

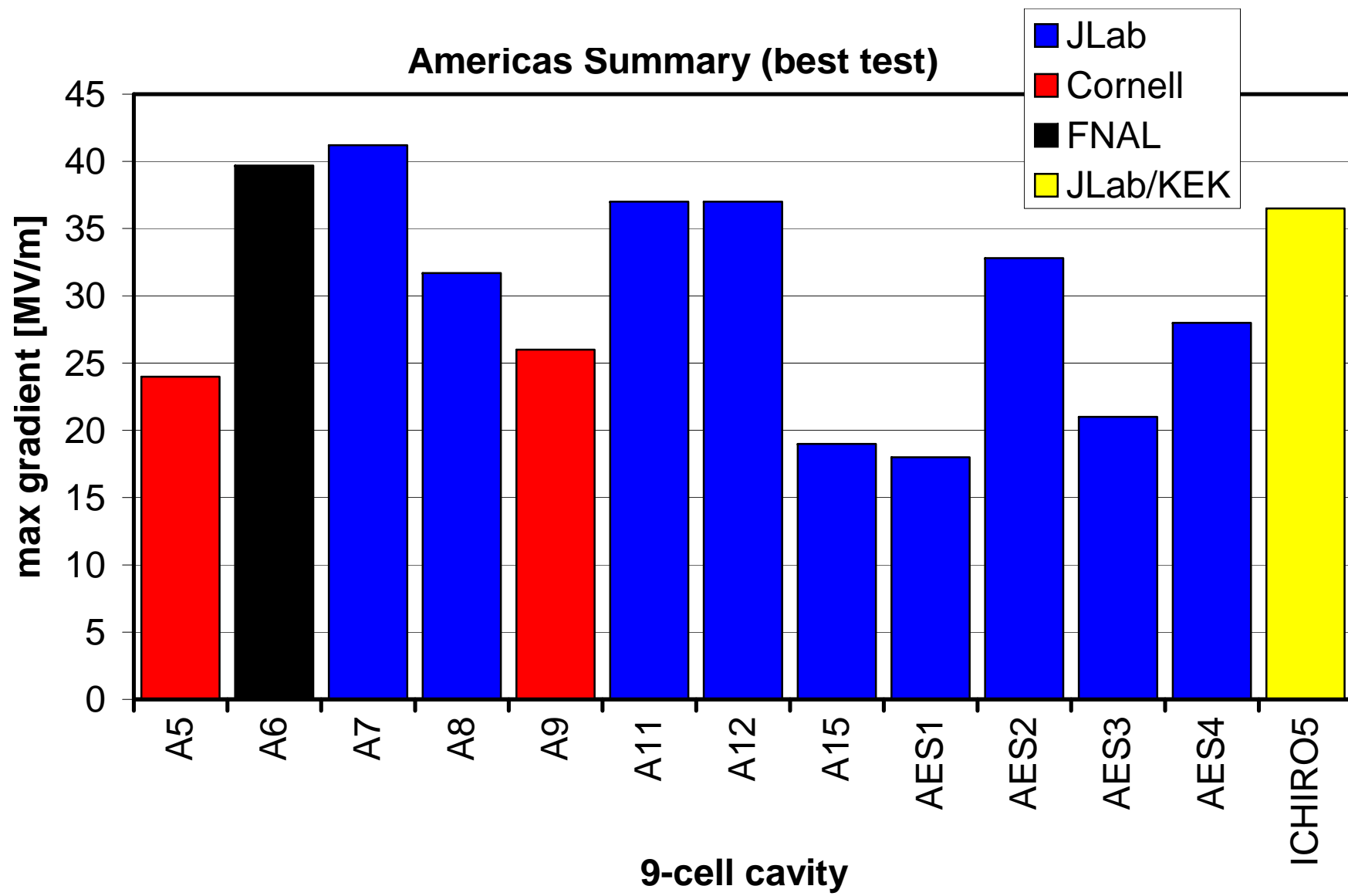


ILC-HiGrade WP6

High-Gradient cavities

Lutz Lilje
DESY

- Where are we?
 - **America and Asia**
 - New vendors and new preparation setups
 - **Europe**
 - Previous production cycle
 - Current production cycle
 - Preliminary data
- Goals for ILC HiGrade
 - **XFEL as an Asset**
- Model for Cavity Fabrication and Preparation



