Global Cavity Database Report

C.M. Ginsburg (Fermilab)

On behalf of the database group (as part of S0 effort):

Rongli Geng (S0 leader, JLab), Sebastian Aderhold (DESY), Kirk Yamamoto (KEK), Zack Conway (Cornell)

July 31, 2009

Database Implementation: Current Status

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- For now, this is an Excel spreadsheet, containing data from all three regions, from the last few years
  - KEK [5 cavities]: [MHI005:MHI009]
  - JLab, Cornell, Fermilab [18 cavities]: [A5: A9], [TB9ACC010:TB9ACC015], [AES1:AES004], [TB9AES005:TB9AES006], JLAB-2
  - DESY [39 cavities]: [AC112:AC129], [Z130:Z145], [AC146:150]

    (Production batches 5, 6, &7 are represented)
- Plan to use the DESY database, to store all the data together
  - ✓DESY kindly agrees to contribute limited effort to this task at the level of putting spreadsheet data into their database
    - Data uploading method/tool and web interfaces are TBD
  - ✓Cornell group agrees
  - ✓KEK group agrees
  - ✓Fermilab group agrees
  - ✓JLab group agrees

Example first plot: Production yield

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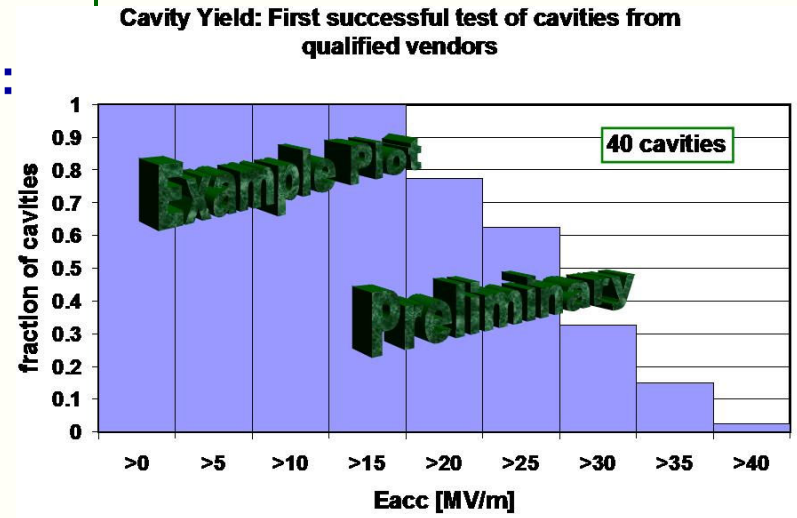
- Vertical axis: fraction of cavities satisfying criteria
  - Denominator (logical and of the following):
    - Qualified vendors (ACCEL and ZANON)
    - Delivered to labs within last 2-3 years
  - Numerator (logical AND of the following):
    - Denominator
    - Accepted by the lab after incoming inspection
    - 1st successful RF test, excluding any test with system failure, has max gradient > (horizontal axis bin) MV/m; ignore Q-disease, field emission
- Horizontal axis: max gradient MV/m
- Exclude cavities which are work-in-progress, i.e., before rejection or 1st successful RF test



Includes EP'd, BCP'd, and R&D processed cavities

Forensic Data Analysis of this Plot

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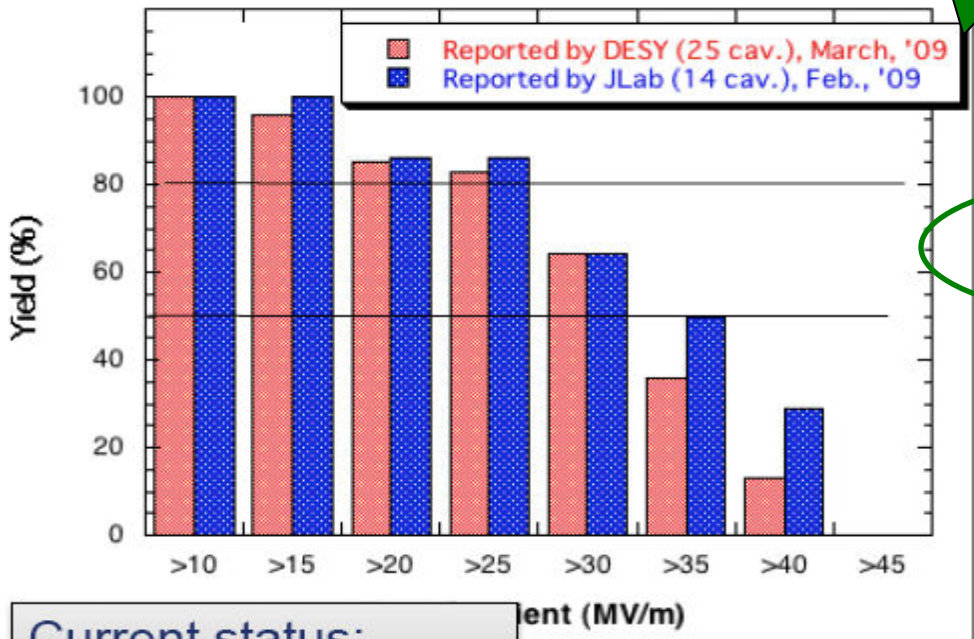
Progress Towards High-Gradient Yield

