

Installation of Test-stand for Conditioning of the Microwave Ion Source at KOMAC*

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* This work has been supported through KOMAC (Korea of Multi-purpose Accelerator Complex) operation fund of KAERI by MSIP (Ministry of Science, ICT and Future Planning)
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Microwave Ion Source for 100 MeV Proton Linac

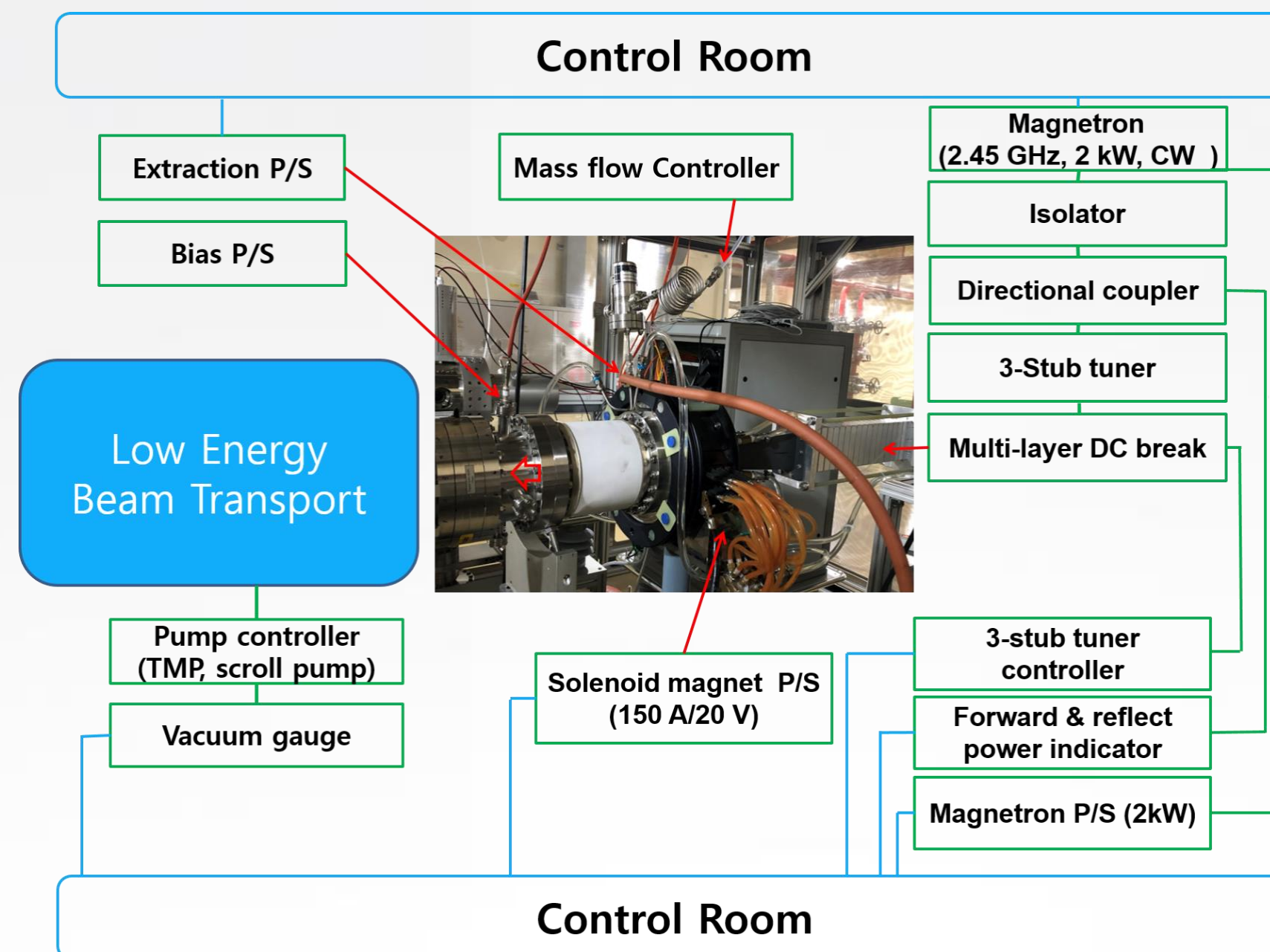
Introduction

- The 100-MeV proton accelerator has been providing beams to users since 2013
- The ion source is a component that accumulates aging of the device.
- The ion source must have the same beam characteristics before and after replacement.
- The process of confirming the characteristics of the ion source after replacement of the ion source component and constructing a test bench for conditioning of the microwave ion source is presented.

