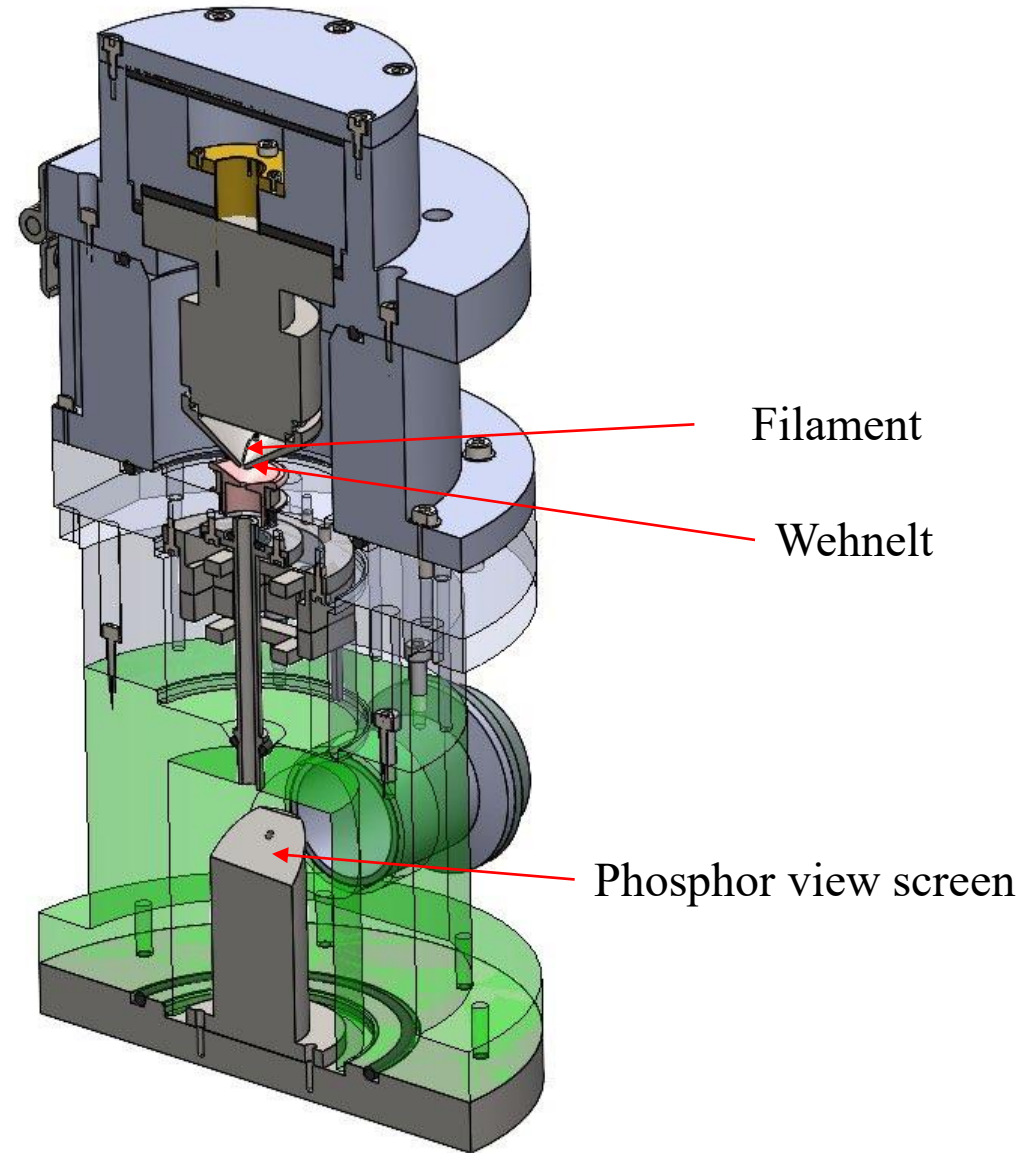
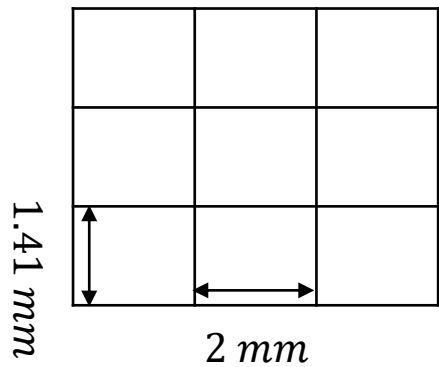
by E. Kongmon and S. Sukara

3D model with electron beam dynamic from CST studio suite.

