

## ***Present state of the GILDA beamline***

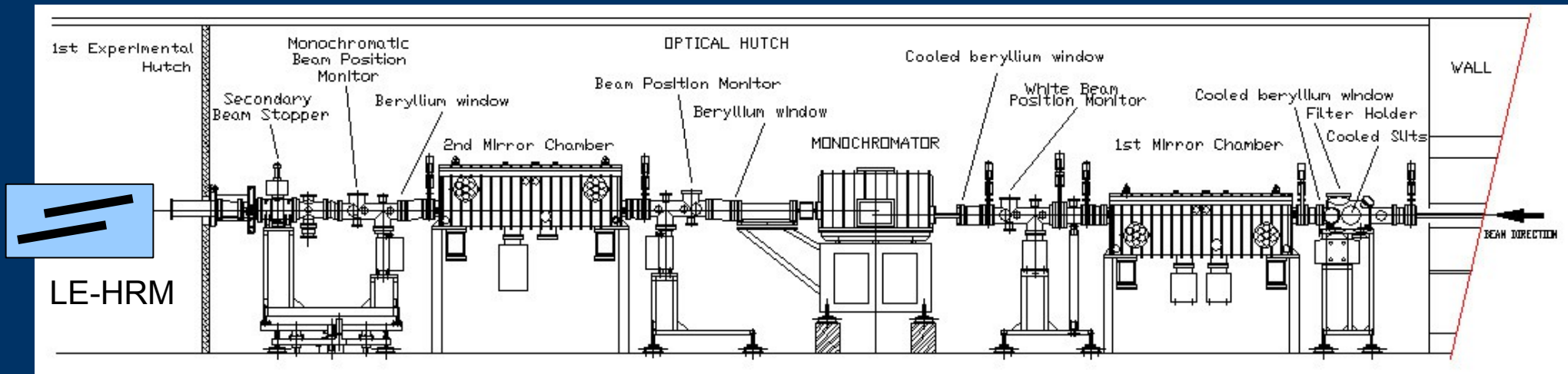
F. d'Acapito, CNR-IOM-OGG

# *Layout*

- Description of the beamline
- Beamline statistics
- Experimental examples
- Perspectives

## *Beamline description*

# X-ray optics

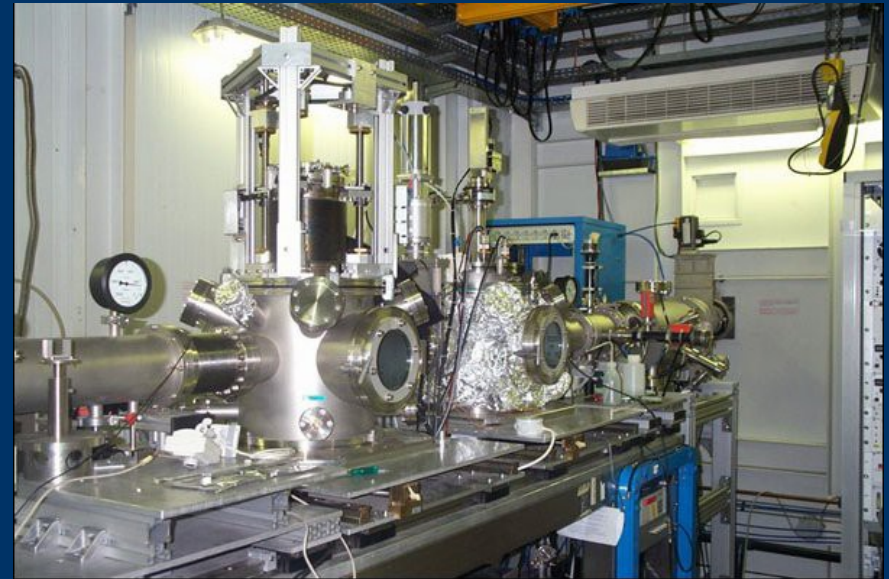


- 1<sup>st</sup> collimating mirror
  - Cylindrical, 3\*0.5m sections
  - Pd and Pt coatings
  - Cutoff 18 & 31 keV.
- Sagittally focusing monochromator
  - Si(111), Si(311), Si(511) xtals
- 2<sup>nd</sup> vertically focusing mirror
  - Cylindrical, 1m
  - Pd and Pt coatings

- Energy range  
4-90 keV
- Flux  
 $10^{11}$ ph/s  $\rightarrow$   $10^9$  ph/s
- Beam size
  - $0.5*2 \text{ mm}^2 \rightarrow 0.2*0.2 \text{ mm}^2$

