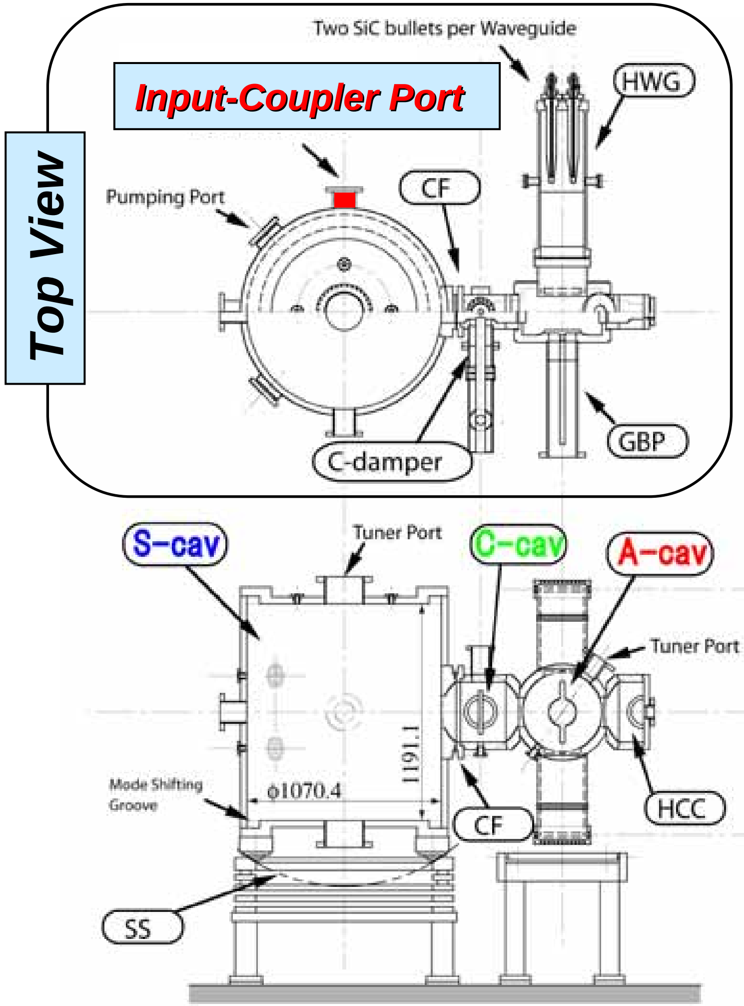
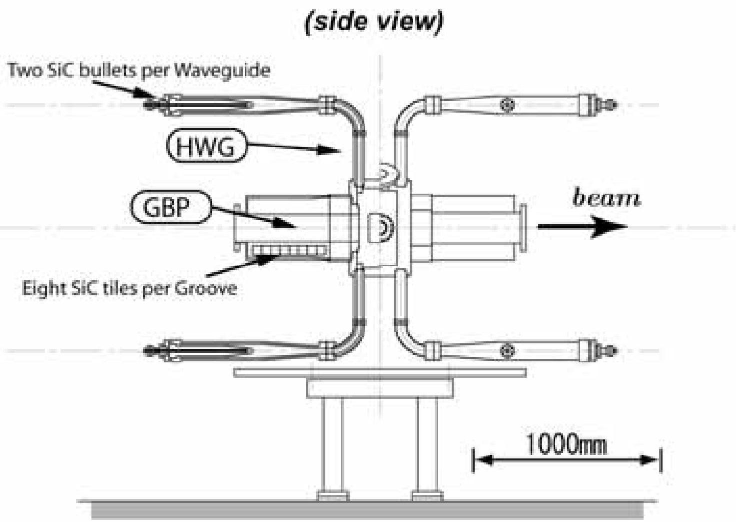
Accelerator Resonantly-coupled with Energy Storage

