

SRF Plasma Processing: How Research Got Me to Japan

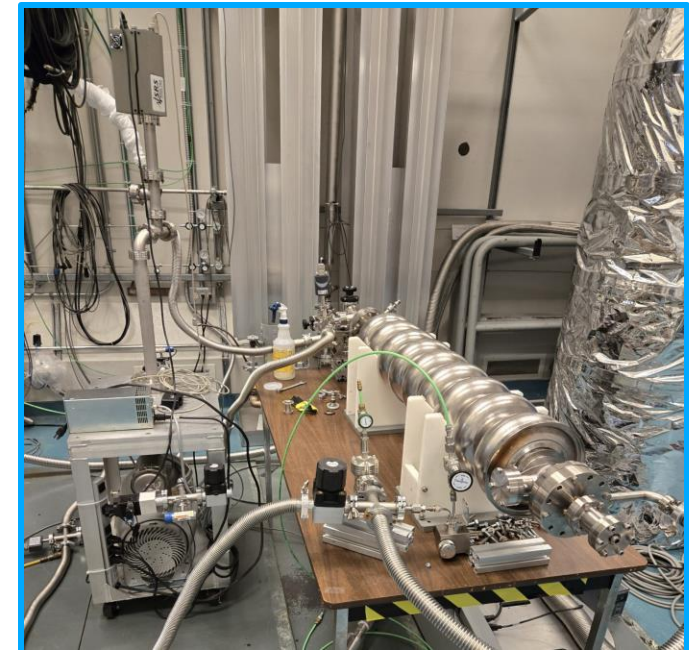
Daniel Hedji

EPECR Selected Talk



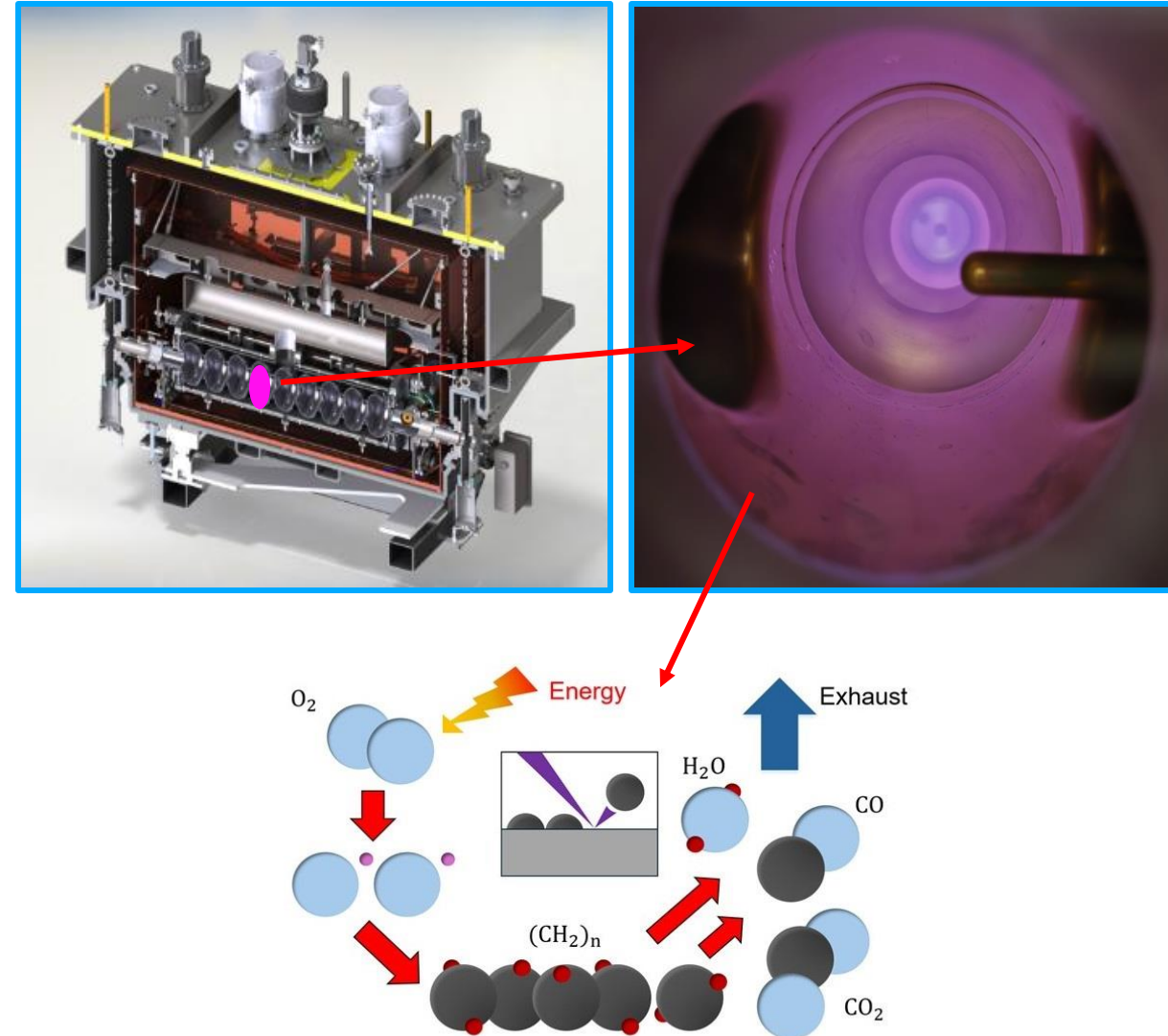
A Little About Me

- I currently work as a detector technician at the University of Victoria for the Hyper-K experiment.
- I enjoy hiking and (sometimes) golf.
- I am an alumni from TRIUMF.
- My work at the time was on SRF plasma processing for ARIEL's e-Linac.
- I was a recipient for the TRIUMF-KEK Exchange Program for Early Career Researchers (EPECR) award in 2025.



