Global Cavity Database Report

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

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Motivation

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- Everyone uses the same data to make plots – a common denominator in yield calculations
- If you show a plot, you specify "I made xxx cuts on the data" and anyone could reproduce it (they might also argue with your cuts)

reliability
transparency
reproducibility

Rules Rules Rules

- 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.
  - If something changes significantly, treatment specification becomes LABX#2, also referenced, etc.
- 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
- Please provide regular updates at predetermined (by Akira) times

Database tool

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- Database is currently an Excel file, not yet a real database
  - http://tdserver1.fnal.gov/project/ILC/S0/ILC-Cavity-Database/DB_coord.html
- Sections
  - Cavity-specific: process type, cavity type, etc.
  - RF-test-specific: gradient, Q0 at max gradient, test limitation, etc.
  - Database-specific: include RF test or not and if not, why not?
- Starting point: Sebastian Aderhold's optical inspection spreadsheet
- DESY agreed to provide limited support for inclusion of global data into their database – this is not implemented yet
  - all the participating labs agreed to put their data into the DESY database 

Details of the dataset

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- Previous "PAC" production plot [25 (DESY) + 14(JLab)] included these data:
  - DESY: Production 4&6, EP, with or without He tank, "last test" as of March 2009
    - Production 4 [10 cavities] Z88, Z93, Z97, Z100, Z101, Z104, Z106, Z107, Z108, Z109
    - Production 6 [15 cavities] AC115, AC117, Z130, Z131, Z137; AC122, AC124, AC125, AC126, AC127, AC149, AC150, Z132, Z139, Z143
  - JLab: 14 cavities EP'd and tested at JLab (best test)
    - Accel/RI [8 cavities] : A6, A7, A8, TB9ACC011, TB9ACC012, TB9ACC013, TB9ACC014, TB9ACC015
    - Not ACCEL or Zanon [6 cavities]: AES001, AES002, AES003, AES004, Ichiro-5, JLab-2

data source for this talk

7/7/2009 Excel spreadsheet contains data from all three regions, from the last few years

- KEK [5 cavities]: [MHI005:MHI009]
  - Requiring already-qualified vendor eliminates all
- JLab, Cornell, Fermilab [18 cavities]: [A5: A9], [TB9ACC010:TB9ACC015], [AES001:AES004], [TB9AES005:TB9AES006], JLAB-2
  - [Reduces to 7] Requiring already-qualified vendor [-7] and standard processing [-3] and one not proc/test yet [-1]: ACCEL6, ACCEL7, [TB9ACC011:TB9ACC015]
- DESY [39 cavities]: [AC112:AC129], [Z130:Z145], [AC146:150]
  (Production batches 5, 6, &7 are represented)
  - [Reduces to 15] Requiring EP [-13], a successful first test [-8], fine-grain [-3]: AC115, AC122, AC124, AC125, AC126, AC127, Z130, Z131, Z132, Z137, Z139, Z141, Z143, AC149, AC150

- We may be able to increase statistics by up to 10 more cavities without testing more cavities by requesting to include DESY production 4 in the database effort
  - This may also be the only hope of a sensible time-dependence plot in the near-term

"Qualified-Vendor" Production Yield Plot - Method

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- Database version 7/7/2009
- Cuts
  - Cavity from qualified vendor: ACCEL or ZANON
  - 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)
- Also known as "first-pass"
- Include binomial errors

