KEK status

May 29, 2009

T. Higo and K. Ueno

Fabrication status

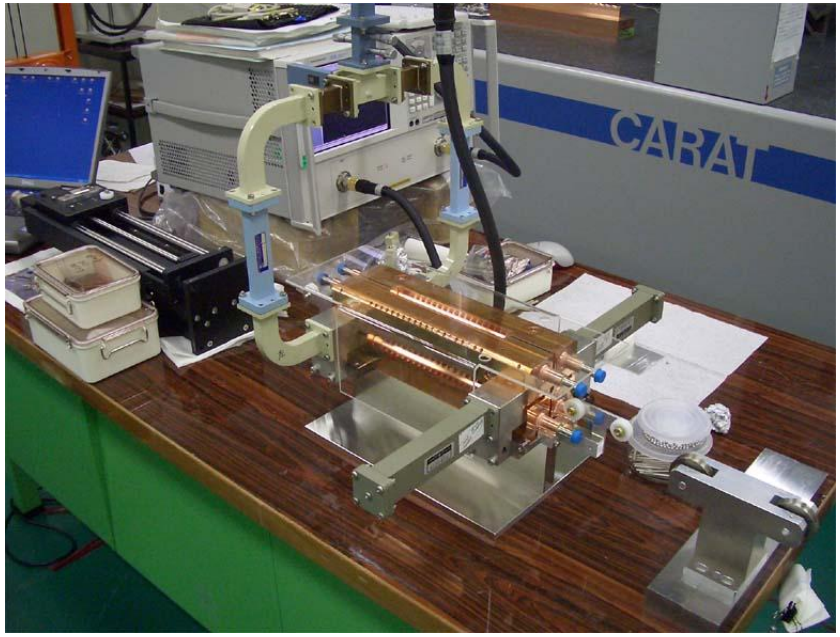
- Quadrant
  - Tuning done, final assembly
  - Chamber vac leakage get solved, now under baking of the chamber
- C10, CD10
  - Set as the first trial for K-project with under collaboration framework between KEK and Tokoku univ.
  - Need to quickly finalize the design
  - Proceed more with US-Japan budget
- T24, TD24
  - Will start design / fab process in a few months
  - Proceed with CERN budget support and SLAC assembly support

