



Update on Global Cavity Database and Yield Evaluation

ILC Cavity Database Group:

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Presented by Kirk Yamamoto



Global Cavity Database Motivation and Goals

- Common data sample, well defined data cuts
 - Everyone uses the same data to make plots – a common denominator in yield calculations
 - Data cuts can be easily specified, and anyone could reproduce your results
- Data entry rules for reliable and reproducible results
 - All RF tests from the last couple of years are included; may be flagged for exclusion
 - Uniform criteria for data entry: only allowed values for as many as possible items
 - Define everything which might vary or have underlying subtleties, e.g., "LABX#1" might be a final surface treatment referenced as a well-defined recipe anyone can look up
 - No private/sensitive vendor data
 - Anything referred to in a comment field must be for information only, and not data selection purposes
 - Minimize effort required for compliance
 - Provide regular updates at predetermined times

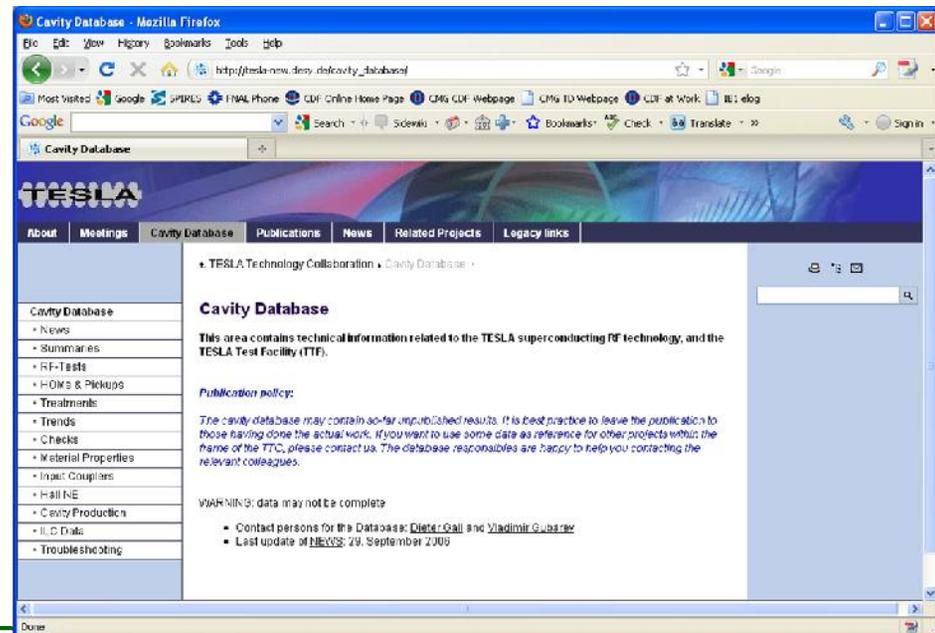


ILC Database tool now fully functional

- ILC Database tool was created by the DESY database group
 - DESY kindly agreed to provide limited support for inclusion of global data into their database
- All the participating labs have put their data into the ILC Database
- ILC Database is now fully functional
 - http://tesla-new.desy.de/cavity_database/

Click on “ILC Data”

Two choices: read-only (public) & edit (requires login)





