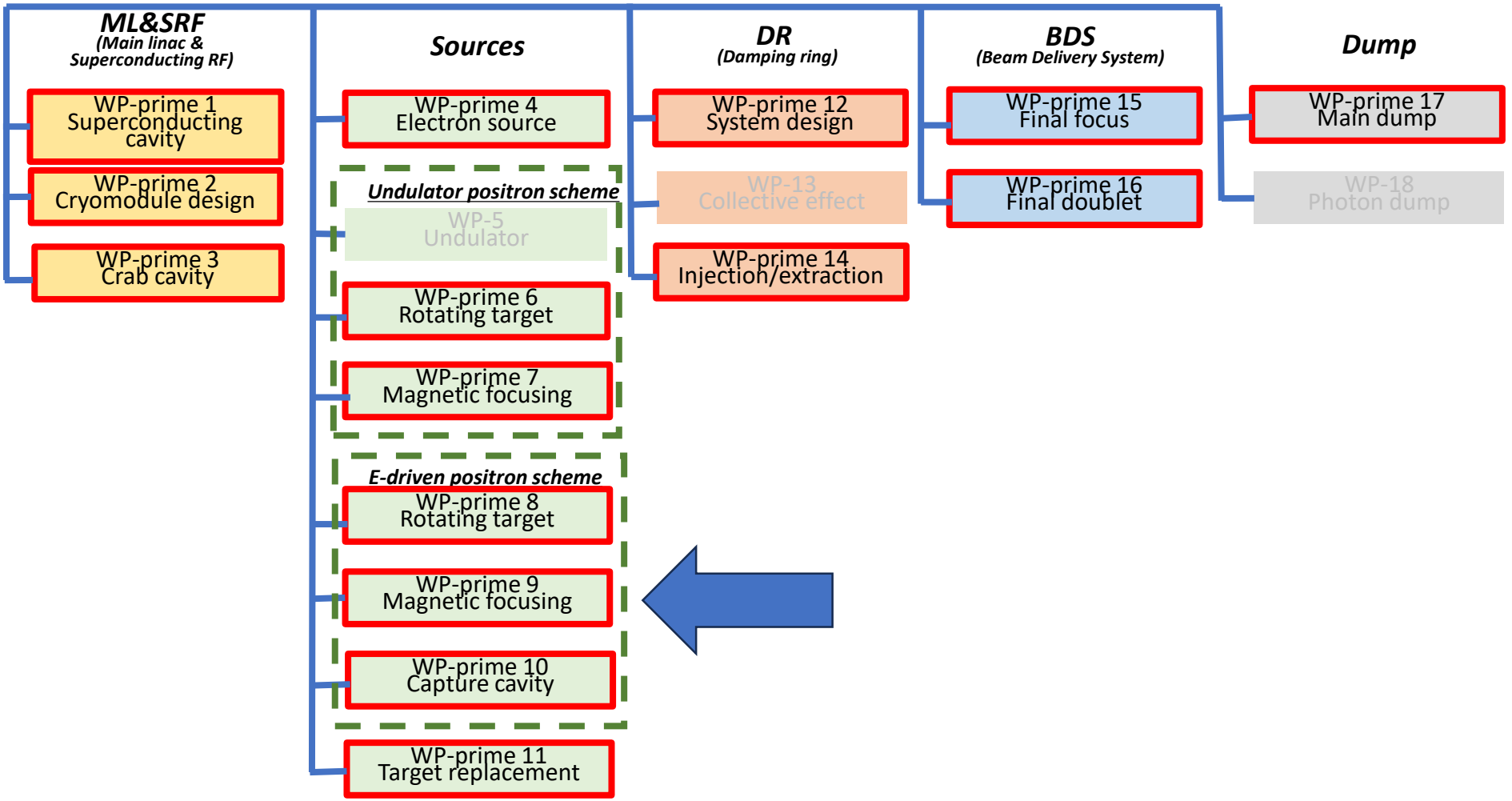
ITN Briefing Meeting for Source Grope
Work packages for e-driven positron scheme

