

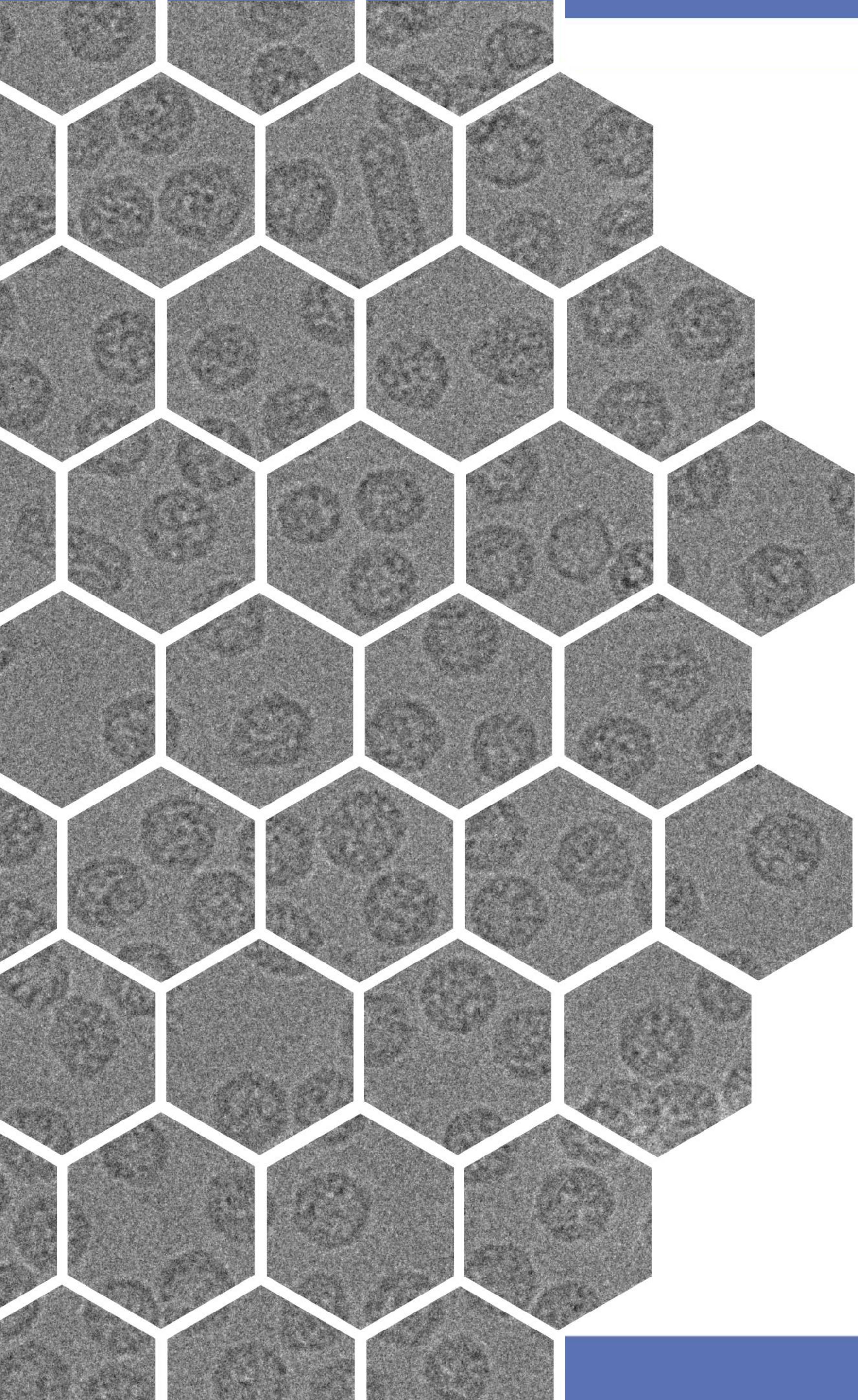
2026 Spring cryoEM course

Welcome and Anatomy of an EM

January 22, 2026



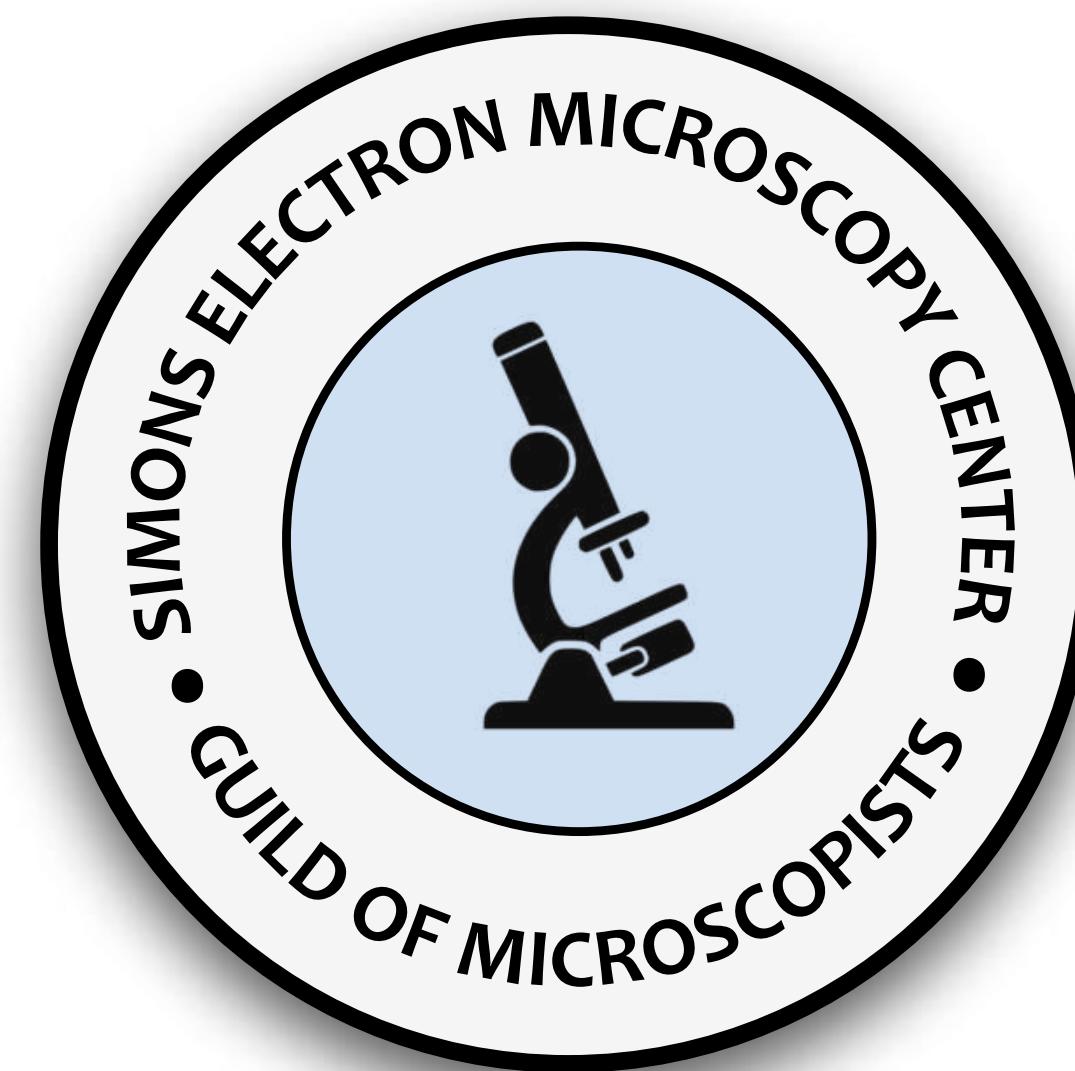
NYSBC SEMC
1



- Course outline
- Student survey
- Anatomy of an EM

Welcome to SEMC

21st year of the course



Course logistics: main website

<https://semc.nysbc.org/workshops/2026-em-course/>



- ◆ Course Administrator:
 - ◆ Ed Eng (eeng@nysbc.org)

- ◆ Teaching Assistants:
 - ◆ Mahira Aragon (NYSBC)
 - ◆ Ricky Pegeuro (NYSBC)
 - ◆ and others

Course logistics: Slack channel

Make sure you're on the email list!

Class Slack channel

#semc-2026-cryoem-course

- ◆ Course Administrator:
 - ◆ Ed Eng (eeng@nysbc.org)

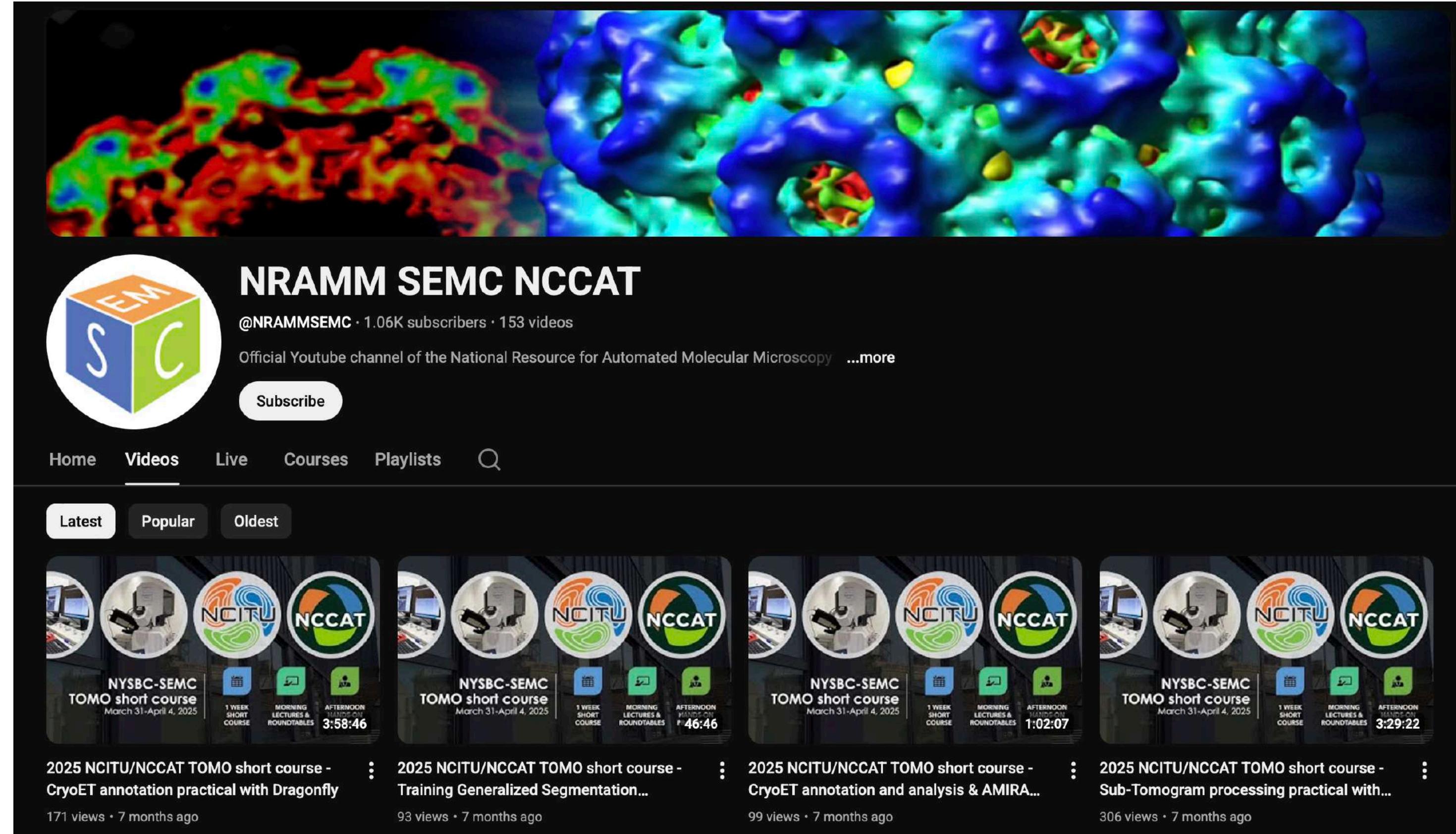
https://join.slack.com/t/nccatworkshops/shared_invite/zt-1aayp8pok-sgO3cB9oeifBfrI6lsTTyw

- ◆ Teaching Assistants:
 - ◆ Mahira Aragon (NYSBC)
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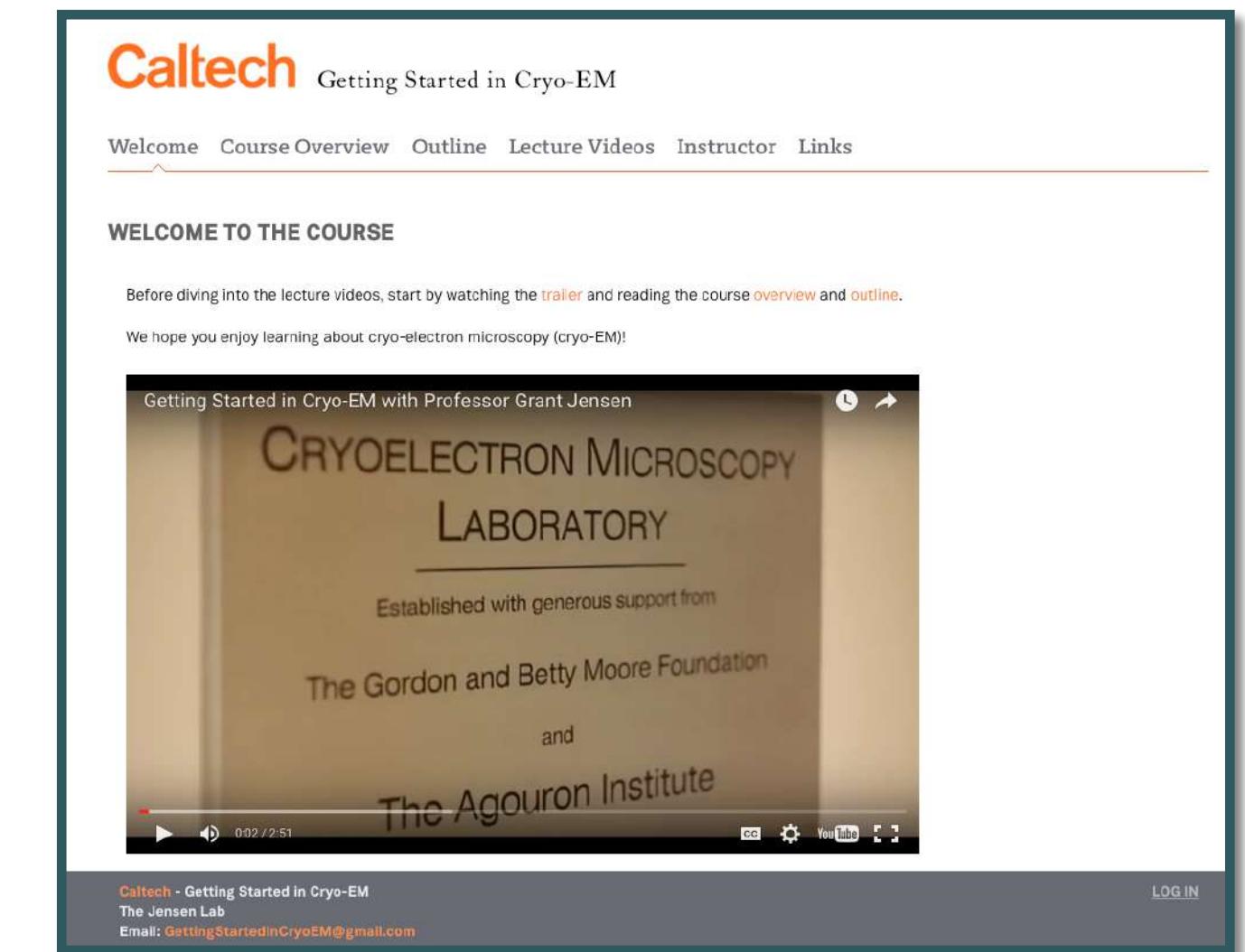


Course logistics: additional resources

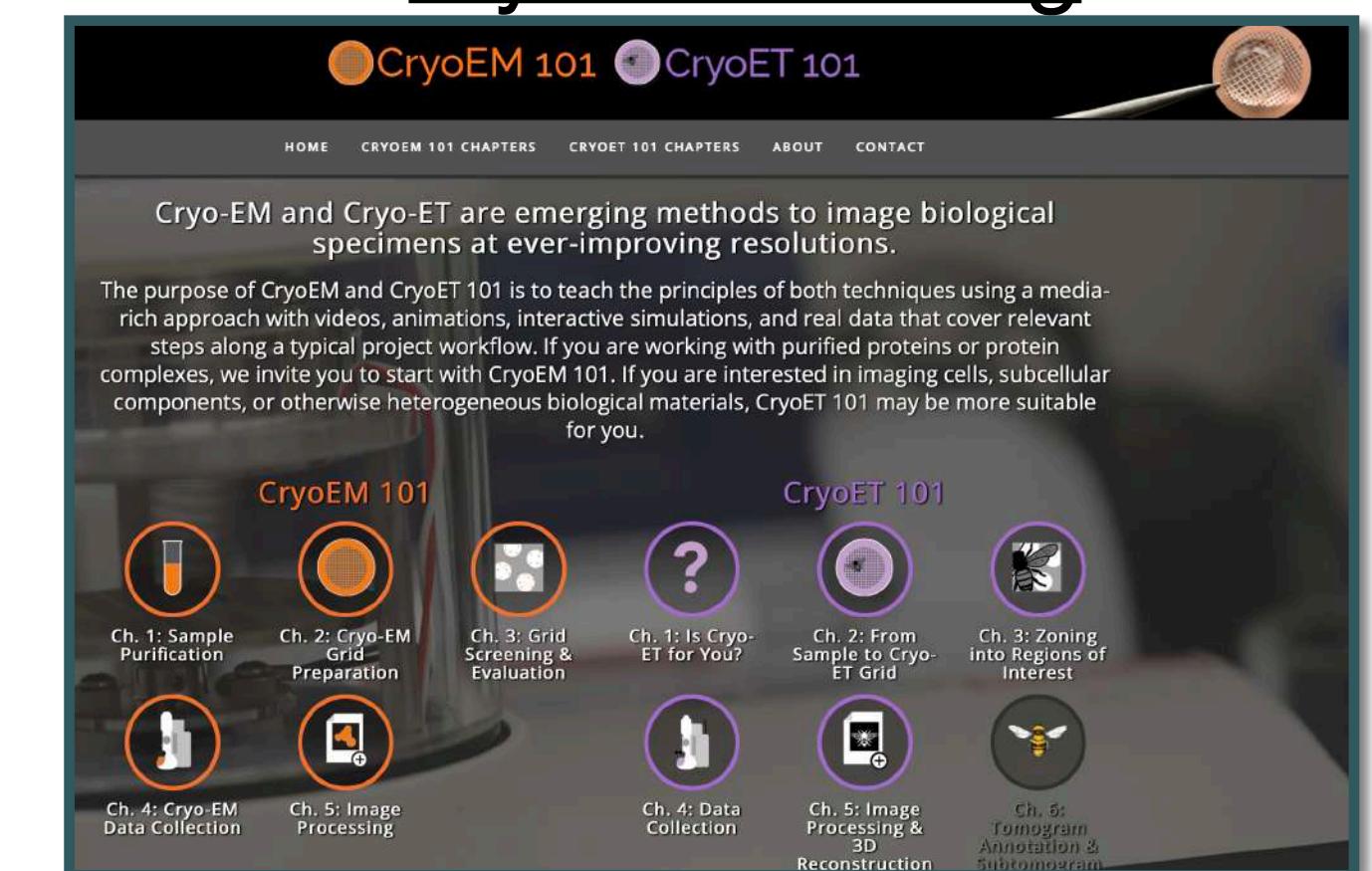
[youtube.com/nrammsemc](https://www.youtube.com/nrammsemc)



cryo-em-course.caltech.edu/videos



cryoem101.org



Course logistics: main topics

Section 1 : EM fundamentals

Section 2 : EM crystallography

Section 3 : Tomography

Section 4 : Single Particle Analysis Short Course
March 16-20

Section 5 : Future perspectives



Course logistics: main topics

Sect

Sect

Sect

Sect

Sect



- ⌚ 1 week.
- 👤 Morning lectures.
- 🧪 Afternoon practicals.
- 📅 March 16-20, 2026.
- 💵 *students/postdocs \$375. staff/PIs/professionals \$450. industry \$625.*
- 🏡 Room/Accomodations NOT included.

[JOIN THE WAITLIST.](#)

Standard applications will close December 15, 2025. Late applications will be considered up to January 2, 2026.

Accepted applicants will be notified early January 2026.

For more information email [nccatuseroffice \[at\] nysbc.org](mailto:nccatuseroffice [at] nysbc.org)

Single Particle Short Course March 16-20, 2026

NCCAT will offer a 1 week workshop focused on the theory and practice of single-particle analysis. The mornings are filled with lectures and stimulating round table discussions. The afternoons provide hands-on practicals to reinforce fundamental concepts and topics covered earlier in the day.

Short-course Agenda

Monday, March 16, 2026

Session	Type	Lecturer	Topic
Morning	Lecture 1 – Keynote	Joachim Frank (Columbia University)	Intro and overview of SPA
Morning	Roundtable 1	students	Flashtalks from students
Afternoon	Lecture 2	SEMC staff	Sample preparation for biological samples
Afternoon	Practical 1	SEMC staff	cryoEM sample prep and grid prep stations

Tuesday, March 17, 2026

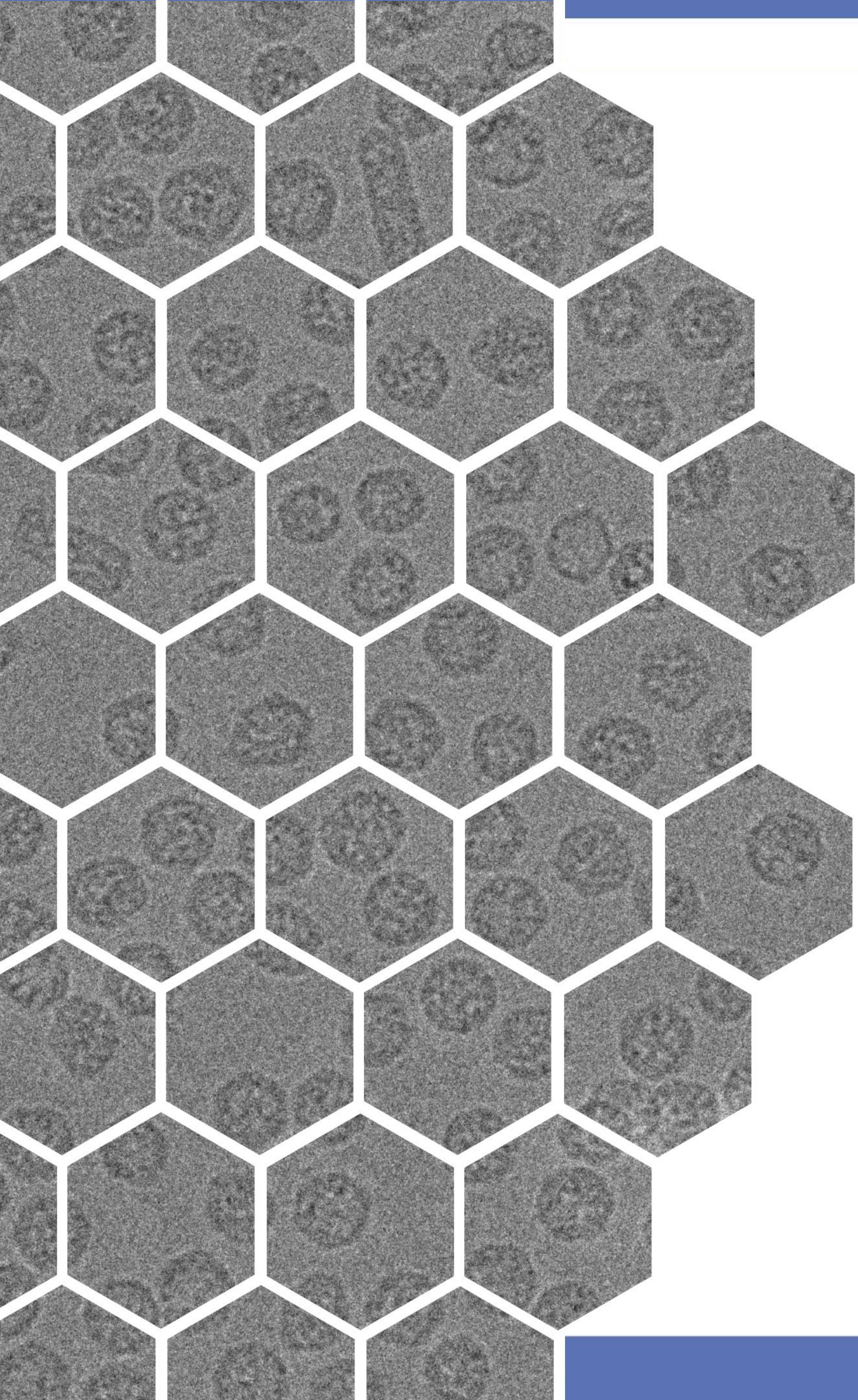
Session	Type	Lecturer	Topic
Morning	Lecture 3a	SEMC staff	Microscopes and tools of the trade
Morning	Lecture 3b	SEMC staff	Maintenance of cryoEM facilities



Course logistics: class for credit

Component	Percentage
Recitation/Participation - JC/HW/questions	50%
Practicals	$10\% \times 3$
Attendance	20%





- Course outline
- Student survey
- Anatomy of an EM



Illustration by David S. Goodsell
RCSB Protein Data Bank.

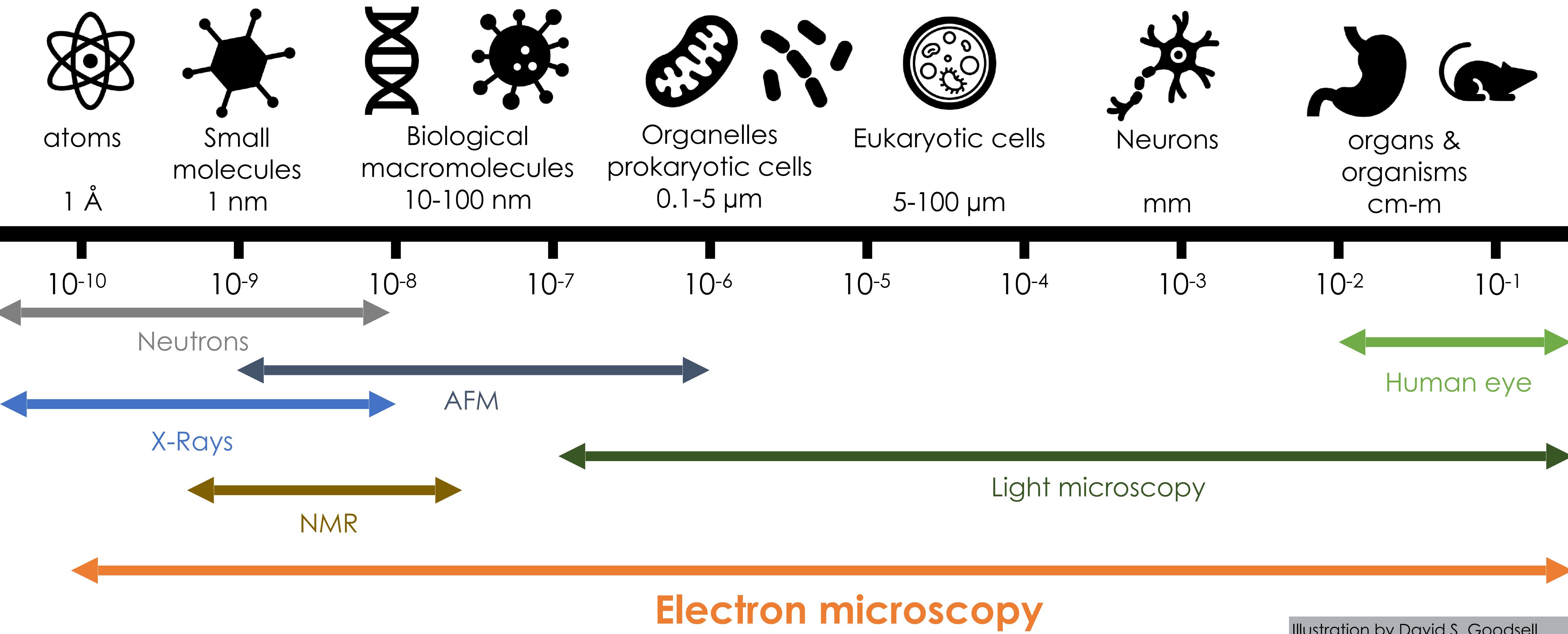
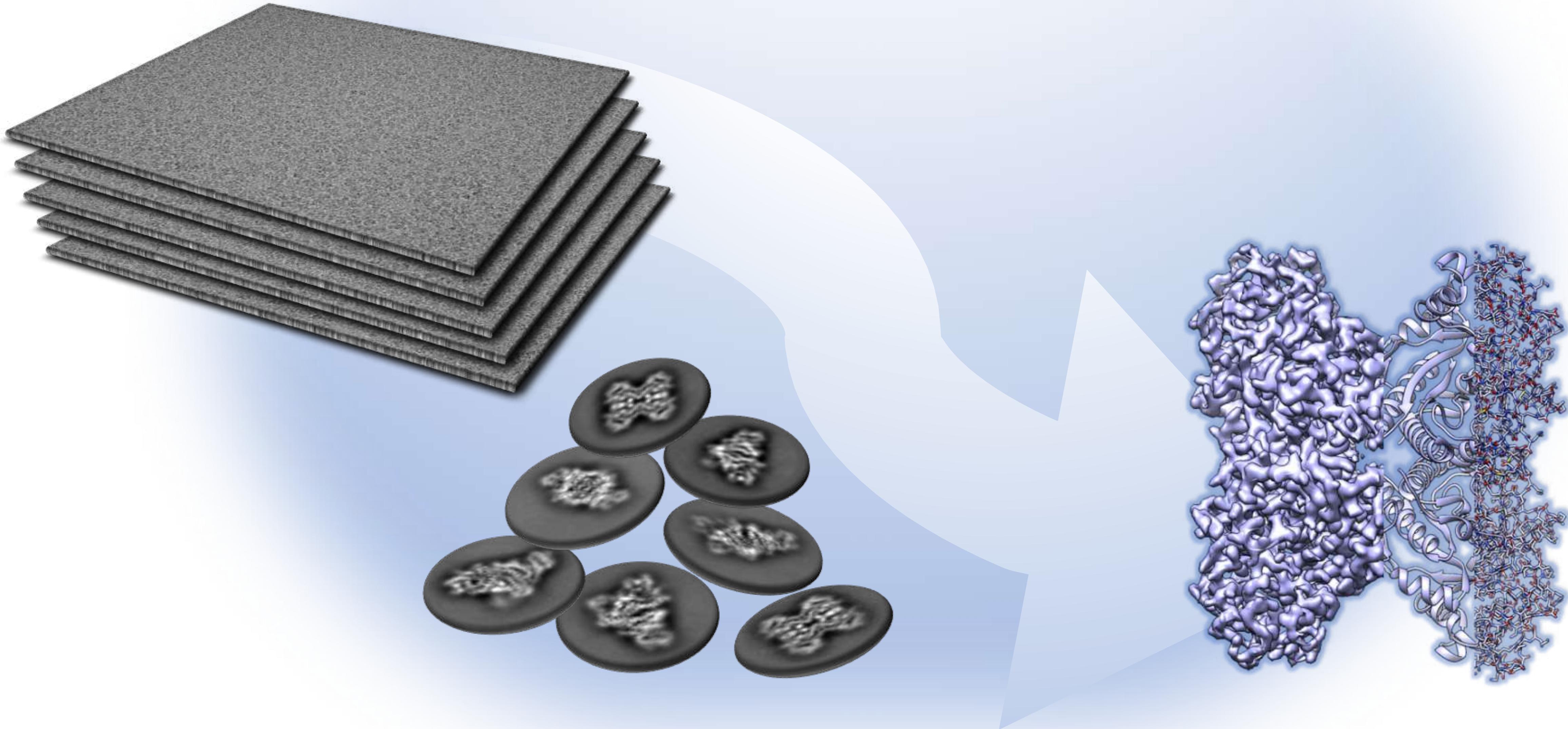


Illustration by David S. Goodsell
RCSB Protein Data Bank.

What is possible today?



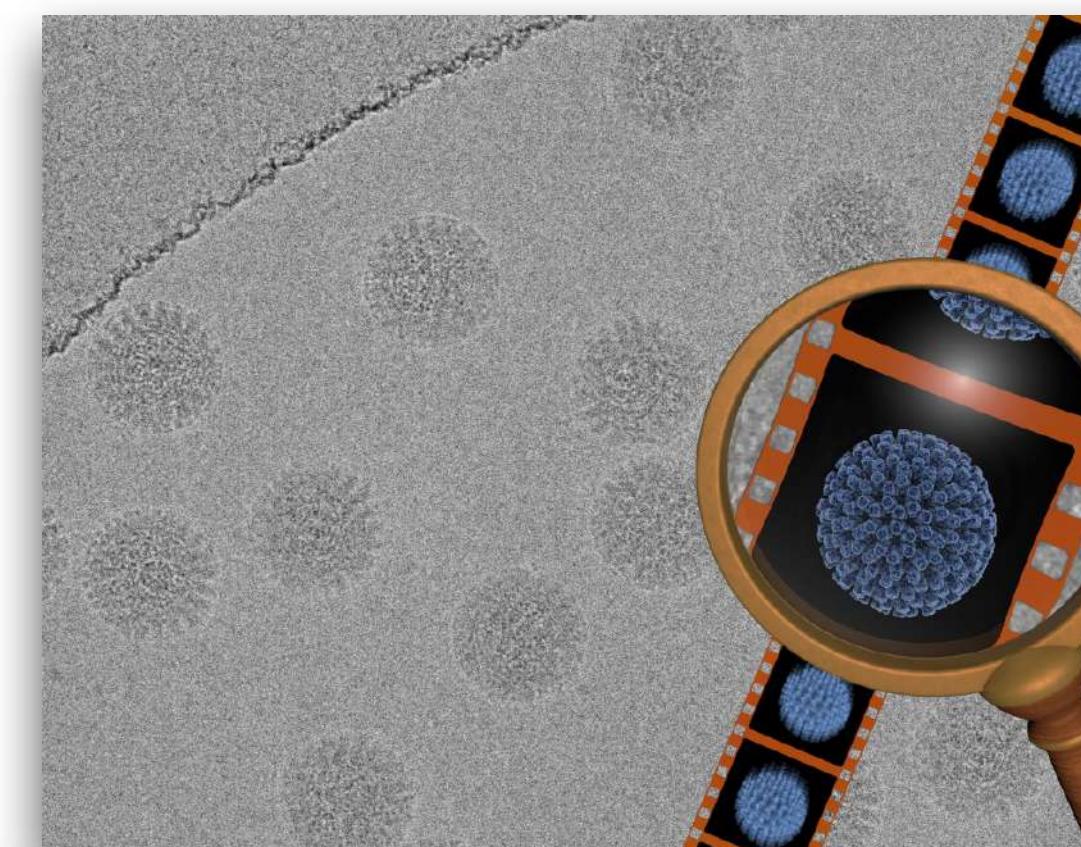
What brought about the resolution revolution?

(~2012-2014)

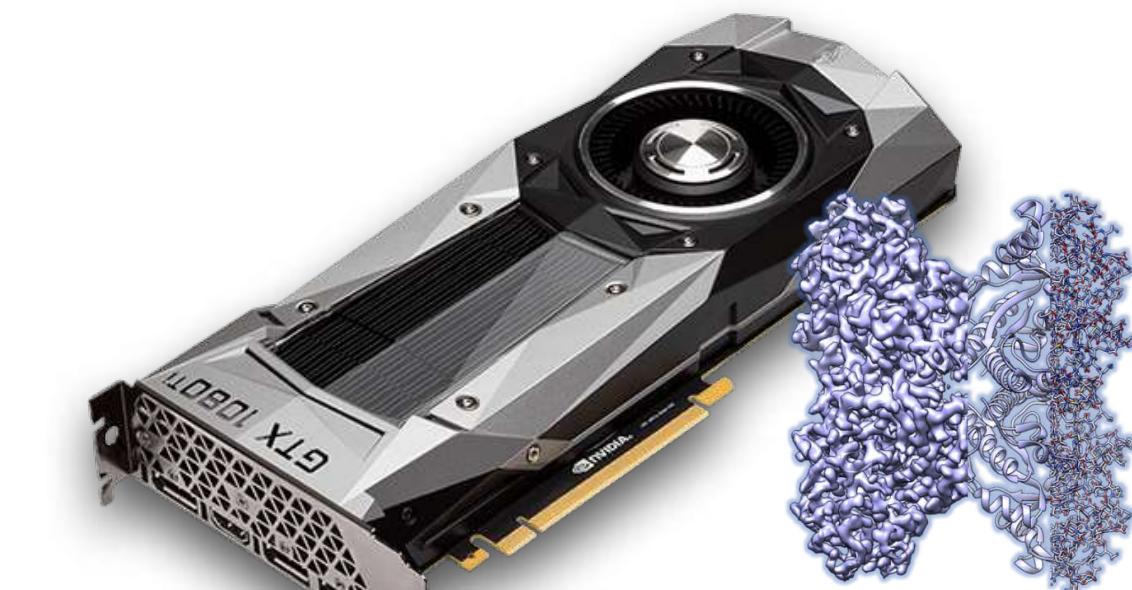
Hardware



Microscopes

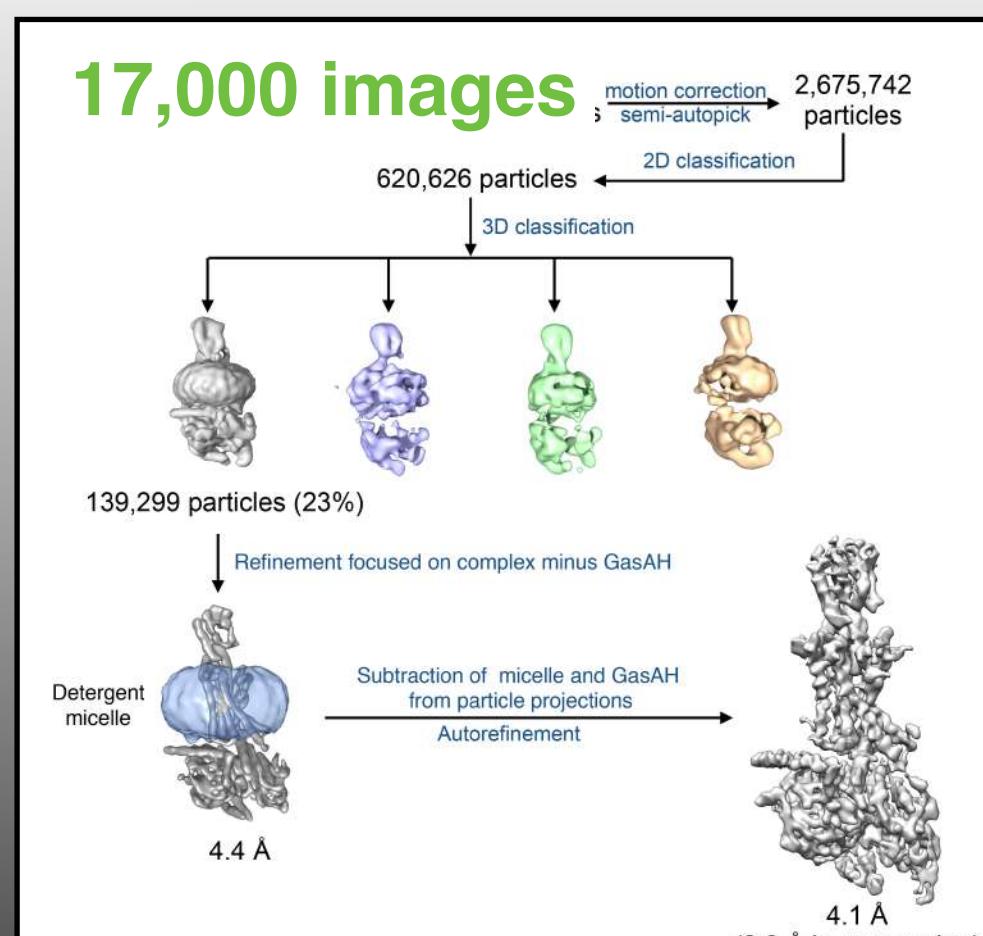


Direct Detectors



2012->2017
Cost reduced by 100x

Software

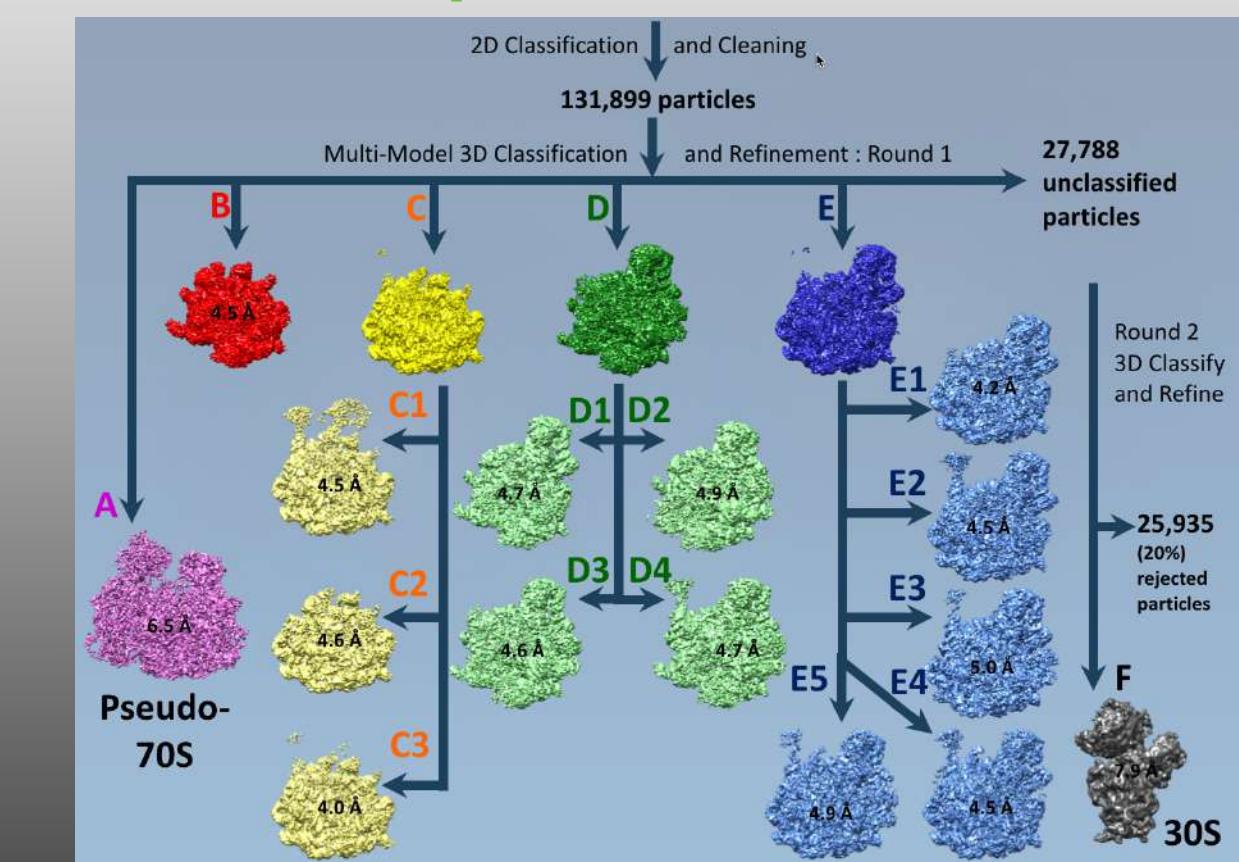


Leginon / SerialEM / EPU, ...

