How Did we get Elettra, FERMI and Elettra 2.0

A. Franciosi

Elettra-Sincrotrone Trieste S.C.p.A. and University of Trieste

Elettra

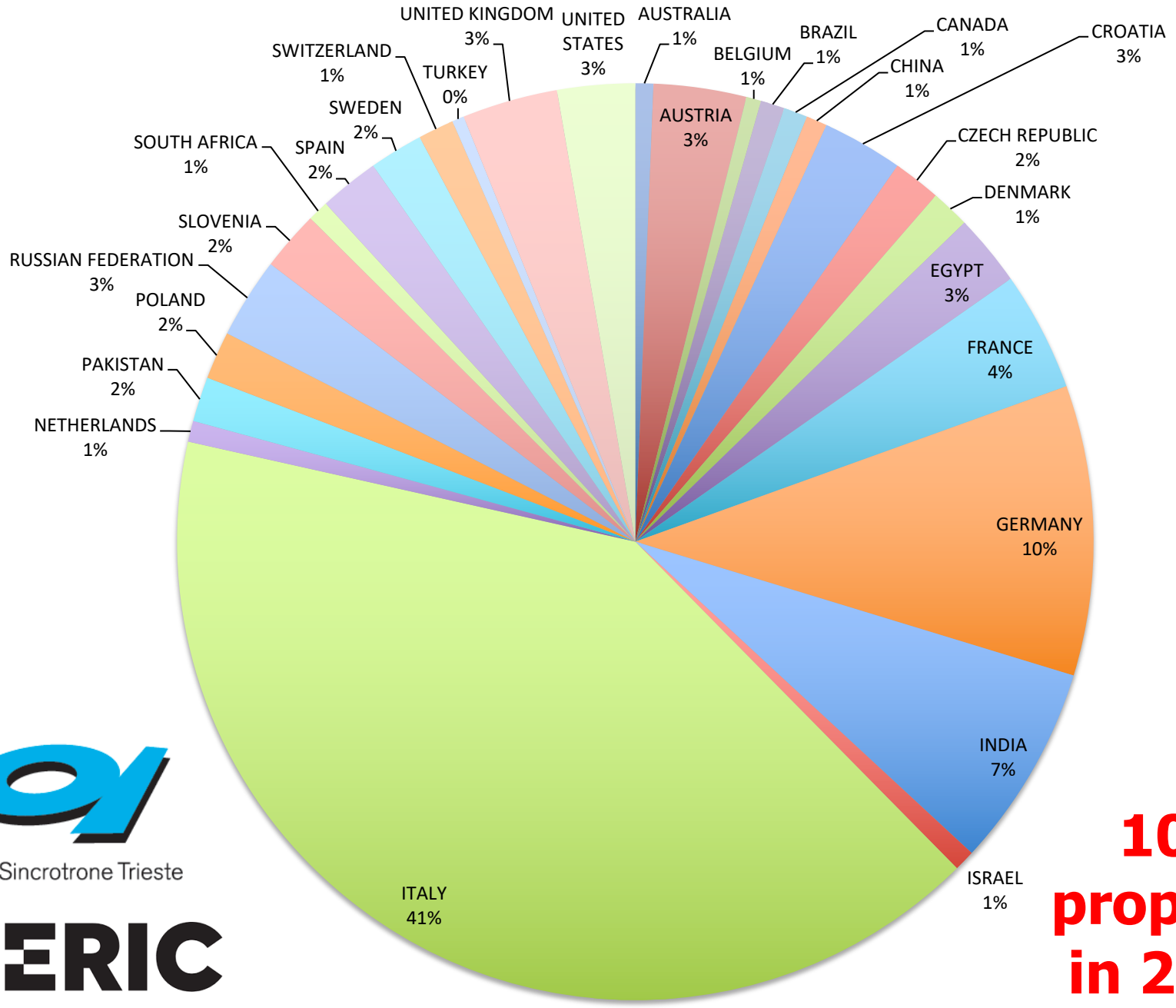
27 beamlines

in operation

major upgrades:

Nanospectroscopy
SISSI
XRF
TwinMic

STILL being negotiated: XAFS2 with Iran



Elettra Sincrotrone Trieste

CERIC

1084 proposals in 2019

The origin of squamates revealed by a Middle Triassic lizard from the Italian Alps

Tiago R. Simões[1]*, Michael W. Caldwell[1,2], Mateusz Talanda[3], Massimo Bernardi[4,5], Alessandro Palci[6], Oksana Vernygora, Federico Bernardini[7,8], Lucia Mancini[9] & Randall L. Nydam[10]

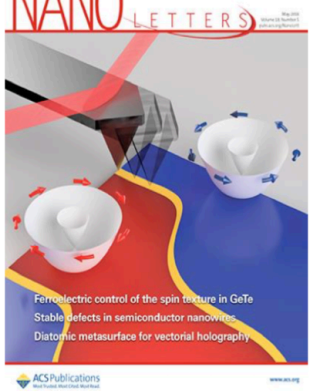
TOMOLAB collaboration

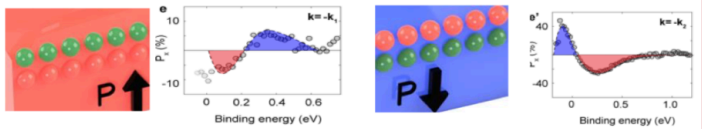
International team of scientists identified Megachirella as the earliest known ancestor of the squamates, the family containing lizards, snakes and wormlike amphisbaenians.

