Report on BL11-NCD

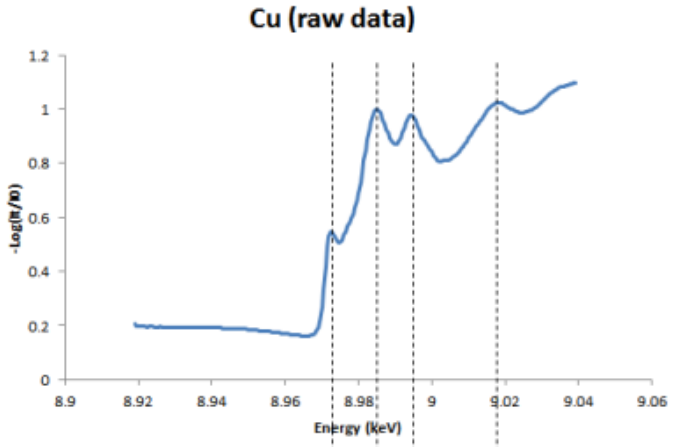
Sac 18, 1st July 2014

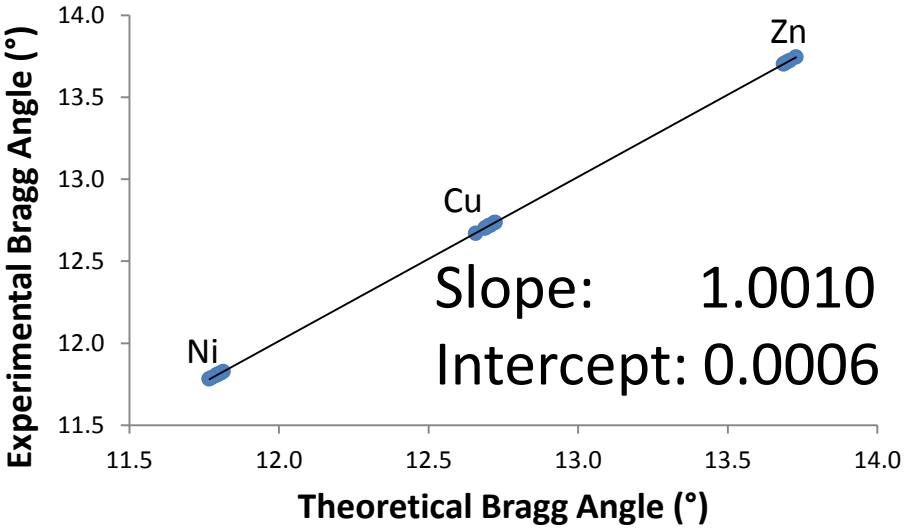
Beamline specifications

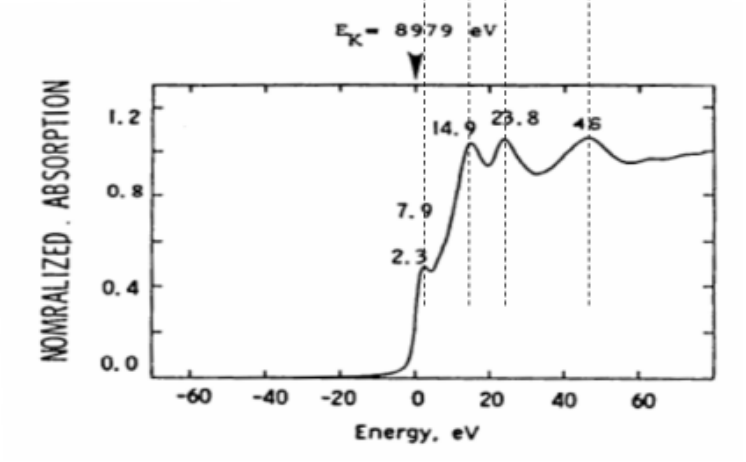
Wavelength (Energy) range	0.9 - 1.9 Å (6.5 -13 keV)
Flux at sample	>1.25 10^{11} ph/s 1.24 Å for a beam current of 250 mA
Bandpass (ΔE/E)	< 10^{-4}
Beam size at sample	Variable between ~65 - 1200 µm horizontally ~30 - 265 µm vertically
Beam divergence at sample	<0.5x0.1 $mrad^2$
Q range SAXS	0.0066-0.7 $Å^{-1}$
2Θ range WAXS	3.0° - 62°

