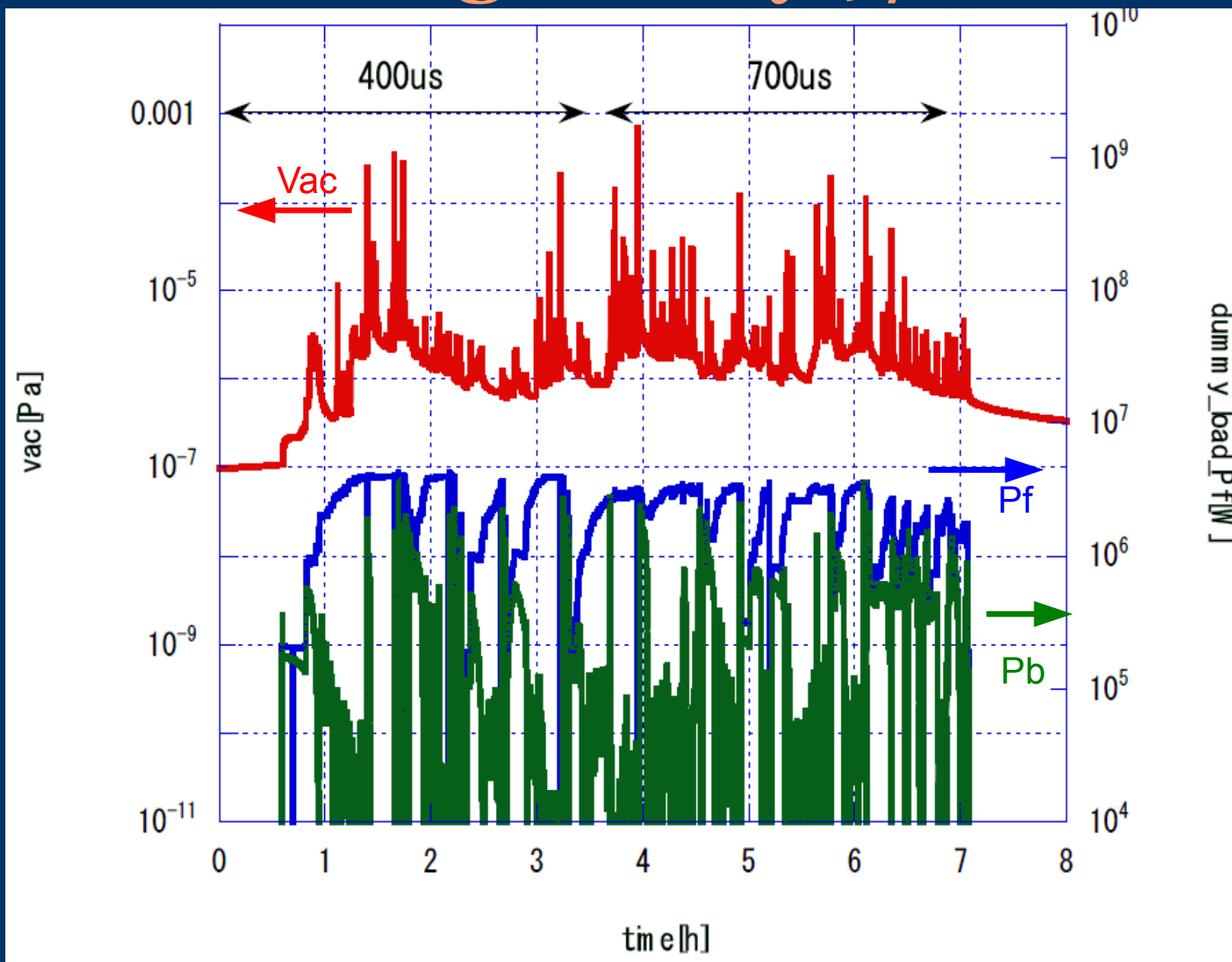


Status of L-band RF Gun(FNAL-Cavity) processing

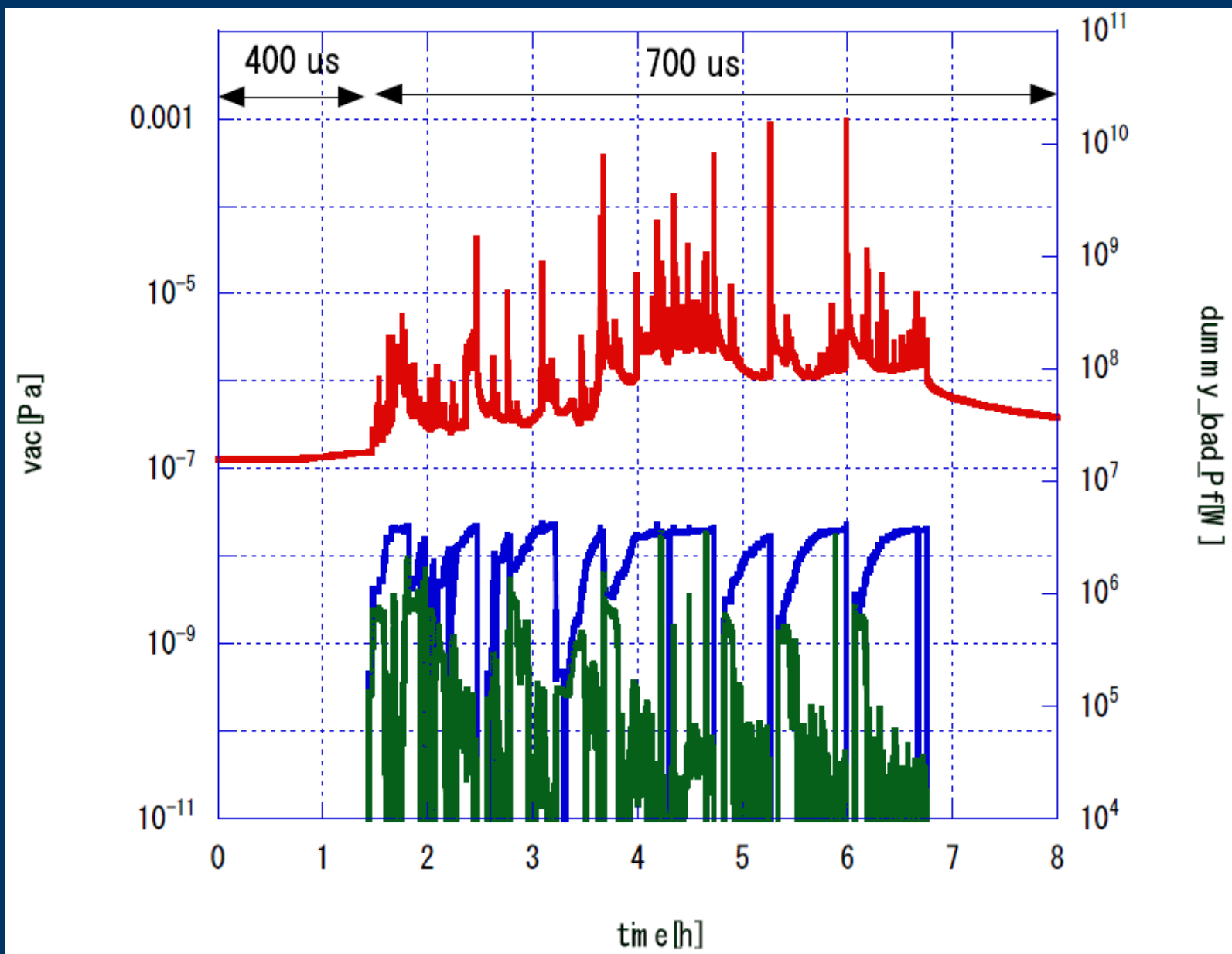
栗木雅夫、増元勇騎、倉本



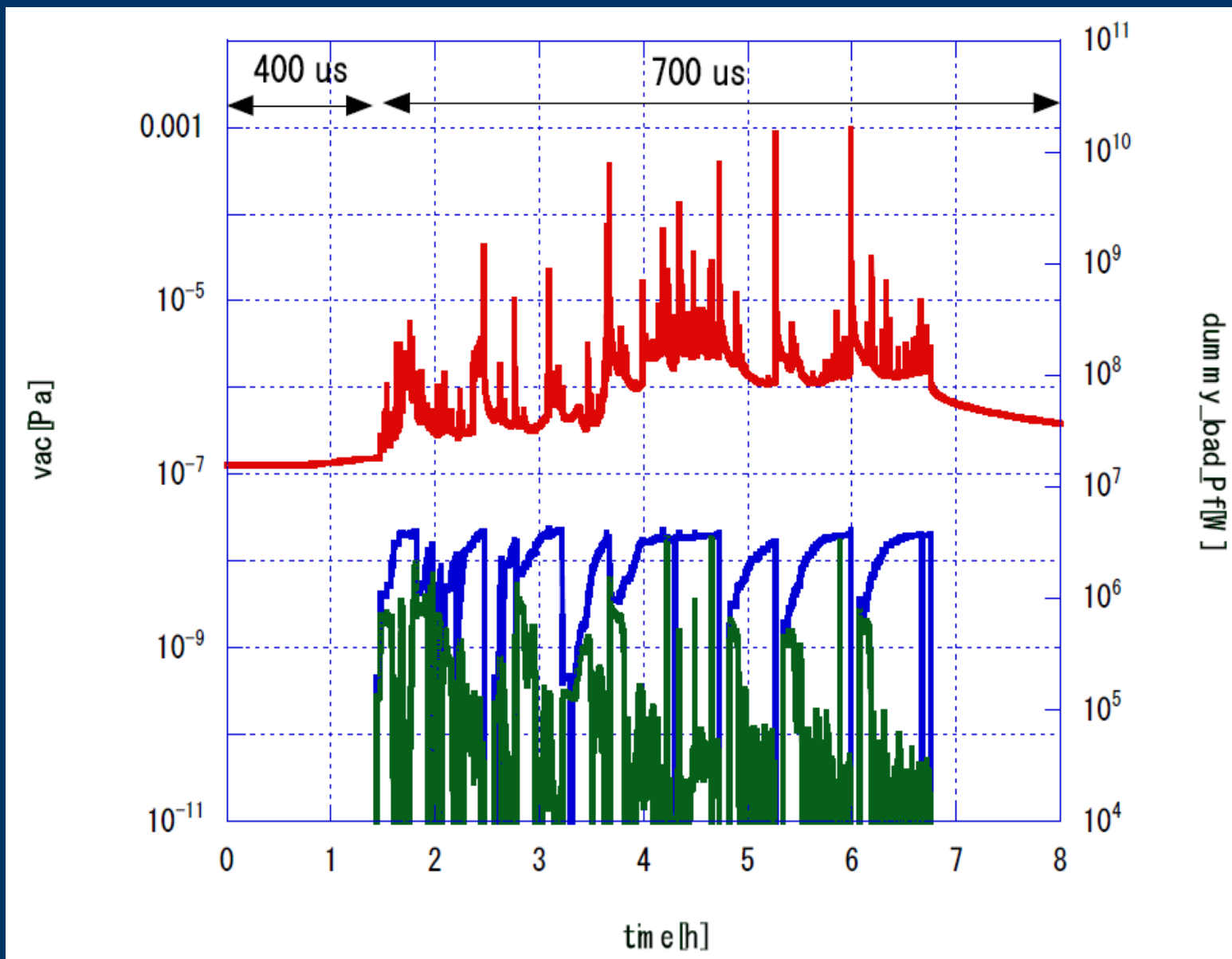