Global Design Effort



Recent DESY/JLab "production" series.

Total 39 cavities (08/09)

Mostly result of **first cold-test** (few cases second-test)

Field Emission greatly reduced (rinses)
→ identified RDR barrier

Baseline gradient re-evaluation (TDP1) expected to be based on sample of >60 cavities

Current status:
50% yield at ~ 33 MV/m;
(80% >25MV/m)

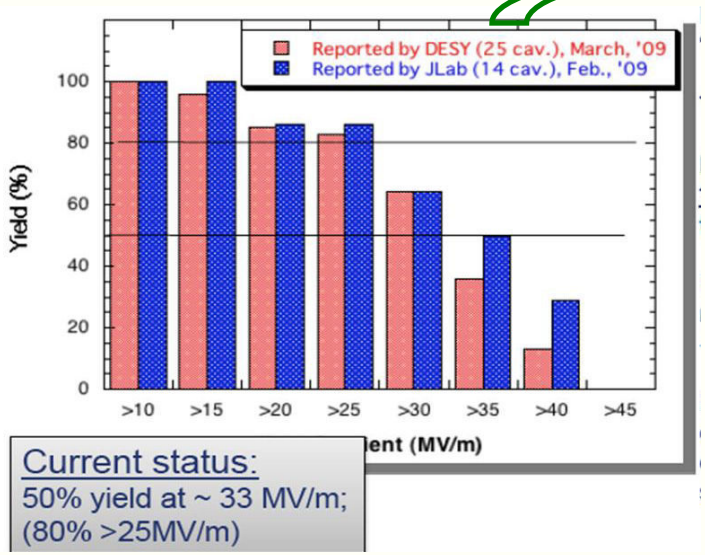
Not shown in plot

FALC July 09
Mike Harrison

Conclusion: DESY/JLab data not described well in slide 4

- **The gradients for DESY data were off by +2MV/m**
- **Not 08/09: large component of 2007, very small component of 2009**
- **Not 1st or 2nd test: instead last (DESY) or best (JLab)**
- **These are not the ideal data from which to infer a production yield**

Corrected version (corrected only for mistakes – same data shown)



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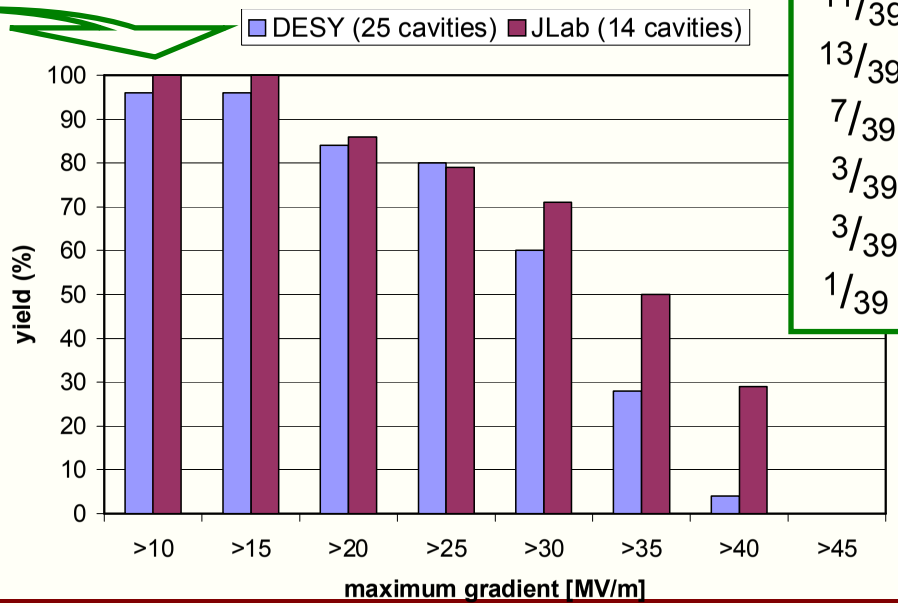

