Status of "BOREAS", ALBA Beamline Of REsonant Absorption & Scattering

- BL overview, highlights
- Optics status
- Status ES-1
- Status ES-2
- User operation schedule
- In-house research

September, 2012

BL overview

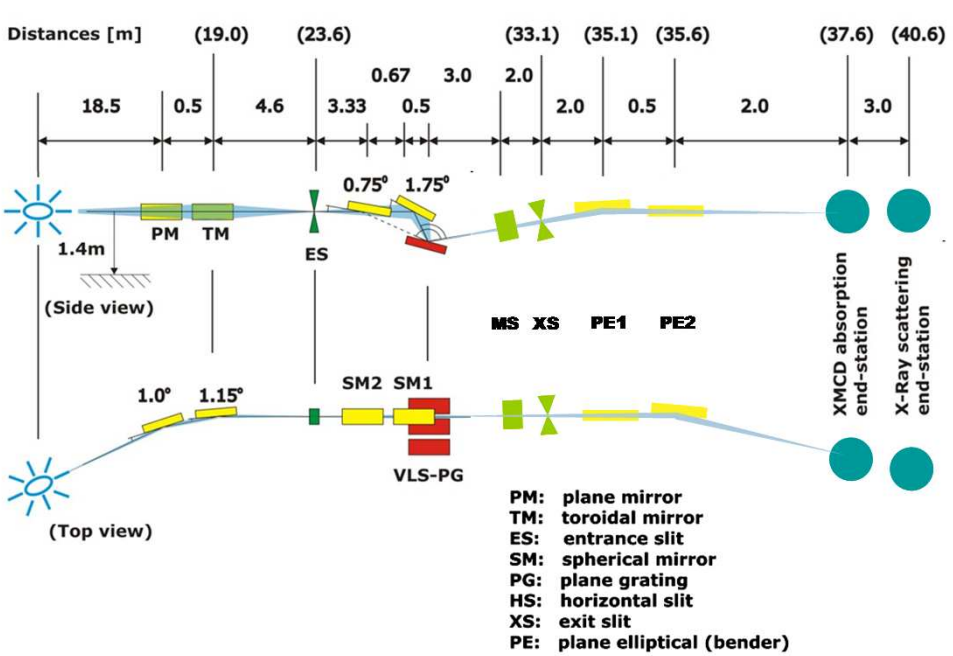
Scientific Case

Beamline designed for soft x-ray polarization-dependent spectroscopy and scattering: XAS,XMCD-XMLD, XRMS

