



Stanford University





LCLS-II-HE SRF Gun Project

Rong Xiang In name of SRF-gun group, <u>ELBE</u>





Rong Xiang I HZDR

Acknowledgements

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Outline

- 1. Background
- 2. Introduction and Status
- 3. HZDR contribution
- 4. Schedule and milestone





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1. Background

SLAC is going to build a **low emittance LCLS-II-HE Injector (LEI)** to extend photon energy range of XFEL, enabling broader photon physics program.



1. Background



New beamline for LEI will be parallel to the present LCLS-II injector

J. Lewellen, T. Xu et al., P3 workshop2021 SLAC, 10-12.10.2021

LCLS-II-HE SRF gun project for 3.5 years (2021.10 – 2025.02). Goal: to build a prototype "beyond state-of-art SRF gun". HZDR responsible for the cathode & load-lock system.



LCLS-II-HE SRF gun design parameters

Parameters	Final Design Value
cavity frequency	185.7 MHz
cathode field	30 MV/m
photo-cathode	Alkali Antimonide
bunch charge	100 pC
Emittance @ 100 MeV	< 0.1 µm @ 100pC
Laser wavelength	515 nm
Laser flattop pulse length	10-30 ps
Cryo-system mechanically decoupled from cavity string	
185.7 MHz QWR	
HZDR Style Cathode System	
Bottom up with Room temperature strong back	

Laser wavelengt Laser flattop pul Cryo-system mechanically decoupled from cavity string 185.7 MHz QWR HZDR Style Cathode System Bottom up with Room temperature strong back

> Member of the Helmholtz Association Rong Xiang I HZDR

185.7MHz SC Cavity

- Optimize field distribution
- Modify multipacting performance
- Stress calculation, manufacturability







Preliminary design finished in April 2022

- Cavity processing plan
- Cryomodule, SC solenoid, coupler
- Clean room assembly plan
- RF, Cryogenic, vacuum, interface ...





Y. Choi, April 2022 SRF Gun Preliminary Design Review, 7, Slide 6

3. HZDR contribution

Cooperating with MSU for a **new cathode stalk**

- Two working modes: 77 K and room temperature
- DC bias -5kV to suppress Multipacting
- Cathode position adjustment
- Simulate resonant mode, MP, RF loss, thermal performance...
- Test platform building at MSU



3. HZDR contribution

Cathode and load-lock system

- Particle free operation
- Ultra high vacuum 1x10⁻¹⁰ mbar
- 100 µm accuary in 1.3 m distance

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- Repeatable, reliable
- Test platform at HZDR



Cathode held by manipulator



insertion system



Cathode stalk in cavity

S. Gatzmaga, P. Murcek

4. Schedule and Milestone

Overall project schedule 2021.10 – 2025.02





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Possible SRF gun structures

R.Xiang, IPAC21



SRF guns in operation



Other SRF guns in developing

DESY SRF gun



HZB SRF gun



KEK SRF gun

PKU DC SRF gun



