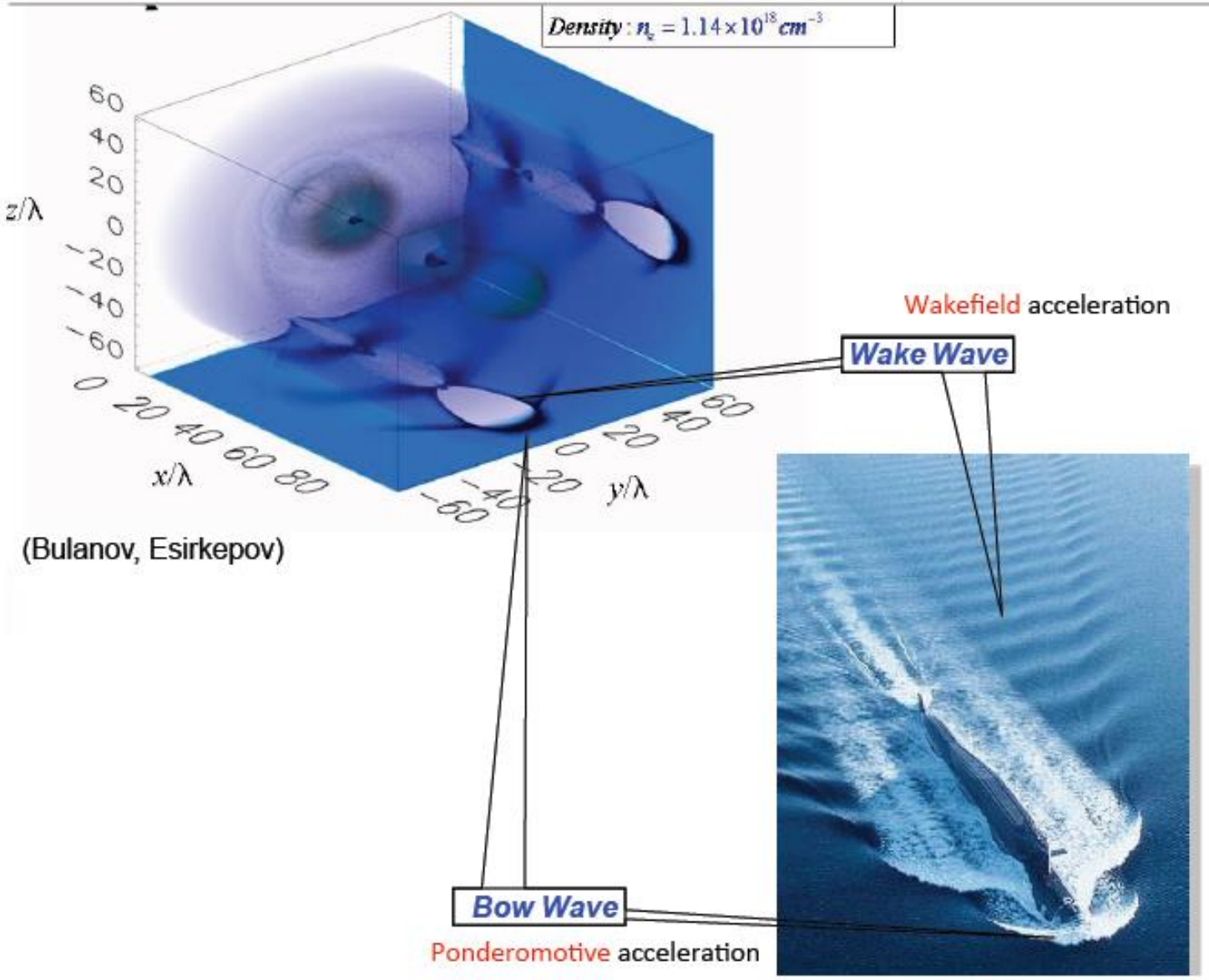
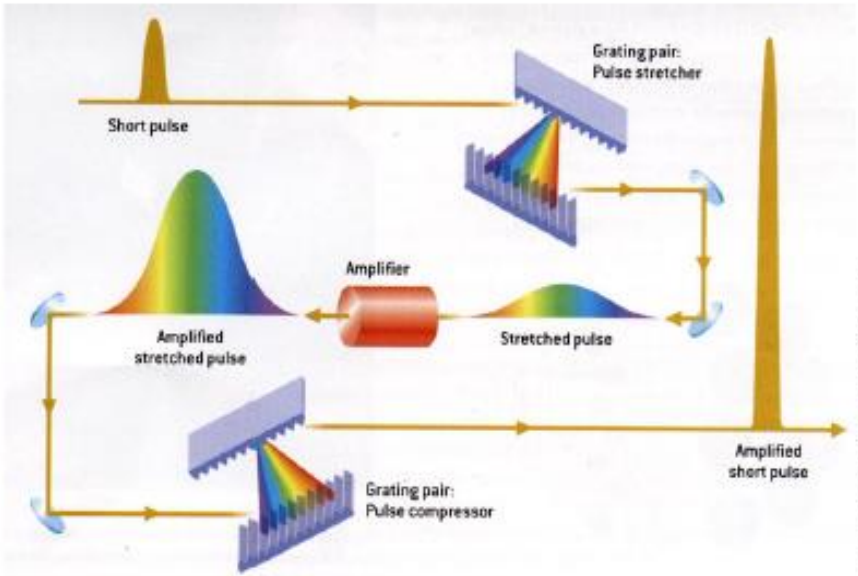
IZEST and Particle Physics

