



Elettra Sincrotrone Trieste

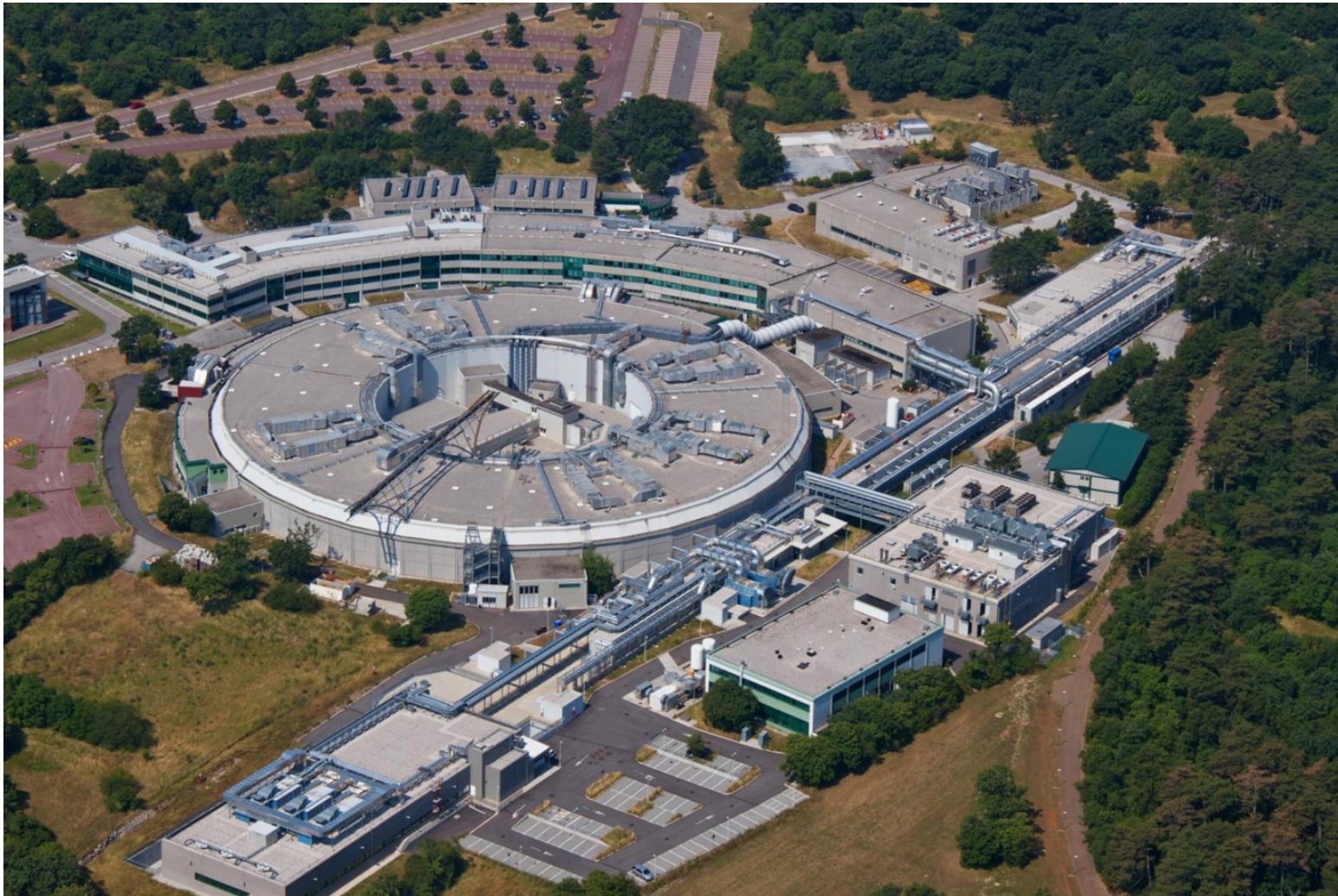
The Elettra Laboratory and its international mission

G. Paolucci
Chief Scientific Officer
Elettra-Sincrotrone Trieste

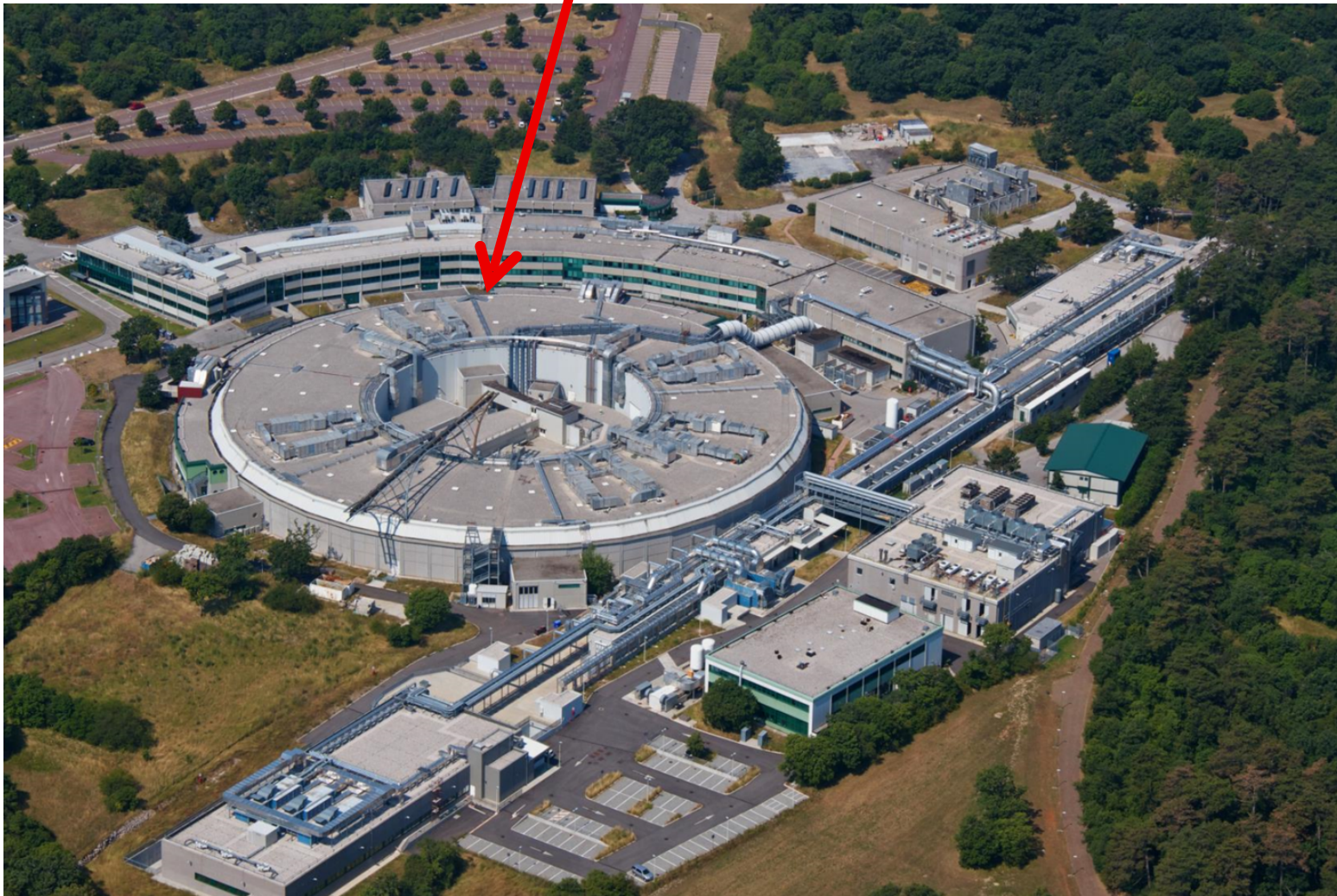


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Sincrotrone
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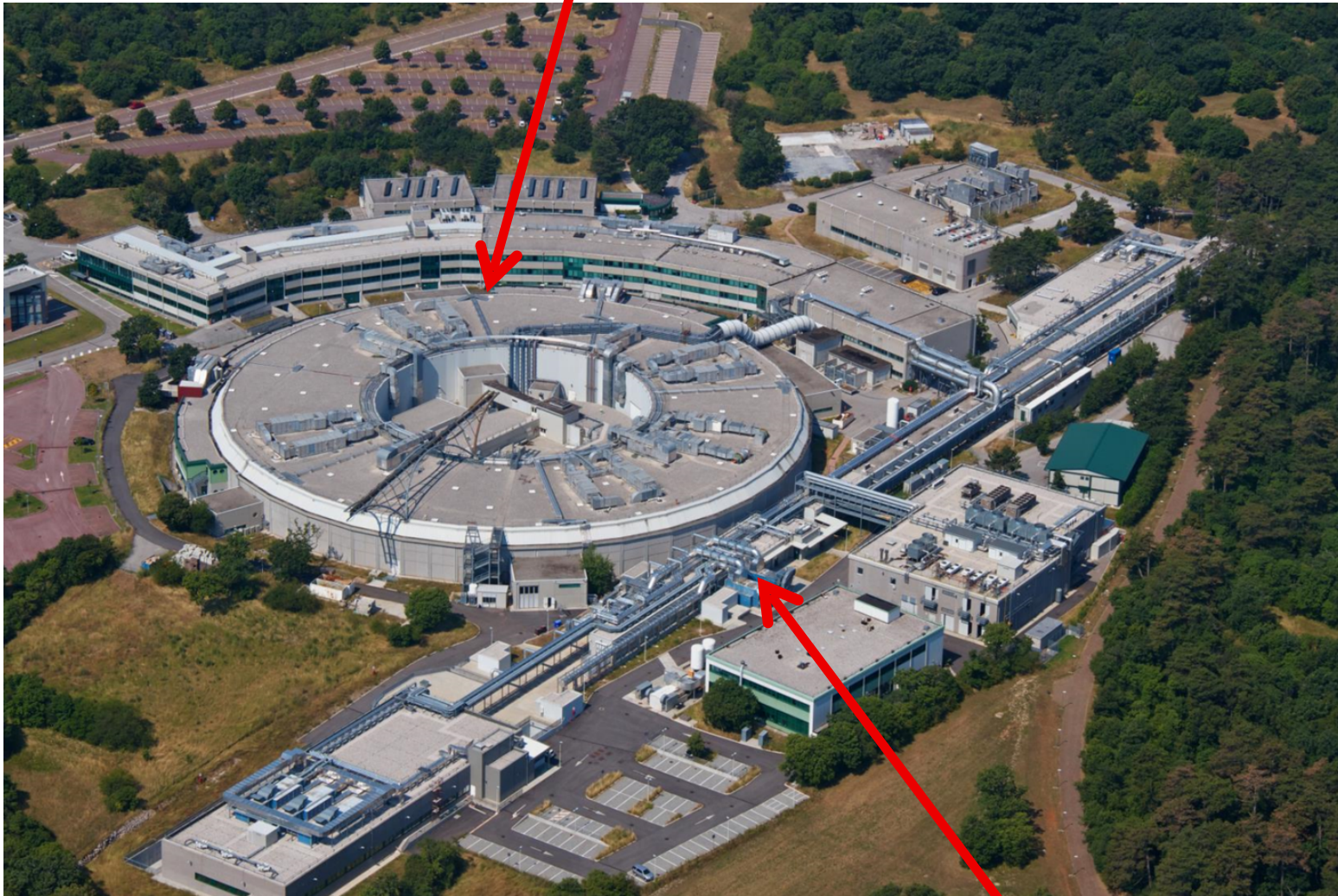
Elettra and FERMI