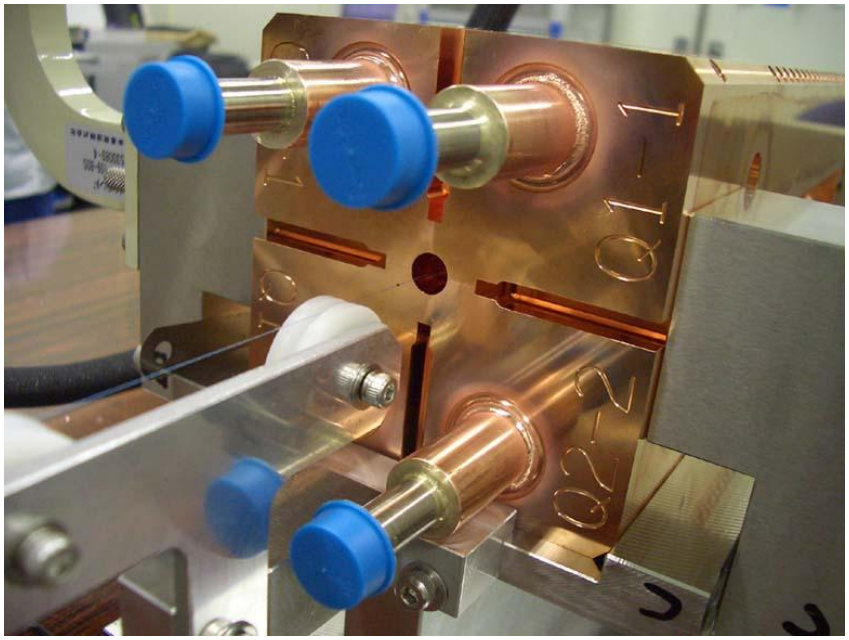
Quad#5 tuning summary

090520

T. Higo, K. Yokoyama and Z. Jingru

Tuning setup

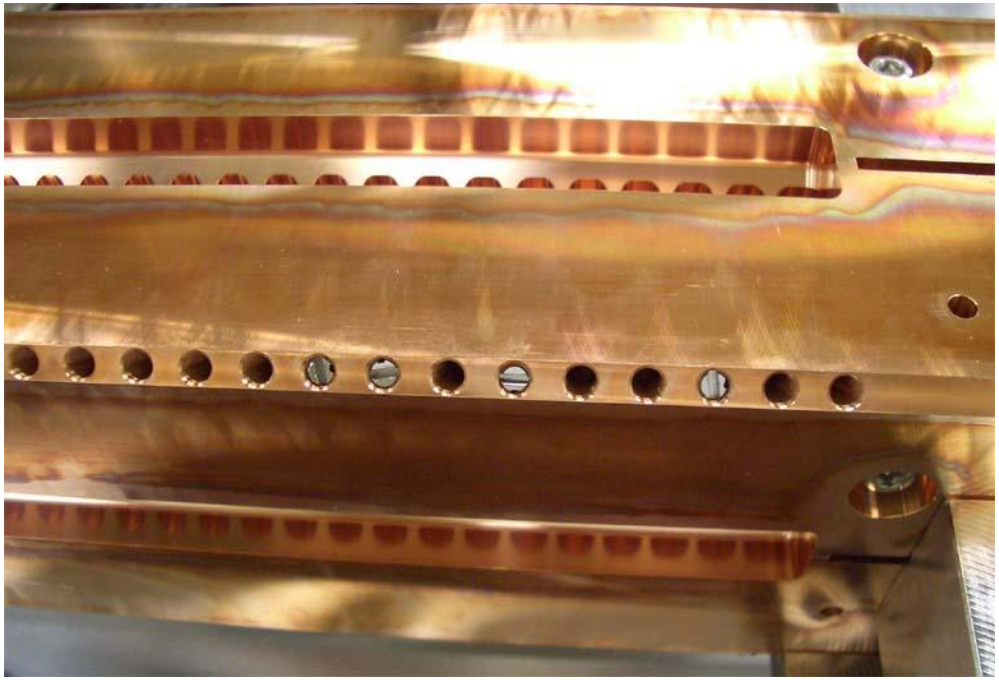


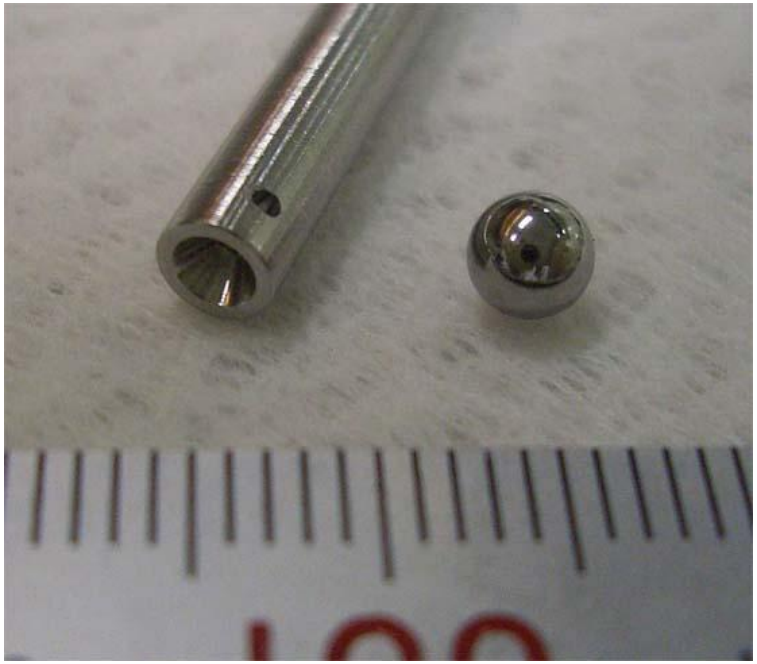


Tuning setup:
Quad#5, bead string, linear stage driven by pulse motor, input divider, network analyzer

Quad assembly configuration seen from input side

Tuning ball pushed by a rod



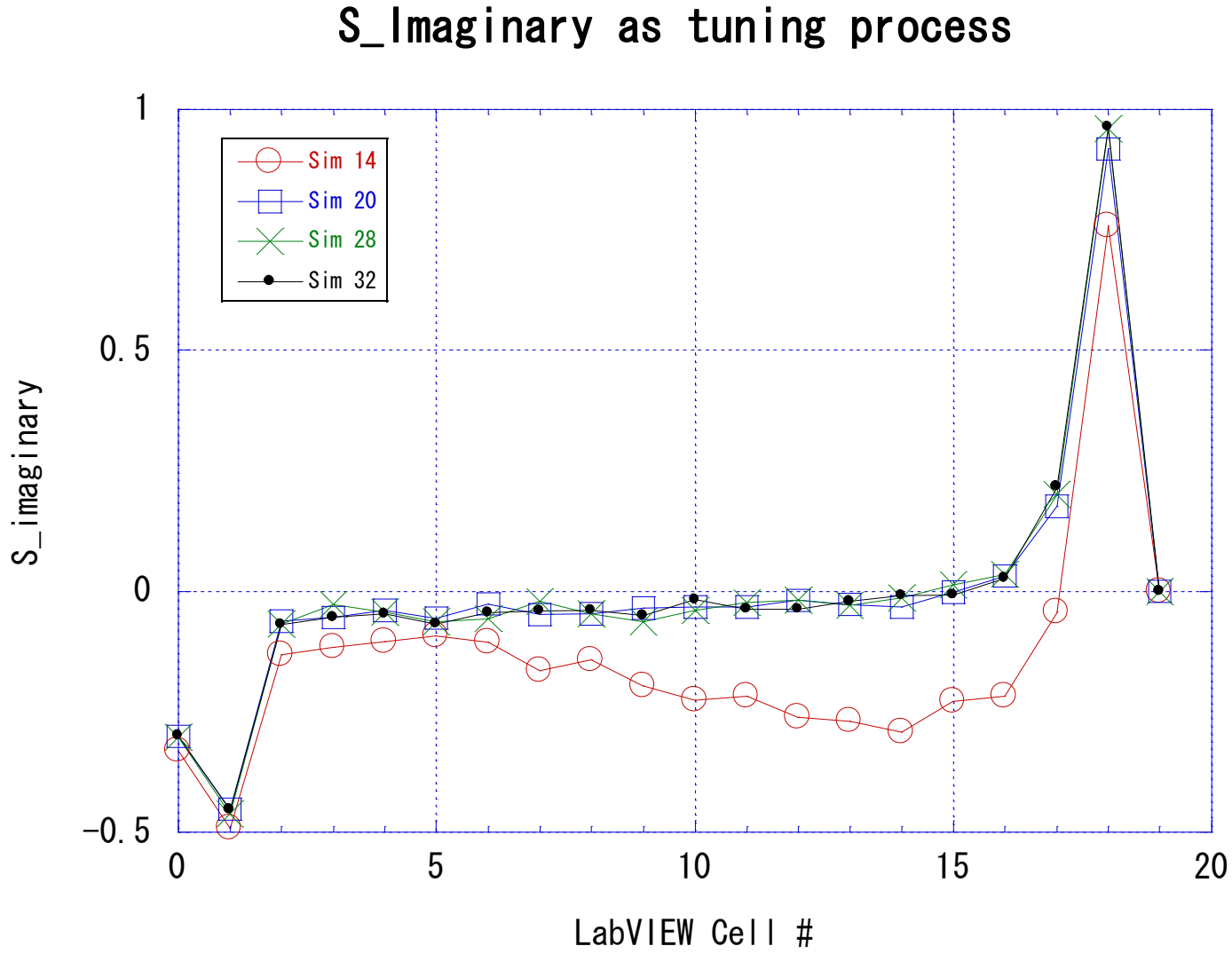


4mm stainless ball pushed by minus watch driver.
Pushing by turning with Higo's hand full force.
Elastic deformation kept, meaning that the tuning pins are kept pushing the balls.

