Update on ALEGRO activities

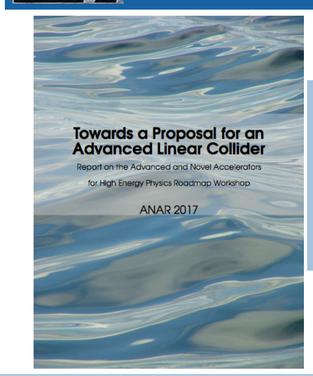
ALEGRO Collaboration

Abstract: ALEGRO, the Advanced LinEar collider study GROup is an international study group promoting advanced and novel accelerators (ANAs) for high-energy physics applications. ALEGRO organizes one workshop each year as well as meetings at prominent ANAs conferences (EAAC, AAC, etc.). ALEGRO also submitted an input to the European Strategy for Particle Physics Update (ESPPU) process and was represented at the ESPPU meeting in Grenada. We will present a summary of the last workshop (CERN, March 26-29, 2019), as well as of the ESPPU meeting in order to inform the EAAC audience and encourage it to contribute to the important goals of ALEGRO.

ALEGRO (Advanced LinEar collider study GROup) is a study group towards Advanced Linear Colliders. ALEGRO's general charge is to coordinate the preparation of a proposal for an advanced linear collider in the multi-TeV energy range. Outcome of the Advanced and Novel Accelerator Concepts Roadmap Workshop, CERN, March 25-28, 2017, organized by the ICFA-ANA Panel.

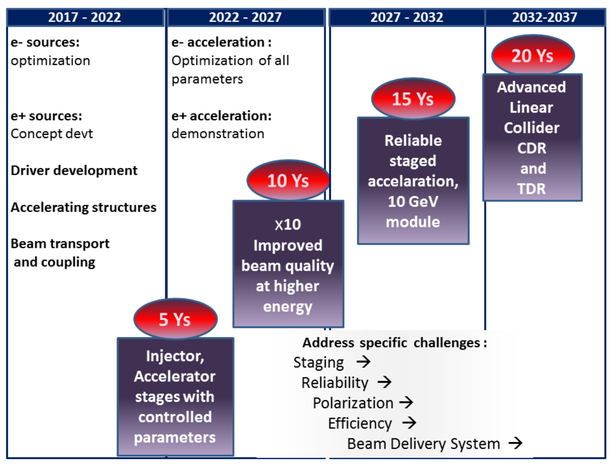
Next ALEGRO Workshop: DESY, March 24-27, 2020

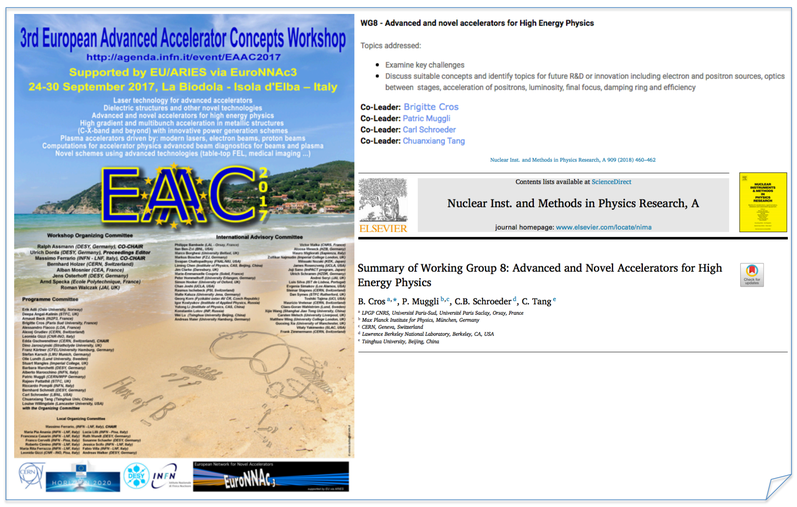
ANAR2017: Advanced and Novel Accelerators for High Energy Physics Roadmap Workshop 2017



Document broadly distributed to laboratories management and funding or deciding agencies…
to demonstrate the existence of a community and of a plan for ANA* applications to high-energy physics

