STATUS OF ALBA BEAMLINES

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Experiments Division

Some Milestones of the project :

- November 07 : LINAC delivered. Reception tests
- April 08: Start booster installation
- June 08: Civil engineery finished. Start hutch construction
- October 08: Reception of the first optical components.
- June 09 : photons from IDs

Phase I beamlines

1.- Non Crystalline Diffraction

2.- Macromolecular crystallography (XALOC)

3.- Photoemission Spectroscopy and Microscopy (CIRCE)

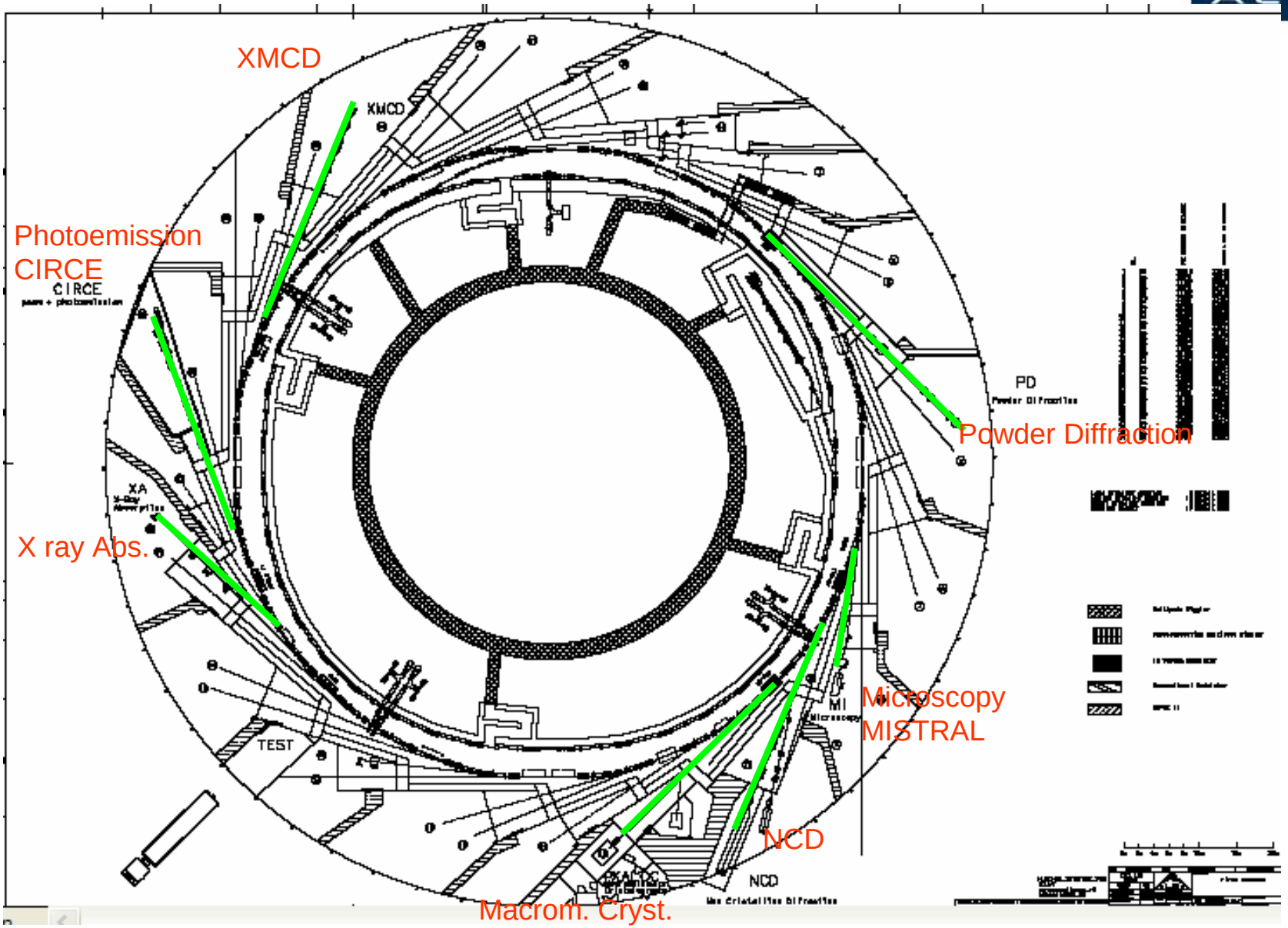
4.- High Resolution Powder diffraction and high pressure

