EU Regional Report

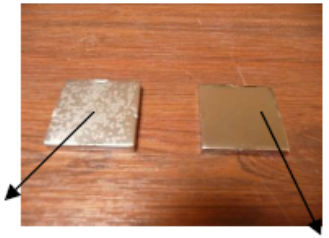
TTC Meeting @ LAL Orsay

16.6.2009

S. Aderhold, DESY

R&D ON ELECTROPOLISHING AT SACLAY

Irfu cea saclay



Sample A: **EP 20V.**

Sample B: **EP 5V.**

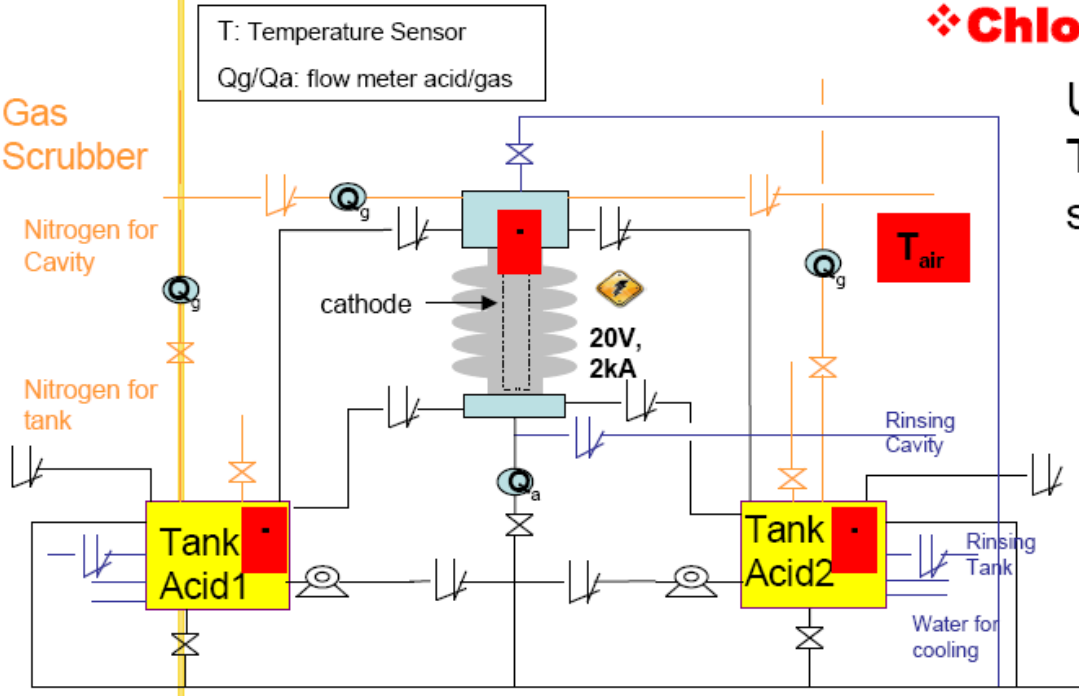
❖Low Voltage EP

Presented at last TTC meeting:

Sample Electro-Polished at 20V covered with sticky spots.

→ Impurities have been extracted from the electrolyte (Mixture HF-HS-H_2O: 1-9-1)

+65% sulphur found in A Mixture!



❖Chloroform Rinsing

Used as Rinsing step on single cell. The same solvant can be used for several treatments.

❖Vertical EP

A set-up for vertical EP is planed in the new lab:

programs Eucard, ILC Hi-Grade

-> Talk by F. Eozenou

Power coupler prototypes for ILC (1)

- New coupler designs as alternatives to the TTF-III baseline power coupler for ILC

- Two power coupler designs were achieved :
  - TTF-V: very similar to TTF-III coupler
  - TW60 : with a different geometry

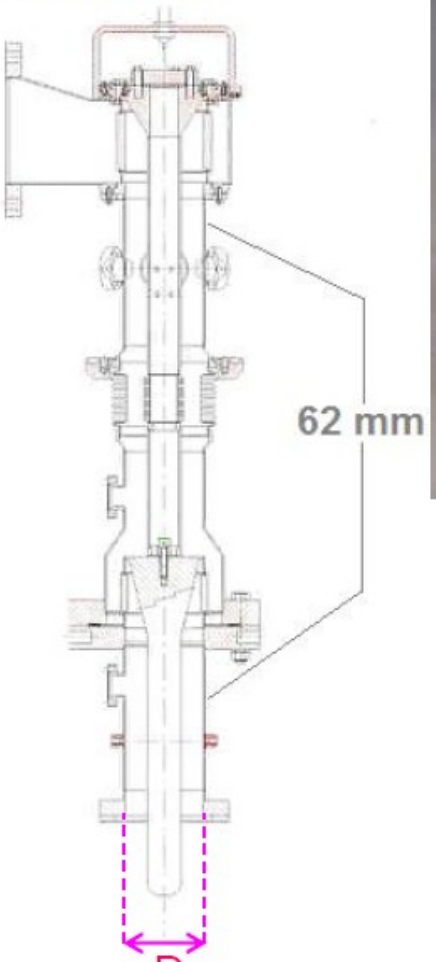
- Conditioning tests to validate the RF design of the new prototypes:
  - Use of the RF conditioning procedure for XFEL: 1 MW for (20μs, 50μs, 100μs, 200μs, 400μs) pulses and 0.5 MW for (800μs, 1300μs) pulses
  - Use of the RF conditioning procedure for ILC (used by KEK): 2 MW for (20μs, 50μs, 100μs, 200μs, 400μs) pulses and 1 MW for (800μs, 1300μs, 1500μs) pulses

- Thermal measurements on couplers during RF tests in order to make better thermal optimization for the possible future version

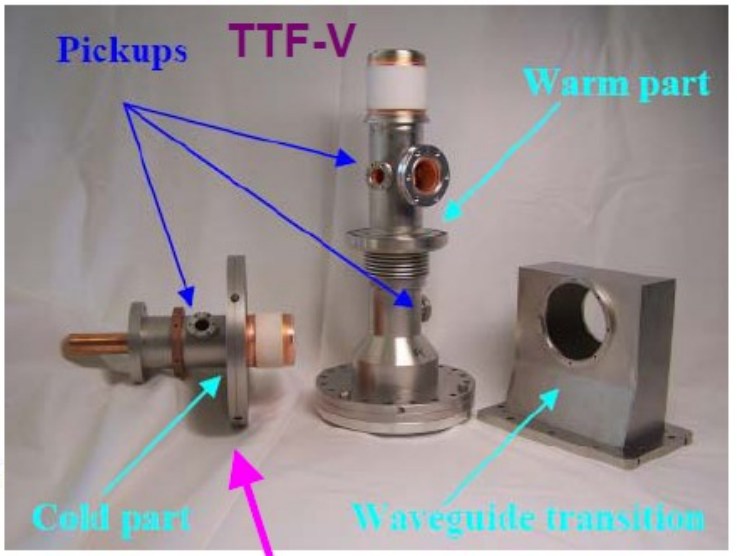
H.Jenhani, LAL Orsay

Power coupler prototypes for ILC (2):
TTF-V coupler prototype

Pierre Lepercq RF Studies (LAL)



Coupler prototype TTF-V



TTF-V is very similar to TTF-III, but, it have larger cold part diameter in order to shift multipacting (MP) to higher power levels.

