Hot Topic II: Is 35 MV/m still a good choice for ILC?

Guide for discussion

- Cavity performance at vertical test (VT)
  - Limit by field emission (FE)
  - Limit by quench
  - Scatter of performance
  - QA of preparation, diagnostics
  - Coordination of activities in different laboratories
  - Activation of additional resources (industry, laboratories)
- Cavity performance in module
  - Improvement / degradation compared to VT
  - Scatter of performance (adjustable RF power)
  - Diagnostics in module
- **Identify action items and give ranking**

ILC Perspective

S0/S1 Status

Lutz Lilje

GDE

Background

- Snowmass definition
  - **'Forward-looking'**
    - ILC operational gradient 31.5 MV/m in accelerator
      - Assumes equal power distribution
    - Margin for operation and potential degradation from low-power acceptance test due to installation to module: 10 %
    - 35 MV/m in vertical test
  - **Problematic issue**
    - Large scatter in performance needs to be addressed
      - Several nine-cell cavities have performed higher than 35 MV/m in low-power and high power tests
    - Understanding of available resources was not well understood at Snowmass
- S0/S1 Goal
  - **Charge and requested timeline**
    - Decision on the gradient by end 2009
      - could be threefold: up, down or don't change
    - Revision of design still possible by 2010 (Publication of the EDR)
  - **Plan and Outlook**
    - Achievements
    - Missing links
  - **Discussion**

Motivation: ILC Cost for lower average gradients

(following C. Adolphsen)

- Assume a distribution of gradients of a current cavity production with a large spread
  - **average 28 MV/m ranging from 22-34 MV/m, flat distribution**
    - e.g. DESY 4th production without Ethanol or flash BCP
  - **tweak power distribution**
  - **reduce overhead a bit**
    - due to a small loss in the efficiency of the RF unit
  - **increases linac length by 12.5 %**
  - **yields 7% increase of total project cost ~500 MILCU**
- Thus a major cost risk is associated with the average gradient.
  - **As long as a wide range of gradients can be accommodated only the average gradient matters.**

S0S1 Gradient Task Force Charge

from ILC Executive committee to R&D board

- The RDB is asked to set up a Task Force to carry out a closely coordinated global execution of the work leading to the achievement of the accelerating gradient specified in the ILC Baseline.
- A definition of the goals for the cavity performance in terms of gradient and yield and a plan for achieving them should be proposed by this group, which should take account of the global resources available and how they may be used most rapidly and efficiently.
- The accelerating gradient performance and yield should be specified both for an individual 9-cell cavity and for an individual cryomodule, and the plan should cover the demonstration of this performance in both cases.
- The GDE will facilitate the coordination at the global level to achieve this vital goal as soon as possible.

