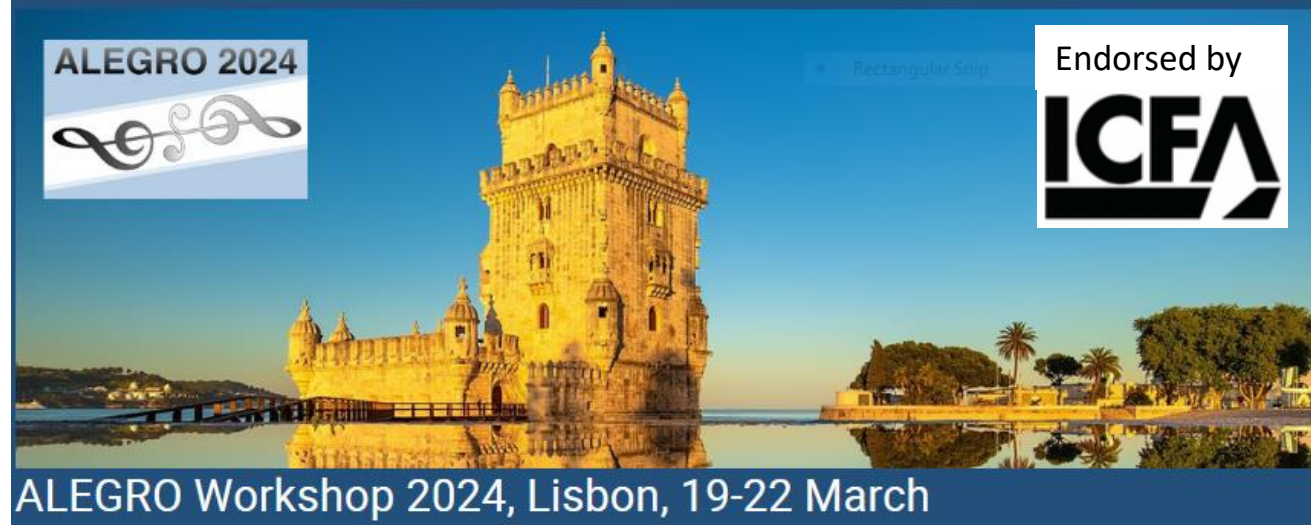


ALEGRO 2024



Patric Muggli
Max Planck Institute for Physics
Munich
muggli@mpp.mpg.de
<https://www.mpp.mpg.de/~muggli>

Brigitte Cros, Jorge Vieira

ALEGRO 2024



Welcome!

WHAT IS ALEGRO?

ALEGRO



Advanced LinEar collider study GROup

is the Advanced LinEar collider study GROup

is a study group towards Advanced Linear Colliders

is driven by the ICFA-ANA panel

workshops endorsed by ICFA

is world-wide

is inclusive

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



HOW DID WE GET HERE?



International Committee For Future Accelerators (ICFA)
Advanced and Novel Accelerators panel (ICFA-ANA)

Chair:

Brigitte Cros (2013-18)

...

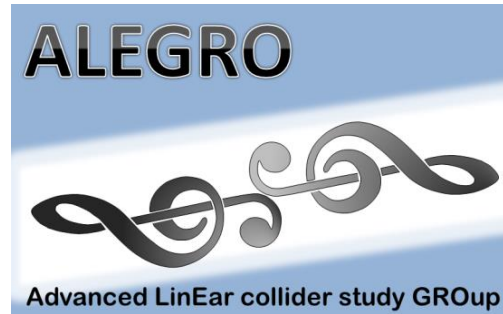
Chuanxiang Tang (2024-2026)

HOW DID WE GET HERE?

<https://indico.cern.ch/event/569406/>



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



... is one of the major outcome of the ANAR 2017 workshop!

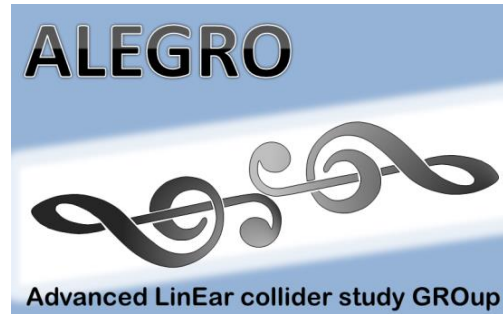
(Advanced LinEar collider study GROup) is a study group towards Advanced Linear Colliders. ALEGRO's general charge is to coordinate the preparation of a proposal for an advanced linear collider in the multi-TeV energy range.

