Beamline Technical Overview

Preliminary requirements for the delivered beam

- High X-rays energies (up to 60 keV)
- Maximum flux for fast dynamic measurements
- Large beam size (up to ~10×10 mm^2)
- High coherence for phase contrast
- Option for a (future?) nano-tomography end station upgrade

Generic beamline layout

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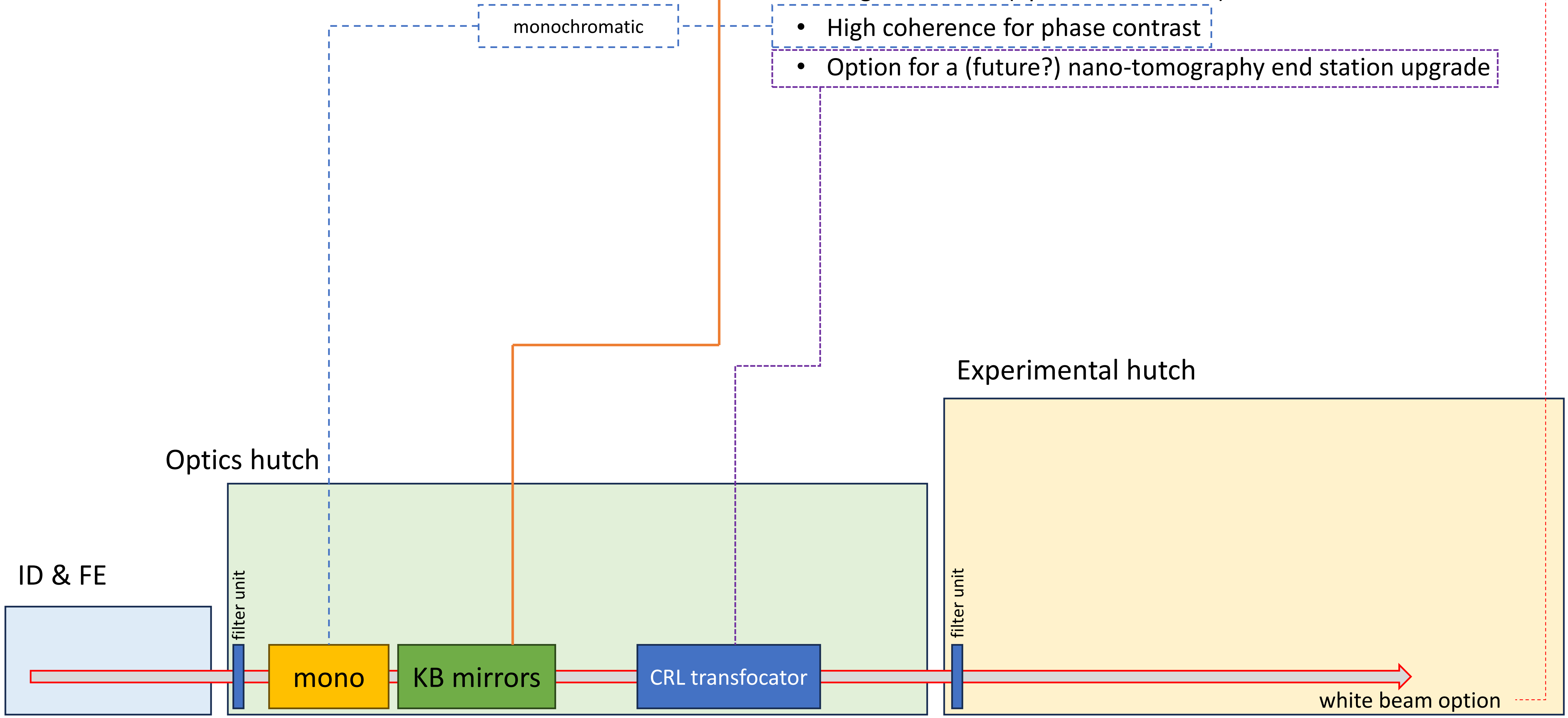
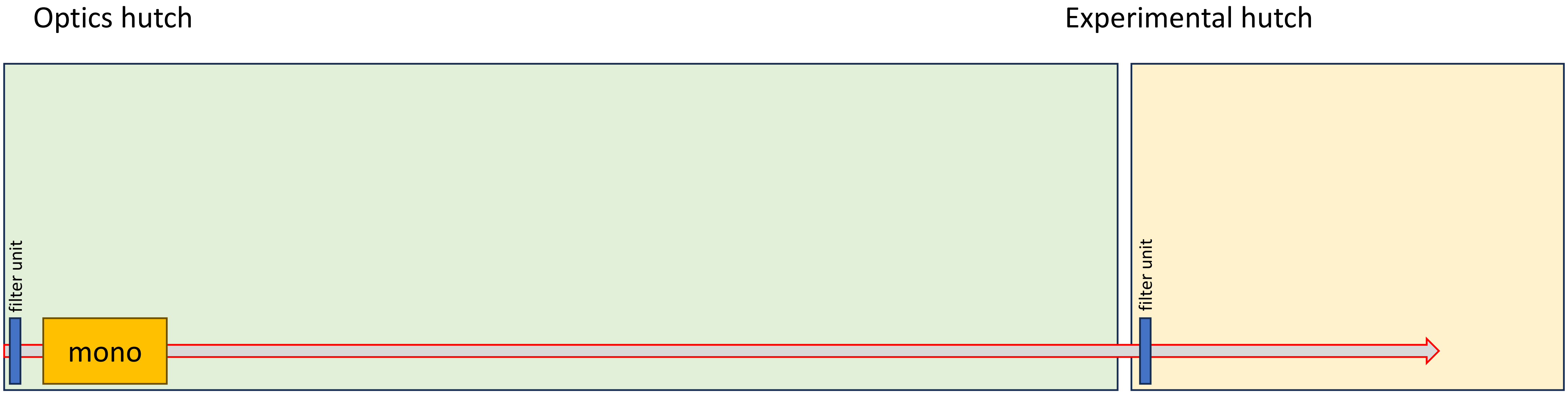
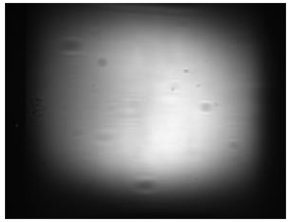


