

Engineering Perspectives on Quadrants (2)

CLIC09 Workshop

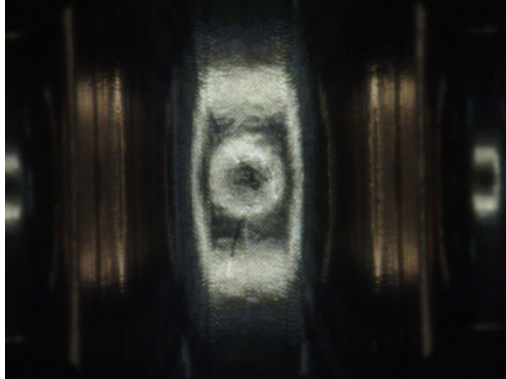
KEK

Y.Higashi

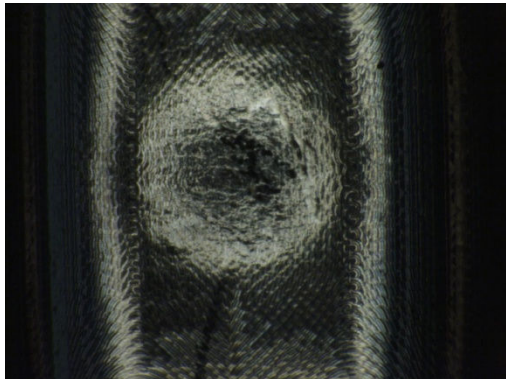
Contents

1. Dark current characteristics on the KEK quadrants structure experiment
2. Surface treatment for dark current/EFE mitigation
3. Material
4. FANUC Co. fabrication method proposal (tentative)
5. Assembly envelopments

Notice: Deformed cavity wall



Cell 3($\times 35$)



Cell 3($\times 100$)

