Summary
Applications

Conveners

Steiner Stapnes (CERN)
Valery Dolgashev (SLAC)
Yosuke Honda (KEK)

Talks

5 talks (30min each) Wednesday afternoon

- Ruth Magdalena Jacobs (DESY)
  "Probing non-perturbative QED and new physics in laser-particle beam collisions at LUXE and prospects for a future Higgs factory"

- Harry Van Der Graaf (Nikhef National institute for subatomic physics)
  "The alignment of the modules of the Cool Copper Collider (C^3) with the Rasnik 3-point alignment
  (remote)

- Valery Dolgashev (SLAC)
  "Compact Traveling Wave X-band Linac with RF Power Flow Outside Accelerating Cavities"

- Emma Snively (SLAC)
  "High-Gradient X-band Linac for Direct Electron Radiation Therapy"
  (remote)

- Brandon Weatherford (SLAC)
  "Modeling and Design of the SLAC 75XP4 Klystron"

- Ruth Magdalena Jacobs (DESY)

"Probing non-perturbative QED and new physics in laser-particle beam collisions at LUXE and prospects for a future Higgs factory"

Overview

What is the LUXE experiment?

- proposed new experiment at DESY Hamburg & Eu.XFEL
- collisions between XFEL electron beam and high-intensity laser → probe (strong-field) QED in uncharted regime
- New physics search with optical beam dump experiment (NPOD)
- synergy between particle, accelerator and laser physics

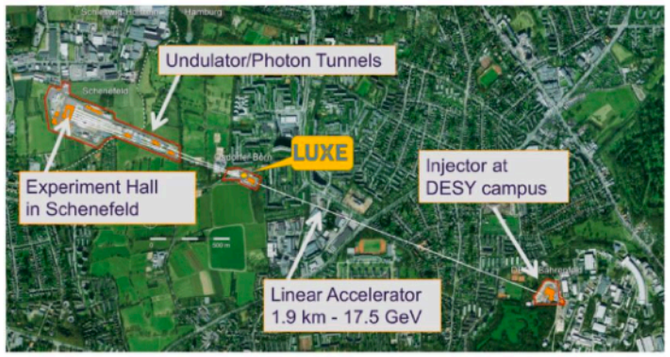
LUXE
LASER Und XFEL Experiment

What will be covered in today's talk?

1) What is strong-field QED and why is it interesting (for linear e^+/e^- colliders)?

2) What does LUXE add compared to previous and current SFQED/beam dump experiments?

3) What could be prospects for a LUXE-like experiment at a future e^+/e^- collider?



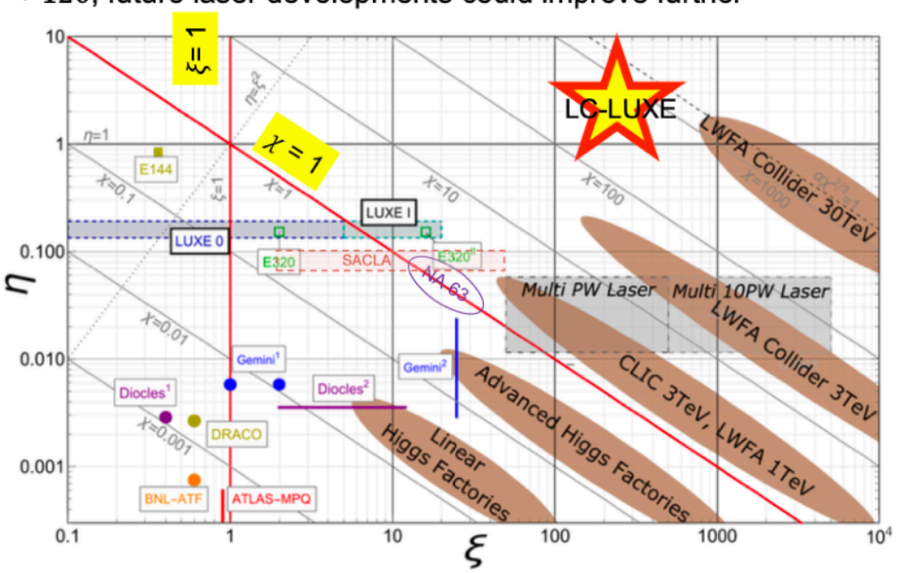
DESY.