HOW DID WE GET HERE?

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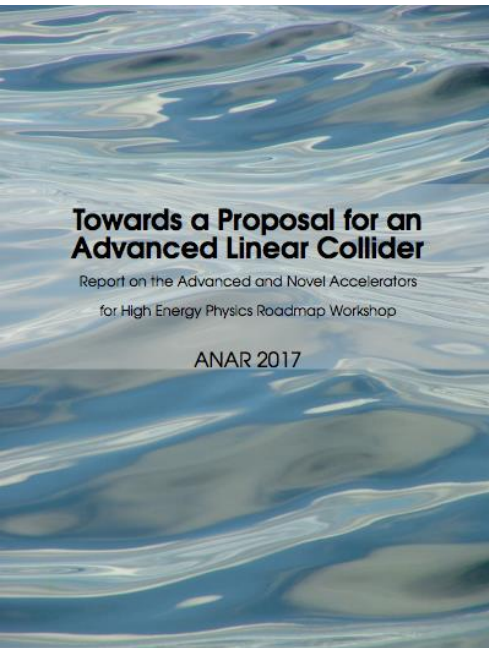
Advanced and Novel Accelerator (ANA) \Leftrightarrow $>1\text{GeV/m}$

HOW DID WE GET HERE?

<https://indico.cern.ch/event/569406/>



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

... is another major outcome of the ANAR 2017 workshop!

*Advanced and Novel Accelerators

ALEGRO INPUT FOR ESPP (2019)

Towards an Advanced Linear International Collider

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

Editing Board

Brigitte Cros, Patric Muggli, Carl Schroeder, Simon Hooker, Philippe Piot, Joel England, Spencer Gessner, Jorge Vieira, Edda Gschwendtner, Jean-Luc Vay, Michael Peskin

ALEGRO collaboration members as of September 2018 : Erik Adli¹, Weiming An², Nikolay Andreev³, Ozgur Apsimon⁴, Ralph Assmann⁵, Jean-luc Babigon⁶, Robert Bingham⁷, Tom Blackburn⁸, Christopher Brady⁹, Michael Bussmann¹⁰, Bruce Carlsten¹¹, James Chappetti¹², Jian Bin Ben Chen¹³, Sebastien Corde¹⁴, Laura Corner¹⁵, Benjamin Cowan¹⁶, Brigitte Cros¹⁷, Joel England¹⁸, Eric Esarey¹⁹, Ricardo Fonseca²⁰, Brian Foster²¹, Spencer Gessner¹³, Leonida A Gizzi²², Daniel Gordon²³, Edda Gschwendtner¹³, Anthony Hartin⁵, Bernhard Hidding²⁴, Mark Hogan¹⁸, Simon Hooker²¹, T. Hughes²⁵, Alexei Kanareykin²⁶, Stefan Karsch²⁷, Valentin Khoze²⁸, Pawan Kumar²⁹, Wim Leemans¹⁹, Francois Lemery⁵, Ang Li³⁰, R. Li¹⁸, Vladyslav Libov⁷, Emily Sistrunk Link³¹, Michael Litos³², Gregor Loisch⁵, Nelson Lopes^{20,33}, Olle Lundh³⁴, Alexey Lyapun³⁵, Edu Mann¹³, Mattias Marklund⁸, Timon Mehrling¹⁹, Patric Muggli^{13,27}, Pietro Musumeci², Zulikar Najmudin³³, Uwe Niedermayer³⁶, Jens Osterhoff⁵, Marc Palmer¹⁴, Rajeev Pattathil⁷, Michael Peskin¹⁵, Philippe Piot³⁸, John Power³⁹, Alexander Pukhov⁴⁰, Heather Ratcliffe⁴¹, Marc Riemann⁴², Veronica Sanz⁴³, Gianluca Sarni⁴⁴, Yuri Saveliev⁷, Levi Schachter⁴⁵, Lucas Schaper⁵, Norbert Schoenenberger³⁰, Carl Schroeder¹⁹, Sarah Schroeder⁵, Daniel Schulte¹³, Andrei Seryi⁴⁶, Sergey Shchelkunov³⁰, Craig Siders³¹, Evgenya Simakov¹¹, Christophe Simon-Boisson¹⁷, Michael Spannowsky²⁸, Christina Swinson³⁷, Andrzej Szczepkowicz⁴⁸, Roxana Tarkeshian⁵, Johannes Thomas⁴⁹, Jumpang Tian¹⁹, J.V. Tilborg¹⁹, Paolo Tomassini²², Vasilii Tsakanov⁵⁰, Jean-Luc Vay¹⁹, Jorge Vieira²⁰, Henri Vincenti²¹, Roman Waczkak²¹, Dan Wang⁵², Stephen Webb⁵³, Glen White¹⁸, Guoxing Xia⁴, Hitoshi Yamamoto⁵⁴, Tevong You⁵⁵, Igor Zagorodnov⁵

