



Introduction, AWAKE Run 2 General Overview and Timeline

HEPHY Seminar
April 7, 2022

Edda Gschwendtner, CERN

History

- 2020/2021: Discussion with Brigitte and Phi about feasibility of a laser driven plasma wakefield accelerator for AWAKE.
- January 2021: Letter of intent of collaboration between IRFU-DACM, CNRS-LPGP and AWAKE. Sent to french directorates.
- February 2022: Restart of discussion, triggered by new recruitment in Phi's team.

25th January 2021

IRFU-DACM, CNRS-LPGP Collaboration with AWAKE


This document is a letter of intent to initiate a formal scientific collaboration between IRFU-DACM, CNRS-LPGP and the AWAKE collaboration towards the study and development of a LWFA accelerator injector for AWAKE Run 2 and future AWAKE applications. Once the respective parties, IRFU-DACM and CNRS-LPGP, and AWAKE will have agreed on the appropriateness of such a collaboration, the collaboration will be formalized through a memorandum of understanding (MoU) between AWAKE, CERN, and IRFU-DACM and CNRS-LPGP.











The project will then be fully integrated into the existing AWAKE project structure.

Today's Program

LWFA4AWAKE meeting

Monday 11 Apr 2022, 09:00 → 12:00 Europe/Zurich

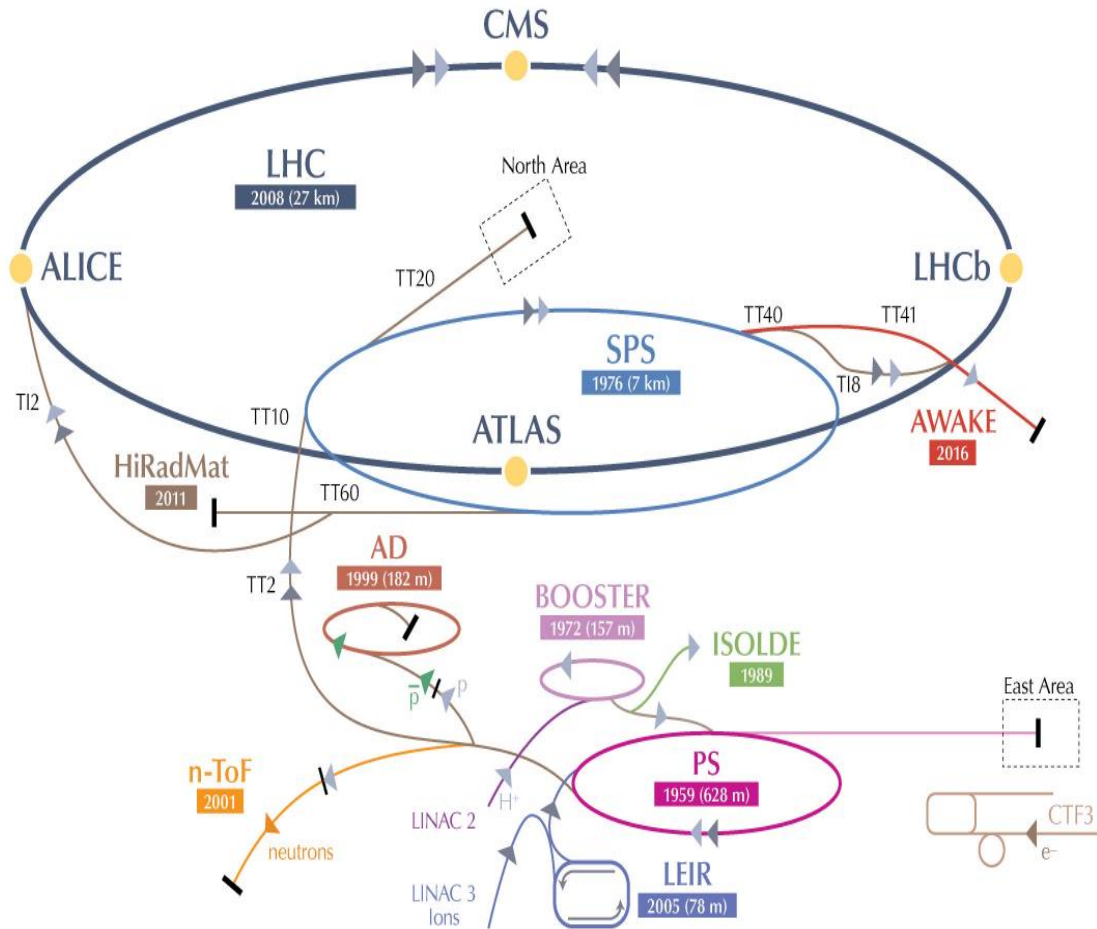
Videoconference  LWFA4AWAKE meeting Join