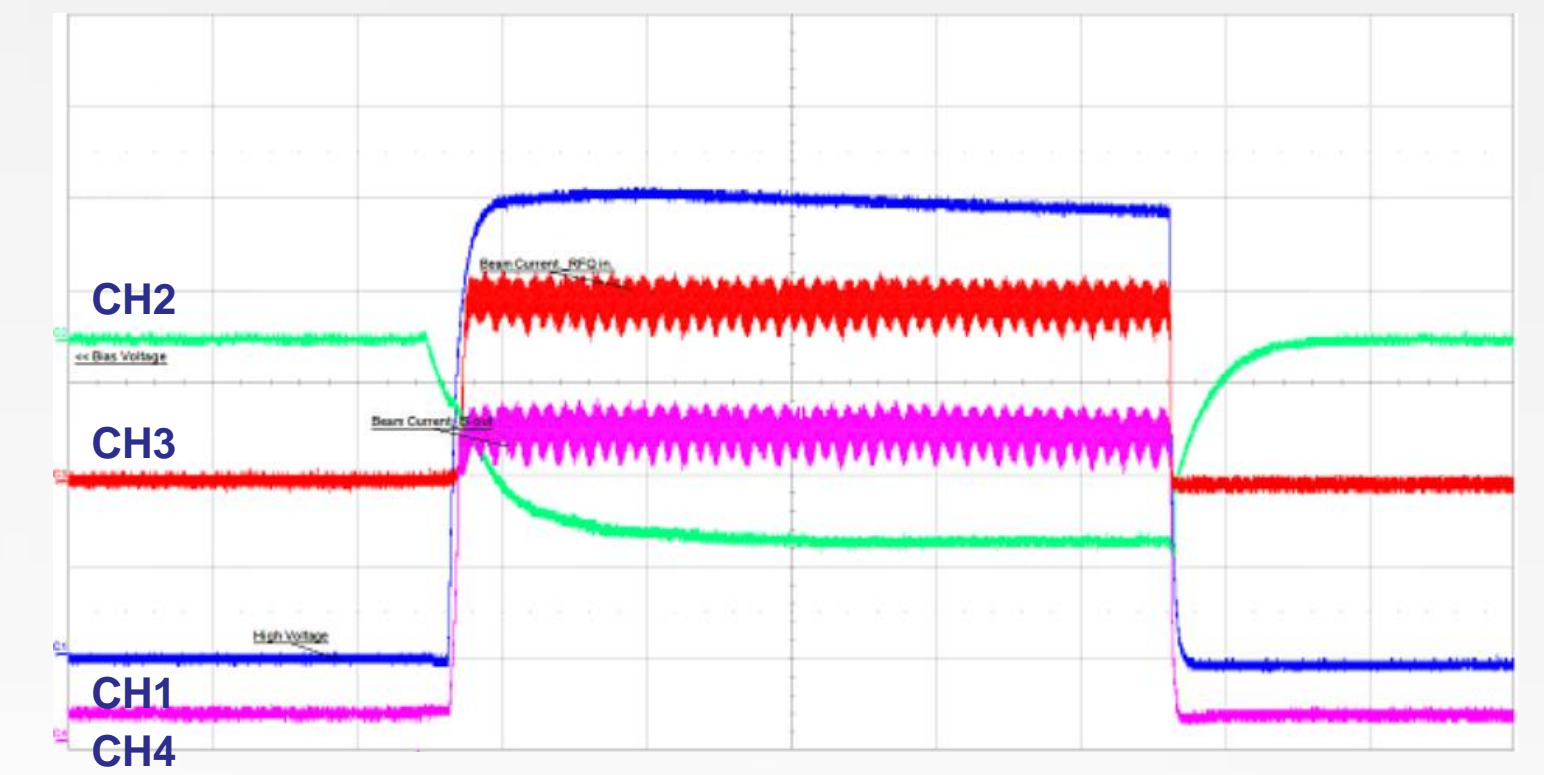
Specification

- Particle : proton
- Beam energy : 50keV
- Operating current : ~ 20mA
- Emittance(Normalized rms) : 0.2π mm mrad
- Proton fraction : > 80%
- Microwave frequency : 2.45GHz