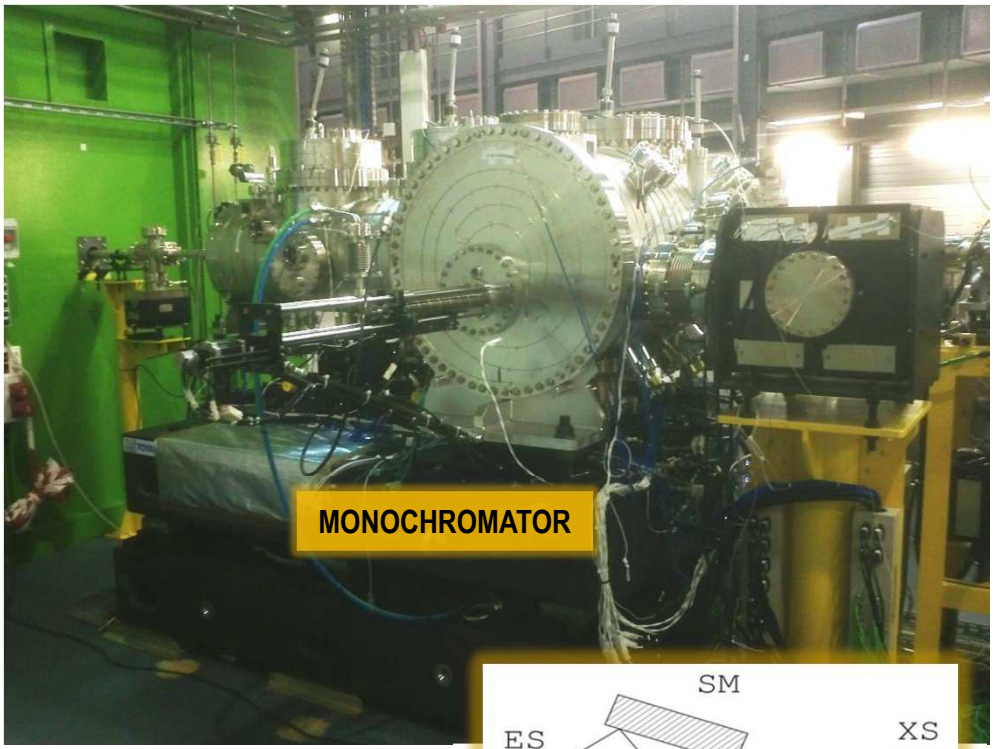
highlights

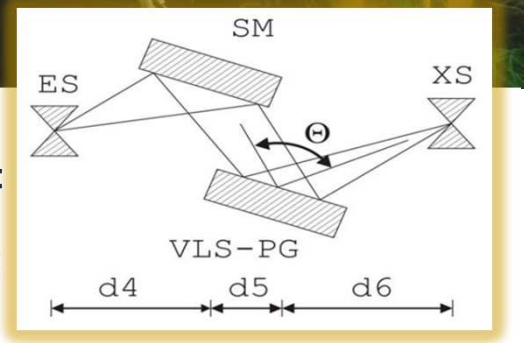
- Full x-ray polarization control (APPLE-II)
- Extended soft x-ray range: 80-4000 eV (high flux, resolving power)
- Variable x-ray beam size and focal distance (KB system)
- (ES1) High-field SC ***vector*** magnet: 6T, 2T with 1.5K-370K sample temp.
- (ES2) UHV scattering chamber, 2T magnet, large access, 20K-350K