"Qualified-Vendor" Production Yield Plot

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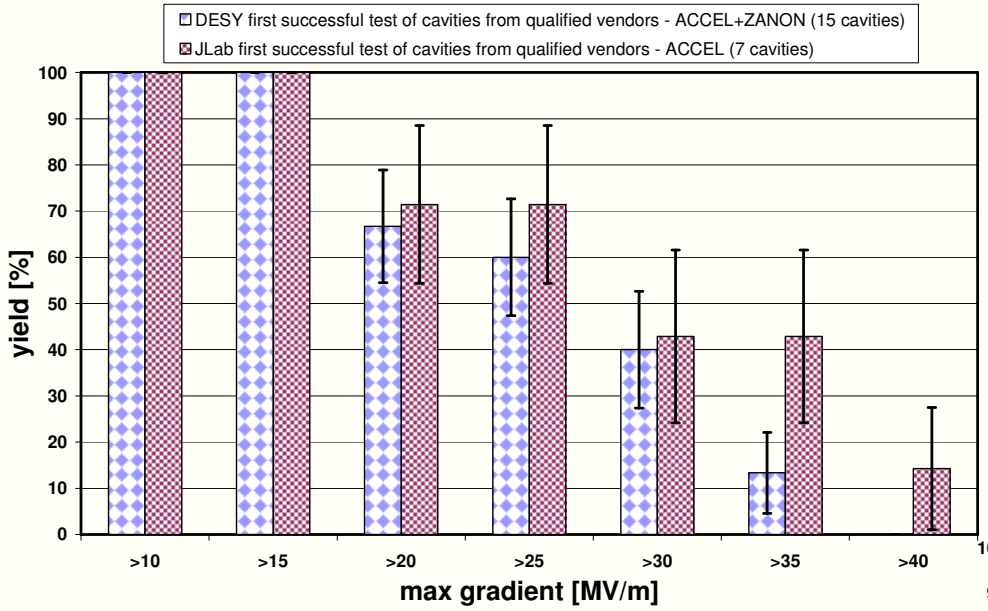
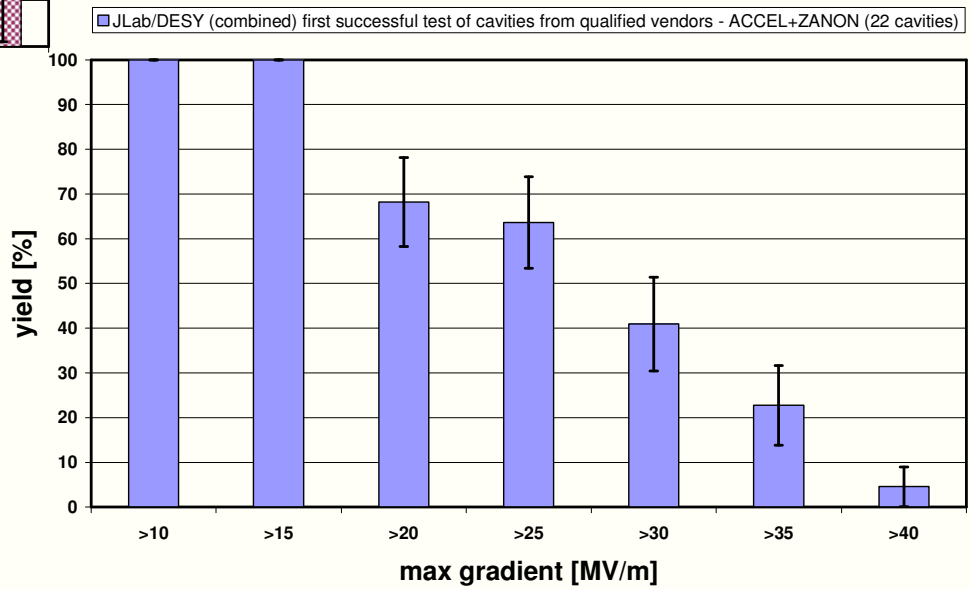
Electropolished 9-cell Cavities



Since DESY and JLab yields are statistically consistent, can combine them to get a smaller error bar