Cell3 deformation : 0.053mm

2009/10/12

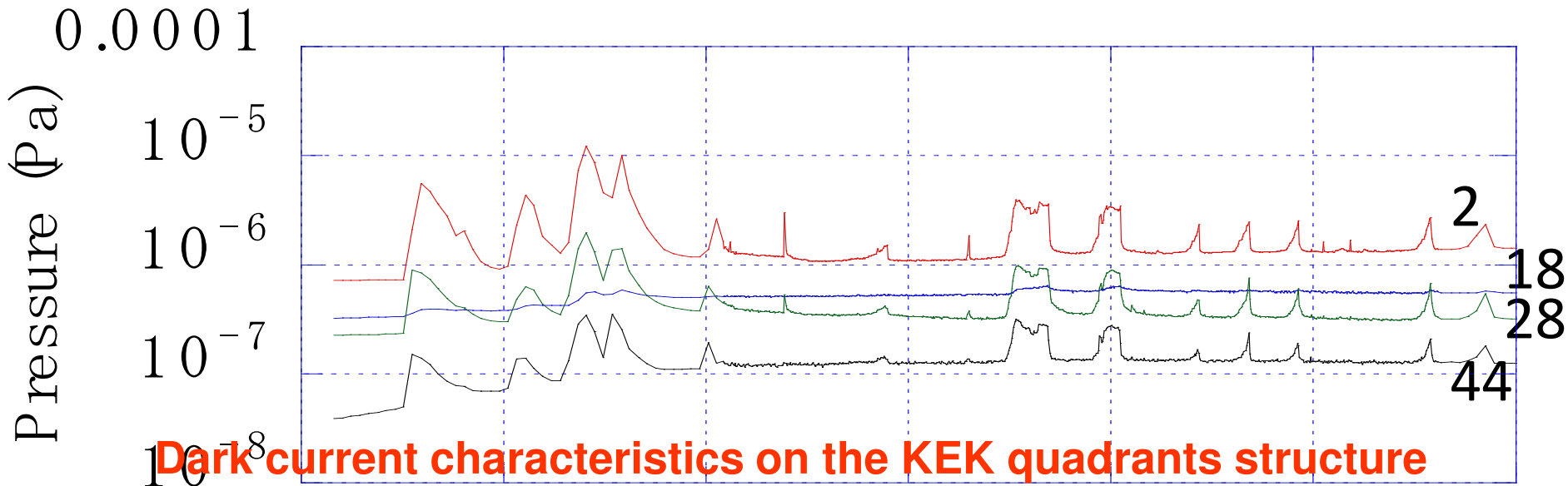
KEK's version: 50 micron chamfer



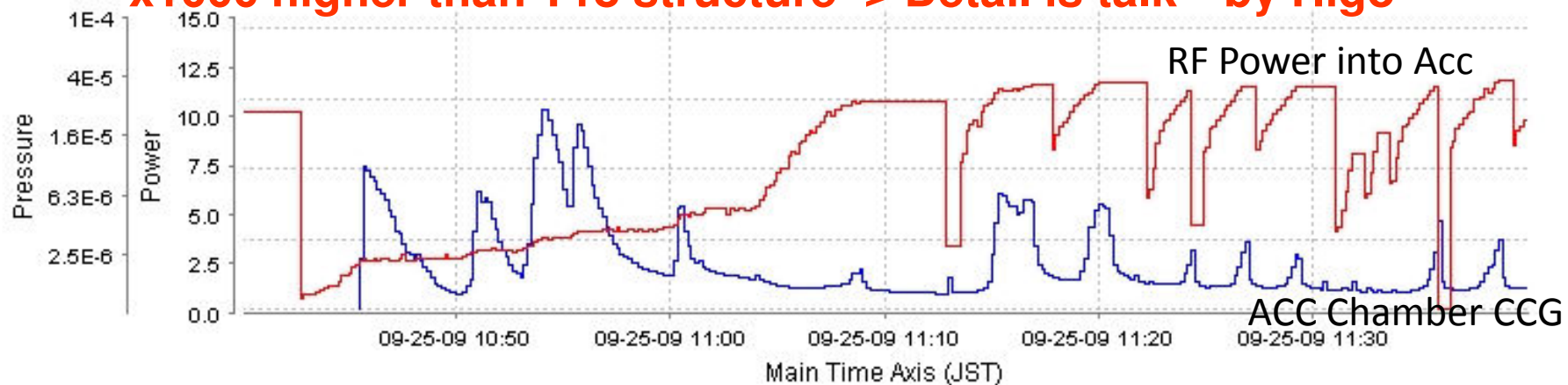
Roughness: ~ 5 micron order?

QMS (1) :RF Power and gases

Pressure of H₂ dominated. Pressure of water is inactive.