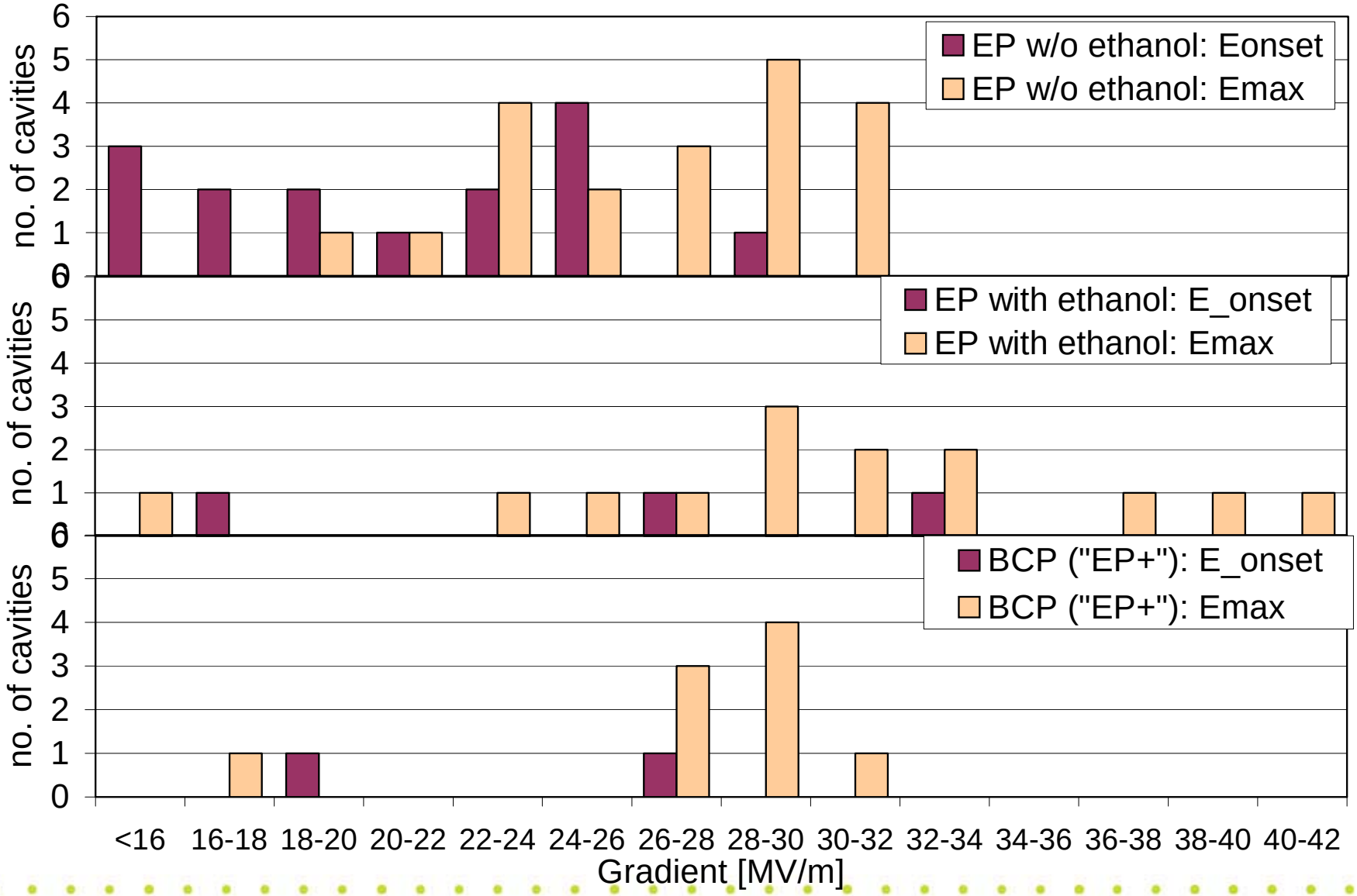
‘S‘-issues: Nomenclature

- S0
  - **Achieve 35 MV/m in 9-cell cavity in vertical dewar tests (low-power) with a sufficient yield**
  - **Staged approach with intermediate goals to track progress**
- S1
  - **Achieve 31.5 operational as specified in the BCD in more than one accelerating module**
  - **… and enough overhead as described in the BCD.**
- S2
  - **a string of N modules with full xyz...by date ...**
  - **Need for a linac ?**
  - **Endurance testing**

