



novel SuperConductors and Synchrotron Radiation: state of the art and perspectives

Adriatico Guesthouse, Trieste, Italy / 10-11 December 2014



Elettra Sincrotrone Trieste



A. Franciosi

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

Elettra-Sincrotrone Trieste S.C.p.A.

- A nonprofit shareholder company of national interest:

AREA Science Park	53.7%
FVG Regional Government	37.6%
CNR	4.9%
Invitalia Partecipazioni S.p.A.	3.8%
- Established in 1987 to construct and manage synchrotron light sources – international facility
 - > Promote cultural and socioeconomic growth at the regional, national and international level
 - > State-of-the art research facilities, technical leadership, skill development and transfer

The NEW ELETTRA Board of Directors for 2014-2016

Member of the board: **S. Casaleggi**
Director General of AREA Science Park

Member of the board: **C. Compagno**
President of Mediocredito, former President of UniUD

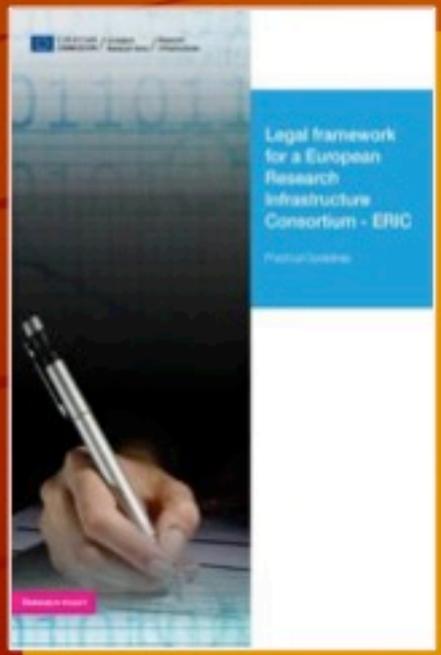
President and Managing Director: **A. Franciosi**
Appointed by MIUR and voted by the Shareholders' Assembly

Member of the board: **A. Morgante**
Director of IOM-CNR

Member of the board: **M. Sancin**
Retired technical director of Kilometro Rosso

ERIC: European Research Infrastructure Consortium

- A new legal framework, at EU level, to facilitate the joint establishment and operation of Research Infrastructures of European interest among several countries
- A legal body recognised in all EU Member States
- Current status:



Awarded ERICs:

- **SHARE** (17/03/2011, hosted by the Netherlands)
- **CLARIN** (29/02/2012, hosted by the Netherlands)
- **EATRIS** (11/11/2013, hosted by the Netherlands)
- **BBMRI** (22/11/2013, hosted by Austria)
- **European Social Survey** (22/11/13, hosted by the U.K.)
- **ECRIN** (29/11/2013, hosted by France)
- **CERIC-ERIC** (28/06/2014, hosted by Italy)
- **DARIAH** (15/08/2014, hosted by France)

Current applications:

ESS, EURO-ARGO, ICOS, JIV, LIFEWATCH

CERIC-ERIC is a **distributed research facility**, set up as an ERIC by nine Countries (*Austria, Croatia, Czech Republic, Hungary, Italy, Poland, Romania, Serbia, Slovenia*), open to other interested countries.



The goals of CERIC are:

- to support excellent research in the field of nano-level analysis and synthesis of materials
- speed-up the alignment of East-West EU

CENTRAL EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM:



Italy (Elettra), Austria (SAXS and TU Graz Laboratory), Czech Republic (Materials Science and Prague Laboratory), Hungary (Budapest Neutron Center), Romania (Magurele Laboratory), Slovenia (NMR center).