~x1000 higher than T18 structure -> Detail is talk by Higo



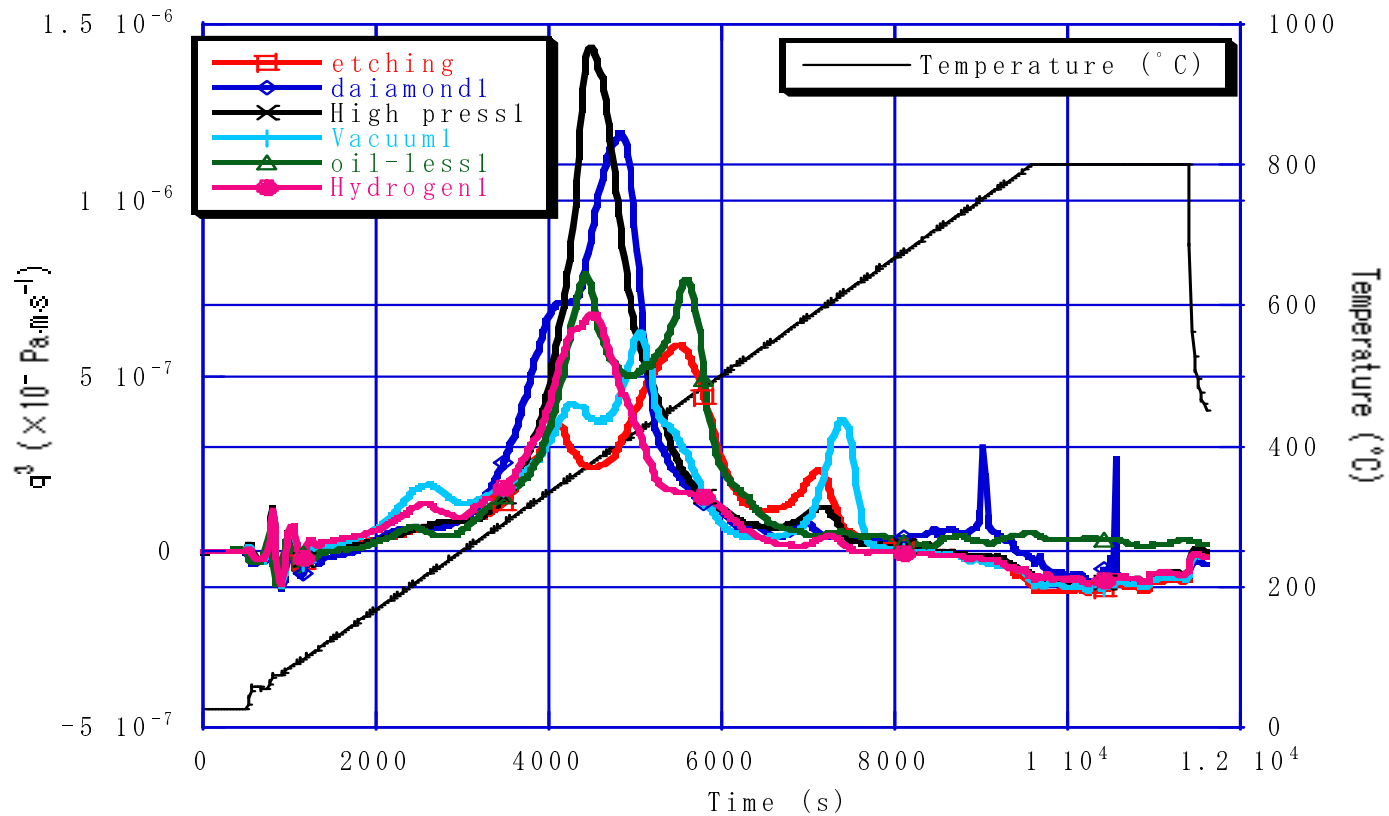
Enhanced Field Emission/Dark current

(Reference :J. Wang, G. loew)

These can be classified into various categories;

- (a) Metallic surface roughness due to imperfect machining, scratches, micro protrusions, “tip-on-tip” productions
- (b) Metallic dust, micro particles
- (c) Grain boundaries
- (d) Molten craters after breakdown
- (e) Dielectric impurities and layers
- (f) Absorbed gas
- (g) Metal-insulator-vacuum (MIV) or metal-insulator-metal (MIM) layers