Electropolished 9-cell cavities



Compare New Production Yield Plot (qual. vendor) with Old One

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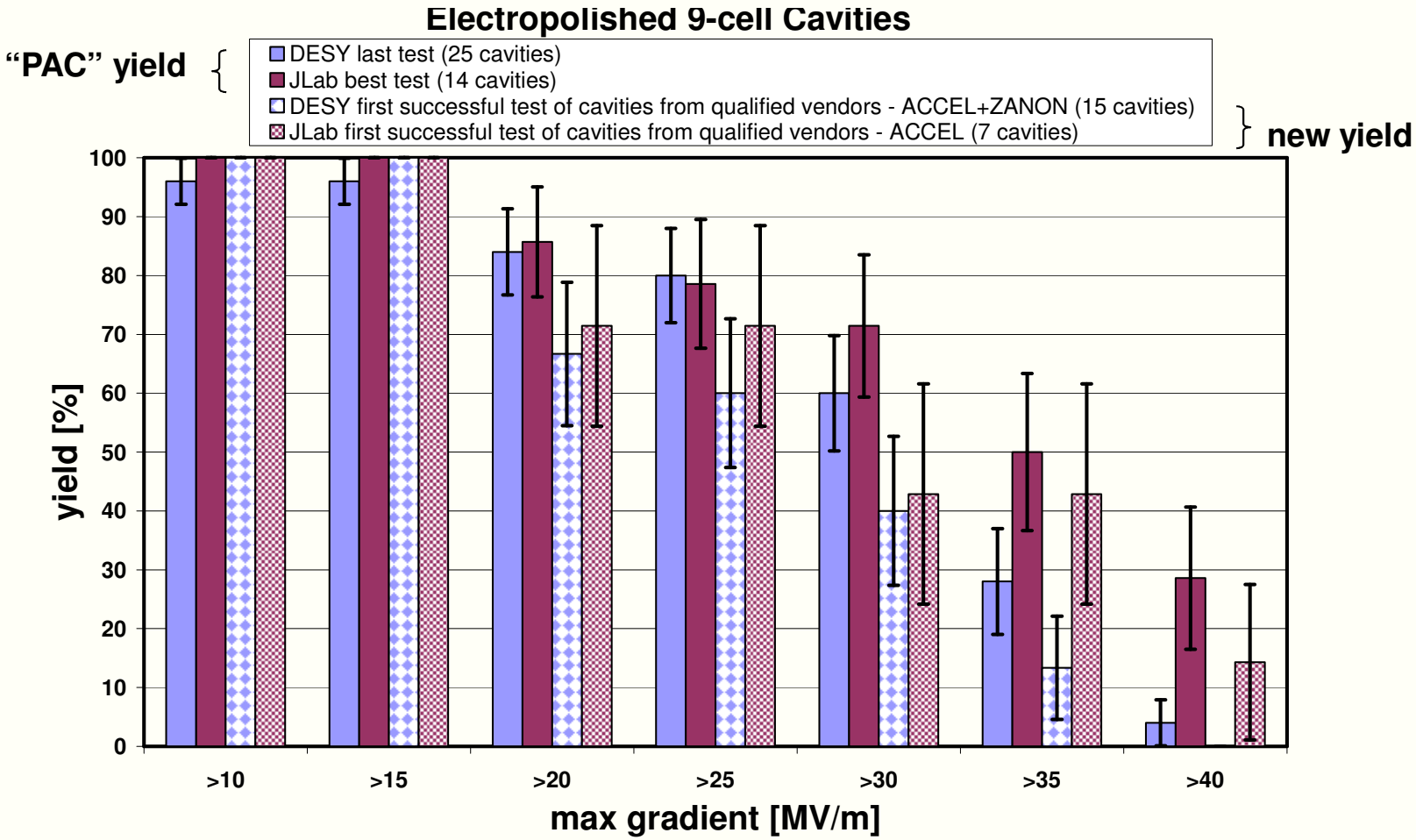

New yields from DESY & JLab are statistically consistent with each other
Old yields from DESY & JLab are also statistically consistent with each other

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

Fermilab

- Database version 7/7/2009
- Cuts
  - Cavity from qualified vendor: ACCEL or ZANON
  - 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