SRF Plasma Processing

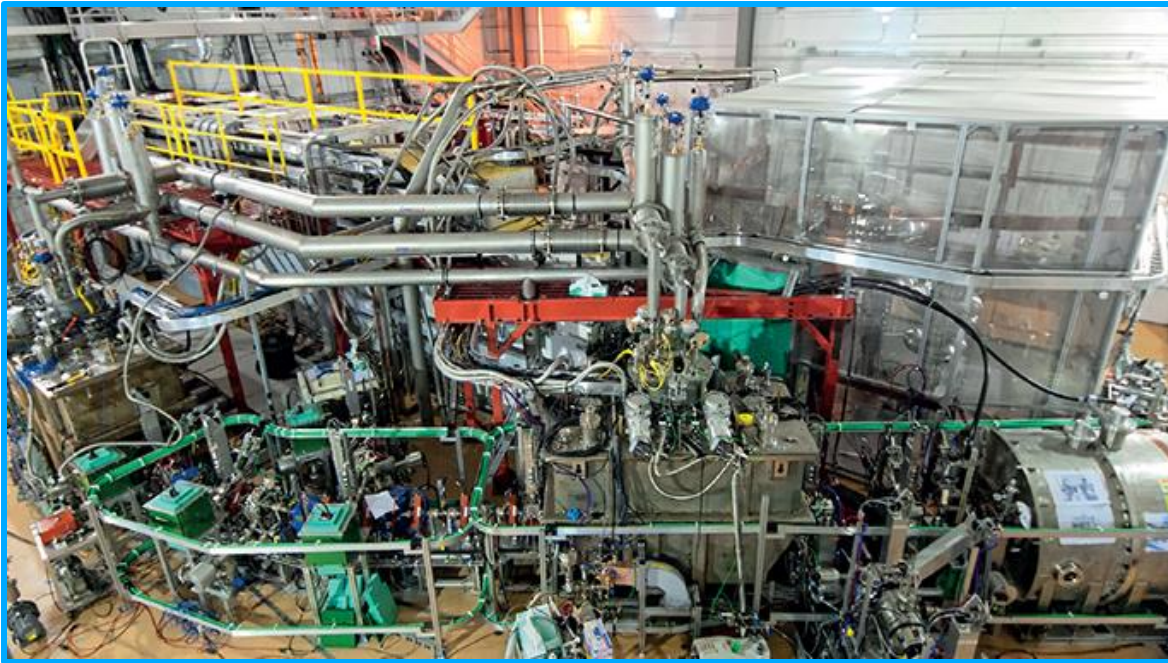
- SRF accelerators are not always efficient.
 - Superconducting materials like to be ultra-clean and ultra-pure.
 - When there are contaminants present, they perform worse.
- Plasma processing counteracts this internally using a plasma.
 - Therefore no need for disassembly!
- To do so, a combination of two gasses is used:
 - Reactive (O_2): Meant to bond with contaminant formations.
 - Inert (He, Ar): Breaks chemical bonds.