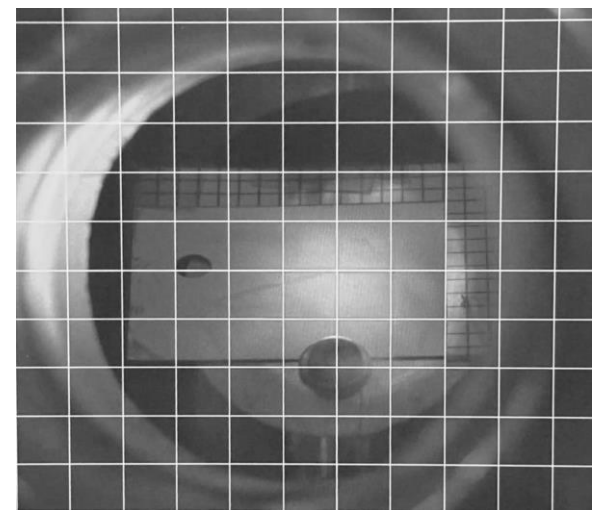
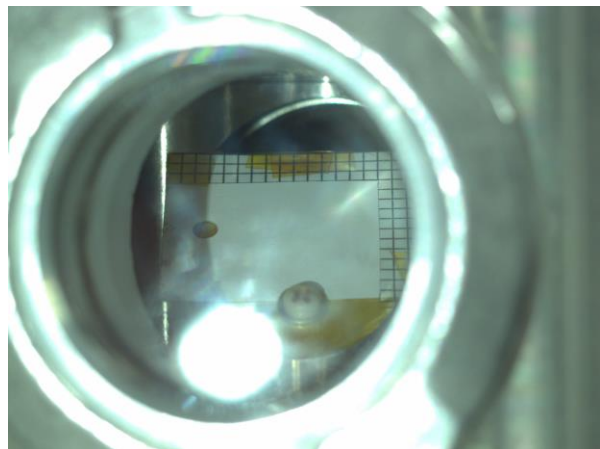
❖ Actual grid sizes



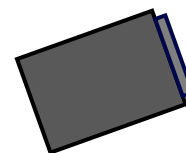
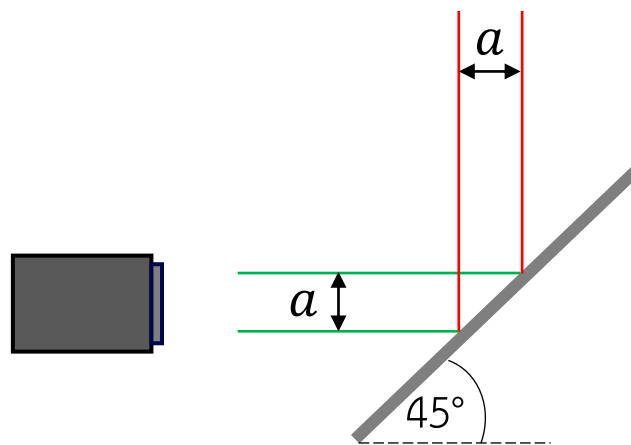
❖ Grid sizes on camera



