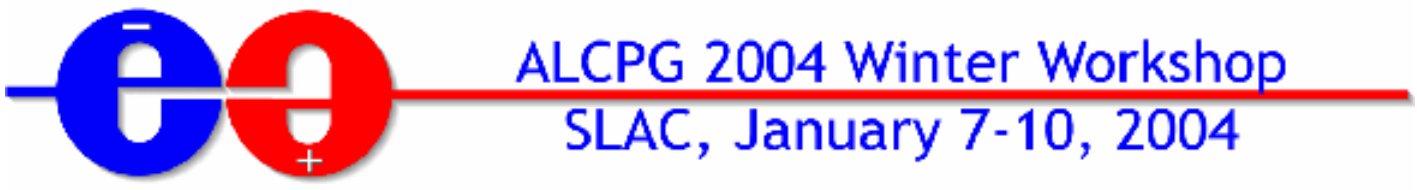
SC Machine News



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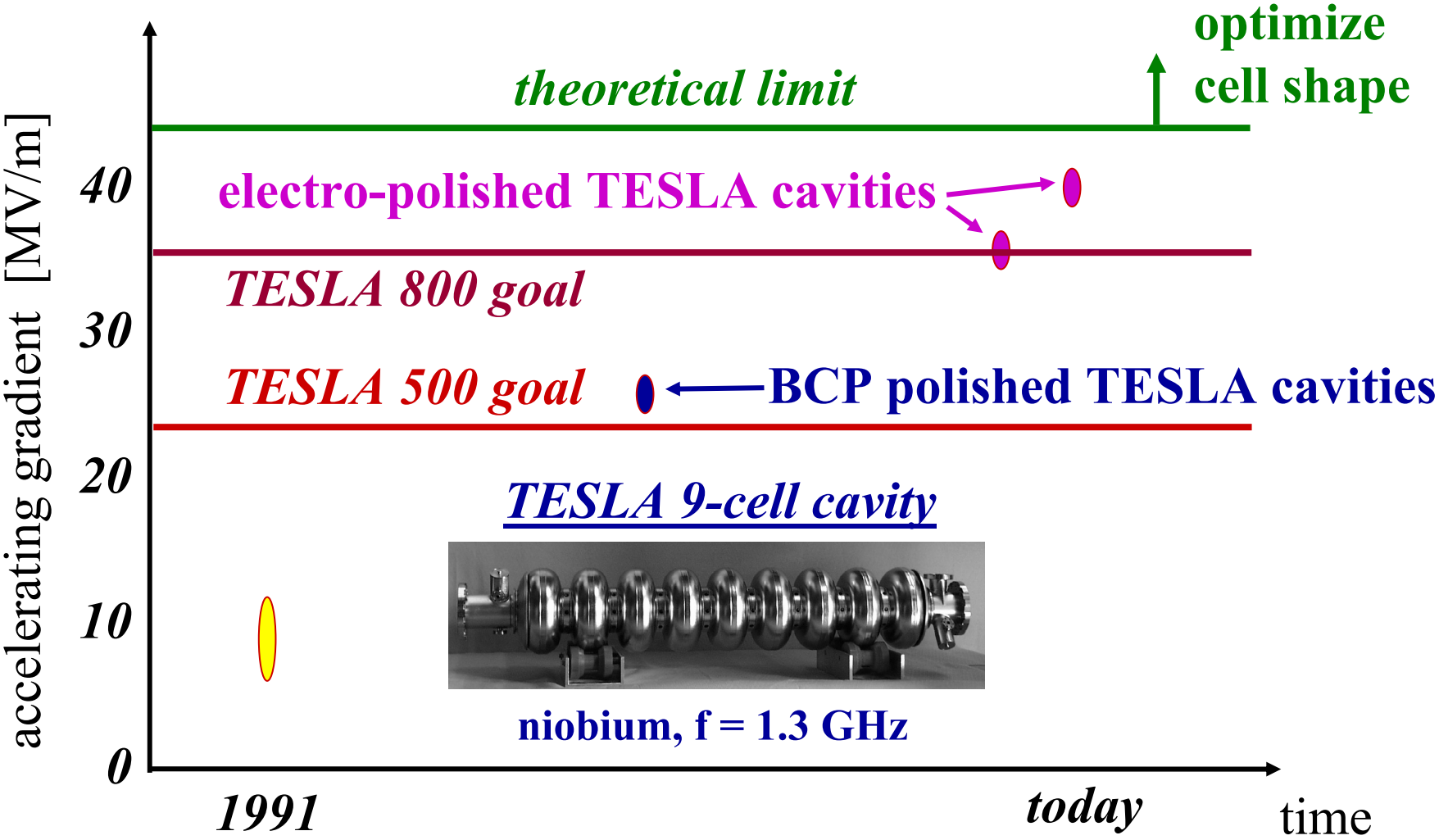
SC Machine News

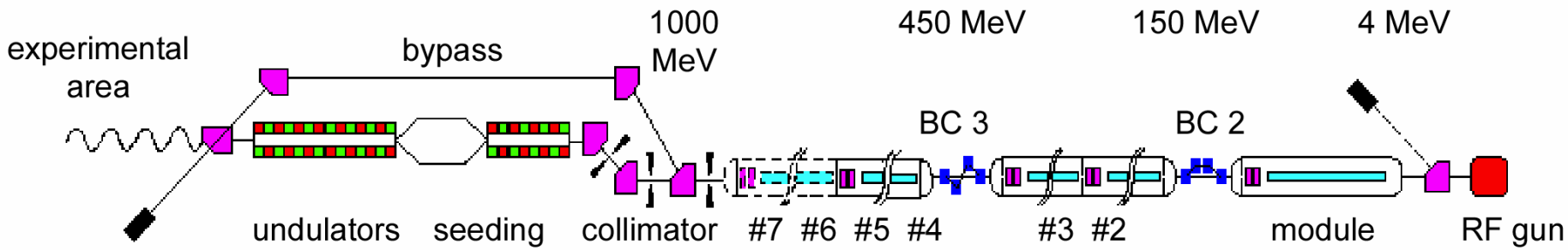
Outline:

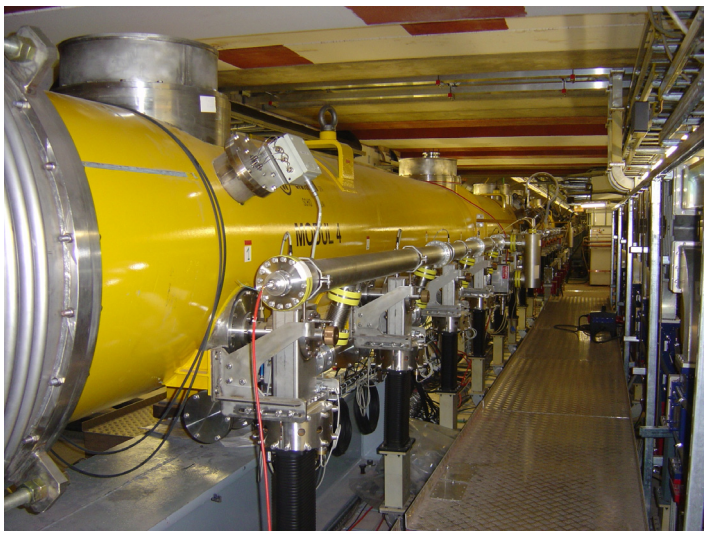
- **High Field Gradients in TESLA 9-Cell Cavities**
  - **TTF modules**
  - **CW performance tests**
  - **High power full system tests**
- **News from**
  - **TTF II**
  - **DESY XFEL**
  - **TESLA**
- **Conclusion**