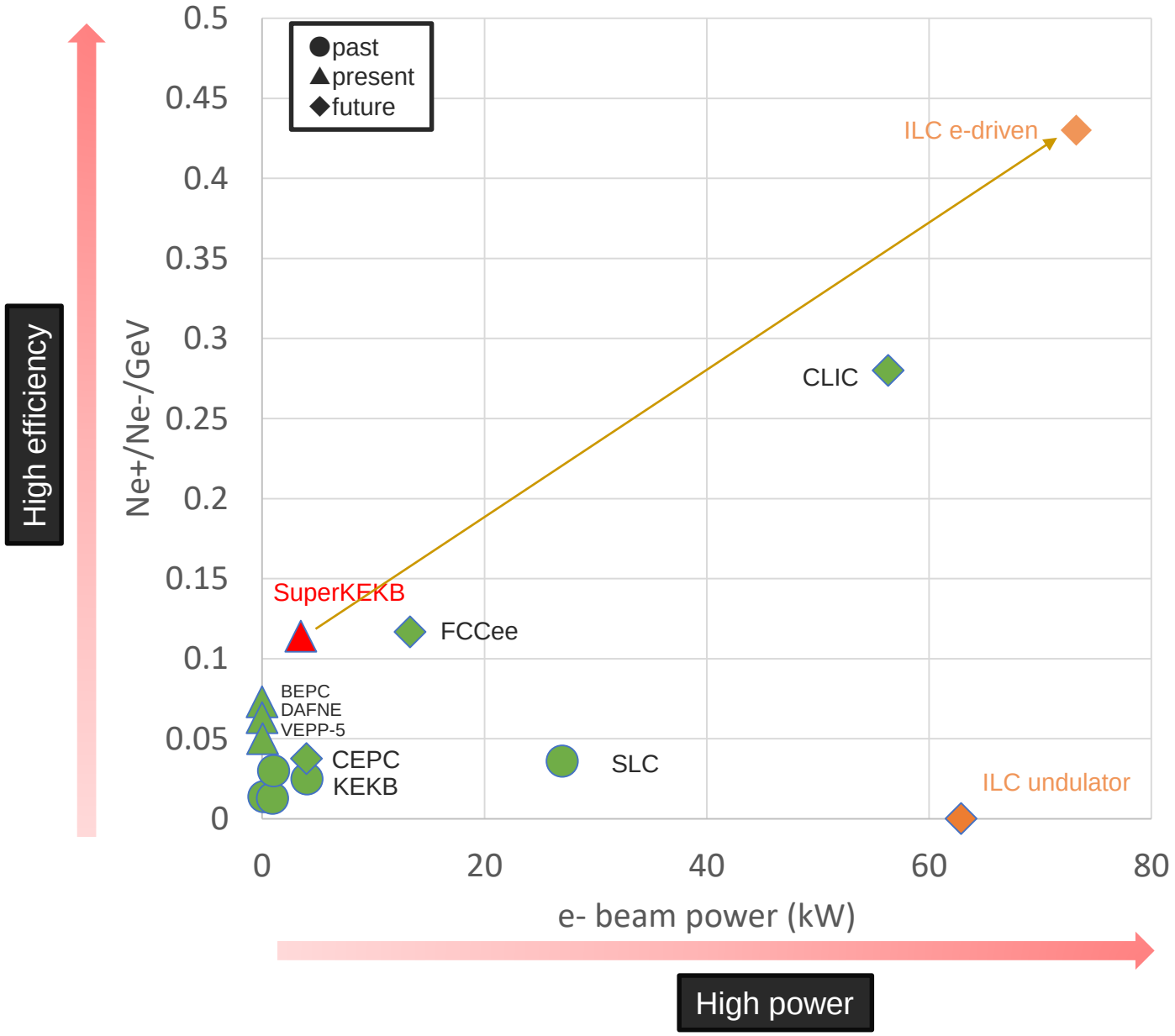
Yoshinori Enomoto (KEK)

ILC Technology Network



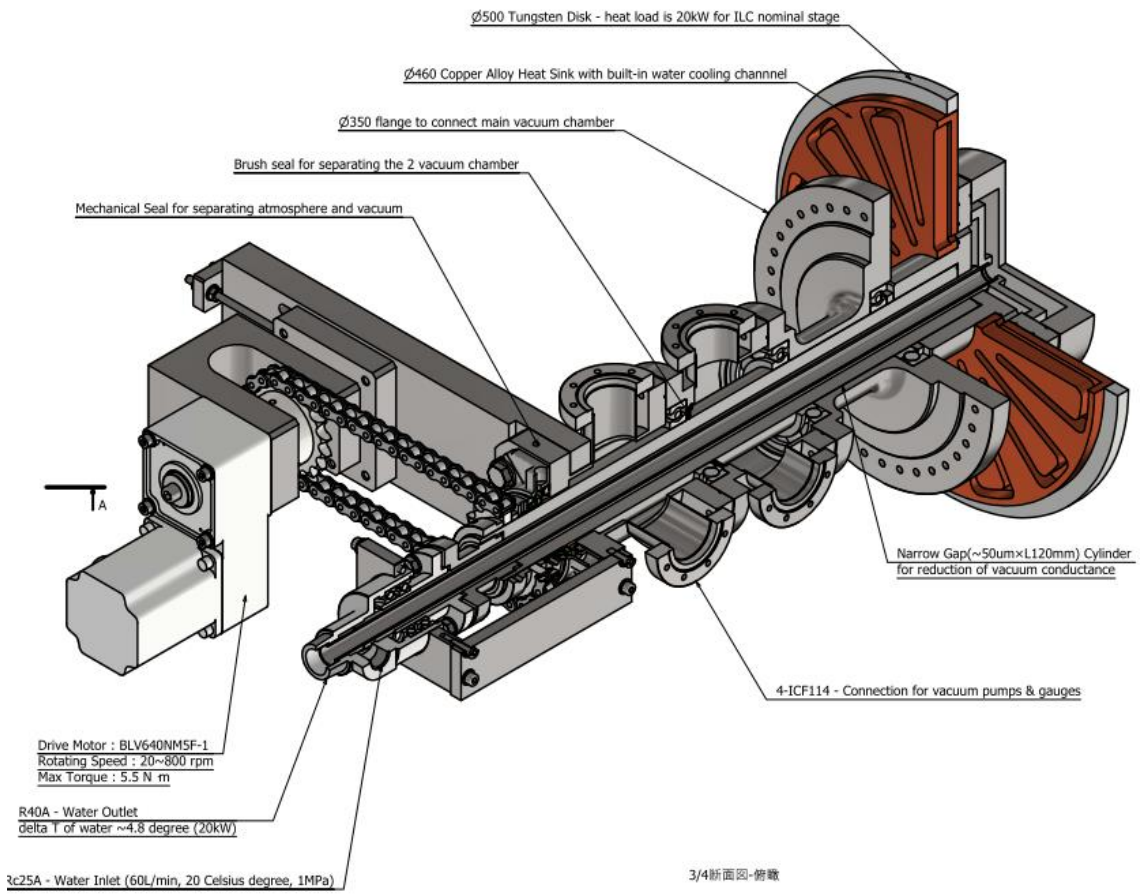
Comparison of positron sources

- Big jump from SuperKEKB and SLC
  - 3 x SLC in beam power (74 kW)
  - 4 x SuperKEKB in capture efficiency
- Technologies developed in the project will be used for more than decades in this field, as SLC did 30 years ago