A LUXE-type experiment at a linear collider?

J. List's talk (LCWS 2023)

- SFQED experiments could be an interesting add-on to future collider facilities → e.g. extract few bunches from the main line and collide with a laser
- „LC-LUXE": LUXE-type experiment at ILC: e-beam energy 16.5 GeV (LUXE) → 125 GeV → 500 GeV → $\chi \cong 0.4 \rightarrow 30 \rightarrow 120$, future laser developments could improve further

$$\chi = \eta\xi$$



An LC-LUXE would enter the completely unknown fully non-perturbative regime!

DESY.

- Harry Van Der Graaf (Nikhef National institute for subatomic physics)
  "The alignment of the modules of the Cool Copper Collider (C^3) with the Rasnik 3-point alignment
  (remote)

Alignment over long distance (> 100 m):
RasClic, later RasDif:

- replace lens by zone plate
- replace coded mask by monochromatic spherical-wave light source (1 $ laser diode)

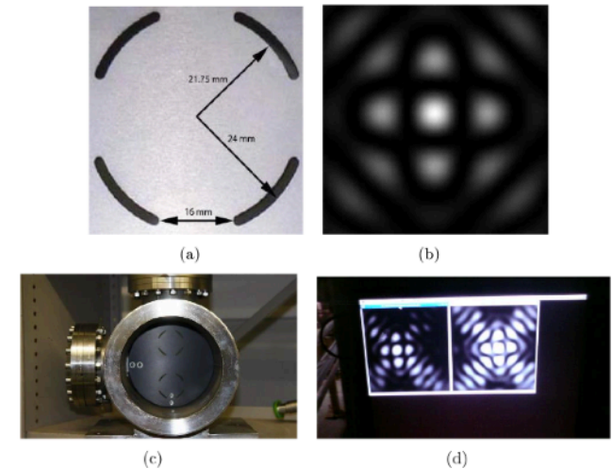


Figure 4.8: (a) Design and dimensions of the diffractic
ulations of the resulting diffraction pattern, (c) a phot
holder and (d) a photograph of the pixel image sensor

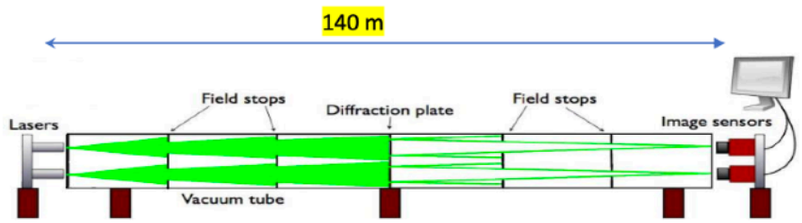


Figure 4.7: Schematic overview of the RasCLiC set-up, showing the operation of the field stops

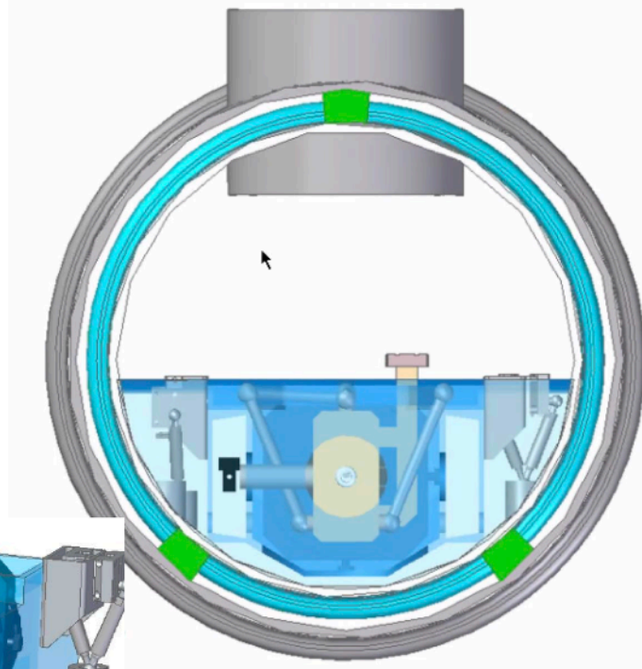
Pioneered by A. Se
Investigation of slow moti
tunnel, SLAC-PUB-8597 85
arXiv:physics/0008195.