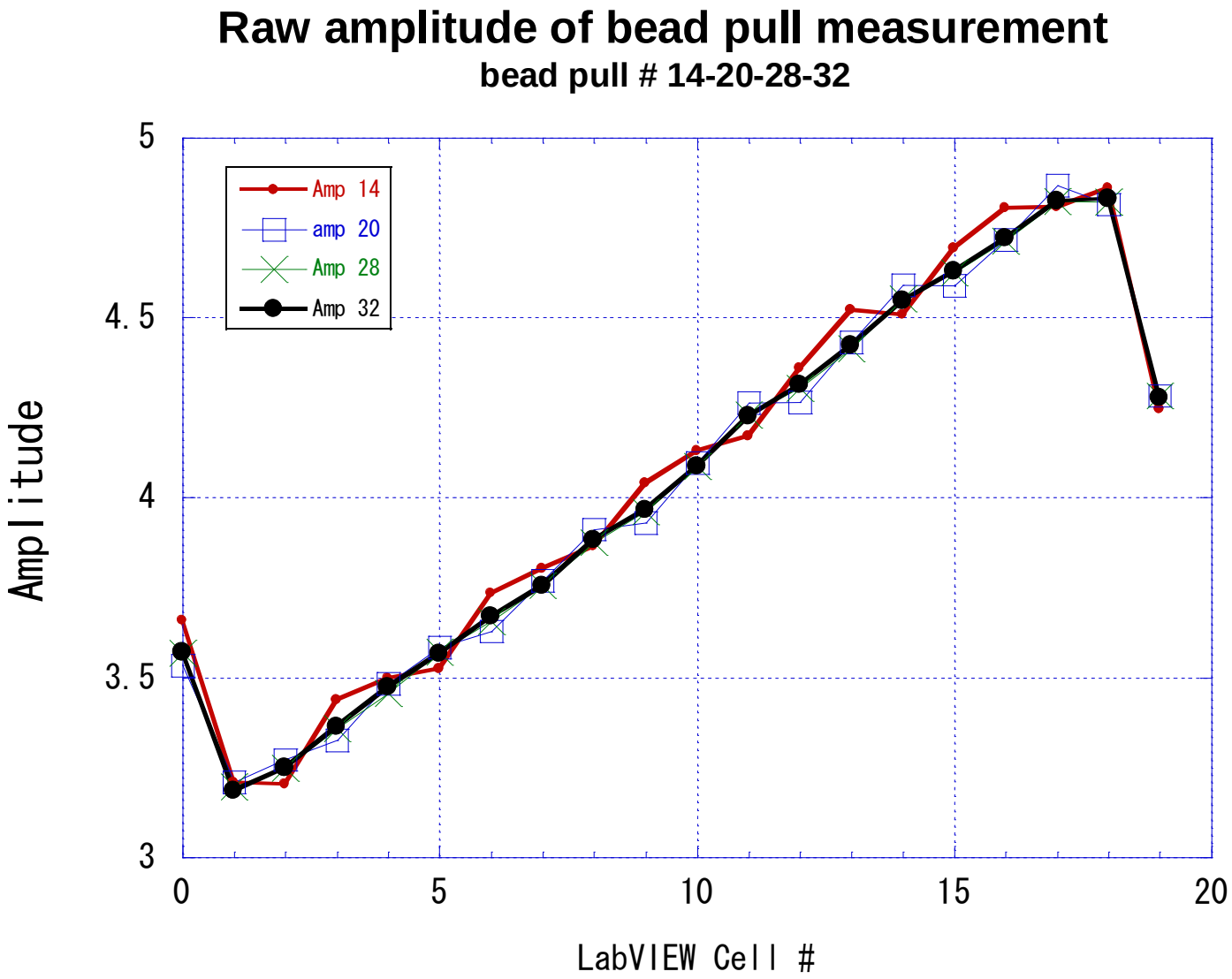
Tuning history

- 090202 S_{11} measured before tuning
- BP14@11422 initial stage
- BP20@11420 after tune up half of the cells
  - Flatten the Sim pattern, especially 9~16 area
- BP-28@11420 after fine tuning
- BP32@11420 after input match tune-2