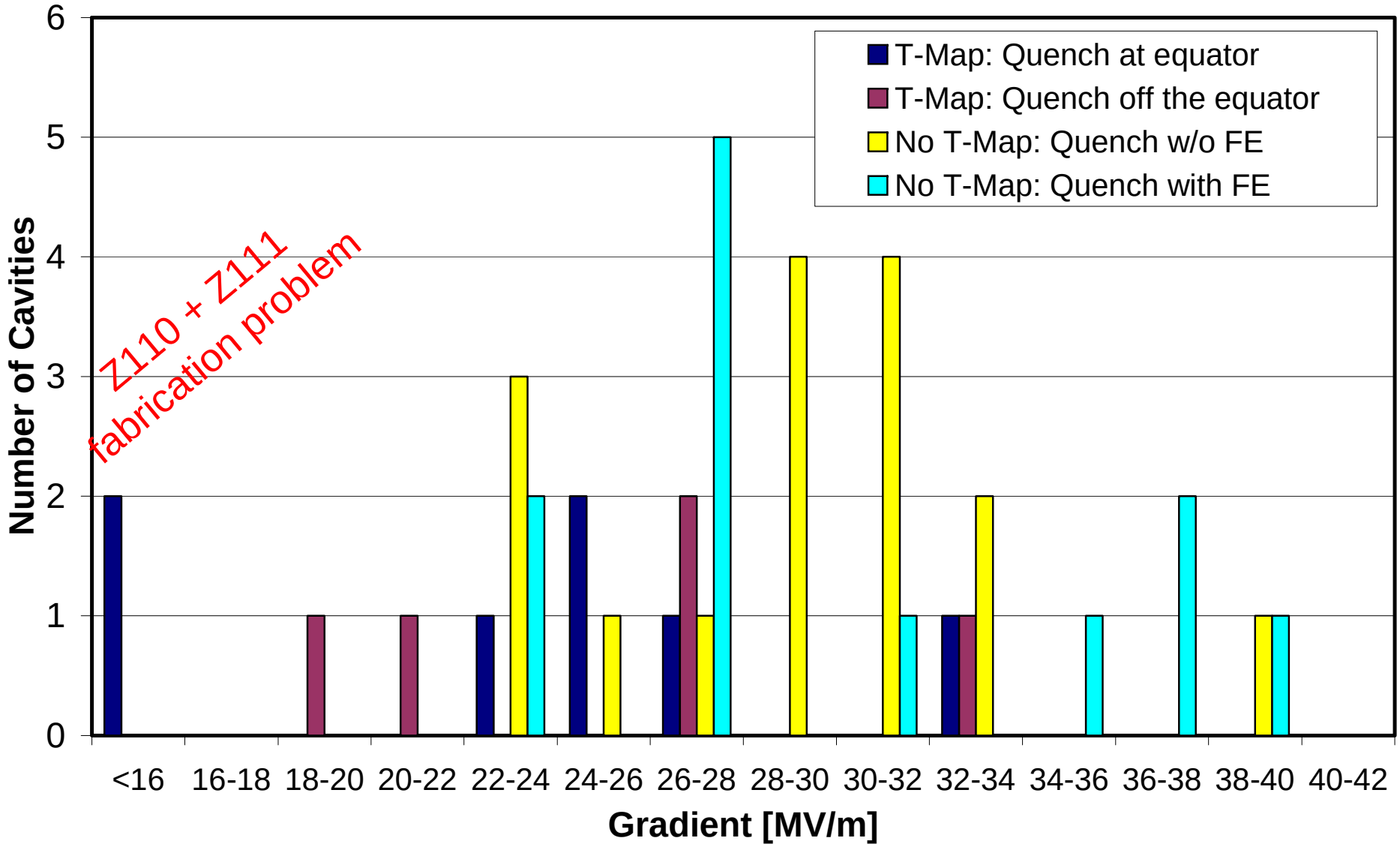
S0 Plan and Status

- Three closely coupled activities partially progressing in parallel
  - **This is needed to separate cavity preparation and production issues**
  - **A lot of data will be (is already) available by the time for the EDR writing**
- Single-cell R&D
  - **Establishing more reliable final preparation parameters**
    - Focus on the final rinse after EP before HPR:
      - E.g. Fresh EP, Degrease, Ethanol
  - **Several results are available esp. KEK (see this Workshop)**
    - In the Framework of TESLA Technology Collaboration
- Tight-loop
  - **International multi-cell cavity exchange**
    - Includes repeated processing in the same institute as consistency check
    - Comparison of regional differences in preparation and testing
  - **First results available esp. US data (see this Workshop)**
  - **Infrastructure not fully available**
    - New installations no yet fully operational
    - Infrastructure blocked
    - Missing redundancy in infrastructures is an issue
- Production effort
  - **Monitor ongoing productions esp. XFEL preparation**
  - **Results from DESY (see this Workshop)**
  - **Qualification of new vendors is difficult**