Elettra 2.0-2.4 GeV 3rd generation Synchrotron Radiation Facility



Elettra 2.0-2.4 GeV 3rd generation Synchrotron Radiation Facility



FERMI 1.5 GeV seeded Free Electron Laser Facility



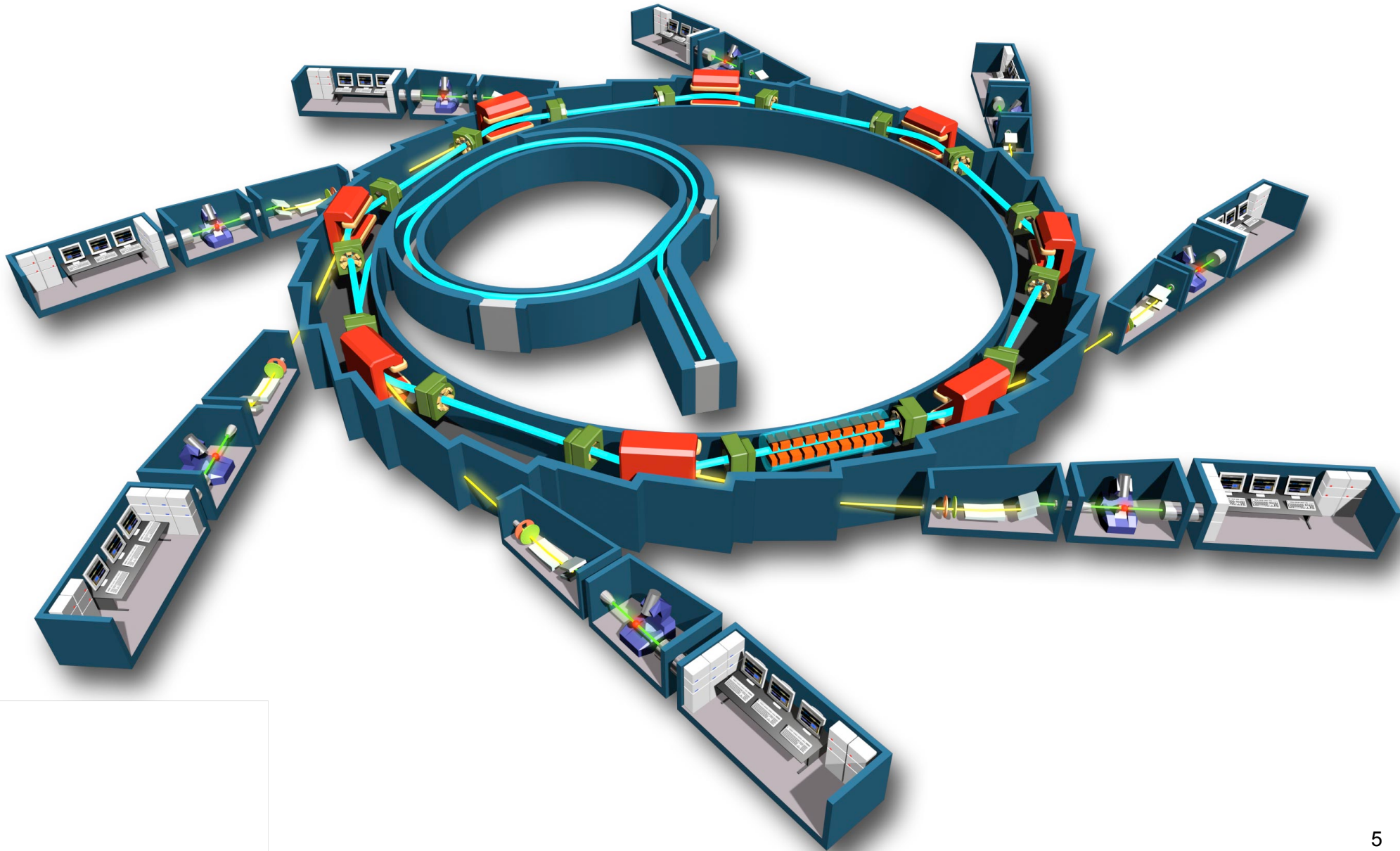
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Elettra: 28 beamlines built and run in partnership with several international institutions

