

Plasma Sources for Acceleration and Focusing in Future Lepton Colliders

Project outline, current “Verbund”

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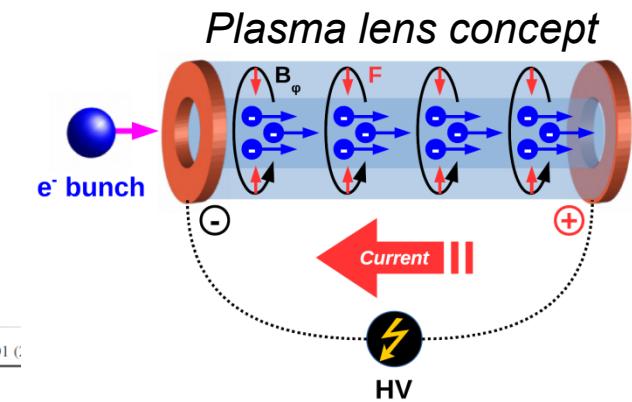
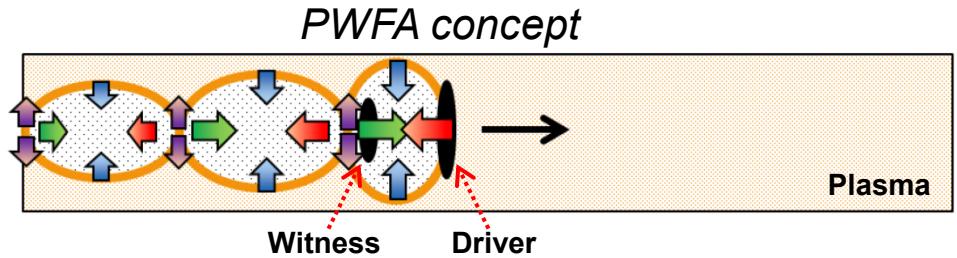
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Applications of plasmas in linear colliders

Acceleration and focusing of particles in plasmas

- ▶ Plasma wakefield acceleration (**PWFA**) offers path to acceleration gradients $\gg 100 \text{ MV/m}$
- ▶ **Plasma lenses** demonstrated (symmetric) focusing gradients $>kT/m$
- Potentially **shrinking size & cost** and **improving positron luminosity** in future collider
- ▶ Focus on 2 applications:
 - ▶ High quality electron acceleration
 - ▶ High gradient, symmetric positron focusing at the source

→ Need tunable, mature & reliable plasma sources



PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS 13, 101301 (2009)

Physics considerations for laser-plasma linear colliders

C. B. Schroeder, E. Esarey, C. G. R. Geddes, C. Benedetti, and W. P. Leemans
Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS, VOLUME 5, 011001 (2002)

Energy doubler for a linear collider

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Staging optics considerations for a plasma wakefield acceleration linear collider

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Plasma wakefield linear colliders—opportunities and challenges

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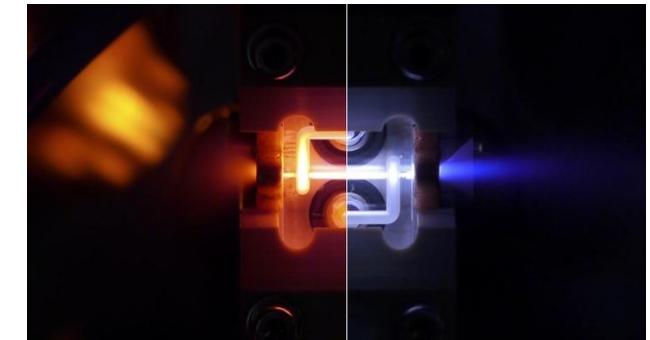
A linear electron-positron collider operating at TeV-scale energies will provide high precision measurements and allow, for example, precision studies of the Higgs boson as well as searches for physics beyond the standard model. A future linear

Development work

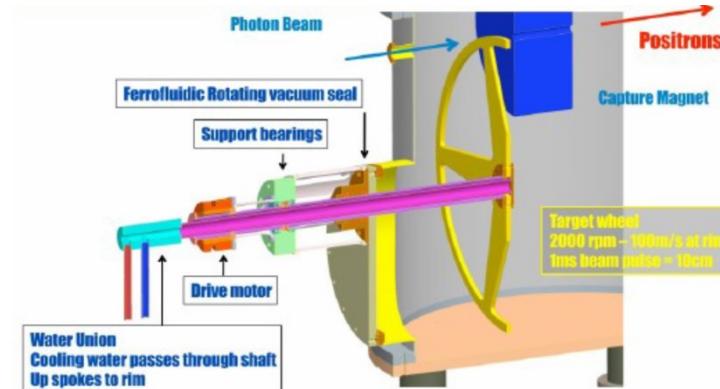
How to develop plasma cells ready for future collider application?

- ▶ Tackle common challenges for plasma sources for focusing & acceleration
 - ▶ Flexible & reliable, high rep. rate pulsed power driver
 - ▶ Fast plasma diagnostics
 - ▶ Discharge plasma modelling
 - ▶ Setup in accelerator beamline for verification
- ▶ Parallel work on individual requirements & interaction models
- ▶ Bring together unique experience/infrastructure
 - ▶ Positron sources, colliders & plasma physics (UHH)
 - ▶ Solid-state pulsed power technology (KIT)
 - ▶ Accelerator & plasma physics (DESY)

High power modulator @KIT



Plasma lenses with different gas species @DESY/CERN



ILC positron source developed @UHH

→ Final goals:

- PWFA cell demonstrating beam quality preservation
- Lens w/ parameters allowing improved positron capture

*Thank you for
your
attention!*

Partners more than welcome,
Please get in touch with us!



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