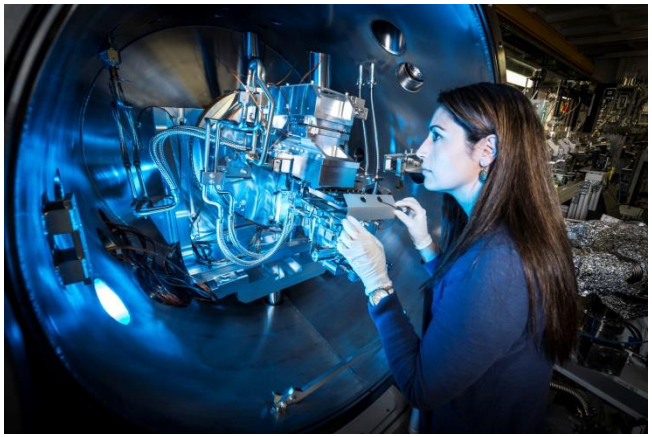
Optics Hutch - Monochromator

Bragg Angle calibration



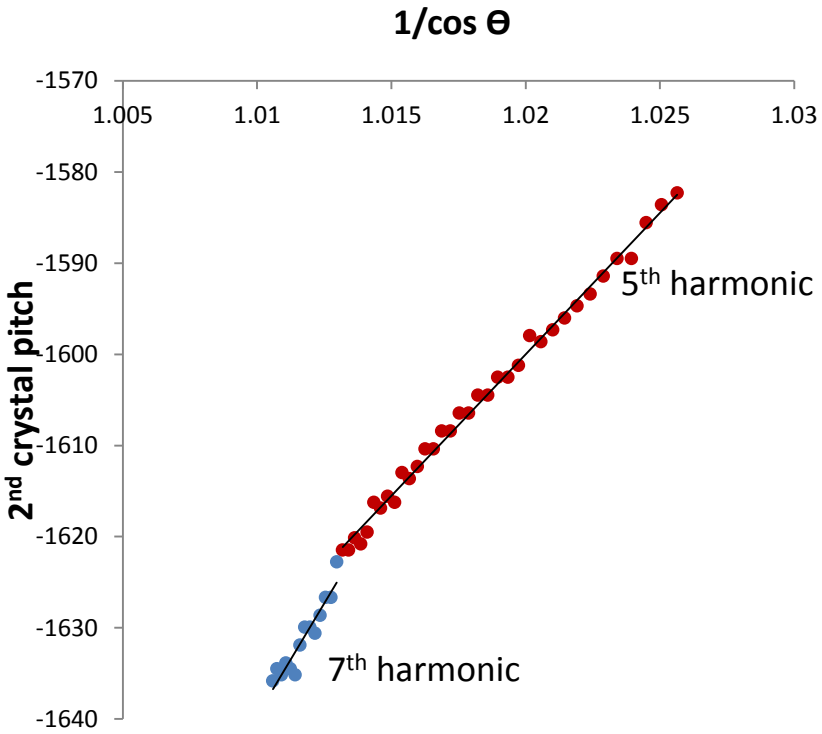






Optics Hutch - Monochromator

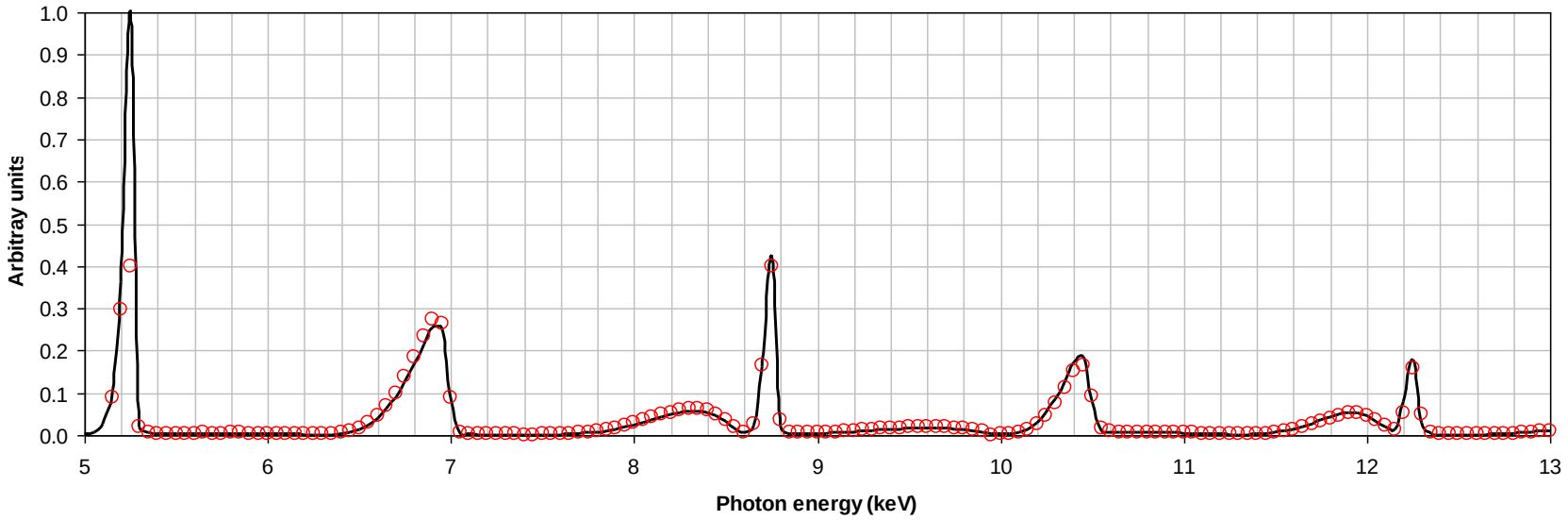
2nd Crystal pitch Calibration



Undulator

Energy scan

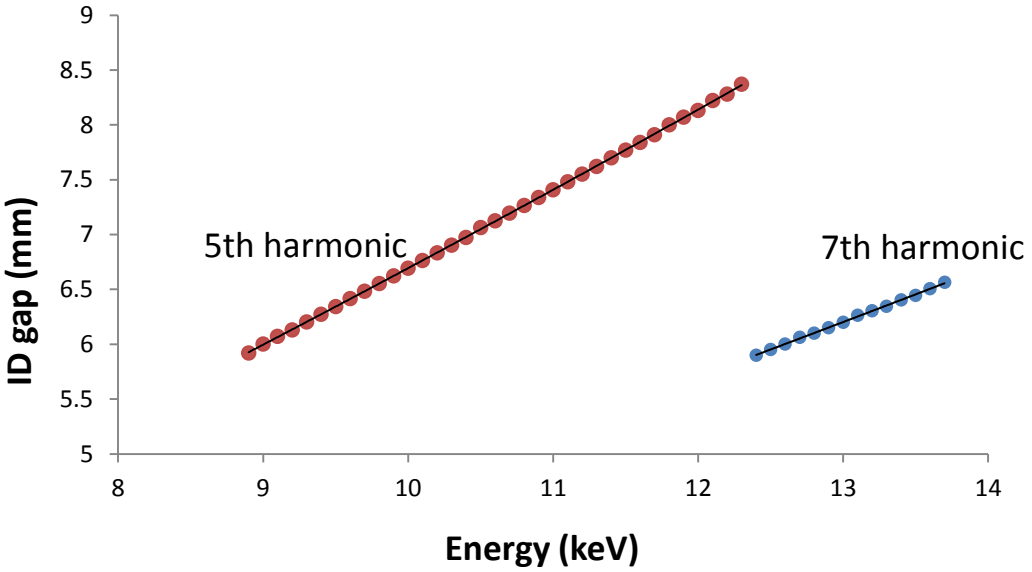
ID gap = 5.8mm



- Experimental data
- Theoretical data calculated with no offset in the front end aperture.

Undulator

Undulator gap calibration



Energy pseudo-motor

Done:

Calibration of the Bragg angle of the DCM

Calibration of the 2nd crystal pitch

Calibration of the undulator gap for the 5th and 7th harmonic

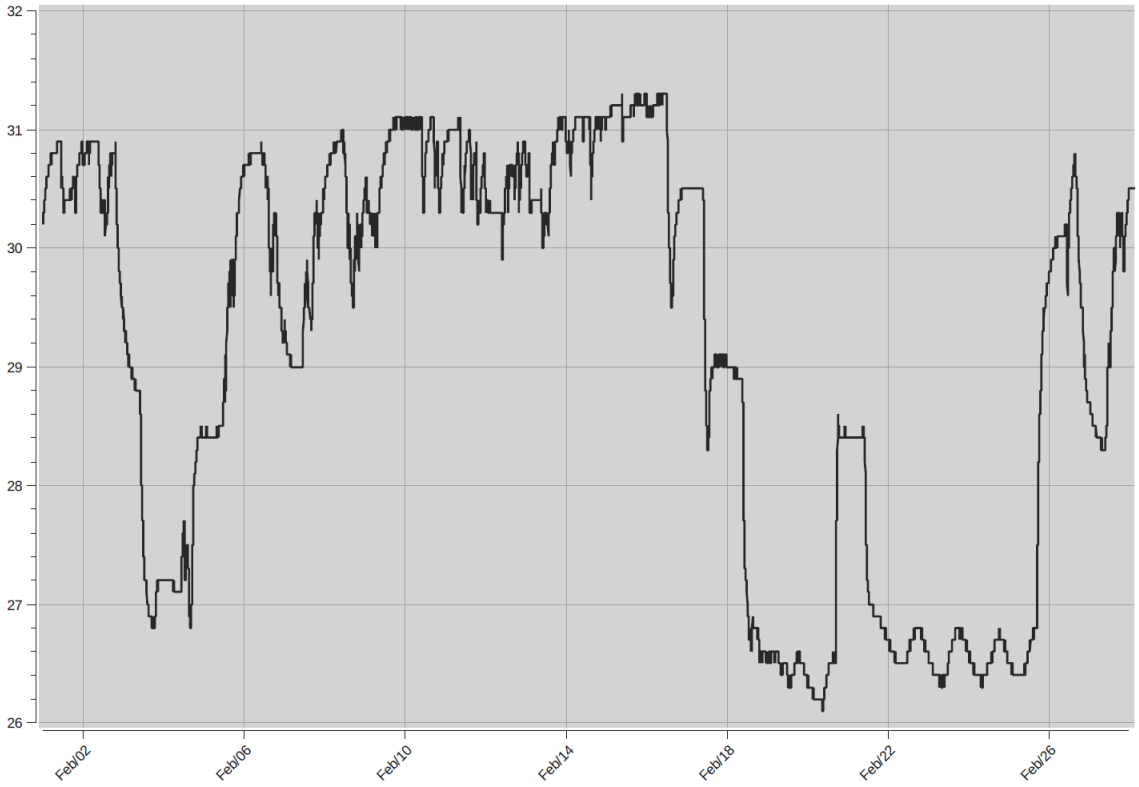
To be done :

Calibration of the undulator gap for the 3rd harmonic

Calibration of the vertical translation of the 2nd crystal

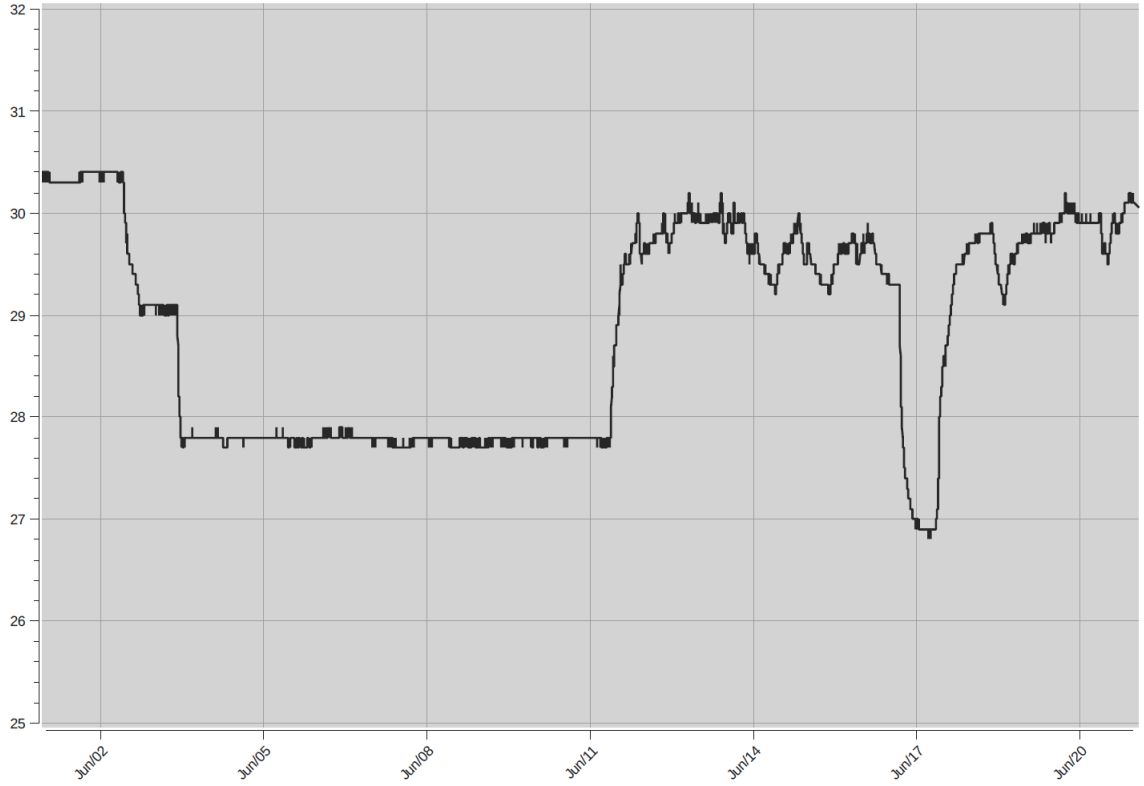
Upgrade – Air conditioning

February 2014



Upgrade – Air conditioning

June 2014 (After fans installations)

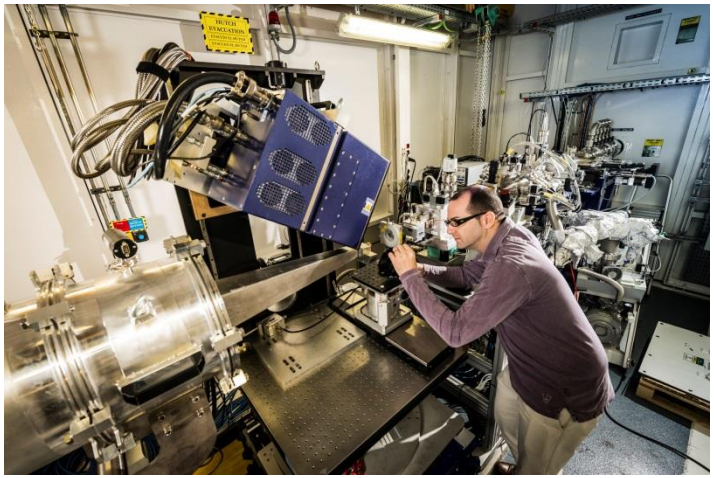


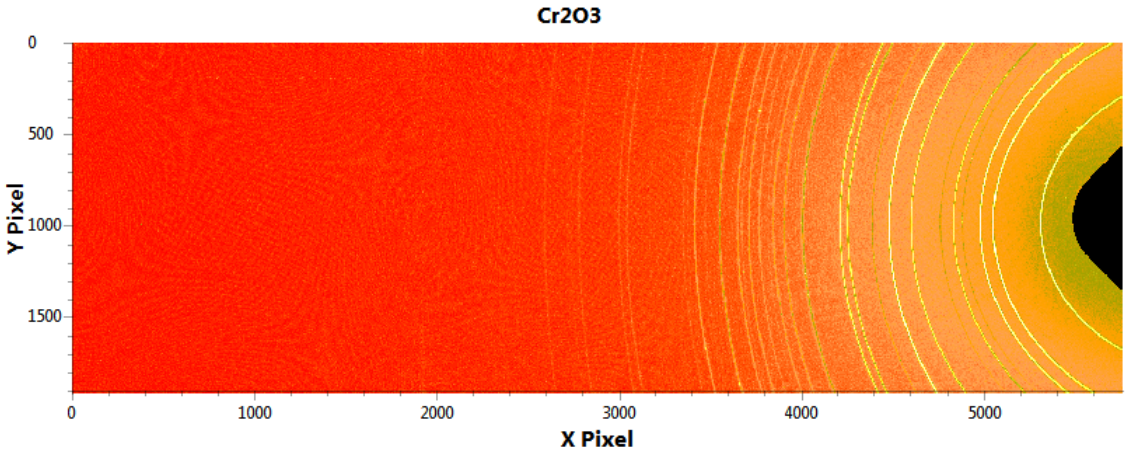
Proper air conditioning to be installed by the end of this year

