Some information from Nextef

For poster session in IWLC

T. Higo

Conclusion

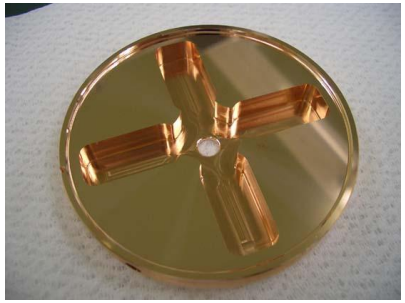
- Damped structure TD18 was tested
  - The BDR seems a little worse than T18.
  - Dark current was measured with beta from time to time. Beta X Es seems roughly speaking constant.
- Very long-term operations
  - BDR decreases but huge time is needed to reach 10^{-7}. Can it be done gradually during operation?
  - Need to evaluate the phase shift for this and compare with that of TD18_#3 tested at SAC for much shorter period.
- Various findings and issues
  - Vacuum pressure gets worse at a few to 10MW level and it is reproducible.
  - Double pulse operation was tried. The BDR for each pulse, former and latter, seems the same.
  - SEM view was taken and we see gap at the highest magnetic field area. Flatness and bonding jigs may be the issue for improving diffusion bonding.

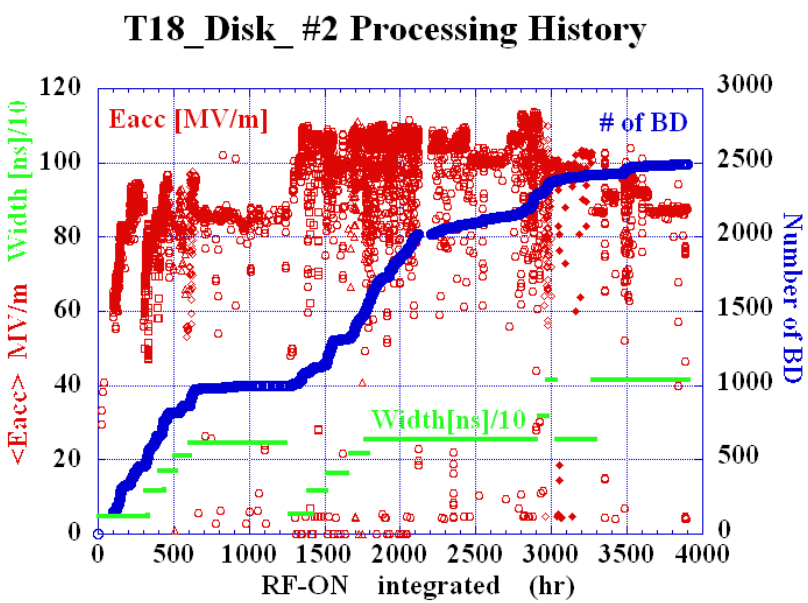
T18_Disk_#2
Undamped disk-based

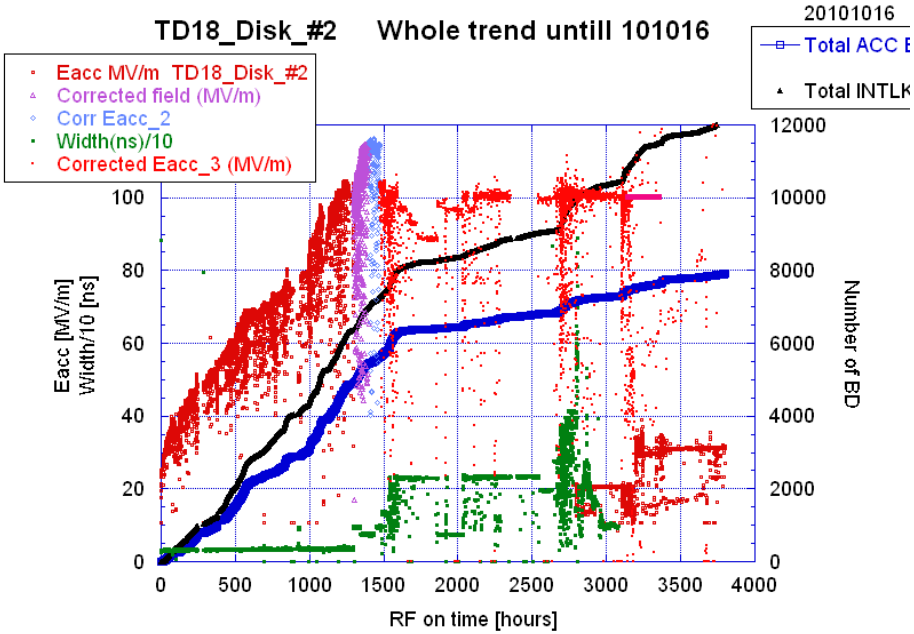
Strategy

Disk-based
CLIC electric design
KEK mecha design +fab
SLAC assembly
Test at SLAC and KEK

