

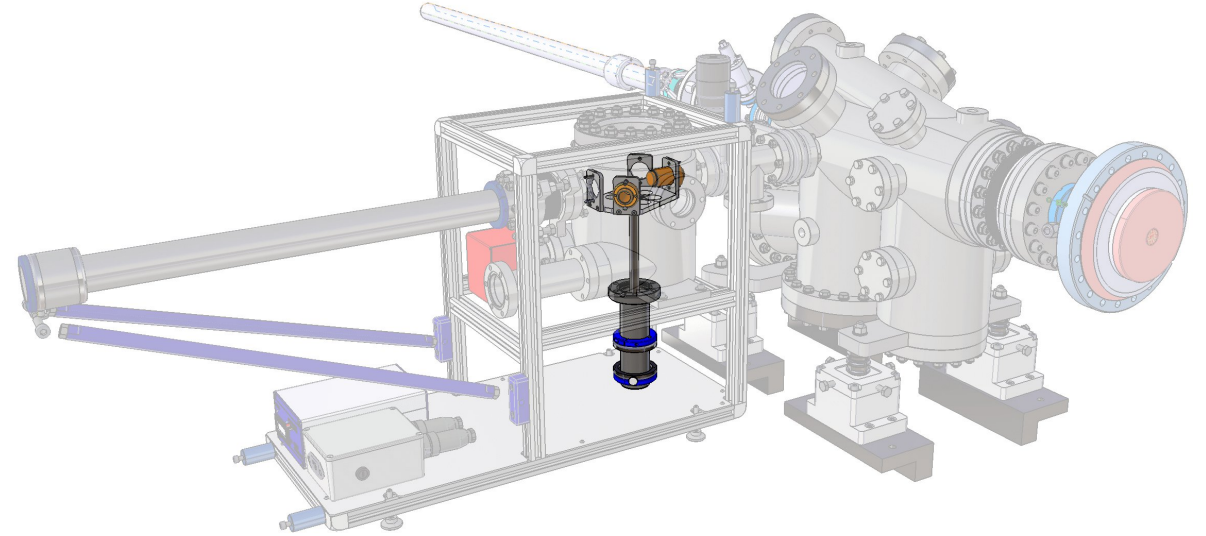
FERROVAC

ULTRA HIGH VACUUM TECHNOLOGY

UHV Transfer Solution for Photocathodes

How we Enable Big Scientific Discoveries with Our UHV Technology

Cyrill Strässle, 2026



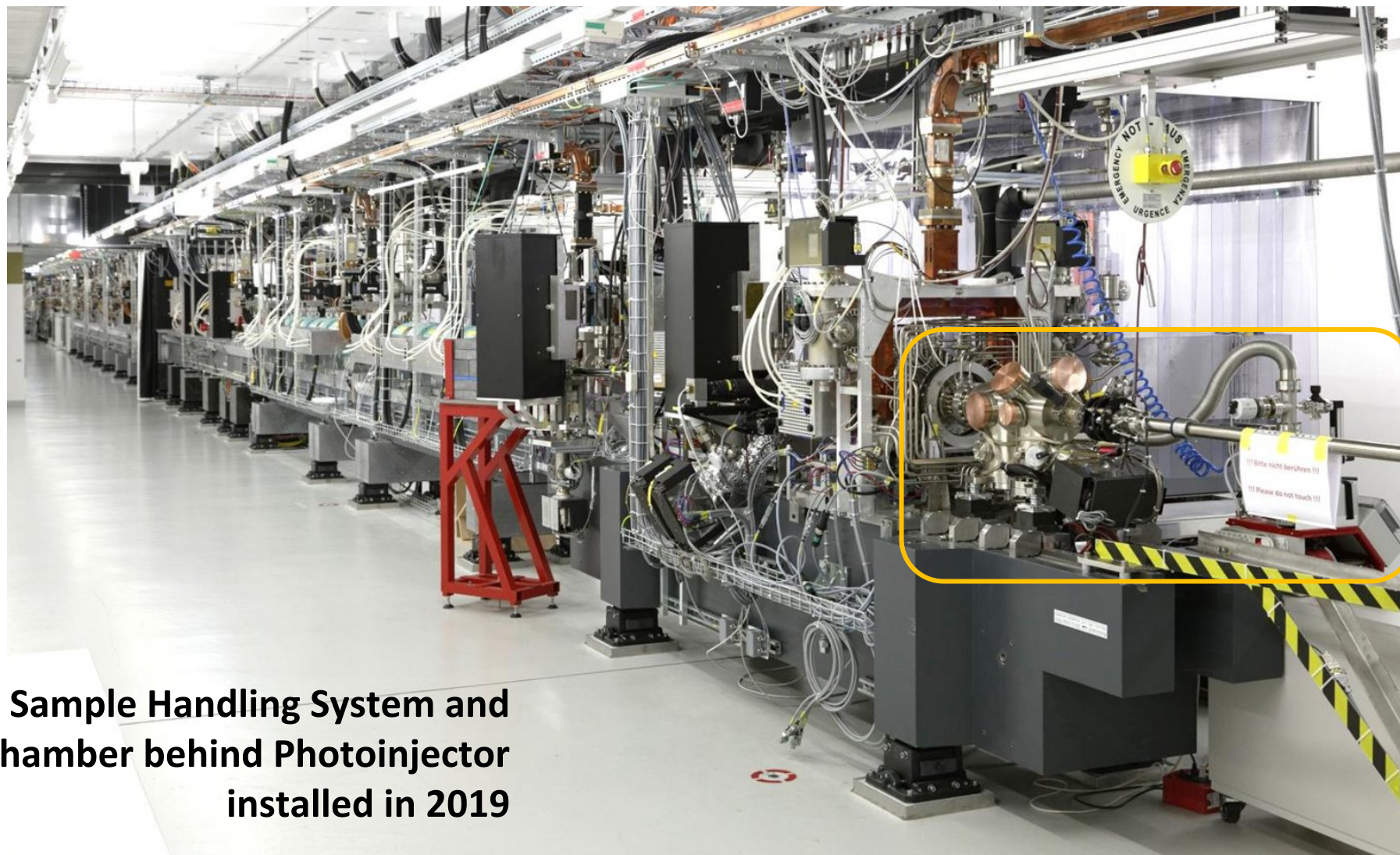
Content:

- Brief History
- UHV Suitcase
- SwissFEL Setup
- Manipulation of the Cathode
- Potential

Cathode Handling @SwissFEL



Hard X-Ray FEL
740 m Long



**Sample Handling System and
Load Lock chamber behind Photoinjector
installed in 2019**

Ferrovac - Swiss UHV technology since 1996

ETH zürich

Magnetically Driven Wobble Stick Manipulators MM100 / MM150

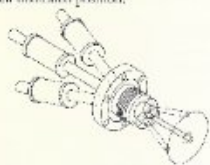
For precise and easy handling of samples in UHV-Systems



The magnetically driven Wobble Stick is particularly designed for delicate and precise manipulations in ultra high vacuum systems.