5.- X-ray Absorption Spectroscopy

6.- Circular Dichroism and Resonant Scattering

7.- X- ray microscopy

In vacuum undulators
Helical undulators
Conventional and superconducting wiggler
Bending magnet


XMCD
Photoemission
CIRCE
X ray Abs.
Powder Diffraction
Microscopy
MISTRAL
NCD
Macrom. Cryst.
XALOC
KMCD
CIRCE
PD
XA
TEST
MI
NCD

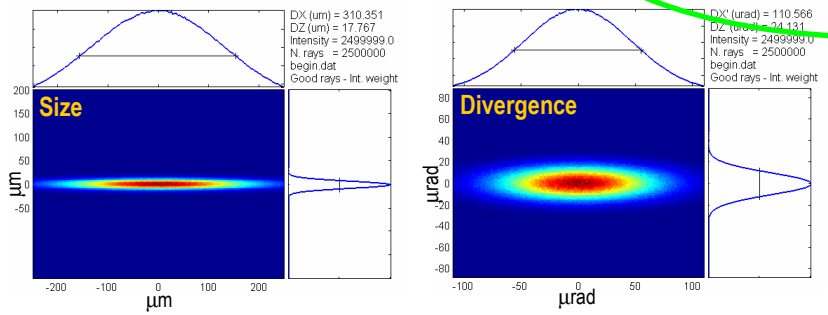
1 and 2:

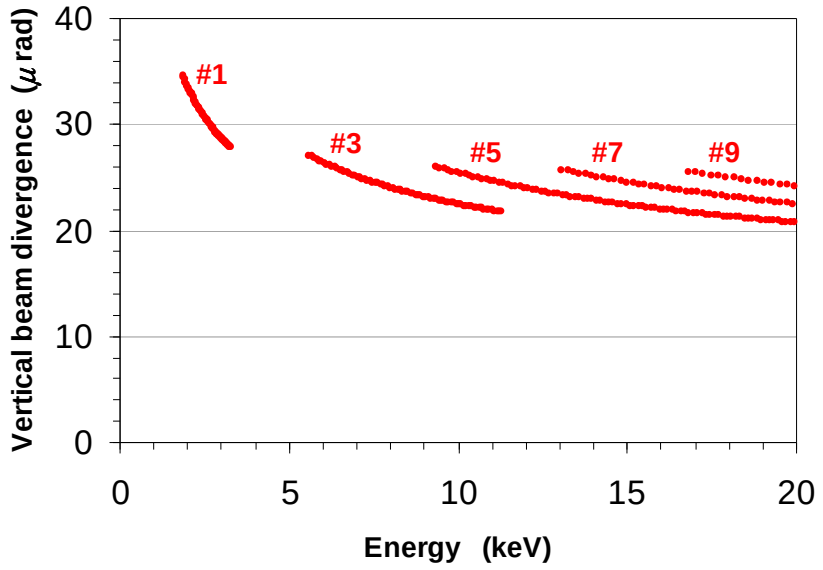
Non Crystalline Diffraction and Macromolecular crystallography (XALOC)

In vacuum undulator source

Source: dimensions (FWHM) and flux

Photon source size (H×V)	$\Sigma_{x,y}$	309 × 18	μm^2
Photon source divergence (H×V)	$\Sigma'_{x,y}$	0.11 × 0.03–0.02	$mrad^2$

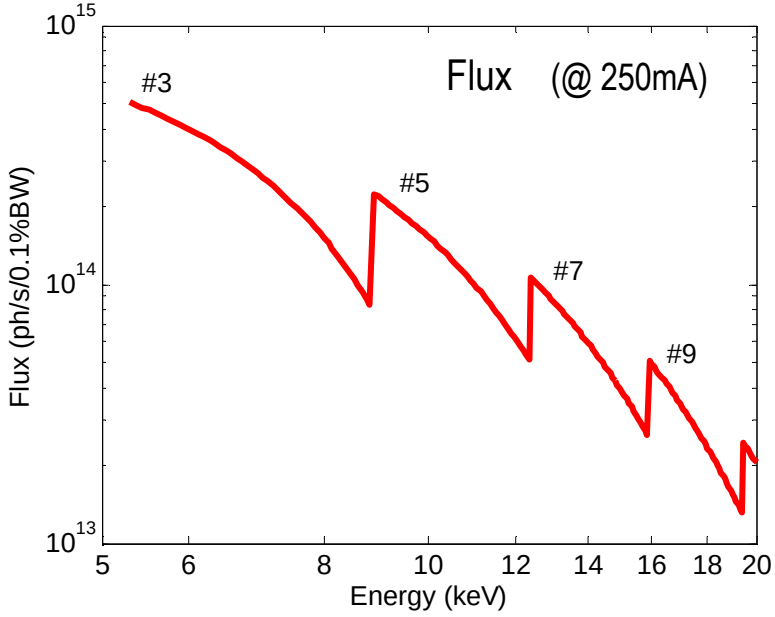




Source dimensions are basically constant in 5-15 keV range.

