

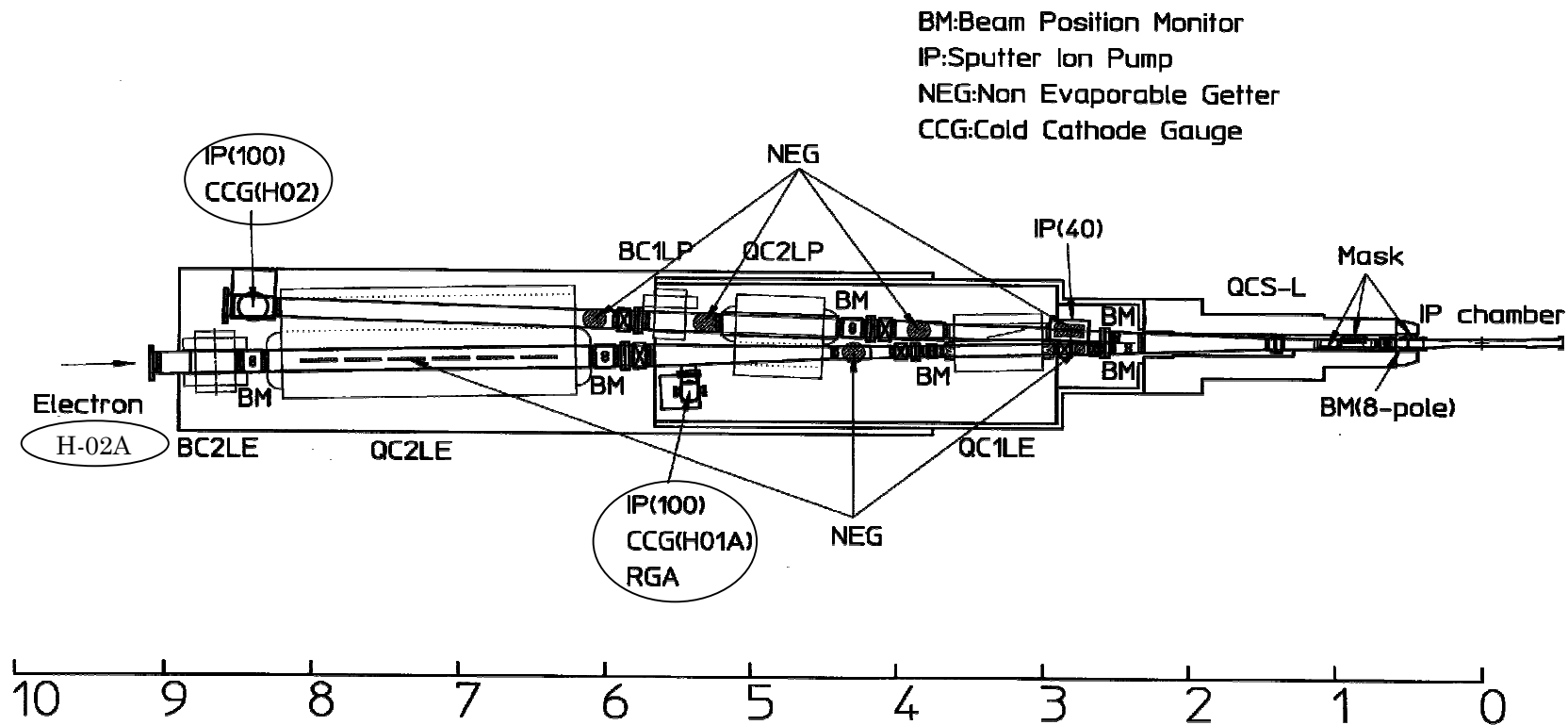
IR Vacuum

From the first anomaly to the final
large helium leak

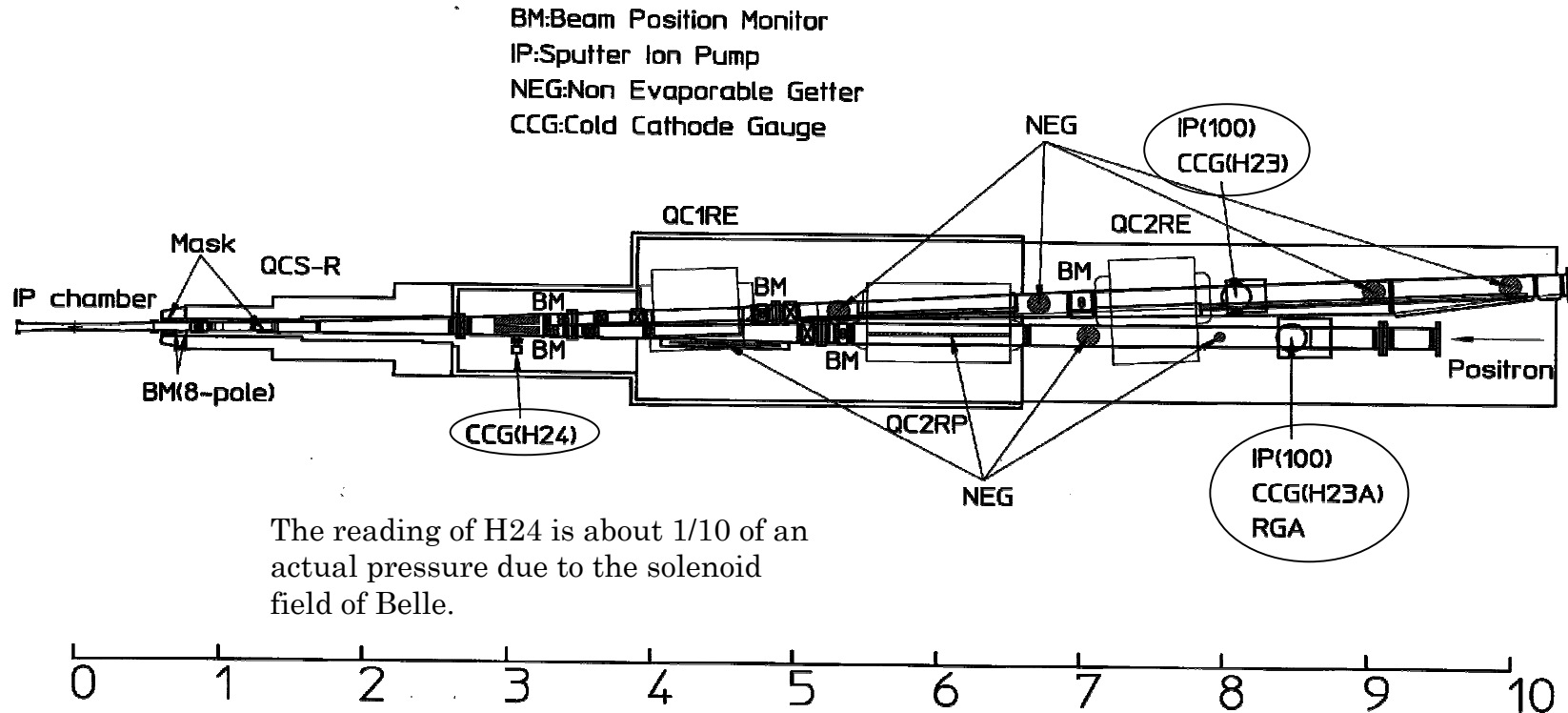
KEKB Accelerator Review
10-11 February 2003

