The AWAKE Electron Spectrometer

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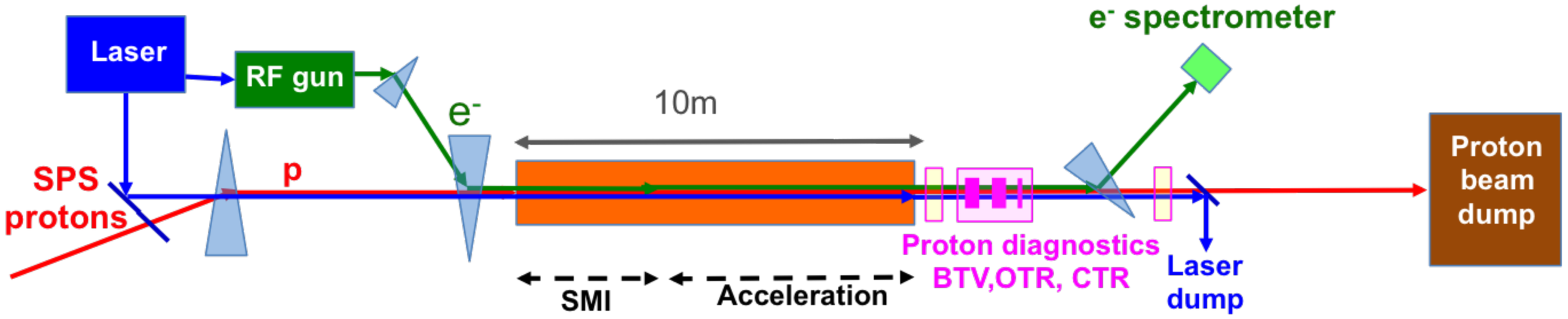
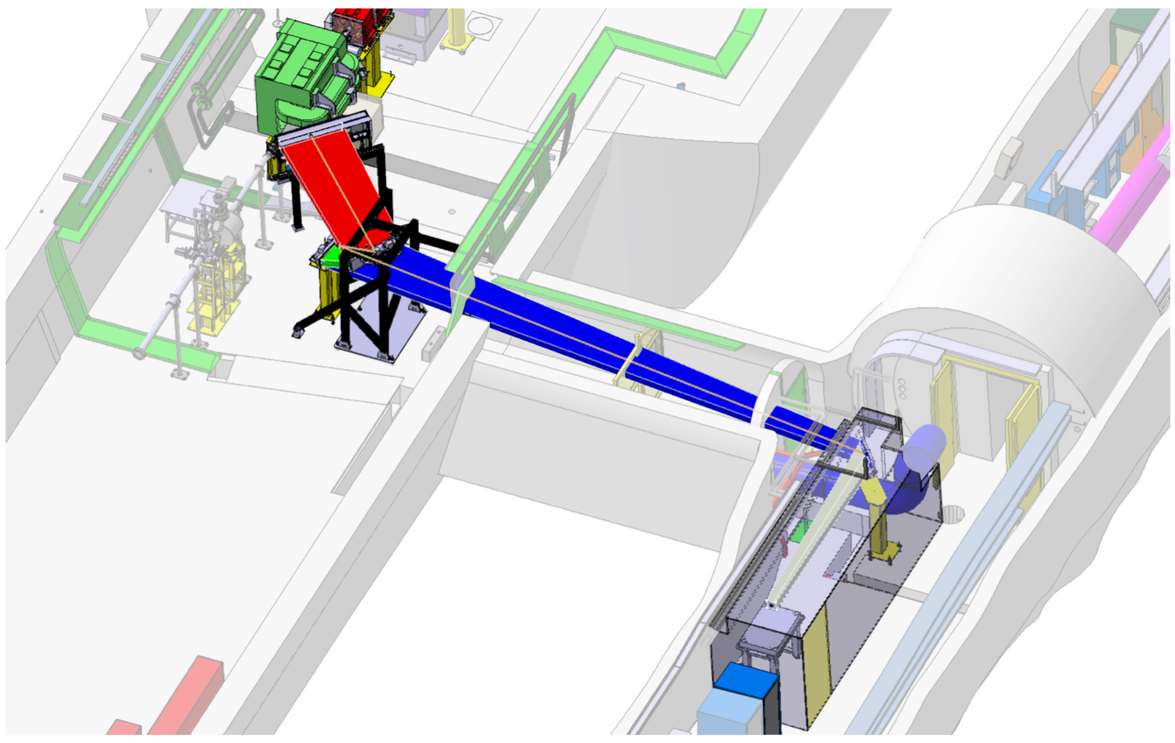
AWAKE

