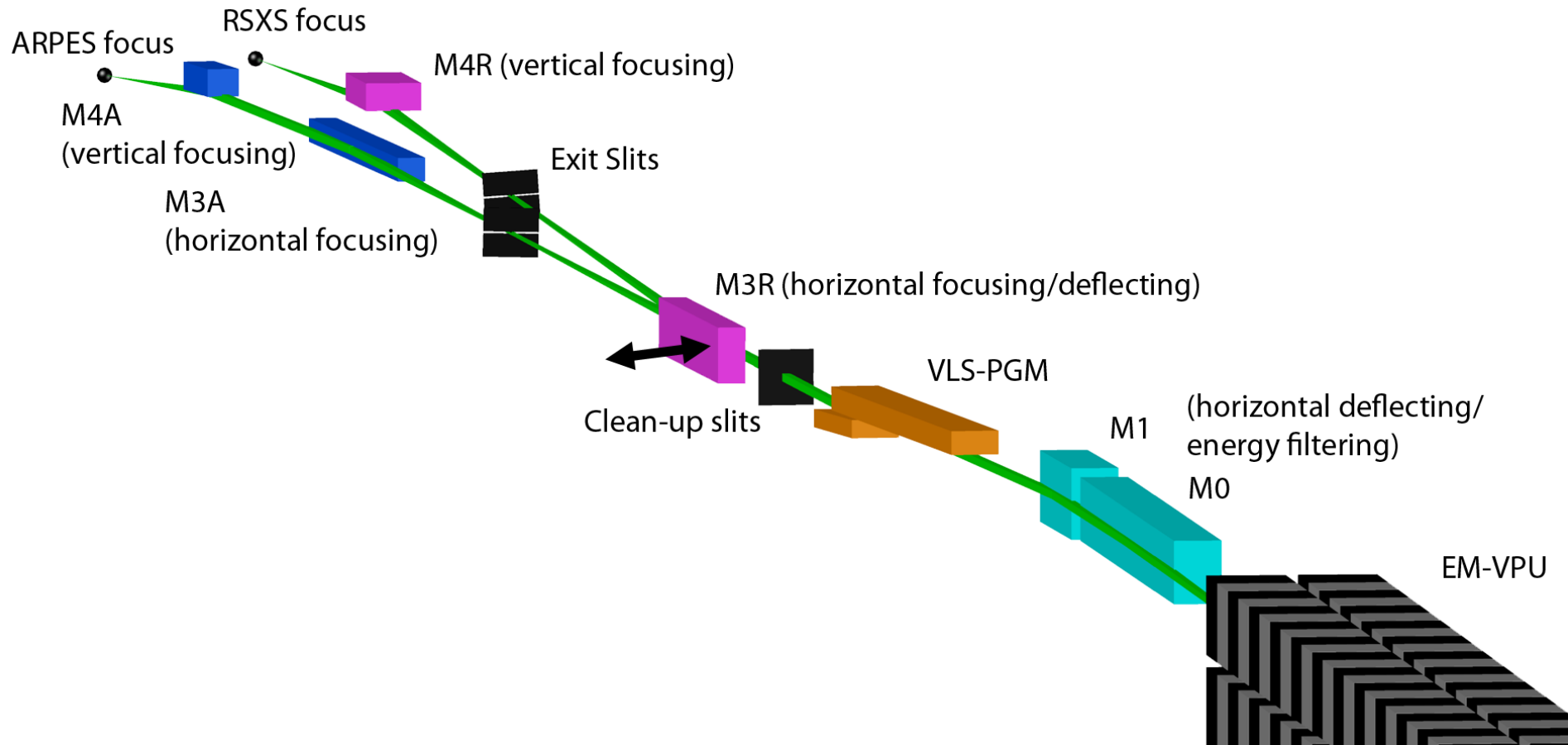# Post mortem analysis of IEX monochromator
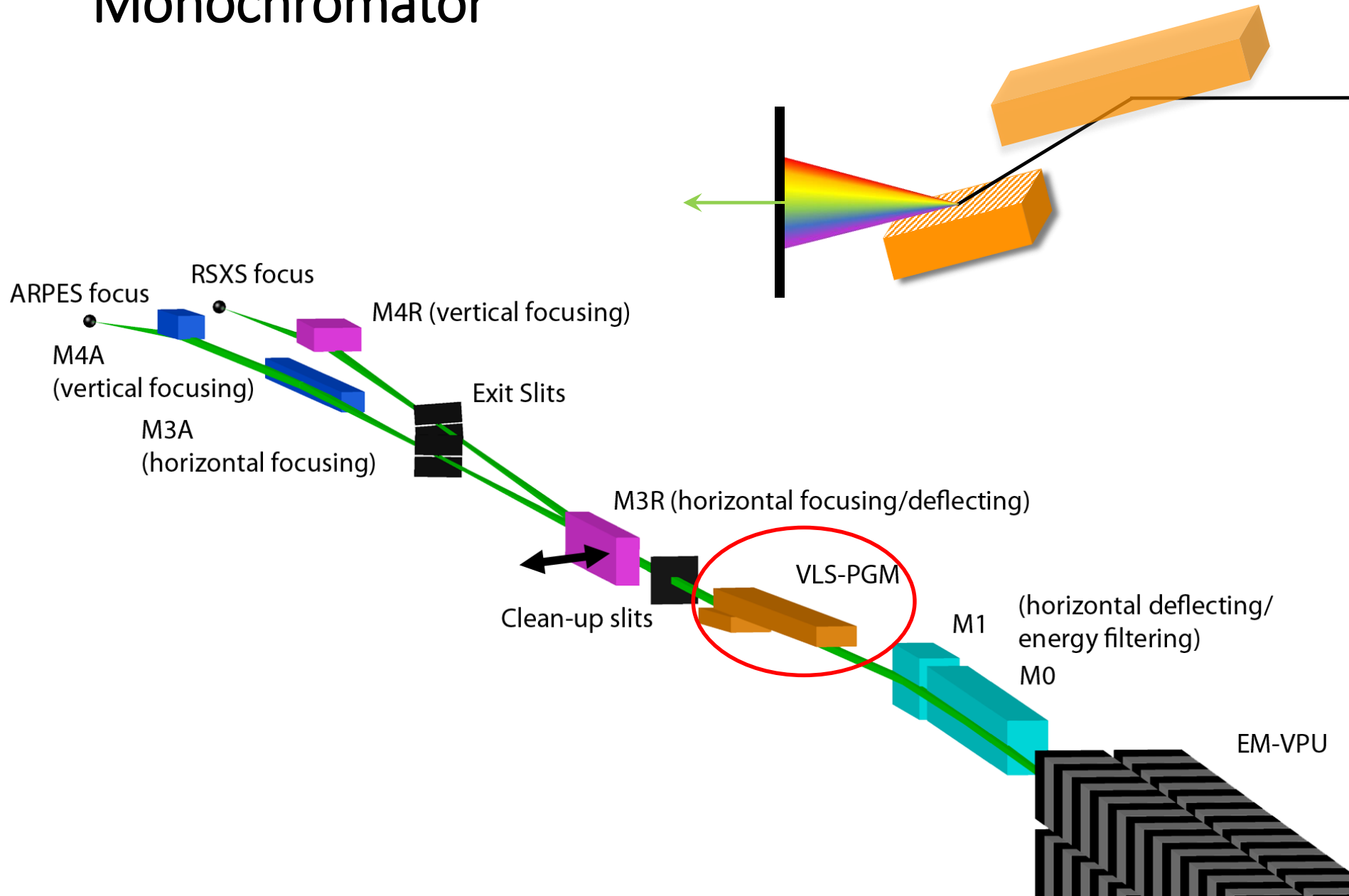
IEX overview

Energy range: 250 - 2500 eV
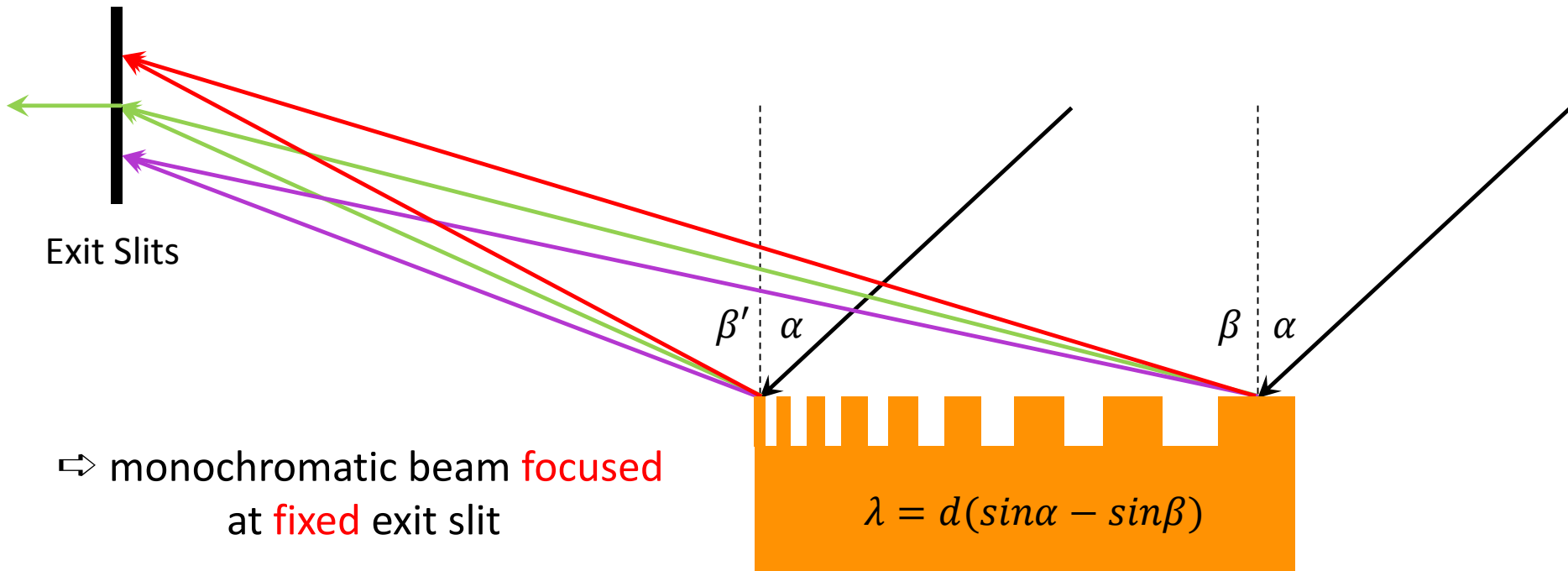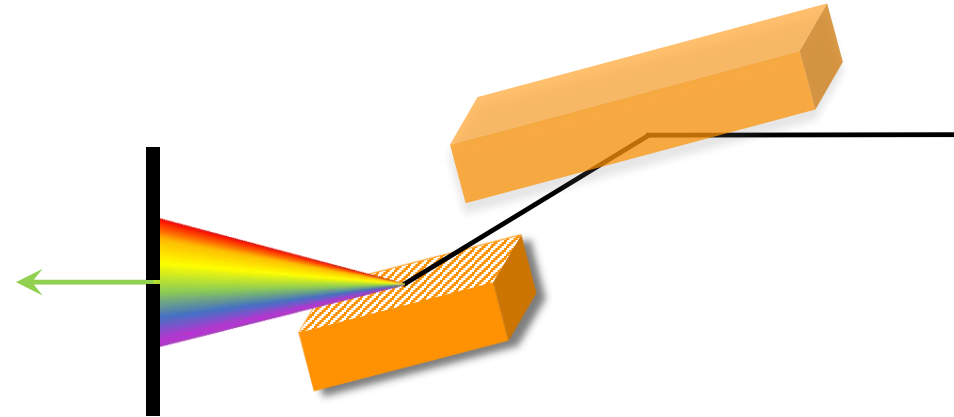
Variable Line Spacing Plane Grating Monochromator