High Gradients

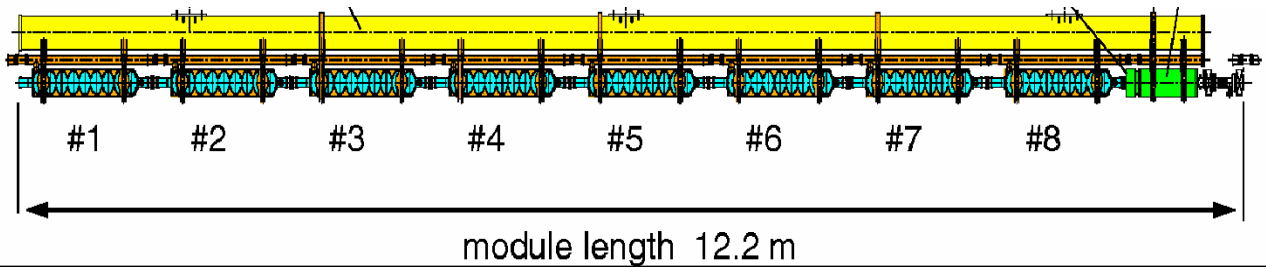


Experience from the TESLA-Test-Facility

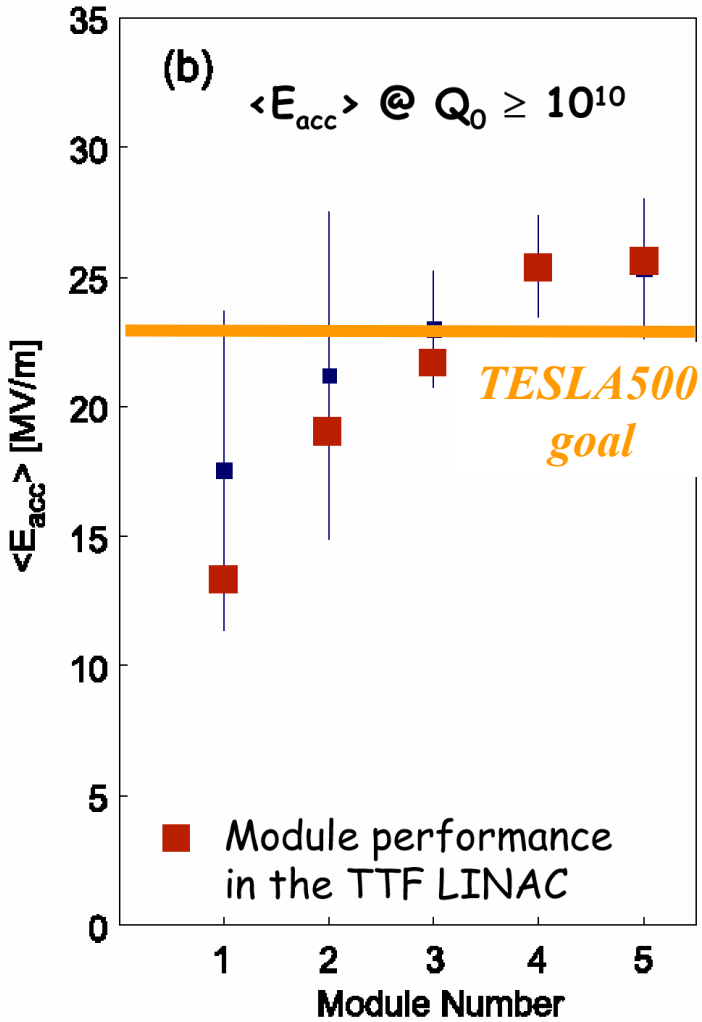


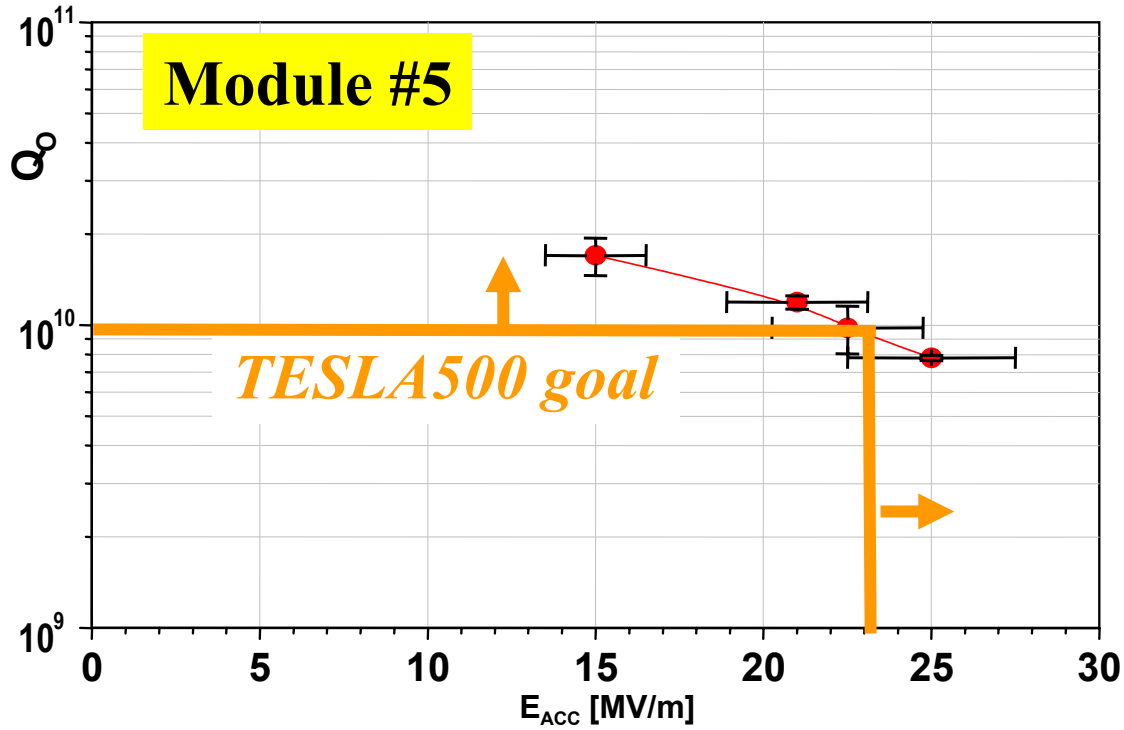


- **Cryomodule 4 and 5 with 25 MV/m cavities installed and tested with high gradients.**
- **Module 6 with EP cavities will be installed later.**
- **Beam operation as user facility in 2004.**



TTF Cavity-Module Performance (Pulsed Operation)

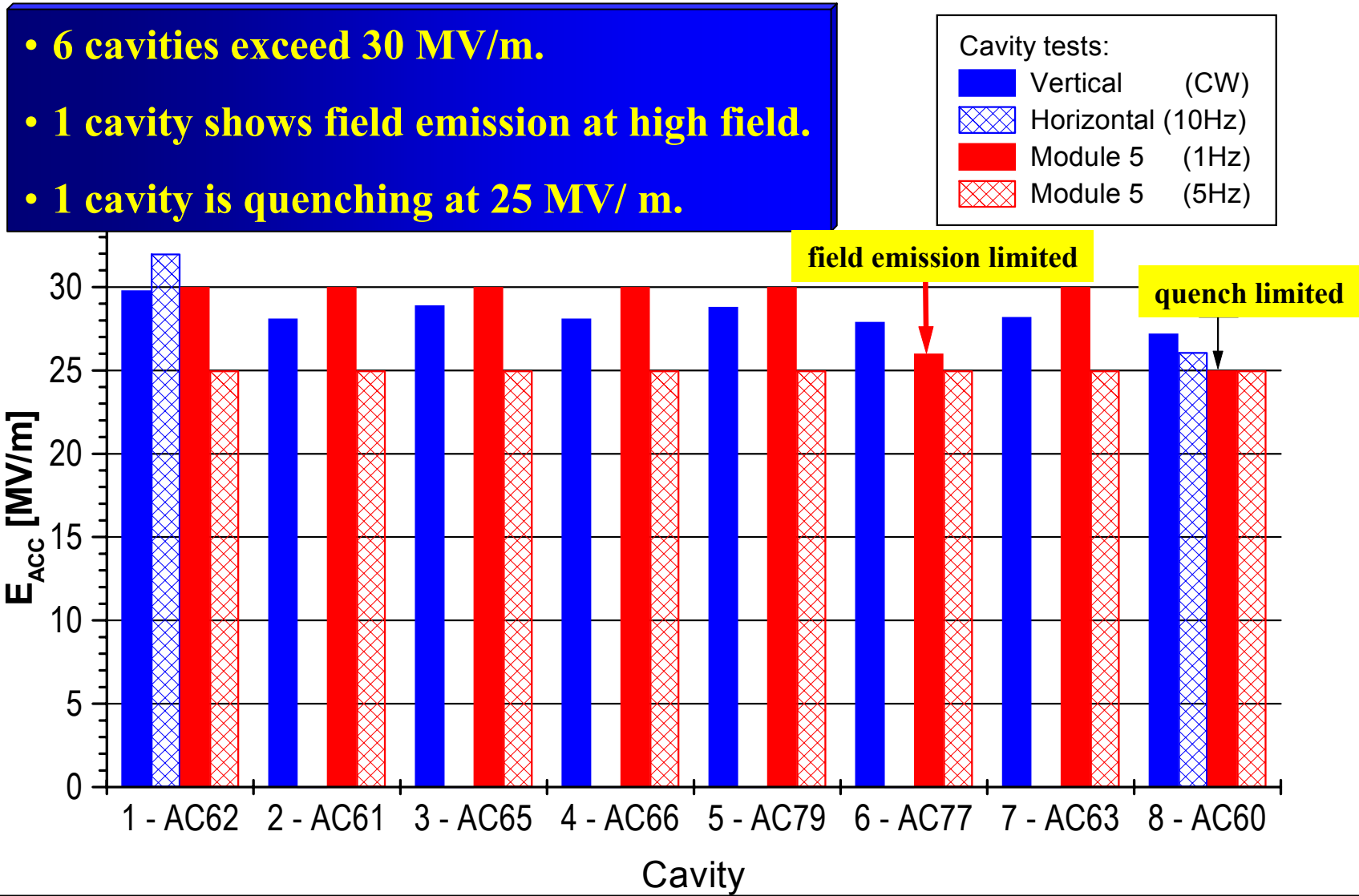




- **High gradient cw performance preserved during cavity installation into linac.**
- **BCP cavity modules #4 and #5 reach TESLA500 performance goal.**