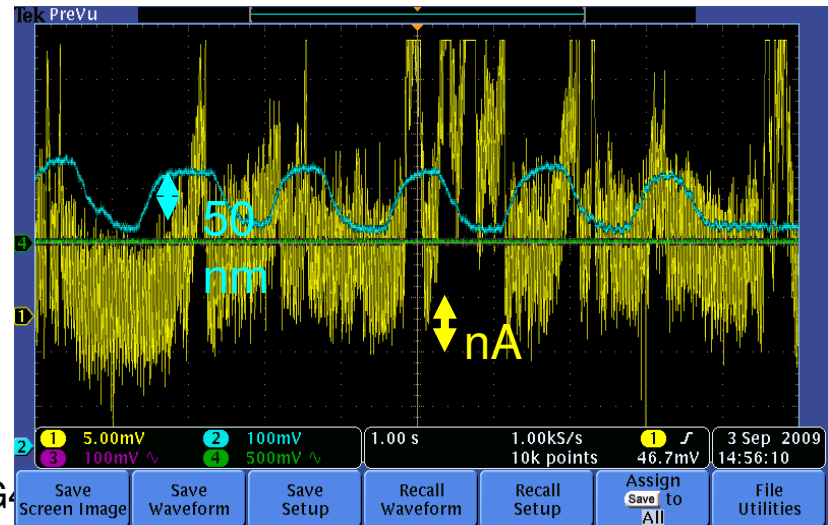
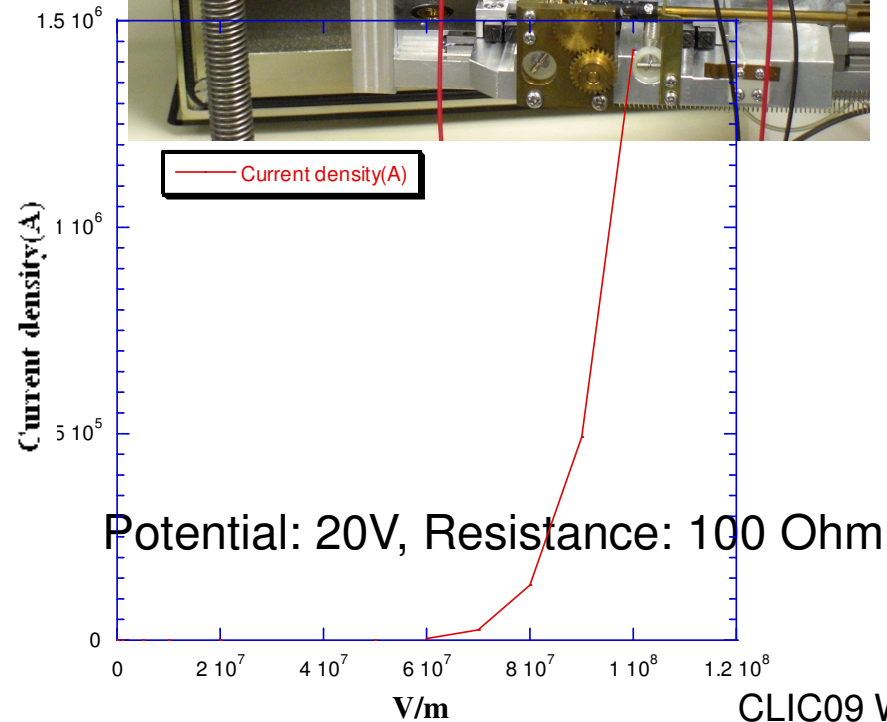
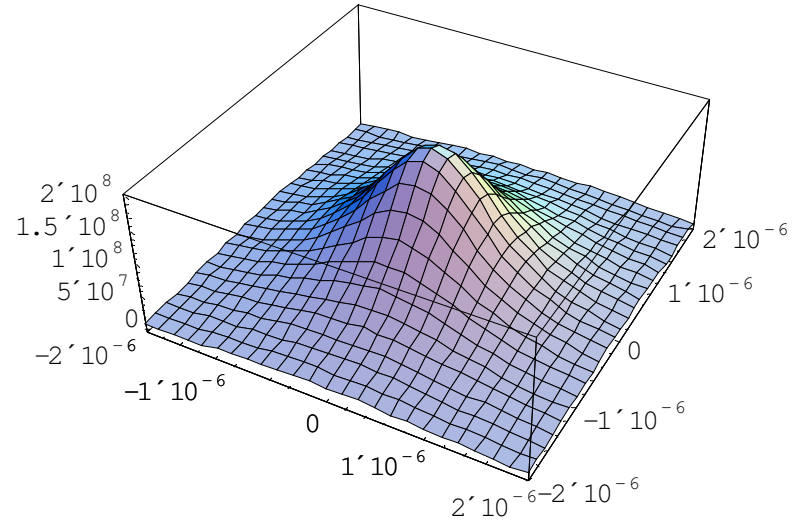
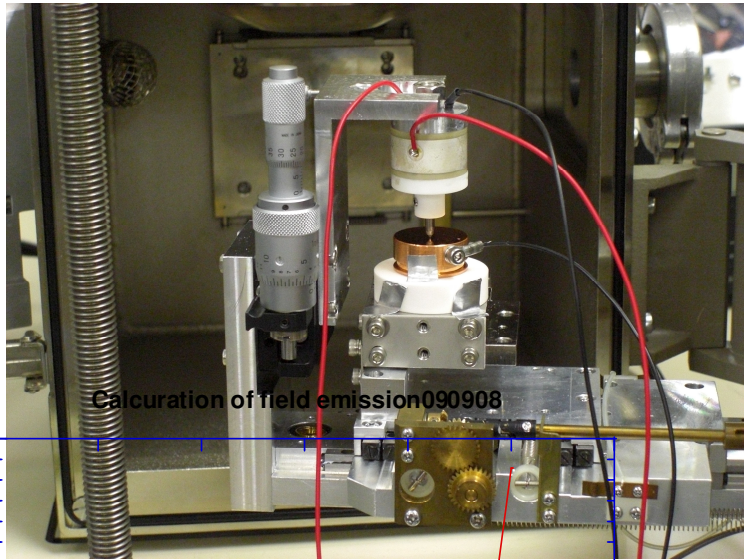
Surface treatment for dark current/EFE mitigation