RF Processing history 9/20



RF Processing history 9/21



RF Processing history 9/22



RF Processing Summary

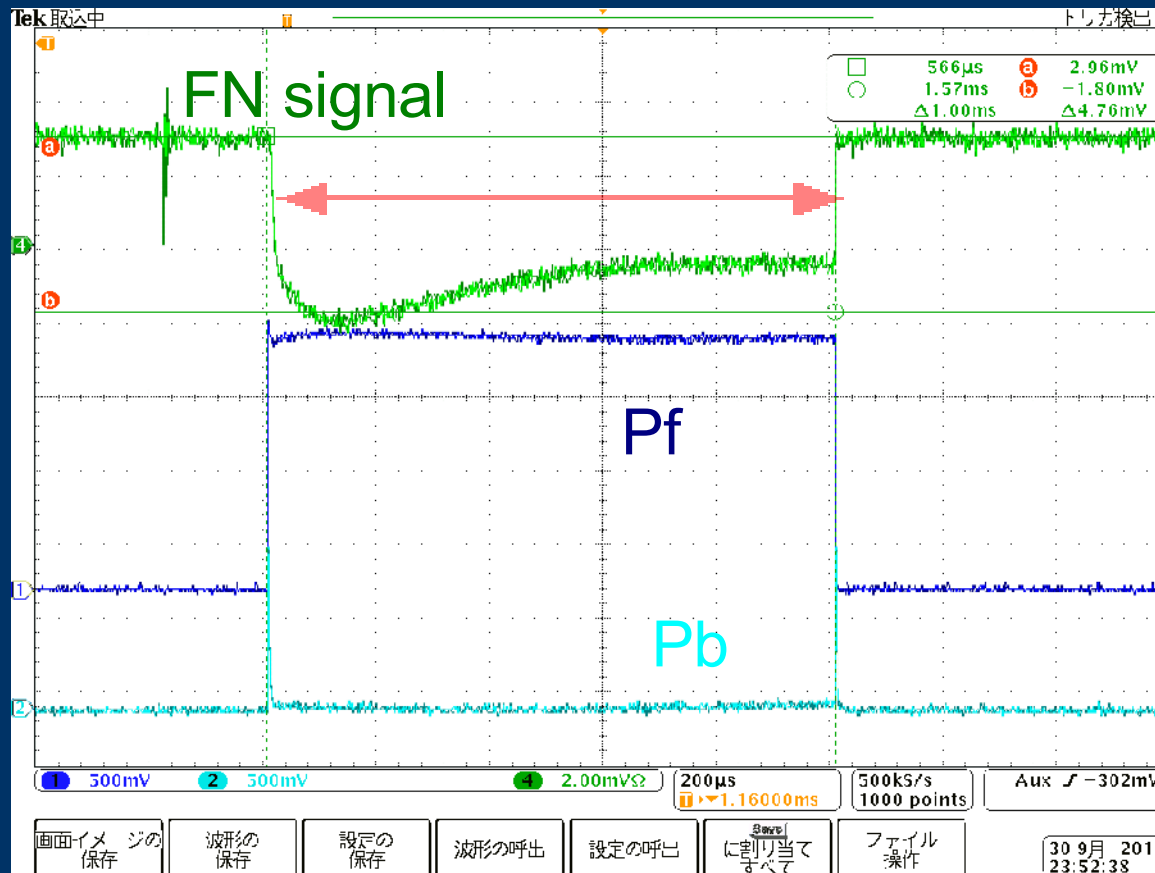
- RF processing was started from 20us to 1000us pulse duration.
- Up to 4.0MW RF power was fed for each duration.
- Finally, 1000us, 4.0MW RF was achieved.
- Trip rate is not qualified yet.

Pulse Duration (us)	Process time (hours)
400	3.5
700	11.5
1000	24

RF processing time since 9/20

Dark current measurement

- The dark current is measured by FC which is at the downstream of the gun cavity.
- By taking the average in a pulse, the dark current is qualified.