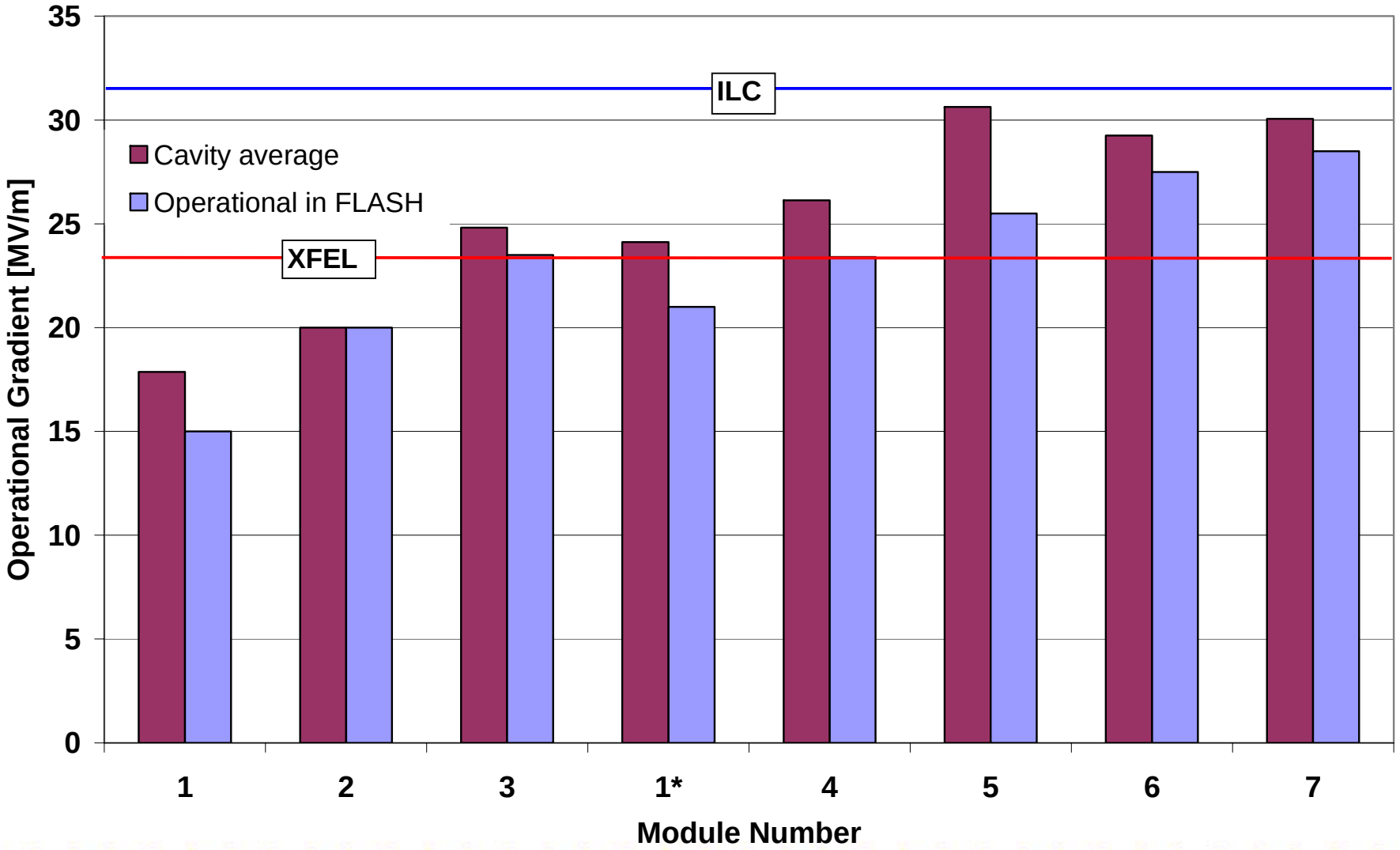
DESY 4th: Field Emission Analysis



Analysis of Quenches 4th Production



S1: Data from DESY

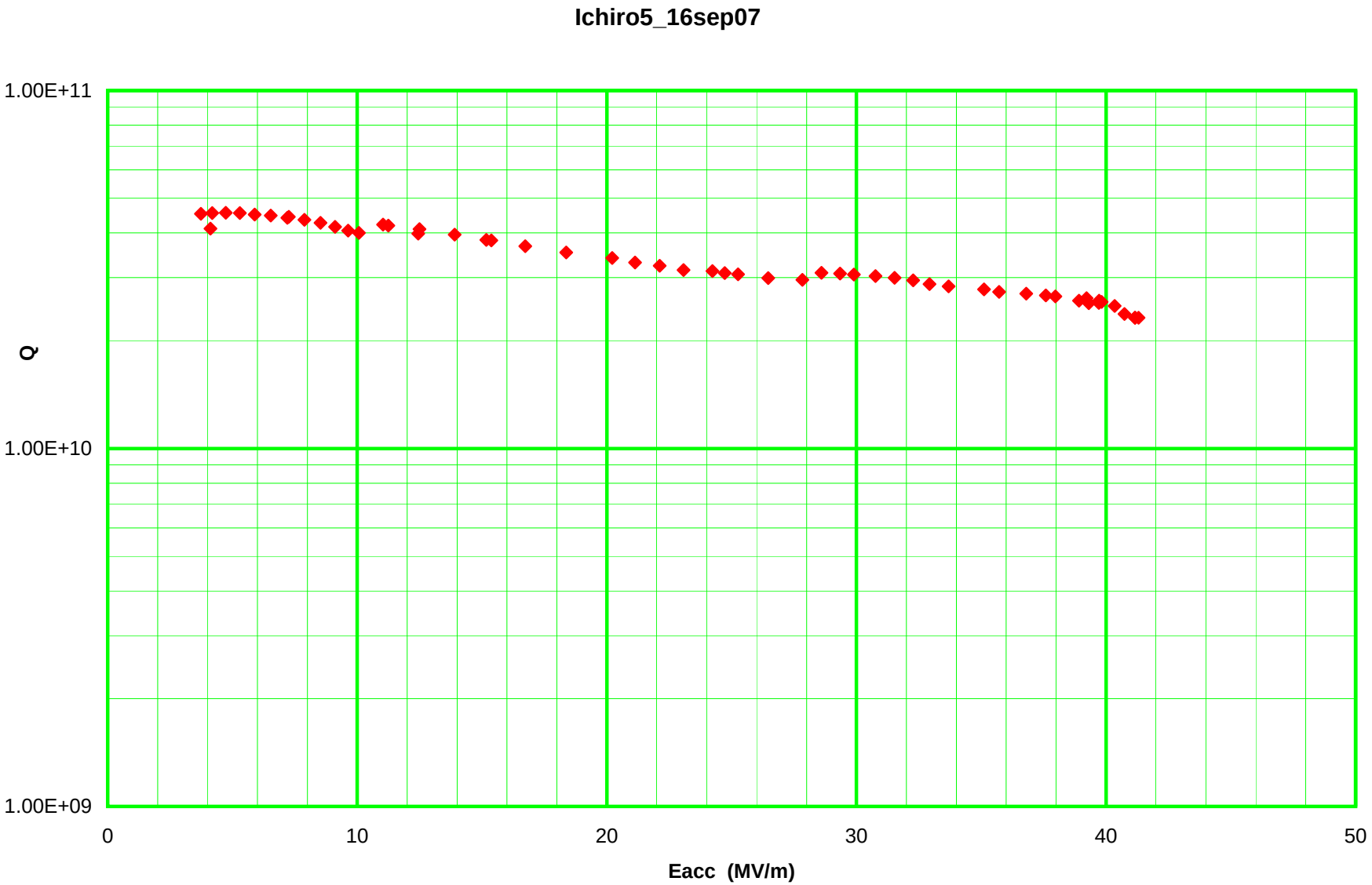


Outlook

- Surface preparation has been improved with Fresh EP, Ethanol rinse and degrease
  - **Field emission has been reduced**
- More data coming up
  - **S0:**
    - Tight-loop exchange of nine-cells starting using the improved rinses where possible
    - More productions on the way e.g. at DESY, US
  - **S1:**
    - 2 more modules under construction this year (DESY,US)
  - **Remember:**
    - Need some answer (up, down, remain same) by end of 2009 for EDR
- The results are still scattering significantly due to thermal quenches
  - **In a lot of cases T-maps point to the electron-beam weld region**
  - **Several questions can be asked...**

Questions & Open Issues

- Fresh EP needs still validation on multi-cells
- Is the lower field consistently related to equator region heating?
  - **A more detailed compilation of the data would be desirable.**
- Are there measurements which could be done to determine the source of the quench i.e. determine the nature of these defects?
- Is the quality control for the weld preparation insufficiently described? If not, how can it be improved?
- A second - less likely - explanation is that the breakdowns observed at the equator region are related to multipacting which for elliptical cavities typically occurs around 17-20 MV/m.
  - **Under normal circumstances low-power processing removes multipacting within a few minutes to up to one hour.**
- Is there a effective processing strategy and is it being applied consistently?


Ichiro5_16sep07
1.00E+11
1.00E+10
1.00E+09
Q
0
10
20
30
40
50
Eacc (MV/m)