# XAS

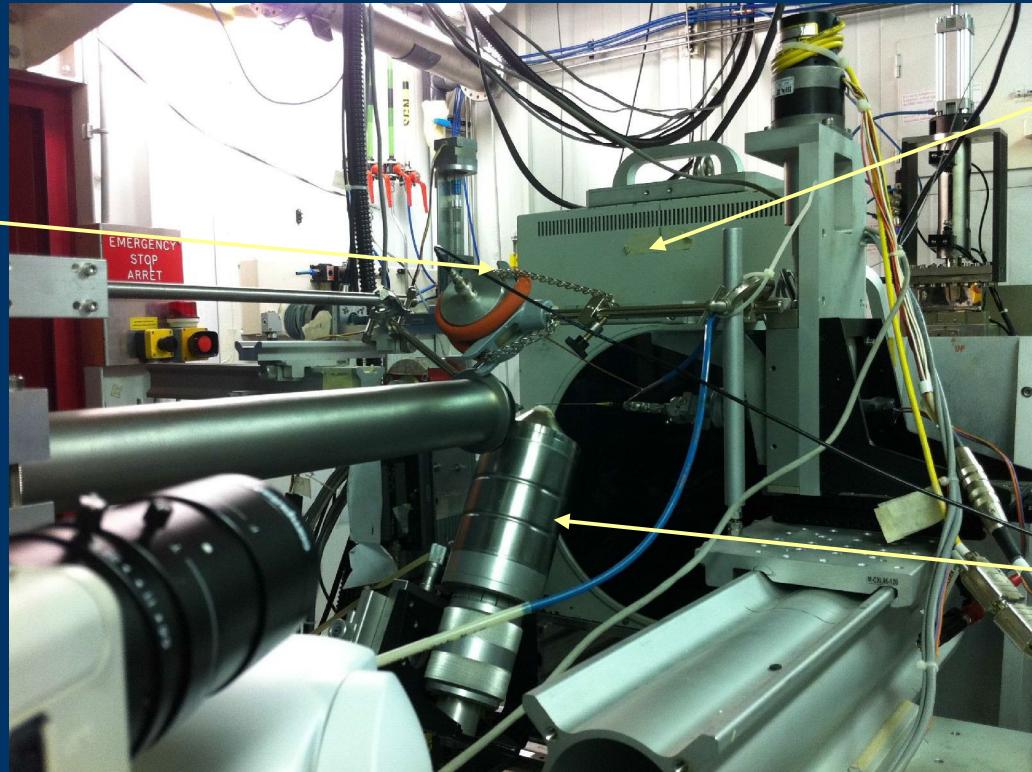
- 2 vacuum chambers
- L-N<sub>2</sub> – L-He cryostat
- Cell for gas-solid reactions
- Cryostat for liquid samples



- 2 HP-Ge detectors
- 3 ICs, sample+reference
- TEY, XEOL
- ReflEXAFS, GIXAS

## XRD

Photodiode



MAR345

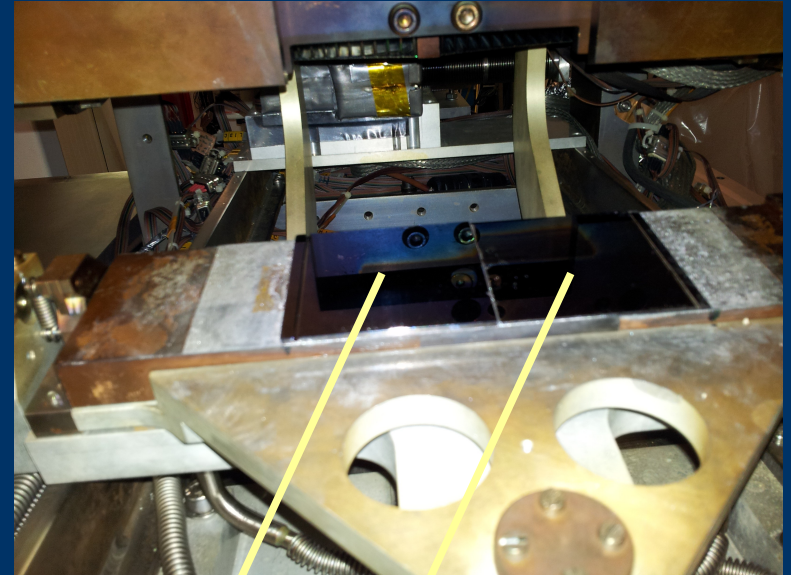
Hot air blower

- Acquisition implemented under SPEC
- Breakdown of the old IP reader
- Use of a MAR 345 detector from the Pool
- Activity eventually abandoned needing considerable resources for refurbishment



## *Interventions in the last 5 years*

- Adoption of SPEC
- Migration to ICEPAP controllers
- One-click beamline alignment
- 5.5-90 keV range available without mechanical interventions
- CARD software for ReflEXAFS
- Surface Elemental mapping
- Strobo Time resolved studies