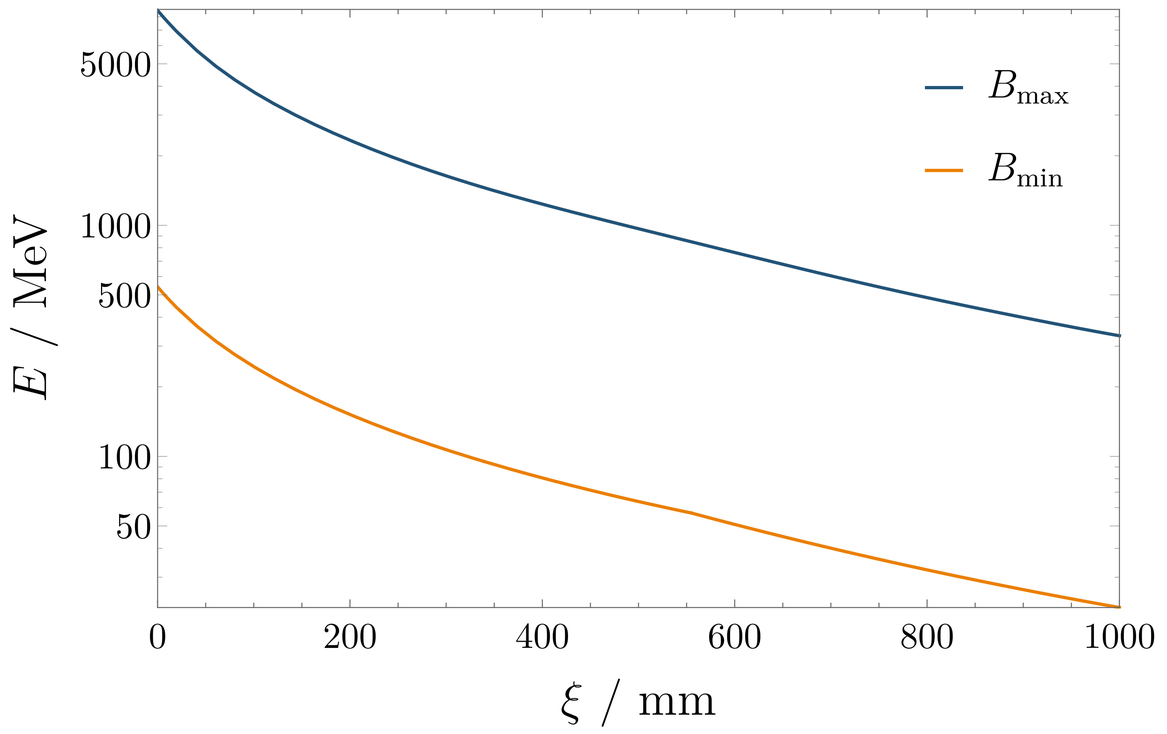
The AWAKE experiment at CERN aims to use a **proton driven** plasma wakefield to **accelerate electrons** from 10–20 **MeV** up to **GeV** energies in a **10 m** long **rubidium** plasma cell.



Spectrometer design

Accelerated electrons are separated from the SPS protons by a 0.1–1.5 T dipole magnet and are incident on a **1 m** wide **DRZ-High** (Gd_2O_2S:Tb) scintillating **screen**. The scintillator light is transported to an **intensified** CCD camera (Andor iStar 340T) in an adjacent tunnel.





Optics

To collect as much light as possible while maintaining **spatial resolution**, a large diameter, **400 mm** focal length **lens** (Nikon AF-S NIKKOR 400 mm f/2.8E FL ED VR) is attached to the camera. Scintillator light is brought to the lens via **three highly reflective mirrors**: two in the same tunnel as the scintillator and a third in the adjacent tunnel. All three mirrors are **optical-grade**, with **λ/2 flatness** over any 100 mm, thus ensuring that the system resolution remains **high**.

	Width	Height
Mirror 1	898.2 mm	121.5 mm
Mirror 2	819.5 mm	126.4 mm
Mirror 3	504.6 mm	140.5 mm

Calibration tests

Charge response tests of the **scintillator** indicate that beam charges of $O(10^{-2}$ **pC**) will be **clearly visible** even in the presence of **significant** proton **background** radiation.

The **temporal evolution** of the amount of **light emitted** by the scintillator has been studied. This emission **decays** away **exponentially** with a measured half-life of **324 ± 5 µs**.

In order to determine the **resolution** of the **optical system** a modulation transfer function (**MTF**) analysis has been carried out using a **masked lamp** with four line pair spacings. The results indicate that the system is **not yet optimally aligned**.