Ferroelectric Control of the Spin Texture in GeTe

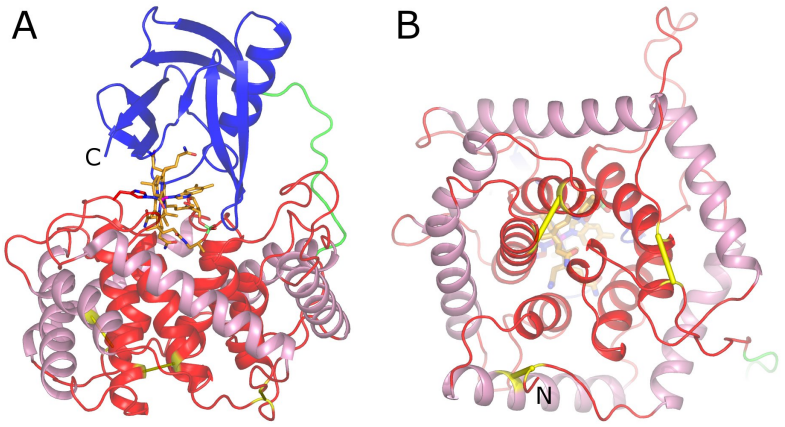
Christian Rinaldi,*[,†,‡] Sara Varotto,[†] Marco Asa,[†] Jagoda Sławińska,[§] Jun Fujii,[∥] Giovanni Vinai,[∥] Stefano Cecchi,[⊥] Domenico Di Sante,[#] Raffaella Calarco,[⊥] Ivana Vobornik,[∥] Giancarlo Panaccione, Silvia Picozzi,[§] and Riccardo Bertacco*[,†,‡]

Spin-ARPES @ APE





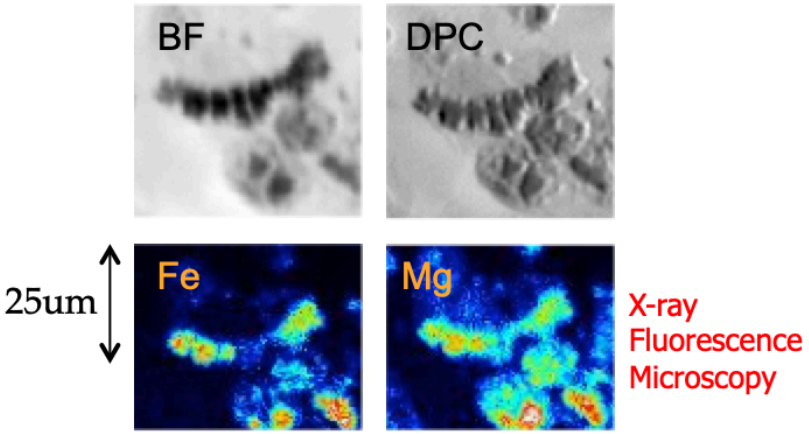
Accessed the band structure of GeTe (Ferroelectric Rashba Semiconductor) **for the two different surface terminations providing in- and out- ward ferroelectric polarizations. Evidenced the intimate correlation between ferroelectric polarization and spin circulation in Rashba bands - the basis toward the possibility of crafting the spin texture via ferroelectric patterning**



Overall structure of transcobalamin

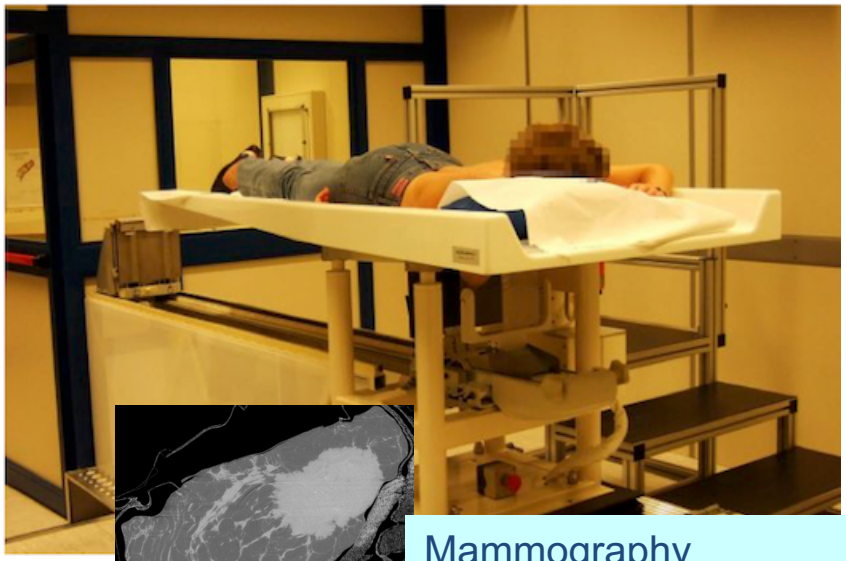
Asbestos in lung tissue

New insights on asbestos toxicity mechanism
(TwinMic and SISSI beamlines)