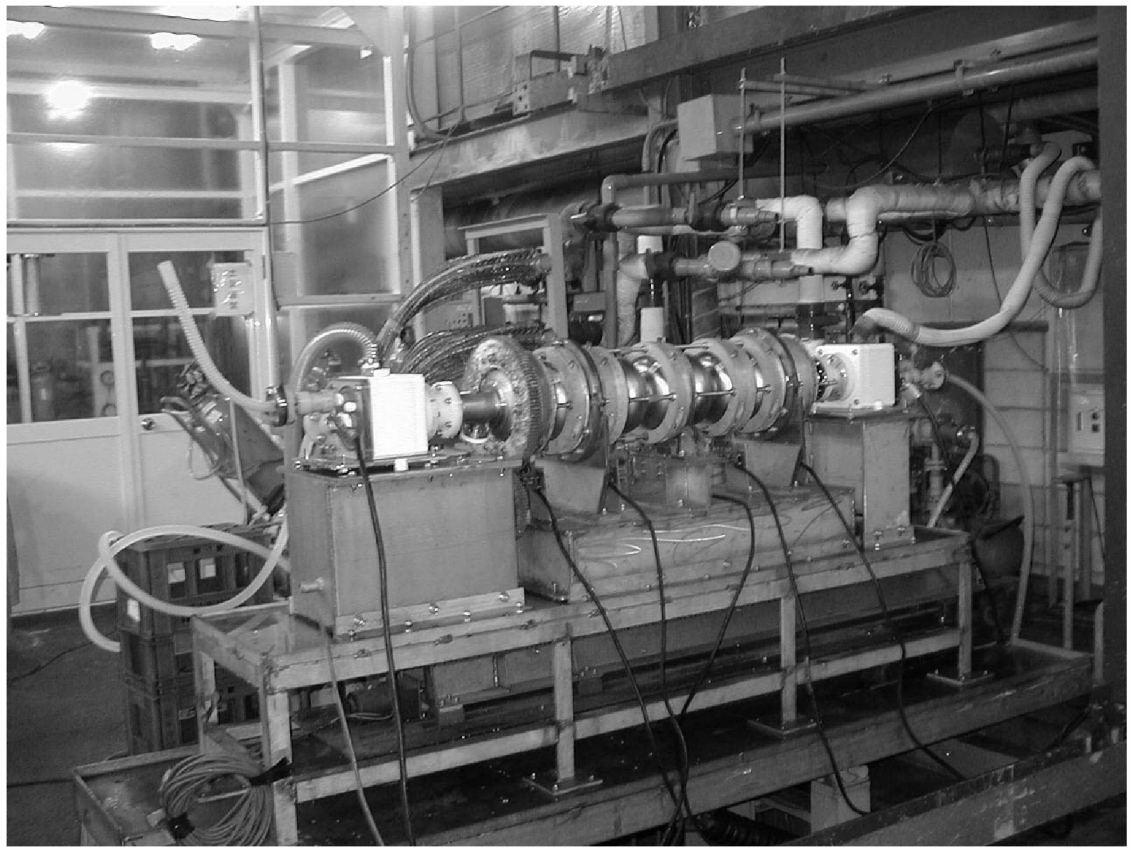
BCP Cavity Module ACC 5: Cavity Performance

- 6 cavities exceed 30 MV/m.
- 1 cavity shows field emission at high field.
- 1 cavity is quenching at 25 MV/ m.



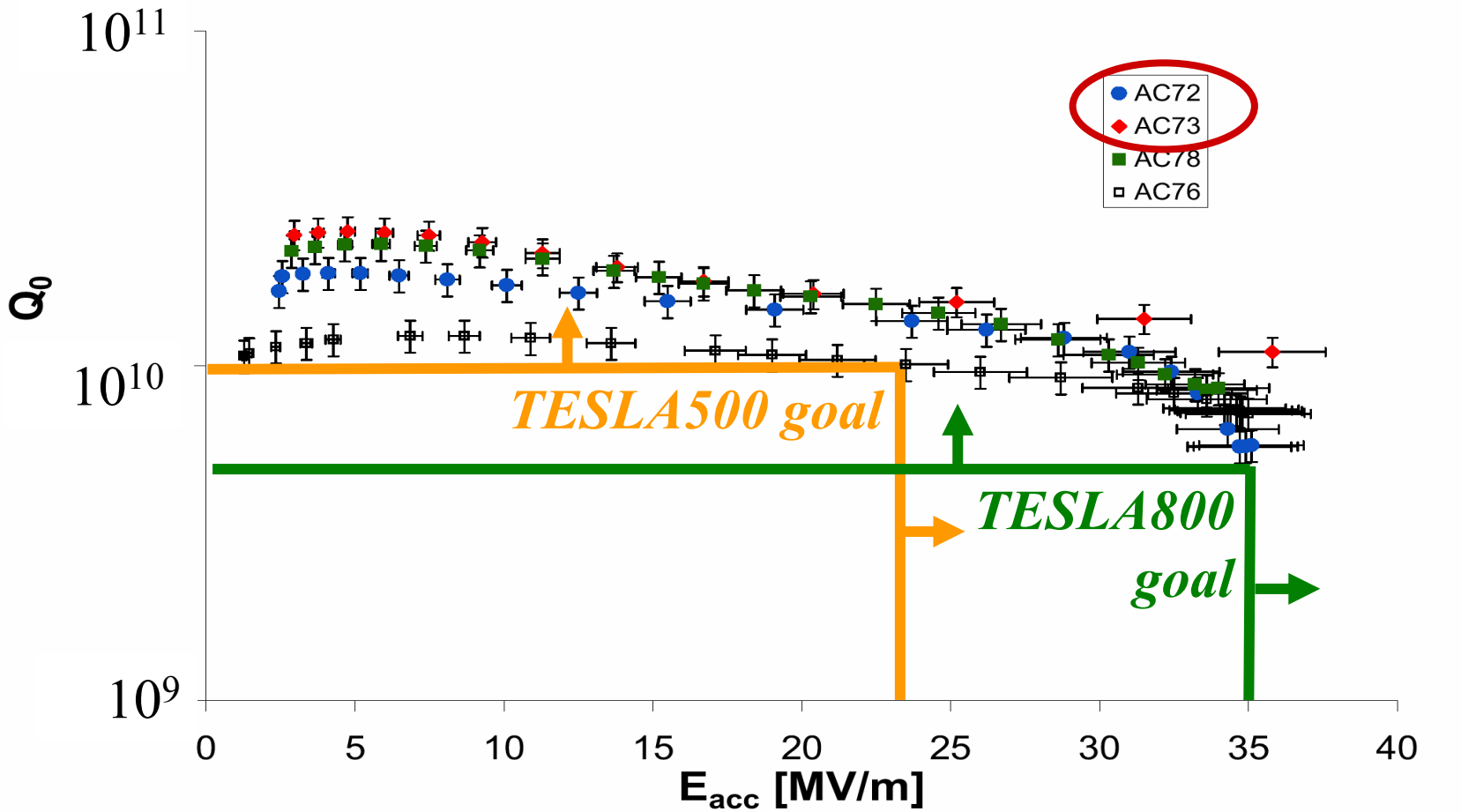
Electropolished 9-Cell Cavities (1)

- **Electropolishing done in industry (Nomura Plating) in collaboration with KEK.**
- **Cleaning (HPR) and test at DESY.**
- **Vertical test: low power cw test of naked cavity (high power coupler, LHe vessel and tuner not installed).**



7 cavities exceeded 30 MV/m.

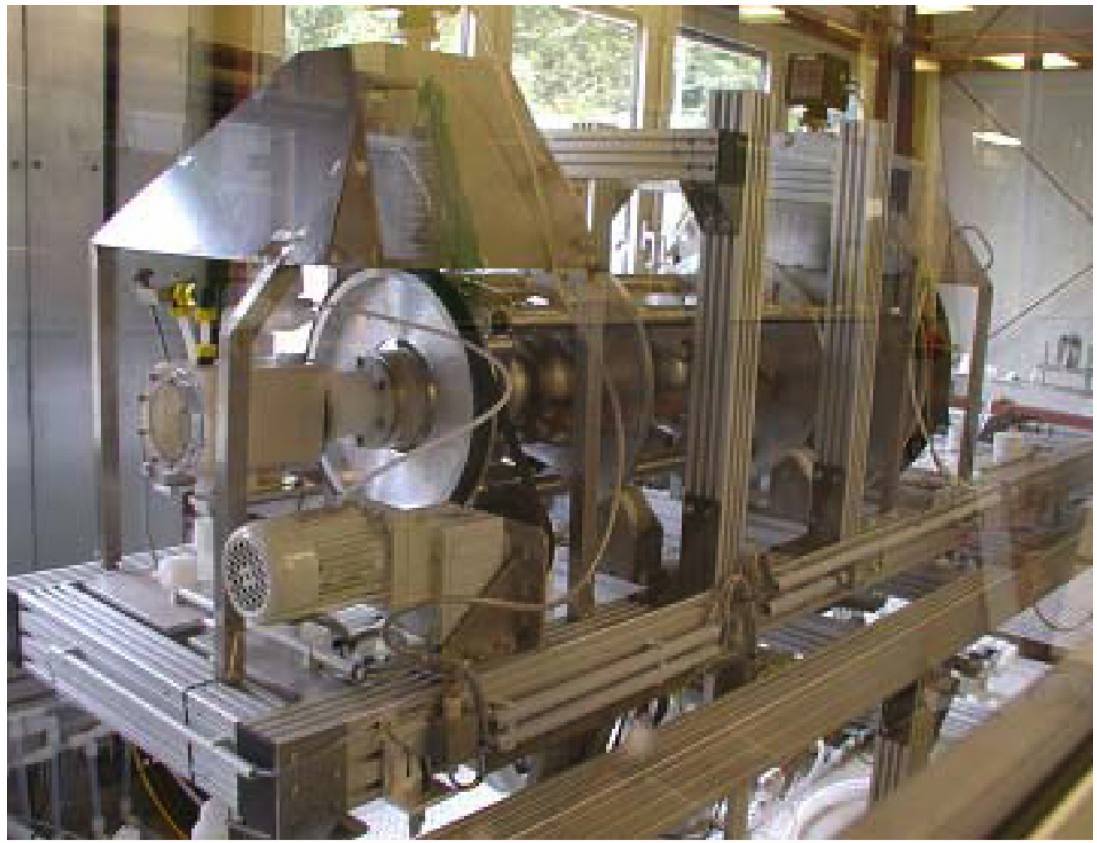
Electropolished 9-Cell Cavities: CW Test Results
EP done at Nomura Plating