ARPES focus

RSXS focus

M4A (vertical focusing)

M4R (vertical focusing)

M3A (horizontal focusing)

Exit Slits

M3R (horizontal focusing/deflecting)

Clean-up slits

VLS-PGM

M1

(horizontal deflecting/ energy filtering)

M0

EM-VPU

Variable Line Spacing Plane Grating Monochromator

VLS law - line density k:

$$k(w) = k_0(1 + 2b_2 w + 3b_3 w^2 + \cdots)$$
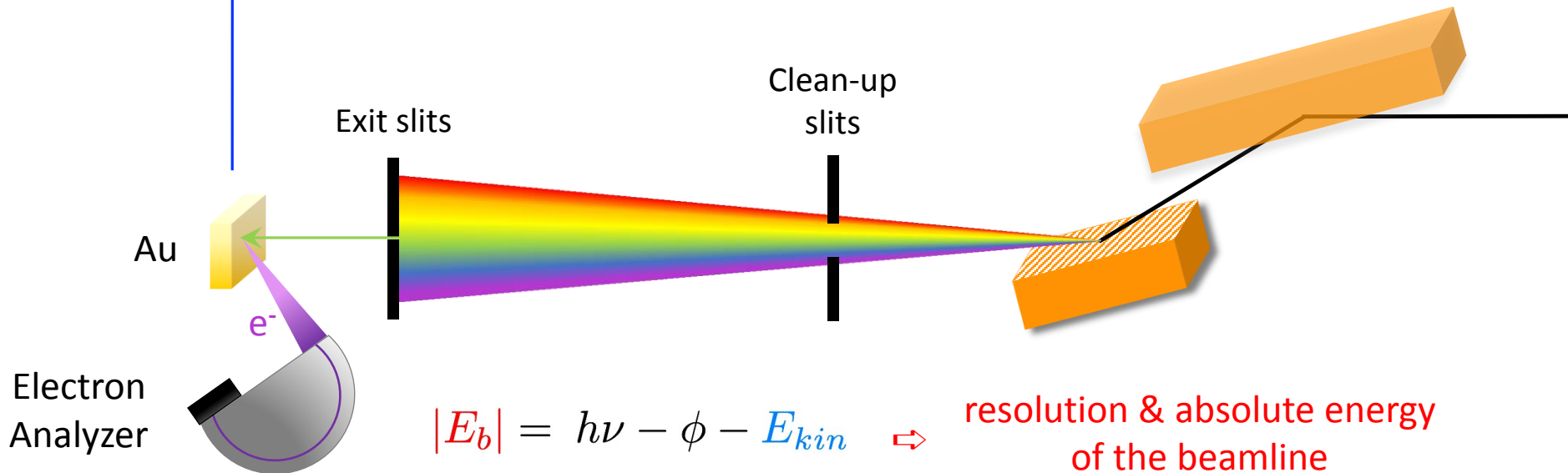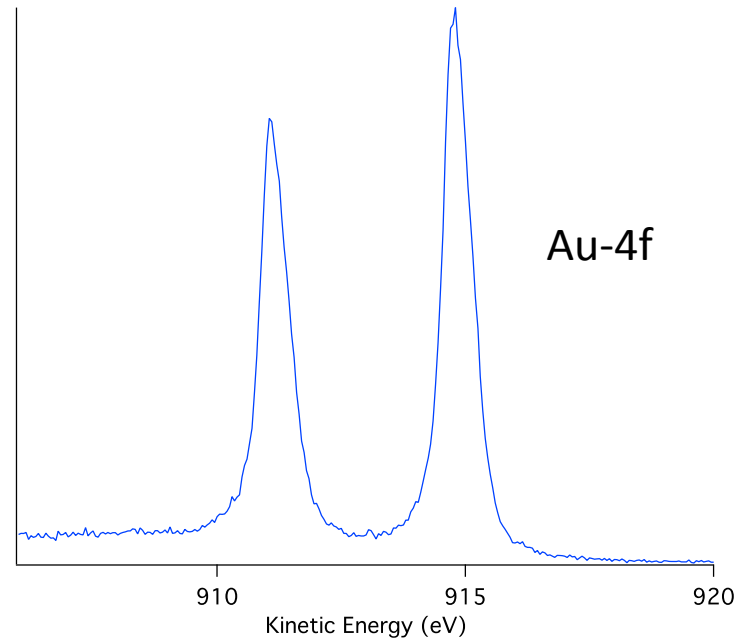
Exit Slits

β' α β α

$\Rightarrow$ monochromatic beam focused at fixed exit slit

$$\lambda = d(sin\alpha - sin\beta)$$

Variable Line Spacing Plane Grating Monochromator
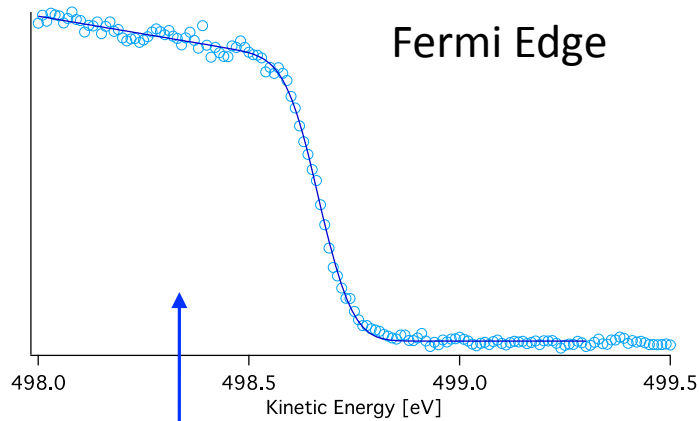
VLS law - line density k:

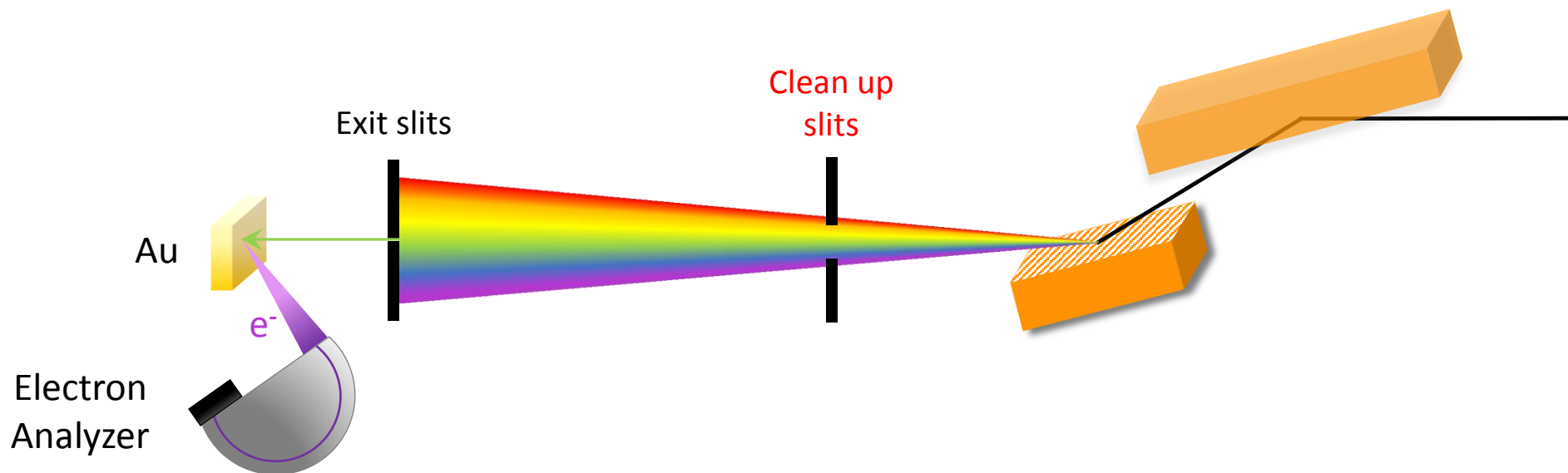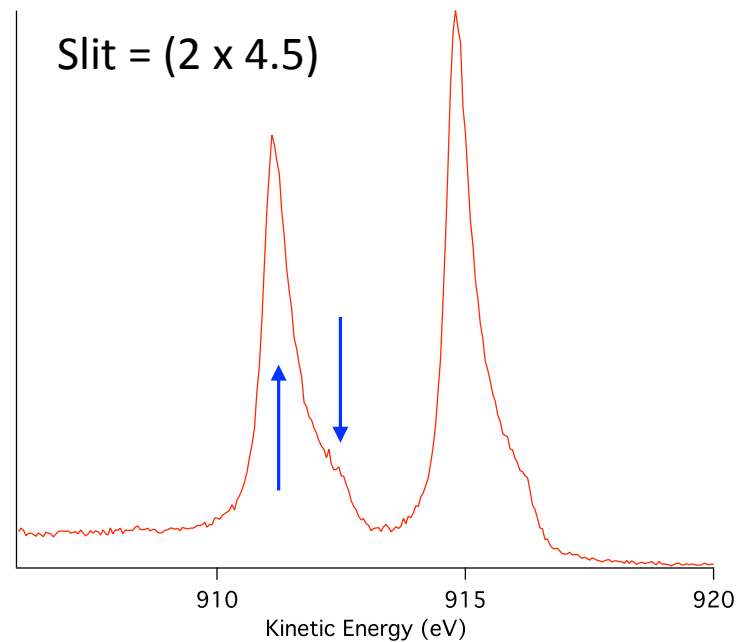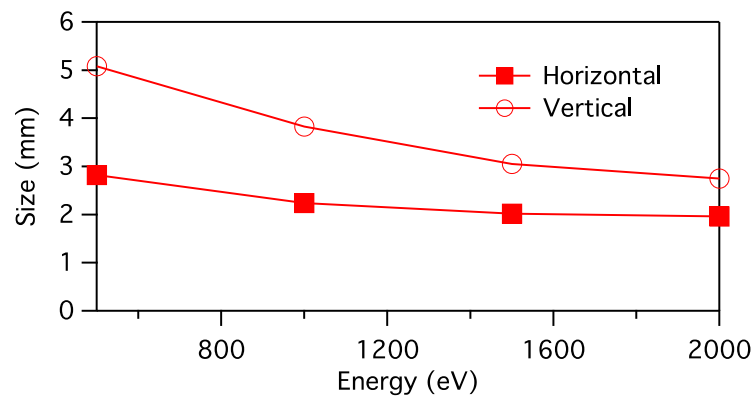$$k(w) = k_0(1 + 2b_2 w + 3b_3 w^2 + \cdots)$$