International
ANA
Community

arXiv:1901.10370v2 [physics.acc-ph] 30 Jan 2019

arXiv.1901.10370

¹ Univ Norway, Oslo, Norway

² UCLA, Los Angeles, California, USA

³ IHED, Moscow, Russia

⁴ Univ. Manchester, UK

⁵ DESY, Hamburg, Germany

⁶ LAL, Orsay, France

⁷ STFC, UK

⁸ Chalmers, Sweden

⁹ Warwick, UK

¹⁰ HZDR, Germany

¹¹ LANL, Los Alamos, New Mexico, USA

¹² University College London, UK

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30 Jan 2019

We will again produce a document!
We expect all speakers to write a “one-page summary” of their presentation!
(no original results expected)

arXiv:1901.10370v2

Ostenhoff^{1*}, Marc Palmer^{2*}, Rajeev Patil^{3*}, Michael Peskin^{4*}, Philippe Piot^{5*}, John Power^{6*}, Alexander Pukhov^{7*}, Heather Ratcliffe^{8*}, Marc Riembau^{9*}, Veronica Sanz^{10*}, Gianluca Sarti^{11*}, Yuri Saveliev⁷, Levi Schachter¹², Lucas Schaper⁵, Norbert Schoenenberger¹⁰, Carl Schroeder¹⁰, Sarah Schroeder⁵, Daniel Schulte¹³, Andrei Seryi¹⁶, Sergey Shchelkunov²⁰, Craig Siders¹¹, Evgenya Simakov¹¹, Christophe Simon-Boisson¹⁷, Michael Spannowsky²⁸, Christina Swinson¹⁷, Andrzej Szczepkowicz¹⁸, Roxana Tarkeshian⁵, Johannes Thomas¹⁹, Junping Tian¹⁹, J.V. Tilborg¹⁹, Paolo Tomassini²², Vasilii Tsakanov²⁰, Jean-Luc Vay¹⁹, Jorge Vieira²⁰, Henri Vincenti²¹, Roman Waczkak²¹, Dan Wang⁵², Stephen Webb²³, Glen White¹⁸, Guoxing Xia⁴, Hitoshi Yamamoto²⁴, Tevong You²⁵, Igor Zagorodnov²

Community

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arXiv.1901.10370

SERIES OF WORKSHOPS



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

2017



Somerville College

ALEGRO 2018 workshop at Oxford

26 March - 29 March 2018, Oxford, UK



2018




ALEGRO Workshop 2024, Lisbon, 19-22 March

2024

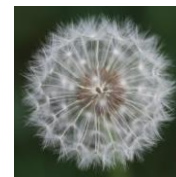


ALEGRO WORKSHOP 2019

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



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



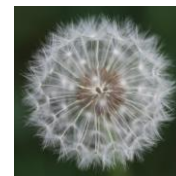
UNIVERSITY OF OXFORD
 JAI
 Somerville College
ALEGRO 2018 workshop at Oxford
 26 March - 29 March 2018, Oxford, UK