TD18_Disk_#2
Damped disk-based





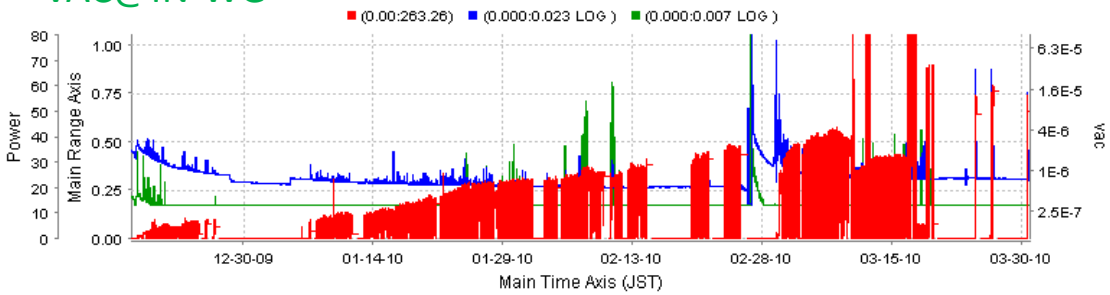


TD18: Characteristics in vacuum pressure increase at very low power level

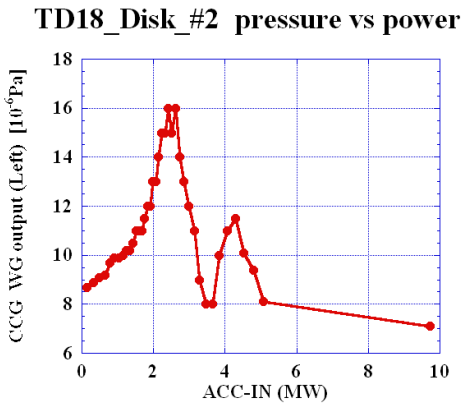
VAC-@OUT-WG

ACC-IN power

VAC@IN-WG



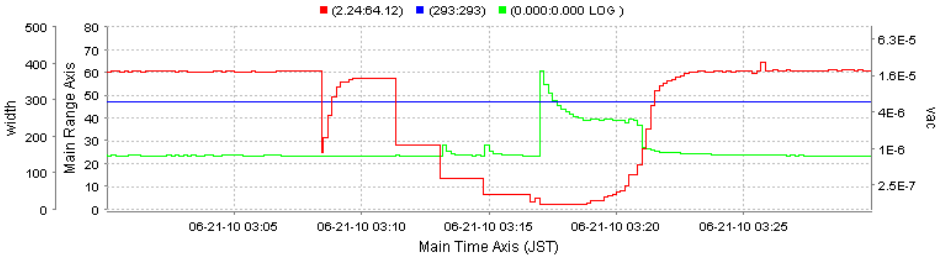
Vacuum level was not so good, ~1x10^-6Pa at worst location.



Even after running at top power, the vacuum gets worse when it decreases power.

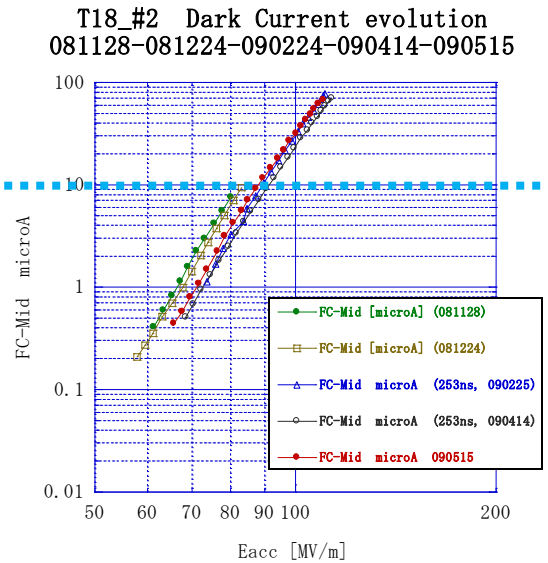
A few hour stop of RF pulses makes the vacuum level worse in the next startup process, during the recovery passing through the region.

It is reproducible.



