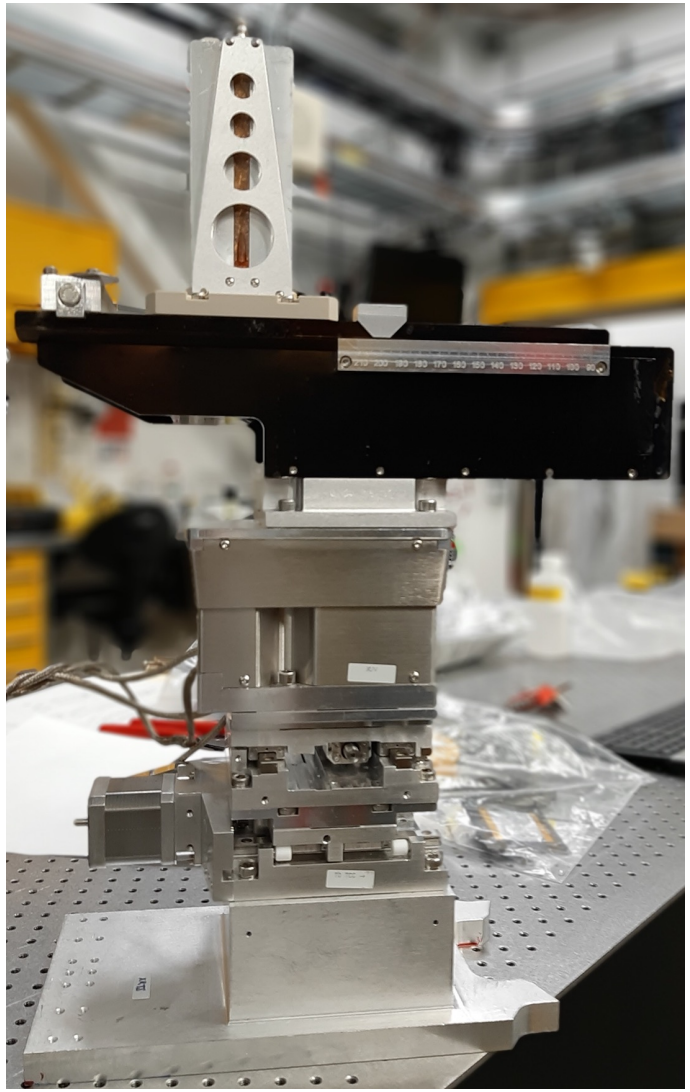
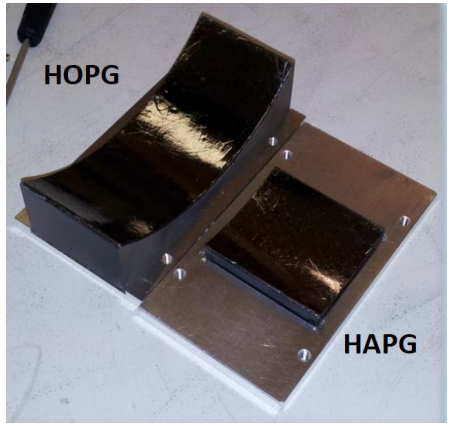
Existing MEC HOPG/HAPG spectrometer for 4-8 keV regime