MotionCorr2, Unblur, ...

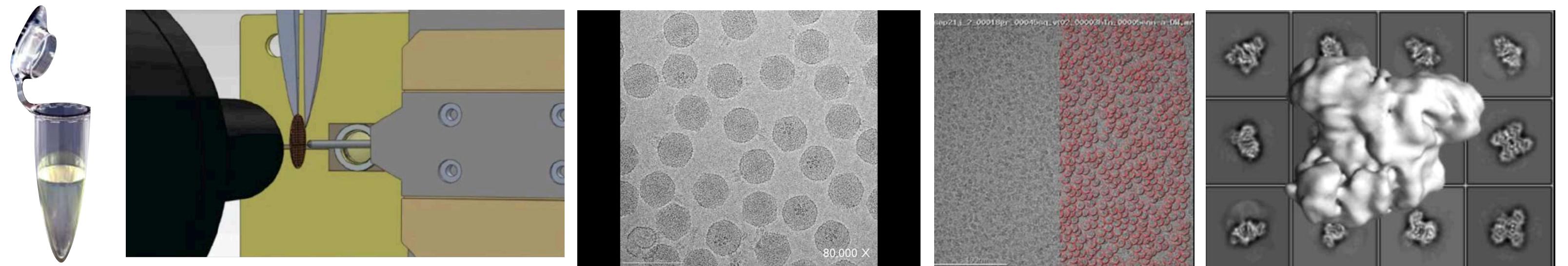
RELION, FREALIGN/cisTEM, cryoSPARC
EMAN, Sparx, SPHIRE, XMIPP, ...

14 independent structures

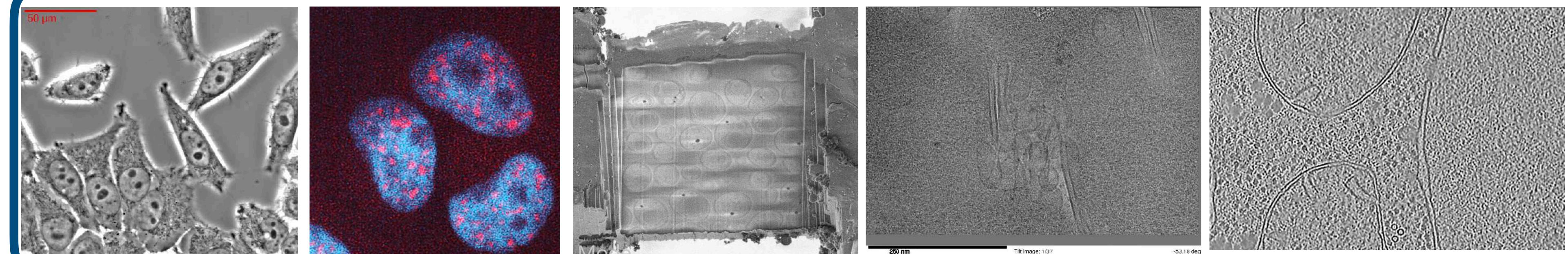


cryoEM: a technology on the rise

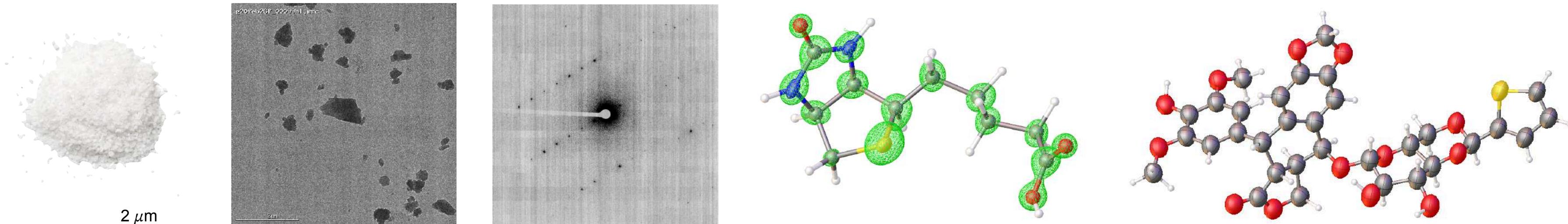
Single particle cryoEM



Cryo Electron Tomography (cryoET)



Micro crystal electron diffraction (microED)



The tool of our trade: EM

Ruska and Knoll in Berlin in the early 1930s

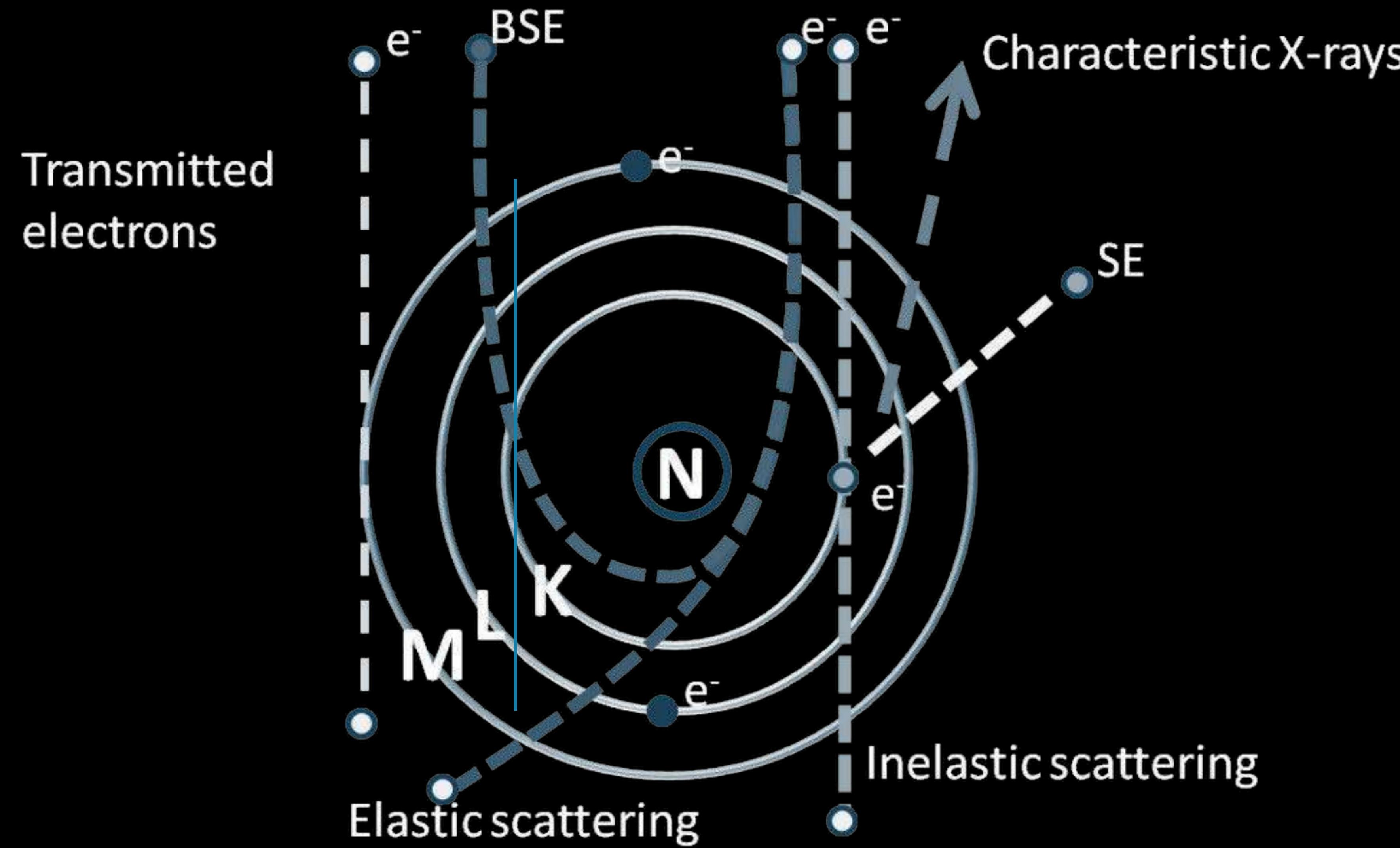
-Wikipedia

The Nobel Prize   @NobelPrize

Take a look at a sketch by physics laureate Ernst Ruska, dated 9 March 1931, of the cathode ray tube for testing one-stage and two-stage electron-optical imaging by means of two magnetic electron lenses (electron microscope). Ruska was awarded the 1986 physics prize for his work.

<img alt="A detailed technical sketch of an electron microscope cathode ray tube. The drawing shows a vertical assembly of various components, including lenses, a filament, and a cathode. Various dimensions are labeled in millimeters (e.g., 125, 132, 135, 137, 142, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190, 195, 200, 205, 210, 215, 220, 225, 230, 235, 240, 245, 250, 255, 260, 265, 270, 275, 280, 285, 290, 295, 300, 305, 310, 315, 320, 325, 330, 335, 340, 345, 350, 355, 360, 365, 370, 375, 380, 385, 390, 395, 400, 405, 410, 415, 420, 425, 430, 435, 440, 445, 450, 455, 460, 465, 470, 475, 480, 485, 490, 495, 500, 505, 510, 515, 520, 525, 530, 535, 540, 545, 550, 555, 560, 565, 570, 575, 580, 585, 590, 595, 600, 605, 610, 615, 620, 625, 630, 635, 640, 645, 650, 655, 660, 665, 670, 675, 680, 685, 690, 695, 700, 705, 710, 715, 720, 725, 730, 735, 740, 745, 750, 755, 760, 765, 770, 775, 780, 785, 790, 795, 800, 805, 810, 815, 820, 825, 830, 835, 840, 845, 850, 855, 860, 865, 870, 875, 880, 885, 890, 895, 900, 905, 910, 915, 920, 925, 930, 935, 940, 945, 950, 955, 960, 965, 970, 975, 980, 985, 990, 995, 1000, 1005, 1010, 1015, 1020, 1025, 1030, 1035, 1040, 1045, 1050, 1055, 1060, 1065, 1070, 1075, 1080, 1085, 1090, 1095, 1100, 1105, 1110, 1115, 1120, 1125, 1130, 1135, 1140, 1145, 1150, 1155, 1160, 1165, 1170, 1175, 1180, 1185, 1190, 1195, 1200, 1205, 1210, 1215, 1220, 1225, 1230, 1235, 1240, 1245, 1250, 1255, 1260, 1265, 1270, 1275, 1280, 1285, 1290, 1295, 1300, 1305, 1310, 1315, 1320, 1325, 1330, 1335, 1340, 1345, 1350, 1355, 1360, 1365, 1370, 1375, 1380, 1385, 1390, 1395, 1400, 1405, 1410, 1415, 1420, 1425, 1430, 1435, 1440, 1445, 1450, 1455, 1460, 1465, 1470, 1475, 1480, 1485, 1490, 1495, 1500, 1505, 1510, 1515, 1520, 1525, 1530, 1535, 1540, 1545, 1550, 1555, 1560, 1565, 1570, 1575, 1580, 1585, 1590, 1595, 1600, 1605, 1610, 1615, 1620, 1625, 1630, 1635, 1640, 1645, 1650, 1655, 1660, 1665, 1670, 1675, 1680, 1685, 1690, 1695, 1700, 1705, 1710, 1715, 1720, 1725, 1730, 1735, 1740, 1745, 1750, 1755, 1760, 1765, 1770, 1775, 1780, 1785, 1790, 1795, 1800, 1805, 1810, 1815, 1820, 1825, 1830, 1835, 1840, 1845, 1850, 1855, 1860, 1865, 1870, 1875, 1880, 1885, 1890, 1895, 1900, 1905, 1910, 1915, 1920, 1925, 1930, 1935, 1940, 1945, 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015, 2020, 2025, 2030, 2035, 2040, 2045, 2050, 2055, 2060, 2065, 2070, 2075, 2080, 2085, 2090, 2095, 2100, 2105, 2110, 2115, 2120, 2125, 2130, 2135, 2140, 2145, 2150, 2155, 2160, 2165, 2170, 2175, 2180, 2185, 2190, 2195, 2200, 2205, 2210, 2215, 2220, 2225, 2230, 2235, 2240, 2245, 2250, 2255, 2260, 2265, 2270, 2275, 2280, 2285, 2290, 2295, 2300, 2305, 2310, 2315, 2320, 2325, 2330, 2335, 2340, 2345, 2350, 2355, 2360, 2365, 2370, 2375, 2380, 2385, 2390, 2395, 2400, 2405, 2410, 2415, 2420, 2425, 2430, 2435, 2440, 2445, 2450, 2455, 2460, 2465, 2470, 2475, 2480, 2485, 2490, 2495, 2500, 2505, 2510, 2515, 2520, 2525, 2530, 2535, 2540, 2545, 2550, 2555, 2560, 2565, 2570, 2575, 2580, 2585, 2590, 2595, 2600, 2605, 2610, 2615, 2620, 2625, 2630, 2635, 2640, 2645, 2650, 2655, 2660, 2665, 2670, 2675, 2680, 2685, 2690, 2695, 2700, 2705, 2710, 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Why electrons?



● Main beam electrons

Why electrons?

Pros

Small wavelength

Can be focused

Cons

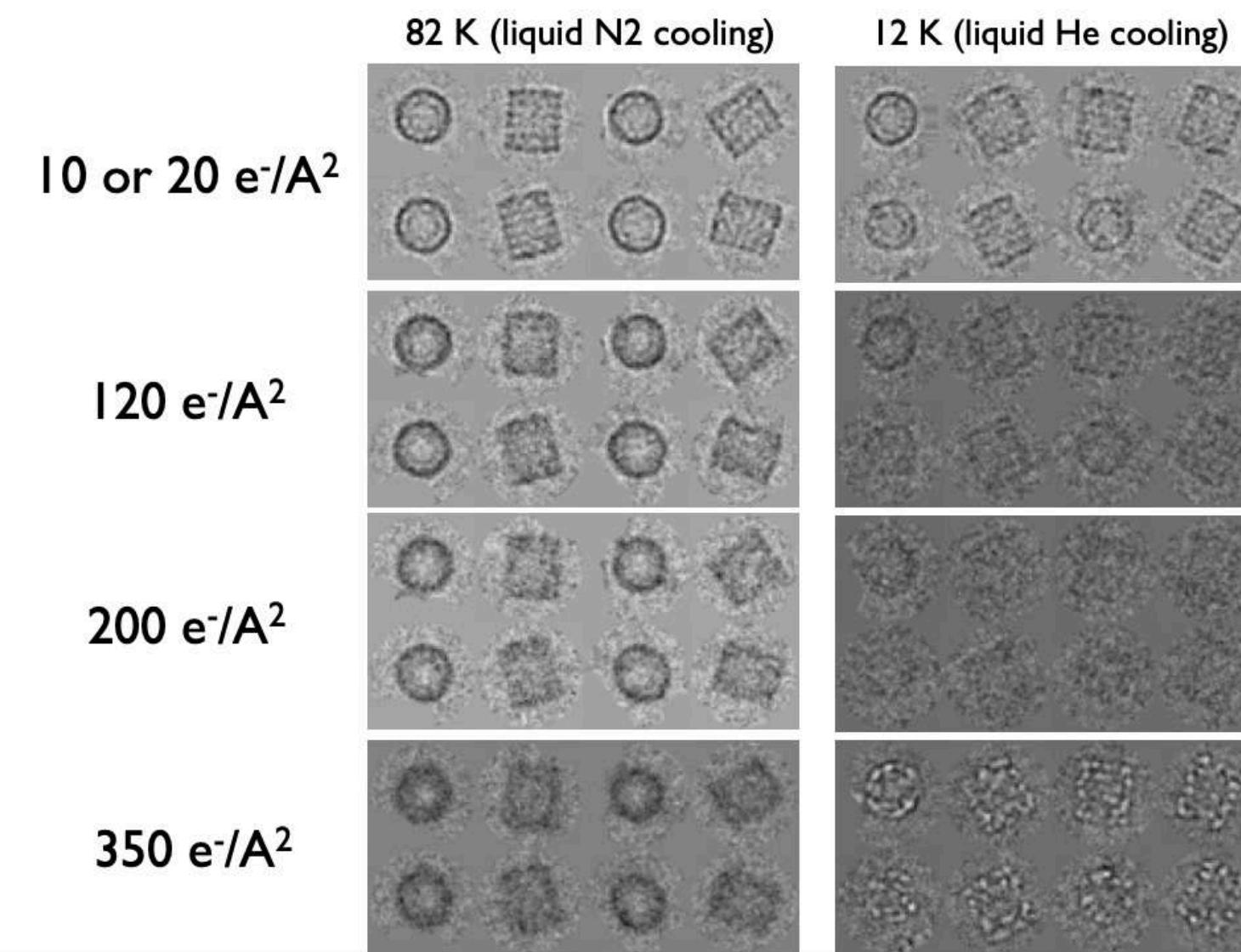
Damages sample
worse with faster electrons

Poor penetration
better with faster electrons

Why electrons?

Ideal dose for cryoEM?

Radiation damage



<https://cryo-em-course.caltech.edu/>

Specimen Behavior in the Electron Beam

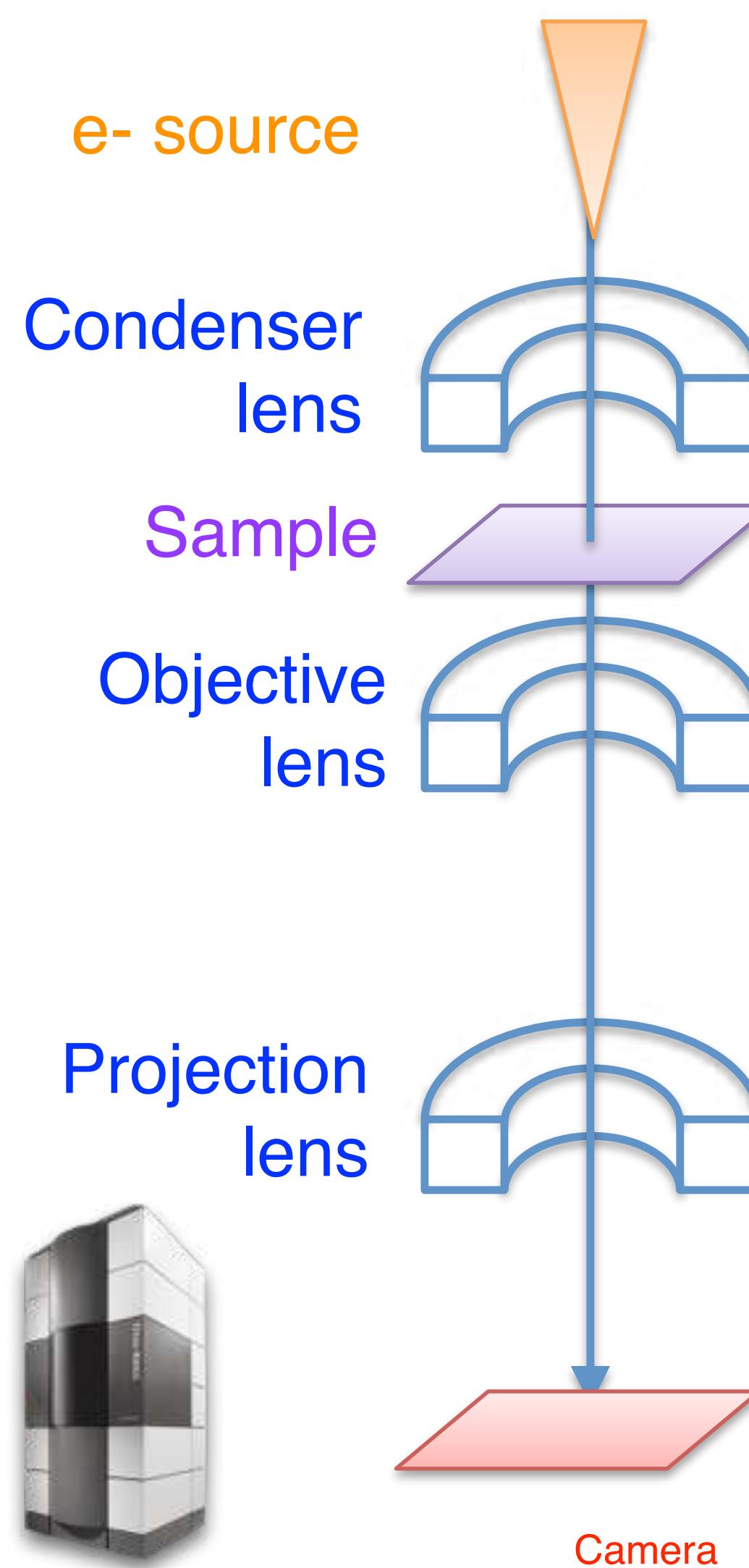
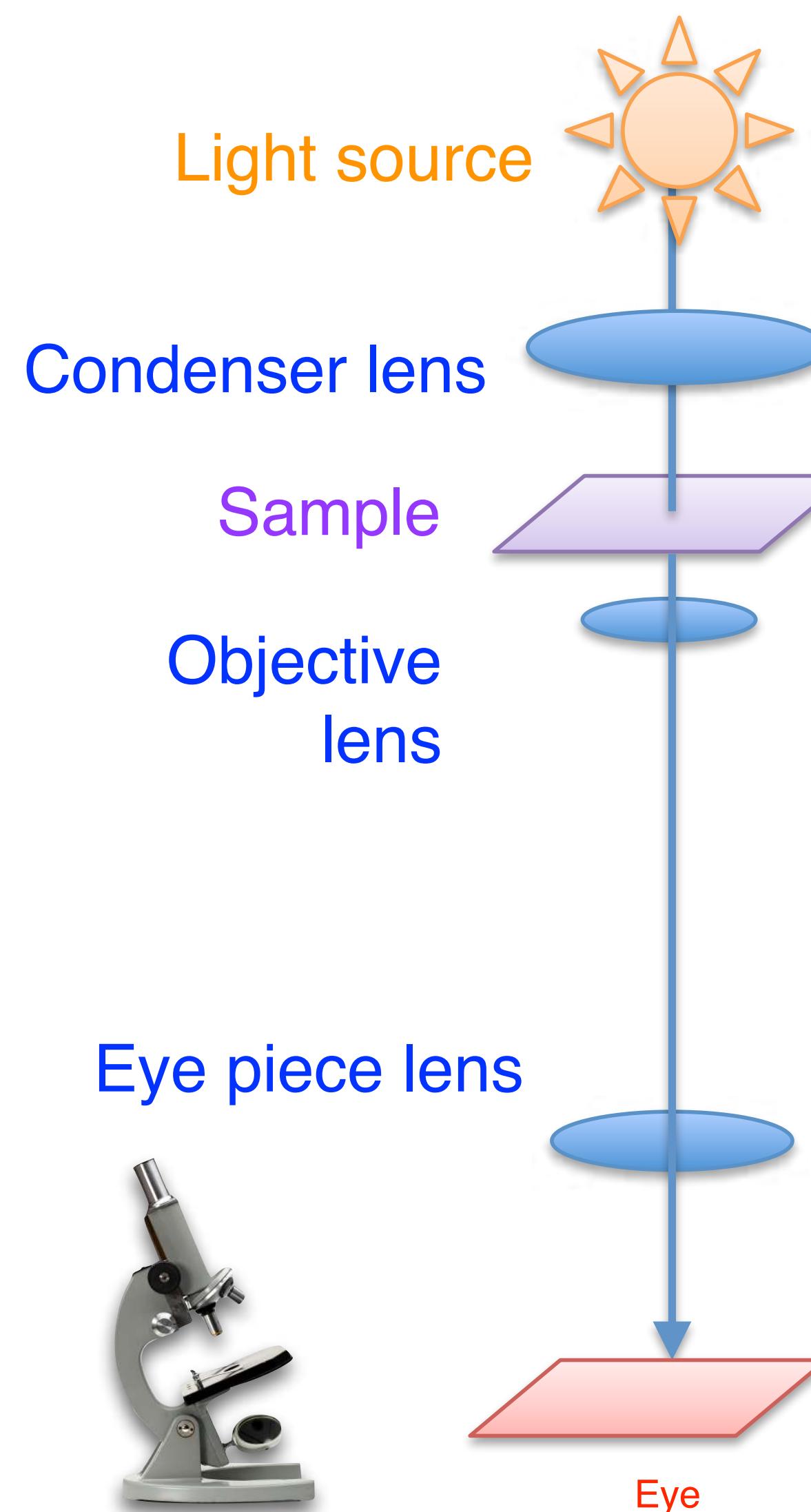
R.M. Glaeser¹

Lawrence Berkeley National Laboratory, University of California, Berkeley, CA, United States

¹Corresponding author: e-mail address: rmglaeser@lbl.gov

- The first noticeable bubbles appear after the accumulated exposure (for 300 keV electrons) is approximately 150 e/A. At this high exposure, high-resolution features would long since be destroyed, of course, but the macromolecular particles might still be visible.

The electron microscope



Light microscope

Visible light

Glass lenses

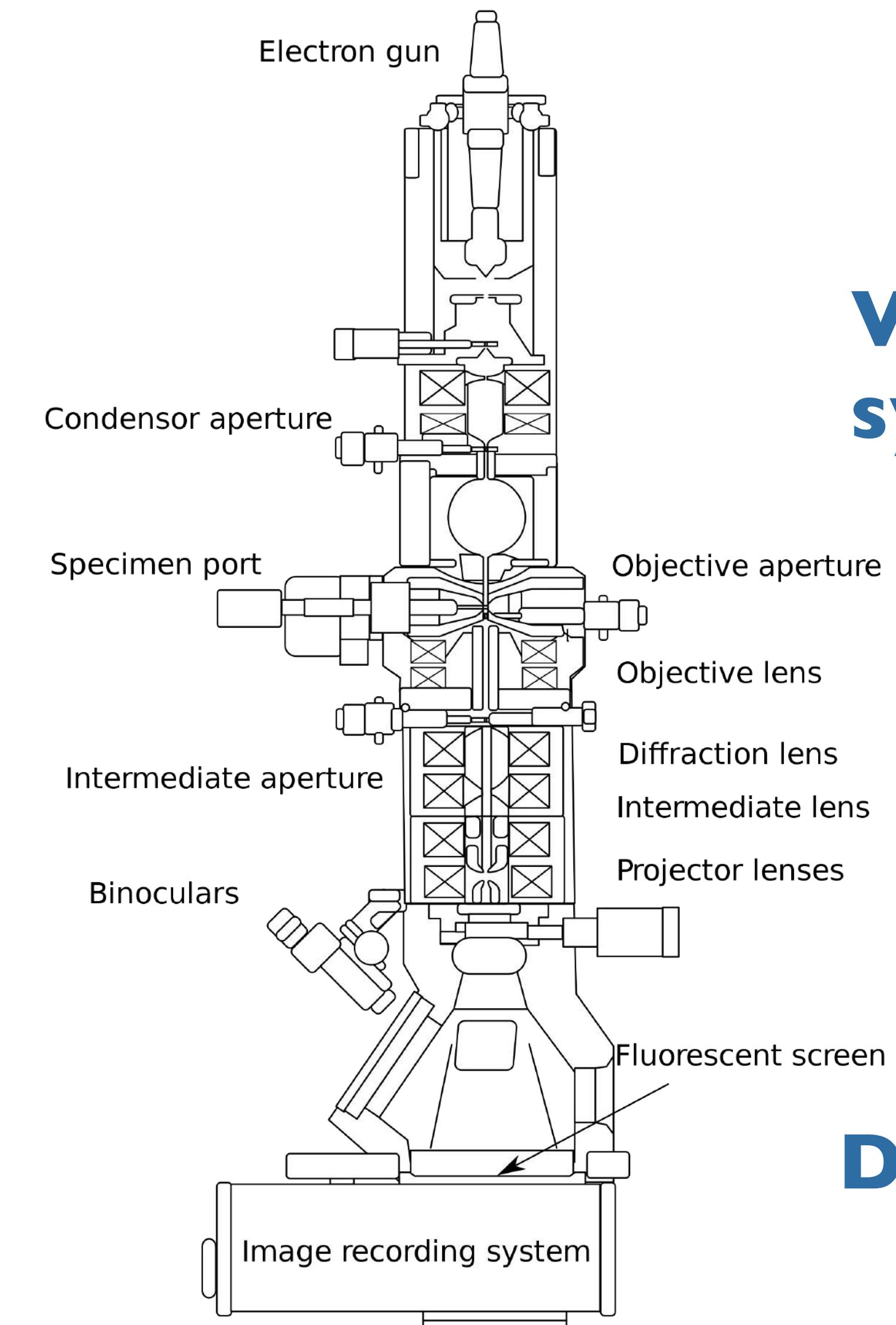
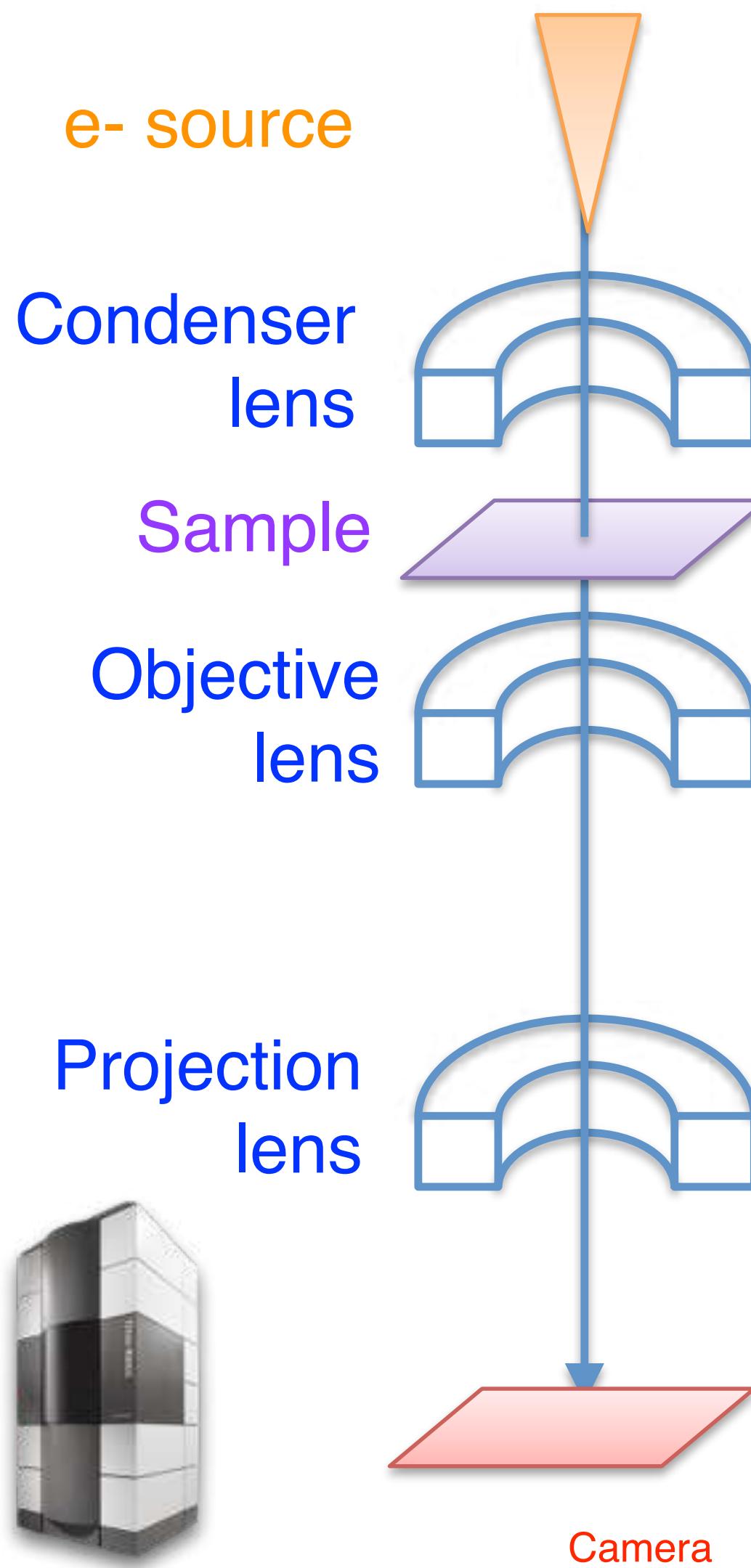
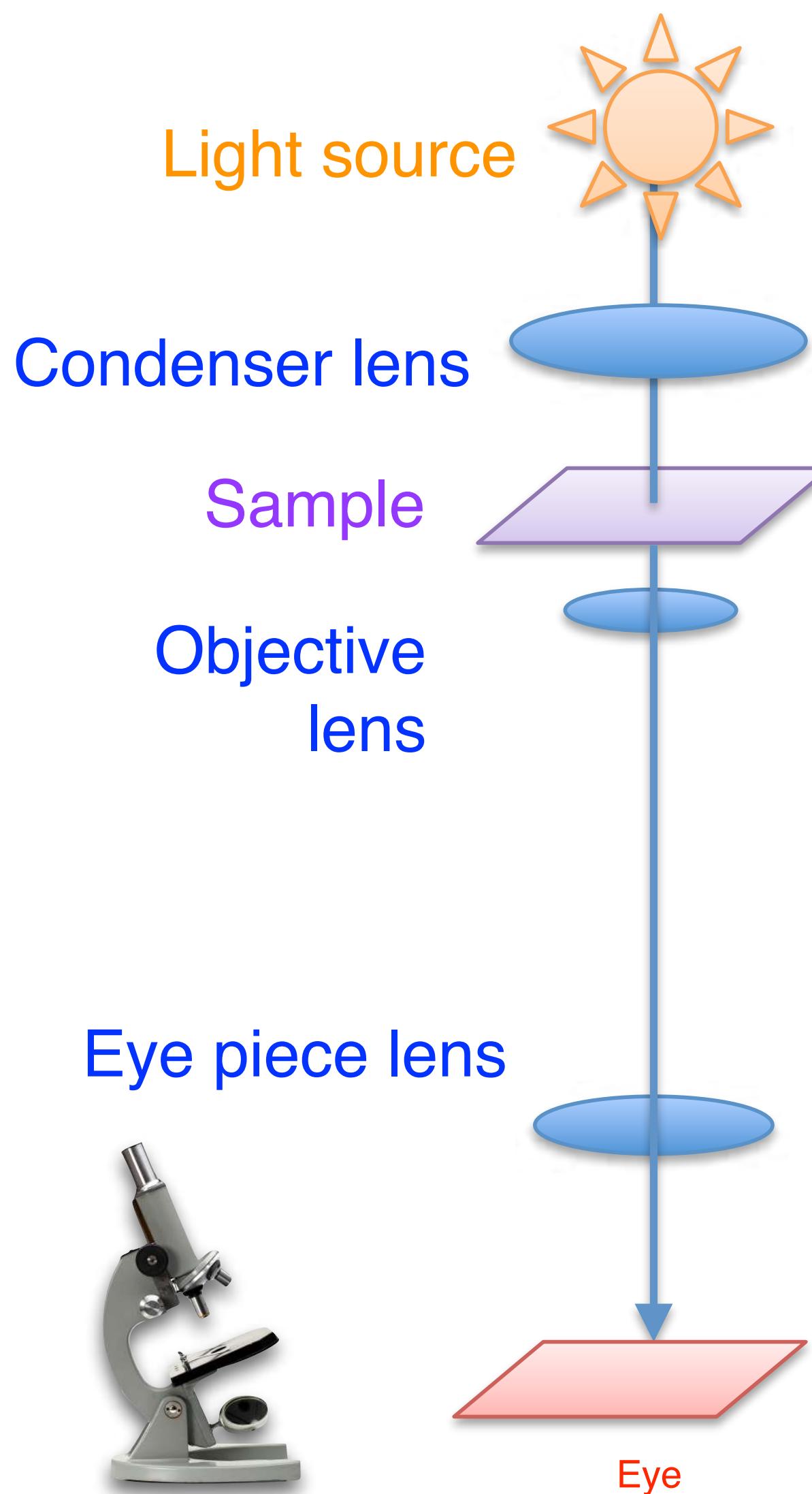
Transmission electron microscope

450-650 nm

3.70 pm (100 keV)
2.51 pm (200 keV)
1.96 pm (300 keV)

