ILC-HiGrade Meeting
WP6: Cavities

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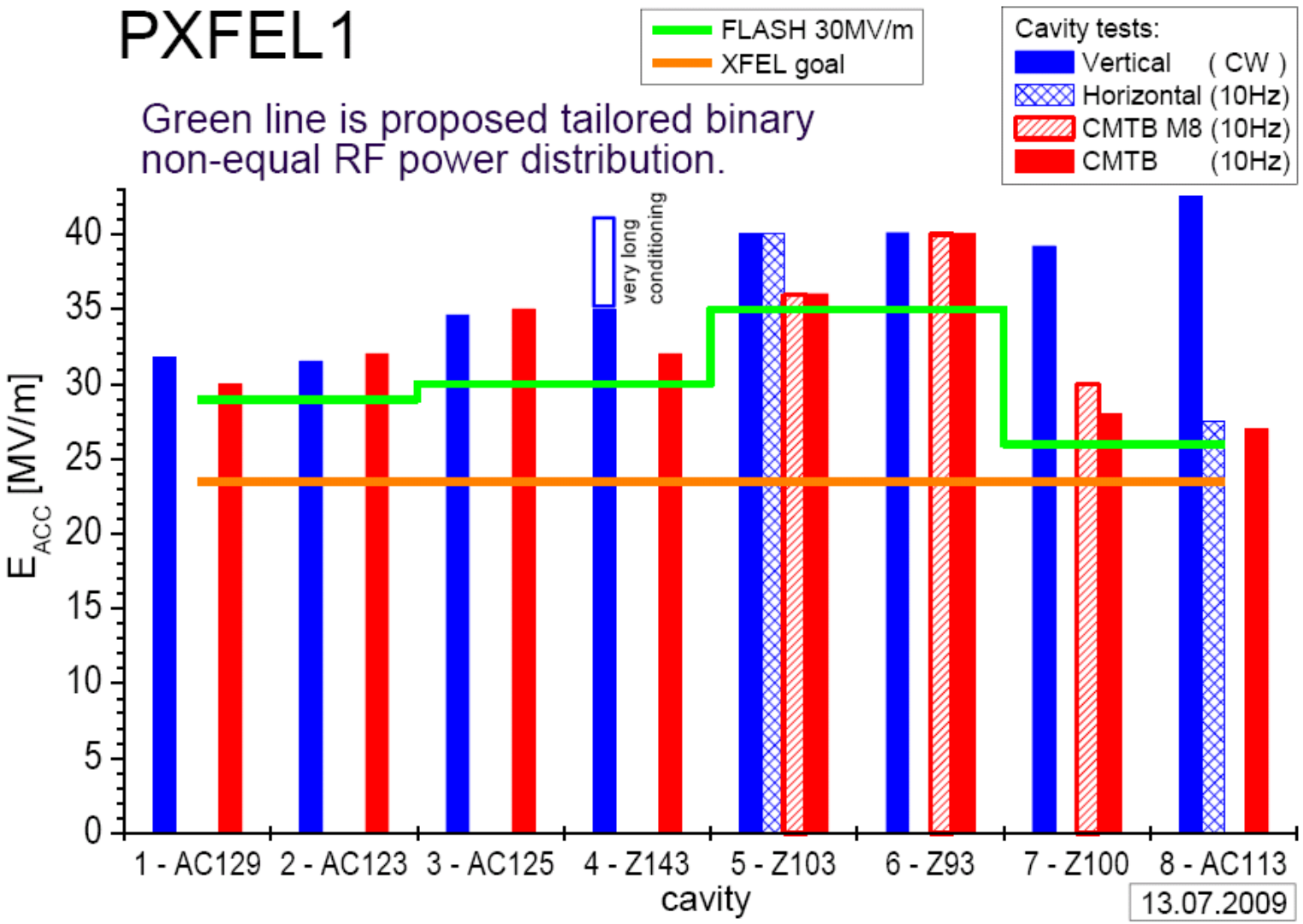
DESY