TESLA800 gradients have been achieved repeatedly.

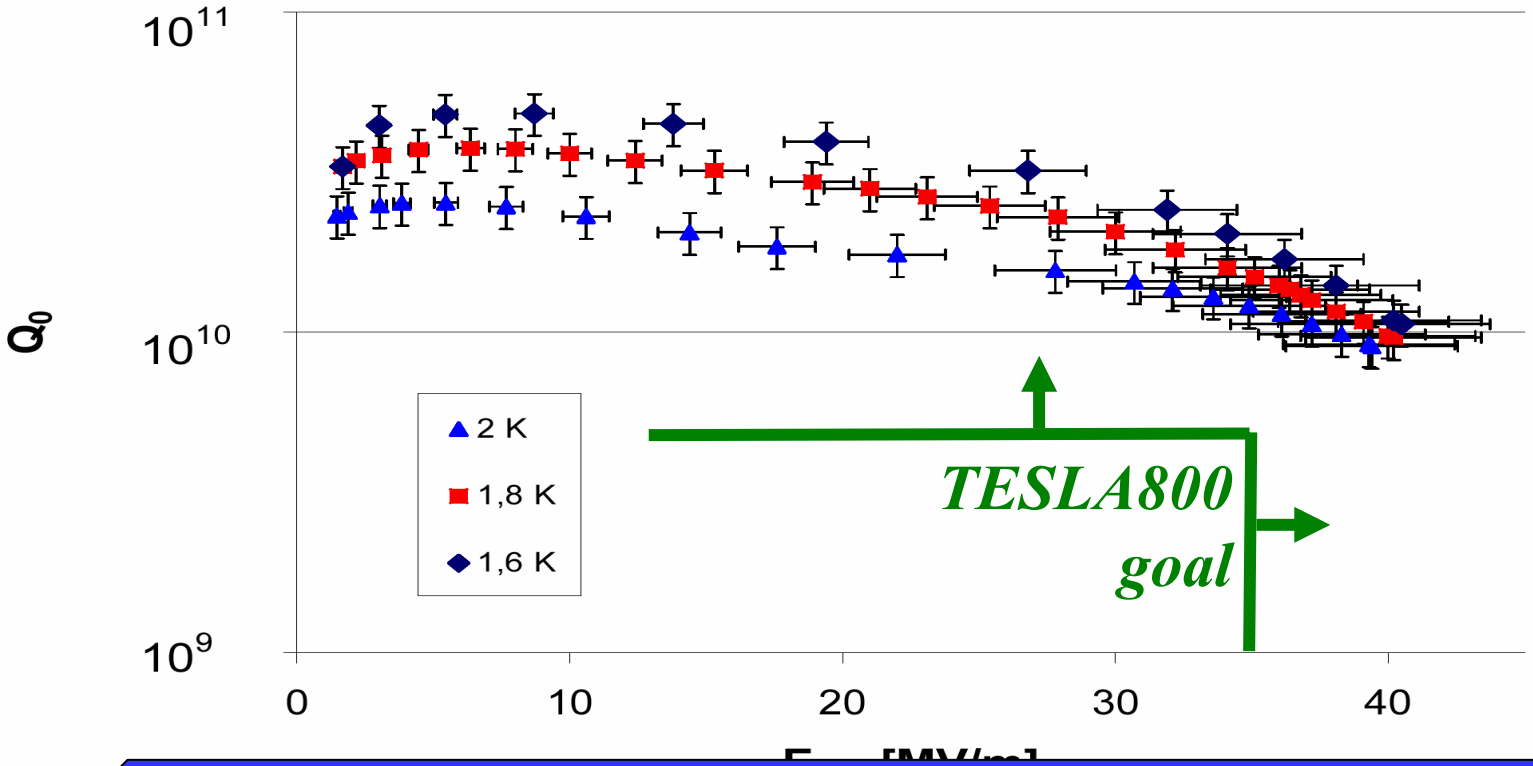
Electropolished 9-Cell Cavities (2)

- **Electropolishing done at DESY with new setup.**
- **9-cell cavity polished and tested.**
- **Vertical test: low power cw test of naked cavity.**



Outstanding result:
TESLA 9-cell cavity reached 40 MV/m.

Electropolished 9-Cell Cavities: CW Test Results EP done at DESY



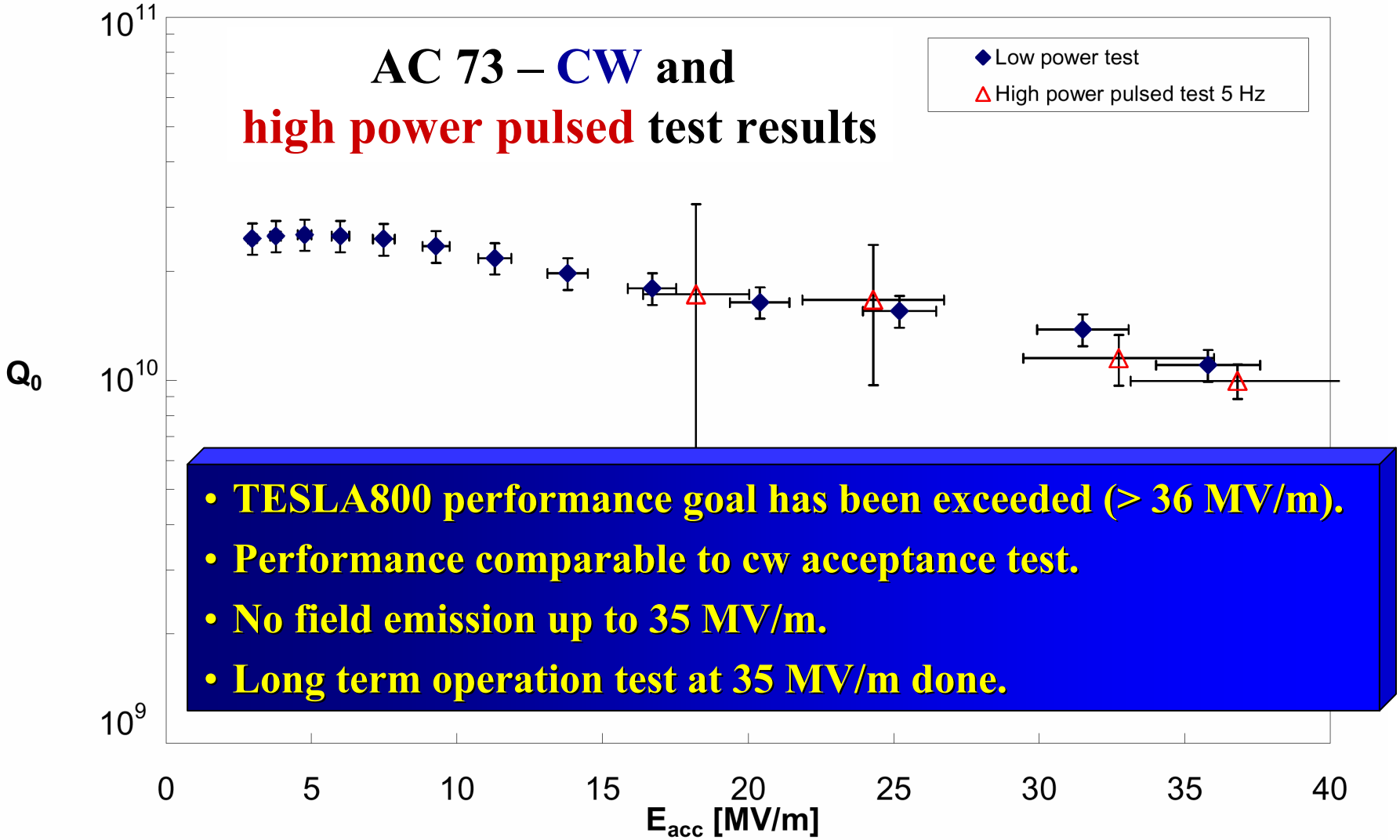
- **TESLA800 gradient has been exceeded (39.4 MV/m at 2K)!**
- **Performance very close to best single-cell cavities.**
- **Negligible field emission.**
- **Only 800 C annealing, no 1400 C ⇒ cost reduction.**

Horizontal High Power Pulsed Test of 9-Cell Cavities

- Cavity is fully assembled, including:
  - Power Coupler
  - Helium vessel
  - Tuner (… and piezo)
- RF Power is fed by a klystron through the high power coupler.
- Similar to 1/12 of a TESLA cryomodule.
- Pulsed RF operation using the pulse shape foreseen for TESLA.