3-cavity system stabilized with the $\pi/2$-mode operation

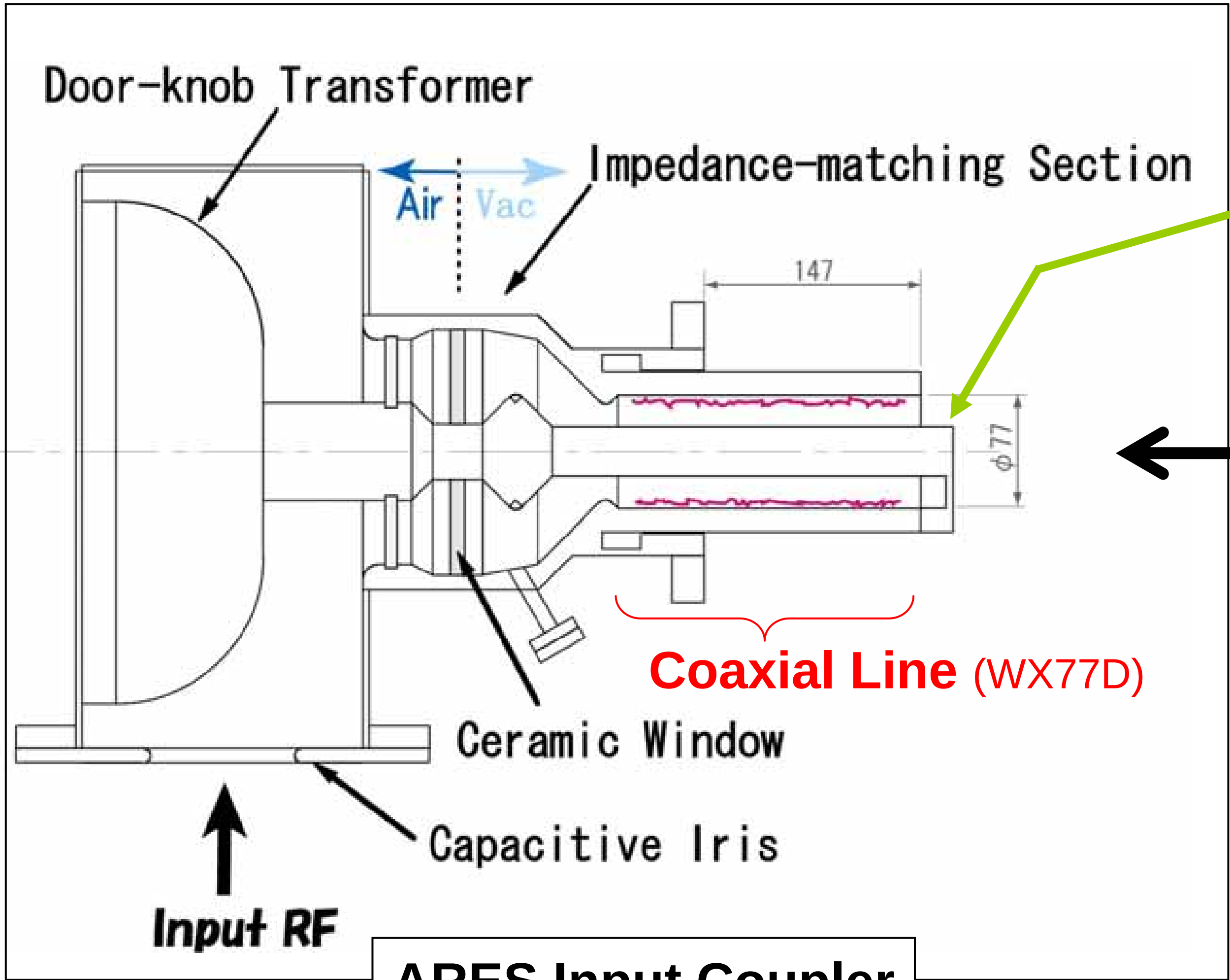


consists of

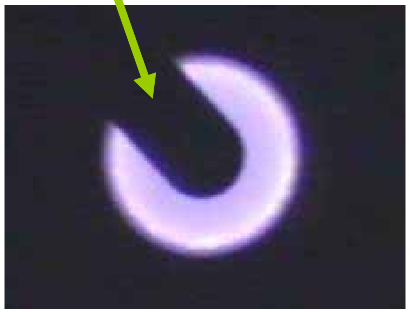
- HOM-damped accelerating cavity (**A-cav**)
- Energy-storage cavity with TE_{013} (**S-cav**)
- Coupling cavity (**C-cav**)
  with a parasitic-mode damper



The problem is the *multipactoring* in the **coaxial line**.