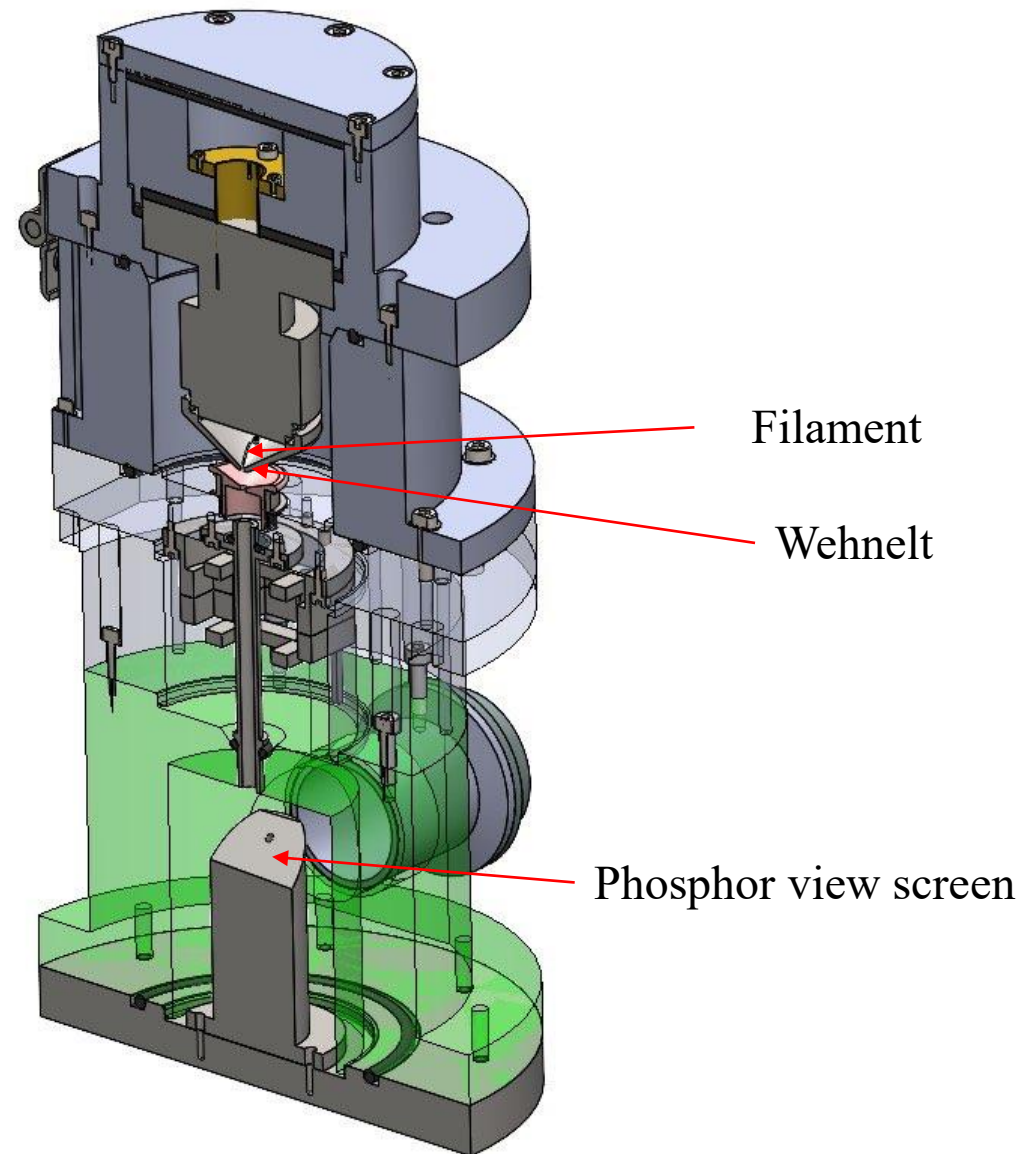
CCD Camera



Monitor screen

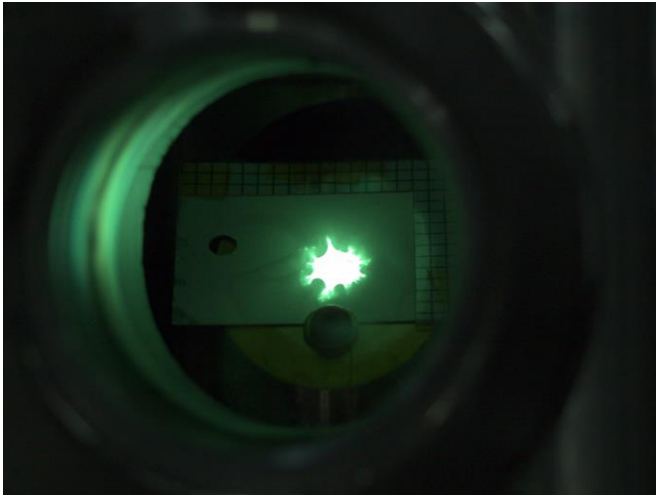


CCD Camera

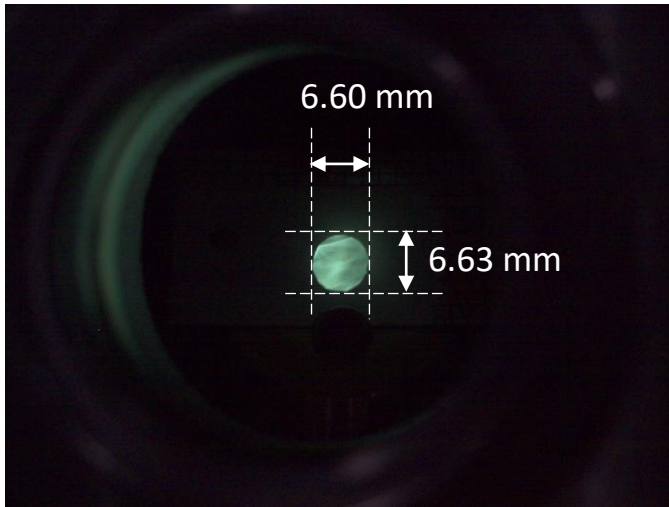




