

Stain problem at KEK

ILC cavity group meeting

25 Aug 2009

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Cavity status; recent KEK activities

MHI-06, MHI-07, MHI-08 were vertical tested in June, July.

- EP acid (1000l) was re-newed on May 15. These cavities were processed by this new EP acid. (MHI-05 reached 27MV/m using aged EP acid. Nb~8g/l)

- MHI-06 22MV/m limited by RF cable trouble. (stain)
- MHI-07 16MV/m limited by field emission. (stain)
- MHI-08 16MV/m limited by cell heating. (black object at equator weld edge)

The EP procedure was tested using old MHI 9 cell cavity (MHI-#0).

*MHI-05,06,07,08,09 are S1G cavity candidates.

Brown spots and traces (so-called stains);

MHI-06: spots or traces on BP#1, cell#1, cell#2, cell#3, cell#4, cell#8, cell#9, #9BP
(red means bad)

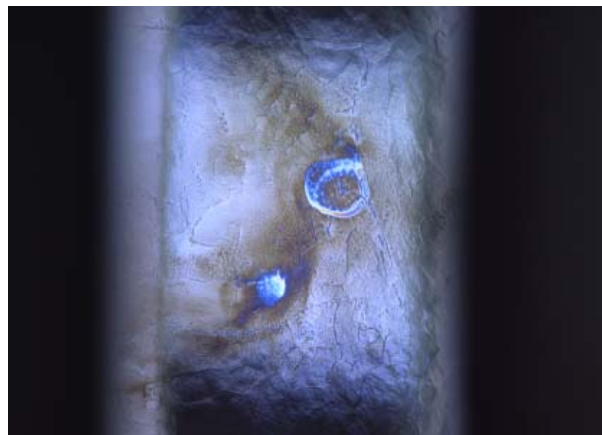
MHI-07: BP#1, cell#1, cell#2, cell#3, cell#4, cell#5, cell#6, cell#7, cell#8, cell#9, #9BP

Kyoto-camera picture examples using new LED illumination

MHI-06 cell#1 equator, t = 306 deg.
Downstream : off welding area



MHI-06, #9BP, t = 241 deg. -1



MHI-06, #9BP, t = 241 deg. -2



Doubting a problem in the draining process of EP acid, and/or following U.P.W. rinse process at STF/KEK. The stains might be some status of Nb-oxide.

Scraping the brown spot by scraper

Scraped the brown spot by scraper.

An old MHI-00 9-cell cavity was EP'ed.