- common entry point and integrated services for users
- single proposal evaluation system
- free and open access by quality selection only
- support and logistic services as required
- joint IPR and industrial policy
- joint educational and outreach activities

CERIC "call zero" received 30 proposals (1/3 accepted)

CERIC "call one" received 44 proposals (1/3 accepted)

Elettra 2.0-2.4 GeV 3rd generation Synchrotron Radiation Facility



FERMI 1.5 GeV seeded Free Electron Laser Facility





Elettra

26 beamlines
total

major upgrades:

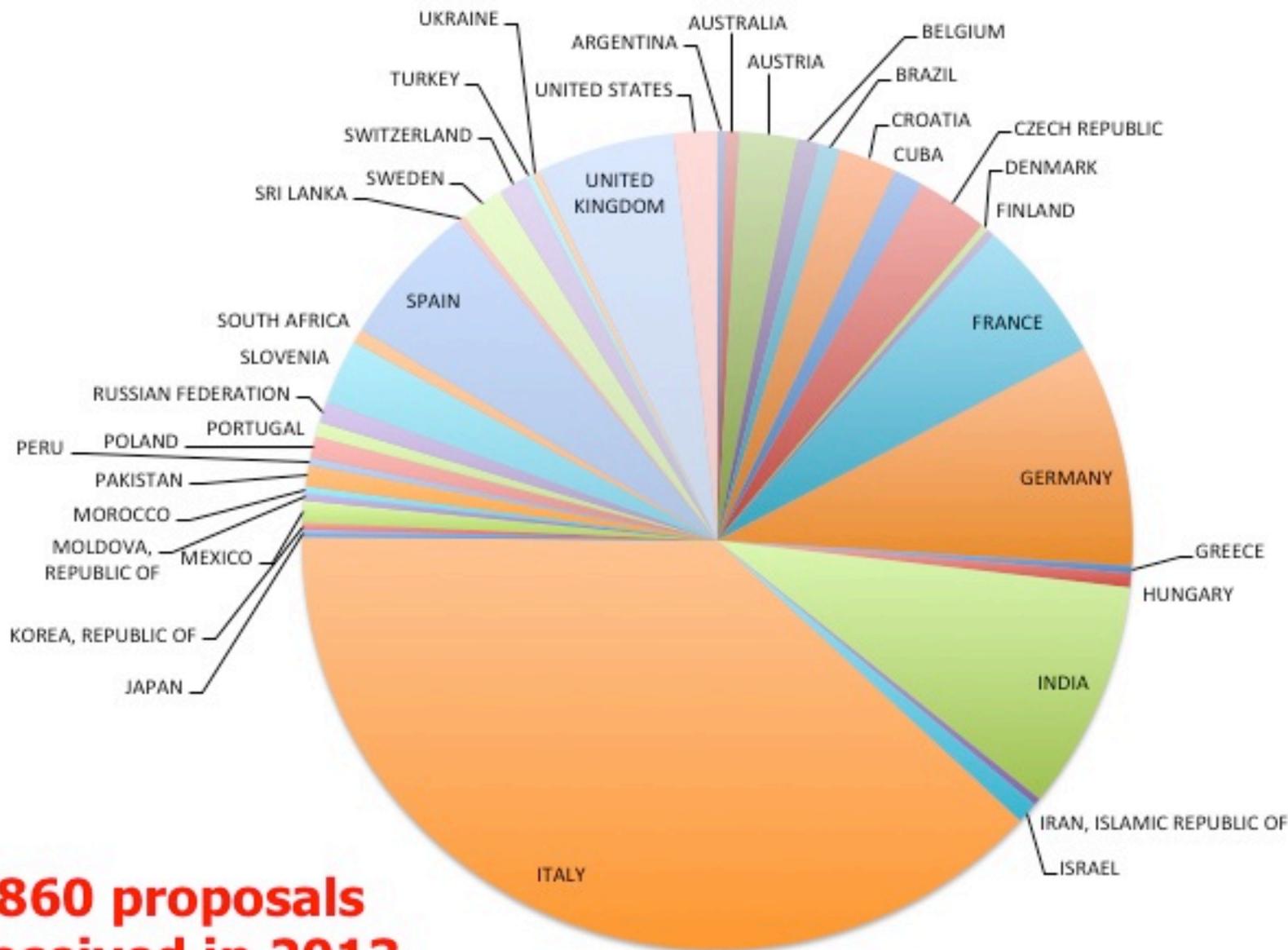
XRD1
SuperESCA
Nanospectroscopy

under construction:

XRD2
XPRESS

March-April 2015

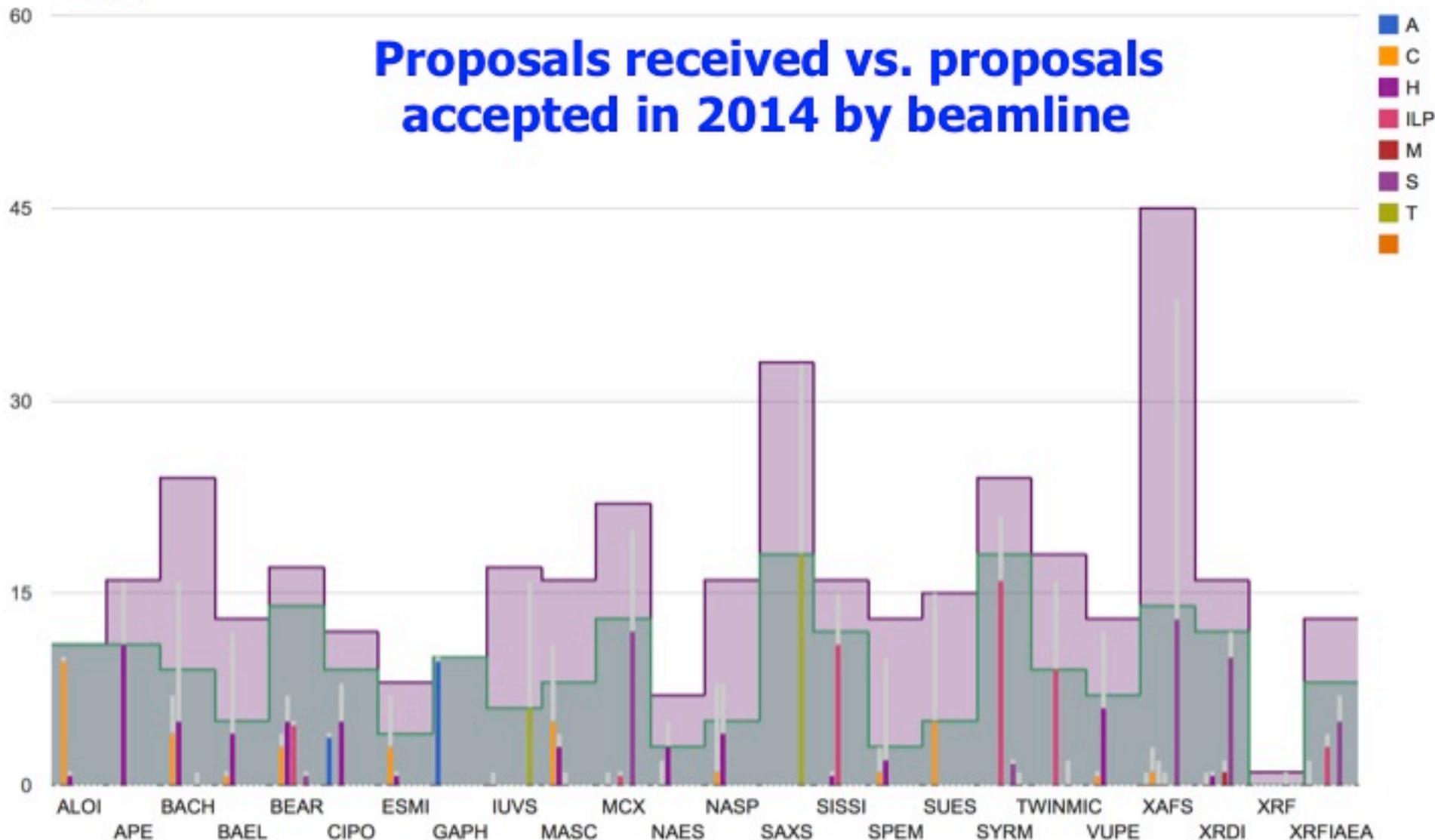
909 Proposals received in 2014 (+5.7%)



**860 proposals
received in 2013**



Proposals received vs. proposals accepted in 2014 by beamline



S=structures **ILP**=inst.&life sci.&polym. **T**=scattering **H**=E&M
A=atom.&mol.sci. **C**=catalysis&surf.sci. **M**=protein¯om.