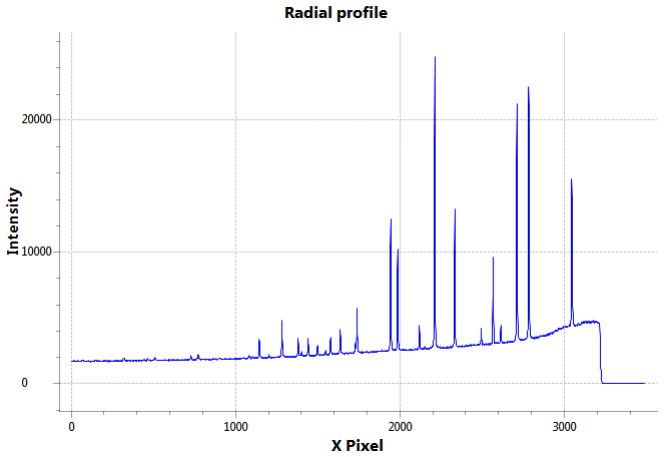
Detector - Rayonix

Waxs detector

- Active image area: 255 x 85 mm^2
- Total number of pixels: 5760 x 1920
- Pixel size (not binned): 44 µm
- Frame rate: 10 – 140 frames / sec
- Global count rate: unlimited
- Dynamic range: 16 bits



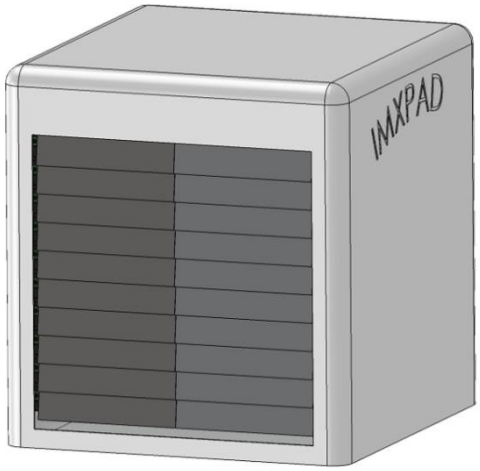


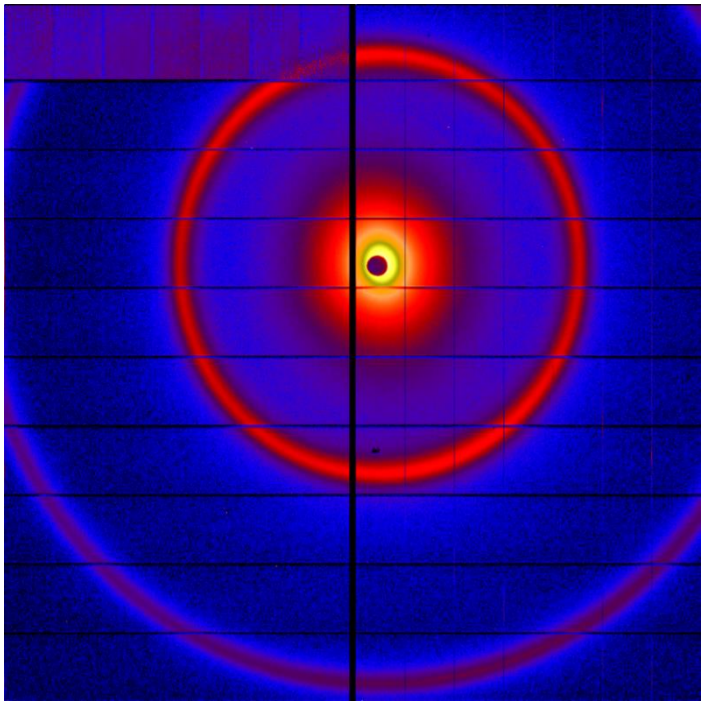


Detector - ImXPAD

Saxs detector

- Active image area: 152 x 149.6 mm^2(H x V)
- Total number of pixels: 1200 x 1120 $pixels^2$ (H x V)
- Pixel size (not binned): 130 µm
- Frame rate: 250 frames / sec
- Global count rate: >10^{11} photons/sec



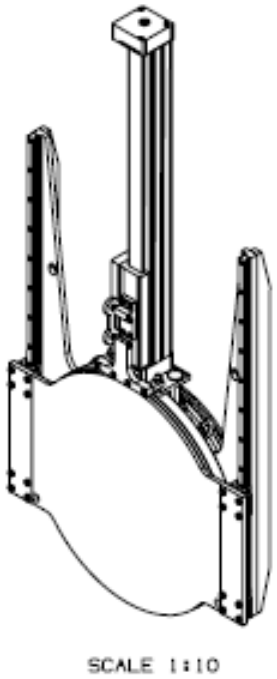


Factory Acceptance Test done in May 2014

Site Acceptance Test planned for September 2014

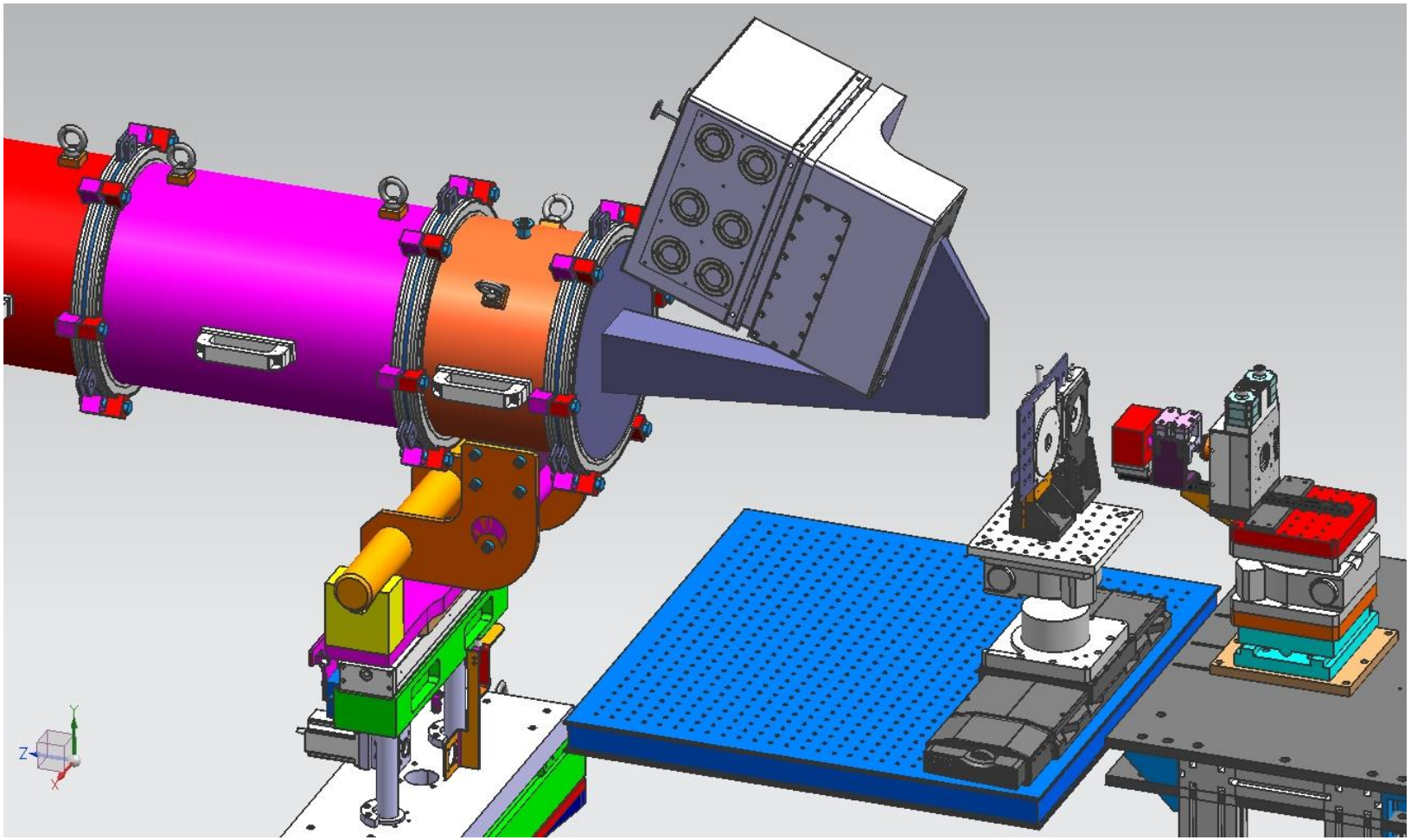
Upgrade – Window protection

- Connected to the photon shutter
- Possibility to open it manually if the vacuum is broken in the pipe
- Light on doors => Safe to enter in the EH