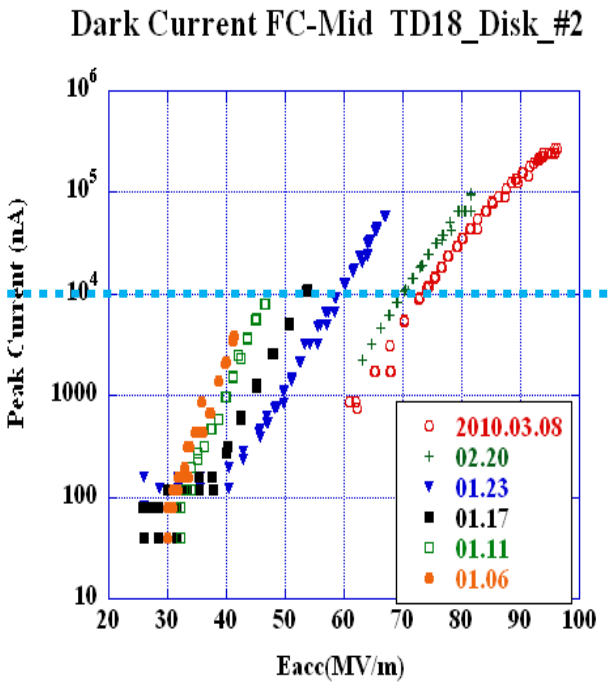
Comparison of dark current

T18_Disk



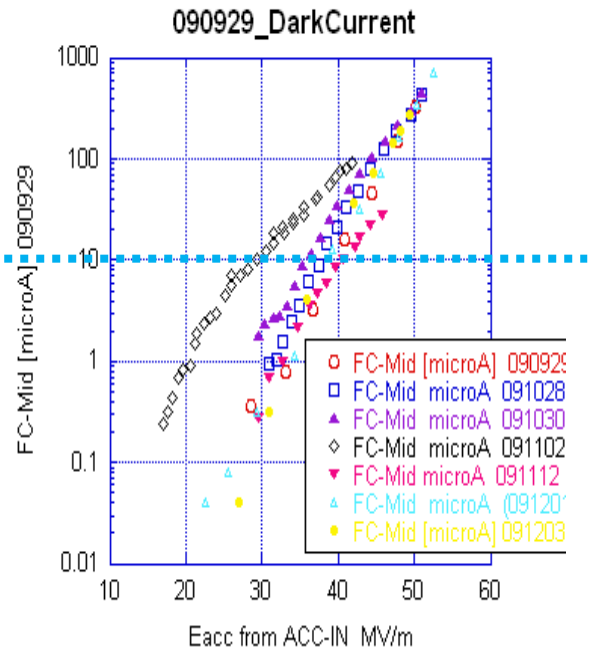
90MV/m

TD18_Disk



70MV/m

TD18_Quad

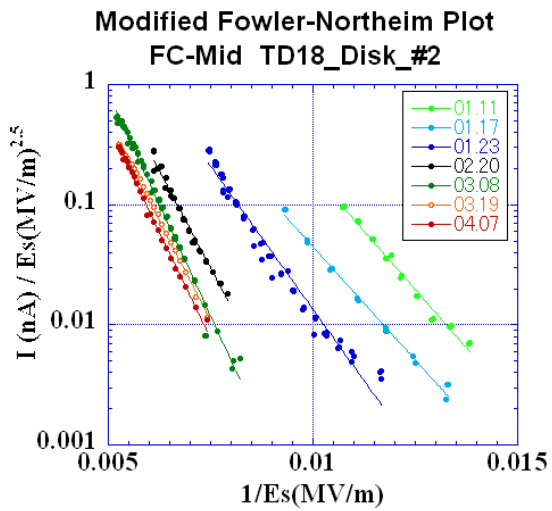


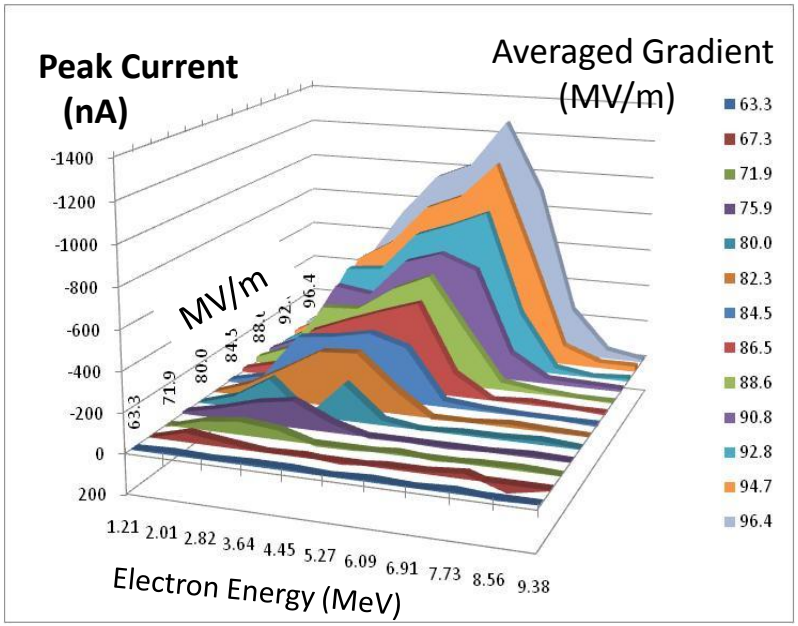
40MV/m

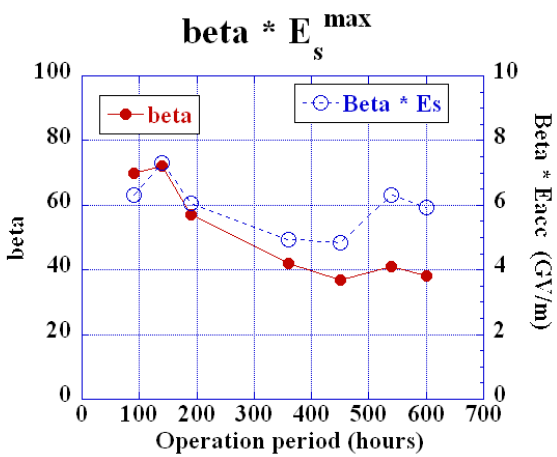
Eacc for peak dark current of 10 μA

The amount of the dark current tells the performance of the high gradient breakdown performance!?