Date Event

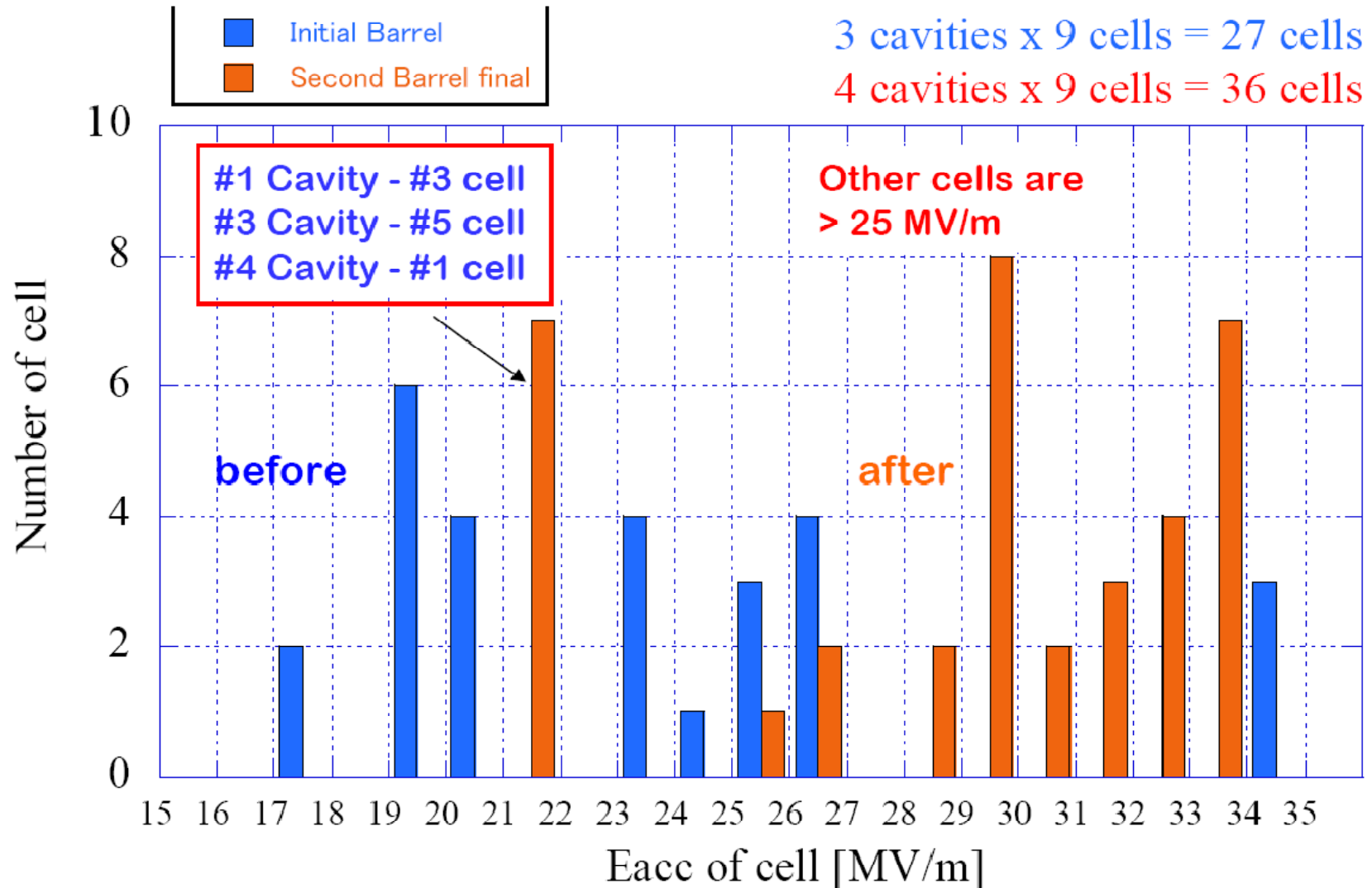


References for Americas Data

- R. L. Geng et al., Proc. SRF2007, Beijing, WEP28 (2007).
- R. L. Geng et al., Proc. LINAC08, Victoria, Canada, in preparation.
- C. M. Ginsburg (FNAL), private communication.
- W. J. Ashmanskas and H. S. Padamsee, Proc. SRF2007, Beijing, WEP39 (2007).

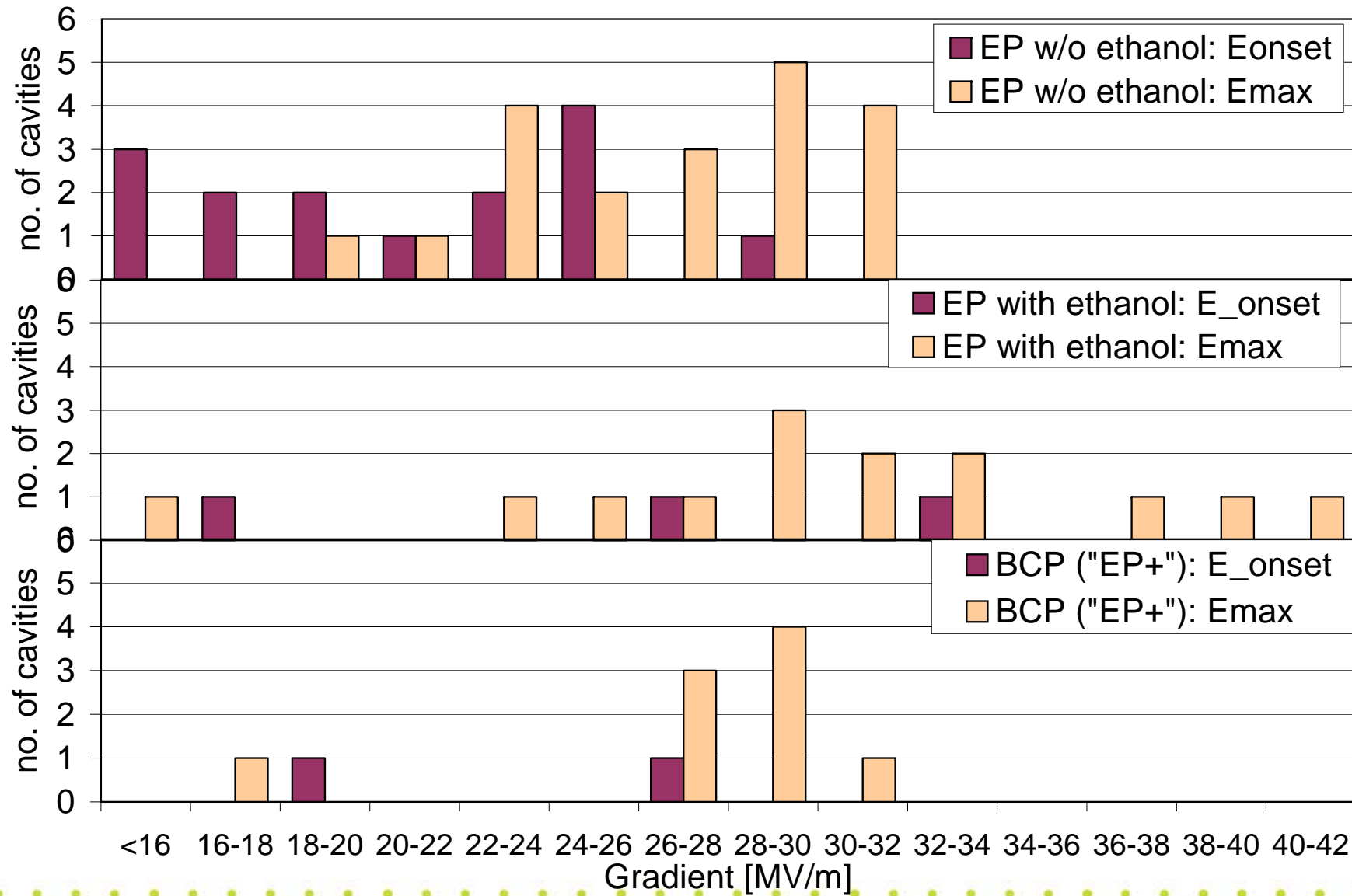
Vertical Test Results, Eacc of cells

Before (total~250 μm), after 2nd BP (total~500 μm)