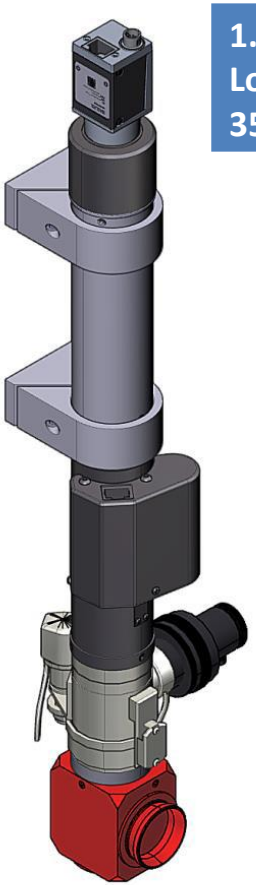
Available in September 2014

Upgrade – WAXS nose cone

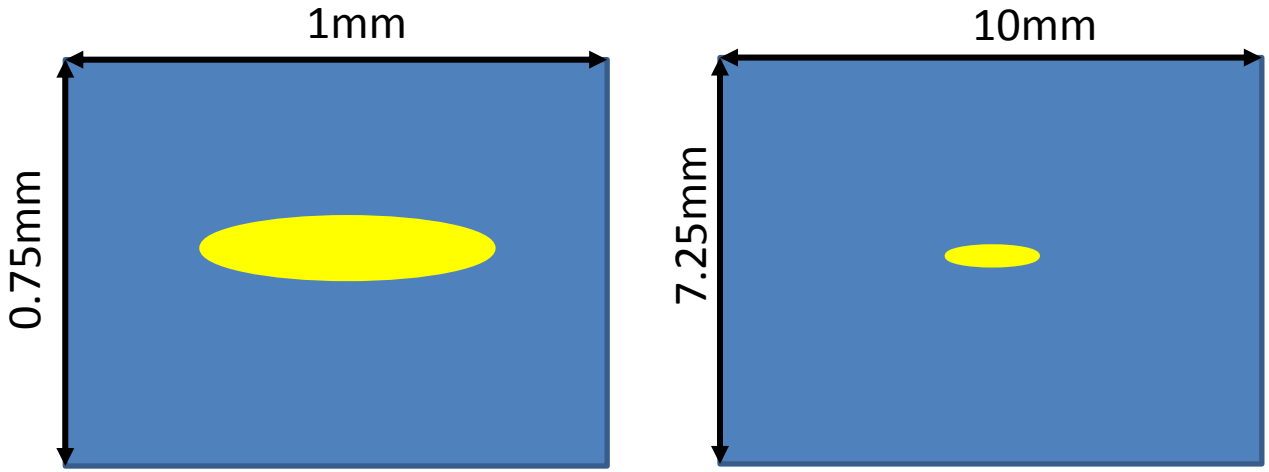


Available in April 2014

Upgrade – On-Axis Camera



1.67X \ 120FL Lower lens 35-00-04-000	WD 155mm, Min Zoom: Mag - 0.47X; Res-22.2□m; DOF-2.5mm; 10mm x 7.7mm Max Zoom: Mag - 5.80X; Res-4.2□m; DOF-0.089mm; 0.83mm x 0.63mm



Available in September 2014

Upgrade – On-Axis Camera

Different lighting system depending on the contrast of the sample

Available in September 2014

Upgrade – Schedule

Project	***Status***	***Delivery***
Flight tube autom. protection	*Under production*	*20/06/2014*
WAXS + Nose cone sup. Stages	*Conceptual Design*	*22/04/2015*
Sample platform		*29/05/2015*
SAXS detector table		*15/04/2015*
Microfocus lenses		*01/04/2015*
BCE fast shutter/camera		*27/05/2015*
DCM foils		*08/07/2015*
Beam stopper		*01/07/2015*
KF support pipes		*30/06/2015*
Flight tube cable chains		*14/10/2015*
Support various		*28/10/2015*
KB system		*30/08/2016*

Control – New projects

you are here: home → intranet → mis applications → cpm

Projects Management Tool

Business Case (Baseline)

Users and interested parties

This project was requested by BL04, BL11 and BL22 scientists.

Involved parties:

- BL04 team
- BL11 team
- BL22 team
- Controls Group
- Electronics Group
- Systems Group

Reasons

The beamline scientists requested a set of new features necessary to control experiments. Some defects of the existing control syste require to be fixed.

Expected Benefits

Any issue related with any beamline will be investigated by a team of at least 5 members.

The quality of the solution will be better and the product will be more robust.

The knowledge will be spread between all the developers.

Every two weeks the BL user will have a chance to validate the controls system increment, rise new issues and modify priorities.

you are here: home → intranet → mis applications → cpm

Projects Management Tool

Business Case (Baseline)

Users and interested parties

This project was requested by Marc Malfois.

Involved parties:

- Beamline scientist.
- Controls Group
- Systems Group
- Electronics Group
- Engineering Group
- Alignment Group

Reasons

Even though the beamline is in operation it still miss some crucial features to full fill the needs of project is to address the lack of these features in order to make the beamline fully operational.

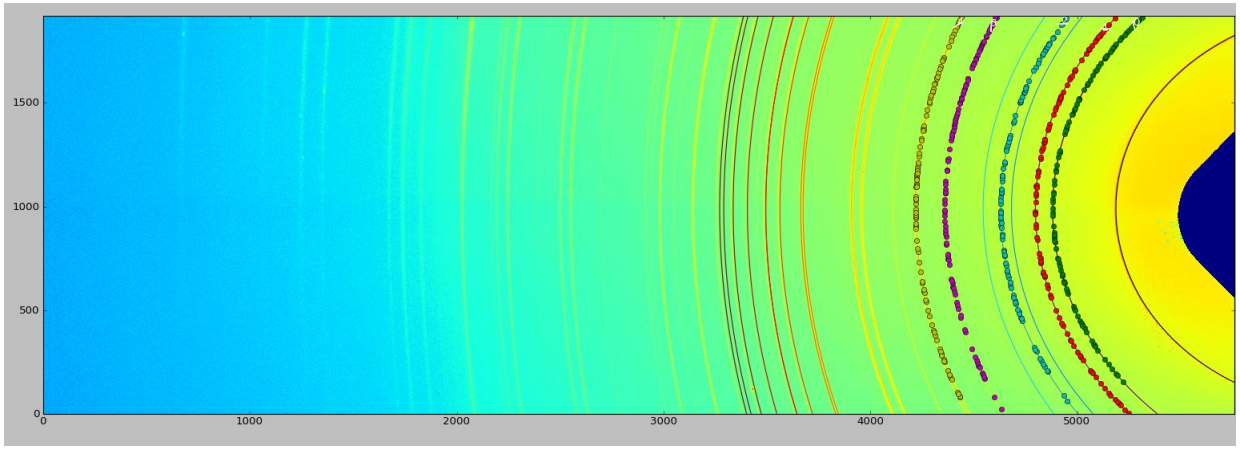
Expected Benefits

- New detectors will be available for SAX and WAX experiments
- Triggered SAX+WAX acquisitions will be possible
- Beam-sample centring will be more efficient with the OAV system
- Beam position deviations will be reduced by the monochromator correction system (MoCo)
- Users will have a better experience with an improved GUI
- Data post-processing will be easier and straight forward for the scientist using DAWN
- Micro focus experiments will be possible

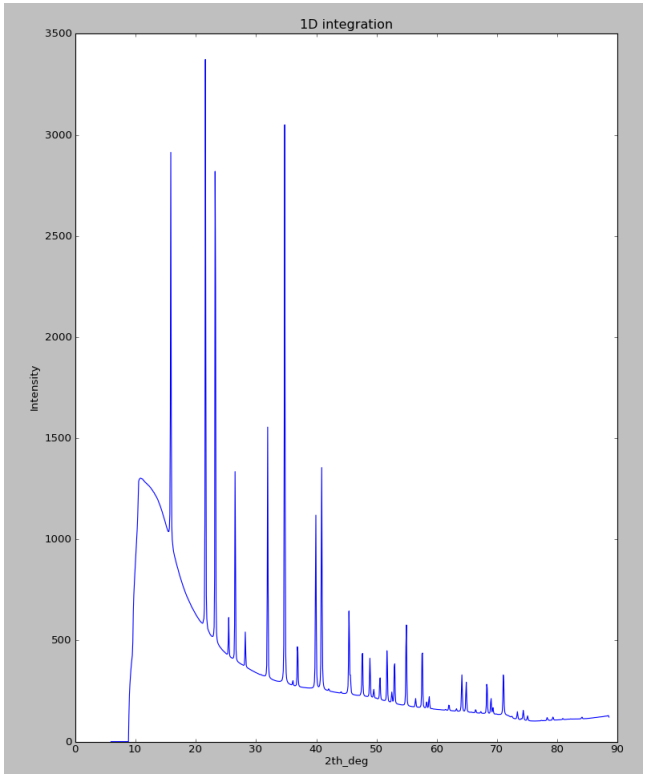
Control – pyFAI implementation

J. Kieffer, PyFAI, Journal of Physics: Conference Series **425** (2013)

Source code available from ESRF



SampleDetDist= 1.260982e-01m
PONI= 4.351847e-02, 1.918830e-01m
rot1=-0.556464 rot2= -0.000100 rot3= -0.000000 rad
DirectBeamDist= 148.503mm
Center: x=6143.644, y=988.719 pix
Tilt=31.883 deg
tiltPlanRotation= -0.011 deg