WP-8 Rotating Target (for e-driven Scheme)

- 74 kW (3 x SLC) beam power
- **Rotating mechanism**
  - **Water-cooled**
  - **UHV compatible**
  - **225 rpm**
- Target disk
  - W-Cu connection
    - Mechanical and thermal evaluation
    - CFD simulation using experimental data
    - HIP, SPS, Brazing
  - Target material selection and evaluation
    - Mechanical property at operating temperature
    - Cost, lead time, available size, uniformity



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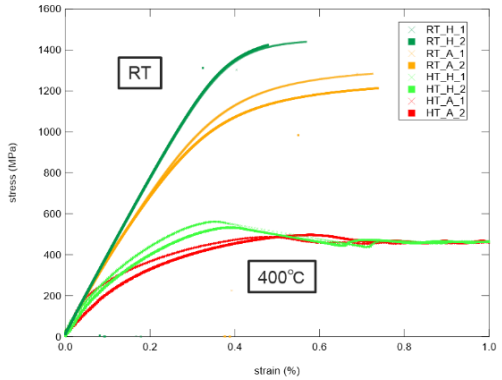
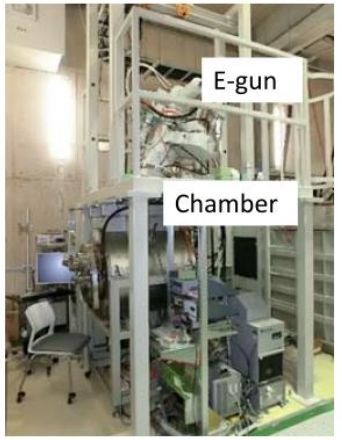
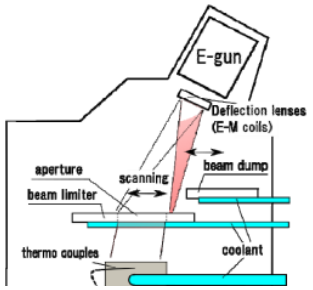


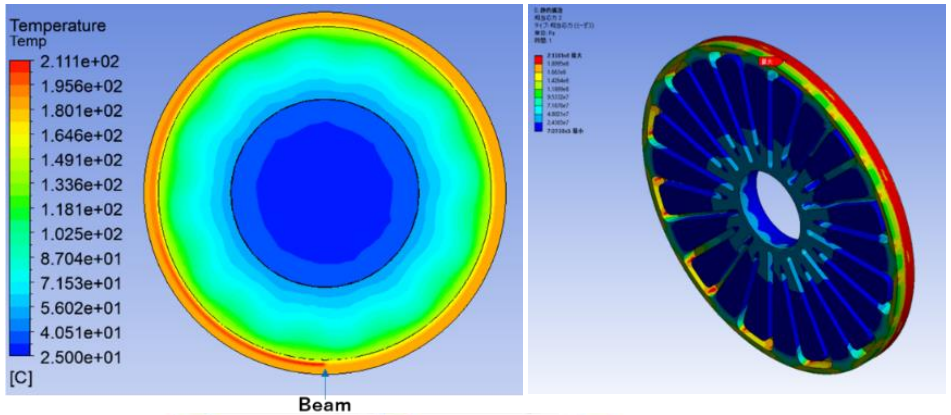
HIP condition : 1050℃, 150 MPa, 2 Hour

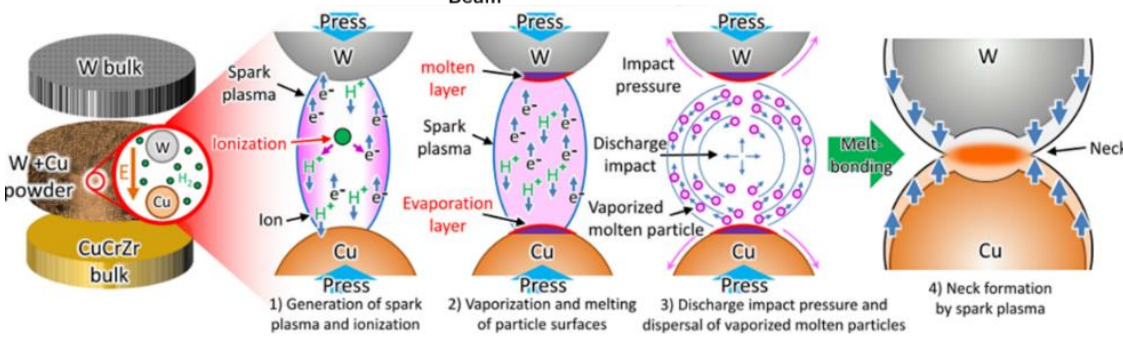


Electron gun: JEBG-3000UB manufactured by JEOL Ltd.



specifications		
parameters	value	unit
max. output power	300 (100)	kW
acceleration voltage	40	kV DC
max. current	7.5	A
max. scanning area	300 x 300	mm
spot size of e-beam	~10	mm