*Advanced and Novel Accelerators





Outline of the document to be submitted to the European Particle Physics Strategy Update

https://cafpe.ugr.es/eppsu2019/

- ALEGRO representatives at ESPP: B. Cros, P. Muggli
- Presentations by W. Leemans (DESY) and E. Gschwendtner (CERN) discussing ANA strategies and facilities
- ANA plasma accelerators discussed for the first time is strategy meetings
- Mentioned as possible future accelerator

ESPP Input Documents

ALEGRO input for the 2020 update of the European Strategy for Particle Physics: comprehensive overview

Contacts: B. Cros[1], P. Muggli[2]
on behalf of ALEGRO collaboration,
member list at http://www.lpgp.u-psud.fr/icfaana/alegro/alegro-members

[1] LPGP, CNRS, Université Paris Sud, Orsay France, email: brigitte.cros@u-psud.fr
[2]Max Planck Institute for Physics, Munich, Germany, email: muggli@mpp.mpg.de

Advanced and Novel Accelerators (ANAs) can provide acceleration gradients orders of magnitude greater than conventional accelerator technologies, and hence they have the potential to provide a new generation of more compact, high-energy machines. Four technologies are of particular interest, all of which rely on the generation of a wakefield which contains intense electric fields suitable for particle acceleration. In the laser wakefield accelerator (LWFA) and plasma wakefield accelerator (PWFA) the wakefields are driven in a plasma by intense laser or particle beams, respectively; in the structure wakefield accelerator (SWFA), the wake is excited by a particle bunch propagating through a structured tube; and in the dielectric laser accelerator (DLA), a laser pulse directly drives an accelerating mode in a dielectric structure.

In view of the great promise of ANAs, and the substantial effort worldwide to develop them, the Advanced LinEar collider study GROup, ALEGRO, was formed at the initiative of the ICFA ANA panel. ALEGRO aims to foster studies on accelerators based on ANAs for applications to high-energy physics, with the ambition of proposing a machine that would address the future goals of particle physics. This document summarizes the current view of the international community on this topic. It proposes a list of priorities that the community would like to invest effort in over the next five to ten years.

We propose as a long-term goal the design of an e+/e−/gamma collider with up to 30 TeV in the center of mass - the Advanced Linear International Collider (ALIC). On the path to this collider, a number of stepping stones have to be established. These will lead to spin-offs at lower energy that will benefit ultrafast X-ray science, medicine, and industrial applications. **The major goal for our community over the next five to ten years is the construction of dedicated ANA facilities that can reliably deliver high-quality, multi-GeV electron beams from a small number of stages.** The successful demonstration of robust stages of this type would provide a platform for ANAs with large number of stages generating high-quality beams in the TeV range.

The document also discusses other challenges that must be met for the complete ALIC concept. These include the design of appropriate particle sources, the development of high-power lasers needed for LWFAs and DLAs, the achievement of required tolerances, and the need for additional tools such as the development of novel diagnostics for the ultra-fast bunches generated by ANAs, and fast simulation methods.

arXiv:1901.08436

ALEGRO input for the 2020 update of the European Strategy for Particle Physics: ADDENDUM

ALEGRO collaboration

Abstract
This document provides additional information to support the ALEGRO proposal for R&D relevant to an Advanced Linear International Collider, ALIC, based on high gradient acceleration concepts.

Keywords
Advanced and Novel Accelerators, multi-TeV electron- positron linear collider

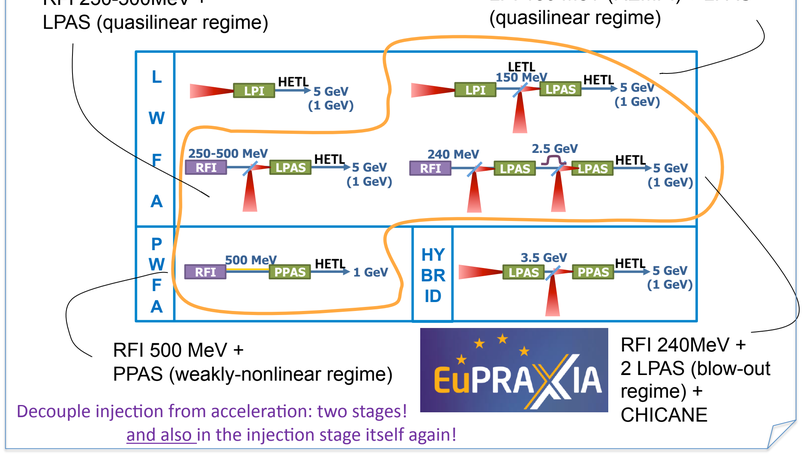
✧First community-wide (and beyond) document!!!