Exit Slits

β' α

β α

$\lambda = d(sin\alpha - sin\beta)$
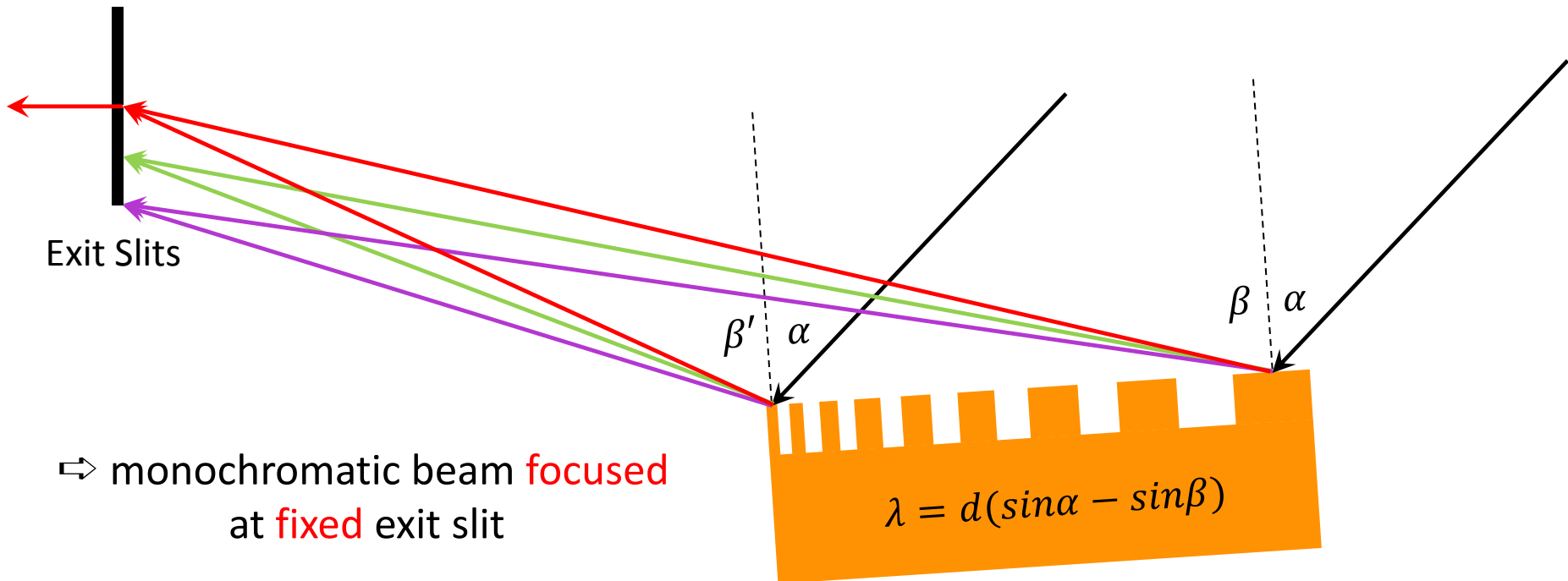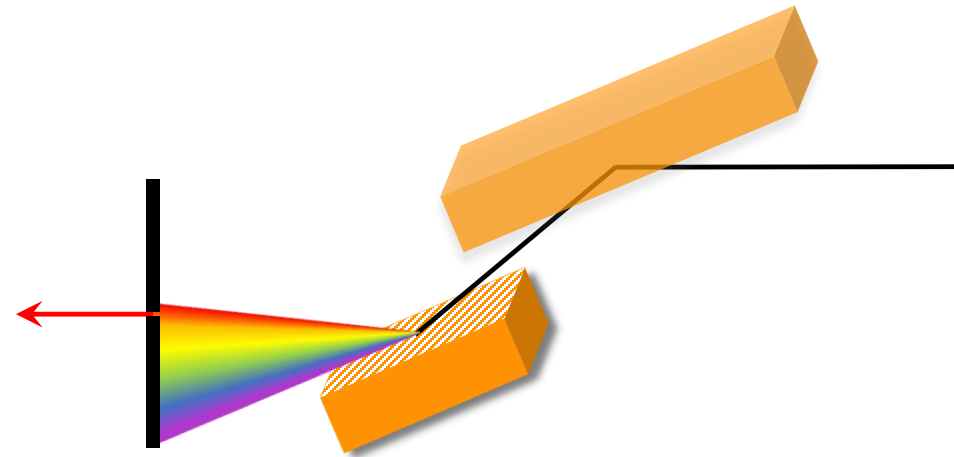
⇨ monochromatic beam focused at fixed exit slit

Beamline calibration
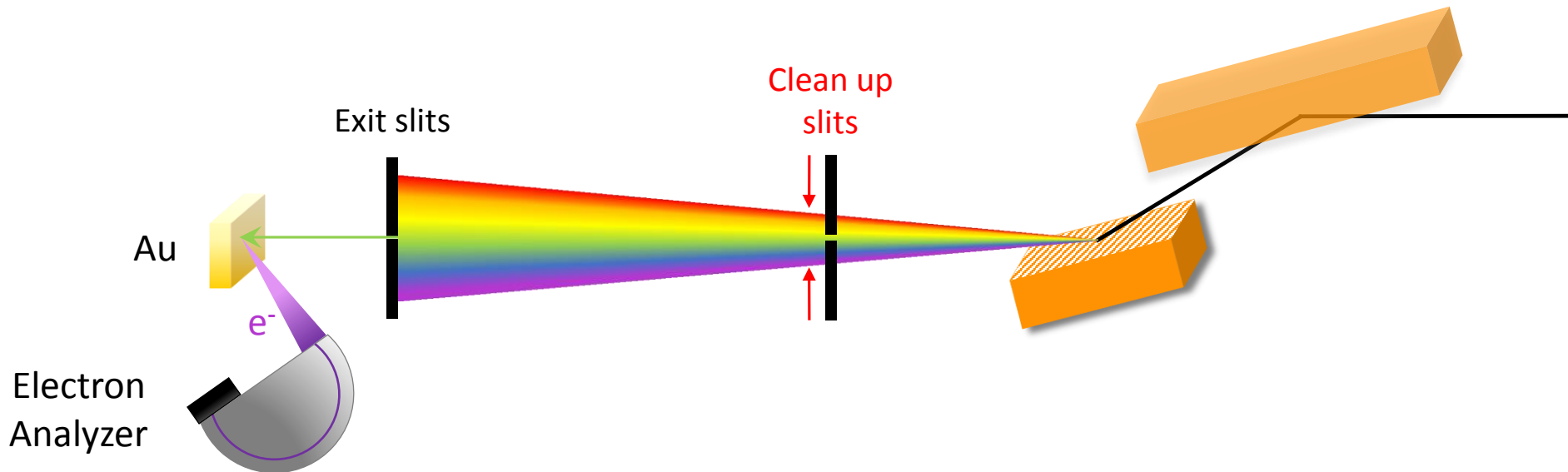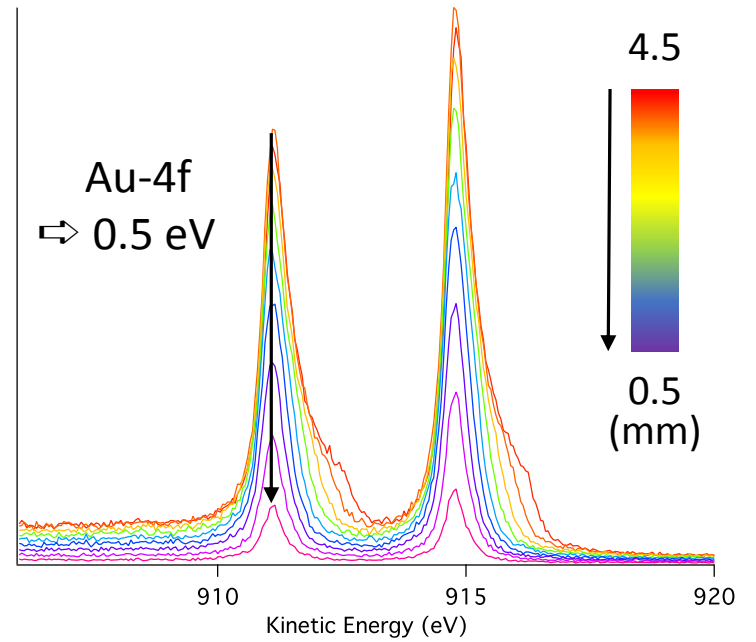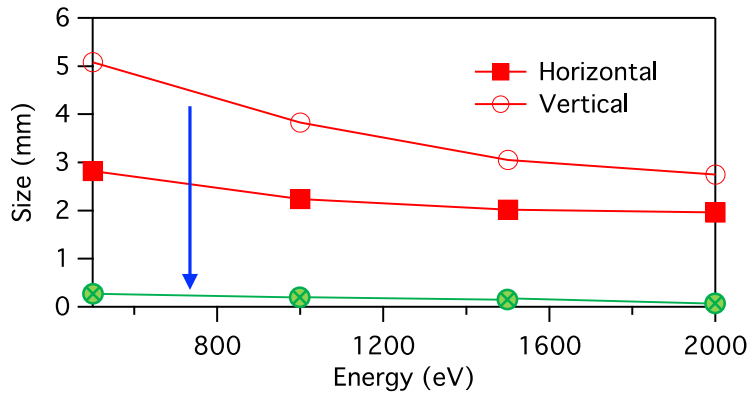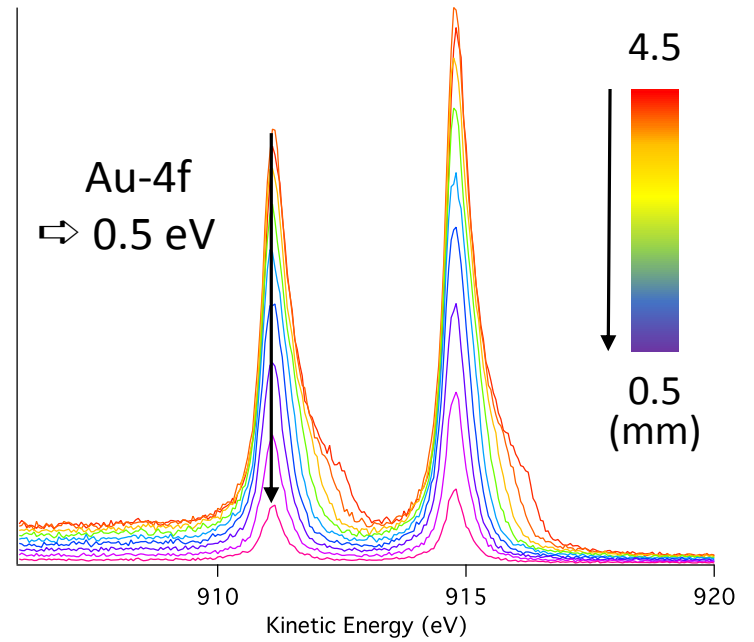
Fermi Edge
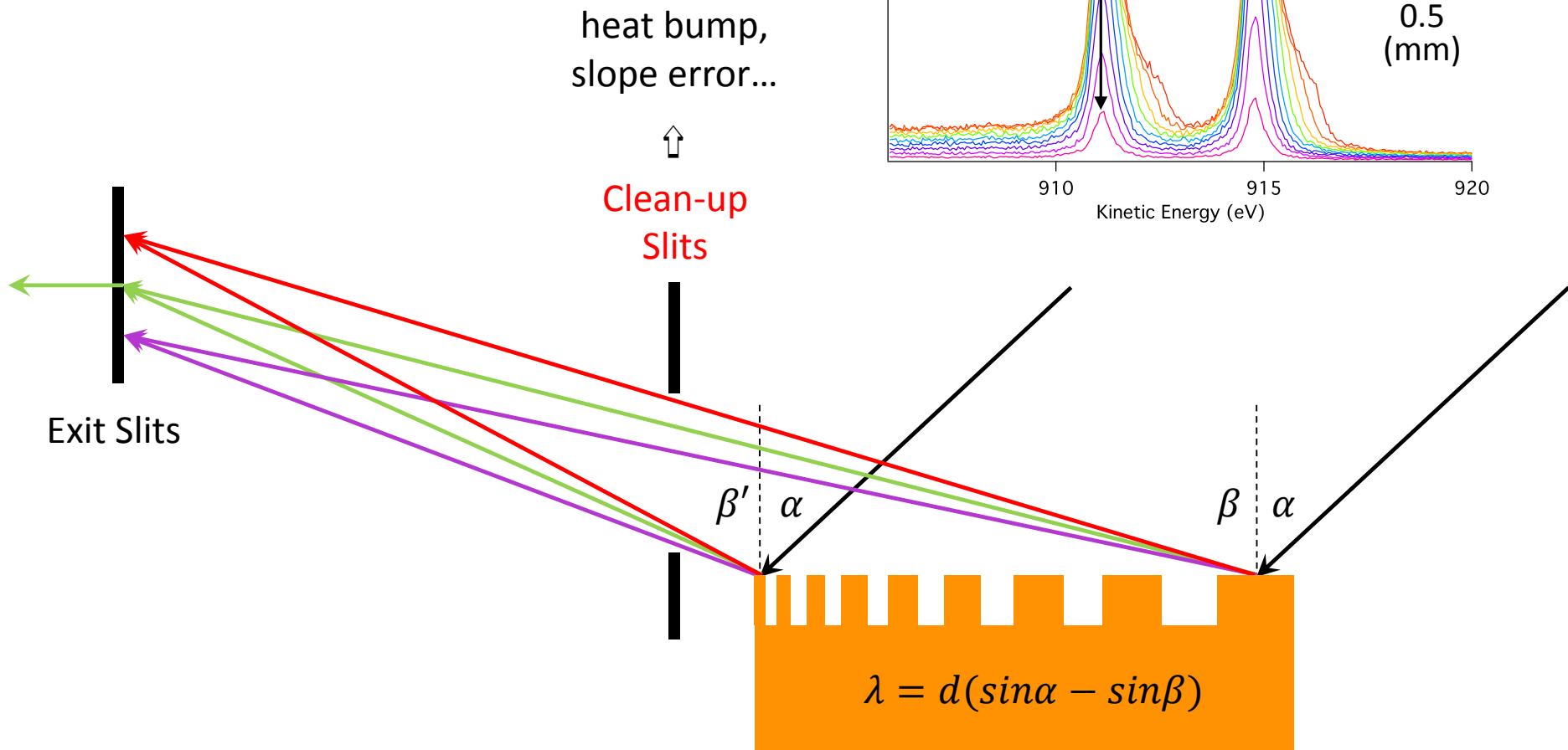
498.0   498.5   499.0   499.5
Kinetic Energy [eV]