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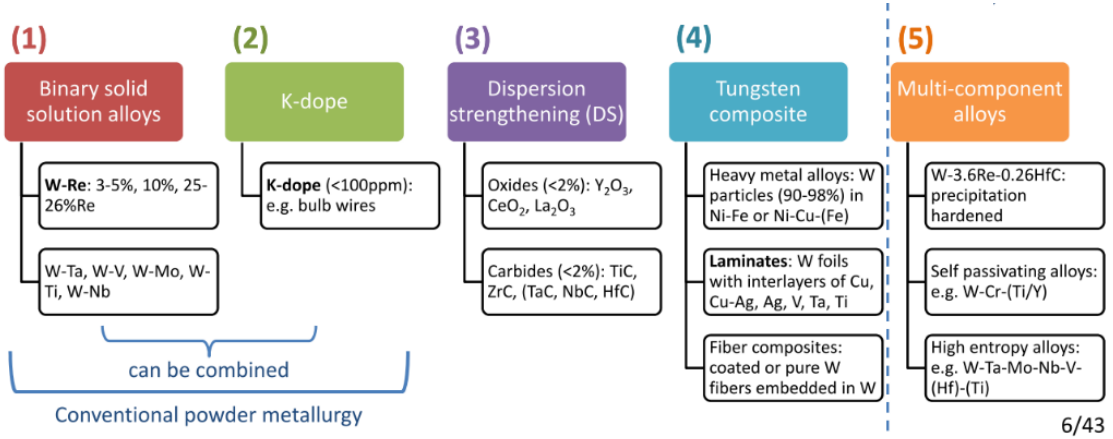


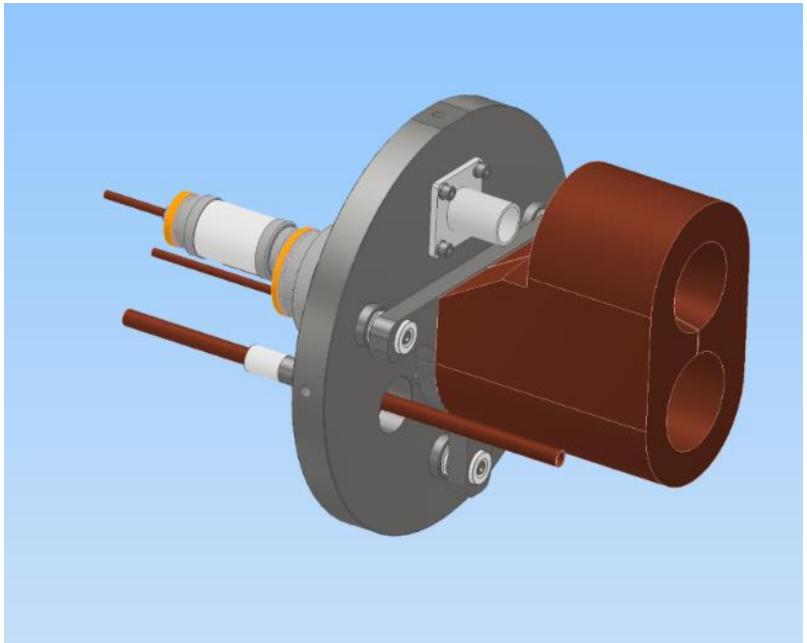
- To improve strength, ductility, recrystallization resistance, radiation tolerance, many alloying and composite technologies have been developed.
- We should keep in mind their availability, cost, lead time and availability.
- Especially, W is made by sintering, making large plate keeping uniformity is difficult.
- In the case of alloy, uniformity is much more important than that for pure W.
- There are no high-power positron target which use large size (50 cm diamater) W-alloy as far as I know.

WP-9 Magnetic focusing (for e-driven Scheme)

- Flux concentrator
  - More than 10 times higher ohmic loss compared with that of SKEKB
  - Additional beam loss from target
  - In addition to EM design, thermal and mechanical engineering are important
- Pulsed power supply
  - 300 Hz compatible
    - Due to un-even pules to pulse period
  - More than 10 times higher power compared with that of SKEKB
  - Energy recovery mechanism is necessary
  - Flat top control during 1 pulse (66 bunches, 500 ns)
  - Compactness to be installed in the accelerator tunnel
  - Similar parameters for kicker magnet power supply

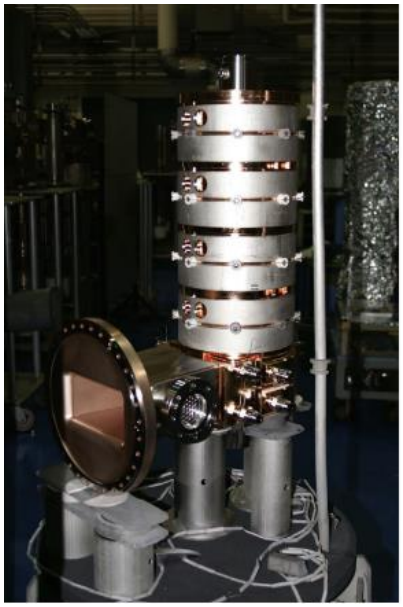
	ILC*	SKEKB
current	35 kA	12 kA
Pulse width	10 us	5 us
Repetition	100 Hz	50 Hz
Ohmic loss	10 kW	0.7～0.8 kW (measured)
Beam loss	4 kW	Small
Total loss@ Load	14 kW	0.7～0.8 kW (measured)
P.S. power	150 kW	12 kW