arXiv:1901.10370v2

ALEGRO Workshop in 2019 to monitor progress towards ALIC: a few highlights

https://indico.cern.ch/event/732810/overview

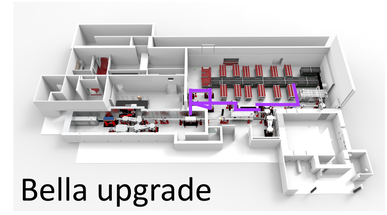
Systematic simulation studies in the Frame of Eupraxia to identify the best way to optimize electron beam parameters



Decouple injection from acceleration: two stages!
and also in the injection stage itself again!

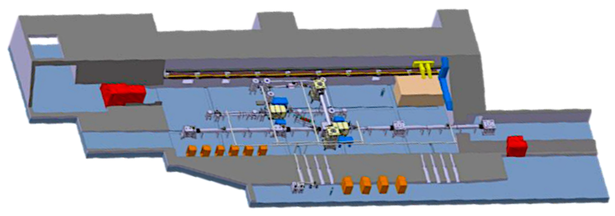
Multi-stage laser driven acceleration to multi-GeV in preparation

Essential for collider scheme (TeV energies)



APOLLON facility

Bella upgrade



Specific components for compact accelerators

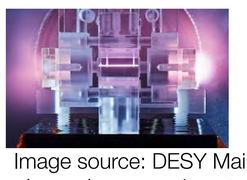
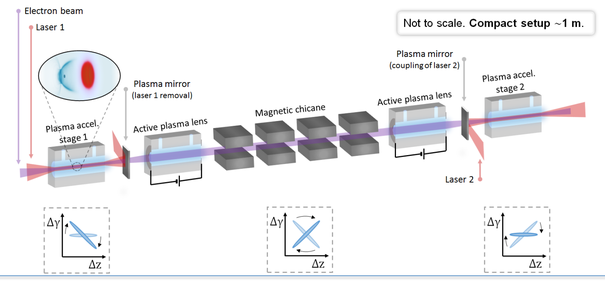


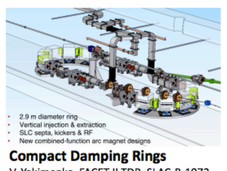
Image source: DESY Mainz plasma lens experiment

Beam transport under design for Eupraxia plasma experiments at DESY, INFN Frascati

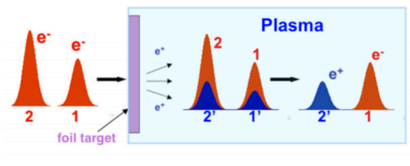
Ferran Pousa, Martinez de la Ossa, Brinkmann, Assmann, **arXiv:1811.07757**



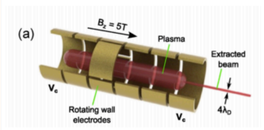
Positron acceleration



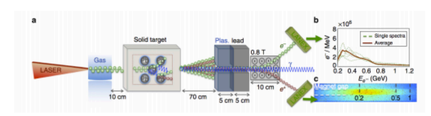
Compact Damping Rings
V. Yakimenko, FACET-II TDR, SLAC-R-1072



In-Situ Positron Generation
X. Wang, PRL 101, 124801 (2008)



Positron Beams from Electro-static Traps
J. Danielson, Rev. Mod. Phys., Vol. 87, 2015



Laser Generated Positron Beams
G. Sarri, Nat. Comm., 6747, 2015

S. Corde 38

Proton bunch driver