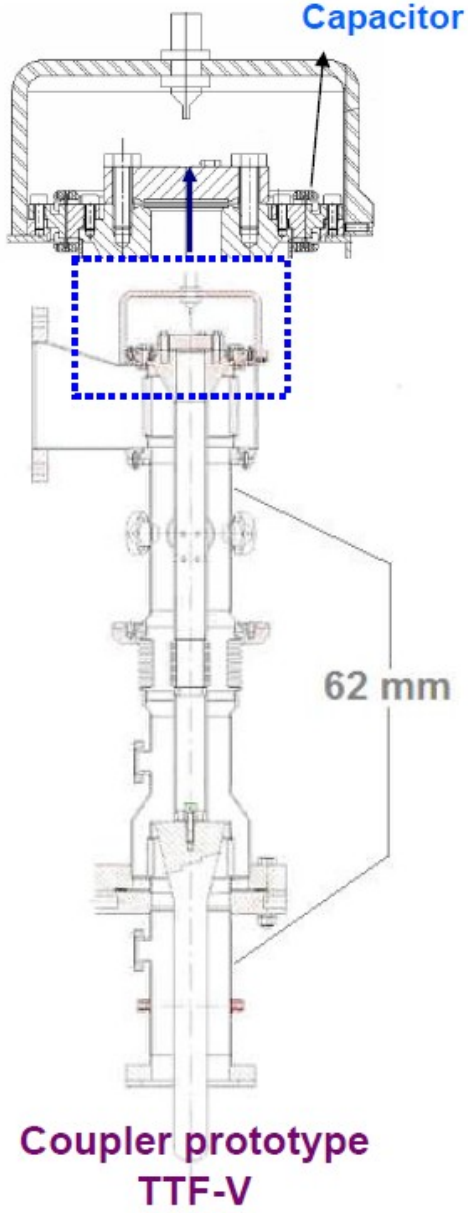
Multipacting scaling law in coaxial lines:

$$P_{1\text{-point}} \sim (f \cdot D)^4 \cdot Z$$

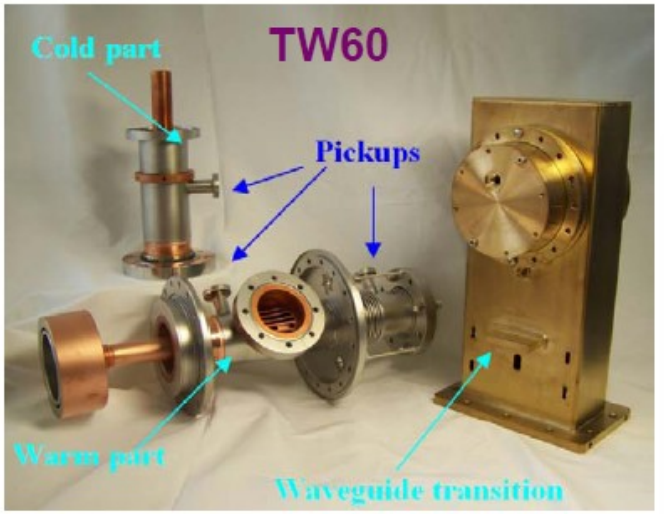
$$P_{2\text{-point}} \sim (f \cdot D)^4 \cdot Z^2$$

H.Jenhani, LAL Orsay

TW60 coupler prototype



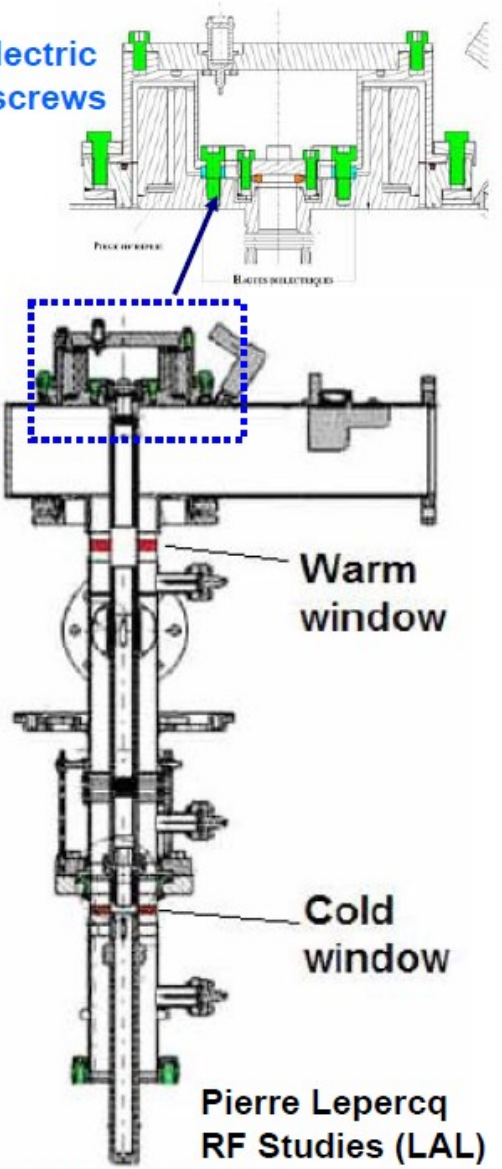
Coupler prototype
TTF-V



TW60 design:

- ✓ Coaxial planar window
- ✓ New polarization system
- ✓ Larger pumping port
- ✓ Simpler geometry

Insulation using dielectric ring and insulating screws



Pierre Lepercq
RF Studies (LAL)

Coupler prototype

H.Jenhani, LAL Orsay

SUMMARY

- The conditioning time performances obtained with old series of the TTF-III couplers were confirmed with the new series.

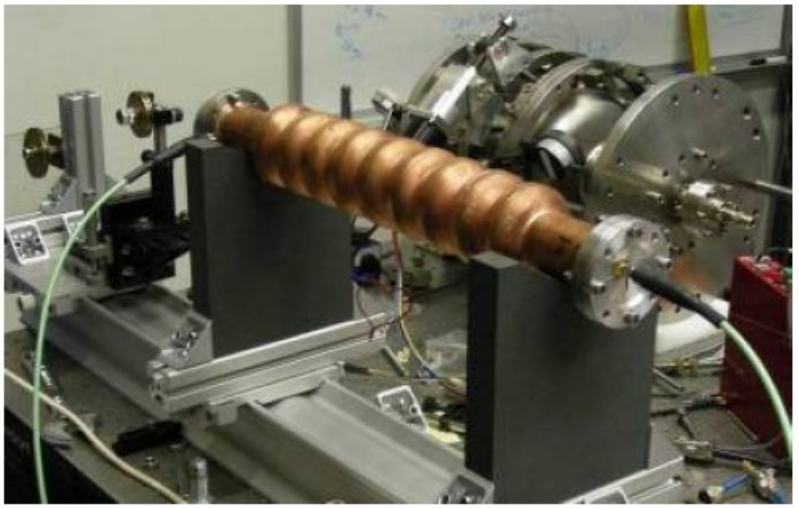
- LAL will have a new experience with the conditioning of 2 coupler pairs at the same time.

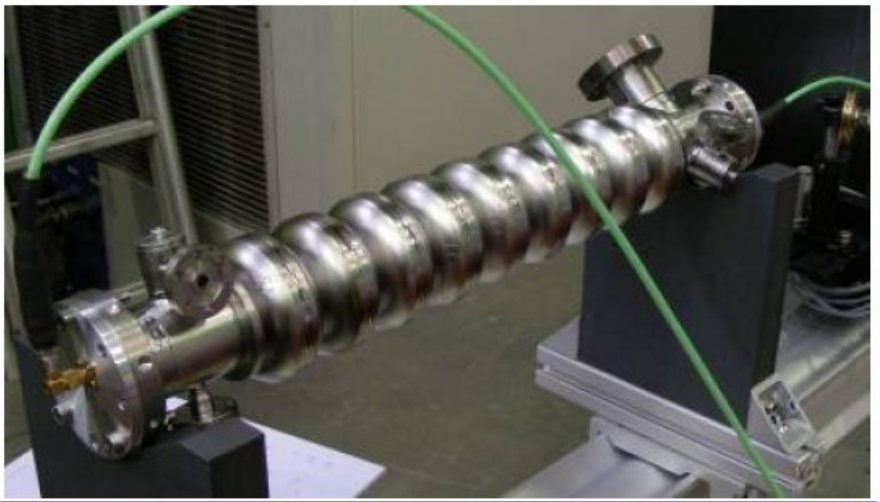
- Two new coupler prototype designs (TTF-V and TW60) were achieved:
  - TTF-V was totally conditioned in collaboration with KEK using their conditioning procedure for ILC power couplers
  - TW60 was totally conditioned using the XFEL conditioning procedures. RF conditioning using the KEK procedure is needed
  - New thermal optimizations on the two coupler prototypes can be made for future versions
- **Ti**tanium-**N**itride (**TiN**) sputtering machine is now used at LAL:
  - Many calibrations of the machine, characterizations of the deposed layers and optimization of the process were made: stoechiometric thin (~10 nm) TiN layers can be obtained.
  - Multipacting tests have to be performed to make further optimisations