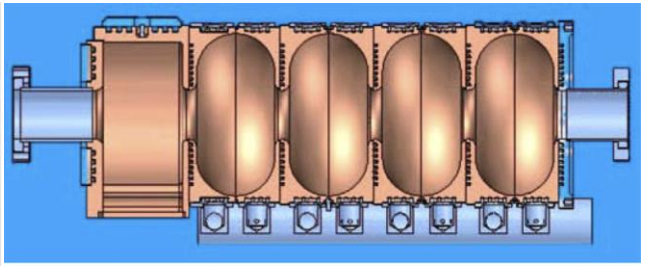
*parameters for ILC are not fixed

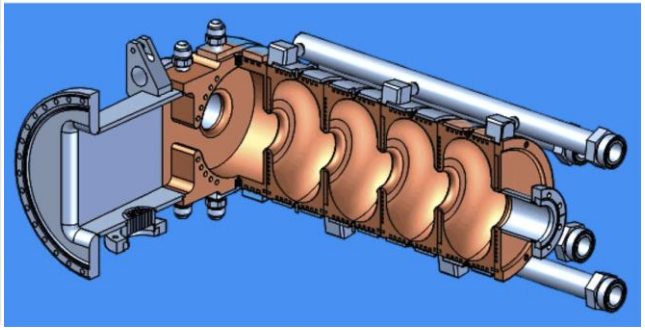


WP-10 Capture cavity

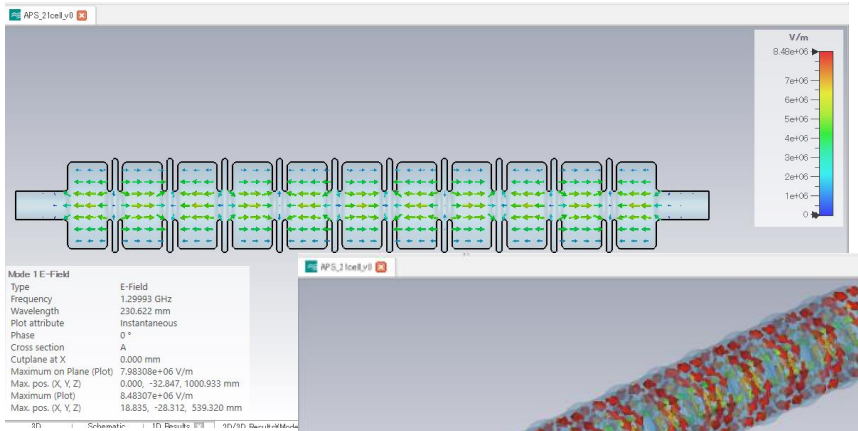
- Design challenges of Large aperture L-band cavity
  - Beam loading compensation for multi bunch operation
    - Full model RF and beam simulation
  - Very high heat load of shower from the target
    - novel cooling design
  - Remote beam flange connection
    - Connection point is surrounded by solenoid

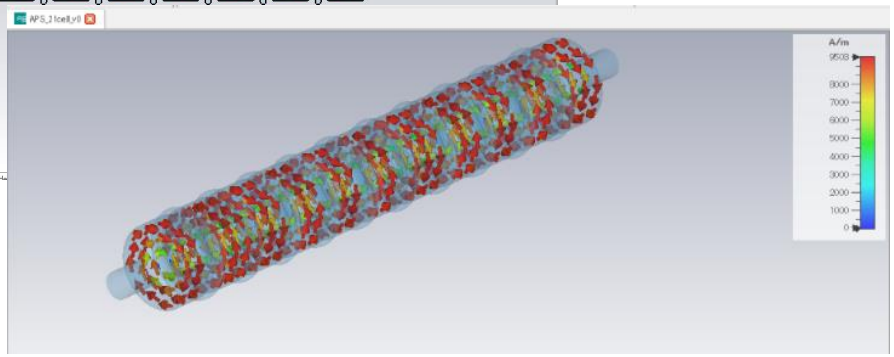






Previous design and prototype at SLAC
Phys. Rev. AB 12, 042001 (2009)