Up-to-second-pass yield, qualified vendors

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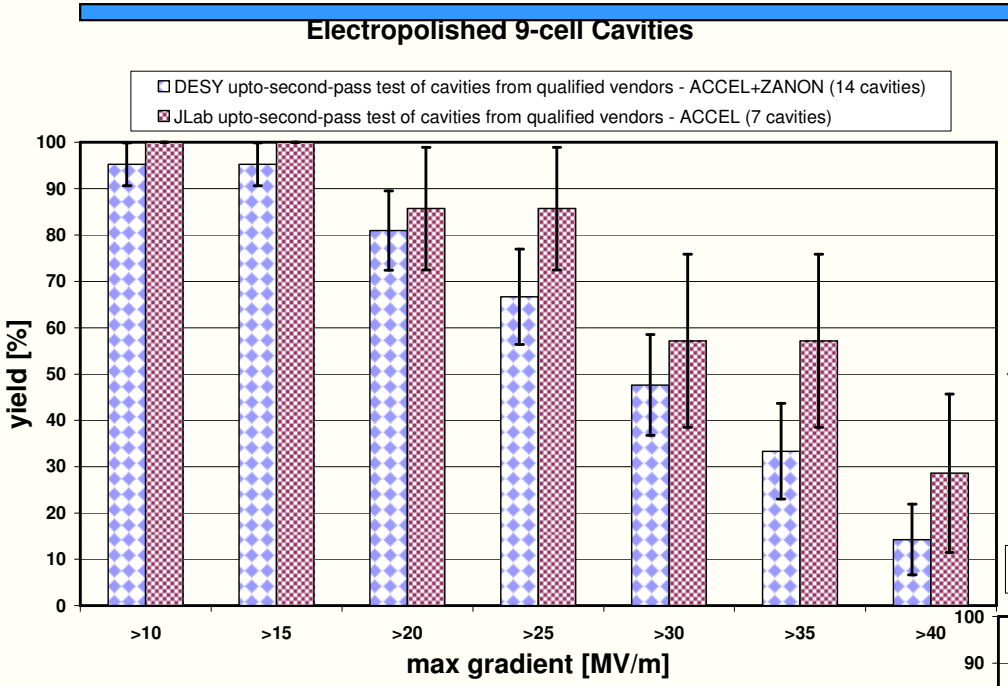
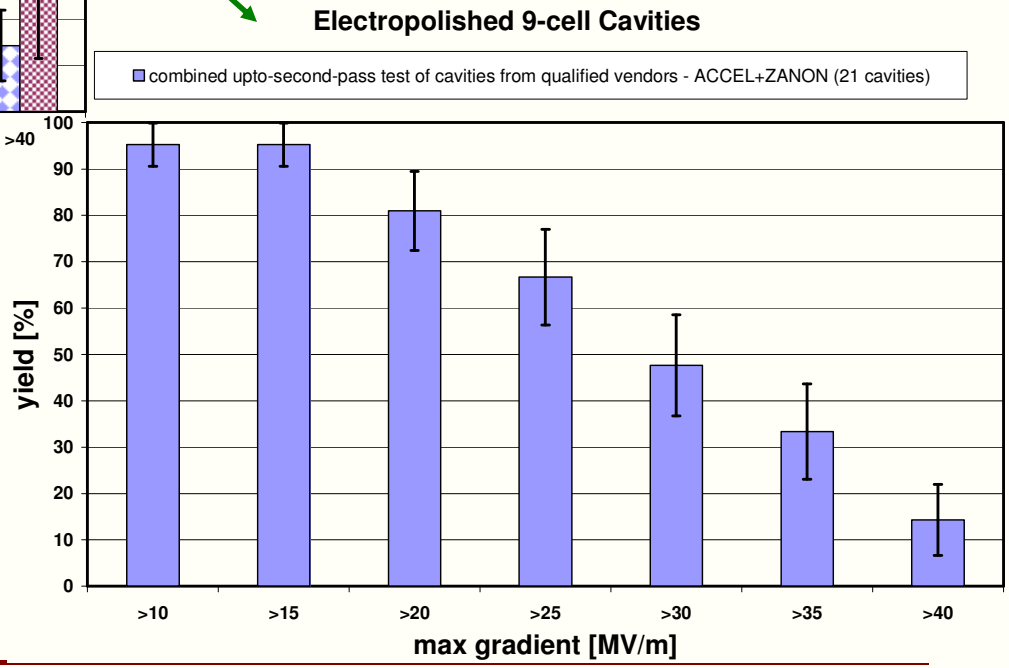


Since DESY and JLab yields are statistically consistent, can combine them to get a smaller error bar