The electron microscope

Electron sources



Vacuum systems



Lenses

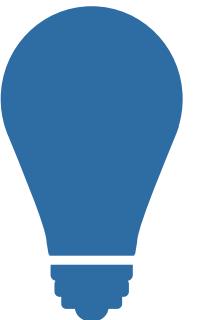


Detectors



The electron microscope

Electron sources



e- gun

produces e-

accelerator

accelerate e- to high energy

Condenser lens

condenser

control illumination

Sample

objective

sample and main imaging lens

Objective lens

Intermediate projection

controls mag and image/
diffraction mode

Projection lens

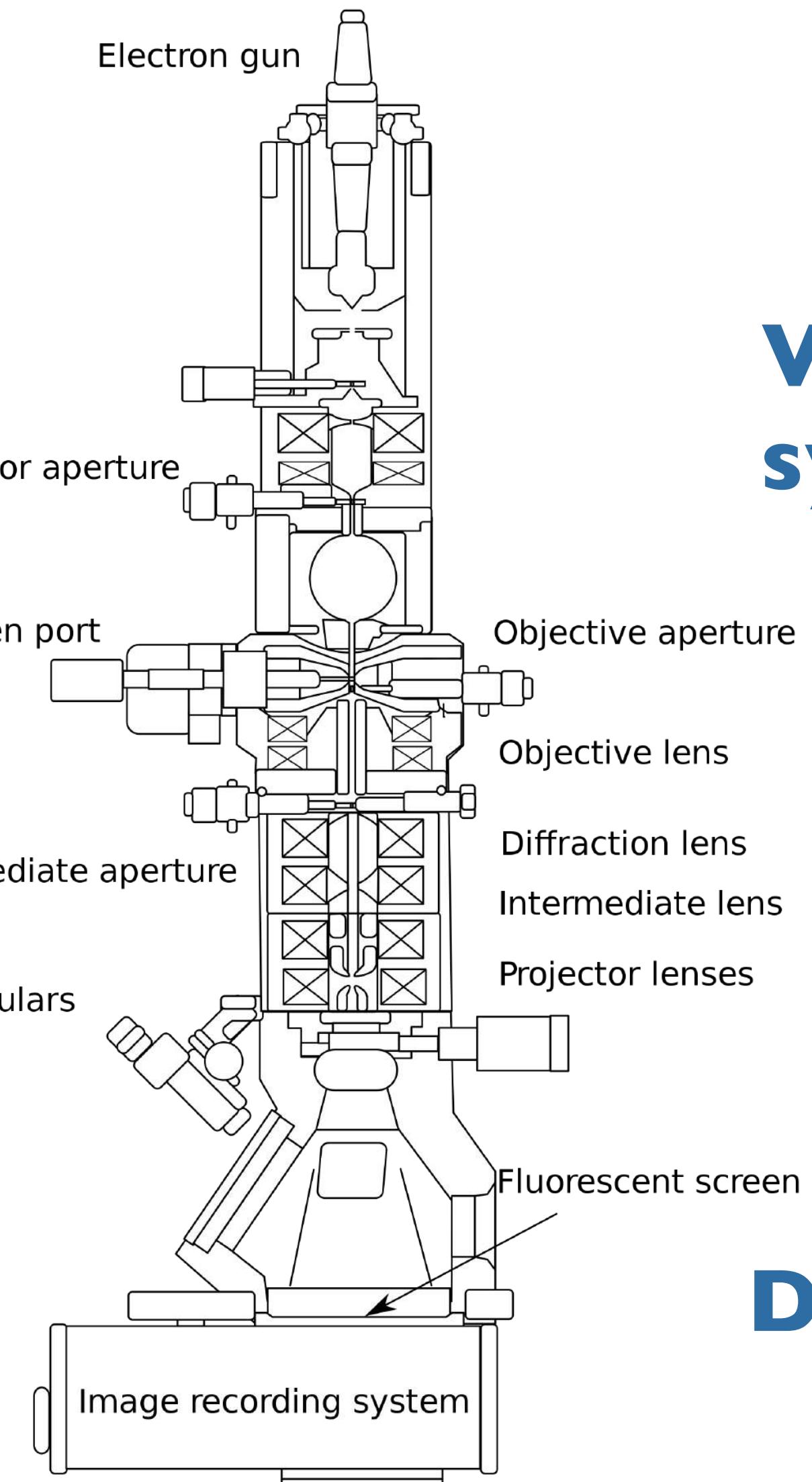
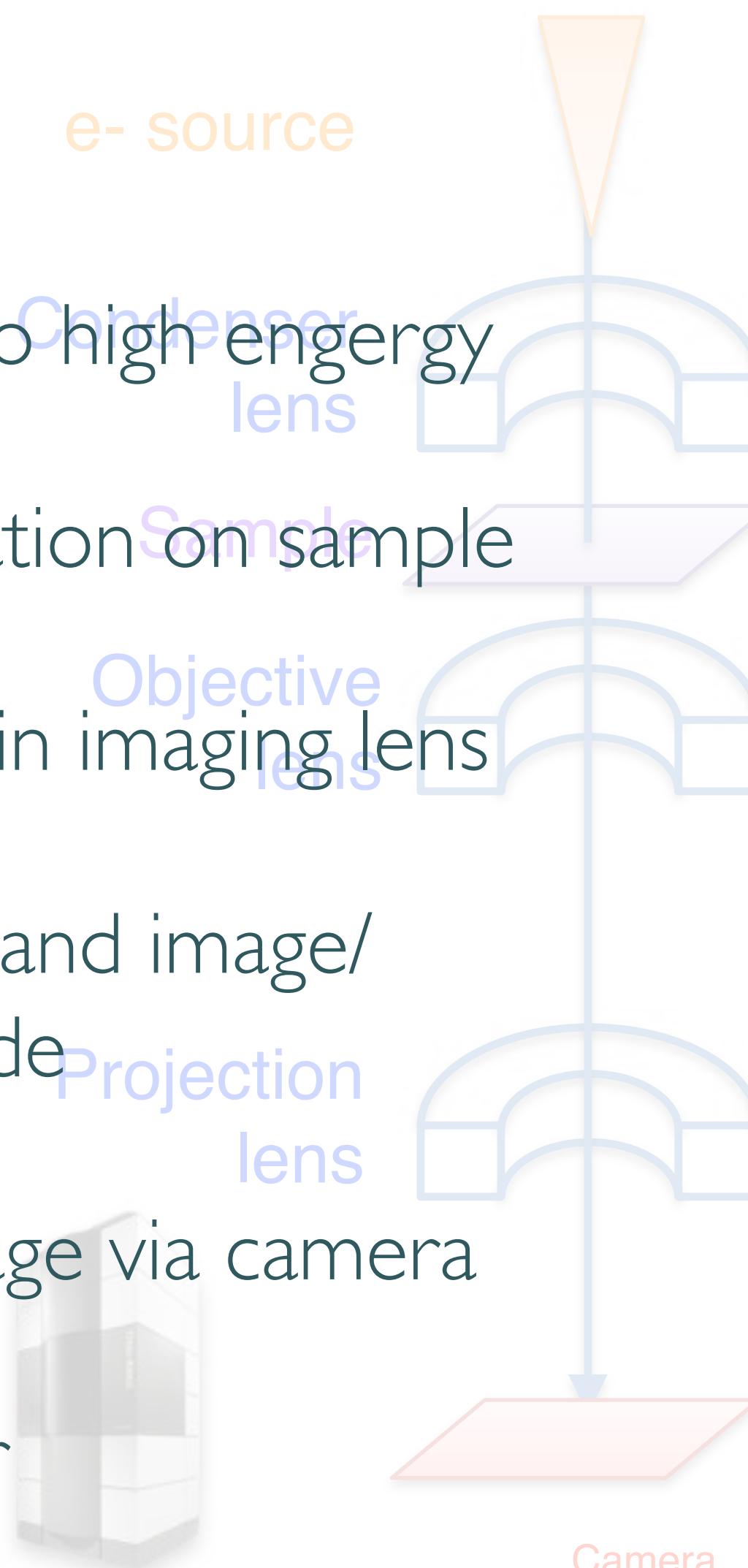
Flu-screen

Flu-screen image via camera

Projection lens

TEM camera

TEM detector



Vacuum systems



Lenses



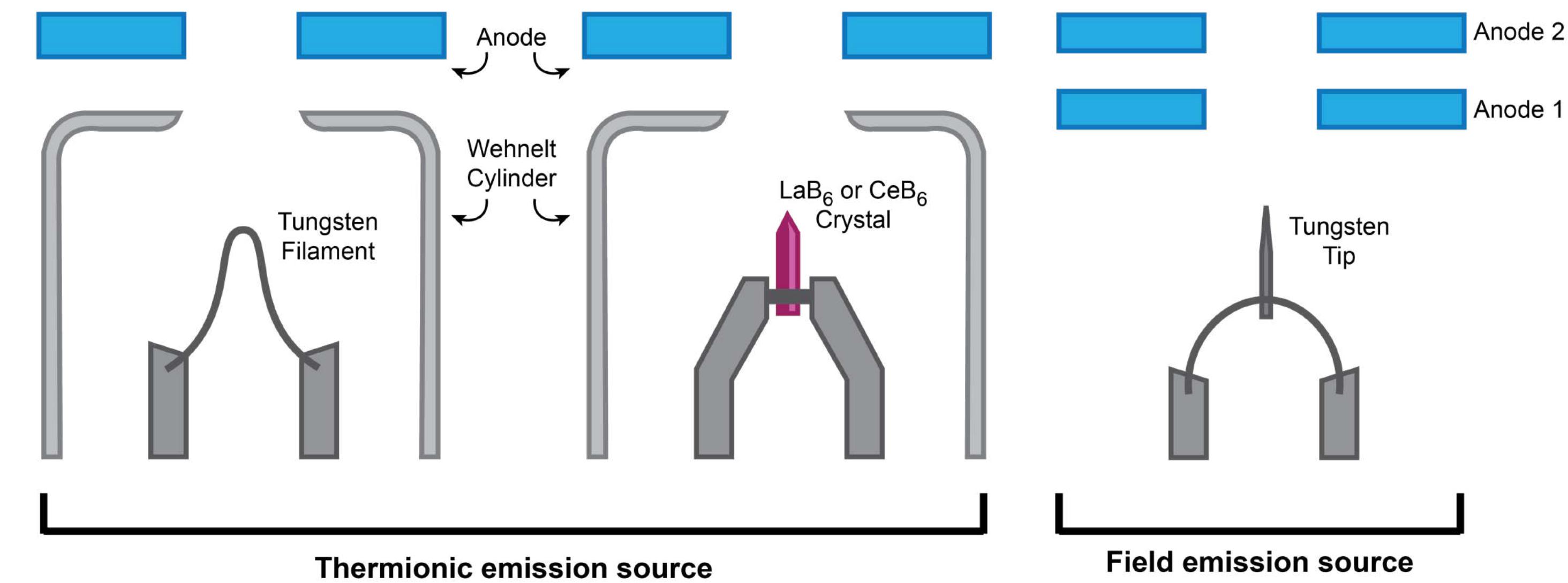
Detectors



Electron sources

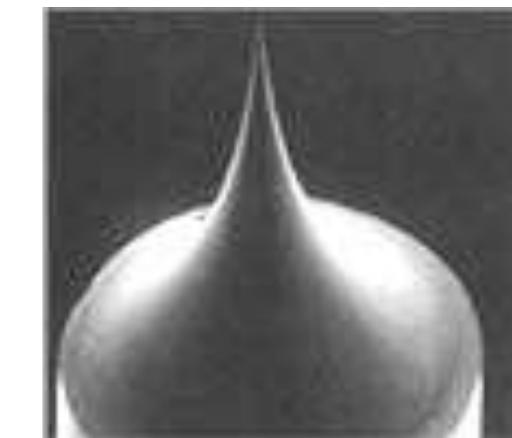
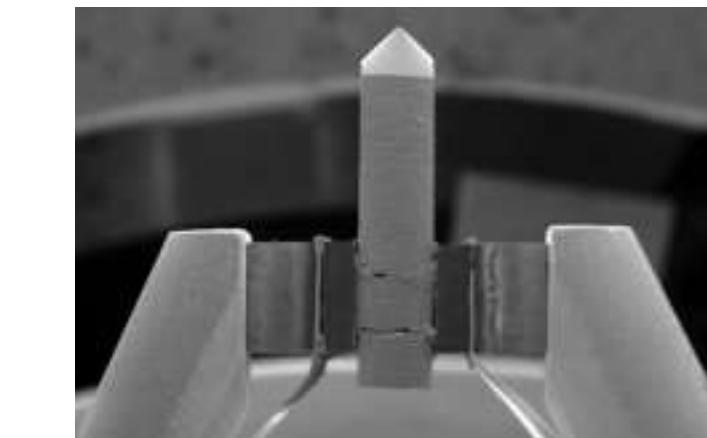
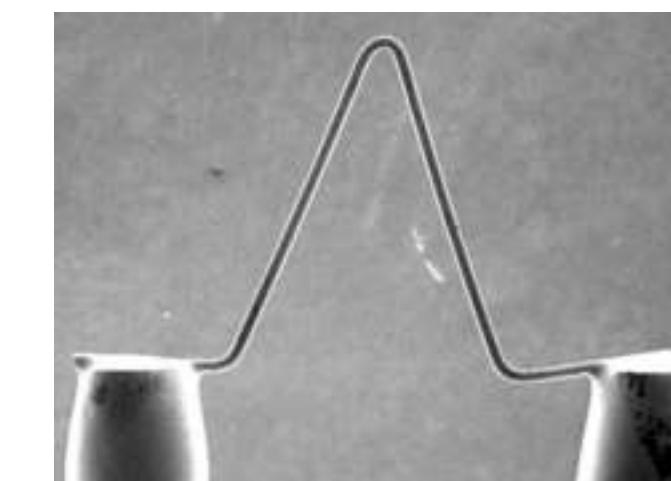


What are the 3 main kinds of electron sources?



www.thermofisher.com

nanoscience.com

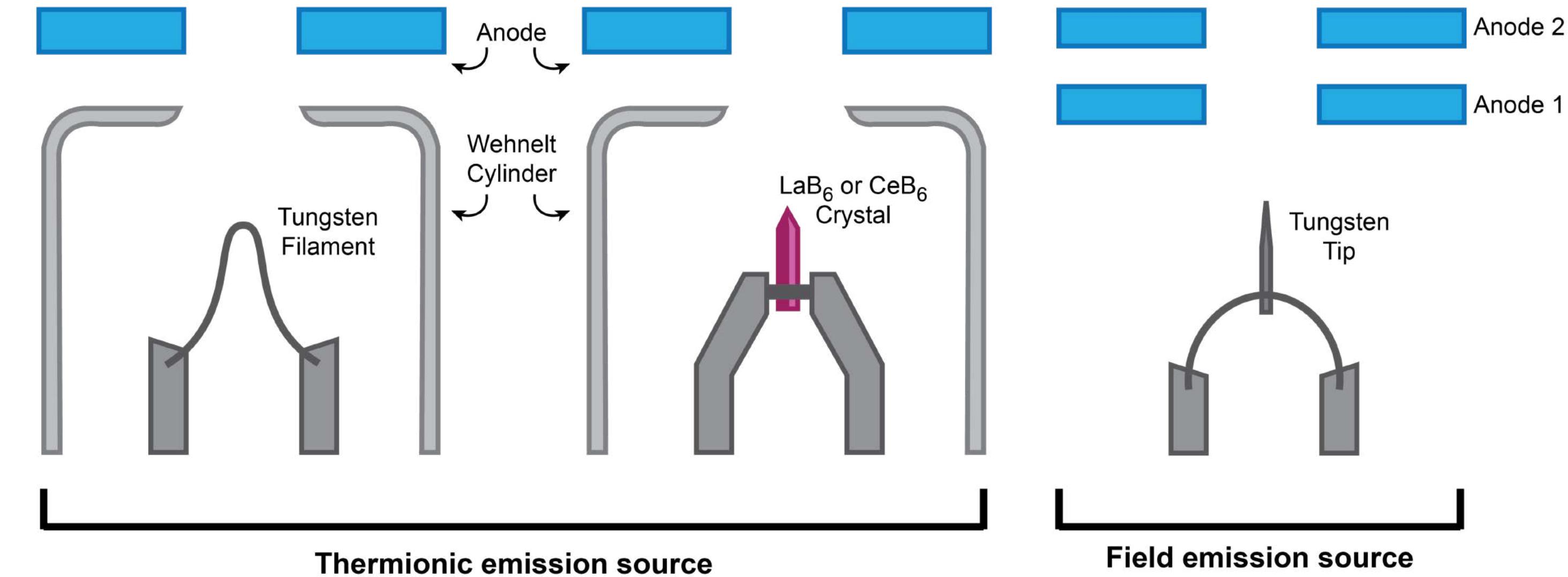
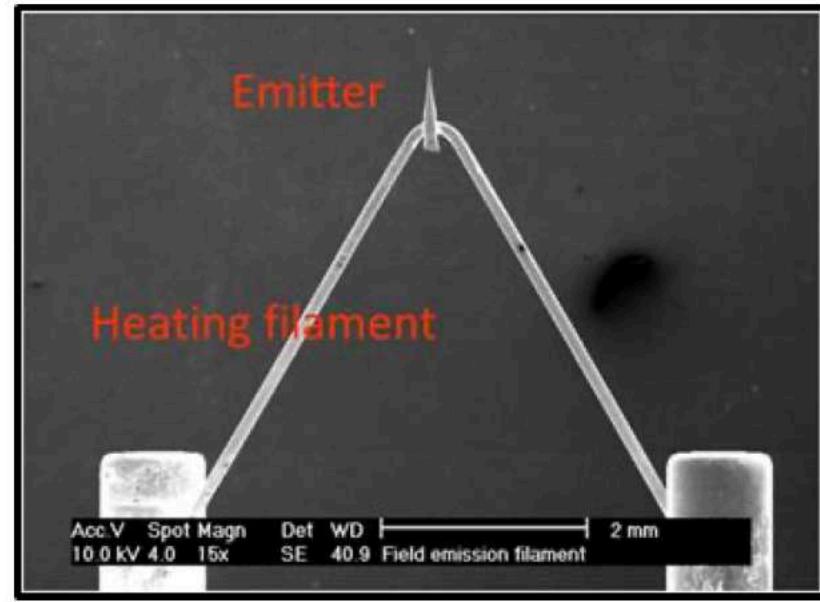


Electron sources

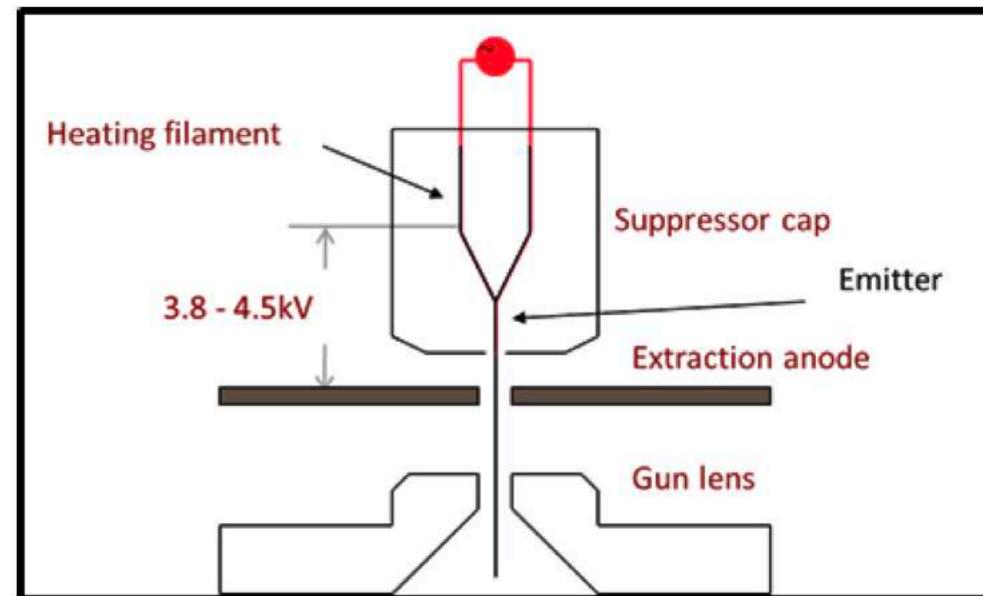


What are the 3 main kinds of electron sources?

Thermionic

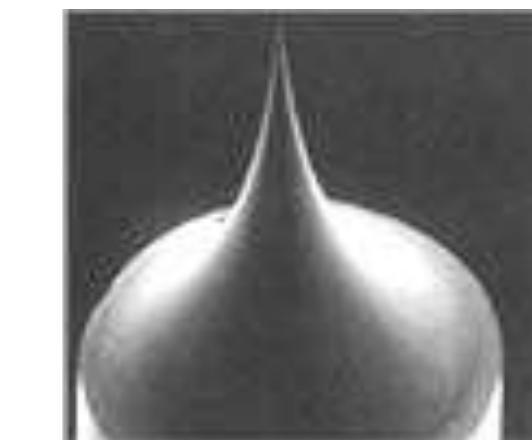
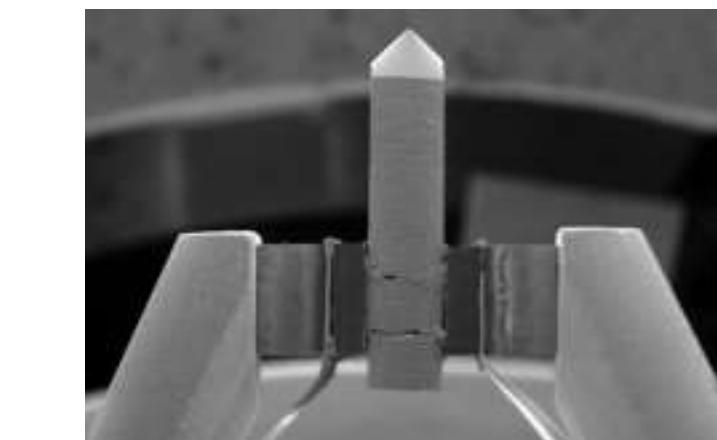
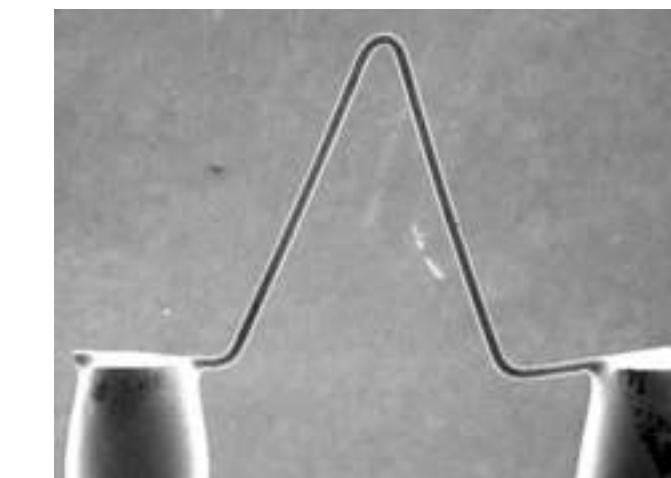


Field Emission Gun (FEG)



thermofisher.com

nanoscience.com



www.thermofisher.com

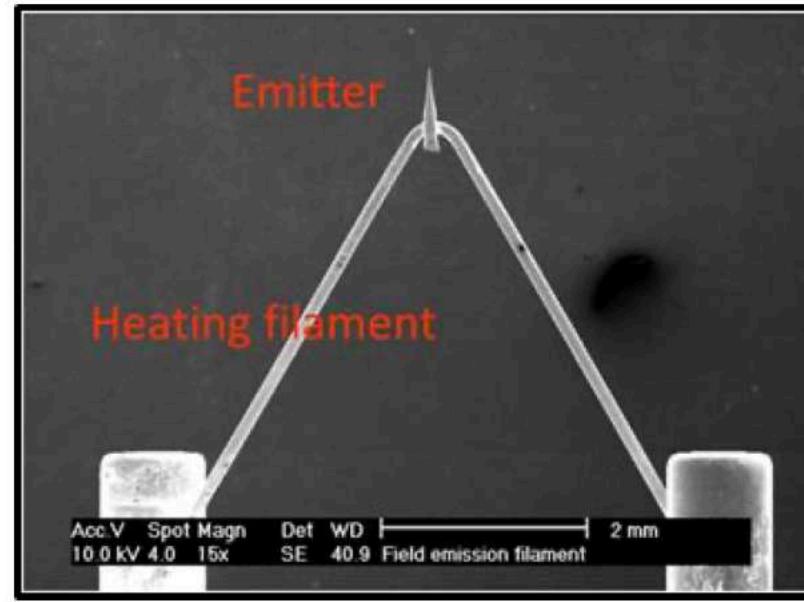
X-CFEG is $1.0 \times 10^8 \text{ A/m}^2 \text{ sr V}$

Electron sources

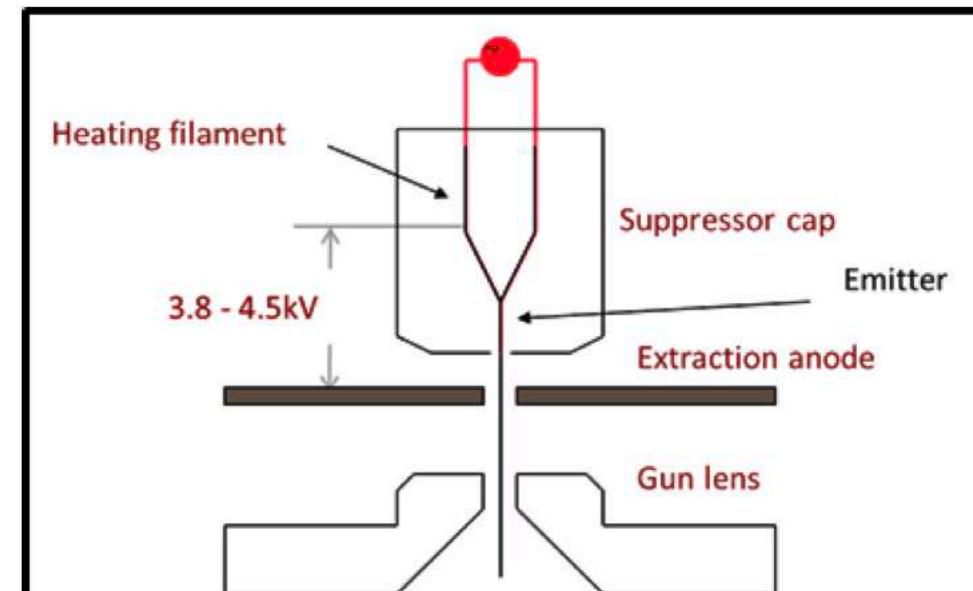


What are the 3 main kinds of electron sources?

Thermionic



Field Emission Gun (FEG)



thermofisher.com

nanoscience.com

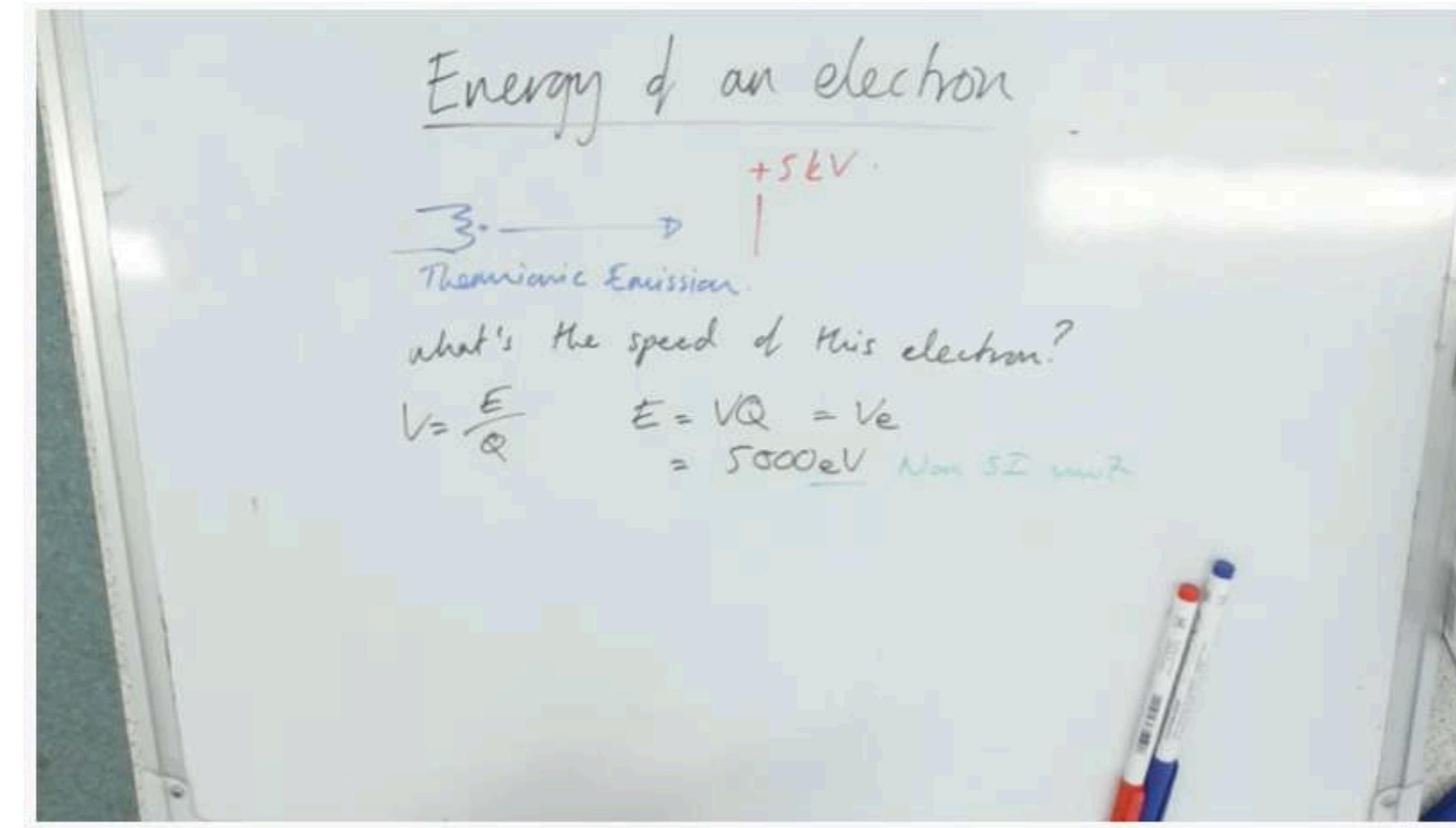
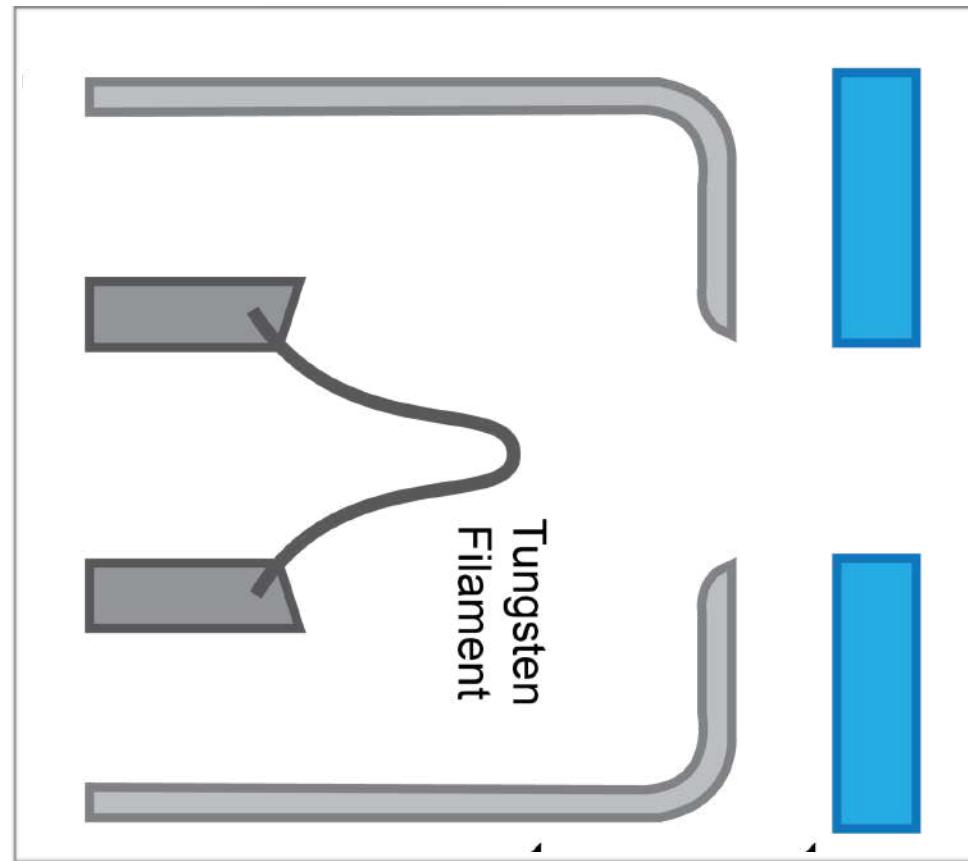
	W Filament	LaB6 or CeB6	S-FEG (Schottky FEG)	X-FEG (extreme high-brightness field emission gun)	C-FEG (low-energy-spread cold FEG)
Relative brightness	1	1-3	250	1250	1625
Energy spread	2.5 eV	1-1.5 eV	<1 eV	0.6-0.8 eV	<0.3 eV
Source size	50-100 μ m	25 μ m	<30nm	<20nm	<5nm
Lifetime	100 h	1,500 h	5,000 h+	1 yr+	1 yr+

X-CFEG is 1.0×10^8 A/m² sr V

Electron sources



How fast are the electrons moving?

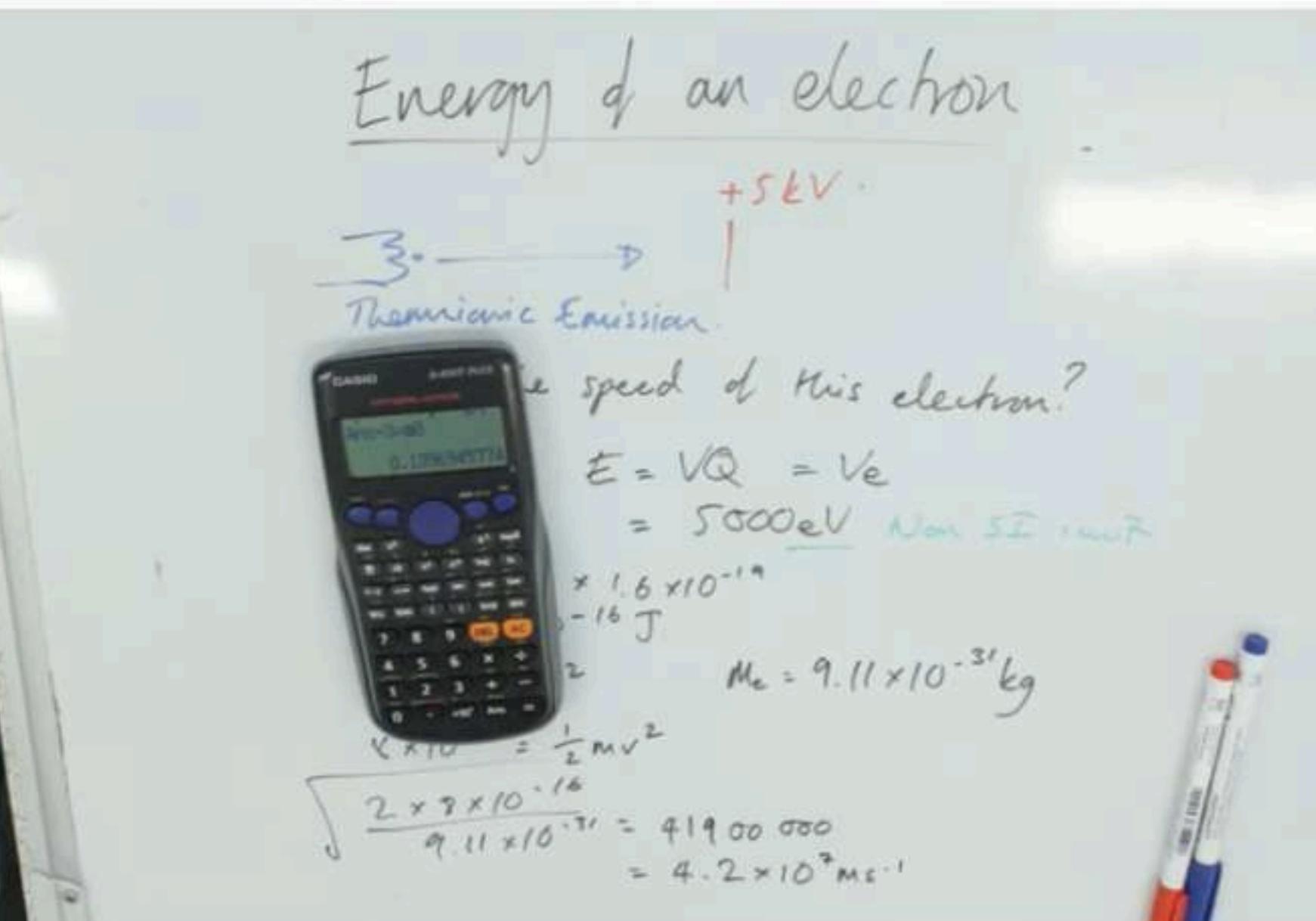
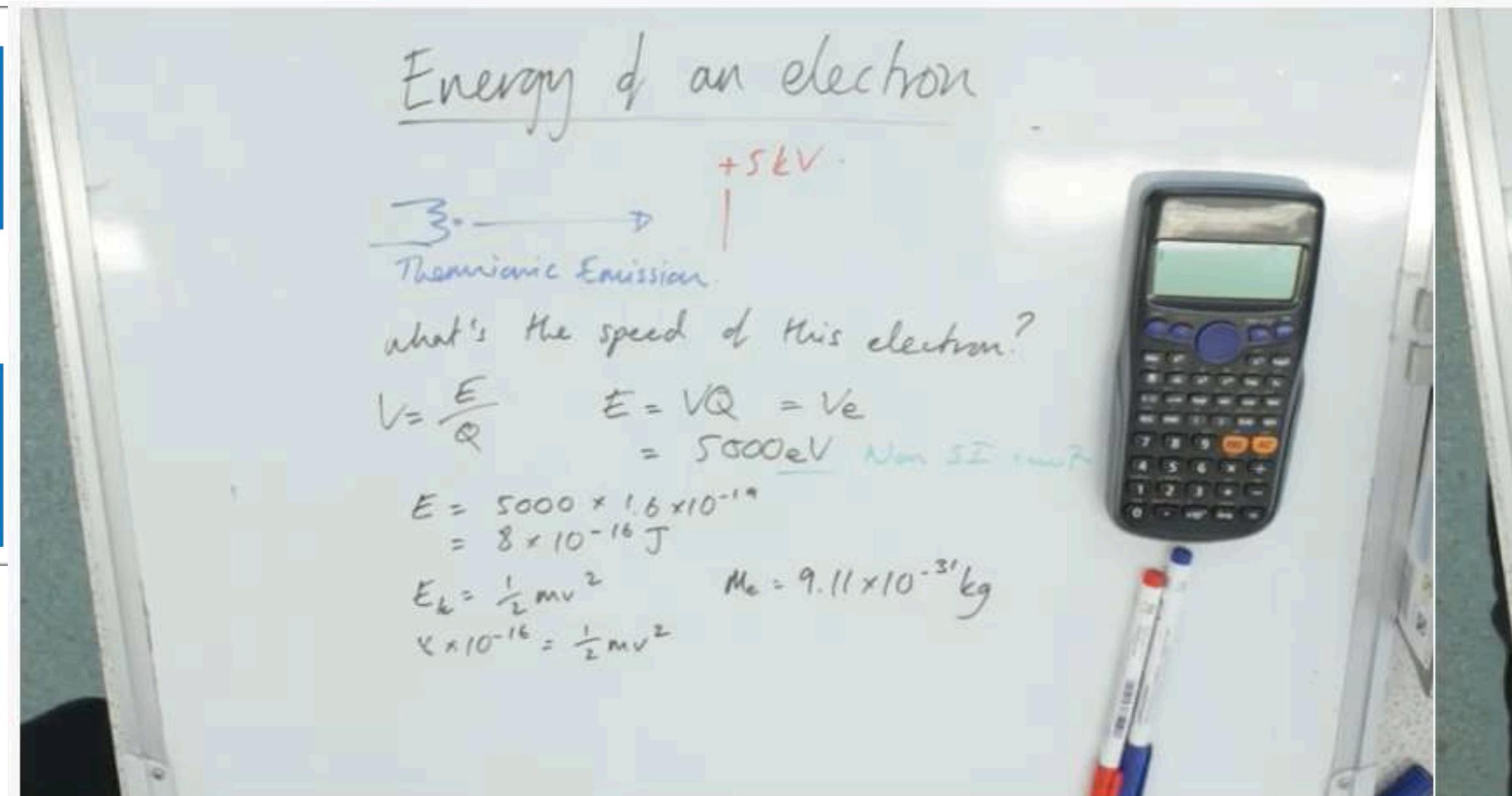
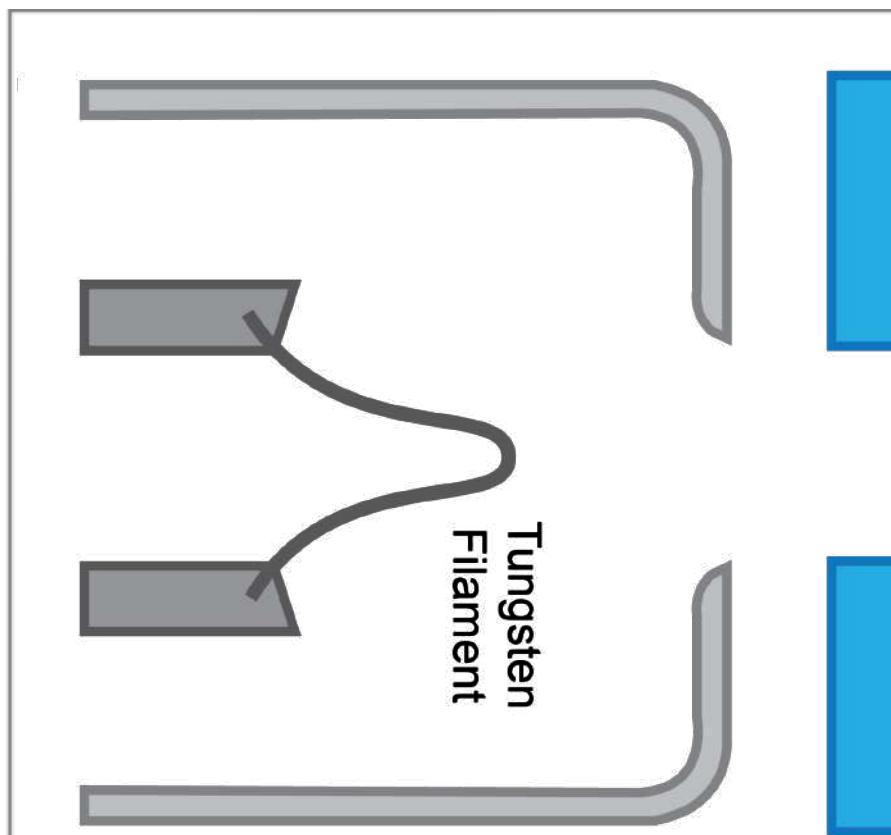


<https://www.youtube.com/watch?v=tYCET6vYdYk>

Electron sources



How fast are the electrons moving?