In opposition to customary products, the motion of the shaft is not affected by the difference between atmospheric pressure and ultrahigh vacuum. Therefore, the shaft of the Wobble Stick can be guided by the operator in a smooth and controlled way. Upon releasing the handle, the shaft remains in the same position. The risk of damaging sensitive instruments inside the chamber is therefore utterly minimized.

In addition to the linear and angular motion, the shaft can be rotated continuously. Accordingly, the MM100/150 can be used as a 'screw driver', for example to tightly lock sample holders in their dedicated position.



ferrovac GmbH

tel. (+41) 01 633 66 19
fax. (+41) 01 633 10 96

Dammstrasse 31
CH-8037 Zürich

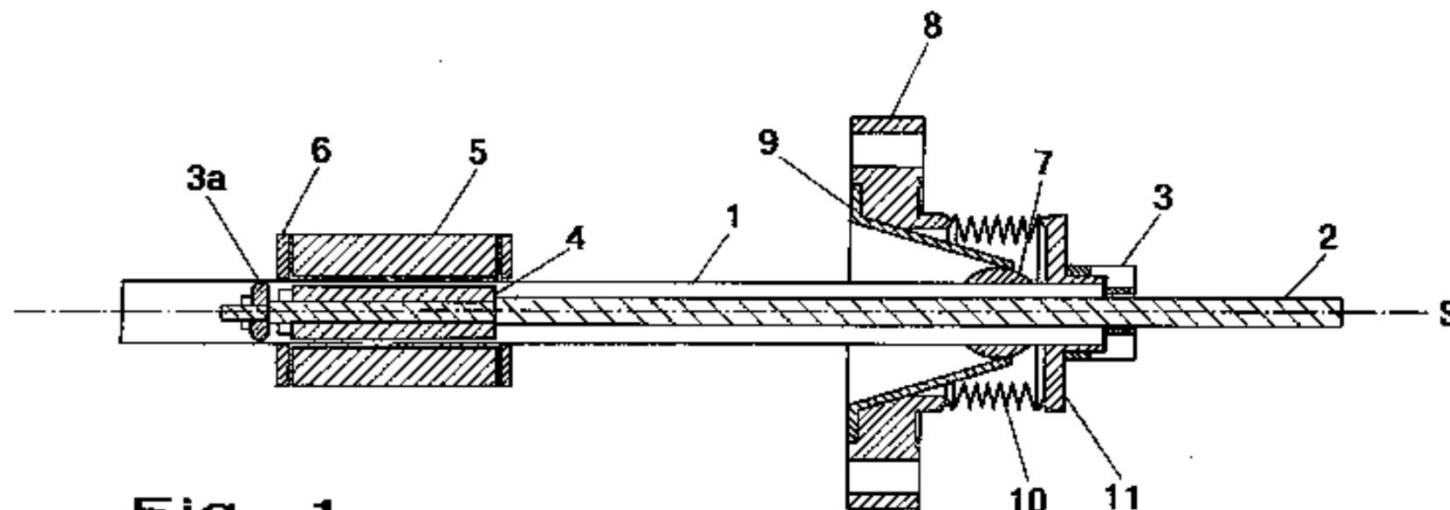
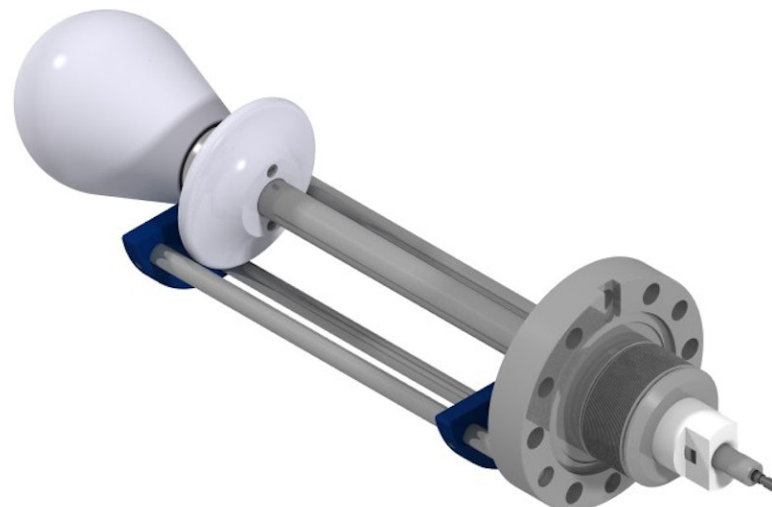
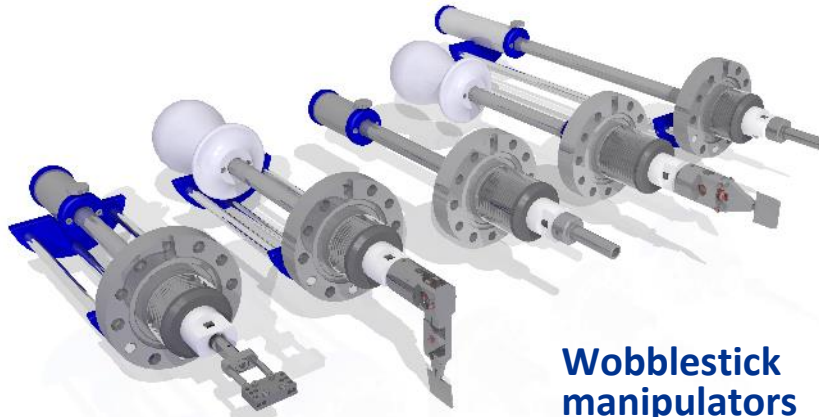


Fig. 1

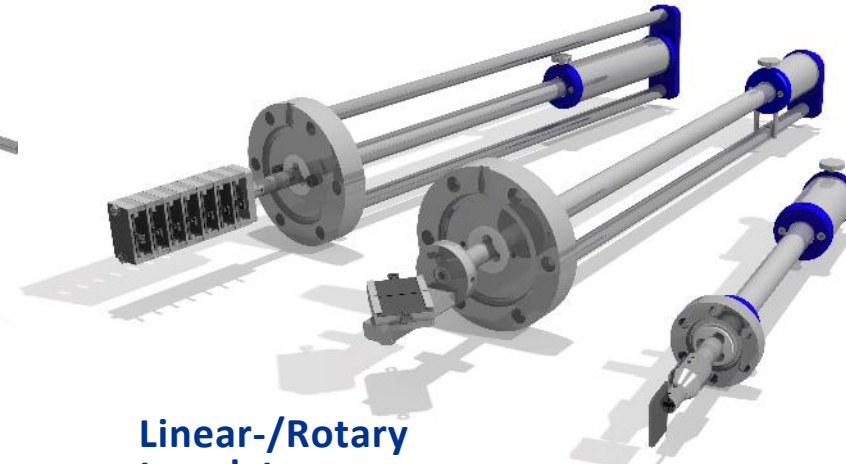
Overview Drawing for Patent Application, 1994, ETH