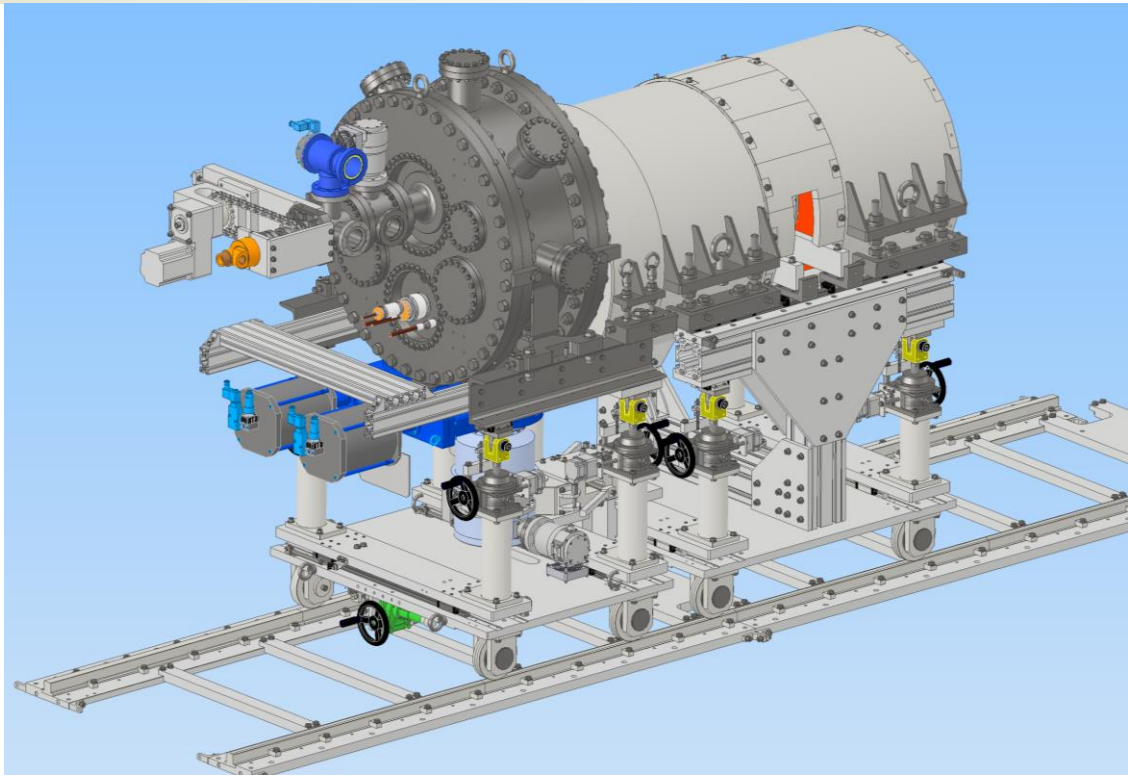




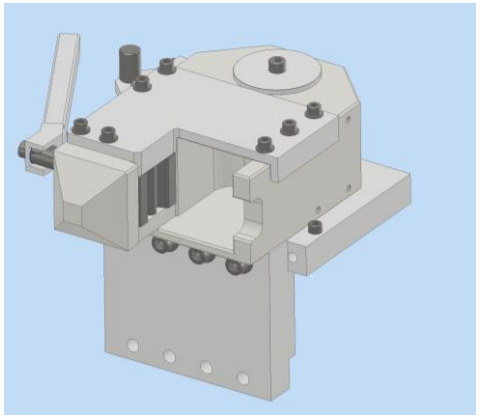
3D RF simulation of APS cavity at KEK

WP-11 Target replacement

- Target area will be activated heavily
- Many Common technology to all the other high-power accelerator
- Not only simulation and evaluation, experience and knowledge transfer are important
  - 3 times exchange experiences through SKEKB operation
  - Collaboration with other high power target facilities, J-PARC, RIKEN, FRIB…
- Mechanical, vacuum engineering
  - Automatic flange connection
  - Movable base