Compare 1st and 2nd pass yields, qualified vendors

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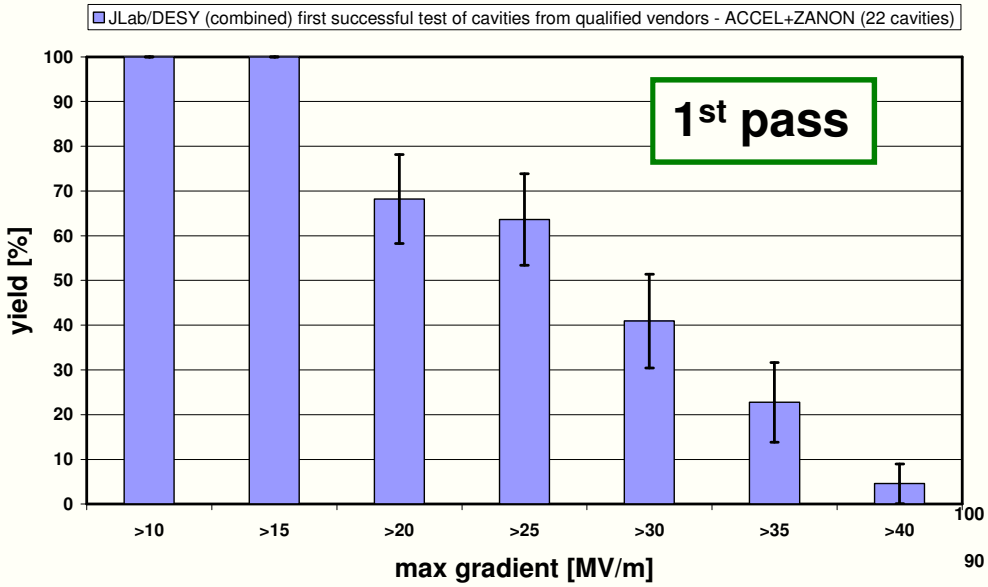
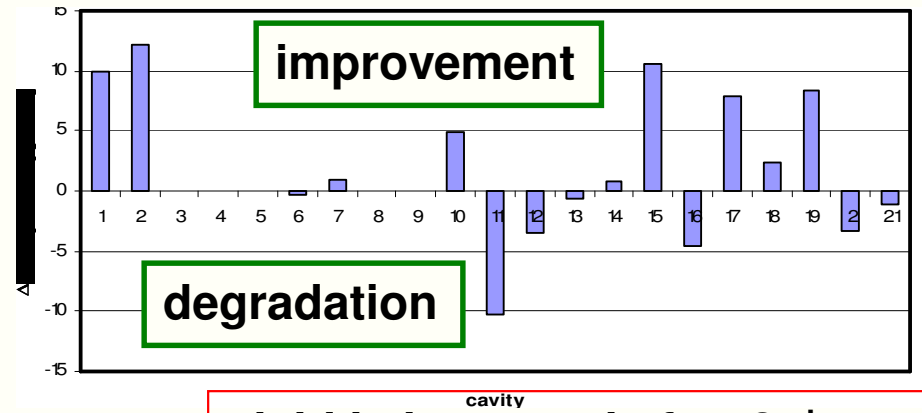
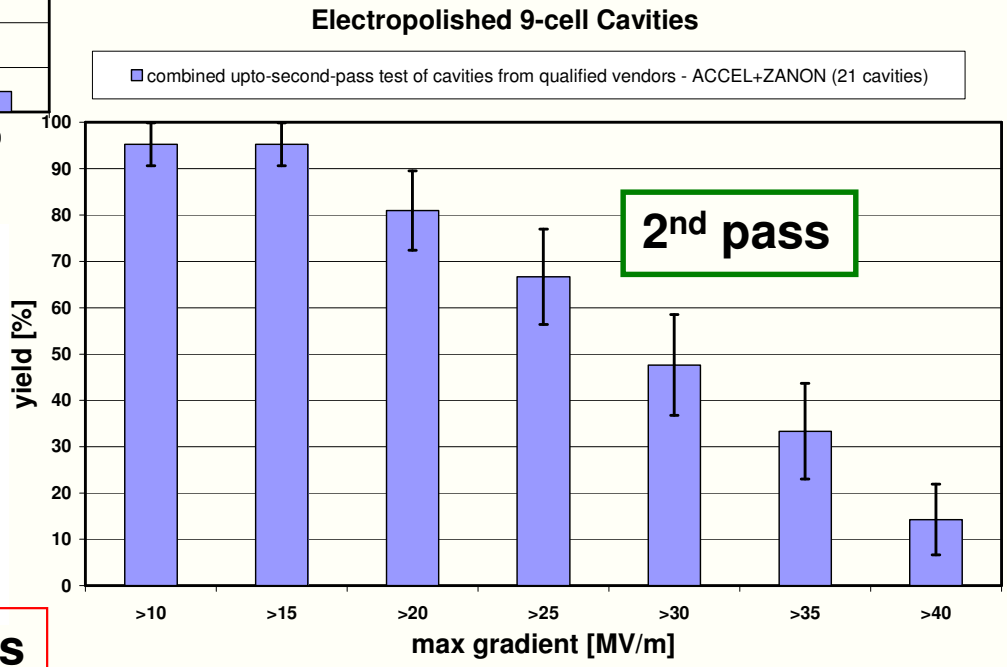
Electropolished 9-cell cavities







yield is improved after 2nd pass

New Vendor 1st and 2nd Pass Yield Plots - Method

- **Database version 7/7/2009**

- **Cuts [same except as marked]**
  - **Cavity from vendor: MHI or AES**
  - **Fine-grain cavity**
  - **Use the first successful (= no system problem) test**
  - **Standard EP processing: no BCP, no experimental processes**
    - **Defined as KEK#1 or JLAB#1**
  - **(Ignore test limitation)**
  - **Second pass**
    - **if (Eacc(1st successful test)<35 MV/m) then [NB: none reached 35 MV/m]**
      - **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**

