



MAX-PLANCK-INSTITUT
FÜR PHYSIK

REPORT

ICFA MEETING, JULY 20, 2024

ICFA-ANA PANEL

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MAX-PLANCK-INSTITUT
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PANEL MEMBERS



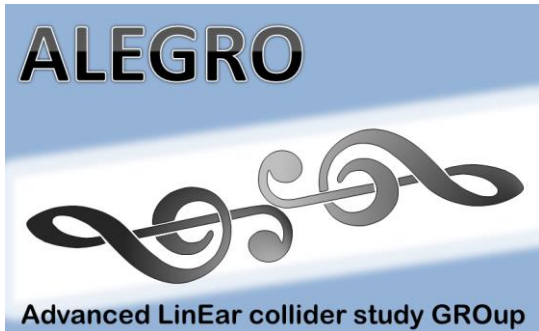
- ✧ Bruce Carlsten, Los Alamos National Laboratory (LANL), USA
- ✧ Brigitte Cros, Centre National de la Recherche Scientifique (CNRS), Université Paris Sud, France
- ✧ Massimo Ferrario, Istituto Nazionale di Fisica Nucleare (INFN), Italy
- ✧ Simon Hooker, University of Oxford, UK
- ✧ Tomonao Hosokai, Univ. Osaka, Japan
- ✧ Masaki Masaki Kando, National Institutes for Quantum and Radiological Science and Technology, Japan
- ✧ Patric Muggli, Max Planck Institute for Physics (MPP), Germany, (chair, May 1, 2024)
- ✧ Jens Osterhoff, Lawrence Berkeley National Laboratory (LBNL), USA
- ✧ Philippe Piot, Northern Illinois University (NIU), Fermi National Accelerator Laboratory, (FNAL), USA
- ✧ James Rosenzweig, University of California, Los Angeles (UCLA), USA
- ✧ Carl Linstrom, University of Oslo, Norway
- ✧ Chuanxiang Tang (previous chair), Tsinghua University, China

PANEL MISSION



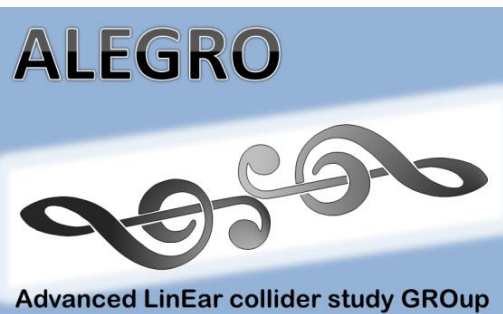
✦ Mission

MAIN ACTIVITY: ALEGRO 2024



Co-chaired by:
Jorge Vieira (IST, Lisbon)
Brigitte Cros (U. Paris Sud, Paris)
Patric Muggli (MPP, Munich)

WHAT IS ALEGRO*?



is the Advanced LinEar collider study GROup

is driven by the ICFA-ANA panel

workshops endorsed by ICFA

is inclusive

worldwide

structures, plasma, particle beams, laser pulses, ...

has no source of funding (so far)


did, and will continue to promote ANAs for application to particle physics

Founded in 2017 by B. Cros, P. Muggli and the ICFA-ANA panel

***Advanced LinEar collider study GROup: 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.

SERIES OF WORKSHOPS



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

2017



ALEGRO 2024
ALEGRO Workshop 2024, Lisbon, 19-22 March

2024



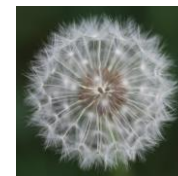
UNIVERSITY OF OXFORD
JAI
Somerville College
ALEGRO 2018 workshop at Oxford
26 March - 29 March 2018, Oxford, UK

2018



ALEGRO WORKSHOP 2019
ALEGRO WORKSHOP 2019 CERN
26-29 March

2019



2023



ALEGRO 2023
22-24 MARCH
ALEGRO 2023
Location: DESY Hamburg, Germany
Organisation: Brigitte Cros, Richard D'Arcy, Patric Muggli, Jens Osterhoff
Administration: Daniela Koch
ALEGRO2023 Workshop