H.Jenhani, LAL Orsay

Overview of XFEL 3.9 GHz activities

- Complete fabrication/preparation by industry of three 3.9 GHz cavities, followed by INFN
  - For f sensitivity, weld shrinkage, tuning machine ops.
    - → 1 Copper mockup, no MC&HOM
    - → 1 Nb mockup, full ports, no tank dishes
  - Optical inspection/tuning control software from INFN

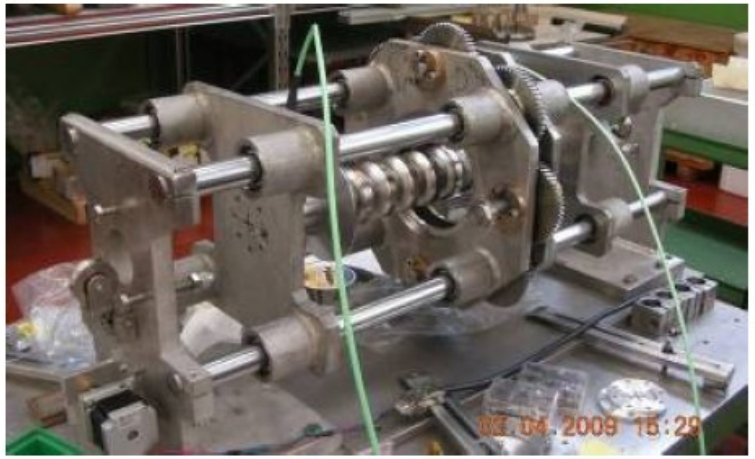


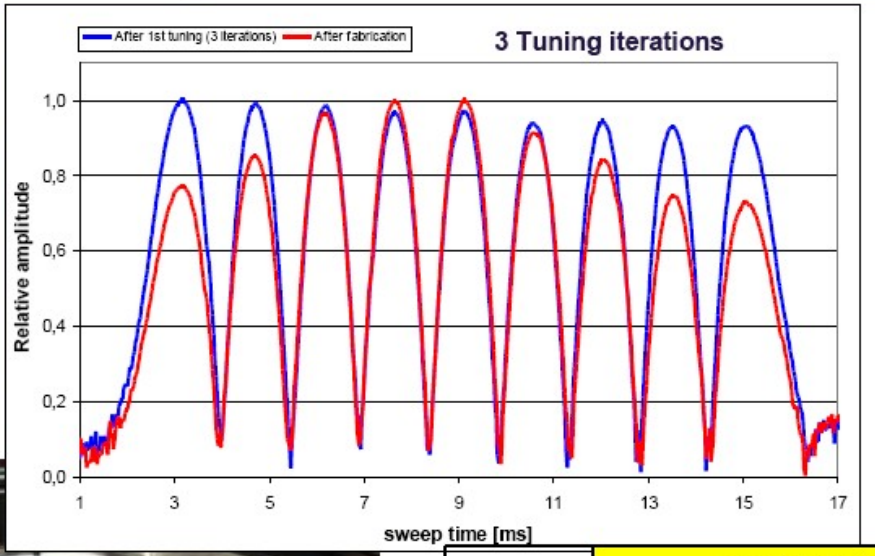


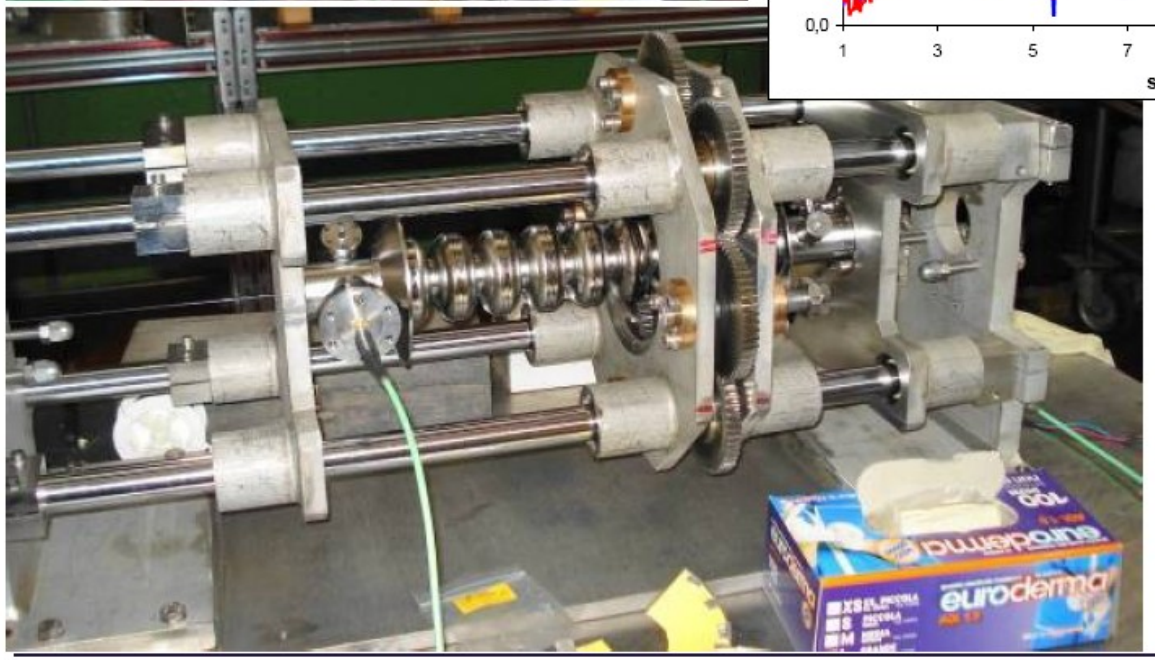
Paolo Pierini, INFN

European XFEL

Commissioning of tuning machine





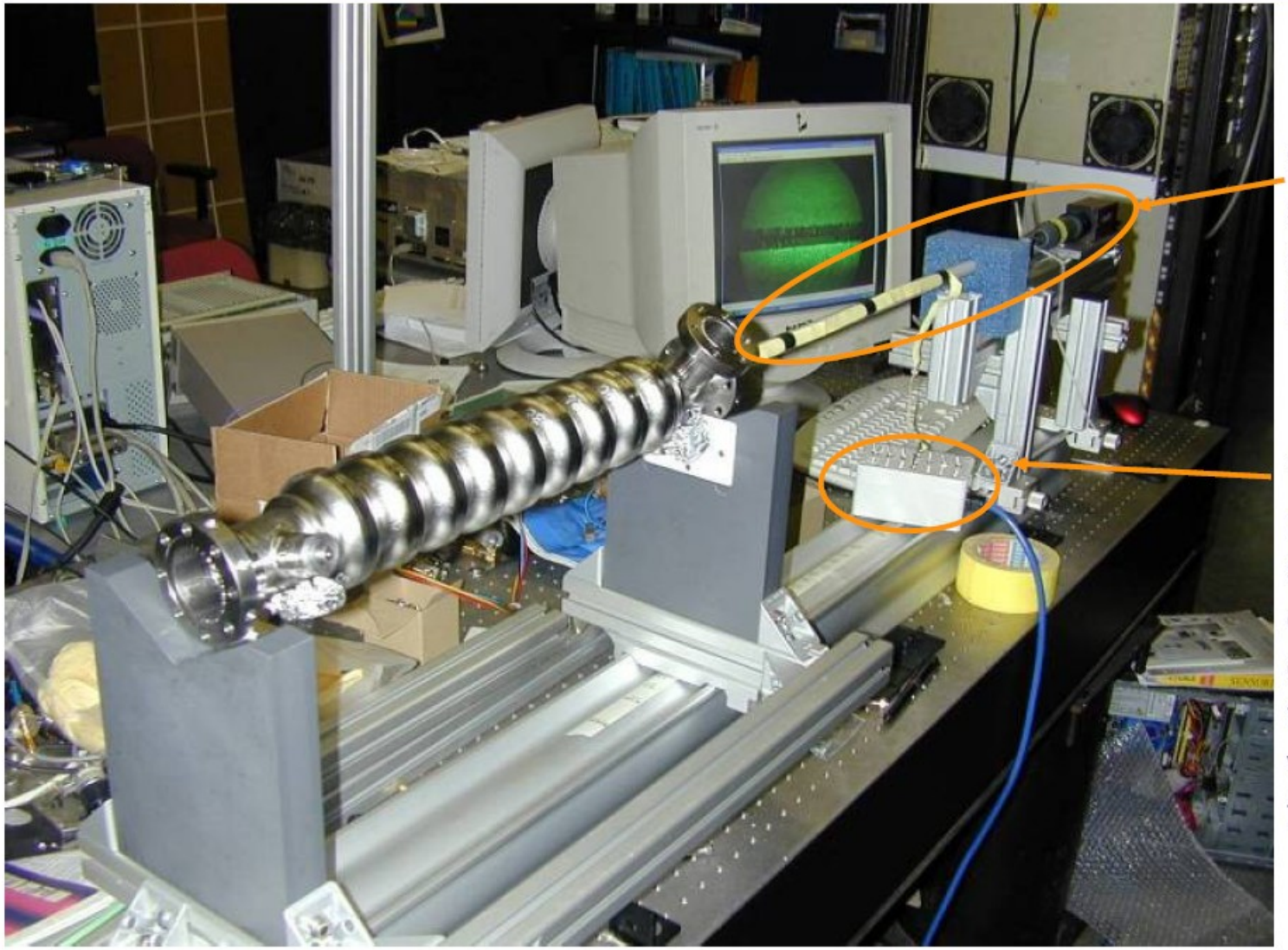


	Cavity After Tune		