Compare first-pass of new/established vendors

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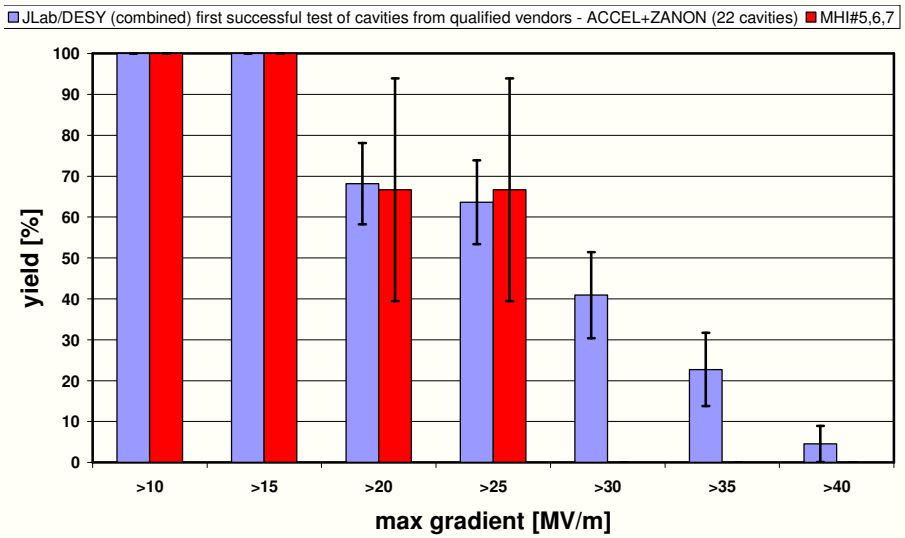
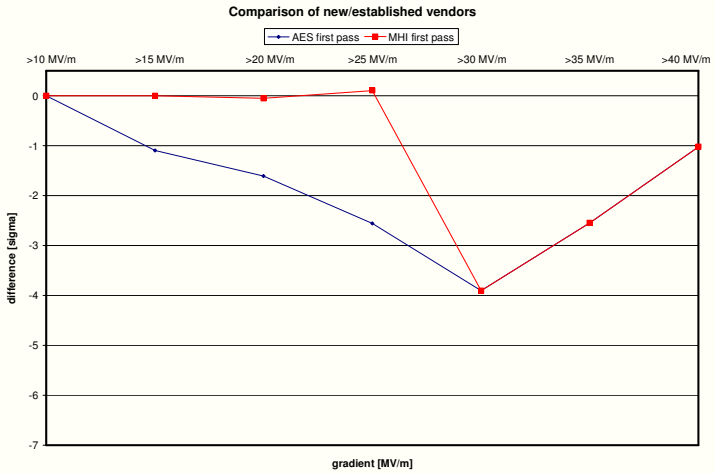
Electropolished 9-cell cavities