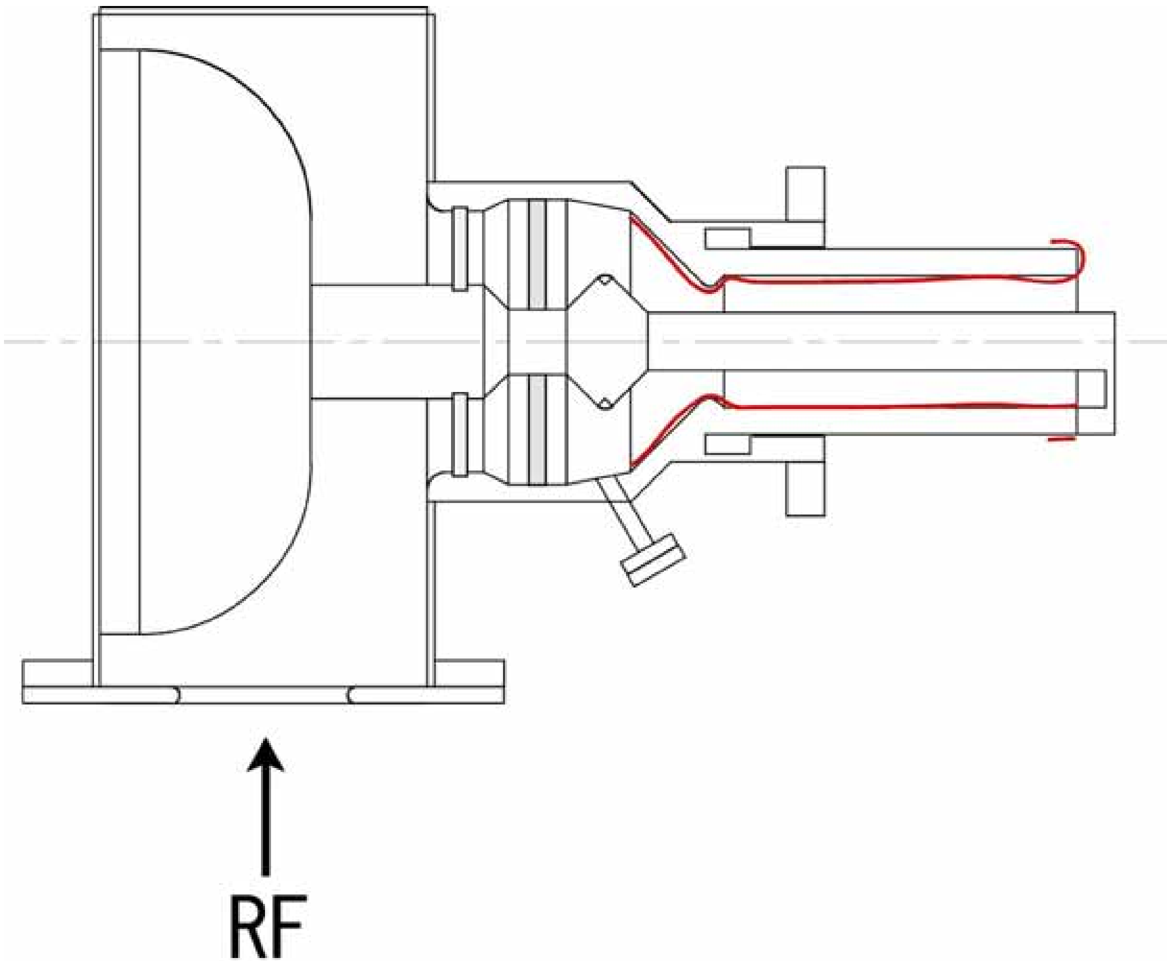


ARES Input Coupler



Example of
the TV-camera snapshots
of the multipactoring
in the coaxial line

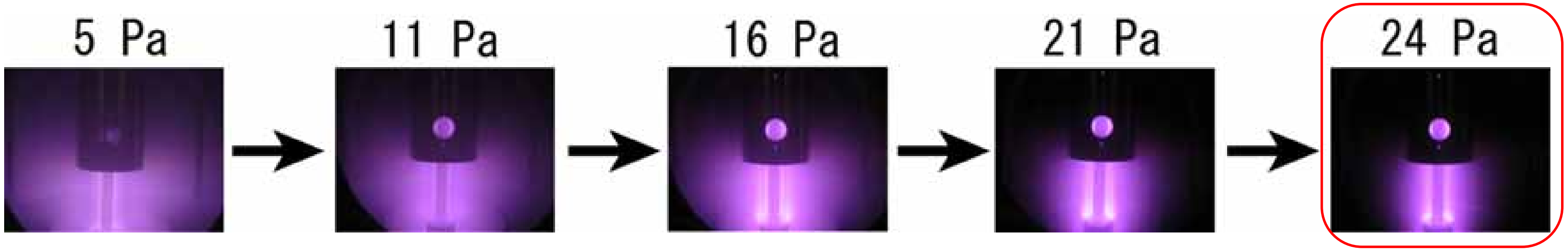
Coating Area



Study on the TiN coating

- Using a dummy conductor and test pieces ($r=15 \times t3$) of
  - ***Glass*** for thickness meas.
  - ***Copper*** for SEY meas.