Cell #	3HZ01	3HZ02	3HZ03
1	1,000	0,996	1,000
2	0,989	1,000	0,993
3	0,972	0,996	0,985
4	0,953	0,997	0,966
5	0,948	0,982	0,971
6	0,939	0,976	0,940
7	0,959	0,967	0,943
8	0,955	0,966	0,931
9	0,938	0,959	0,932
Flatness	**93,8%**	**95,9%**	**93,1%**

Paolo Pierini, INFN

European XFEL

Optical inspection system (boroscope)



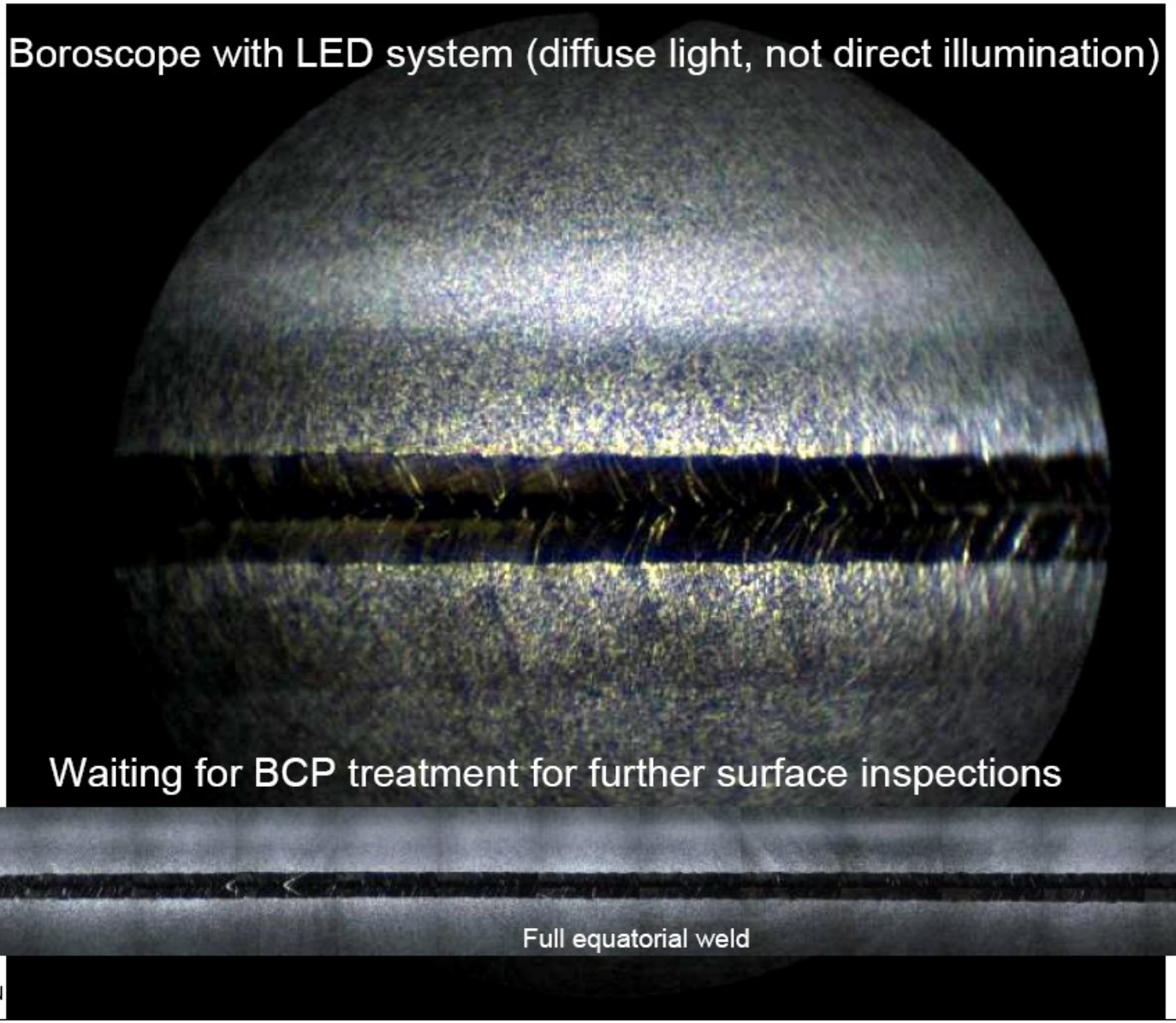
90° angle small wand (8 mm) boroscope

10 individually powered LED shining from opposite side of boroscope to light region with reflections from Nb surface

Paolo Pierini, INFN

European XFEL

Equator weld inspection (after fabrication)