Endorsed by



PROGRAM ALEGRO 2024

Tue 19/03 Wed 20/03 Thu 21/03 Fri 22/03 All days

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Season legend

EU and US Roadmap Welcome Session and Introduction

14:00	Registration	
15:00	Opening Words	Luis Silva et al.
15:30	ROAD Roadmap of the European Particle Physics Strategy	Wim Leemans
15:30-16:00	US perspective on plasma based accelerators and future colliders	Cameron Geddes
16:00	Discussion on Organisation / Funding	
16:30-17:00	Coffee Break	
17:00-17:30	Physics considerations for laser-plasma linear colliders: achievements and perspectives	Celio Bordeia
17:30-18:00	Advances in Structures Wakefield Accelerator R&D for integration in a Linear Collider	Philippe Phu
18:00		

Tue 19/03 Wed 20/03 Thu 21/03 Fri 22/03 All days

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Season legend

Advanced collider concepts Staging Staging and scalability Sustainability

10:00	Sustainability	Dennis Weisler
10:00-10:30	Sustainability at CERN: strategy for future machines	Roberto Leo
10:30-11:00	Discussion on sustainability (efficiency budget prospects for LWF, PWFA)	
11:00	Coffee Break	
11:00-12:00	Prospects and challenges for high-repetition-rate plasma sources for future colliders	Simon Heide
12:00	General staging issues	Michael Bachhausen
12:00-12:30	Lunch Break	
13:00	Plasma mirrors for coupling stages	Christopher Spindler
14:00	Multistage LWFA based on curved plasma channels	Ryosuke U.
14:30-15:00	Hybrid LWF A-driven PWFA as a test platform for staged plasma acceleration	Susanne Schöber
15:00-15:30	Simulations of Next-Generation Colliders	Dr Axel Huebl
15:30-16:30	Coffee Break	
16:30-17:00	HALIF	Brian Foster et al.
17:00-17:30	Towards a Higgs Factory based on Proton Driven Plasma Wakefield Acceleration	Alexander Pukhov
17:30-18:00	Discussion	
18:00		

Tue 19/03 Wed 20/03 Thu 21/03 Fri 22/03 All days

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Season legend

Applications of advanced accelerators Deam Delivery System and positron acceleration Positer Session Structured Wakefield Accelerators

10:00	Existence mixing of flat beams in plasma accelerators	Severin Diederichs
10:30-10:30	Challenges for flat focusing	Yara Cervera
10:30-11:00	Laser driven production of ultra short high quality positron beams	Giulio Sim
11:00-11:30	Coffee Break	
11:30-12:00	Experiences with Wakefield Acceleration at SASEd SL	Evan Evans
12:00-12:30	Beam quality preservation using multi-staged dielectric based rectangular waveguides	Oliver Apollon
12:30-13:00	Lunch Break	
13:00		
14:00	AWAKE e plasma wakefield accelerator for particle physics	Marlene Farnik
14:30-15:00	The EuPRAXIA project: a plasma-based accelerator user facility for the next decade	Massimo Ferrero
15:00-15:30	Injector for PLSTIA IV	
15:30-16:00	Injector for a circular electron positron collider	Wu Li
16:00-16:30	Coffee Break	
16:30-17:00	Positer Session	
17:00		

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Season legend

Open Discussion and Conclusion Positrons and divergence physics

10:00	SFQED - Disruption Interplay in Leptonic Beam Interaction for Future Colliders	Dr Thomas Griesmayer
10:30-10:30	Positron acceleration in plasma wakefields for linear colliders: a review of progress and challenges	Sebastian Coste
10:30-11:00	SLAC FAJACET II Positron Source	Mark Heeper
11:00-11:30	Generation and acceleration of polarized electron bunches in plasma accelerators	Krzysztof Pfaber
11:30-12:00	Coffee Break	
12:00-12:30	Discussion on Simulations	Jorge Varela
12:30-13:00	Conclusions	
13:00-13:30		



- ❖ Monitor progress
- ❖ Understand the landscape (science, collaborations)
 - ❖ ESPP, Snowmass, P5
- ❖ Sustainability: feature advantages, sustainability:
 - ❖ ANA collider: 2x shorter, 2x less concrete, less SF₆, γ(>4)x more sustainable!