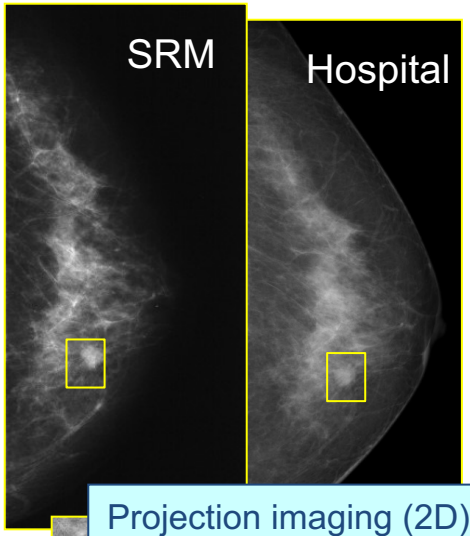
X-ray Fluorescence Microscopy

X-ray imaging @ SYRMEP



CT Slice

High-Res X-ray absorption and phase-contrast imaging (microtomography)



Projection imaging (2D)

Mammography
- 2D protocols
- Low dose breast CT studies under evaluation

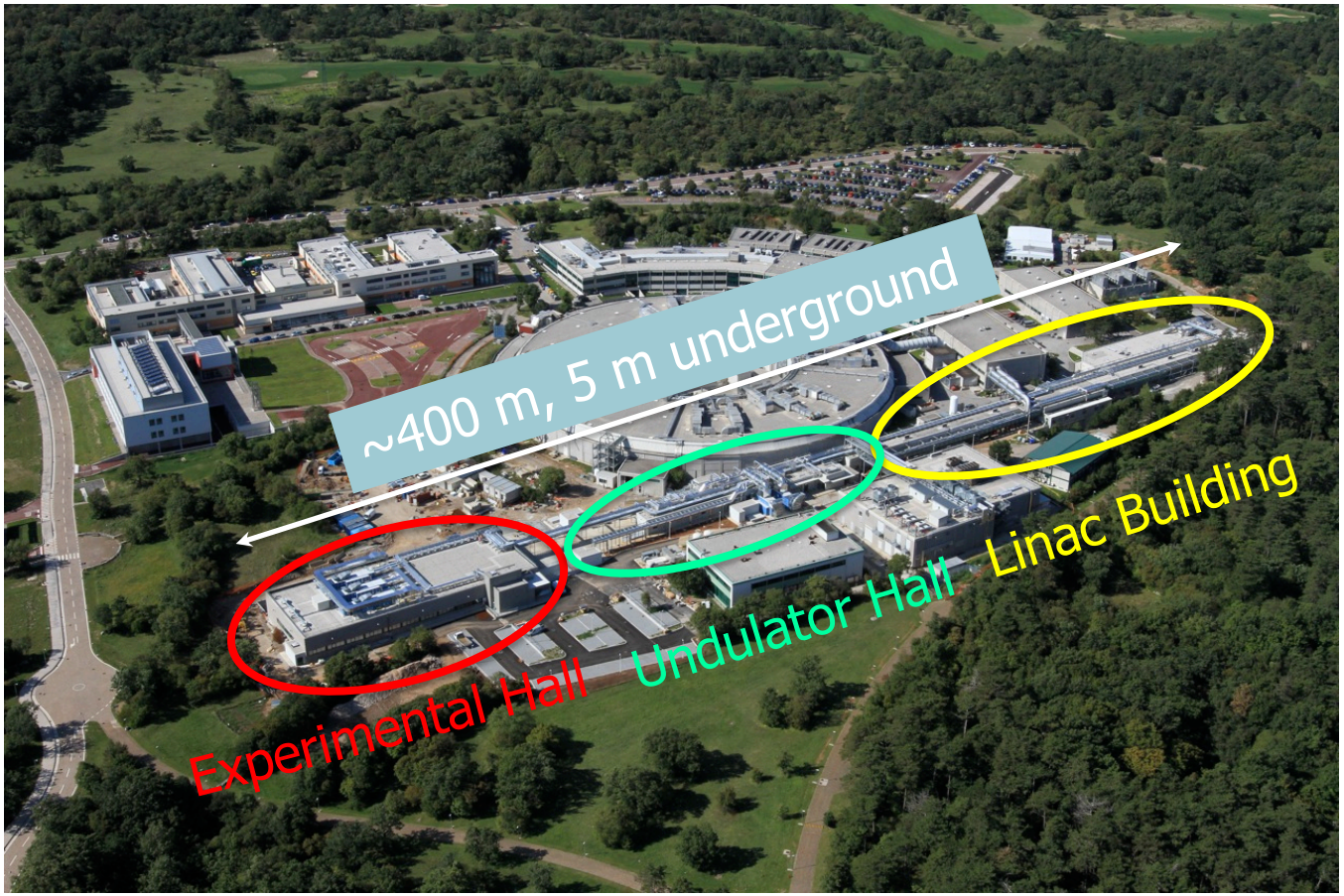
Pre-clinical and clinical phase contrast imaging (2D and 3D)
- ✓Cell tracking techniques
- ✓ Study of novel contrasts agents
- ✓Morphological and functional imaging
- ✓ Dynamic CT imaging (4D)
- ✓In-vivo imaging on small animal models
- ✓ **Breast imaging**