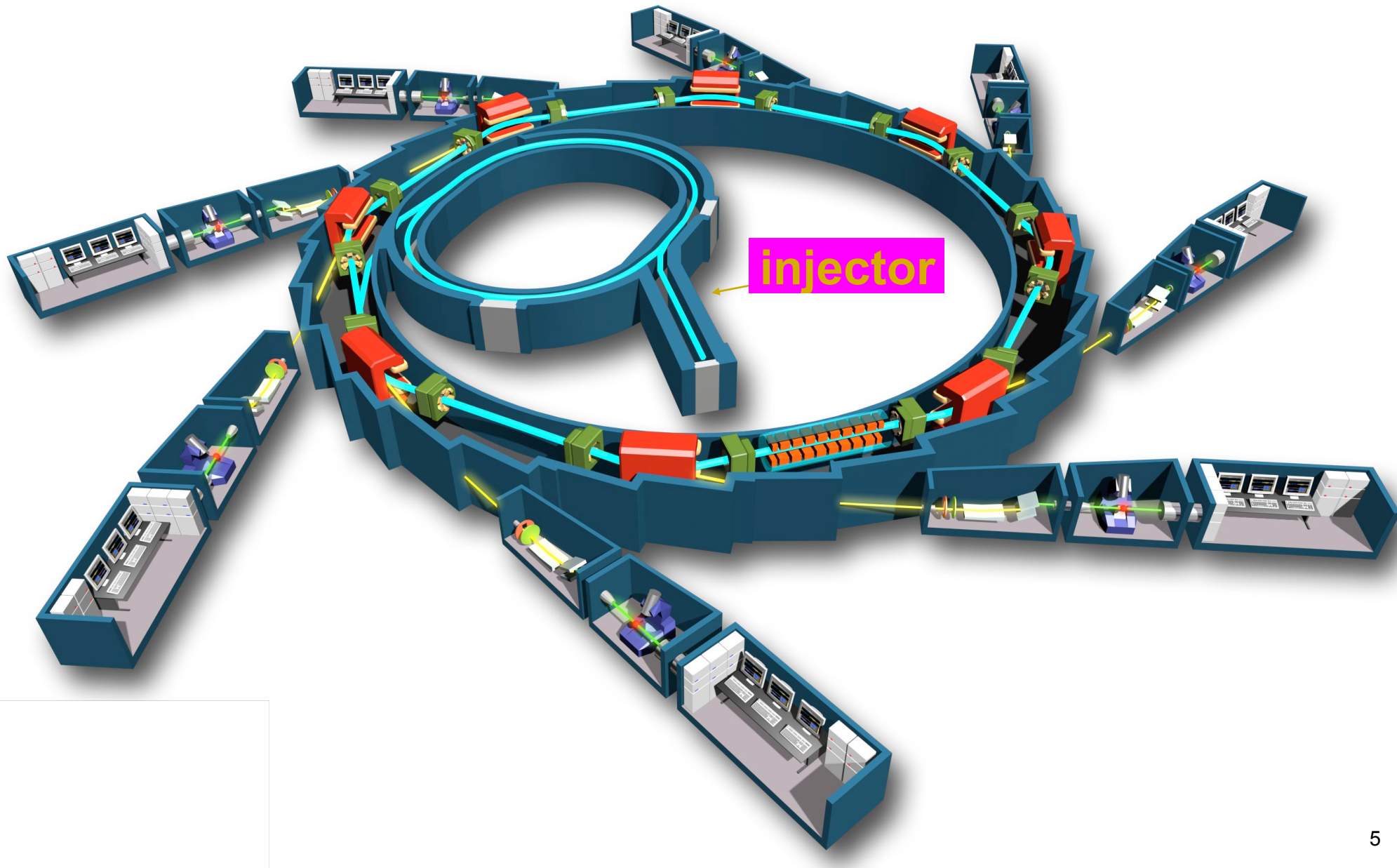


A synchrotron light source

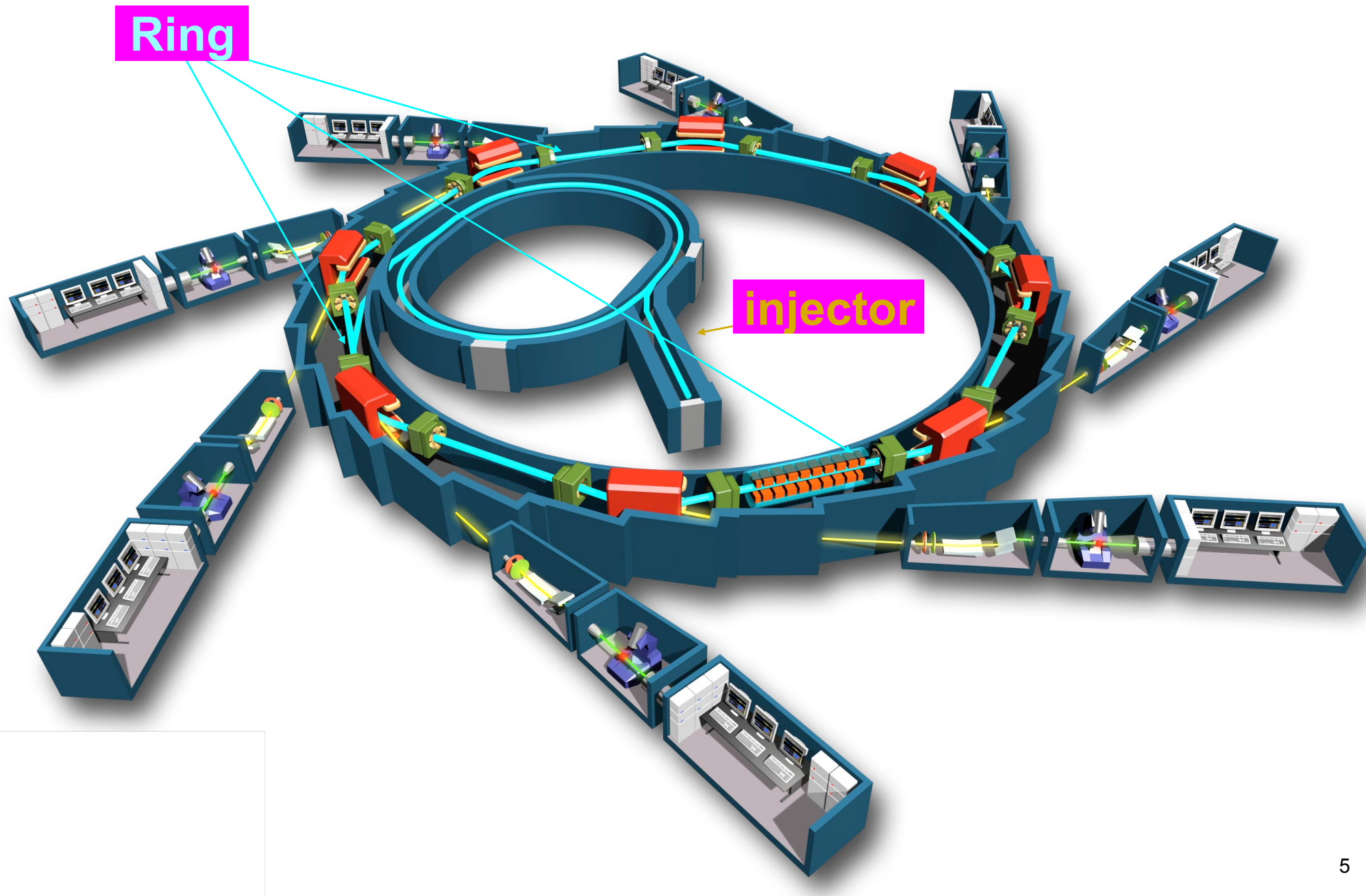
A synchrotron light source



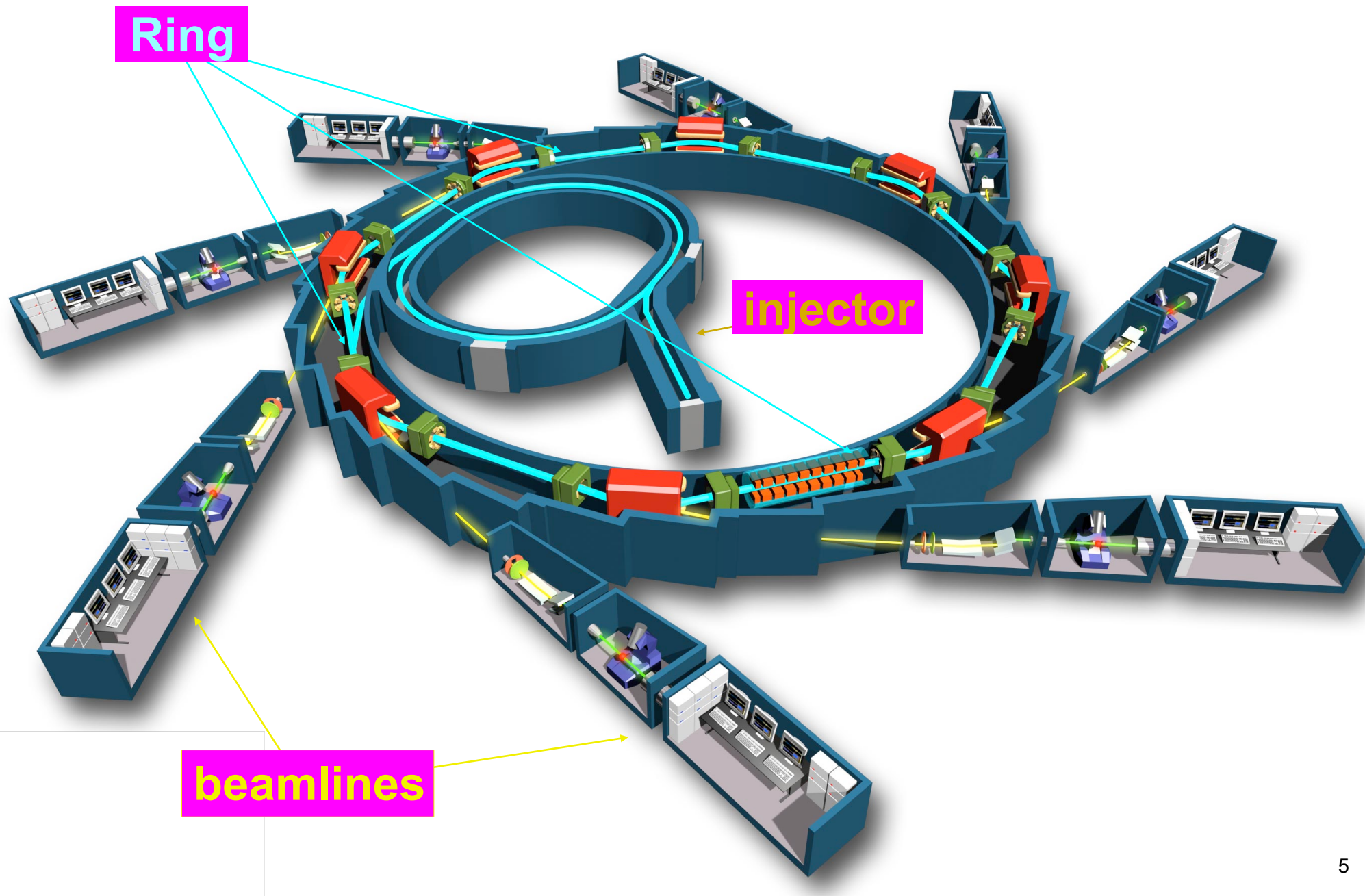
A synchrotron light source



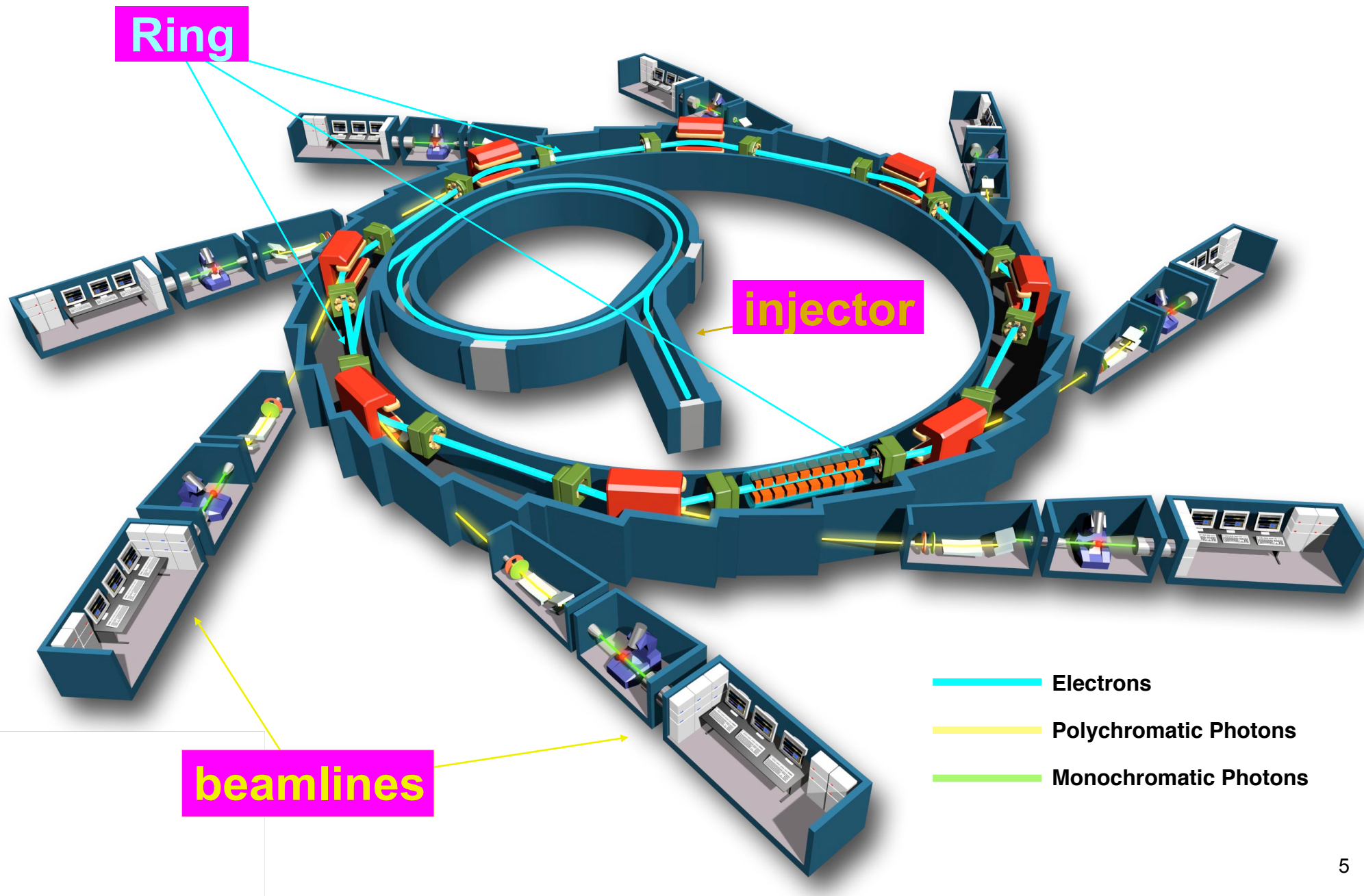
A synchrotron light source



A synchrotron light source

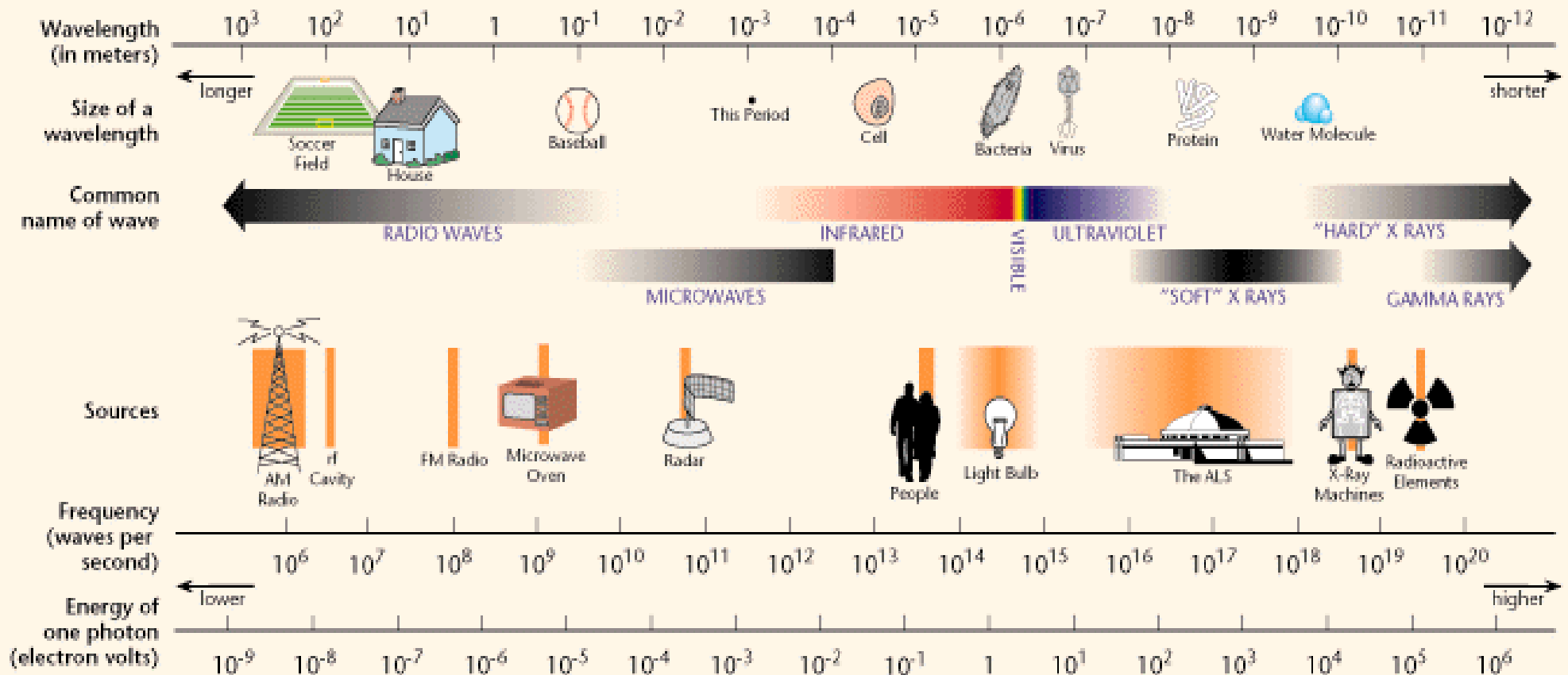