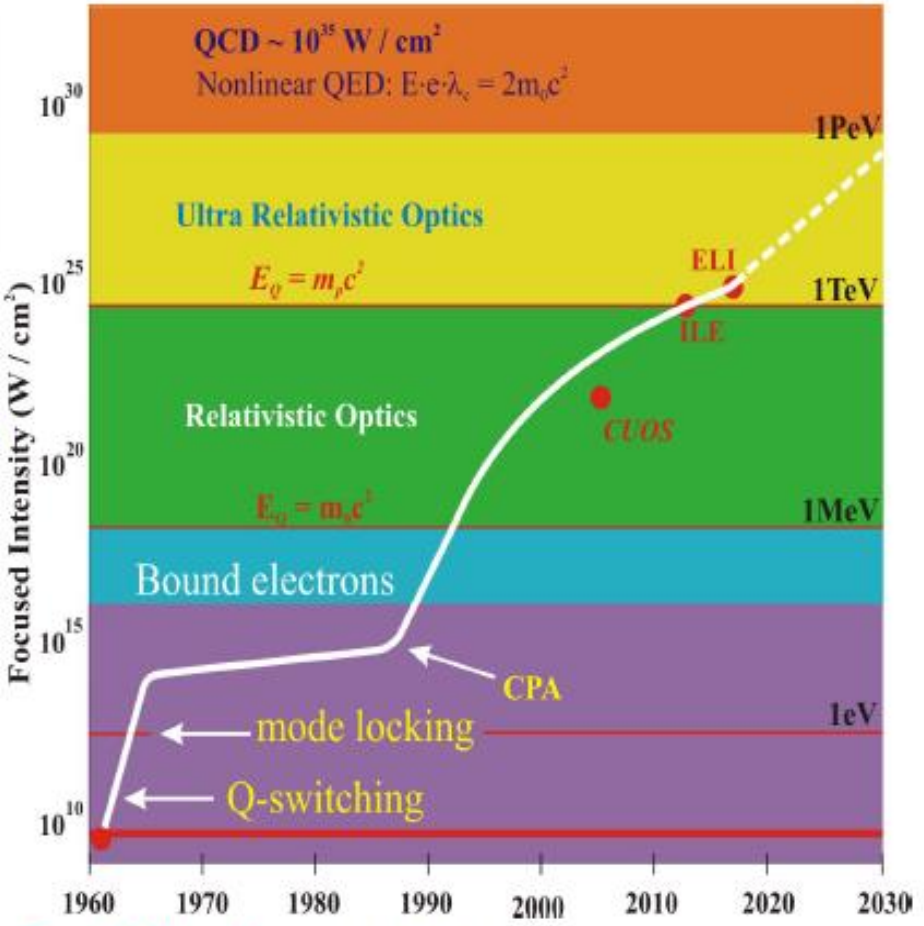
Michel Spiro April 4th, 2017

Laser-driven Bow and Wake



Enabling technology: laser revolution