2018



ALEGRO WORKSHOP 2019
ALEGRO WORKSHOP 2019 CERN
 26-29 March

2019



2023



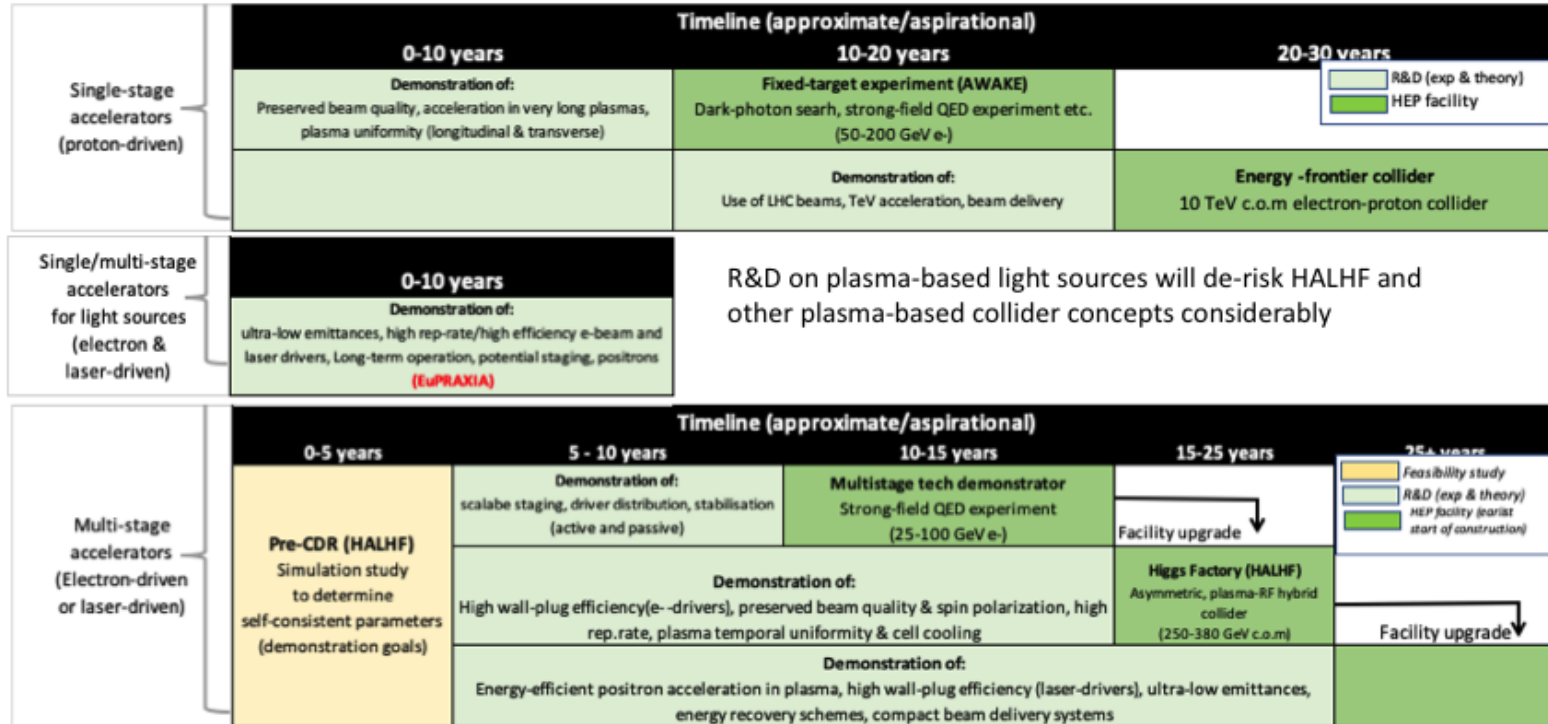
ALEGRO 2023
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 Location: DESY Hamburg, Germany
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 Administration: Daniela Koch

Next: USA 2025?
Driven by US ANA panel members?



ESPP (IN EUROPE)