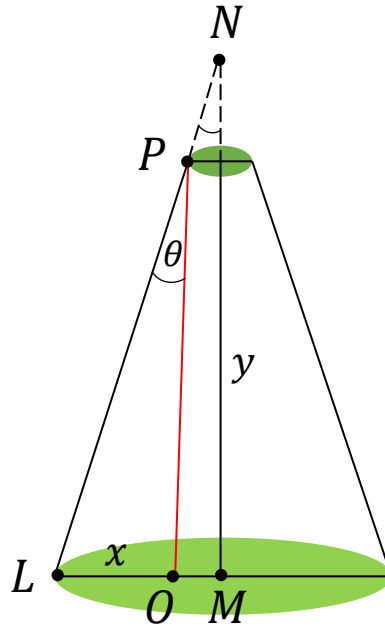
❖ Before tube cleaning



❖ After tube cleaning

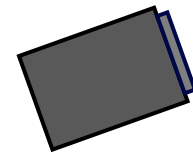


Beam divergence

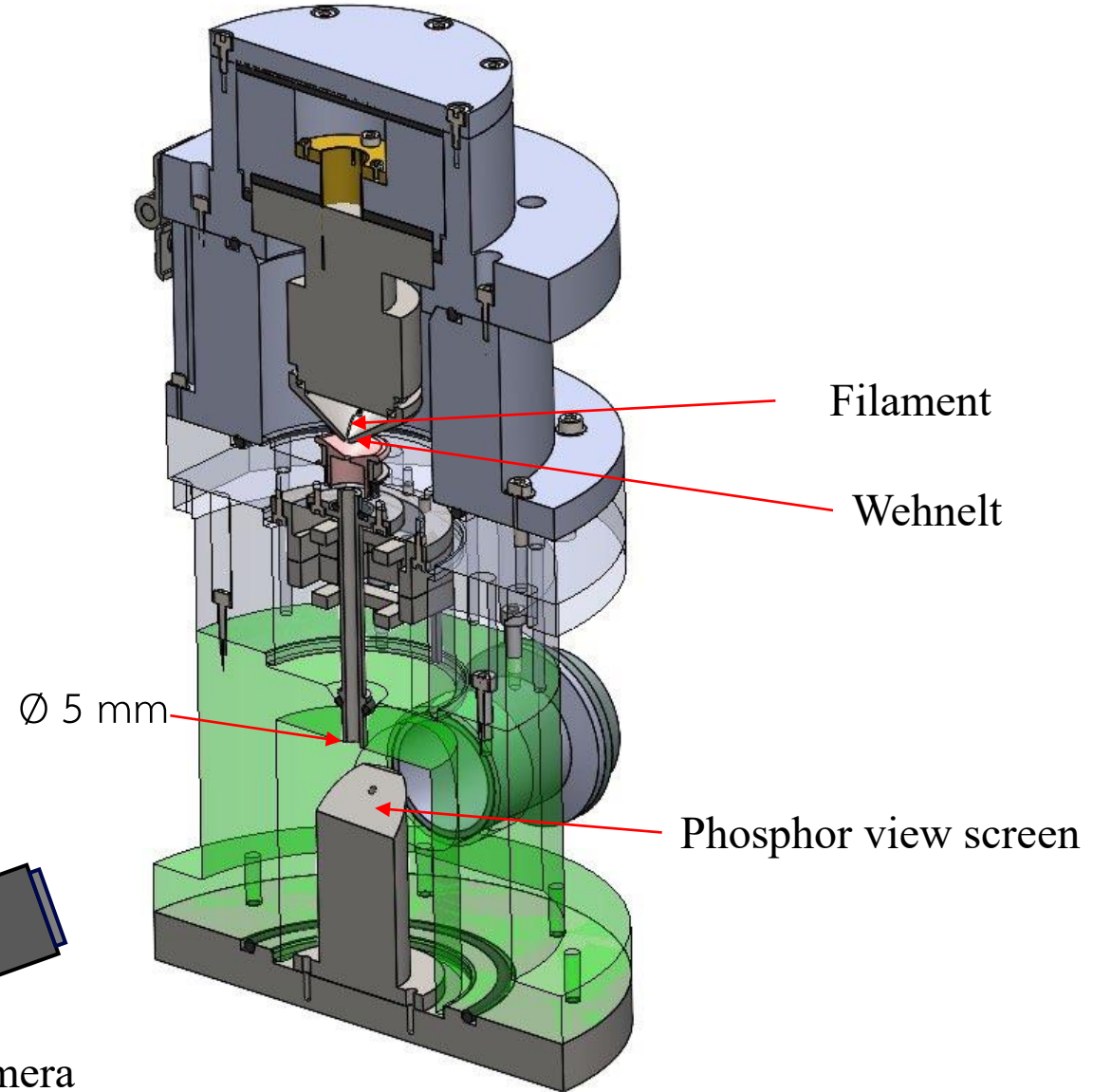


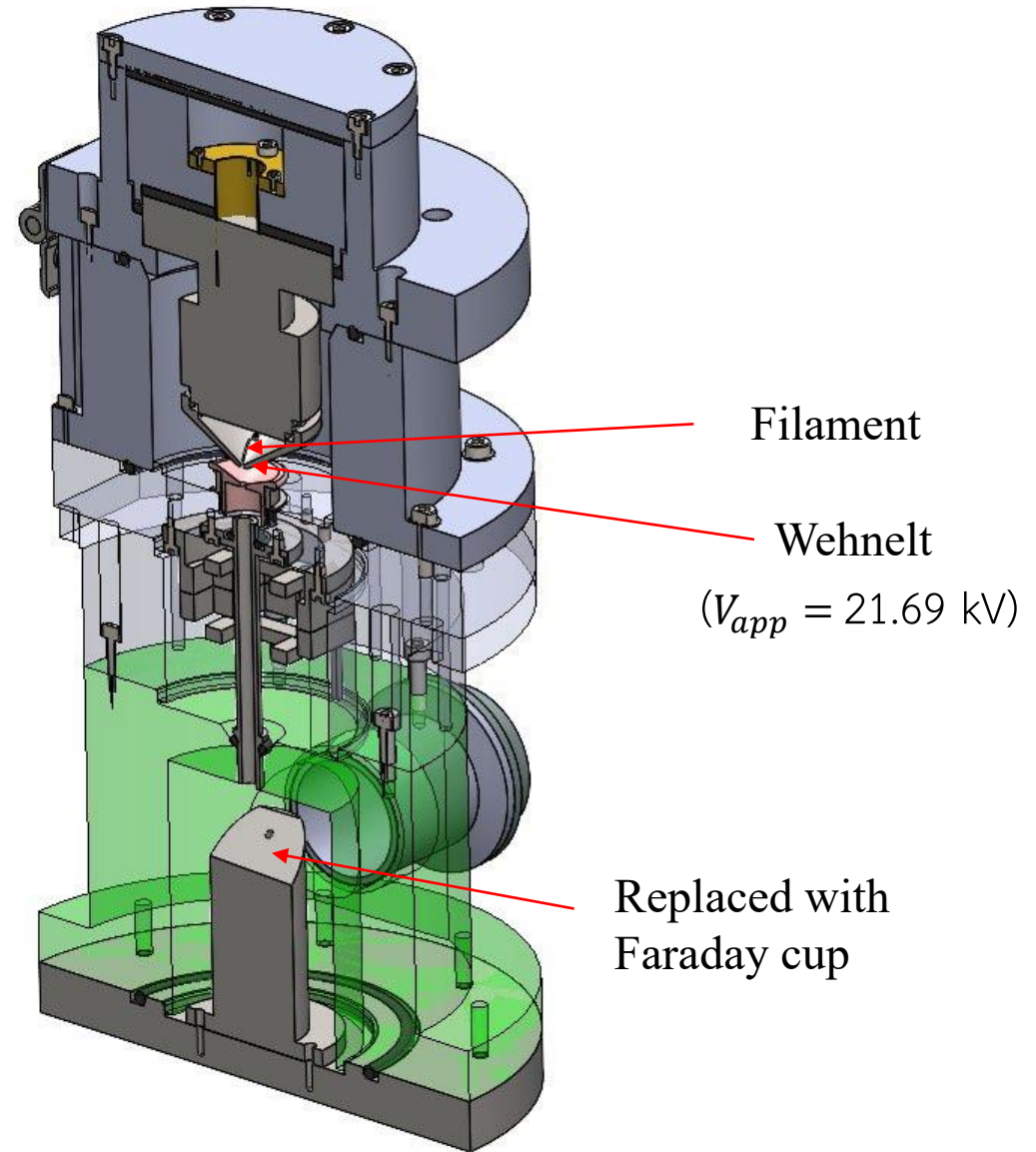
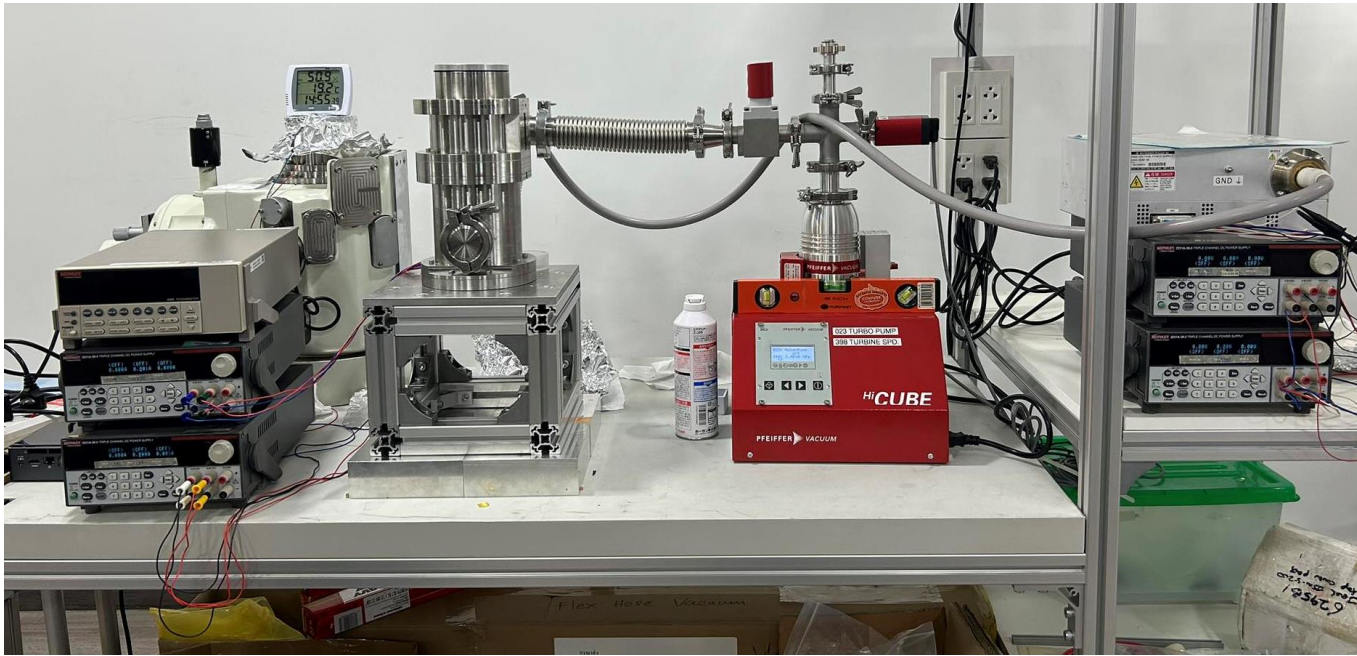
$$\theta = \tan^{-1} \left(\frac{x}{y} \right)$$