System Block Diagram



Operation Conditions



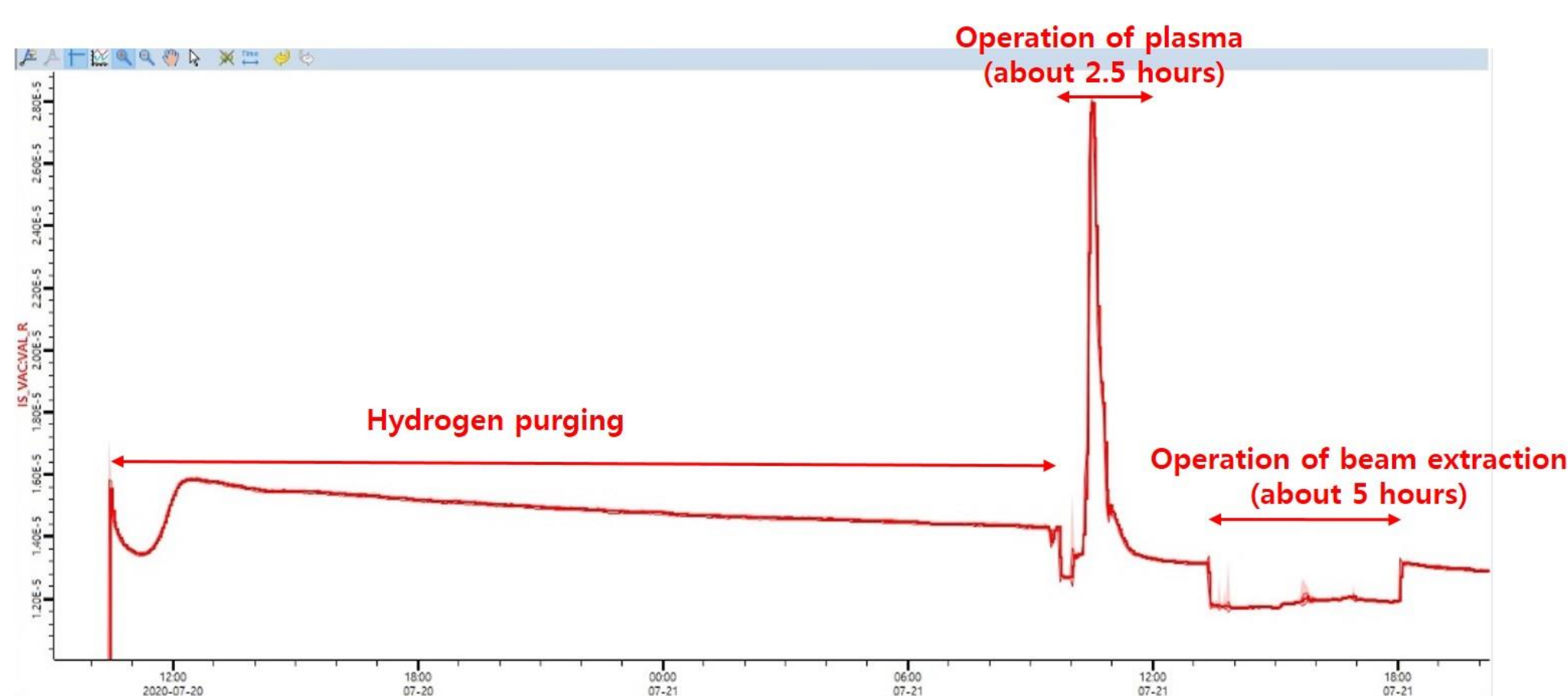
CH1: Extraction voltage, CH2: Bias voltage, CH3: LEBT CT, CH4: Ion Source CT