Two electropolished 9-cell cavities tested so far (AC73 and AC72).

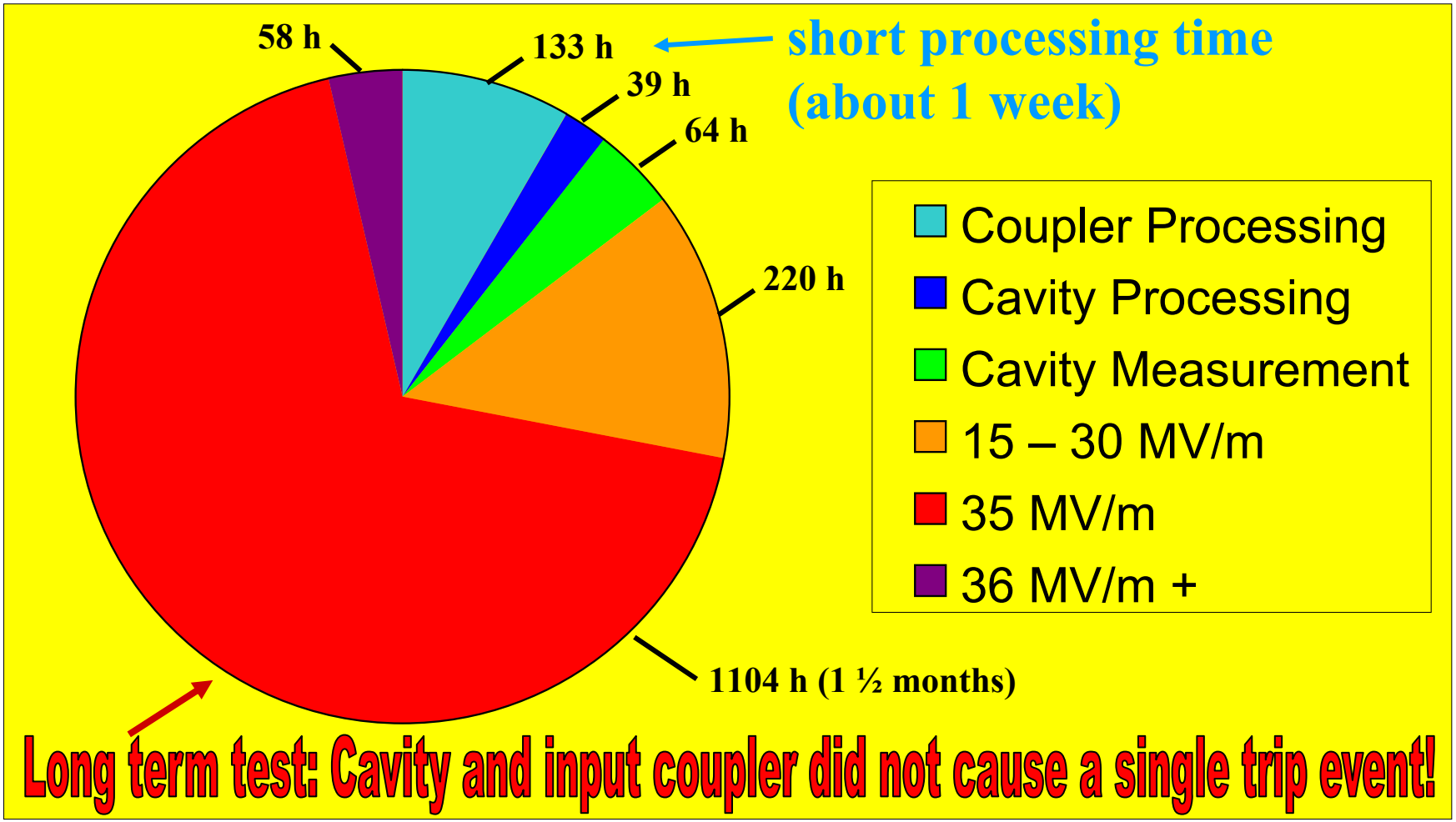
Electropolished TESLA 9-Cell Cavity AC 73: Horizontal Pulsed High Power Test



- **TESLA800 performance goal has been exceeded (> 36 MV/m).**
- **Performance comparable to cw acceptance test.**
- **No field emission up to 35 MV/m.**
- **Long term operation test at 35 MV/m done.**

Electropolished TESLA 9-Cell Cavity AC 73: Horizontal Pulsed High Power Test (2)

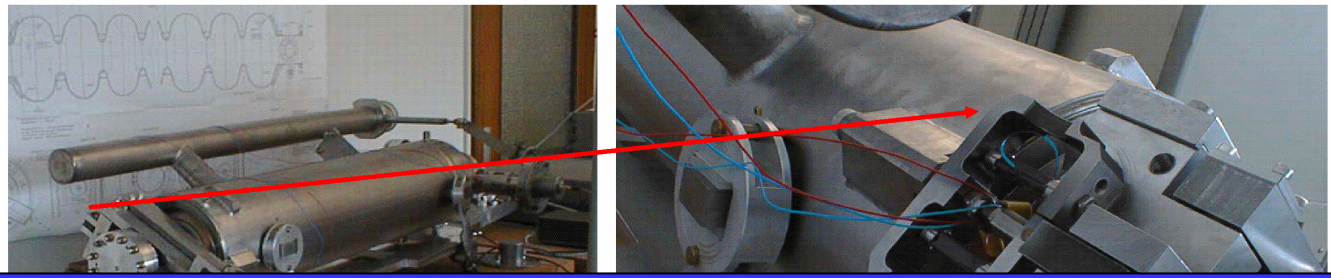
Time Distribution of RF Test:



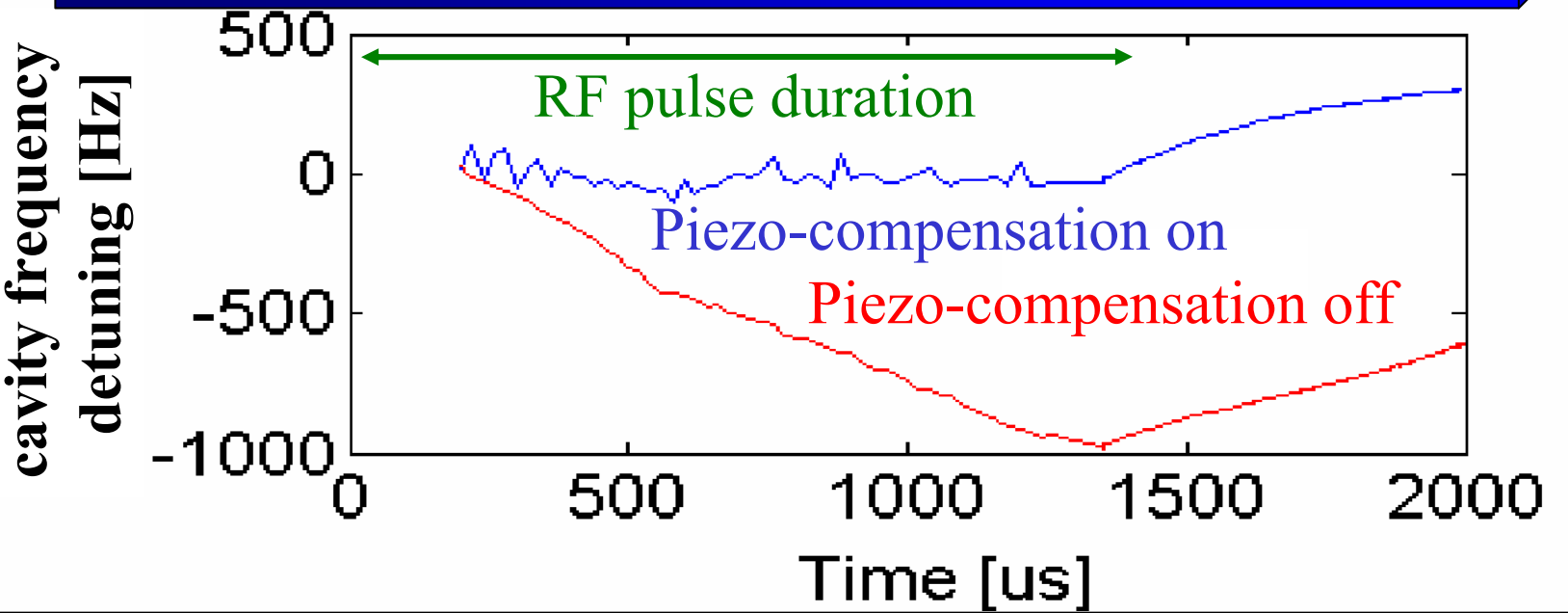
Electropolished TESLA 9-Cell Cavity AC 73: Horizontal Pulsed High Power Test (3)