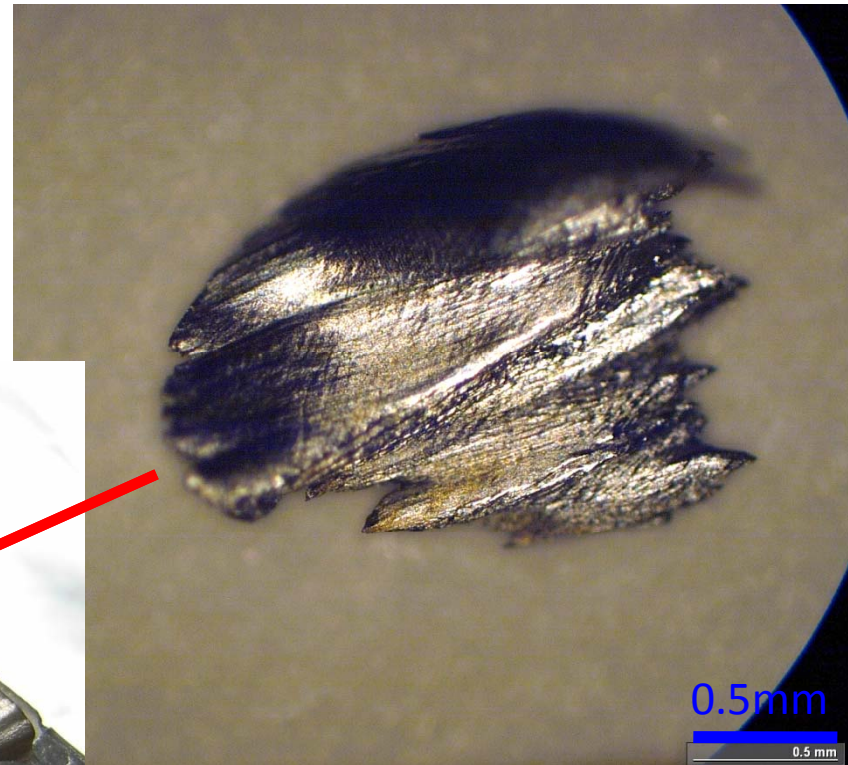
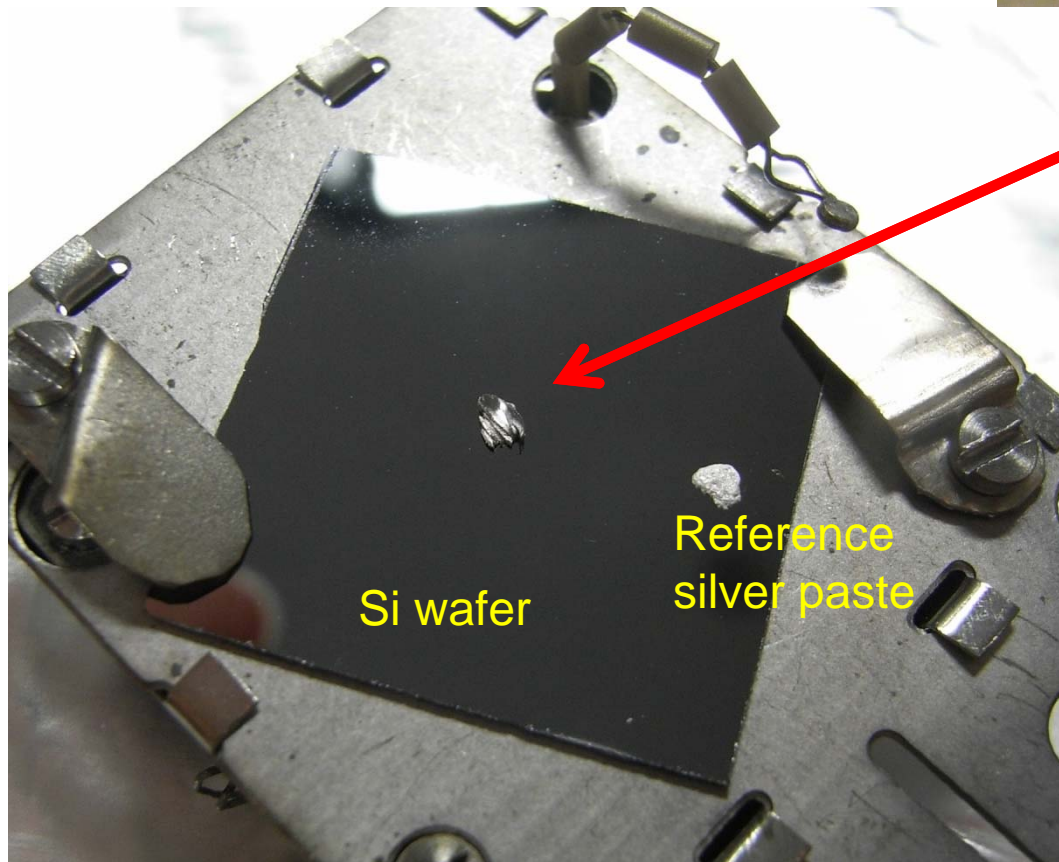


A brown spot was found inside the beam-pipe of old MHI-00 9-cell cavity after the EP.