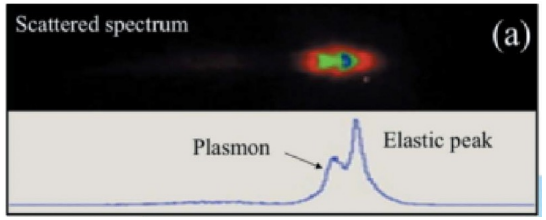


Cylindrically curved graphite crystal spectrometer in von Hamos geometry

Any crystal with ROC ~ 50 mm is compatible with this housing

Spectral window ~ 600 eV





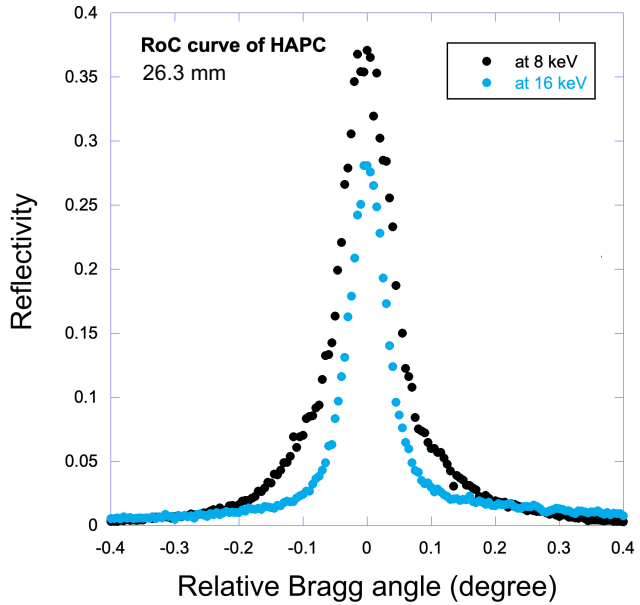
HOPG (Highly oriented pyrolytic graphite)

R= -50mm size: 30 mm x 70 mm
Mosaic spread: ~ 0.4°
Thickness: 150 μm & 300 μm

HAPG (Highly annealed pyrolytic graphite)

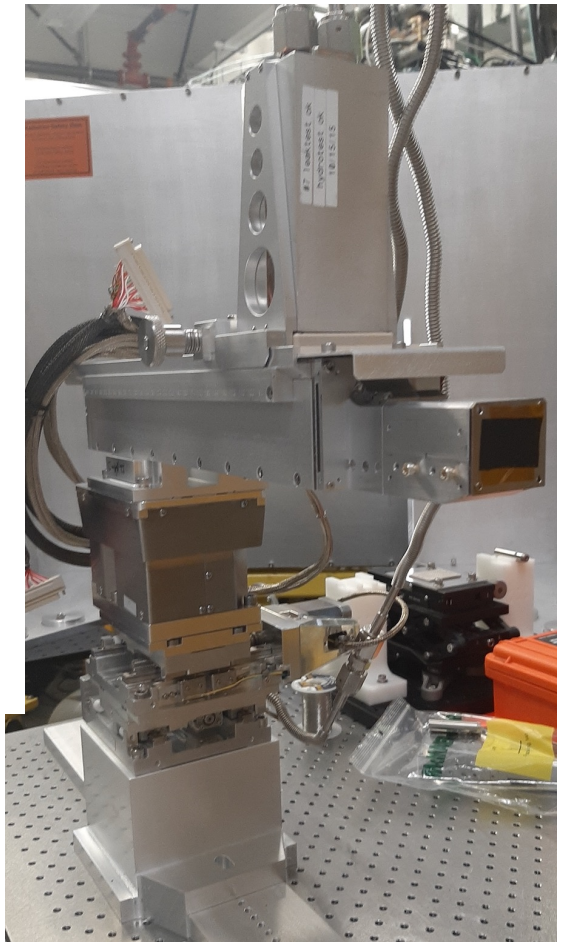
R= -51.7mm size: 32 mm x 30 mm
Mosaic spread: ~ 0.14°
Thickness: 40 μm & 100 μm

New compact HAPG spectrometer for 7.6-25 keV regime



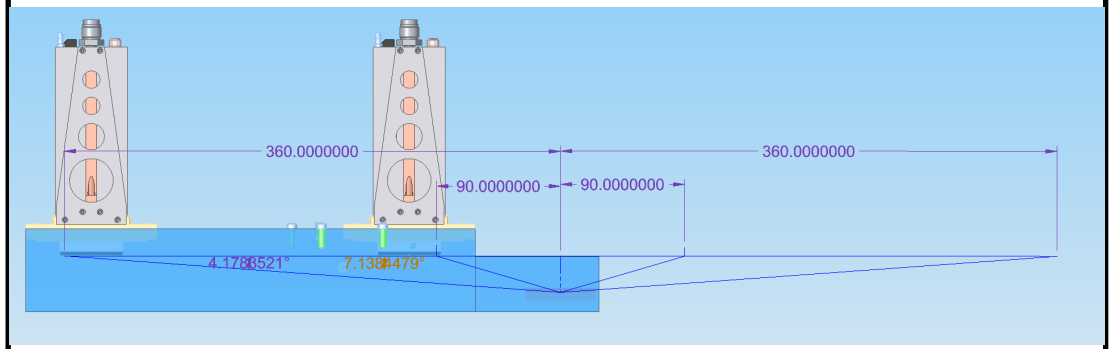
HAPG crystal
40um thickness
50.8 (L) x 25.4 (W)