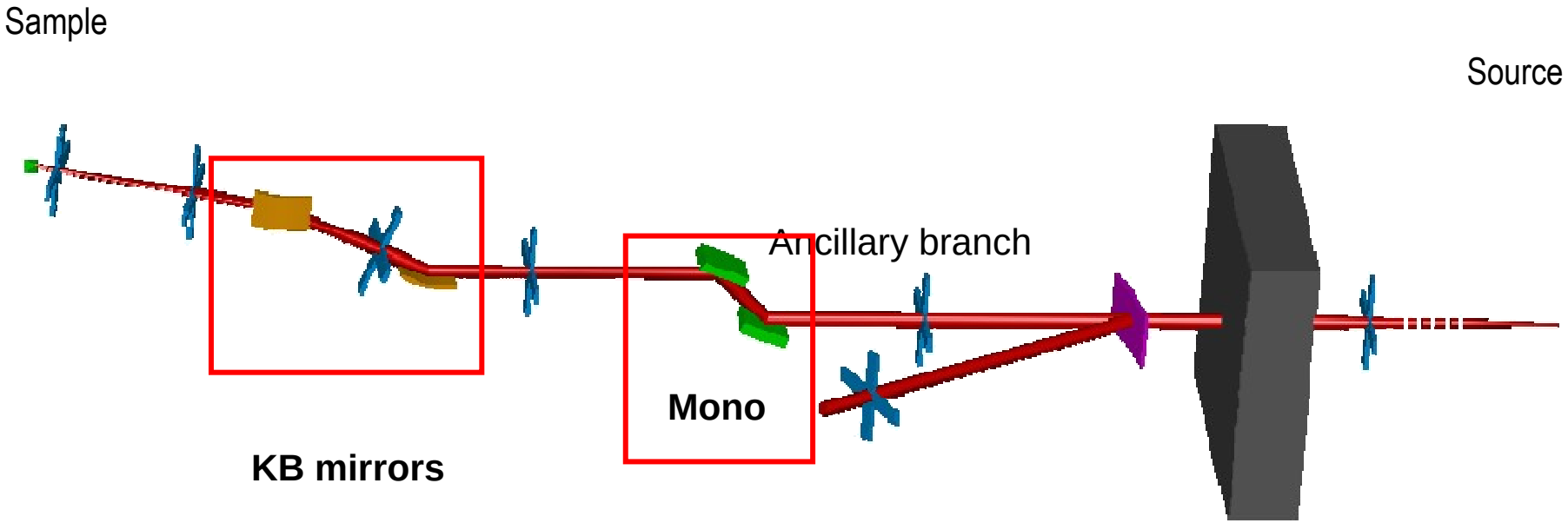
Only the vertical divergence changes due to the electron energy spread