Clinical images with SR have:
- *higher specificity,*
- *better agreement with the golden standard (biopsy),*
- *improved image quality,*
- *strong reduction of X-ray doses.*

Elettra Sincrotrone Trieste

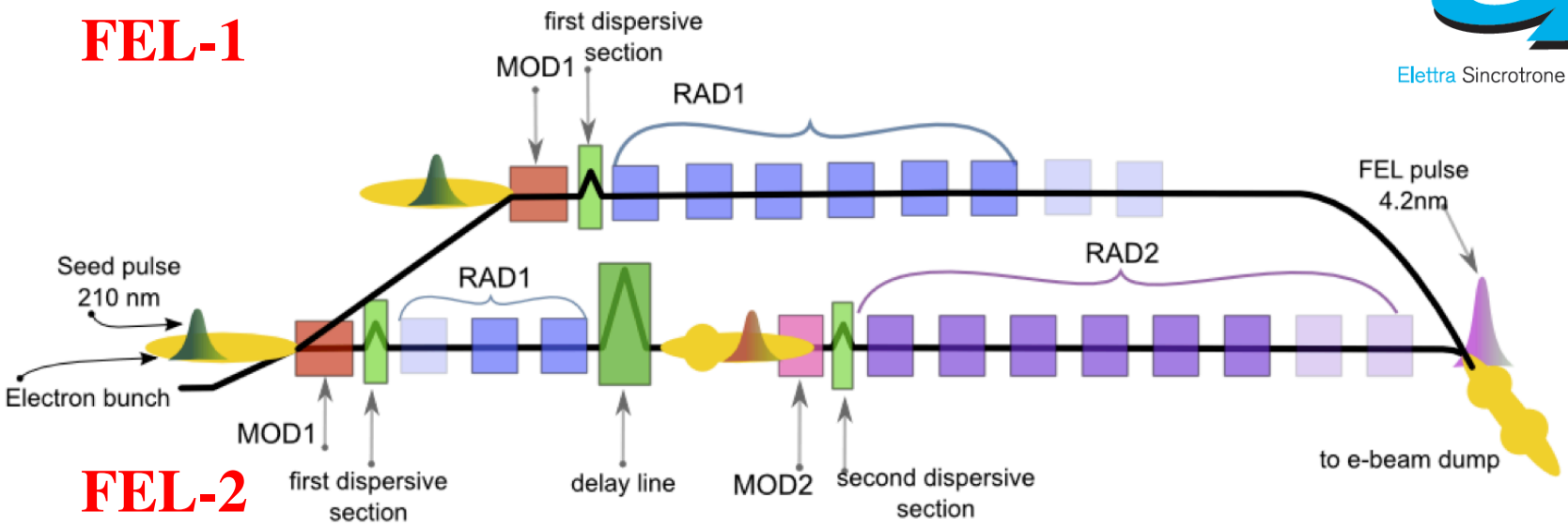
FERMI@Elettra

Overall length of underground part (5 m below ground): ~ 400 m
Three main parts: Linac & Klystron Hall; Undulator Hall; Experimental Hall