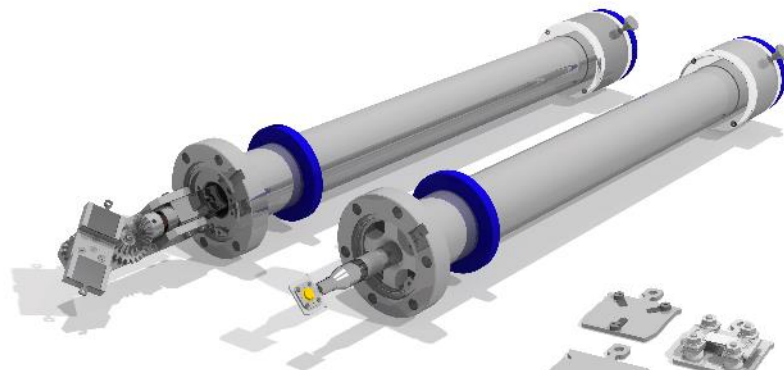
The Selection of Components grows



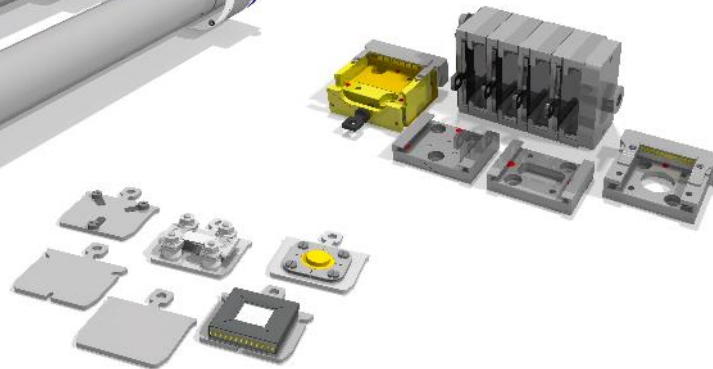
Wobblestick
manipulators



Linear-/Rotary
translators



Sample transporters

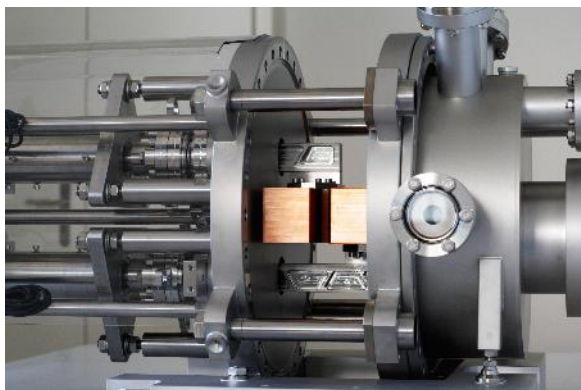


Sample holders and accessories

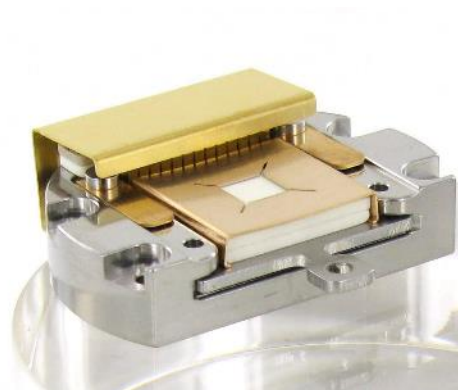


XYZ Manipulators

You name it – we build it



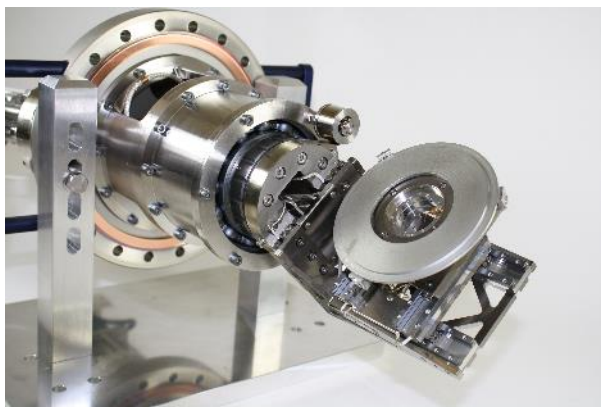
HOENCOL @ Swiss FEL
Energy Collimator for the Swiss Free Electron Laser



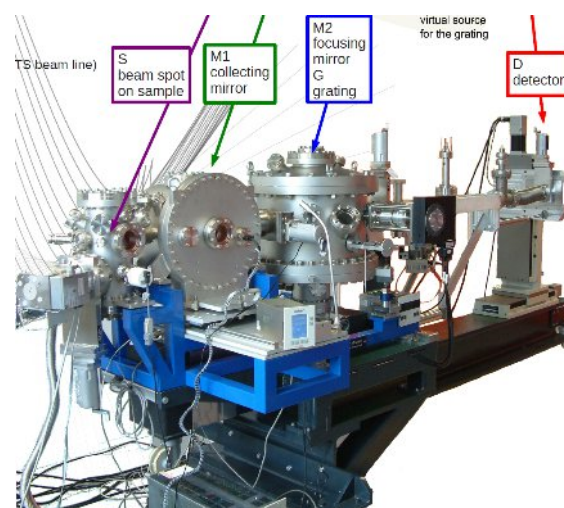
SHOM/RECOMEC13
Transferable Sample Holder with 13 electrical contacts



