Draft 0.1 Roadmap

Suggestions for Contents, Focus and Structure - for Discussion

Goal: In March: Basic outline which we may rely and work on.

First session of the ERL expert panel, ZOOM, 25 February, 2021. Max Klein with Andrew Hutton

The Development of Energy Recovery Linacs

A Contribution to the European Strategy for Particle Physics
Long Write-UP

We believe we need a long write-up
as a reference and a short summary

The ERL Panel:

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Abstract (DRAFT)

Sth like that..

Energy recovery linacs (ERL's) have been emphasised by the recent (2020) update of the European Strategy for Particle Physics as one of the most promising technology for the accelerator base of future high energy physics. They are indeed beginning to assert their potential as game changers in the field of accelerators and their applications. Their unique combination of bright, linac-like beam quality with high average current and extremely flexible time structure, unprecedented operating efficiency and compact footprint opens the door to previously unattainable performance regimes. This paper summarises the previous achievements on ERLs and the status of the field and its basic technology items. The main possible future contributions and applications of ERLs to particle and nuclear physics as well as industrial developments are presented. Many of the single resulting requirements will be or have been already met in the ongoing concerted effort, which will move the field forward with complementary facilities. A corresponding roadmap is established, describing major opportunities, new facilities, milestones, deliverables and necessary investments, as a coherent global effort to meet expectations in the next five years and further ahead. It thus is realistic to predict that a viable technical ERL base will originate in the not distant future serving as a reliable input to strategic high energy physics decisions to come.

The paper includes a vision for the further future, beyond 2030, as well as a comparative data base for the main existing and forthcoming ERL facilities. At hand is an unprecedented technology combining strongly enhanced performance of electron and photon beam based physics with sustainable power consumption, by using the decelerated beam for new acceleration, and with non-radiative waste, as the beam is dumped at injection energy. A series of continuous innovations, such as on intense electron sources or high quality superconducting cavity technology, will massively contribute to the development of accelerator physics at large. Industrial applications potentially are revolutionary and may carry the development of ERLs much further, establishing another shining example of the impact of particle physics on society and its technical foundation with a view on sustaining nature.

Will surely be updated as the paper emerges

Structure A: Linear Write-up

In brief

DRAFT 24/2/21
Note: First Panel Meeting 25/2/21

May well become 1-200 pages paper

In more detail

← Facility Overview here

Cf next pages

6.1: Aim is to present status and progress of the various crucial technology elements wrt goals set in preceding section

6.2: To present MESA, sDALINAC, bERLinPRO, Recuperator and PERLE as the facilities to operate in Europe in the twenties
keep context with US and Japanese developments

↓

PR: Compared to plasma, ERL has underdeveloped public attention

We have to consider perception of ERLs, care for graphics and plots

In more detail

Subdivison Structure **B**: introduce Chapters

Expand the different science cases, add industry, to a chapter 2. ←

Move recommendations out into the executive summary ←

Probably independently of A or B

Structure **B**

Chapter 1

Structure **B**

Chapter 2

These shall be BRIEF introductions references, 1-2 plots, to establish link to ERL and motivate parameter goals

For Discussion

- Your opinion on basic structure: Long-Writeup [A or B or..] plus Recommendation/Summary. No need to decide today:
- We shall take time to get the (sub)headings right and identify (next time) lead authors
- Before we can write/decide we shall take time for mutual information and discussion (plan for a 2 day meeting April?)
- What are we missing? What do we emphasise as critical topics?
- Priority is probably: high current multi-turn ERL, we are orders of magnitude below the required ~20mA
- The roadmap timing of 5 years is very short. We need to stay realistic while requesting support, include 10y horizon
- ERL is a global development, huge expertise outside Europe, needs integration and a coherent picture:
- Coherence can be established exploiting complementarity: CEBAF hi E, eCOOLER/bPRO hi I, CBETA/PERLE multiturn, MESA polarised…
- This panel is an advisory board, we have no executive power. We shall think about how to attract ERL community.
- When it comes to five roadmaps, ERL will have to stand scrutiny, **it is about the others understanding and us collaborating** ....