TD18_#2: Evolution of dark current and its spectra



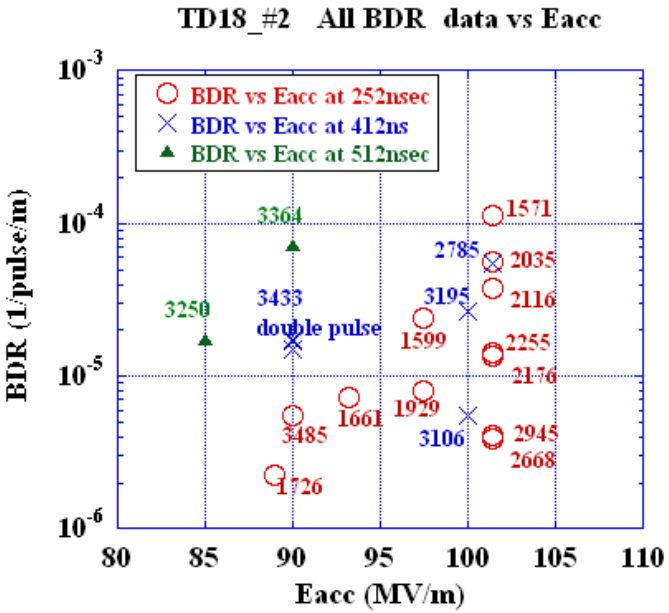




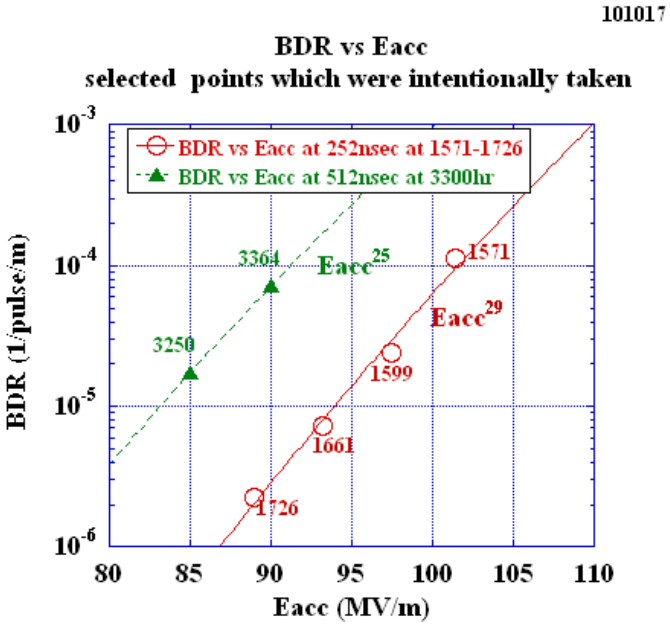
In T18_#2 at 108MV/m, energy peak at 7.5MeV and 3.5MeV, similar to TD18 shown here.

Dark current reduced by three order of magnitude.
It followed roughly modified F-N formula.
β reduced from 70 to 40.
$\beta * E_s^{max} \sim 5\sim7$ GV/m

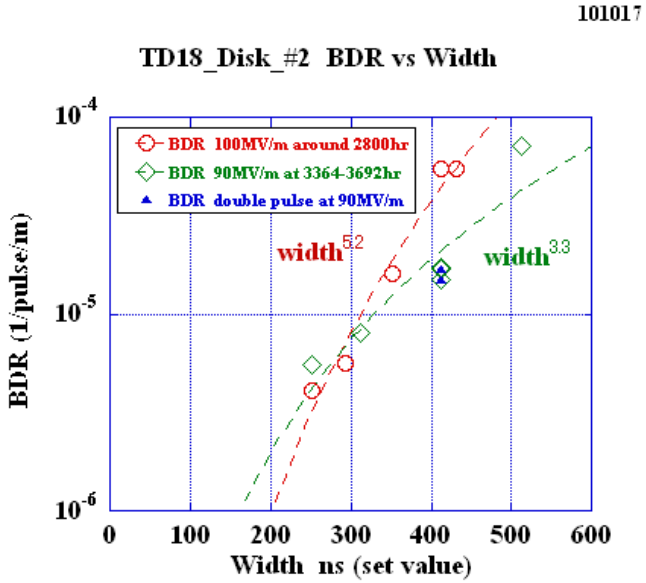
Breakdown rates in various cutting views



Eacc

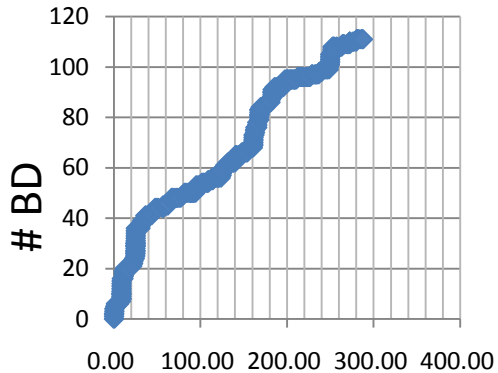


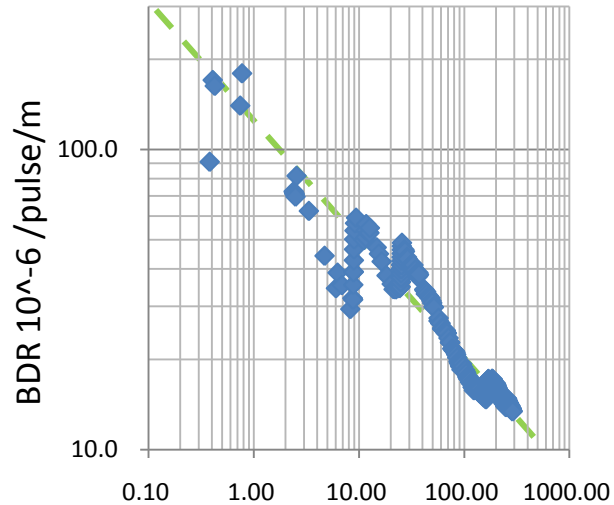
width



Always changing in this stage of processing, only (? !) a few thousand hours since time=0.