Generic beamline layout

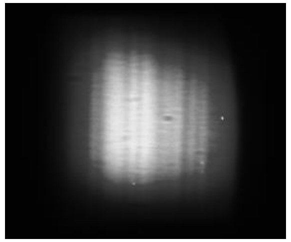


Monochromator selection:

Type	ΔE/E	Coherence	Flux	Beam profile
DCM (Si 111)	1e-4	Maximum	x1	Flat
Multilayer	~2%	High	x200	Stripes



Si(111) DCM beam @DanMAX

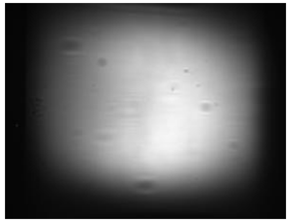


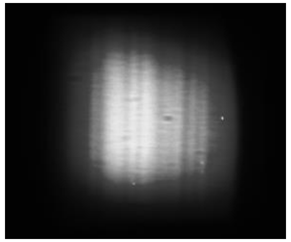
MLM (Ni/B_4C) beam @DanMAX

Generic beamline layout

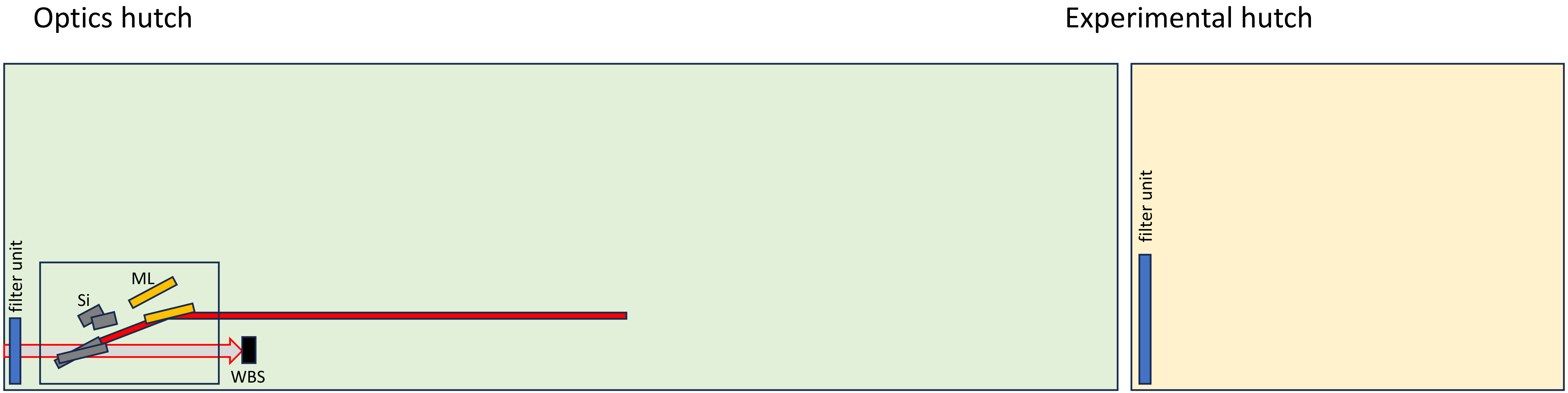
Monochromator selection:

Type	ΔE/E	Coherence	Flux	Beam profile
DCM (Si 111)	1e-4	Maximum	x1	Flat
Multilayer	~2%	High	x200	Stripes





Generic beamline layout



Monochromator selection:

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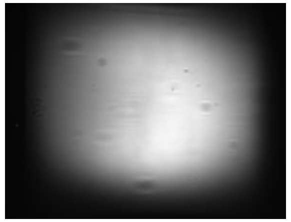
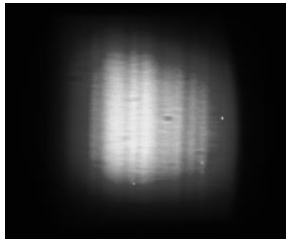
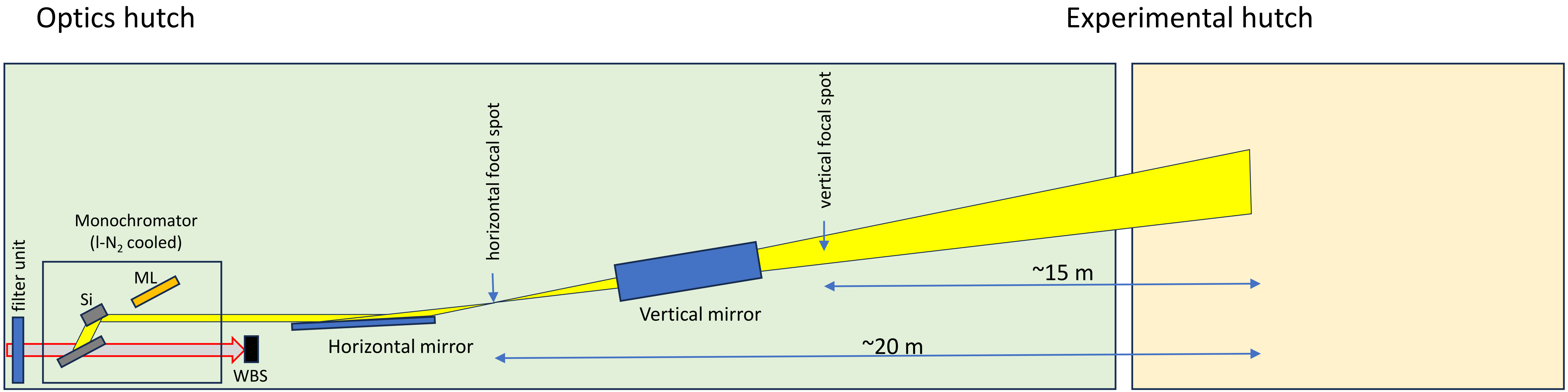