Au-4f

910   915   920
Kinetic Energy (eV)

Clean-up slits

Exit slits

Au

e⁻

Electron Analyzer

$$|E_b| = h\nu - \phi - E_{kin} \Rightarrow$$

resolution & absolute energy of the beamline

Slits calibration

Slit = (2 x 4.5)

Size (mm) vs Energy (eV): Horizontal ■, Vertical ○

Kinetic Energy (eV)

Au

e⁻

Electron Analyzer

Exit slits

Clean up slits

Energy Resolution?

Au-4f
⇨ 0.5 eV

Exit slits

Clean up
slits

Au

e⁻

Electron
Analyzer

Energy Resolution?

heat bump,
slope error…

⇧

**Clean-up
Slits**

Exit Slits

$$\beta' \quad \alpha \qquad \beta \quad \alpha$$

$$\lambda = d(sin\alpha - sin\beta)$$
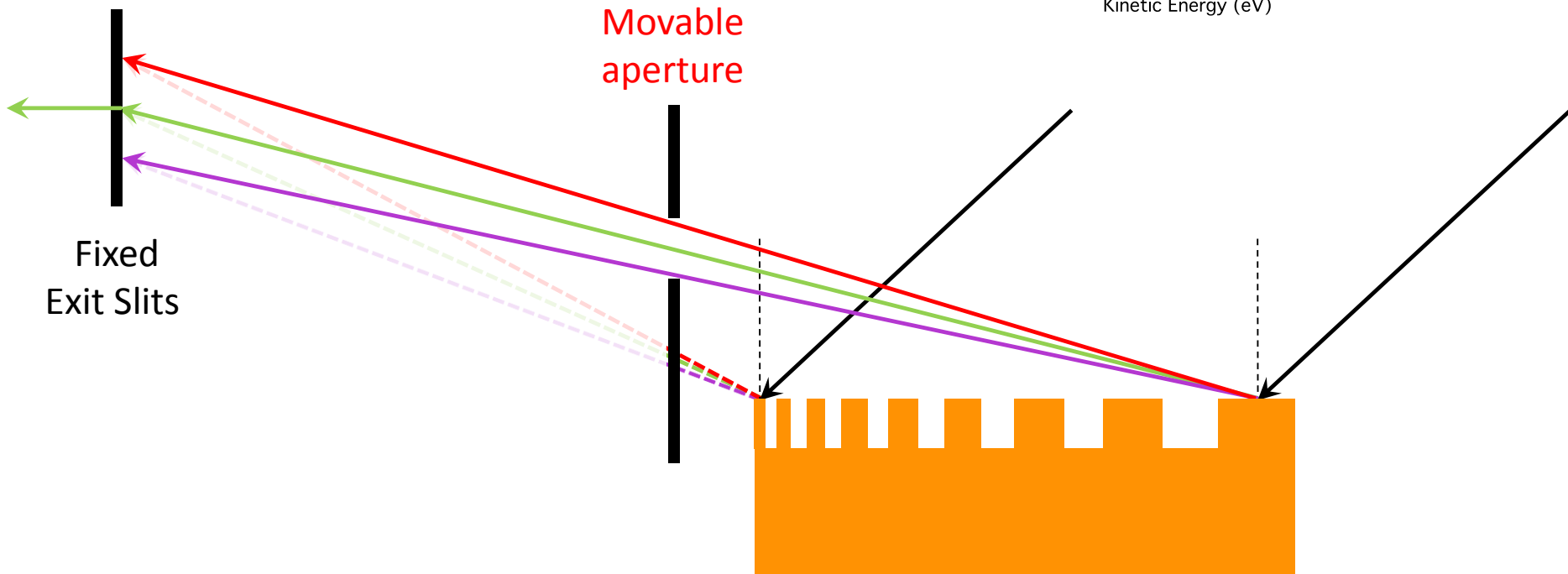
Au-4f
⇨ 0.5 eV

4.5

0.5
(mm)

Kinetic Energy (eV)

Troubleshooting

Use clean-up slits as
movable aperture
to map the grating

Fixed
Exit Slits

Movable
aperture

Kinetic Energy (eV)