FWHM at 8 keV: ~0.075º
FWHM at 16 keV: ~0.058º



Compact HAPG spectrometer

- spectral coverage from 7.5 to 25 keV
- spectral window by detector: ~1.15 keV
- compatible with long pulse laser beam delivery
- compact design
- smaller radius of curvature for HAPG crystal to allow for extended spectral coverage



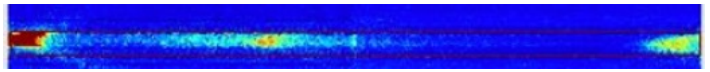
X-ray photon energy (keV)	projected distance, d crystal to detector (mm)	θ_B (º)	crystal order	ROC (mm)
8	110.7	13.4	1	26.3
16	226.1	6.6	1	26.3
16	110.7	13.4	2	26.3
24	340.4	4.4	1	26.3
24	168.7	8.9	2	26.3
25	354.7	4.2	1	26.3

Commissioning of a compact HAPG Spectrometer

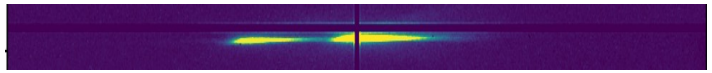
Ni Kα at 7.48 keV, Kβ at 8.26 keV, Compton feature, and elastic peak at 8.35 keV

Co Kβ at 7.65 keV, Compton feature, and elastic peak at 8.35 keV

Bi L line at 12.9 keV, Compton, and elastic peak at 14 keV

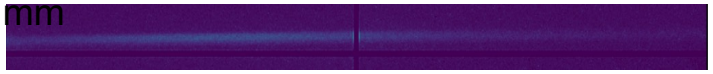


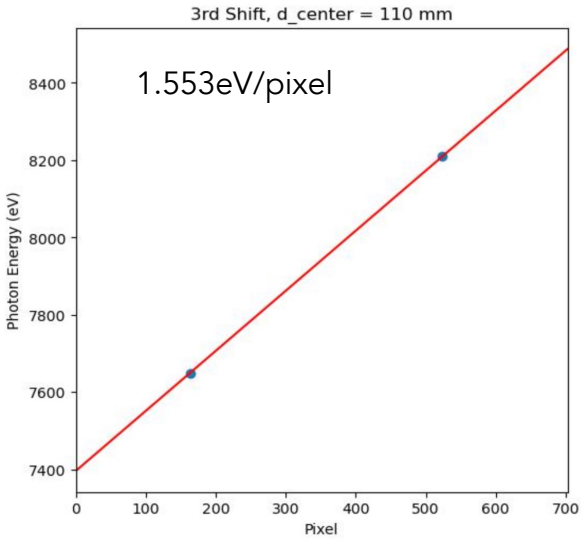
Ag Kα1 and Kα2 lines at ~22.16 keV, and 21.99 keV