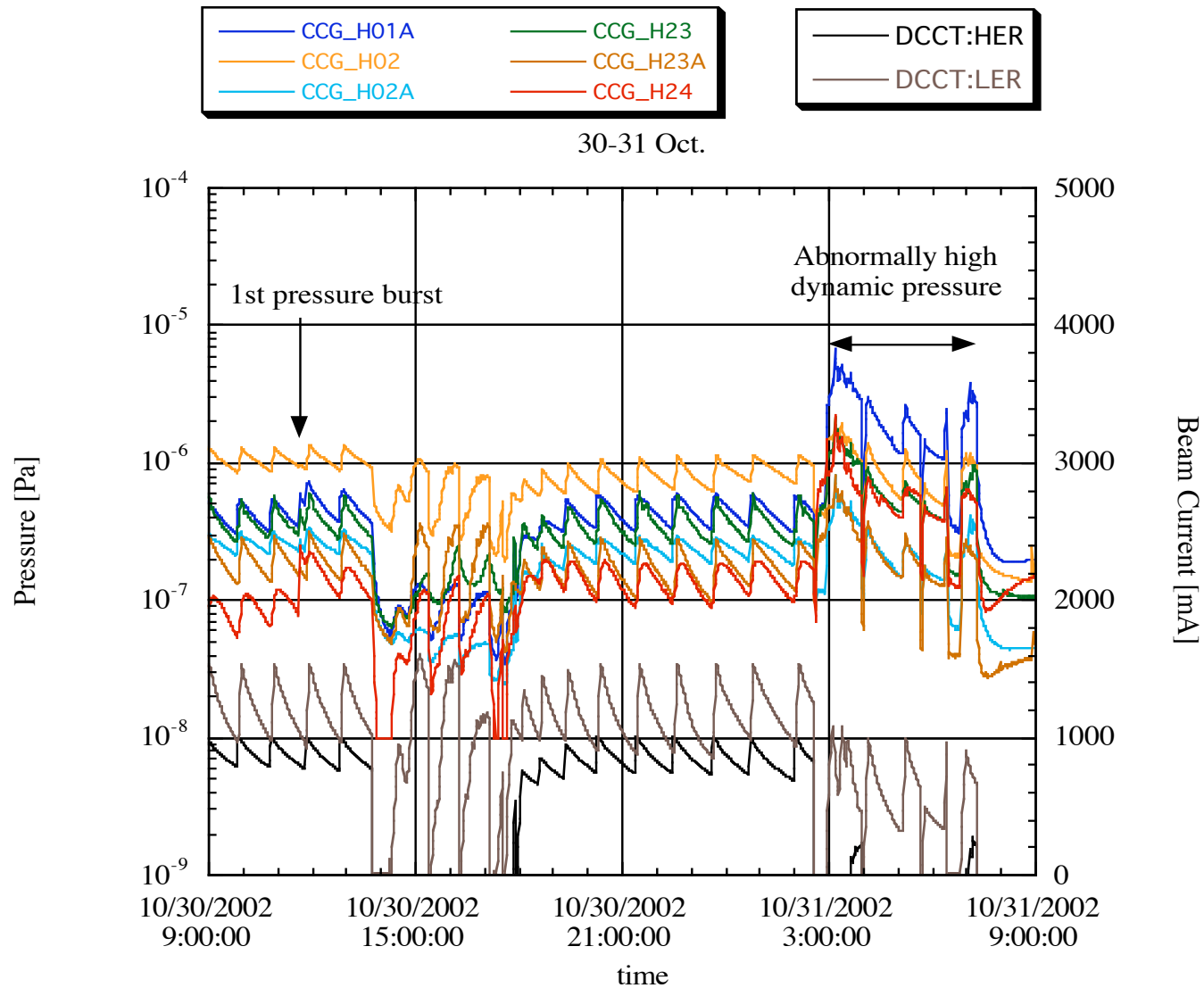
K. Kanazawa

Location of vacuum gauges (L-side)



Location of vacuum gauges (R-side)