- Increased the total gas pressure ($Ar+N_2$)



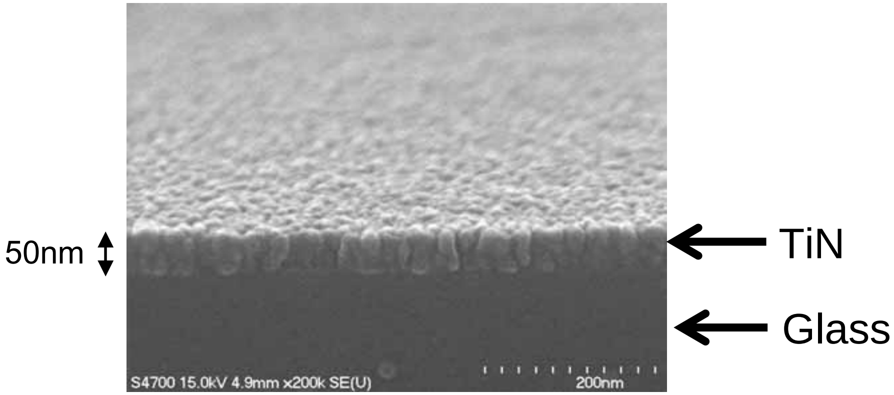
set

- One free parameter: *gas mixture ratio* to be adjusted to obtain
  - Appropriate thickness
  - Minimum secondary-electron yield (SEY)

Measurement of TiN Thickness

- Using glass test pieces polished with Ra~0.5nm

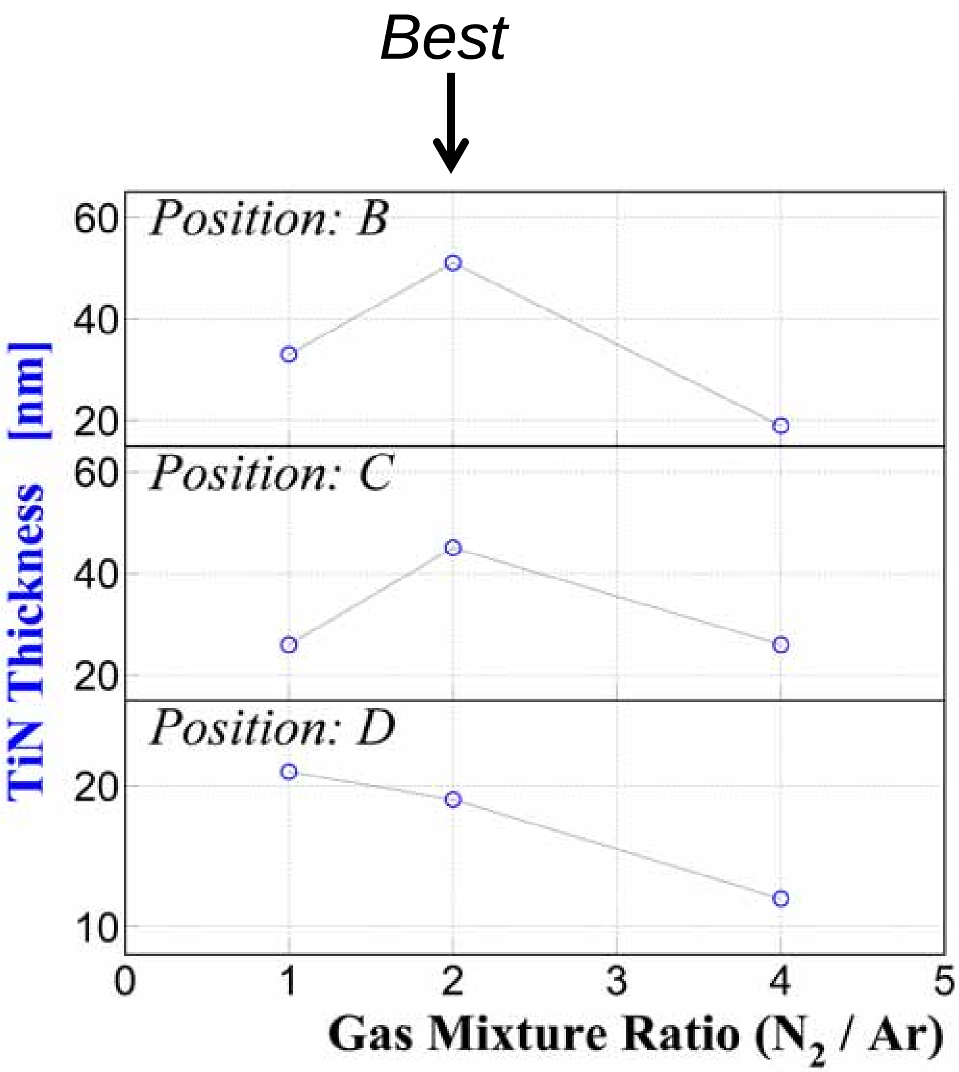
- Done by direct observation of cut samples using SEM(x200000)

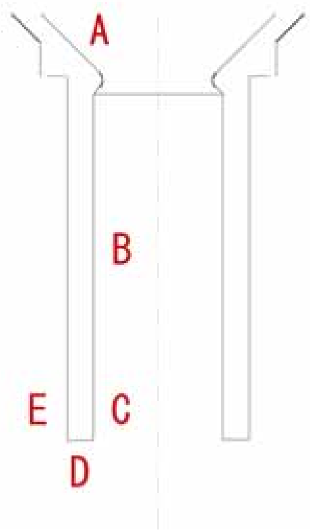


- 12 measurements at different positions were averaged.