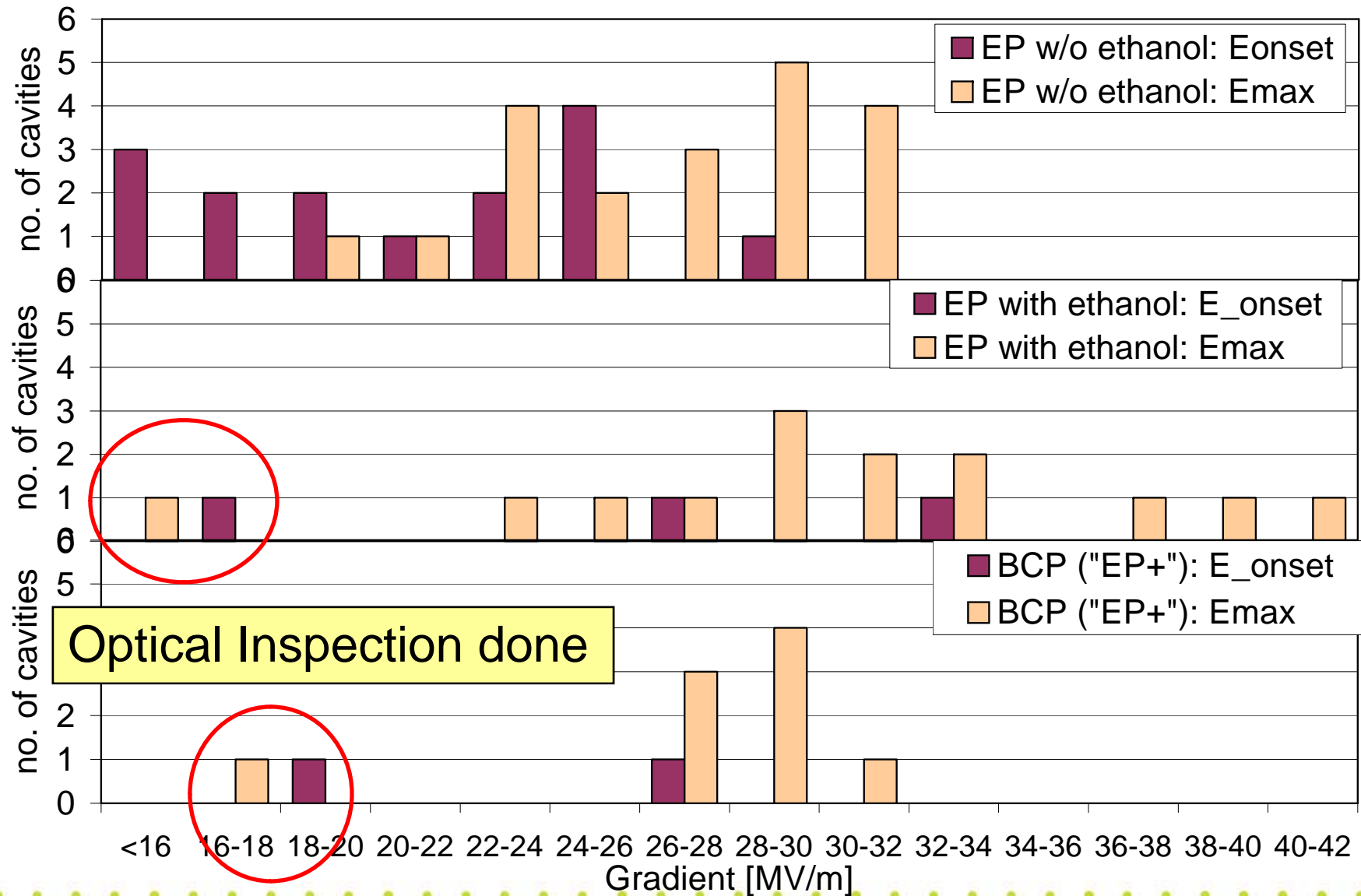


DESY 4th: Field Emission Analysis



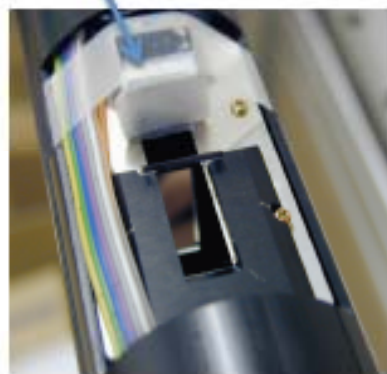
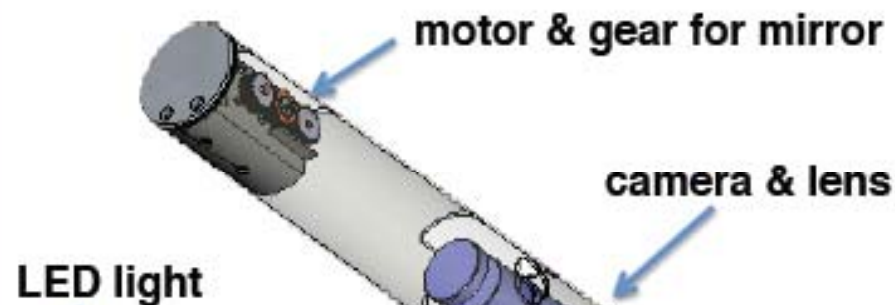


DESY 4th: Field Emission Analysis



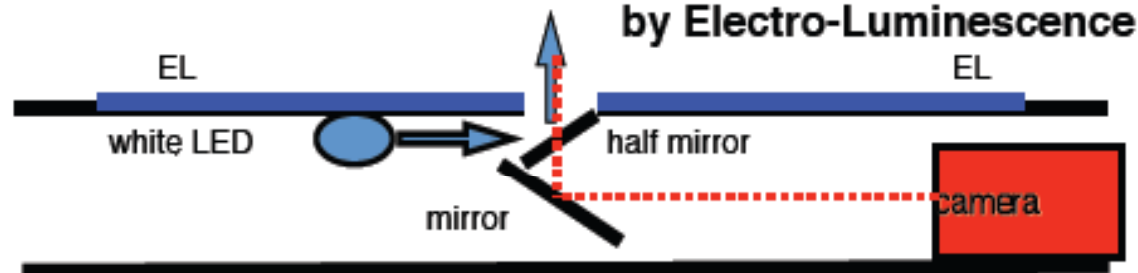
Kyoto/KEK High Resolution Camera

For visual inspection of cavity inner surface.



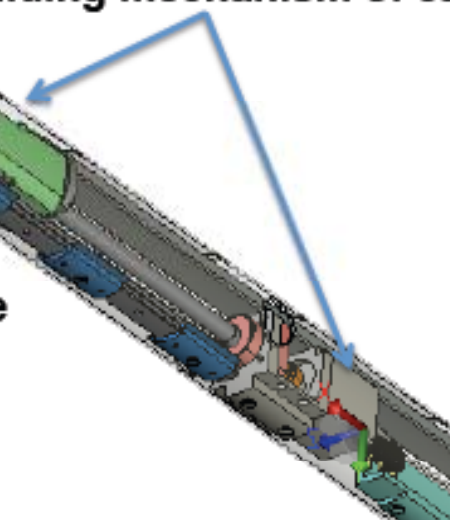
Camera system ($7\mu\text{m}/\text{pix}$)
in 50mm diameter pipe.