Timelines for R&D on plasma-based colliders



ESPP clearly mentions need for R&D of ANAs

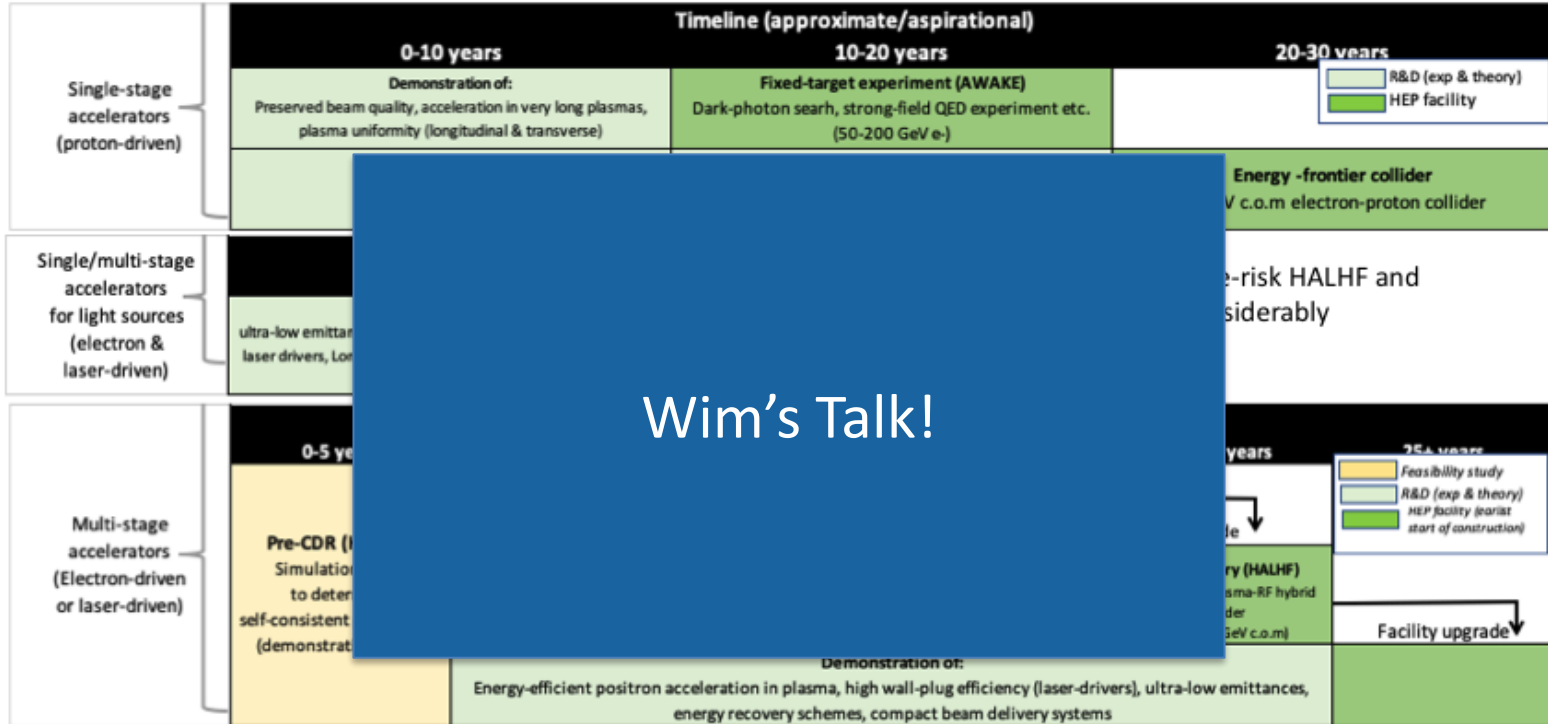
Update of the ESPP roadmap

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

Emphasis on “other than TeV collider” contributions!

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SNOWMASS & P5 (USA)

High-energy particle physics is the largest supporter of wakefield R&D in the US (DoE-HEP)

P5:

Highlights the importance of accelerators and the need for R&D to meet the needs of the future of the field

Supports a offshore Higgs factory this decade based on ready to build technology: either ILC or FCCee
Other Higgs factory options may be evaluated by the next P5 if neither goes forward

Supports R&D toward a cost-effective 10 TeV pCM collider based on proton muon or possible wakefield technologies including an evaluation of options for US siting of such a machine with a goal of being ready to build major test facilities and demonstrator facilities within the next 10 years

10 TeV is the motivating target, and staging steps at lower energies should support this goal

Emphasis on targeted collider R&D investments for developing comprehensive designs with cost models guiding technology advancements and collider pathways establishing advanced performance benchmarks for detectors and accelerators and training the next generation of experts. Including accelerator and detector.

A key next step for the wakefield community is delivery of an end-to-end design concept for 10 TeV including cost scales with self-consistent parameters throughout

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Supports a offshore Higgs factory
Other Higgs factory options

Priority: either ILC or FCCee
moves forward

Supports R&D toward a cost-effective
technologies including an evaluation
build major test facilities and
10 TeV is the motivating

on or possible wakefield
with a goal of being ready to
support this goal

Cameron's Talk!