A synchrotron light source



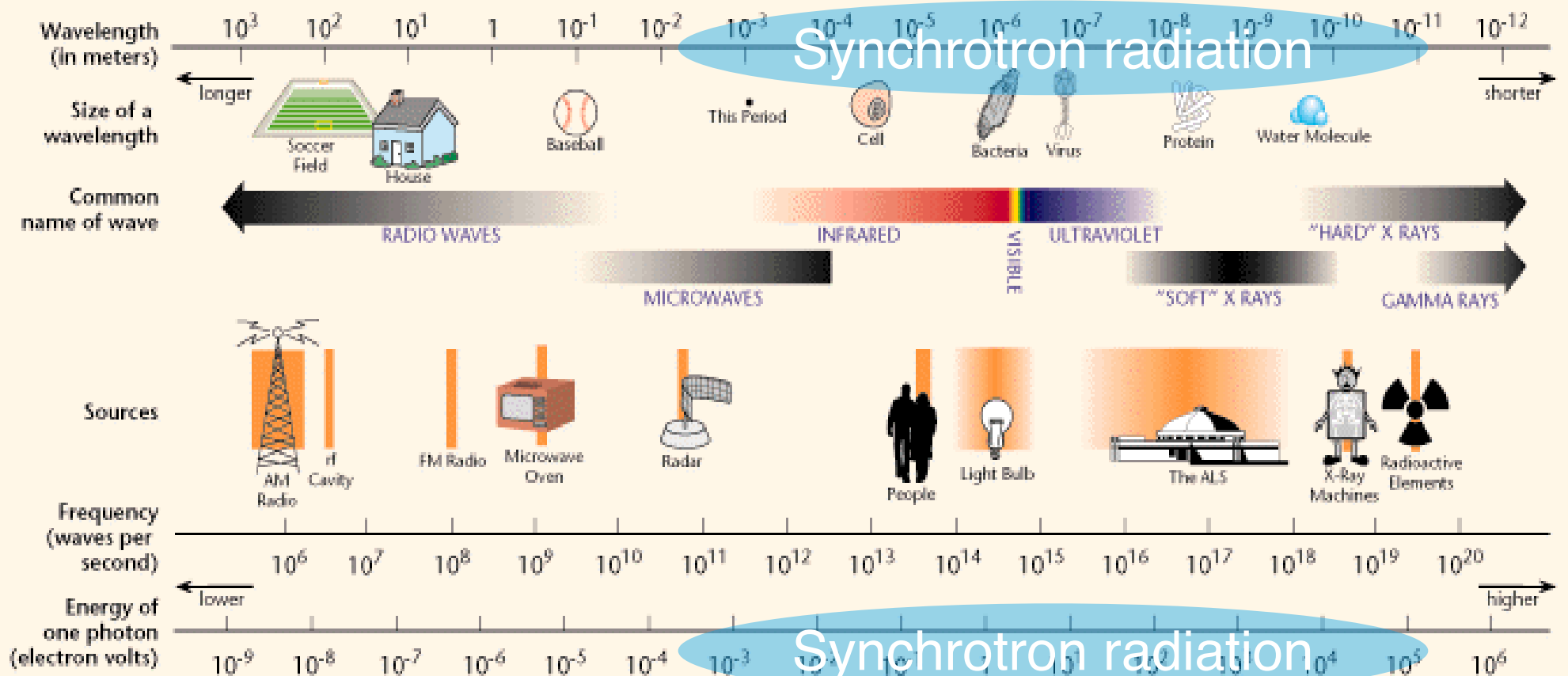
Synchrotron Radiation

THE ELECTROMAGNETIC SPECTRUM



Synchrotron Radiation

THE ELECTROMAGNETIC SPECTRUM

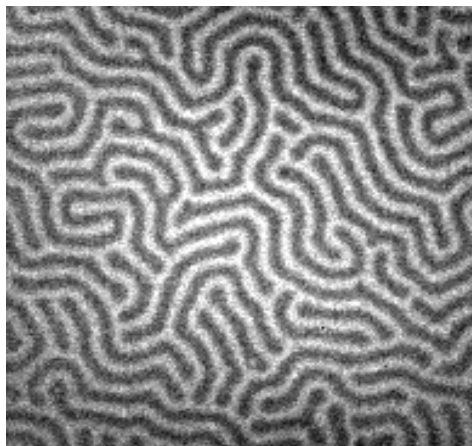




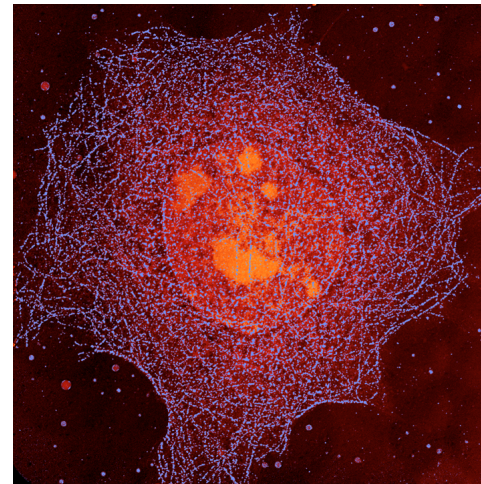
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Synchrotron Radiation