- Gas flow rate : 3.0 SCCM
- Extraction voltage : 51 kV
- Bias voltage : -4 kV
- Solenoid magnet current : 72 A

Conditioning of Microwave Ion Source

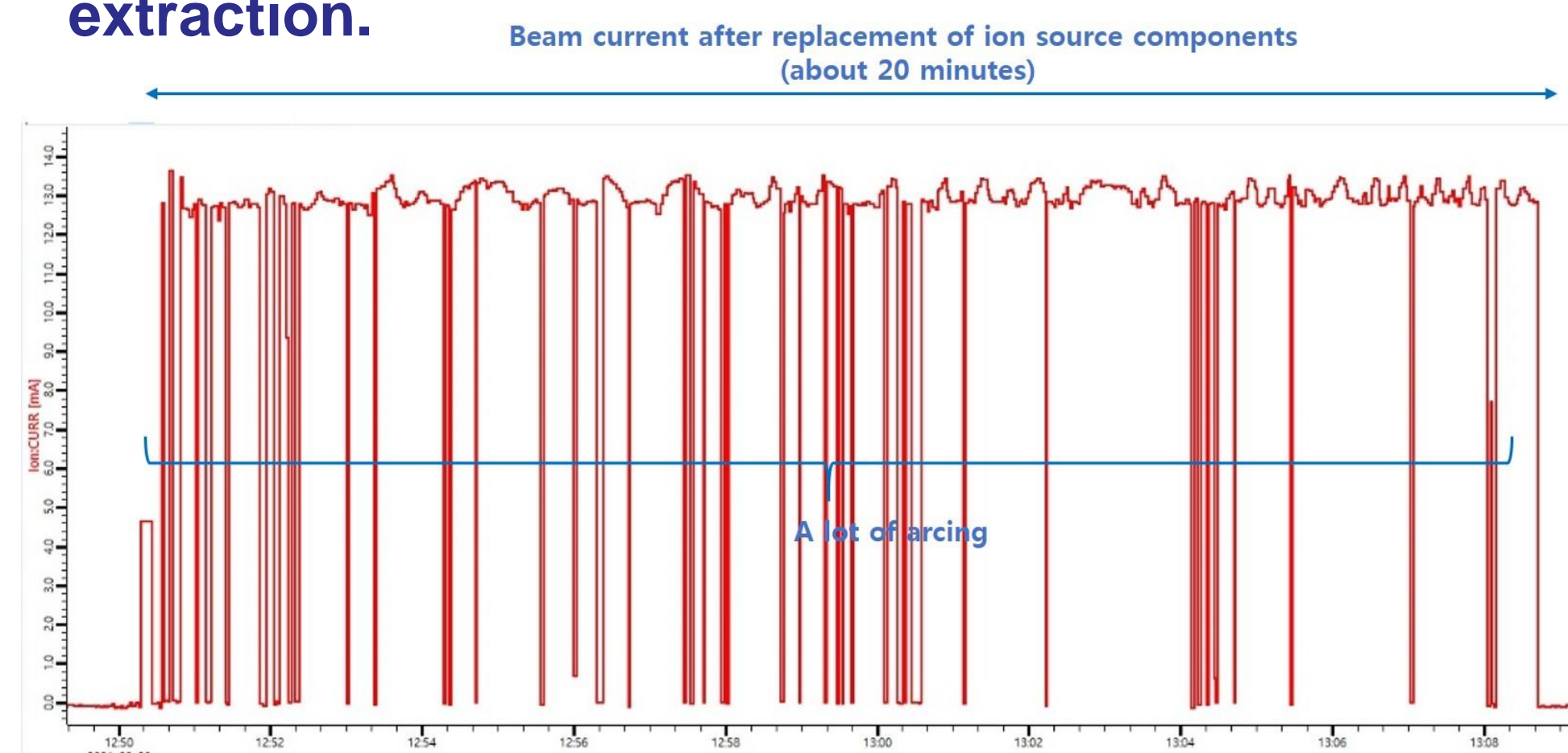
Vacuum trace of microwave ion source

- Purging the initial hydrogen gas
- Plasma discharge after replacing the microwave window and plasma chamber
- Operation of beam extraction