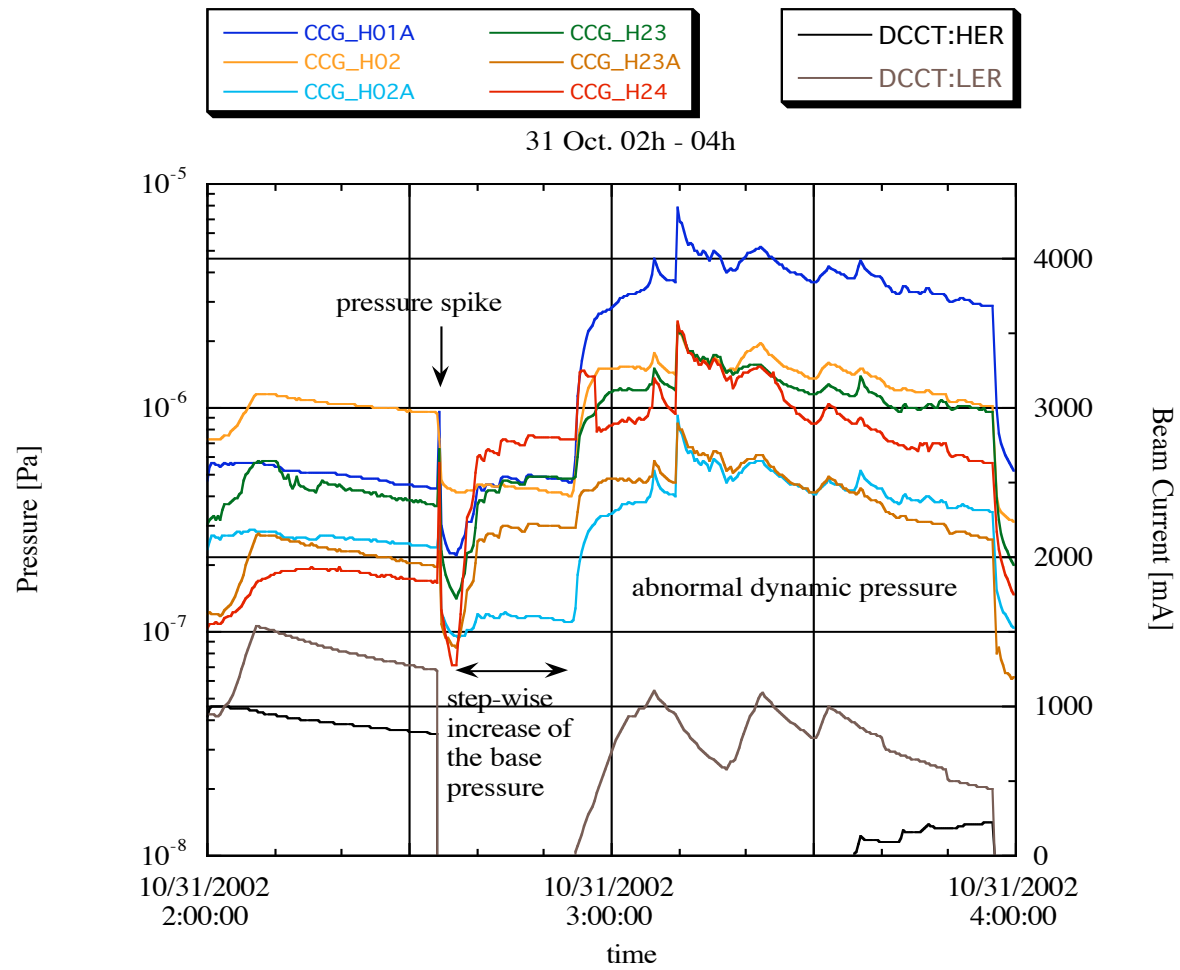


In the early morning of 31 Oct., an abnormal pressure was noticed at IP.