Paolo Pierini, INFN

Treatment setup nearly ready at vendor

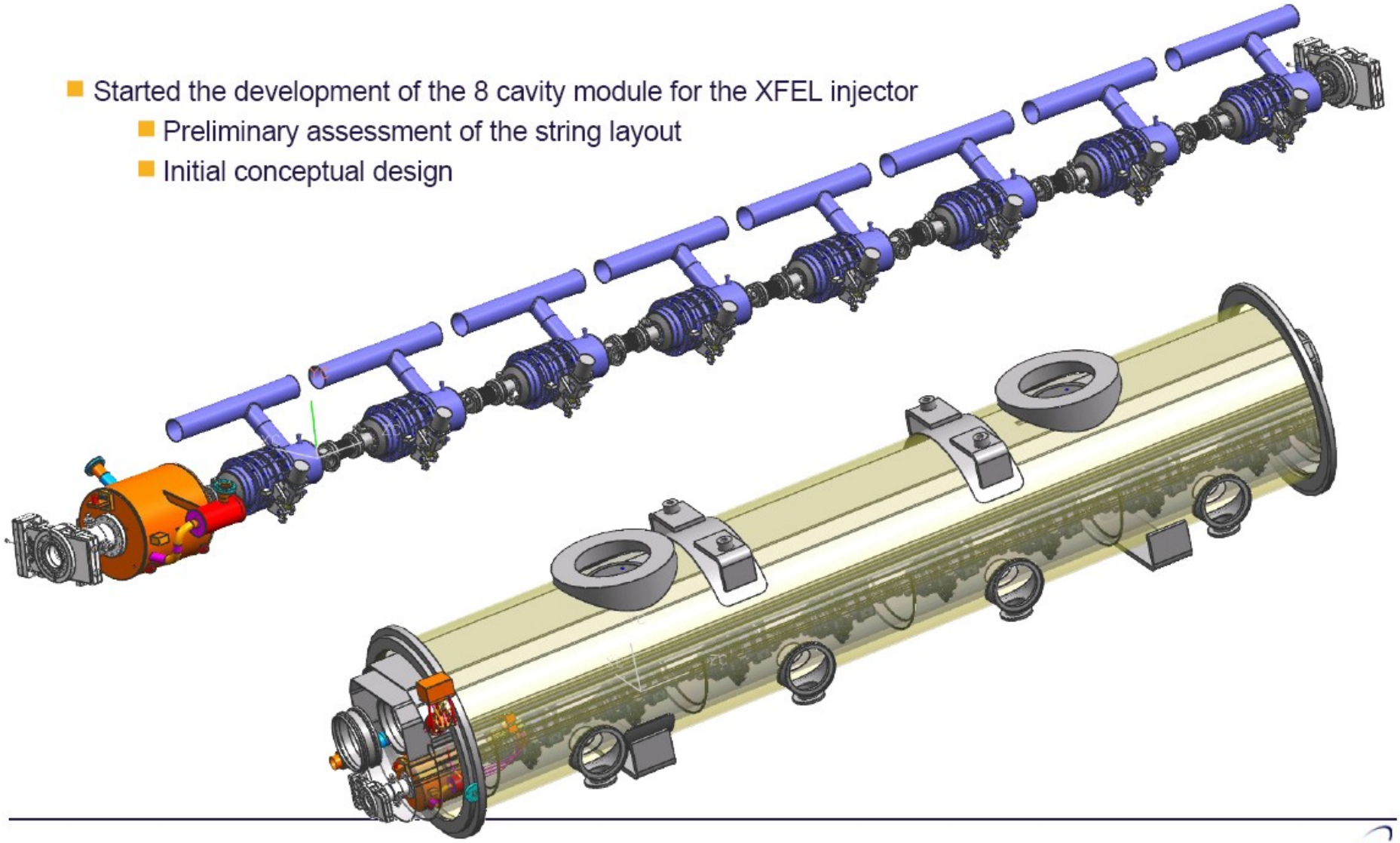
- BCP Cabinet nearly ready, being finalized
  - Tests with water soon
- UPW System under acquisition
- HPR cabinet in preparation

Paolo Pierini, INFN

European XFEL

XFEL WP46: 8 cavity module

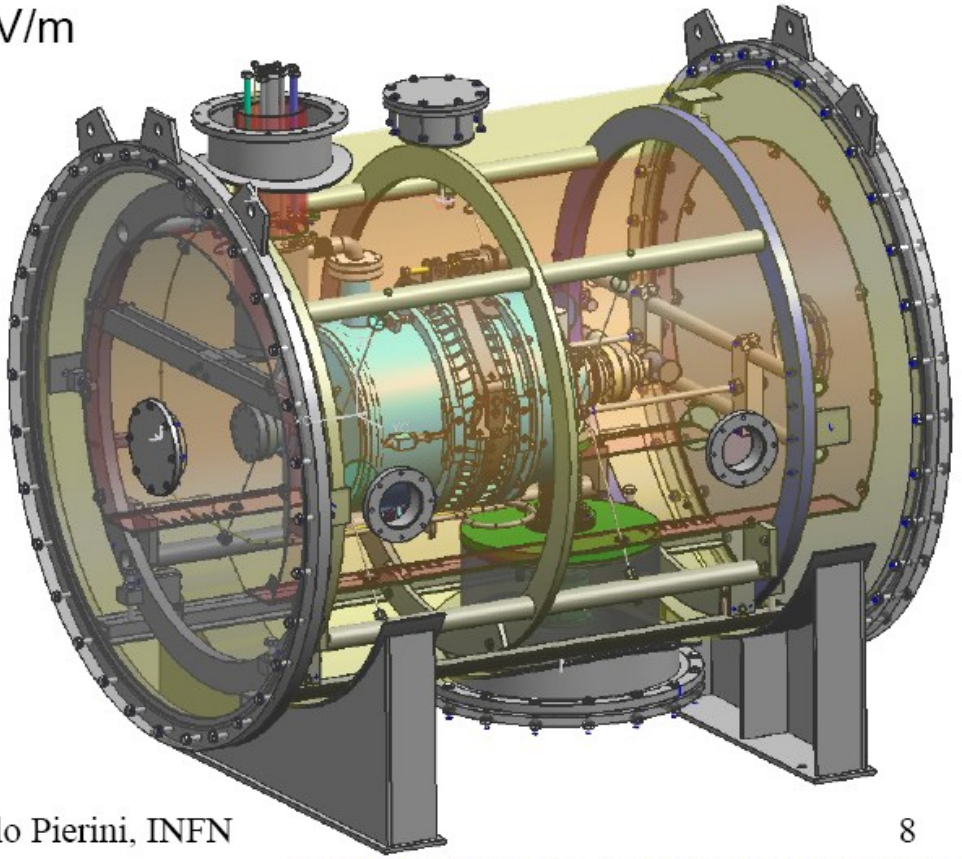
- Started the development of the 8 cavity module for the XFEL injector
  - Preliminary assessment of the string layout
  - Initial conceptual design



Paolo Pierini, INFN

β=0.5 proton cavities @ 704 MHz

- 2 complete cavities with blade tuner (fast+slow), under EC programs
  - 1 dedicated to single cavity prototype module in fabrication for ADS (waste transmutation, EUROTRANS)
  - 1 dedicated to tests for “SPL” LLRF studies (SLHC-PP)
- Vertical tests yielded up to 17 MV/m



Paolo Pierini, INFN 8

EUROTRANS module, to be installed at IPN Orsay

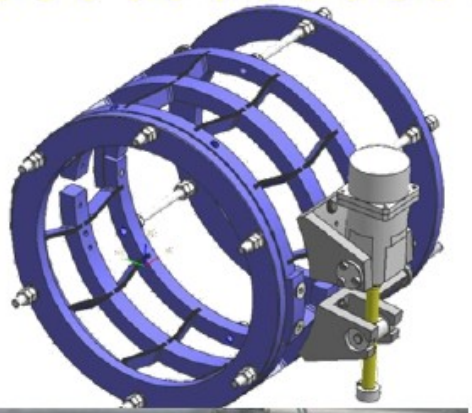
ILC-HiGrade Cavities

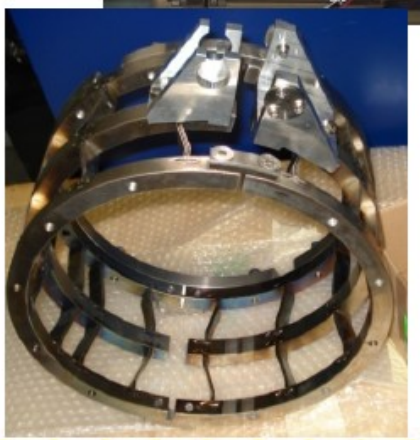
- ~30 add. cavities in XFEL order covered by HiGrade program
- QC sample out of production stream
  - undergo all regular steps (except He-tank-welding)
  - Appendix to XFEL specification
- Will be separated from other cavities in Saclay
- Add. Tests (e.g. T-map, optical inspection) and preparations, → details to be defined
-

Resuming

Status of the Blade Tuner development:

- "Slim" design prototype with piezo realized from the original *SuperStructures* tuner. Manufactured and intensively cold tested at CHECHIA (DESY) and HoBiCaT (BESSY) searching for limits and performances
- From the experience gained, a "revised" Blade Tuner was designed. Guidelines: titanium, stiffness, strength, piezo action and further simplification.
- New design tuners manufactured in a small series of 8 units, 2 more are under production.





