



Discussion of Optical Inspection and Temperature mapping Results

- Several new inspection and mapping systems are online now
 - **Temperature mapping, 2nd sound**
 - **High-resolution optical inspection (KEK-Kyoto, Questar)**
- Need to get an overview of where similar problems have been observed
 - **Catalogue of defects observed**
 - **Measure the effectiveness of optical inspection**
- Several people from several institutes have contributed their data in a common format
 - **Thanks to K. Watanabe (KEK), R. Geng (JLab), C. Ginsburg (FNAL), Z. Conway (Cornell), S. Aderhold (DESY)**
 - **Thanks to all colleagues involved in the data taking**
- This is a work in progress and therefore not complete
 - **Further data will be added when available e.g. LANL just came in**



Short Overview of the Common Template

A51		NR1-2													
Cavity Information															
Cavity Name	Type of cavity	Cell shape	Material	Final surface treatment	High temperature heat	Remarks	Gradient [MV/m]	Q0							
1															
11															
12															
27															
28	STF BL#5	9-cell	TESLA (KEK)	Fine-grain	EP125um	600-800									
29	STF BL#6	9-cell	TESLA (KEK)	Fine-grain	EP125um	600-800									
30															
31	ERL-injector 2cell	other (please specify in remark)	TESLA (KEK)	Fine-grain	not yet (As received)			2cell cavity, MHI		Not yet					
32															
33	JLab														
34															
35	ICHIRO5	9-cell	Ichiro	Fine-gr											
36	AES4	9-cell	TESLA (EU and US)	Fine-gr											
37	A8	9-cell	TESLA (KEK)	Fine-gr											
38	A15	9-cell	TESLA (EU and US)	Fine-gr											
39	A12	9-cell	TESLA (EU and US)	Fine-gr											
40	A13	9-cell	TESLA (EU and US)	Fine-gr											
41	J2	9-cell	TESLA (EU and US)	Fine-gr											
42	J1	9-cell	TESLA (EU and US)	Fine-gr											
43	JL001	9-cell	TESLA (EU and US)	Fine-gr											
44	LG1	9-cell	TESLA (EU and US)	Large-g											
45	PKU9-1	9-cell	TESLA (EU and US)	Fine-gr											
46	HG006	other (please specify in remark)	other (please specify in	Fine-gr											
47	IA15	other (please specify in remark)	other (please specify in	Fine-gr											
48															
49	Cornell														
50															
51	NR1-2	1-cell	TESLA (EU and US)	Fine-gr											
52	NR1-3	1-cell	TESLA (EU and US)	Fine-gr											
53	NR1-5	1-cell	TESLA (EU and US)	Fine-gr											
54	NR1-6	1-cell	TESLA (EU and US)	Fine-gr											
55															
56															
57															
58															
59															
60															
61															

P35		NR1-2													
T-map Data										Optical Inspection Data					
Number of hot spots	Location	Comments	Date	Correlation with t-map	Size of defect at hot spot location [um]	Type of defect	Full weld inspection	Inspection outside weld area	# of defects						
1															
11															
12															
13															
14															
15															
16										Group of Spots, 10mm length along EBW seam	Bump				
17										Group of Spots, 15mm length along EBW seam	Bump				
18															
19						No T-map	12. Jun 08	no				yes	yes		
20	2	Cell 4	Stiffening ring area				10. Mrz 08	no	600	Bump	yes	yes	yes		
21		Cell 2	Stiffening ring area				10. Mrz 08	no							
22															
23															
24															
25	1	Cell 3	Equator HAZ				15. Okt 08	yes		diameter = 800 um, Height = ??? Over a measuring limit	Bump	yes	yes		
26	1	Cell 3	Equator HAZ			same location heating at 8-D	12. Nov 08	yes		diameter = 800 um, Height = about 50 um	Bump	no	yes		
27															
28															
29															
30															
31															
32															
33															
34															
35						its		no			other (please sp	no			
36						Stiffening ring area		no			Fit	no			
37						Equator weld		no			other (please sp	no			
38	1	Cell 3	Equator HAZ					yes		200-300 diameter	Fit	no			
39	1	Cell 7													
40						will T-map cells 6 based on inspection data						yes	yes		
41	2	Cell 1	Equator HAZ			T-mapping cell 6, 9 MV/m in P1 mode (md) gas									
42															
43								no			Fit				
44															
45		Cell 5													
46															
47															



Cavity and RF Data

- Cavity Information
 - Cavity Name
 - Type of cavity
 - Cell shape
 - Material
 - Final surface treatment
 - High temperature heat treatment
 - Remarks
- RF Result
 - Gradient [MV/m]
 - Q0 [10¹⁰]
 - Field emission Onset field [MV/m]
 - Limitation
 - Comment



Optical and T-map Data

- T-map Data
 - **Date**
 - **Type of T-map**
 - **Mode which was t-mapped**
 - **Number of hot spots**
 - **Location**
 - **Comments**
- Optical Inspection Data
 - **Date**
 - **Correlation with t-map**
 - **Size of defect at hot spot location [um]**
 - **Type of defect**
 - **Full weld inspection**
 - **Inspection outside weld area**
 - **# of defects**
 - # defects >500 um
 - # defects 200-500 um
 - # defects 100-200 um
 - # defects <100 um



Data Analysis

- This cannot be done immediately
 - **Should be careful to do interpretation correctly**
 - **Feedback with the Lab where data originates should be integrated**
- **Very preliminary first look**



Preliminary Summary

- Number of cavities inspected
 - **21** **nine-cells**
 - **4** **single-cells**
 - **3** **other**
- T-map **and** optical inspection available on
 - **13** **Cavities**
 - Other Cavities have
 - incoming inspection only
 - no t-mapping yet
- Correlation T-map – Optical inspection
 - **7** **Yes**
 - Various types of defects have been found
 - **3** **Field emission**
 - Scratches found in other locations
 - **3** **No direct match**
 - Still surface defects have been found
 - Partially additional surface treatment after last t-map



Next Steps

- Optical inspection has shown very good initial results
 - **Immediate improvement of production process e.g. Cornell new vendor single-cells**
 - **Local repair needs to be evaluated on cavities for effectiveness**
- Need to
 - **Continuously follow-up incoming data**
 - **Establish correlation between types of defects and RF performance**
 - **Follow up on the nature of defects on samples**
 - Geometrical features
 - Chemical composition
 - Other?