Contract Manufacturing
precision engineering

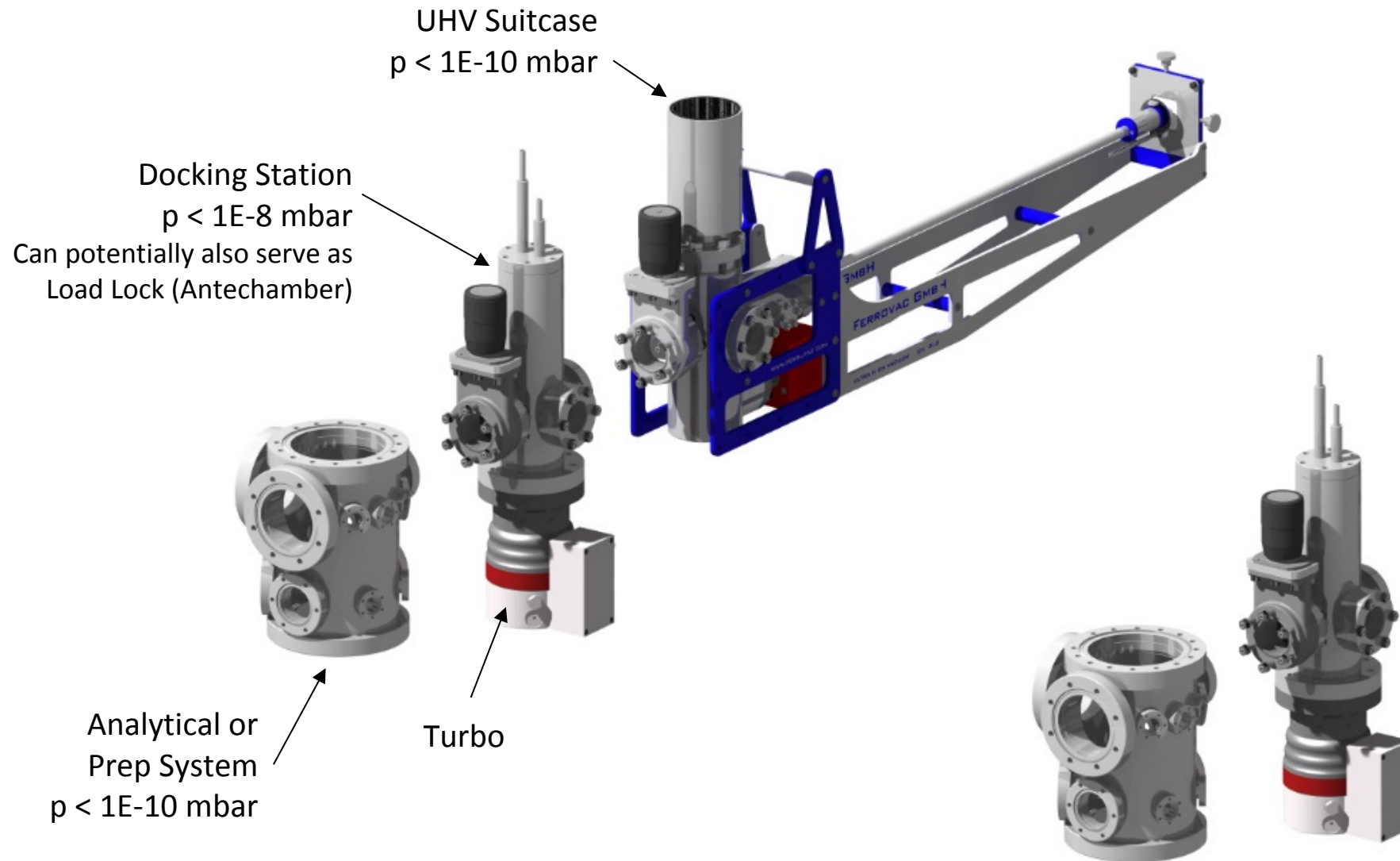


NPSTAGE @ Ioffe Institute
6 Axis nanostage for 4 inch wafers

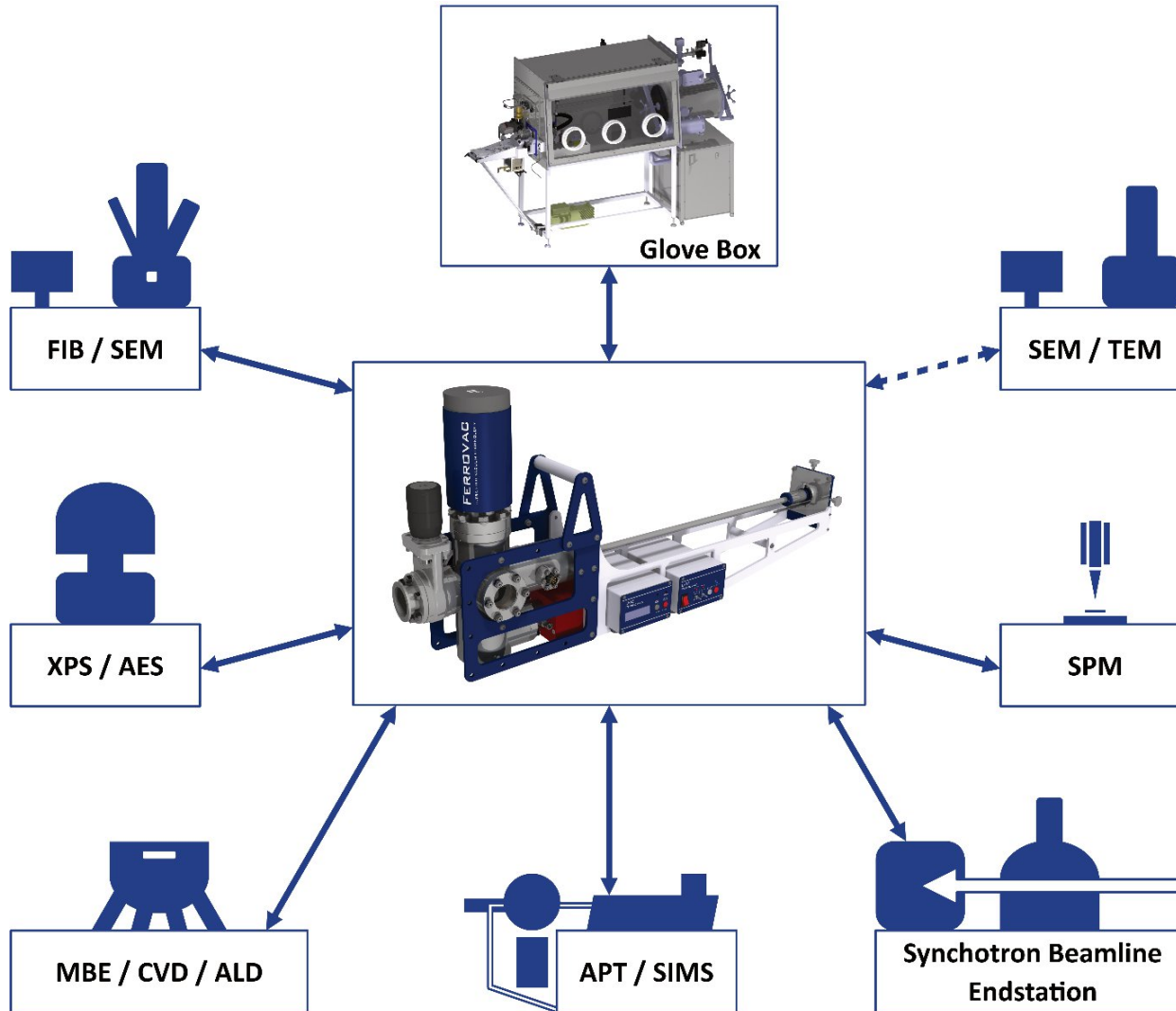


RIXS resonant interference X-ray scattering @ SOLEIL
Design and performance of AERHA, a high acceptance high resolution soft x-ray spectrometer.
Chiuzbăian SG¹, Hague CF¹, Avila A¹, Delaunay R¹, Jaouen N², Sacchi M², Polack F², Thomasset M², Lagarde B², Nicolaou A², Brignolo S¹, Baumier C¹, Lüning J¹, Mariot JM¹.
Rev Sci Instrum. 2014 Apr;85(4):043108.
Doi: 10.1063/1.4871362.