Out gas characteristics on various treatment of OFC

Field Emission Microscope

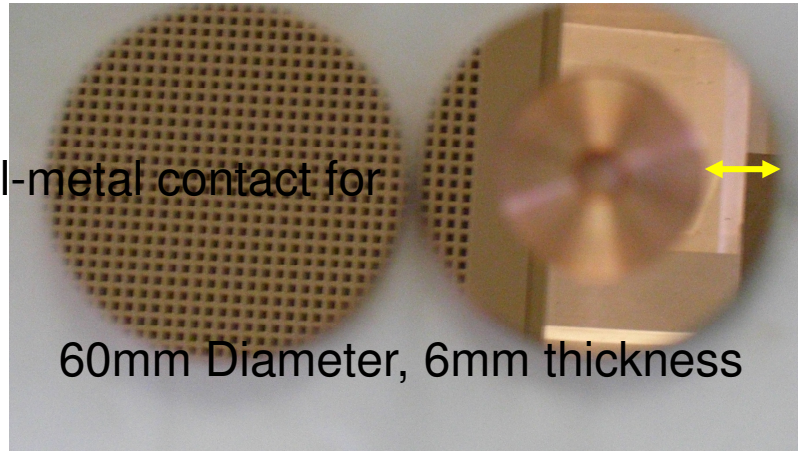
Check Grain boundaries, impurity, material defect, roughness



Ultra High-Precision Diamond Tuning Surface of Copper

Class1

Enough quality as metal-metal contact for Quadrants?

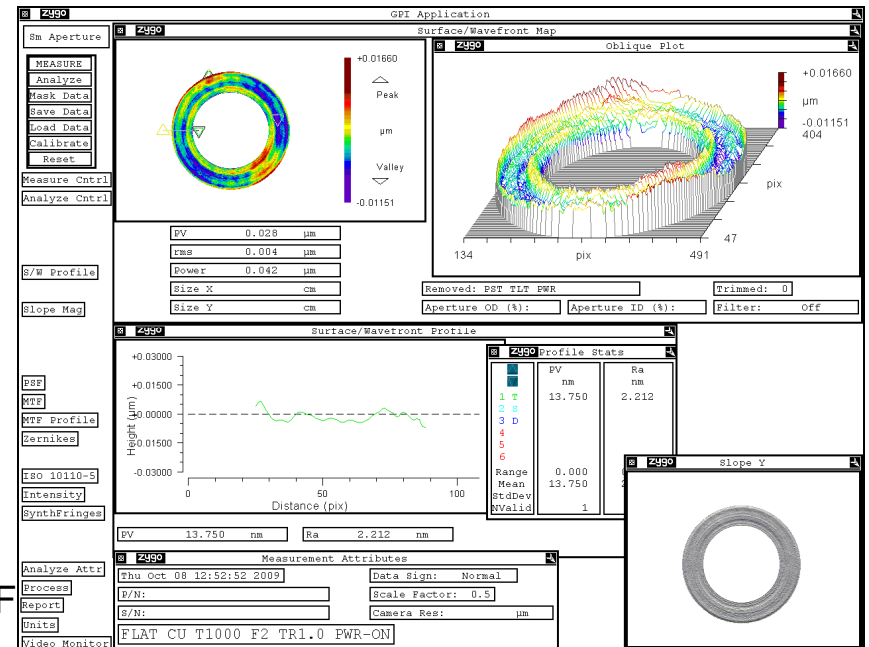
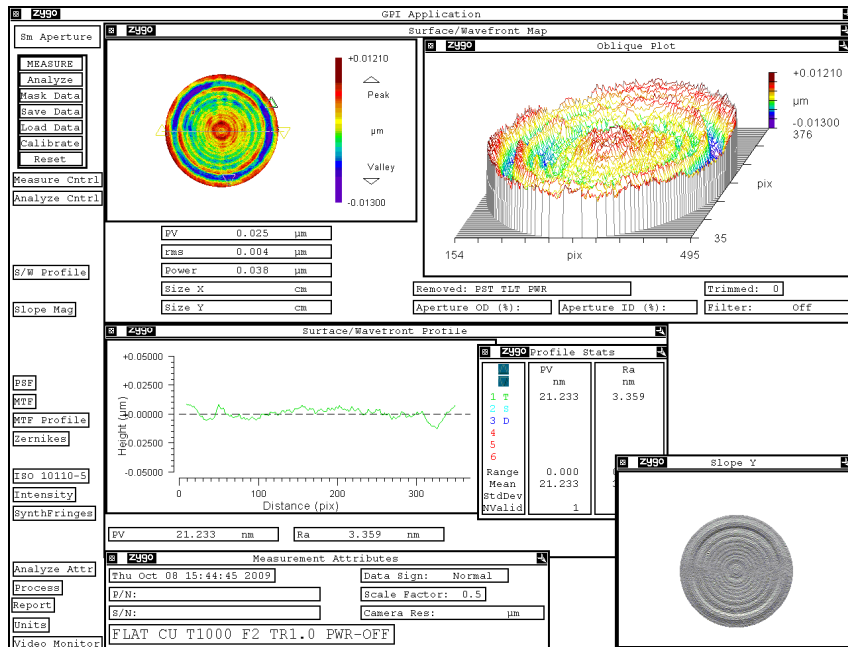