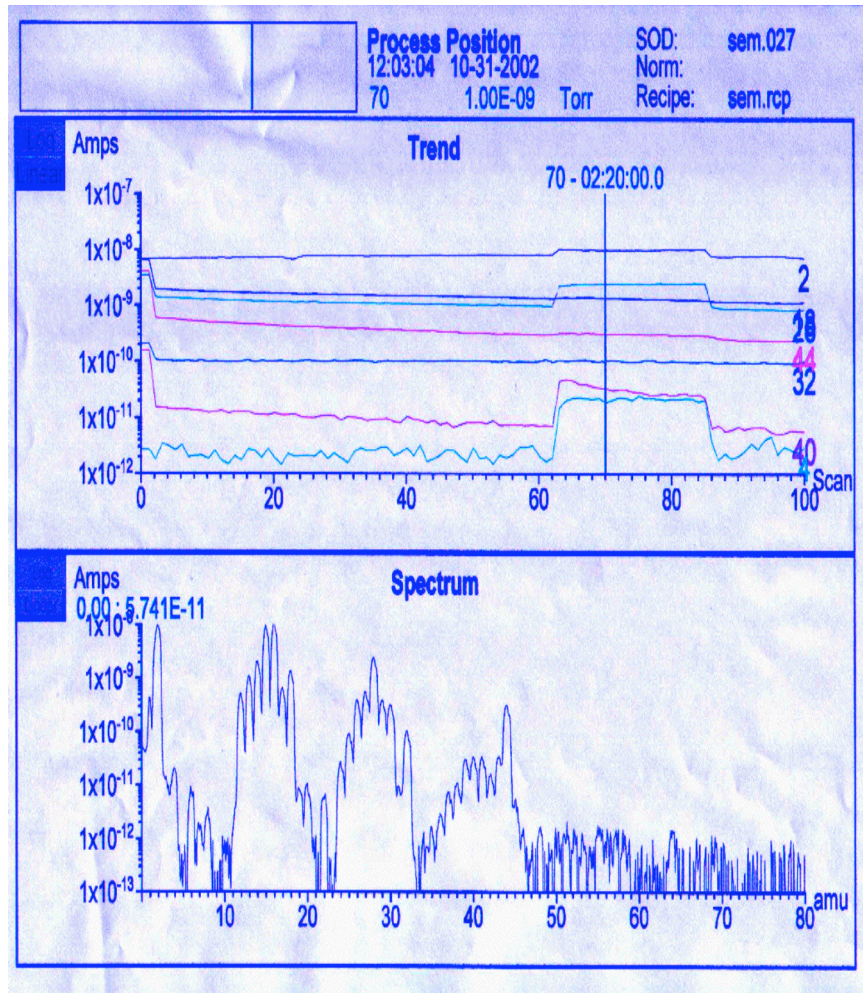
On the record it was found that the anomaly of pressure began the day before.

From 9:30 of 31 Oct., we started the leak test for the IR.

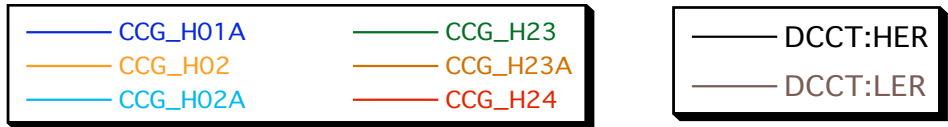
Detail of 31 Oct. 2h-4h.



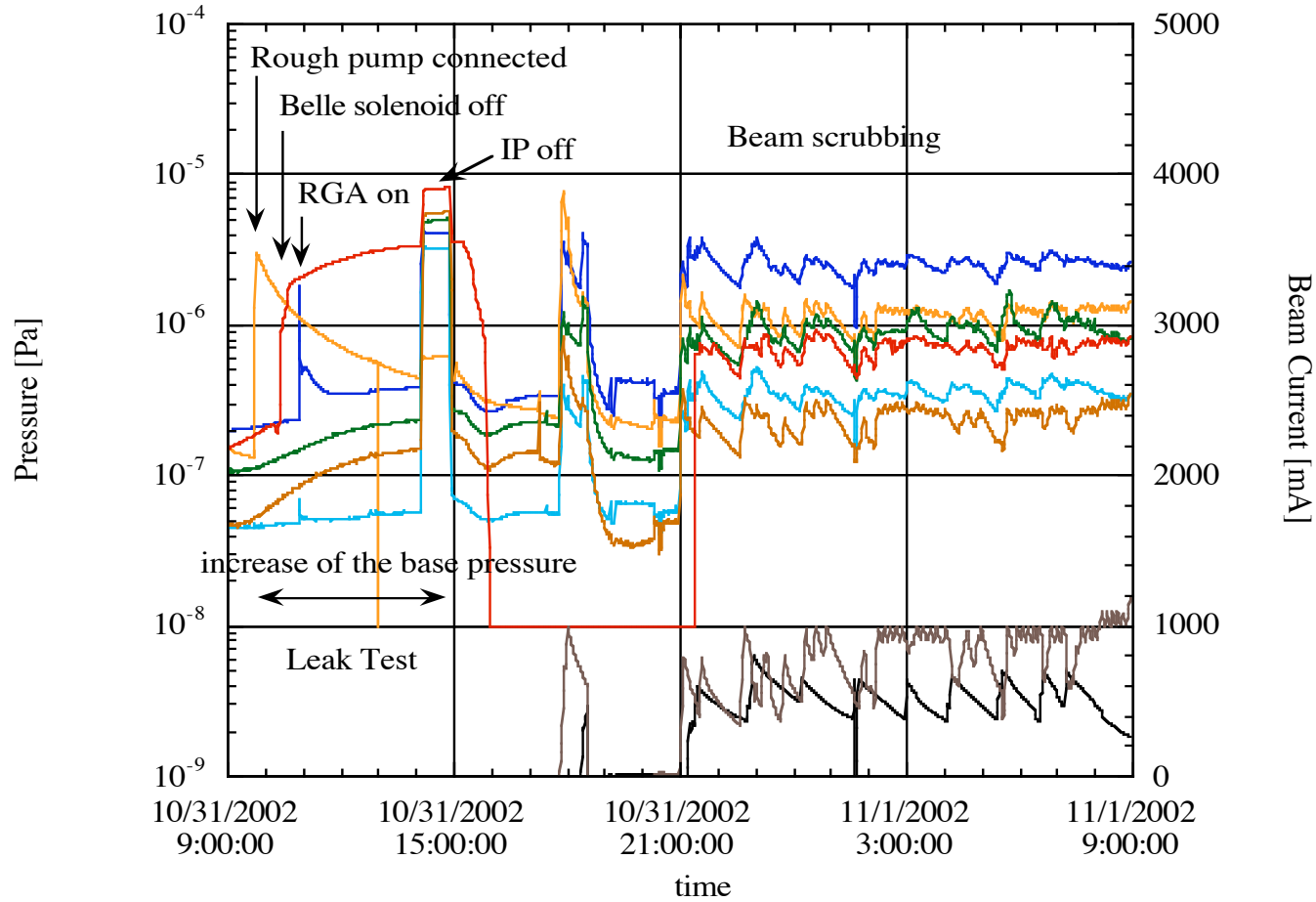
Leak Test on 31 Oct.