Troubleshooting
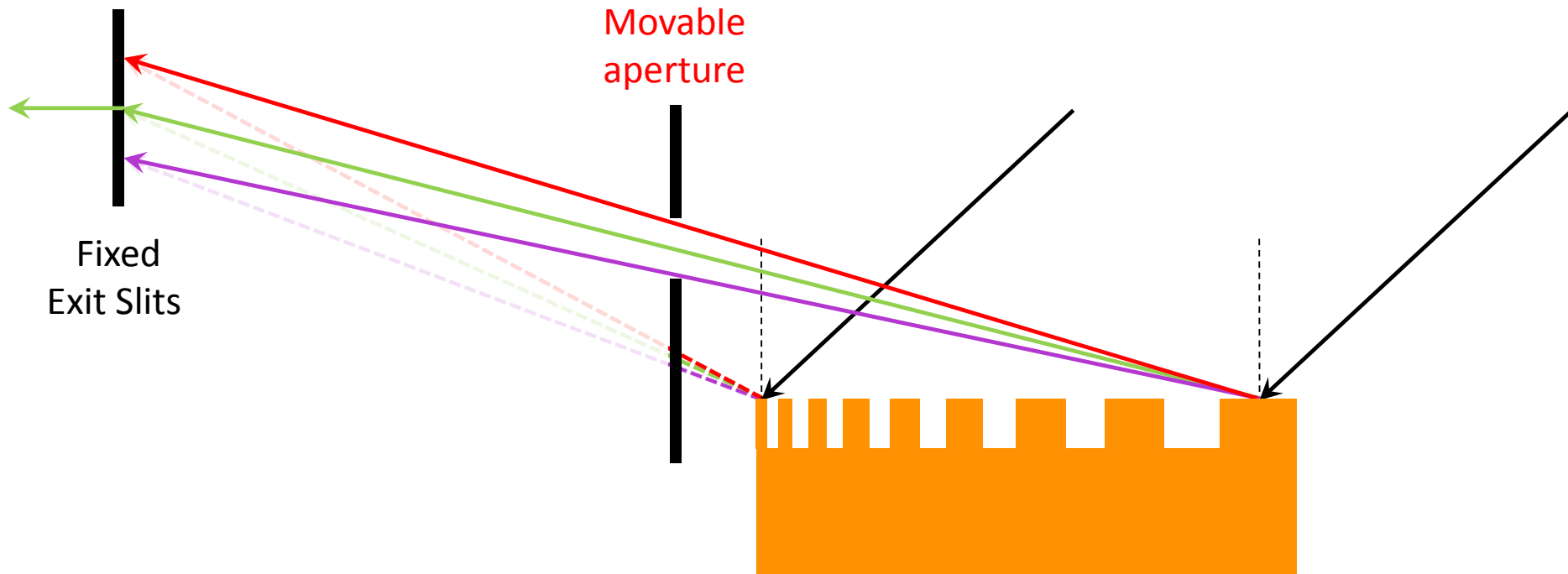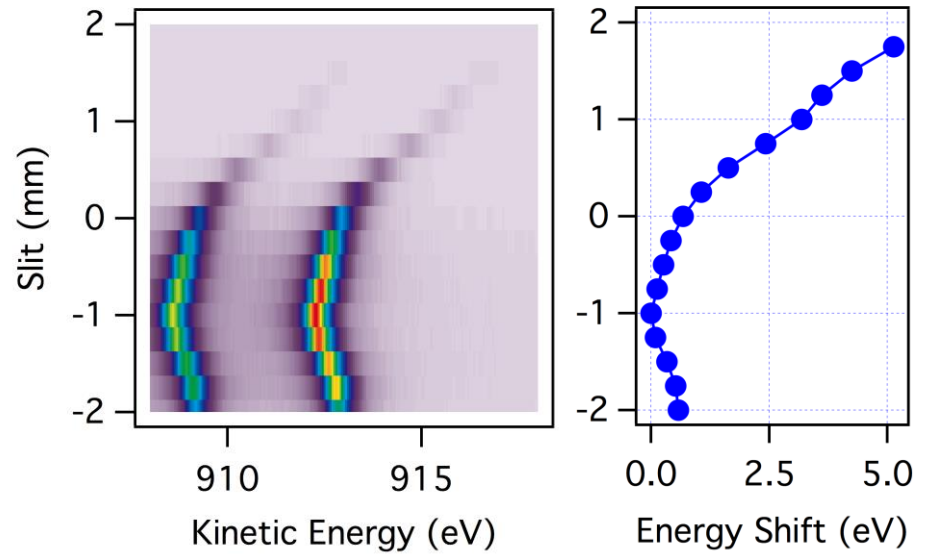
Use clean-up slits as
movable aperture
to map the grating

Movable
aperture

Fixed
Exit Slits

Troubleshooting

Use clean-up slits as
movable aperture
to map the grating

Fixed
Exit Slits
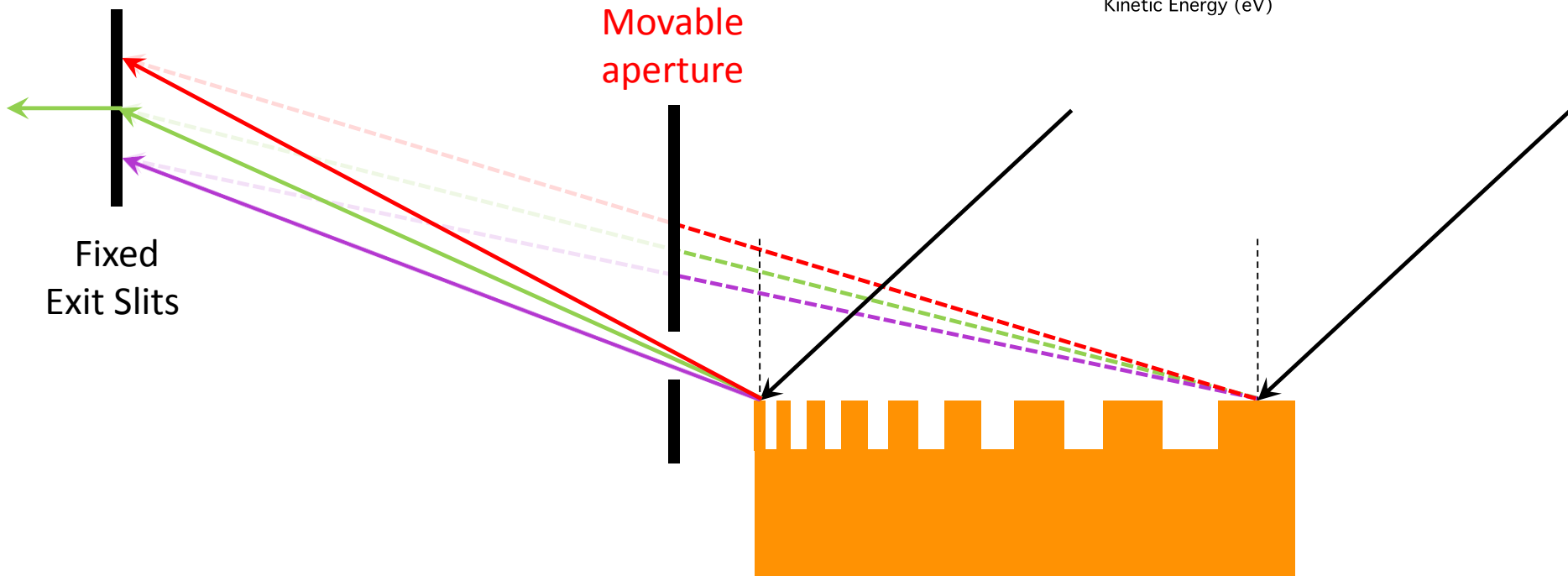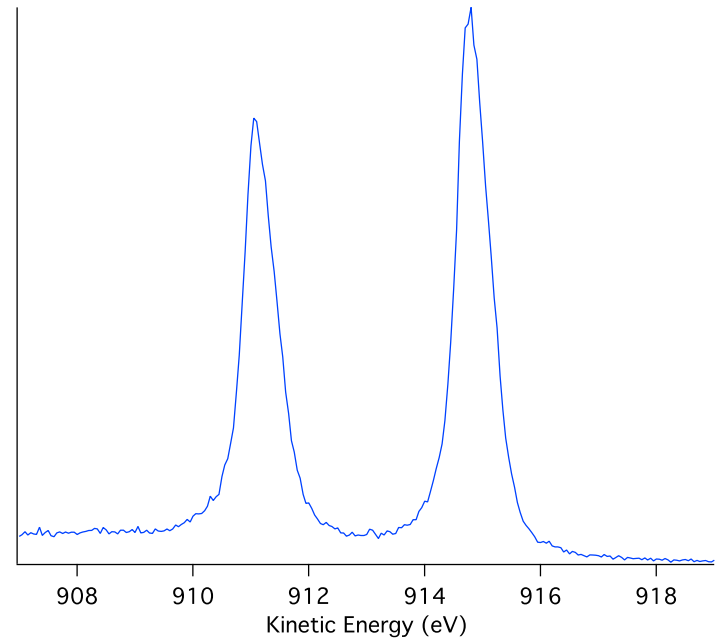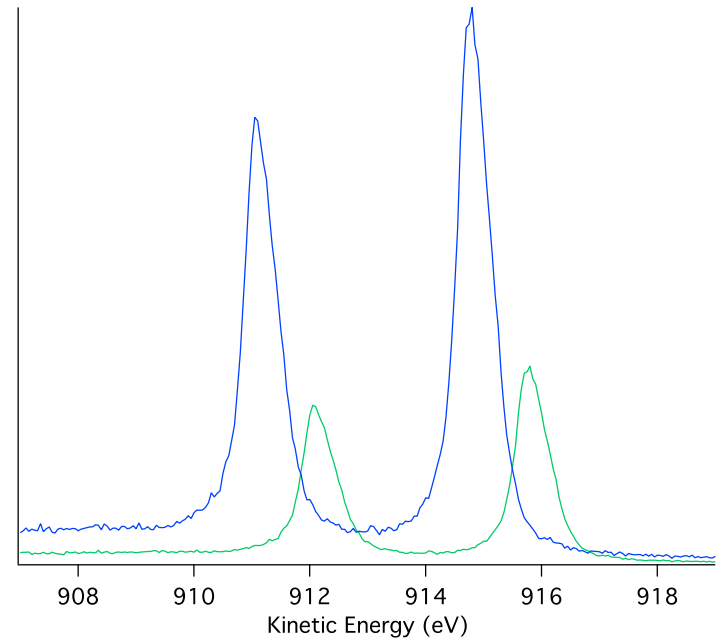
Movable
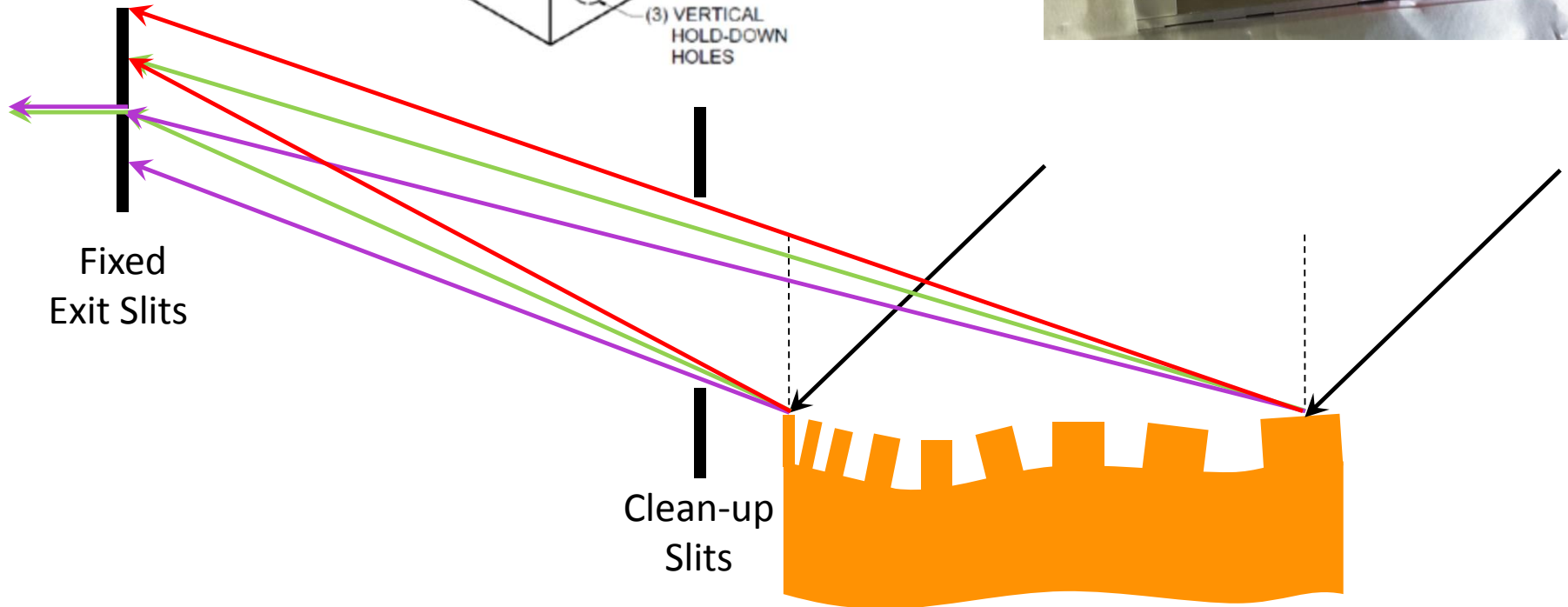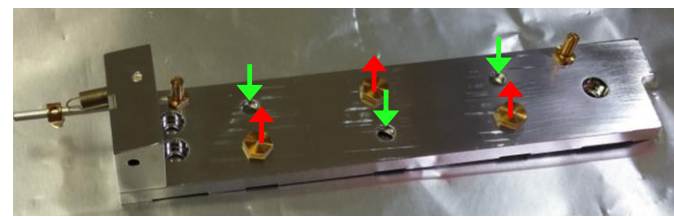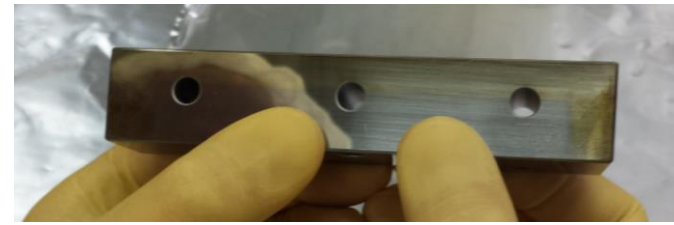aperture