- Minimum requirement: 20nm
  - No difference on SEY between 10nm and 20nm
  - No increase of SEY of 20nm-coating after brazing (820degC for 5min)

Results of the TiN-thickness Measurement (1)

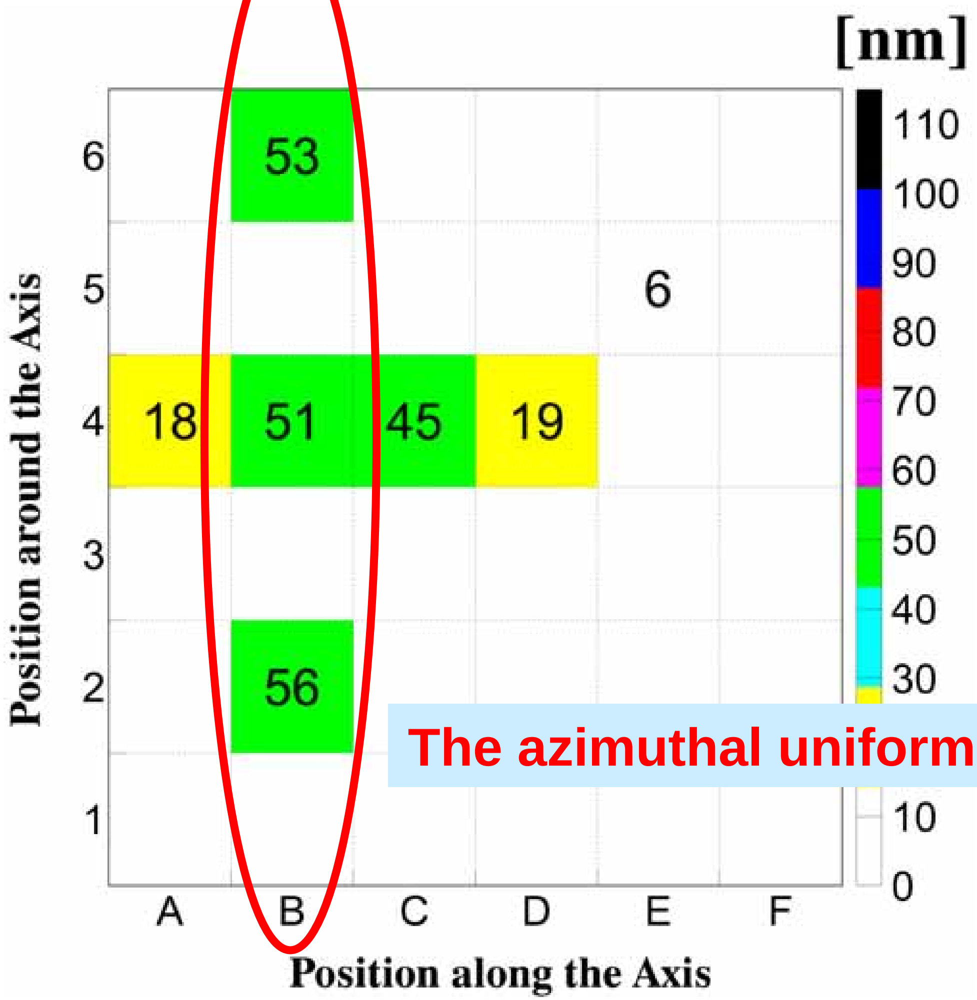




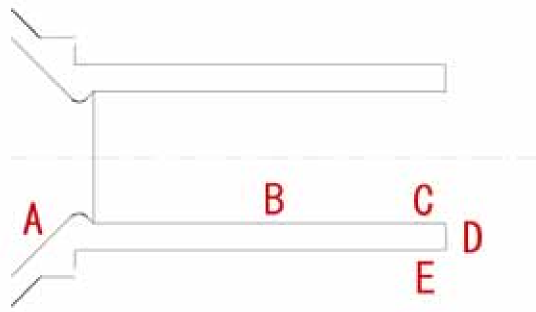
- Total 24 Pa fixed
- 40mA kept for 6hrs

Results of the TiN-thickness Measurement (2)

(Ar:N_2=1:2)



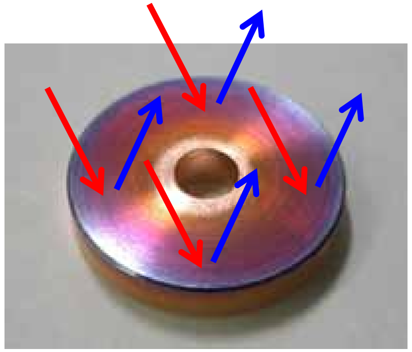
The azimuthal uniformity is O.K.!