optical layout



BL overview: photon flux, energy range, …

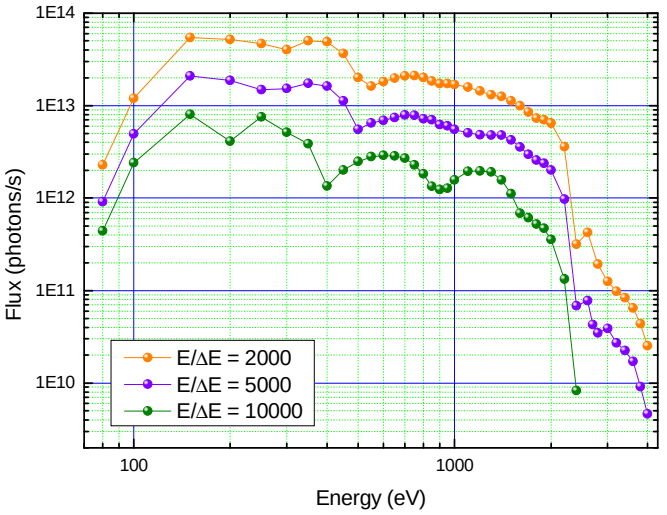




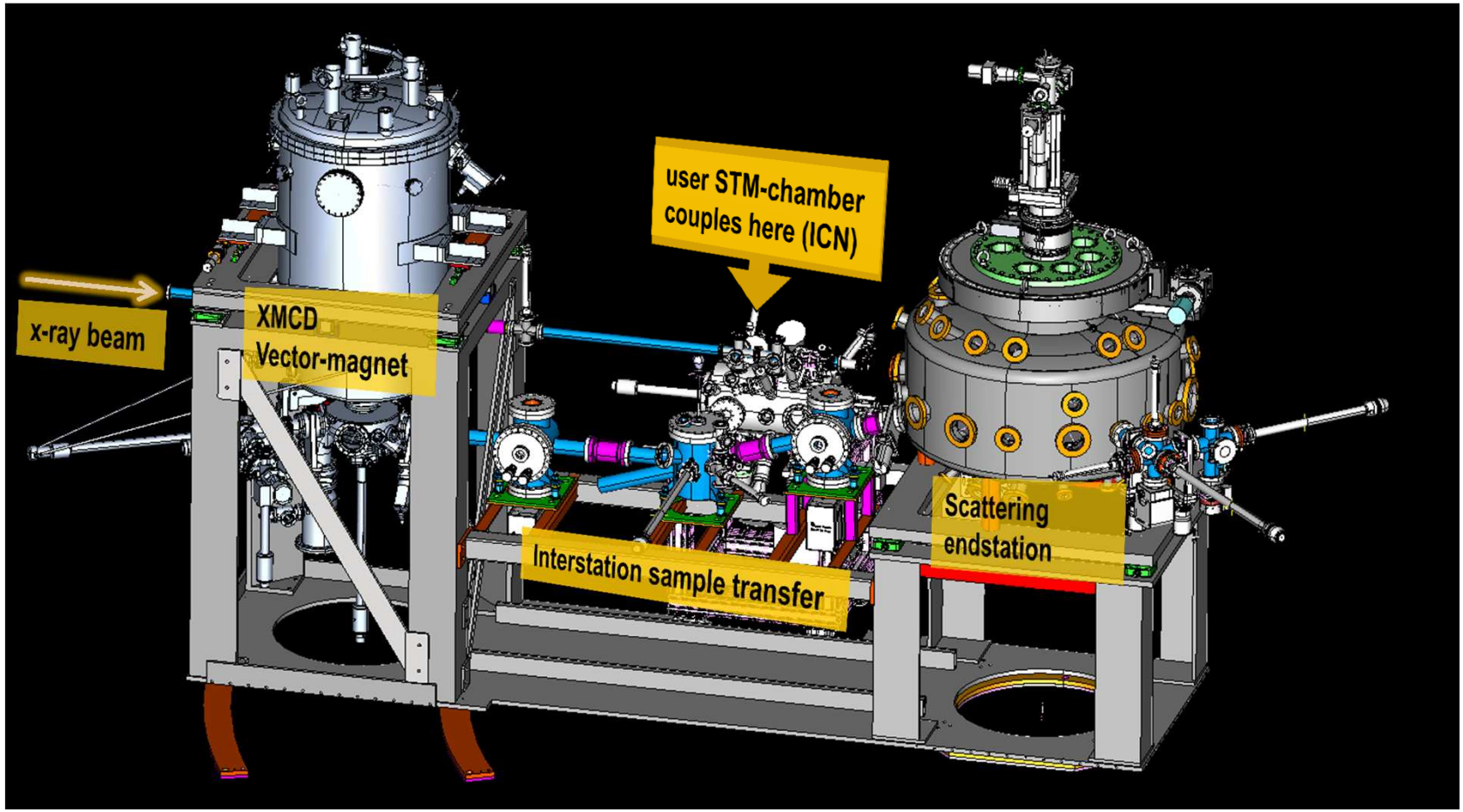
- **Monochromator chamber : 3 gratings + 2 mirrors** ***(mechanics by Toyama co.)***

GRATING MIRROR COMBINATIONS	
80 – 300 (800) eV	SM1+LEG
250 – 600 (1400) eV	SM2+LEG
380 -1700 eV	SM1+MEG
950 - 3000 eV	SM2+MEG
600 – 2100 eV	SM1+HEG
1900 – 4500 eV	SM2+HEG

Photon flux ***(calculated)***

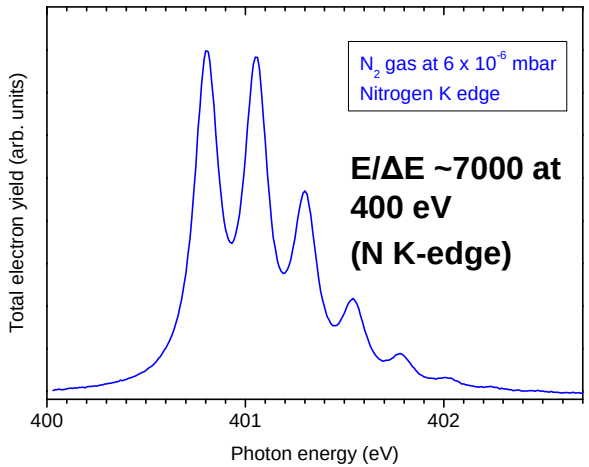


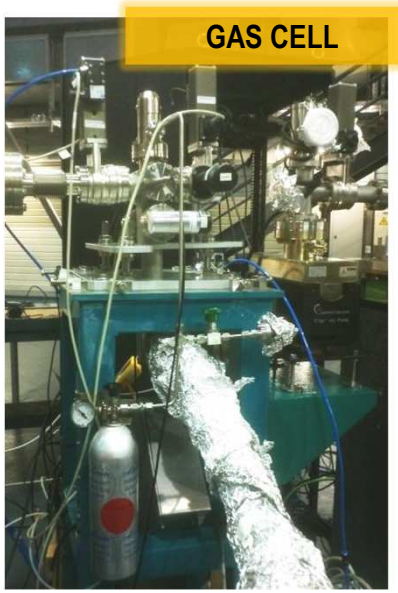
BL overview: experimental endstations



BL Optics status: performance

Resolving power (ES=15/XS=15)