Elettra 2.0

N-bends	Emittance (nmrad)	σ_x (μm) ID	σ_y (μm) ID	σ_y (μm) @1% coupl ID
2	7	240		14
4	0.82	70	43	4.3
5	0.65	40	30	3
6	0.25	32	32	3.2
7	0.19	29	29	2.9
8	0.12	25	22	2.2
9	0.087	18	17	1.7

As the number of dipoles increases free space is generally reduced

To save space one should combine the elements as much as possible:

Defocusing in dipoles

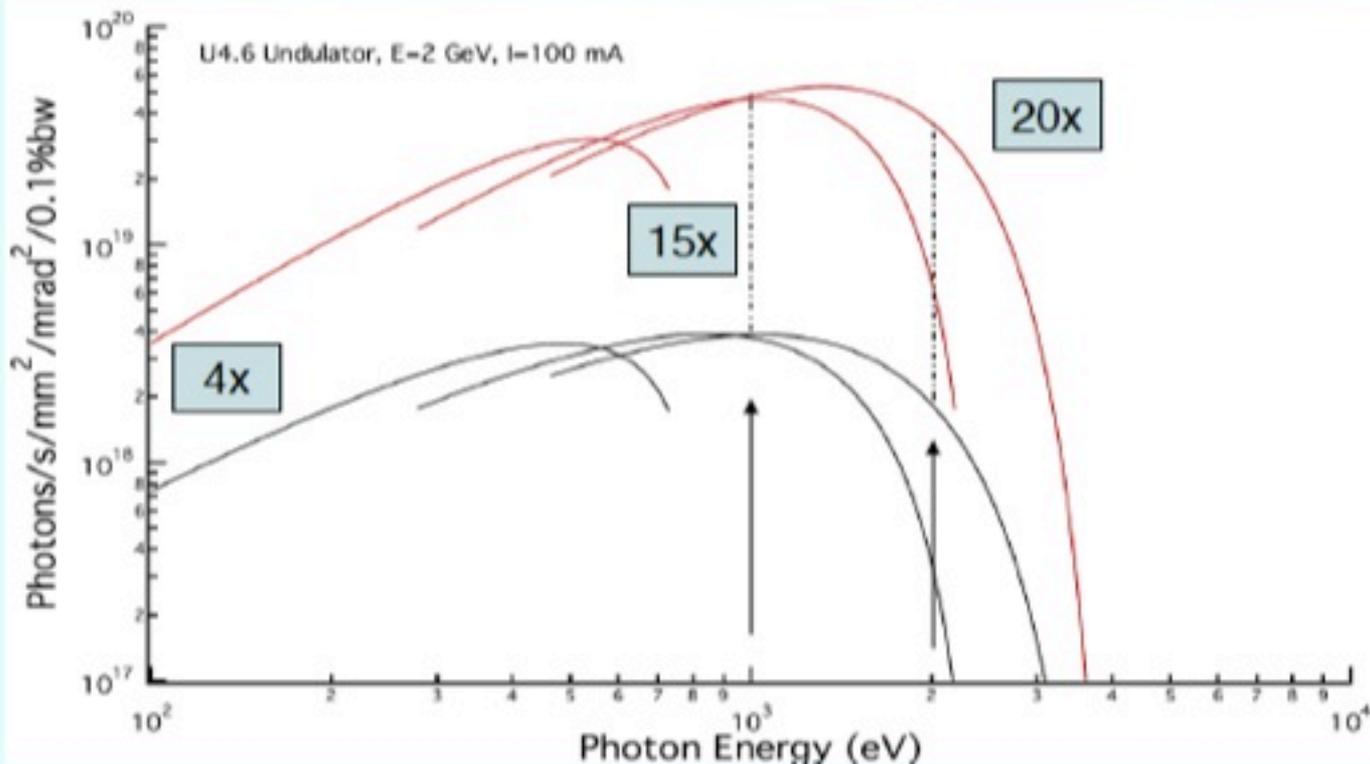
Skew quads + correctors

Sextupoles + correctors

BPM inside the quadrupoles

Lateral pumping

Dynamic aperture is reduced but still quite acceptable as we will see.