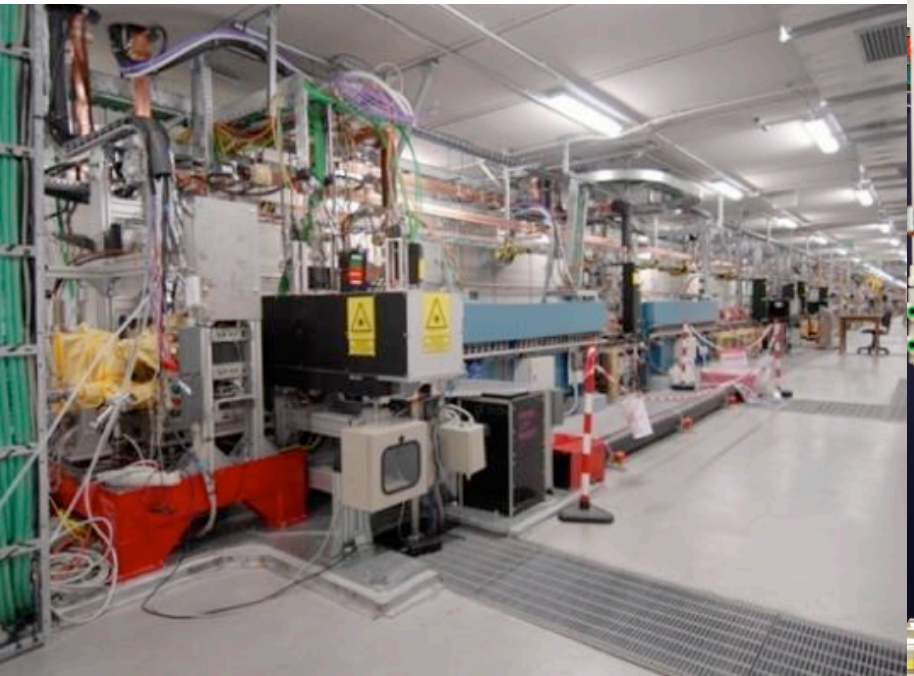


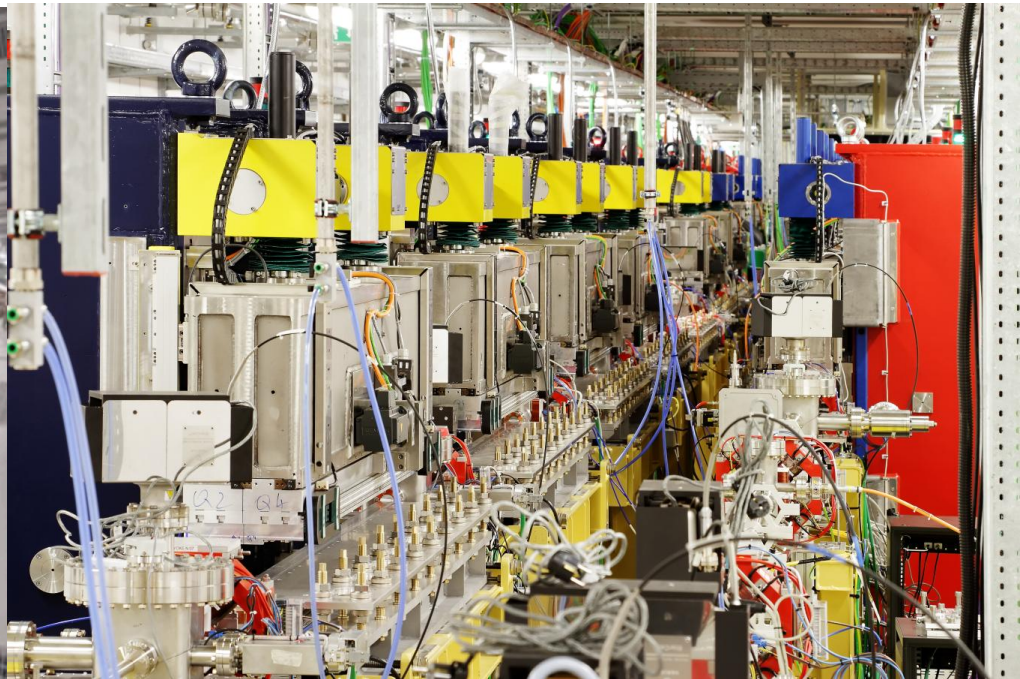
Elettra Sincrotrone Trieste

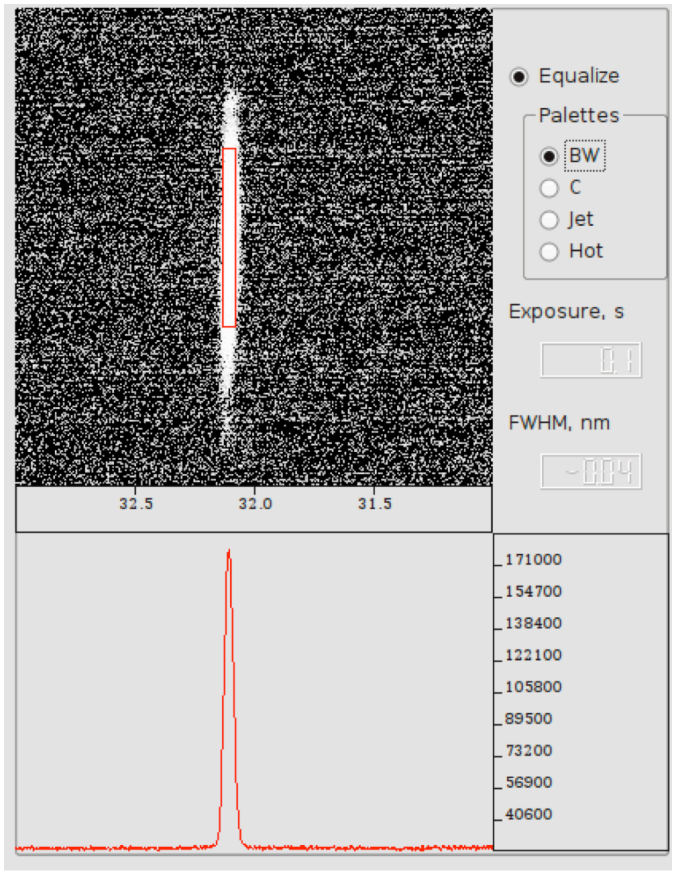
FEL-1



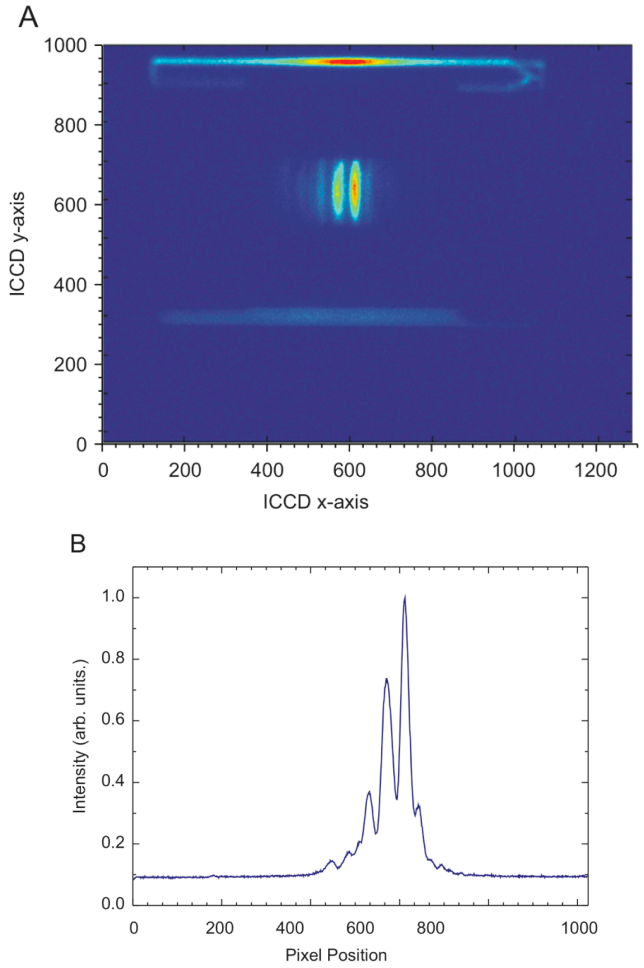