- **Fully equipped cavity exceeds TESLA800 performance goal.**
- **Cavity performance can be preserved during assembly of the main input coupler and installation into a cryomodule.**
- **Long term (1 ½ months) test at 35 MV/m shows that s.c. cavities can reliably be operated very close to the quench limit.**
- **No performance degradation of has been seen in neither the cavity nor the input coupler. Induced quenches did not affect the cavity performance.**
- **Piezo compensation of Lorentz-force frequency detuning at 35 MV/m has been demonstrated.**

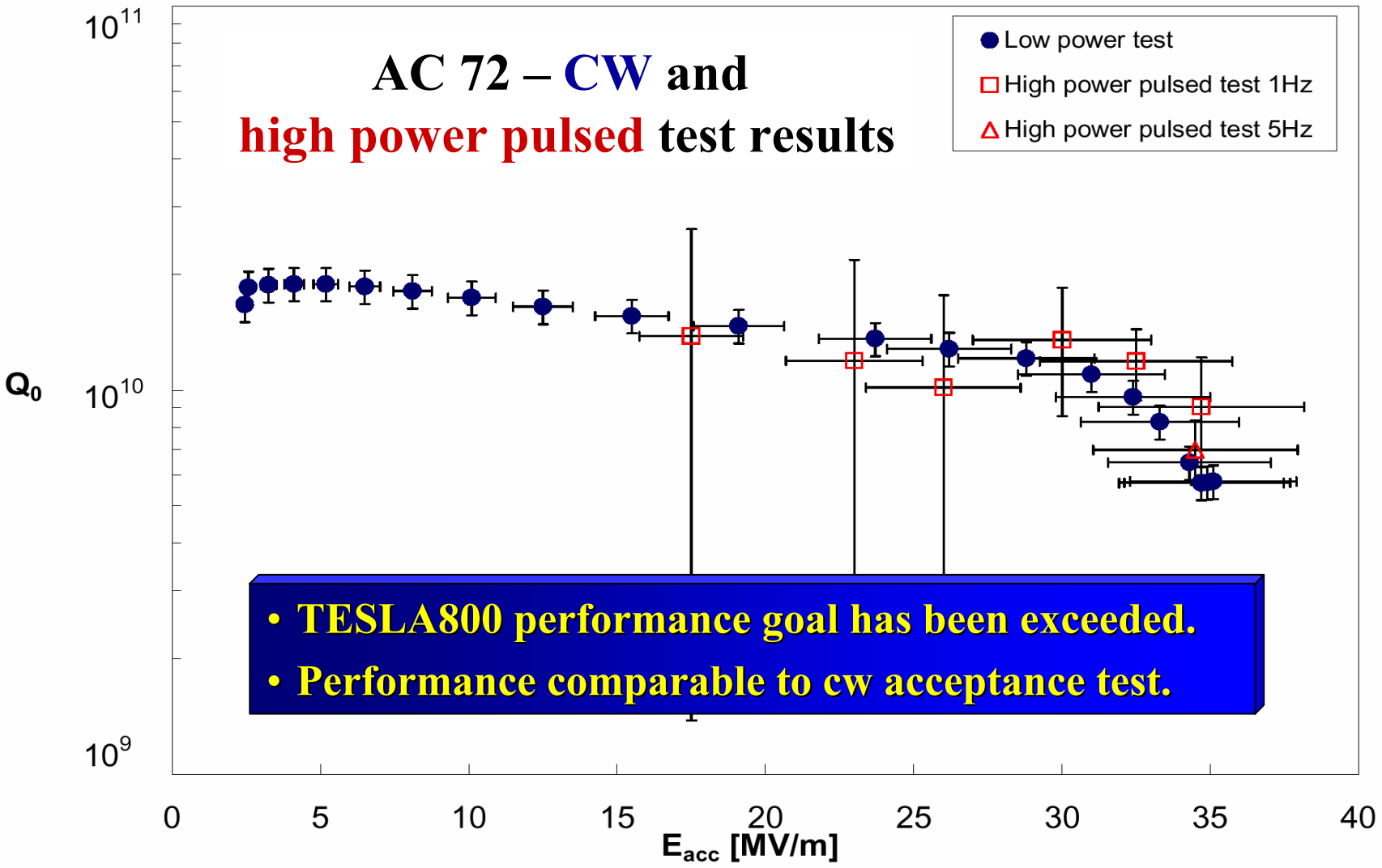
Electropolished TESLA 9-Cell Cavity AC 73: Piezo Actuated Lorentz-Force Detuning Compensation



Detuned cavity ⇒ More RF power is required to maintain an accelerating gradient.



Electropolished TESLA 9-Cell Cavity AC 72: Horizontal Pulsed High Power Test



High Gradient Cavity Work: What remains to be done?

- **TESLA800 performance goal has been exceeded in several 9-cell cavities.**
- **But:**
  - **Beam acceleration at 35 MV/m still needs to be demonstrated (R1 TRC rank for TESLA800).**
  - **A full cryomodule with eight electropolished cavities will not be tested with beam before 2005, but**
  - **The EP cavity AC72 will be installed in a TTF module and tested with beam acceleration in 2004.**
  - **More electropolished 9-cell cavities will be tested in pulsed high power mode to finalize the cavity preparation procedure. ⇒ Minimize cost, reproducible high gradients**

