



ILC-HiGrade WP6

High-Gradient cavities

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DESY



Goals of HiGrade WP6

- Improve over XFEL performance
 - **XFEL will make a choice on the cavity preparation cycle soon**
 - **Ongoing R&D might show improved methods for cavity preparation**
 - **HiGrade will implement these steps on a subset of XFEL cavities**
- Therefore maximum synergy is achieved between the projects
 - **HiGrade can jump onto XFEL production**
 - Quality control on a regular basis by
 - Support optical inspection of all cavities
 - Thermal mapping of cavities
 - **XFEL can profit from HiGrade Cavities**
 - Soon to finance pre-series (tbd)
 - in the long run as Spares or for higher energy
- Deliver ~30 cavities after a well-defined fabrication and preparation
 - **First test should rely on XFEL preparation cycle**
 - QC of the XFEL process
 - **Second test is to be decided**
 - Demonstrate yield acceptable for ILC mass production in low-power tests
 - **Further steps to be decided**
 - **Final step is tank welding**
 - Could add on horizontal high-power test
 - Results on this will be very late for HiGrade



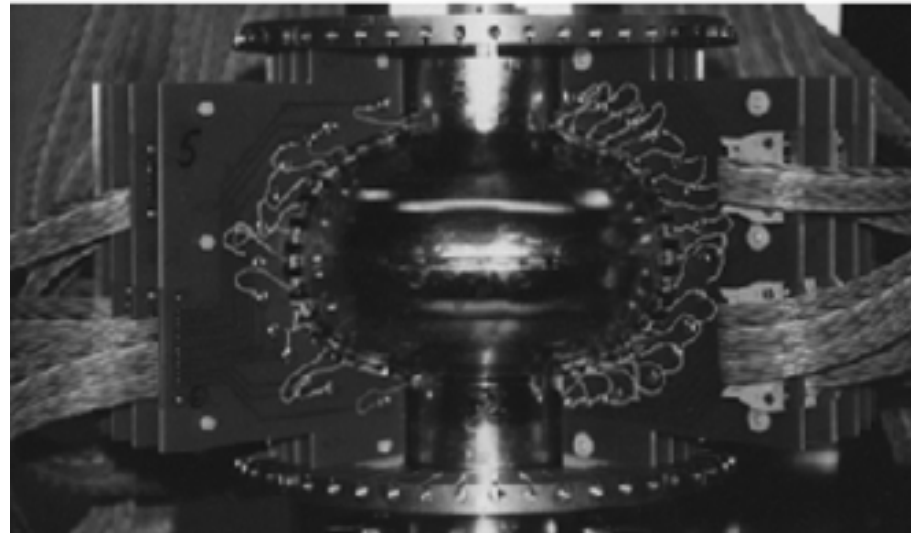
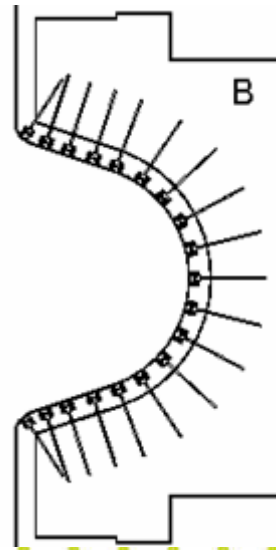
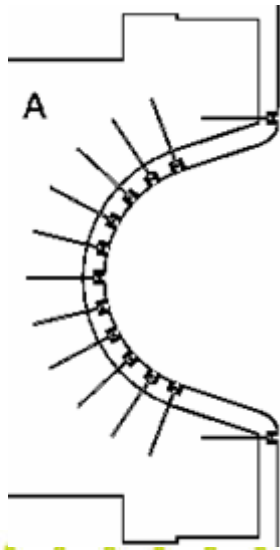
Where are we?