$$\theta = 1.87^\circ$$

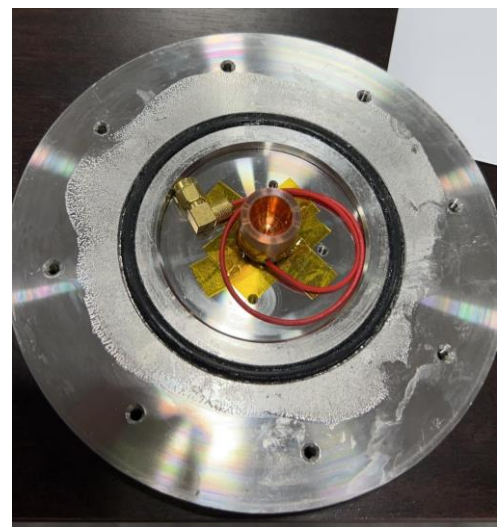


CCD Camera





❖ Faraday cup
Copper material
Ø 12 mm

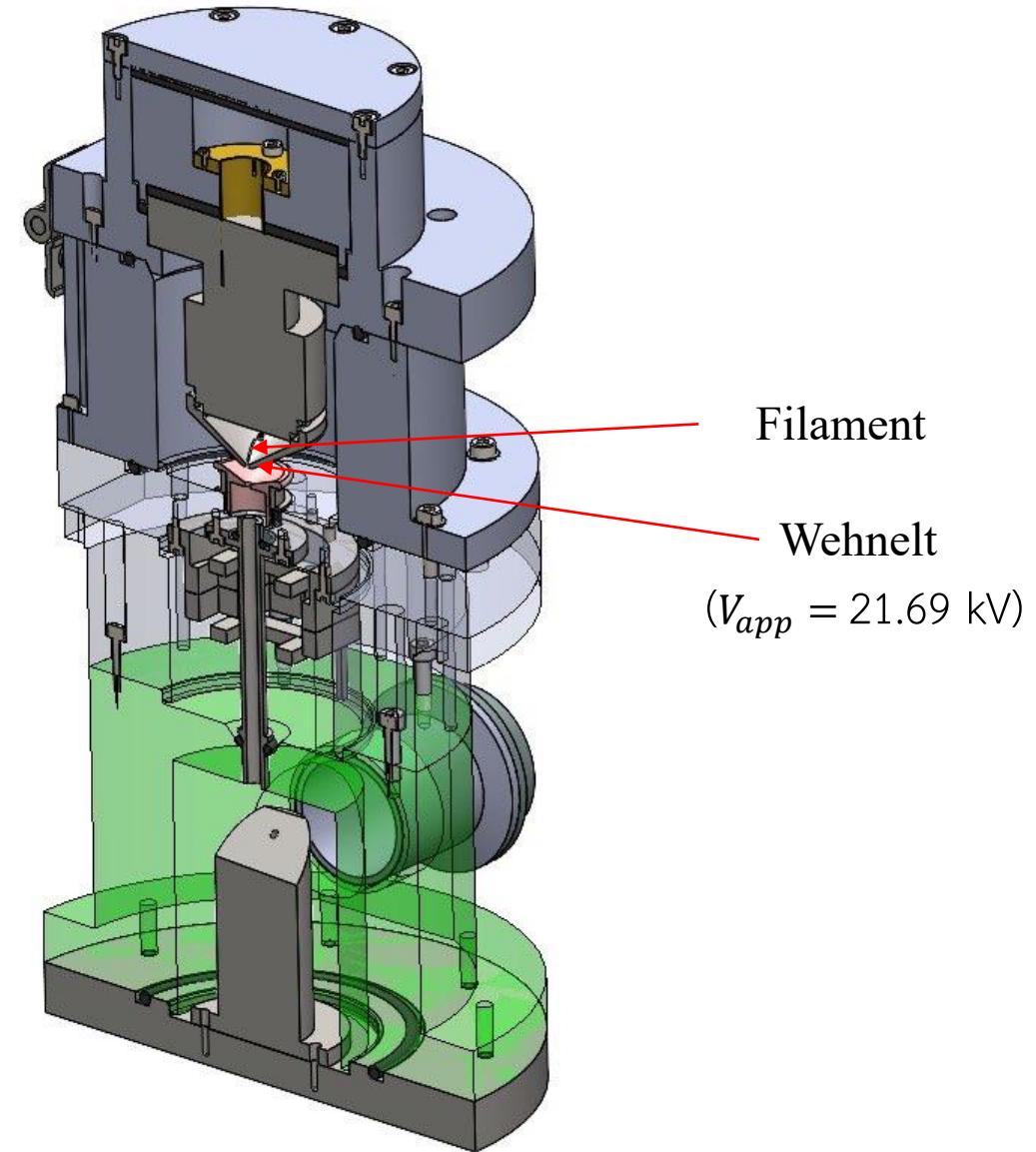


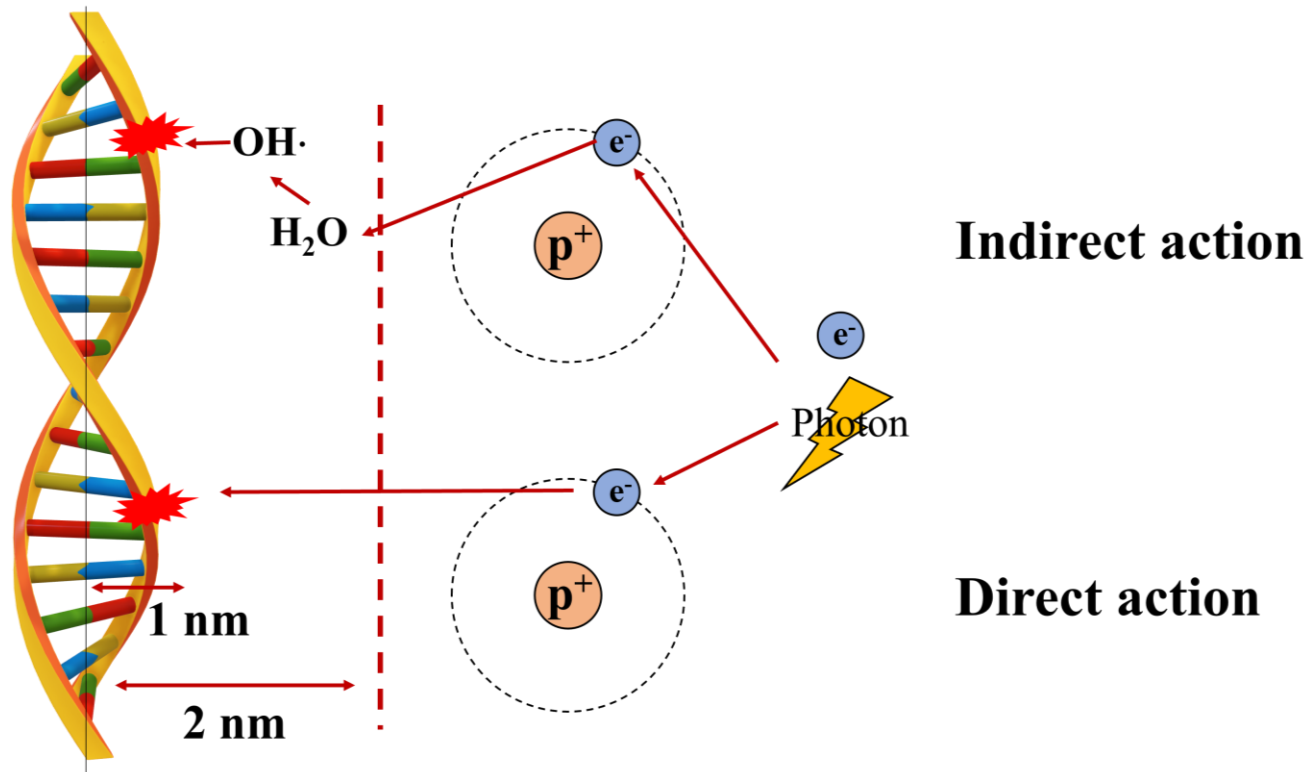
Beam current: $111.560 \pm 0.102 \text{ nA}$

Experiment date: 17/08/2023

❖ Comparison of electron beam properties.

Parameter	Simulation	Measurement
Beam energy	20 keV	21.69 keV (estimated from V_{app})
Electron current (at screen)	2.22 nA	111.560 ± 0.102 nA
Beam diameter (at screen)	6.24 mm	x-axis: 6.60 mm y-axis: 6.63 mm