perpendicular illumination
by LED & half mirror



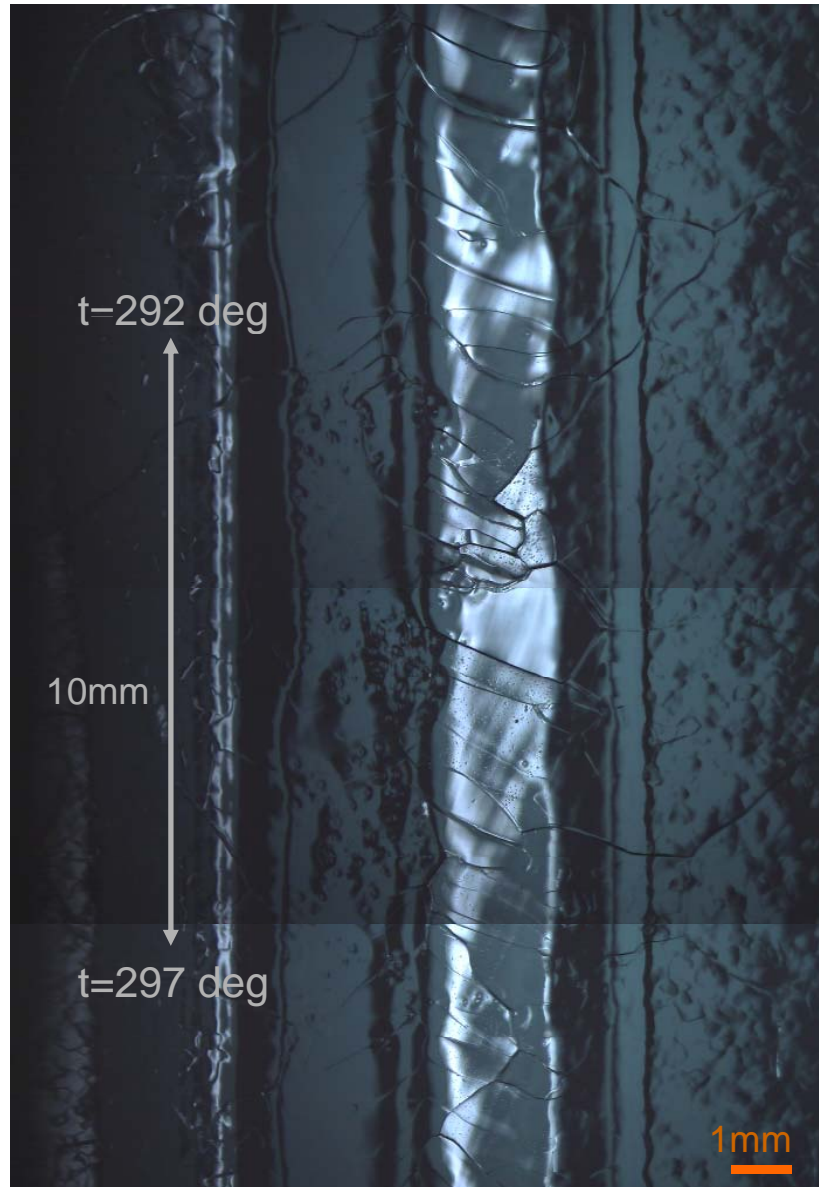
tilted sheet illumination
by Electro-Luminescence

sliding mechanism of camera

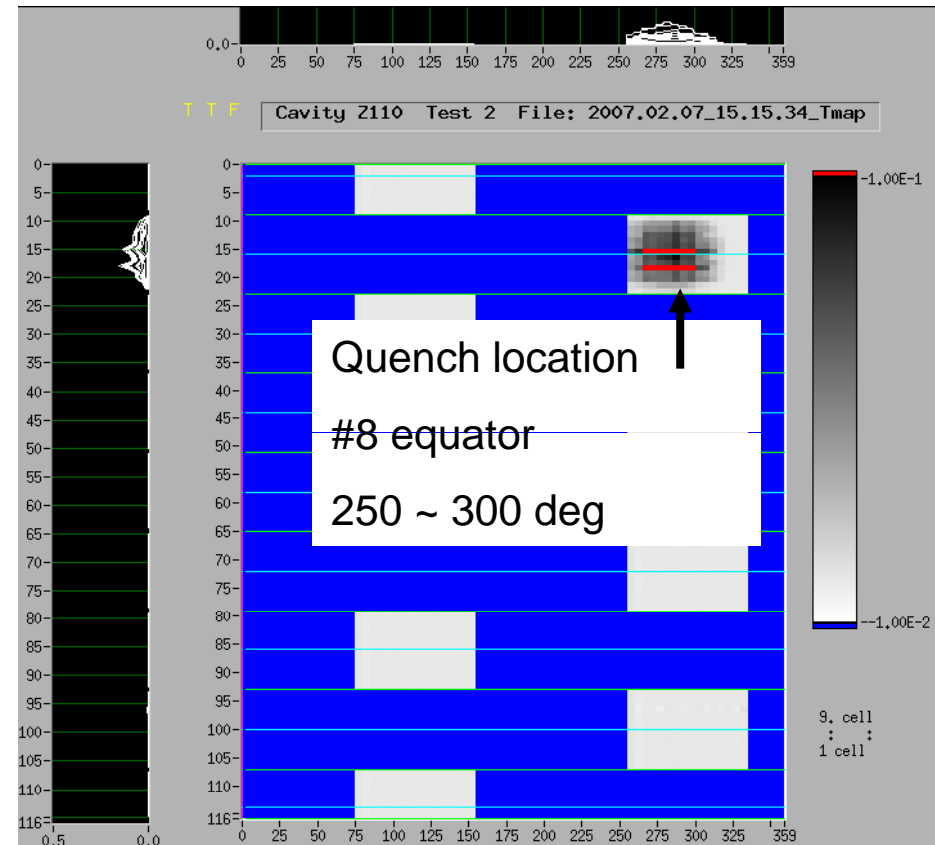


TESLA cavity Z110: #8 cell equator

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



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

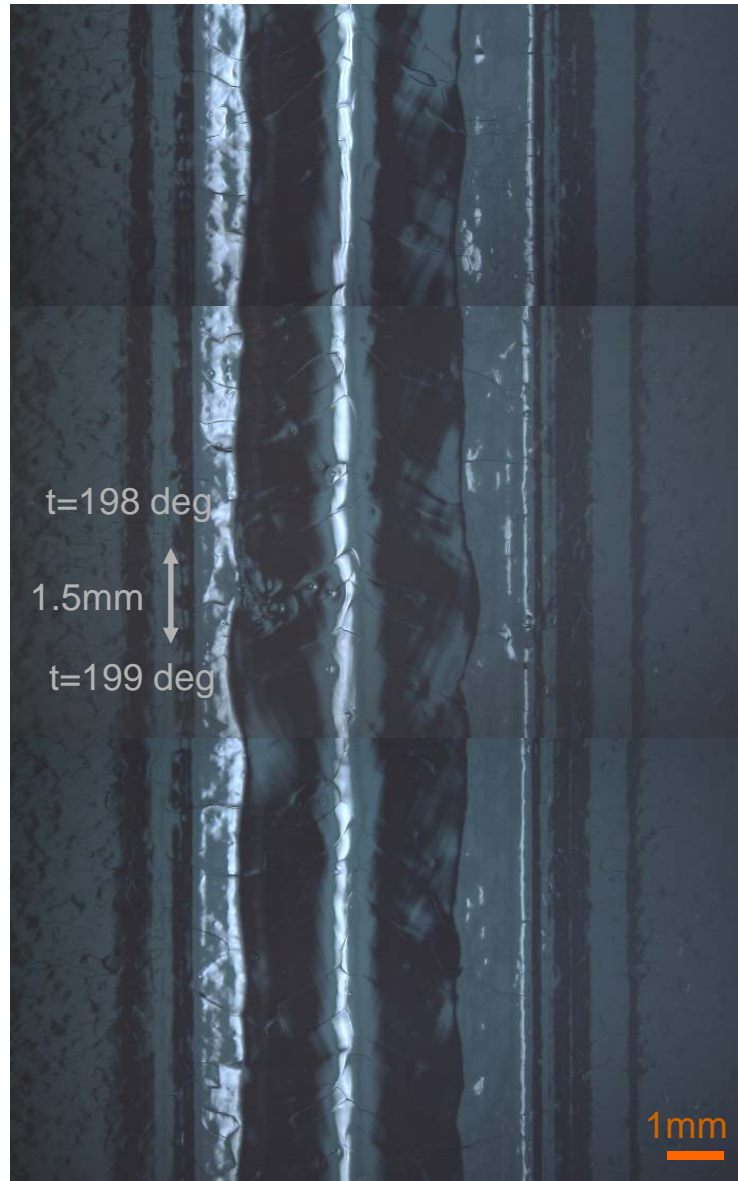


group of beads(?) with 10mm wide were observed.