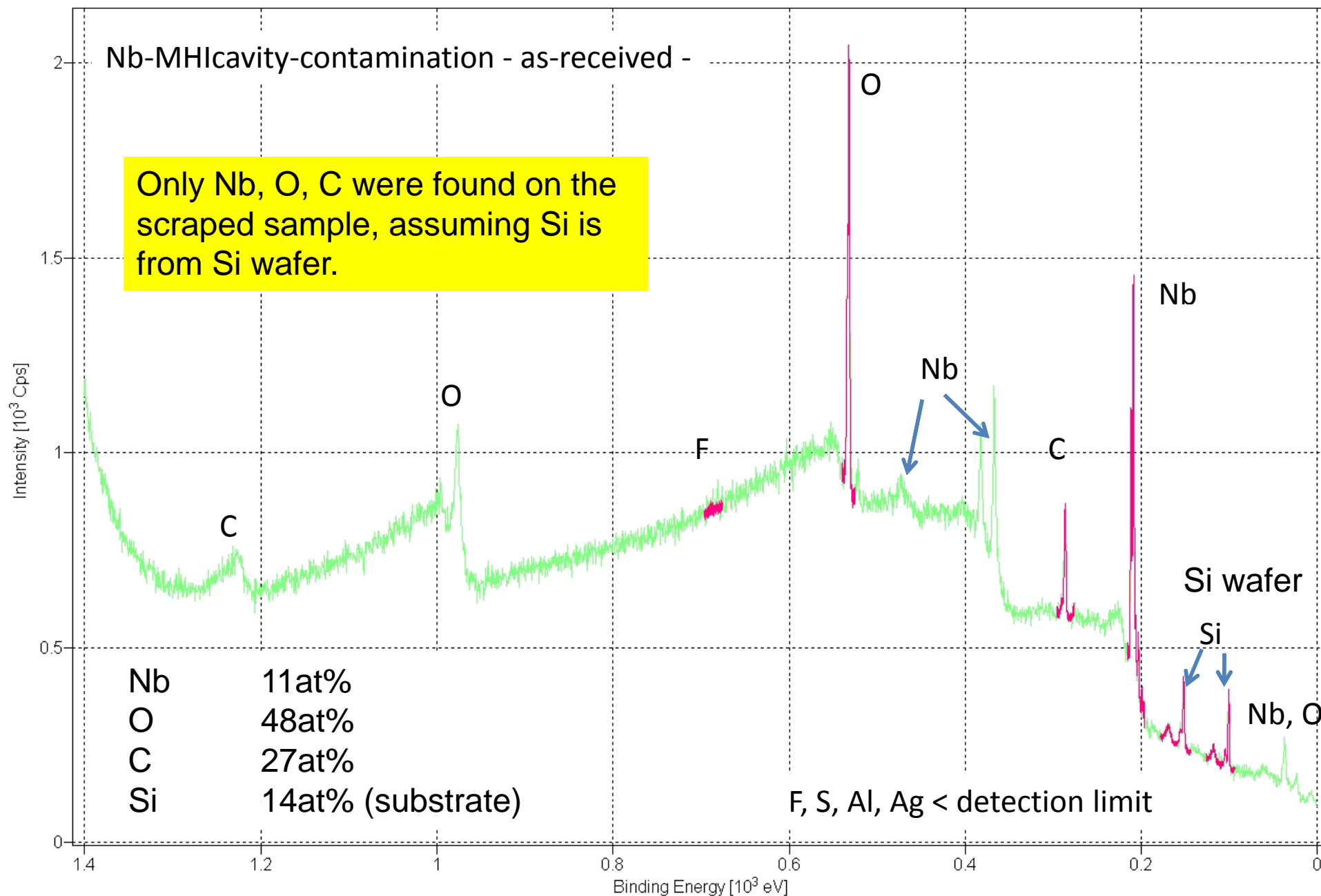
Sample preparation

Sample was set on Si wafer by silver paste.