Contacted region
Inner diameter 35mm

60mm Diameter, 6mm thickness

PV: 21nm

PV: 13nm



WG4 RF

Roughness: 3.3nm (PV)

Microscope Application

20X Mirau

MEASURE

Analyze

Mask Data

Save Data

Load Data

Calibrate

Reset

Measure Cntrl

Analyze Cntrl

Stage Controls

Focus Controls

Sequence Controls

Test+Ref Ctrl

Surface Profile

Slope X Map

Slope Mag Map

Spectrum Map

Spectrum Profile

Intensity

Analyze Attr

Report

Process

Units

Video Monitor

Stage

zygo Surface Map

zygo Oblique Plot

PV	5.715	nm	Points	306915
rms	0.685	nm	Removed:	Cylinder
Ra	0.556	nm	Trimmed:	0
Size X	0.35	mm	Data Fill:	Off
Size Y	0.26	mm	Remove Spikes:	On

Filter: Off

Filter High Wavelen: mm

Filter Low Wavelen: mm

zygo Surface Profile

	PV	rms	Ra
1 T	3.312	0.496	0.395
2 S			
3 D			
4			
5			

Range 0.000 0.000 0.000

Mean 3.312

StdDev

NValid 1

zygo Profile Stats

PV	3.312	nm	Ra	0.395	nm
rms	0.000	μm			

zygo Slope Y Map

zygo Measure Attributes

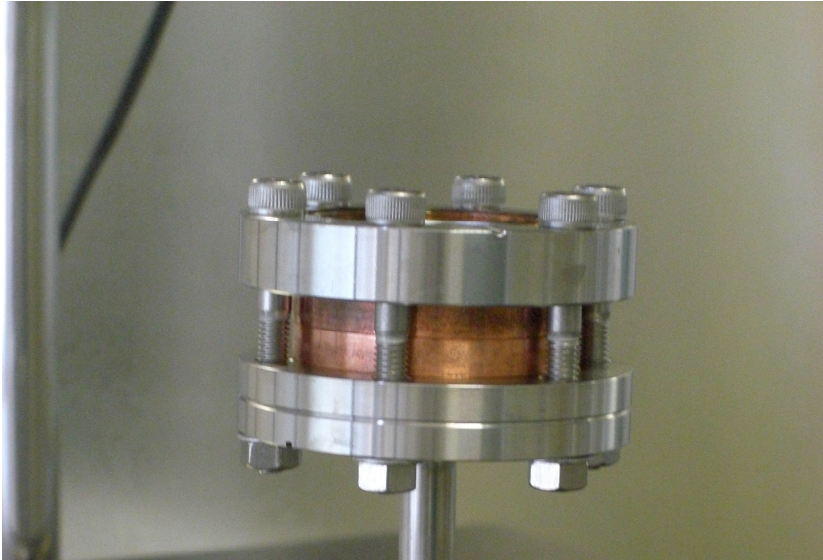
08/10/09:16:12:13

Image Zoom: 1X

KOU-ENE WORK1 FLAT T1000 F2 TOOL

Field enhancement occurs?