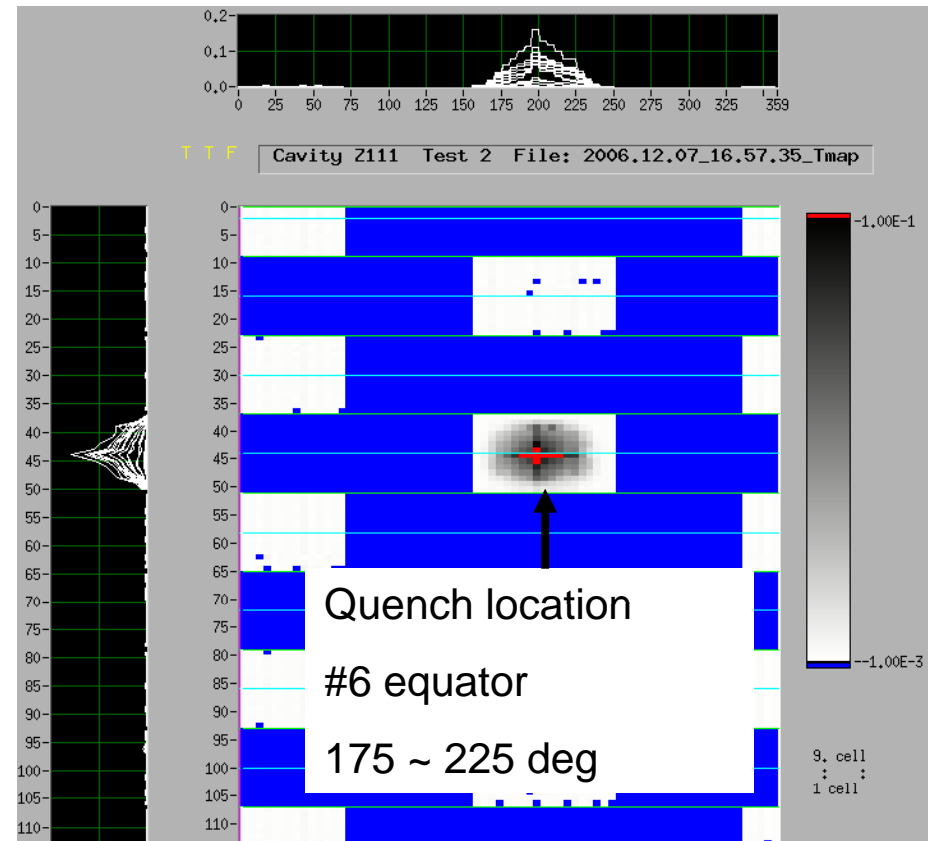
Similar beads group were also observed in several places. see following slides.

TESLA cavity Z111: #6 cell equator

#6 equator, t=193 ~ 204 deg



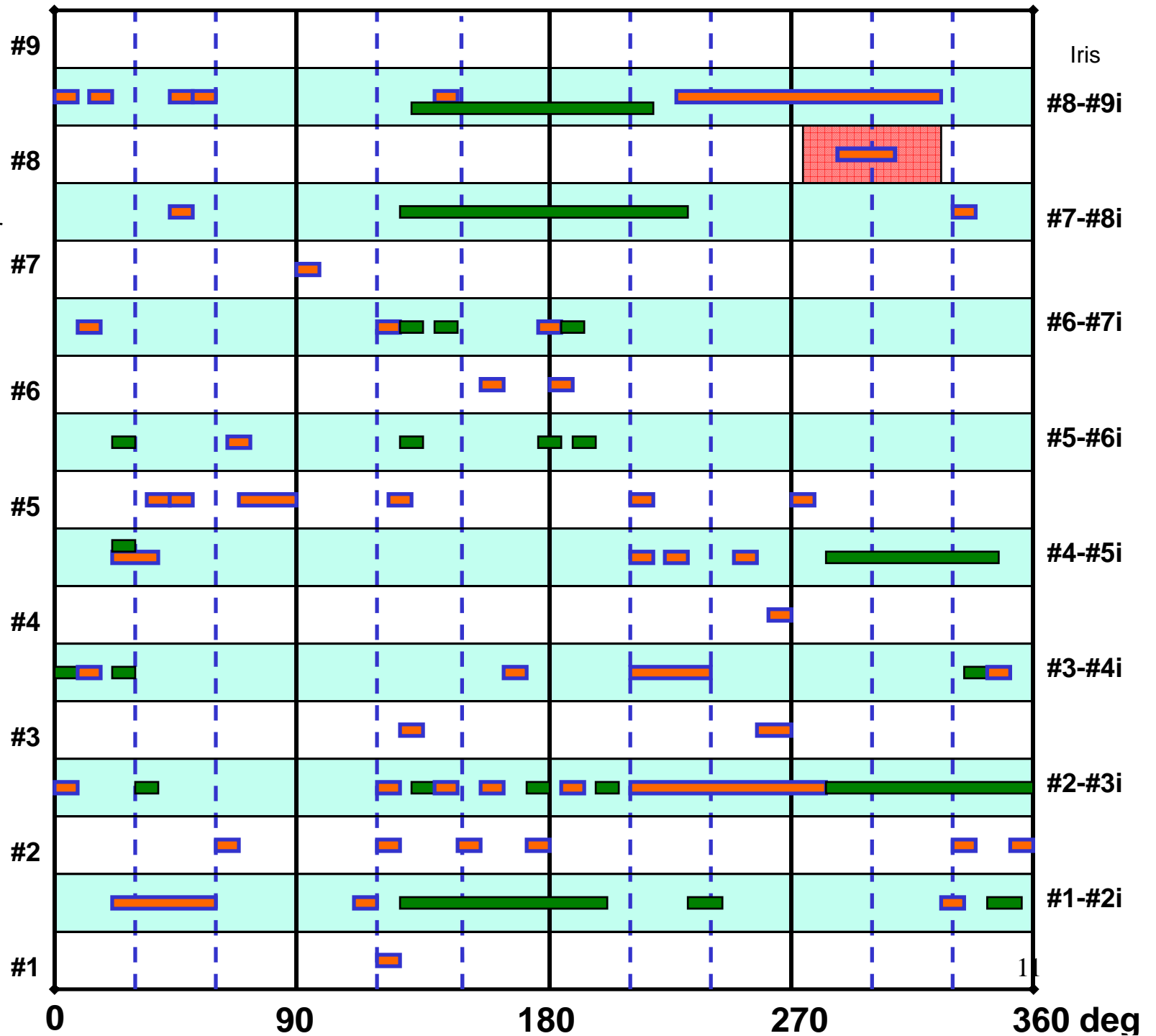
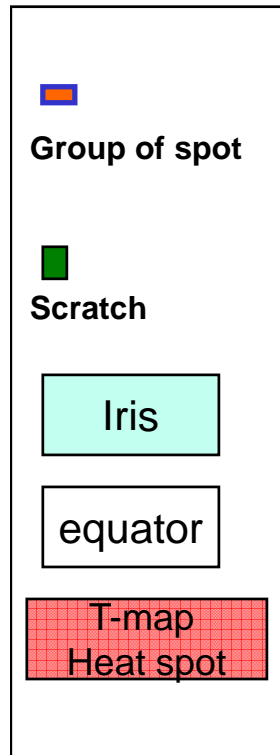
T-map data in test 2, 16.0 MV/m