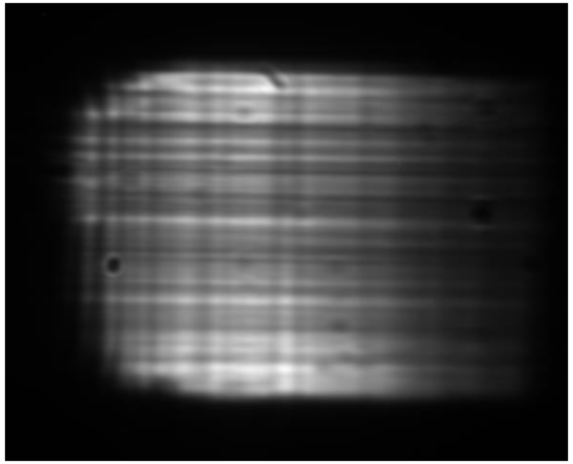


Generic beamline layout



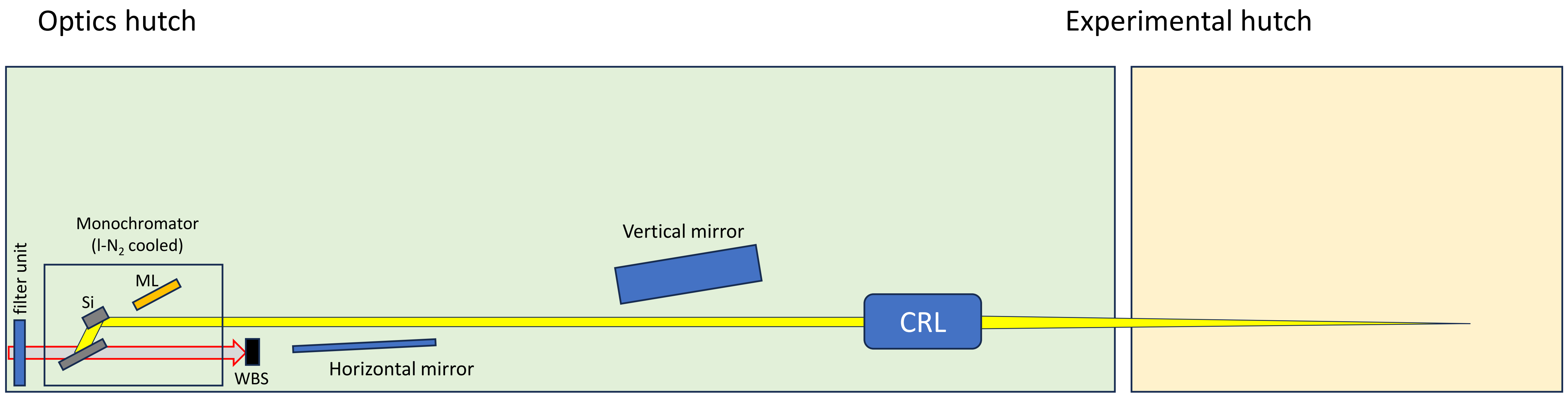
Focusing mirrors (Pt coating)
Separate horizontal and vertical focusing mirrors at ~1.4 mrad incidence angle

+ achromatic, works for all energies and white beam
- introduce stripes structure to the beam
- deviates the beam by about 25 mm



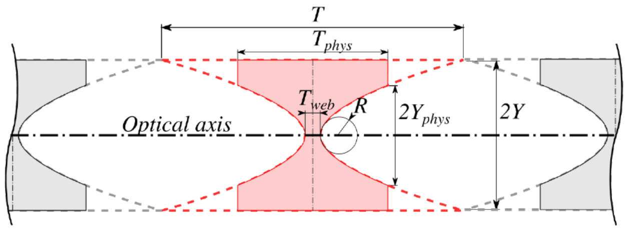
ForMAX beam

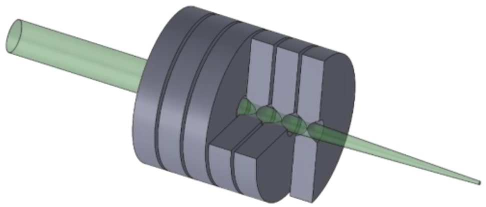
Generic beamline layout



CRL transfocator

Compound refractive lenses to collimate/prefocus the beam to ~100 - ~200 µm size to match the aperture of secondary focusing optics for nano-tomography station





10 – 30 keV: 2D Be parabolic lenses

20 – 35 keV: 2D diamond lenses

35 – 60 keV: 1D Al lenses

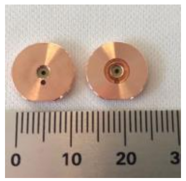
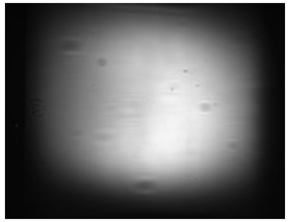
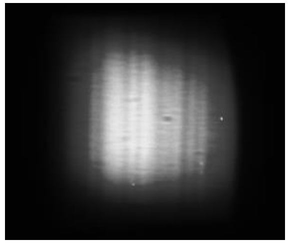