Tuning in practice

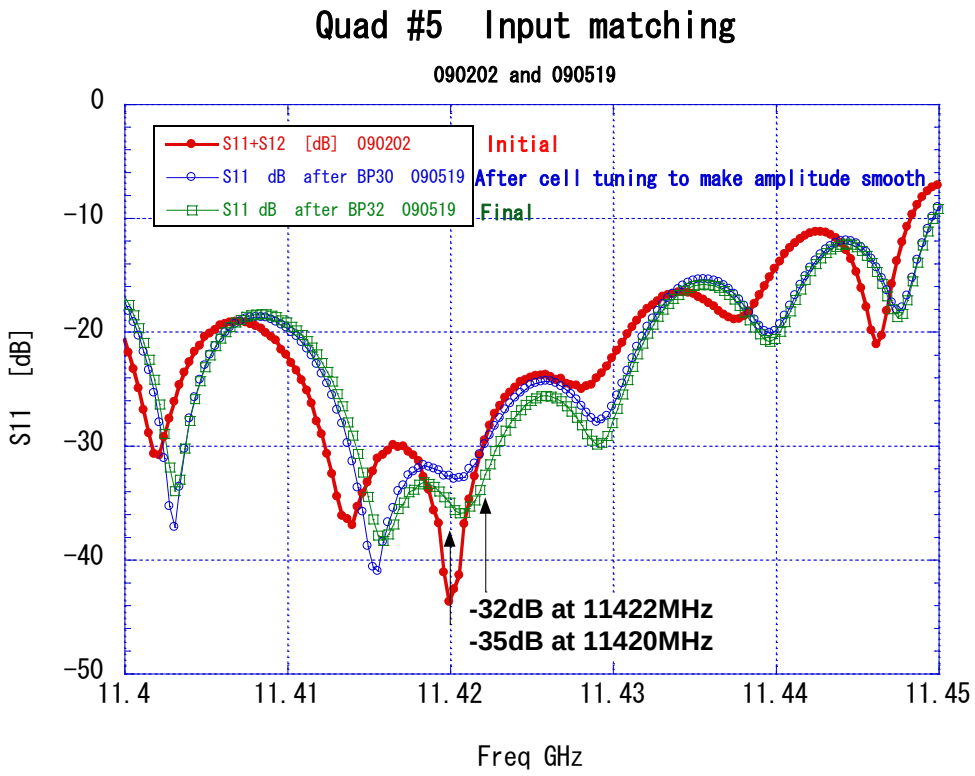


Tuning in practice



Evolution of S11 near 11420MHz

090520

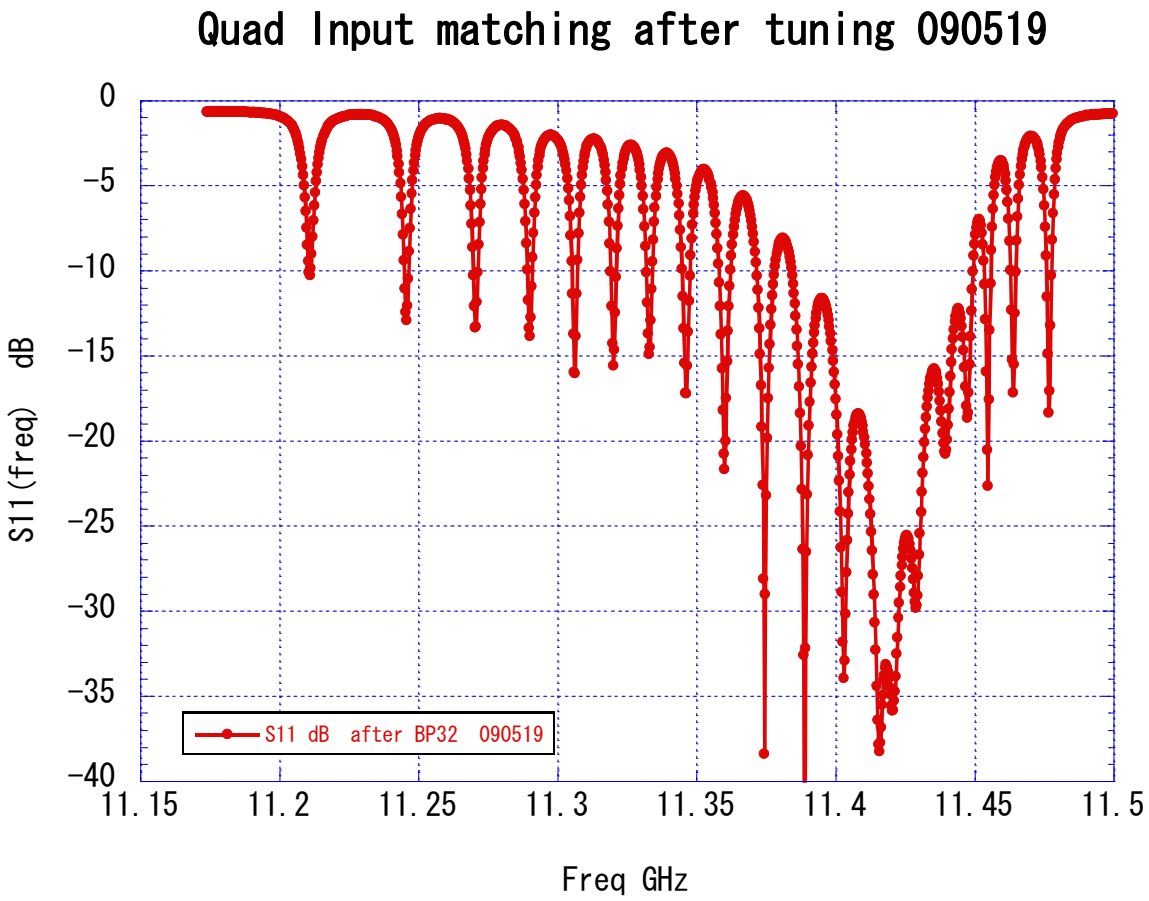


090202
initial

090519
after cell tuning, BP-30

090519
after input match tuning

Input matching after tuning

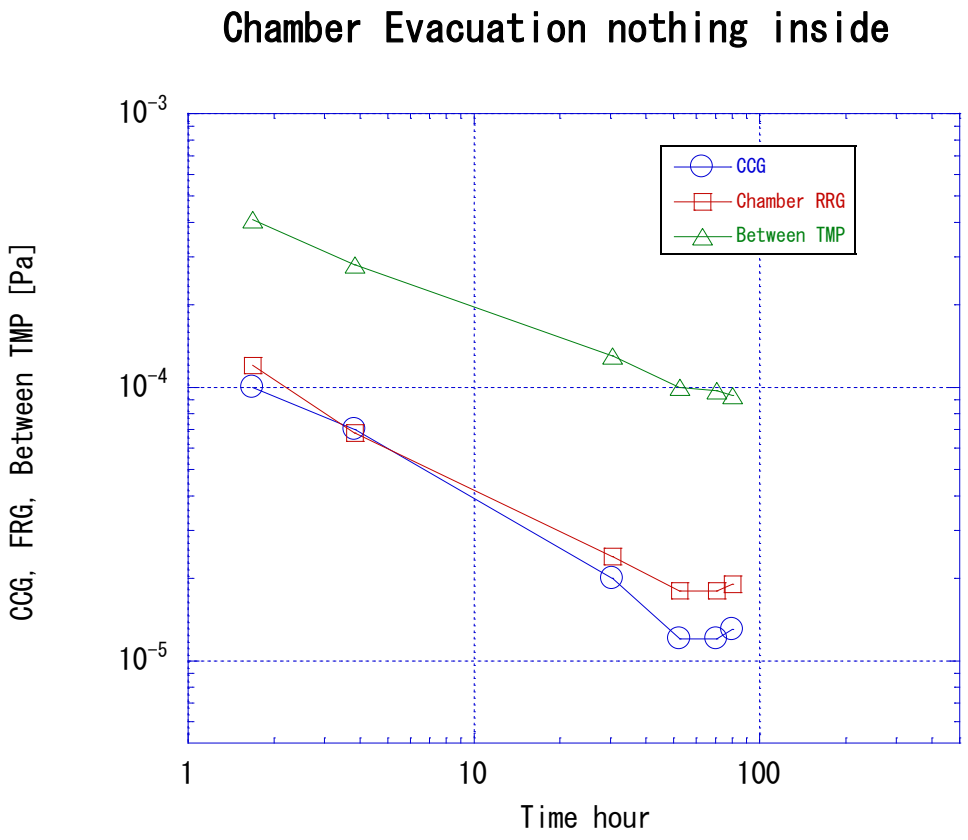


$|S_{11}|$= -32dB at 11422MHz, -35dB at 11420MHz
Operation at 11422MHz at 30C in vacuum is planned.
22C in air → 30C VAC makes 2MHz higher frequency.
So the input match should be -35dB, good enough.

Near future processes

- Finish tuning (done)
- Rinsing with acetone (done)
- Final assembly
- Check RF
- Install in vac chamber
- Install to Nextef
- High gradient test at 11422MHz at 30C

Quadrant chamber evacuation.