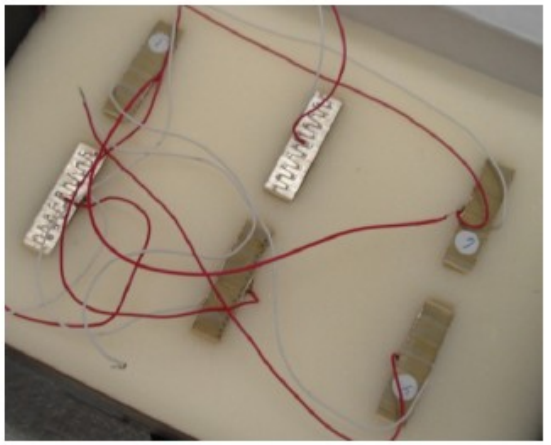
C.Pagani @ TILC09

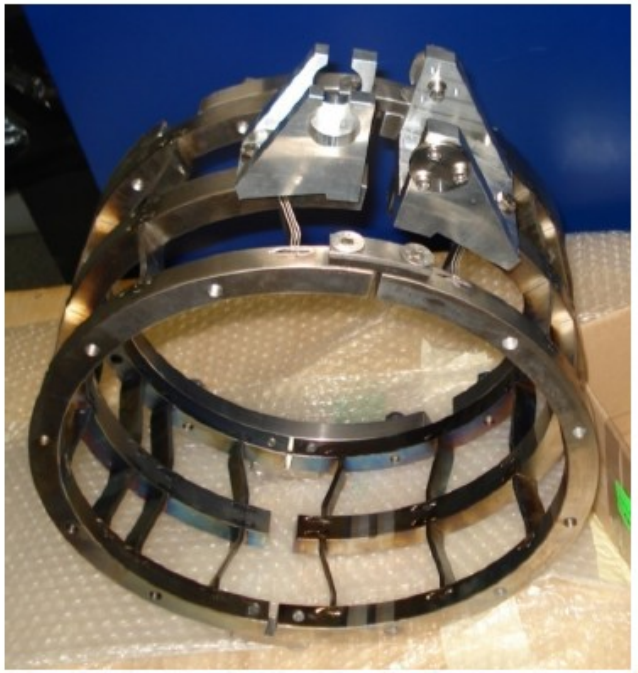
Manufacturing

Important installations to come in short times:

- Cryomodule 2 (CM2) of **ILCTA** facility at New Muon Lab, FNAL, US: 8 units
- **S1-Global** facility at KEK, Japan: 2 units

ILC-HiGrade of EU FP7 is also on the way: 24 units

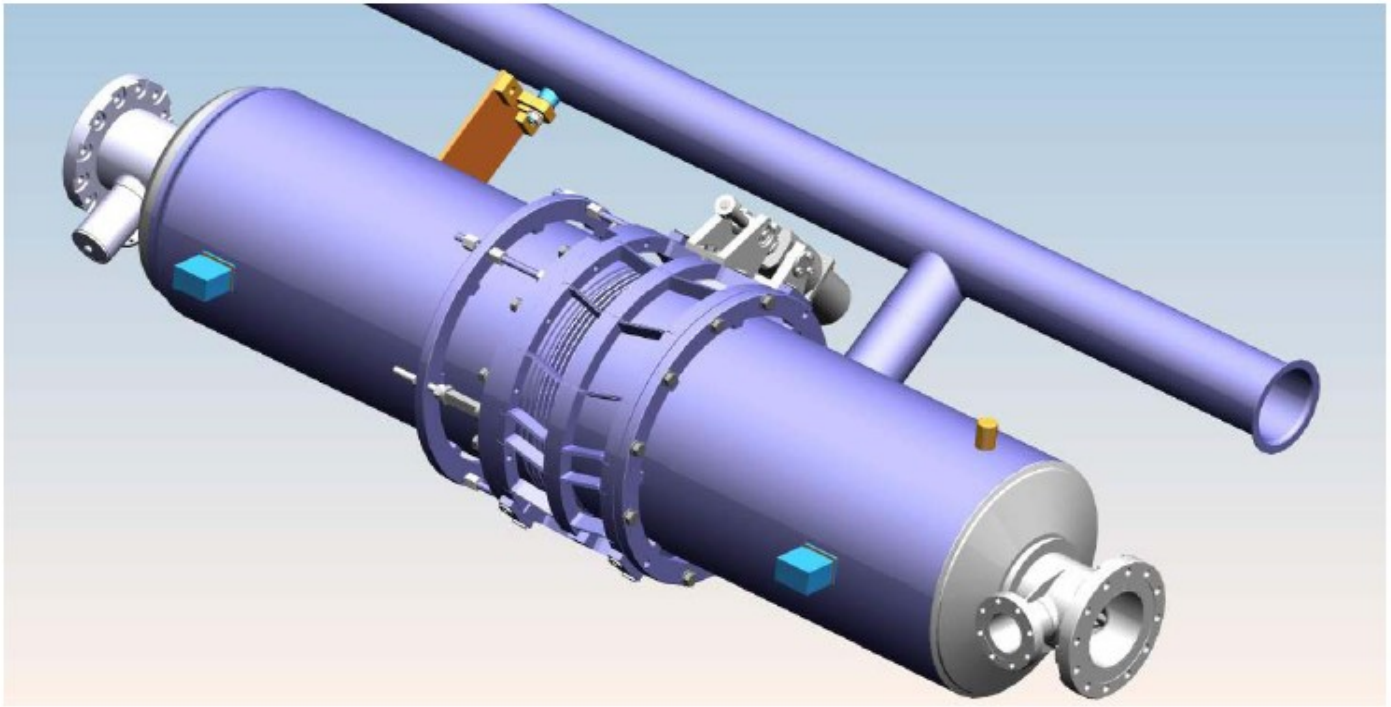




C.Pagani @ TILC09

ILC-XFEL Plug Compatible Cavity

- Cavity with Helium Tank, Tuner and pipe connections
  - Plug Compatible with the 3 Regional Infrastructures
  - Plug Compatible with the FLASH and XFEL Cryomodules



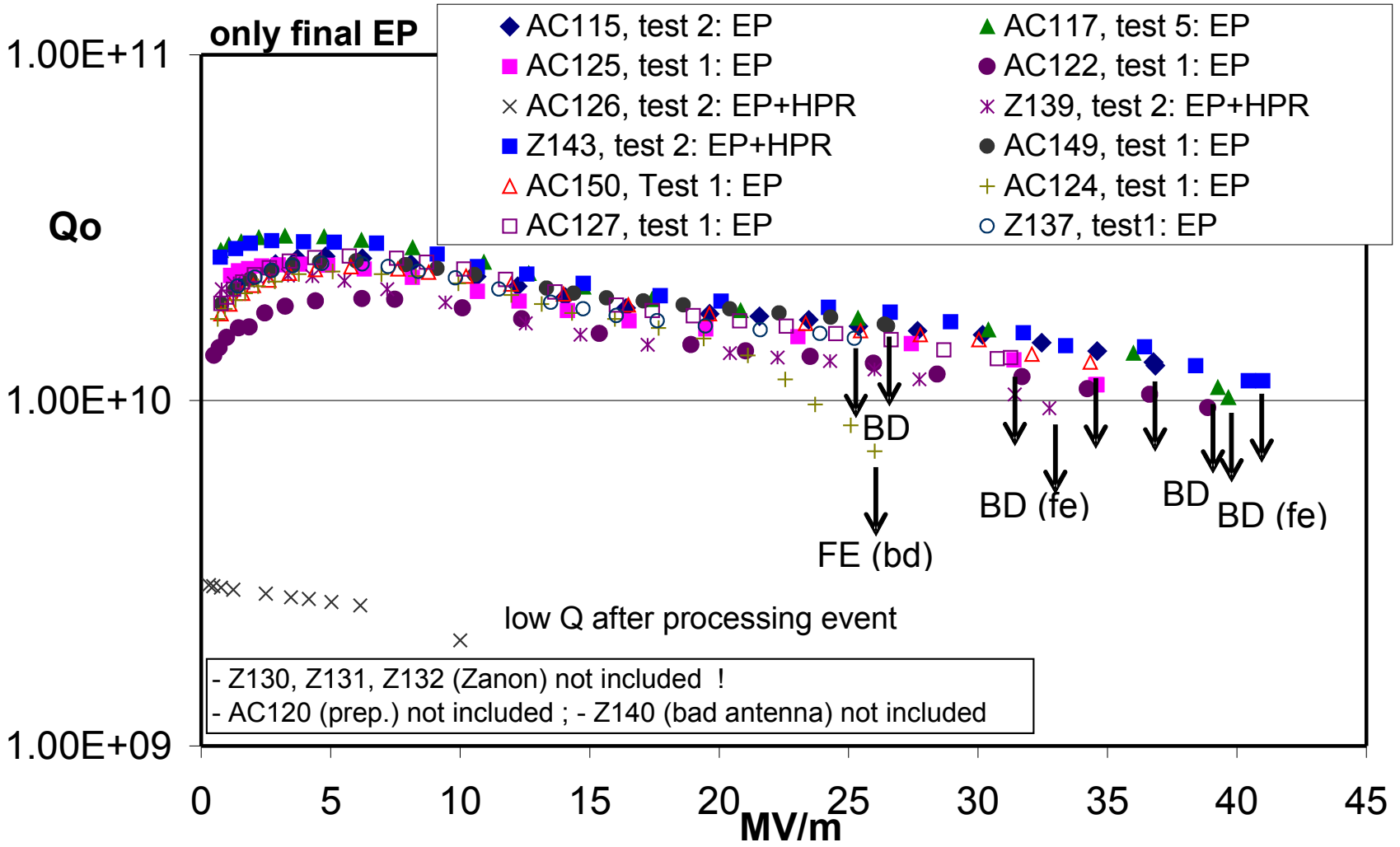
INFN Milan strongly promotes and supports the plug compatibility concept to make the best use of XFEL expected synergies for the ILC