Scraped Nb sample

XPS analysis of scraped sample from old MHI 9-cell cavity



MHI-00 EP'ed and observed by kyoto-camera

ギア側:入力ポート

By K. Watanabe

Stains in 3 levels

3段階で分ける

Red: very bad

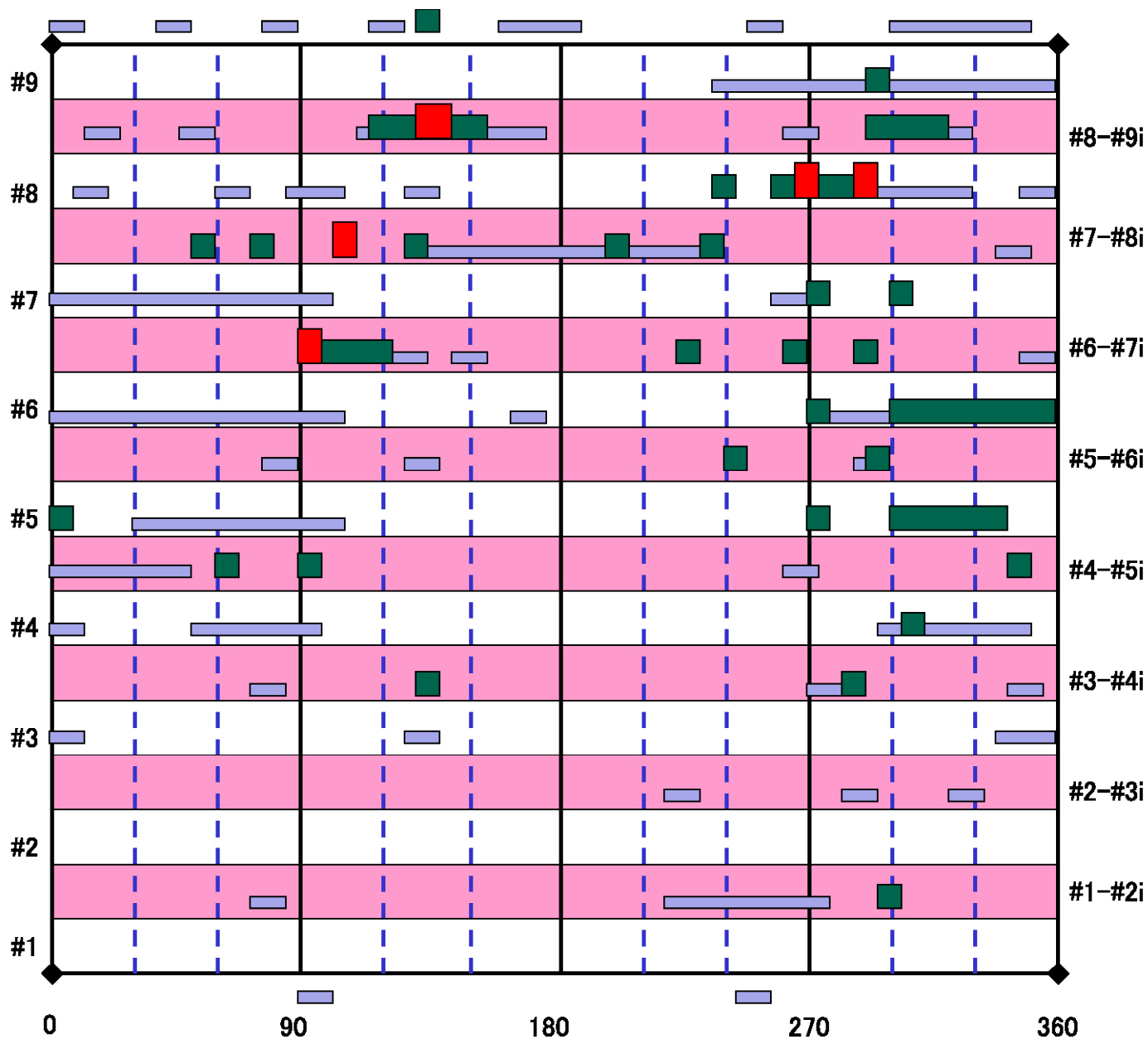
Green: bad

Grey: light

T-mapで反応
のあった箇所

OLD MHI-#0
液交換後9回目

高速液抜き(窒素
加圧0.02MPa)