Nothing inside.
~50liter/s TMP directly attached.

P = 1~2 x 10^-5Pa
Better vacuum level is required!
Should make baking?
Structures etc. should be integrated to realize the vacuum level.

SLAC level ~ ???

High gradient test status

- Nextef
  - T18 test in its final stage
  - Preparing to install quad #5 in mid June
- Narrow waveguide test at KT-1
  - acquiring more data points in breakdown rate measurement
- C-band high power test
  - Keep going as scheduled
  - Will finish structure test by early July
  - Should start preparing to use for pulse compression test
- Should discuss on how to configure the X-band test
- Preparing a review of X-band activity in Jul.-Aug. for Oide

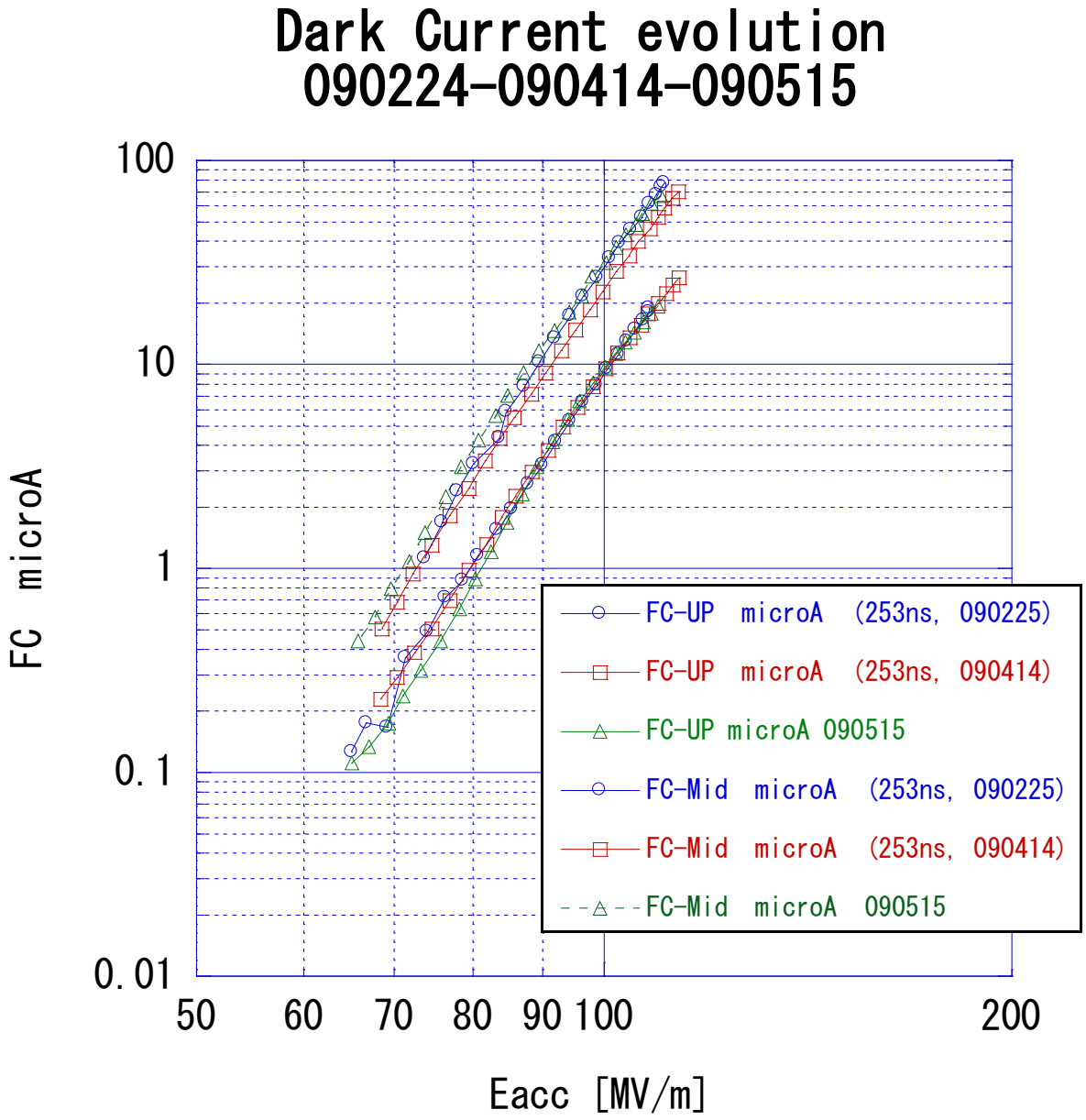
Some typical pages from T18_VG2.4_Disk_#2 processing (13)