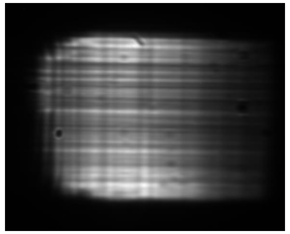
image courtesy: JJ X-Ray

Beam parameters matrix

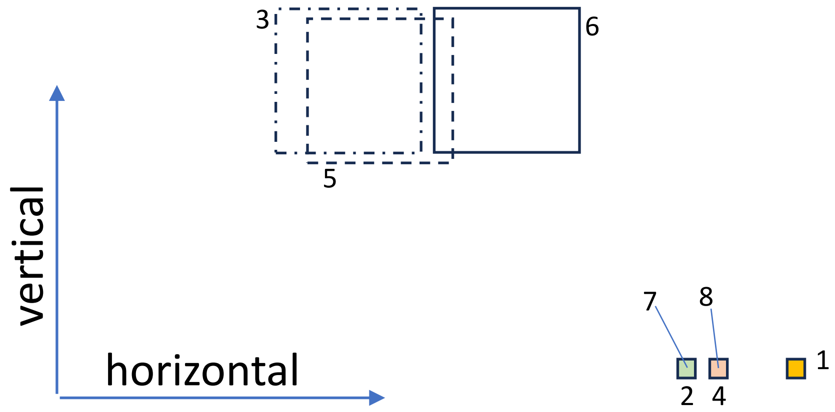
Option #	DCM	MLM	KB mirrors	CRL	Beam size	Flux	Coherence	Profile
1					1.2×1.2 mm^2	1e6	low	flat
2					1.2×1.2 mm^2	1	perfect	flat
3					12×12 mm^2	0.6	high	many stripes
4					1.2×1.2 mm^2	200	high	some stripes
5					12×12 mm^2	120	high	many stripes
6					12×12 mm^2	1e5	low	many stripes
7					100x100 µm^2	0.4	perfect	flat
8					100x100 µm^2	60	high	flat







Relative beam positions



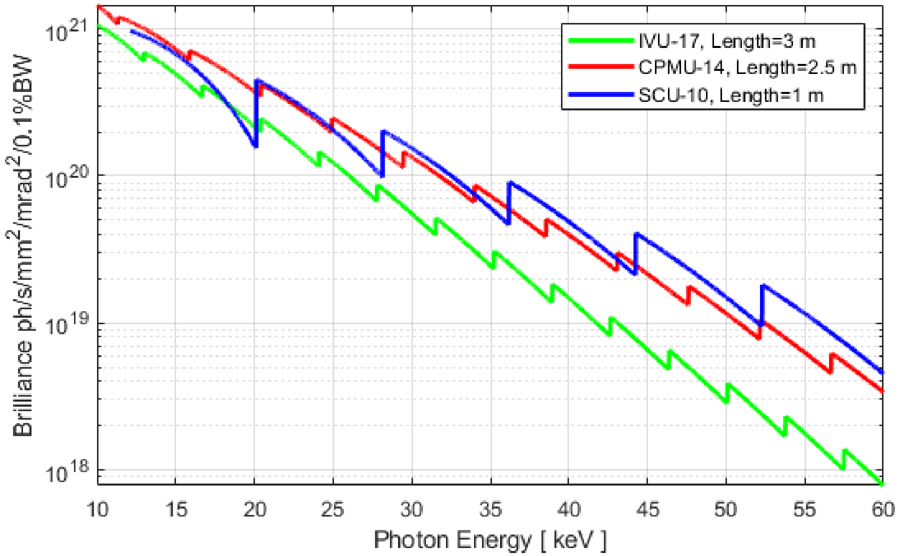
Insertion device selection

Electron beam parameters in the middle of the straight section of the MAX IV ring.