Analysis based on Field emission

- The dark current is analyzed by Fowler-Nordheim theorem as follows;

$$I \propto (\beta E)^{2.5} \exp\left(-\frac{G}{\beta E}\right)$$

$$G = 6.53 \times 10^9 \times \phi^{1.5}$$

ϕ : workfunction in eV, 4.7eV for Cu

β : field enhancement factor

E : surface field in eV/m

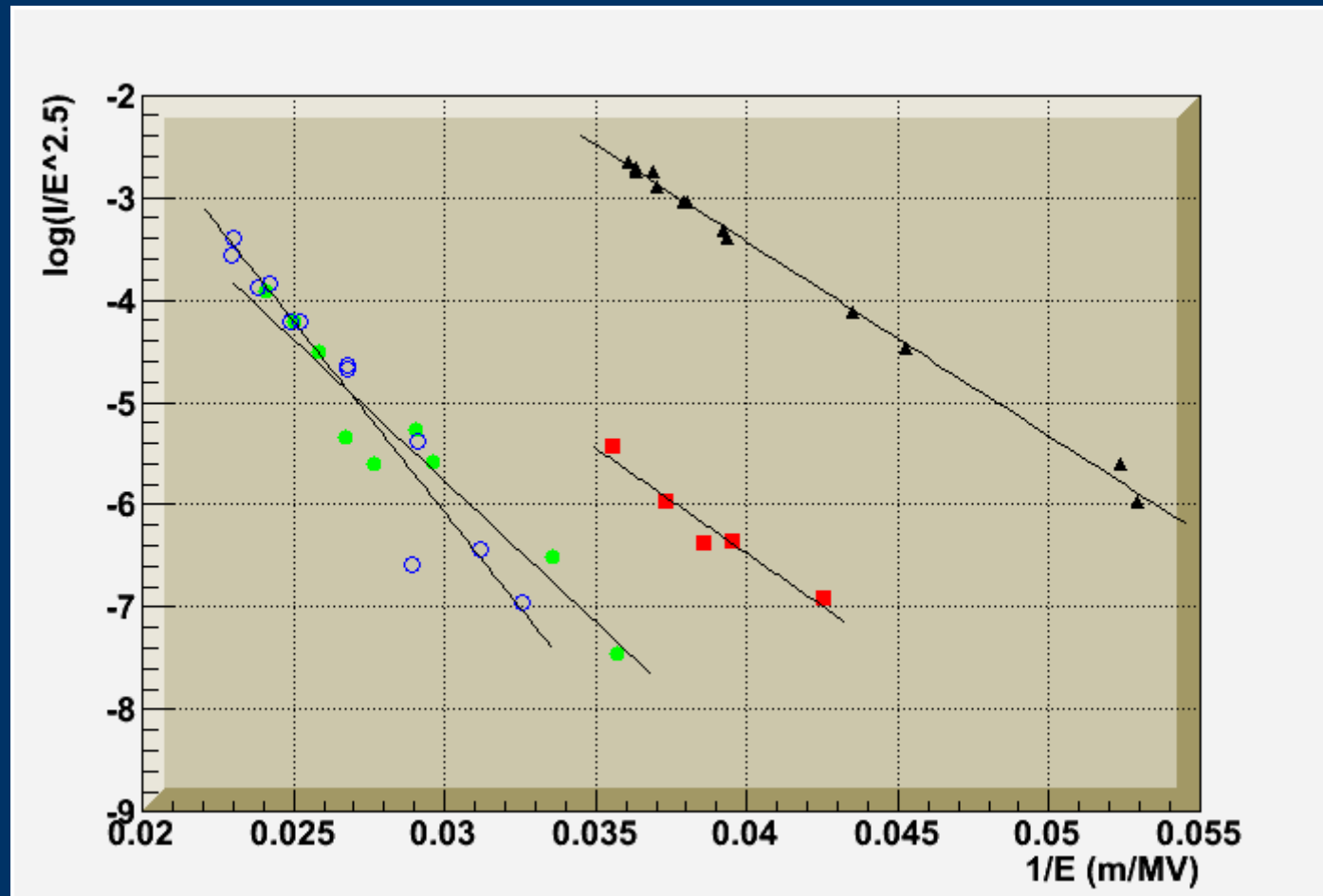
FN plot

- According to FN theorem, $\ln(I/E^{2.5})$ becomes on a straight line as a function of $1/E$ (FN plot).
- Field enhancement factor, β is extracted from gradient of FN plot as