Dark current as of 090515
Breakdown rate evaluation at 412nsec
Final work listup

090526

T. Higo, S. Matsumoto and Nextef group

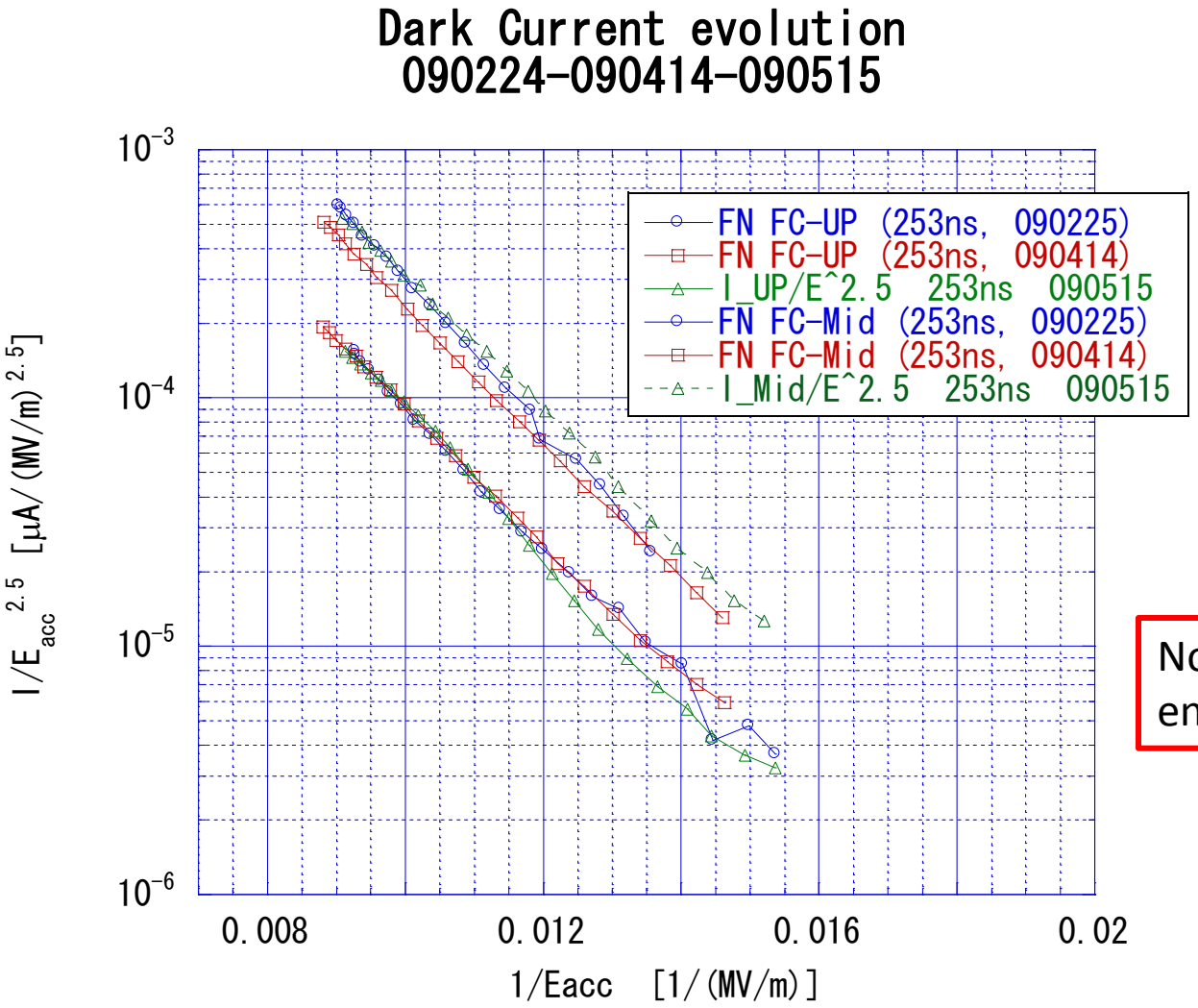
Dark current evolution 252nsec



No reduction of dark current in 700 hrs running at >100MV/m level from 090225 (RF on ~2200hr) to 090414 (RF on ~2900hr)

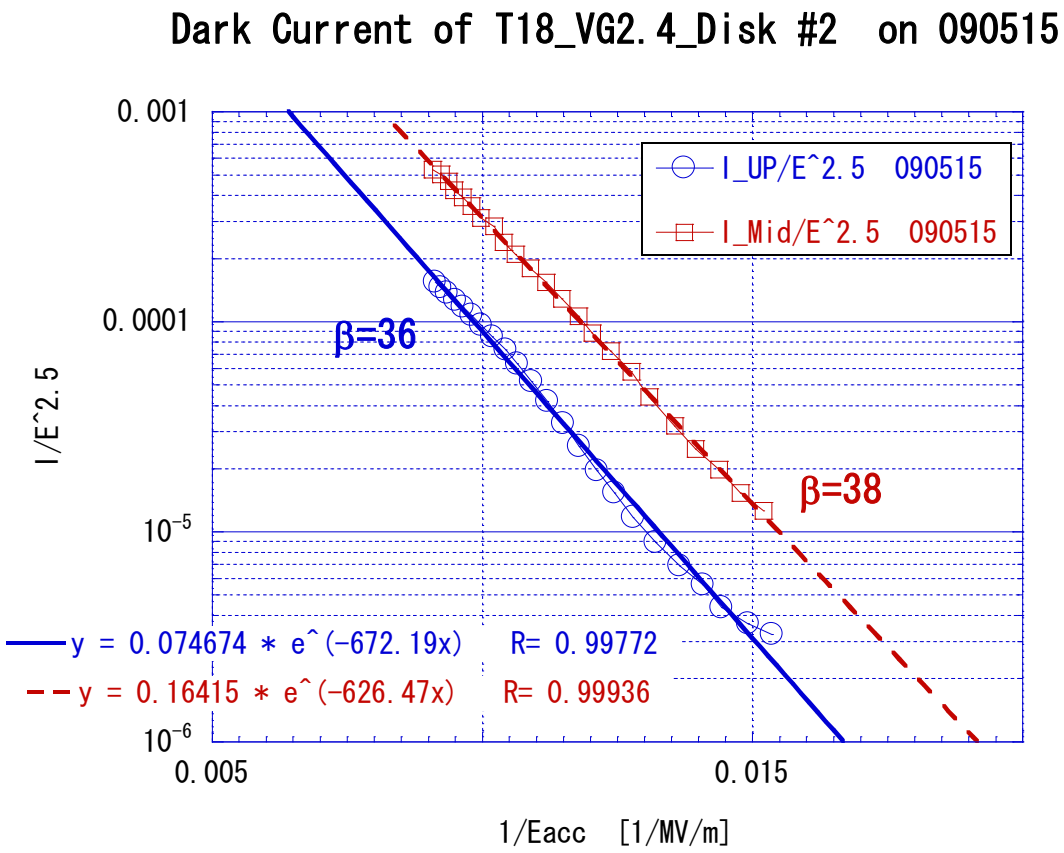
Neither for ?? Hours from 090414 to 090515

Dark current measurement 090414



No big change in field enhancement factor

Field enhancement factor as of 090515



Following the formula and parameters of the following page

Deduction of the field enhancement factor

Fitting of modified F-N curve

$$\frac{I}{E^{2.5}} \propto e^{-\frac{6.53\times10^{9}\,\phi^{1.5}}{\beta E_s(V/m)}} = e^{-\frac{\alpha}{E_{acc}(MV/m)}}$$