$^{11}/_{39}$ 1st test
$^{13}/_{39}$ 2nd test
$^{7}/_{39}$ 3rd test
$^{3}/_{39}$ 4th test
$^{3}/_{39}$ 5th test
$^{1}/_{39}$ 8th test

First version of data accumulation

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- 7/7/2009 CMGinsburg using input from Y. Yamamoto, Z. Conway, S. Aderhold

- Format/global:
- Add Cornell VEP to Bulk Surface Removal Technique
- Add Cornell BCP to Bulk Surface Removal Technique
- Add Cornell#1 to Latest Surface Treatment
- Add Cornell#2 to Latest Surface Treatment
- Add Ningxia to material vendors
- Add ACCEL bulk EP to Bulk Surface Removal Technique
- Add Henkel bulk EP to Bulk Surface Removal Technique
- Add ACCEL bulk BCP to Bulk Surface Removal Technique
- Add DESY-800C to High temperature heat treatment

- Cavity data:
- (1) First global combined data set!
- (2) Add Cornell data for A5, A8, A9, TB9ACC010
- (3) Add KEK data for MHI005, MHI006, MHI007, MHI008, MHI009
- (4) Add DESY data for [AC112:AC129], [Z130:Z145], [AC146:150]
- (5) Add JLab and Fermilab data for AES002, AES003, AES004, ACCEL6, ACCEL7, A8, [TB9ACC011:TB9ACC015], TB9AES005, TB9AES006, JLAB-2

- Corrections made:
- (1) Cavity names of ACCEL_5, ACCEL_8, Accel_9 changed to A5,A8,A9 because these are what is used in Fermilab documents. Please inform me if you know what serial numbers are etched on the cavity.
- (2) ACCEL_5 owner changed from Fermilab to ACCEL/RI

- Remaining improvements needed (probably a subset):
- (1) add test location
- (2) high-temperature heat treatment can happen more than once per cavity - put in brown section.
- (3) inconsistent date pattern MM/DD/YY vs. DD/MM/YY
- (4) is AC121 test #1 missing?
- (5) Fixes needed to AES001 tests at KEK (CMG's error reported by Kirk)
- (6) Update required for KEK processing description (reported by Kirk)
- (7) Check that quench/FE is given as cause if FE present in cavity with quench limitation (error reported by Sebastian)

Next steps

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- Spreadsheet
  - Few entries to be completed and minor errors to be fixed (don't affect plot p.3)
- Plots
  - Improve the example/preliminary plot on slide 3 to include only production-style EP'd cavities
    - For Aug.7 A.Yamamoto/Barish meeting to be presented Aug.12 to ILCSC (Lab directors)?
  - Add error bars to the plots (thanks Nobu Toge!)
  - Add more plots, as previously proposed, see next slide…
- Database itself
  - Develop with DESY colleagues the precise tools for database uploading
  - Add a limited number of new stored quantities – for discussion
    - Test location
    - High-temperature heat treatment can happen more than once per cavity – move to brown section
    - Power loss due to field emission (Detlef)
    - Field flatness immediately before/after vertical test (Kirk)
    - Qext in pi-mode (Kirk)
    - Rs at 2K (Kirk)
    - Presence/absence of other TM010 passband mode excitation (Kirk)
    - Average helium temperature/pressure during vertical test (Kirk)
- Next deadline proposed for week of August 31 – suitable meeting?

Schedule/Plan

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- ✓ FALC meeting July 13, 2009
  - Provide an example plot of production yield (p.7), citing caveats (whatever they are at the time)
    - Using preliminary and incomplete data for past 2-3 years from the simple Excel spreadsheet format, no web interface
  - Provide the people list (p.2) , and the plan
- ✓ End July 2009: Determine whether DESY DB is viable option, and timescale for implementation
- ALCPG/GDE Sept. 28 - Oct. 2, 2009
  - Dataset is web-based (thanks to support by DESY)
  - Some well-checked, easily explainable, and near-final plots available for discussion such as
    - Production yield
      - Qualified vendors
      - All vendors
    - Process yield
    - Time evolution of some quantities
- End Nov. 2009: With colleagues' input, finalize DB tool, web interface, standard plots, possibly with longer-term tool improvement plans