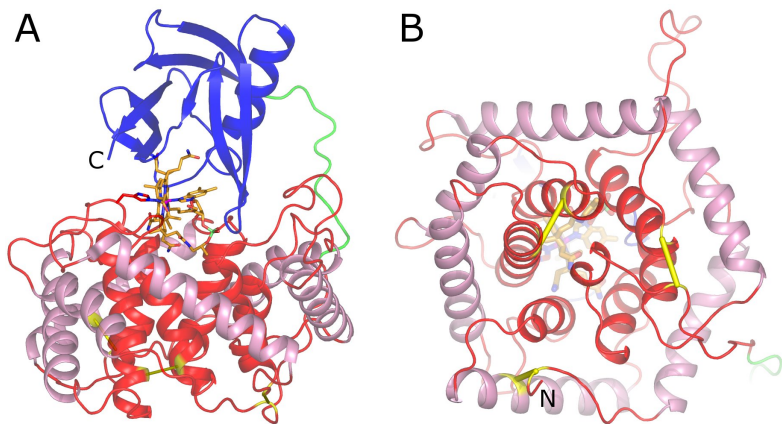
FeGd
Multilayer



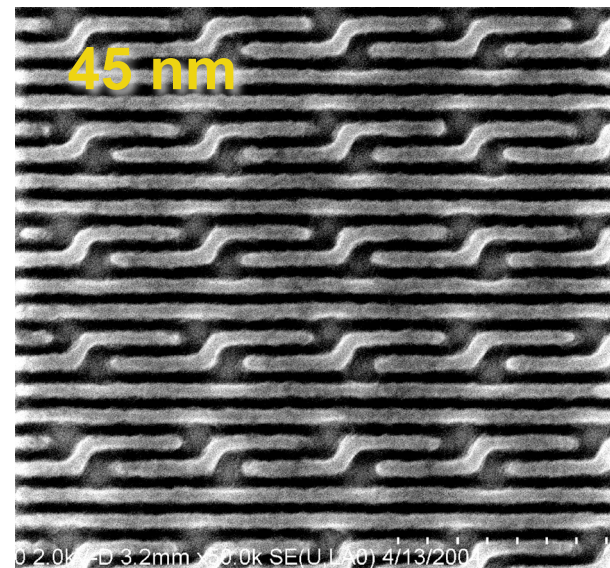
$\hbar\omega = 707.5 \text{ eV}$
Fe L_3 -edge

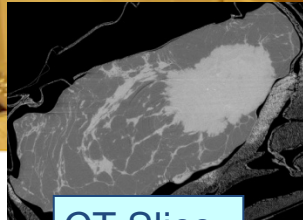
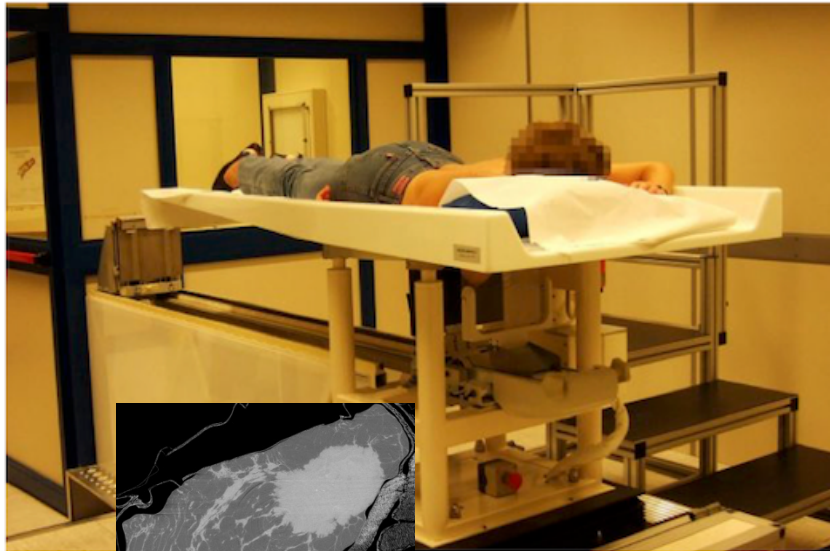


Microtubules in a mouse epithelial cell



Overall structure of transcobalamin



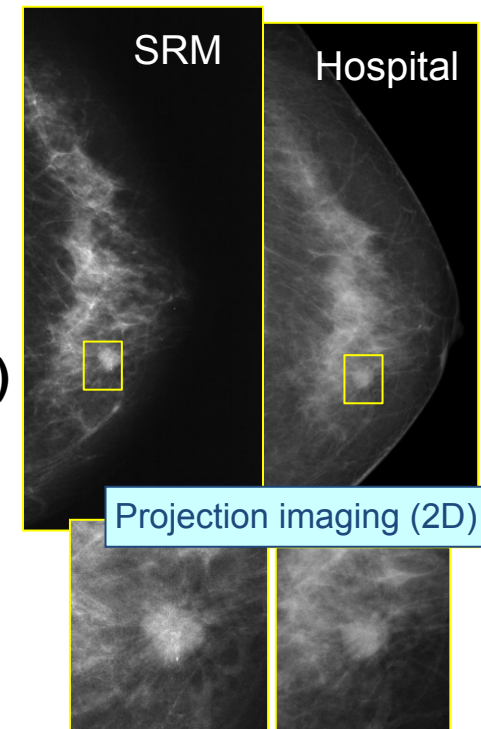


CT Slice

Mammography

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

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



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**

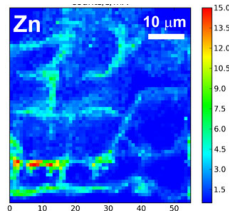
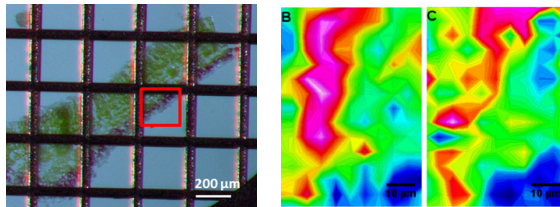
Clinical images with SR have:

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

Nanotoxicology: localization of toxic metals in leaves

Cd/Zn accumulation in *Noccaea praecox*

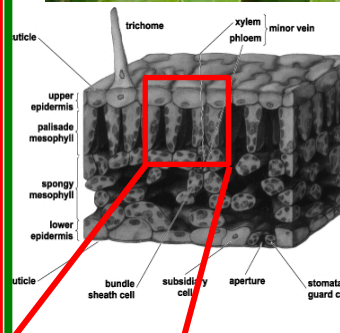
FTIR Microscopy analysis



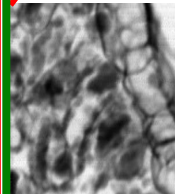
Spatially resolved characterization of leaves of Cd/Zn hyperaccumulating *Noccaea praecox* (SISSI beamline)

Aluminum localization in tea leaves

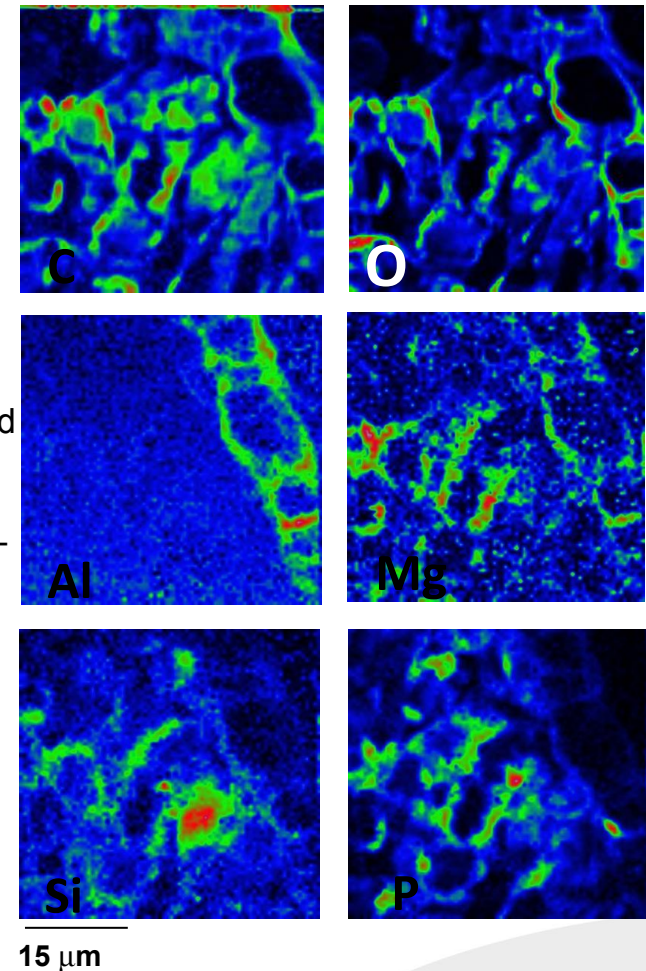
Cross-section of a leaf



Functionality and toxicity of Al in tea leaves analysed at sub-cellular level (TwinMic Beamline, XRF)