Wim Leemans, Europe



- ✧ ESPP supports investigation potential of LWFA/PWFA (for HEP)
- ✧ Effort driven by the LDG (Leemans, Pattathil)
- ✧ Pre-CDR 2026
 - ✧ based on HALHF, asymmetric (conventional $31e^+$, PWFA $500e^-$ GeV) Higgs factory
 - ✧ many possible upgrades presented
 - ✧ higher CM energies, multiple IPs and detectors, $\gamma\gamma$ collider, ...
- ✧ Broader roadmap includes:
 - ✧ AWAKE, EuPRAXIA, HALHF
 - ✧ all R&D for HEP or PP applications: staging, high rep-rate drivers, etc.

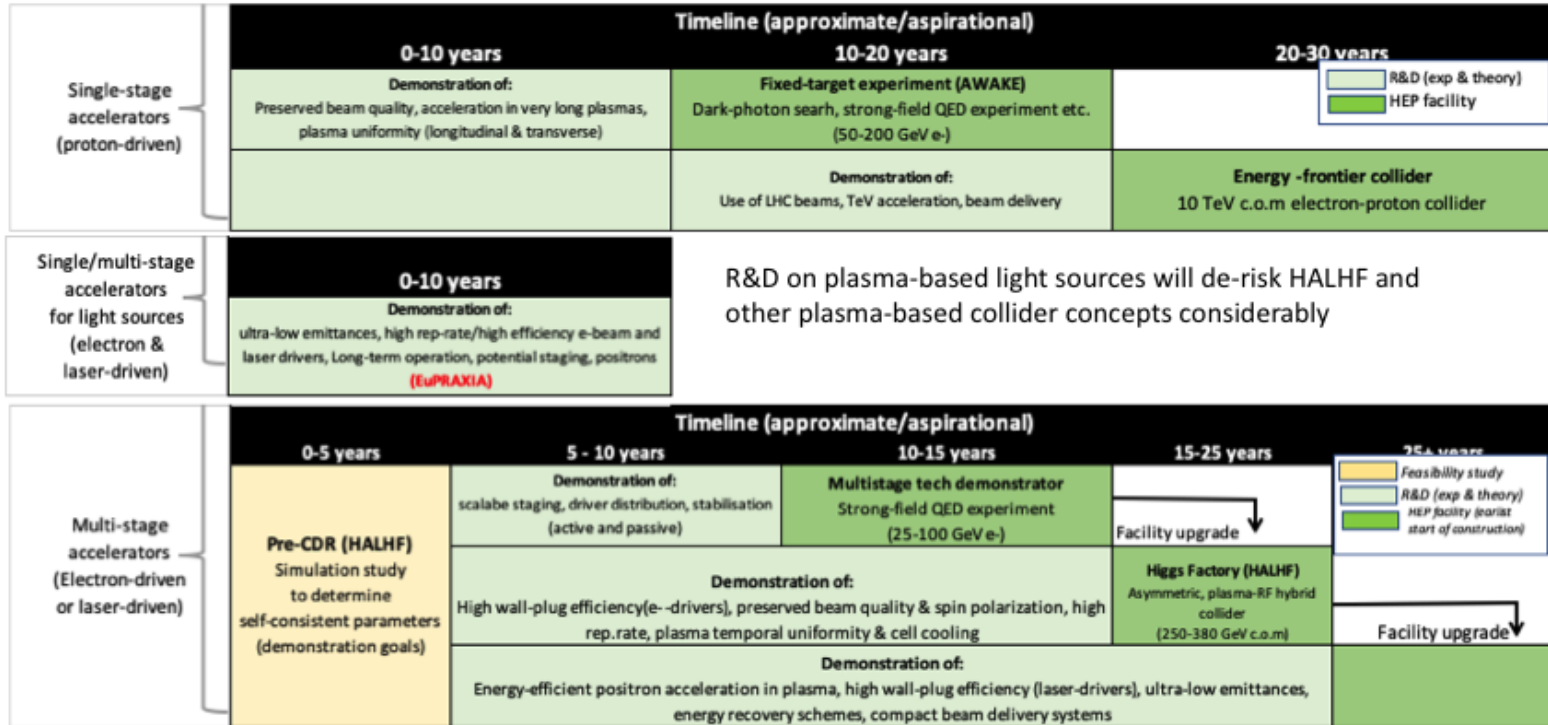
Cameron Geddes, USA



- ✧ Snowmass, P5
 - ✧ 10TeV lepton collider, i.e., e^-e^+ , e^-e^- , $\gamma\gamma$ for advanced concepts
 - ✧ existing effort, LBNL, SLAC, Argonne

ESPP (IN EUROPE)

Timelines for R&D on plasma-based colliders



ESPP clearly mentions need for R&D of ANAs

Update of the ESPP roadmap

Driven by the laboratory directors group (LDG), Wim, Rajeev

Emphasis on “other than TeV collider” contributions!

SOME TOPICS DISCUSSED

✧ Sustainability

✧ Essential

✧ Asset of ANA-based acceleration: high-gradient, less concrete, higher luminosity/power, ...

✧ Diversity of contributions

✧ EU: AWAKE, EuPRAXIA, HALHF, injector for PETRA IV and CEPC

✧ US: 10TeV lepton collider

✧ ANA community needs funding to make progress

✧ Main effort based on numerical simulations

✧ Exploit unique parameters of ANAs (high gradient, compactness, sustainability, ...)

✧ ICFA-ANA/ALEGRO has a role to play ... complementing existing efforts/projects/collaborations

✧ 10TeV lepton collider pre-conceptual design

OUTCOME OF THE WORKSHOP

Report on the Advanced Linear Collider Study Group (ALEGRO) Workshop 2024

ALEGRO 2024



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Document

Summary of the workshop

“One-pager” from each presenter

To be distributed: arxiv, ICFA panel, etc.