FEL-2



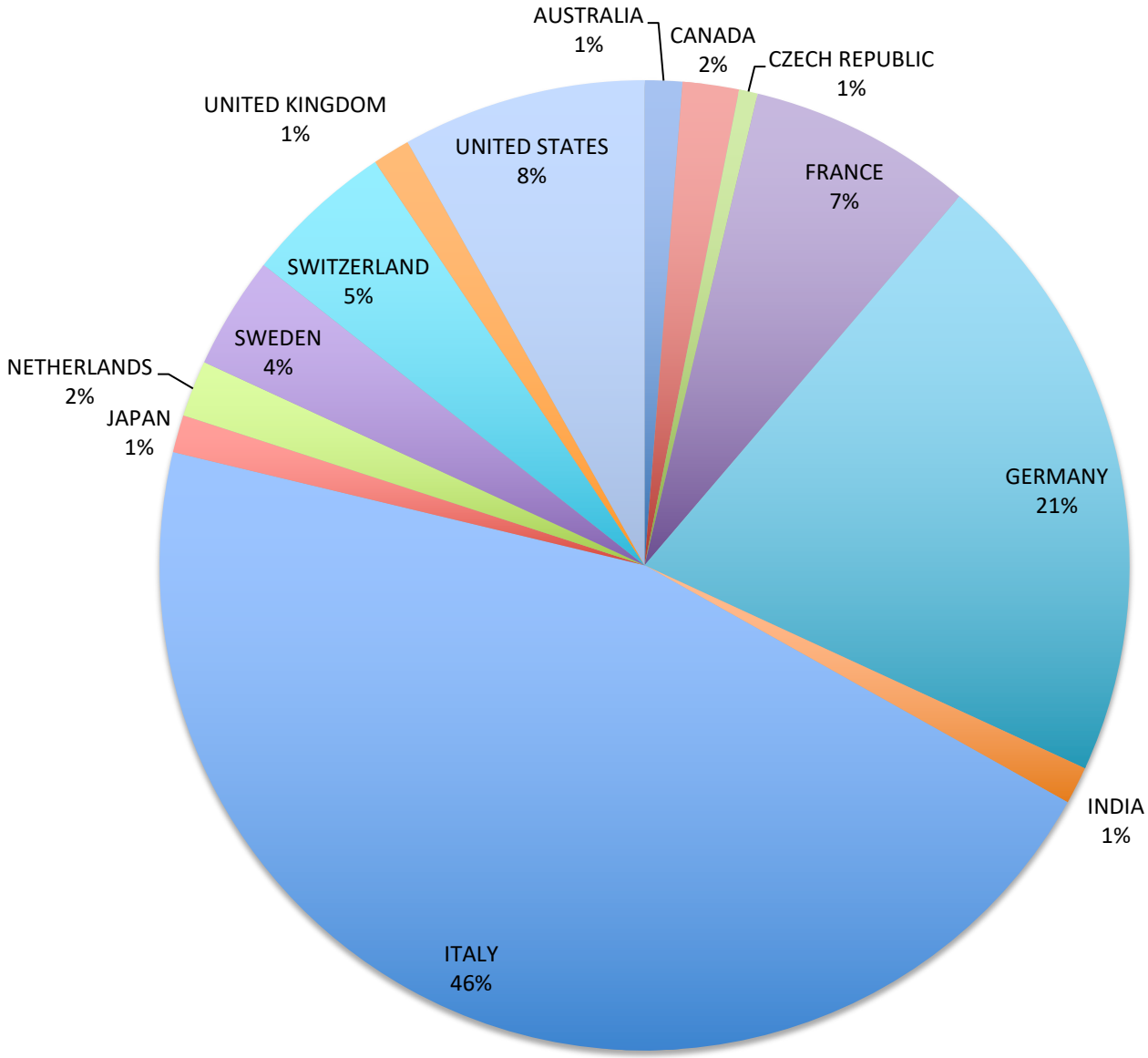




26.4 nm



Spectral lines as measured at FERMI@Elettra (left panel) and at the FLASH SASE facility in Hamburg, Germany (right panel).