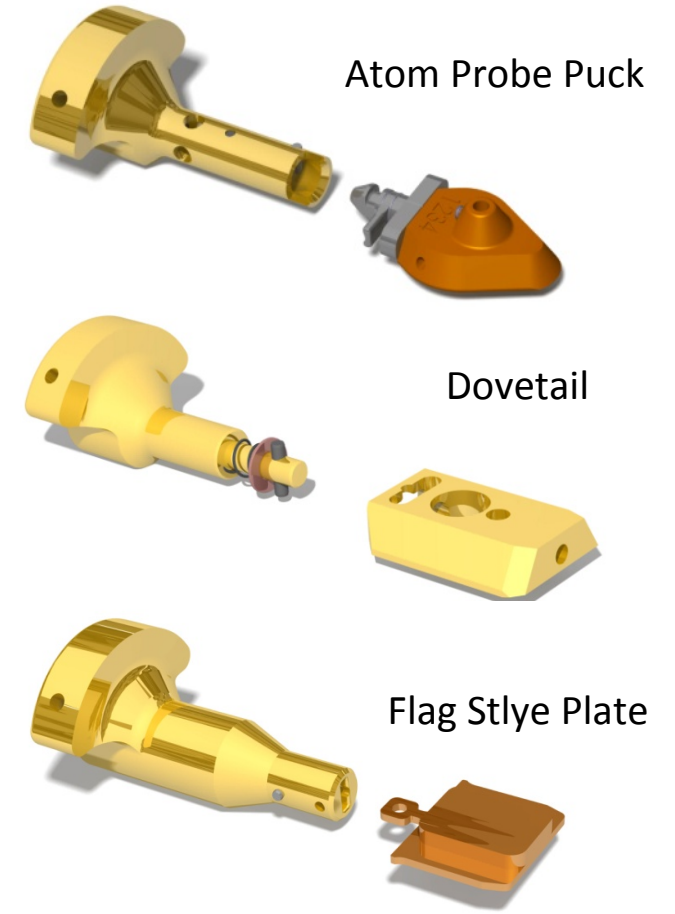
How to UHV Transfer



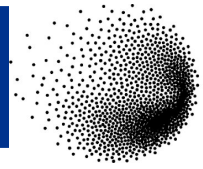
The Suitcase as Connecting Link



Selection of standardised Sample Holders and Grippers



Recap: System @ SwissFEL



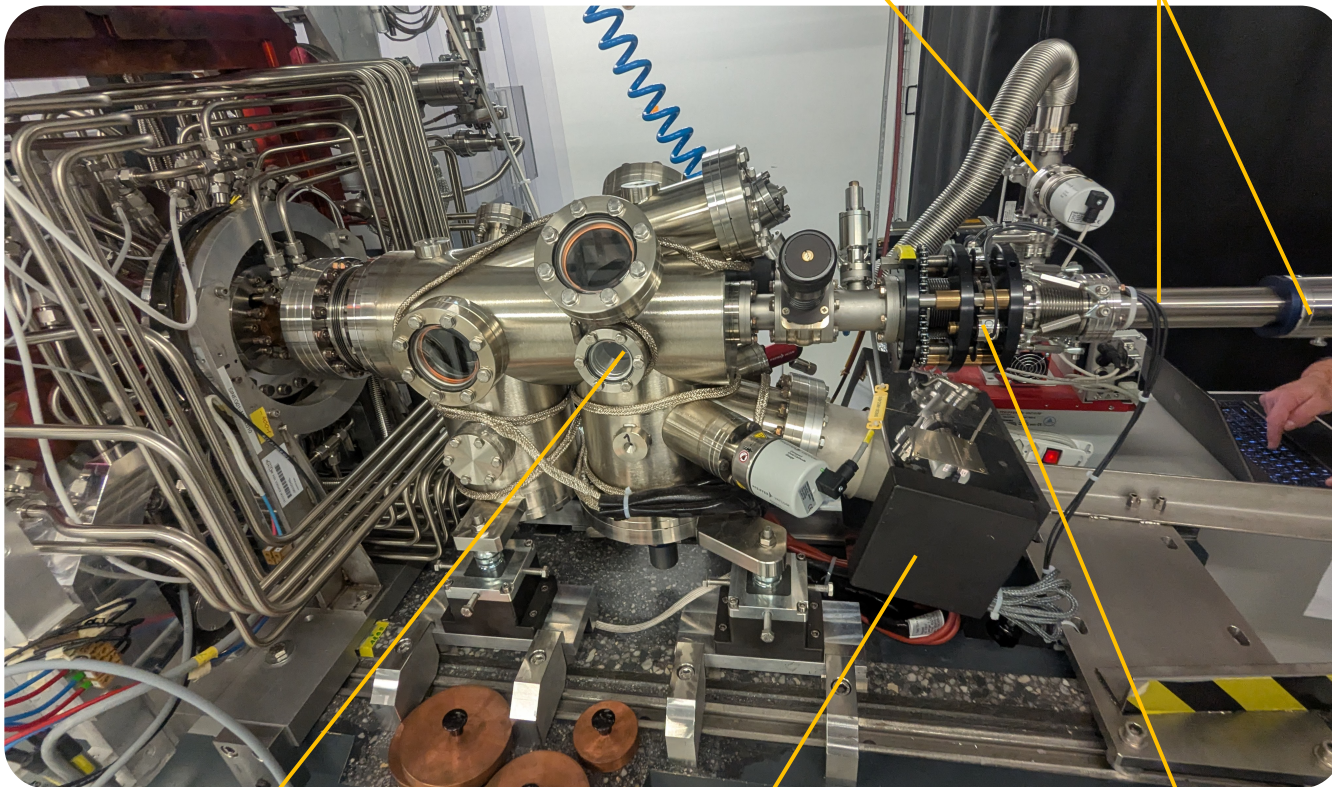
PSI

Cathode load-lock system (Photo injector)

- $p < 5E-10$ mbar

Docking Station (separate)

sample transorter
with bayonet coupling



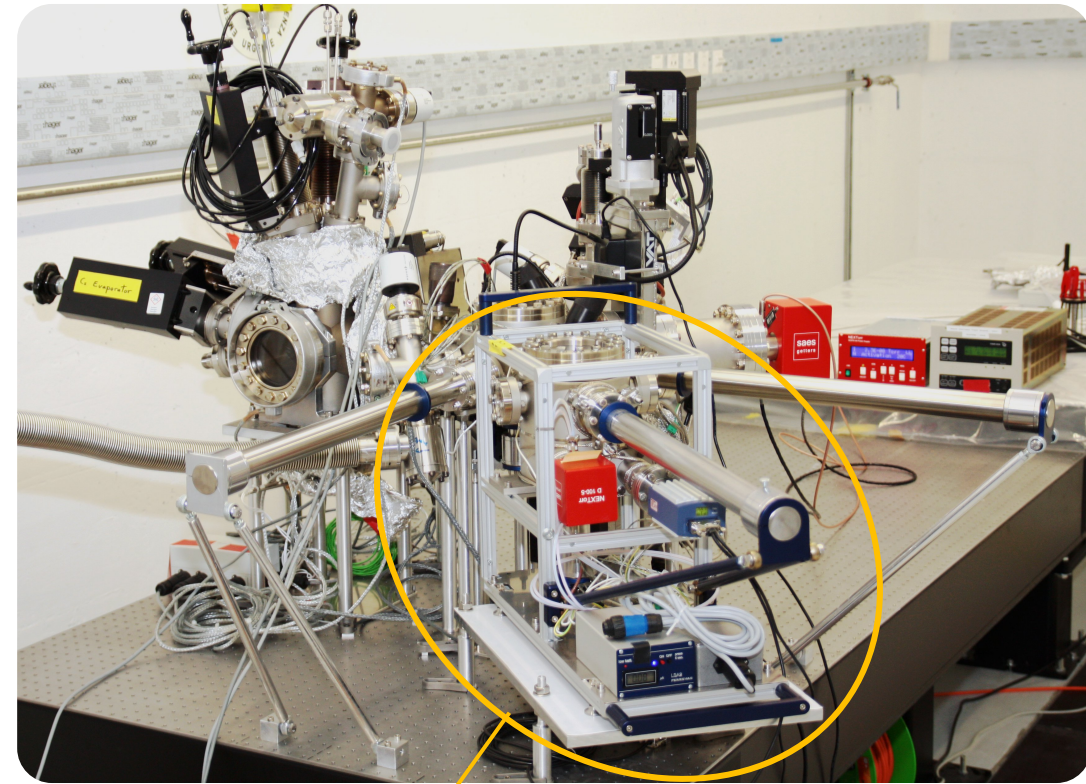
Carousel for storage of
4 cathodes

NEG/SIP Pump

linear translator
with 2600 N

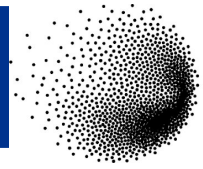
Cathode preparation system:

- Linking chamber ($p < 5E-10$ mbar)
- Carousel for storage of 4 cathodes



Suitcase

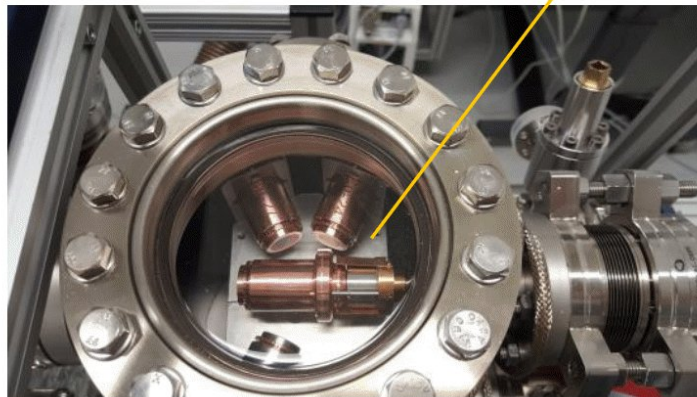
The UHV Suitcase



PSI

Cathode Suitcase

- $p < 5E-10$ mbar
- DN40CF connecting flange



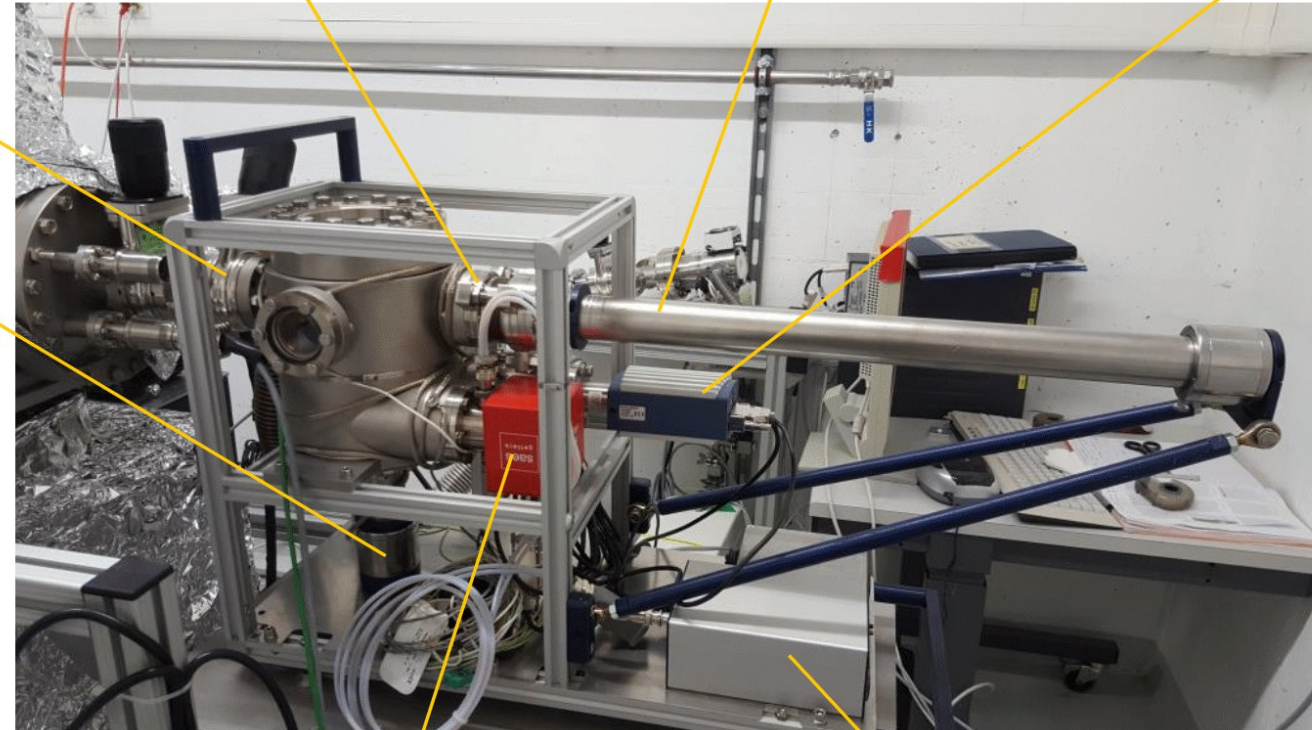
Carousel mounted on a rotary feedthrough, holding 4 cathodes

Gate valve (manual)

Port aligner for adjustment of the linear rotary feedthrough orientation

Linear rotary feedthrough for transfer motion of the cathodes

Pressure measurement with display

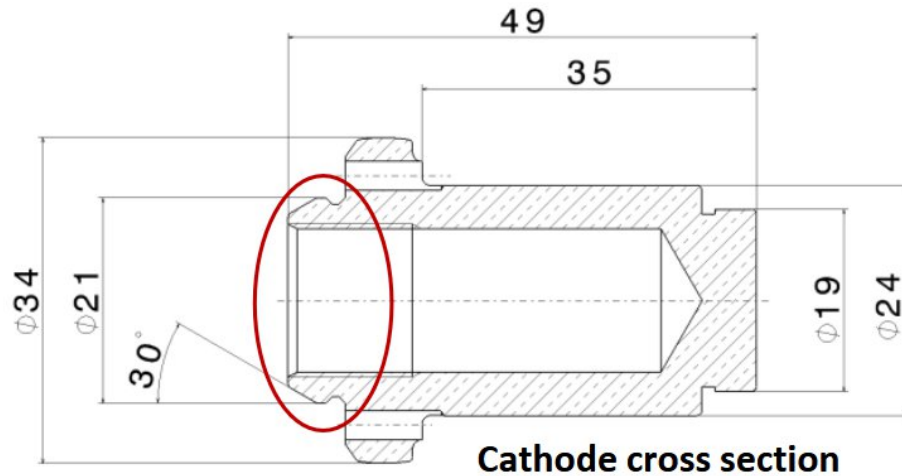


NexTorr vacuum pump (NEG/SIP)