I zero: AXUV100 (IRD) absolute diode, QE=hv[eV]/3.65

photon flux

hv	I_{SR}	Diode current	flux
500eV	70μA	17.3 μA	7.8×10^{11} photons/s(*)

(*) : Circular polarization, ES=15um; XS=5um;
Extrapolates to 4-5×10^{12} photons/s at I_{SR}=400μA

Beam size (micron)

Element	Vertical	Horizontal
exit slit	10	250
ES1	600	250

BL optics status summary

ELEMENT/ PERFORMANCE	STATUS	HIGHLIGHTS, INCIDENCES
Front-end Masks	READY	Work well
Plane and Toroidal Mirrors	READY	- Works fine ; UHV gets a bit high (1x10-8mbar) with beam
Monochromator	Operative	Overall works nice: good vacuum, reproducibility, fast, resolution - MEG, HEG reinstalled, commissioning is due end Sept'.
Slits	READY	Work well
diagnostics, gas cell	READY	Work well
re-focusing mirrors (KB)	Operative, status temporary	- Mirror pitch works ; Benders fixed at nominal ES1 focus ; translations blocked (but beam aligned through)
Signal normalization	Operative/ READY	- Works well with last mirror; Io mesh under commissioning
High Flux	Confirmed	Measured flux agrees with theoretical flux
High Resolution	Confirmed	Gas cell : 7000 at 400 eV; Ti $L_{2,3}$, others

Status ES1: High-field vECTOR magnet already allowing experiments

- 1.5K sample temperature
- 6 Tesla along beam, 2T vector field
- Drain current contact, 4-contacts
- Fast Load-lock (up to 4 samples)

In-situ Sample Preparation:

- Ion gun
- Metal e-beam evaporator
- Organic molecule cell
- Cleaver & Files

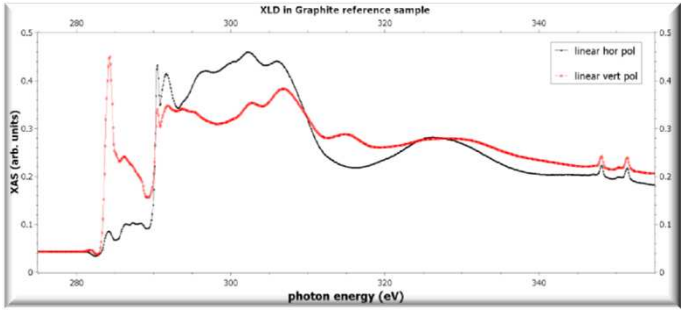
Under development (Sept'2012):