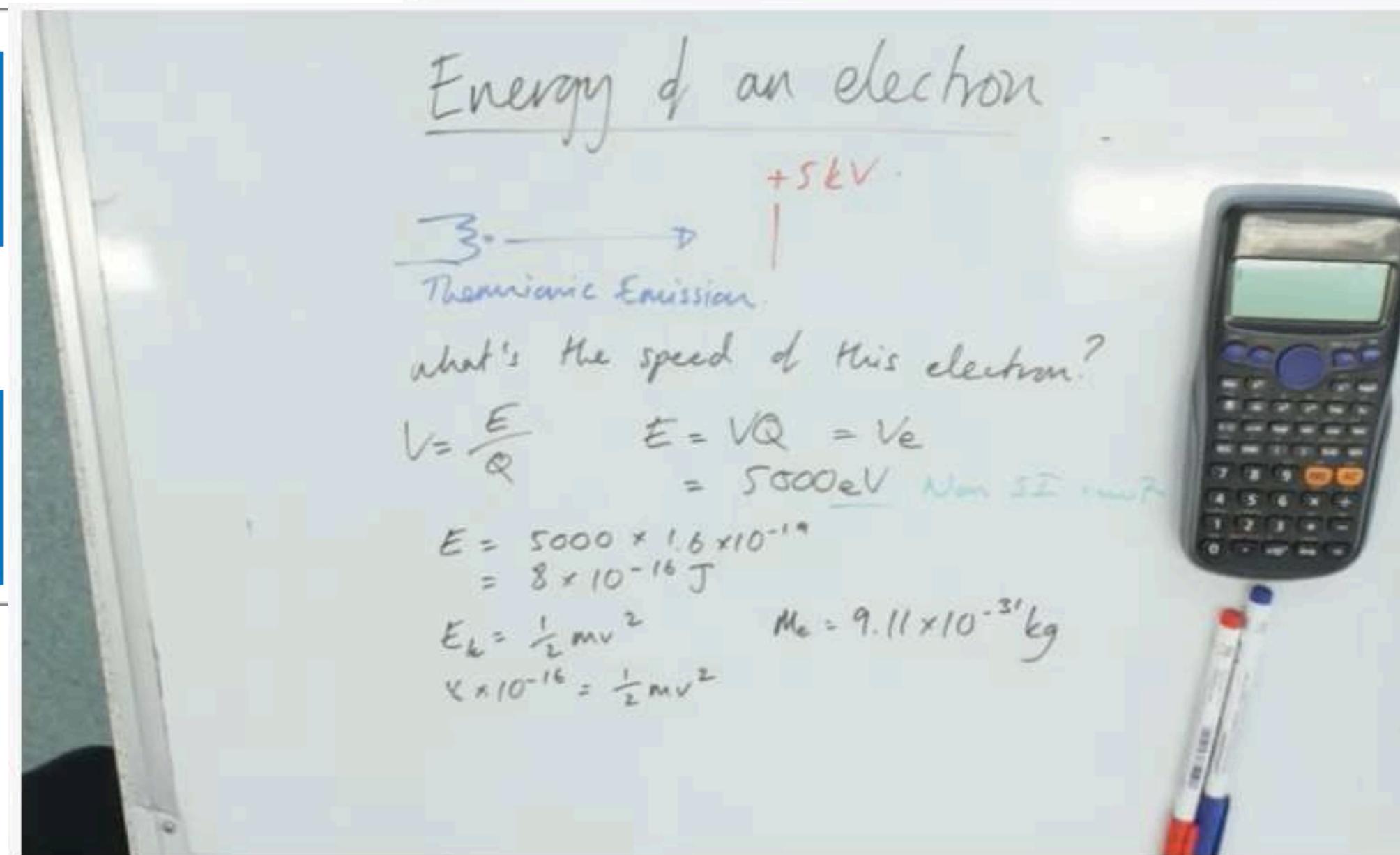
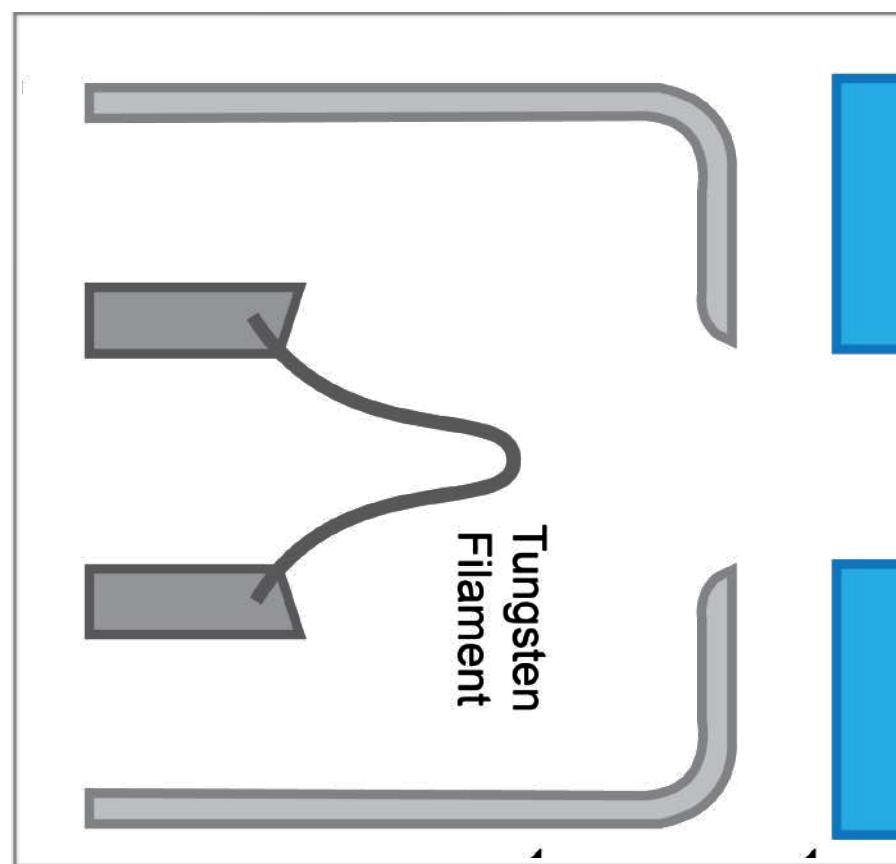
<https://www.youtube.com/watch?v=tYCET6vYdYk>

Electron sources

How fast are the electrons moving?



Light microscope	Transmission electron microscope
------------------	----------------------------------



Visible light

Glass lenses

450-650 nm

speed of light in
vacuum c

Electrons

Electron-magnetic
lenses

3.70 pm (100 keV)
2.51 pm (200 keV)
1.96 pm (300 keV.)

0.548c (100 keV)
0.695c (200 keV)
0.776c (300 keV.)

<https://www.youtube.com/watch?v=tYCET6vYdYk>

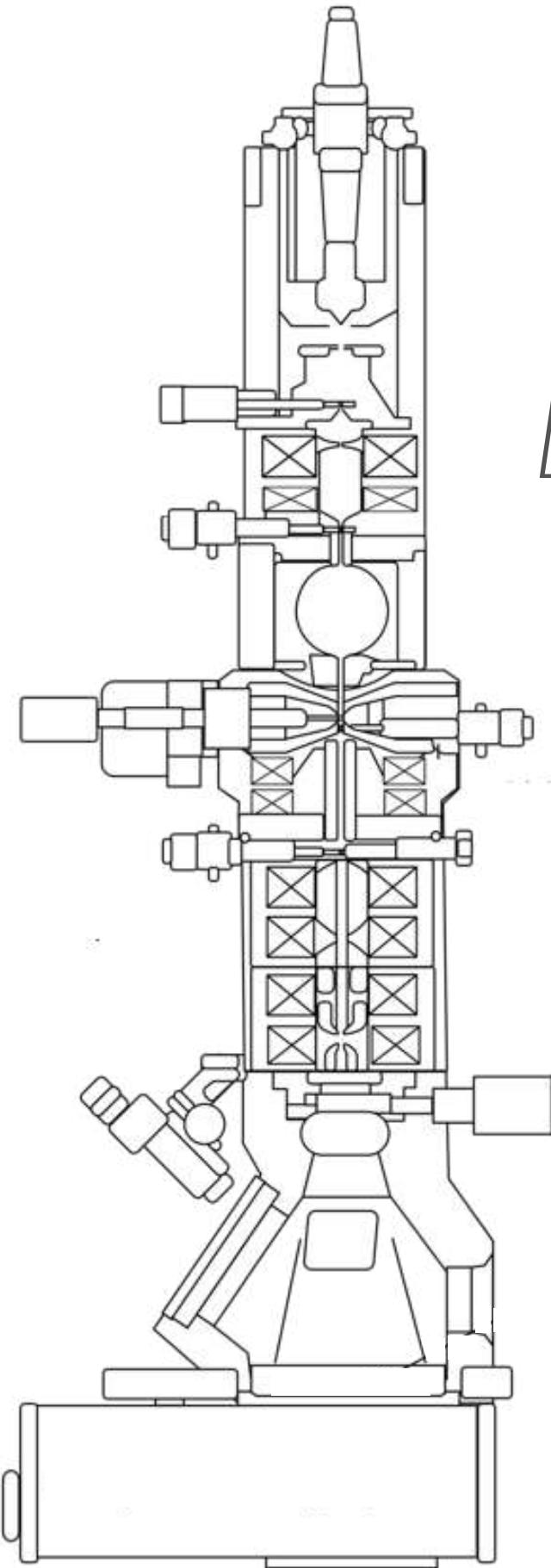
Electron sources

80-120 kV: Hitachi 7800, JEOL I400, TFS Talos I20

W or LaB6

High contrast & robust
sub-nm resolution

[developments ongoing to push resolution with FEG systems]

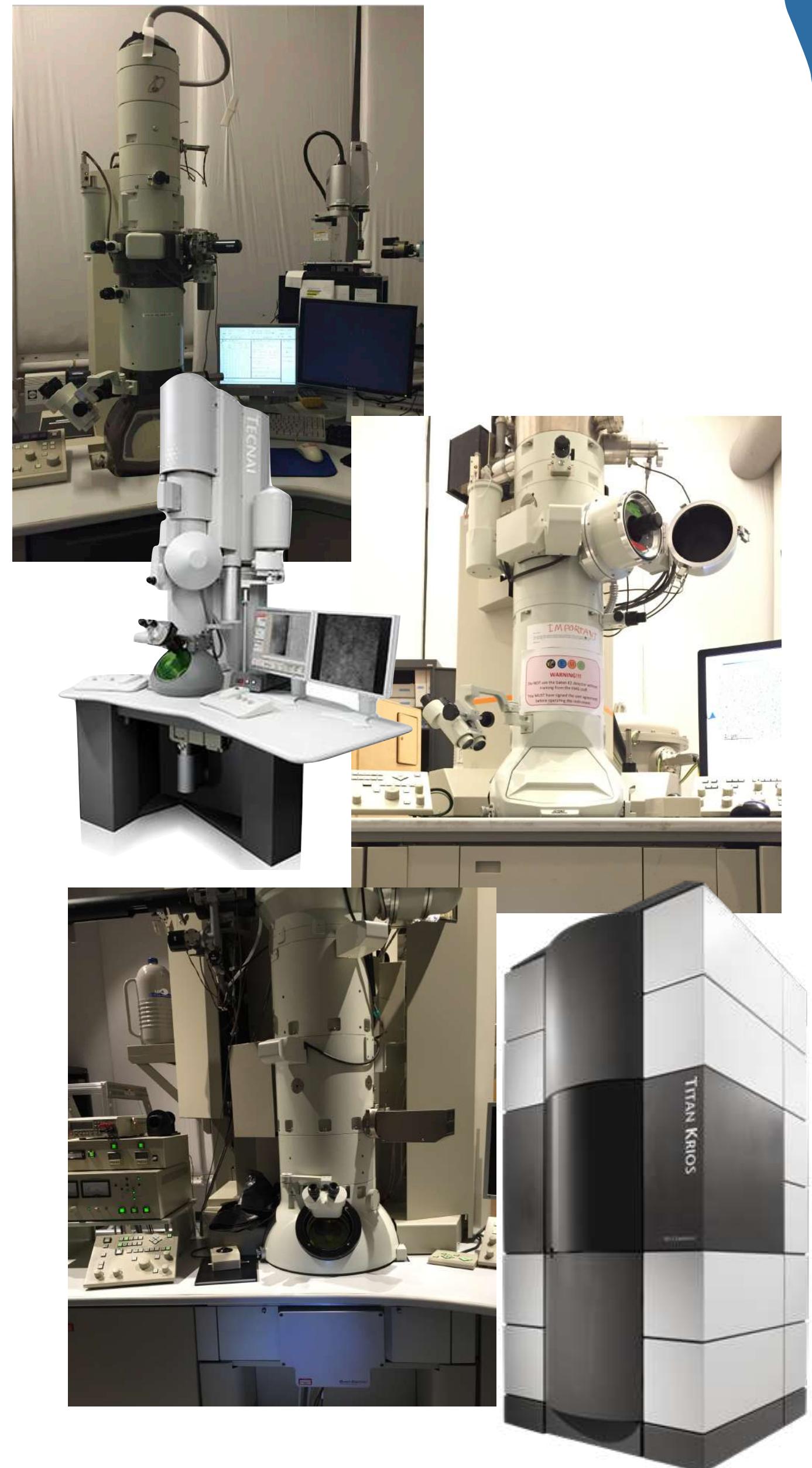


200 kV: J2100F; TFS Tecnai, Glacios, Arctica
FEG

2+ Å resolution (3.5-4 Å)

300 kV: JEOL3200FSC, cryoARM; TFS Krios, Halo
FEG

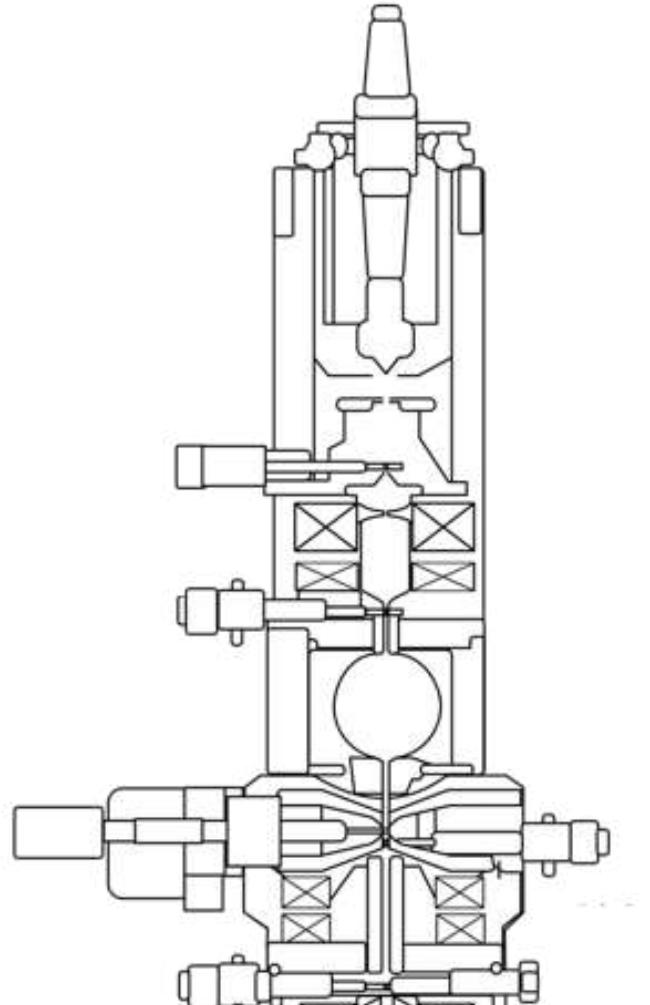
Smaller effect on unwanted lens aberrations
1.5-3 Å resolution



Electron sources

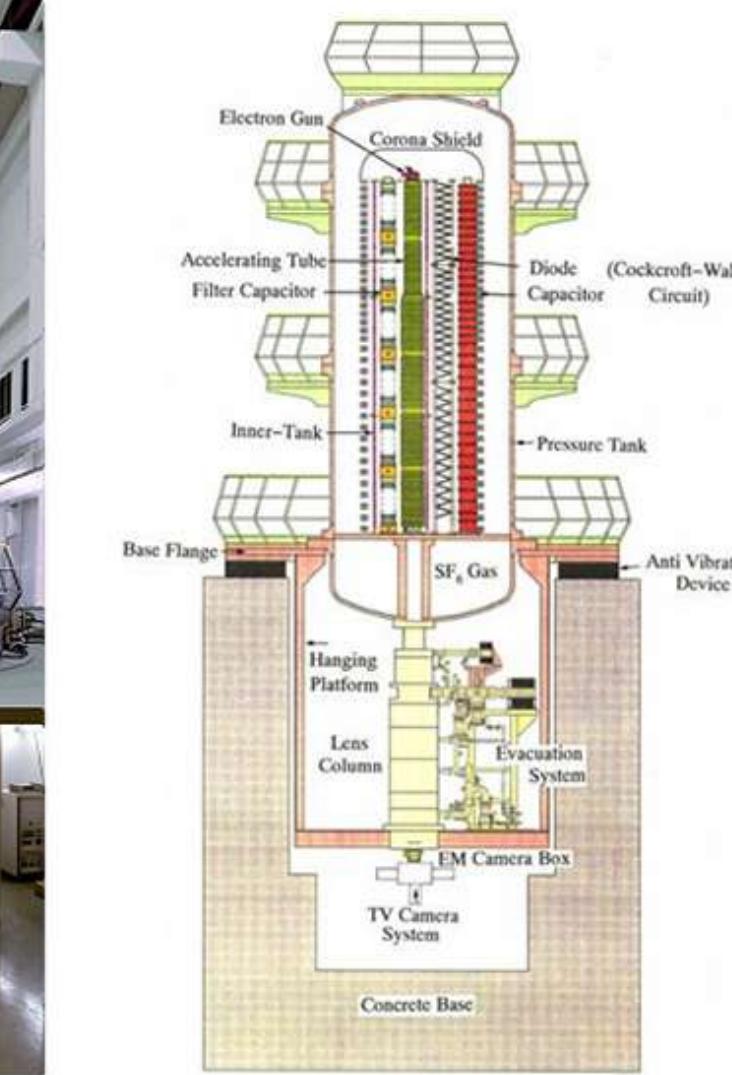
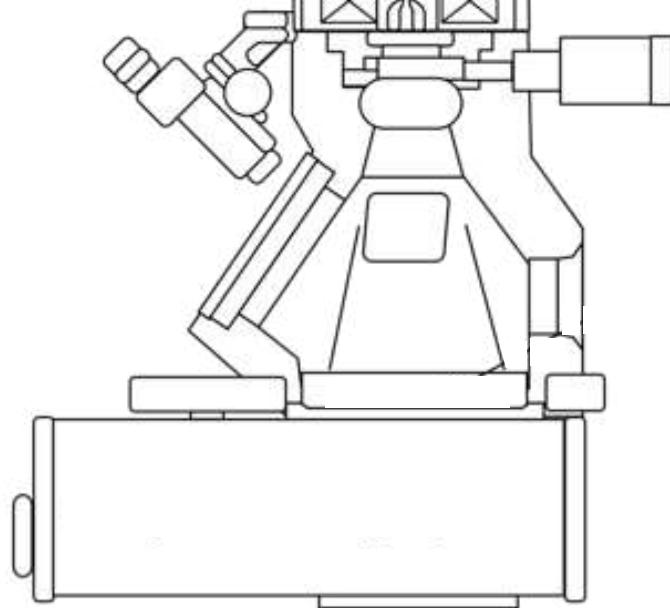


I-I.2 MV: Hitachi, JEOL
LaB6

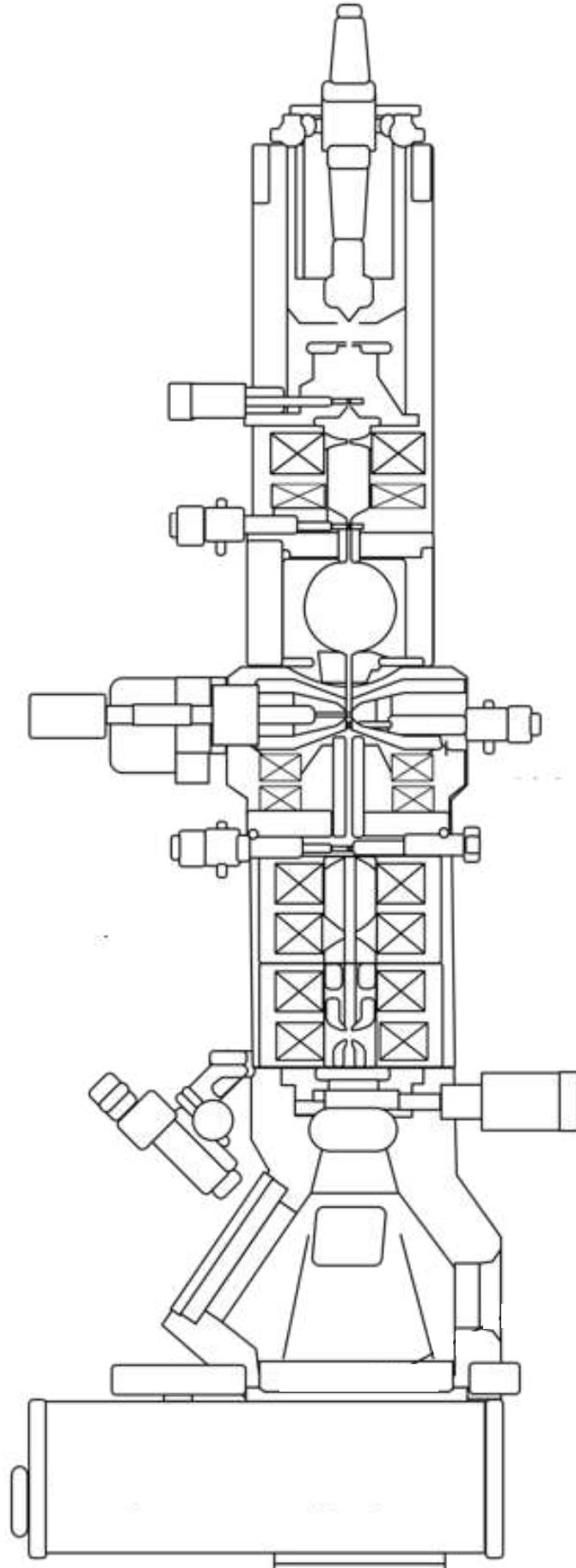


uhvem.osaka-u.ac.jp

3 MV: Hitachi H3000
LaB6



Vacuum systems



Why do we need a vacuum?

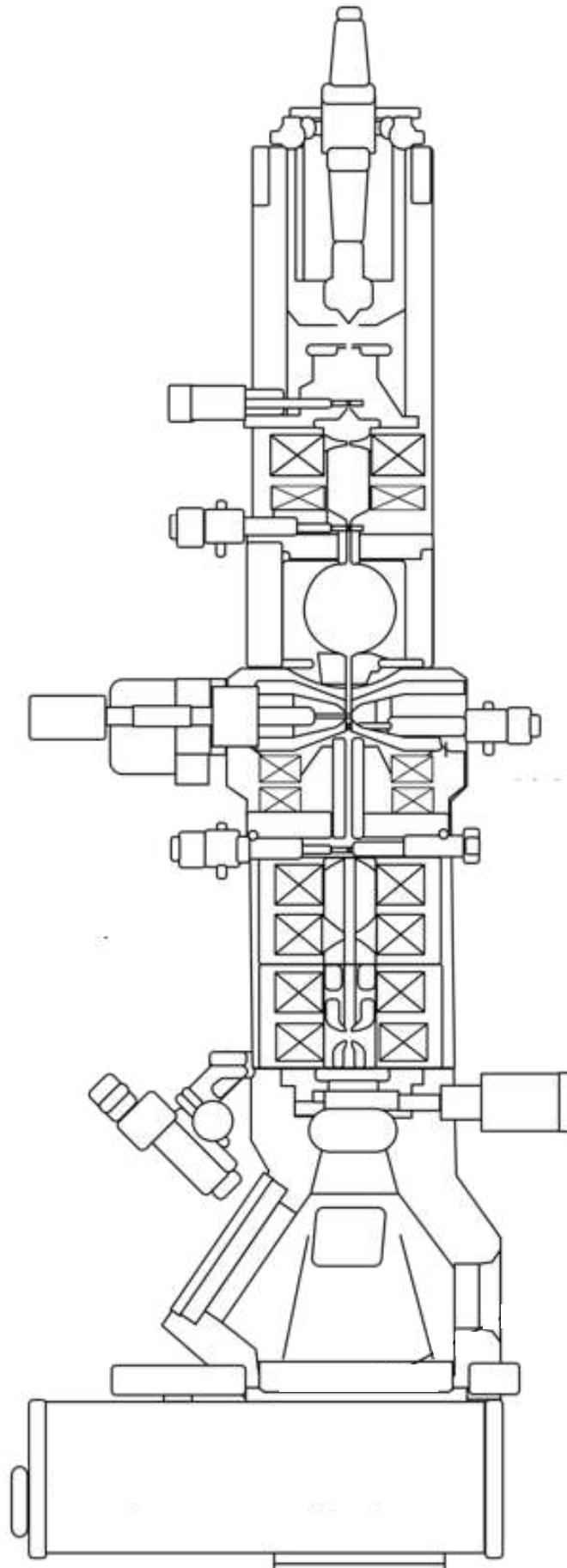
Beam coherence - at STP mean free path ~ 1 cm

Insulation - interaction between e- and air

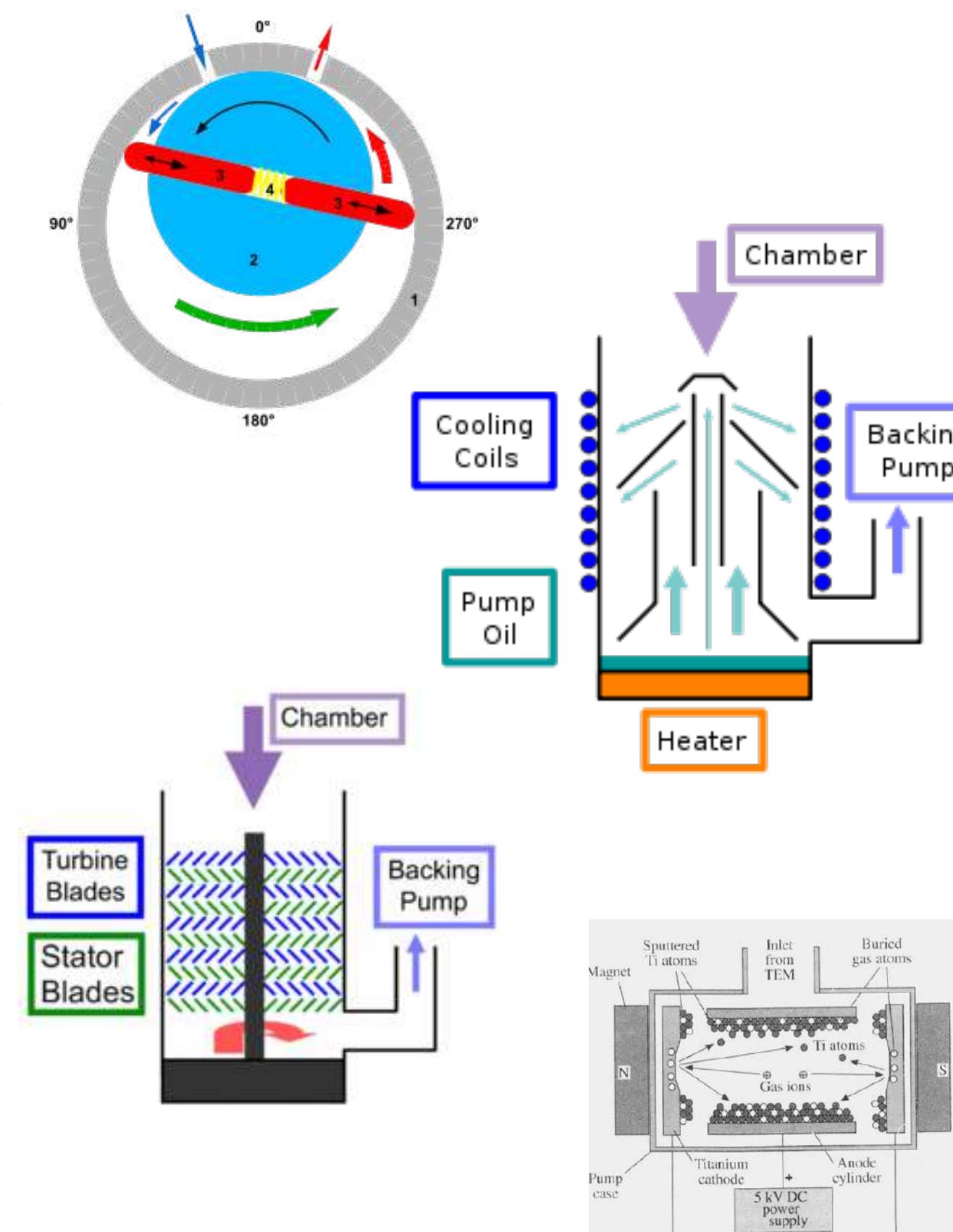
Filament - O₂ will burn out source

Contamination - reduce interaction gas, e-beam and sample

Vacuum systems



What types of pumps do we have?



wikipedia.com

PVP / Rotary

Diffusion

Turbo

IGP

$1 \text{ mm Hg} = 1 \text{ Torr} = 10^2 \text{ Pa}$
 $1 \text{ atm} = 760 \text{ Torr} = 7.5 \times 10^4 \text{ Pa}$

$10^{-3} \text{ Torr} \quad | \quad >0.1 \text{ Pa}$

$10^{-3} - 10^{-6} \text{ Torr} \quad | \quad 0.1 - 10^{-4} \text{ Pa}$

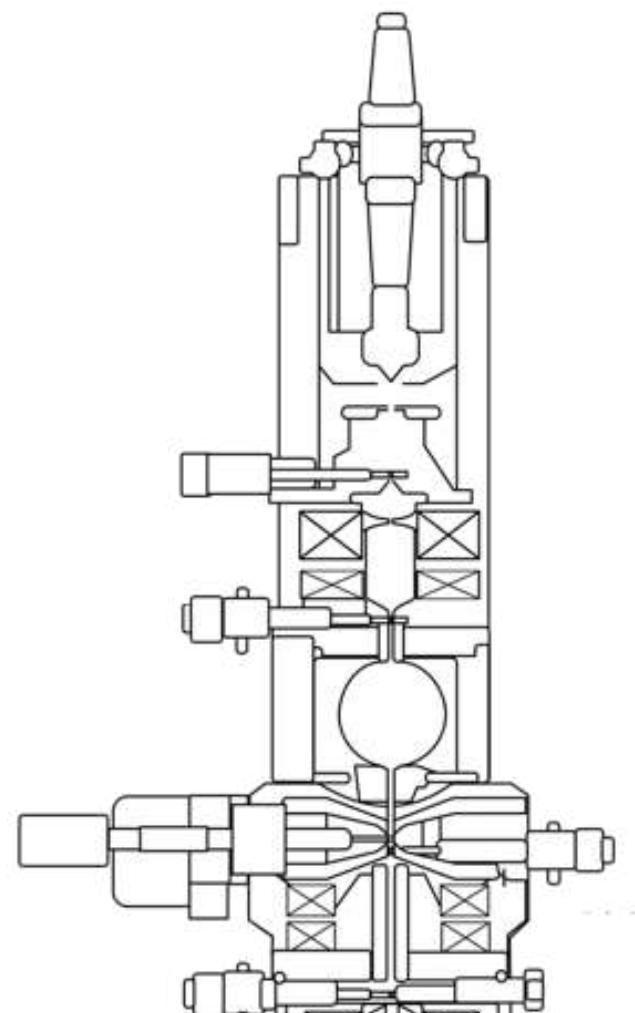
$10^{-6} - 10^{-9} \text{ Torr} \quad | \quad 10^{-4} - 10^{-7} \text{ Pa}$

$10^{-9} - 10^{-12} \text{ Torr} \quad | \quad 10^{-7} - 10^{-9} \text{ Pa}$

Vacuum systems

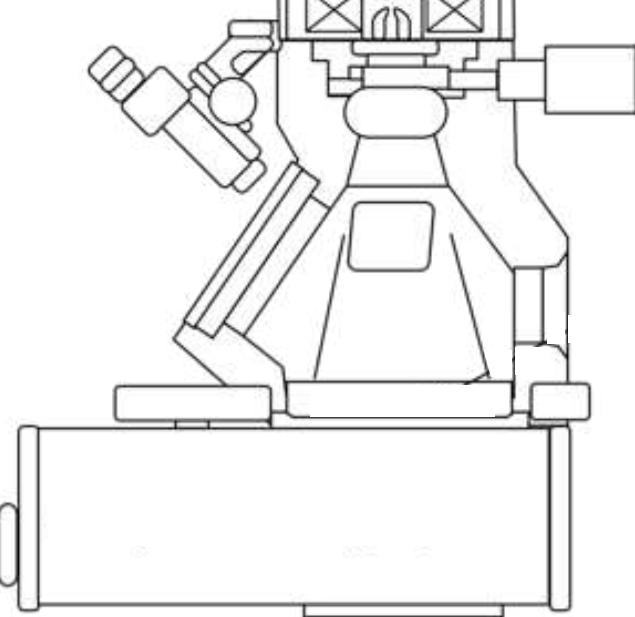


What types of pumps do we have?