R.Paparella@HiGrade-meeting 6.3.2009

DESY

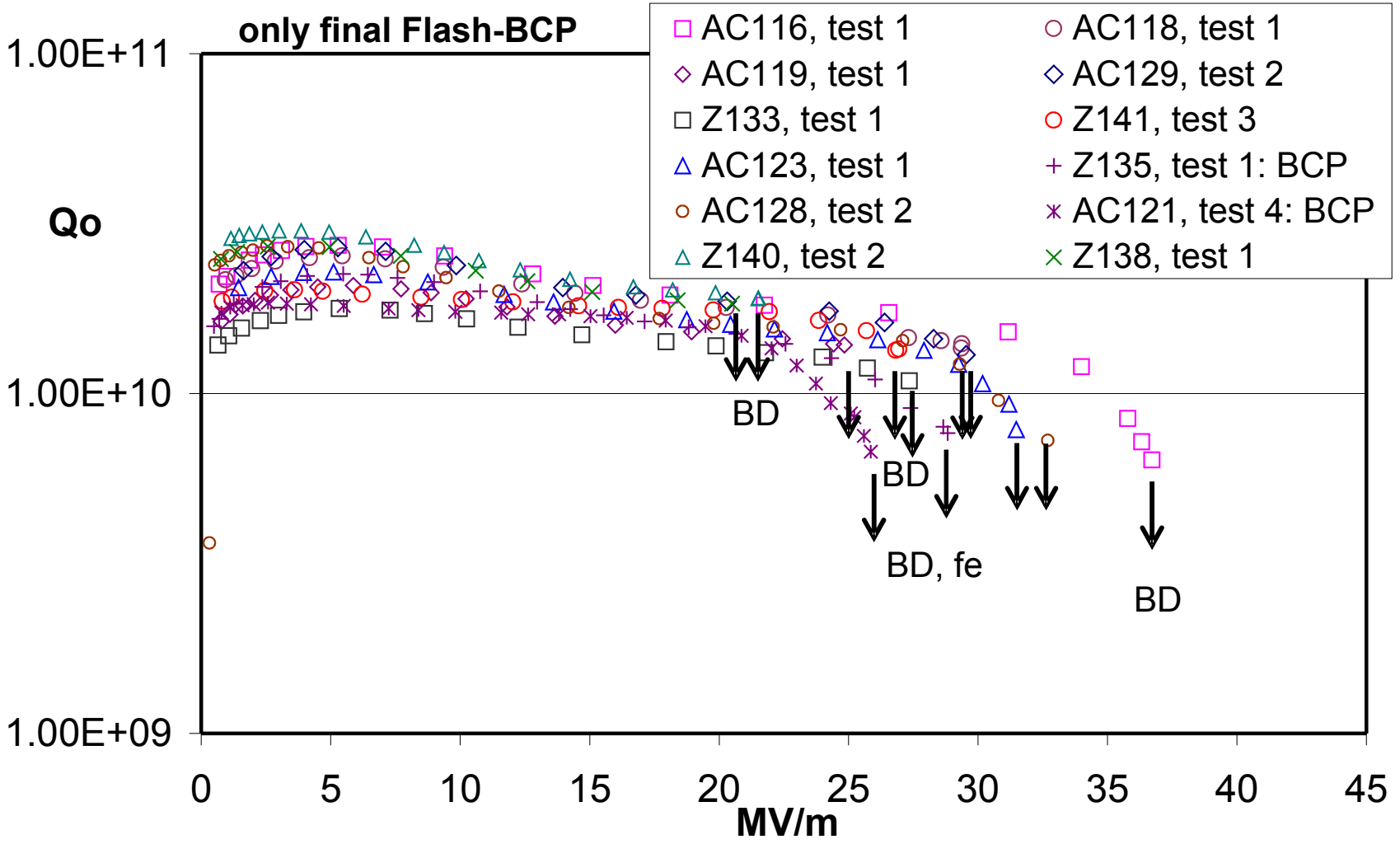
- Call for tender of 800 cavities for XFEL under preparation
- 3.9 Ghz-module for FLASH arrived from FNAL
  - Test on CMTB under preparation
- Optical inspection (Kyoto/KEK-Camera) in good use
- Cavity RF test result analysis (details in talk by D. Reschke)

6th production: Q(E) of final EP-cavities



=> high gradients at high Q; low gradient Z-cavities after EP; sometimes field emission (with and w/o He-tank)