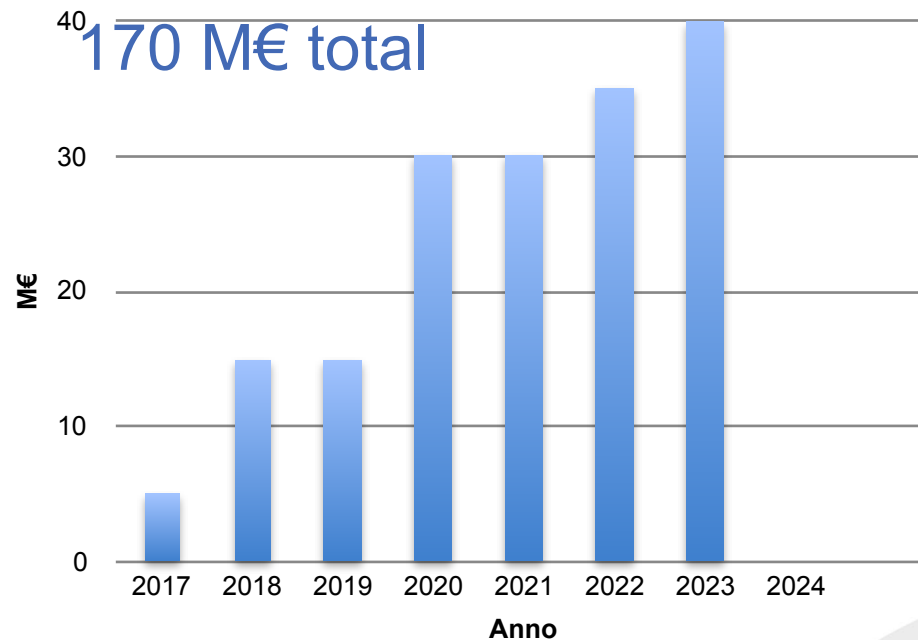
In young tea leaves the preferential accumulation of Al occurs at the end of the transpiration stream, in the epidermal cell walls



Elettra 2.0

- Upgrading Elettra toward the theoretical limit in brightness
- Diffraction-Limited Storage Rings through multibend technology
- A new six-bend achromat machine in the same building
- A two orders of magnitude increase in brightness
- Upgrade of all beamlines required to exploit the new machine

Funded by the Italian
Finance Ministry under
art. 1, paragraph 140
of law # 232/2016.



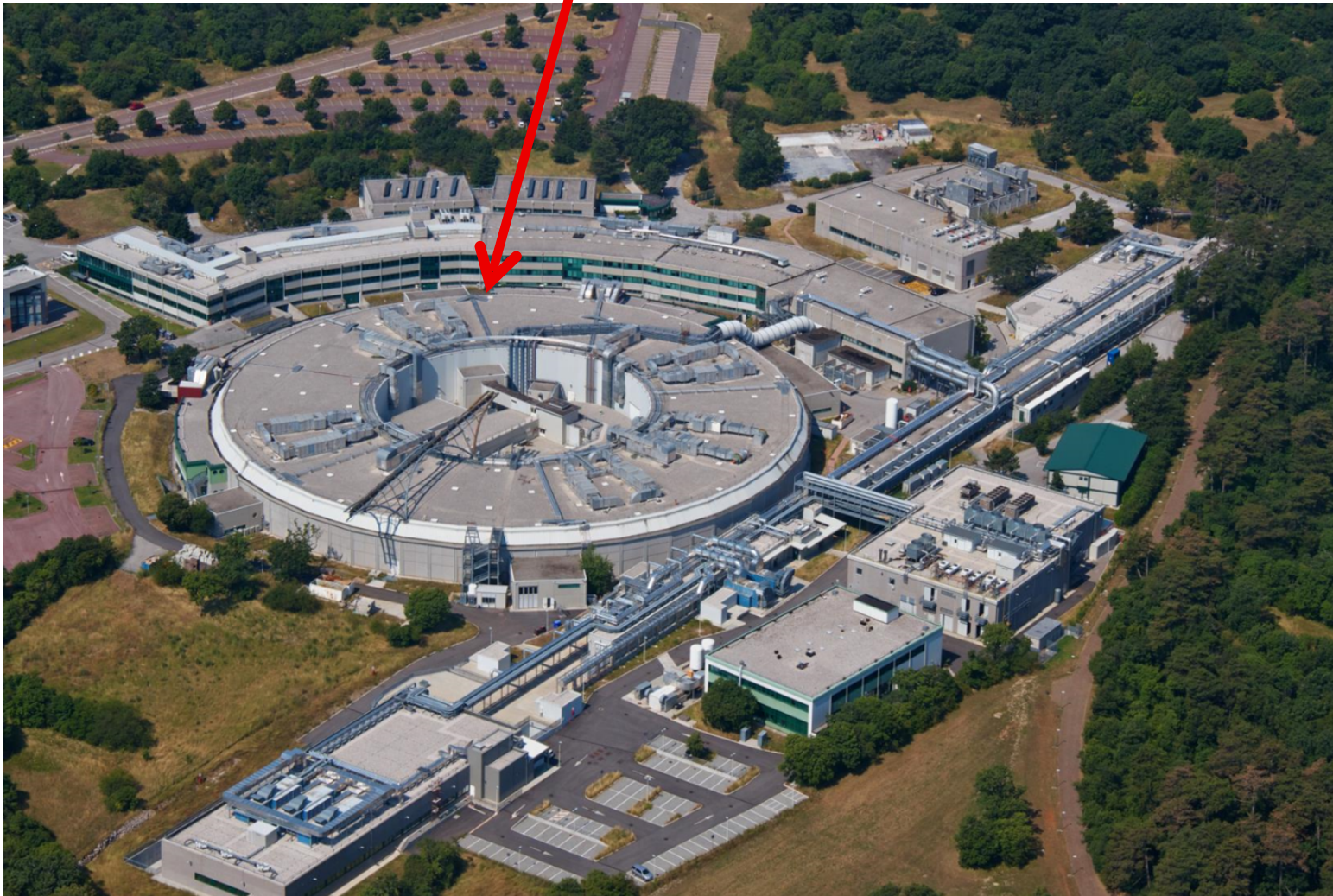


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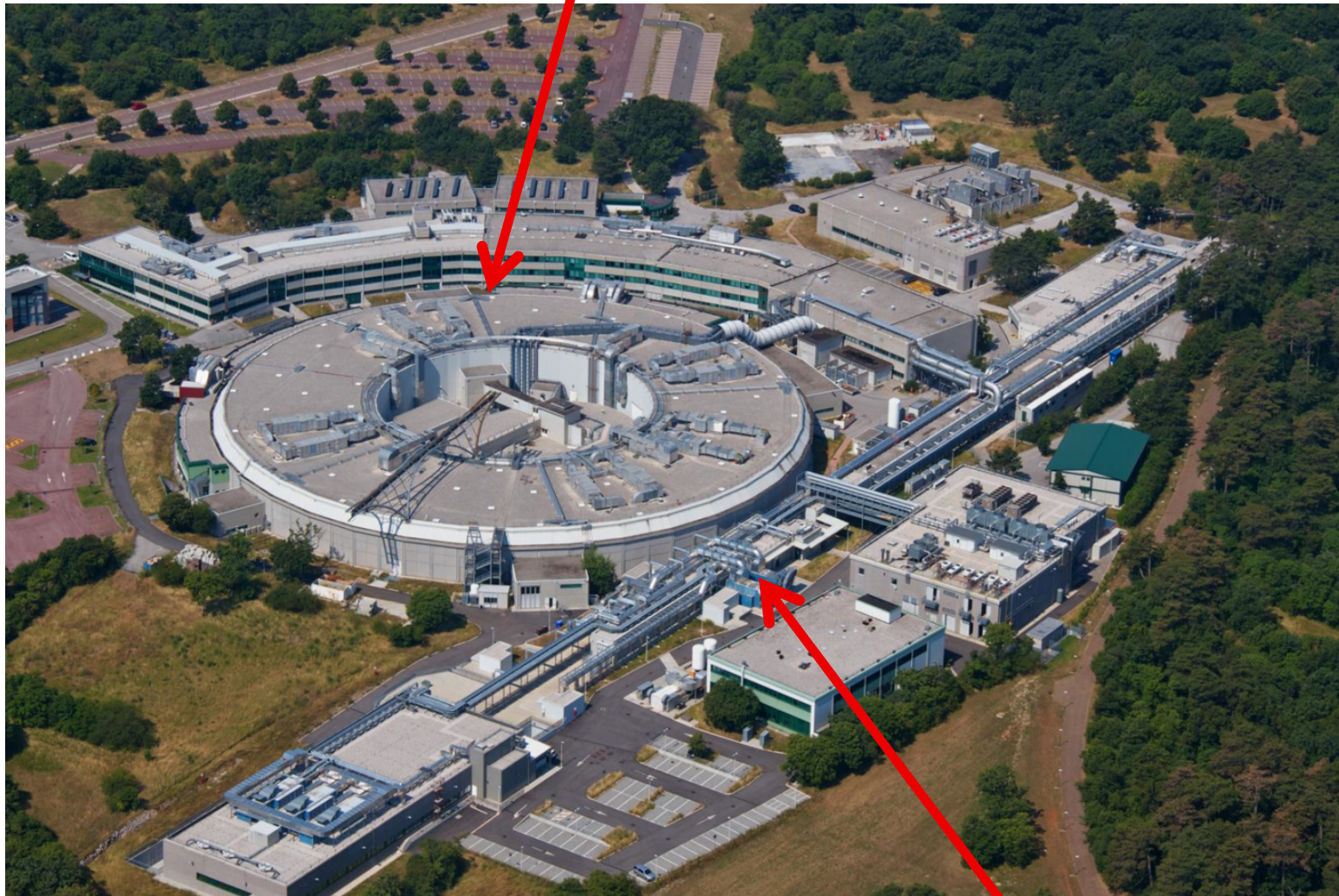
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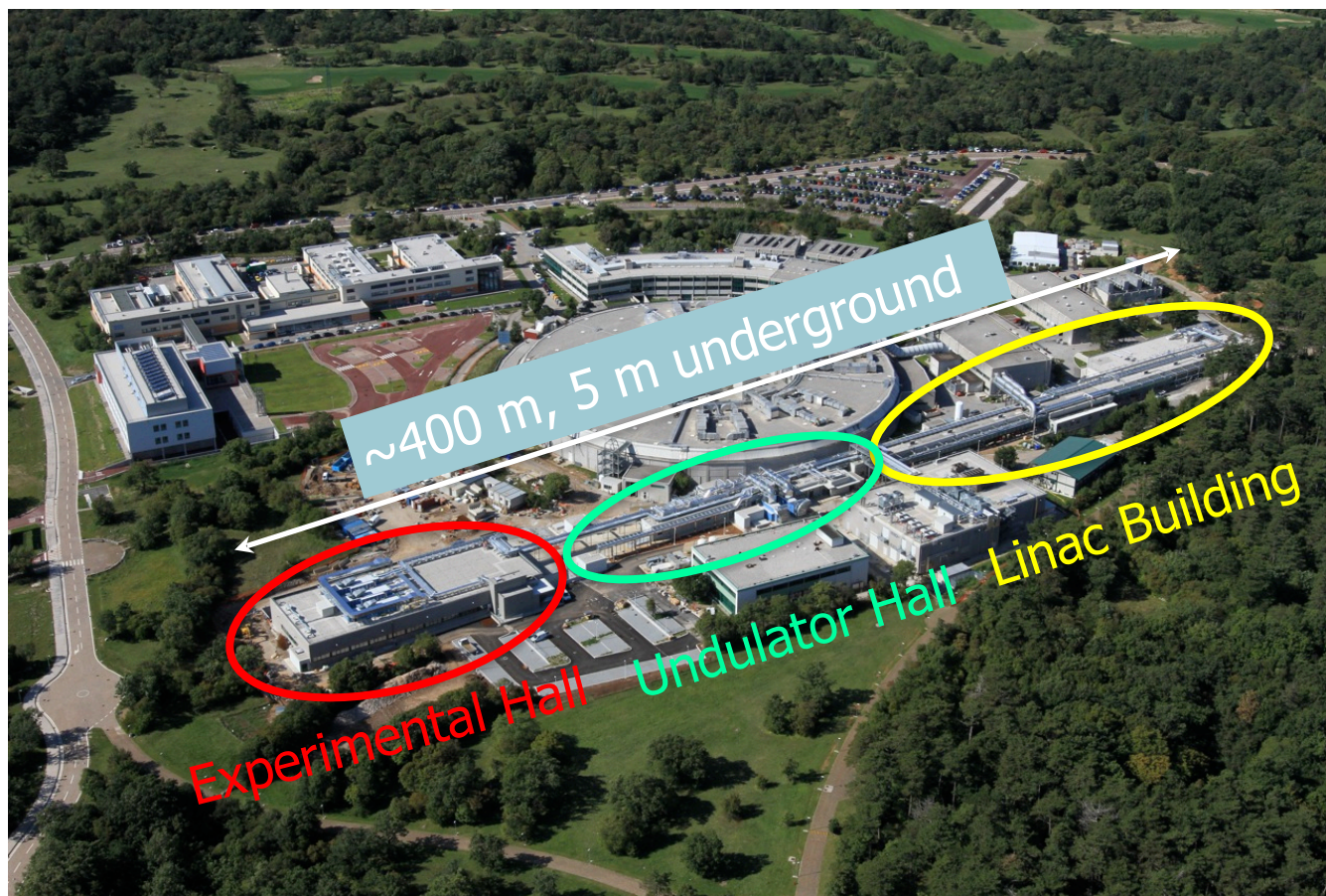