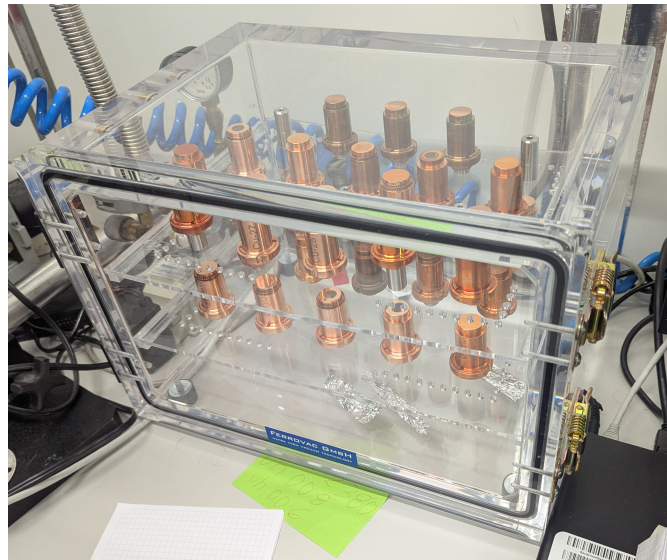
Portable HV power supply

[Graphic by Romain Ganter]

Cathode Handling



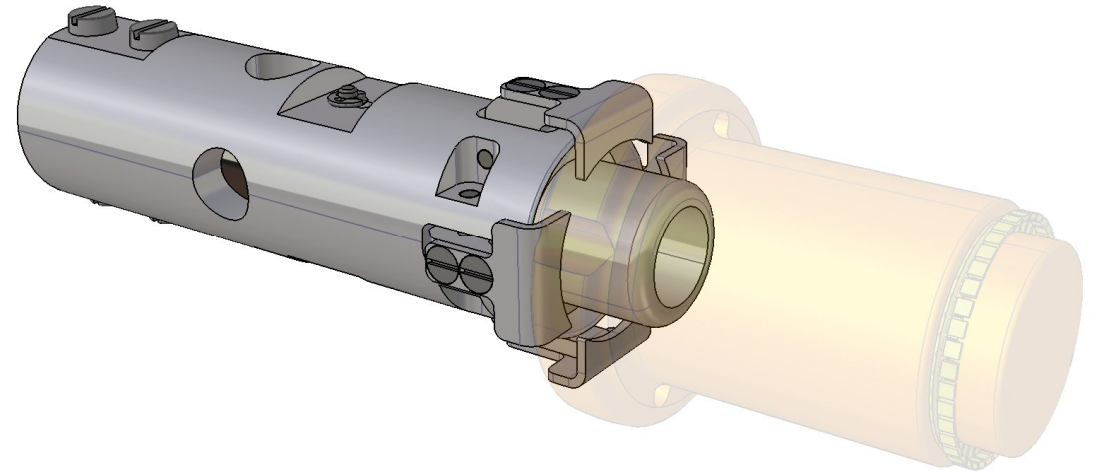
CERN design:
CLIC Note 303 (1996)