MHI-00 EP-acid-rinsed and observed by kyoto-camera

ギア側:入力ポート
By K. Watanabe

Stains in 3 levels

3段階で分ける

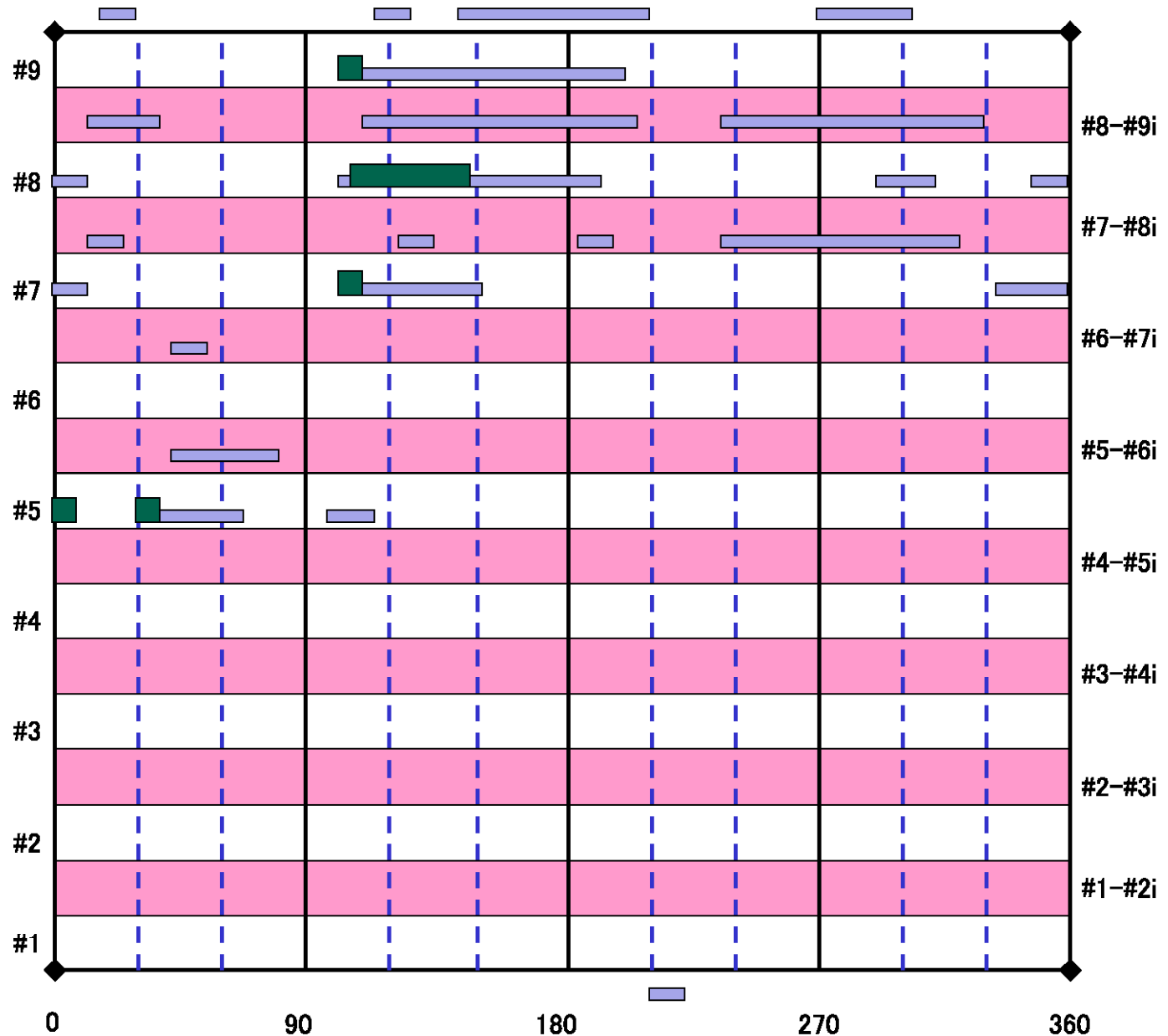
Red: very bad

Green: bad

Grey: light

T-mapで反応
のあった箇所

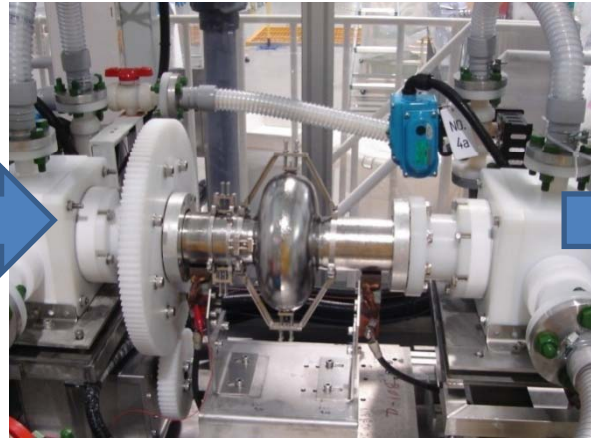
OLD MHI-#0
液交換後10回目
EP液リンス



Draining /rinse Process after EP at STF/KEK



Drain EP acid for 15 min.



Horizontal for 5 min.



Drain EP acid for 10 min.
Then UPW rinse starts.

U.P.W. rinse process at STF/KEK:
[Pouring U.P.W. for 7 min. and draining U.P.W. for 10 min.] x 6 times.

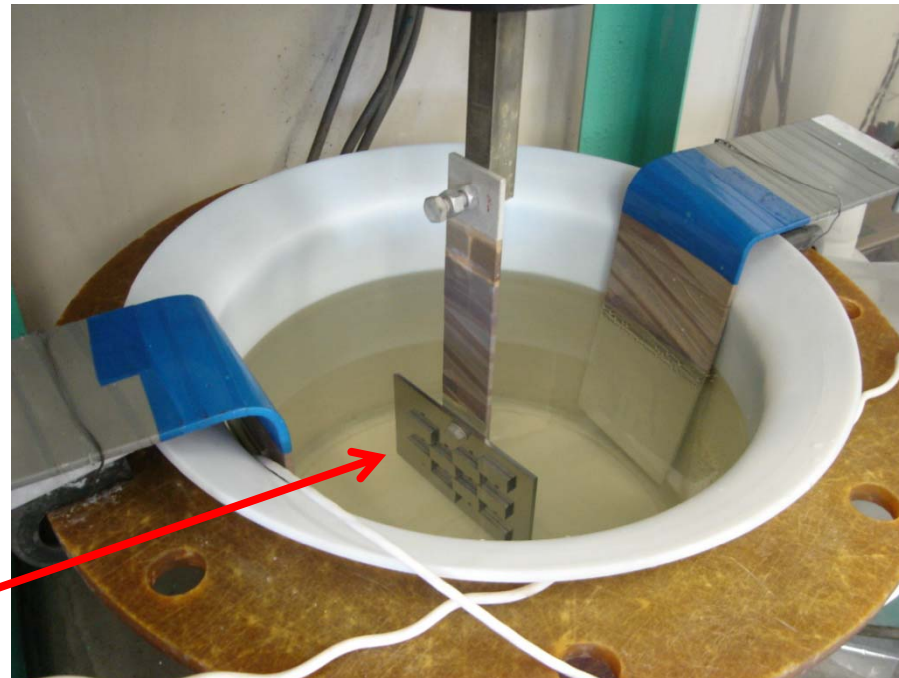
(But the draining process at Nomura is done within a few min.
Some difference between Nomura and STF/KEK.