Measurement of Secondary Electron Yield (SEY)

- Using SEM modified for SEY measurements
  (with the help of S. Michizono)

TiN coating



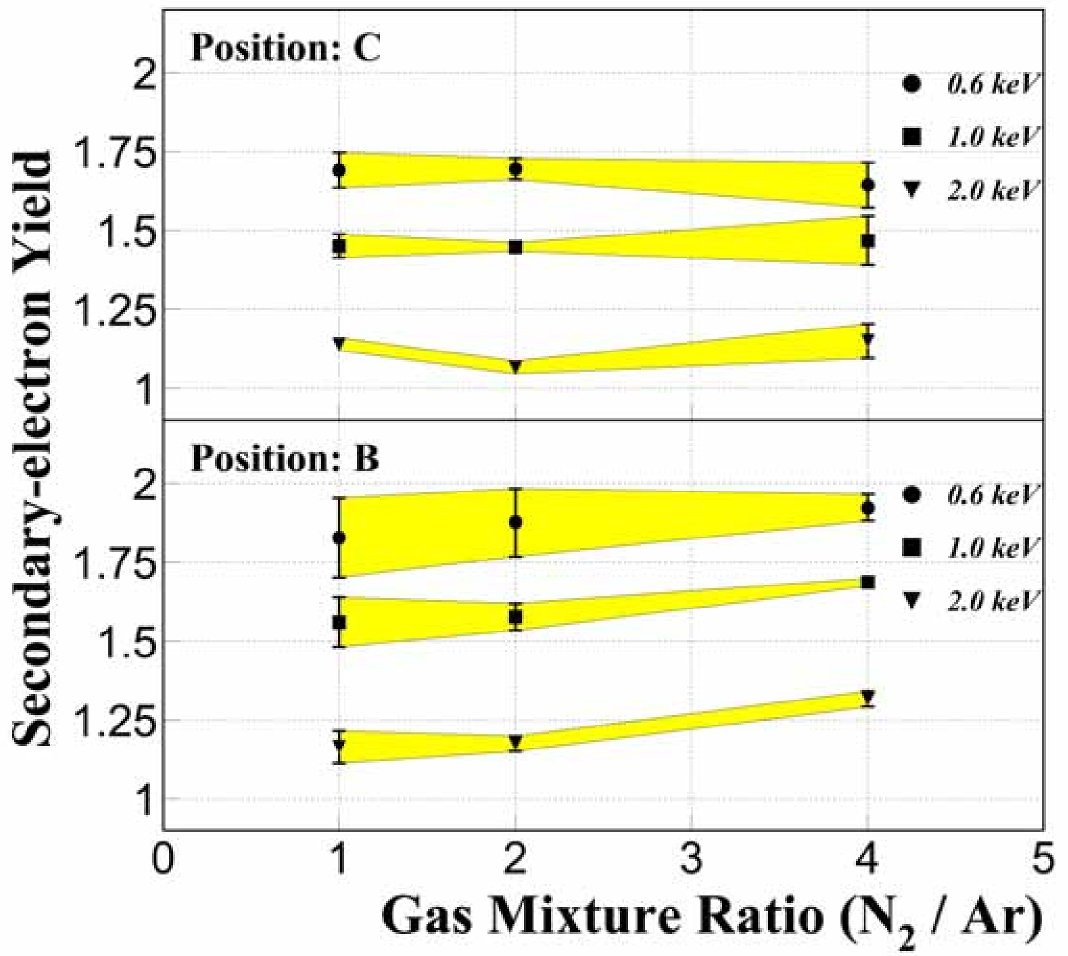
- Primary and secondary currents were measured with Faraday cups.