- The outgassing around IP was one order higher than usual. But...
- No leakage was detected by splaying helium from outside.
- A small helium peak (1/1000 of the hydrogen peak) was observed by RGA (left picture). The identification of the source of this helium peak was not done because it cannot explain a large pressure rise.
- The amount of hydrogen was gradually increasing during the leak test, which seemed to correspond to the gradual increase of the base pressure.
- **Conclusion**
 - No detectable leak.
 - The phenomena looks as if a fresh surface appeared near IP.

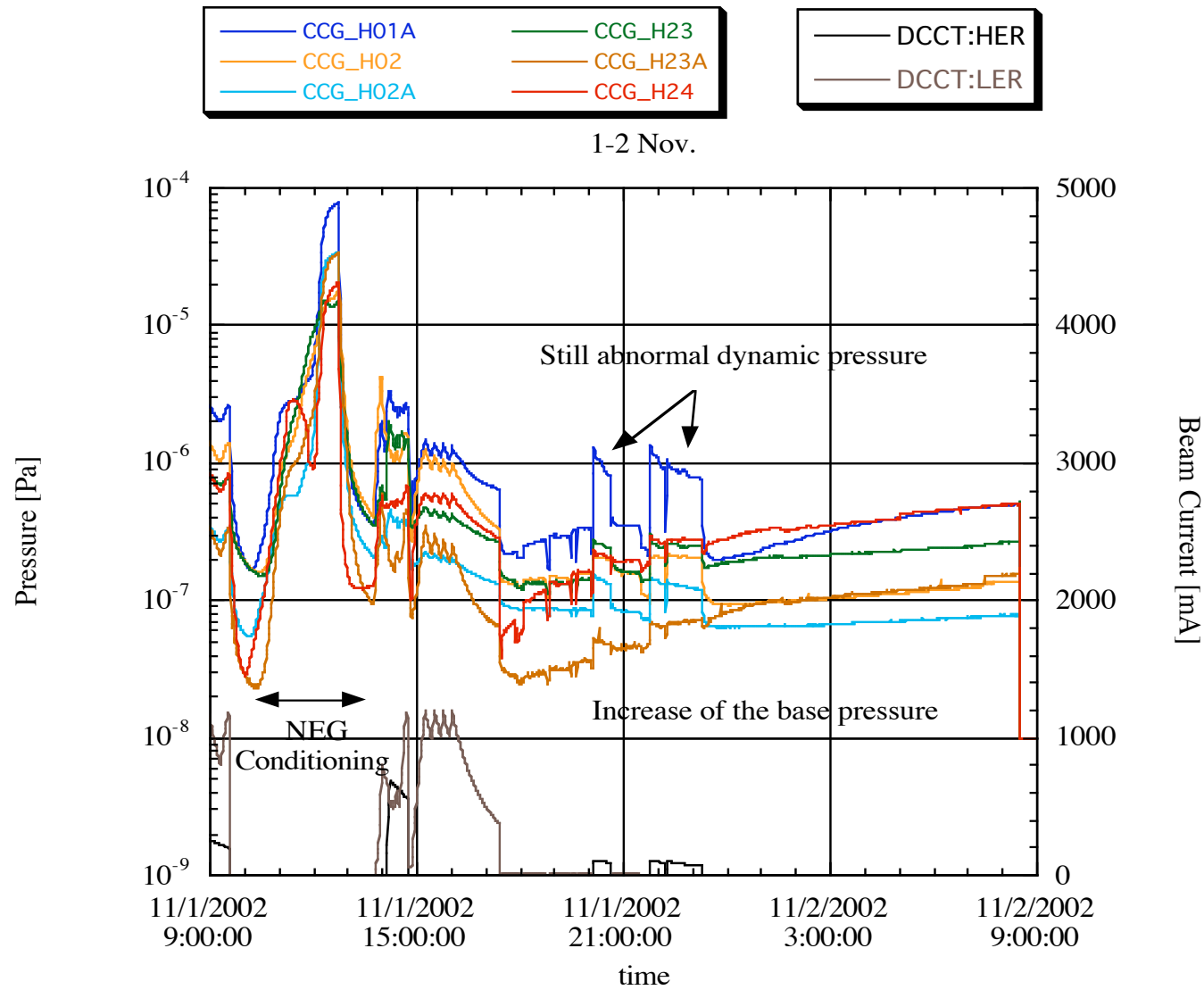