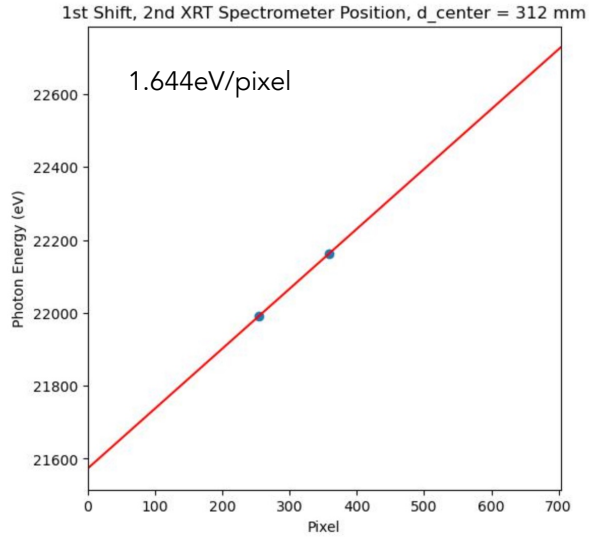


Ag Kβ at 24.9 keV, d_center = 340 mm

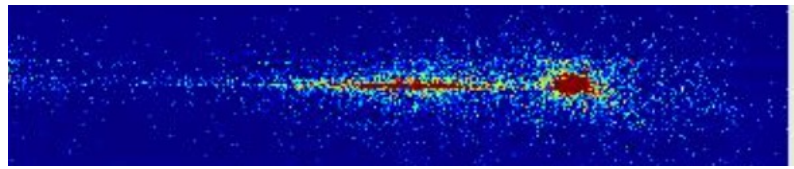
Cu Compton feature from 25.6 keV X-ray, d_center = 340 mm