HiGrade WP6

- Assumptions
  - **XFEL is the only place with large quantity of „industrial“ cavities**
  - **Recipe known and applicable to >30 MV/m cavities**
- Goals
  - **Improve over XFEL performance**
    - XFEL will make a choice on the cavity preparation cycle soon, tendering is ongoing and includes HiGrade cavities
    - Ongoing R&D might show improved methods for cavity preparation, evolution of treatment
    - HiGrade can implement these steps on a subset of XFEL cavities
  - **Maximum synergy between the projects**
    - HiGrade can jump onto XFEL production
      - Establish QC on a regular basis by
        - » Support optical inspection of all cavities
        - » Thermal mapping of cavities -> 2nd sound
  - **Focus: Tool development and validation**

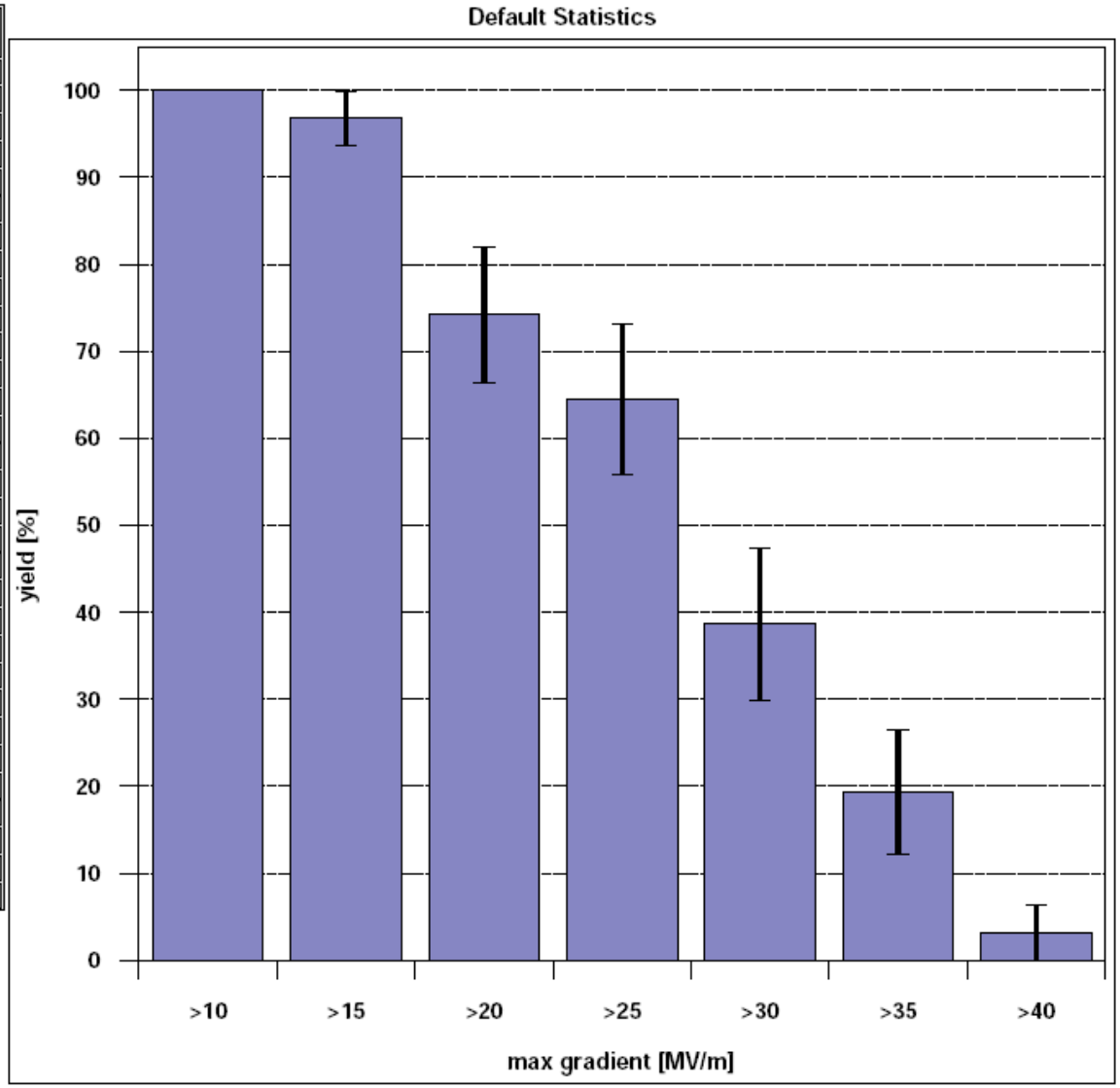
Cavity Performance in Modules: PXFEL1