group of beads(?) with 1.5mm wide were observed.

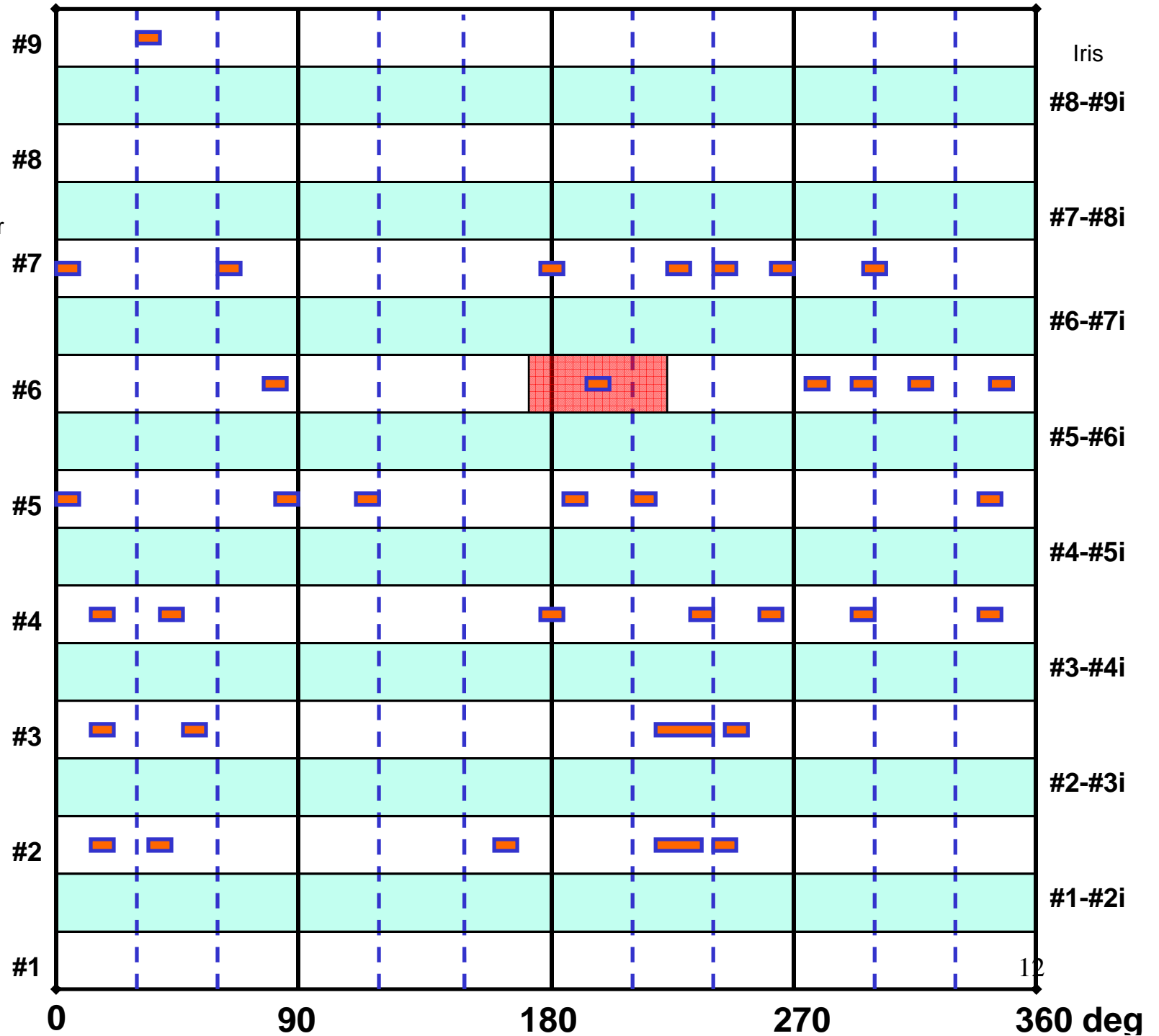
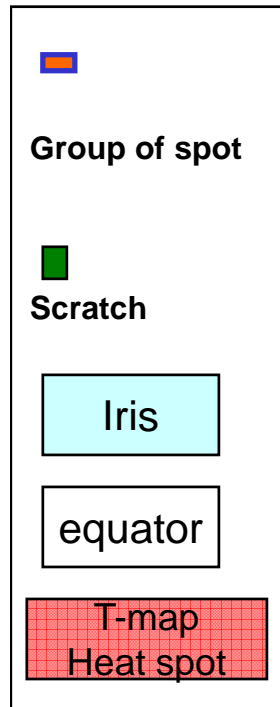
Z110
summary
08/05/12