Elettra Sincrotrone Trieste

118 PROPOSALS RECEIVED IN 2019

Elettra Sincrotrone Trieste

A few clients of analitical services

Elettra Sincrotrone Trieste

Commercial Use of Beamlines and Laboratories in 2011- 2019 (as % of industrial income)

39% Structural characterization of biomolecules, nanostructured matl's

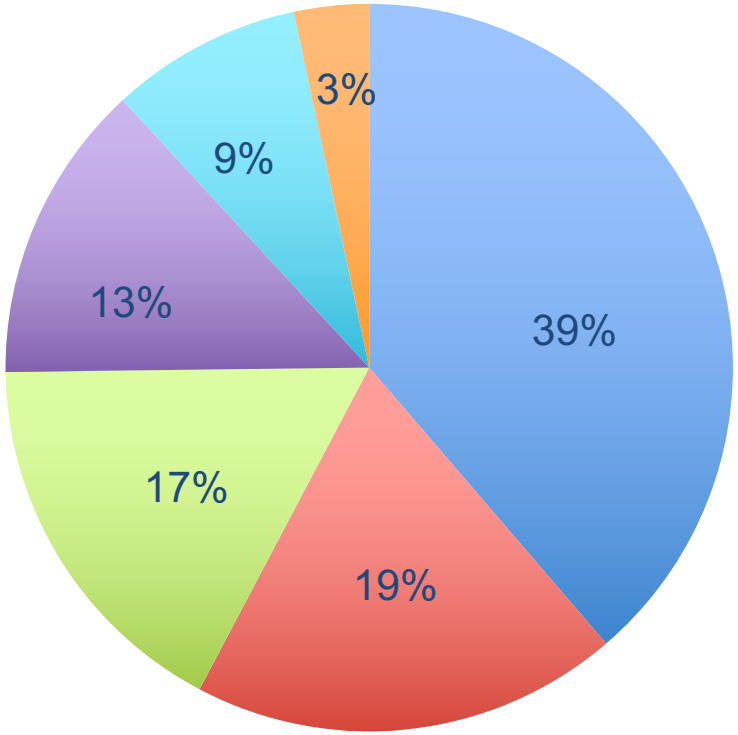
19% Chemical characterization of organic materials

17% Protein expression and/or biotechnology applications

13% Coatings, thin film and surface characterization

9% X-ray tomography

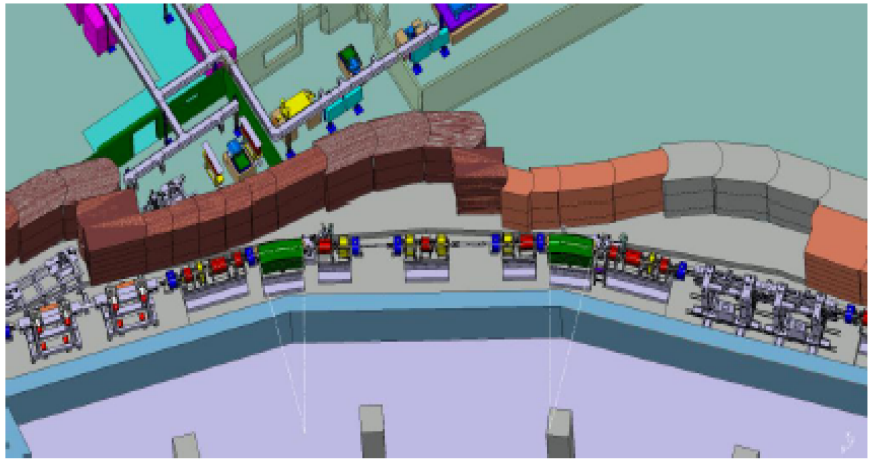
3% Other (e.g., gas analyisis, optics metrology, microfabrication



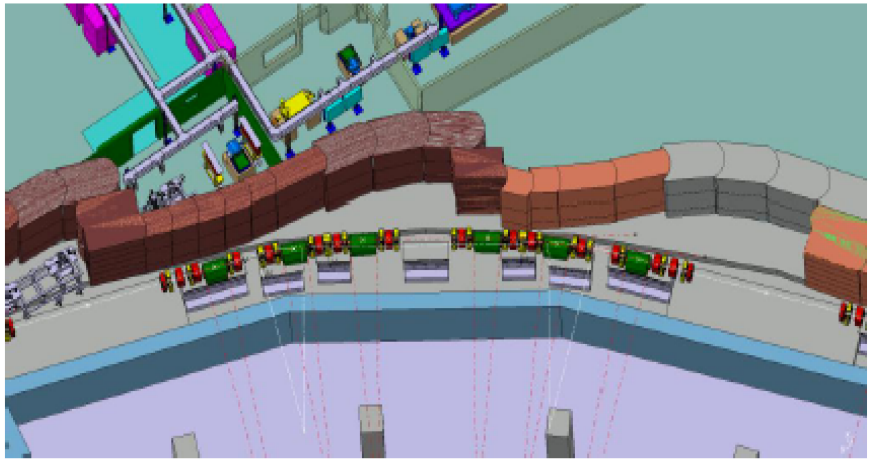
Elettra
Sincrotrone
Trieste

Elettra 2.0 Lattice
as in the CDR

Best configuration, satisfying all requirements, including the free space for IDs is based on **Symmetric Six-Bend** achromat (S6BA or Elettra like). A conceptual design already exists