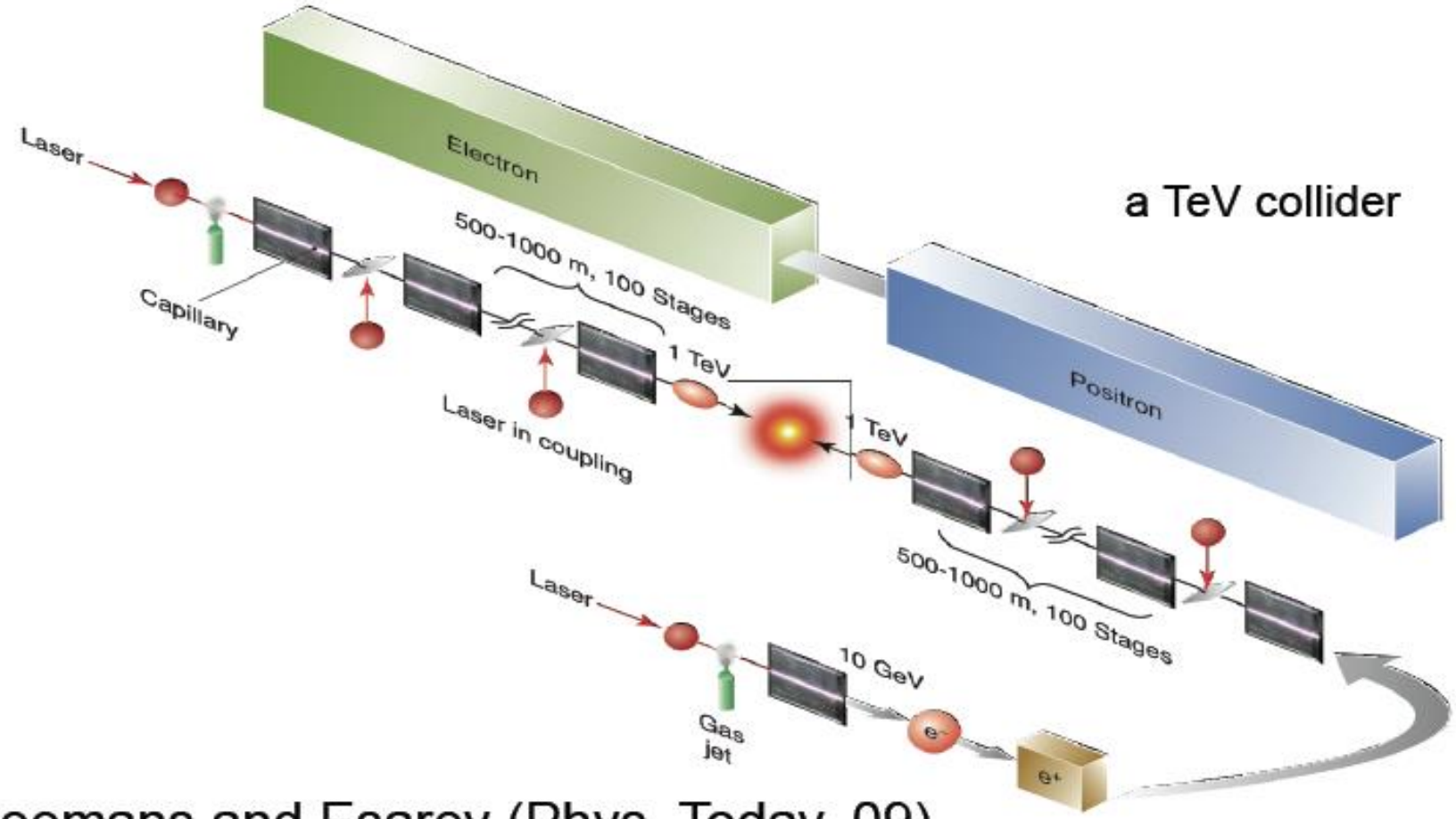


G. Mourou invented Chirped Pulse Amplification (1985)

Laser intensity exponentiated since,

to match the required