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Report from WG4 ALEGRO

Discussion on TOC con'd
Assessment on positron sources
Dedicated facilities Eupraxia, kBella
support dedicated facilites for ANA R&D

Summary of day 1 (Tuesday)

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Physics of **nonlinear and quasi-linear regimes** well understood
May want different regimes for different stages of accelerator
Quasi-linear regime allows use of multi-pulse drivers & bunch trains
Energy recovery could be important for efficiency & heat management

Many options for **laser-driven injectors**; more R&D needed to be collider relevant
Careful management of **staging & coupling** is required; more R&D needed

There are concrete plans for EuPRAXIA 5 GeV, ~ 10 Hz beam
Several laser technologies have been identified, but significant R&D needed

Positron sources, Less mature at this stage
Consensus on need for more work in this area
Hollow channels likely needed; how to make them?
Novel cooling methods likely to be needed (bunches too short for damping rings)
More experimental facilities needed to test concepts. Possibilities are EuPRAXIA, APOLLON, RAL …

Outline of day 2 (Wednesday)

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Facilities
Proposed statement on positron sources
Dedicated facilities Eupraxia, kBella
Proposed doc structure

Two project relevant to collider studies are underway

Bella facility

Multi-GeV Staging objective is an important milestone for accelerator development

Proposed upgrade to KHz operation is a major step toward a collider

Eupraxia DS / facility

Reliability objective is an important milestone for accelerator development

One beamline for applications, useful for collider relevant studies

For example, the development of a positron source and acceleration mechanism

Alegro strongly support this opportunity of positron study

Proposed statement on positron sources

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ALEGRO has identified a clear need to develop plasma based technology to make positron beams for particle physics.
As EuPRAXIA is planning to have a dedicated electron beam to create a positron source, there is an opportunity for an international project to work on a positron beam alongside EuPRAXIA.
The idea of such a project has full support of ALEGRO.
Plasma based technology to make positron beams for particle physics is vital for plasma based colliders. A facility of this type would complement very well FACET-II program at SLAC and could lead to very much needed industrial applications.

Discussion on diagnostics

Innovative instrumentation is needed for beams with extreme parameters

Duration , transvers size, timing

Need to define the requirements

(compatible with 10MW beams)

Talk on new diags particle beam induced ionization techniques

Bunch density monitor, based on field ionization

Simulations, sub fs resolution

Challenges and need for a flagship facility

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List of key milestones / challenges for the next decade

GeV positron acceleration in a LWFA
kHz LWFA operation
Demonstration of collider-relevant 6D brightness
High-efficiency laser driver demonstration (10%)
Efficient laser to bunch demonstration

Energy recovery & heat management
Plasma engineering
Efficient & emittance-preserving staging

Need for an accelerator test facility

1-Preservation of beam quality (Eupraxia type machine)
2- Test facility aimed at specific goals (high energy, specific applications)

The ALEGRO report for the European Strategy Study 2020 discussion in WG4

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- 1. **Introduction**; vision statement
- 2. **Review of the ANAR 2017 report**: reference
- 3. **Facilities using advanced acceleration**: ongoing project, current investments, results/status, spinoffs or synergy with other applications
- 4. **Our long-term goal: the Collider of the Future (COF), call for a better name? Compact Linear Collider? introduce a few sets of parameters,** discuss what is needed from the advanced accelerator technology so that the pieces fit together
- 5. **Physics considerations that justify the parameters of the COF energy and luminosity** (30 TeV, 10^36) (250GeV, ??), (1TeV, ??)
- 6. **COF CLC Machine components**
  For each component: what is achieved already ? what are the next milestones ? what are the possible show-stoppers, and how can these be addressed? planned near term test facilities
- **7. integrated system**: 7.1tolerances, 7.2 instrumentation, 7.3 simulation
- 8. **Partners and resources, current activity level. what is needed? What do we support?**

The ALEGRO report for the European Strategy Study 2020 with names for WG4

- 1**. Introduction**; vision statement Eric Esarey
- 2. **Review of the ANAR 2017 report**: reference
- 3. **Facilities using advanced acceleration**: Eu :Ralph Assman, US: Carl Schroeder, Asia:
- 4. **Our long-term goal:** Carl Schroeder, Dan Gordon, Daniel Schulte
- 5. **Physics considerations that justify the parameters of the COF energy and luminosity** (30 TeV, 10^36) (250GeV, ??), (1TeV, ??) physics group

The ALEGRO report for the European Strategy Study 2020 with names for WG4

- 6. **COF CLC Machine components**
- 6.1 e-/e+ sources, cooling; Oznur Apsimon+positron group+Stefan Karsch (contributes)
- 6.2 accelerating structures; Simon Hooker, Pawan Kumar
- 6.3 Coupling/transport components between stages; Jens Osterhoff, Maxence Thevenet,
- 6.4 drivers , lasers Wim Leemans, Laura Corner, Stefan Karsch (contributes)
- 6.5 BDS: IP components and detectors, Andrei Seryi, Ralph Assmann, Stepan Bulanov
- **7 integrated system**:
- **7.1 tolerances**, Carl Schroeder, Daniel Schulte, PHI Nghiem/Jorge Viera
- **7.2 instrumentation**, Roxana Tarkashian, Jeroen van Tilborg
- **7.3 simulation** WG TMS
- 8. **Partners and resources, current activity level. what is needed? What do we support?** Simon Hooker, Brigitte Cros