- Production issues
 - **Low-gradient cavities show defects found by temperature map and optical inspection**
 - **Training of manufacturers is mandatory**
- Preparation issues
 - **Rinses developed within ILC R&D have shown effectiveness**
 - Ethanol (DESY), Ultrasound (JLab), Short EP (KEK)
- Clear path forward
 - **Apply high resolution inspection systematically to improve weld quality**
 - New optical inspection data is available, not yet understood
 - Large grain material, repaired area, spots on the outside
 - **Apply optimum surface preparation e.g. ethanol rinse**



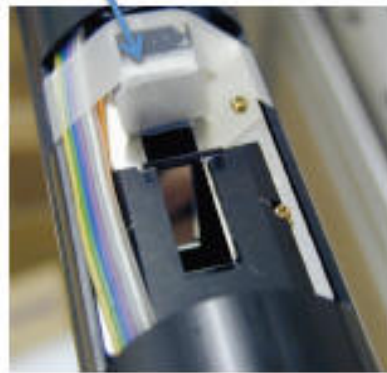
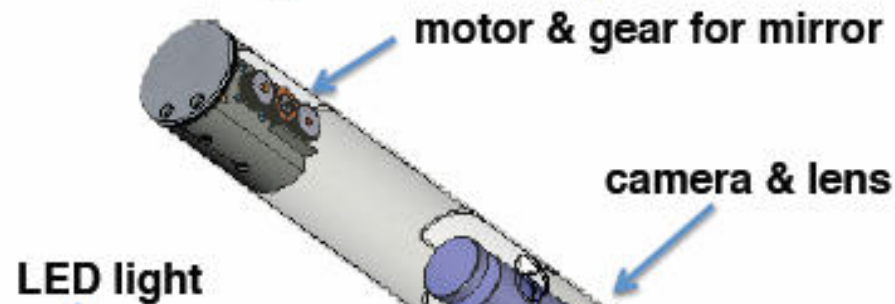
Tools to be used

- XFEL cavities will be a well advanced standard
 - E.g. HOM Design is well proven
- Advanced high-resolution optical inspection
 - Will be included into the XFEL production cycle
 - Will improve performance of manufacturers online
- T-mapping on all HiGrade cavities
 - Essential tool to pin down high-gradient hot spots
 - Need bare cavities



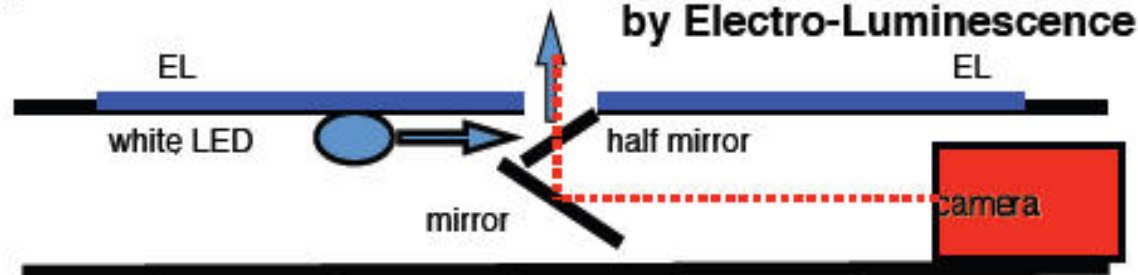
Kyoto/KEK High Resolution Camera

For visual inspection of cavity inner surface.

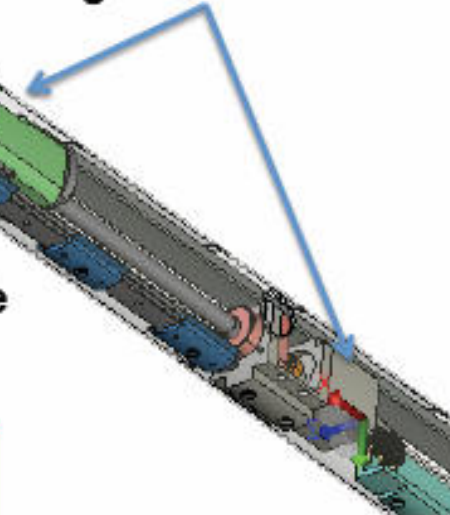


Camera system ($7\mu\text{m}/\text{pix}$)
in 50mm diameter pipe.