Flux



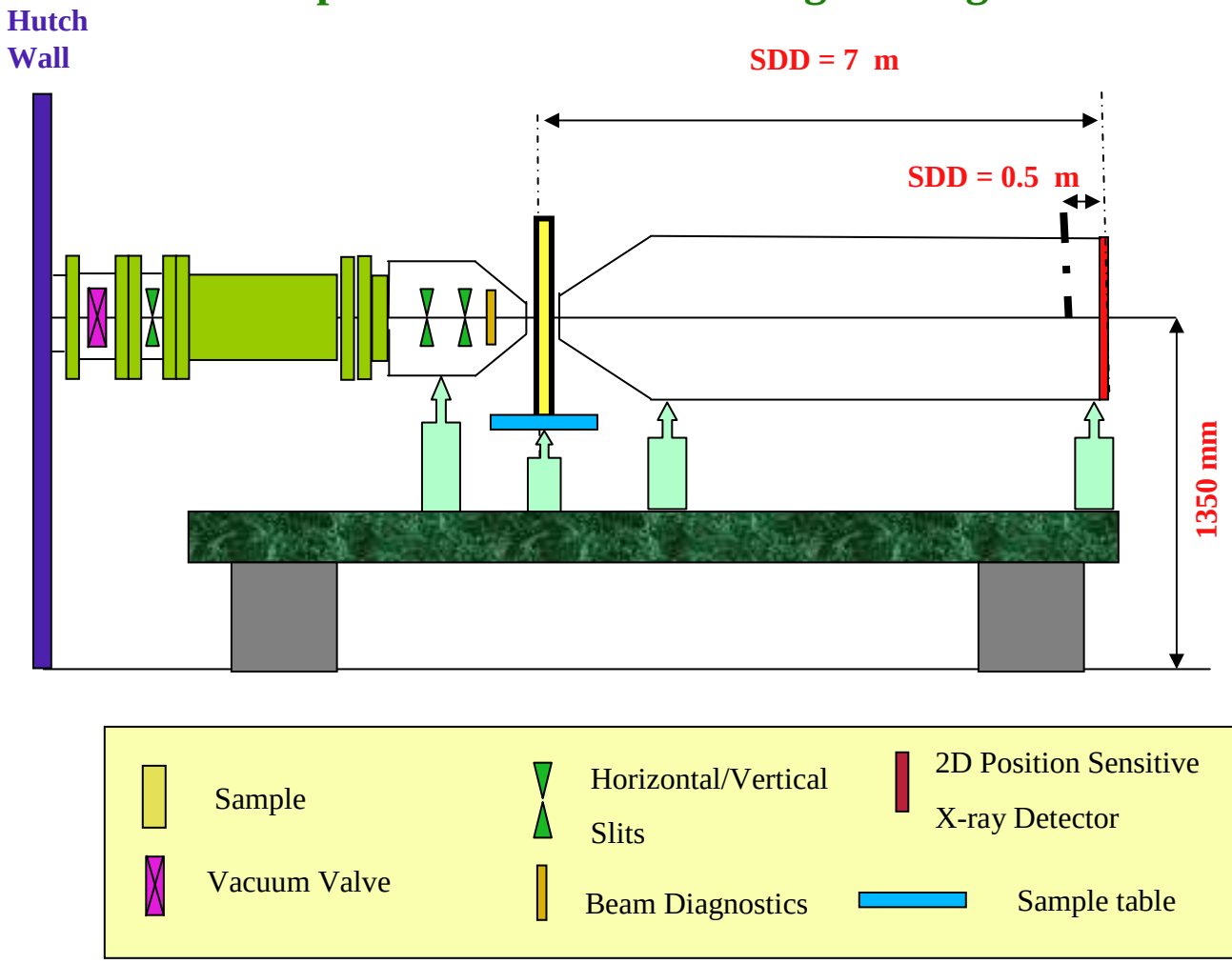
2.- Macromolecular Crystallography (XALOC): structure of proteins

Optics



EXPERIMENTAL HUTCH LAYOUT

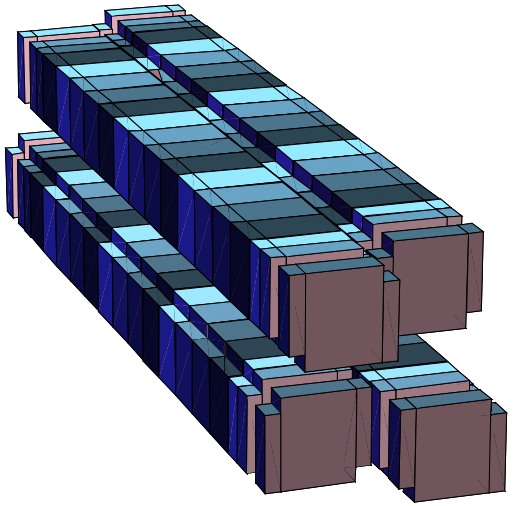
Sample, sample table and slit unit including guard slits is to move along the optical bench on bars using bearings.