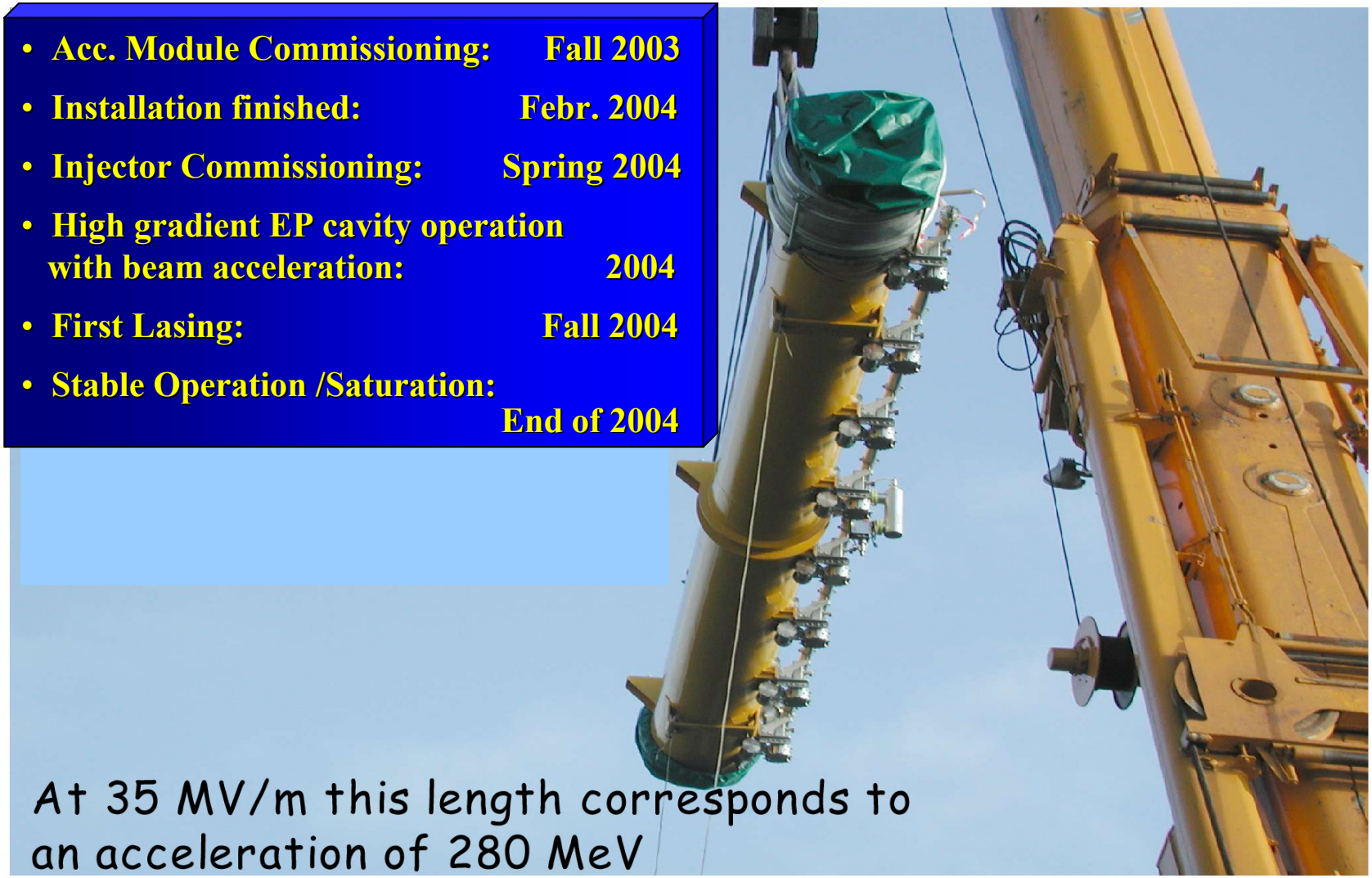
News from TTF II

TTF1 is being extended to reach 1 GeV in 2003

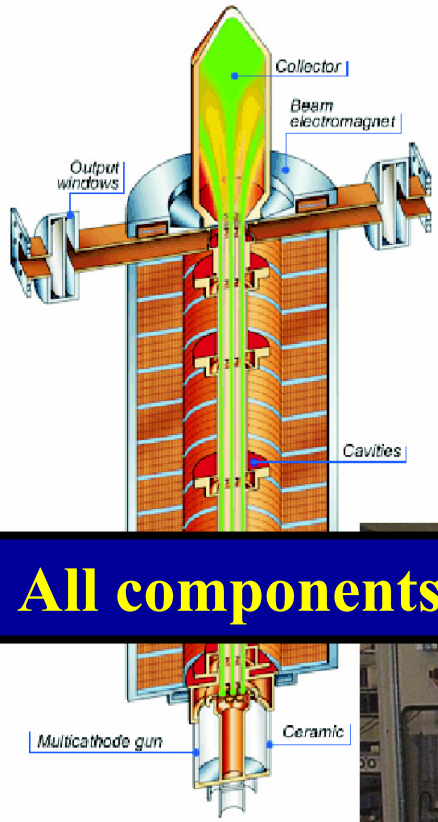
and becomes a user facility in 2004

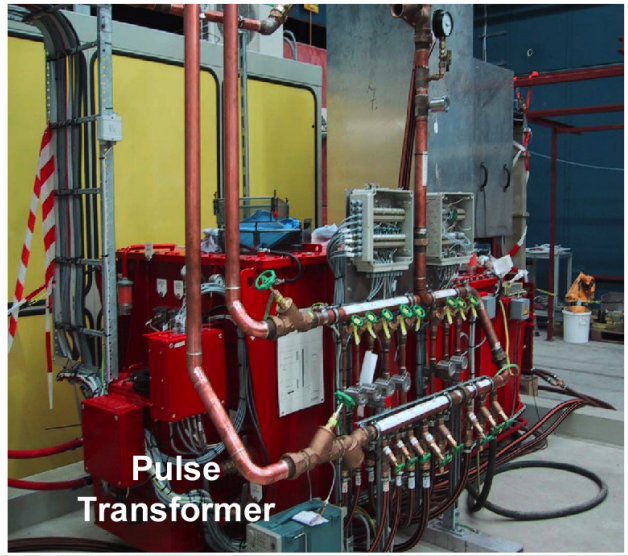
News from TTF II

- Acc. Module Commissioning: Fall 2003
- Installation finished: Febr. 2004
- Injector Commissioning: Spring 2004
- High gradient EP cavity operation with beam acceleration: 2004
- First Lasing: Fall 2004
- Stable Operation /Saturation: End of 2004



High Power RF for TTF, XFEL, TESLA

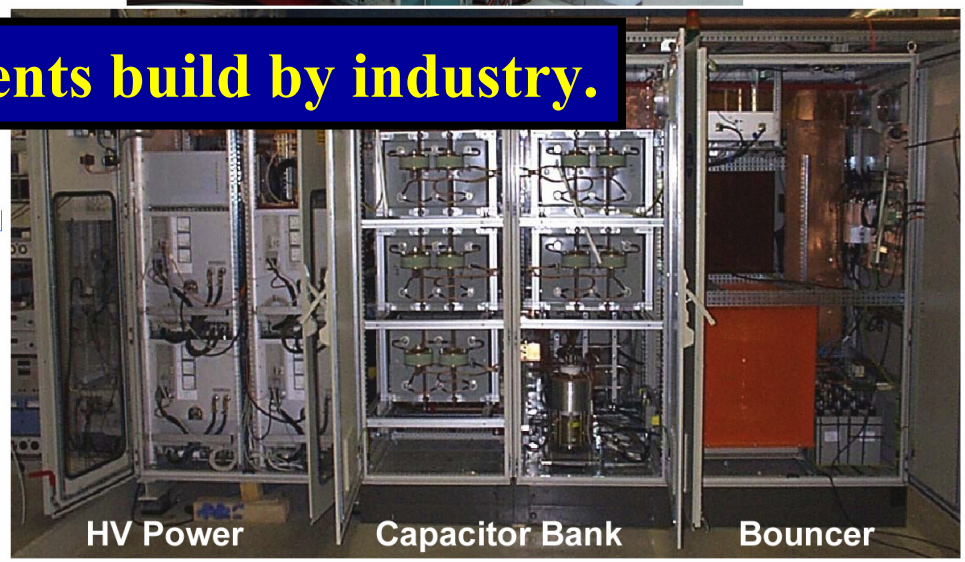




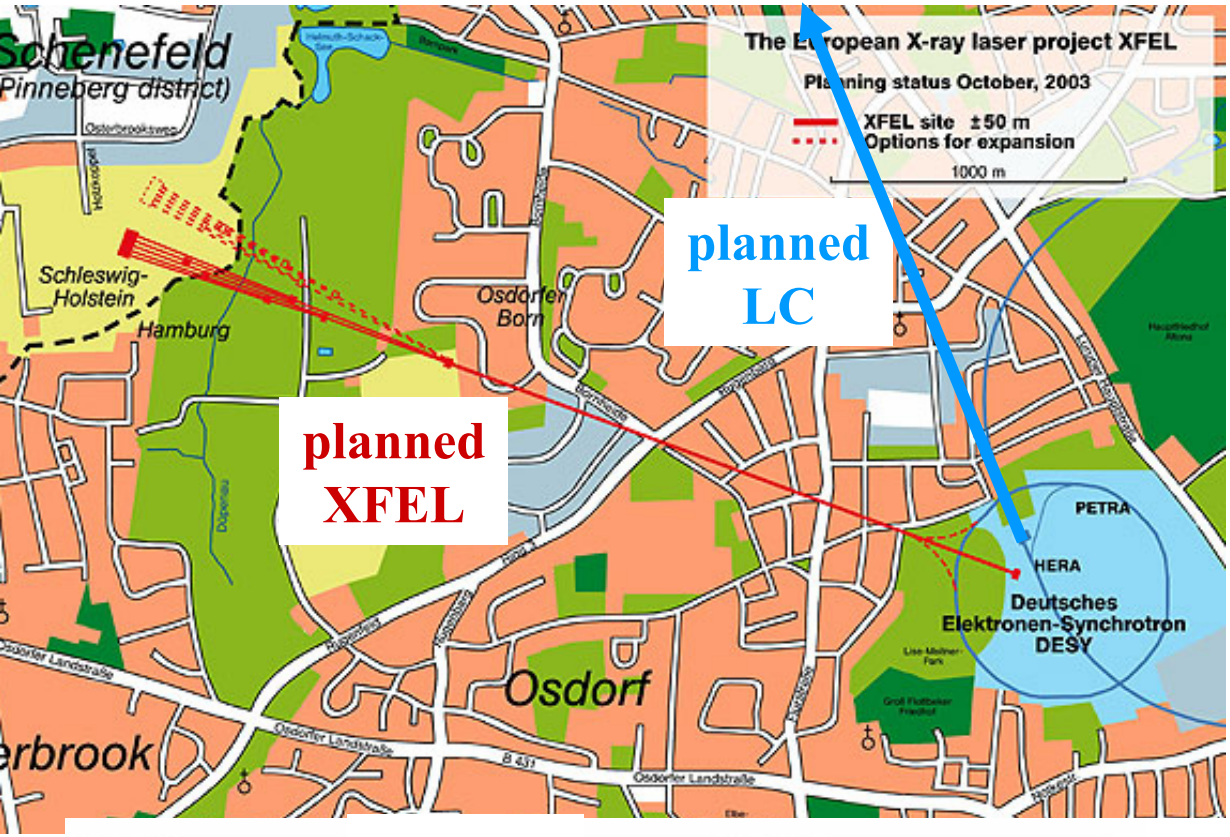
IGCT Stack

All components build by industry.