intensity for Tajima-Dawson's LWFA (1979)

Laser driven collider concept



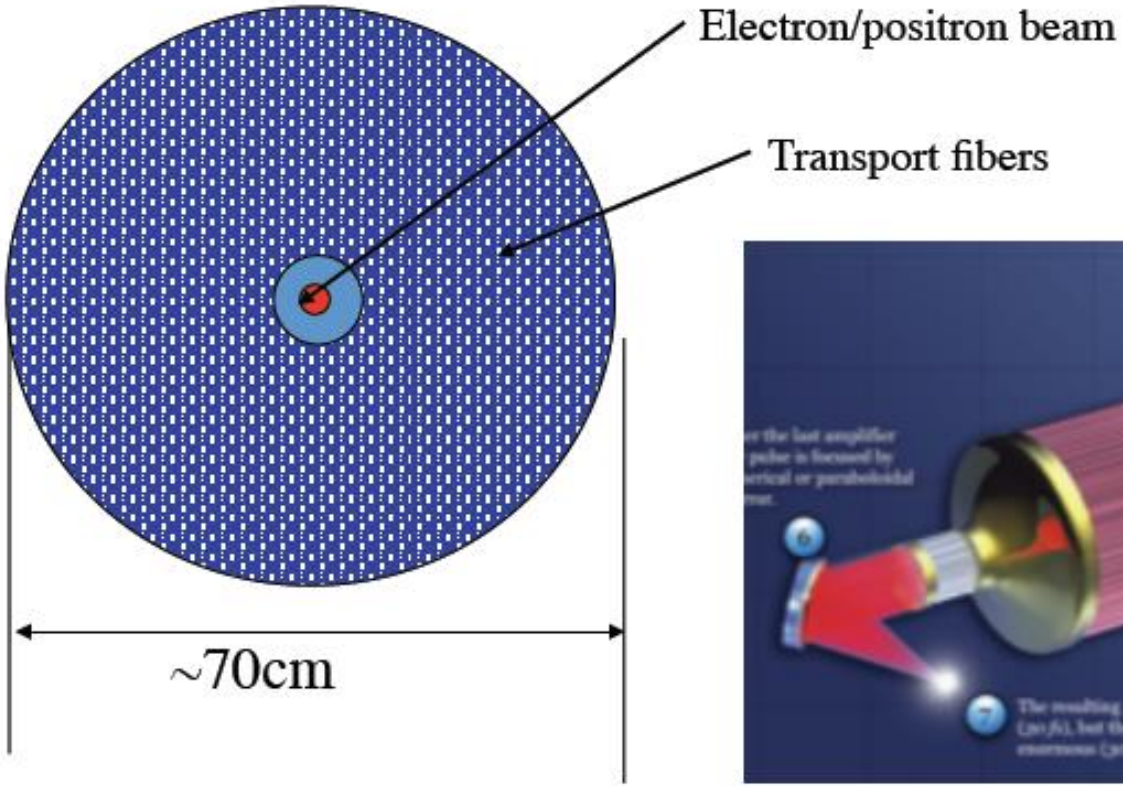
Leemans and Esarey (Phys. Today, 09)