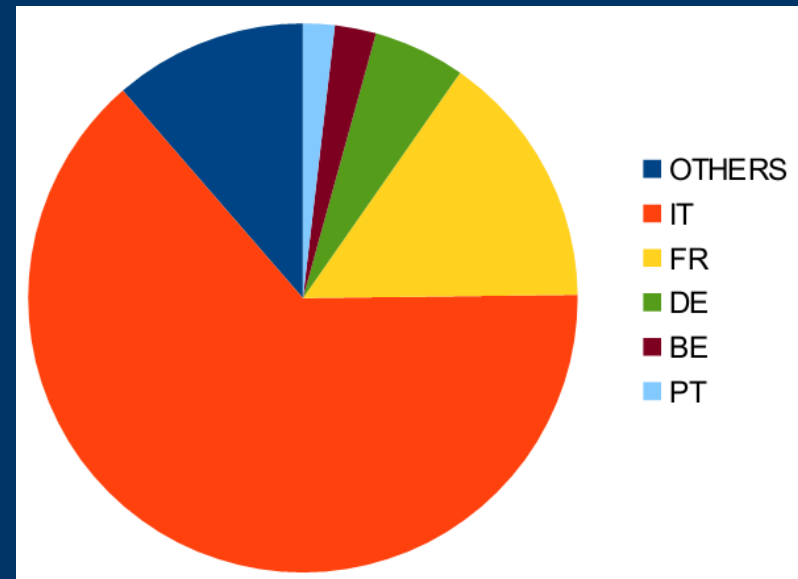
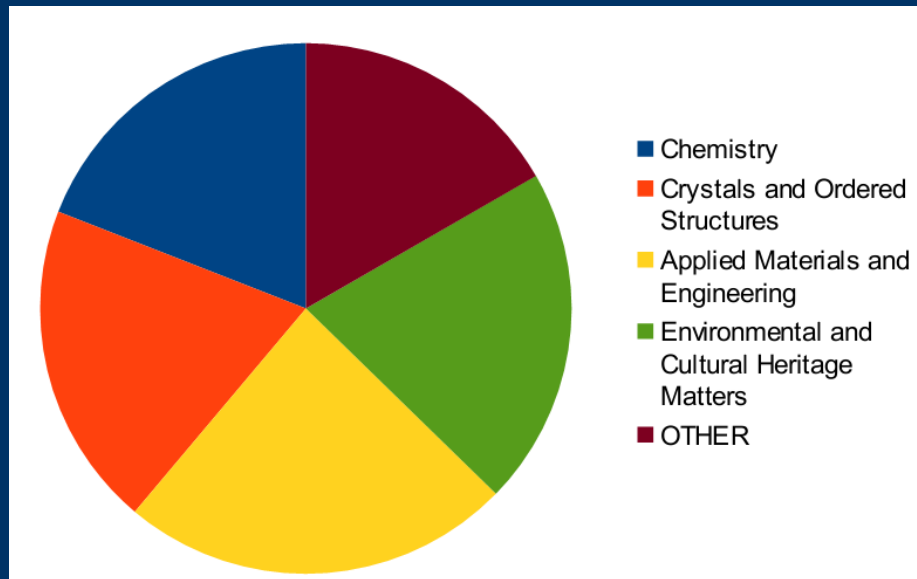
Si(755)

Si(311)

## *Beamline statistics*

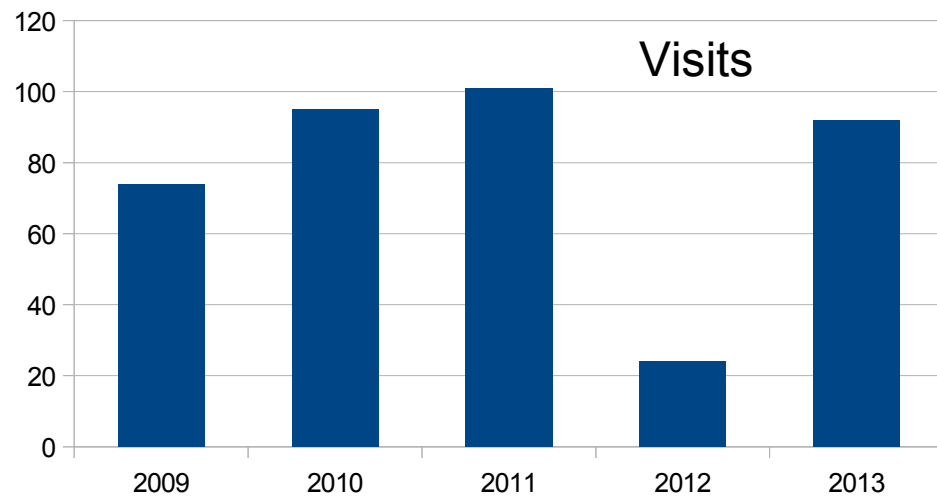
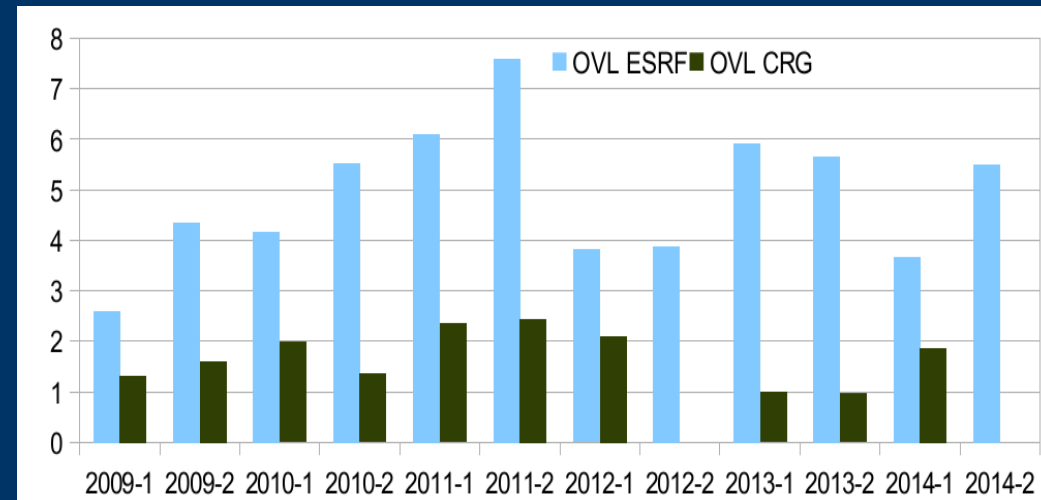
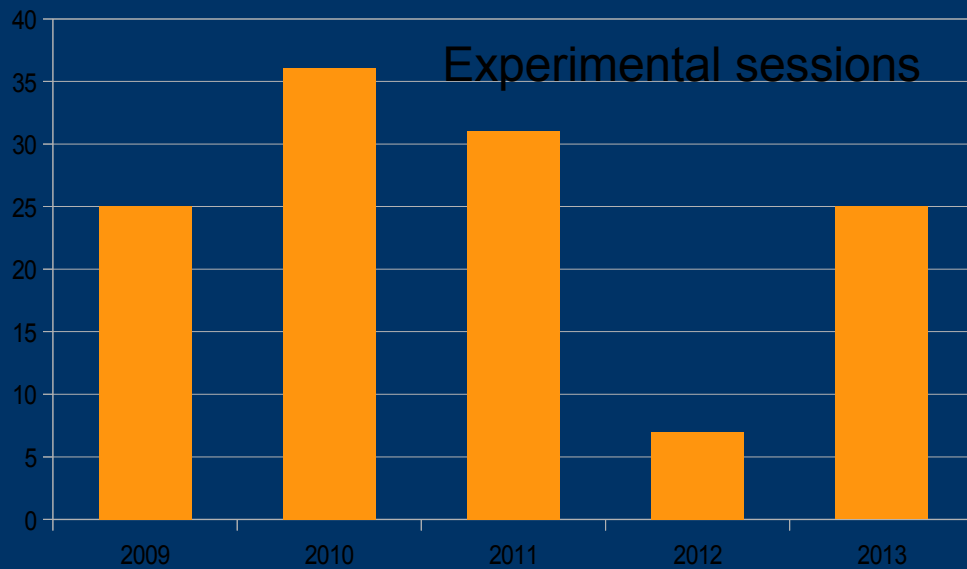