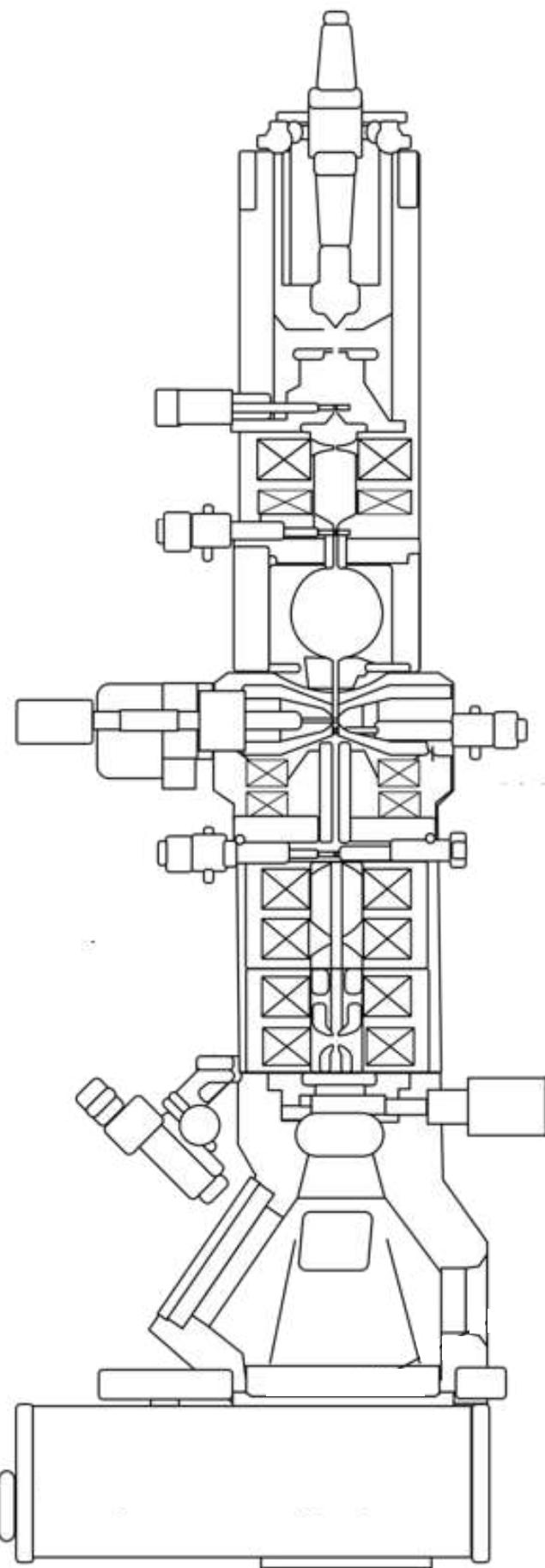
Gun

10^{-9} Torr



Specimen

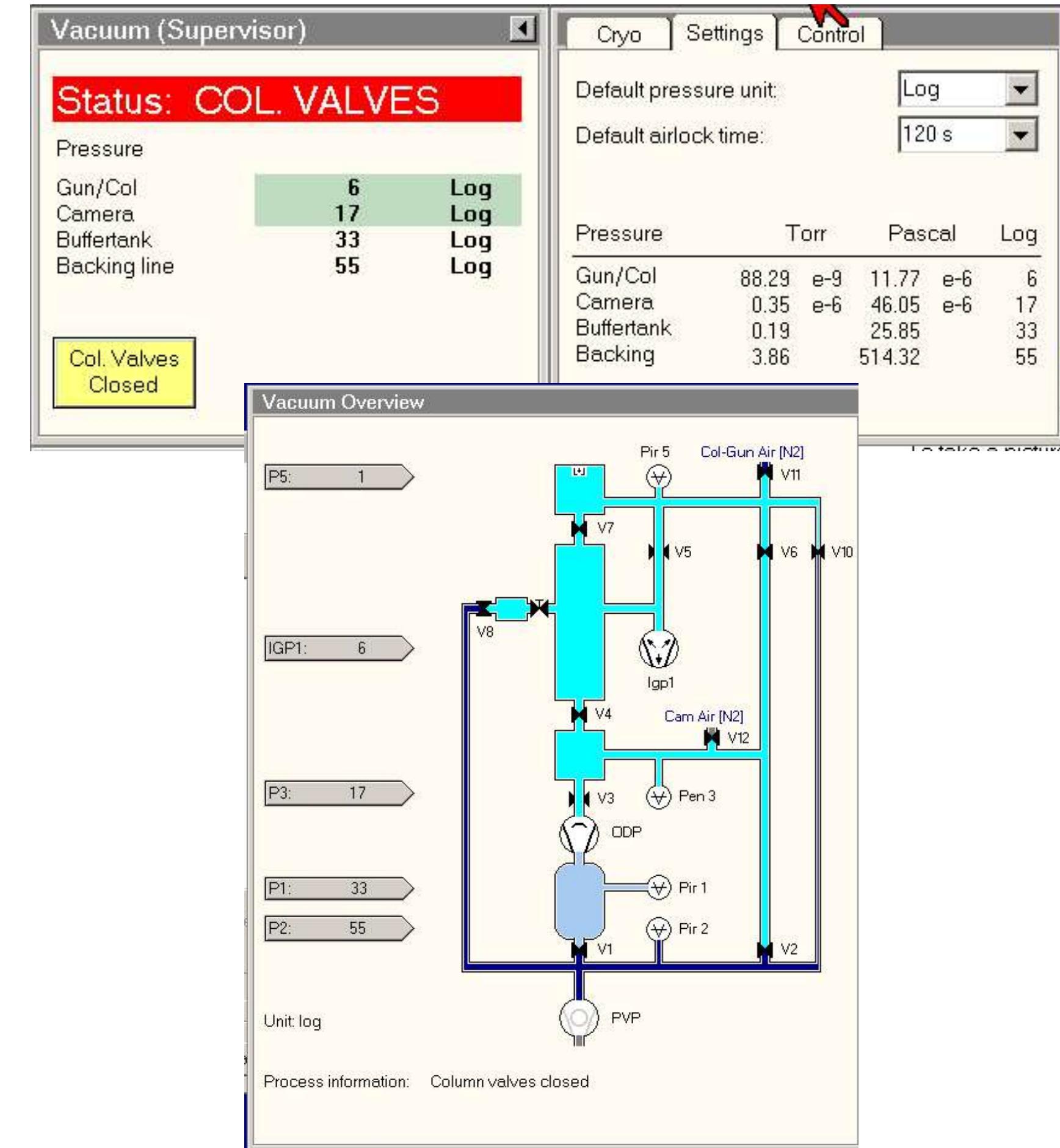
$10^{-6} - 10^{-7}$ Torr



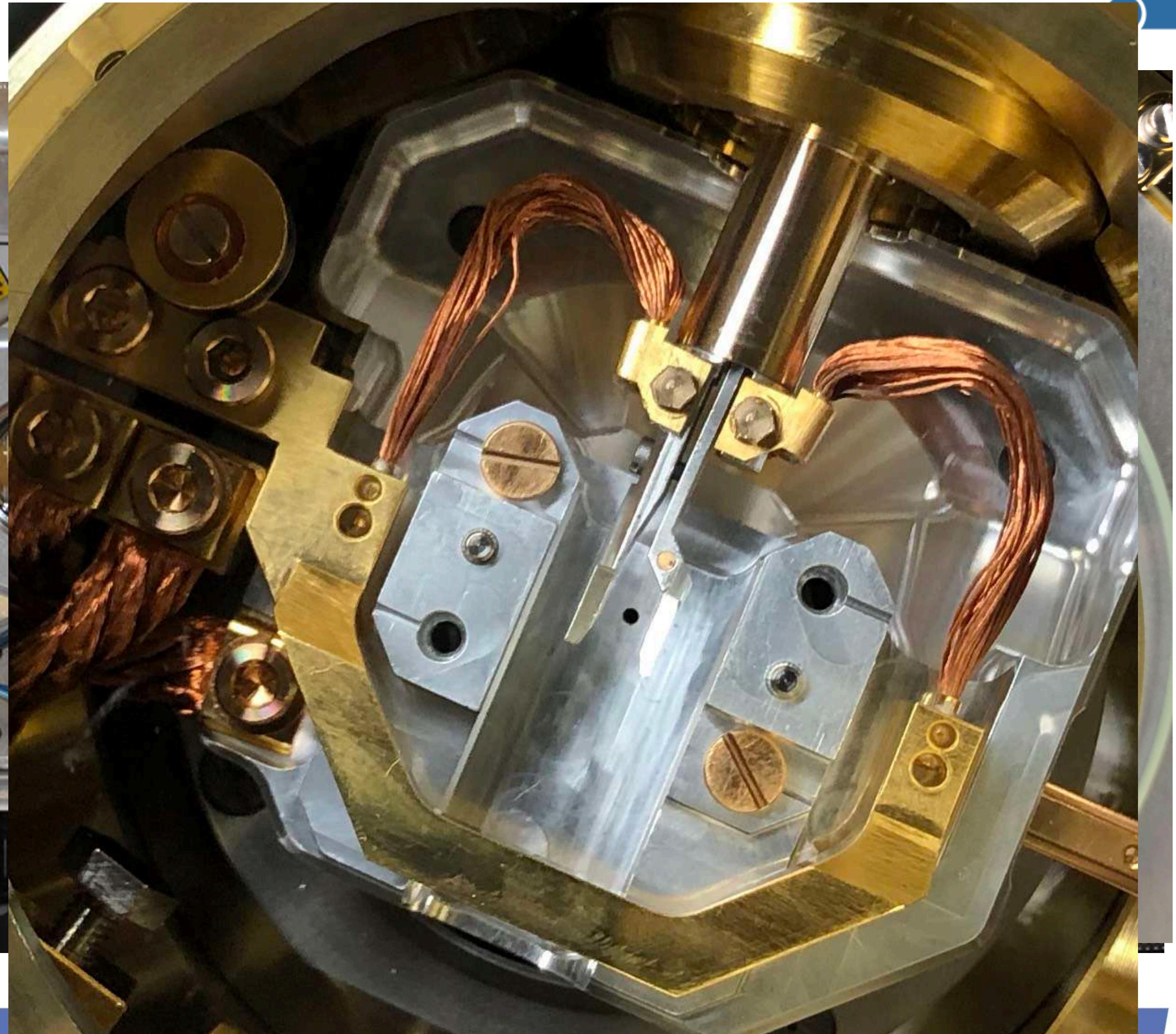
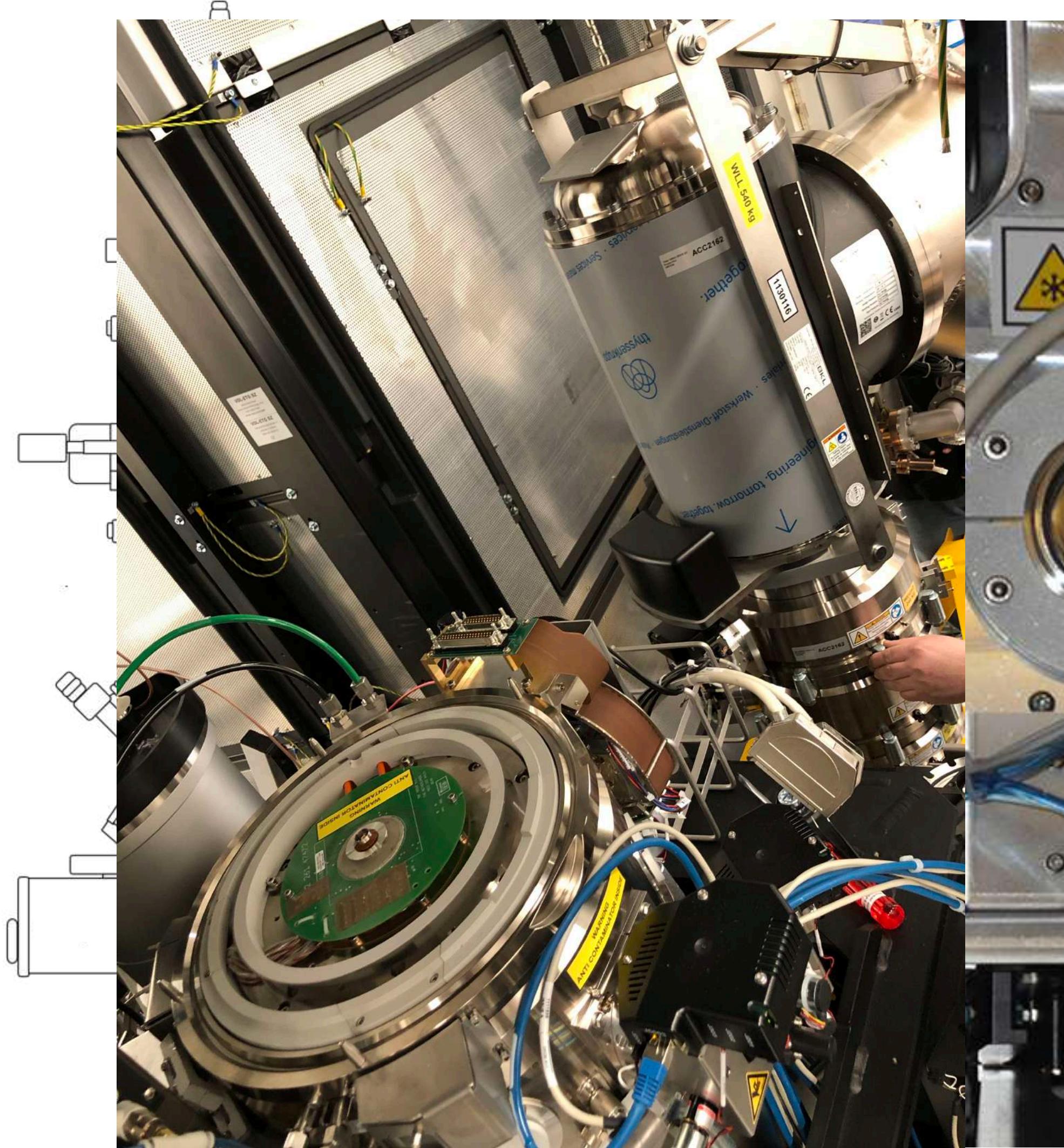
Chamber and Camera

$10^{-5} - 10^{-6}$ Torr

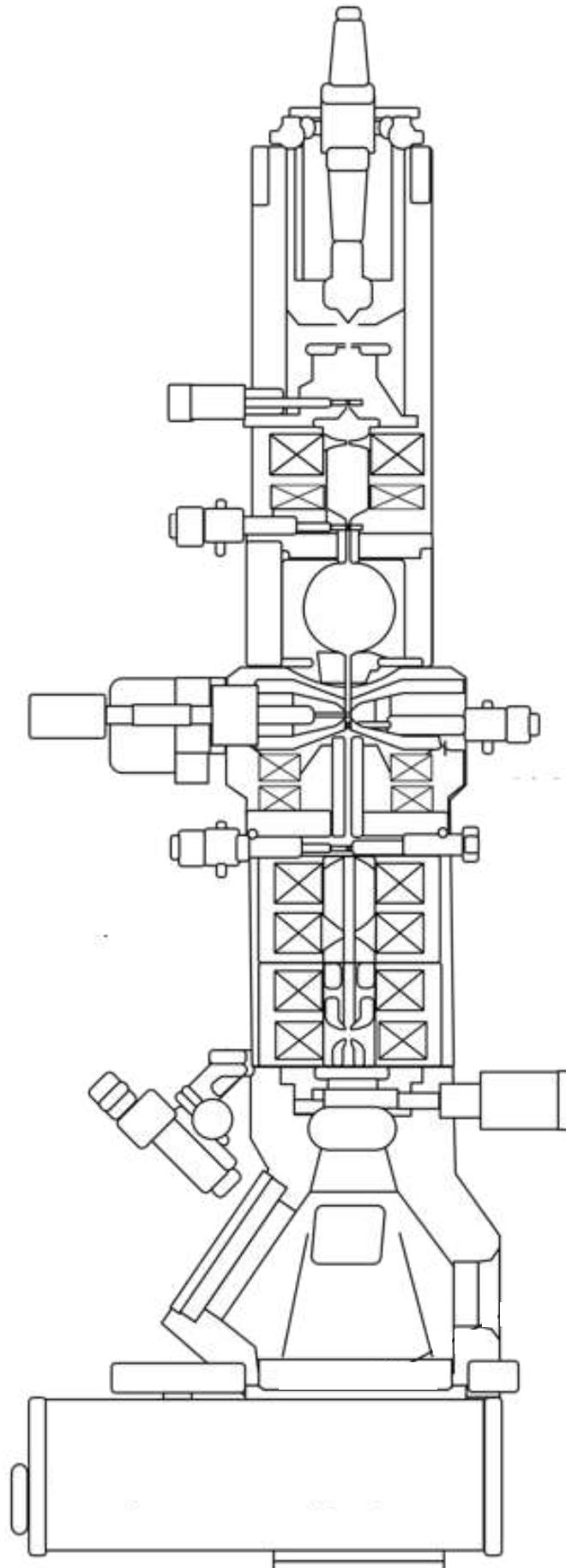
$1 \text{ mm Hg} = 1 \text{ Torr} = 10^2 \text{ Pa}$
 $1 \text{ atm} = 760 \text{ Torr} = 7.5 \times 10^4 \text{ Pa}$



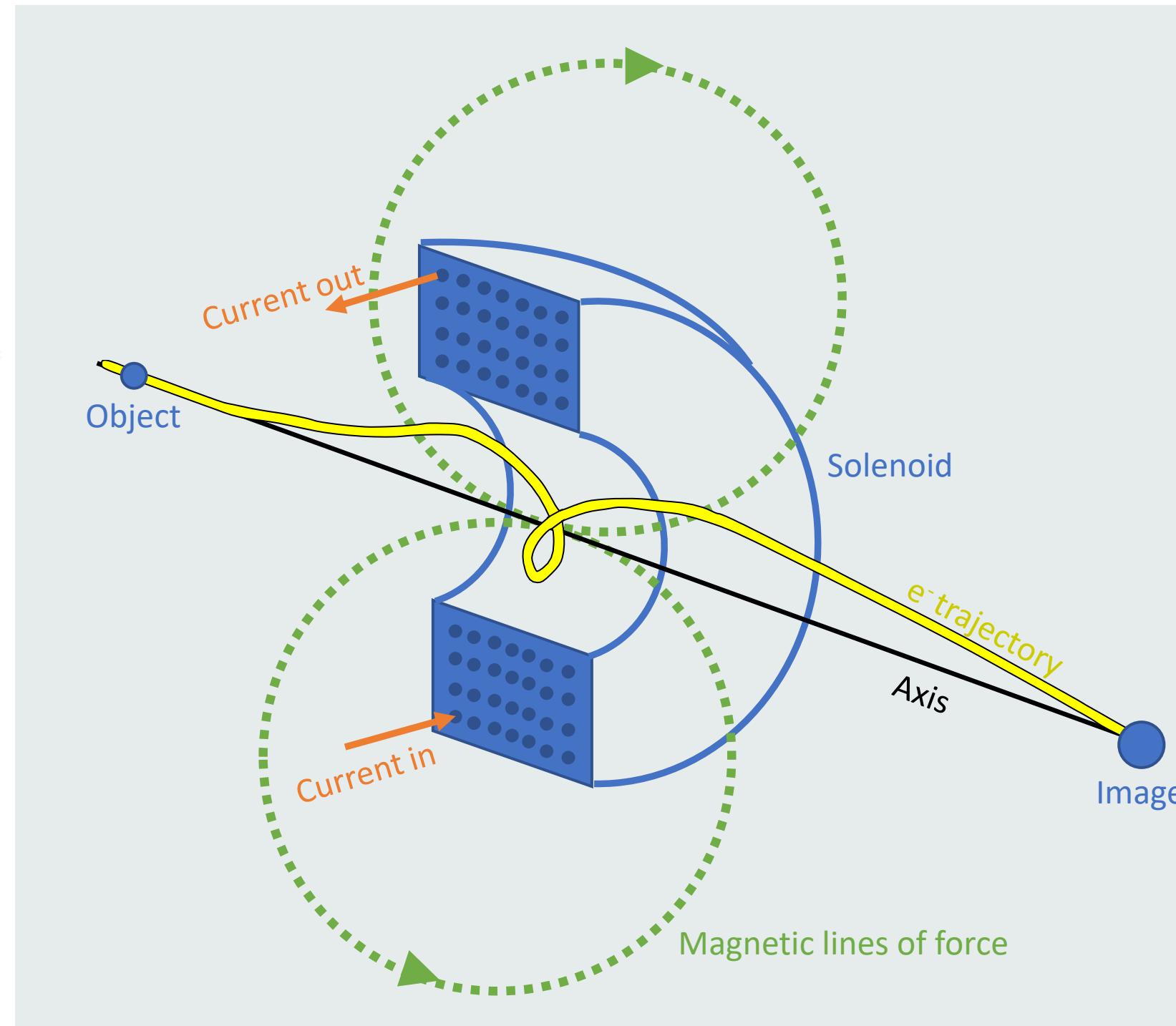
Vacuum systems



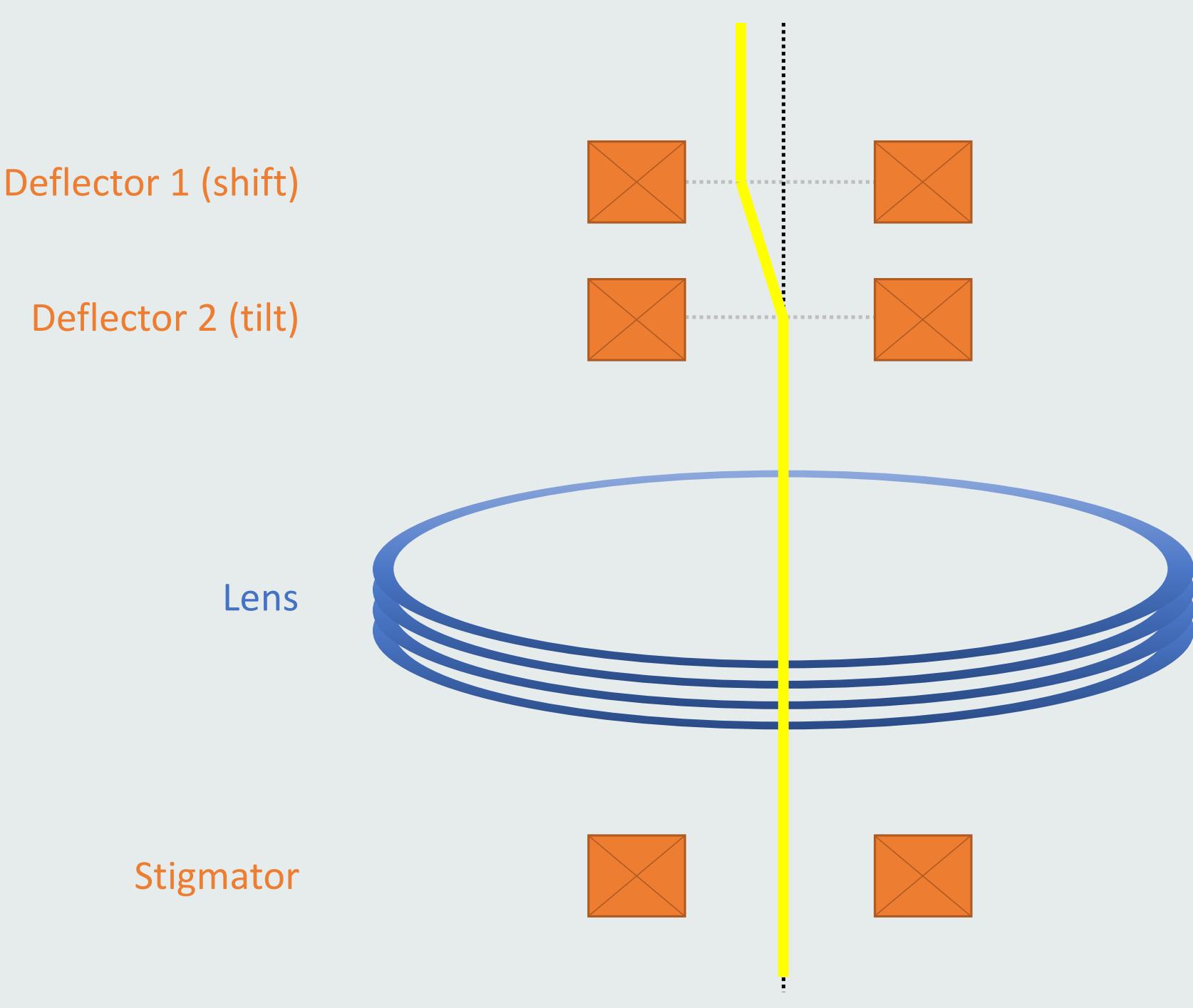
Lenses



What types of lenses do we have?



- Focus
- Magnify
- Rotate

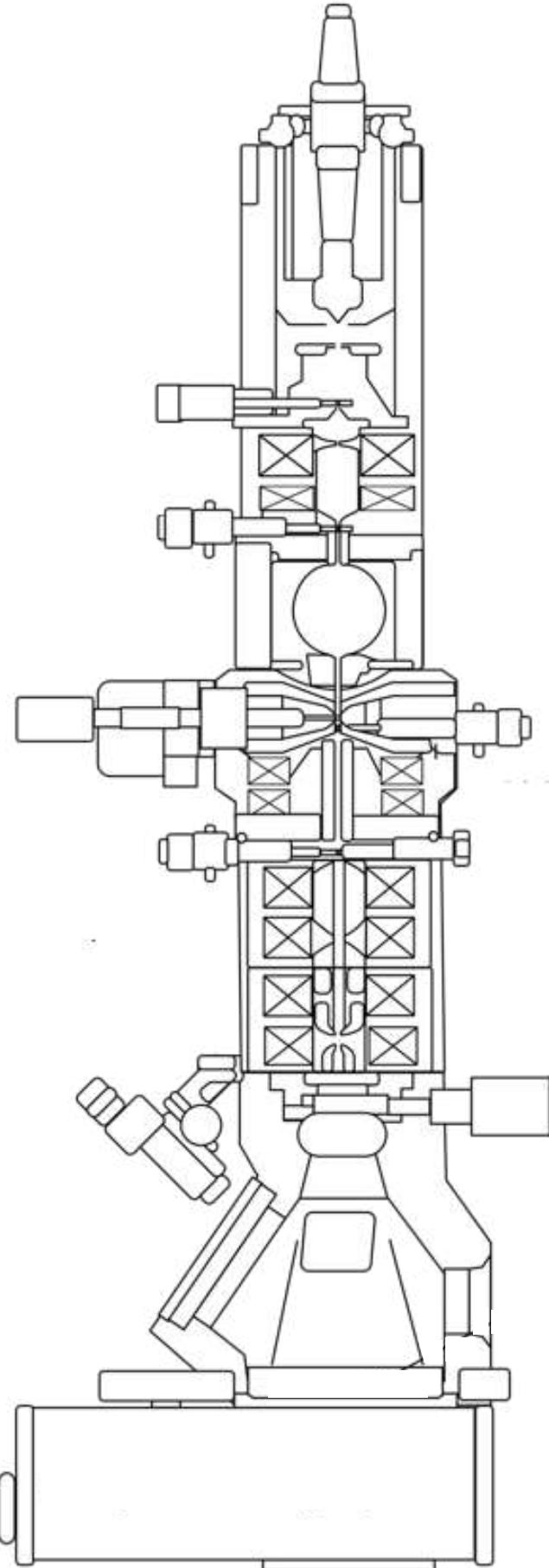


Lenses

Microscope Alignments What to do & what not to do



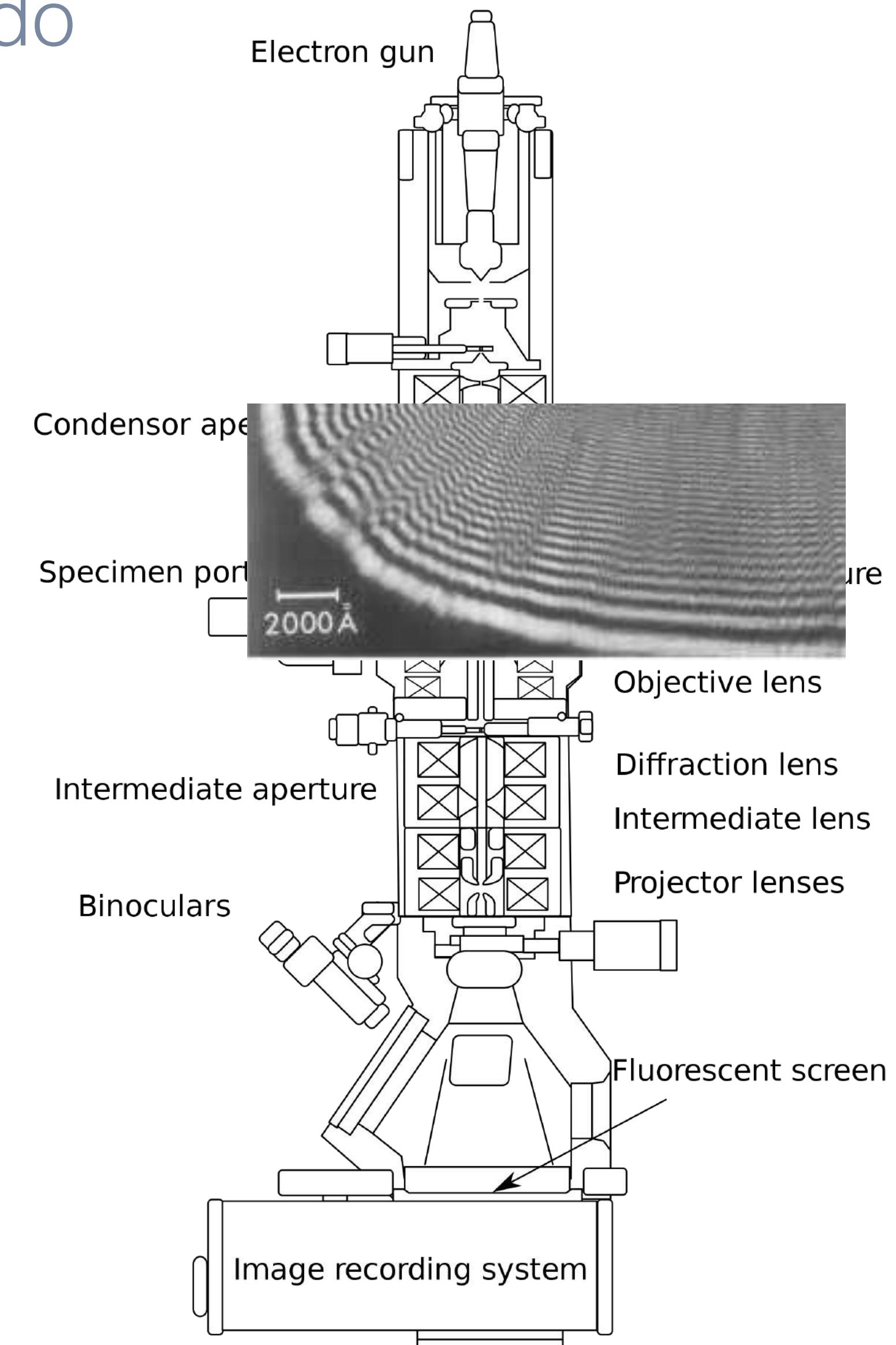
- Do:



- Start at eucentric height and focus
- Check if it is already good before attempt
- Align from top to bottom

- Not to do:

- ~~Align without a way to undo~~
- ~~Align when TEM is not stable (i.e., temperature)~~

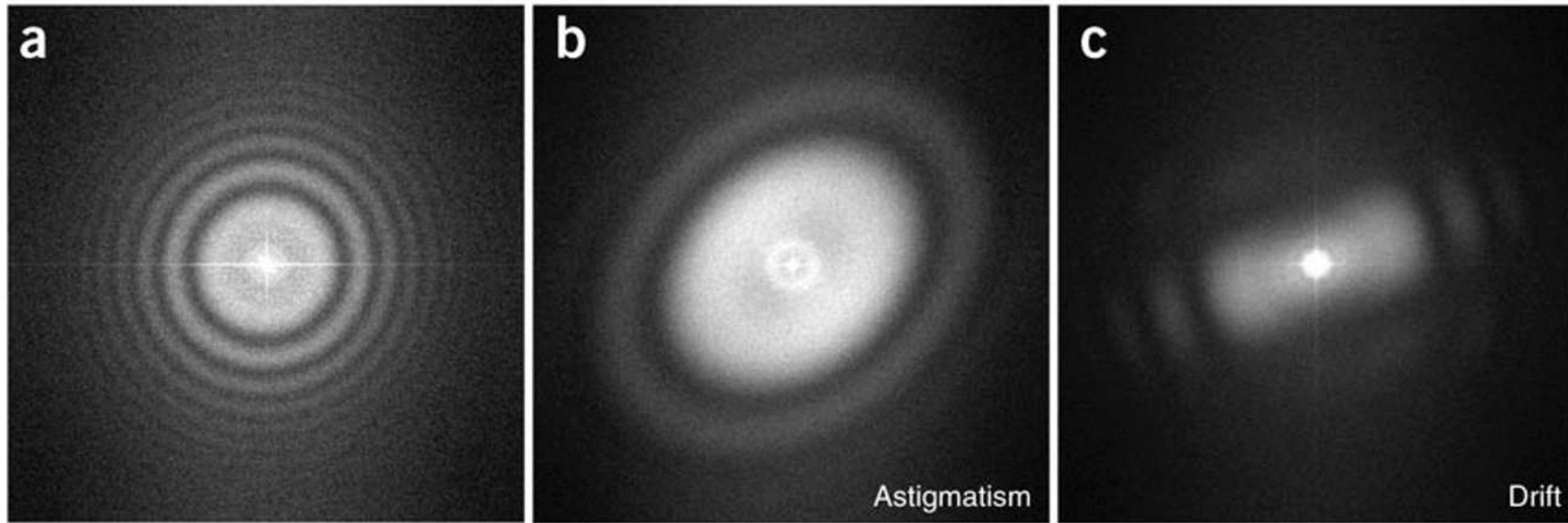
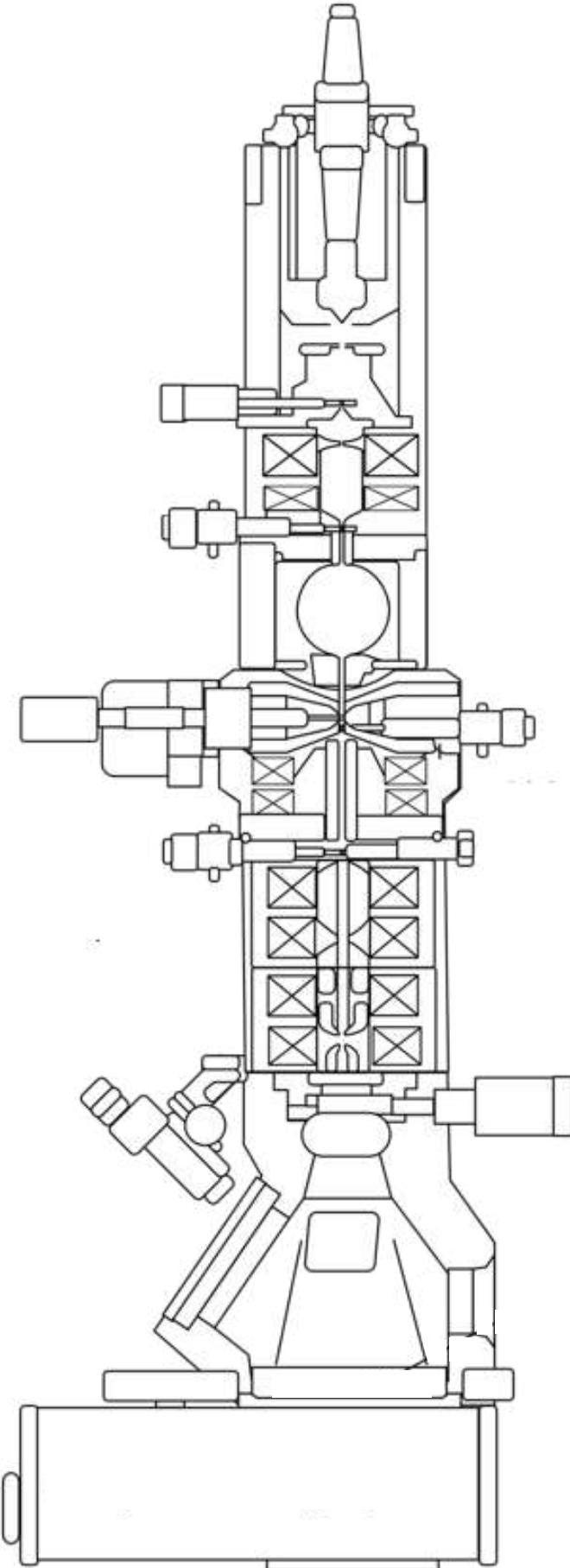


Lenses

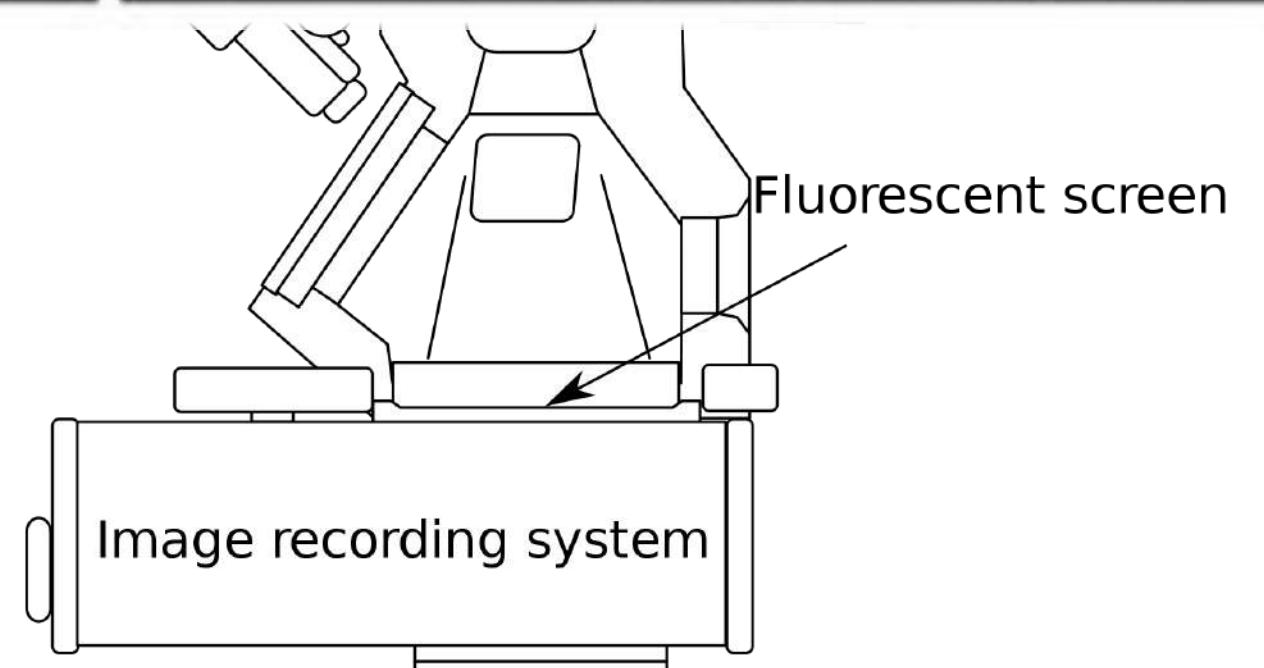
Microscope Alignments What to do & what not to do

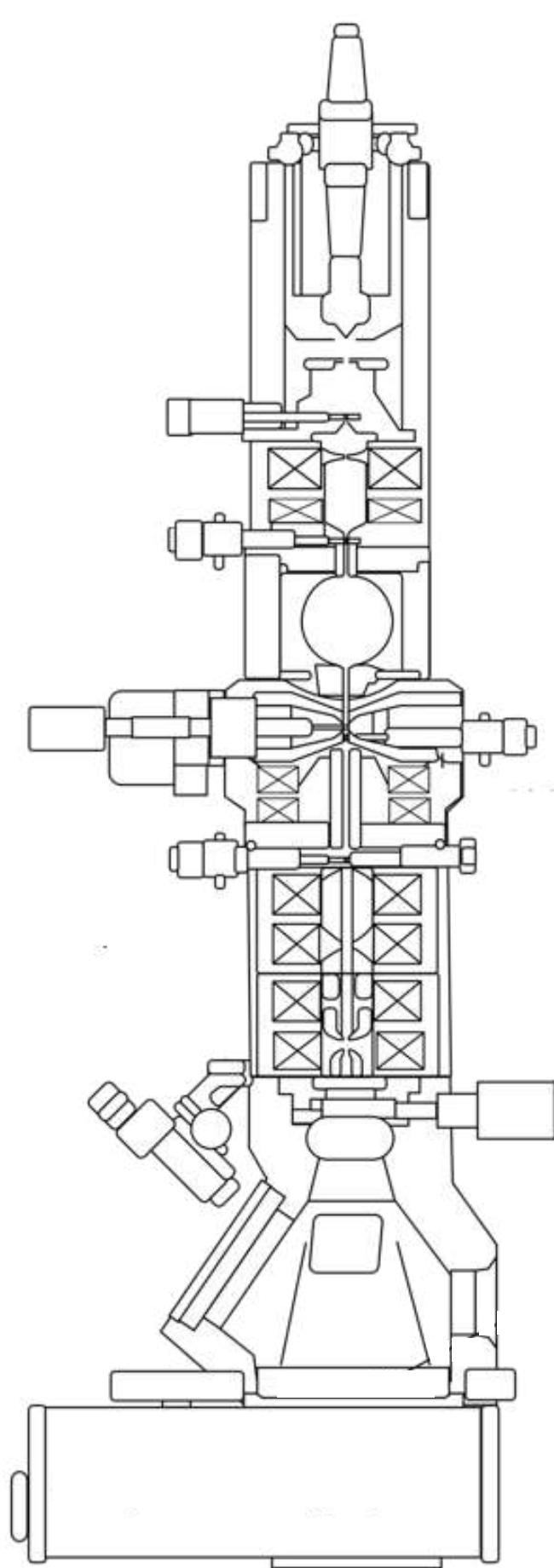


- Do:



- ~~Align without a way to undo~~
- ~~Align when TEM is not stable
(i.e., temperature)~~



**a**

The **contrast transfer function (CTF)** mathematically describes how aberrations in a transmission electron microscope (TEM) modify the image of a sample

The phase shift (phase distortion function) due to the objective lens can be combined into a single phase factor χ , given by,

$$\chi(|g|) = \left(\frac{1}{2} \pi C_s \lambda^3 |g|^4 - \pi \Delta f \lambda |g|^2 \right) \quad [4236a.a]$$

$$= \frac{2\pi}{\lambda} \left(\frac{1}{4} C_s \alpha^4 - \frac{1}{2} \Delta f \alpha^2 \right) \quad [4236a.b]$$

where,

C_s -- The spherical aberration coefficient, defining the quality of objective lens,

λ -- The wave-length,

Δf -- The defocus value,

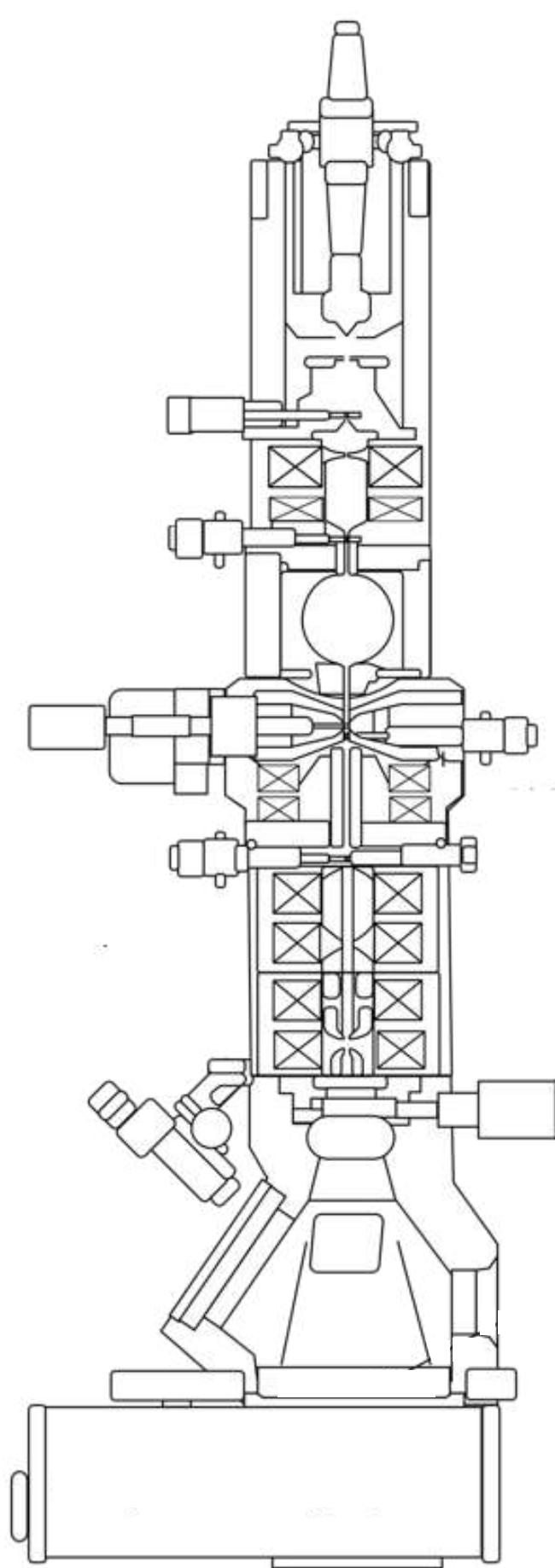
$|g|$ -- The spatial frequency,

α -- The convergence semi-angle.