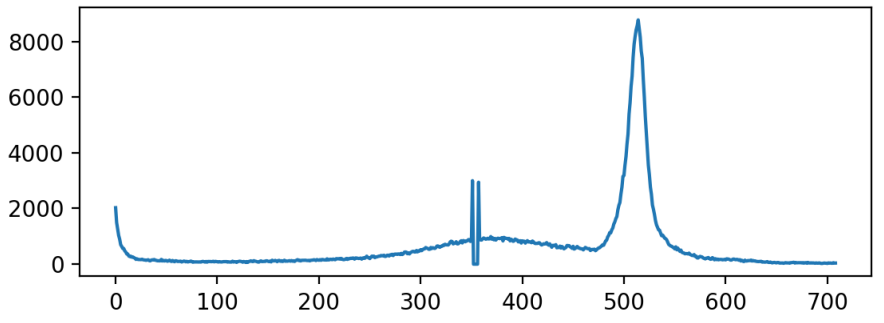




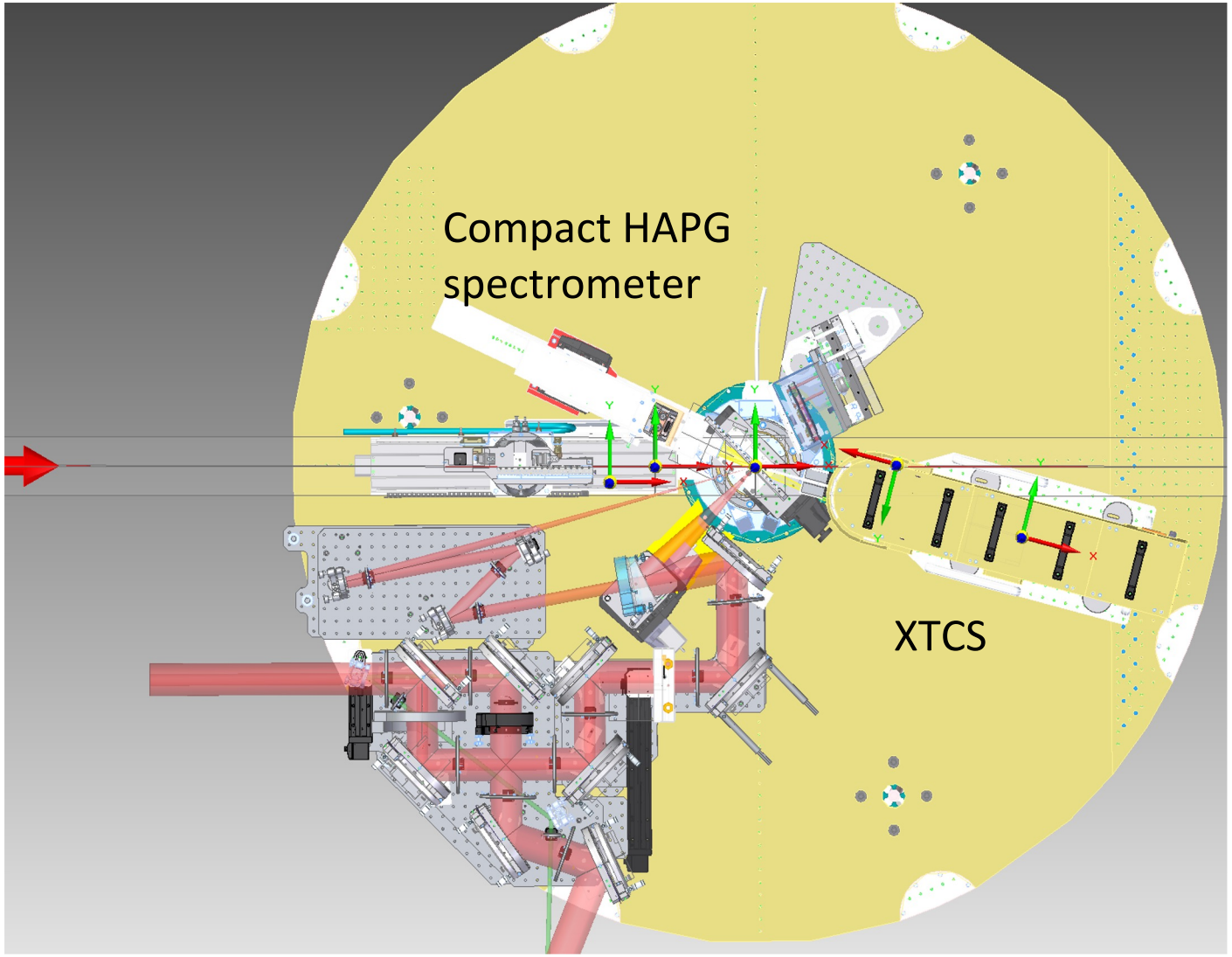


Cold Ni Compton feature (R123) at 8.21 keV

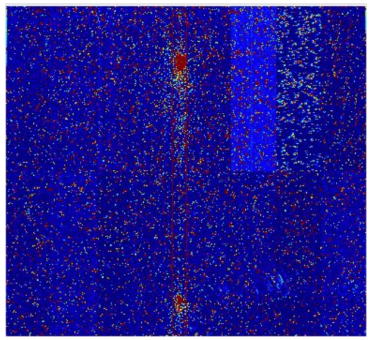




Commissioning with short pulse laser environment

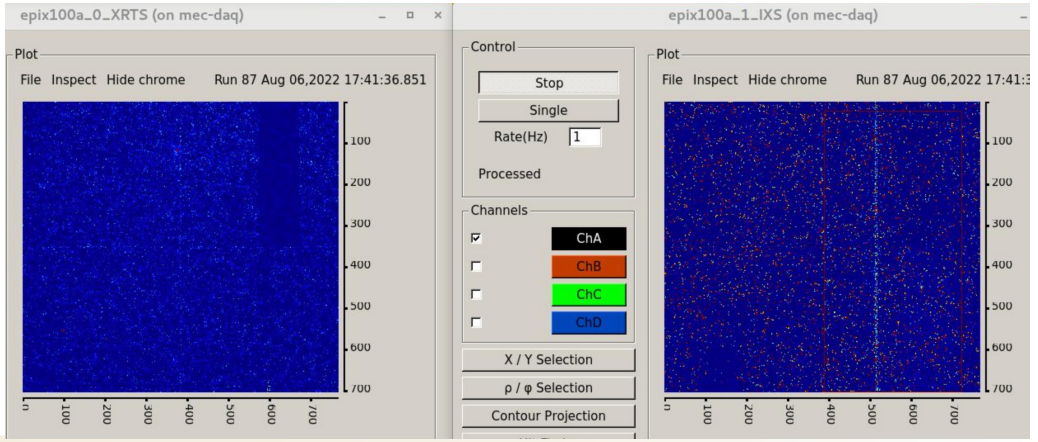


MEC team built a standard beam delivery platform for the short pulse laser (previous talk by Dimitri Khaghani)



Cu Kα at ~8 keV, Kβ at ~8.9 keV by ~250mJ at 400 nm, 50fs optical beam only
R19

No Cu lines on HAPG spectrometer by ~600 mJ at 400 nm optical beam only
faint Cu line on XTCS (no shielding, no magnet)
R87



LCLS-II allows scattering and emission studies at higher X-ray photon energies > 12 keV