Labo-EP of samples at Nomura

11 Aug. 2009



**9 square-type Nb samples
(10 μm BCP before labo-EP)**



**Labo-EP (20 μm) with new EP acid
at Nomura**

Exposing samples to the air after labo-EP

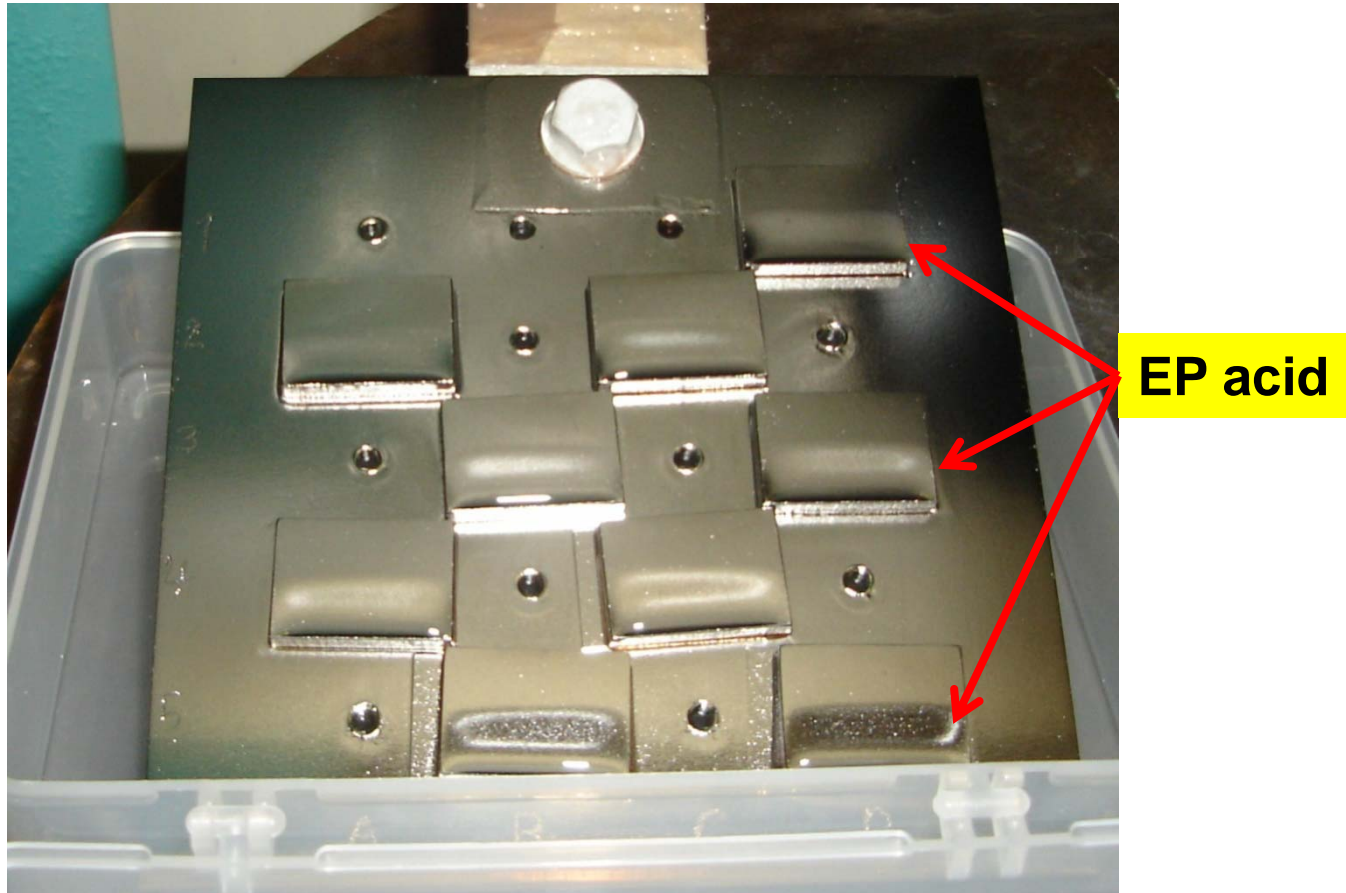


**Taking out samples after Labo-EP
(20 μm)**



**Exposing the samples to the air
w/o Pure-Water (P.W.) rinsing.
The setting angle of samples is
simulating the iris position of
cavity in vertical EP-acid
draining process.**