How can it be used at KEK?

- KEK's cERL and ARIEL's e-Linac have similar specifications.
 - In addition to using similar SRF cavities.
- Developing a processing stand at KEK would allow parallel plasma processing R&D between TRIUMF and KEK.

ARIEL e-Linac



30 MeV, 3 mA beam

KEK's cERL



20 MeV, 1 mA beam

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4. Experience living and working in Japan

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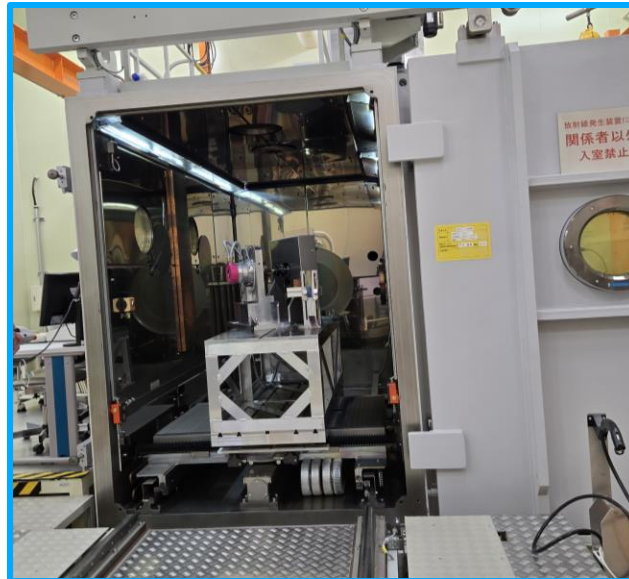
4. Experience living and working in Japan

- Adapt to a different research culture.

The Exchange

Initial Impressions of Tsukuba and KEK

- Arriving in Tsukuba was a BIG change compared to Tokyo.
 - It was much quieter.
 - Greener.
 - And had a lot more bugs.
- The KEK campus was also much larger than I expected.
- It's SRF program had a heavy focus on cavity production.
 - Lots of equipment I had never seen before.
- Needless to say, I was still nervous going into the exchange.



Meeting the SRF Team

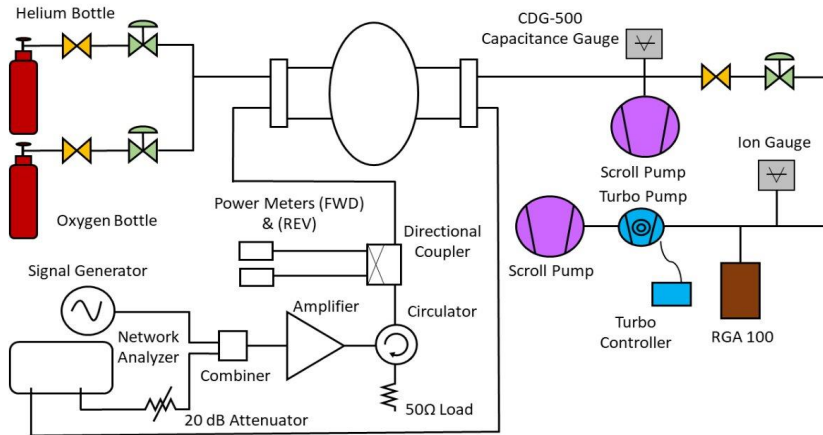
- The SRF team calmed my nerves quickly.
- They welcomed me with open arms on day one.
 - Introductions
 - Facility tours
 - Weekly lunches around Tsukuba
- There was a lot of excitement about the technique and its uses within the cERL.
- We started project planning shortly after initial introductions.