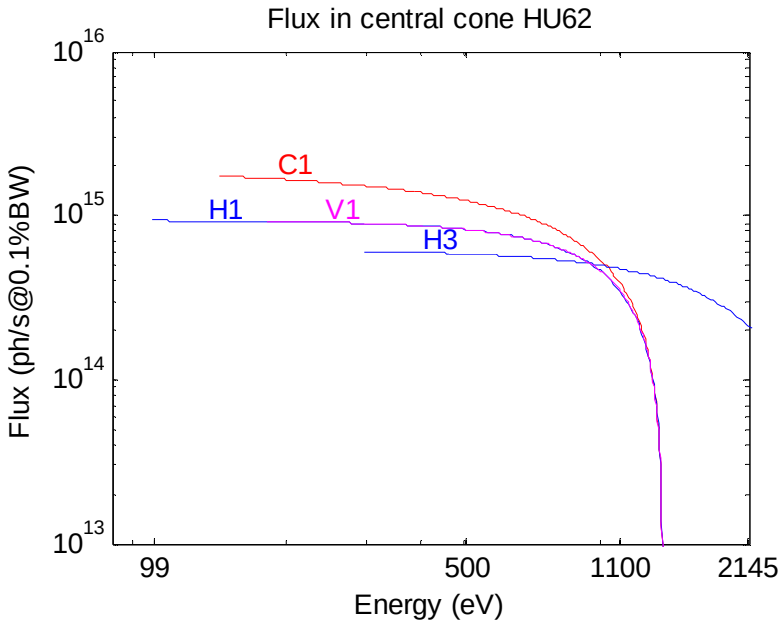


3 and 4: Photoemission Spectroscopy and Microscopy (CIRCE) X ray Circular Magnetic Dichroism

Source Parameters

Parameter	Value		
Type of ID	PPM Apple II		
Period (mm)	61.8		
Number of periods	27		
Magnetic gap (mm)	15.5-90.0		
Magnetic length (mm)	1496.93		
Linear phase range (mm)	-31 to +31		
Polarization modes	C.. Left, C. Right, Linear 0º-90º		
Polarization	**Horiz.**	**Vert.**	**Circular**
B_X (T)	0	0.64	0.51
B_Y (T)	0.88	0	0.51
K_X	0	3.67	2.98
K_Y	5.12	0	2.98
Min. Energy (eV)	98	179	140
Max. Flux @250mA (Ph/s/0.1%BW)	$9.3 \cdot 10^{14}$	$9.2 \cdot 10^{14}$	$1.7 \cdot 10^{15}$
Power@400mA (kW)	2.99	1.54	2.03

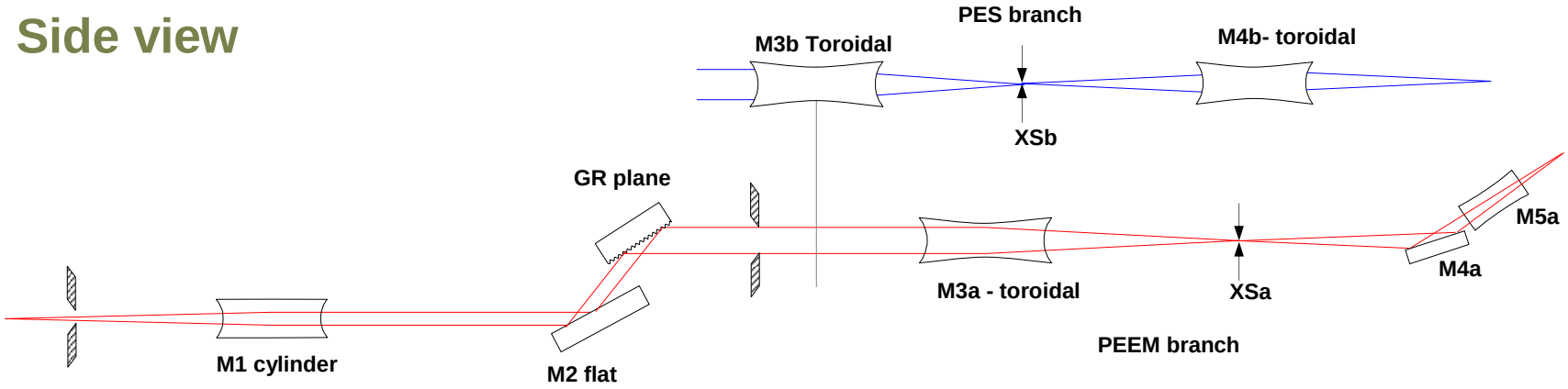


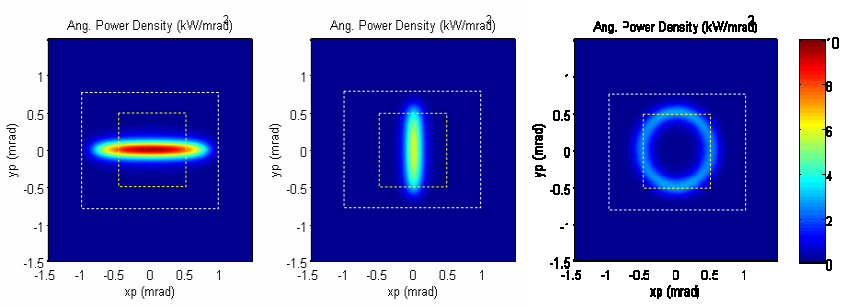


Photoemission Spectroscopy and Microscopy (CIRCE)