09:00	→ 09:15	Introduction, AWAKE Run 2 general overview and timeline Speaker: Edda Gschwendtner (CERN)	15m	
09:20	→ 09:30	Physics goals of Run 2 Speaker: Patric Muggli (Max Planck Institute for Physics)	10m	
09:30	→ 09:40	Electron beam requirements Speaker: John Patrick Farmer (MPP / CERN)	10m	
09:45	→ 10:05	Studies on an LWFA injector for AWAKE Run 2 Speakers: Phi Nghiem, Brigitte Cros	20m	
10:05	→ 10:20	Discussion	15m	
10:20	→ 10:35	Baseline Electron Source Speaker: Steffen Doebert (CERN)	15m	
10:35	→ 10:50	Coffee/Tea Break	15m	
10:50	→ 11:05	Baseline Electron Line Speaker: Vittorio Bencini (John Adams Institute for Accelerator Science (GB))	15m	
11:05	→ 11:20	Baseline Laser System Speaker: Edu Granados (CERN)	15m	
11:20	→ 11:35	Plasma source Speaker: Michele Bergamaschi (Max-Planck-Institut für Physik/CERN)	15m	
11:35	→ 12:00	Discussion	25m	

Goal of this Meeting

- Present the current baseline and timeline of AWAKE Run 2
- Present idea of LWFA for AWAKE as alternative electron beam
- Discuss the feasibility of LWFA4AWAKE
- Identify milestones and decision points
- Define who is doing what

AWAKE at CERN



Advanced WAKEfield Experiment

AWAKE Run 1 (2016-2018):

- ✓ 1st milestone: Demonstrate seeded self-modulation of the proton bunch in plasma (2016/17)
- ✓ 2nd milestone: Demonstrate electron acceleration in plasma wakefield driven by a self-modulated proton bunch. (2018)