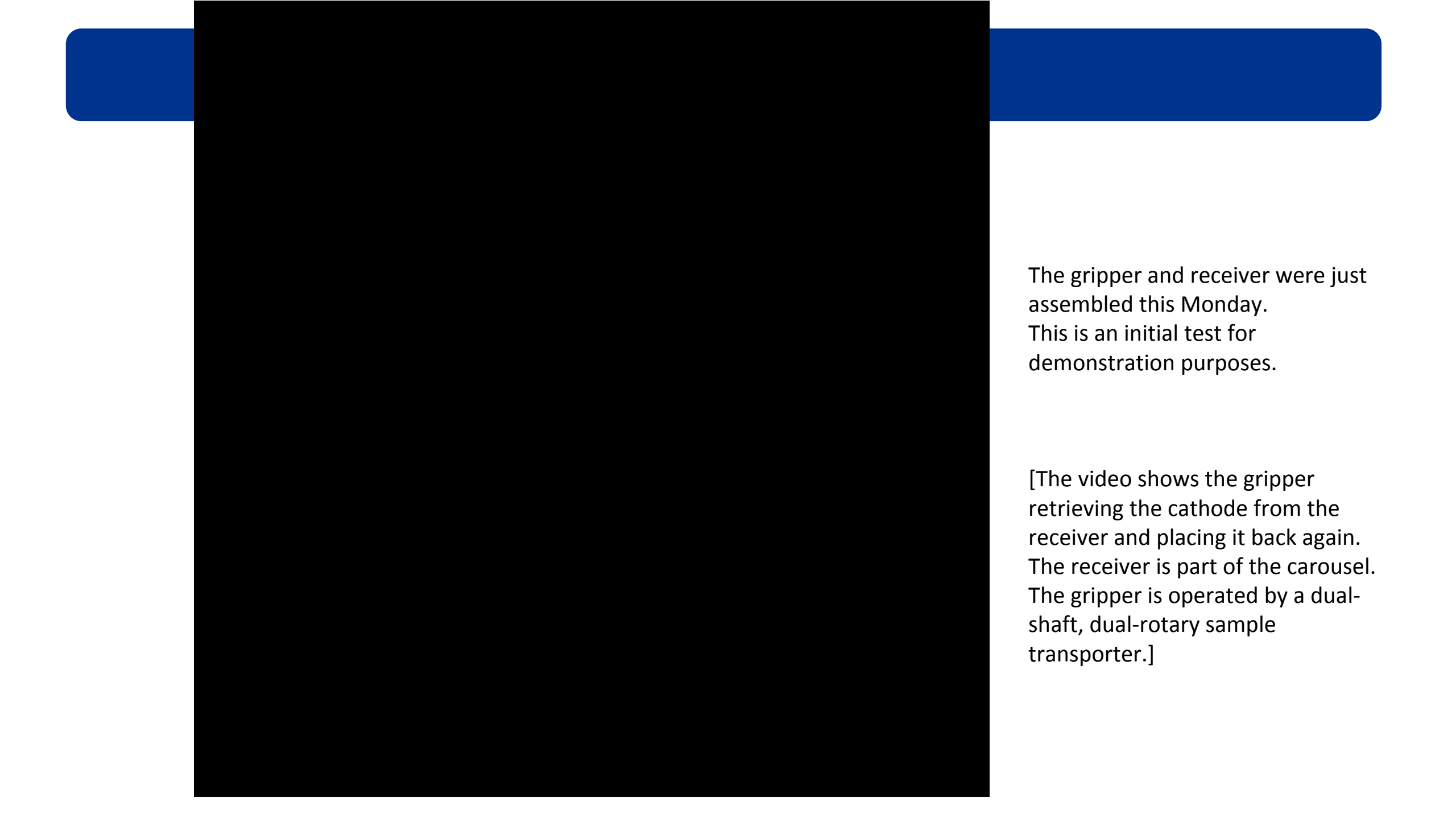


Cathode Gripper

The search for a secure gripper

Now compatible with SwissFEL and CERN Cathodes

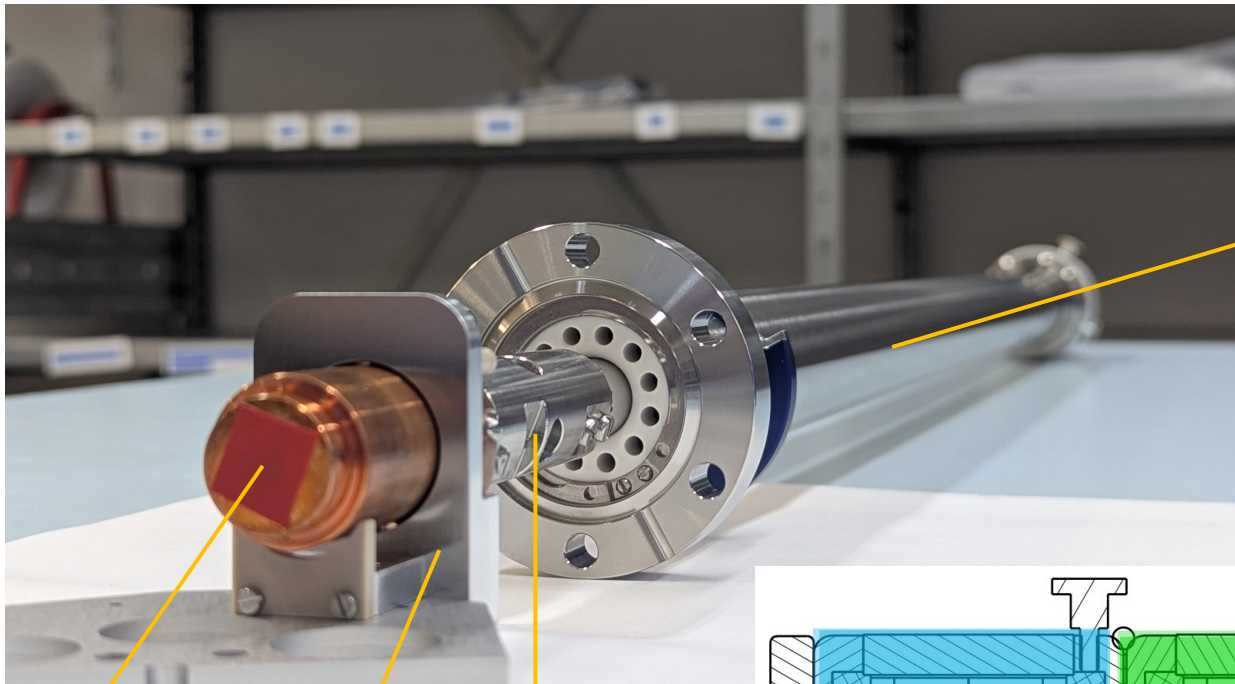




The gripper and receiver were just assembled this Monday. This is an initial test for demonstration purposes.

[The video shows the gripper retrieving the cathode from the receiver and placing it back again. The receiver is part of the carousel. The gripper is operated by a dual-shaft, dual-rotary sample transporter.]

Cathode Handling



Cathode
PSI/CERN

Receptor
(part of the carousel)

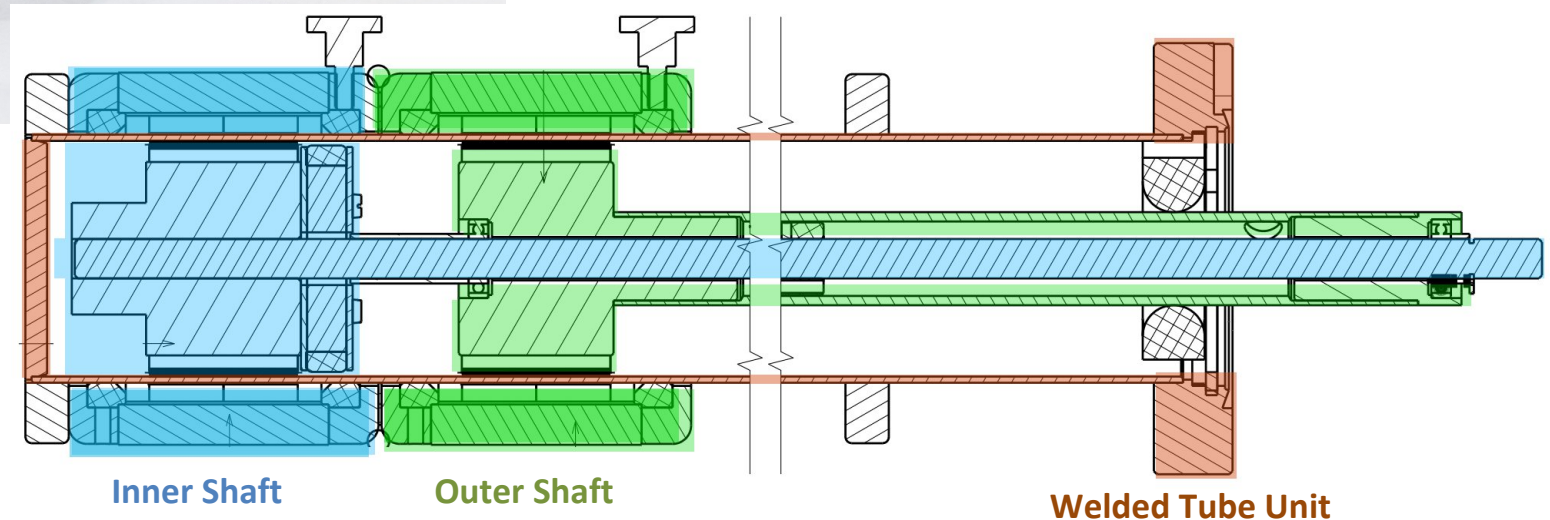
Grabber

Dual Shaft, Dual Rotary Sample Transporter

- *contains a special bayonet coupling

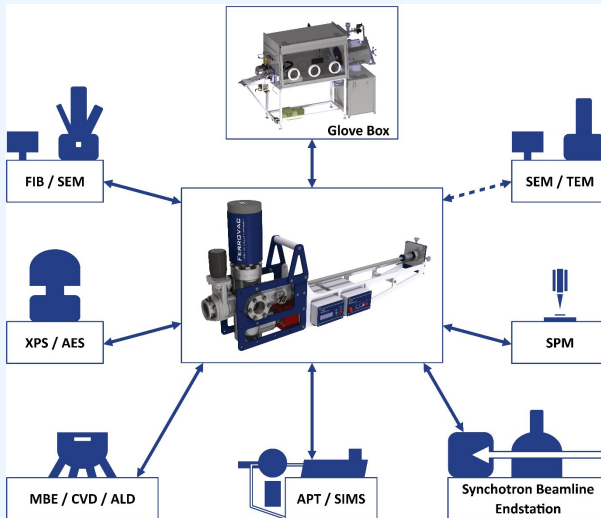
Specifications:

- linear Travel to 1250 mm
- reinforced Teflon
- Magnetic coupling: Linear Force: 70N, Torque: 5Nm



Potential

- Standardised interfaces enable a unified handling system
- Cathode exchange without borders



Thank you very much for your CONTRIBUTION!

Special thank to Romain Ganter and David Stephan
for collaboration on the Project.

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Ferrovac AG
Thurgauerstrasse 72
CH - 8050 Zürich

+41 44 273 16 38
sales@ferrovac.com
ferrovac.com