Super ESCA @ 2 GeV 100 mA

Graph by B. Diviacco

Brilliance increasing as expected

Spot size/div decreased by a factor of 5

Elettra : 7 nrad
 Beam dimensions:
 x,y (245,14) μm
 x',y' (28, 6) μrad

Long straights - 0.25
 nm-rad

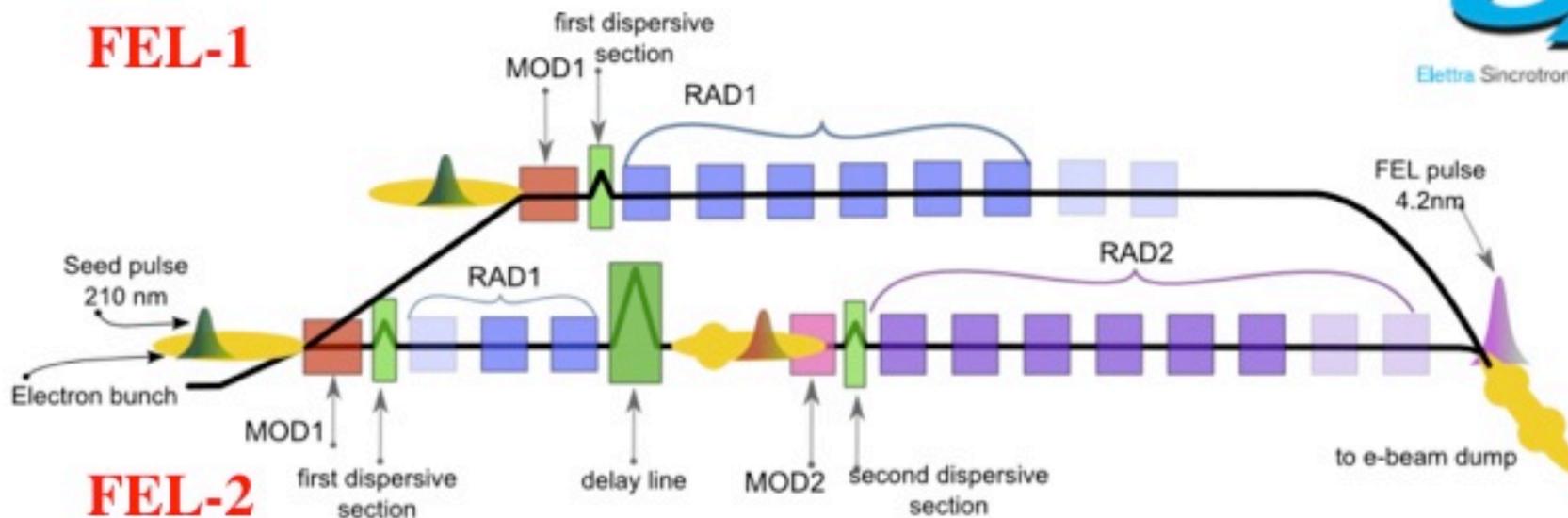
Beam dimensions:
 x,y (43,3.0) μm
 x',y' (5.7, 0.8) μrad