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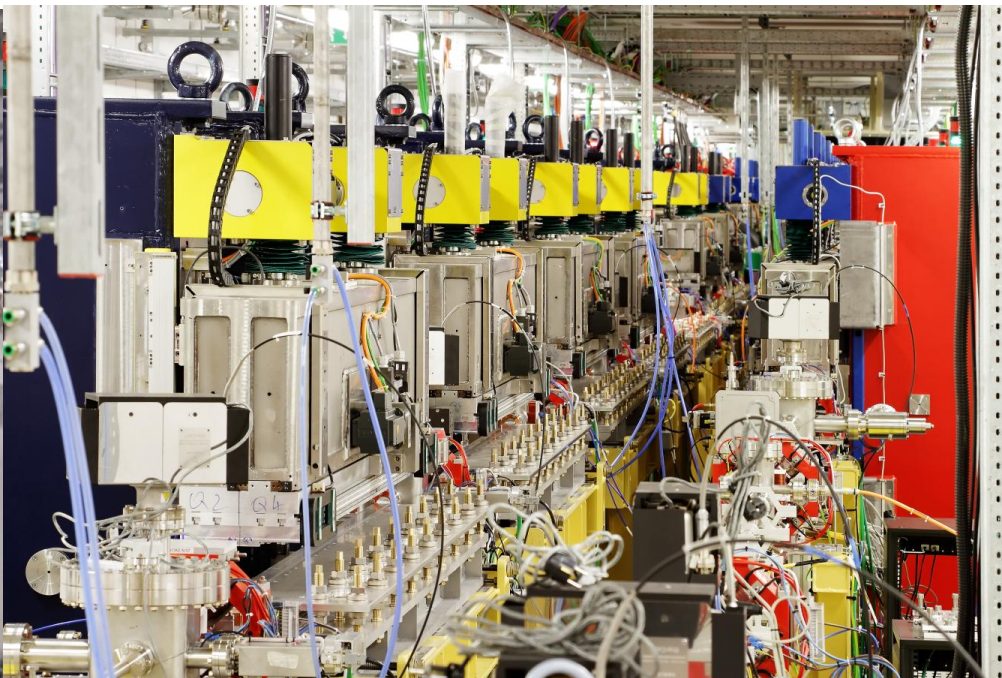
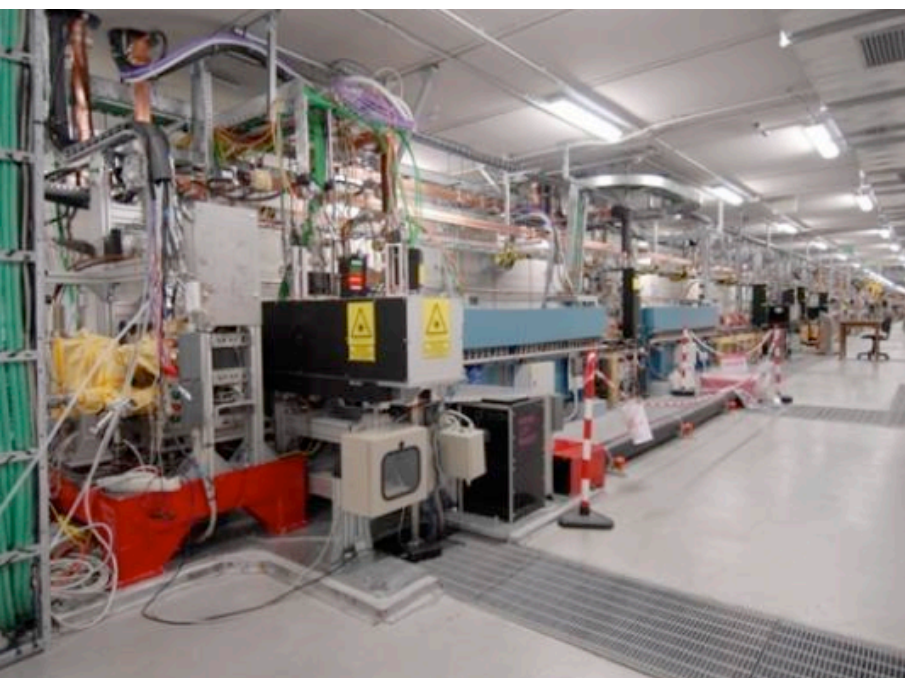
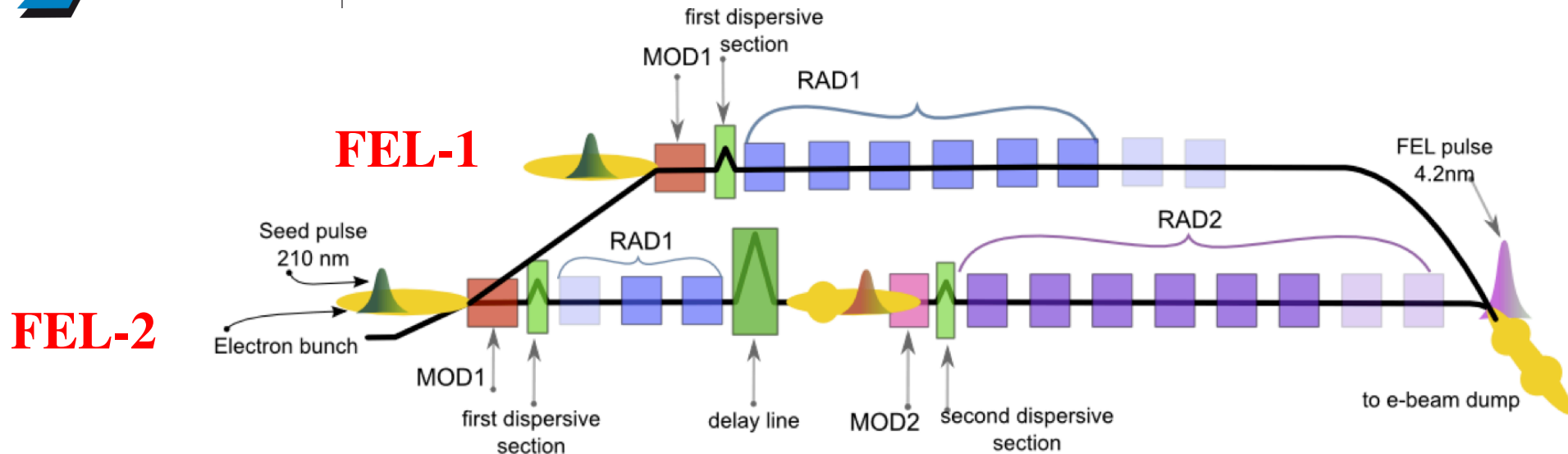
Overall length of underground part (5 m below ground): ~ 400 m
Three main parts: Linac & Klystron Hall; Undulator Hall; Experimental Hall