Plasma Processing at KEK – The Start

- There were four main stages with developing the new P.P. system:

Conceptualization

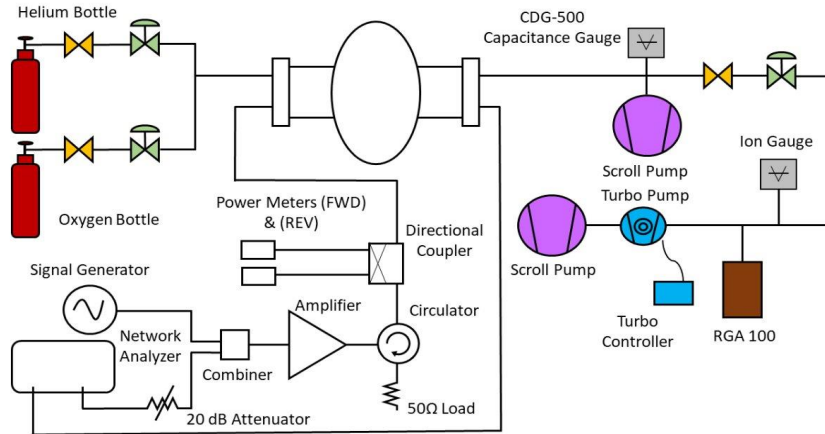


Schematic of TRIUMF's plasma processing assembly.

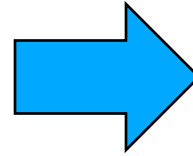
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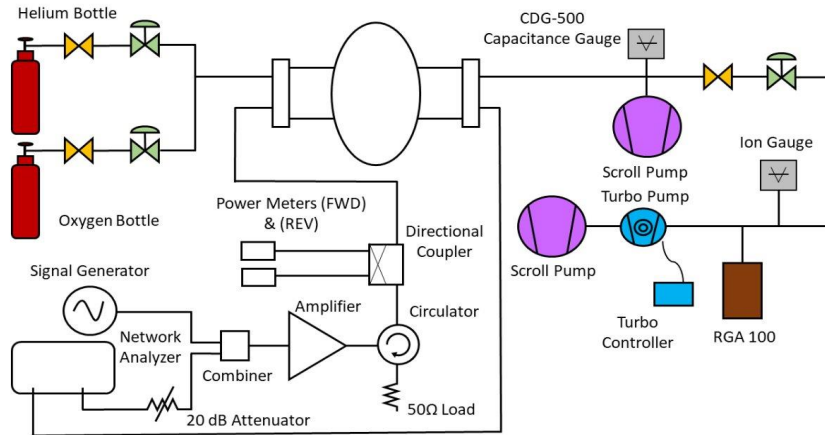


Helium and Oxygen bottles used for plasma processing.

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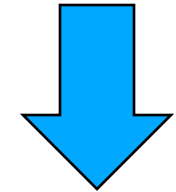


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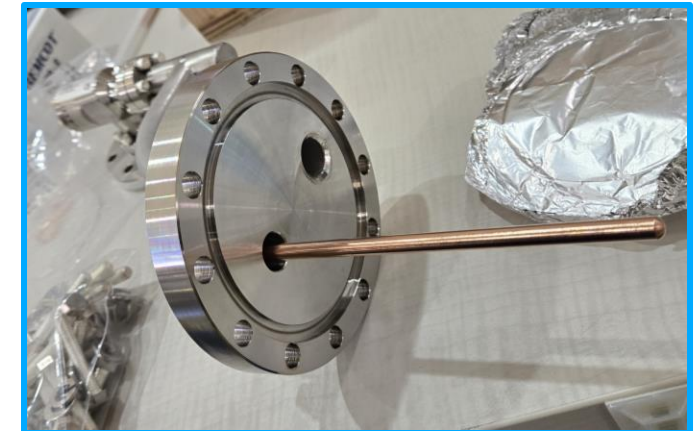