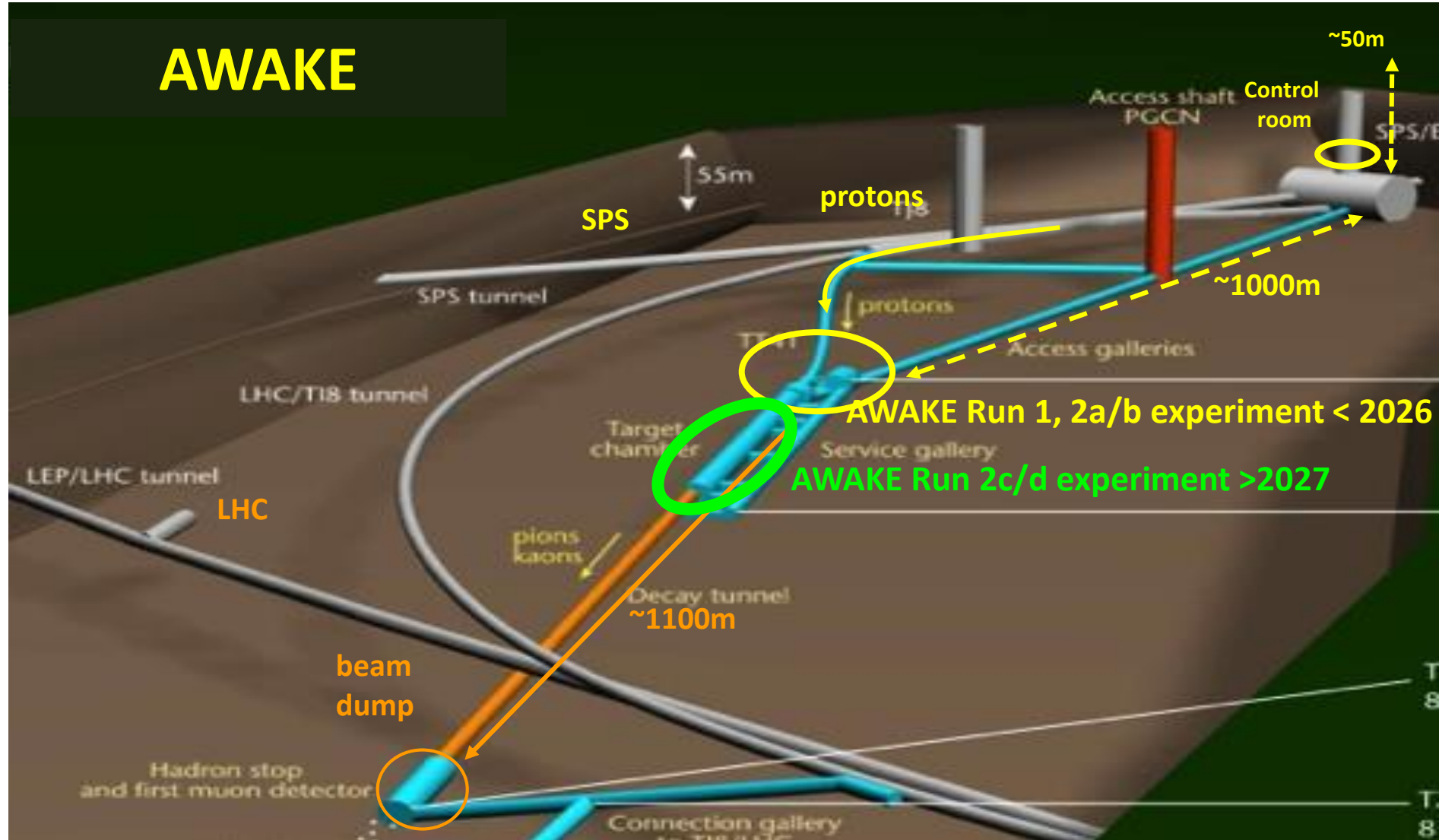
AWAKE Run 2 (2021 – ~2029):

Accelerate an electron beam to high energies (gradient of 0.5-1GV/m) while preserving the electron beam quality and demonstrate scalable plasma source technology.

Once AWAKE Run 2 demonstrated: First application of the AWAKE-like technology:

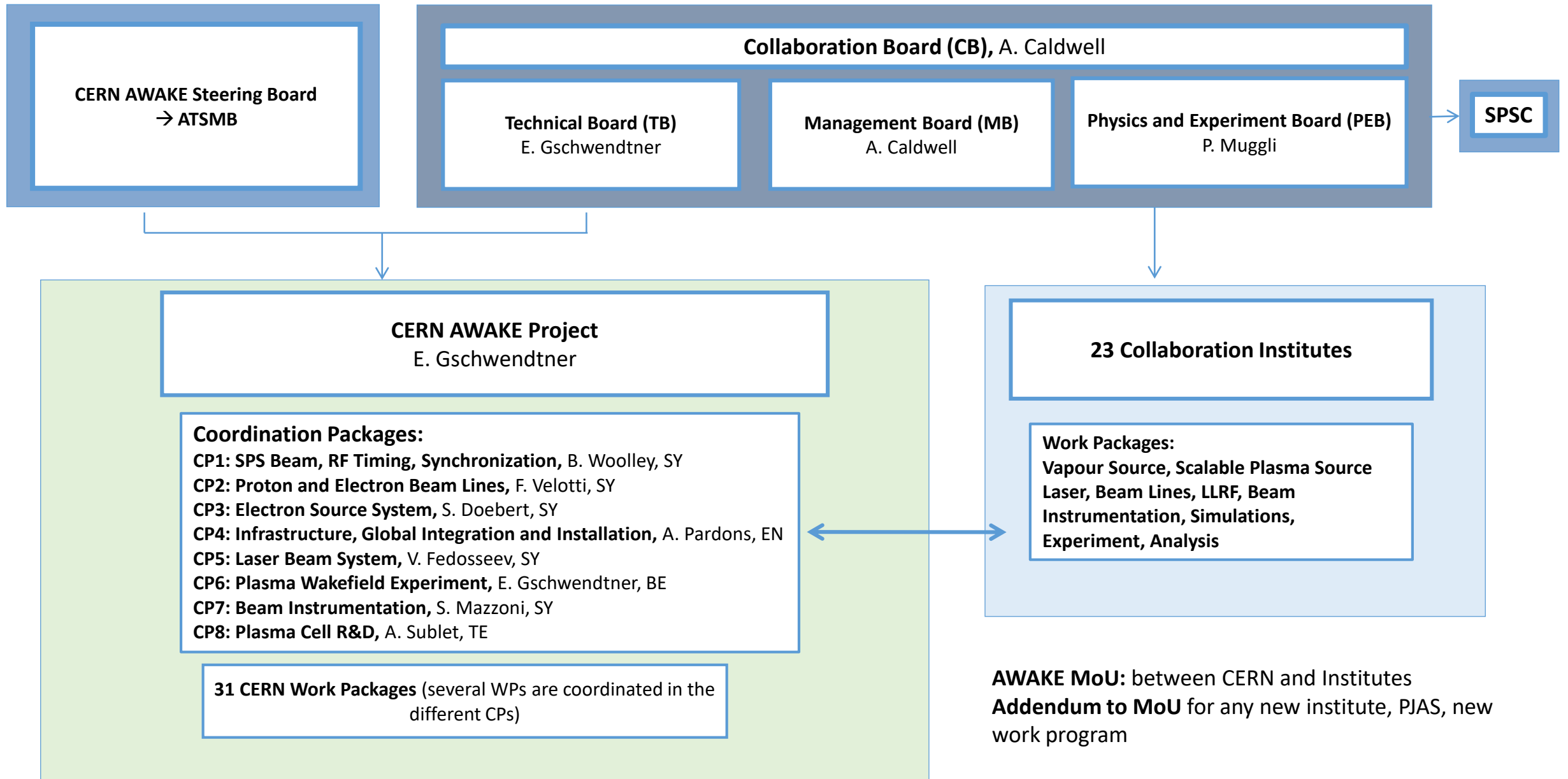
Fixed target experiments for e.g. dark photon search.

AWAKE at CERN



AWAKE installed in CERN underground area

AWAKE Collaboration Structure



CERN ↔ Institutes

Technical Coordinator/Technical Board:

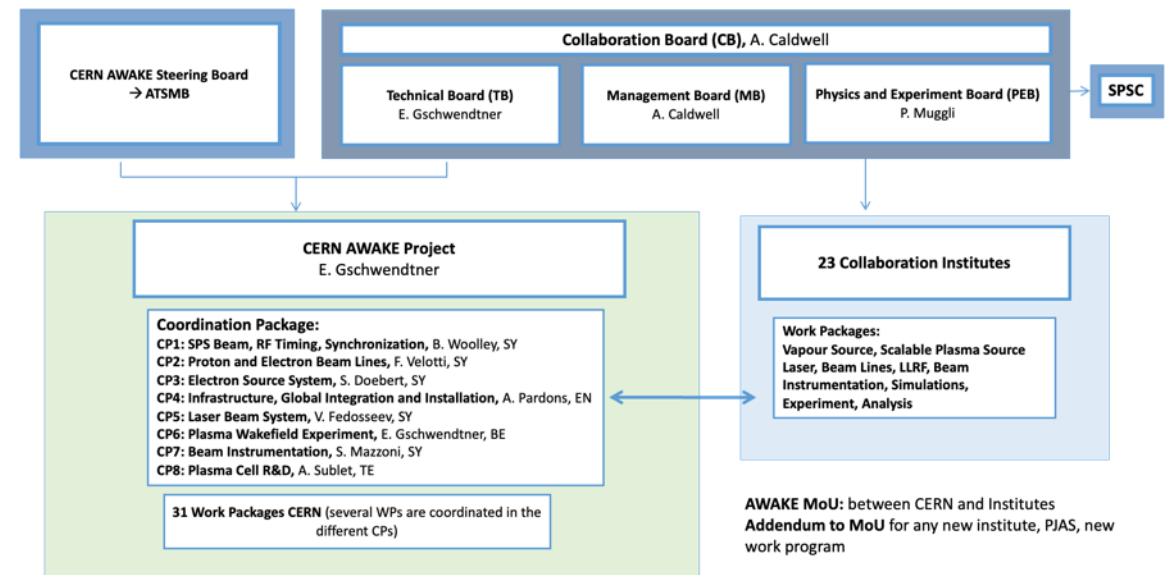
The Technical Coordinator coordinates **design, integration, interfaces** and **commissioning of the experiment, planning and milestone tracking** of the experiment, and **specifications for the technical implementation** of the experiment. → meetings every ~6 weeks, indico, minutes.

