

Extreme Light Infrastructure ELI

Recommended to be on the
ESFRI Road Map

ELI

Centered around an Exawatt class Laser

Few kJ.~10fs, >1sh/mn)

Modular:

- 1) front end at 100Hz-kHz, 5fs-5J, PW level,
- 2) Last stage at the exawatt level @ >1shot/mn
- 3) $a_0 \sim 10^2 - 10^4$

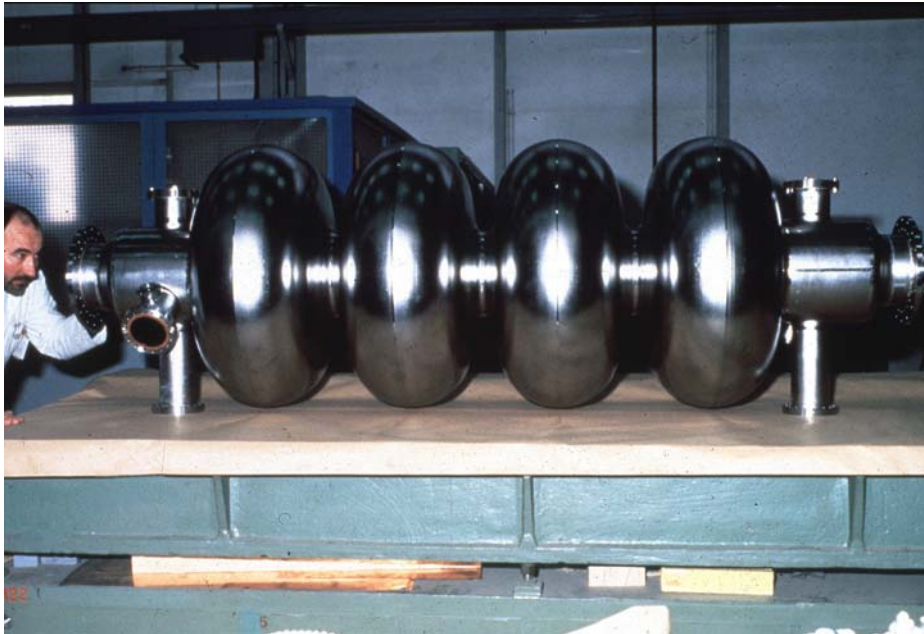
ELI Scientific Program: Rests on Three Scientific Pillars

- **Ultra high Field Science:** access to the ultra-relativistic regime, ELI will afford new investigations in particle physics, nuclear physics, gravitational physics, nonlinear field theory, ultrahigh-pressure physics, astrophysics and cosmology.
- **Attosecond science:** snap-shots in the attosecond scale of the electron dynamics in atoms, molecules, plasmas and solids.
- **High Energy beam facility:** ELI will provide ultra-short energetic particle (>10 GeV) and radiation (up to few MeV) beams produced from compact laser plasma accelerators.

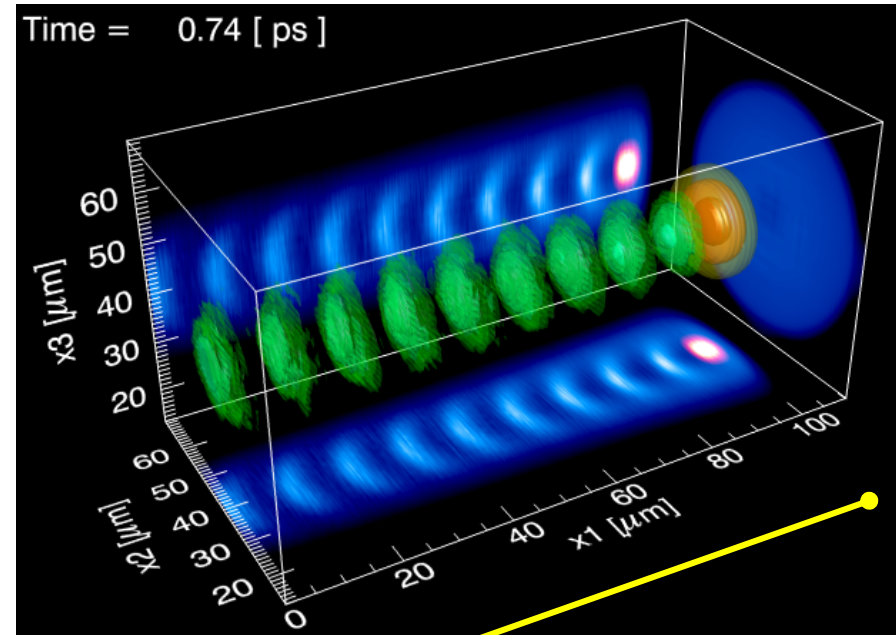
Societal Benefits

- ELI will afford wide benefits to society ranging from improvement of oncology treatment, medical imaging, fast electronics and our understanding of aging nuclear reactor materials to development of new methods of nuclear waste processing.