## Users



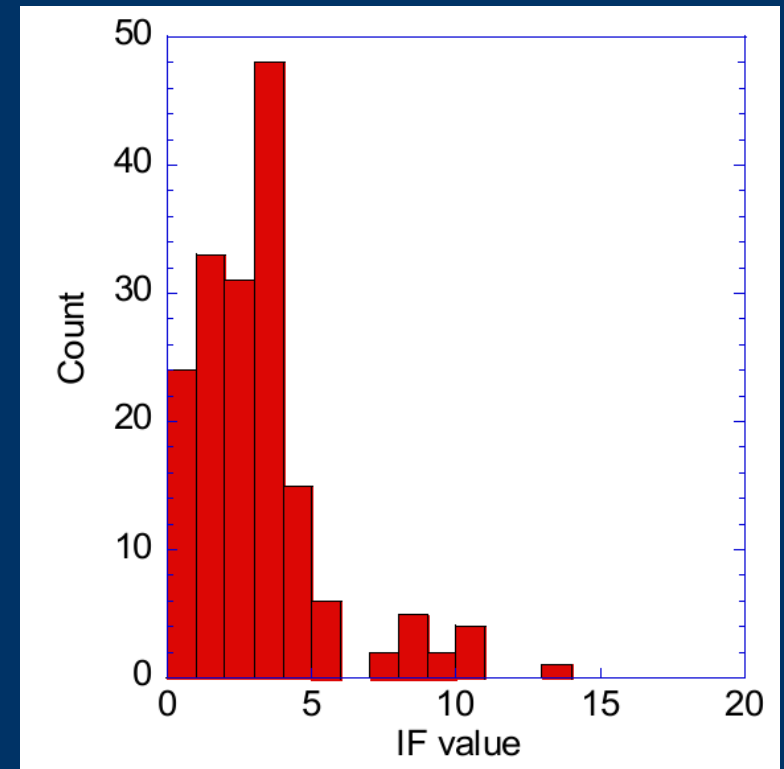
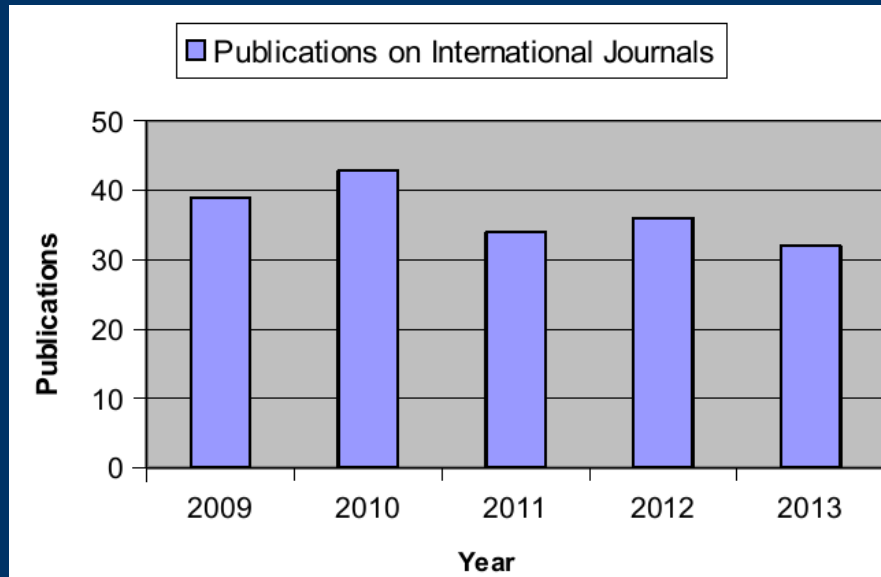
- Growth of some communities (environment, cult. Heritage) in the latest years.
- Users mainly from Italy