Break down rate evolution in TD18_#2

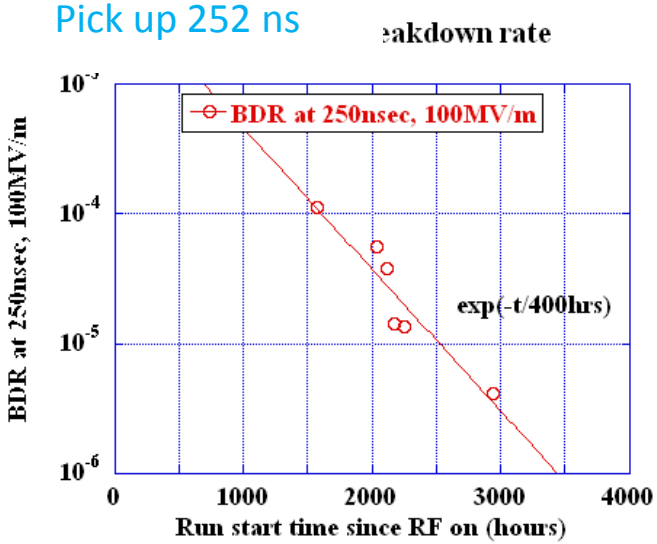




In a short period

Decreasing in a logarithmic time scale BDR ~ t^-0.38

Pick up 252 ns



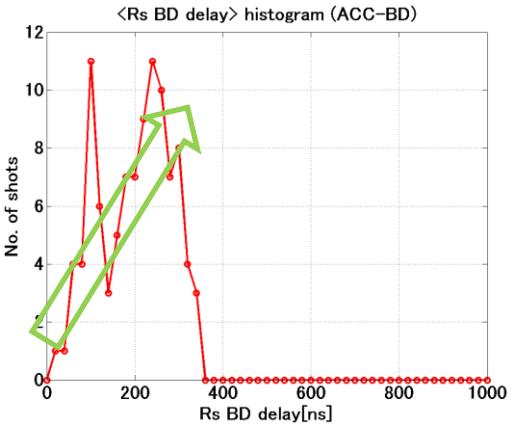
Need too much time to reach 10^{-7} level.

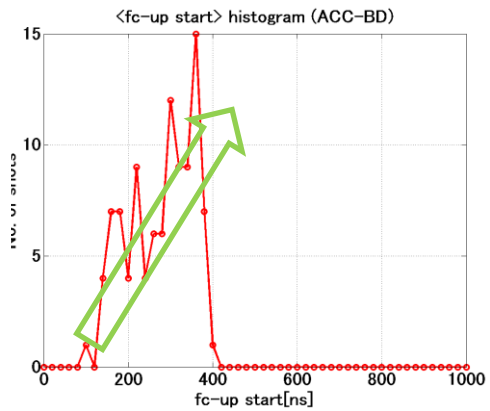
Cannot wait this long time. Need proper care in fabrication.

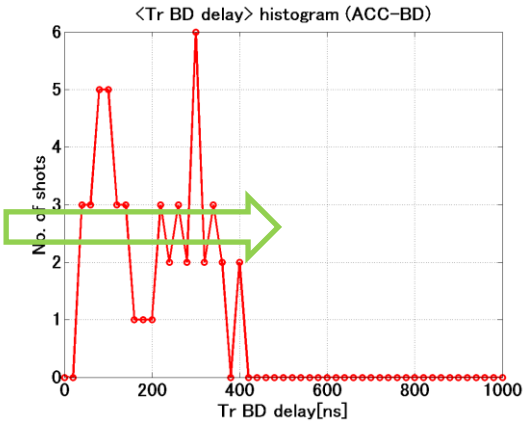
When in the pulse breakdown starts?