0.25 nm-rad – short
 straights

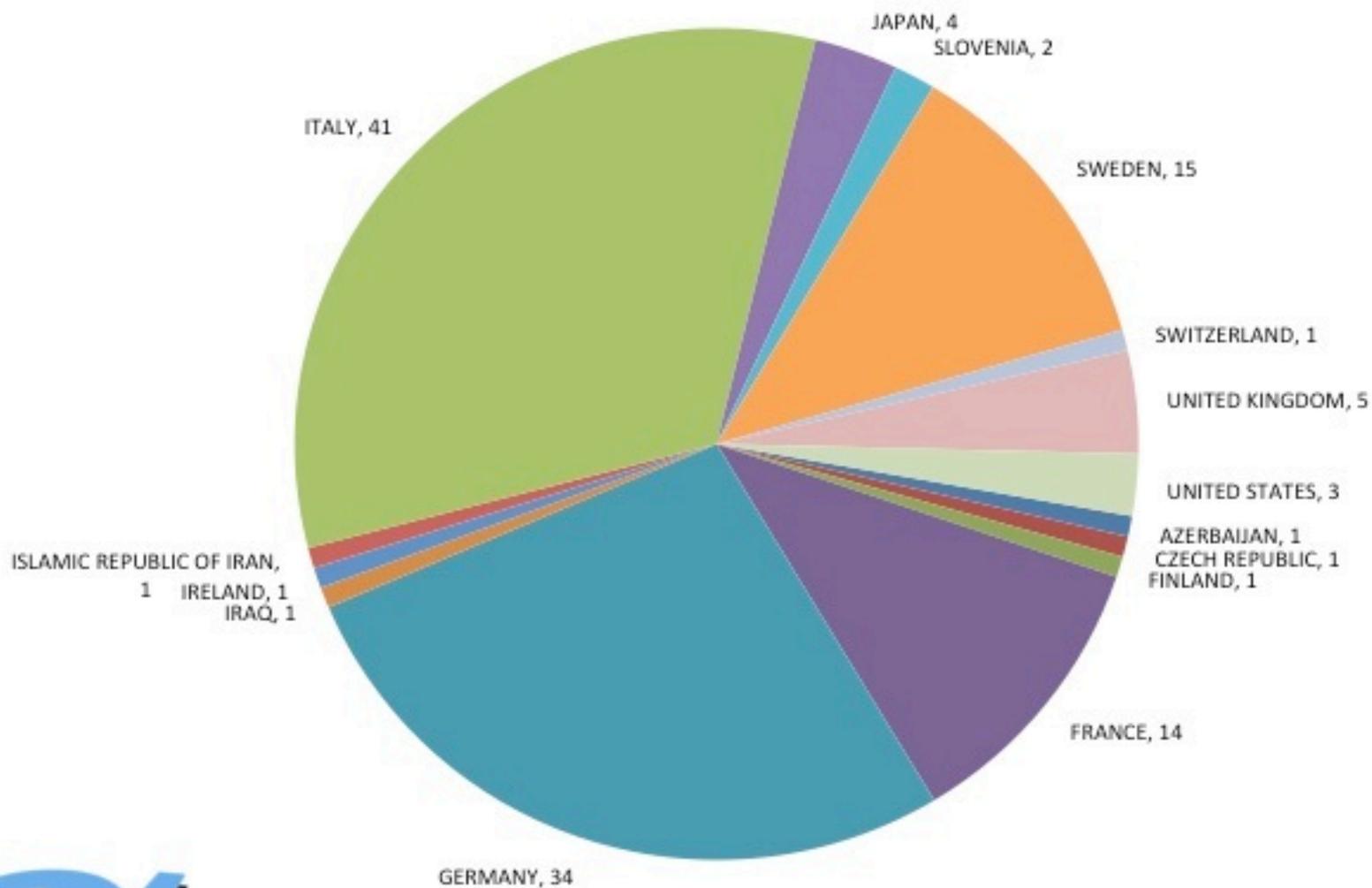
Beam dimensions:
 x,y (45,3.1) μm
 x',y' (8, 0.9) μrad