ROLE OF ALEGRO/ICFA-ANA?

- ✧ Gather the community to discuss progress and plans towards ...
- ✧ Structure the community around the development of a linear collider
- ✧ Monitor progress in, and determine the state-of-the-art of the ANA field
- ✧ Understand the landscape ...
- ✧ Inform ICFA about activities about worldwide ANA activities (ICFA panel!!!)
- ✧ Coordinate US/Europe/Asia efforts, complement existing programs/collaborations, ...



Possibilities to obtain funding:

- ✧ Identify best tools among existing collaborative programs funded by EU (e.g. , doctoral network, ERC synergy,...) to fund a simulation design study towards a pre-CDR for a TeV collider
- ✧ Other options to be identified (US, ...)
- ✧ Requires strong community involvement!

Expected outcome of the workshop!

ROLE OF ALEGRO/ICFA-ANA?

- ✧ Complement existing effort through coordination and quest for funding
- ✧ Contribute to 10TeV CM collider pre-CDR, already on-going in the US
- ✧ Determine through general studies and numerical simulations parameters of key elements:
 - ✧ interstage concepts, scaling of interstage; plasma mirrors; witness bunch parameters; plasma-based injector, IP physics; beam delivery system; plasma sources; accelerator module, two plasmas and inter-stage, 100GeV(?) modules; drivers
- ✧ Gather a group of 'enthusiasts' to:
 - ✧ determine state-of-the art
 - ✧ prepare a funding request:
 - ✧ US DoE ongoing effort
 - ✧ EU funding
 - ✧ joint US-EU finding (NSF?)



Expected outcome of the workshop!

ICFA-ANA PANEL ACTIVITIES

- ✧ Energize the very diverse and fragmented ANA community towards applications to high-energy physics
- ✧ Coordinate worldwide efforts
- ✧ Complement existing efforts
- ✧ Search for funding ... (EU)
- ✧ Motivate US panel members to organize ALEGRO 2025 (will request endorsement)



Thank you!