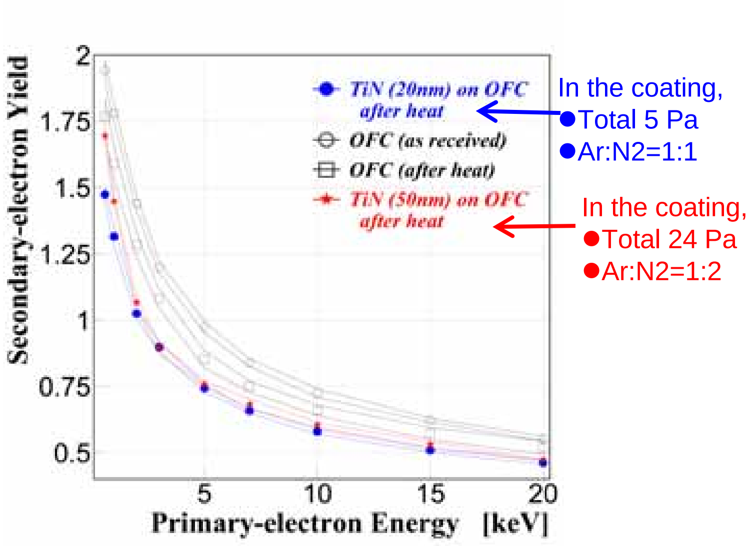
- SEY definition: $\delta \overset{def}{=} \dfrac{\text{Secondary Current (including elastically-scattered electrons)}}{\text{Primary Current}}$

- Measurements at 4 different positions were averaged.

- ~2E-4 Pa during the measurements

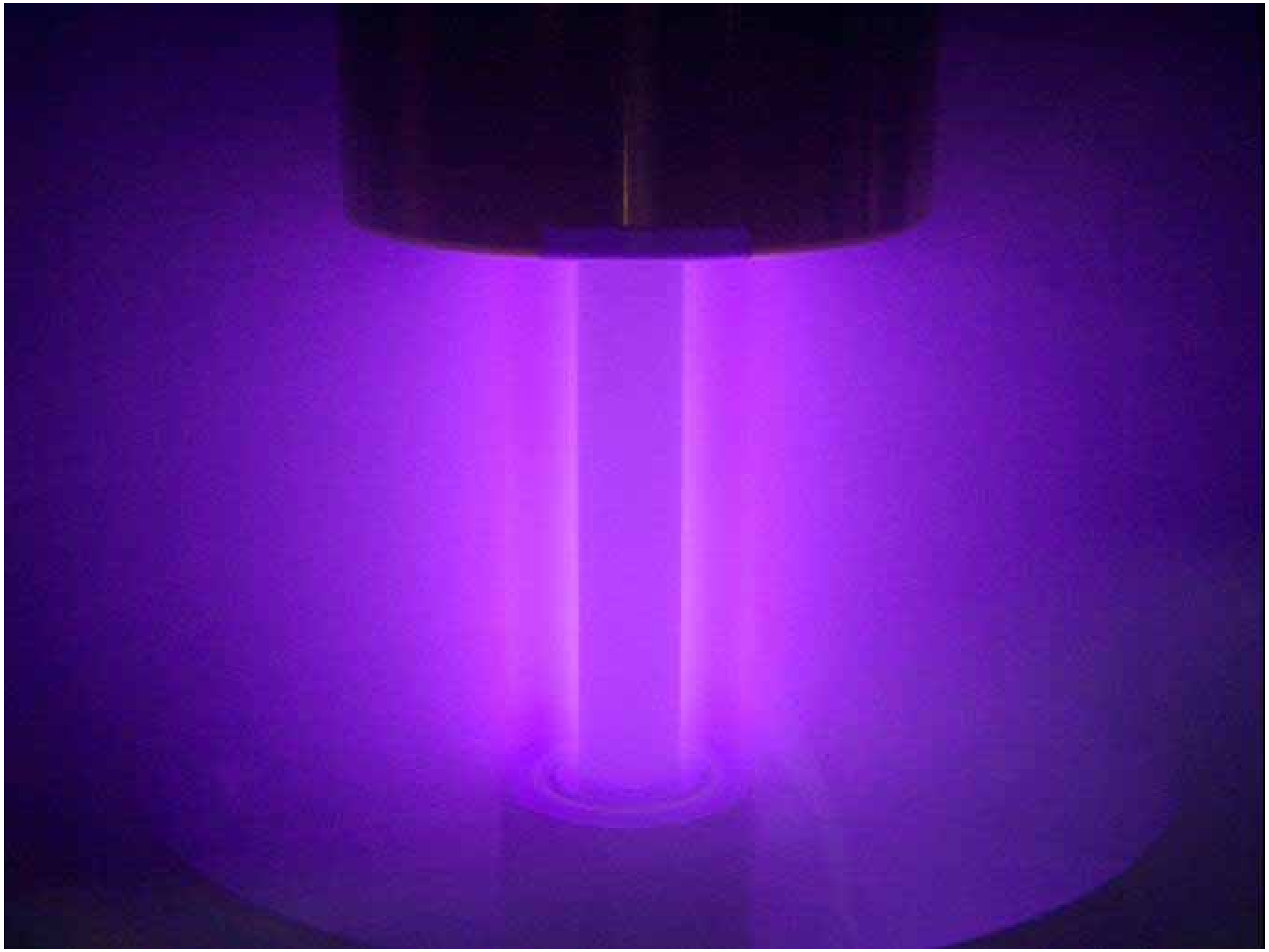
Results of the SEY Measurements





→ **No significant dependence on the gas mixture ratio!**

The TiN coating on the real coupler was done in the final condition.