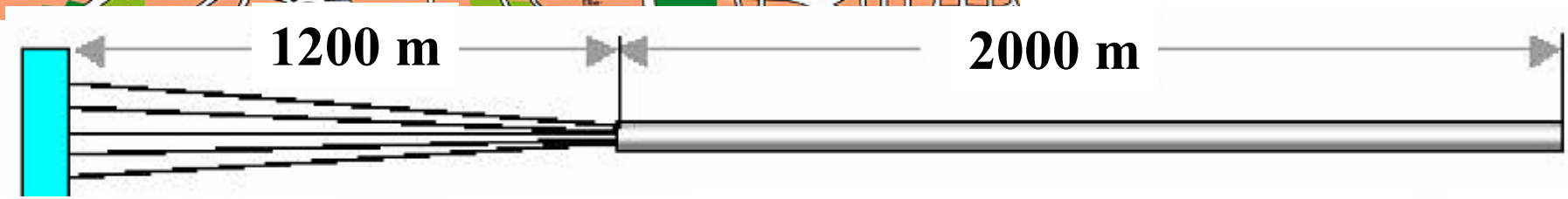
TH1801
Multi-Beam
Klystron



News from the DESY XFEL

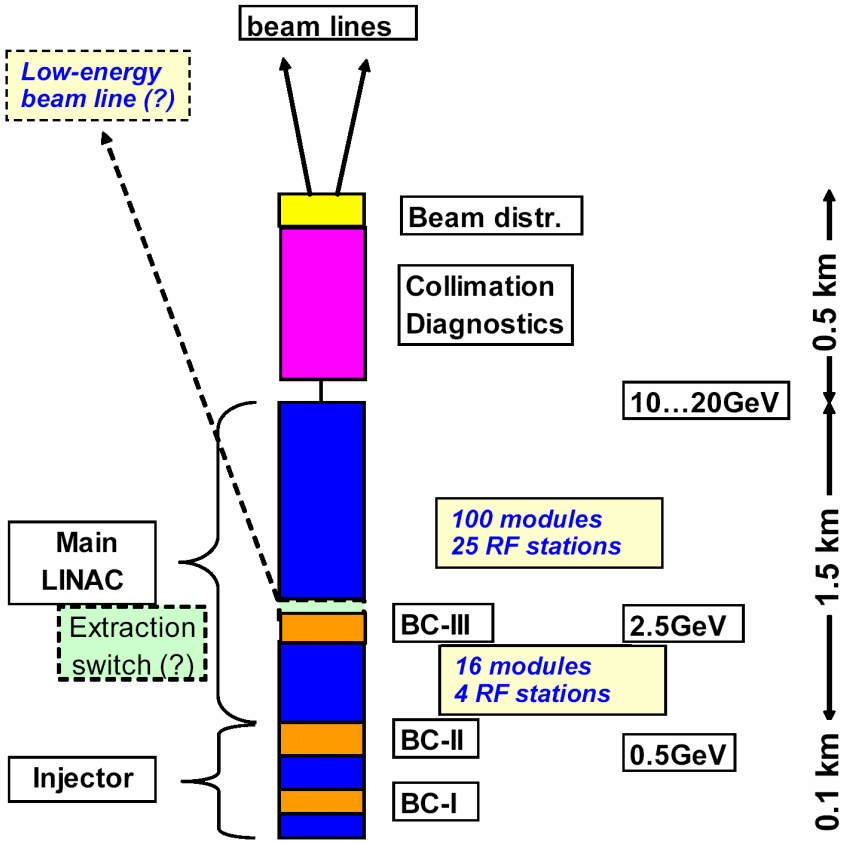


- **Site for XFEL chosen to maximize use of DESY infrastructure and to avoid interference XFEL/LC.**
- **European project, 50 % of funding from German government.**
- **Goal: Start construction in 2005.**



X-ray laboratory ***20 GeV superconducting main linac*** ***source***

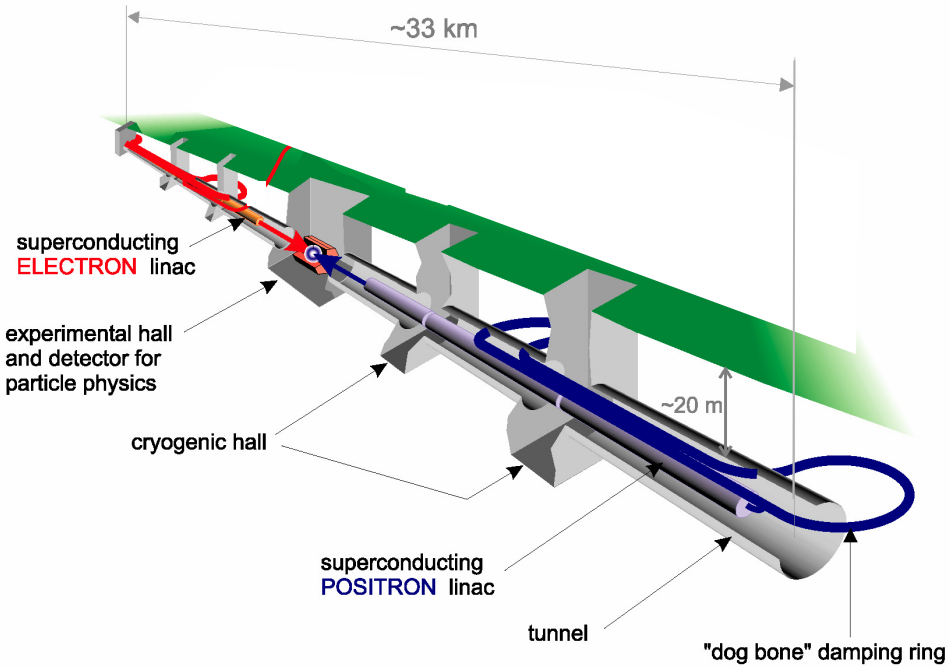
News from the DESY XFEL (2)



- **DESY has established a XFEL project group.**
- **Technical specifications are under discussion.**
- **Reference parameter:**
  - **20 GeV**
  - **22.9 MV/m accelerating gradient**
  - **116 cryomodules with 8 cavities each**
  - **5 mA beam current, 10 rep. rate**

Superconducting LC would profit from experience with XFEL.

News from TESLA
LC View by the German Government



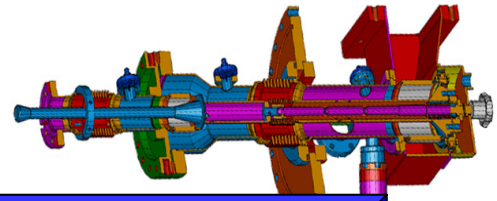
"The German government has decided … not to proceed nationally and at this moment not to propose a German site for TESLA. We have to wait for the international development. But we will continue our efforts to be able to participate in a global linear collider project. Let me underline: my (German) government is the first one to have announced to be principally committed to participating in the project."

(Dr. H. Schunck)

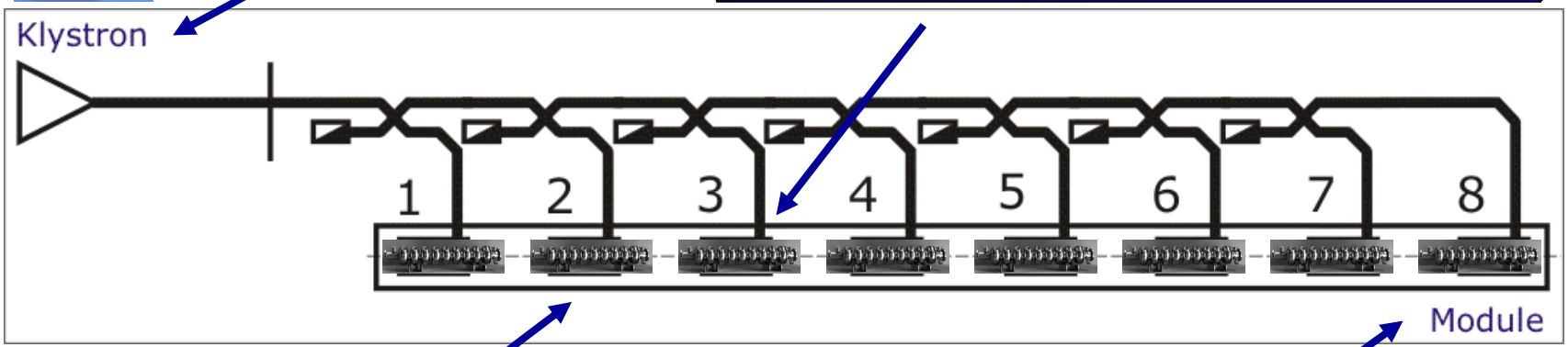
See LC as global project. ⇒ Importance international consensus.

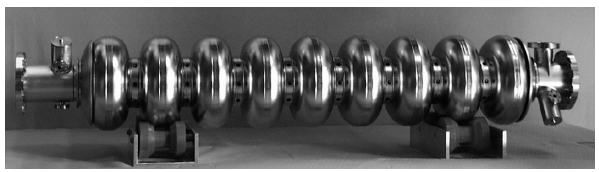
Components for the TTF/ XFEL/TESLA Main Linac

- 10 MW Klystrons and modulators built by industry.



- Input coupler built by industry.
- Tested to > 1 MW.





- Cavities built by industry.
- EP done in industry.
- Reach 35 MV/m.

- Parts for cryomodule built by industry.
- Assembly done at DESY.

Conclusion

- **TESLA800 gradients (35 MV/m) have been achieved repeatedly in 9-cell cavity tests.**
- **The EP system at DESY is in operation and the *a* 9-cell cavity reached an cw accelerating gradient of 40 MV/m.**
- **The high cw cavity performance of cavities can be preserved:**
  - **BCP cavities in the TTF linac show performance similar to their cw test results. The BCP cavity module #4 and #5 with eight 9-cell cavities each reached TESLA500 performance.**
  - **Two out of two EP cavities reached 35 MV/m in a full system high power test. Only minimal cavity processing was required. Stable long term operation at 35 MV/m was demonstrated.**
- **TTF II and the XFEL will give valuable information for a superconducting LC.**