Troubleshooting

⇨ VLS law ?

$$k(w) = k_0(1 + 2b_2 w + 3b_3 w^2 + \cdots)$$
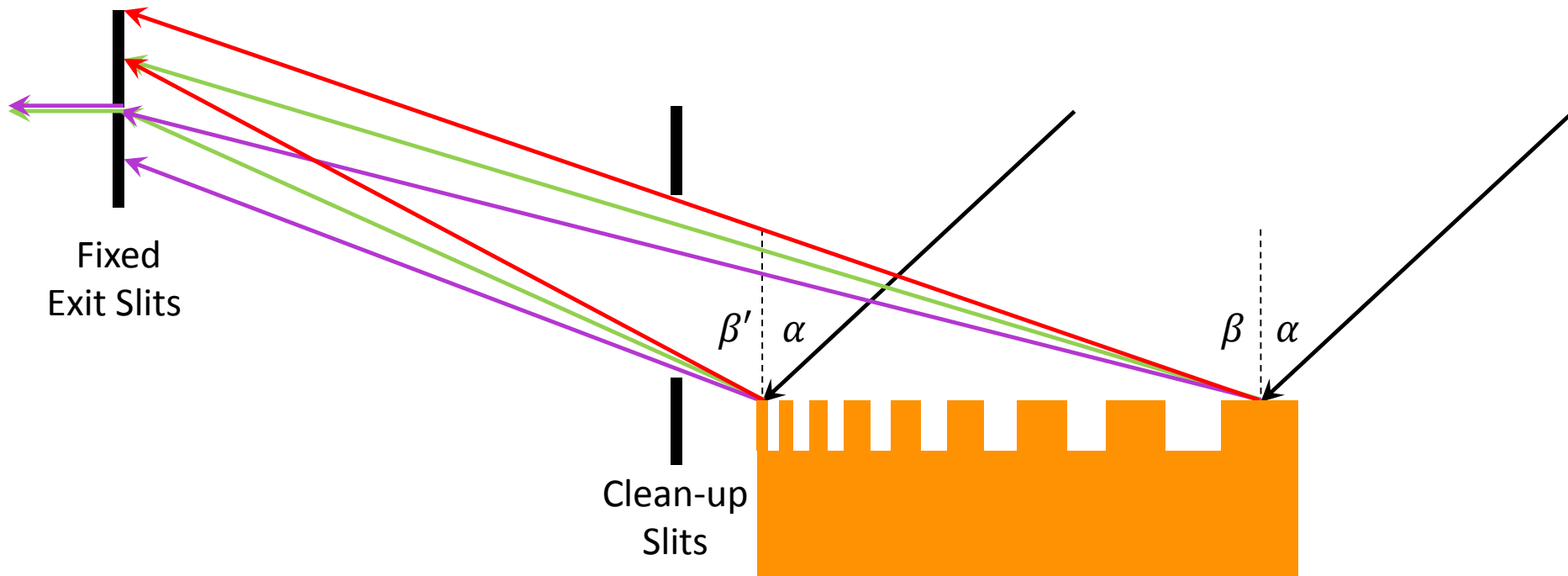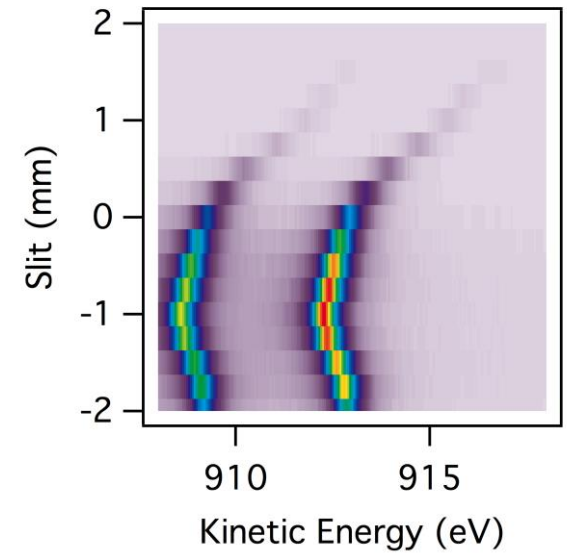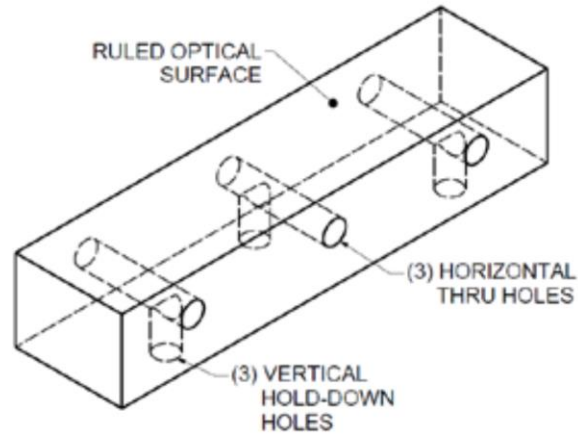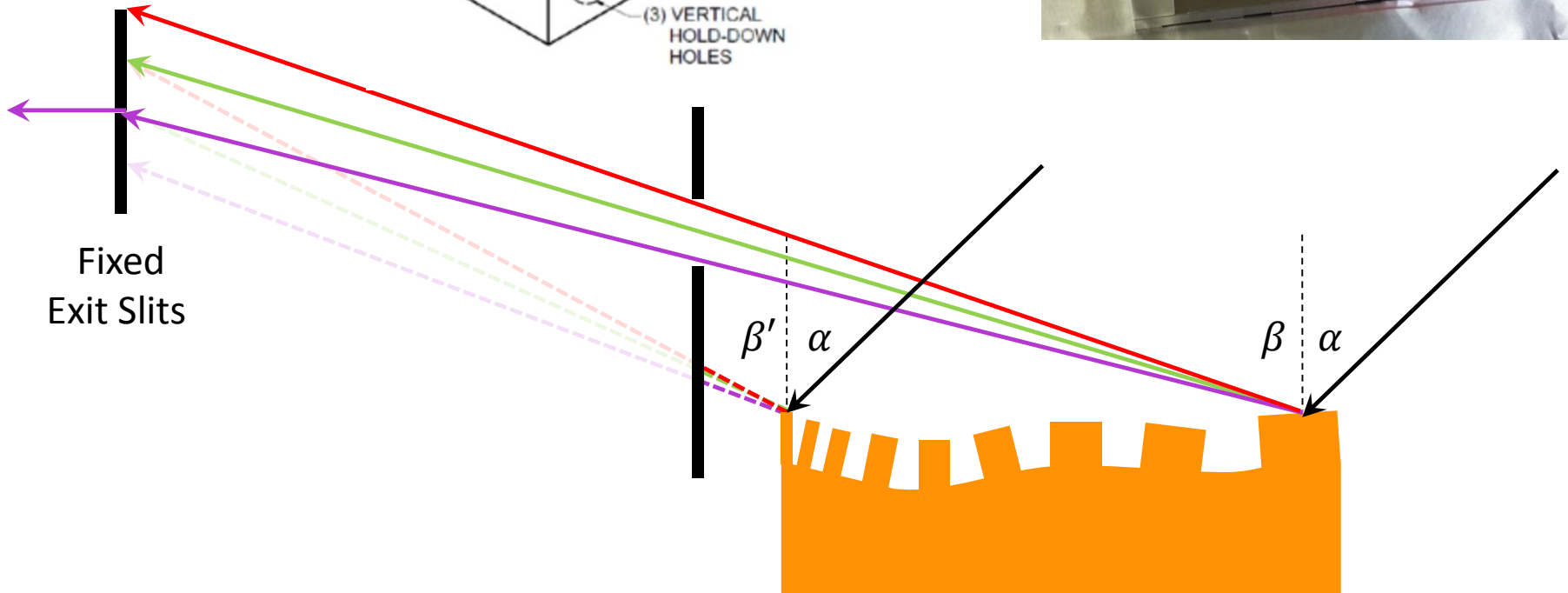