perpendicular illumination
by LED & half mirror

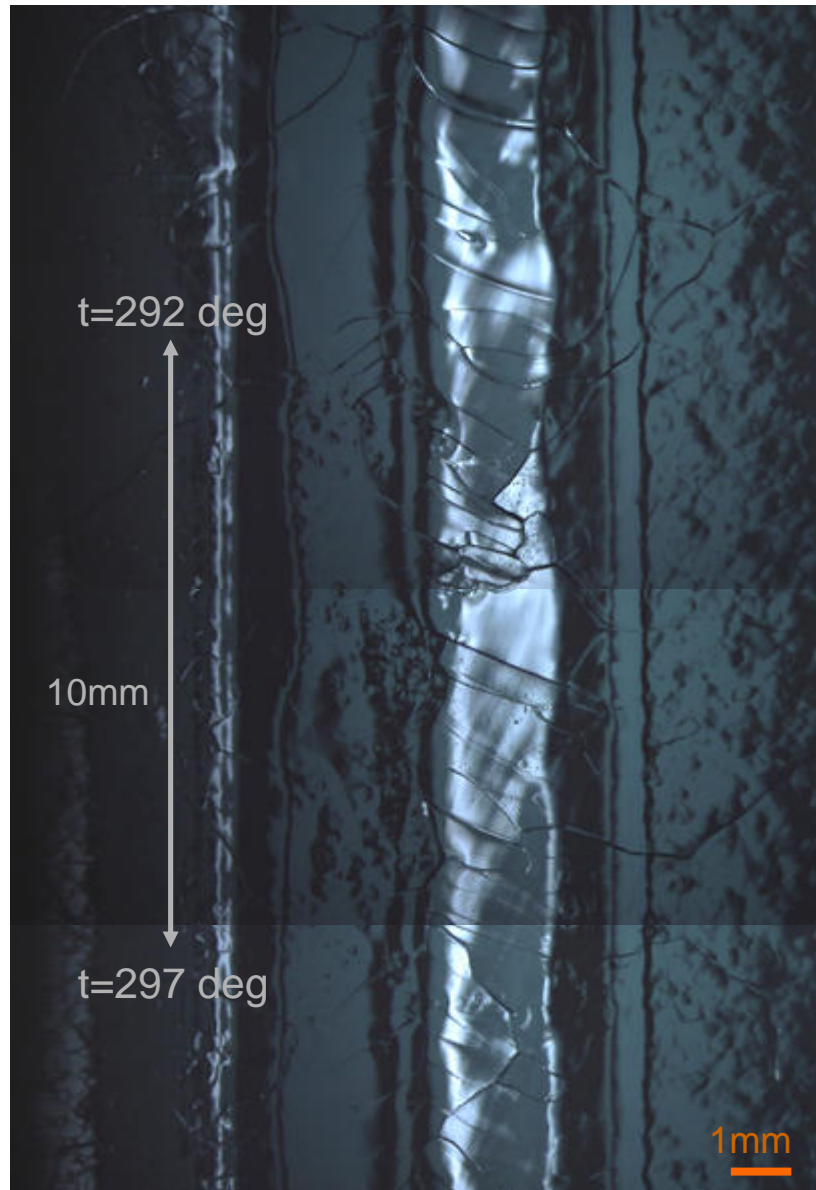


sliding mechanism of camera

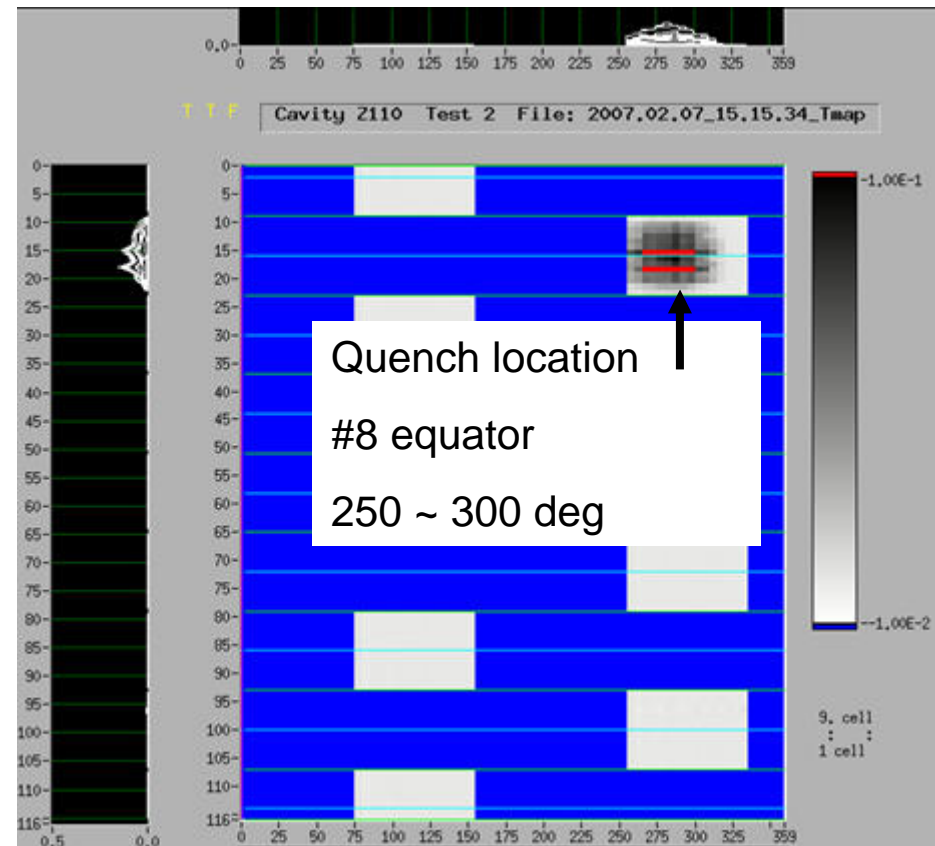


TESLA cavity Z110: #8 cell equator

#8 equator, $t=288 \sim 299$ deg



T-map data in test 2, 14.2 MV/m



Group of defects with 10mm wide were observed. Similar beads group were also observed in several places.



OLD:

Model for ILC-HiGrade Cavity Production and Preparation

	Technical Choices	Location	Remark
Fabrication	XFEL-like	Company	Might include optical inspection already
Rough Surface Preparation	XFEL-like	Company	
Optical Inspection I	XFEL-like	Company	
Furnace	XFEL-like	Company	
Final Surface Preparation	XFEL or ILC recipe	Company, DESY, CEA	QC Argument would necessitate XFEL prep
Test I	T-map mandatory	DESY, CEA	No t-map at CEA yet
Optical Inspection II	Compare with T-map	DESY, CEA	Guided repair option?
Final Surface Preparation	ILC recipe	DESY, CEA	CEA time line? Company?
Test II	T-map mandatory	DESY, CEA	No t-map at CEA yet
Tank welding	Bladetuner with Piezos	Company, DESY, CEA	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