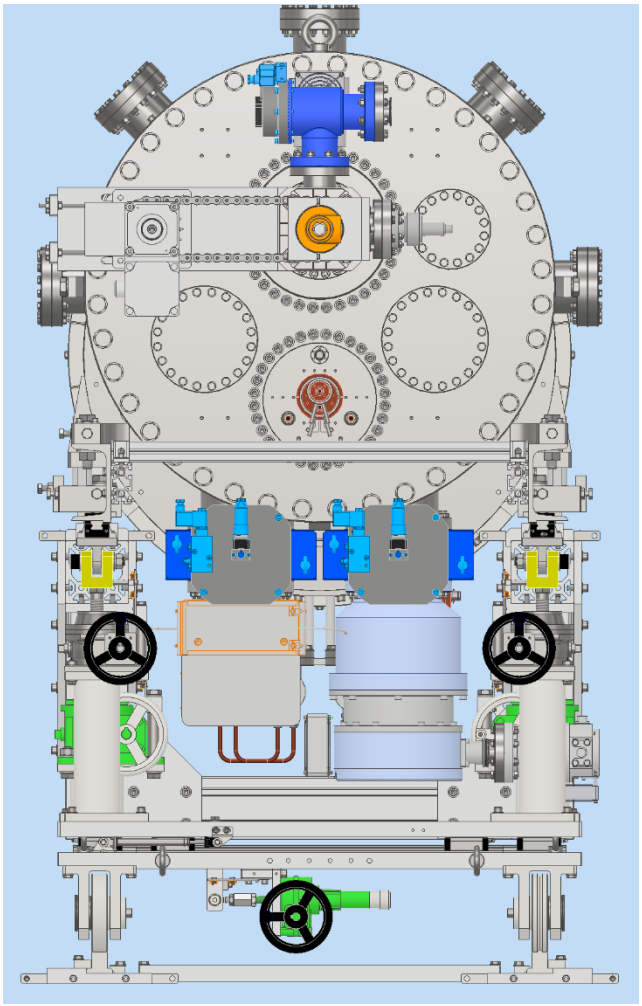
Girder structure on rail

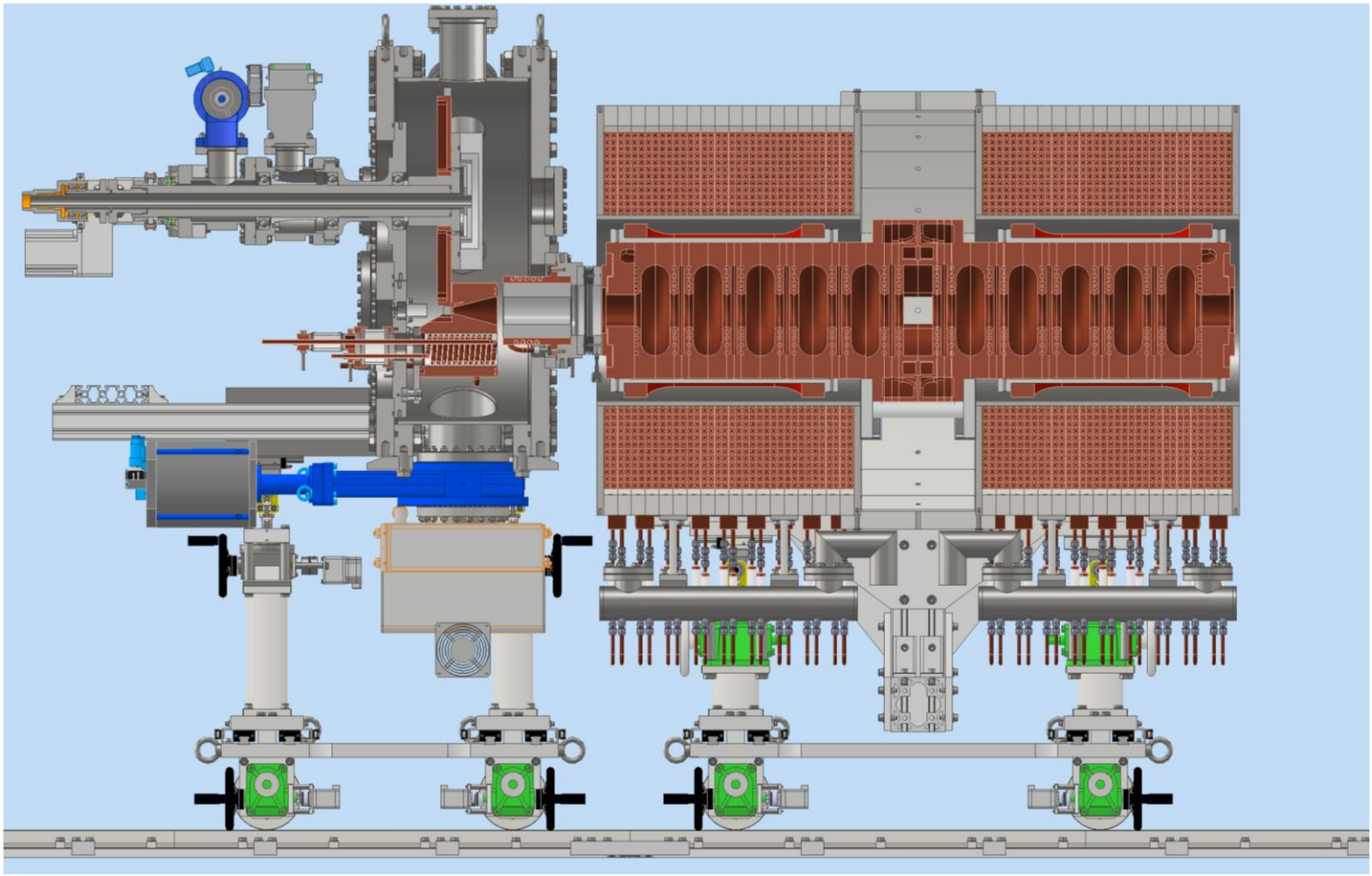


Automatic connection coupler

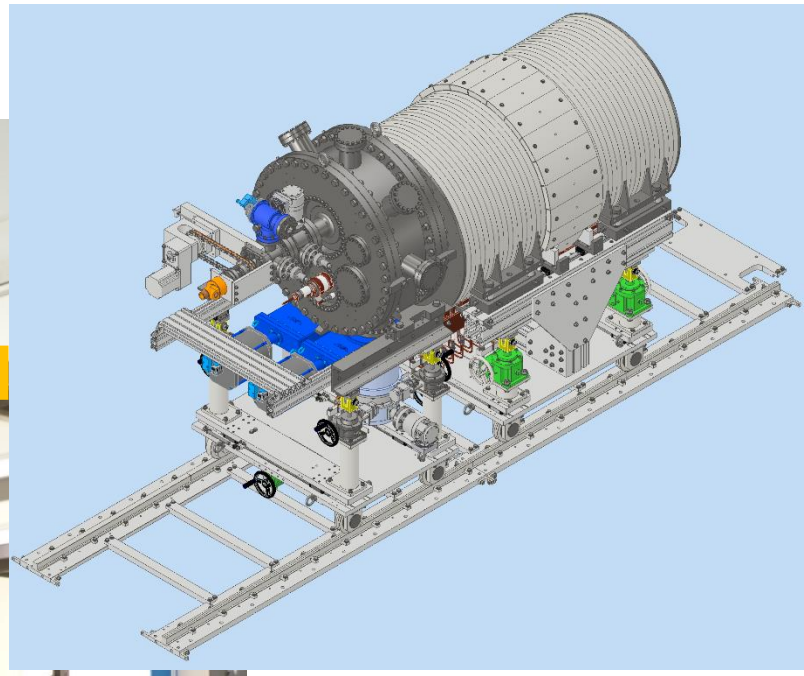
Pillow seal

Latest 3D model





Test bench in KEK



IJCLab / FCCee

14th International Particle Accelerator Conference,Venice, Italy JACoW Publishing
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BENCHMARKING THE FCC-ee POSITRON SOURCE SIMULATION TOOLS USING THE SUPERKEKB RESULTS *