Optics

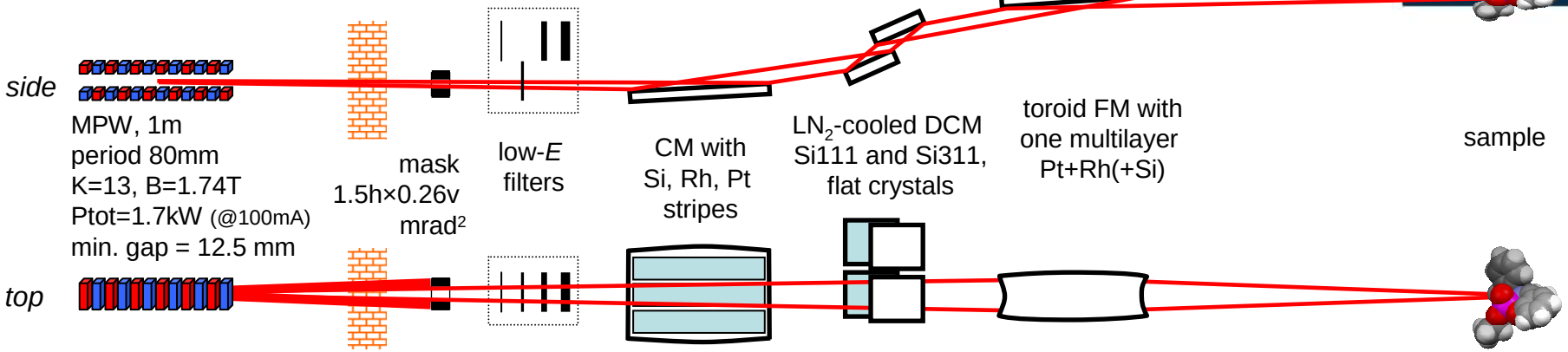
Side view





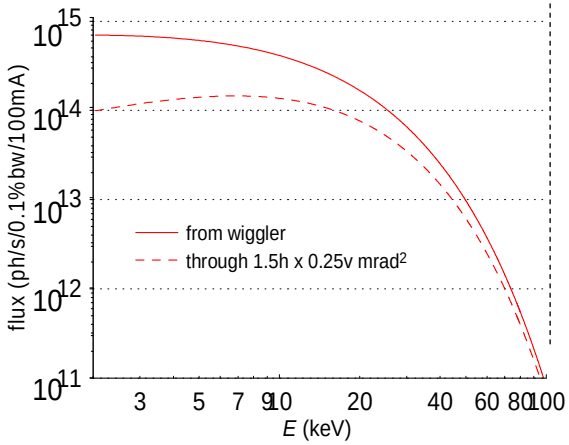
Top view

5:X-ray Absorption Spectroscopy Beamline



meters: 0 ····· 16 17 ····· 19 ····· 21.5 ····· 24 ····· 36

Wiggler and mask are optimized (J.Campmany) for maximum flux under constraints:
power absorbed at CM < 1kW,
power absorbed at DCM < 700W

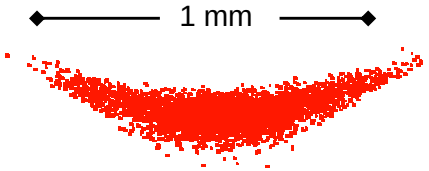


CVD – diamond
70 µm – 3 mm
or
Sigradur®
140 µm – 7.5 mm

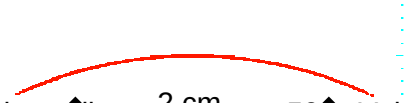
Studied by FEM with respect to different cooling schemes and materials (L.Nikitina, M.Quispe)

<u>Si111:</u>
2.4 (2.1?) – 15 keV with >2·10¹² ph/s at the sample;
1.3·10¹³ ph/s @ 9 keV
<u>Si311:</u>
up to 30 keV with 5·10¹¹ ph/s and
up to 50 keV with 5·10¹⁰ ph/s
at the sample

2.4 (2.1?) – 20 keV: excellent focusing (216×75 µm² FWHM)