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Collaboration

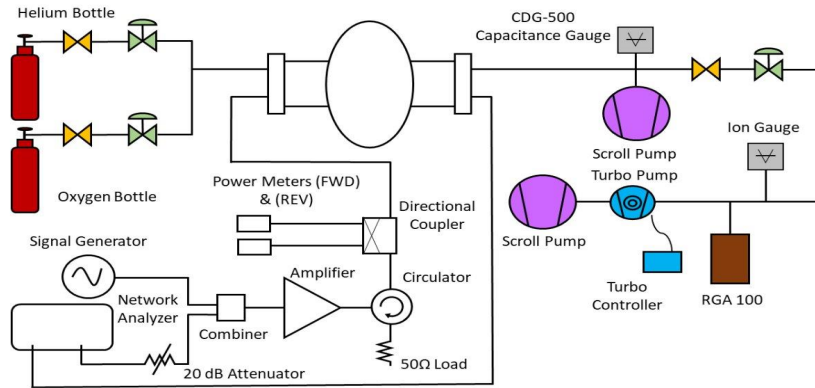
An RF coupler specifically designed for reaching optimal ignition conditions.



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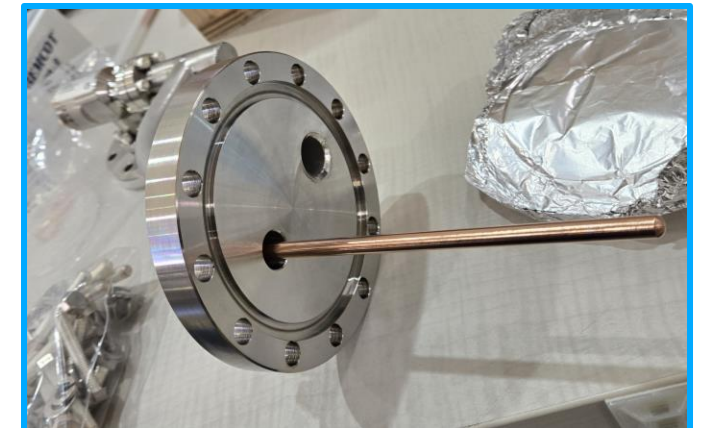
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Creation



Initial assembly of the plasma processing stand with a single-cell cavity.