x 28 reduction in emittance, x 5 reduction in beam size and divergence

FEL-1

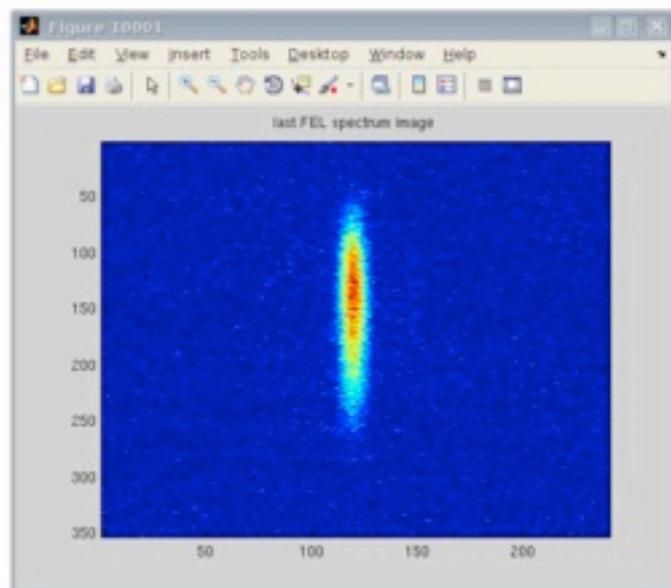


125 Proposals submitted to FERMI in 2012-2013

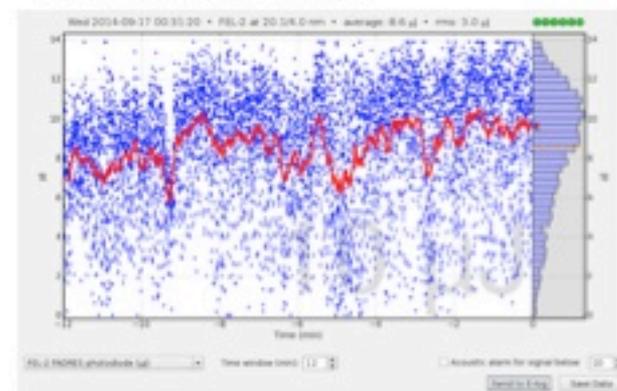


5.4 nm - Single mode spectrum

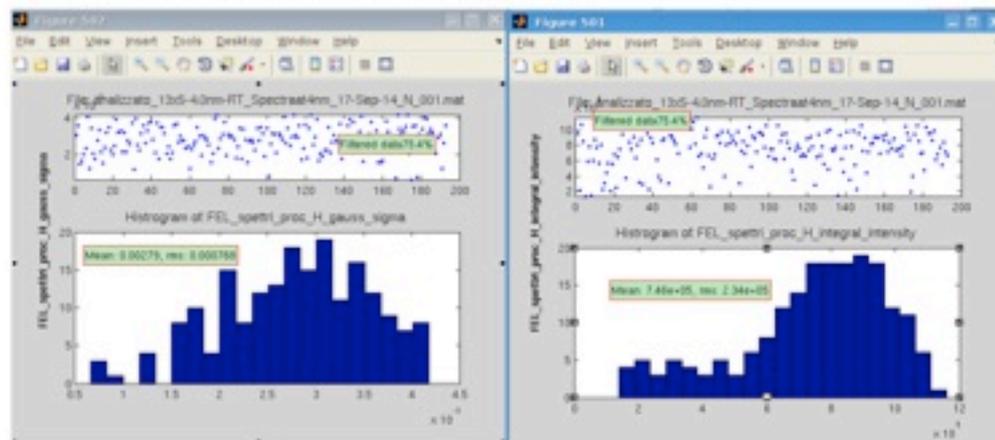
Spectral linewidth 3×10^{-4} (rel. rms – 90%shots)



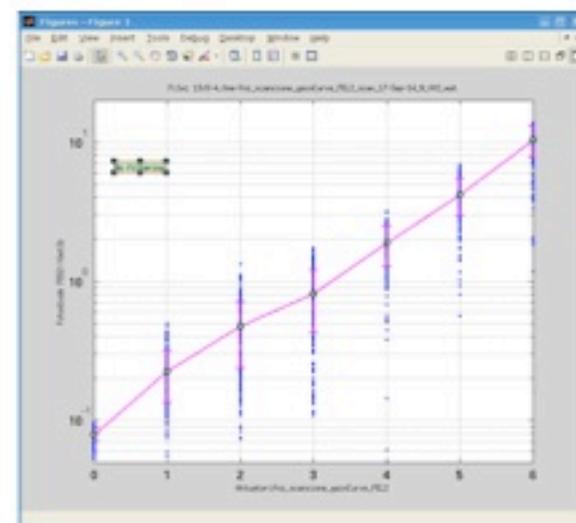
4 nm – 10 μ J “average” energy per pulse