Relativistic microelectronic devices



1 m
RF cavity

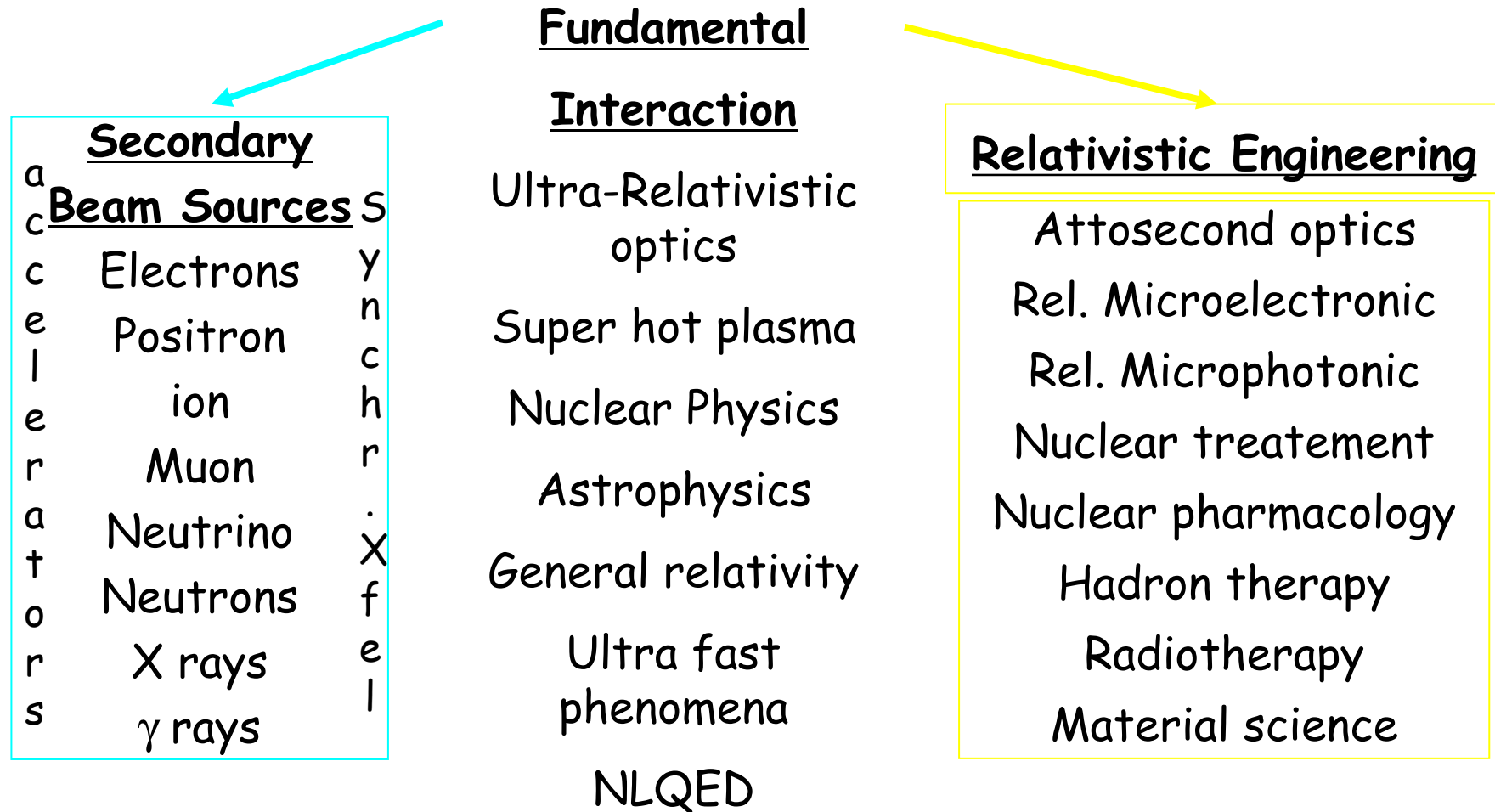


100 μm
Plasma cavity

Courtesy of W. Mori

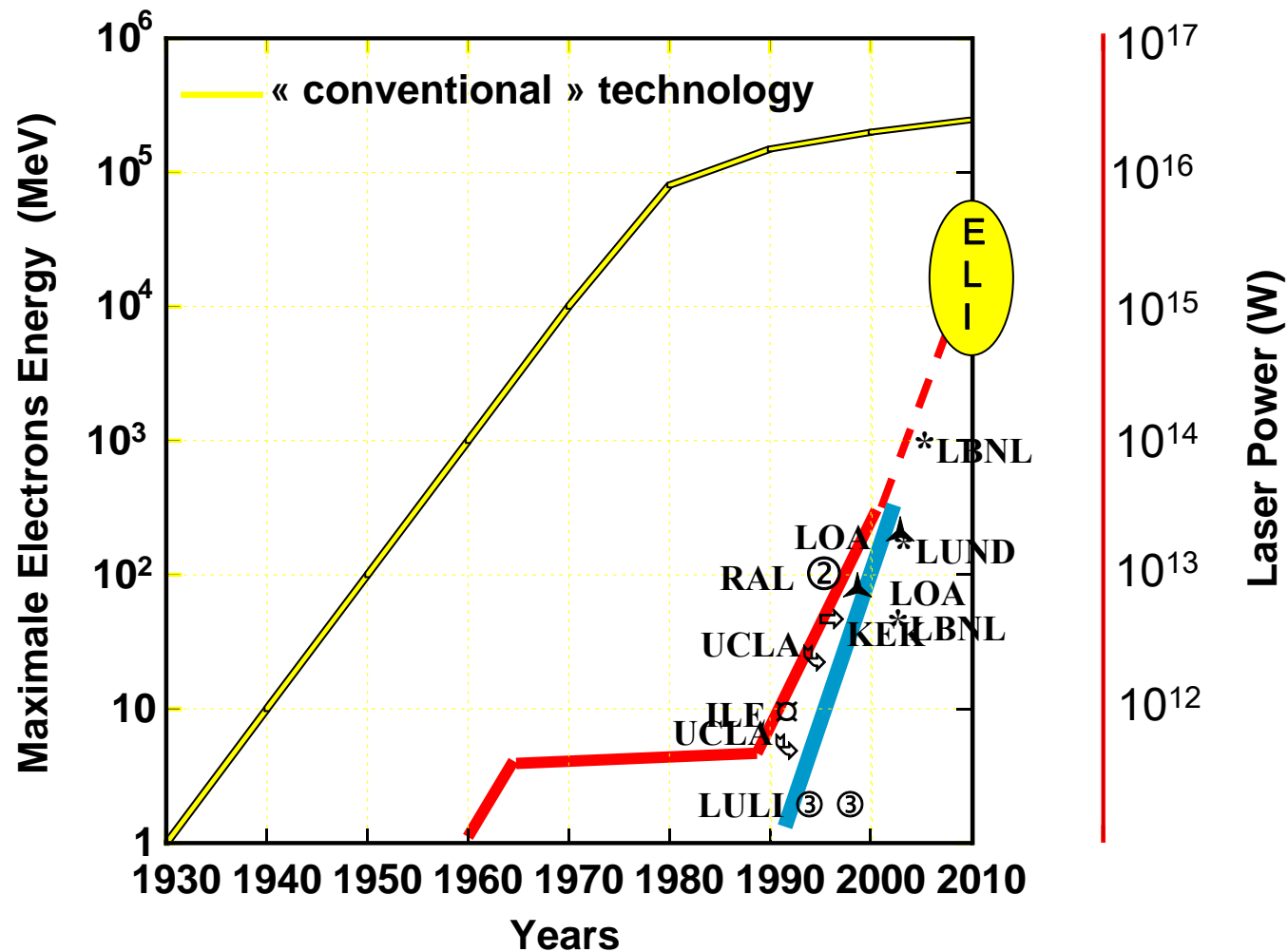


Extreme Light Infrastructure Exawatt Laser





Electron beam energy and laser power evolution



Parameter designs Laser Plasma Accelerators



ELI : > 100 GeV

P(PW) E(J)	τ (fs)	$n_e(\text{cm}^{-3})$	W_0 (μm)	L(m)	a_0	Q(nc)	E(Gev)
0.12/3.6	30	2e18	15	0.009	4	1.3	1.12
1.2/120	100	2e17	47	0.28	4	4	11.2
12/3.6k	300	2e16	150	9	4	13	112
120/120 k	1000	2e15	470	280	4	40	1120

Extreme Light Infrastructure

ELI



A science integrator that will bring many frontiers of contemporary physics, i.e. relativistic plasma physics, particle physics, nuclear physics, gravitational physics, nonlinear field theory, ultrahigh pressure physics, and cosmology together.