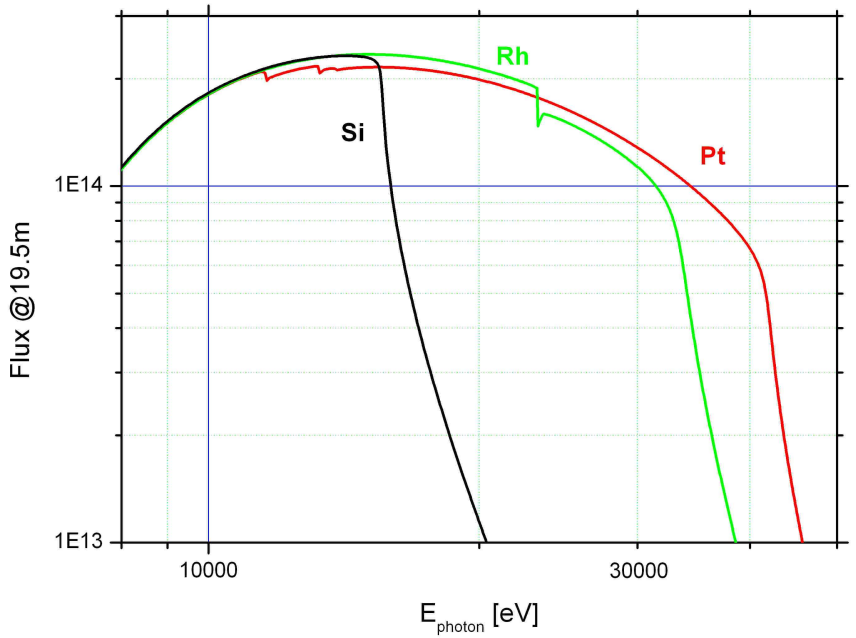
20 – 50 keV: poor focusing



but still a g (at 50 keV: in the central part (8×0.4 mm²) flux~ 2·10¹⁰ ph/s at the sample

6:High Resolution Powder Diffraction beamline +High Pressure

ID: SCW31, P_{tot}=19kW



Flux @ 19.5 m, opening 5.85x2.4 mm
Transmitted by collimating mirror
Si, Rh, Pt coating
@ 2mrad glancing angle

Absorbed Power at maximum K-value:
10kev: 796W (Mir.) 307W (Mono.)
40keV: 233W (Mir.) 870W (Mono.)

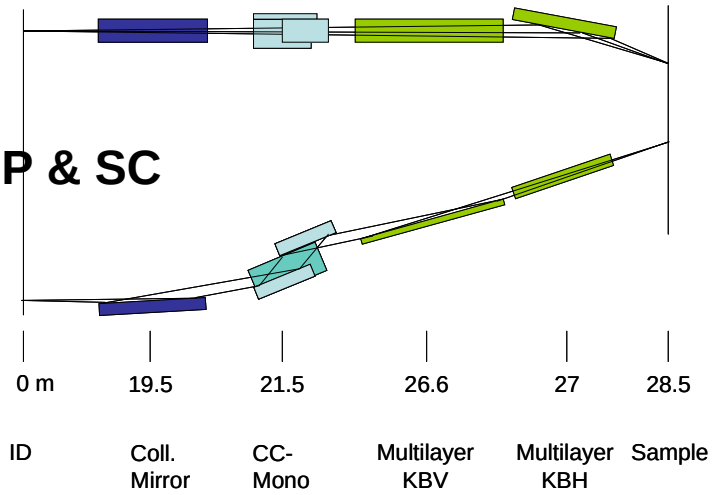
HP: KB mirror up to 50keV (optional)
PD: sag. 1:1 focusing mir. (optional)