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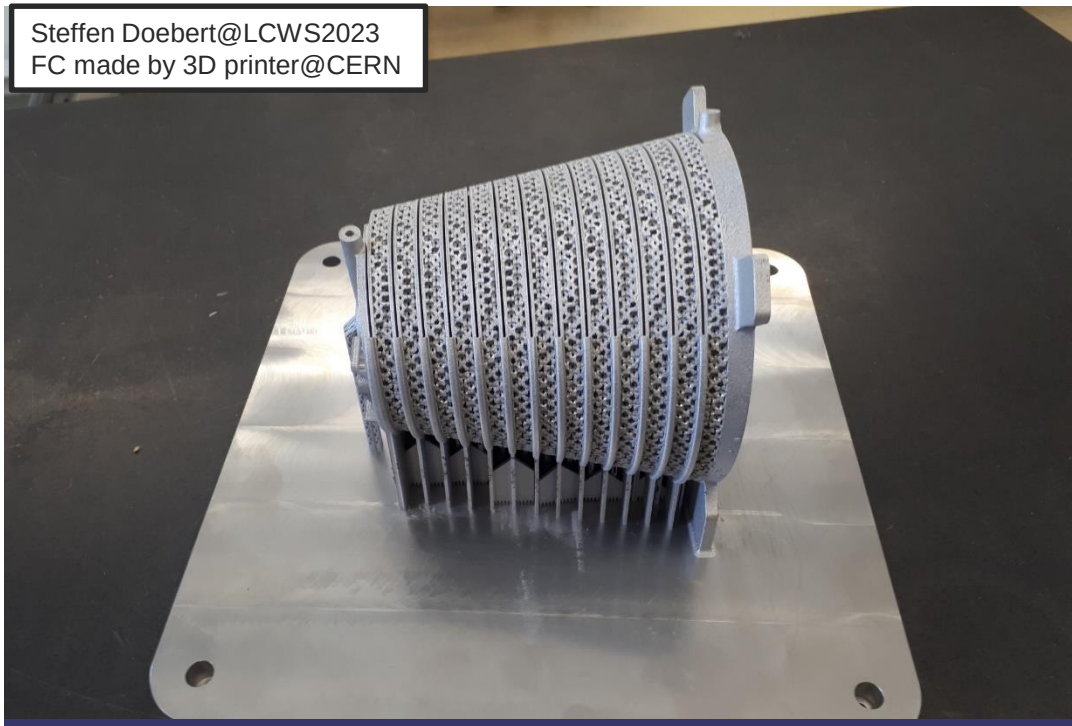
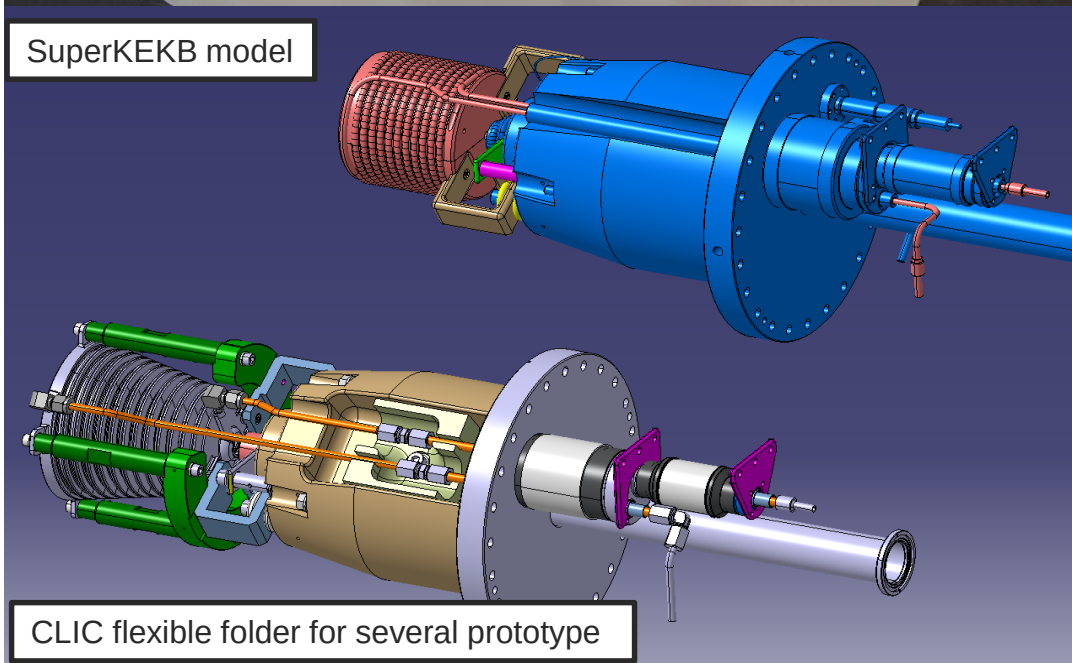
rk, publisher, and DOI.

- SuperKEKB and FCC-ee has been collaborating for many years using the framework of FJPPL
  - Iryna-Enomoto collaboration started in 2018
  - First collaborative work between KEK and LAL started in 1980's by our Predecessors.

CERN / CLIC

- Discussion about FC with CERN date back to LCWS2019 at Sendai
- Steffen showed big progress on the development of FC at LCWS2023





Discussion

- SuperKEKB and FCC-ee, CLIC already have some kind of collaboration and connection.
- How do we expand and integrate collaboration using ITN framework?
- Considering present status and progress of ILC, FCC-ee and CLIC, it’s a good timing to advance our collaboration!!