ILC Database Screenshot

Cavity	Owner	Vendor	Arrival Date	Test No.	Last Surface Treatment	Removed Mater. [mu-m]	Last HT before Test	Test Date	Test Location	Max. Eacc [MV/m]	Qo @ Max. Eacc	Limitation	Eacc @ (100W/9) cell#	Included
AC115	DESY	ACCEL/RI	24.Apr.08	1	DESY#2	204	DESY-800C	11.Dec.07	DESY	38.6	1.1E+10	FE/quench		Yes
				2	DESY#2	253		01.Oct.08	DESY	36.9	1.3E+10	FE/quench		Yes
Z143	DESY	ZANON	03.Jan.08	1	DESY#2	163	DESY-800C	09.Oct.08	DESY	32.6	8.1E+09	FE/quench		Yes
				2	HPR only	263		12.Nov.08	DESY	41.0	1.1E+10	FE/quench		Yes
A9	Fermilab	ACCEL/RI	29.Jan.07	1	Cornell#1	220	JLab-600C	15.Aug.07	Cornell	26.0	7.0E+09	FE/quench		Yes
				2	Cornell#1	20		14.Sep.07	Cornell	26.0	2.0E+10	Quench		Yes
				3	Cornell#1	30		24.Dec.08	Cornell			other (please		No
				4	none	0		03.Feb.09	Cornell			other (please		No
				5	none	0		12.Mar.09	Cornell	26.0	6.0E+09	FE/quench		Yes
TB9ACCD13	Fermilab	ACCEL/RI	28.Nov.07	1	JLab#1		JLab-600C	01.Dec.08	JLab	41.8				Yes
				2	JLab#1			27.Mar.09	Fermilab	38.0		FE/quench		Yes
MHI005	KEK	MHI	29.Feb.08	1	KEK#1	175		05.Dec.08	KEK	27.3	3.7E+09	FE/quench		Yes
				2	KEK#1	225		26.Feb.09	KEK	19.7	1.2E+10	FE/quench		Yes
				3	KEK#1	245		17.Apr.09	KEK	27.1	7.5E+09	FE/quench		Yes

Cavity remark: more improved in EBW procedure than MHI#1 - #4 cavities

Test result: Mode measurement: Max Eacc = 36MV/m at cell 1 and 9, 32MV/m at cell 2 and 8, 34MV/m at cell 3, 4, 6 and 7, 31MV/m at cell 5. T-mapping: cell 5 at pi and 3pi/9, cell 1 and 9 at 4pi/9.

Remark: Optical inspection: No correlation between heating location and several pits. EBW seam around heating location was not good.

Accept remark:

For those who have used the DESY database, this will look and feel very familiar



ILC Database: Selected Features (1)

Order and select cavities by features

Cavity Information					RF Test Information											
Cavity	Owner	Vendor	Arrival Date	Bulk Surface removal technique	Test No.	Last Surface Treatment	Removed Mater. [mu-m]	Last HT before Test	Test Date	Test Location	Max. Eacc [MV/m]	Qo @ Max. Eacc	Limitation	Eacc @ (100V/9) cell#	Included	Statistics
					7	none	327		17.Mar.08	DESY	17.5	1.5E+09	Field emission		Yes	
					10	HPR only	375		14.Jan.09	DESY	42.4	6.0E+09	FE/quench		Yes	
					11	HPR only	375		18.Jun.09	DESY	41.0	1.0E+10	FE/quench		Yes	
AC113	DESY	ACCEL/RI	28.Jul.06	DESY bulk BCP	3	DESY#1	140		21.Mar.07	DESY	27.3	1.7E+10	Quench		Yes	
					4	DESY#4	188		07.Feb.08	DESY	36.8	6.5E+09	Field emiss		Yes	
AC114	DESY	ACCEL/RI	10.May.06	DESY bulk BCP	2	DESY#1	140		08.Mar.07	DESY	26.8	1.5E+10	Quench		Yes	
					3	DESY#4	236		03.Dec.07	DESY	14.1	1.6E+10	Quench		Yes	
					4	none	236		06.Dec.07	DESY	13.7	1.6E+10	Quench		Yes	
					5	HPR only	236		23.Jan.09	DESY	14.1	1.5E+10	Quench		Yes	
AC115	DESY	ACCEL/RI	24.Apr.08	DESY bulk EP	1	DESY#2	204	DESY-800C	11.Dec.07	DESY	38.9	1.1E+10	FE/quench		Yes	
					2	DESY#2	253		01.Oct.08	DESY	36.9	1.3E+10	FE/quench		Yes	
AC116	DESY	ACCEL/RI	25.May.07	ACCEL bulk EP	1	DESY#5	150	DESY-800C	22.Feb.08	DESY	26.7	6.4E+09	FE/quench		Yes	
AC117	DESY	ACCEL/RI	28.Feb.07	DESY bulk EP	1	DESY#5	163	DESY-800C	19.Jul.07	DESY	21.6	6.1E+09	Field emission		Yes	
					2	none	163		26.Jul.07	DESY	23.3	1.2E+10	Field emission		Yes	
					3	HPR only	163		27.Aug.07	DESY	31.5	1.1E+10	Field emission		Yes	