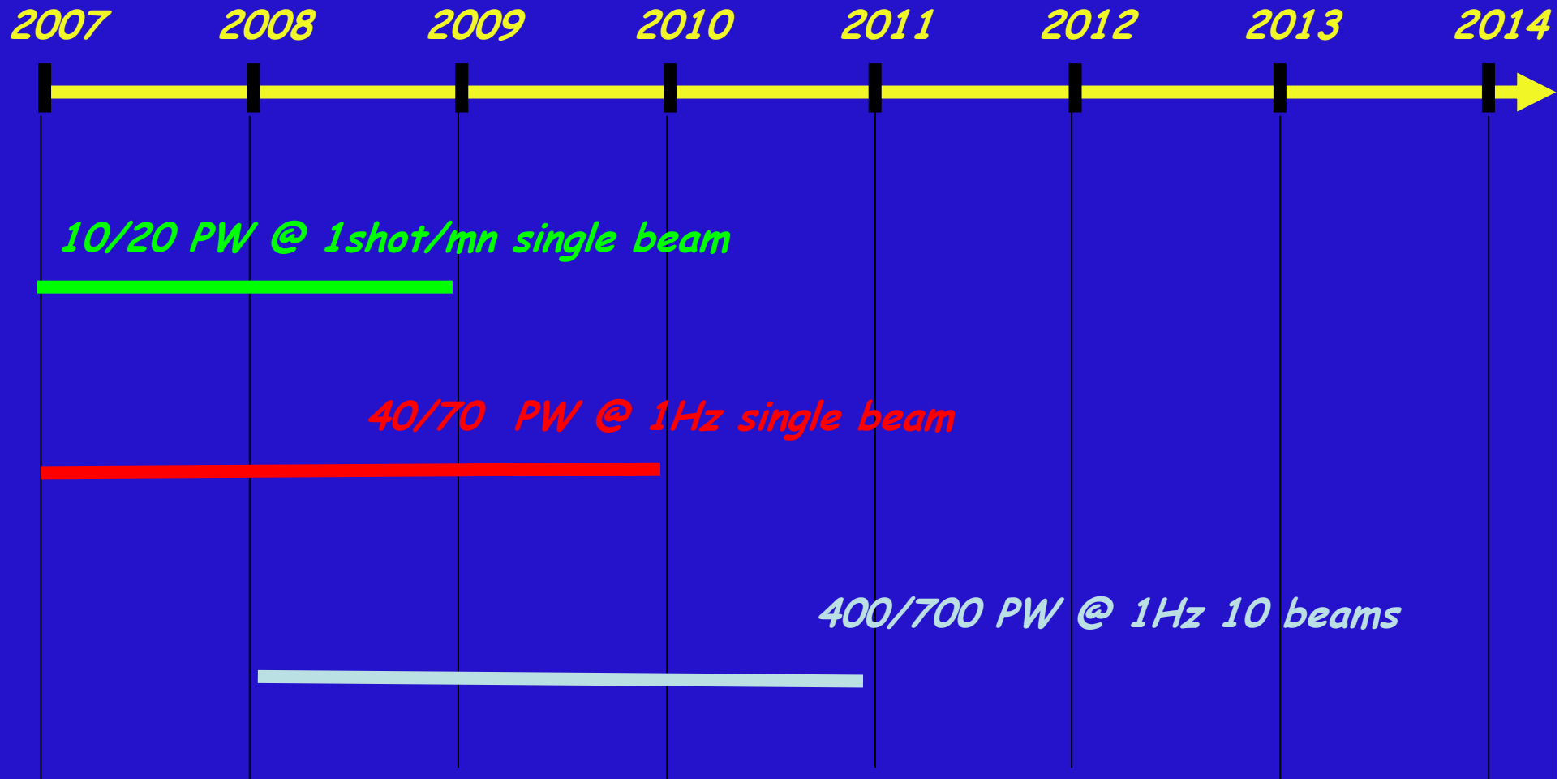
ELI will provide a new generation of compact accelerators delivering ultra short (fs-as) and energetic particle and radiation beams for European scientists. ELI will work in close contact with synchrotron XFEL community.

ELI will also be an Extreme Light technology platform ready to reduce to practice the latest invention and discovery in relativistic engineering

Education and Training:

ELI will be the most sophisticated Optoelectronic Grand Instrument (Ultrashort short pulse, Ultra relativistic intensity, High repetition rate, wavefront correction, Coherent Addition of Beams) and will be a fertile ground for Education and Training.

Time line



ELI Participating Countries

- France
- Germany
- Spain
- Italy
- Greece
- Lithuania
- Austria

ELI Participants

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