31 Oct. - 1 Nov.



Since no leakage was found, beam scrubbing was tried.

But there was no improvement.



Even after NEG conditioning, pressures did not recover.

It was decided to inspect the inside of IP vacuum chambers on 2 Nov.

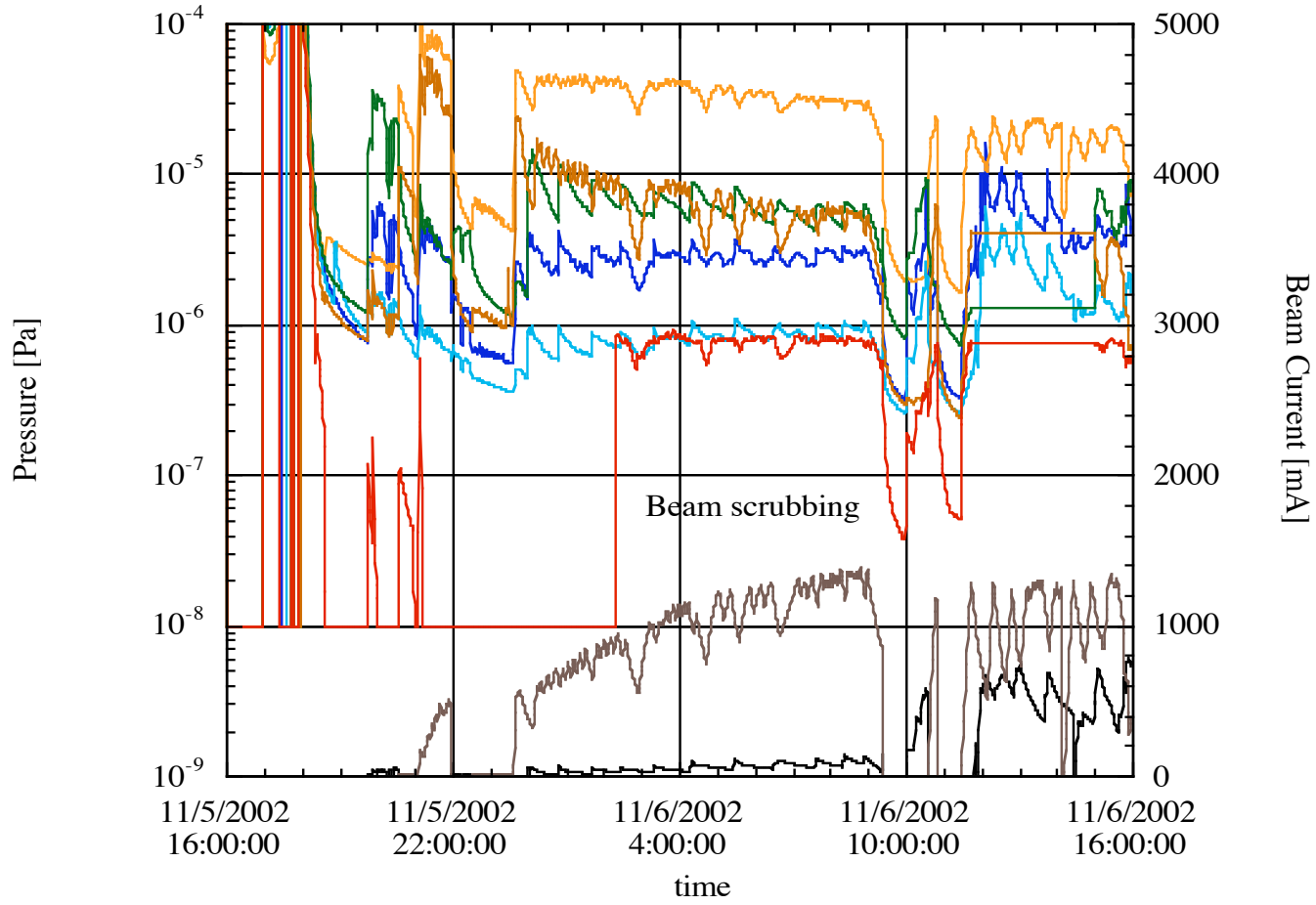
Inspection by CCD scope



- Dark spots on Au plating of IP chamber were found.
- But no other serious defects of the inner surface of vacuum chambers were not found.
- Without finding any measures, we started pumping down of the IR in the afternoon of 4 Nov. and continued beam scrubbing till the morning of 7 Nov.