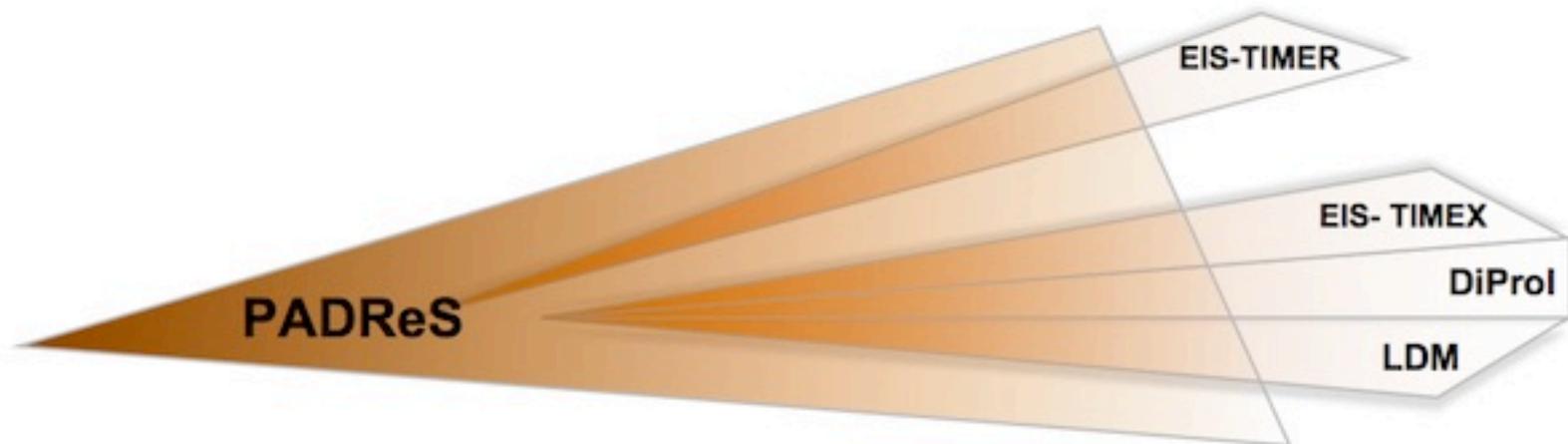


4 nm - spectral linewidth 7×10^{-4} (rel. rms 75%shots)
energy stability 30% rms fluctuations in energy



4 nm - exponential gain





DIFFRACTION AND PROJECTION IMAGING M. Kiskinova

- *Ultrafast Coherent Imaging*
- *Full-field x-ray Microscopy and Lensless Imaging*

ELASTIC AND INELASTIC SCATTERING PROGRAM C. Masciovecchio

- *t-Resolved Spectroscopy of Mesoscopic Dynamics* **TIMER**
- *Elastic Scattering from Matter under Extreme Conditions* **TIMEX**

LOW DENSITY MATTER PROGRAM C. Callegari

- *Atomic, Molecular and Optical Science*
- *Spectroscopic Studies of Reaction Intermediates*
- *Clusters and Nanoparticle Spectroscopies*
- *Ultrafast Proc. & Imaging of Gas Phase Clusters and Nanoparticles*

Under construction: MAGNEDYN, TERA FERMI, TIMER



novel SuperConductors and Synchrotron Radiation:
state of the art and perspectives

Adriatico Guesthouse, Trieste, Italy / 10-11 December 2014



Elettra Sincrotrone Trieste

An aerial photograph of the Elettra Sincrotrone Trieste facility, showing a large circular building complex surrounded by greenery and a forest. In the background, the Adriatic Sea and the city of Trieste are visible.

THANK YOU!

A. Franciosi

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