Assuming Es/Eacc=2

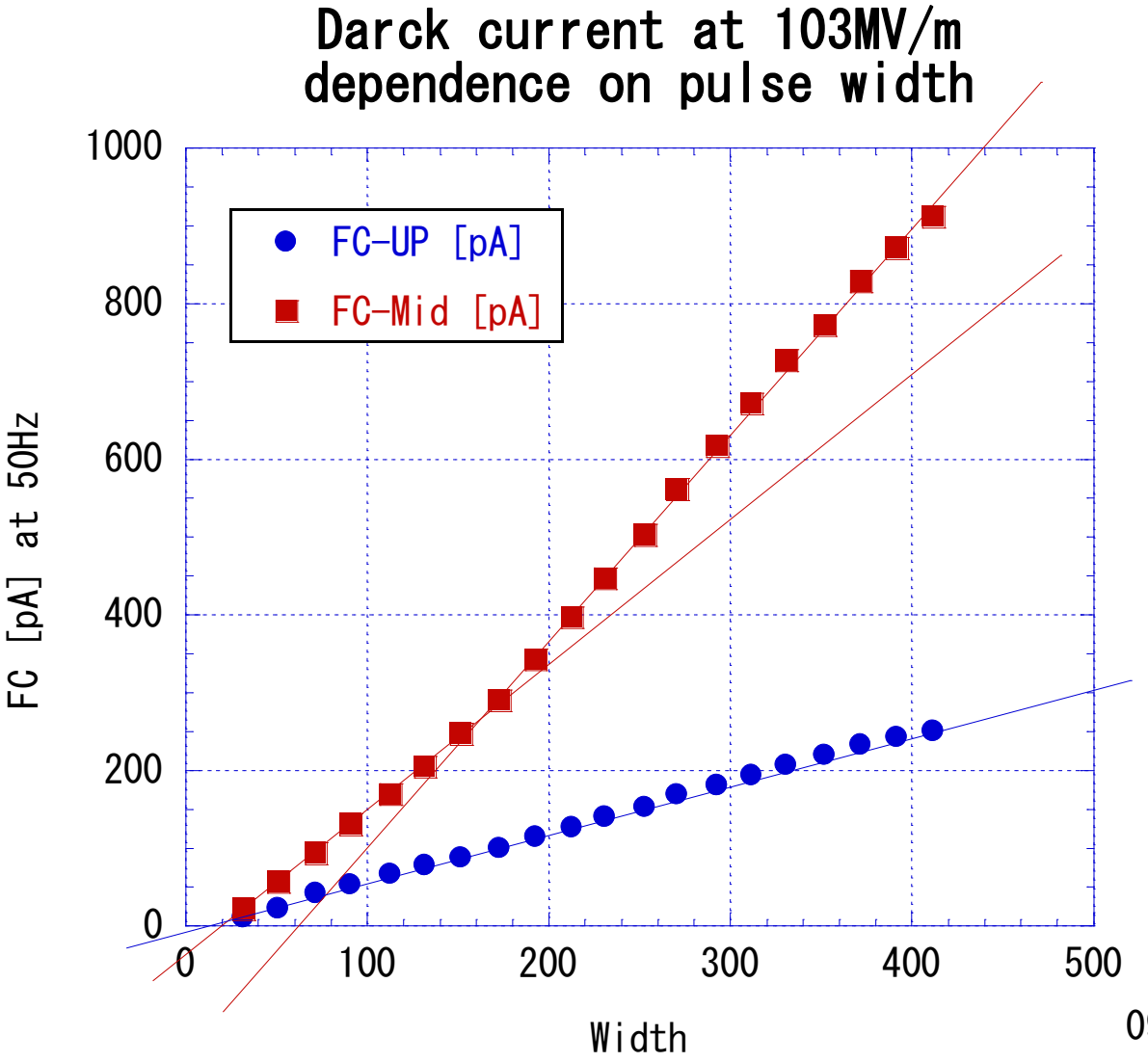
actually T18_VG2.4_Disk

Es/<Eacc>~2.62 max

ϕ(Cu)=4.52eV

$$\beta = \frac{6530\,\phi^{1.5}}{\alpha\,(E_s / E_{acc})} = \frac{23951}{\alpha}$$

