# STATUS OF HIGH GRADIENT EXPERIMENTS AT NEXTEF

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*Abstract*

High-gradient studies have been in progress at Nextef (New X-band Test Facility at KEK) since 2006 [1]. This report presents the first high power tests of T18_VG2.4_DISK_#2 structure, the fabrication status of TD18_VG2.4_Quad_#5 and the high-power tests with narrow waveguides.

## T18_VG2.4_DISK #2 AT NEXTEF

T18_vg2.4_Disk structure has disk loaded 18 cells without HOM damping slots. It was developed in 2007-2008 in collaboration with CERN and SLAC. It was planned that four identical structures were made based on the same design and fabrication process. The high power test of structure #1 has been done at SLAC [3]. The second structure T18_VG2.4_Disk #2 has been processed in Nextef since last October. Steady state dark currents were evaluated at the Faraday cups (FC) at upstream and downstream of the beam line. The RF processing time reached up to approximately 2000 h, with breakdowns of about 2000 events. We firstly started to run up to 90 MV/m and we took the break down rate at 80MV/m. We found a lot of breakdowns at the initial processing stage. But the breakdown rate reached $10^{-6}$ order after 500 hours processing as shown in Figure 1. Now we are processing up to 110 MV/m and we are planning to take breakdown rate at 100 MV/m. The test results will be compared to that of #1 tested at SLAC to check the reproducibility of the structure performance.

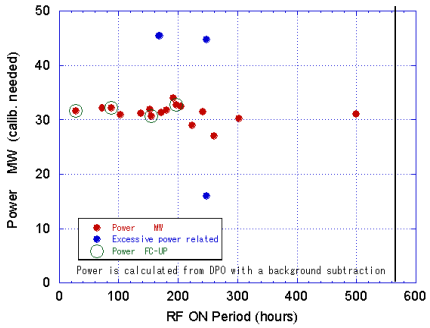


Figure 1: Power at BD's and BDR during 27 days at 80MV/m (35MW) level.

## TD18_VG2.4_QUAD_#5 AT KEK

One of the special CLIC accelerator designs is the choice of the quadrant as a constituent of the accelerator structures. The quadrant fabrication study is also one of our basic research activities. At first, we made a short (~10 cm) models with three cells in the middle through five different vendors. And then, reviewing the result of the above short model study, we decided to make a full quadrant based on the same technology but with more care on the dimensions of the longer object. we made a full structure with much care on the dimensions of the longer object. Fig.2 shows the structure TD18_VG2.4_QUAD_#5 and the results of measurements of S-parameters. We started test tuning and will install it in April for high-power testing.

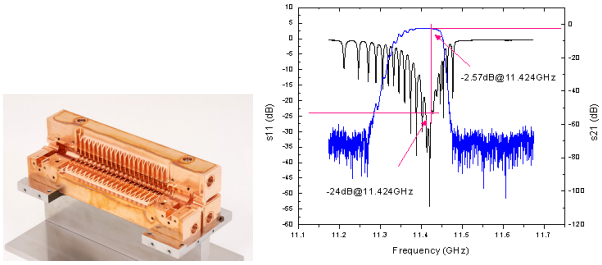


Figure 2: TD18_VG2.4_QUAD_#5 structure and S-parameter.

## NARROW WAVEGUIDE AT KT-1

To study the characteristics of different materials on high-field RF breakdown, we have performed high-gradient experiments by using a narrow waveguide that has a field of around 140 MV/m at 50 MW power [4]. The first high-gradient test was conducted by using a waveguide made of copper (CU002) at XTF, the old X-band Test Facility at KEK. The second high-gradient test has been conducted by using a stainless-steel waveguide (SUS003) at KT-1 station in Nextef. The result of second test showed that the stainless-steel waveguide had a better performance, namely fewer RF breakdowns to reach the same power level than the copper waveguide as shown in Fig.3. The comparison of the tests done at different facilities is not straightforward so that we are conducting a high-power test of another copper waveguide (CU005) now at KT-1.

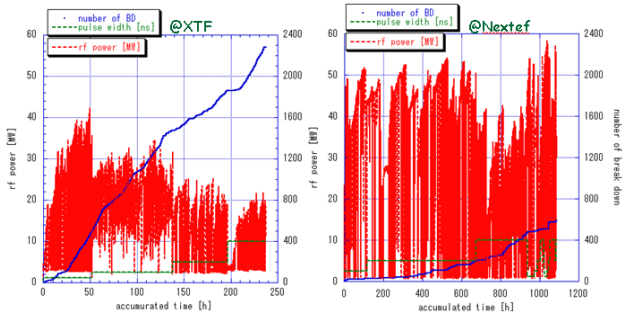


Figure 3: Processing history of CU002 and SUS003.

## ACKNOWLEDGEMENTS

Many of the works here are the outcomes of the collaboration with those who have been studying the X-band accelerator structures at CERN and SLAC.

## REFERENCES

[1] S. Matsumoto, "Update of KEK X-band activities", in this meeting.

[2] T. Higo, et. al., "FABRICATION OF A QUADRANT-TYPE ACCELERATOR STRUCTURE FOR CLIC", Proc. of EPAC08, Genoa, Italy, June 23-27, 2008, pp.2716-2718.

[3] Wang Faya, "Breakdown study of L-band SW and X-band CLIC structure", in this meeting.

[4] K. Yokoyama, et. al., "High-Gradient Experiments with Narrow Waveguides", Proc. of EPAC08, Genoa, Italy, June 23-27, 2008, pp.2758-2760.