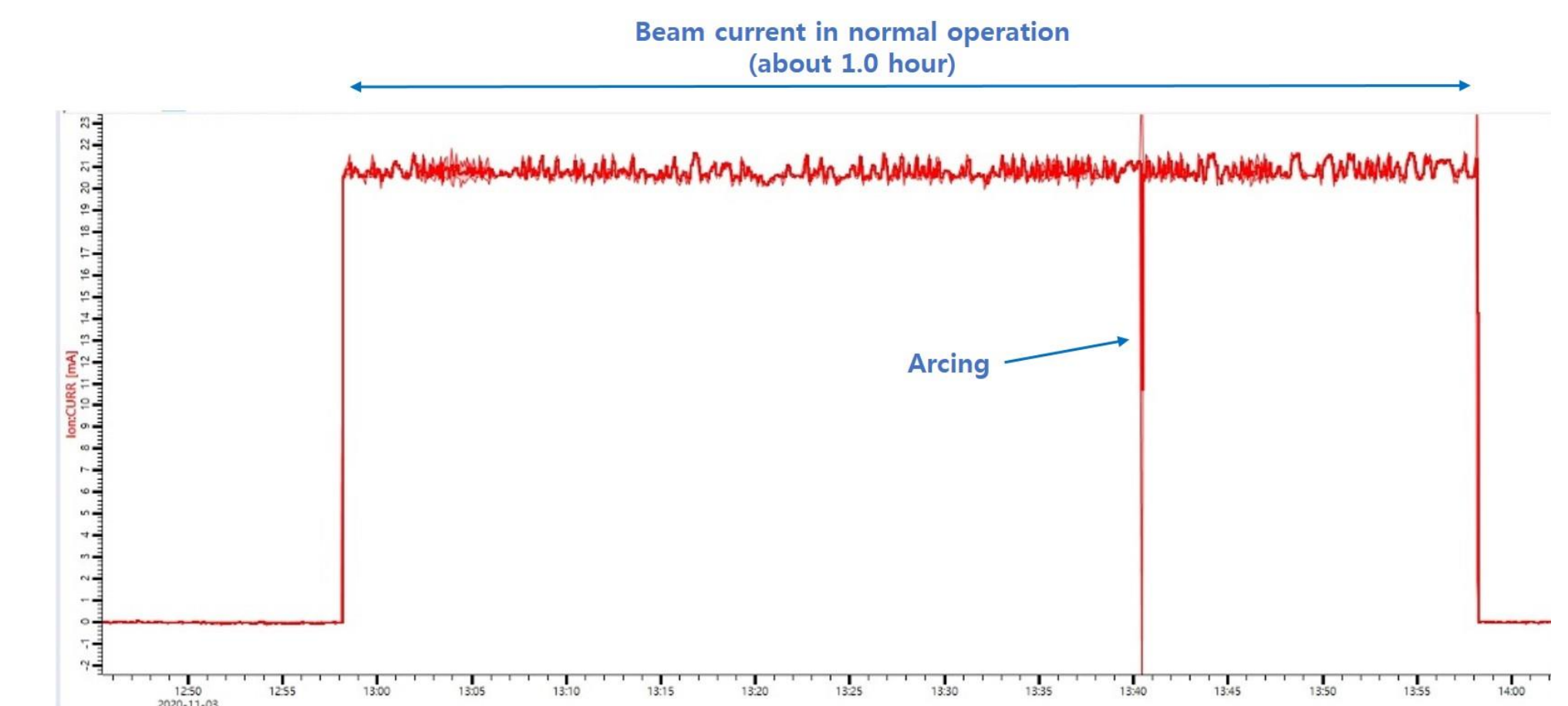
Beam current in LEBT during conditioning of microwave ion source

- Continuous arcing occurred.
- It can be seen that the number of arcing occurs decreases toward the second half of the beam extraction.



Beam current in normal operation after conditioning of high voltage of microwave ion source

- The average beam current is 20.8 mA.
- The beam stability is ± 3.9 %.