<https://www.globalsino.com/EM/page4236.html>

Lenses

CTF



a

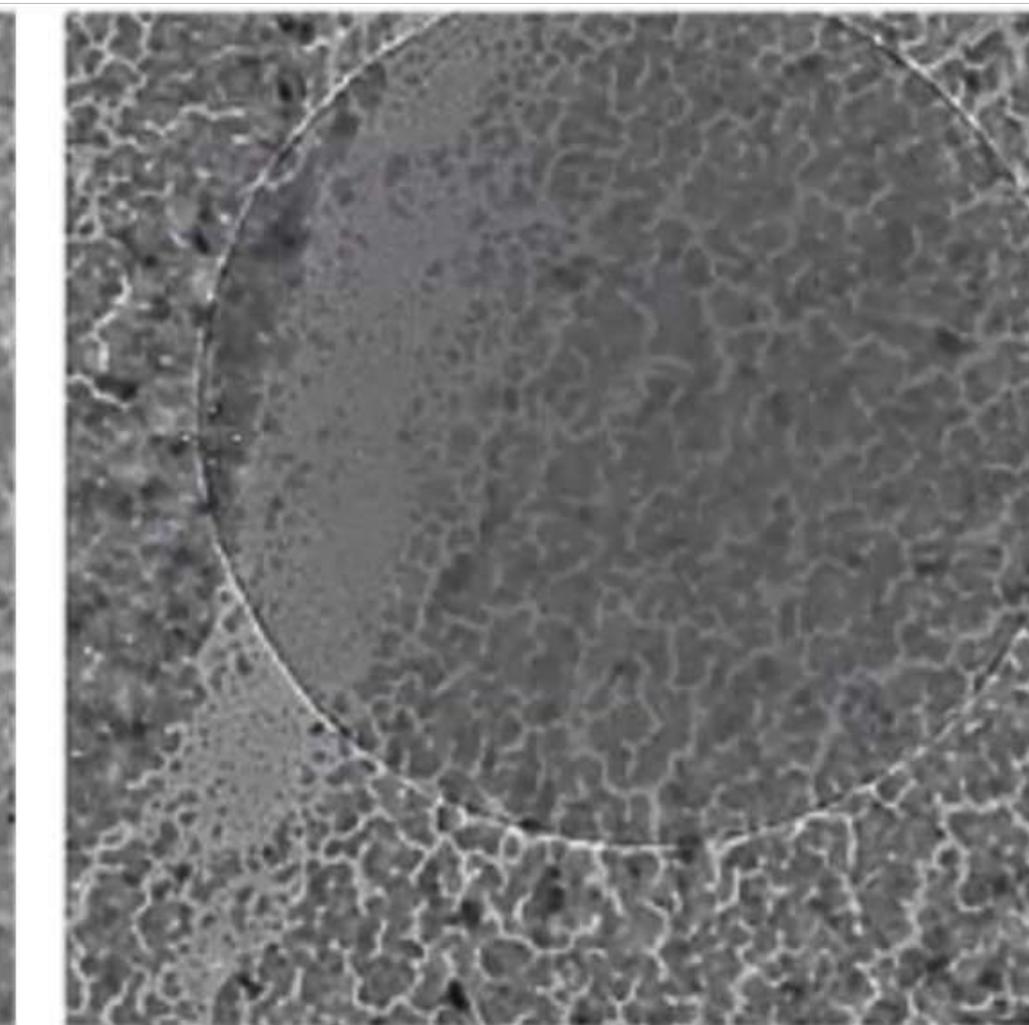
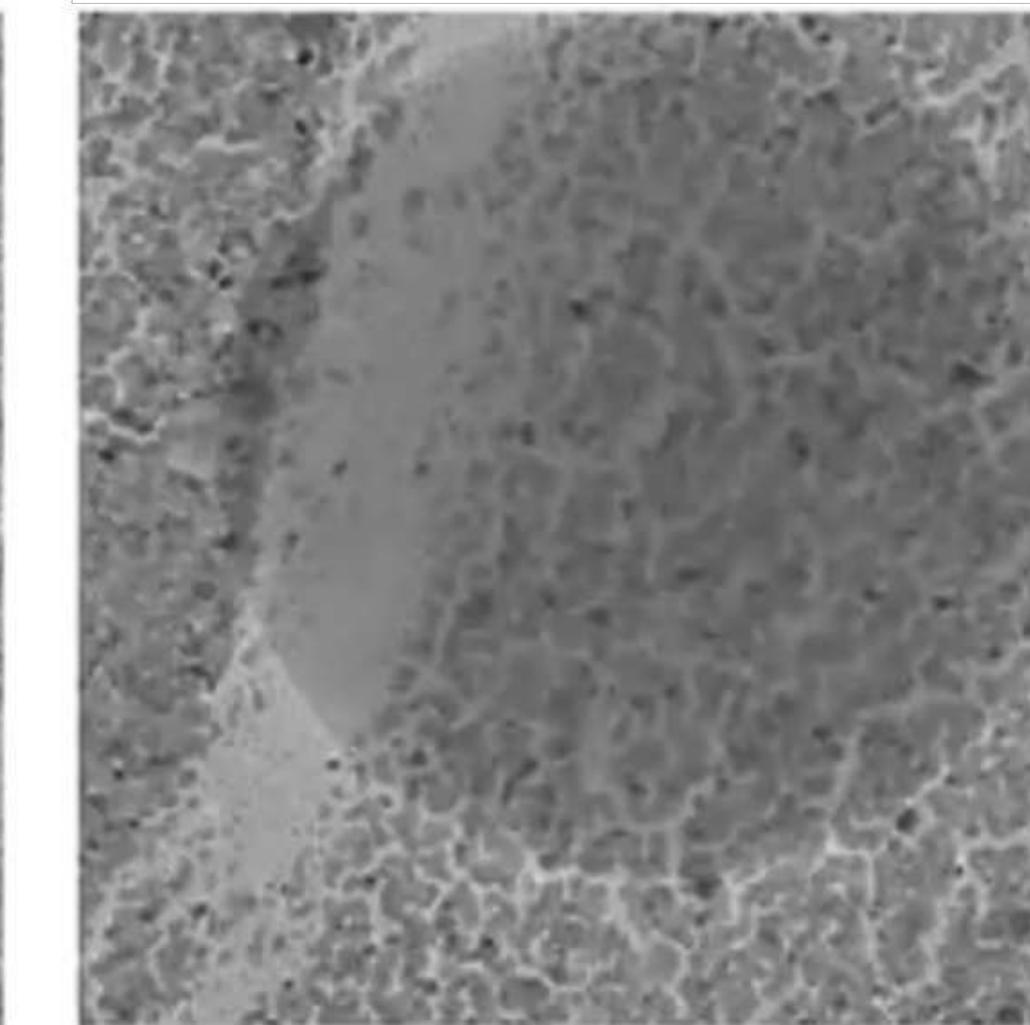
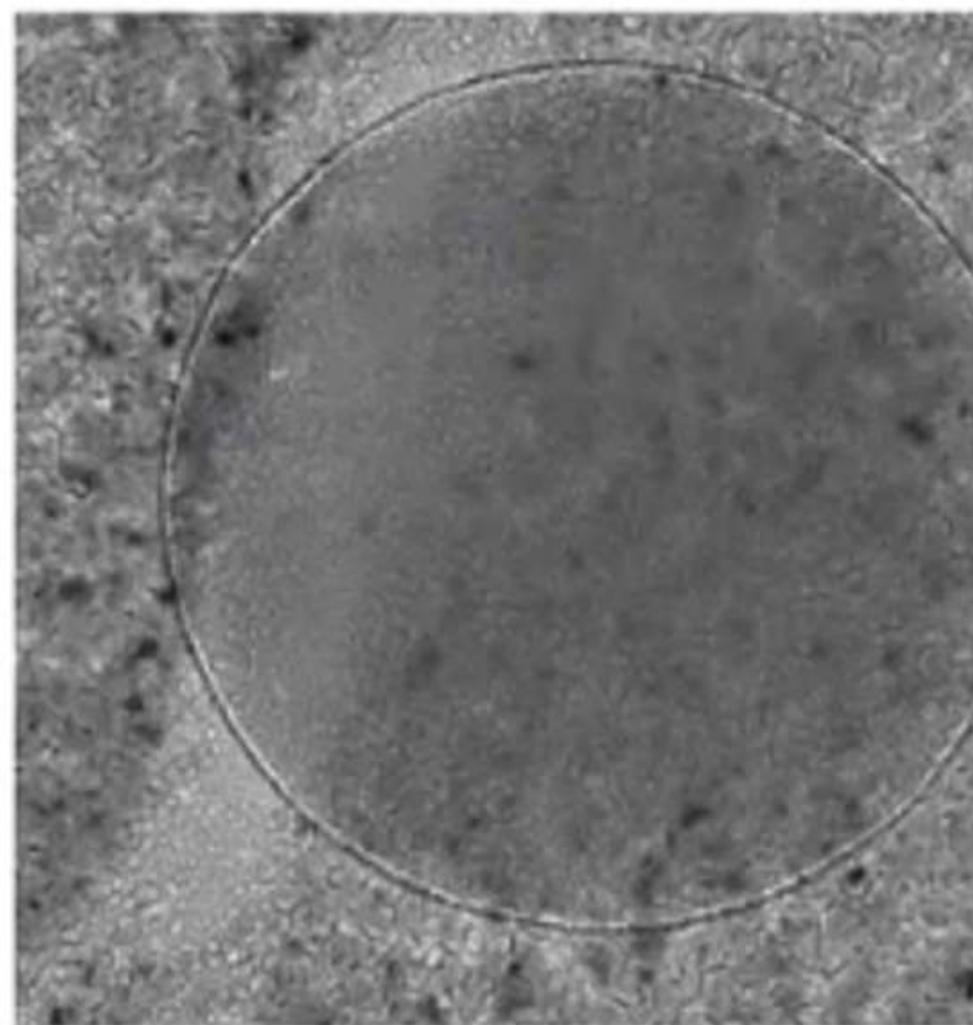
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where



Lenses

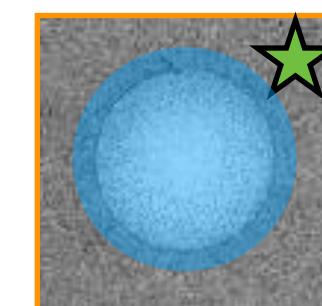
How to increase efficiency?



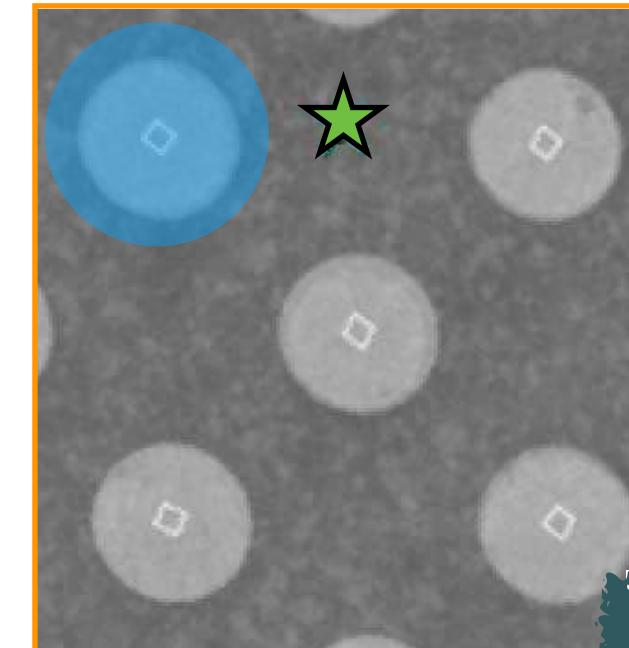
1 target/setup
80 s/image
~1000 images/day



13.6MP



beam tilt
0 mrad

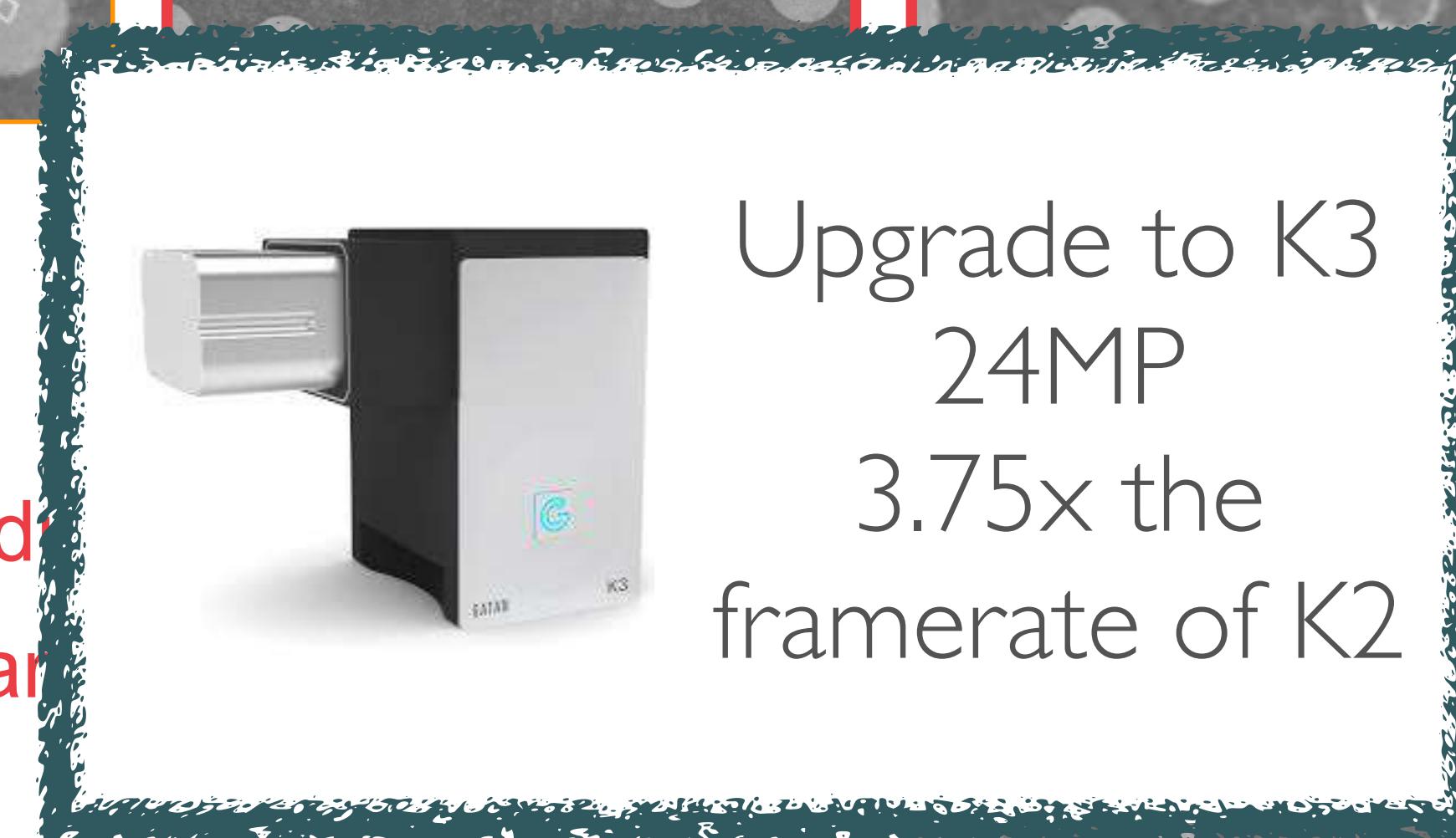


beam tilt
0.5 mrad

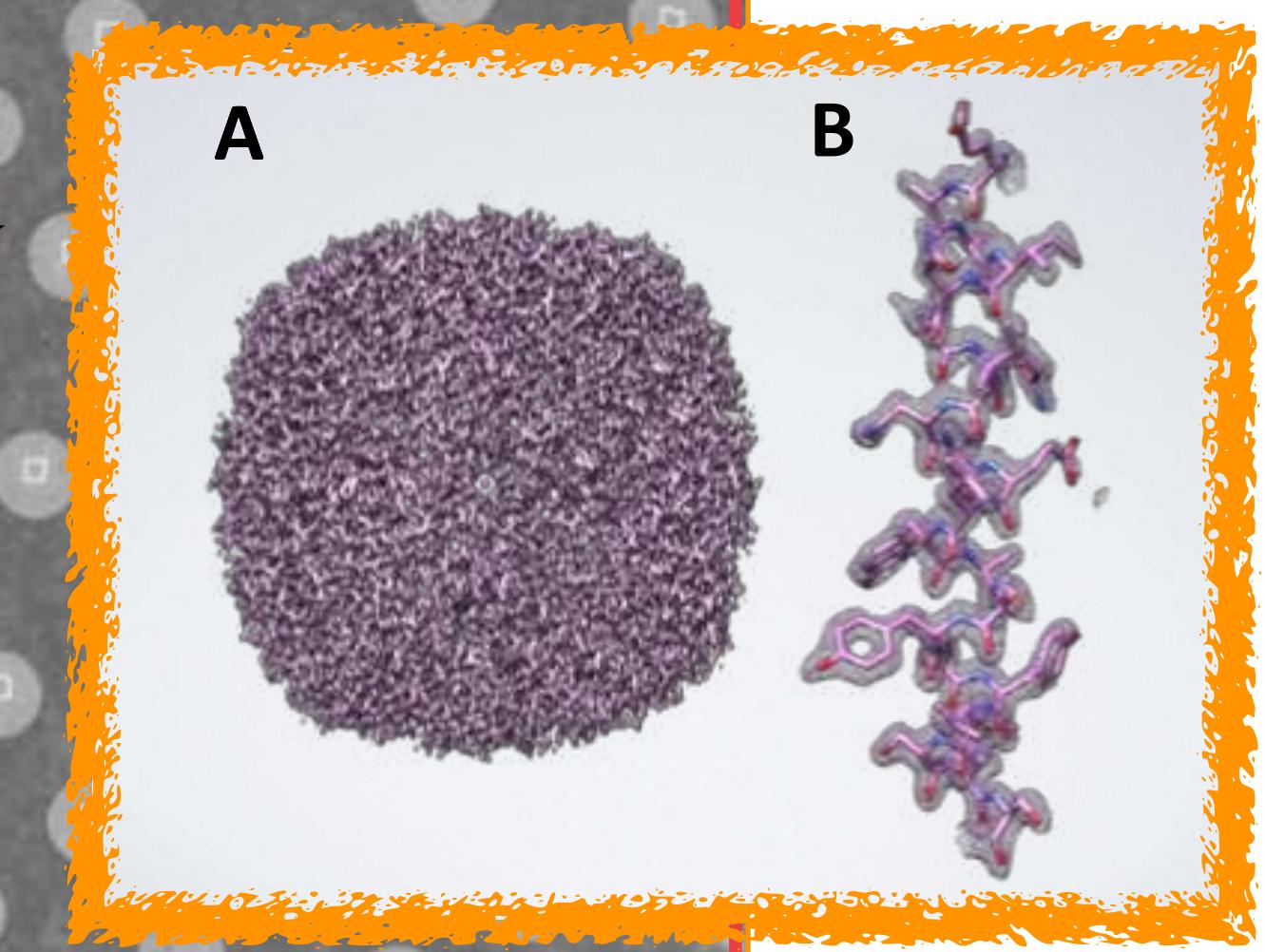
5 targets/setup
35 s/image
~2500 images/day

30 targets/setup
22 s/image
~3800 images/day

70 targets/setup
18 s / image
~ 4800 images/day



Upgrade to K3
24MP
3.75x the
framerate of K2



beam tilt
~3 mrad

Overhead
30 s stage move and settling
30 s focus and drift check
20s for K2 40 frame movie to save



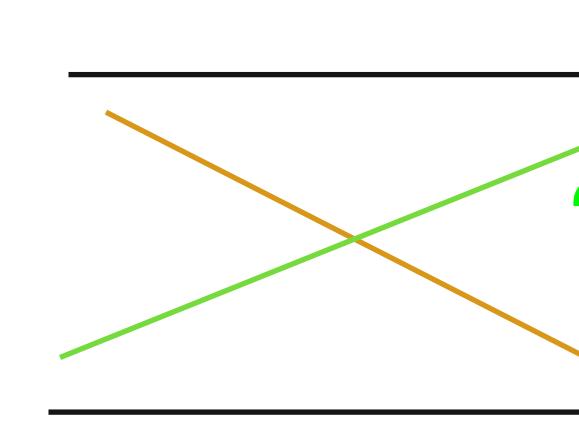
Anchi Cheng

Detectors

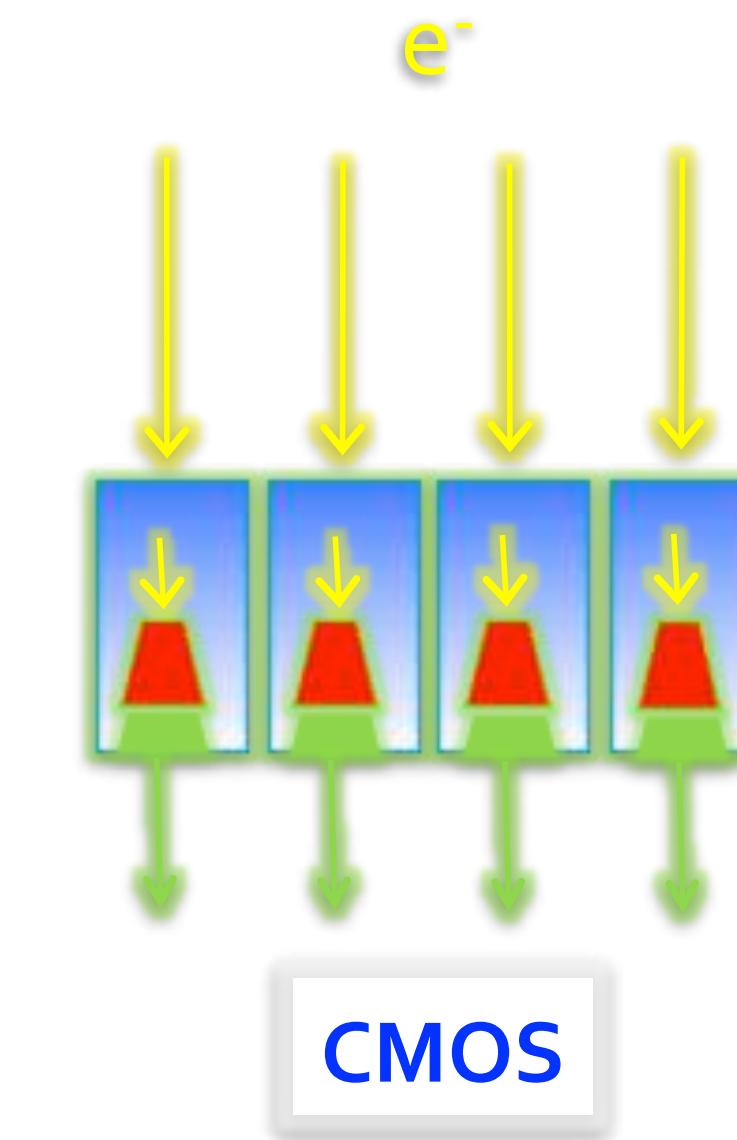
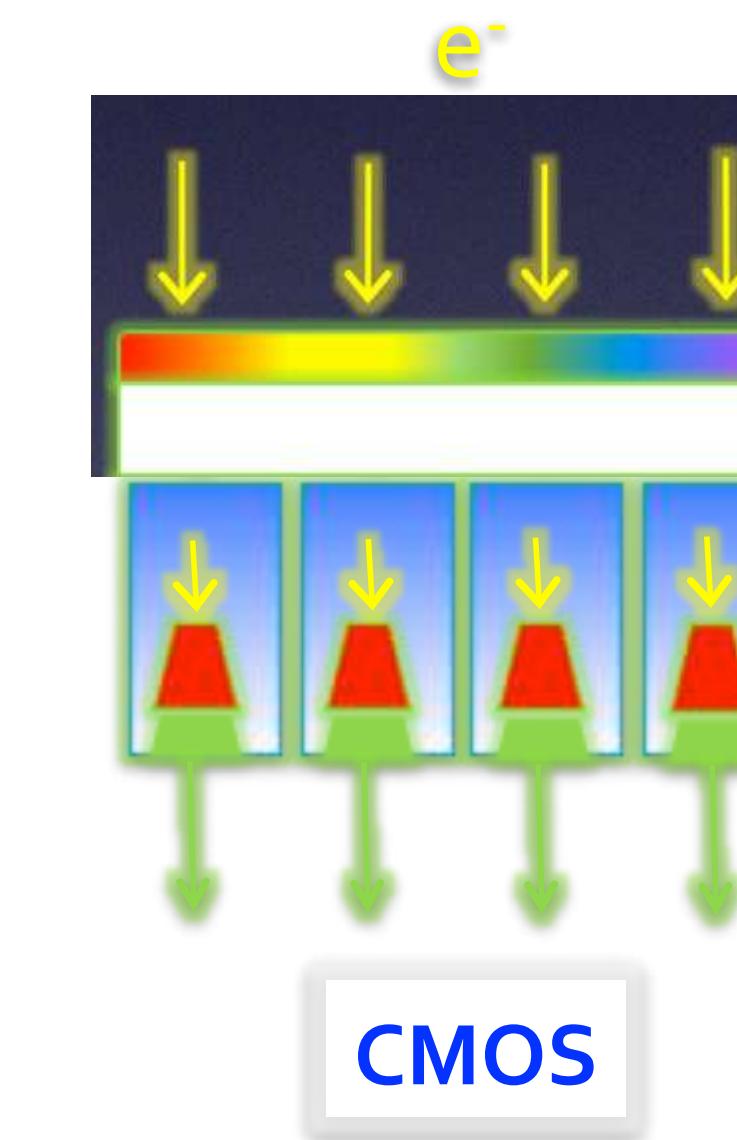
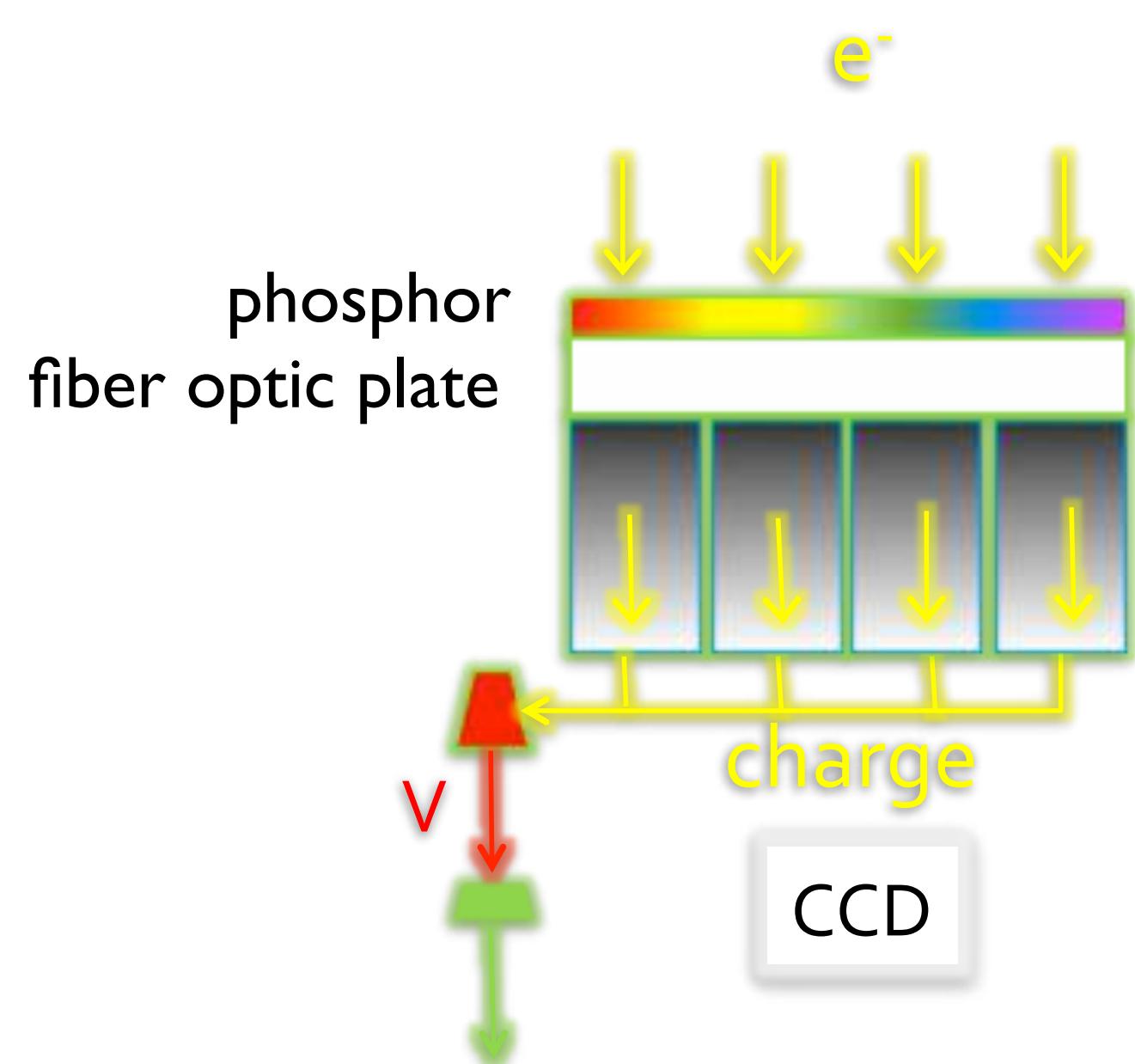
Digital Cameras for TEM



- Photon converted
- Direct sensing



- **CCD** Charge Coupled Device
- **CMOS** Complementary Metal Oxide Semiconductor



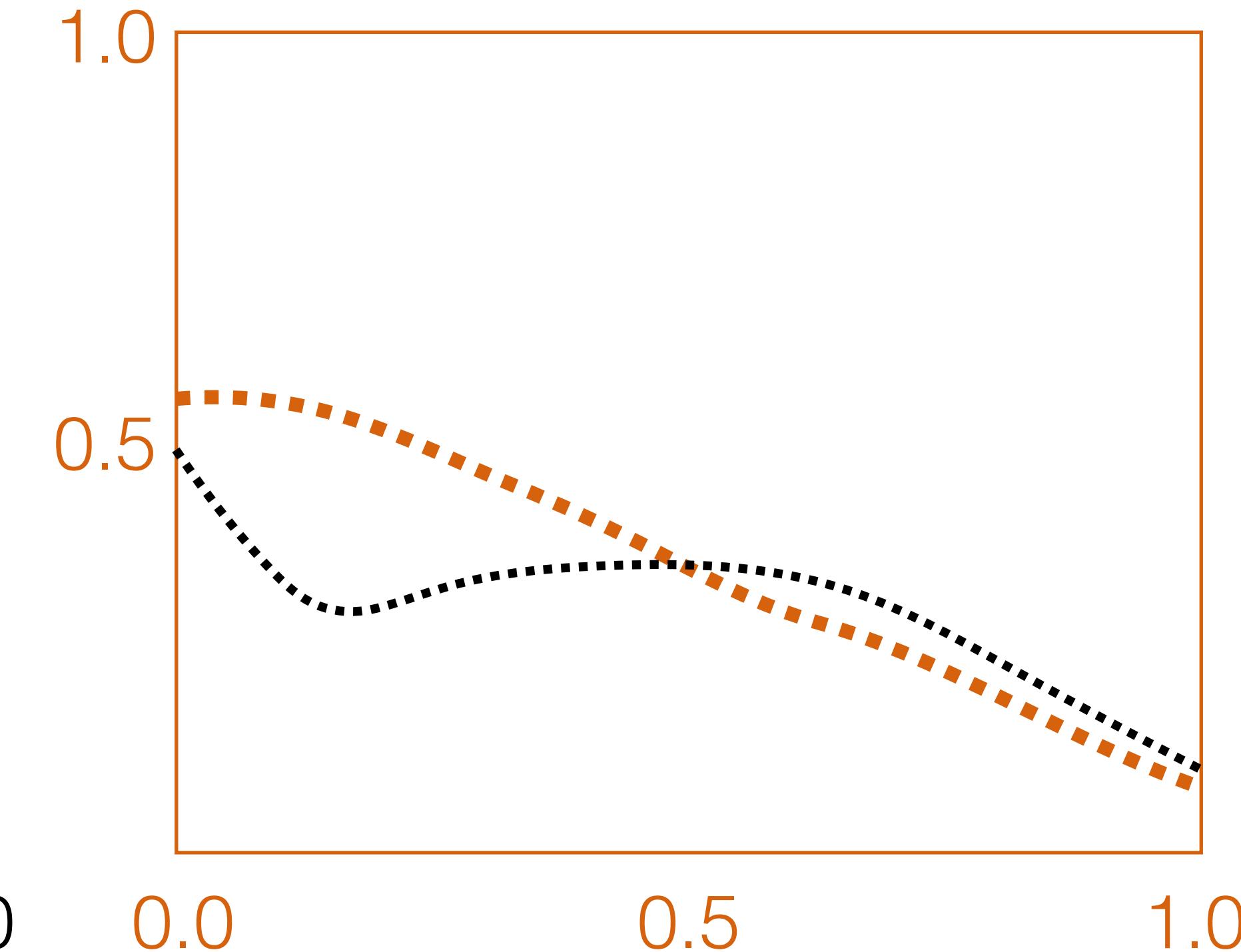
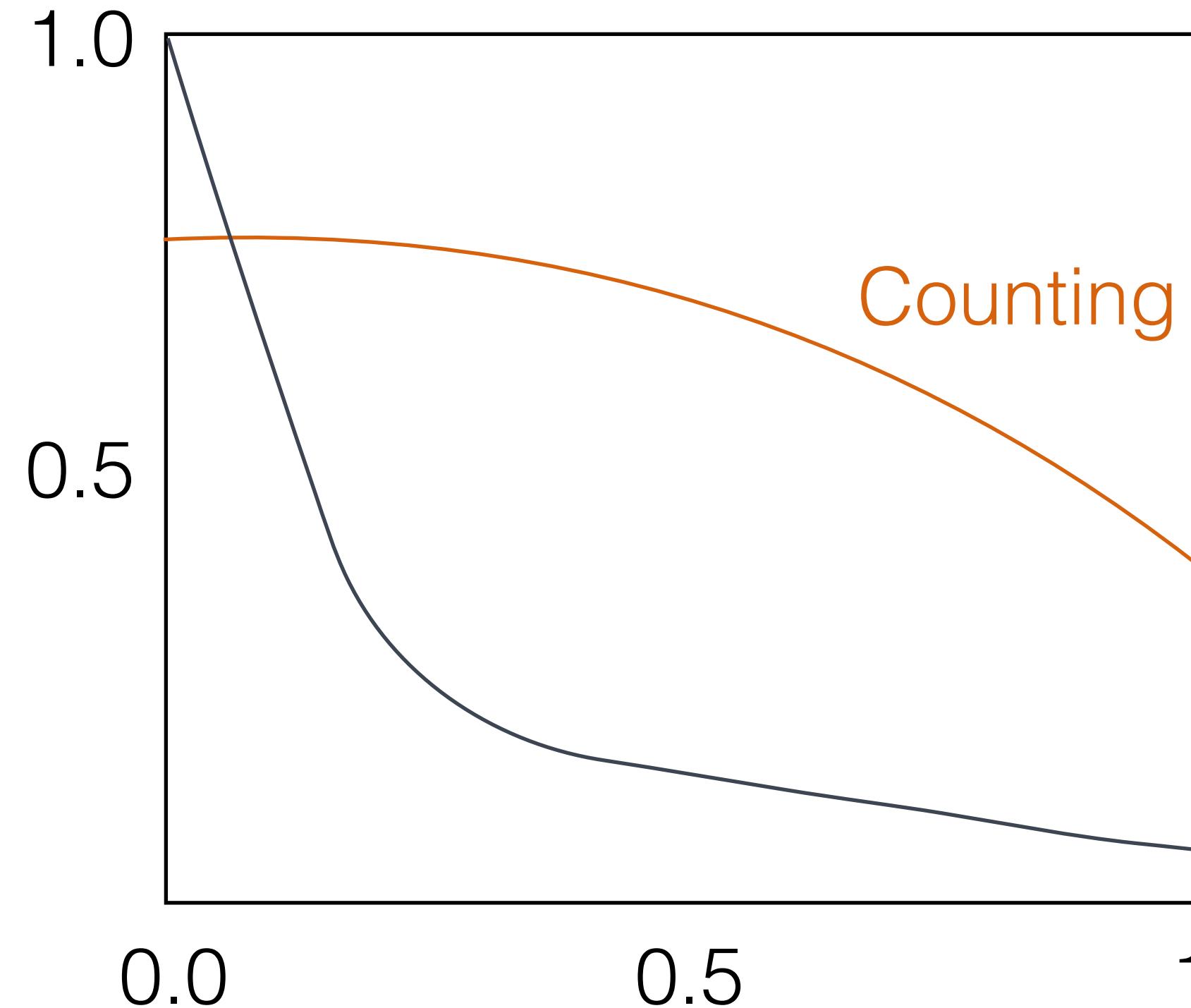
high dose rate

Direct Detectors

Anchi Cheng

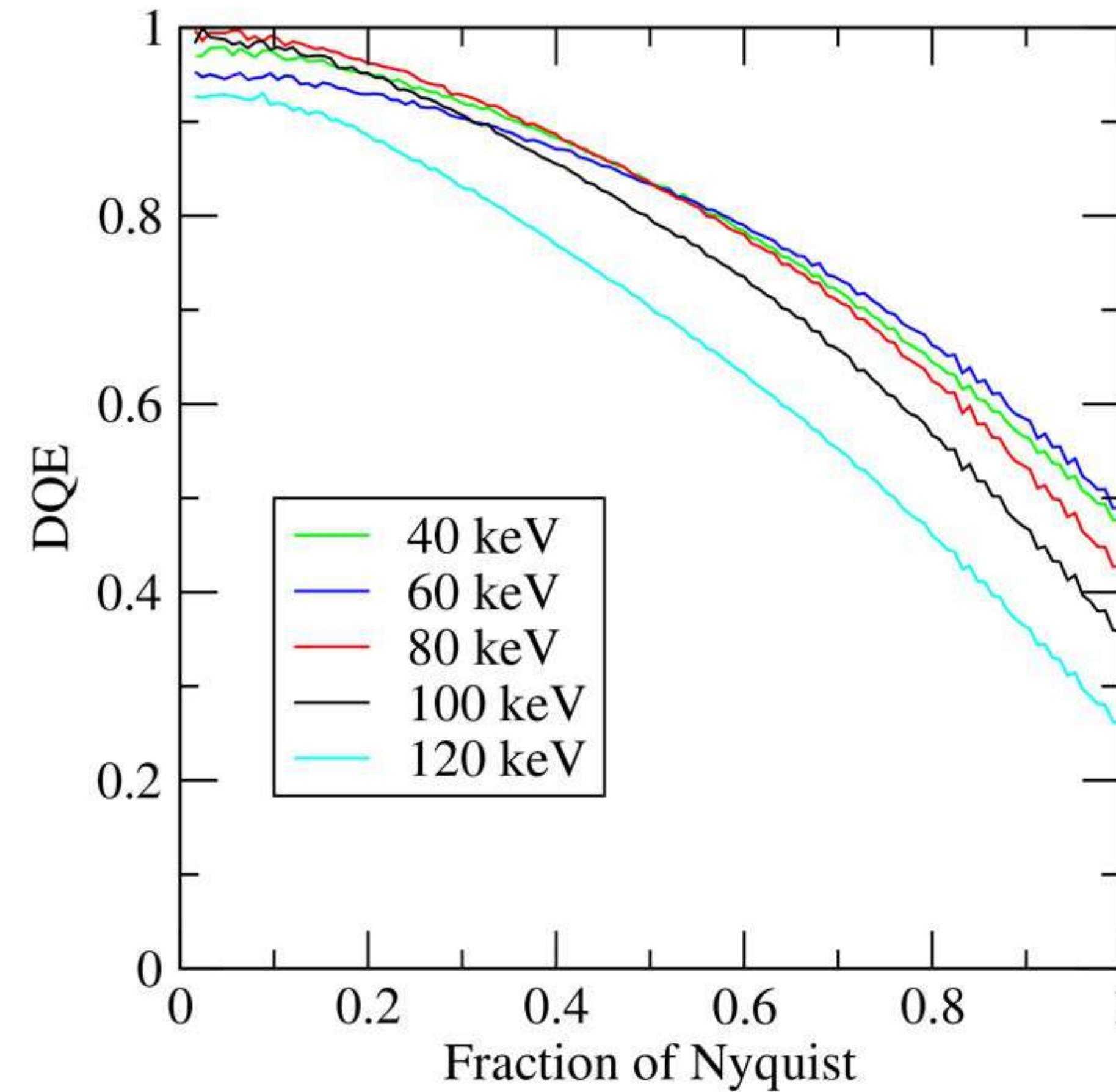


- MTF (Modulation Transfer Transform)
- contribute to signal envelope
- DQE (Detector Quantum Efficiency)
- S/N over spatial frequency range