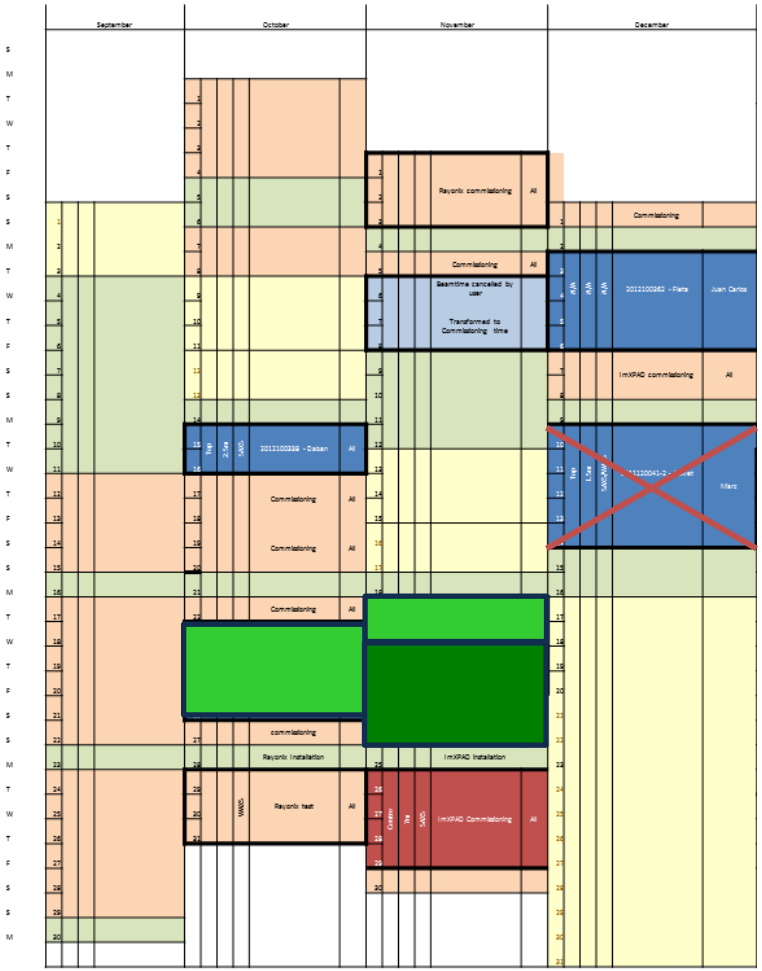


Control –New features

Save environment information in image headers

- Basic image information: Exposure time, time stamp and readable image date time. (End of March 2014)
- To have this information in the ASCII file(End of March 2014)
- First energy, machine current, ion chamber current (End of March 2014)
- Next will be to have other values as temperatures for linkam scans
- Final solution will be a way to set a list of attributes to be saved in image headers **(End of summer shutdown 2014)**
- To have Rayonix information like time stamp in the header

Users - 2013

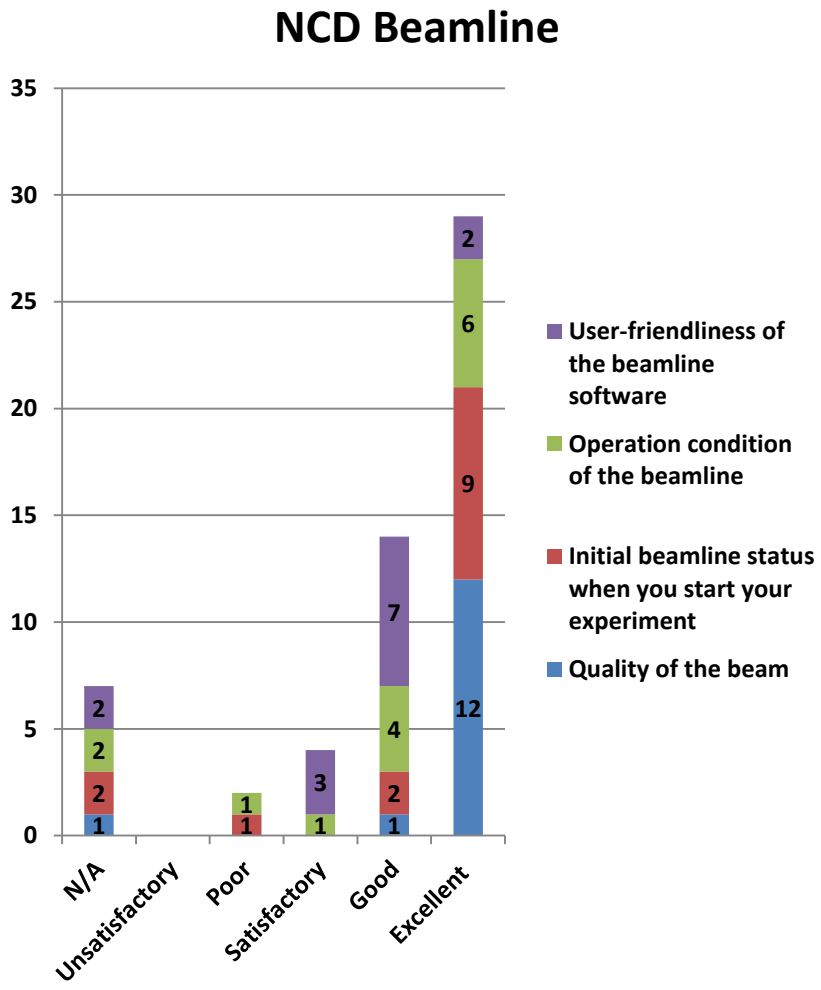


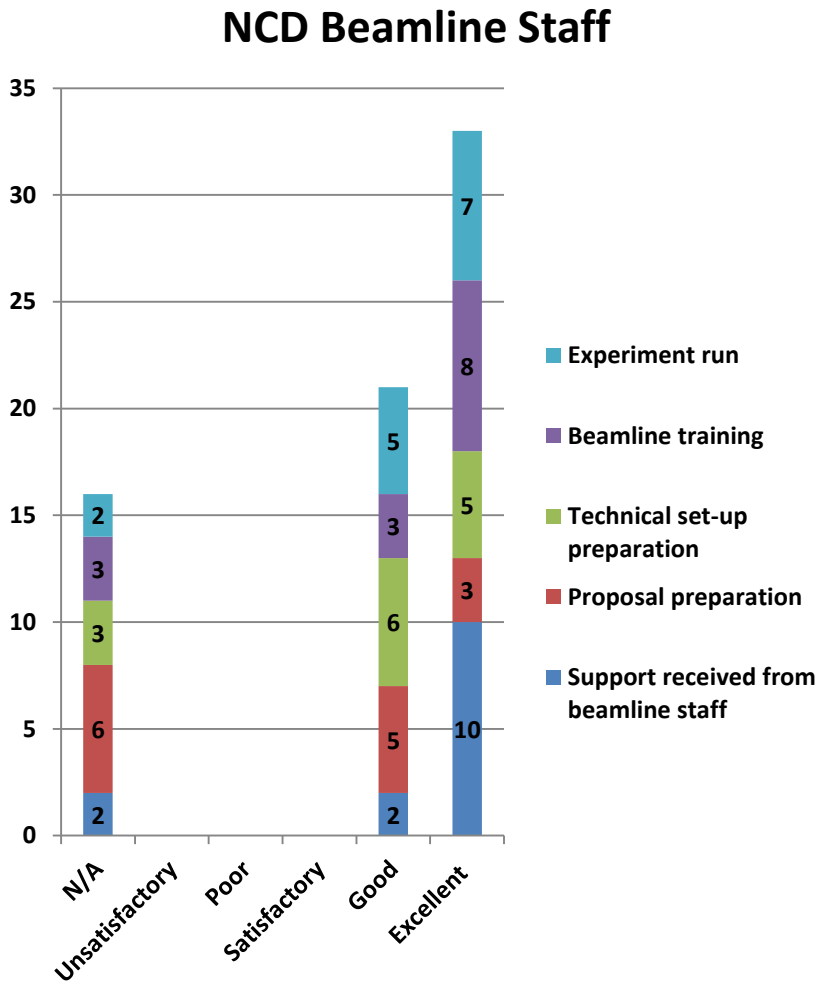
8 users groups

7 publications

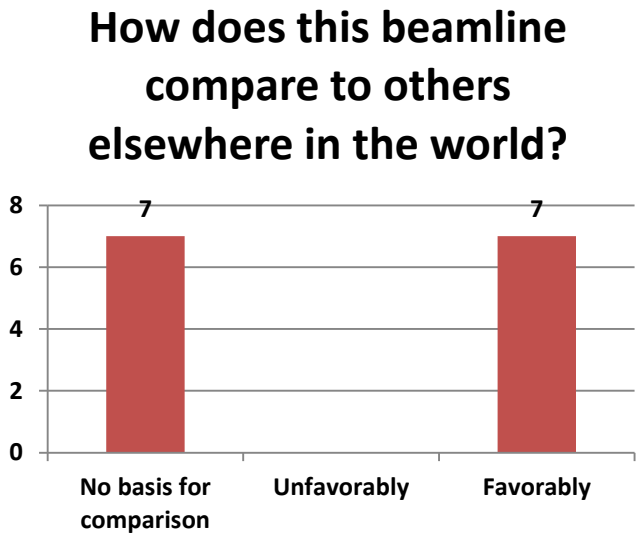
but 1 group is publishing 3 articles after 5 days of beamtime