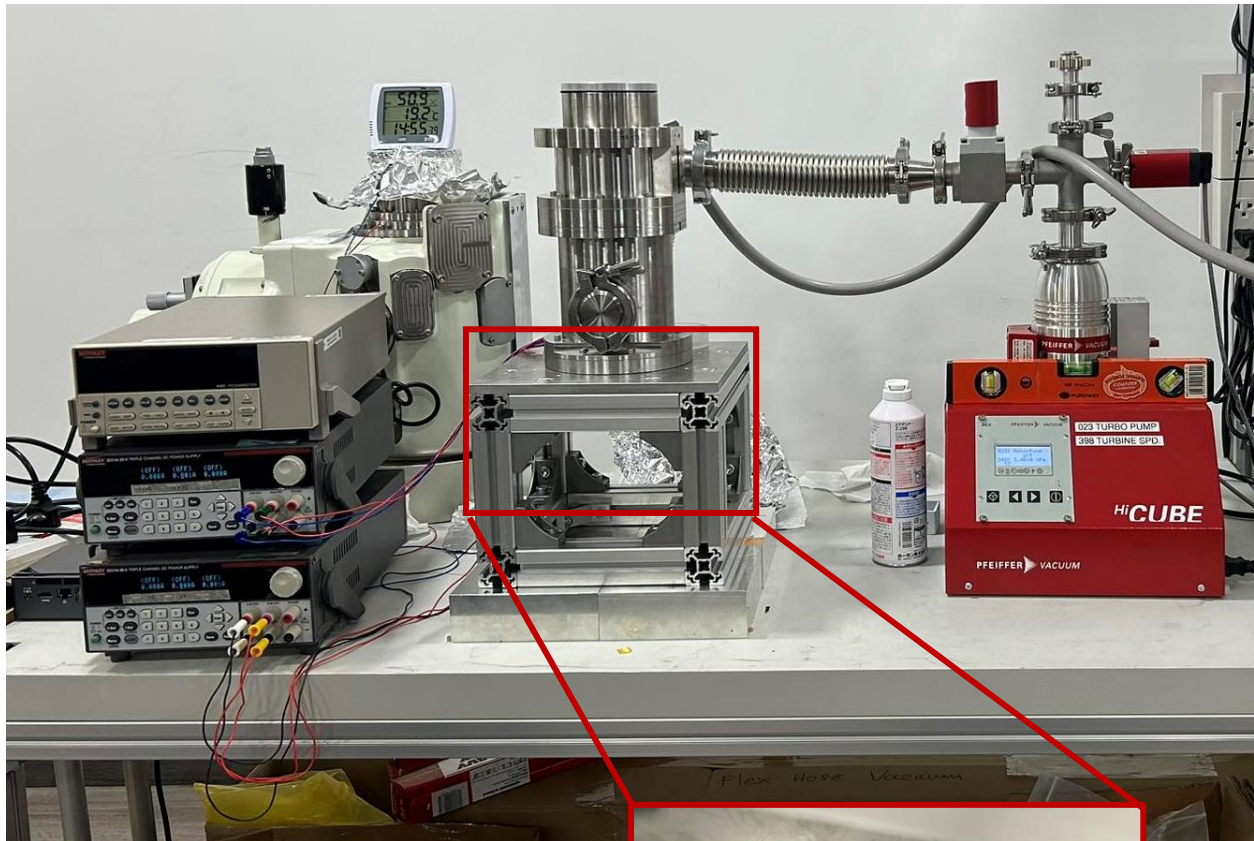




- There are two actions on DNA after receiving the radiation, which are direct and indirect actions.
- In this study, we would like to investigate the effect of LEE (keV energy) on DNA (considered the direct action).

by P. Apiwattanakul

After LEE irradiation, DNA were tested with biological technique and FTIR spectrometer.

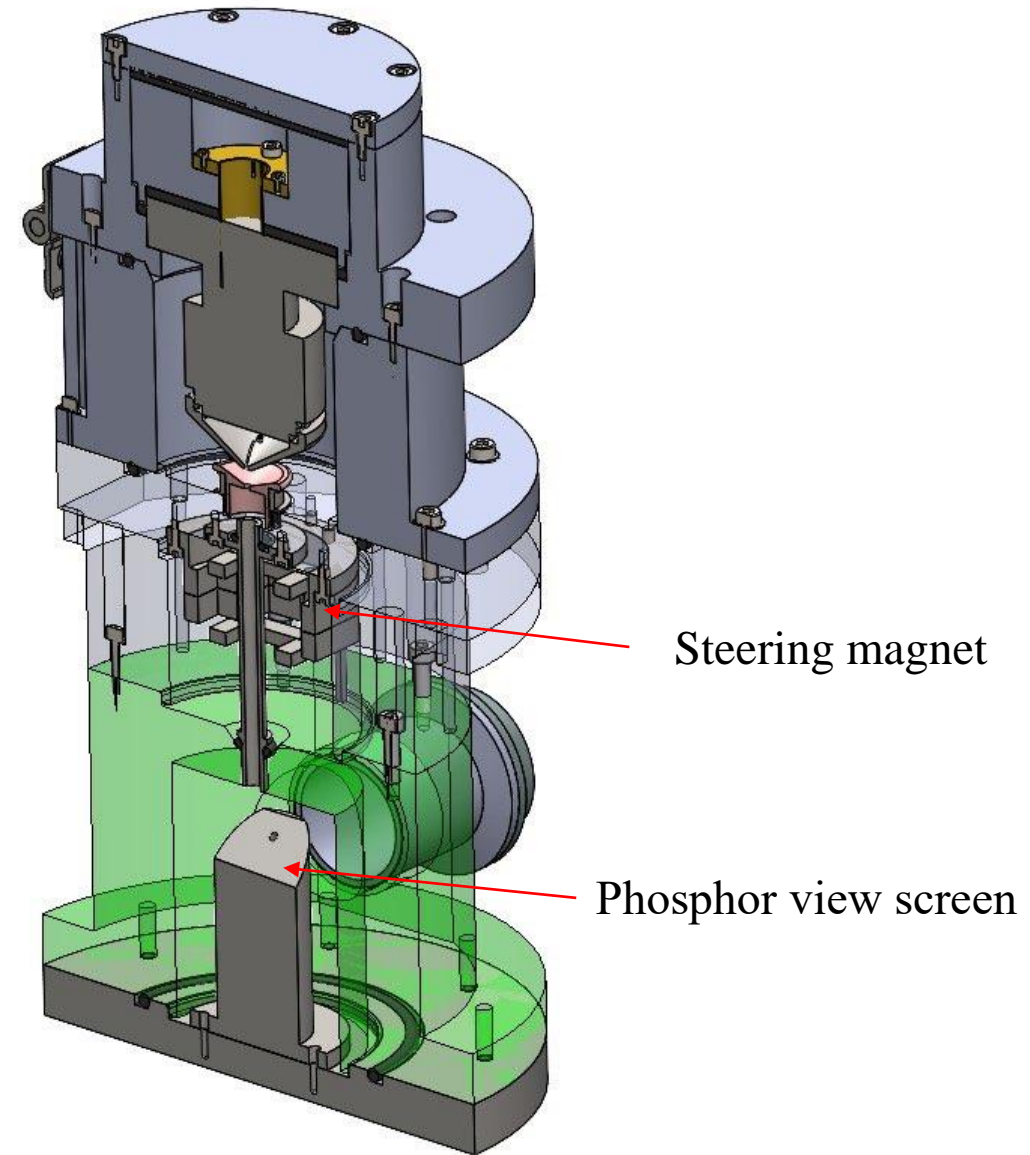


Sample holder was placed at the electron gun exit.



Experiment date: 21-29/08/2023

- Measure the electron beam energy by using a steering magnet and a phosphor view screen.
- Operate electron beam with different cathode temperatures (applied voltages) and measure the beam properties and limitations.
- Simulate and measure the beam properties of the current model (Model V2).



THANK YOU
for your attention



inkohereige