Collaboration

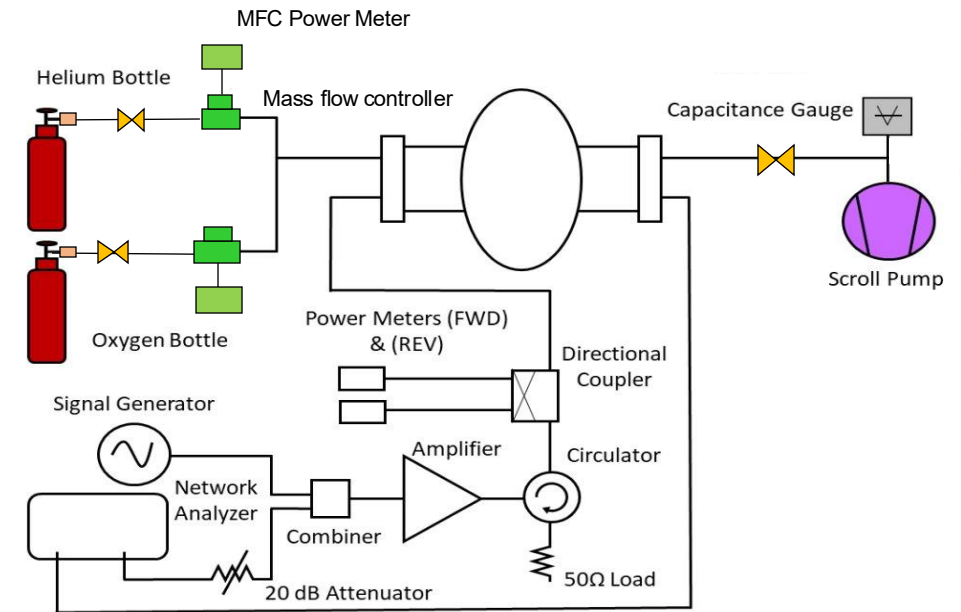


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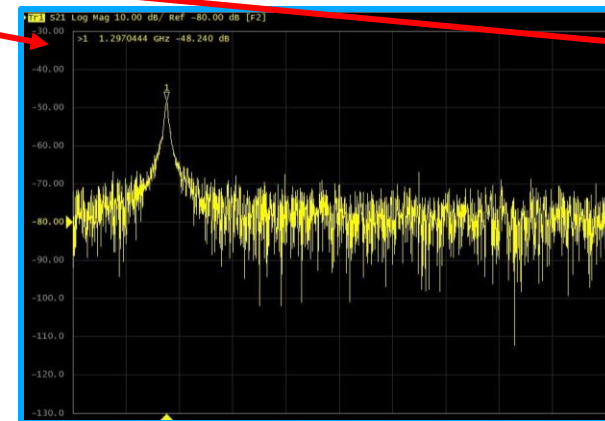
Plasma Processing at KEK – The Finish



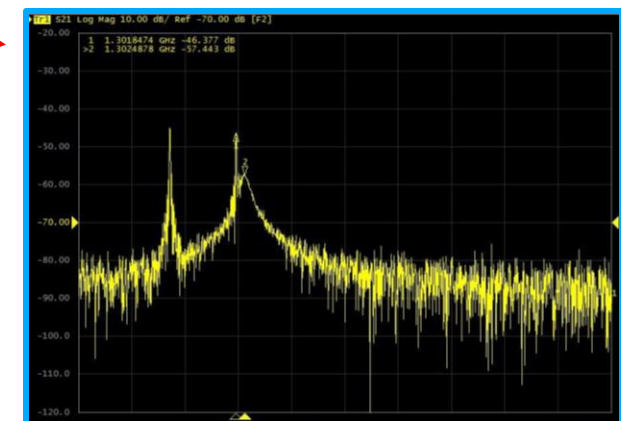
KEK's plasma processing bench assembly.



Schematic of KEK's plasma processing assembly.



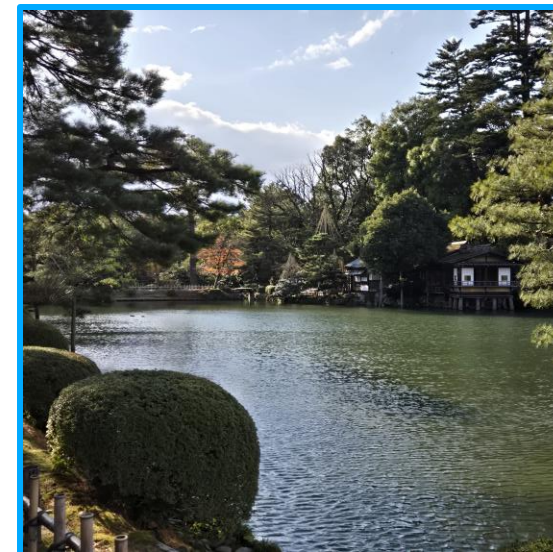
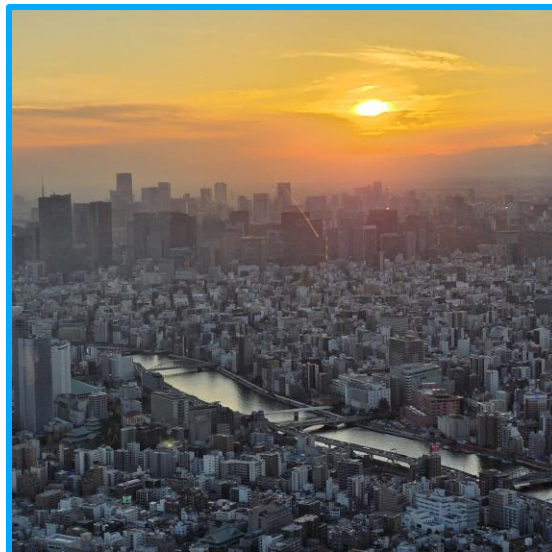
Before plasma



After plasma

My EPECR Experience

- Professional:
 - Expanded my experience with SRF preparation and research techniques.
 - Strengthened my hands-on experimental skills.
 - Built connections within the international SRF community.
- Personal:
 - Stepped out of my comfort zone.
 - Gained perspective with international collaboration.
 - Experienced Japan's culture firsthand.



Thank you
Merci

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