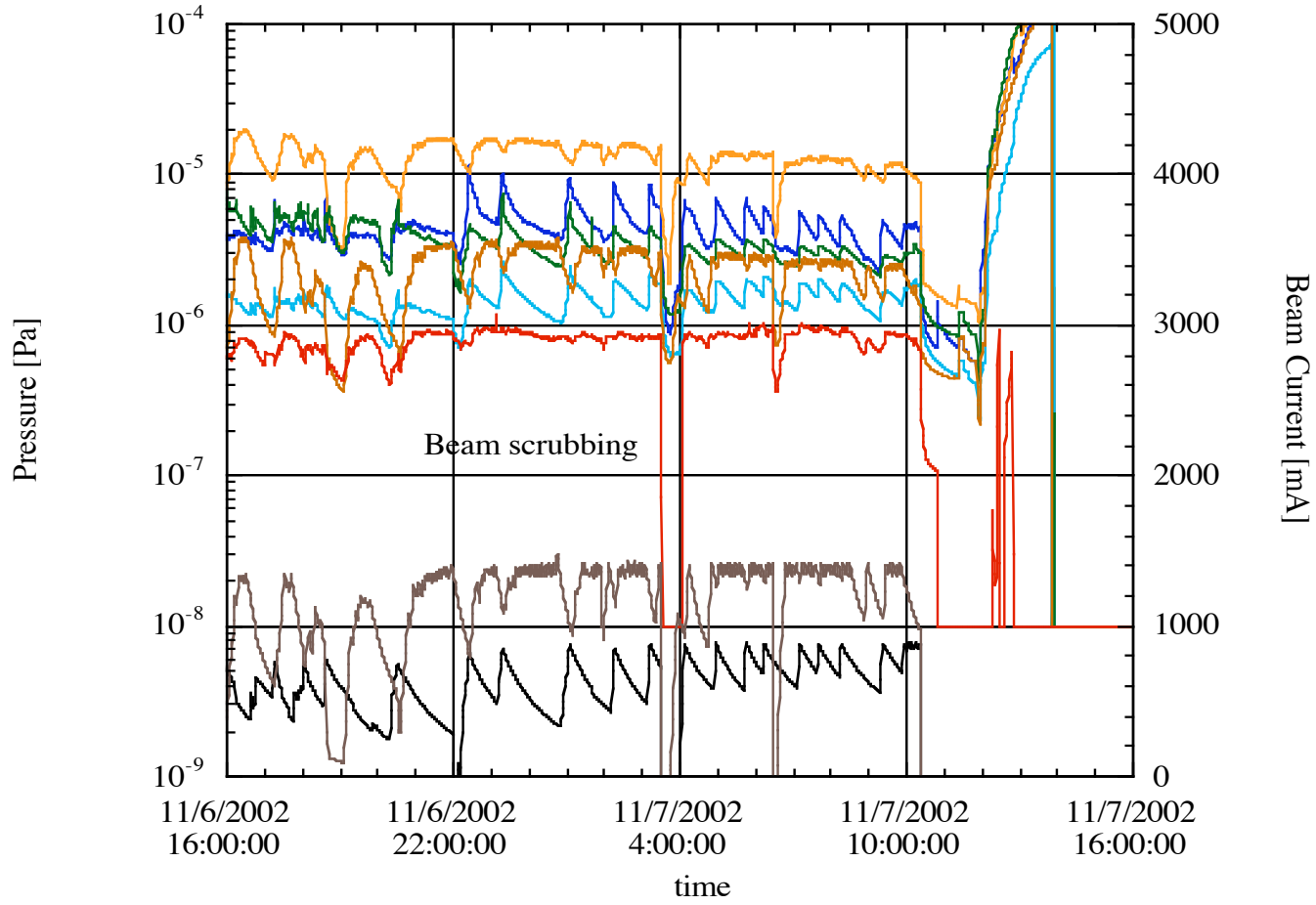


5-6 Nov.

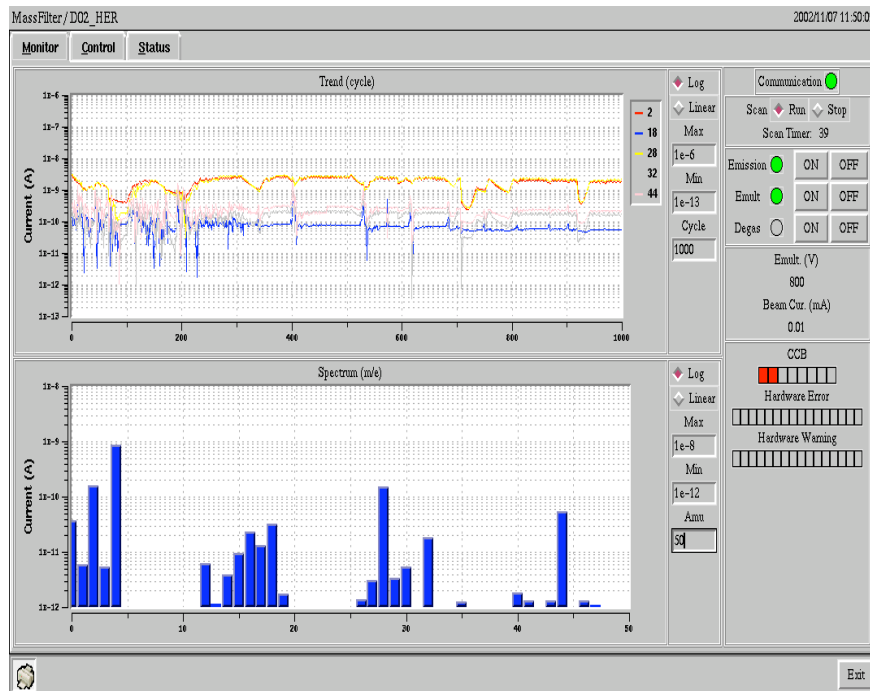




6-7 Nov.