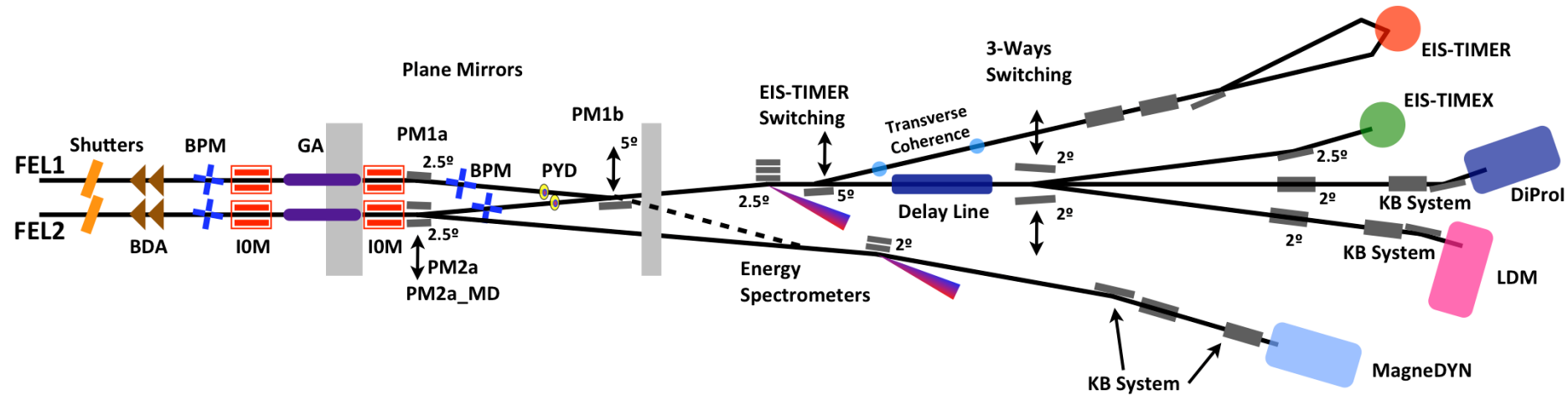


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FERMI@Elettra



FERMI@Elettra: End Stations & Laser Labs

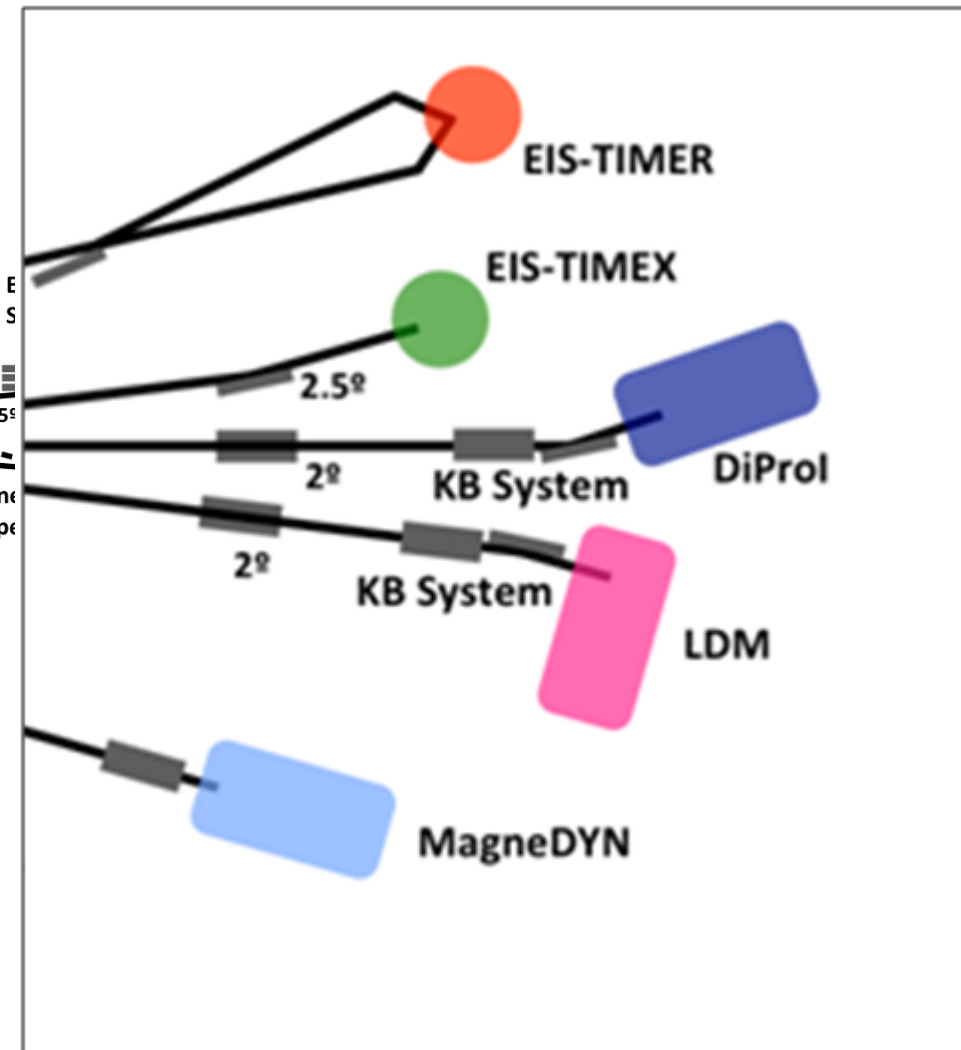
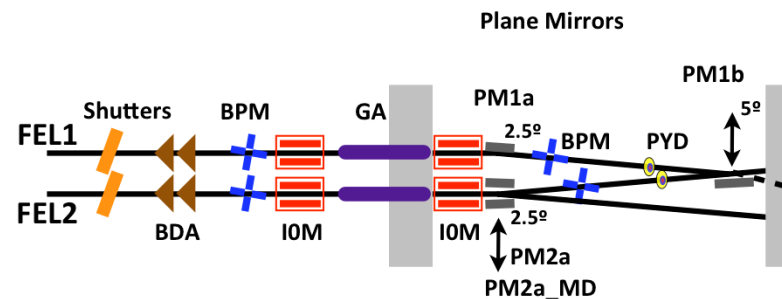


TeraFERMI (THz beamline)

T-ReX (table-top facility)

CITIUS (table-top facility)

FERMI@Elettra: End Stations & Laser Labs



TeraFERMI (THz beamline)

T-ReX (table-top facility)

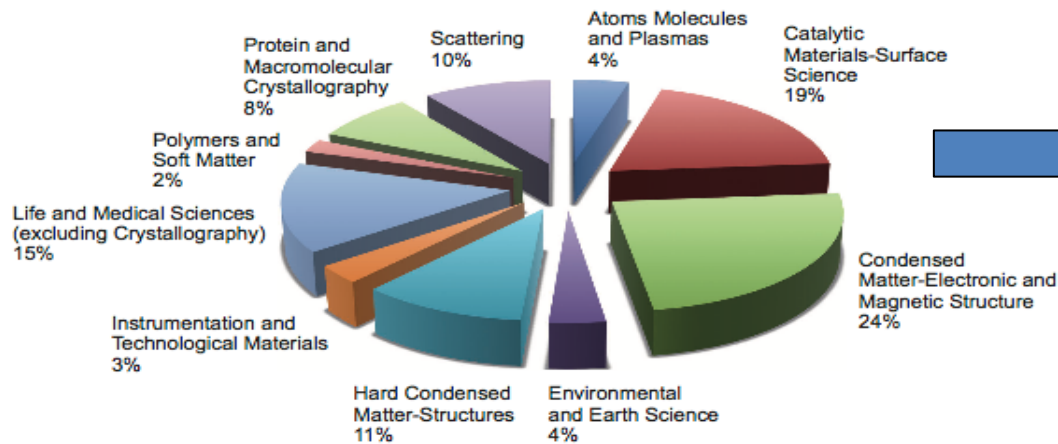
CITIUS (table-top facility)



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Proposals and areas of investigation

Elettra proposals allocated by research area



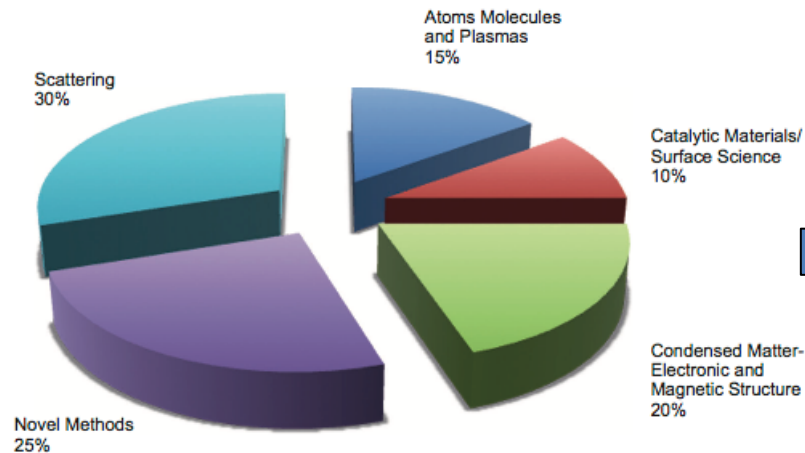
Novel materials, novel characterization and processing techniques, nano- and life sciences

>1200 proposals in 2017

from > 50 countries

438 ISI publications

FERMI proposals allocated by research area



Non equilibrium states, new phases of matter, new phase transitions

Thank you!



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