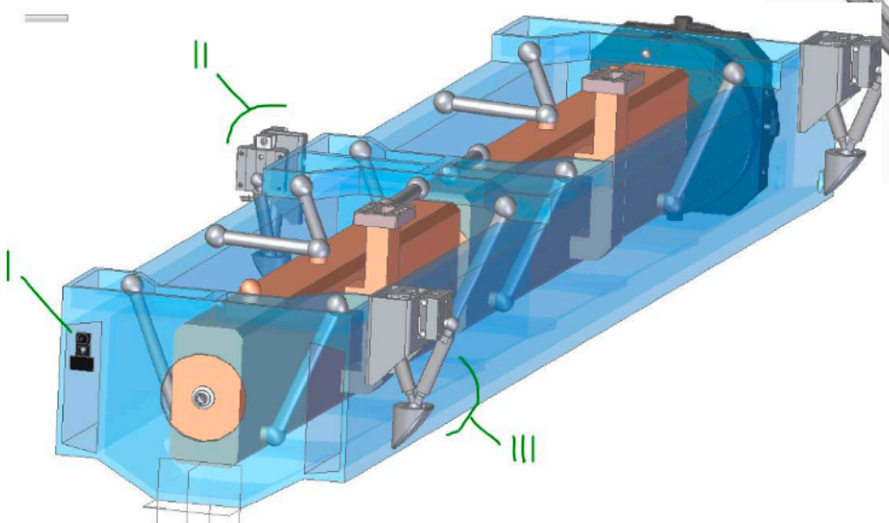
Ongoing C3 R&D project:

the **Quarter Cryo Module QCM**

Phase 1: dummy AccStructures: testing cooling, mechanics, vibrations

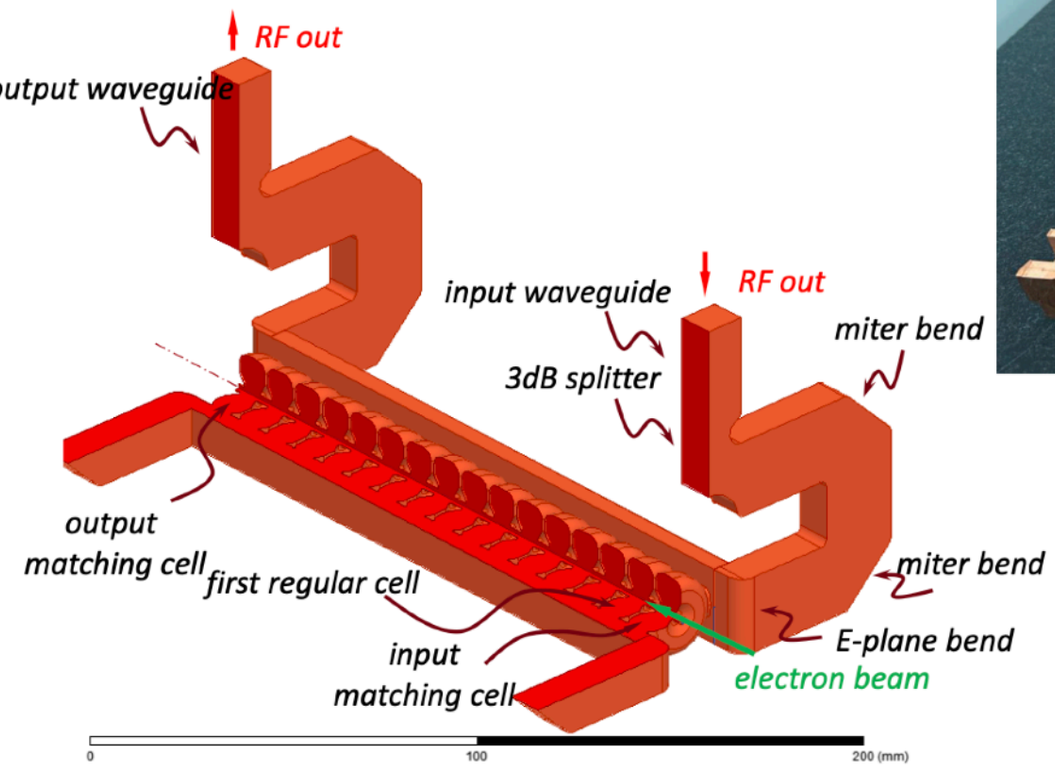
Phase 2: real operational AccStructures

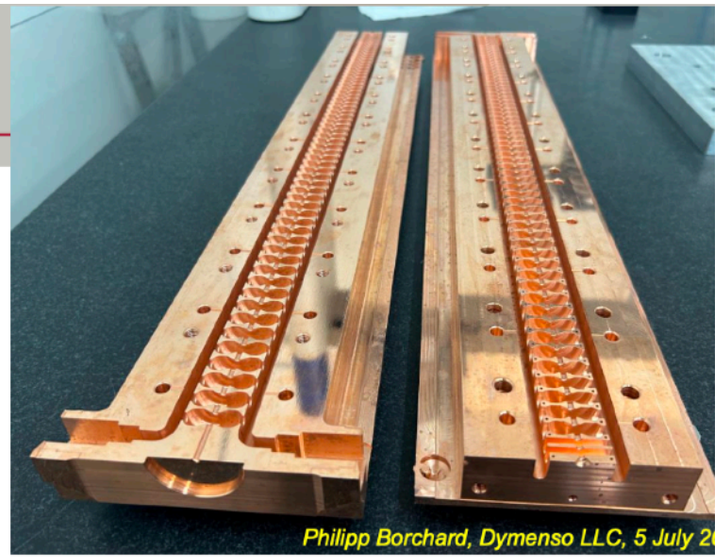




- Valery Dolgashev (SLAC)
  "Compact Traveling Wave X-band Linac with RF Power Flow Outside Accelerating Cavities"

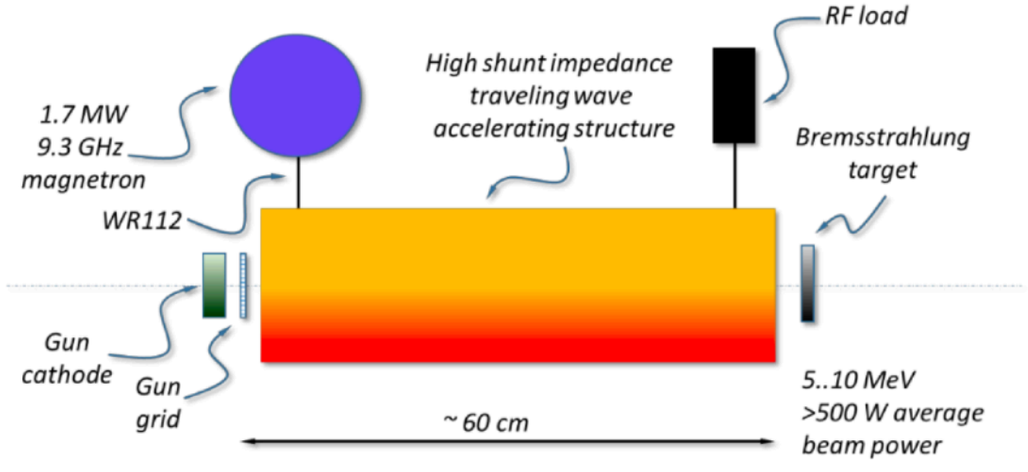
Implementation Concept





Concept of High Efficiency 9.3 GHz Linac With Pulse-to-pulse Changeable Energy

SLAC



A schematic of a compact X-band linac with tunable output energy based on the high shunt impedance travelling wave accelerating structure. The linac does not need a circulator to protect magnetron. Output beam energy is changed by changing beam-loaded gradient.