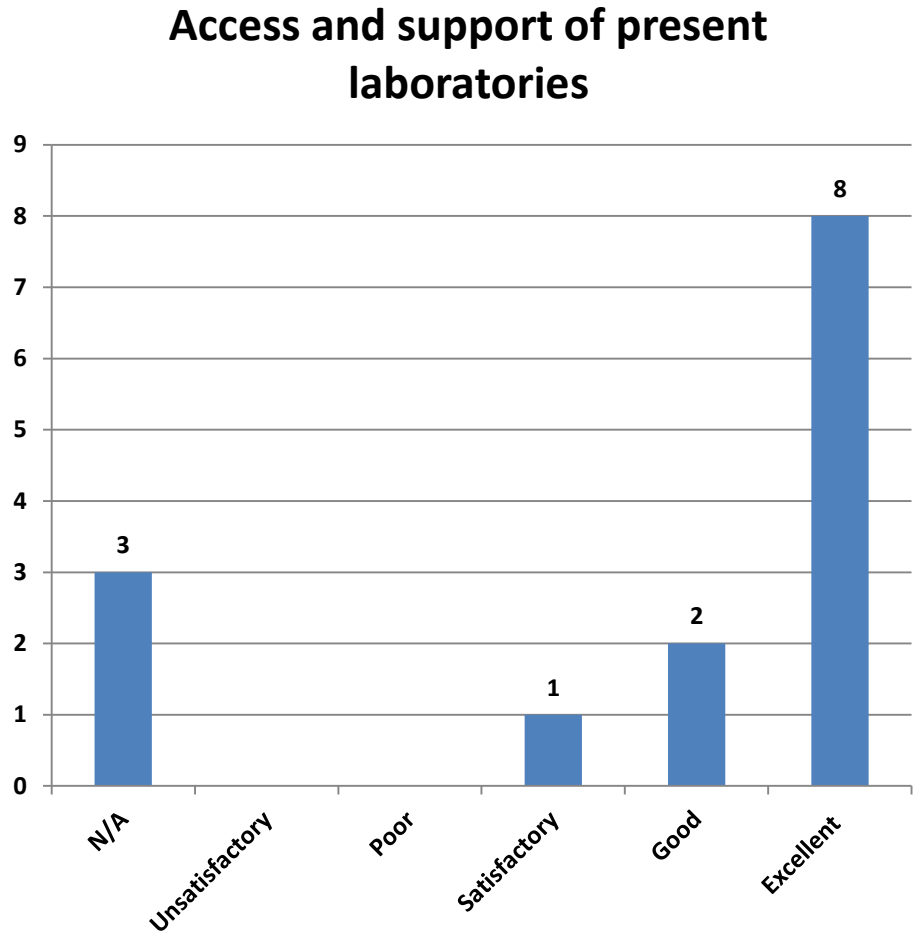
Users feedback 2013





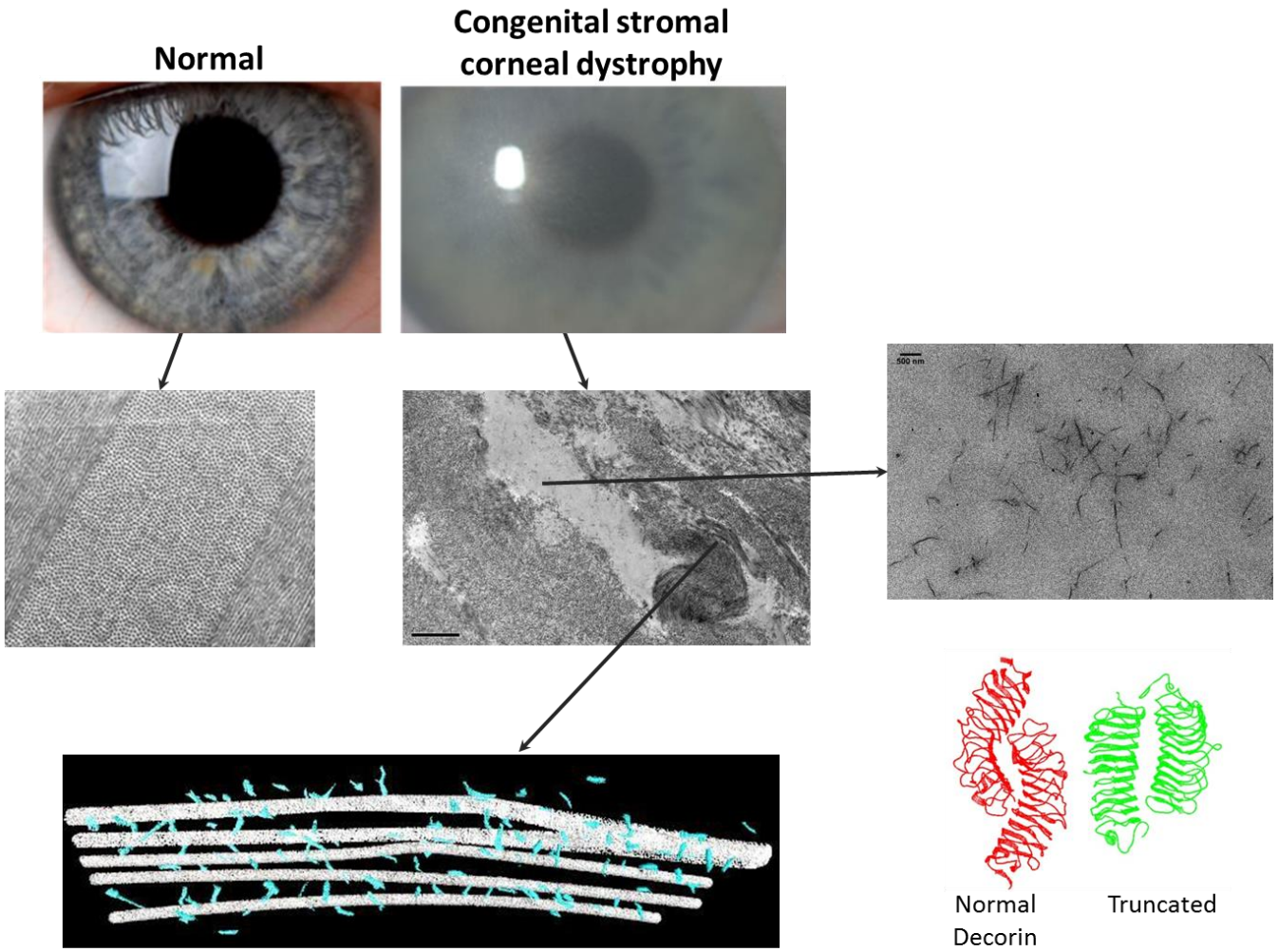
Users feedback 2013





The role of decorin in organizing the extracellular matrix

Christina Kamma-Lorger (PI), Marc Malfois, Juan Carlos Martinez, Eva Crosas, Keith M Meek, Carlo Knupp, Cecilie Bredrup, Eyvind Rødahl, Alex Peralvarez

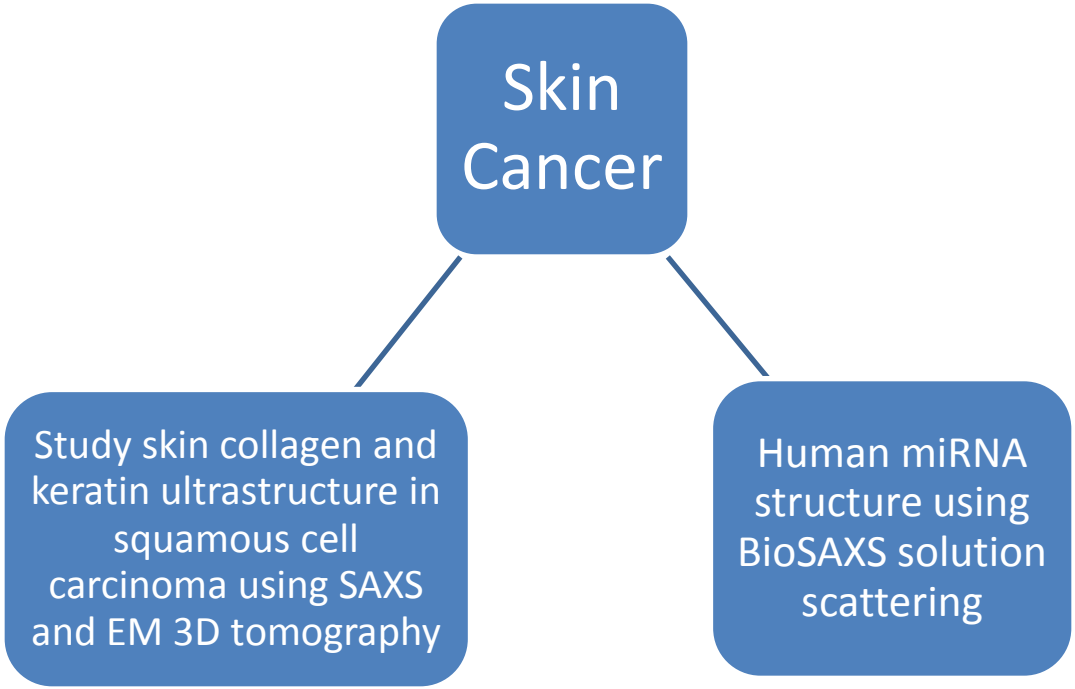


Fusion of fibrils doesn't seem to change radically fibrillar diameter. Measured average diameter: 37.69 ±1.86

In house project 2014

An investigation of structural changes of fibrillar skin proteins and microRNAs in cancer

Christina Kamma-Lorger (PI) and Marc Malfois



Current progress:

Internal funding was granted for 2014. Installation of cell culture laboratory facility.

Study of radiation damages on Macromolecules – A NCD/XALOC project

E. Crosas, A. Castellvi , C. Kamma-Lorger, F. Gil, J.C. Martinez, M. Malfois, M.A.G Aranda, J. Juanhuix

Funded by the Spanish Safety Nuclear Council (CSN)

Radiation damage is observed as aggregation of the protein in the small angle S region, affecting size and shape determination of the protein.

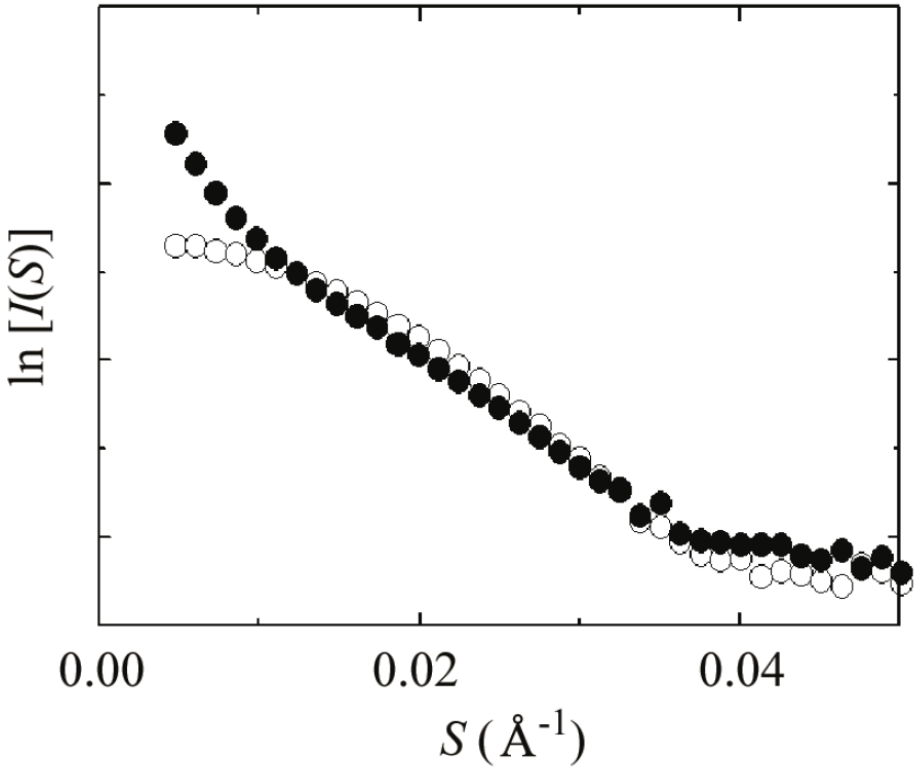


Figure
Effect of radiation damage on lysozyme. Open circles: short-exposure (165 Gy); solid circles: long-exposure (3300 Gy). The upward curvature in the small S region (solid circles) points to the presence of radiation-induced aggregates.