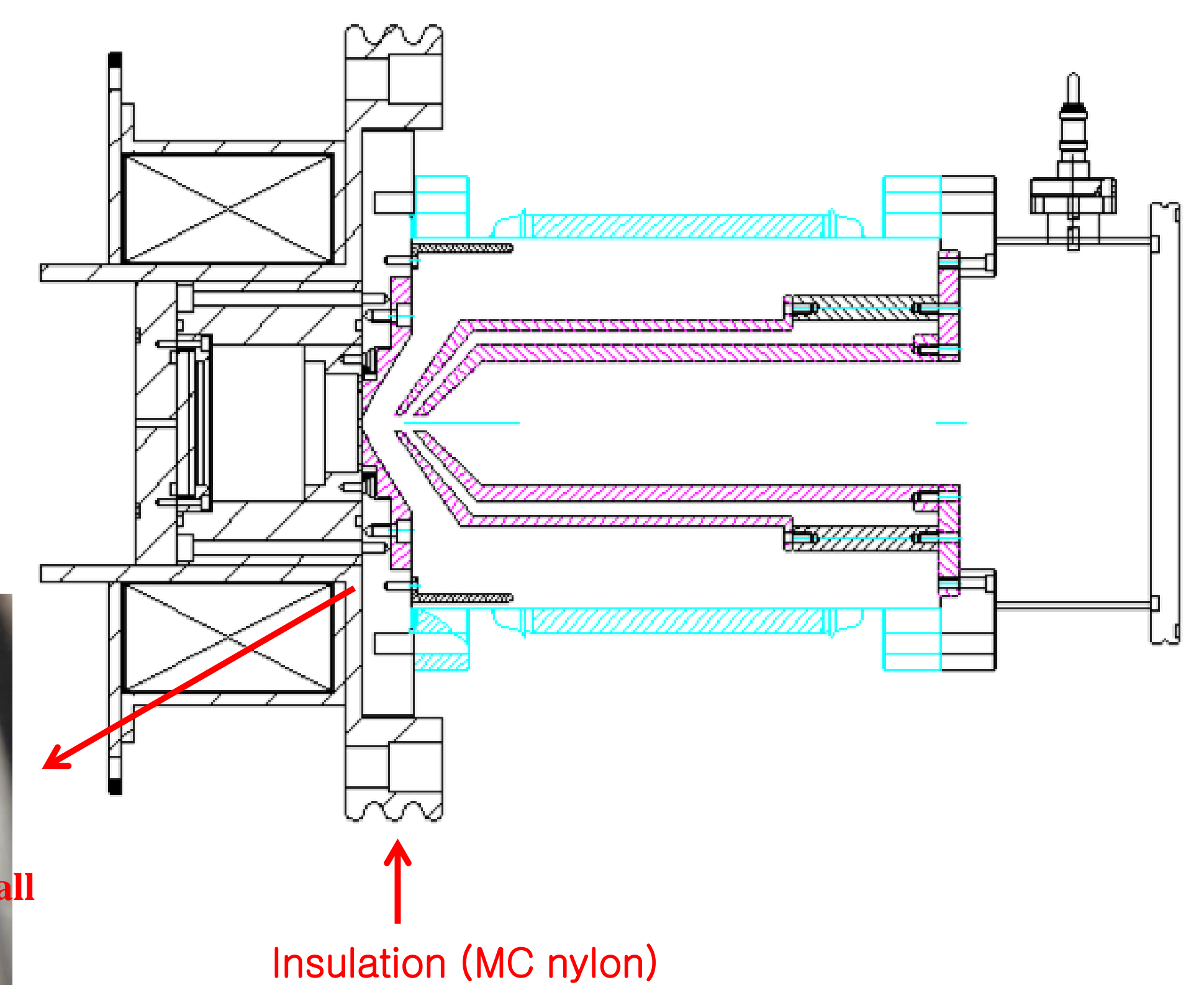