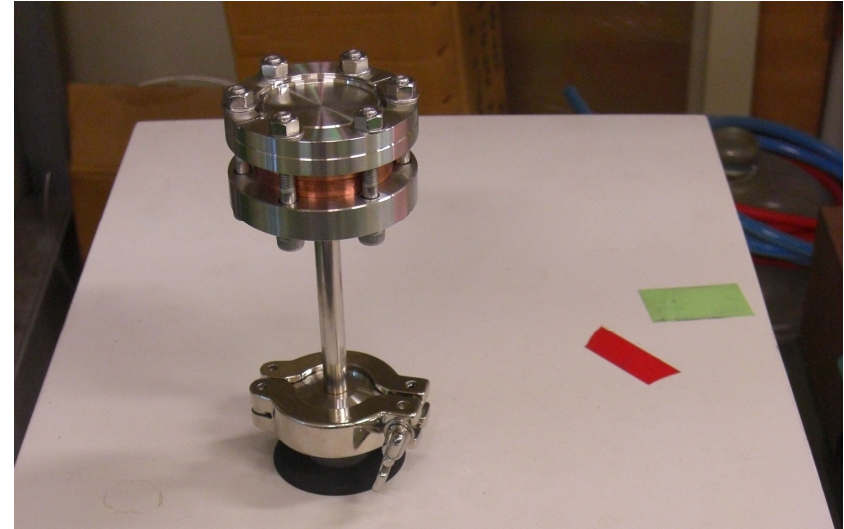
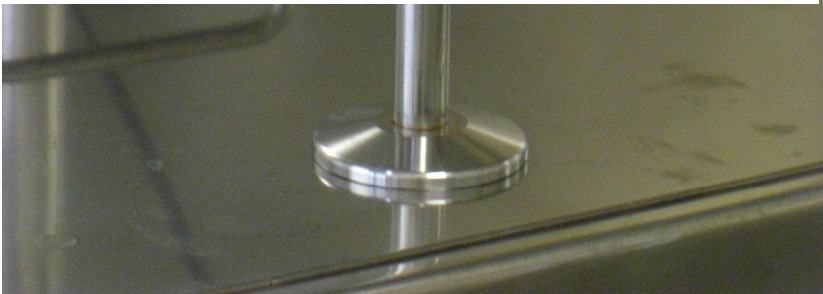
No vacuum leak was found



IP (Semicon grade) Rinse (50degC)