- Heating stage, STM-style holders
- Transmission, fluorescence diodes

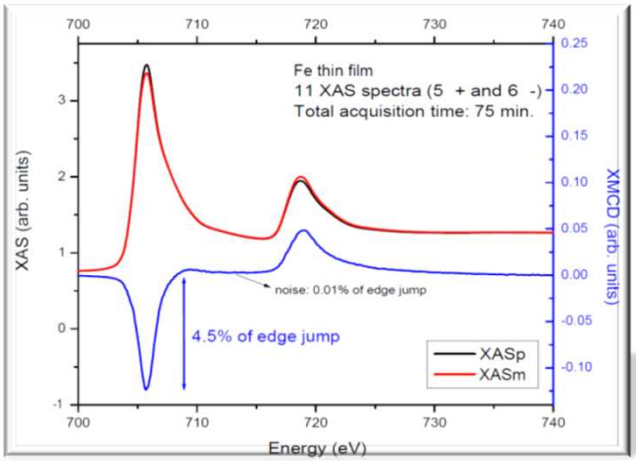
Manufacturer:
Scientific Magnetics

• Benchmark, reference experiments

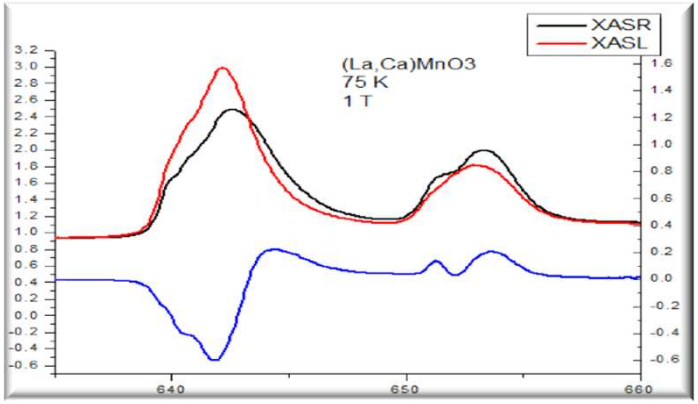
ref. sample (BRFM): Graphite XLD

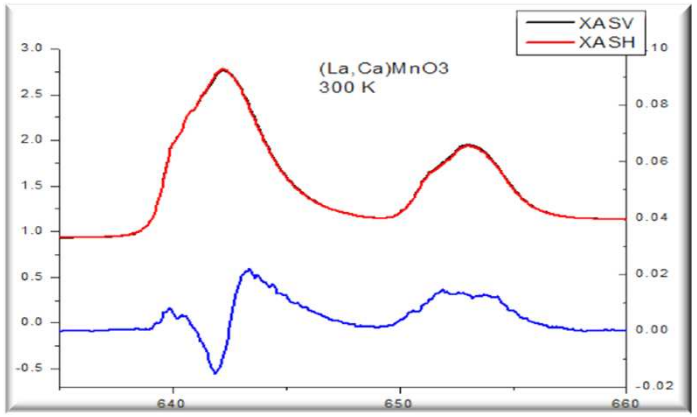


ref. sample (BRFM): Fe film XMCD



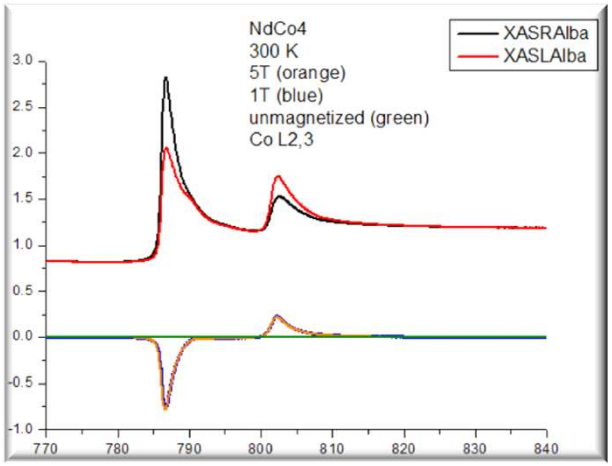
(LaCa) MnO3 sample in high field magnet:
Mn $L_{2,3}$ XMCD, XLD under 1 Tesla field