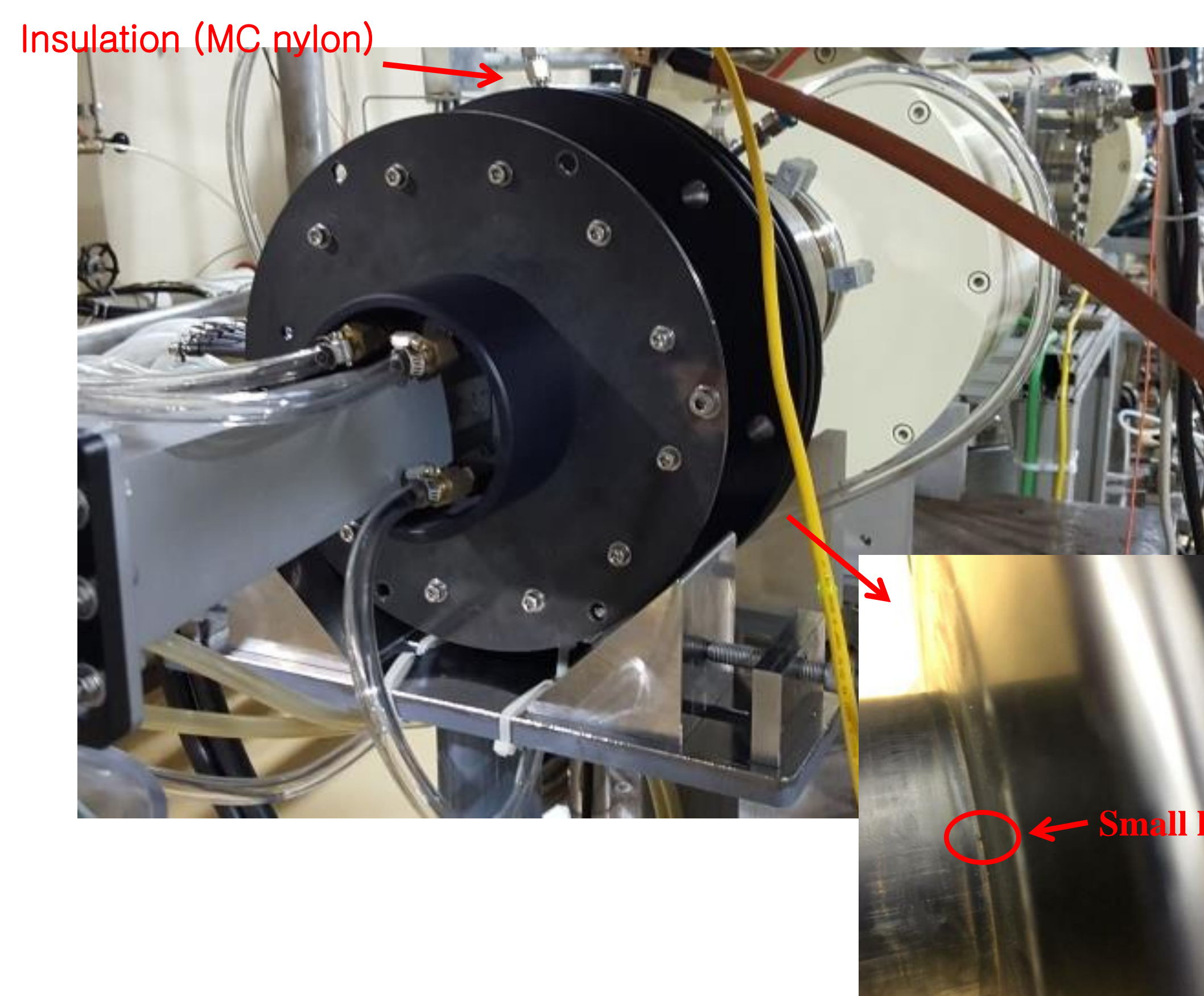