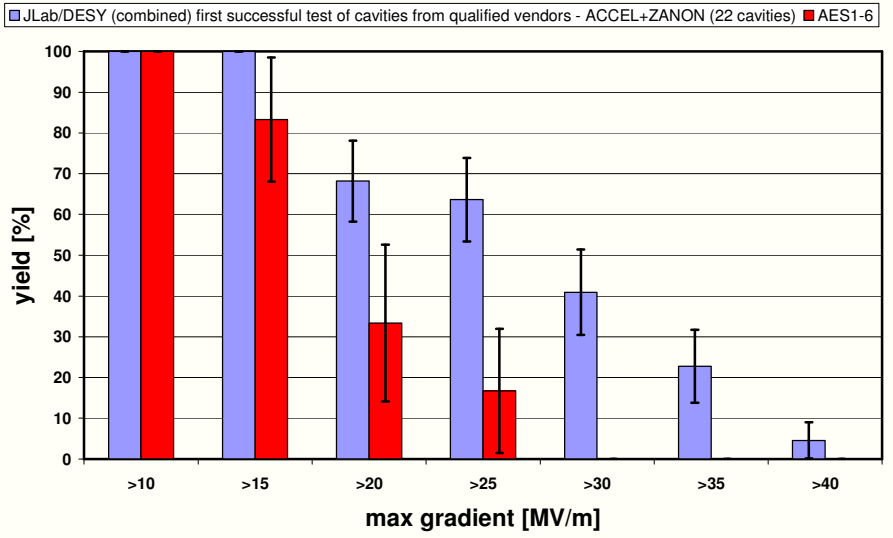


MHI005,MHI006,MHI007

AES001,AES002,AES003,AES004, TB9AES005,TB9AES006



Electropolished 9-cell cavities



1st to 2nd pass for new vendors

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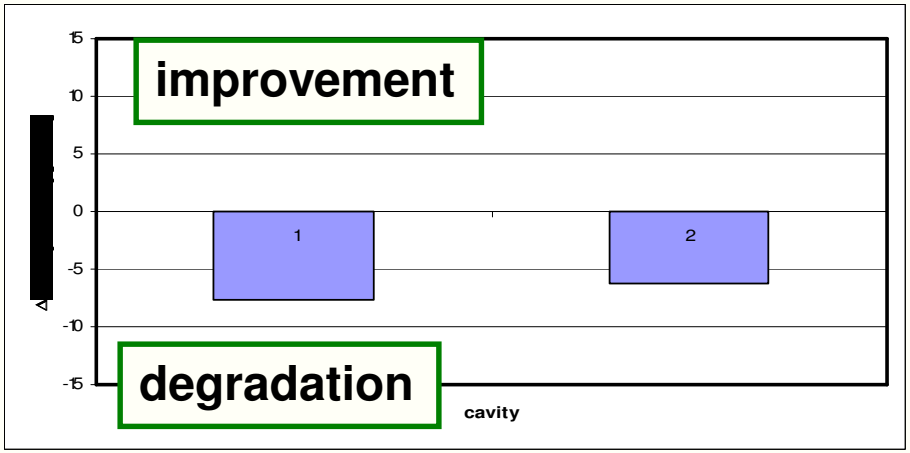