After TiN Coating

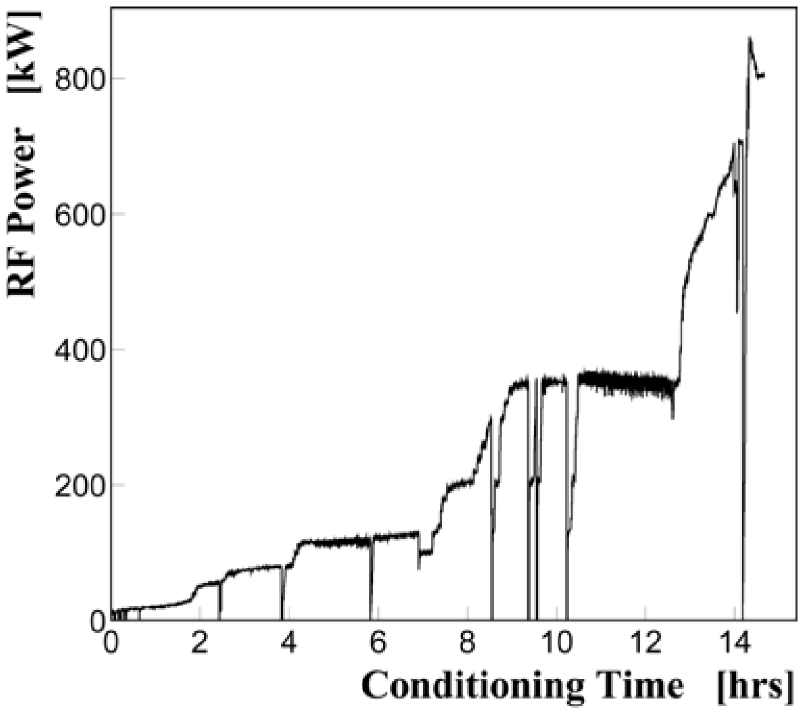
Before coating

Passed leak tests.

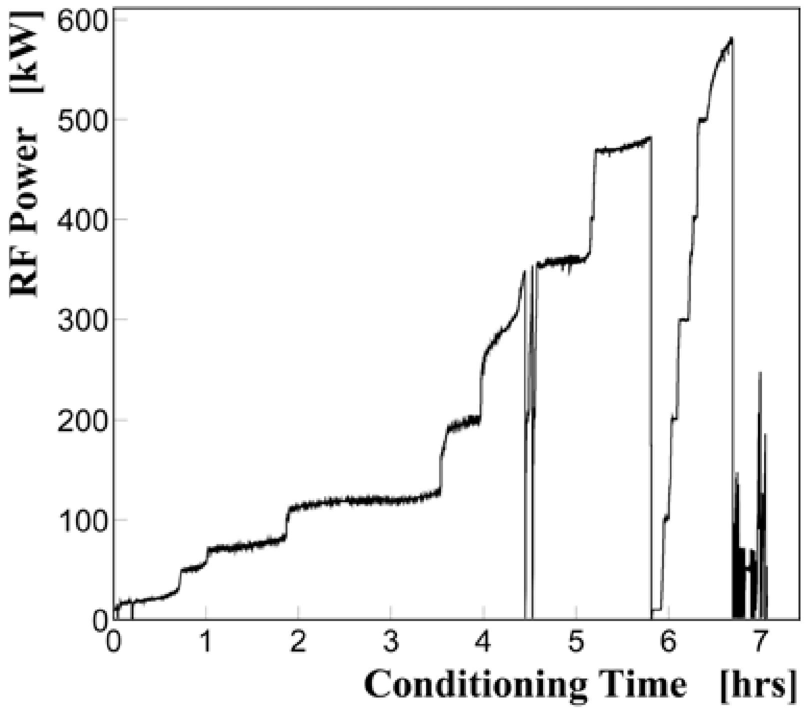
For high power tests…

High-Power Tests in the upgraded coupler test stand

1st-tested TiN-coated coupler



2nd-tested TiN-coated coupler



→ No improvement so far compared to non-TiN-coated couplers

Summary and Conclusions

- TiN coating was applied to the inner surface of the outer conductor.
- Studies were performed in various coating conditions.
- The TiN-coated couplers were tested in the upgraded coupler test stand.
- No significant improvements were seen so far in the conditioning time.
- Further tests are to be done, and alternatives to be considered,
  e.g. to modify the shape to avoid multipactoring.