Trouble-shooting

- Occurs during operation
- It hasn't been long since it was replaced.

Reason

- : Insulation breakdown due to accumulated fatigue(arcing)
- : Reduced insulation strength of insulators due to the heat generation source of plasma chamber



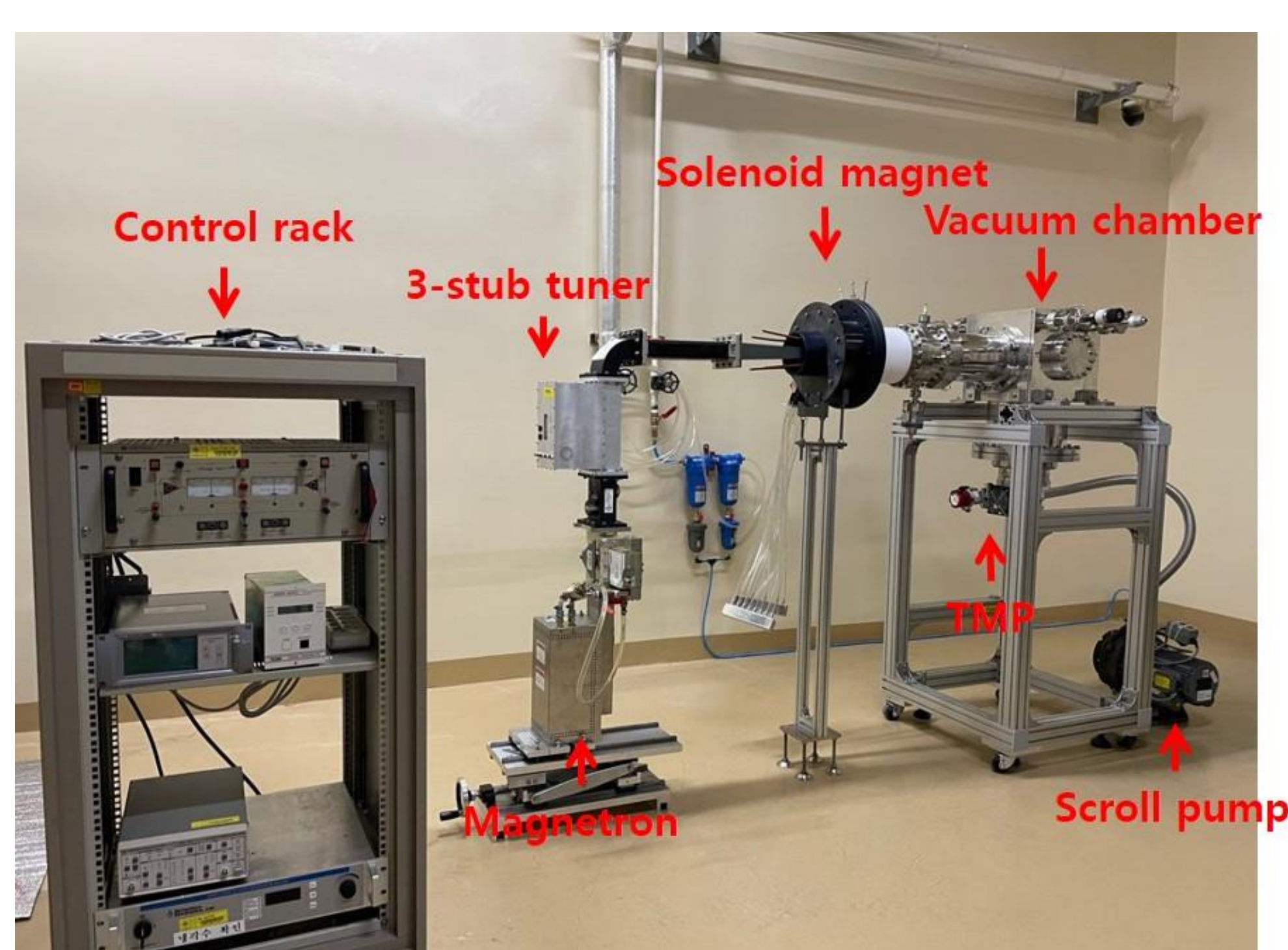
Test-stand for the Microwave Ion Source

Installation

- The microwave ion source of the test-stand is a spare part and has the same shape as the existing microwave ion source, and it is a concept that changes it to the whole when it is regular or irregular.

- At test-stand

- : Plasma conditioning
- : High-voltage conditioning
- : High current beam conditioning
- : Components test for improvement



Components related to the high voltage test are omitted.

In Future

- In test-stand

- : Conditioning of the new microwave ion source
- : Thermal analysis of the plasma chamber

- Insulation improvement

- : insulation size change
- : changing the size of the solenoid electromagnet.