Exposing samples to the air after labo-EP



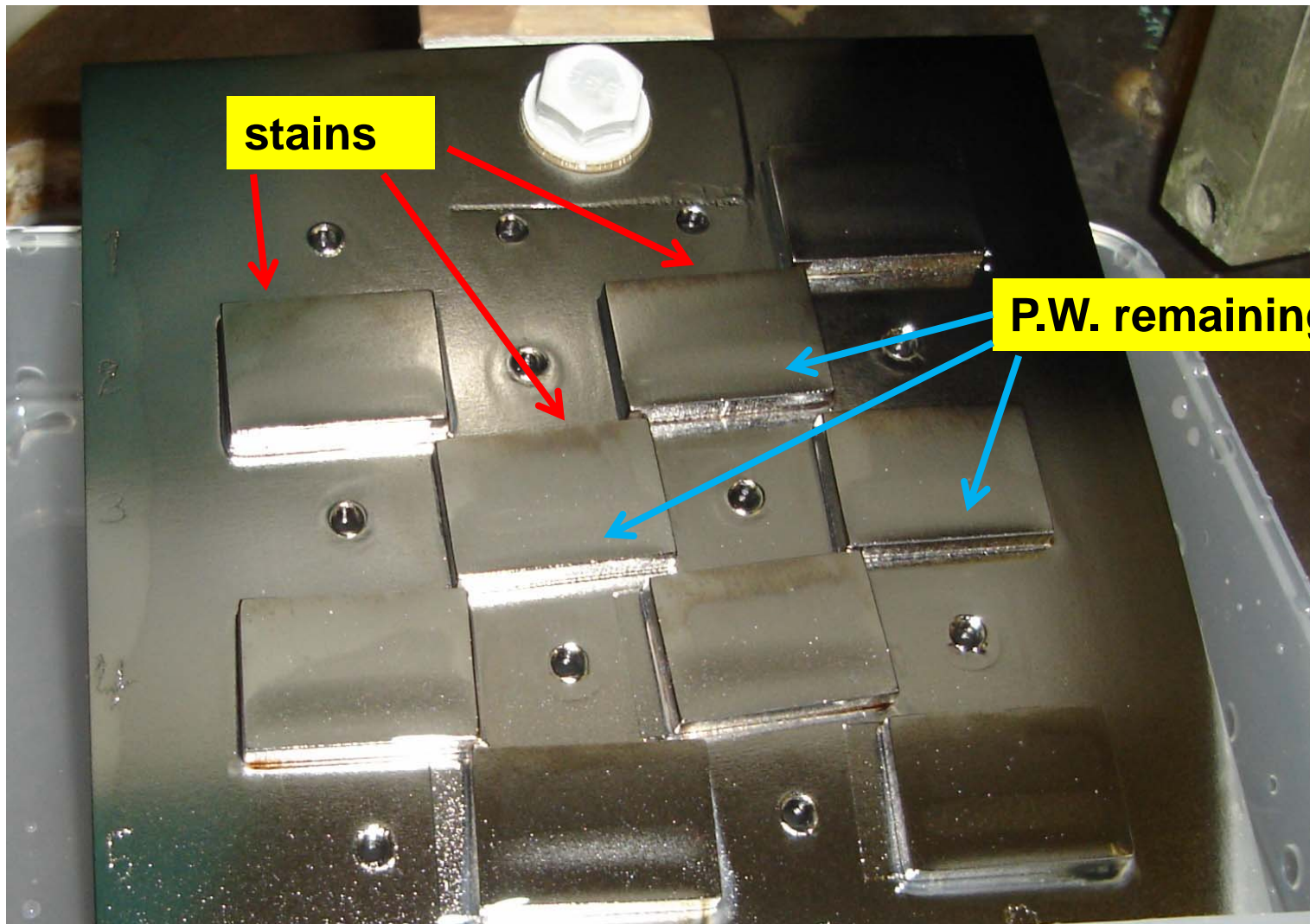
Exposing the samples to the air for **70 minutes**.
But we did not see any stain on the surface of
samples.

Rinsing samples with Pure-Water (P.W.)



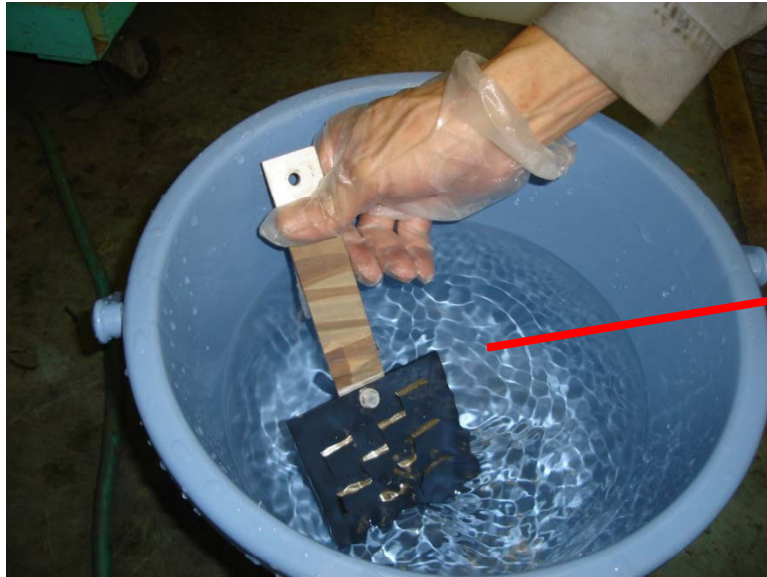
Rinsing samples with P.W. for a few 10's seconds.

Exposing samples to the air after P.W. rinse



Stains appeared within a minute after exposing the samples to the air. The stains appeared in the area where P.W. dried.