Optical layout

Top view

Side

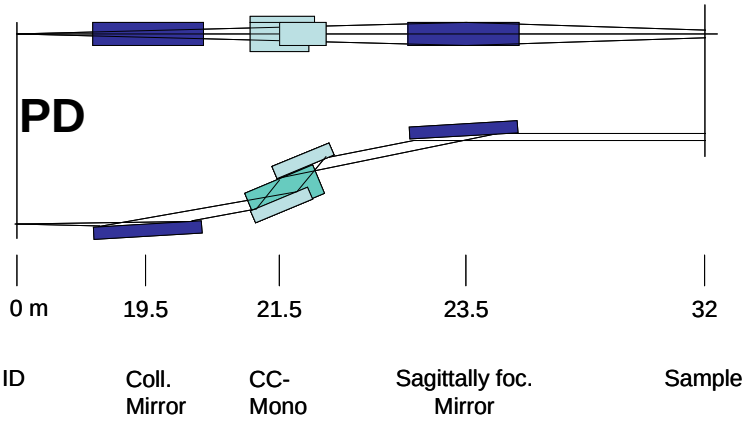
HP & SC



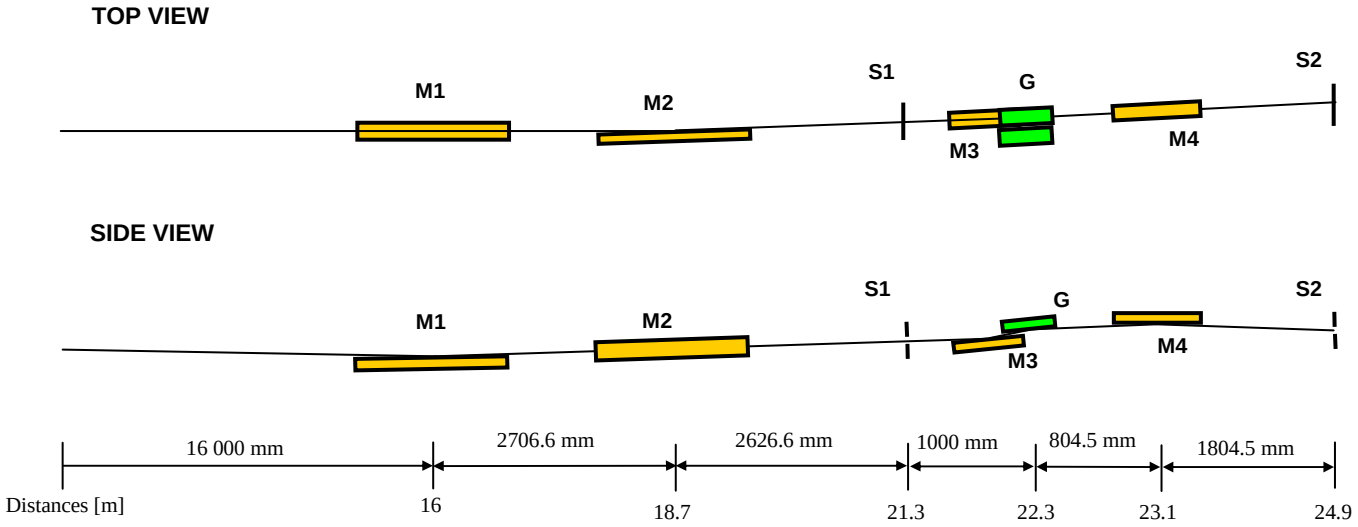
Top view

Side

PD



7.-X ray Microscopy: soft X ray full field x ray microscope for applications to biology



MISTRAL Beamline sketch showing the KB pair M1 & M2, the VLS PGM constituted by a plane mirror M3, two VLS plane gratings G (only shown in the top view) and an elliptically bent mirror M4. The PGM works at constant magnification. The entrance (S1) and exit (S2) slits are kept fixed. The deflection angle is 2.4º for M1, M2 & M4.

End Stations:

1.- Non Crystalline Diffraction :

Slits, sample positioning stage, beam diagnostics, flight tube

detectors: one CCD camera for SAXS and another for WAXS
and a possible Rapid detector for ms time resolved experiments (2D).

2.- Macromolecular crystallography (XALOC)

Slits, beam monitoring, spindle, automatic sample mounting, cryostream…

detector: CCD or pixel detector

End Stations:

3.- Photoemission Spectroscopy and Microscopy (CIRCE):

PEEM: electron microscope with energy filtering .

Detector : channel plate +phosphorus +CCD in air or TOF based on 2D delay lines (ns time res.)

NAPP (Near Ambient Photoemission): electrostatic analyzer with differential pumping.

Detector: channeltrons or channelplate

6.- Circular Dichroism and Resonant Scattering

XMCD: UHV chamber + 7 T magnet + liquid He cryostat.

Detector: Si diode and electrometer (total electron yield meas.)

Resonant Scattering : UHV chamber + diffractometer + 0.1 T magnet

Detector : Si diode or APD and CCD for 2D imaging

End Stations:

4.- High Resolution Powder diffraction and high pressure

θ-2θ diffractomer + multidetector detector arm .

Detectors: scintillators (NaI, YAP, LaCl…) and APD for soft x rays

High pressure station: diffractomer and pressure cells.

Detectors: CCD or image plate

5.- X-ray Absorption Spectroscopy.

Reaction chambers for catalysis, ovens ,… and a fluorescence analyser spectrometer.

Detectors: Ionization chambers, 1D pixel detector (Mythem) or 2D pixel as Medipix 2 or 3.

End Stations:

7.- X- ray microscopy (Full field water window microscope)

X ray microscope: condensing optics-sample- objective optics (Zone Plate)

Detectors: direct illumination CCD (200-1000 eV) , conventional CCD