$$\beta = \frac{G}{k}$$

k : gradient of FN plot

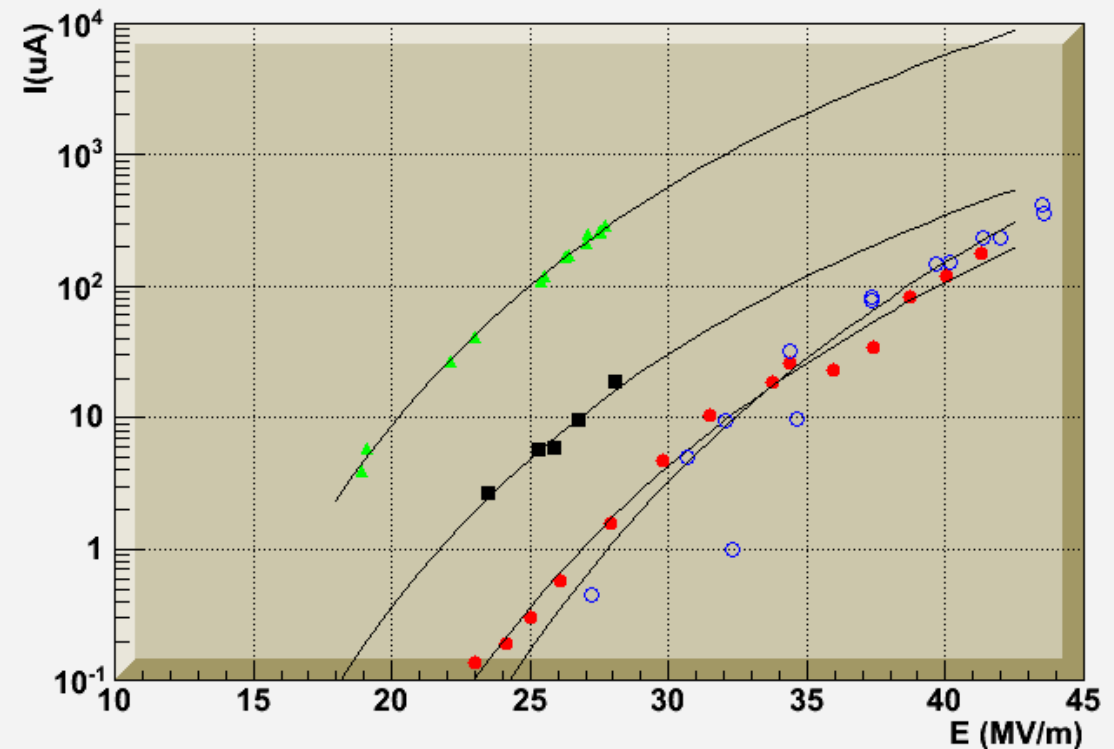
Data set	beta
2010/7	350
2011/1	325
2011/9/22	219
2011/9/30	176



I-E plot

- Dark current was decreased by
 - Ethanol rinse (1007->1101)
 - High power RF process (1101 -> 1109)
- 110922 and 110930 are equivalent?

Gradient (MV/m)	Dark curr.(uA)
35	28
37.5	69
40	150
42.5	302



Summary

- RF processing of L-band RF gun at STF (FNAL cavity) was reported.
 - It was found to be that the dark current has been decreased by the ethanol rinse and RF process.
 - The dark current is even acceptable for a real operation at 40 MV/m (1.5% of the beam current).
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