Repeating P.U. rinse + exposing to the air



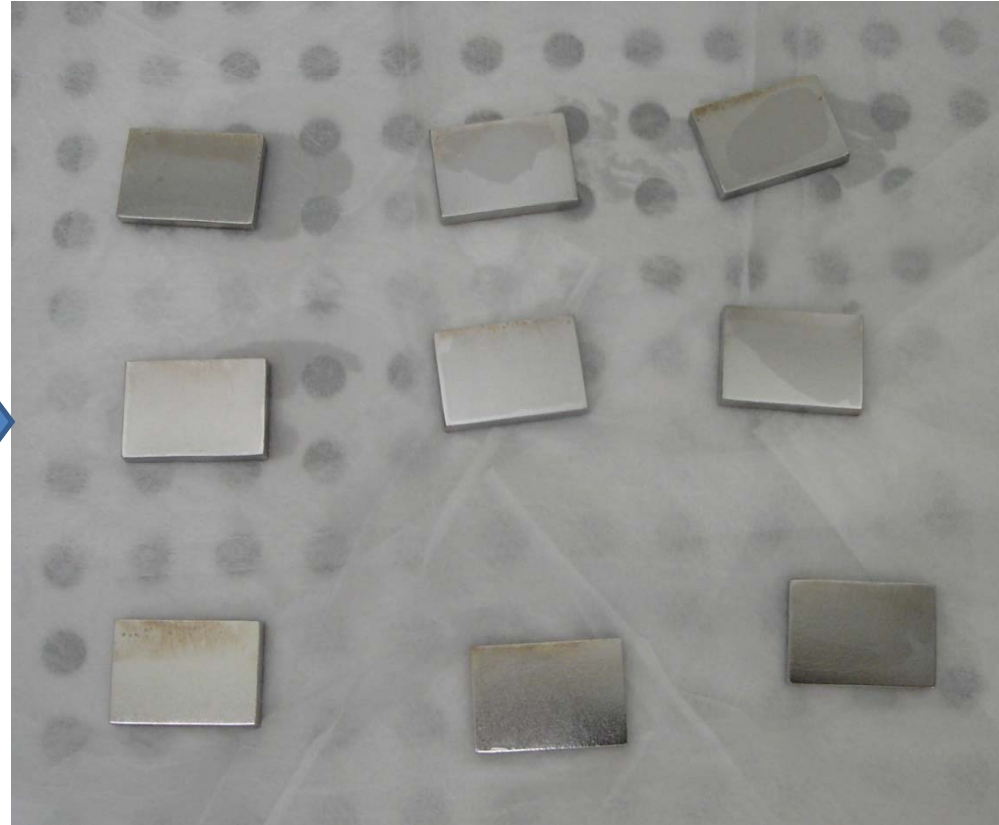
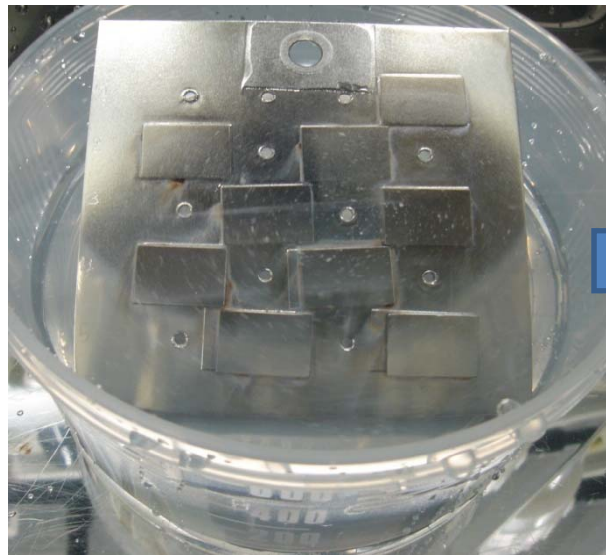
Repeating (P.W. rinsing + exposing to the air) 3 times. The stains did not change so much.

Packing and transportation of samples



Samples were packed in a container with P.W. and transported to KEK for ~ 2 hours.

Drying the samples in clean-room at STF/KEK



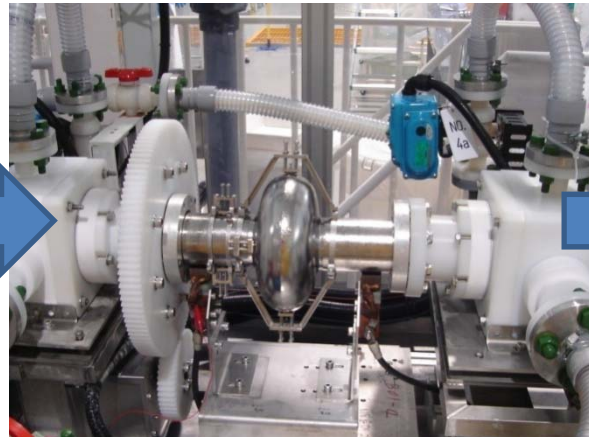
Samples were dried in the clean-room at STF/KEK. The samples are kept in the air in the clean-room now.

Considerations and plan

Draining procedure at STF/KEK can be changed.



Drain EP acid for 15 min.



Horizontal for 5 min.



Drain EP acid for 10 min.
Then UPW rinse starts.

U.P.W. rinse process:
[The U.P.W. rinse will continue **with overflow** for 1 hour] x 2 times.

Analysis of samples with stains.

- 1 sample with stains was sent to Saga University for analysis.
- 2 ~ 3 samples will be analyzed by XPS/SEM at KEK. But the tools are now in maintenance. The analysis will start in the beginning of September.
- It is a very interesting idea to analyze 2 ~ 3 samples by Auger and FSEM at JLab. In particular, the FSEM is the unique method to see if the stains are the source of field emission.