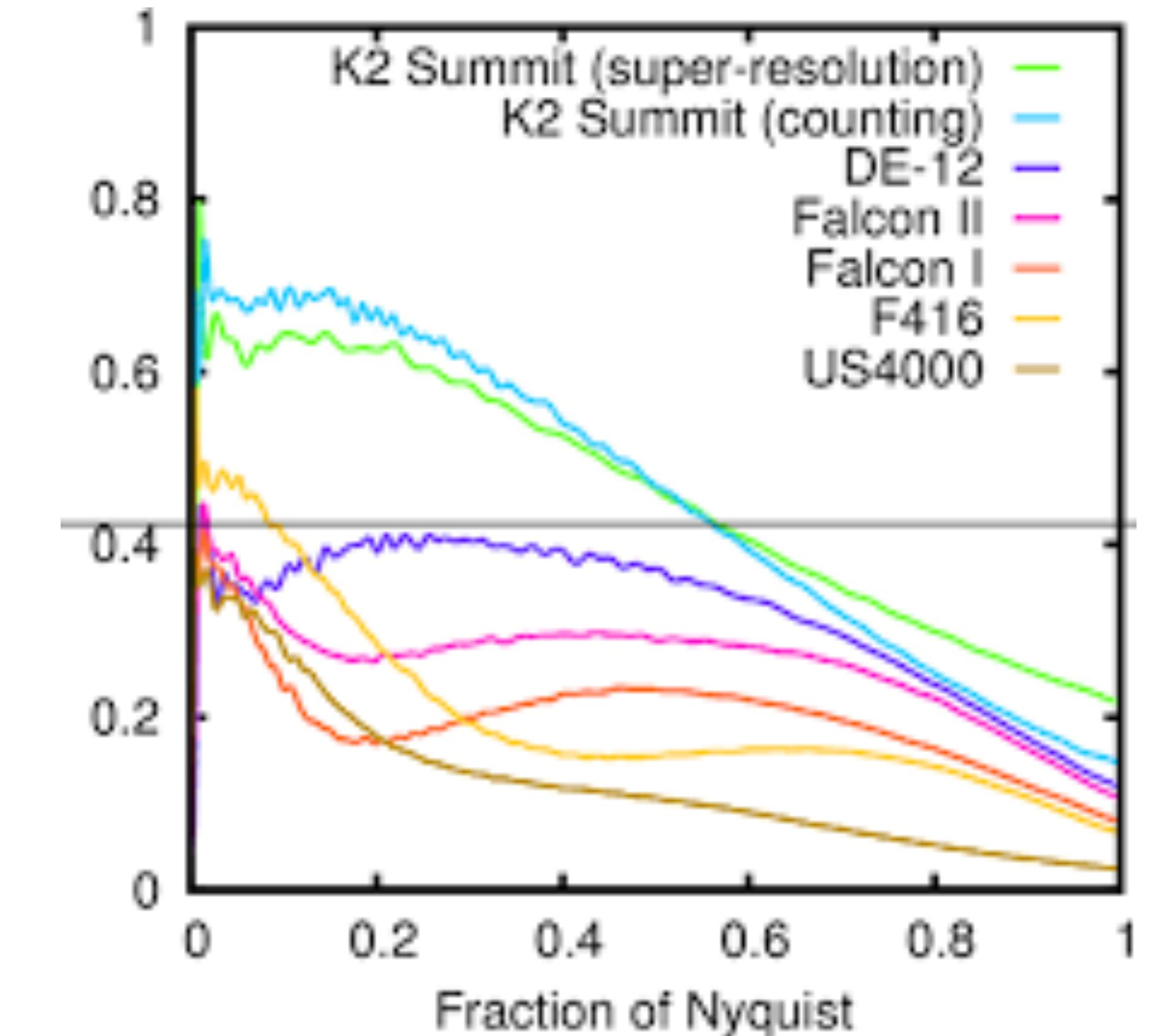


Detectors

Detector Performance Characterization



dectris.com



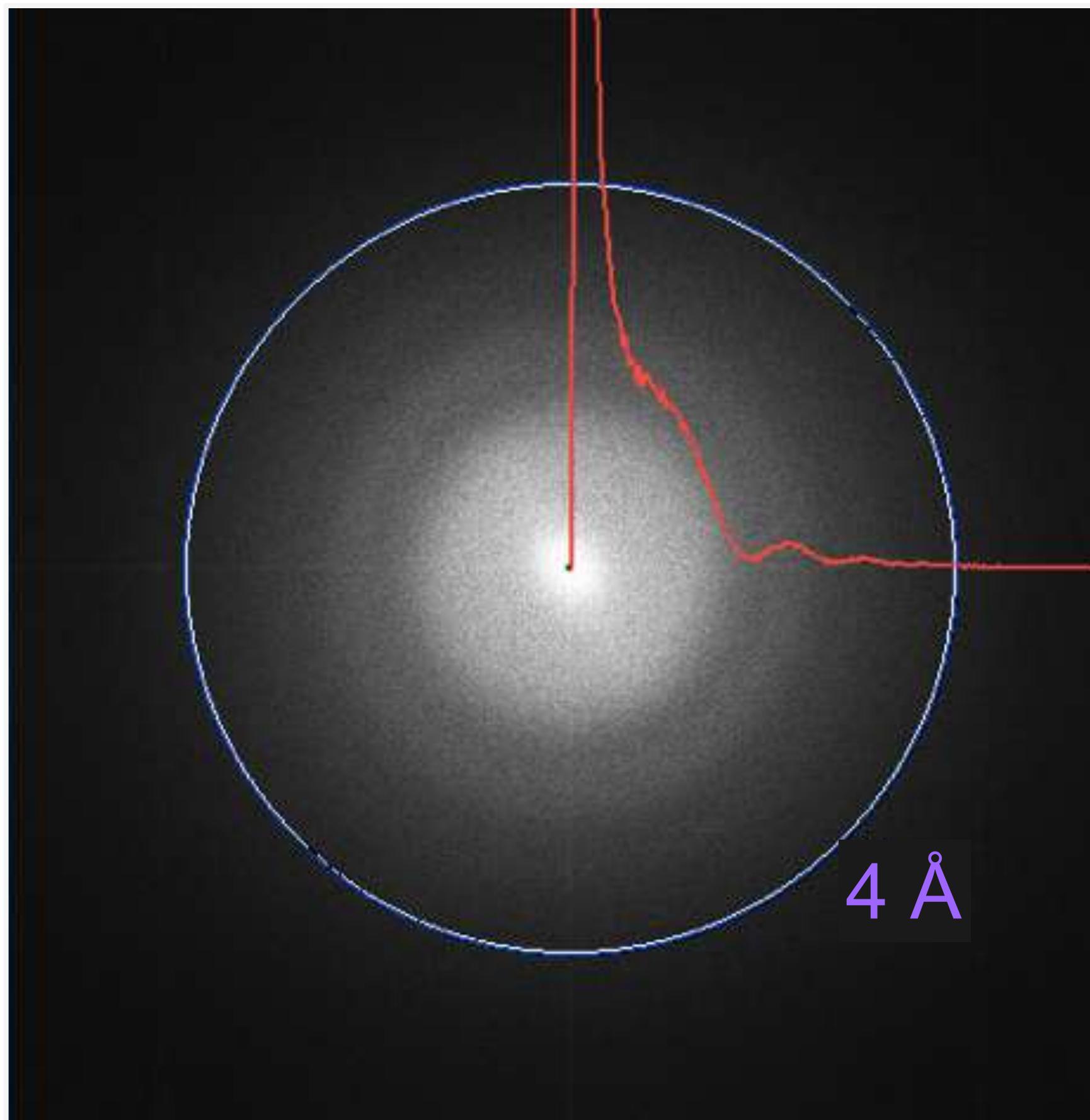
Ruskin, et al JSB

Detectors

Improving the resolution:
Detecting electrons instead of photons

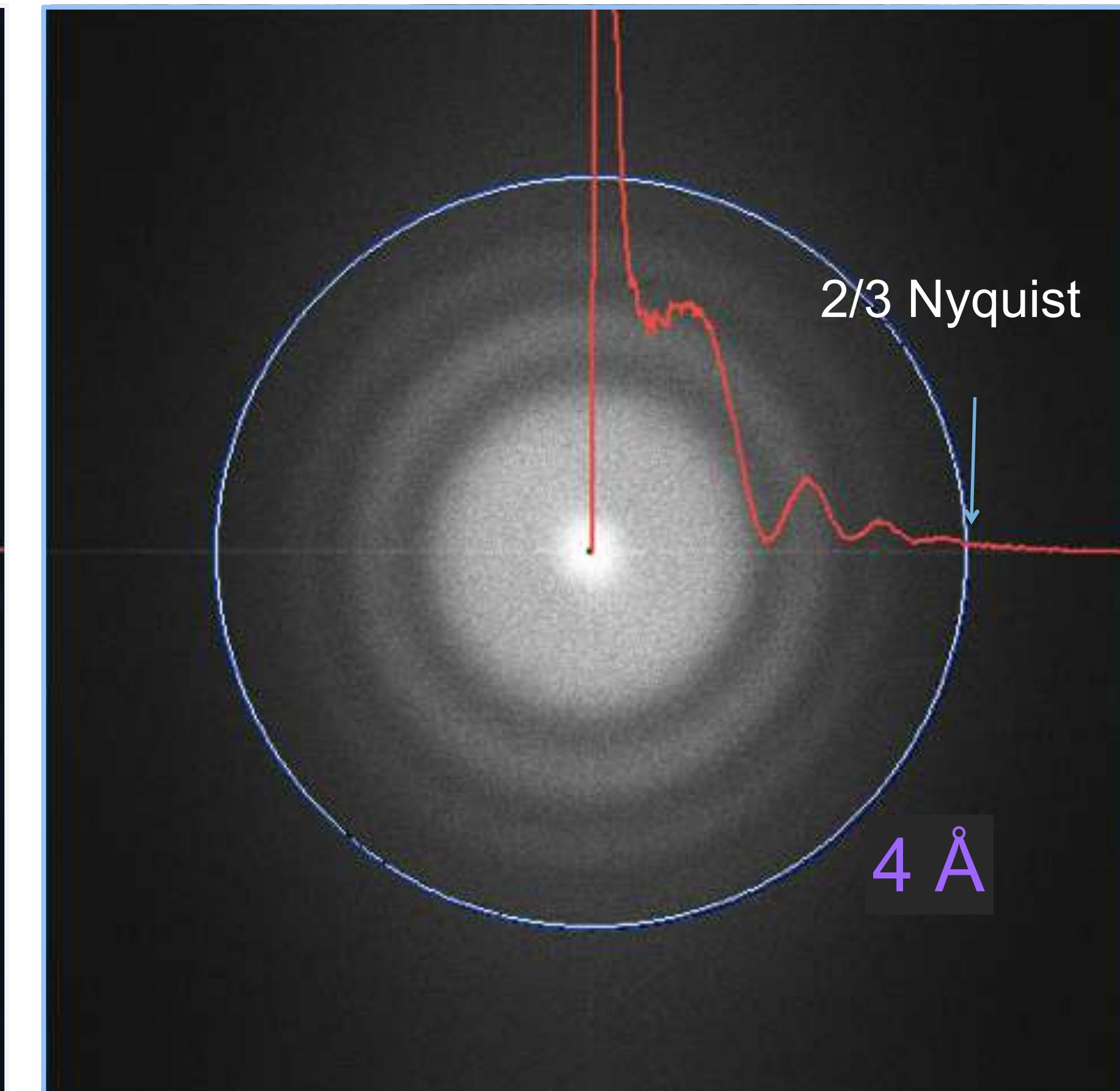


CCD



1.37 Å/pixel

DDD



1.38 Å/pixel

200KeV ; 20 e-/Å² ; carbon film ;
3k x 3k image

Detectors

Improving the resolution:
Detecting electrons instead of photons



K3 specs



Specifications

	K3	K3 Base
TEM operating voltage (kV)	200 / 300	
Sensor size (pixels)	5,760 x 4,096	3,456 x 4,096
Readout modes	Counting Super-resolution	Counting
Max. image size (pixels)	11,520 x 8,184 Super-resolution	3,456 x 4,096
Performance relative to physical Nyquist (DQE)		
Peak	>0.87 / >0.83	>0.8
0.5	>0.53 / >0.53	>0.5
Sensor read-out (full fps)	>1500	
Transfer speed to computer (full fps)	>75	>25
Motion correction	Inline	
Gatan Microscopy Suite® software	Included	
Automation support	Latitude and other third-party software	

<https://www.gatan.com/K3>

Specifications are subject to change without notice.



NYSBC



SEMC

45

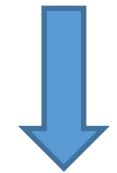
Detectors

Improving the resolution:
Detecting electrons instead of photons

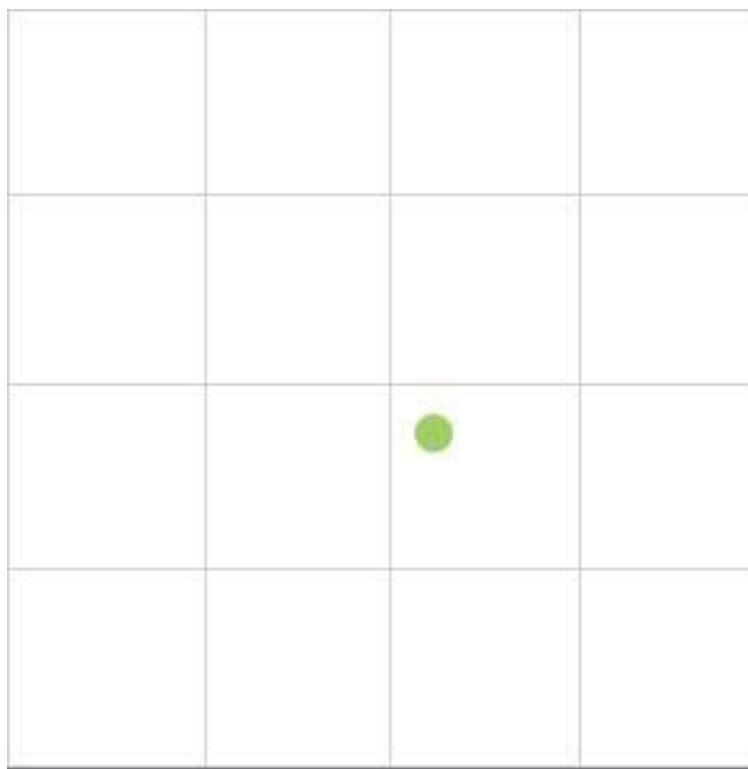


5,760 x 4,096 px

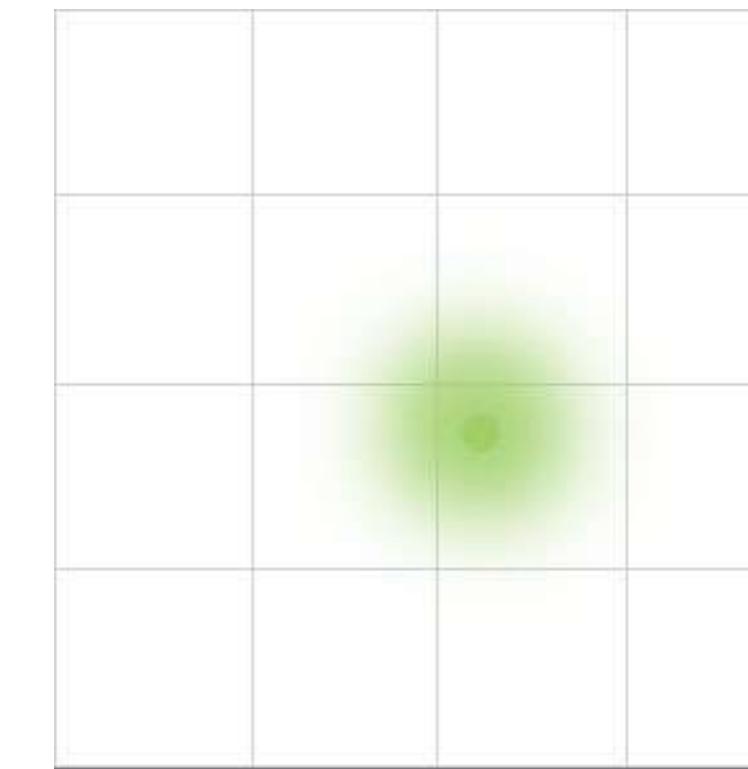
Counting mode



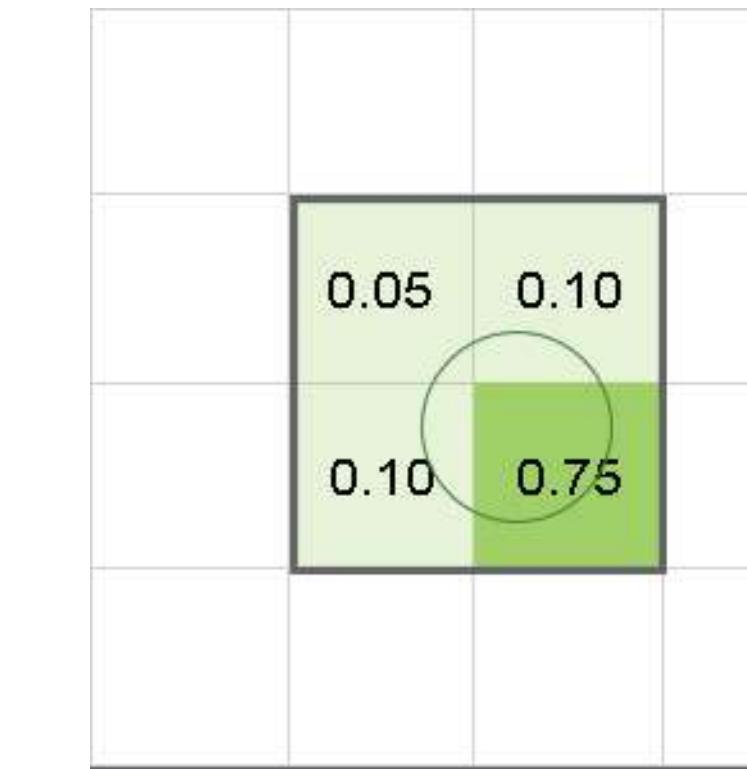
11,520 x 8,184 px



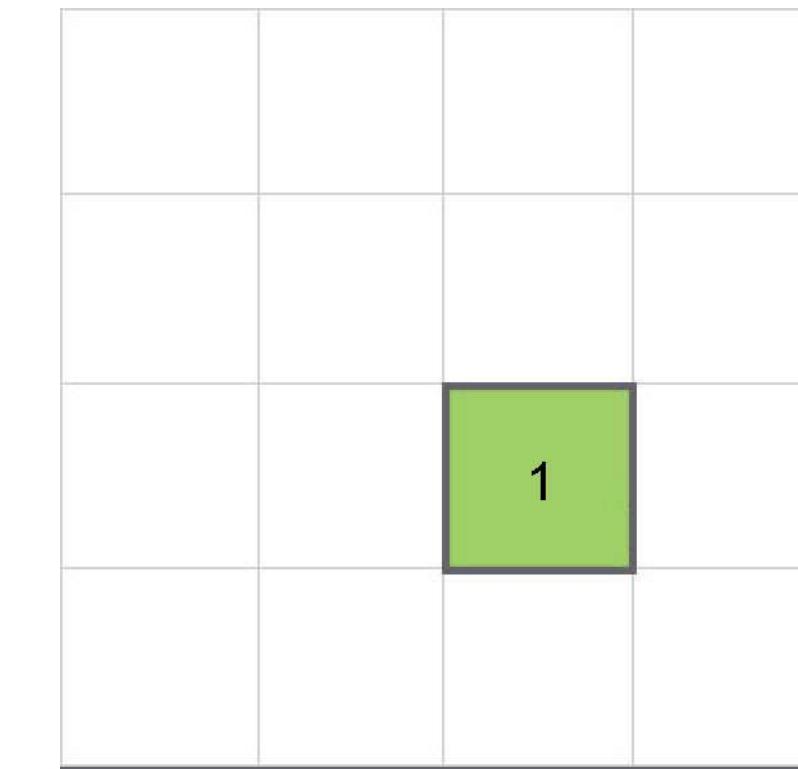
Electron enters
detector.



Electron signal is
scattered.



Charge collects in
each pixel.



Events reduced to
highest charge pixels.

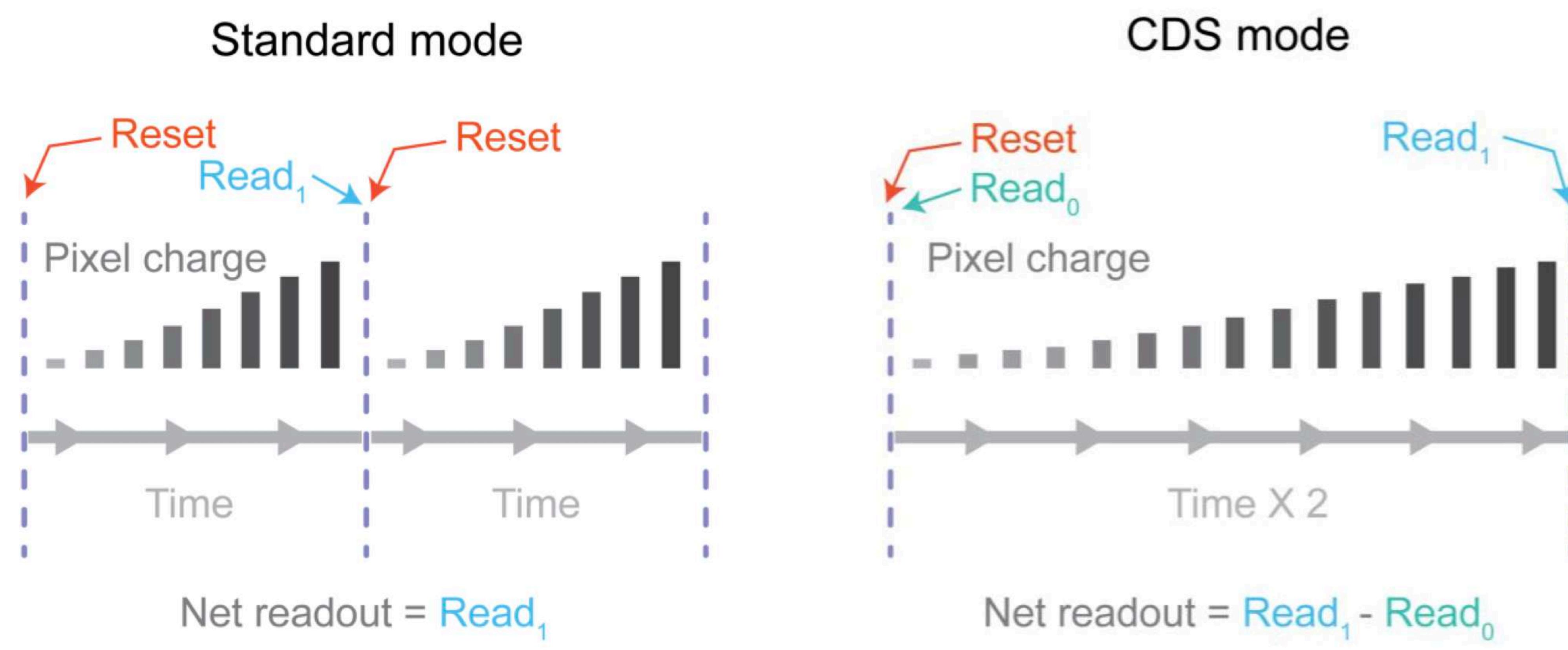
<https://www.gatan.com/improving-dqe-counting-and-super-resolution>

Detectors

Improving the resolution:
Detecting electrons instead of photons



K3 lowers Read Noise with Correlated Double Sampling (CDS)



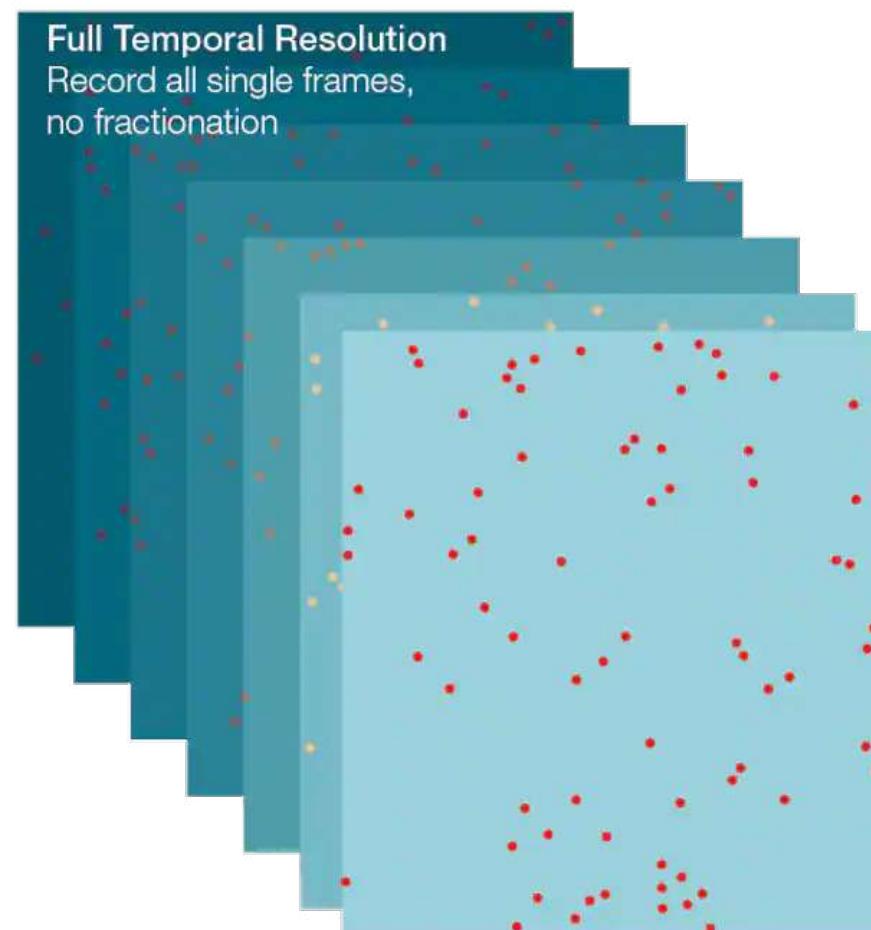
<https://www.gatan.com/>

Detectors

Improving the resolution:
Detecting electrons instead of photons



Falcon4 specs



Full Spatial Resolution	
All localized events	
Coordinates	
x	y
3953.24	2845.63
919.78	1447.39
3864.43	348.13
3606.05	1539.54
1758.86	2971.55
...	...
3983.58	531.96

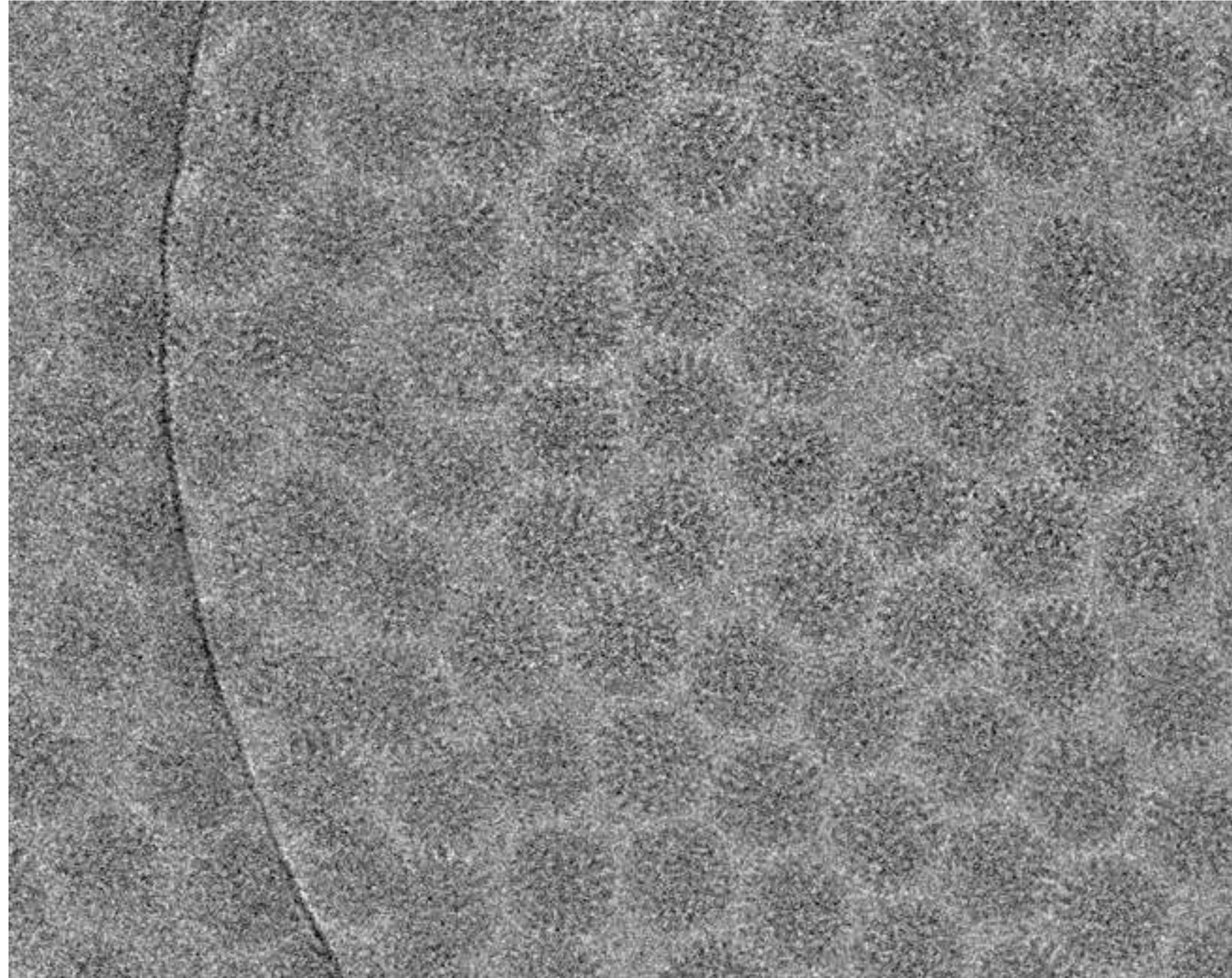
Counted events of all raw frames with full temporal resolution (320 fps) and spatial resolution (events are localized to one-sixteenth of a pixel).

Camera architecture	Direct electron detection	
Sensor size	4,096 × 4,096 pixels, ~ 5.7 x 5.7 cm ²	
Pixel size	14 x 14 μm^2	
TEM Operating voltage	200 kV, 300 kV	
Internal frame rate	320 fps	
Frame rate to storage	320 fps (EER mode) Electron-event representation (EER)	
Camera Overhead time	0.5 s per acquisition	
File formats	EER (native), MRC, TIFF, LZW TIFF	
Lifetime (<10% DQE degradation)	5 years in normal use (1.5GeV/px)	
Detection Modes	Electron counting mode Survey mode (fast linear mode)	
Imaging performance in EER mode (4k x 4k)	300 kV	200 kV
DQE (0)	0.92	0.91
DQE (½ Nq)	0.72	0.62
DQE (1 Nq)	0.50	0.33

<https://www.thermofisher.com/us/en/home/electron-microscopy/products/accessories-em/falcon-detector.html>

Detectors

Images are movies



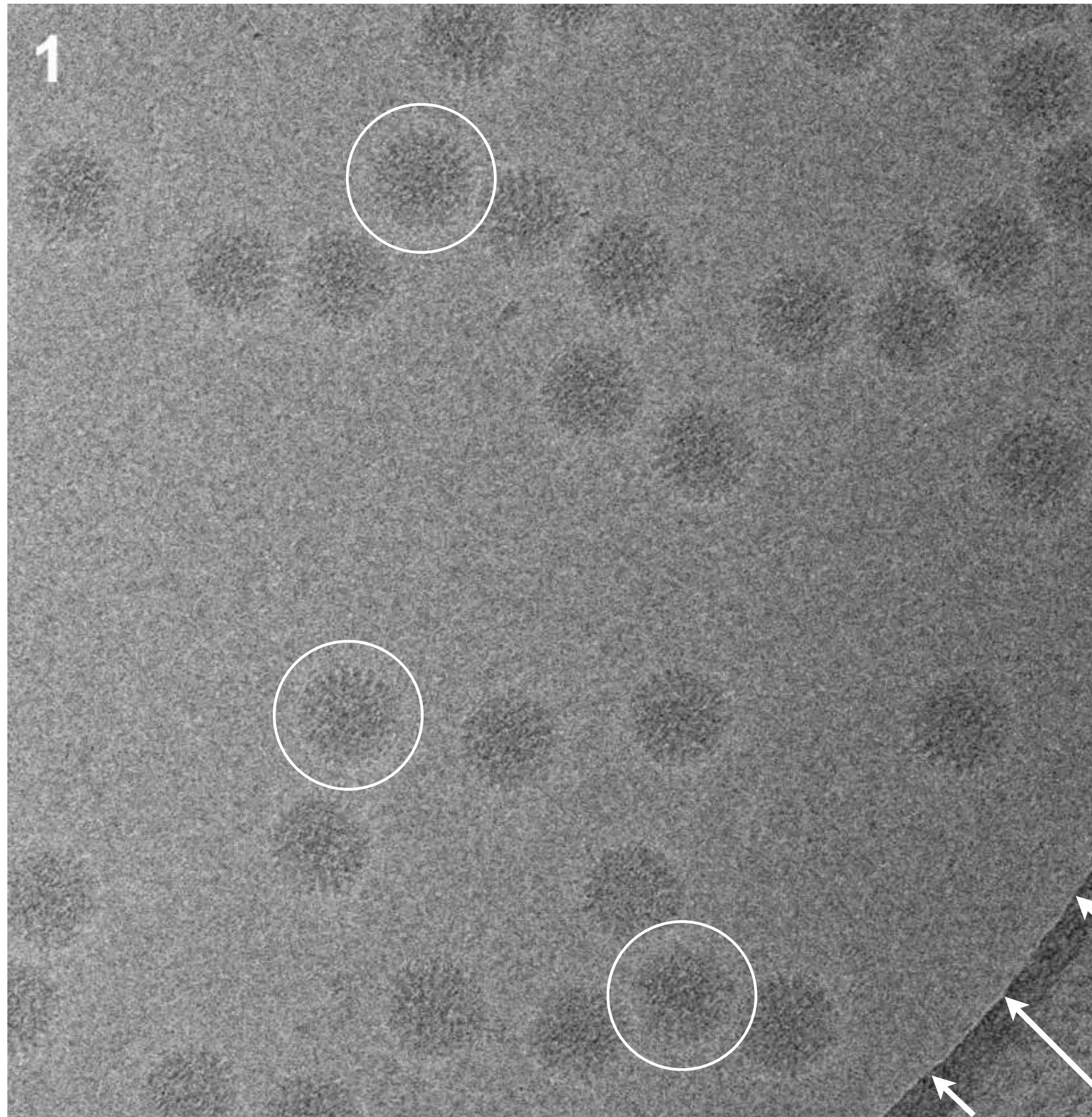
0.5 e⁻/Å²/frame

Image = Frame1 + Frame2 + Frame3 + Frame4 + Frame5

We can use DDD movies to examine (and correct) “beam induced motion”

Detectors

Images are movies



10 frame averages

Each averaged frame corresponds to 0.25 s.

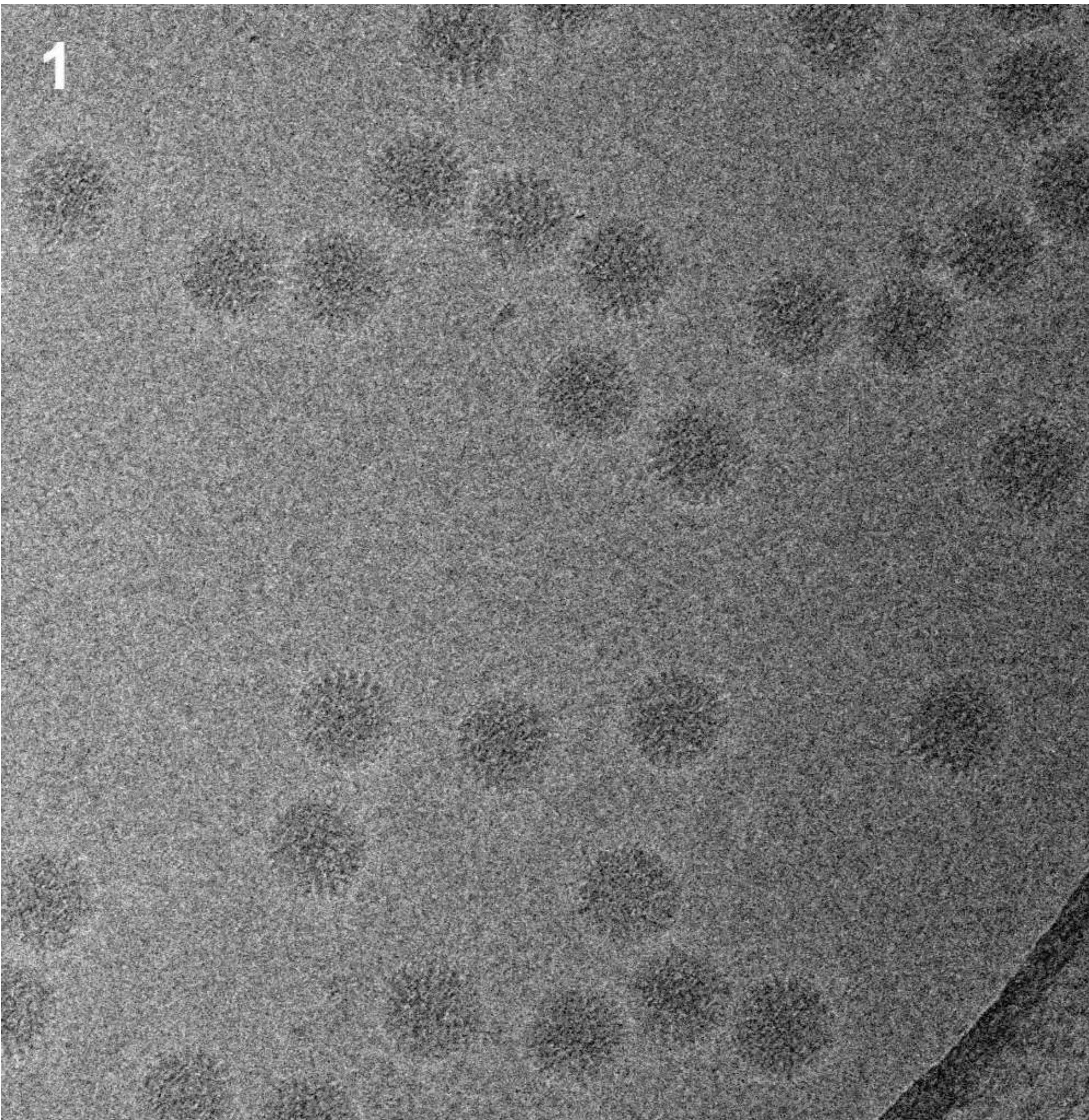
Dose/frame = 5 e⁻/Å²

A “movie” of rotavirus exposed to electron beam

Brilot C.F. et al. (2012) J Struct Biol.

Detectors

Images are movies



Translations over time

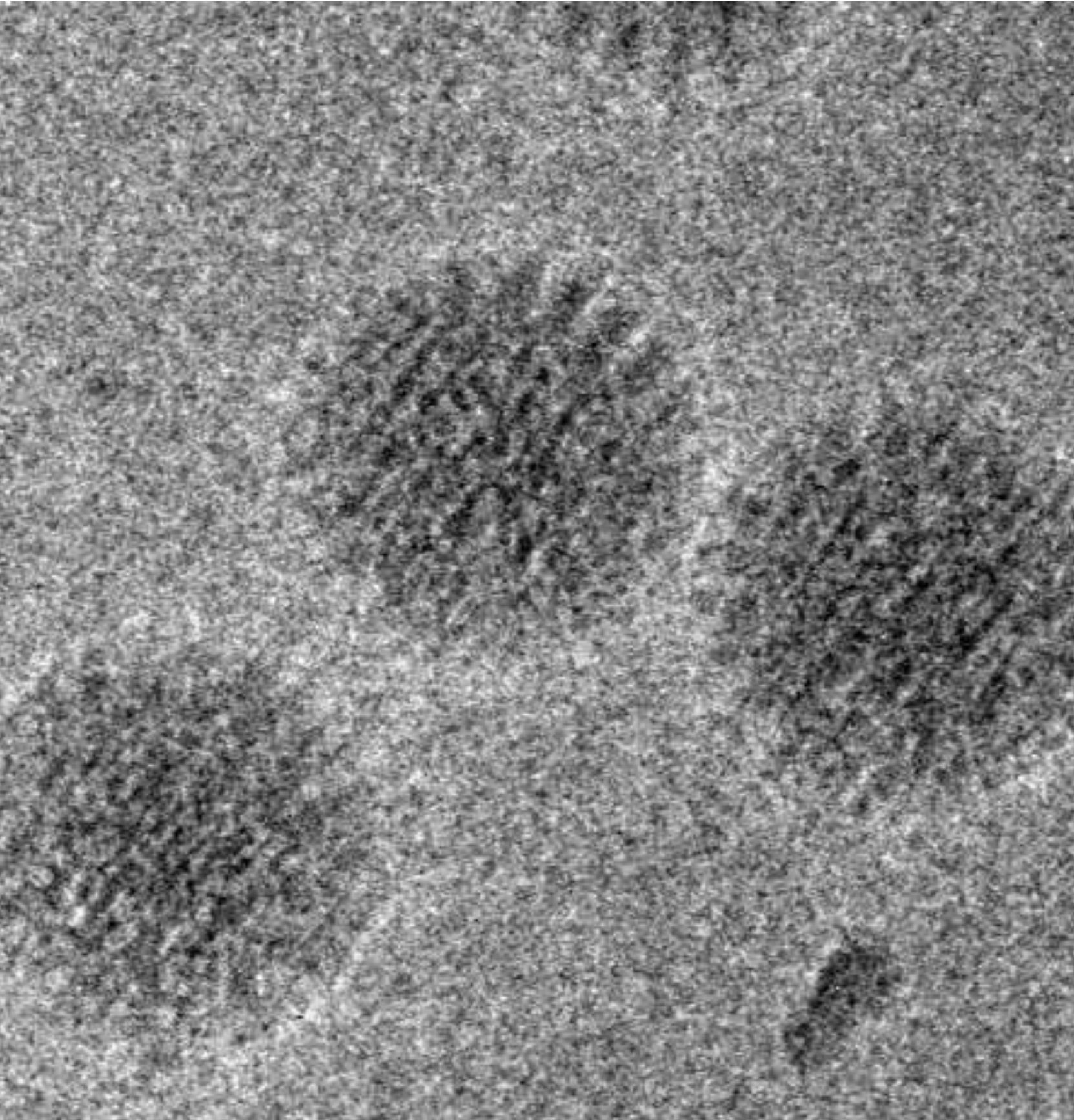
2.5nm

Detectors

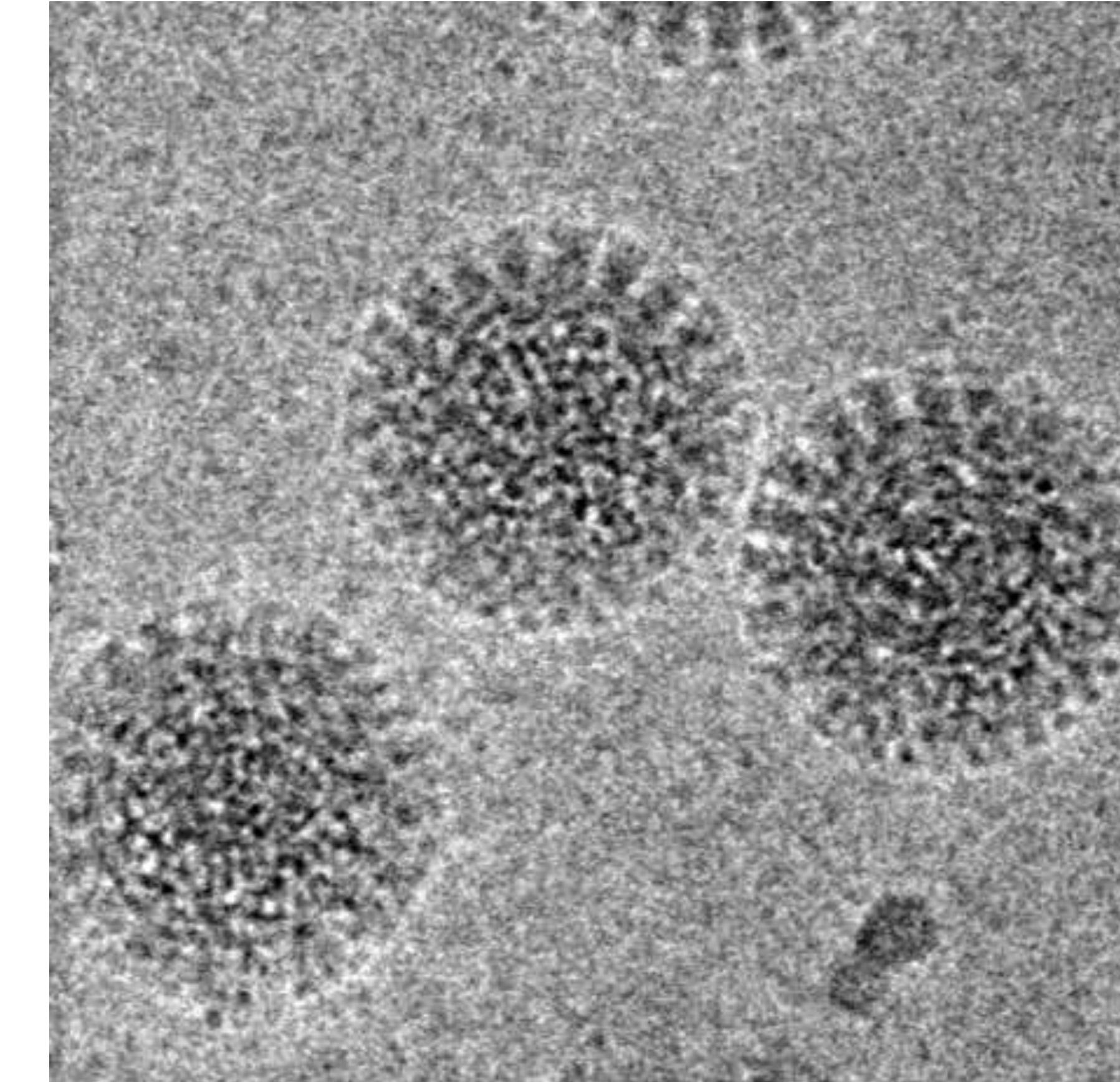
Correcting for movement



60-frame average
(no alignment)



60-frame average
(translational alignment)



Brilot C.F. et al. (2012) J Struct Biol.