From Kuwamoto S., J Synchrotron Radiat. 2004 Nov 1;11(Pt 6):462-8

Study of radiation damages on Macromolecules – A NCD/XALOC project

E. Crosas, C. Kamma-Lorger, J.C. Martinez, M. Malfois, A. Castellvi, F. Gil, J. Juanhuix

- Systematic comparison of radiation damage on several proteins using both SAXS and MX techniques
- Test different pH conditions and scavengers, including new potential compounds against radiation damage
- Correlation of SAXS and MX results with functional studies such as:
  - Mass Spectrometry MALDI-TOF
  - Enzyme activity assay

Beamtime awarded:

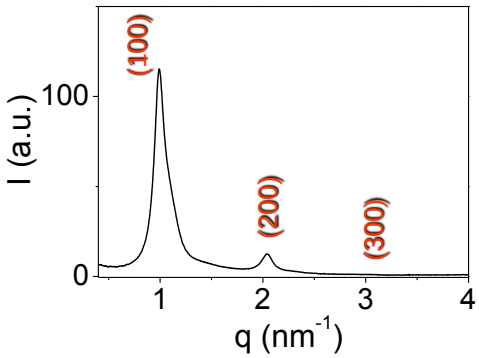
- ALBA
- ESRF and Diamond to take advantage of the BioSAXS robot.

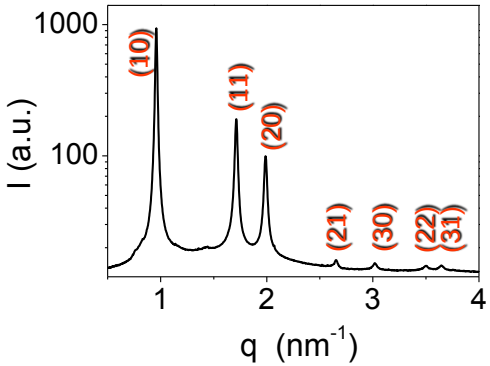
For more information, see the related poster tomorrow

Liposomes in gene therapy: Lipoplex structure-biological activity relationship

A. L. Barrán-Berdón, B. Yélamos, M. Malfois, E. Aicart and E. Junquera

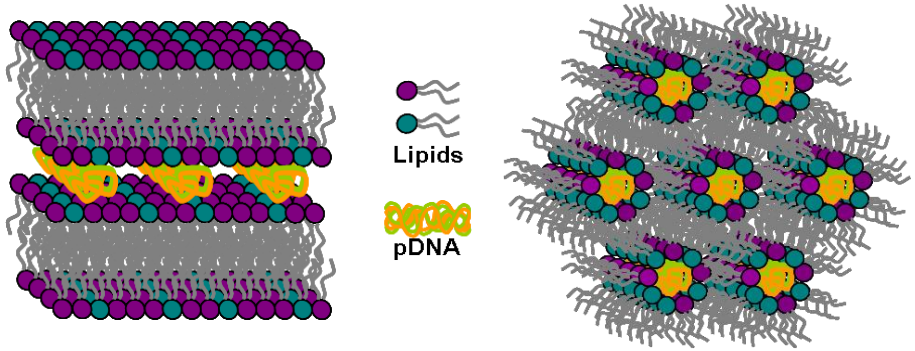
Submitted in *Langmuir*





- Lipofection is a technique used to introduce genetic information (DNA or siRNA) into a cell by means of lipid nanostructures that can easily fuse with the cell membrane.

- Lipoplex (lipids + DNA or siRNA) structure is known to clearly affect transfection efficiency (TE).



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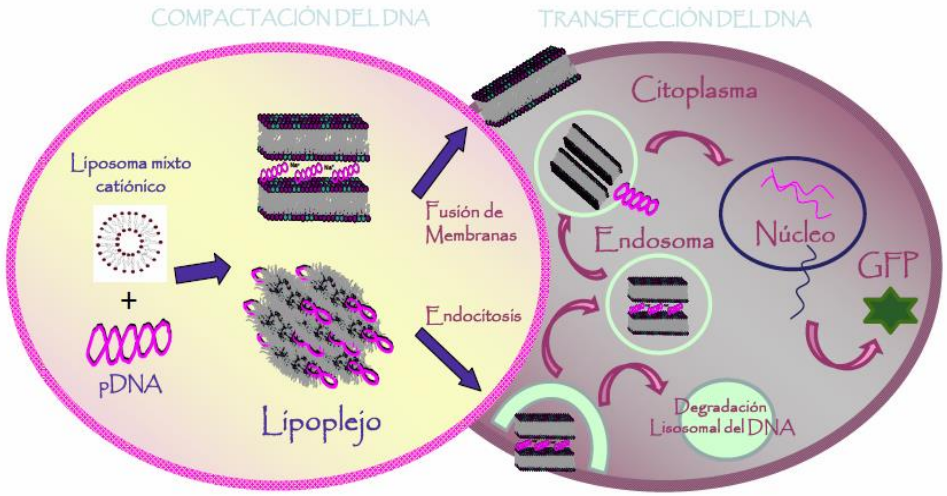
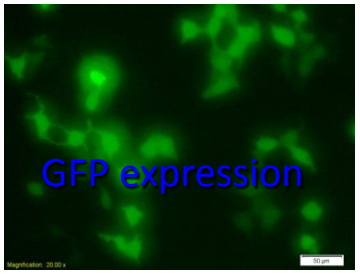




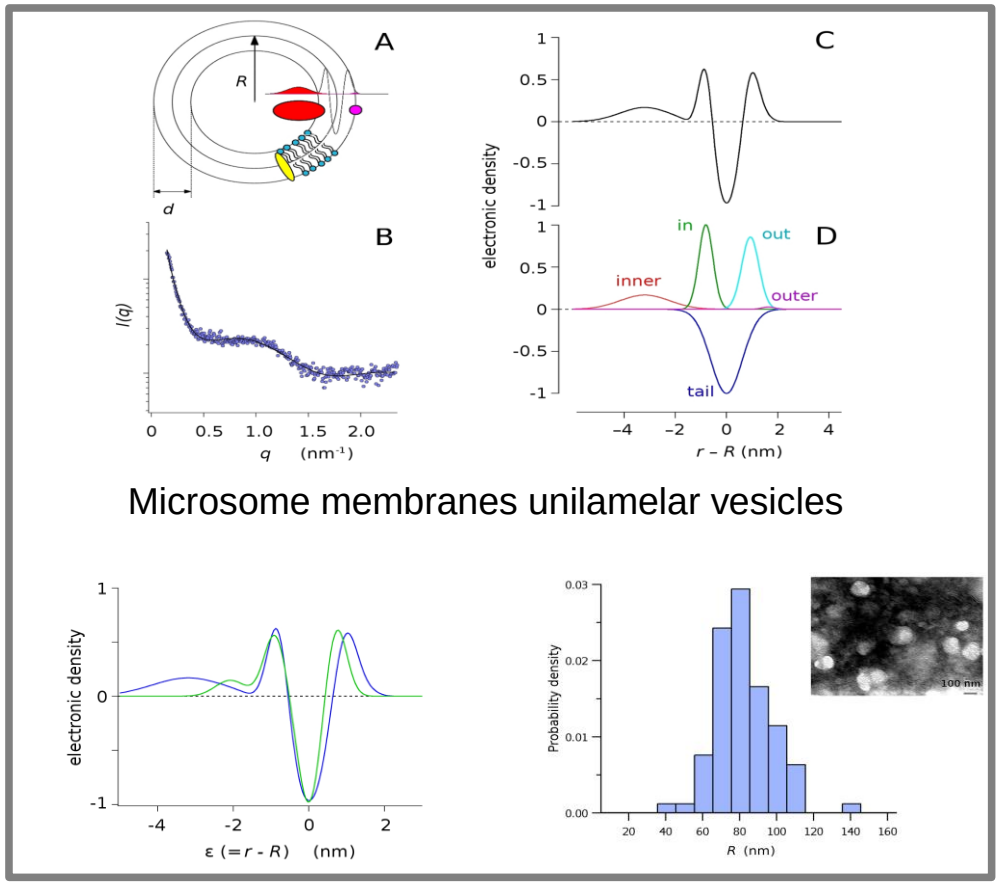
- Lipoplex structure depends on the molecular characteristics of the lipids used.
- Lipoplexes showing inverted hexagonal phases (H_{II}) are more efficient on transfection than lipoplexes with a lamellar ones (L_α). Hexagonal phases are more fusogenic; accordingly, after endocytosis, they release more easily DNA, from the endosome to the cytosol.
- SAXS together with transfection assays reveal as a potent tool to correlate lipoplex structure with transfection levels (structure-biological activity relationship).

Application of SAXS to the structural analysis of membrane vesicles

Oscar Moran, Istituto di Biofisica, CNR, Genova, Italy

Published in *Eur. Biophys. J.*
Submitted in *Cellular and Molecular Life Sciences*

From scattering theory, analytic expressions are derived for the bilayer form factor over a spherical geometry, assuming the lipid bilayer electron density to be composed of a series of Gaussian shells.



A) Sketch of the model of a vesicle consistent with the measured SAXS data.

B) SAXS spectra of the WT-CFTR membranes

C) The electronic density profile was calculated from the five Gaussian model

D) The decomposition of each singular Gaussian used to model the electronic density

Electron density profiles of from microsome vesicles wall of native cells (green) and cells overexpressing CFTR (blue; protein involved in cystic fibrosis). Micrographs of vesicles are shown.