ICFA-ICUIL Joint Task Force on Laser Acceleration(Darmstadt,10)

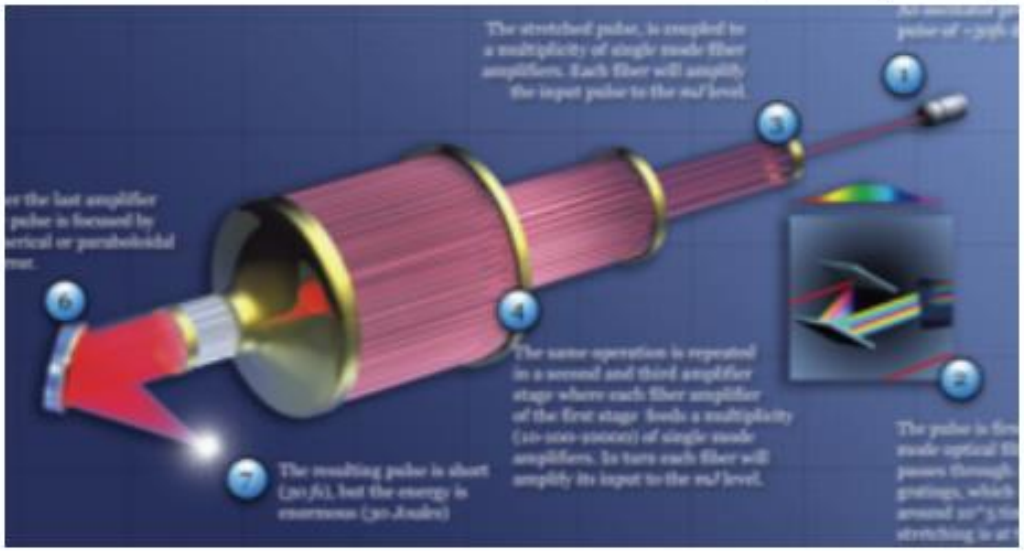
CAN Laser:

Need to Phase

32 J/1mJ/fiber~ 3×10^4 Phased Fibers!



G. Mourou: patent (2005)
Mourou et al. patent (2012)



Length of a fiber ~2m Total fiber length~ 5 10^4km

Future R§D and particle physics experiments: IZEST

- Exponential developments in this field (we are at > 1 Gev/m gradients)
- Other breakthroughs to be expected (TeV/m with nanoporous materials or proton plasma wakefield)
- Problems to solve: multi-stage acceleration, beam quality, reliability, reproducibility, repetition rate, plug efficiency
- First steps for particle physic (?): exploration of quantum vacuum, search for axions
- First steps for the ultra high energy frontier (?): low luminosity ultra high energy collider (plasma or chip accelerated electrons on LHC protons or ions?), gamma gamma collider.
- **Be prepared to propose IZEST developments for the next European Strategy for Particle Physics: process starts already end of 2017! The secretary should be known by June this year**

Thanks also to great technological progress, many scientifically strong opportunities for high-intensity/high-energy future colliders are available → decision on how to proceed, and the time profile of the projects, depends on science , maturity of technology, cost and availability of funding, worldwide perspective.

None of these opportunities is easy, none is cheap.

HOWEVER

1) The extraordinary success of the LHC (result of ingenuity, vision and perseverance of the worldwide HEP community and > 20 years of talented, dedicated work) demonstrates the strength of the community (accelerators, experiments, theory)
→ asset in view of future, even more ambitious, projects.

2) The correct approach, as scientists, is not to abandon our exploratory spirit, nor give up due to financial and technical challenges. The correct approach is to use our creativity to develop the technologies needed to make future projects financially and technically affordable


LHCb
ATLAS
CERN Meyrin
CERN Prévessin
SPS 7 km
SUISSE
FRANCE
CMS
ALICE
LHC 27 km

Thank you !