## Experiments

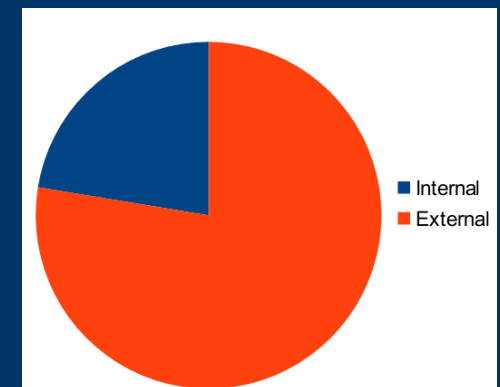


- 15-18 shifts per experiment on average
- No support for CRG users

## *Publications*



- $\sim >30$  pubs/y
- Average IF=3
- 20% from internal activity



# Staff

- On site

- Responsible → F. d'Acapito
- Scientist → A. Trapananti
- Post Doc → S. Torrenco



- Non resident technical support



- V. Tullio → INFN-LNF
- A. Martin → CNR-IOM



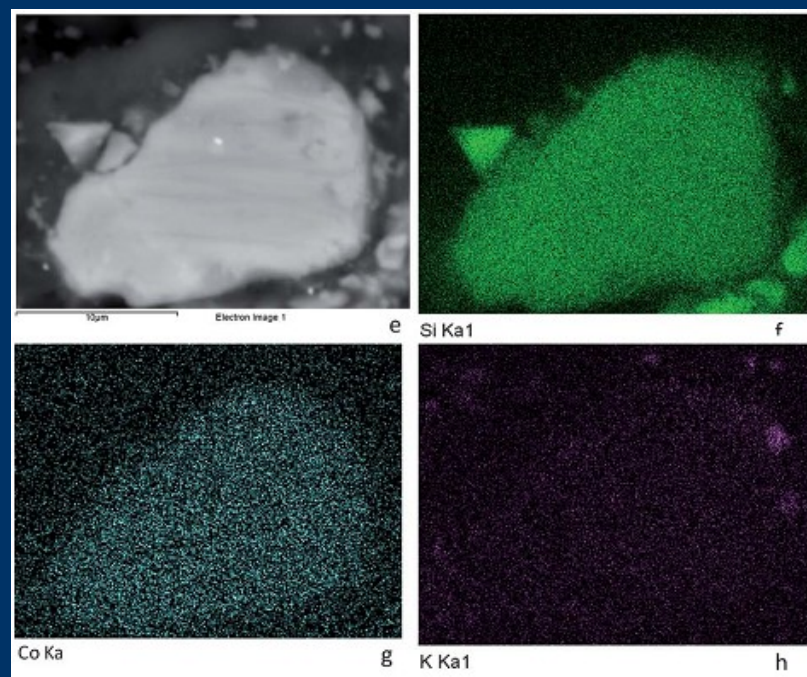
## *Experimental examples*

## Discoloration of the smalt pigment: experimental studies and *ab initio* calculations†

Ilaria Cianchetta,<sup>a</sup> Ivan Colantoni,<sup>b</sup> Fabio Talarico,<sup>\*c</sup> Francesco d'Acapito,<sup>d</sup> Angela Trapananti,<sup>d</sup> Chiara Maurizio,<sup>e</sup> Simona Fantacci<sup>f</sup> and Ivan Davoli<sup>b</sup>

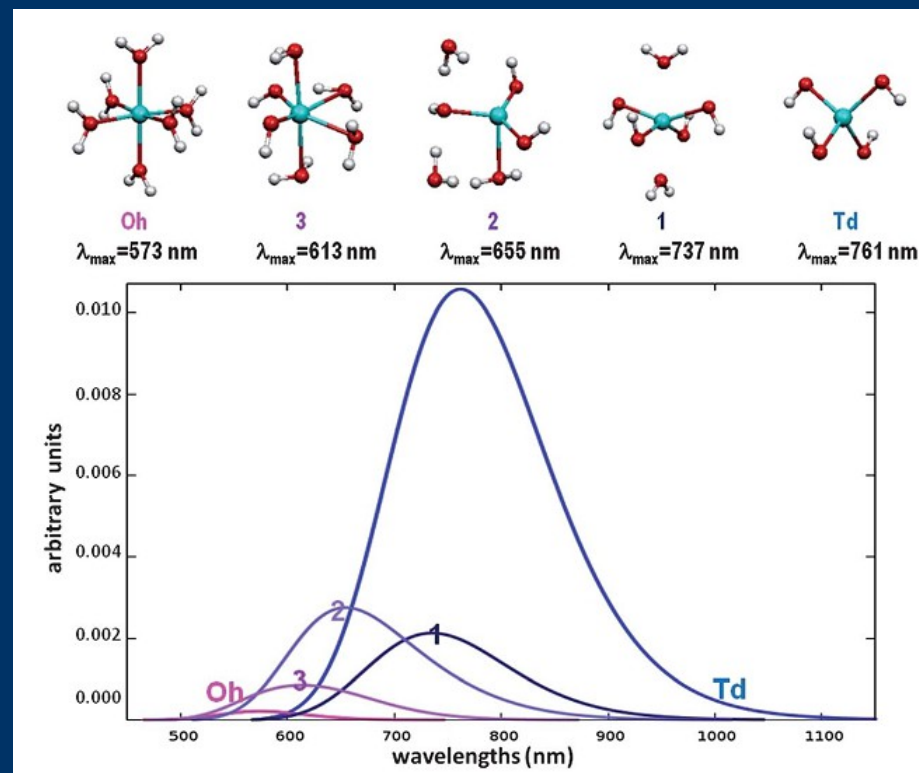
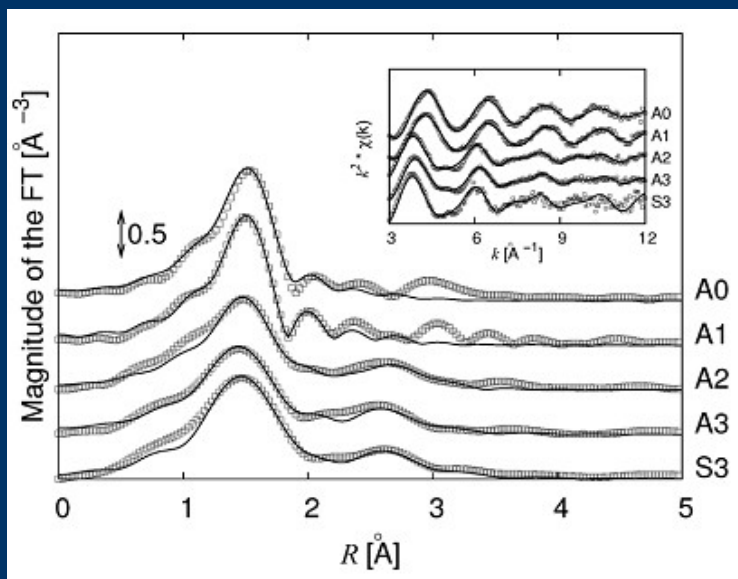
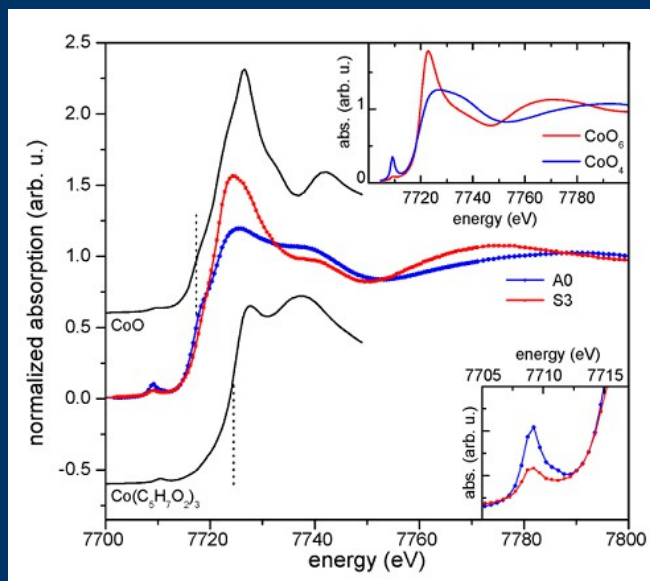