- Emma Snively (SLAC)
  "High-Gradient X-band Linac for Direct Electron Radiation Therapy"
  (remote)

Very High Energy Electron (VHEE) Therapy

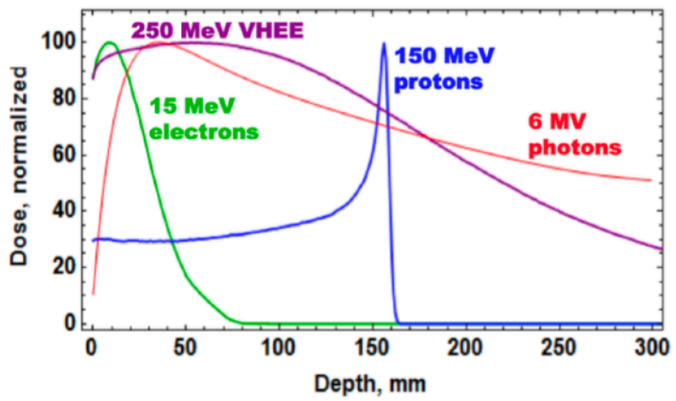
Why VHEE?

Types of radiotherapy currently available:

- 6-18 MV photons
- 5-20 MeV electrons
- 50-300 MeV hadrons (protons, Carbon-12)

Near future?

- 100-250 MeV "Very-High-Energy-Electrons" (VHEE)

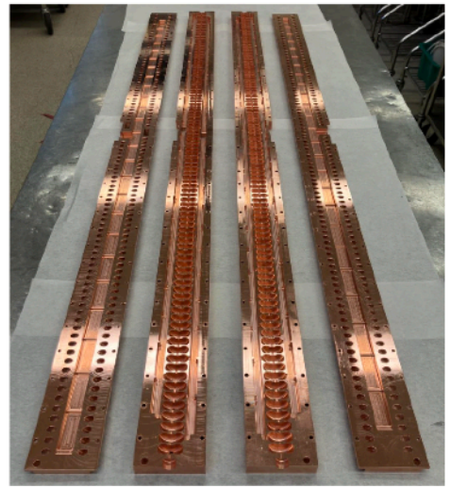


Summary

VHEE linac designed for 100 MeV/m gradient with 526 MΩ/m shunt impedance operating at 77 K

- Medical accelerator R&D projects support and benefit from advances in accelerator technology for discovery-science facilities
  - Overlapping demand for more efficient, compact structures
  - Testbed for novel accelerator technology and beamline components
  - Successful transition to commercialization can help prepare the accelerator manufacturing sector to deliver on the large-scale discovery-science initiatives at the core of the HEP mission

D.O.E. Accelerator Stewardship Program



- Brandon Weatherford (SLAC)

"Modeling and Design of the SLAC 75XP4 Klystron"

75XP Series Klystrons as RF sources for C^3

The SLAC 75XP is a PPM-focused, X-band klystron designed for 75 MW peak power

Motivated/funded by the Next Linear Collider (NLC) program

Years of engineering effort → attractive candidate for a potential C^3 demonstrator

Specification	Target
Beam Voltage	490 kV
Beam Current	257 A
RF Output Power	75 MW
Frequency	11.424 GHz
RF Pulses	1.5 μs @ 60 Hz
Saturated Gain	55 dB
Bandwidth	75 MHz
Efficiency	60%

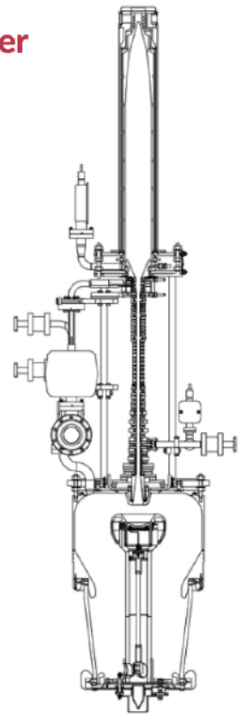
Design Features:

Large "DESY" HV gun insulator

7-cavity gain circuit

5-cell extended-interaction output

Isolated collector



The next design iteration, 75XP4, was partially complete when NLC was cancelled

The goal was to make the 75XP4 more robust against 75XP3 failure modes:

- Potential for gun and output oscillations
- Complexity of PPM stack
- Runaway conditions of overheating magnets near output
- Design sensitivity of gun coils
- High gradient RF breakdown in output

For the C^3 demonstrator source, we simulated the design that was already completed, and made further changes to address past issues.