Physics and Experiment Coordinator/Board:

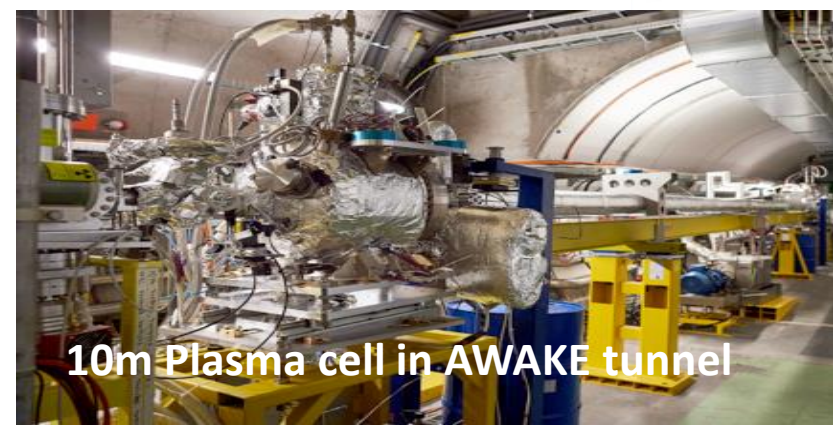
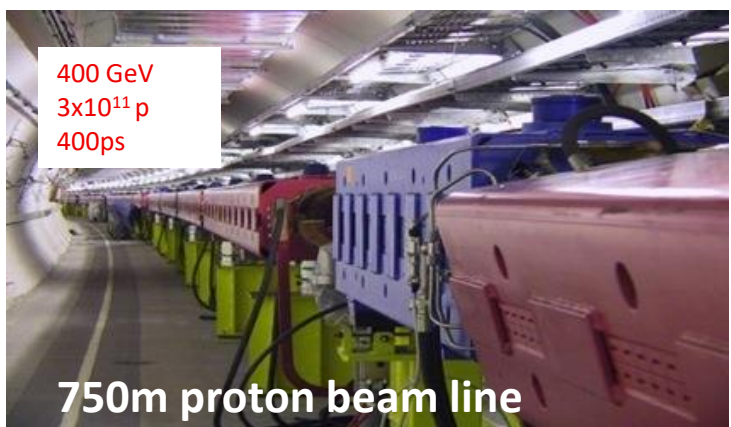
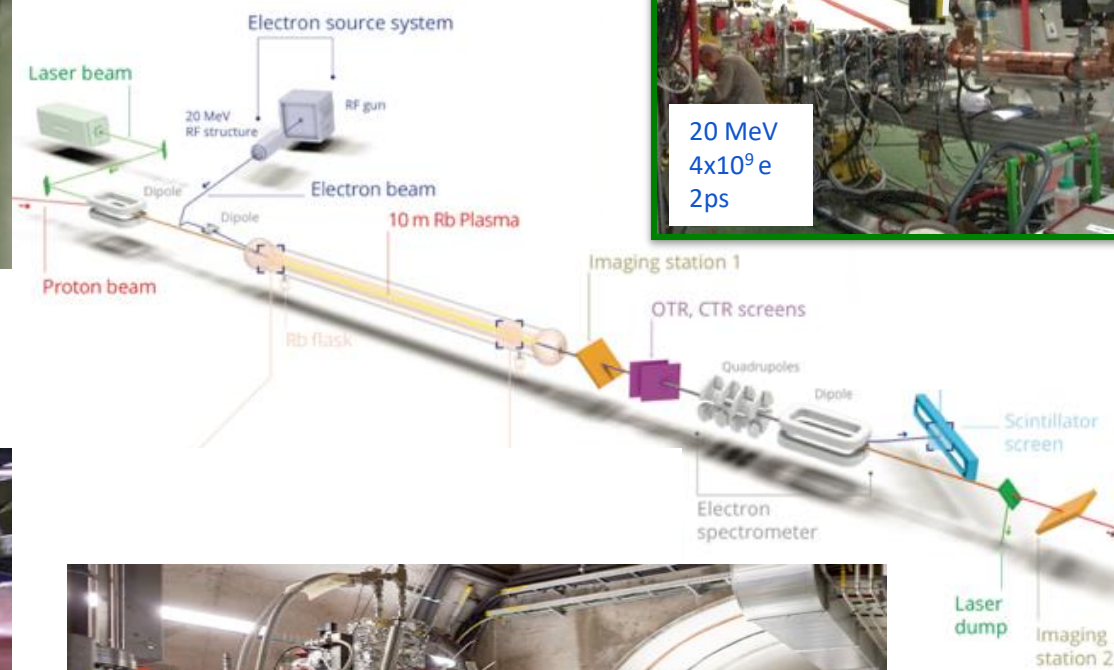
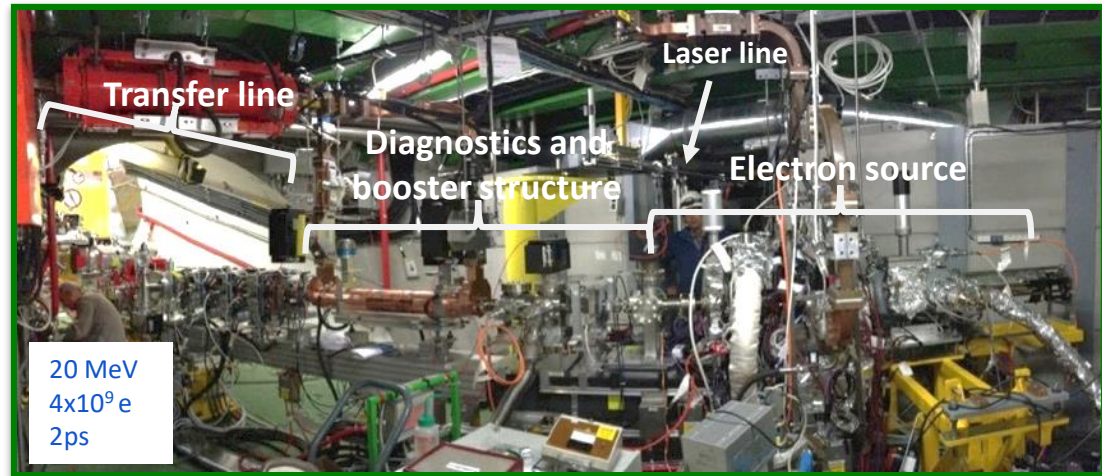
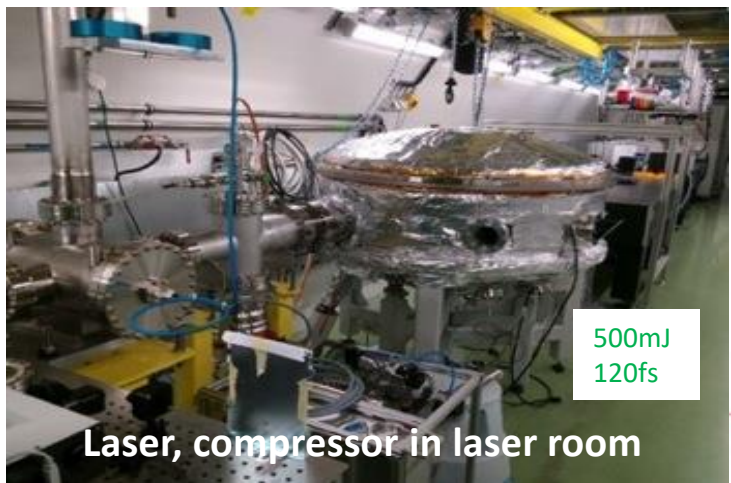
The Coordinator defines the Physics **goals of the experiment, set the simulation, measurement and data analysis strategy**, formulate the specifications on the beams, plasma cell and related equipment and diagnostics devices and defines the data analysis tools and strategies. → meetings every ~6 weeks, indico, minutes.