Fixed
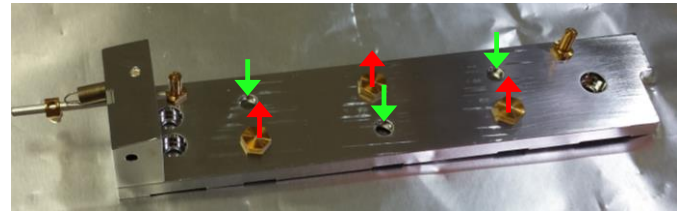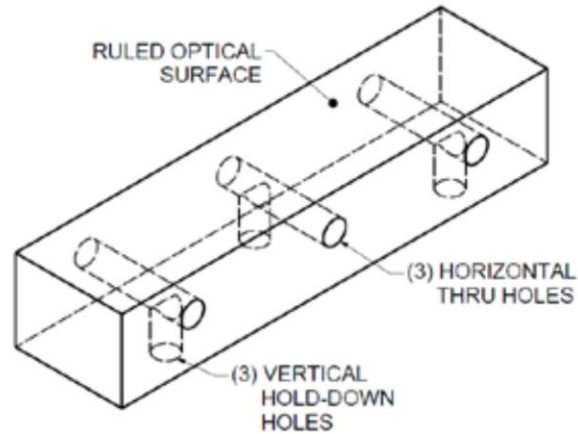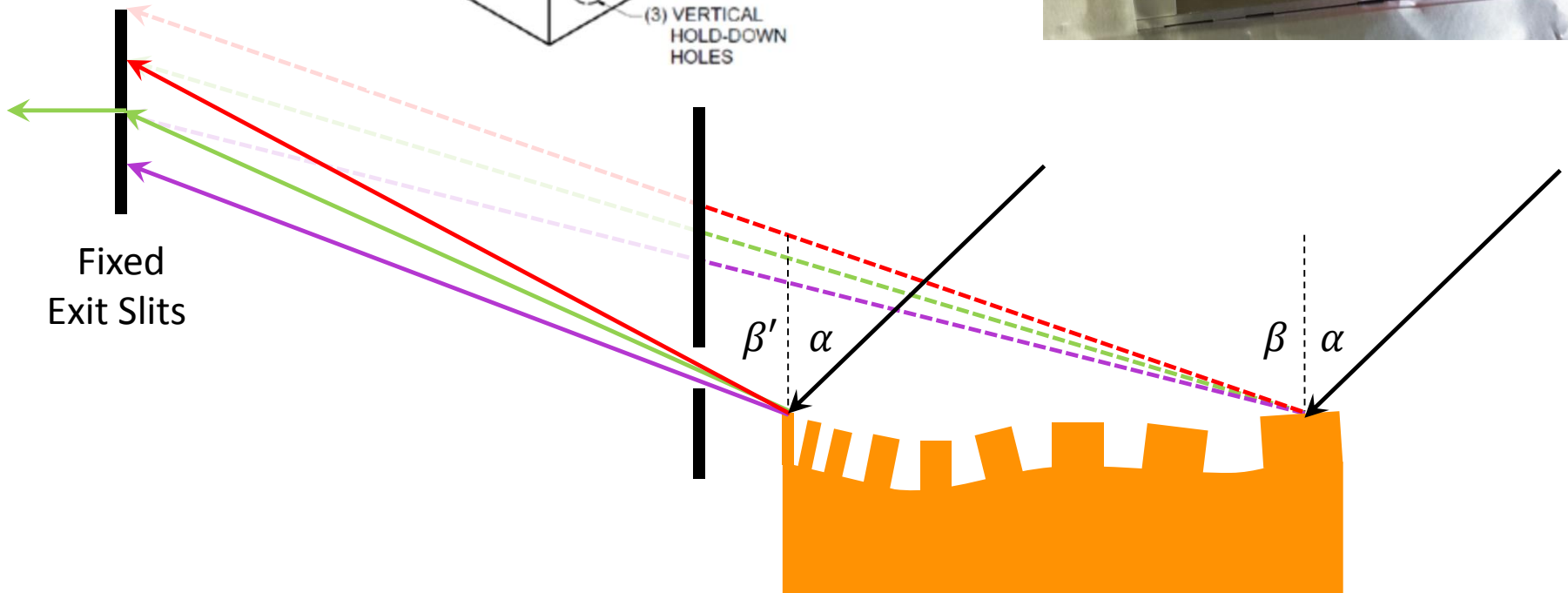Exit Slits

Clean-up
Slits

β' α

β α

Troubleshooting

⇨ Substrate distortion?

RULED OPTICAL SURFACE

(3) HORIZONTAL THRU HOLES

(3) VERTICAL HOLD-DOWN HOLES

Fixed Exit Slits

Clean-up Slits

Troubleshooting

⇨ Substrate distortion?

RULED OPTICAL SURFACE

(3) HORIZONTAL THRU HOLES

(3) VERTICAL HOLD-DOWN HOLES

Fixed Exit Slits

β' α

β α

Troubleshooting

⇨ Substrate distortion?

RULED OPTICAL SURFACE

(3) HORIZONTAL THRU HOLES

(3) VERTICAL HOLD-DOWN HOLES

Fixed Exit Slits
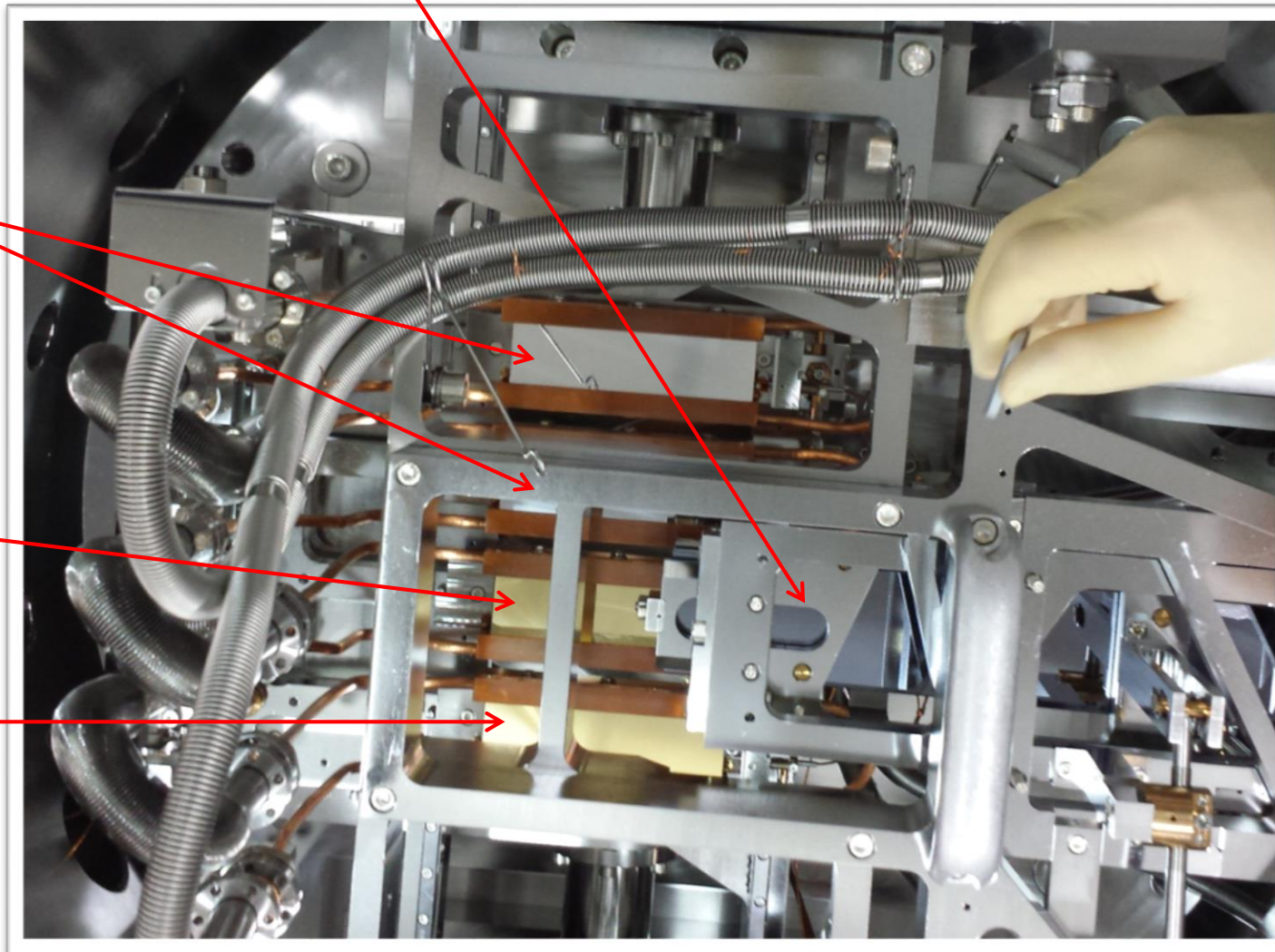
β' α

β α
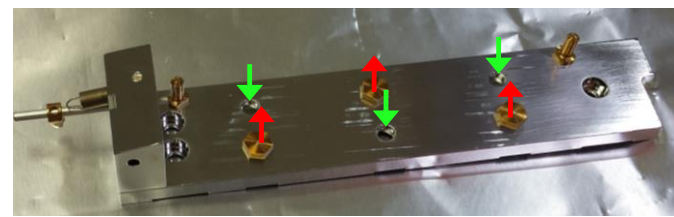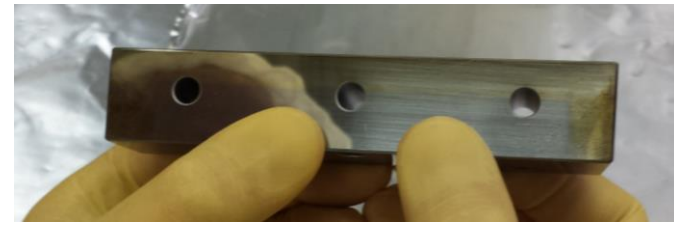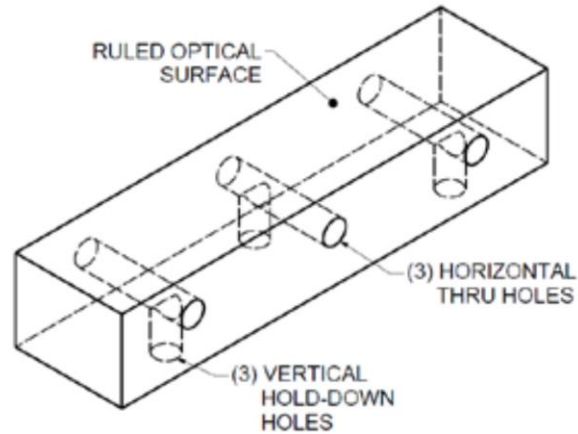
May Shutdown 2016
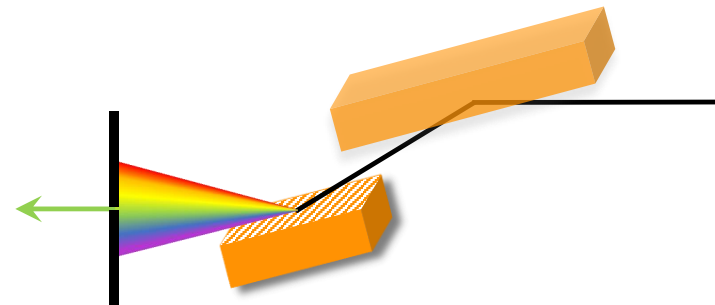
Mirror