Degreasing

Assembly: Class 100



Leak rate: $< 1.7e-11 \text{ Pa} \cdot \text{m}^2 / \text{sec}$



RF S

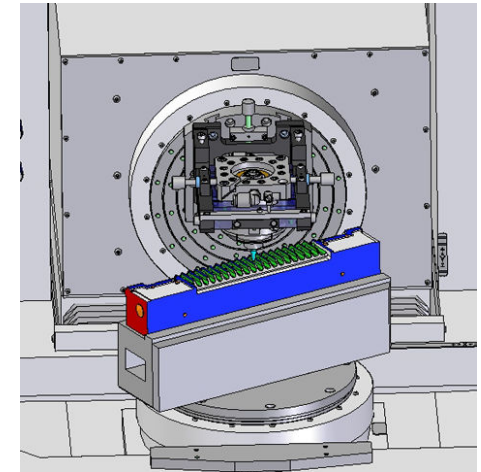
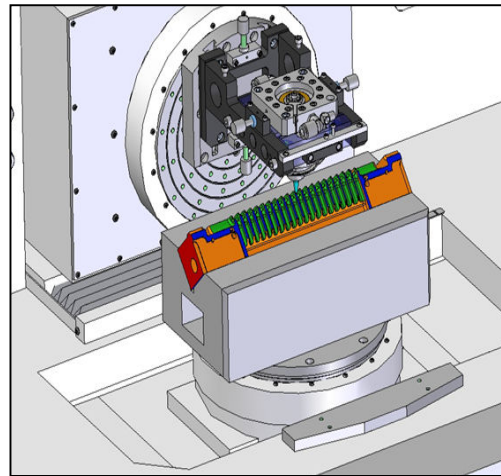
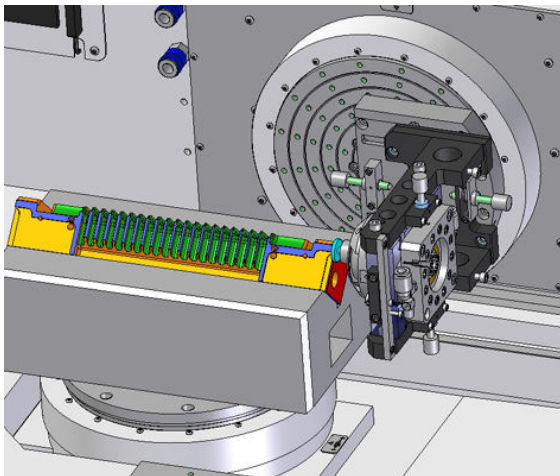
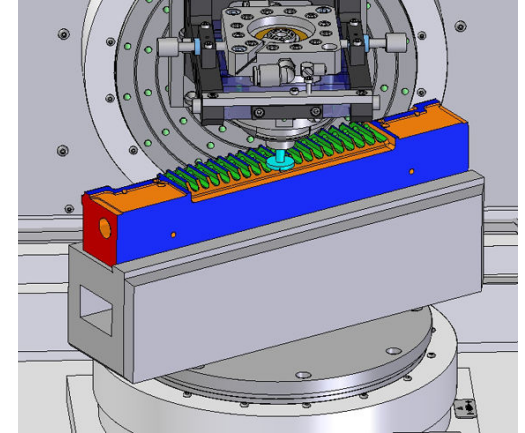
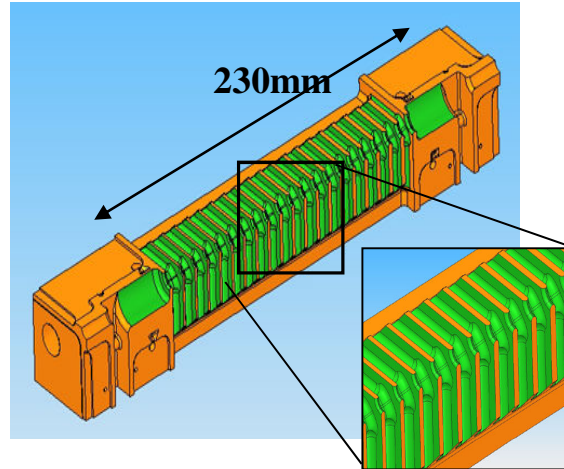
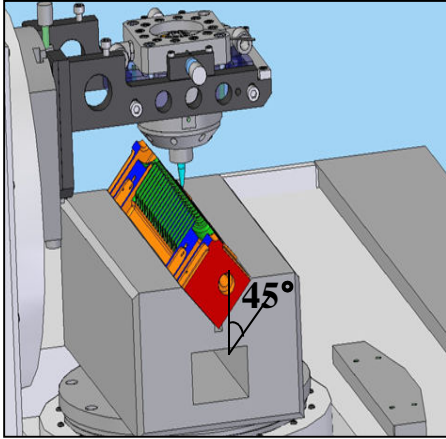
Surface Treatment for Quadrants

- Pre-machining (remain 100 μm)
- 650 degC annealing
- Final machining (same surface roughness to disk)
- Chemical Etching ($\sim 5 \mu\text{m}$)
- HPWR (remove burs, particle)
- Degreasing (remove particle and fine oxide layer)
- 150~200 degC baking in vacuum
- Assembly in the ILC grade clean room

Material

**Should be Considered High Gradient
Test Results of Single Cell SW Structures**


FANUC Co. fabrication method proposal (tentative)



CLIC09 WG4 RF Structure

Cost Estimation (very rough)

TD18 structure Unit is MYen

	Disk Type		Quadrants
Material			
Whole fabrication	2.5		2.8
Vacuum chamber	-		1.0
Surface treatment	0.5		0.3
Bonding (Assembly)	1.5		0.5
RF Tuning	0 (eventually)		0 (eventually)
Absorber			
Baking	0.5		0.5
Instauration			
Alignment			
Total			

Summary

1. One order more precise machining (roughness, dimension) technologies glowed up compare to NLC/GLC generation, So Quadrants is very attractive
2. 5000~7000 disks, 25~30 structures fabricated for NLC/GLC
3. In order to understand fabrication technologies for high gradient quadrants structures, may be needed 2~3 years