Beam Energy	3 GeV
Beam Current	500 mA
Horizontal Emittance	320 pm.rad
Vertical Emittance	8 pm.rad
Energy Spread	0.0009
Horizontal / Vertical beam size	54 µm / 4 µm
Horizontal / Vertical beam divergence	6 µrad / 2 µrad

Basic parameters of the two undulators options
based on room temperature and cryogenic permanent magnet technologies.

	IVU-17	CPMU-14
Period Length	17 mm	14 mm
Undulator Length	3 m	2.5 m
Minimum gap	4.2 mm	4.0 mm
Maximum K_{eff}	1.85	1.84
Power @ 500 mA	11.4 kW	14 kW
RMS Phase Error	< 3°	< 3°



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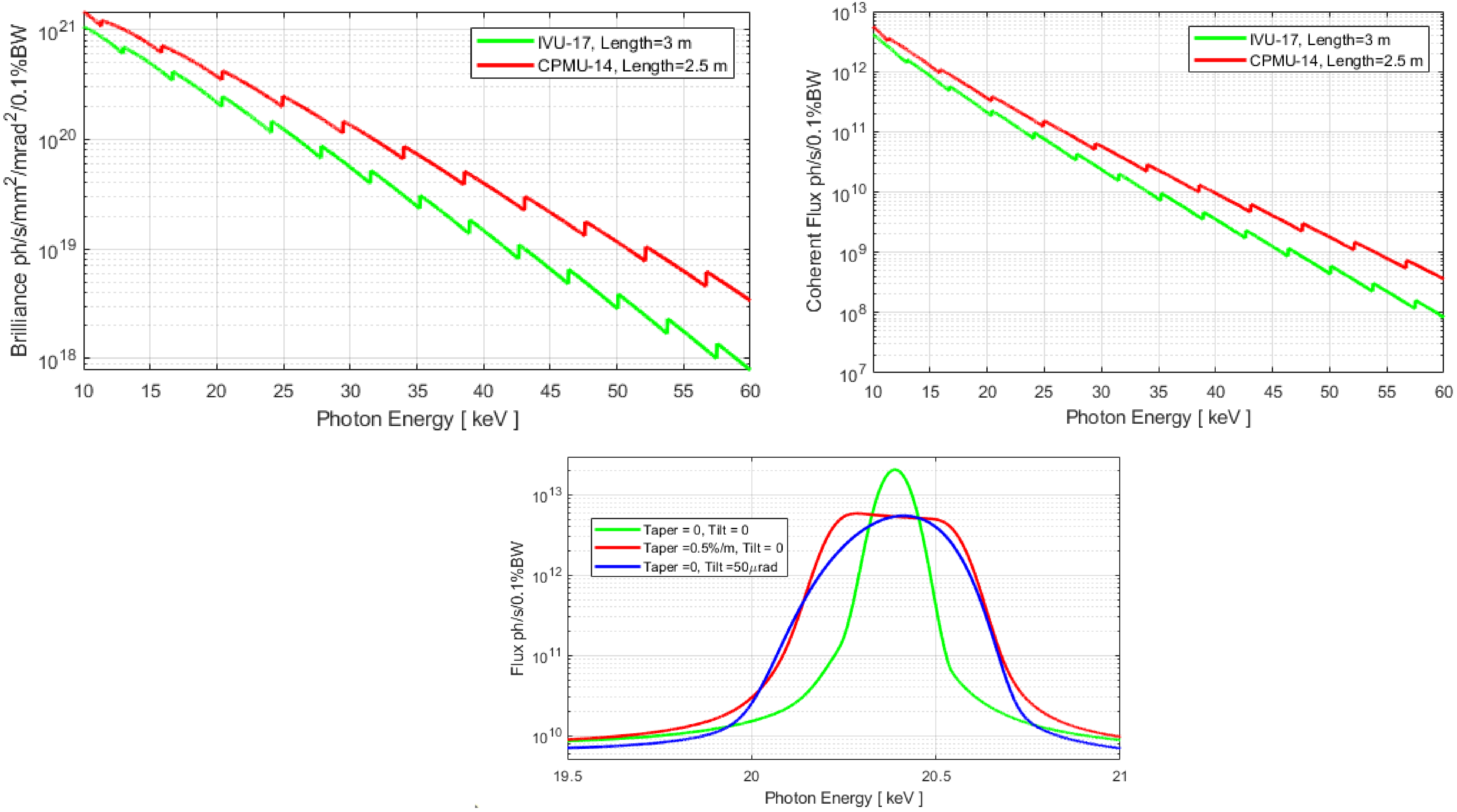
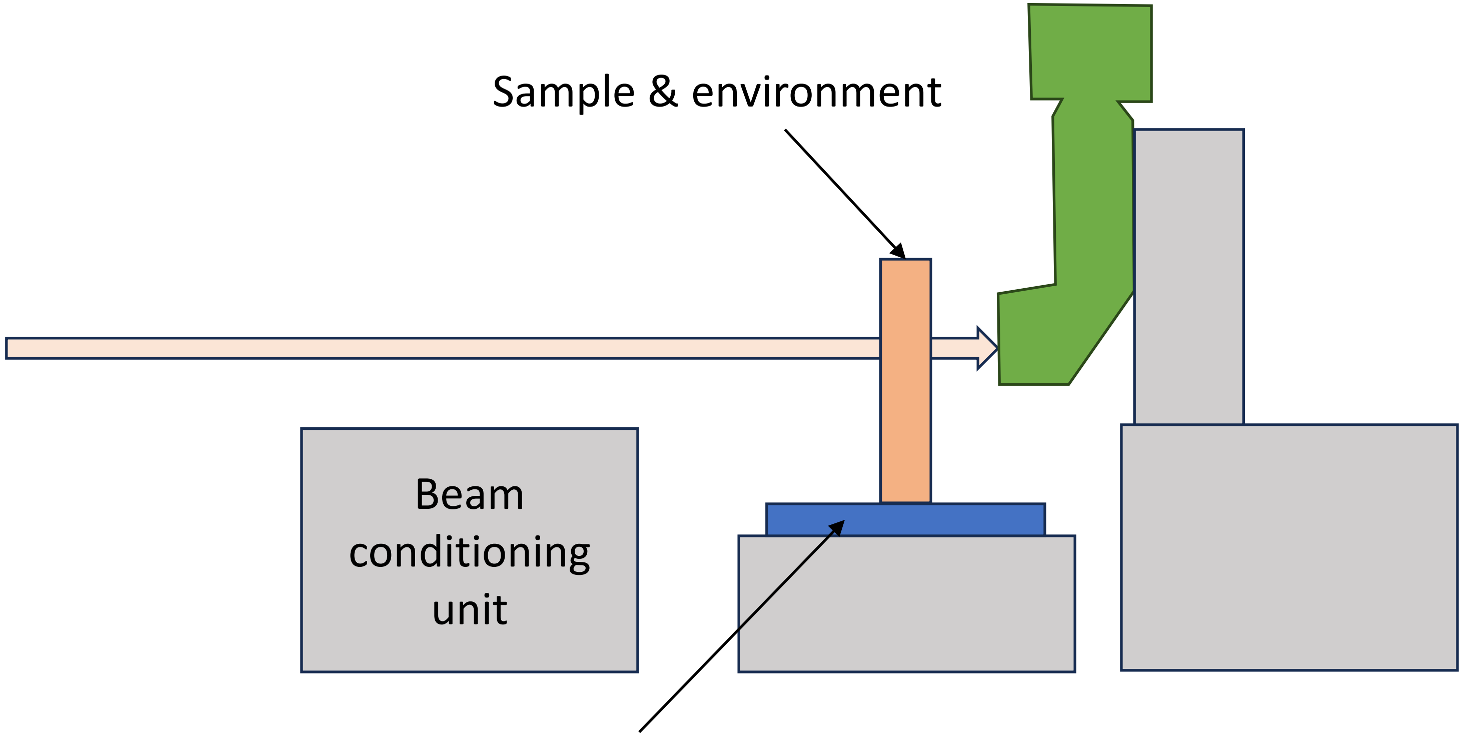


End stations

"Standard" end station:

Medium-to-low resolution (0.5 µm to 10 µm)
Beam size between 1 mm – 12 mm
In-situ and time-resolved measurements



In-situ sample environments ready
(sliprings, fluids rotary union)

End stations

Nanotomo end station:

High resolution (20 nm – 200 nm)

Beam size between 50 µm – 200 µm

Secondary focusing optics:

- KB mirror system (similar to NanoMAX)
- Multilayer Laue lenses