SUPERCONDUCTING ACCELERATING MODULE TESTS AT DESY; D. Kostin et al.; Proceedings of SRF2009, Berlin, Germany, pp. 180-184; TUPPO005

ILC cavity yield

No.	Cavity	Test Date	Max. Eacc [MV/m]
1	TB9ACC013	01.Dec.08	41.80
2	AC122	26.Aug.08	38.88
3	AC115	11.Dec.07	38.60
4	Z104	20.Jun.07	37.80
5	TB9ACC011	21.Aug.08	37.00
6	TB9ACC012	07.Jul.08	35.10
7	AC125	15.Jun.08	34.59
8	AC150	30.Jan.09	34.33
9	Z143	09.Oct.08	32.57
10	Z88	25.Jul.07	32.10
11	AC127	13.Feb.09	31.25
12	Z106	25.Jan.07	30.10
13	Z101	13.Feb.07	29.20
14	ACCEL7	05.Sep.06	29.00
15	Z102	23.Aug.06	26.80
16	AC149	28.Jan.09	26.51
17	Z97	30.May.07	26.20
18	AC124	05.Feb.09	26.01
19	TB9ACC014	17.Apr.09	26.00
20	Z137	24.Feb.09	25.23
21	Z139	12.Sep.08	24.93
22	Z108	09.Jan.07	22.90
23	Z93	30.Mar.06	22.50
24	ACCEL6	12.Dec.06	19.00
25	Z141	16.Apr.08	18.29
26	TB9ACC015	02.Jul.08	18.00
27	Z130	01.Sep.08	17.30
28	Z131	20.Aug.08	17.17
29	Z132	19.Aug.08	16.83
30	AC126	05.Sep.08	16.37
31	Z110	19.Dec.06	13.80