Dummies

MEG

HEG

Metrology measurements

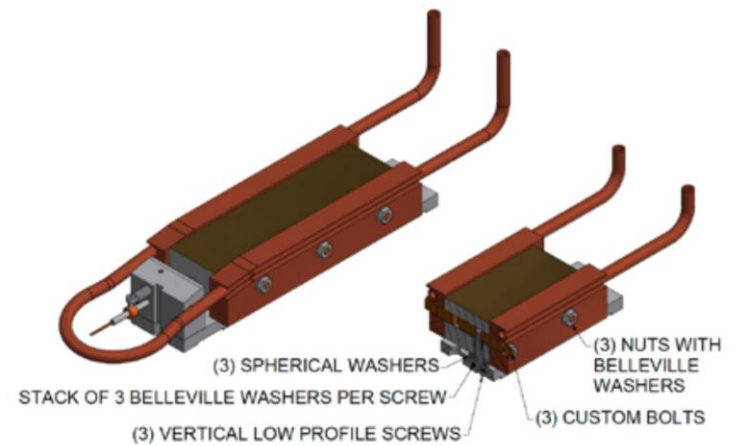➯ Wyko 6000 Interferometer
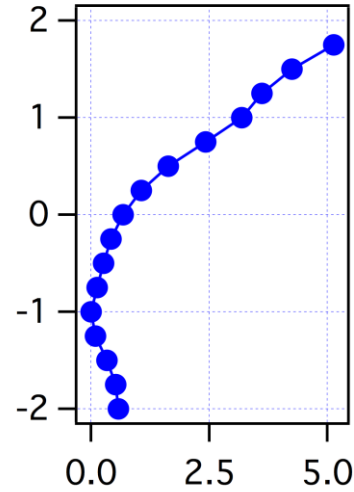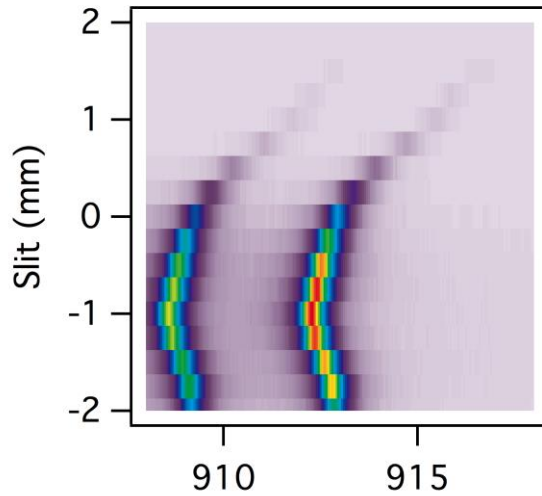

Unruled Subtrate:
- - - Original Holder
——— Free Standing
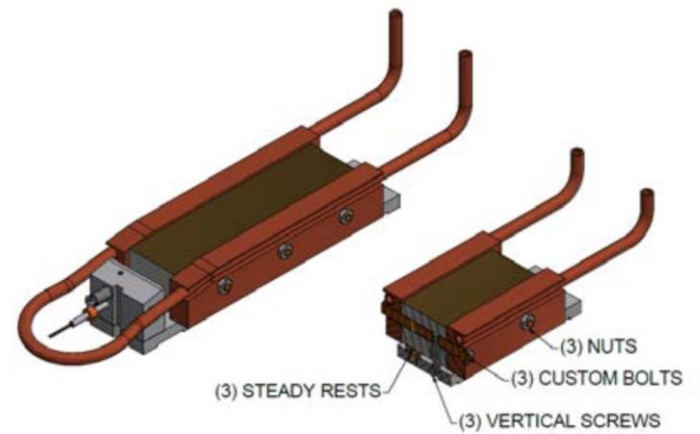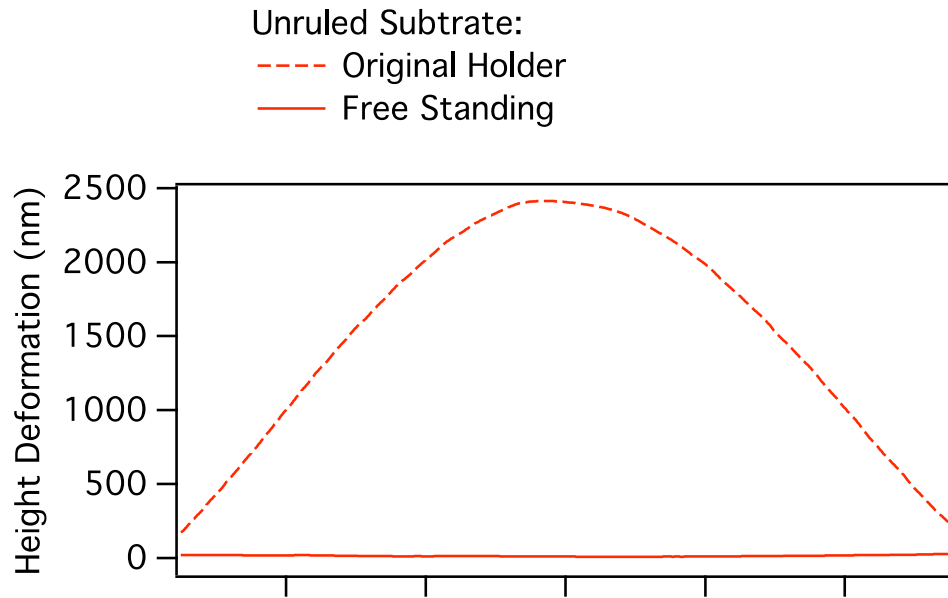
Grating holder modification
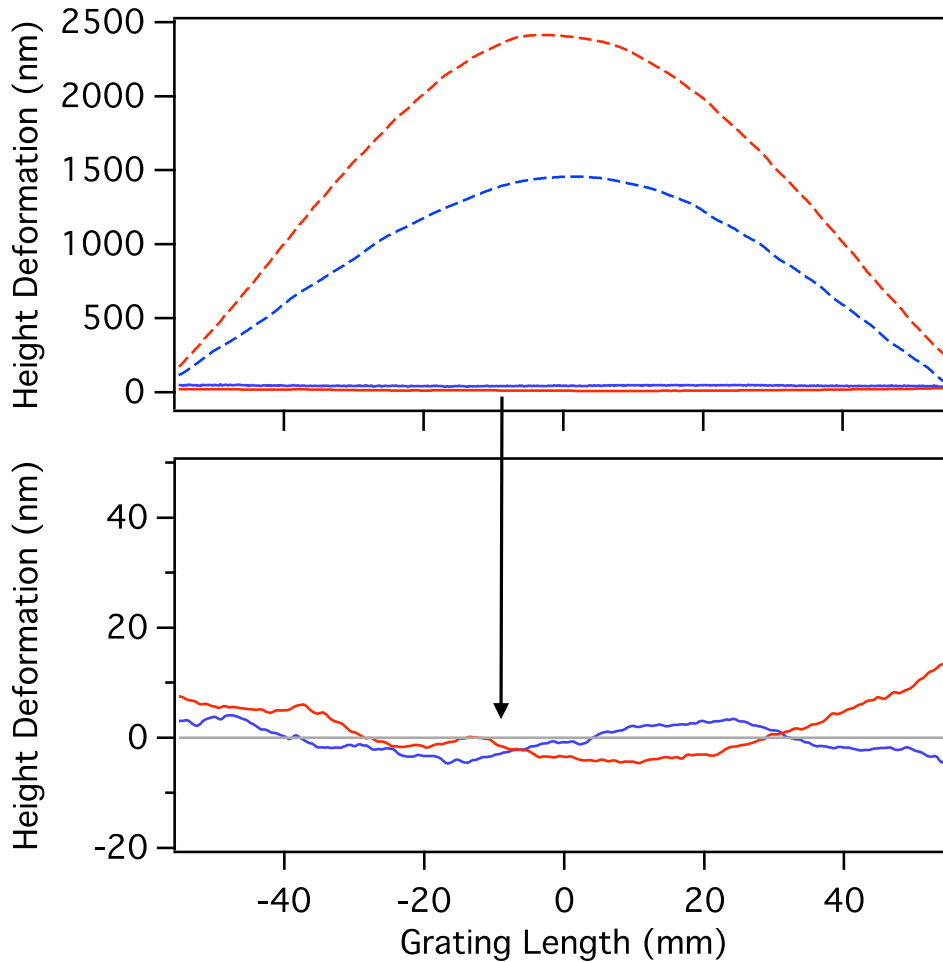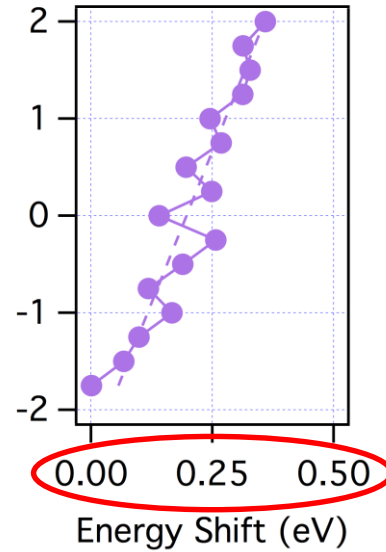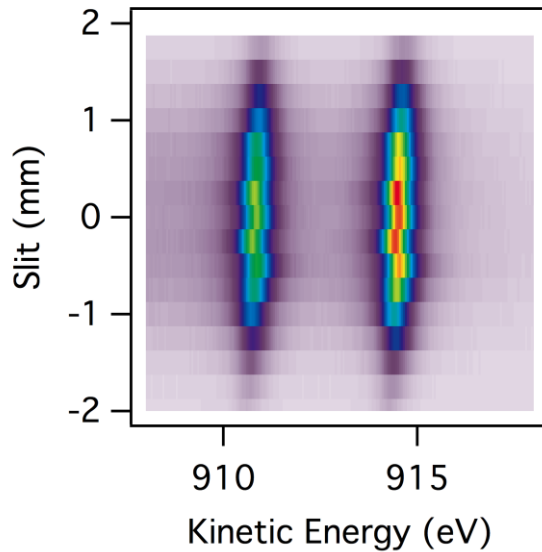
Like the phoenix our mono will rise...

2016-1

2016-2

$$\frac{\Delta E}{E} = 200$$

$$\frac{\Delta E}{E} = 2000 - 5000$$