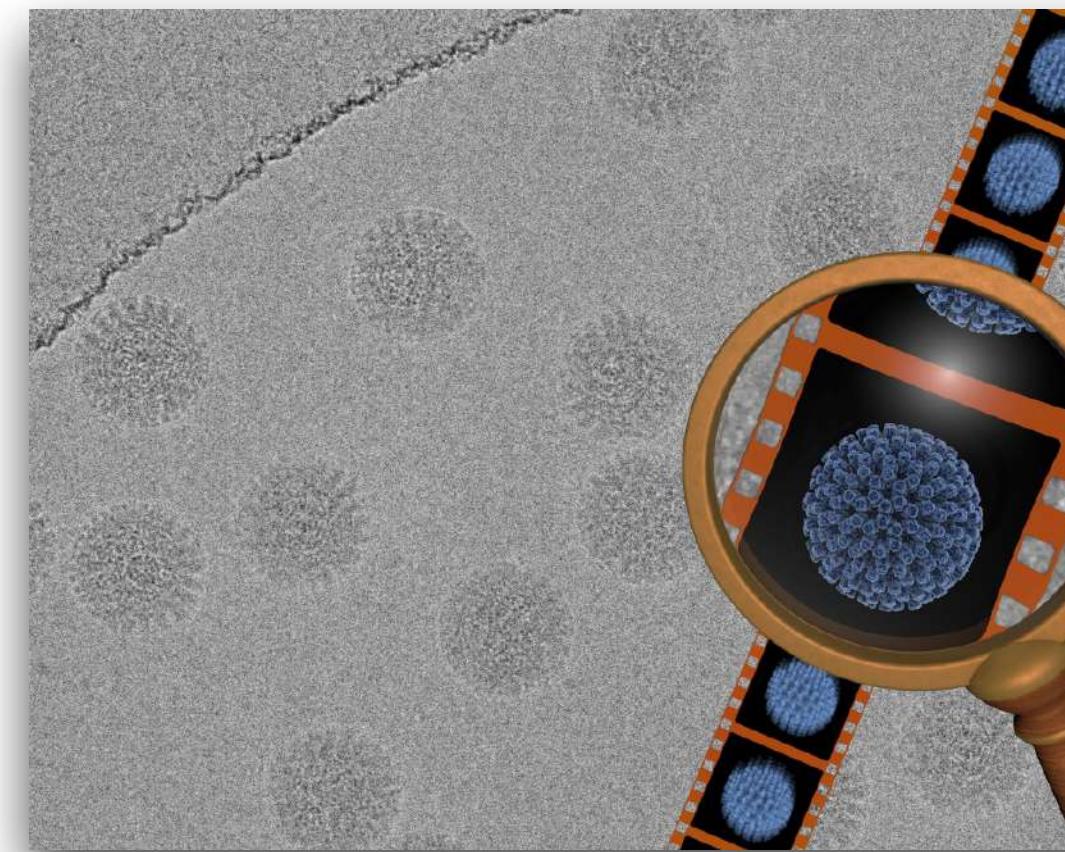
What brought about the resolution revolution? (~2012-2014)

Hardware

Microscopes



Direct Detectors



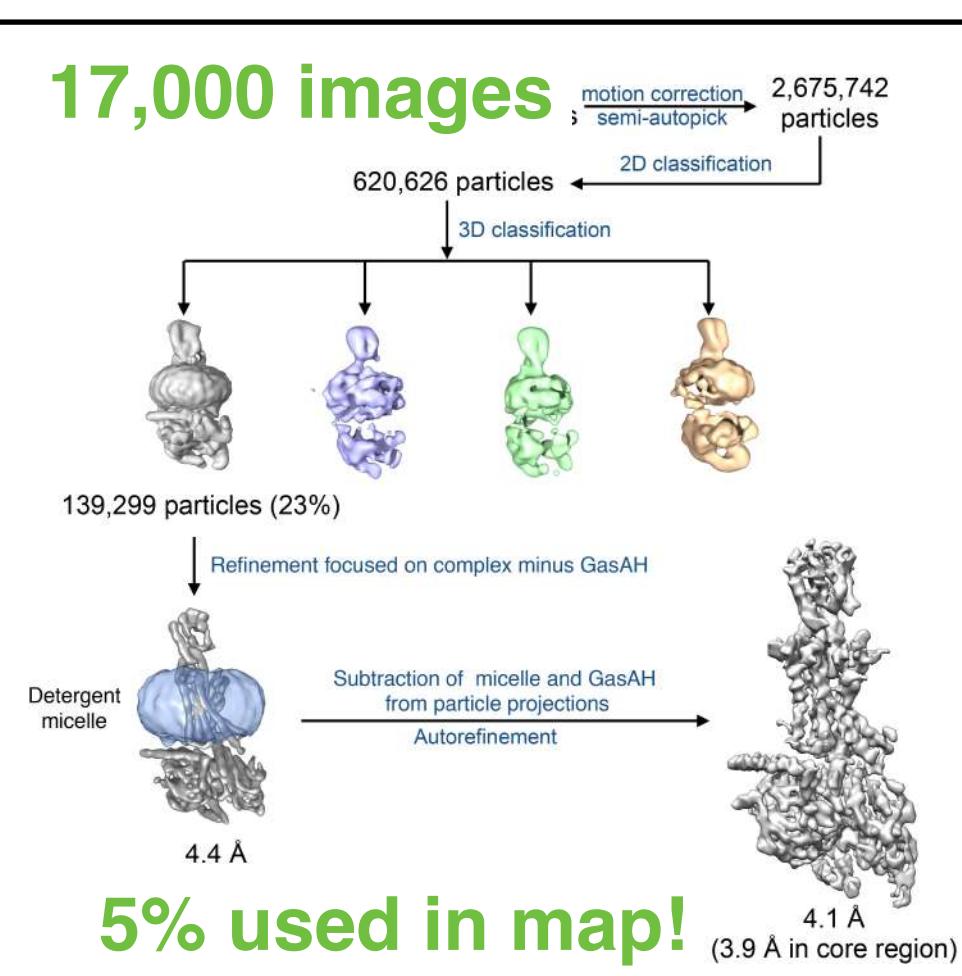
Computers



2012->2017

Cost reduced by 100x

Software

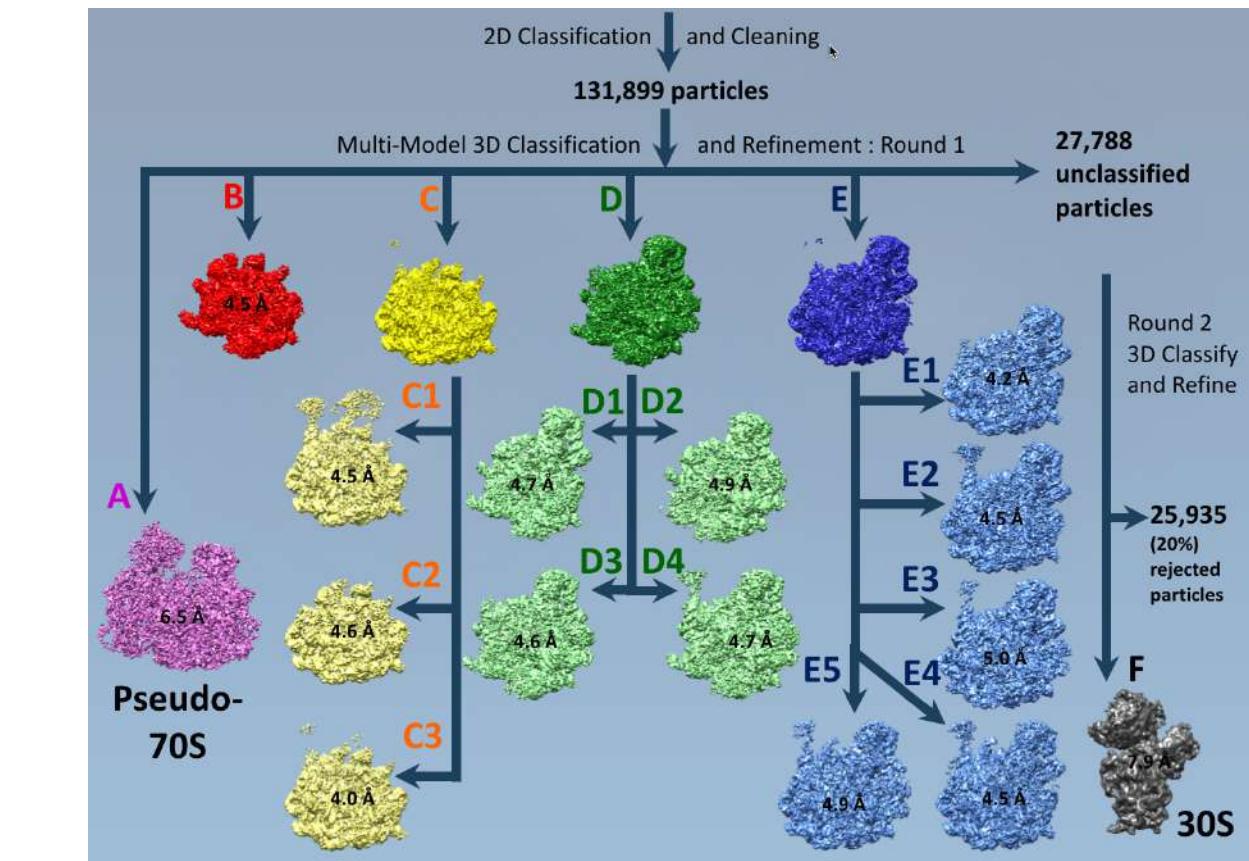


Legion / SerialEM / EPU, ...

MotionCorr2, Unblur, ...

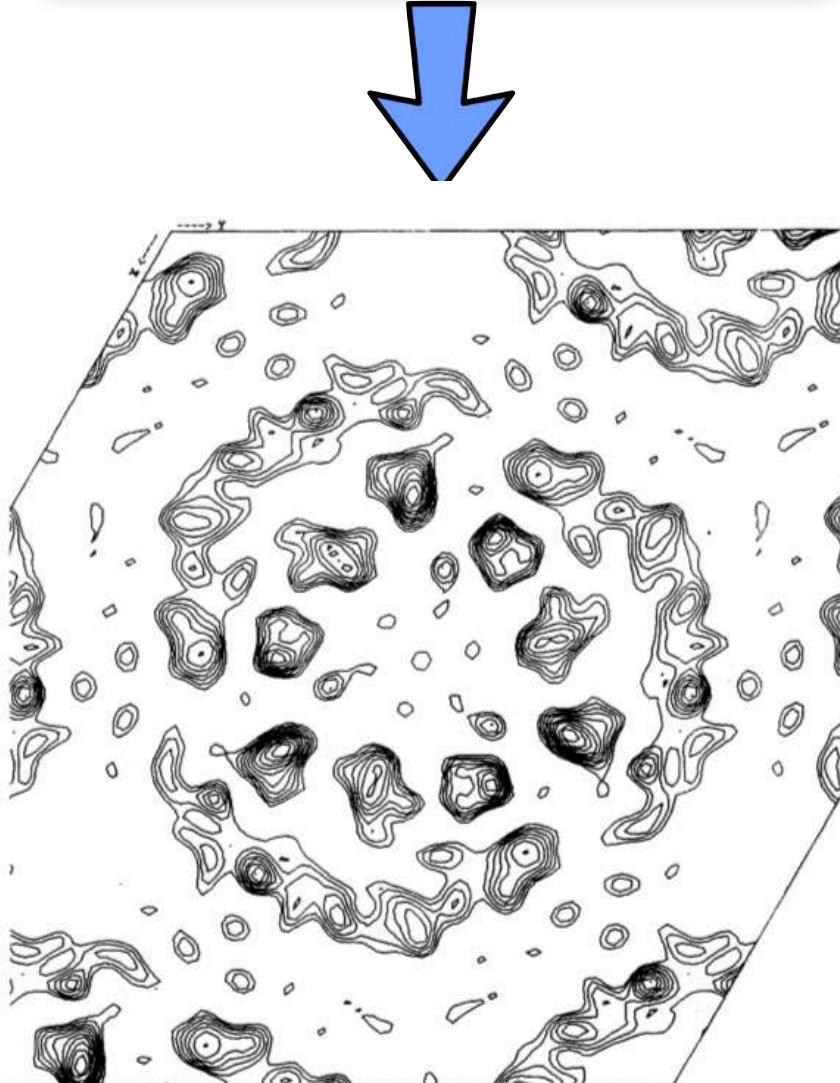
RELION, FREALIGN/cisTEM, cryoSPARC
EMAN, Sparx, SPHIRE, XMIPP, ...

14 independent structures



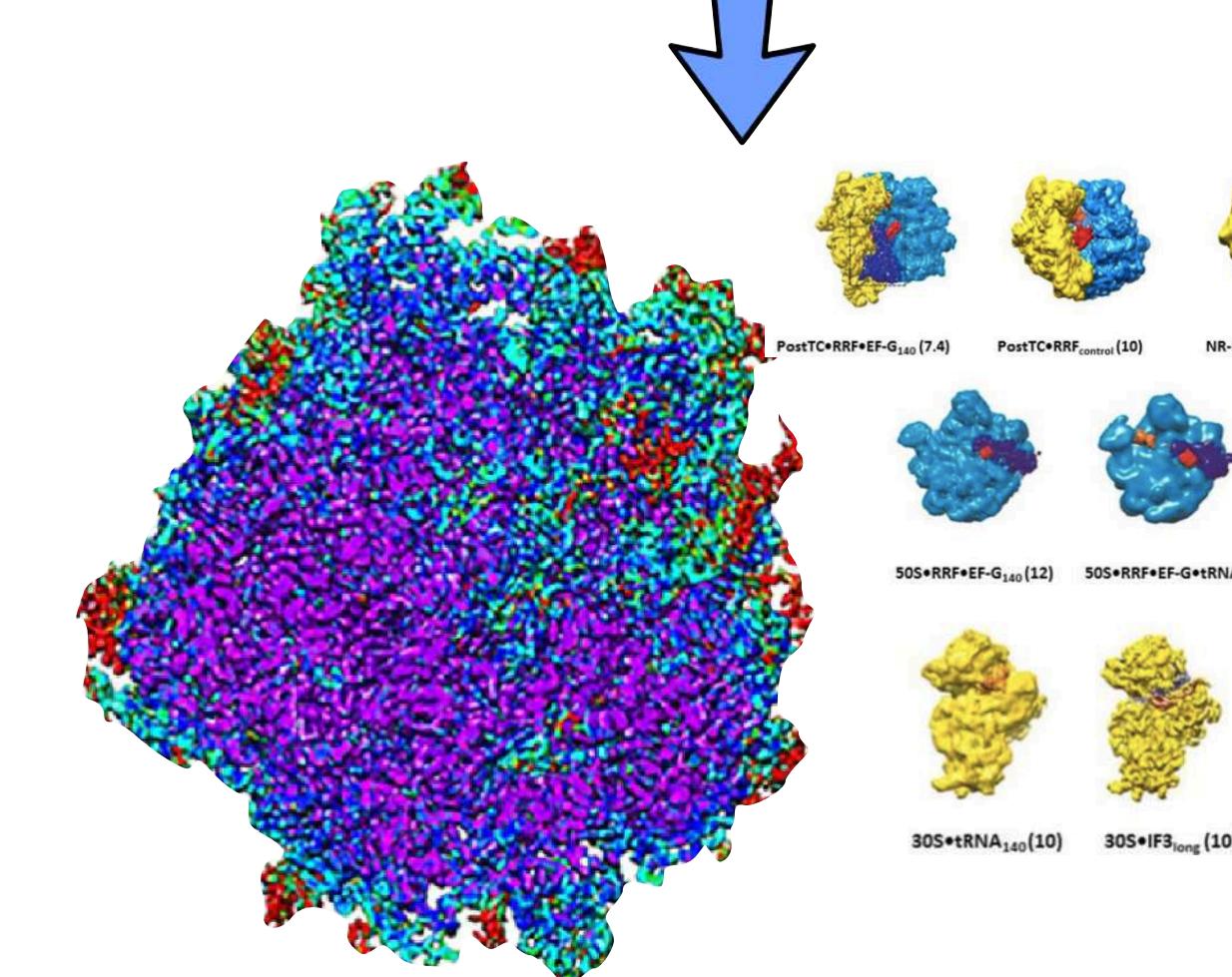
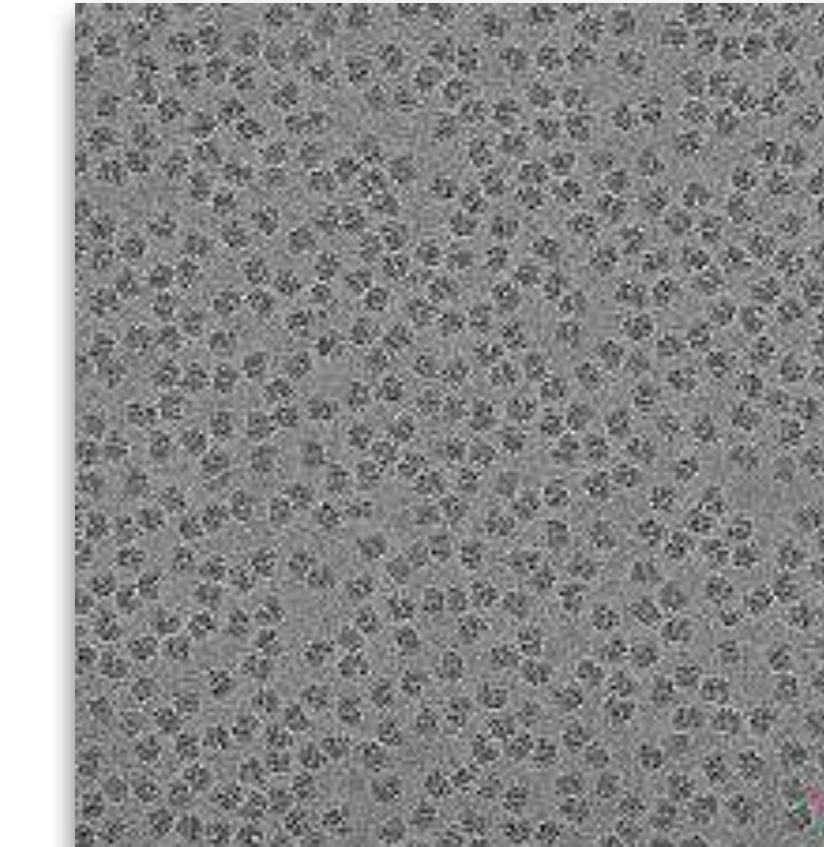
cryoEM: technology on the rise

1986



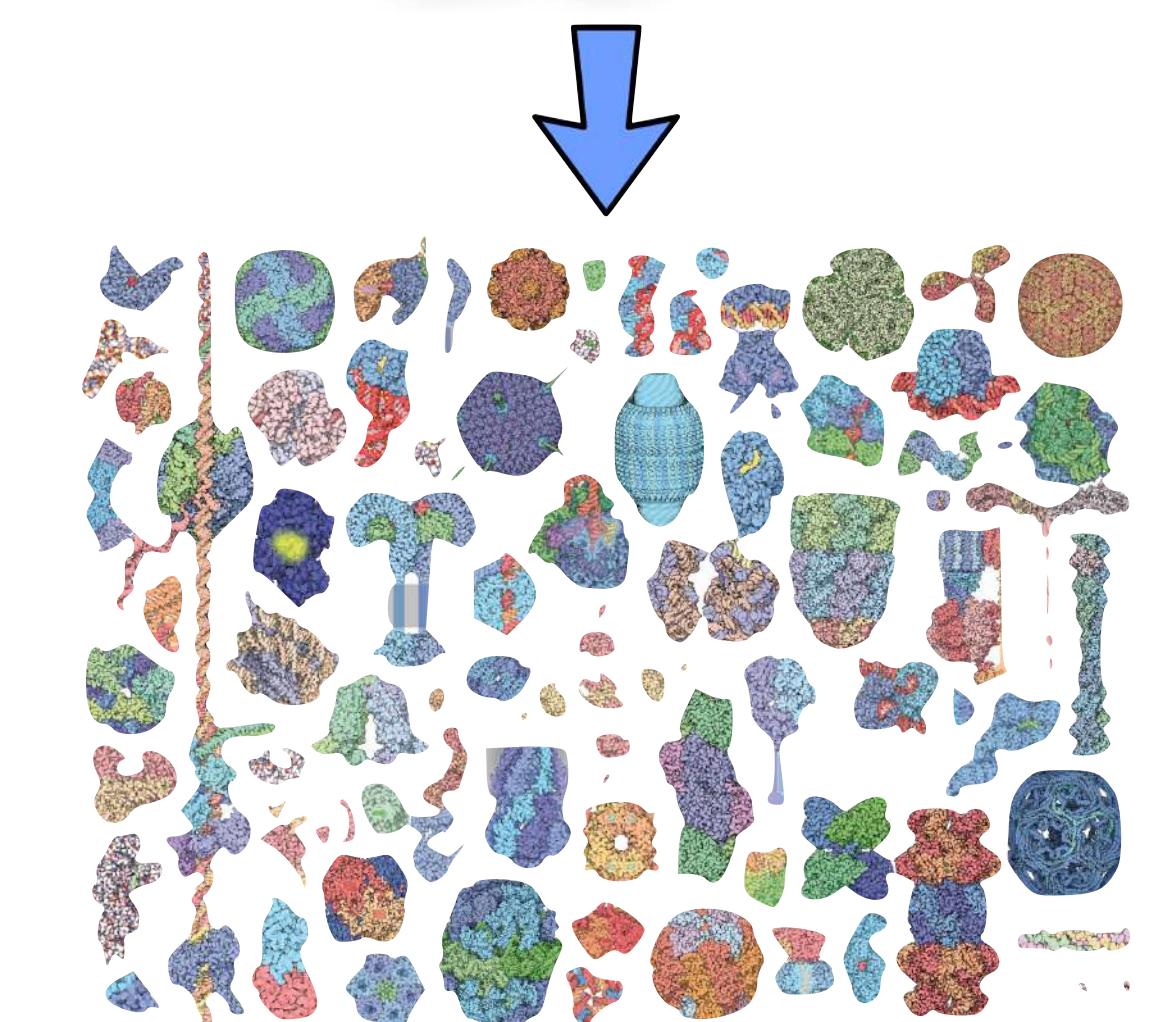
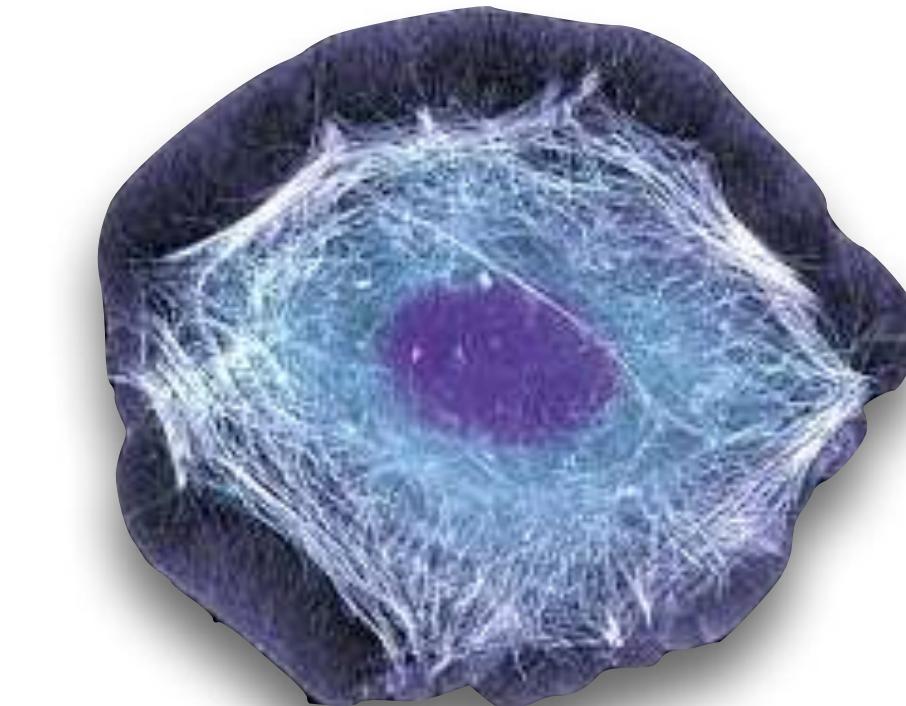
Henderson et al. (1986)

2017



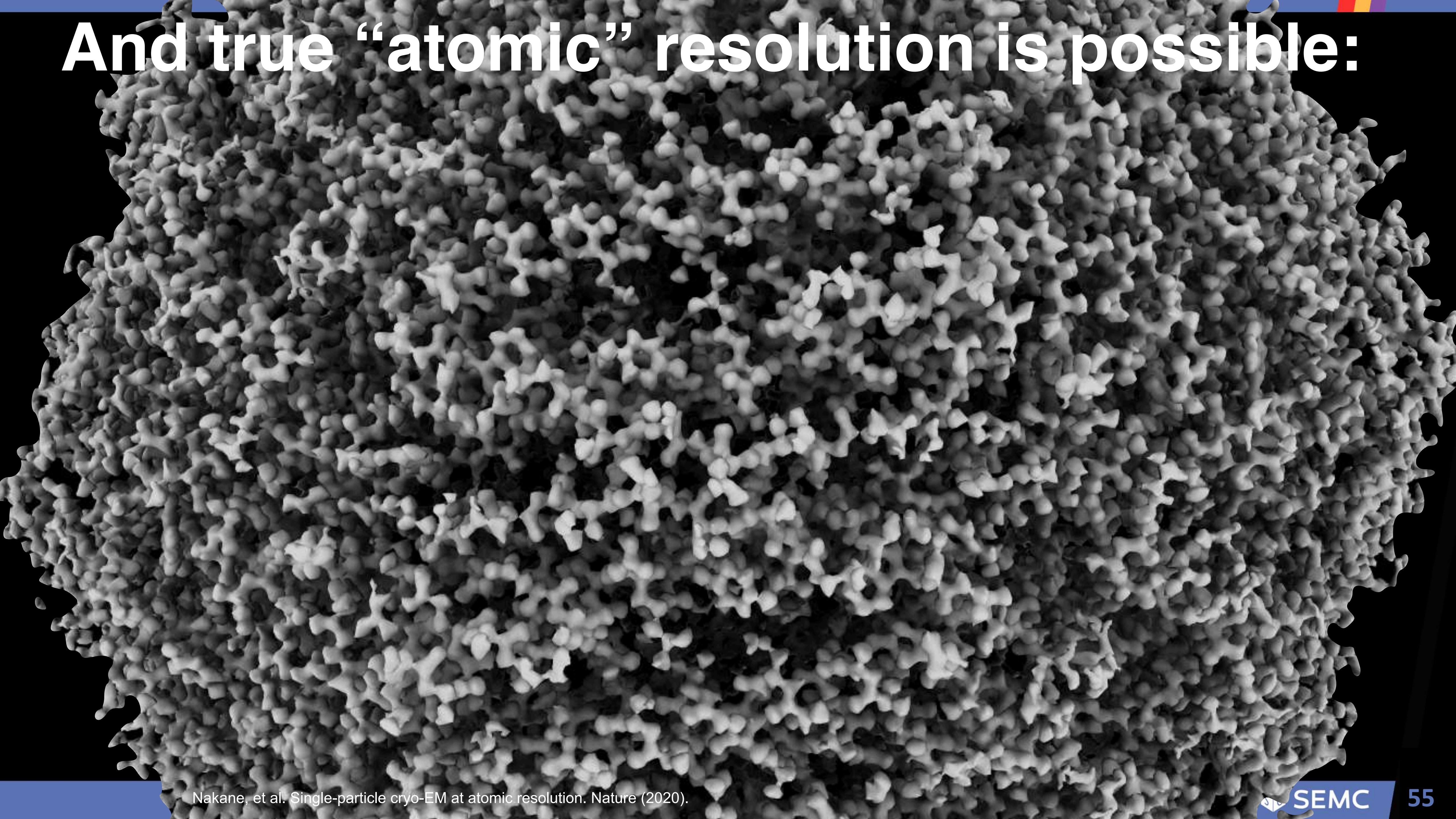
Frank et al. (2017)

in progress

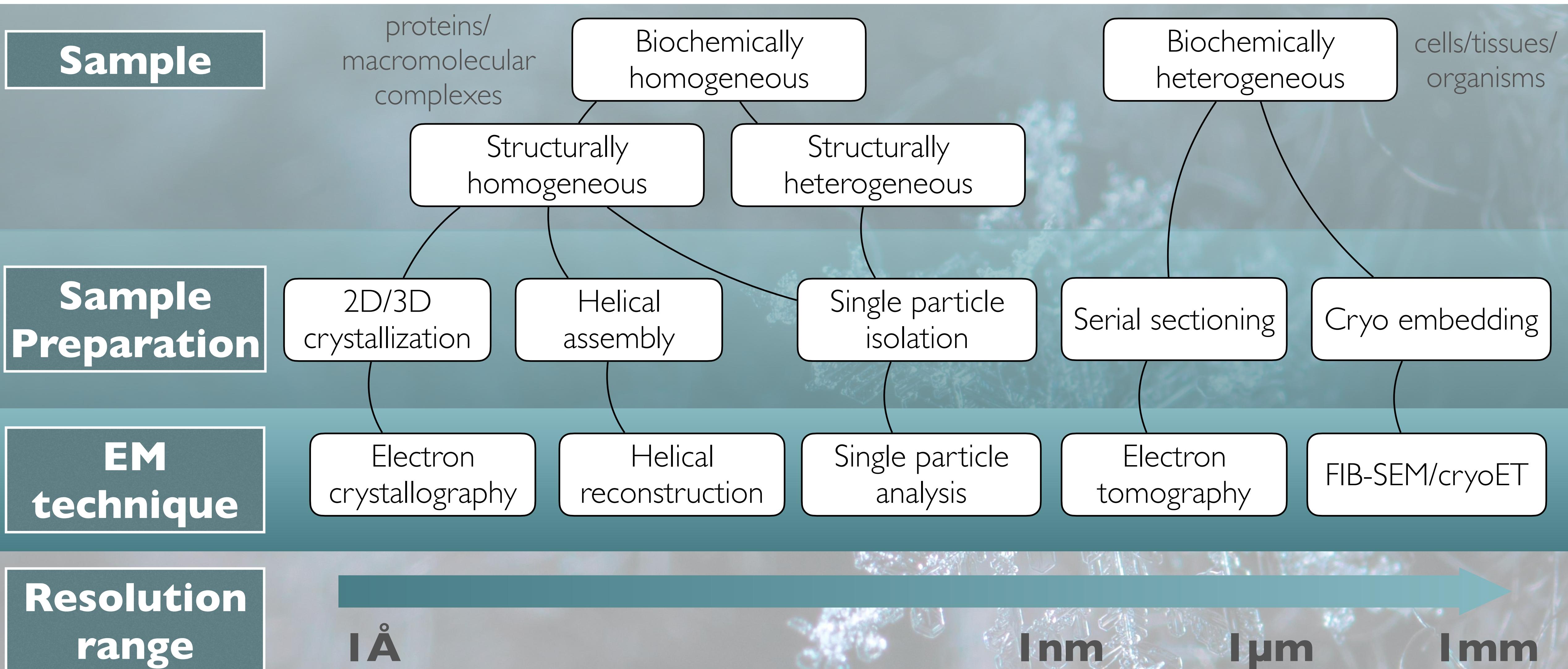


the next chapter

And true “atomic” resolution is possible:

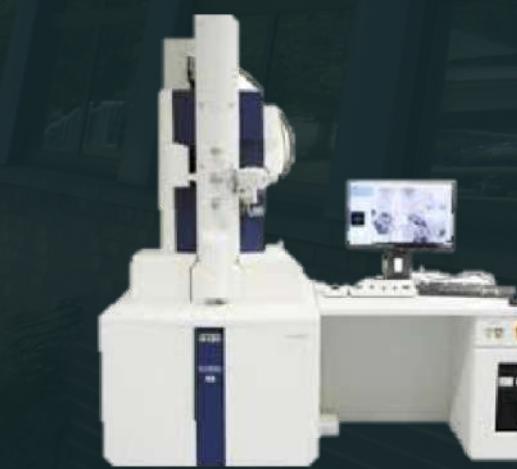


How are samples prepared for cryoEM?





Krios1
G2



Hitachi
7800



Krios3
G2



Tundra



Krios4
G3i



Krios5
G3i



Krios6
G4



Krios7
G3i



Krios8
G3i



Krios9
G1



Glacios1
G1



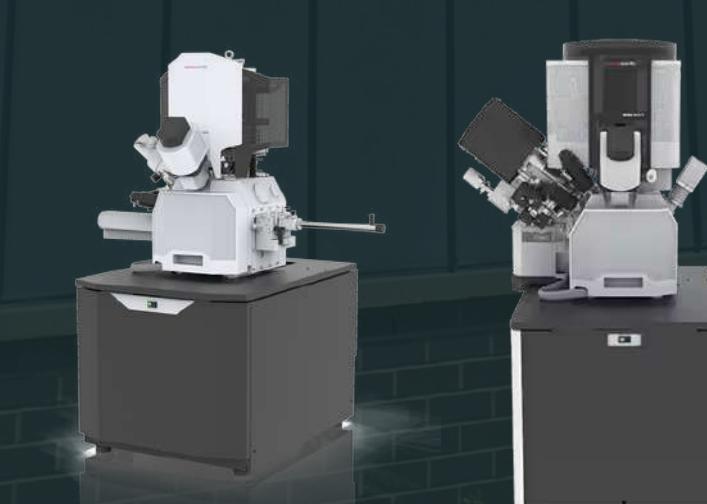
Glacios2
G2



Glacios3
G2



Glacios4
G1



Aquilos2



Helios5



Arctis



CUBEII

Support: NIH NIGMS. Common Fund; NYSTAR

SIMONS FOUNDATION

Simons Resource for Automated Molecular Microscopy nramm.nysbc.org
National Center for CryoEM Access and Training nccat.nysbc.org
National Center for In-situ Tomographic Ultramicroscopy ncitu.nysbc.org
Simons Machine Learning Center smlc.nysbc.org
Simons Electron Microscopy Center semc.nysbc.org

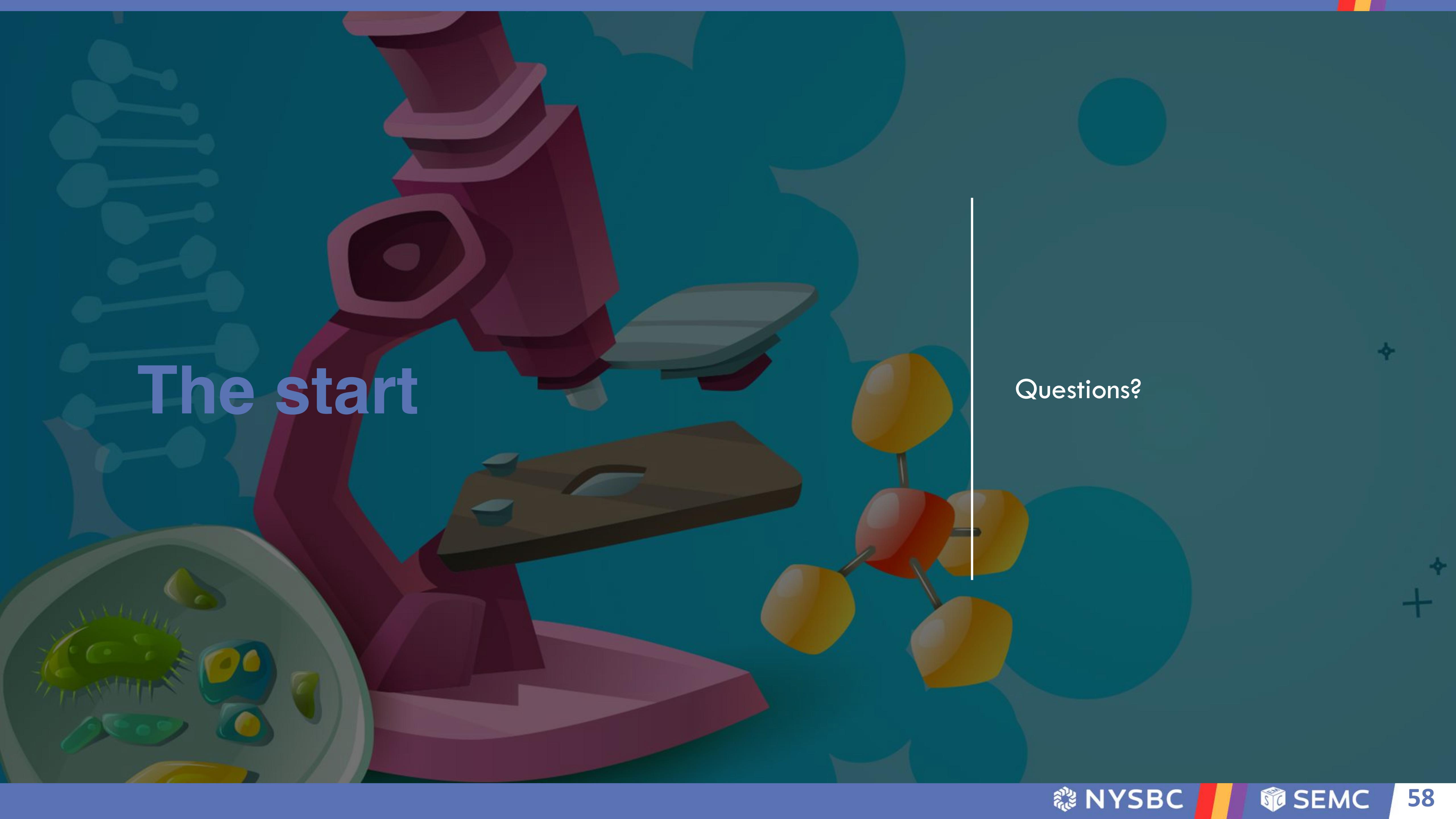


NYSBC



SEMC

57



The start

Questions?