Application of SAXS to the structural analysis of membrane vesicles

Oscar Moran, Istituto di Biofisica, CNR, Genova, Italy

Published in *Eur. Biophys. J.*
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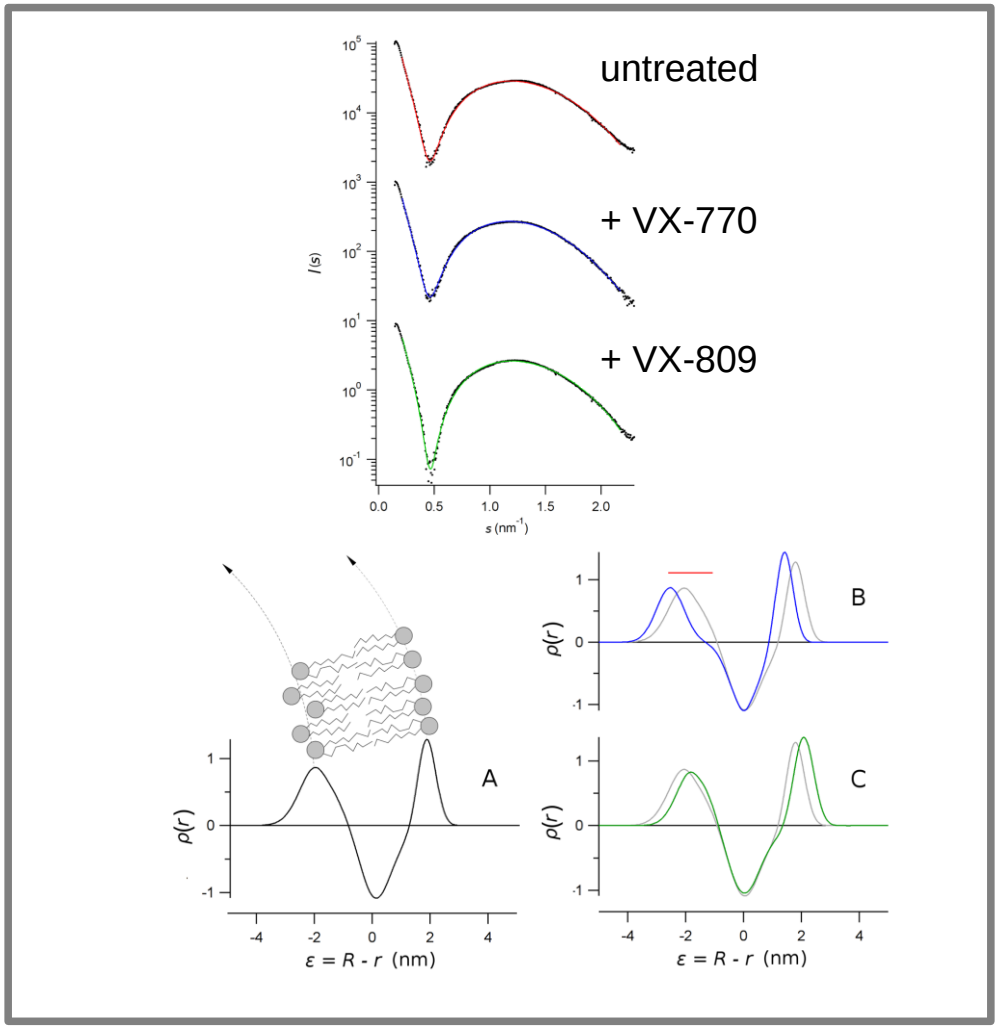


Large unilamellar liposomes (LUV) obtained by extrusion of phospholipids, treated with drugs for the cystic fibrosis therapy.

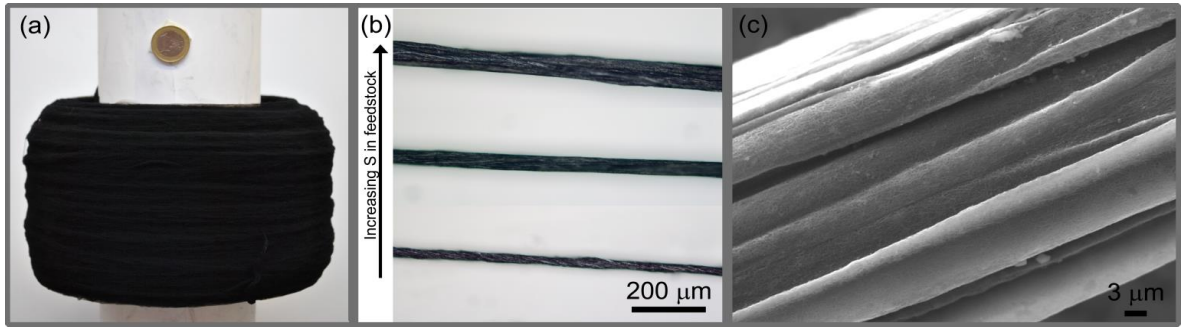
Electron density of the LUVs wall showing the destabilization induced by drugs.

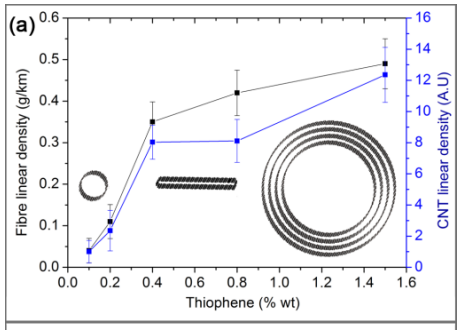
Partially supported by the Italian Cystic Fibriosis Foundation

Carbon nanotube - 1-

Controlling carbon nanotube type in macroscopic fibers synthesized by the direct spinning process Reguero et al. accepted at Chemistry of Materials

The research group has a process to produce kilometres of continous macroscopic fibres of CNTs

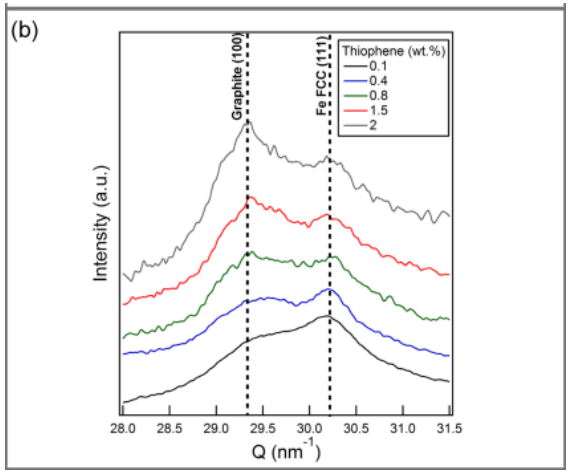




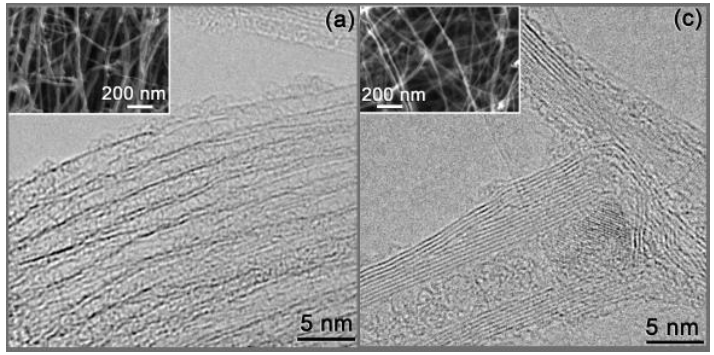
Synchrotron XRD confirms the increase of graphitic layers at turbostratic separation

S ↑ in feedstock → Intensity ratio [(100)Graphite / (111)Fe]

They can tailor thee type of nanotubes through the addition of sulphur precursor (thipohene)



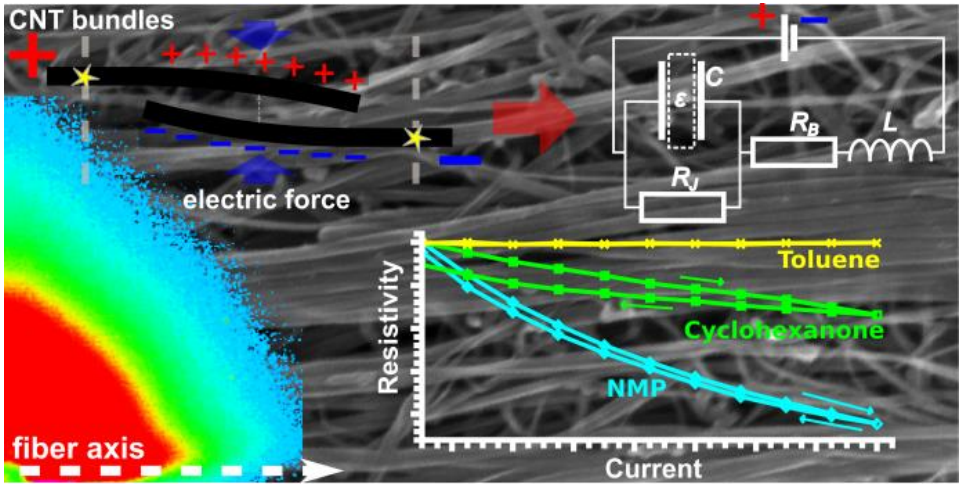
Low S → SWCNTs High S → MWCNTs



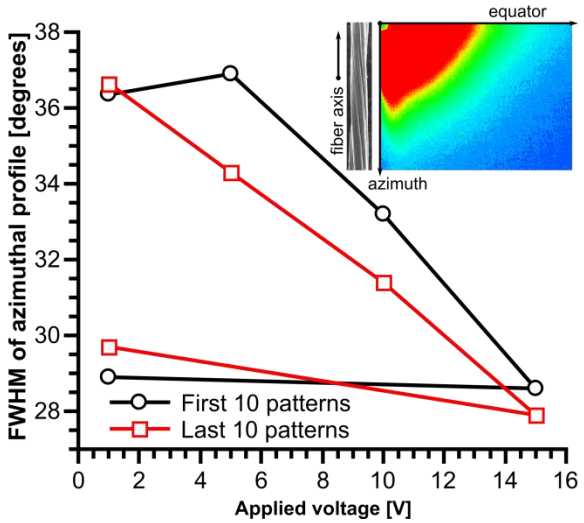
Carbon nanotube - 2-

Electric Field-Modulated non-Ohmic Behavior of Carbon Nanotube Fibers in Polar Liquids *(Terrones et al., ACS Nano, submitted)*

The CNT fibres have a complex hierarchical structure. Its mesoporosity makes liquids infiltrate the fibre, which changes its eletrical conductivity.



This non-Ohmic behaviour is a manifestation of nanoscale effects observed on a macroscopic scale.
It arises due to fibre swelling, which can be observed by SAXS.



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