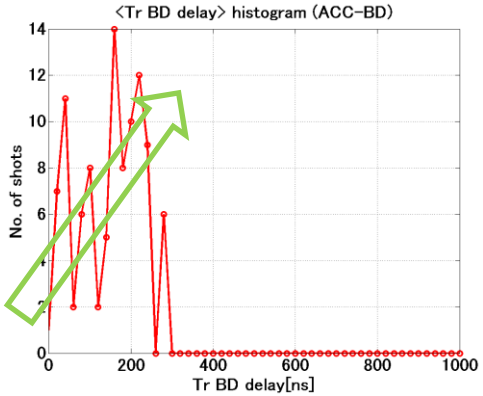
252 nsec run

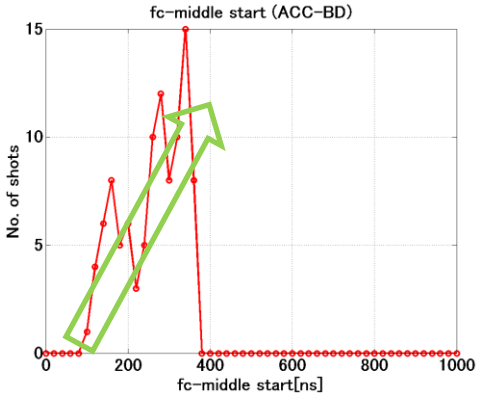
512 nsec run

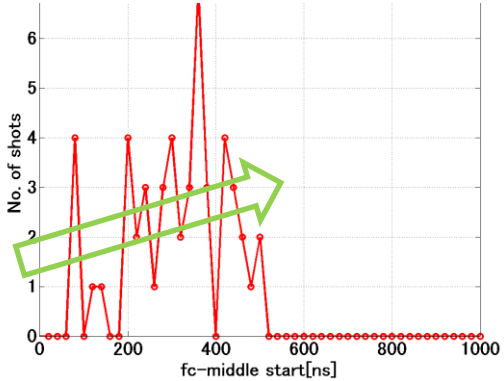








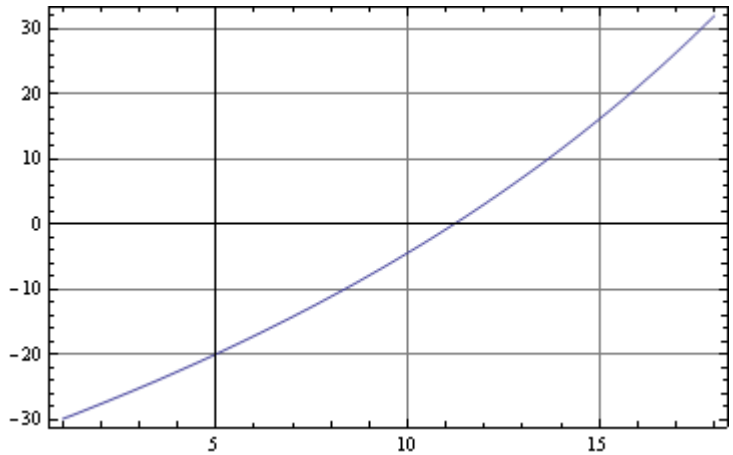




fc-mid, Tr-delay
→ramping as time
→ building up as time?

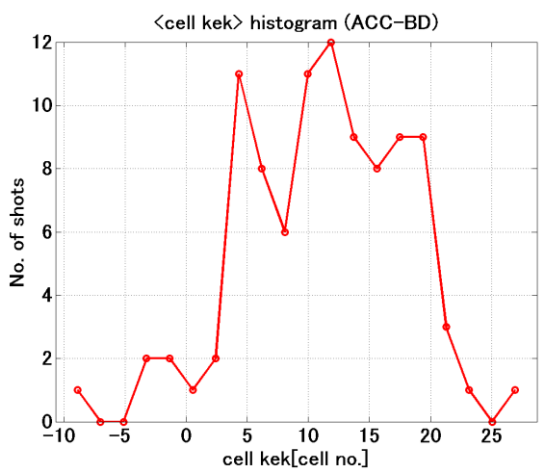
Little increase vs time!
Different from the left figures.
Need more statistics to judge.

Time difference between Rs and Tr

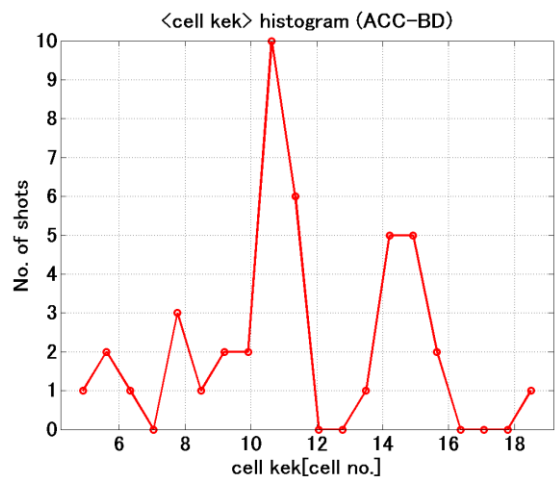


Where in the structure the breakdown happens?

51+52 BD position



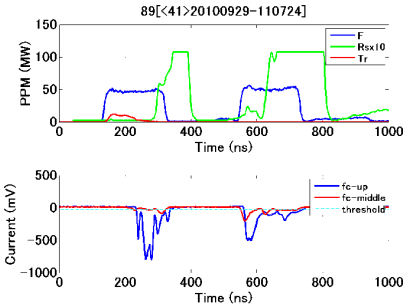
82 BD position

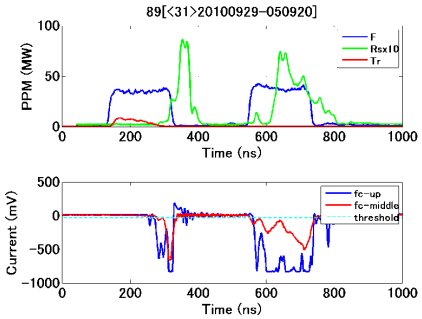


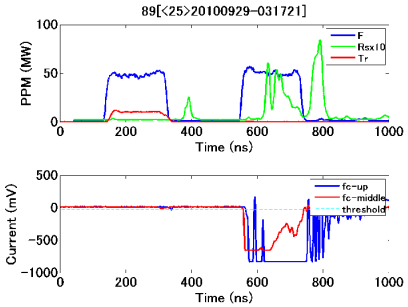
More to be confident.