Il battesimo di Gesù, A.  
Signorelli XV cen



Electron Microprobe maps of  
a discolored grain

## XAS results



Ab-initio TD-DFT simulation of the optical absorption based on EXAFS data



## Supramolecular Aggregation of Block Copolymers in the Solid State As Assisted by the Selective Formation of Inclusion Crystals

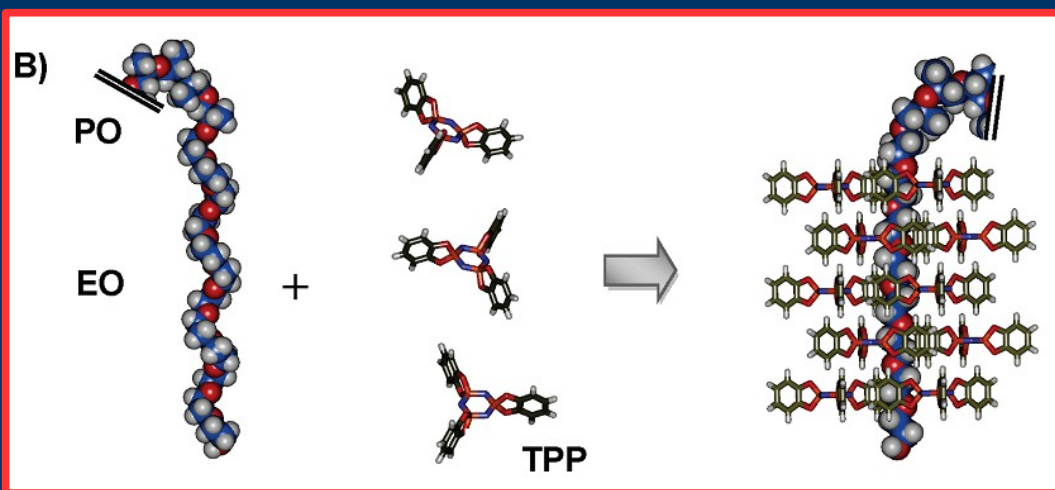
Silvia Bracco, Angiolina Comotti,\* Lisa Ferretti, and Piero Sozzani

Department of Materials Science, University of Milano Bicocca, Via R. Cozzi 53, 20125 Milano, Italy