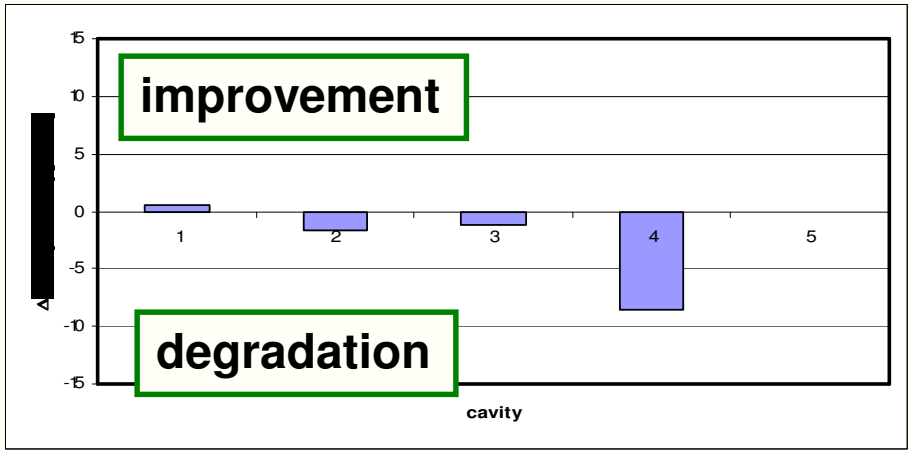

A word of caution:
The new-vendor cavities were not improved in the 2nd pass…

2nd pass for new vendors

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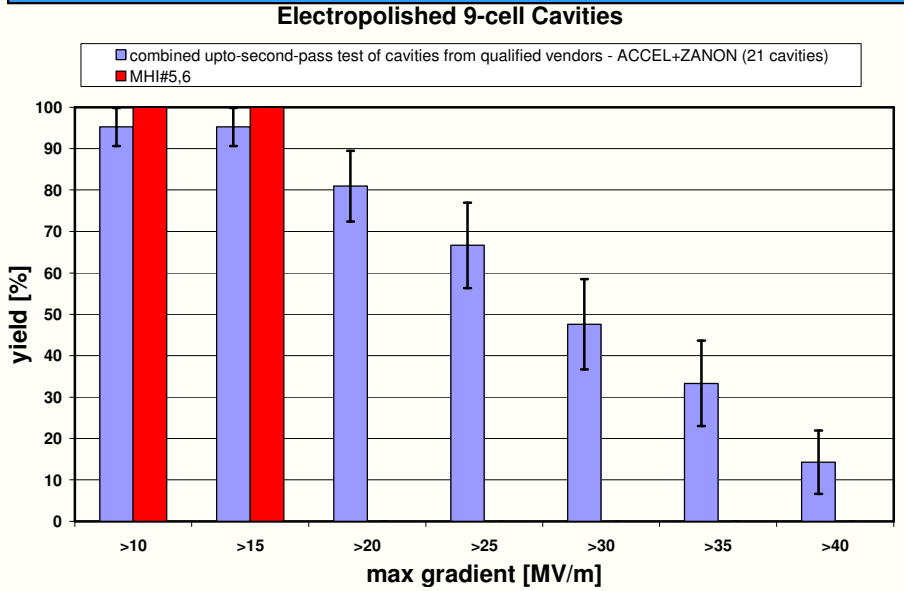
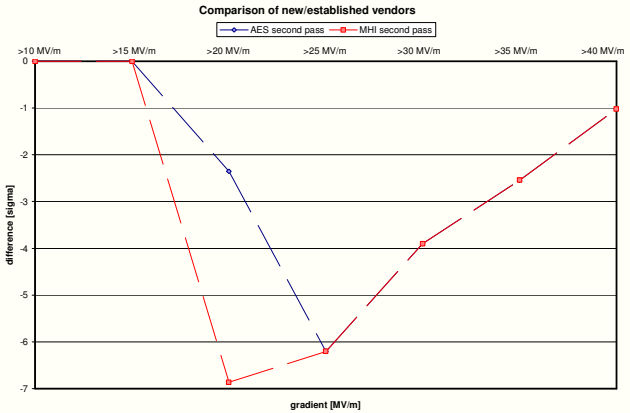
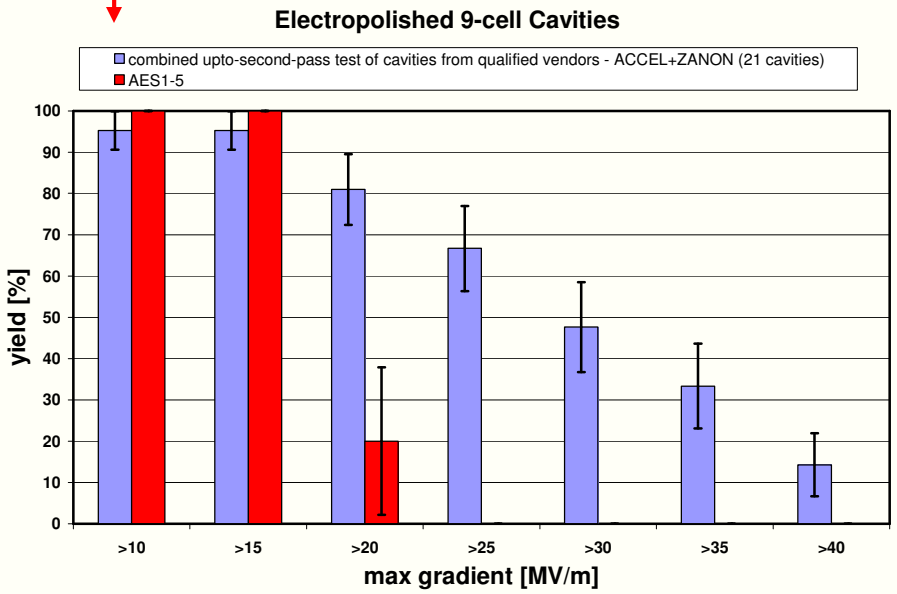


MHI005,MHI006,MHI007

AES001,AES002,AES003,AES004, TB9AES005,TB9AES006





Because degradation occurred between 1st and 2nd process/test, I wouldn't draw conclusions about vendor accomplishment from these plots

Next steps

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- **Spreadsheet**
  - Add DESY Production 4
  - Few entries to be completed and minor errors to be fixed (don't affect plots)
- **Database itself**
  - Develop with DESY colleagues the precise tools for database uploading
    - if you have an opinion on this other than "it must minimize work" please let us know
  - Add a limited number of new stored quantities

Schedule/Plan

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- ✓ FALC meeting July 13, 2009
  - Provide an example plot of production yield, 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, and the plan
- ✓ End July 2009: Determine whether DESY DB is viable option, and timescale for implementation
- ALCPG/GDE Sept. 28 - Oct. 2, 2009
  - o 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
      - ✓ New vendors
    - ✓ Process yield
    - o 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

before time evolution & web-based tool, add Prod 4