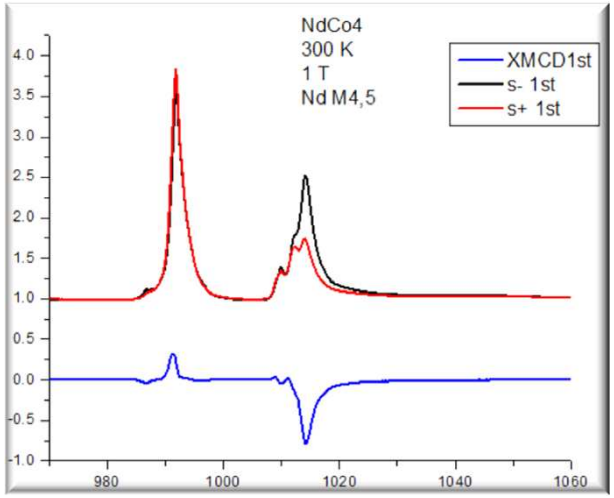




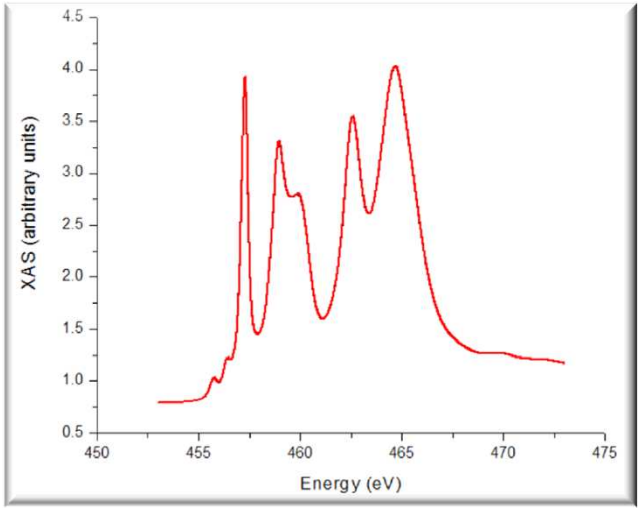
• Benchmark, reference experiments

NdCo4 thin film: Co $L_{2,3}$ and Nd $M_{4,5}$ XMCD

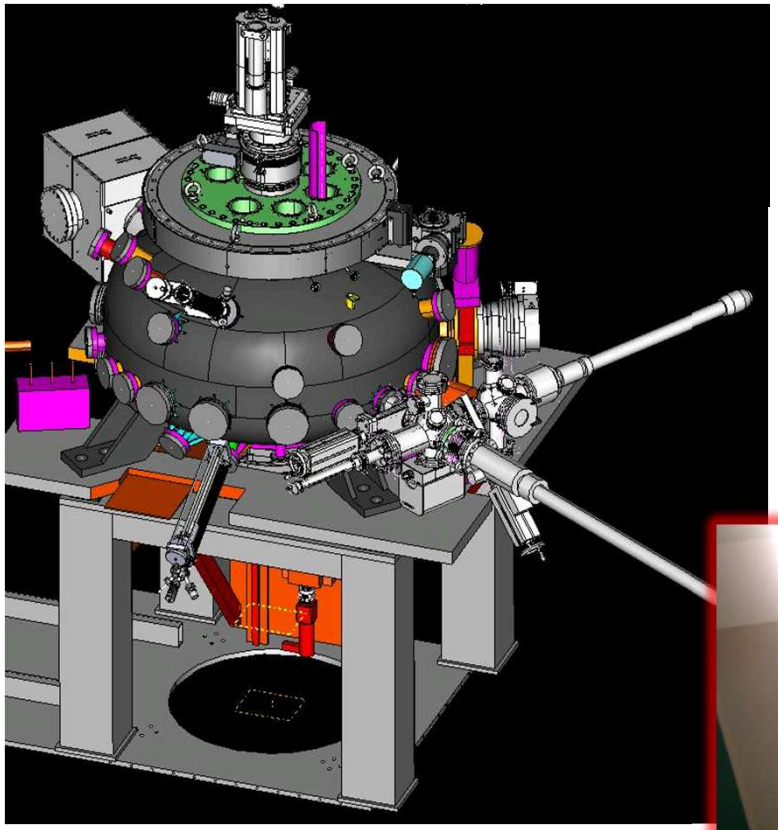




TiO2 thin film: Ti $L_{2,3}$

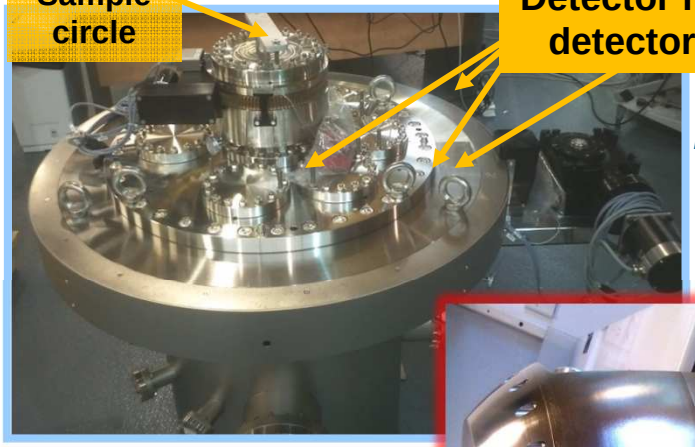


MAgnetic REsonant Scattering endstation (ES2) delayed early/mid 2013



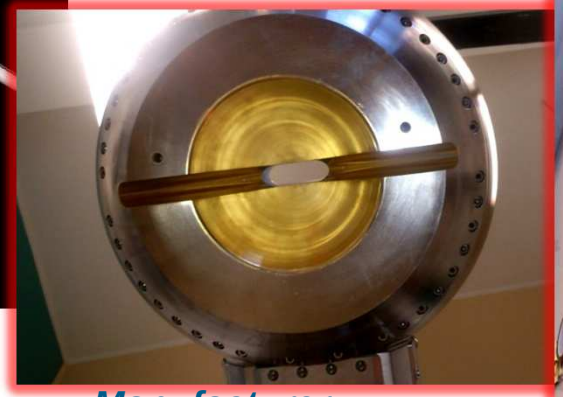
Sample circle

Detector flanges, detector circle



Manufacturer: PINK

In-vacuum large access HTS magnet

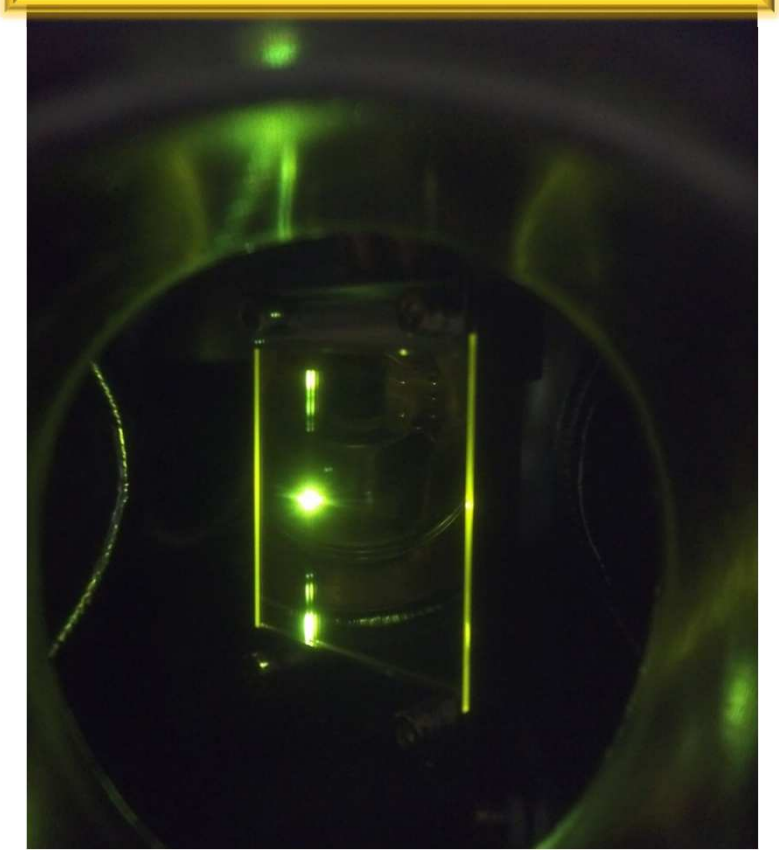


Manufacturer: HTS-110

BL use & endstation status summary

COMPONENT/FEATURE	STATUS	HIGHLIGHTS, INCIDENCES
ENDSTATION 1	Ready	- Ready, works well - Prep. Chamber well equipped - Control integration almost full: 3D vector field mode, and H-loops soon - Missing:transmission, fluorescence diodes
ENDSTATION 2	Completed early/mid 2013	- Reflectometer delivered, tested (GOOD) - Cryomanipulator,HTS-magnet:FATs (June) - Vessel in manufacturing (May) - CCD: CFT to award (2013) - Support:part.design; Detectors:>Nov'2012
SAMPLE TRANSFER	Designed	- Almost finalized full design - Verification prior to order of longer delivery time components
Control/ GUI	Operative/ Ready	- GUI is nice, friendly-use, a bit unstable - ID&BL Pools synchronization difficulties - Develops&debugging, user macros/on-call
XAS, XMCD&XMLD measurement summary	Operative, few bugs	- Work reasonably well, fast ; few but relevant bugs (mono+undulator scans)

THANKS FOR YOUR ATTENTION AND ADVICE ON BOREAS BEAMLINE !



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