Extract data in ASCII format and use your private spreadsheet

Make the standard first-pass yield plot defined by ILC DB group,
or make a plot using your own selection



ILC Database: Selected Features (2)

The screenshot shows the 'CW-Test Results for ILC Cavities' application. The main window displays a table with columns for Cavity, Owner, Vendor, Arrival Date, Bulk Surface removal technique, Test No., Last Surface Treatment, Removed Mater. [mu-m], Last HT before Test, Test Date, Test Location, Max. Eacc [MV/m], Qo @ Max. Eacc, Limitation, Eacc @ (100V/9) cell#, Included, and Statistics. Two dialog boxes are open: 'DESY#2' and 'FE/quench'. Red circles highlight 'DESY#2' and 'FE/quench' in the table, with red arrows pointing to the dialog boxes.

Cavity	Owner	Vendor	Arrival Date	Bulk Surface removal technique	Test No.	Last Surface Treatment	Removed Mater. [mu-m]	Last HT before Test	Test Date	Test Location	Max. Eacc [MV/m]	Qo @ Max. Eacc	Limitation	Eacc @ (100V/9) cell#	Included	Statistics
					7	none	327		17.Mar.08	DESY	17.5	1.5E+09	Field emission		Yes	<input type="checkbox"/>
					10	HPR only	375		14.Jan.09	DESY	42.4	6.8E+09	FE/quench		Yes	<input type="checkbox"/>
					11	HPR only	375		18.Jun.09	DESY	41.0	1.0E+10	FE/quench		Yes	<input type="checkbox"/>
AC113	DESY	ACCEL/RI	28.Jul.06	DESY bulk BCP	3	DESY#1	140		21.Mar.07	DESY	27.3	1.7E+10	Quench		Yes	<input type="checkbox"/>
					4	DESY#4	188		07.Feb.08	DESY	36.8	6.5E+09	Field emiss		Yes	<input type="checkbox"/>
AC114	DESY	ACCEL/RI	10.May.06	DESY bulk BCP	2	DESY#1	140		08.Mar.07	DESY	26.8	1.6E+10	Quench		Yes	<input type="checkbox"/>
					3	DESY#4	236		03.Dec.07	DESY	14.1	1.6E+10	Quench		Yes	<input type="checkbox"/>
					4	none	236		06.Dec.07	DESY	13.7	1.6E+10	Quench		Yes	<input type="checkbox"/>
					5	HPR only	236		23.Jan.09	DESY	14.1	1.5E+10	Quench		Yes	<input type="checkbox"/>
AC115	DESY	ACCEL/RI	24.Apr.08	DESY bulk EP	1	DESY#2	204	DESY-800C	11.Dec.07	DESY	38.6	1.1E+10	FE/quench		Yes	<input checked="" type="checkbox"/>
					2	DESY#2	253		01.Oct.08	DESY	36.9	1.3E+10	FE/quench		Yes	<input type="checkbox"/>
25.May.07		ACCEL bulk EP			1	DESY#5	150	DESY-800C	22.Feb.08	DESY	36.7	6.4E+09	FE/quench		Yes	<input type="checkbox"/>
28.Feb.07		DESY bulk EP			1	DESY#5	163	DESY-800C	19.Jul.07	DESY	21.6	6.1E+09	Field emission		Yes	<input type="checkbox"/>
					2	none	163		26.Jul.07	DESY	23.3	1.2E+10	Field emission		Yes	<input type="checkbox"/>
					3	HPR only	163		27.Aug.07	DESY	31.5	1.1E+10	Field emission		Yes	<input type="checkbox"/>

DESY#2

- cleaning
- electropolishing (48 um)
- HPR
- ethanol rinse
- clean room assembly
- tank welding
- clean room assembly
- 6 x HPR
- 120C baking for 48h

FE/quench

Test ends in quench, accompanied by significant field emission. You may of may not think that field emission caused the quench.