6th production: Q(E) of final Flash-BCP cavities

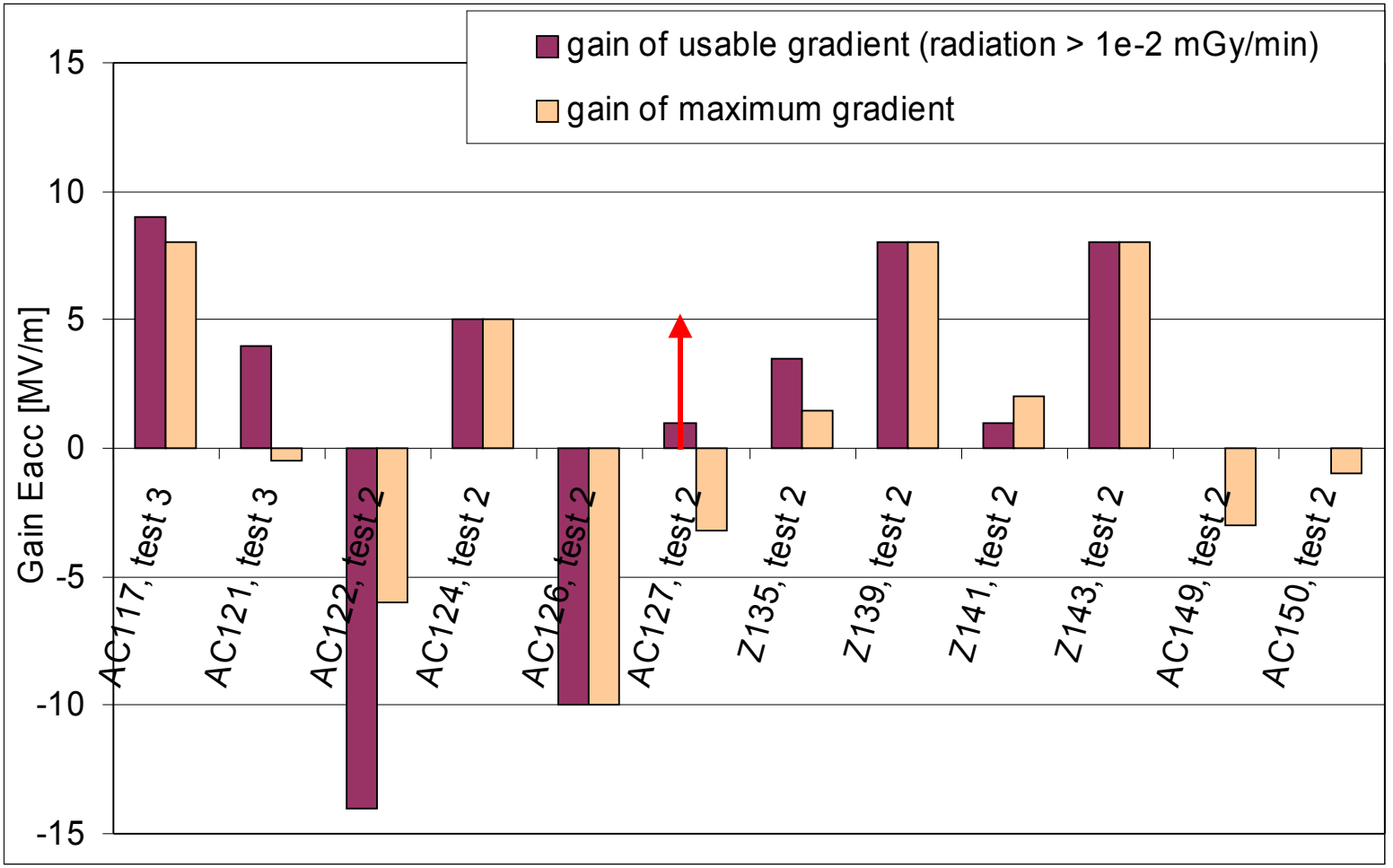


=> Q-slope present though 120C baked; less field emission ??

(- with and without He-tank)

6th production: cavity reprocessing

- Additional HPR:



6th production: cavity reprocessing

- New chemical treatment:

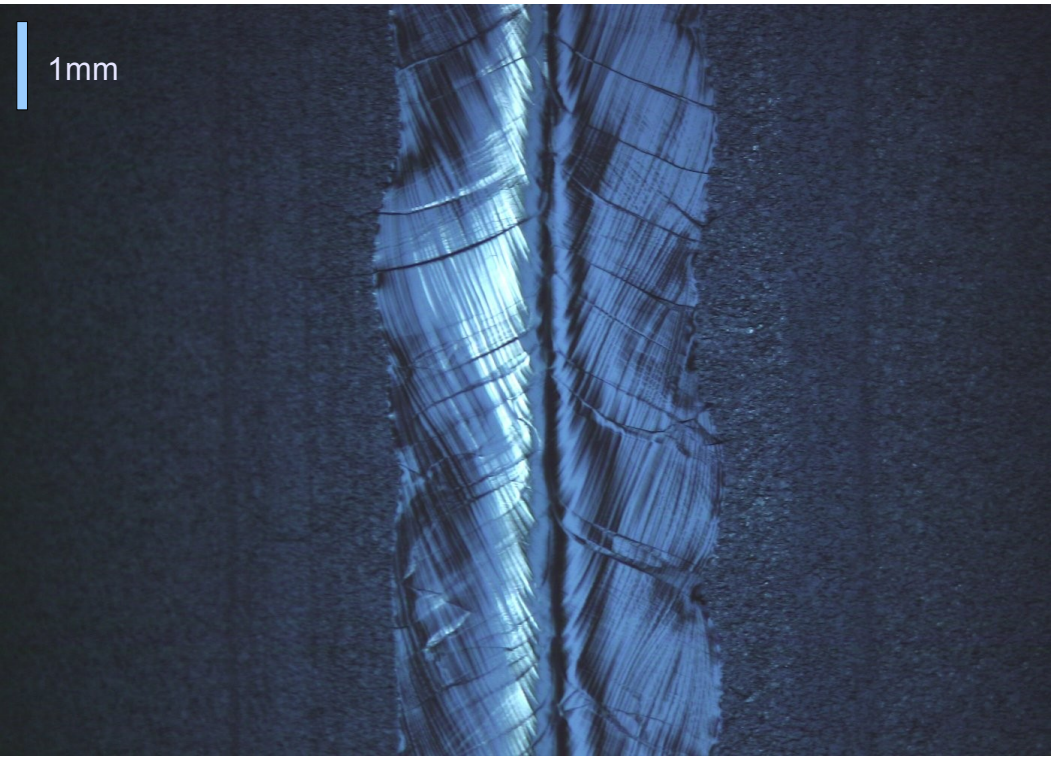
Cavity	Treatment	**Gain in $E_{acc,max}$**	Gain in **usable gradient (x-rays < 10^{-2} mGy/min)**
AC115, test 2	EP + HPR (no ethanol)	- 2 MV/m	- 2 MV/m
AC117, test 5	EP + HPR (eth) after FE	+ 13 MV/m	+ 13 MV/m
AC121, test 4	BCP + HPR after FE	+ 4 MV/m	+ 6 MV/m
Z141, test 3	BCP + HPR after FE	+ 6 MV/m	> 12 MV/m

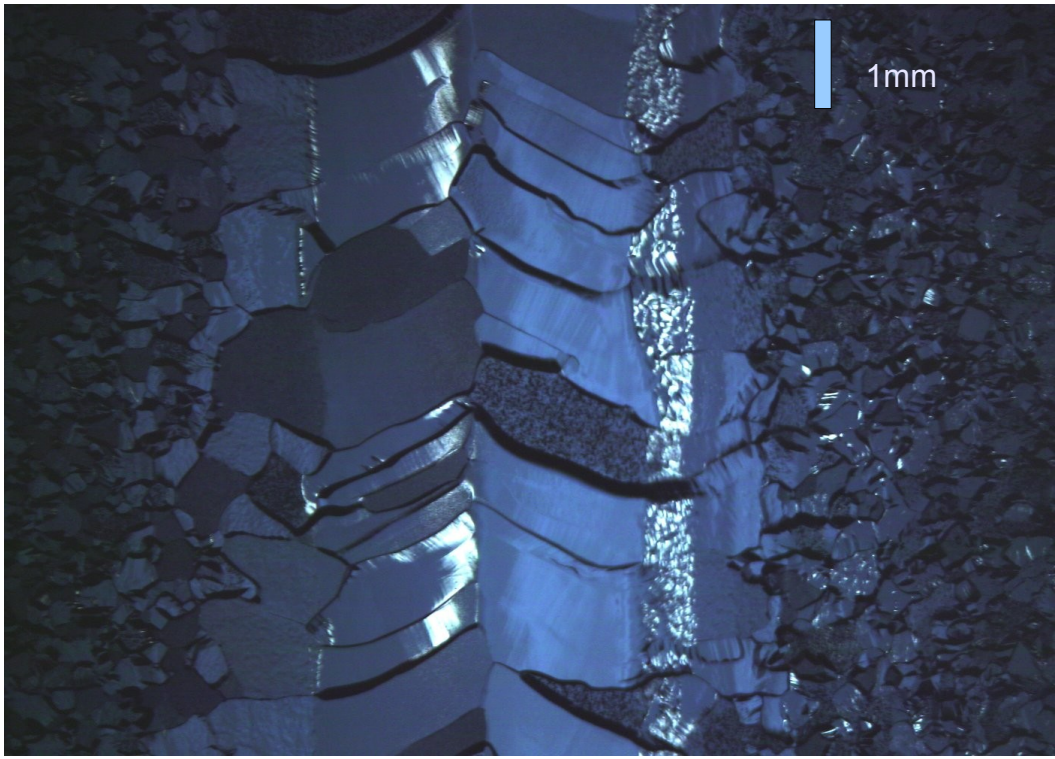
Optical inspection @ DESY

- Inspected >20 9-cell-cavities
  - Several in different stages of preparation
- Tracking of defects from „as manufactured“ state to vertical test with T-map
- Improvement towards automation for „industrial“ application is ongoing

Optical inspection @ DESY

Equator #1 at 23 deg. Z137 Equator #1 at 20 deg.





Before treatment

After 108 μm main EP

- Equator #1 shows large steps and rough grains after main EP
- All other equators look normal

Many thanks to all colleagues

who provided slides or data

for this talk!