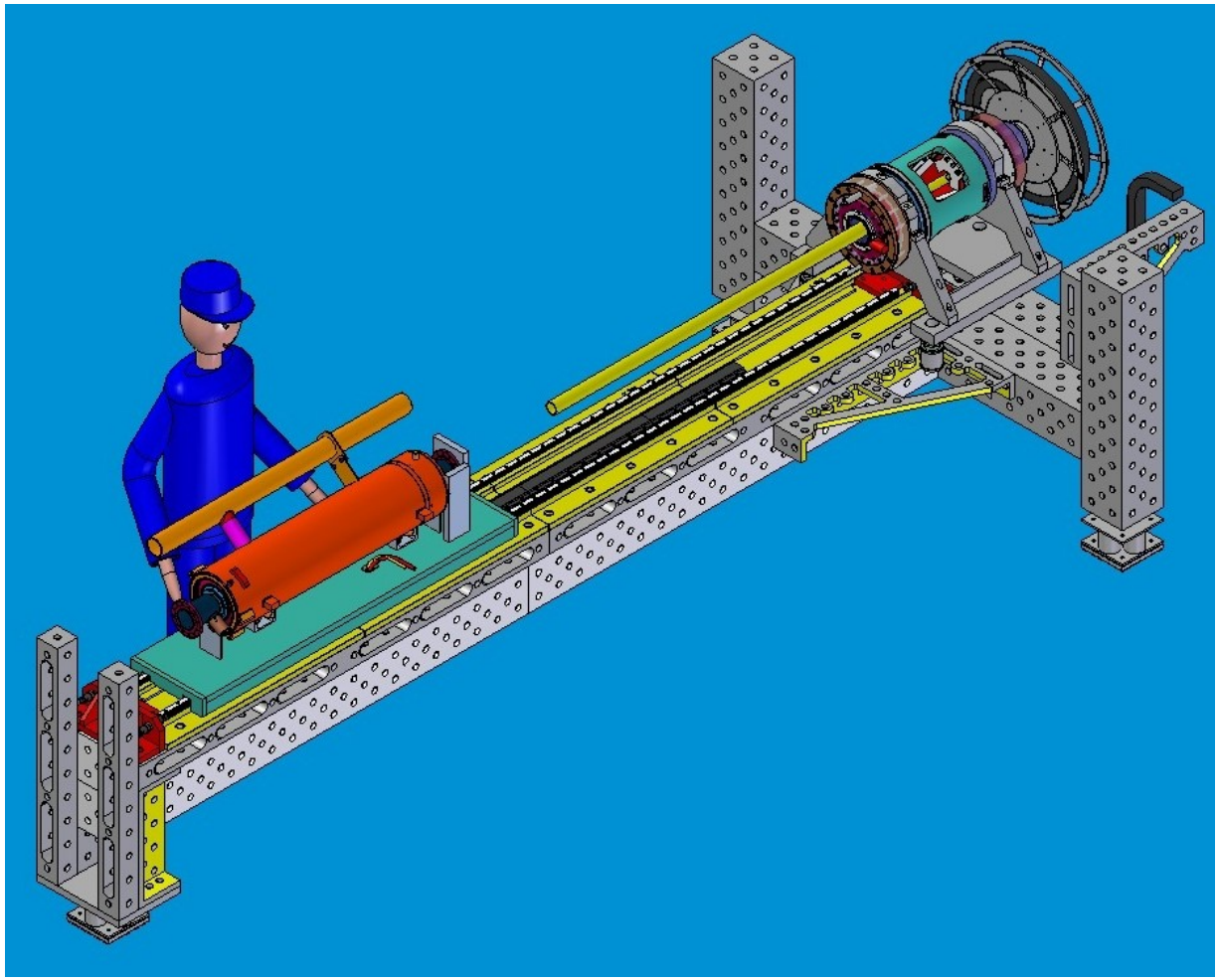


From soon to launch ILC-cavity-DB

Optical inspection

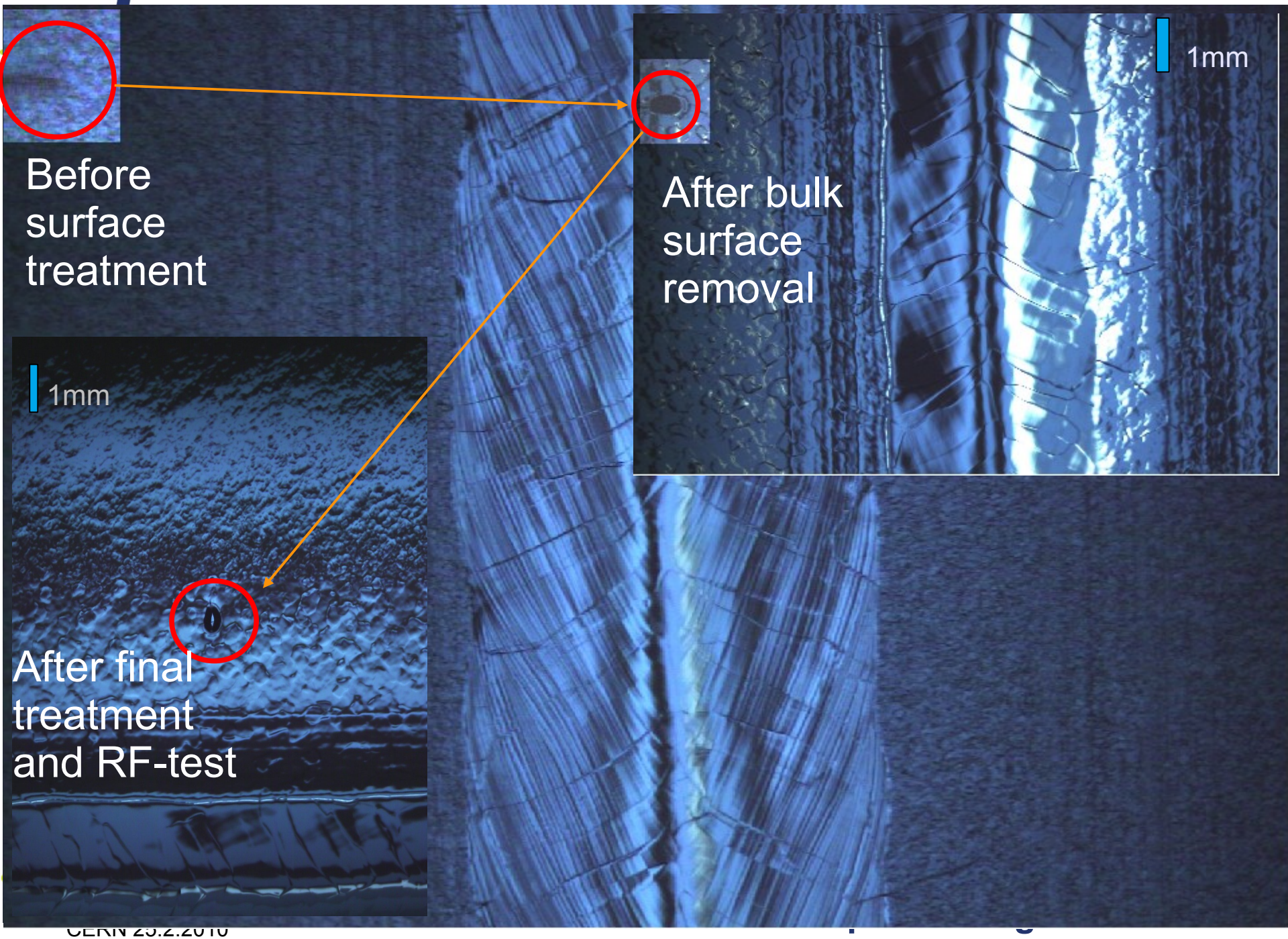
- High quality pictures available with new KEK/Kyoto-type inspection setup
- Characterise impact of „defects“ found
  - **Correlation with T-map data**
- Learn how feature-size and -number affects gradient
- Ideas for local repair
- Installation in production process as tool of quality assurance
- Welding seams: ~ 1000 pictures per cavity
- -> Automated inspection is needed

Optical inspection



- Automated setup prototype
- High precision positioning
- Easy to operate
- Fast inspection