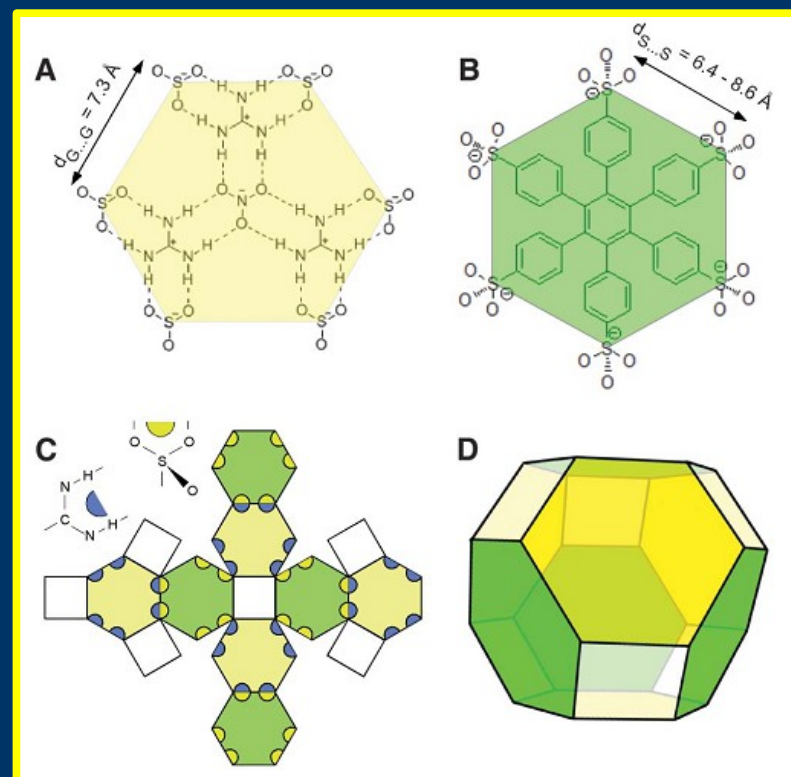
### • Supramolecular assembly of

• block copolymers

• Molecular tiles

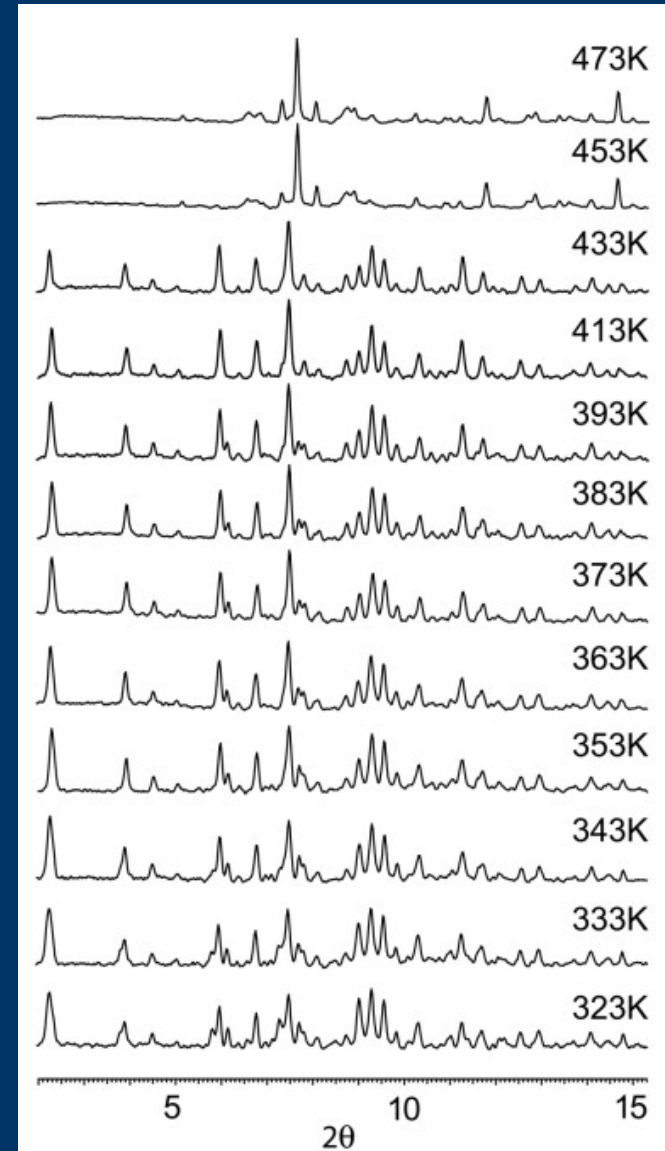
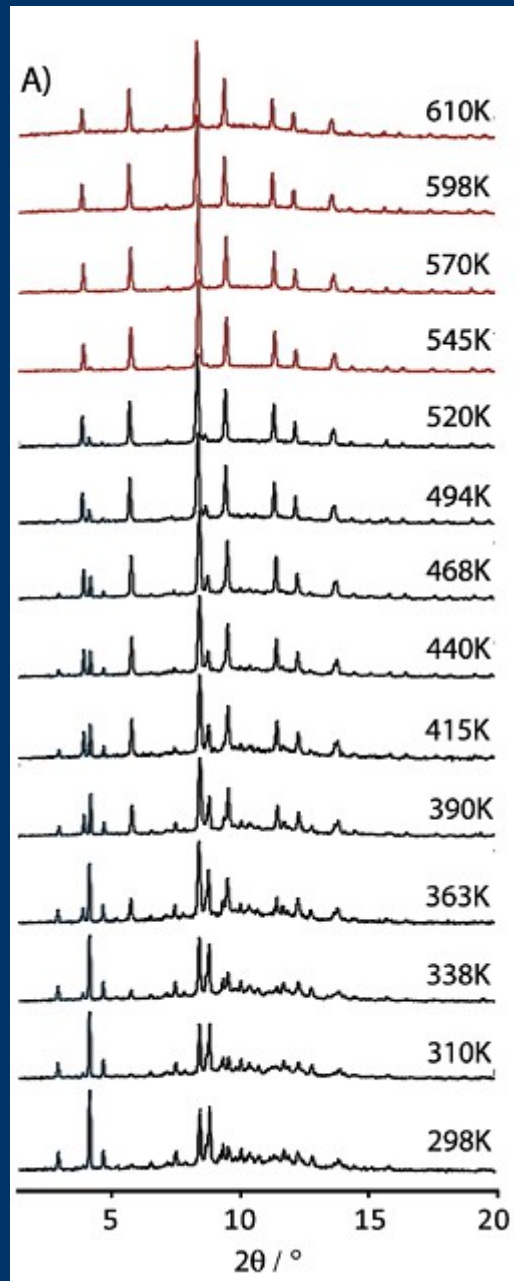