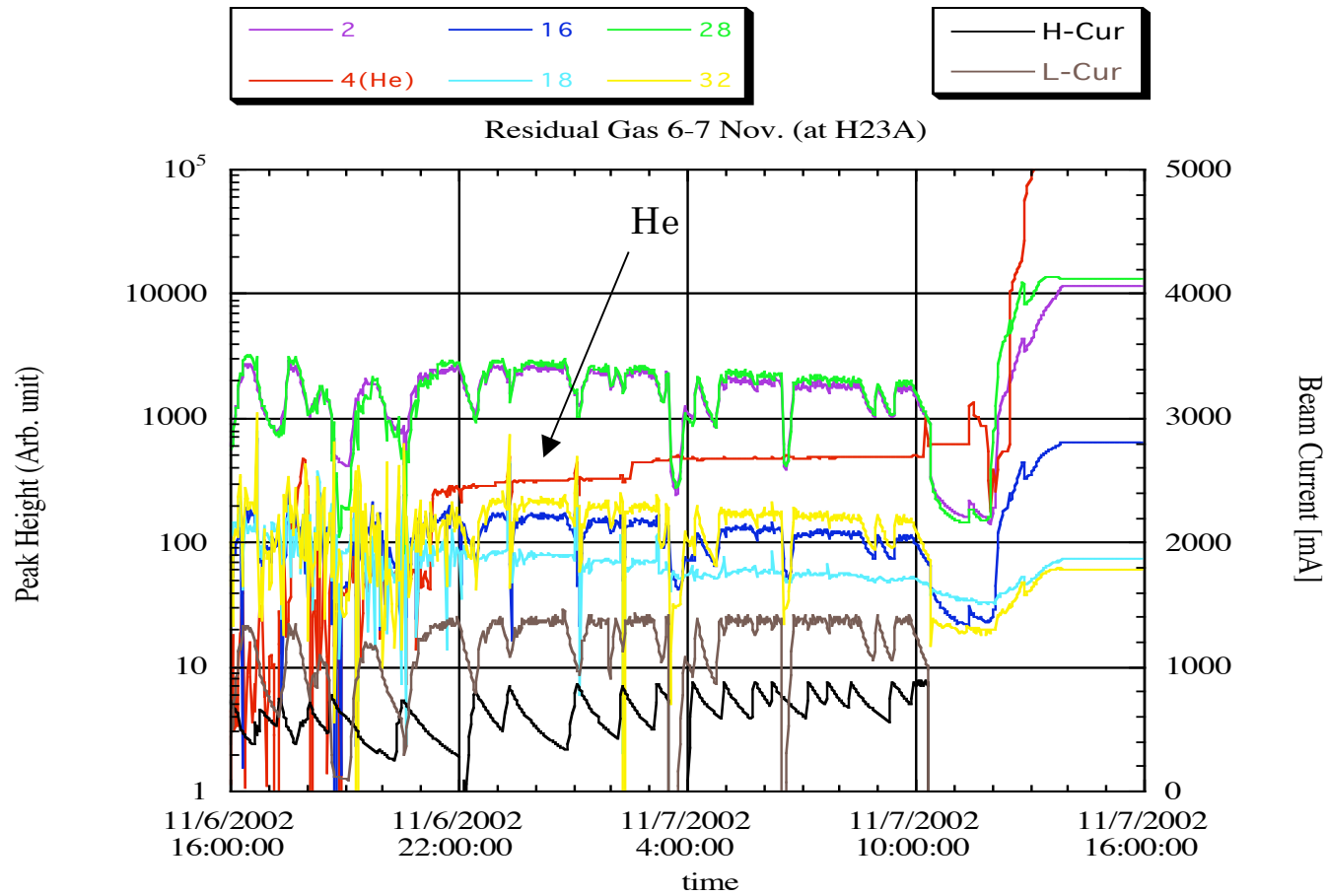


Final large Helium leak



- In the morning of 7 Nov., a large amount of helium was seen on the display of RGA.
- By changing a helium supply for the IP chamber to argon and then to nitrogen, it was confirmed that the leakage is from the IP chamber.

Trend of the residual gas from 6 Nov. to 7 Nov.



Final Remark

- Now it is confirmed that the leakage is from the beryllium part of the IP chamber.
- The first symptom of the leakage was an abnormal outgassing around IP. The main component of the outgassing was hydrogen gas according to the experience during the leak test on 31 Oct. The outgassing rate was roughly 10^{-6} Torr l sec⁻¹.
- Though helium was observed in the residual gas, the partial pressure was negligibly small.
- Obviously the heat cycle due to the beam contributed to develop the leak.
- The final leak rate of helium was 2×10^{-4} Torr l sec⁻¹

END