CURRENT:
Model for ILC-HiGrade Cavity Production and Preparation

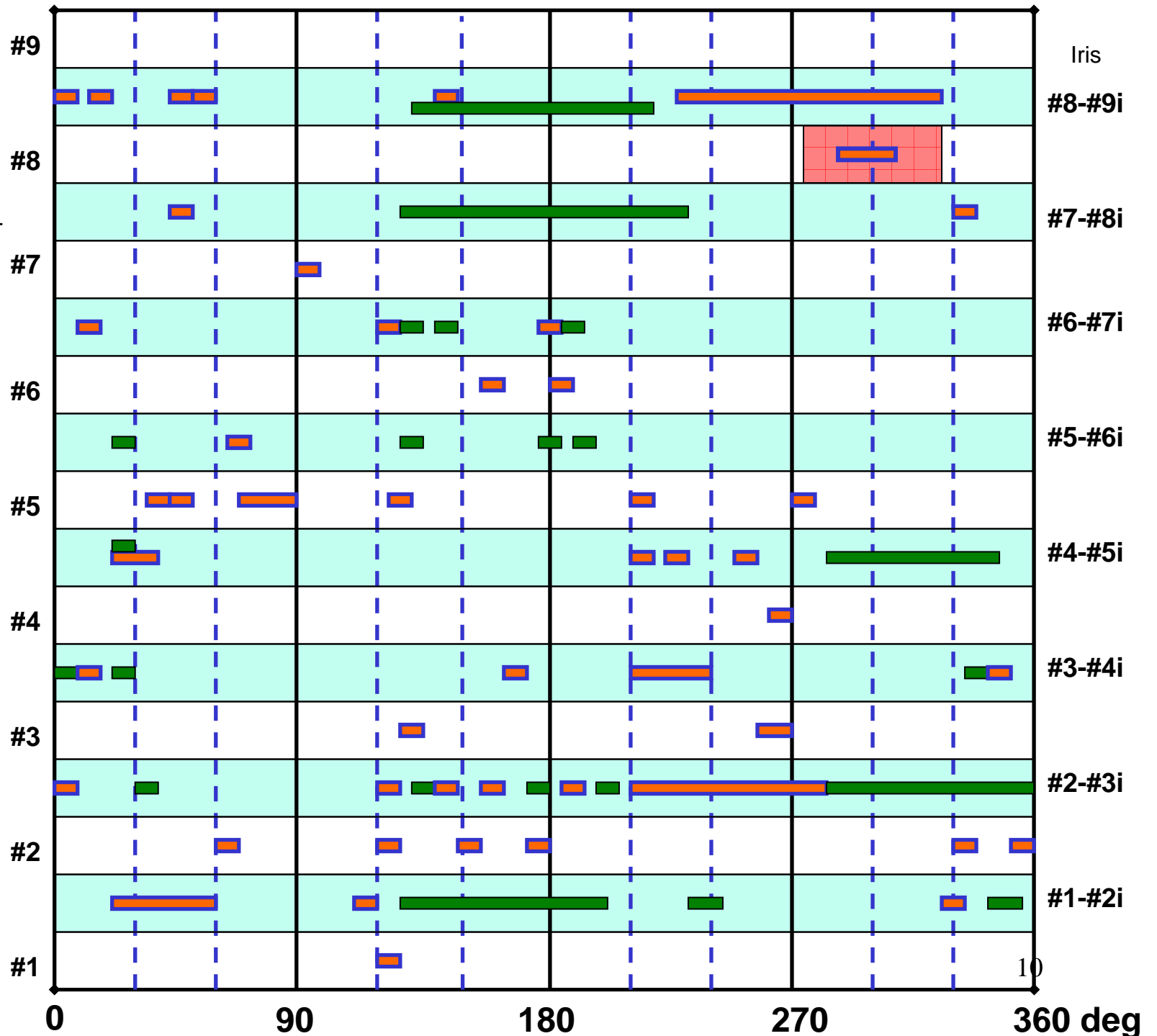
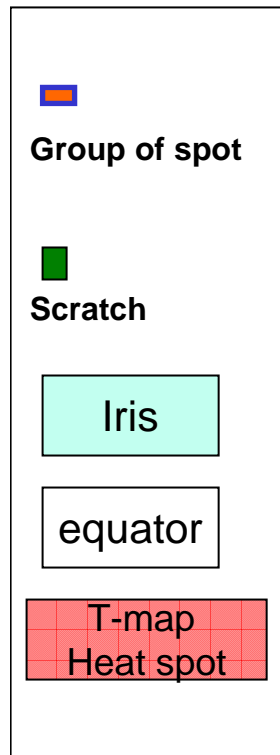
	Technical Choices	Location	Remark
Fabrication	XFEL-like	Company	Include optical inspection
Rough Surface Preparation	XFEL-like	Company	
Optical Inspection I	XFEL-like	Company	
Furnace	XFEL-like	Company	
Final Surface Preparation	XFEL	Company	QC Argument
Test I	T-map mandatory	DESY	DESY Manpower? Second 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

Summary

- Issues with cavities are identified
 - **Fabrication quality to be improved**
 - **Final surface preparation has been improved within ILC R&D work**
- ILC-HiGrade and XFEL will profit from each other
 - **Quality control support via HiGrade**
 - HiGrade will inspect and test with t-map on regular basis
 - Detailed delivery schedule to be negotiated
 - **XFEL Cavities as well defined tool to start from**
- Model for a cavity production has been presented
 - **Changed due to unavailable infrastructure at CEA**
 - EP
 - Tests with T-map
 - **Need some discussion on available infrastructure and manpower**

Z110
summary
08/05/12

cell equator



Z111
summary
08/05/15

cell equator