Click on an item to bring up a dialog box explaining definition



ILC Database Status/Plans

- All baseline requirements have been implemented by the DESY DB group
- A few fine-tuning items are still under discussion, to be implemented as time is available, e.g.,
 - How best to incorporate inevitable changes to the logic for standard plots
 - Implement more standard plots, etc.
- All cavity yield plots in the rest of this talk use data extracted from the ILC Database



LCWS2010 Cavity Yield Dataset

- ILC Database currently contains data from all three regions, from the last few years [92 cavities]
 - KEK [5 cavities]: [MHI005:MHI009]
 - JLab, Cornell, Fermilab [22 cavities]: [A5: A9], [TB9ACC010:TB9ACC017], [AES001:AES004], [TB9AES005:TB9AES010], JLAB-2
 - DESY [65 cavities]: [Z82:Z110], [AC112:AC129], [Z130:Z135,Z137:Z145], [AC147,AC149,AC150] (Production 4,5,6,7)

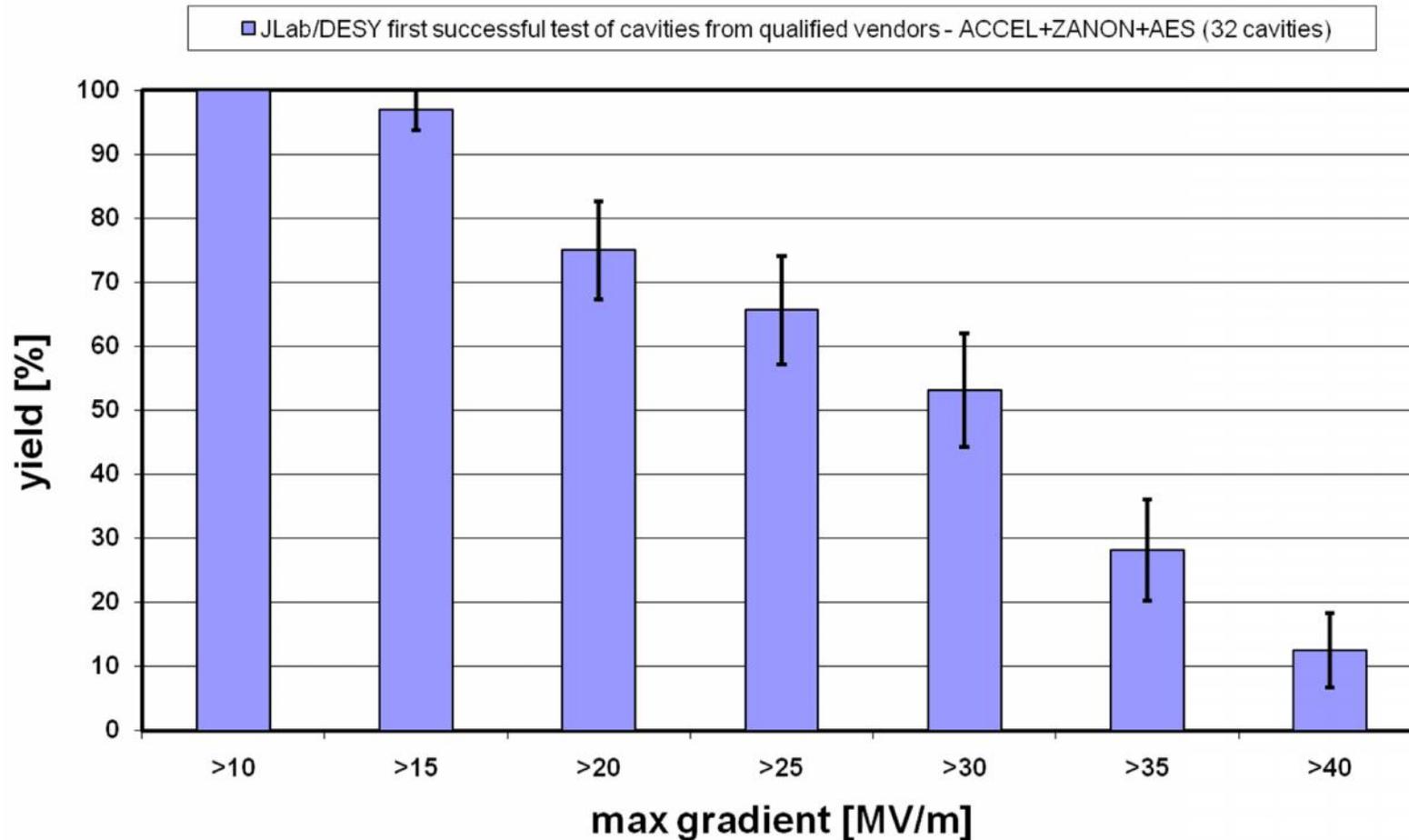


“Qualified-Vendor” Production Yield Plot (First Pass) - Definition

- **ILC Database 26.Mar.2010**
- **Cuts**
 - **Cavity from qualified vendor= ACCEL or ZANON or (AES SN \geq 5)**
 - **Fine-grain cavity**
 - **Use the first successful (= no system problem/limitation) test**
 - **Standard EP processing: no BCP, no experimental processes**
 - **Defined as JLab#1, DESY#2 (weld tank before test), DESY #4 (weld tank after test)**
 - **Ethanol rinse and 120C bake required for DESY cavities**
 - **(Ignore test limitation)**
- **Also known as “first-pass”**
- **Include binomial errors**

"Qualified-Vendor" Production Yield Plot (First Pass)

Electropolished 9-cell cavities



First-pass cavity yield at >25 MV/m is (66 ± 8) %

>35 MV/m is (28 ± 8) %

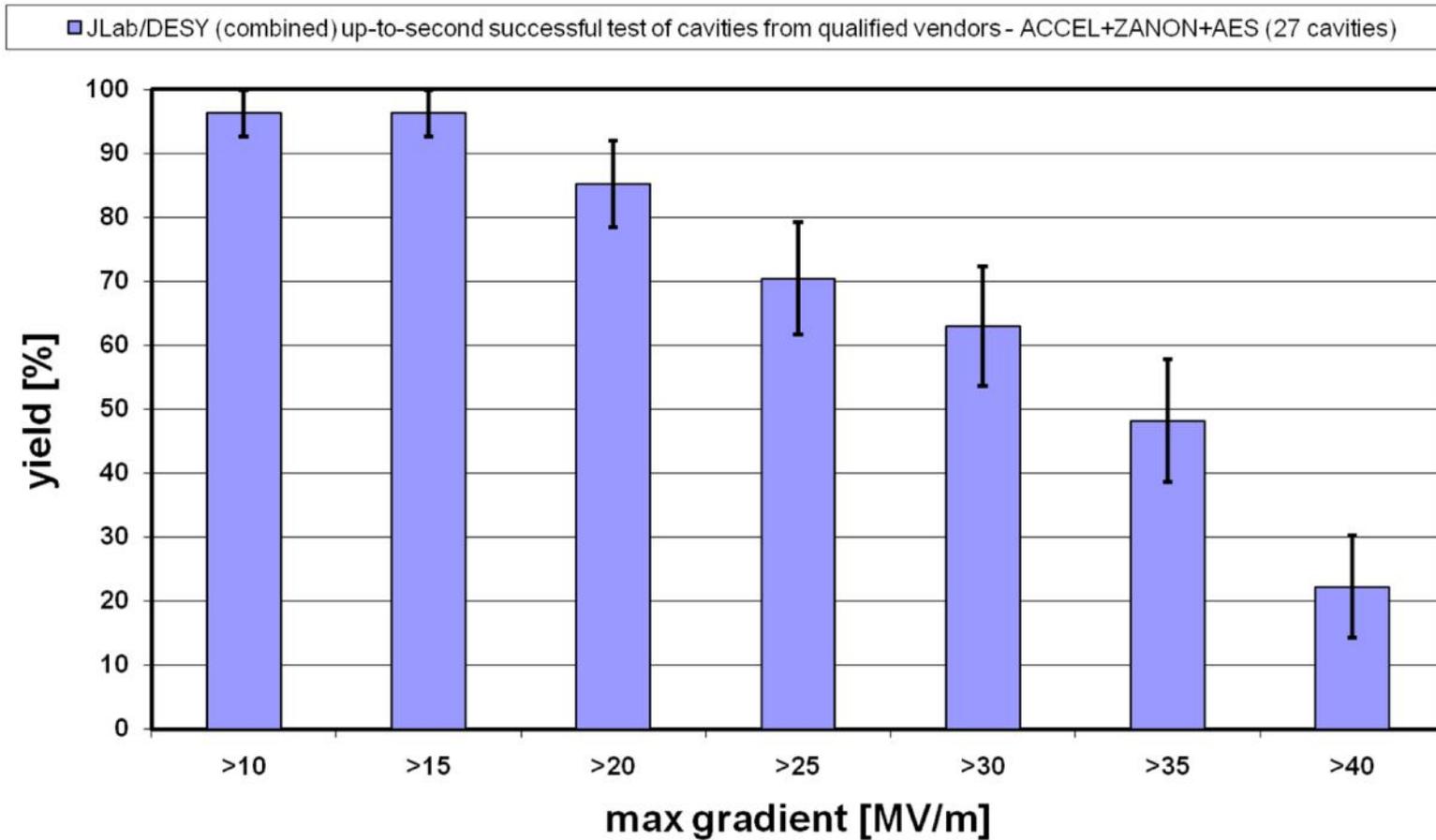
ILC Up-to-second-pass" Production Yield Plot (qual. vendor) - Definition