Simulation Coordination: → bi-weekly meetings, indico, minutes.

Run Coordination: Near-term organization of experimental program, analysis of recent issues bi-weekly meetings, indico, minutes

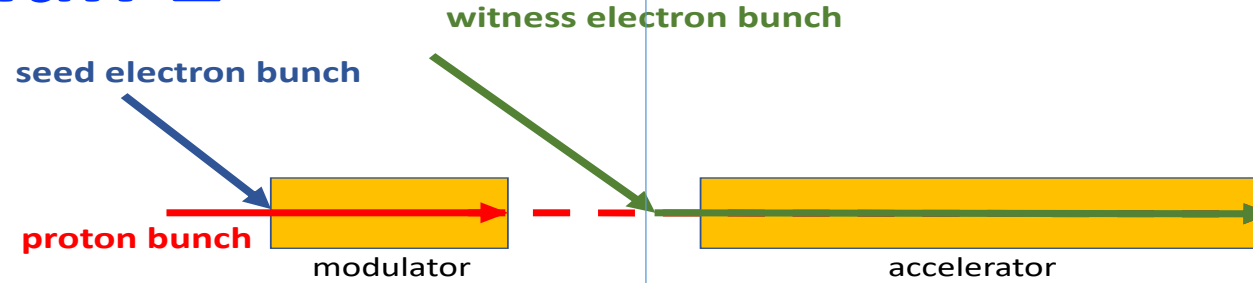


Key Ingredients of AWAKE



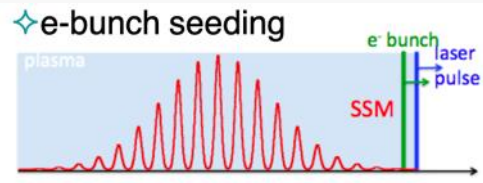
AWAKE Run 2

Optimize self-modulation of the proton bunch



Optimize acceleration of electrons in p-driven plasma wakefield

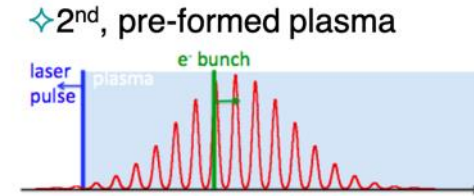
AWAKE Run 2a: self-modulation of entire p-bunch seeded with an e-bunch



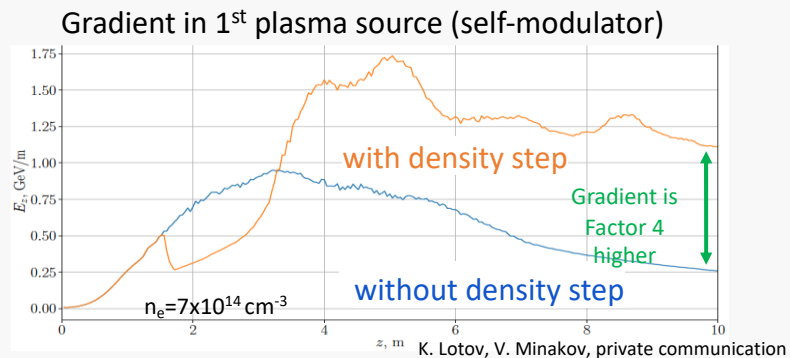
2021/
2022

2028 ++

AWAKE Run 2c: electron acceleration and emittance control

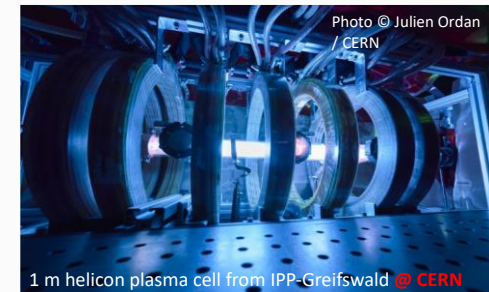


AWAKE Run 2b: stabilization of the micro-bunches with a density step in the plasma cell and maintain high gradient



2023/
2024

AWAKE Run 2d: scalable plasma sources



➔ In existing AWAKE facility

➔ In extended AWAKE facility

AWAKE Run 2 Global Schedule with Milestones