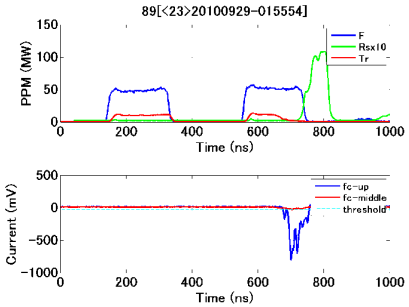
Duble pulse operation

200ns + 210ns + 200ns

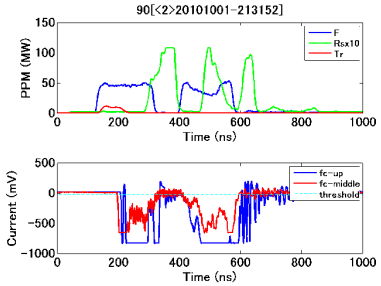


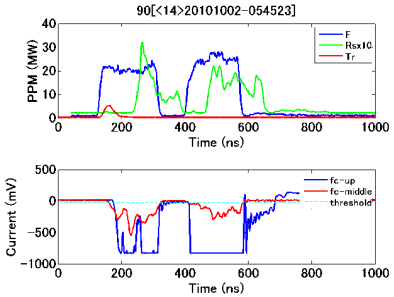


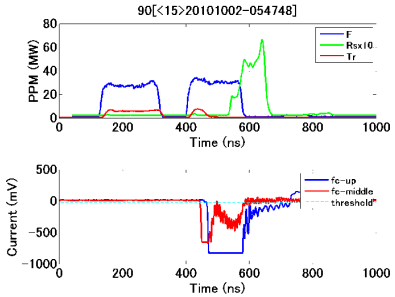


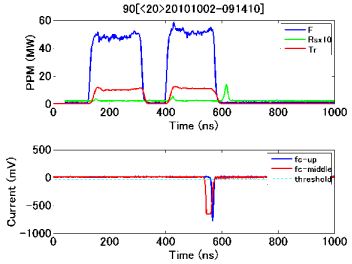


200ns + 50ns + 200ns

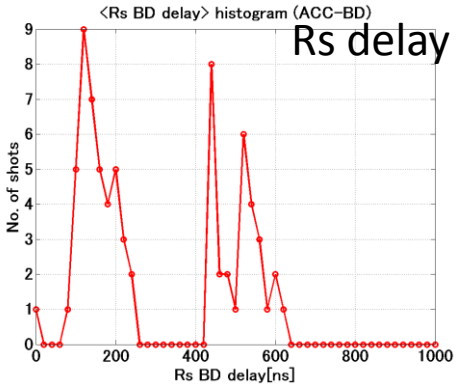


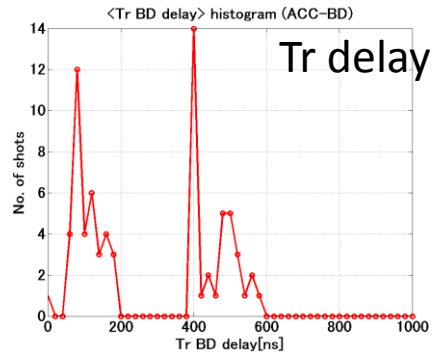


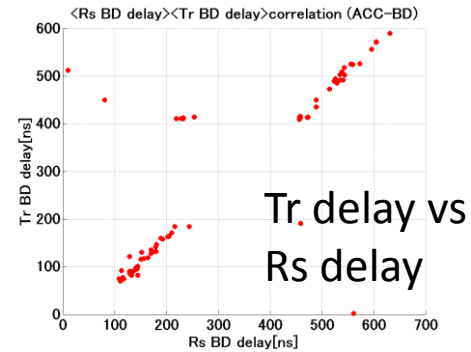


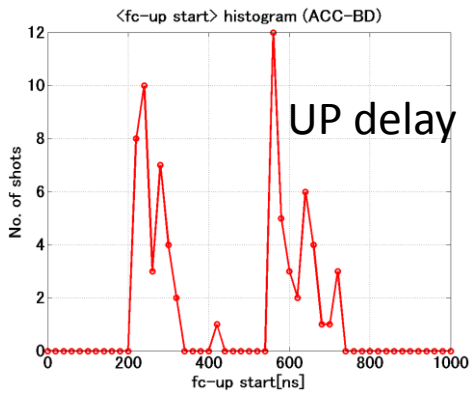


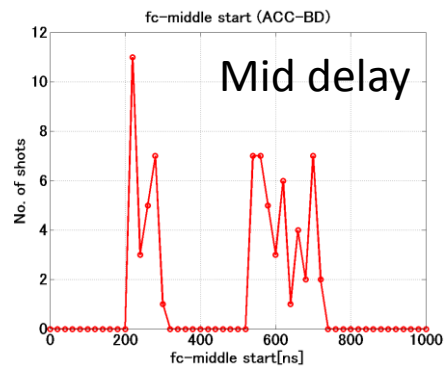
BD timings

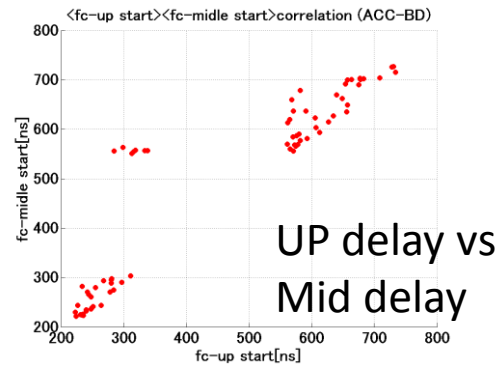


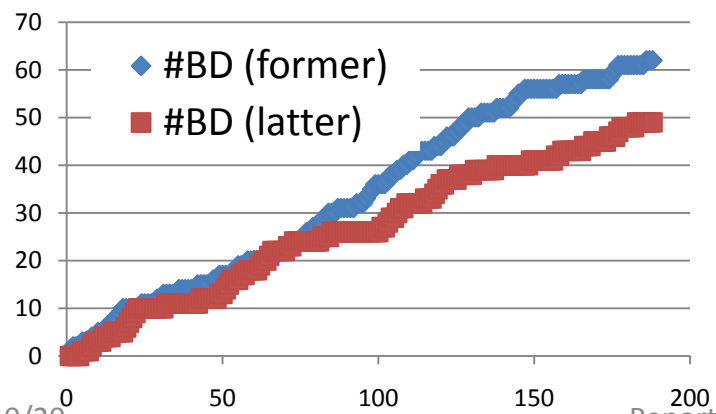








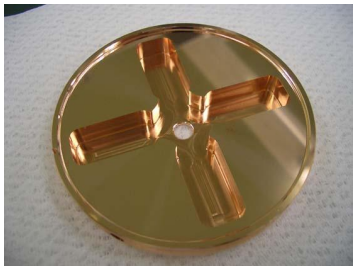




Equal probability for BD to happen in former/latter pulse.