- ILC Database 26.Mar.2010
- Cuts
 - Cavity from qualified vendor: ACCEL or ZANON or (AES SN \geq 5)
 - Fine-grain cavity
 - Use the first successful (= no system problem) test
 - Standard EP processing: no BCP, no experimental processes
 - Defined as JLab#1, DESY#2 (weld tank before test), DESY #4 (weld tank after test)
 - (Ignore test limitation)
 - Second pass
 - if (Eacc(1st successful test) $<$ 35 MV/m) then
 - if (2nd successful test exists) then
 - » plot 2nd test gradient
 - else
 - » plot nothing [assume 2nd test didn't happen yet]
 - endif
 - else
 - plot 1st successful test gradient
 - endif
- Include binomial errors



“Qualified vendor” Up-to-Second Pass Yield

Electropolished 9-cell cavities

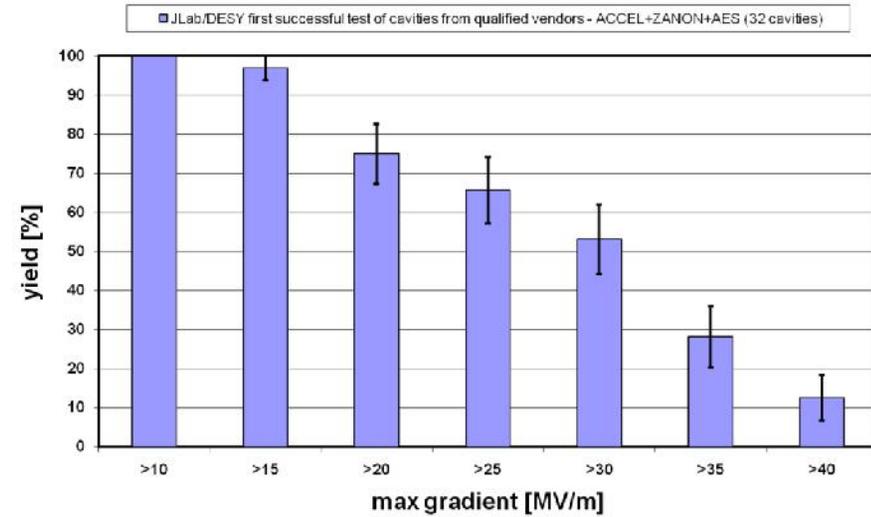


Up-to-second-pass cavity yield at >25 MV/m is (70 +- 9) %

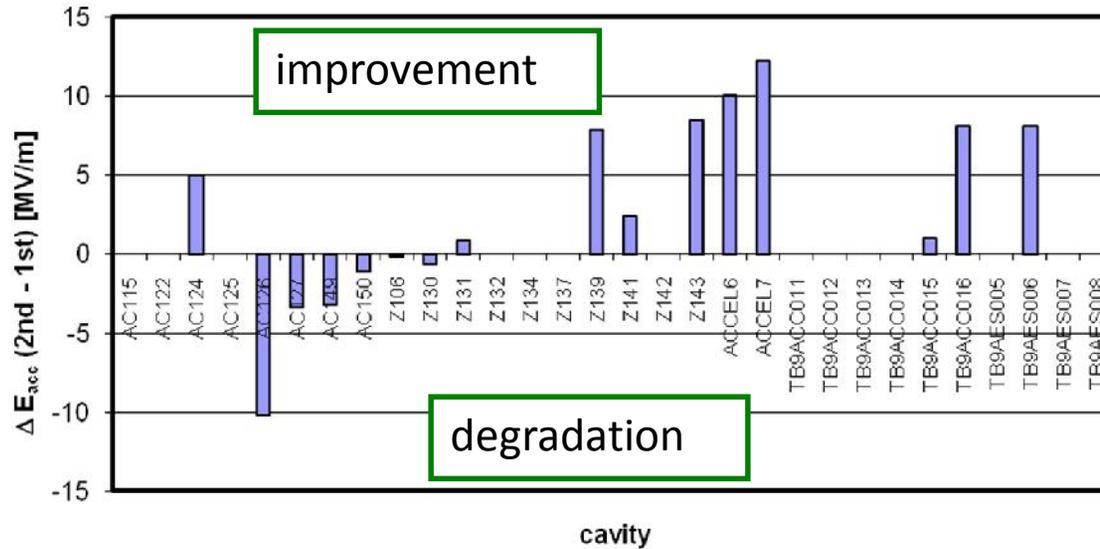
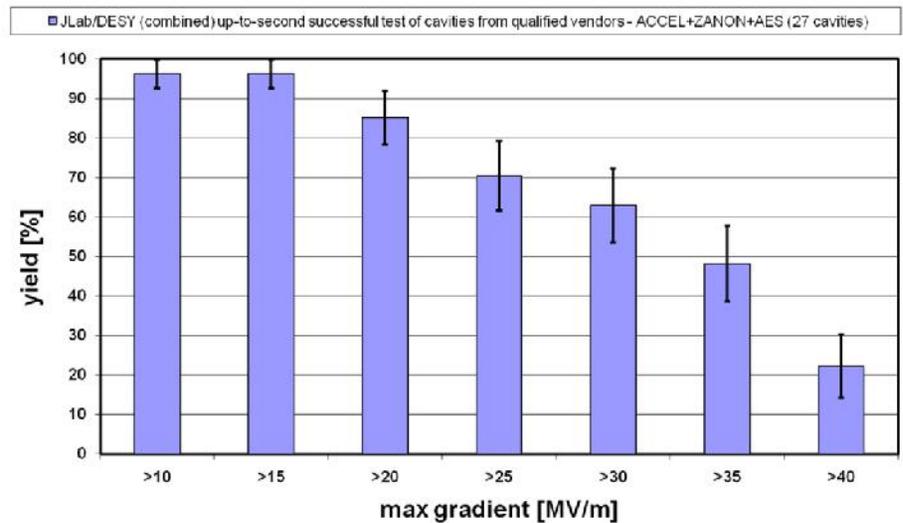
>35 MV/m is (48 +- 10) %

Compare 1st and 2nd pass yields

Electropolished 9-cell cavities



Electropolished 9-cell cavities





Yield as a Function of Time (one way of looking at it...)

	yield for [%]			
	>25 MV/m		>35 MV/m	
	1st pass	2nd pass	1st pass	2nd pass
ALCPG-Albuquerque 1.Oct.2009	63+-10	67+-10	23+-9	33+-10
AAP-Oxford 6.Jan.2010	63+-9	64+-10	27+-8	44+-10
LCWS-Beijing 28.Mar.2010	66+-8	70+-9	28+-8	48+-10

NB: errors are very strongly correlated

Within the very limited additional statistics accumulated over the last six months there appears to be improvement in the yield



Summary

- ILC Database now fully functional and available for use
- Updated yield plots were shown
 - First-pass cavity yield at >25 MV/m is (66 ± 8) %
 - >35 MV/m is (28 ± 8) %
 - Up-to-second-pass cavity yield at >25 MV/m is (70 ± 9) %
 - >35 MV/m is (48 ± 10) %
- We will continue to update the ILC database as we have more cavity tests, and systematically update the cavity yield data