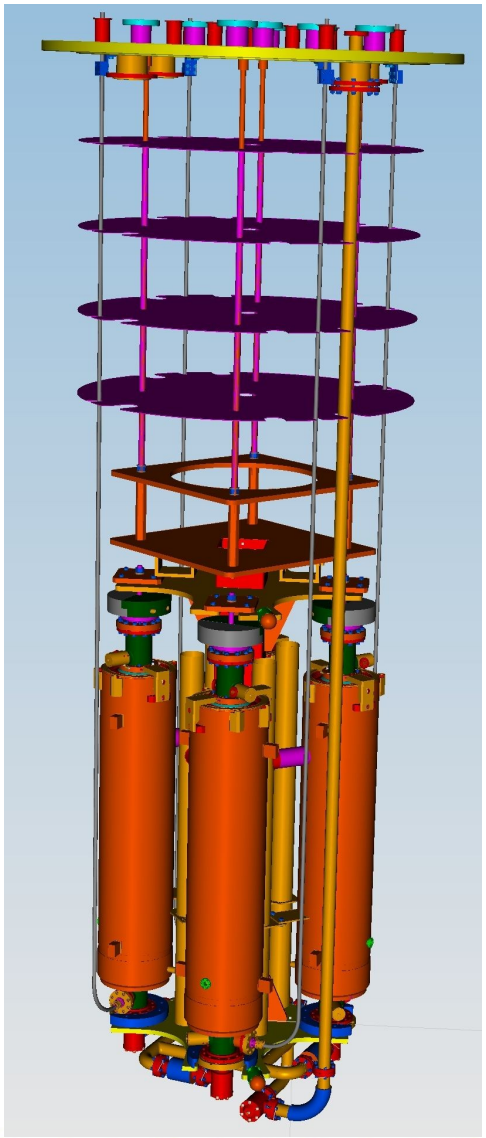
  ~2-3h/cavity


Before surface treatment
After bulk surface removal
1mm
1mm
After final treatment and RF-test

Second sound

- Pioneered at Cornell university
- Detect quench location by triangulation of 2nd sound wave
- Much faster than „usual“ T-mapping (resistor based)\
  - **Easier setup, permanent installation at insert possible**
- 2nd sound system similar to Cornell under construction at DESY
- Operating on „naked“ cavities
  - **Possibility to use on dressed cavities?**

Vertical insert for AMTF



- Design has been completed and specification has been written
- Suitable for cavities with and without He-vessel
- Lower part serves as transport frame
  - **Mounted to transport trolley with shock absorbers**

  -> transport simulation

Cavity transport simulation

- Check influence of shocks during transport on cavity perfomance
- 3 tests carried out
- Shock absorbers work efficient, setup for simulation has to be improved
- 3rd test with XFEL-like equipped cavity
  - **Deterioration**
  - **Antenna changed between vert. Test and transport -> repeat transport simulation**
- Next transport simulation under preparation

Automated vertical test infrastructure

- Reproduceability
  - **No operator intervention**
  - **e.g. automatic calibration**
- Increased testing speed
  - **Automatic determination of phase und frequency**
  - **Parallel measurement of gradient, power and radiation level at one cavity**
- Results are checked for consistency automatically
- Remote control is possible
- Very compact setup

Summary – ToDos for next year

- Optical inspection:
  - **Setting-up of protoype**
  - **Automated analysis and characterization**
- 2nd sound
  - **Setting-up of protoype system for large no. of cavities**
  - **Characterization of parameters**
    - Collaboration with Saclay?
- Vertical insert
  - **Tendering and construction (XFEL)**
- Automated vert. test
  - **Set-up in AMTF**

Model for ILC-HiGrade Cavity Production and Preparation

	Technical Choices	Location	Remark
Fabrication	XFEL-like	Company	Include optical inspection
Rough Surface Preparation	XFEL-like	Company	
Optical Inspection I	XFEL-like	Company	
Furnace	XFEL-like	Company	
Final Surface Preparation	XFEL	Company	QC Argument
Test I	T-map mandatory	DESY	DESY Manpower? Second sound?
Optical Inspection II	Compare with T-map	DESY	Guided repair option?
Final Surface Preparation	ILC recipe	DESY, CEA, Company	DESY capabilities? Which Company? Horizontal vs. Vertical EP
Test II (or more)	T-map (or second sound) mandatory	DESY, CEA	Second sound at DESY or CEA
Tank welding	Bladetuner with Piezos	Company, DESY	Compatible XFEL Cav. ! Tuner from INFN
Coupler assembly and Final rinse	High-pressure water rinse after assy	DESY, CEA	Coupler from LAL
High-power test		DESY, CEA	CHECHIA, CryHoLab