Need better bonding quality!?

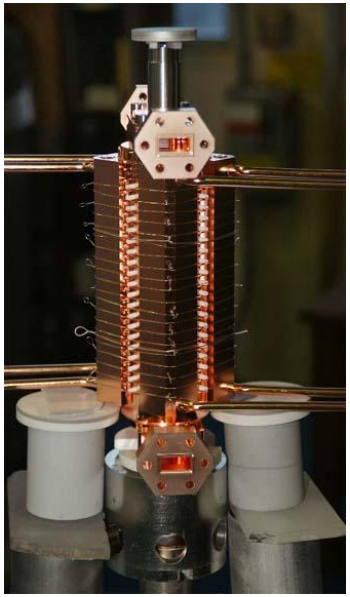
Machining



Diffusion bonding at high temperature

Need good flatness for the surface to deform within a finite bonding time at high temperature.

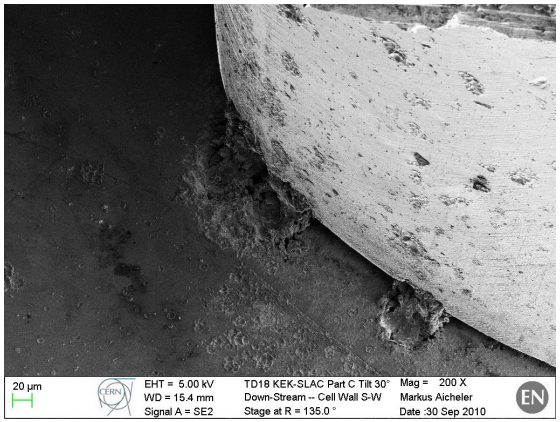
Brazing



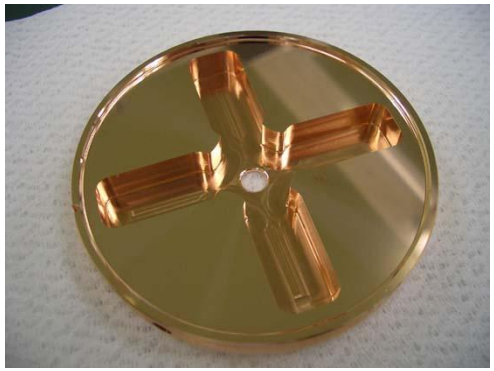
Vacuum baking.

Only for surface change. No bonding quality change.

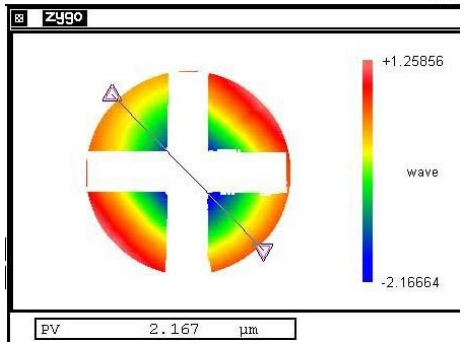
TD18_#3
After high gradient test
SEM taken at CERN
See a gap !?



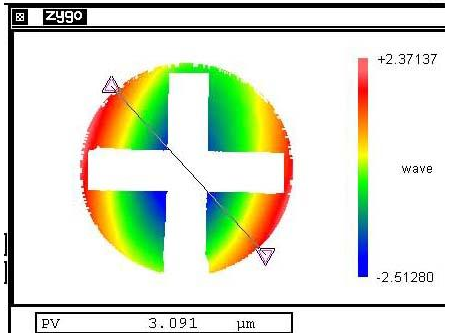
Flatness of cells for TD18_#2

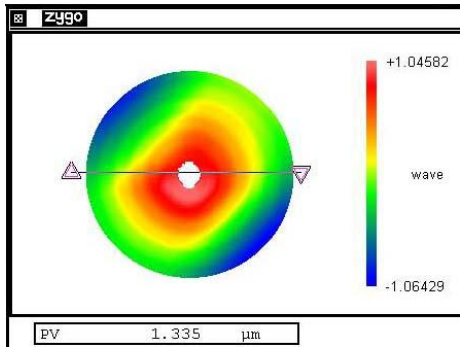


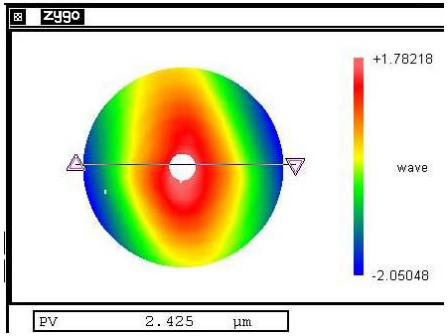
TD18_#2_15b



TD18_#2_09b_2







Even ~3 micron flatness was accepted as long as the opposite side was reversely deformed.

Judgment was done by estimating the residual flatness error to be less than 0.5 micron after sandwiching by flat plates.

Mostly potato chip type (right) but one or two cases the conical shape (left) was accepted.