Elettra

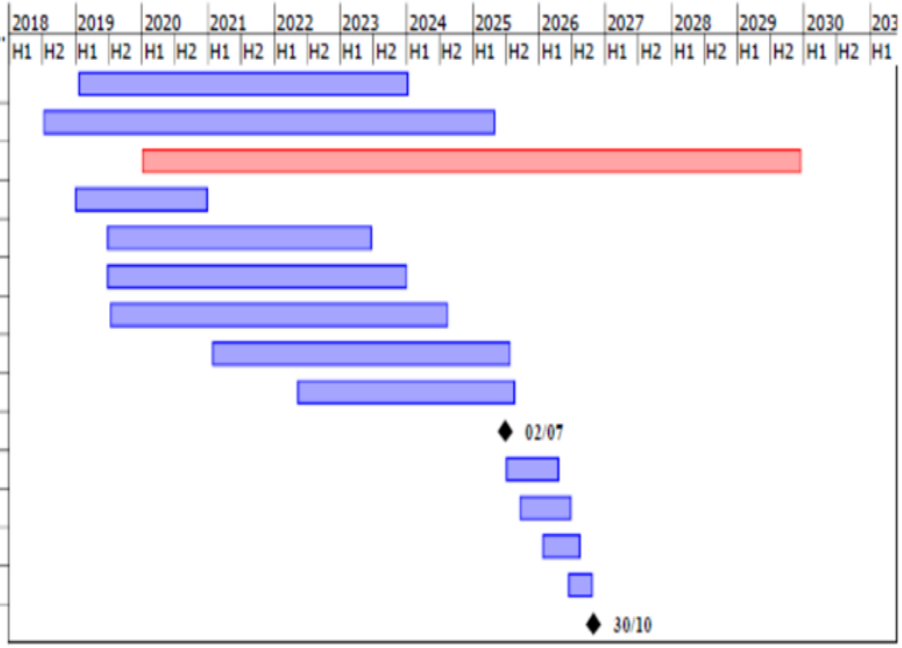


Elettra 2.0

Elettra 2.0:

- Elettra 2.0 will be able to operate at both 2.0 and 2.4 GeV to follow the evolution of the user community, but the long-term operating energy will be 2.4 GeV
- Maximise emittance reduction for microprobe applications
- Maximise coherence increase for ptychography, CDI
- New μXRD, μXRF, HB-SAXS, CDI beamlines
- Implement the most effective methods for time-resolved measurements on the picosecond scale
- Microspot in-vacuum undulator beamlines will go on the dispersionless, longer straight sections
- 6T superbends for selected hard-X-rays applications
- New partners for new beamlines (e.g., XAFS2, CDI, etc.)

	Name	Duration	Start	Finish
1	Infrastructures upgrade and spaces	1,300 days?	23/01/19 08:00	16/01/24 17:00
2	Some Accelerator systems upgrade	1,780.5 days?	13/07/18 13:00	09/05/25 17:00
3	Beam lines upgrade	2,600.5 days?	06/01/20 08:00	24/12/29 13:00
4	Technical Design study	524 days?	01/01/19 08:00	01/01/21 17:00
5	Engineering Design	1,040.5 days?	01/07/19 08:00	26/06/23 13:00
6	Prototyping	1,184 days?	01/07/19 08:00	11/01/24 17:00
7	Calls for tender	1,331 days?	18/07/19 08:00	22/08/24 17:00
8	Manufactoring construction and testing	1,176 days?	27/01/21 08:00	30/07/25 17:00
9	Preparations and assembly	864 days?	09/05/22 08:00	28/08/25 17:00
10	End of user mode	1 day?	02/07/25 08:00	02/07/25 17:00
11	Ringdecomissioning	215 days?	03/07/25 08:00	29/04/26 17:00
12	Installations	203 days?	21/09/25 08:00	01/07/26 17:00
13	Accelerator system tests/commissioning	153 days?	23/01/26 08:00	25/08/26 17:00
14	Beamlinescommissioning	97 days?	15/06/26 08:00	27/10/26 17:00
15	Elettra 2.0 user mode	1 day?	30/10/26 08:00	30/10/26 17:00



Cifre in milioni di euro, IVA compresa

Sorgente	**59,0 €**
Linee di Luce	**70,0 €**
Infrastrutture	**26,0 €**
Personale	**10,0 €**
Riserva	**5,0 €**
Elettra 2.0	**170,0 €**

Summarising a few suggestions:

- Select a type of legal entity that will allow some measure of flexible operation and administration
- A solid primary national sponsor/host will be needed
- Pursue an international approach and involve institutions from neighboring countries capable of providing collaborations (a critical mass is needed, not just funds)
- Looking for scientific "niche markets" will help characterizing what your have to offer
- Innovative funding instruments should be explored (development loans)
- Involve companies as early as possible
- International organizations (UNESCO, IAEA, etc.) are often bureaucratic, but contain "true believers" who can help

How Did We Get Elettra, FERMI and Elettra 2.0

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