Emphasis on targeted collider

designs with cost models

guiding technology advancements and collider pathways establishing advanced performance benchmarks for detectors and accelerators and training the next generation of experts. Including accelerator and detector.

A key next step for the wakefield community is delivery of an end-to-end design concept for 10 TeV including cost scales with self-consistent parameters throughout

ROLE OF ALEGRO?

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 worldwide ANA activities (ICFA panel!!!)

Coordinate US/Europe/Asia efforts



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 this workshop!

PROGRAM

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

Print PDF Full screen Detailed view Filter

Season legend

EU and US Roadmap Welcome Session and Introduction

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

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

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

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Season legend

Applications of advanced accelerators Beam Delivery System and positron deceleration Poster Session Structured Wakefield Accelerators

10:00	Existence mixing of flat beams in plasma accelerators	Severin Diederichs
10:00 - 10:30	Arbeitskreis Fano, Institut Superior Técnico	
10:30 - 11:00	Challenges for flat focusing	Vera Ceder
10:30 - 11:00	Arbeitskreis Fano, Institut Superior Técnico	
11:00 - 11:30	Laser driven production of ultra short high quality positron beams	Giulia Sem
11:00 - 11:30	Arbeitskreis Fano, Institut Superior Técnico	
11:30 - 12:00	Coffee Break	
11:30 - 12:00	Arbeitskreis Fano, Institut Superior Técnico	
12:00	Experiences with Wakefield Acceleration at SLAC/SL	Evatt Evans
12:00 - 12:30	Arbeitskreis Fano, Institut Superior Técnico	
12:30 - 13:00	Beam quality preservation using multi staged dielectric based rectangular waveguides	Oliver Apollon
12:30 - 13:00	Arbeitskreis Fano, Institut Superior Técnico	
13:00	Lunch Break	
13:00 - 14:30	Arbeitskreis Fano, Institut Superior Técnico	
14:00	AWAKE & plasma wakefield accelerator for particle physics	Marlene Farnik
14:30 - 15:00	Arbeitskreis Fano, Institut Superior Técnico	
15:00	The EUPHROSIA project: a plasma-based accelerator user facility for the next decade	Massimo Ferraro
15:00 - 15:30	Arbeitskreis Fano, Institut Superior Técnico	
15:30 - 16:00	Injector for PLSTIA IV	
15:30 - 16:00	Arbeitskreis Fano, Institut Superior Técnico	
16:00	Injector for a circular electron positron collider	Wu Li
16:00 - 16:30	Arbeitskreis Fano, Institut Superior Técnico	
16:30 - 17:00	Coffee Break	
16:30 - 17:00	Arbeitskreis Fano, Institut Superior Técnico	
17:00	Poster Session	
17:00 - 18:00	Arbeitskreis Fano, Institut Superior Técnico	

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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
10:00 - 10:30	Arbeitskreis Fano, Institut Superior Técnico	
10:30 - 11:00	Positron acceleration in plasma wakefields for linear colliders: a review of progress and challenges	Sebastian Coste
10:30 - 11:00	Arbeitskreis Fano, Institut Superior Técnico	
11:00 - 11:30	SLAC FAJACET 8 Positron Source	Matt Heugan
11:00 - 11:30	Arbeitskreis Fano, Institut Superior Técnico	
11:30 - 12:00	Generation and acceleration of polarized electron bunches in plasma accelerators	Kristen Pifer
11:30 - 12:00	Arbeitskreis Fano, Institut Superior Técnico	
12:00	Coffee Break	
12:00 - 12:30	Arbeitskreis Fano, Institut Superior Técnico	
12:30 - 13:00	Discussion on Simulations	Jorge Vieira
12:30 - 13:00	Arbeitskreis Fano, Institut Superior Técnico	
13:00	Conclusions	
13:00 - 13:30	Arbeitskreis Fano, Institut Superior Técnico	

Conference Dinner

20:00	
21:00	
22:00	
19:30 - 22:30	

Monitor progress
Understand the landscape (science, collaboration)
Sustainability:

ANA collider: 2x shorter, 2x less concrete, less SF₆, Y(>4) x more sustainable!

THANK YOU!!!



HUGE **thank you** to Jorge and all the LOC!

Enjoy the workshop!

Thank you for participating!