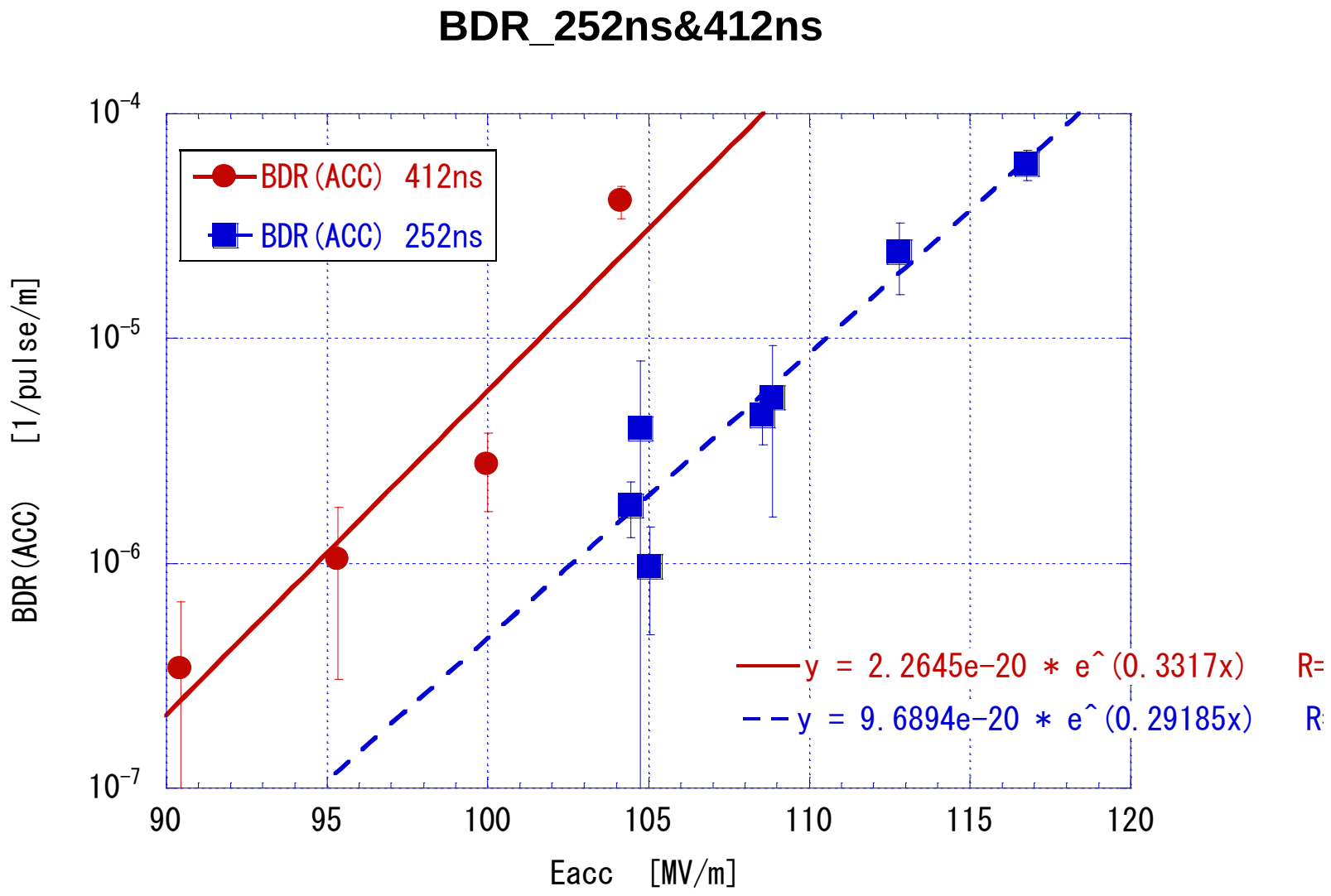
090515 Width dependence



Upstream current behaves as linear on width

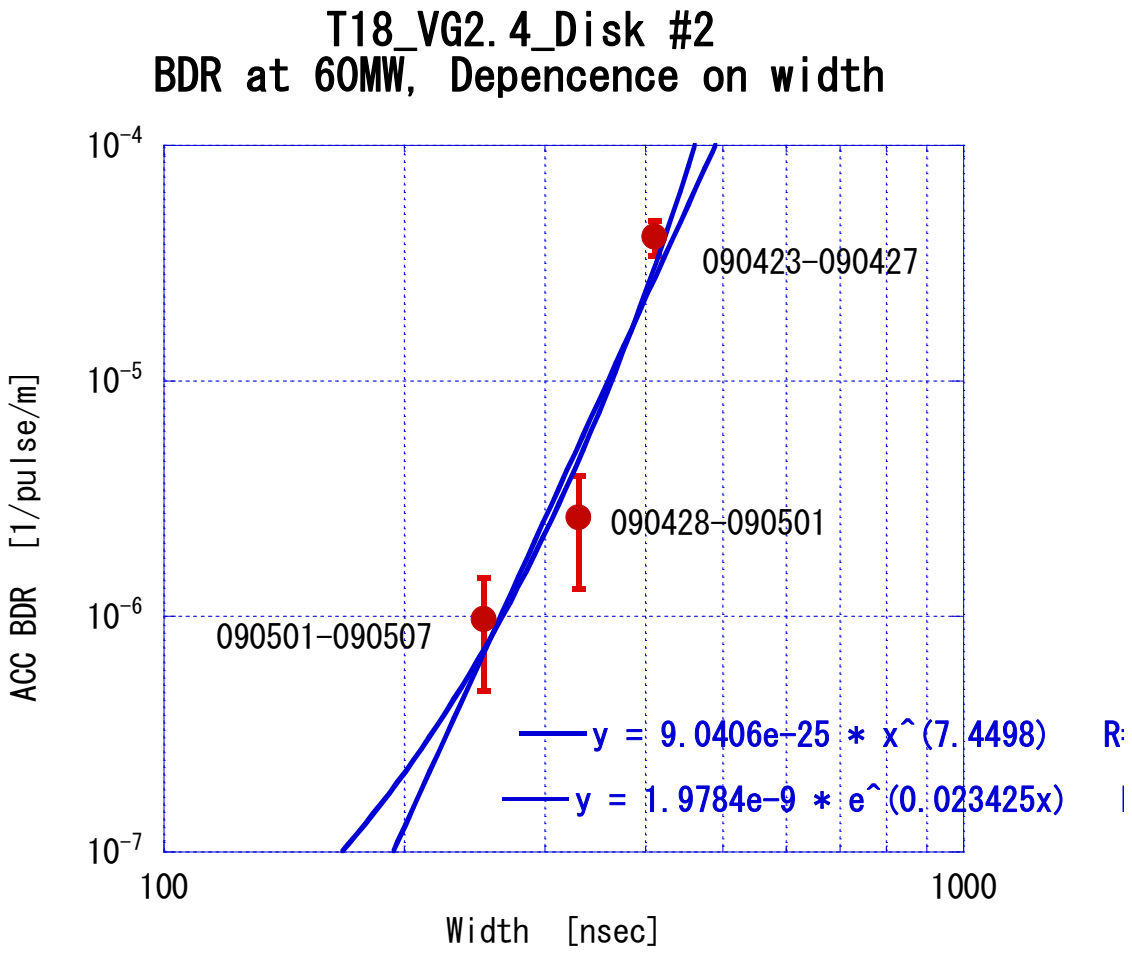
Downstream current has two components.

Breakdown rate at 252ns and 412ns



Width dependence of breakdown rate at 60MW

090507



No firm idea exists explaining the functional form. These fittings are only for getting the taste.

Summary and last plan until installation quadrant

- Width dependence is linear.
- Breakdown rate was measured at 252ns and 412ns. In summary;
  - BDR vs Eacc at 252ns, 412ns
  - BRD vs. width at 104.4 MV/m
  - Final data taking at 412ns, low power points
    - 50MW for ~2 days and 45MW for a week
- Additional check and measurement items are listed in the following page. ~ 1 week

Items of checking / confirmation / developments (1)

- Measure dark current spectrum (0.5d~)
  - Check missing 3MeV peak
  - Automation?
- Check waveguide system (0.5d)
  - Big waveguide loss by varying temperature
  - Identify breakdown locations at longer pulse with acoustic sensor, etc
- System power final calibration for future use (1d)
  - KLY(S+N)_Comb_out as a reference
  - Measure monitor power, TDS, DPO at ACC-IN and Rs
    - versus power level and pulse width
  - In quad test, this new ACC-IN becomes the refernece!!
- Trial of reflection phase meas. with IQ-demodulator (2d)
  - with carrying RF signal directly to control room for ACC-IN and Rs
  - and dividing into two, one for phase and one for amplitude

Items of checking / confirmation / developments (2)

- Pursue to find FC-UP origin
  - how??
- Develop data recording into xylion (a few days)
  - DPO, TDS and relevant parameters
  - In every second?, all INTLK, 3pulses?.....