Time resolved XRD study



## Results

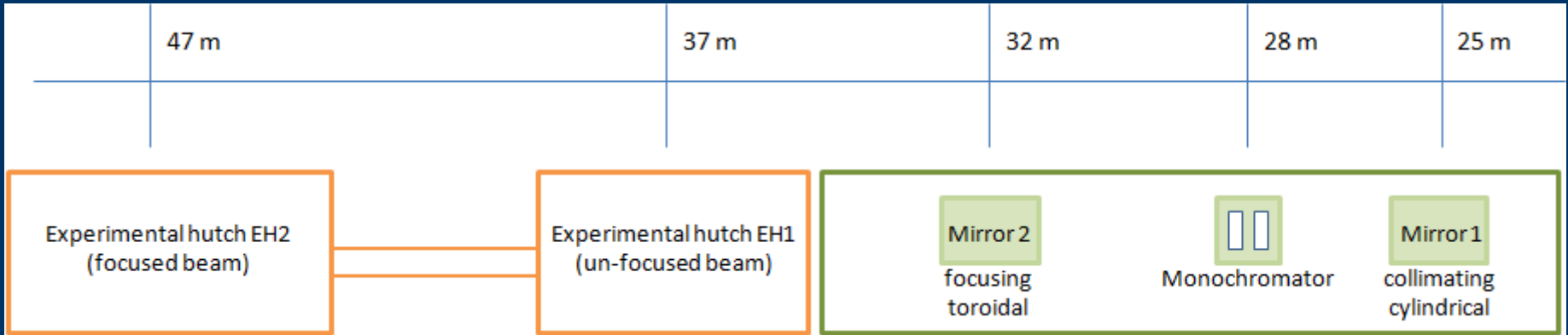
- Formation of ordered structures at 545 K



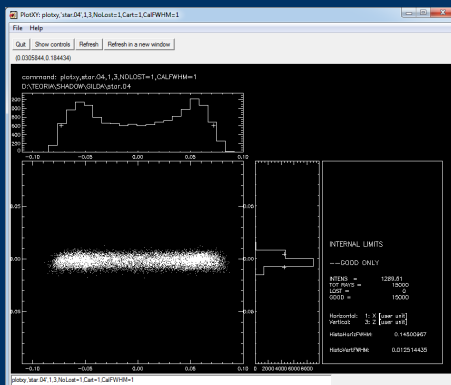
Stability of the polyhedra up to 453K

## *Project for a new beamline*

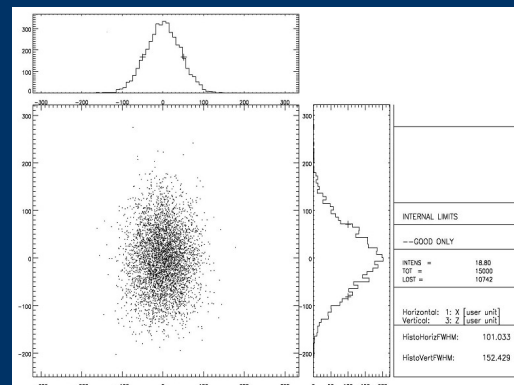
# Layout



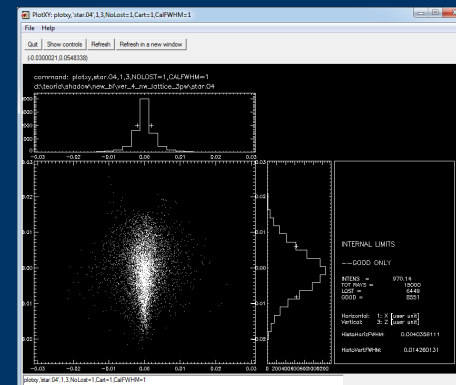
## Present Lattice & optics



## Present Lattice & New optics



## New Lattice & optics



\*120 times flux in a Ø50µm pinhole

## Scientific activities

- GI- or Refl- XAS in linear dichroism
  - Pollutant-surface interaction
  - Thin films
- Large area valence state/symmetry mapping
  - Cultural heritage
- Stroboscopic time resolved studies
  - Photosensitive systems
  - Ferroelectrics
- High quality transmission XAS
  - Chemistry
- Quick XAS
  - Gas-solid reactions
- **High resolution fluorescence**
  - High resolving power
    - Multiple pollutants in soils and airborne dust
  - X-ray emission spectroscopy
    - Valence/spin states
- **High energy XPS**
  - Chemical characterization of buried systems
  - Electronic devices

## *Timetable & funding*

- Phase 0
    - Design and preparation of the calls for tender
  - Phase 1
    - Refurbishment of the X-ray optics
  - Phase 2
    - Refurbishment of the experimental apparata & detectors
- 
- 2014 → 0.5 M€
  - 2015 → 0.5M€
  - 2016 → 0.5 M€ (to be confirmed)

## Summary

- GILDA: a beamline for XAS on diluted samples and thin films
- Renewal of instrumentation → simpler BL operation
- 25 expts, 30 pubs, 80 visits / year
- New project for an improved beamline
  - Now mostly funded