cell equator



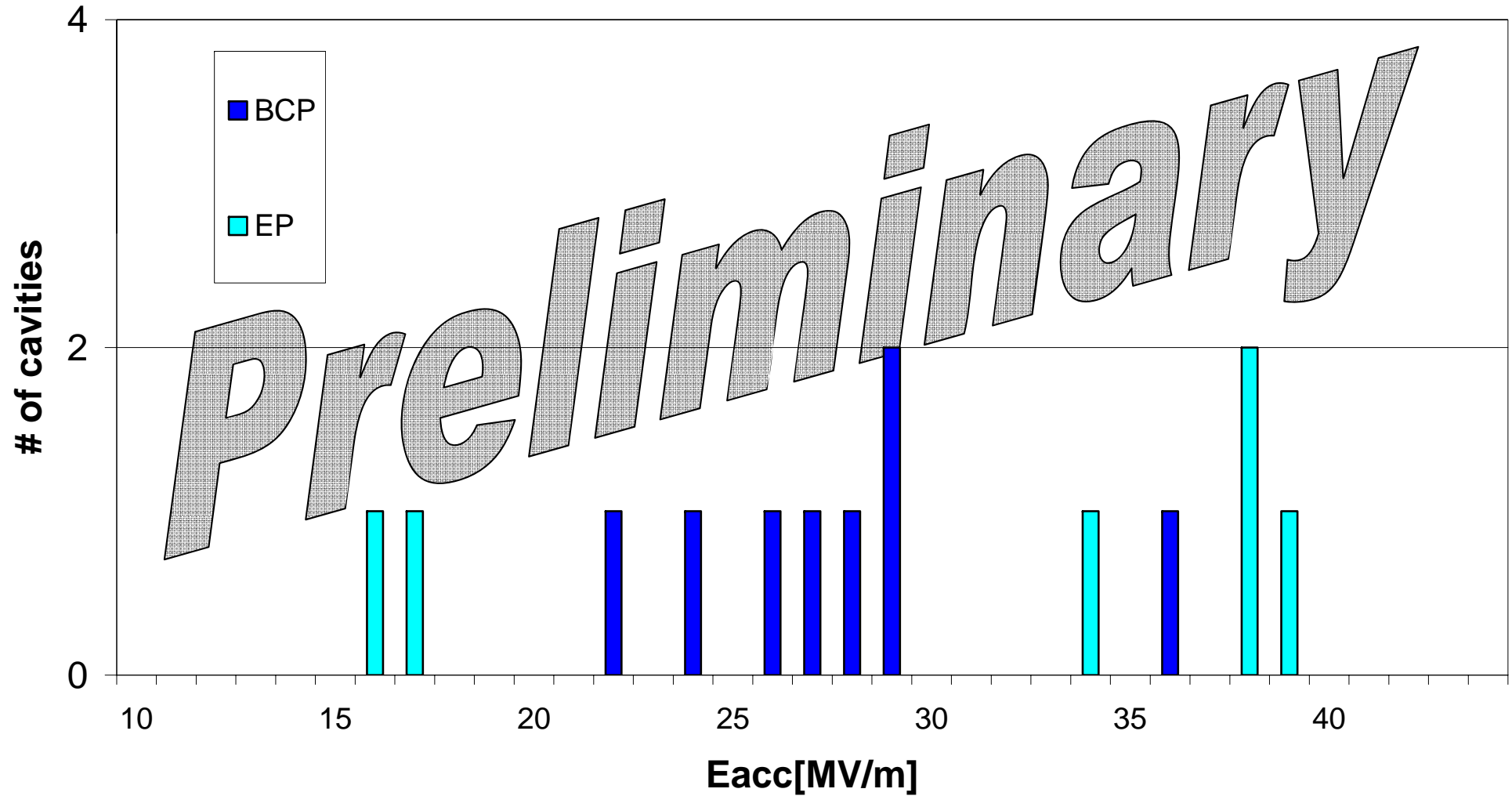
Z111
summary
08/05/15

cell equator



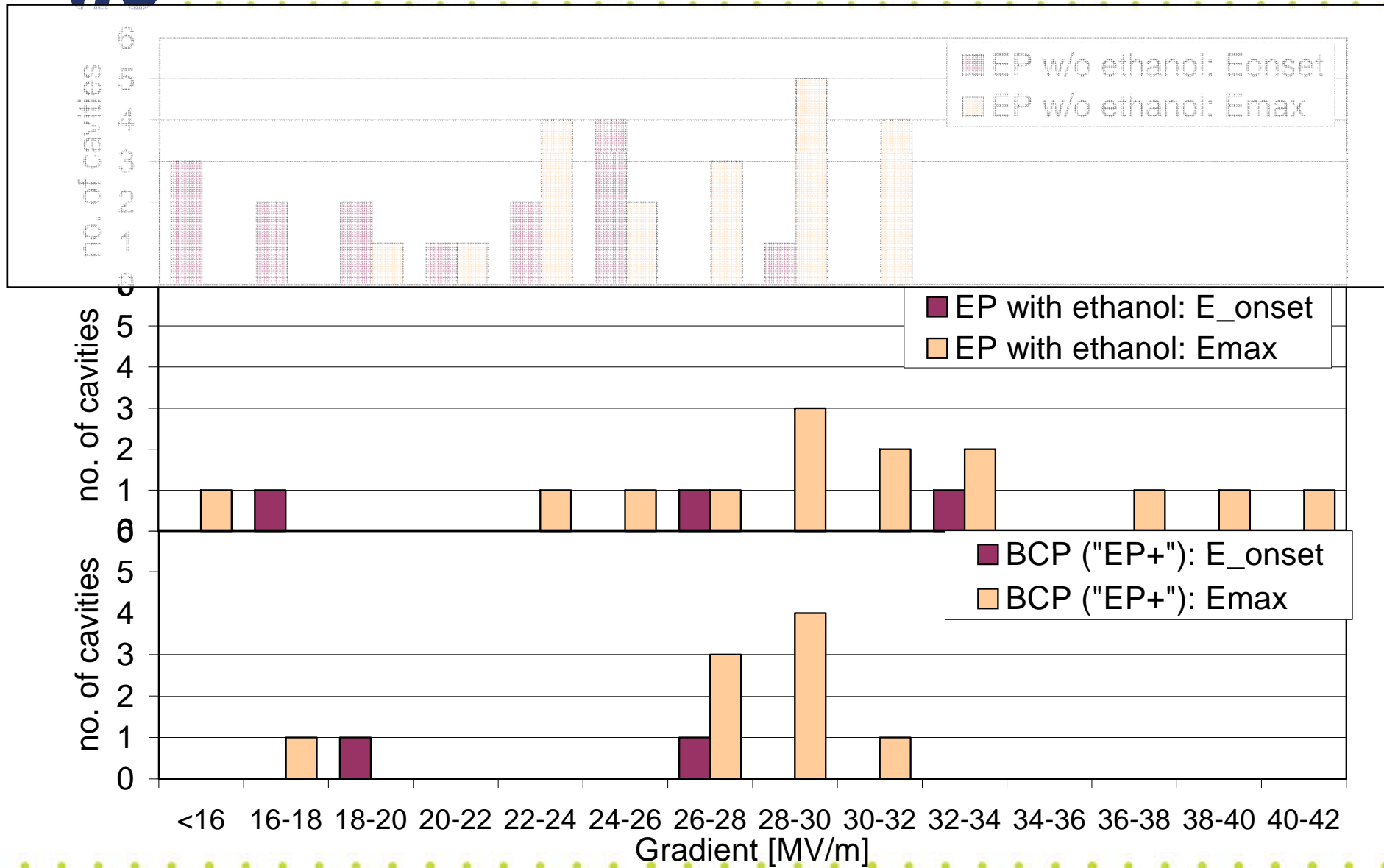


DESY Current Production: Comparison of Final Treatment



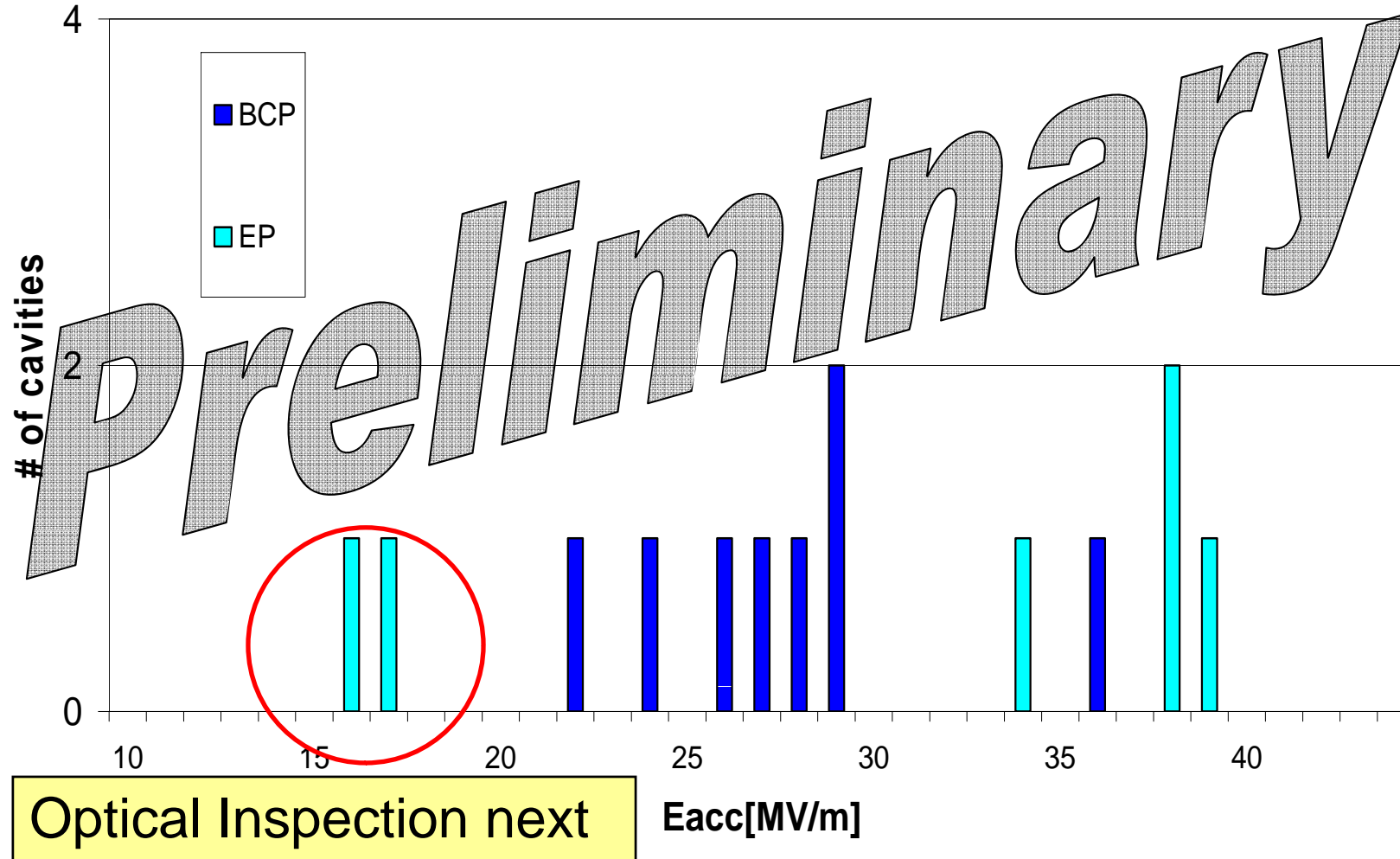


DESY 4th: Field Emission Analysis





DESY Current Production: Comparison of Final Treatment





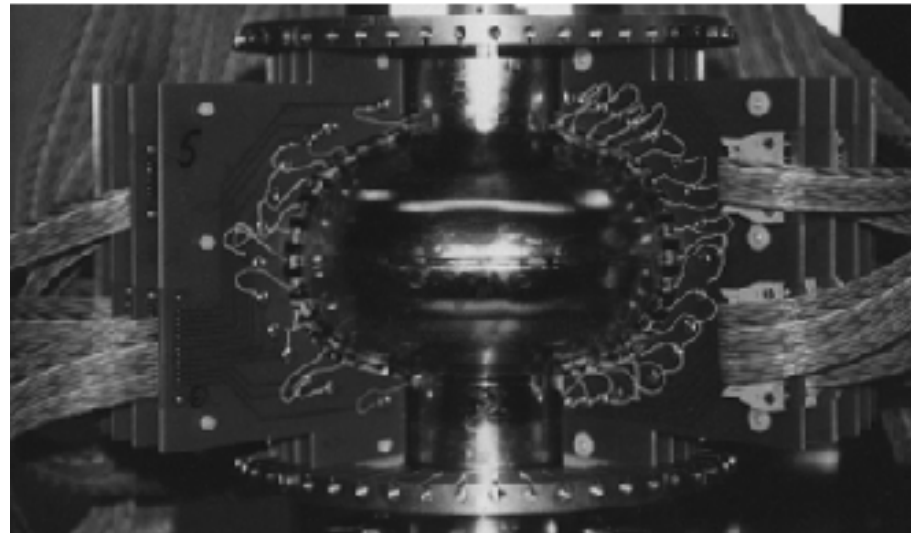
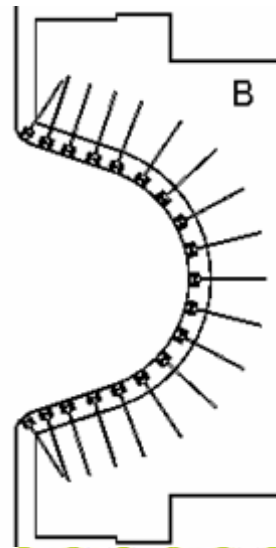
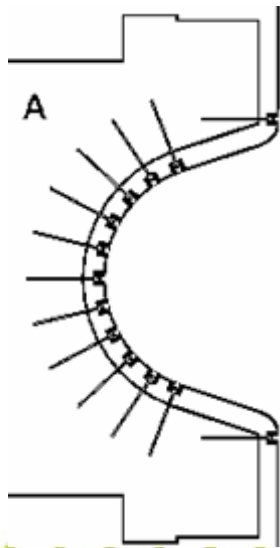
Where are we? II

- Production issues
 - **Low-gradient cavities show defects found by temperature map and optical inspection**
 - **Training of manufacturers is mandatory**
- Preparation issues
 - **Have less impact currently**
 - Rinses developed within ILC R&D are successful
 - Ethanol (DESY), Ultrasound (JLab), Short EP (KEK)
- Clear path forward
 - **Apply high resolution inspection systematically to improve weld quality**
 - **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
 - Option to include this into the XFEL production cycle
 - Improve performance of manufacturers online
- T-mapping on all cavities
 - Essential tool to pin down high-gradient hot spots
 - Need bare cavities





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 by
 - Support optical inspection of all cavities
 - Thermal mapping of cavities
 - **XFEL can use HiGrade Cavities in the long run**
 - Spares or higher energy
- Deliver ~30 cavities after a well-defined fabrication and preparation
 - **Demonstrate yield acceptable for ILC mass production in low-power tests**
 - **Could add on horizontal high-power test**



Model for ILC-HiGrade Cavity Production and Preparation

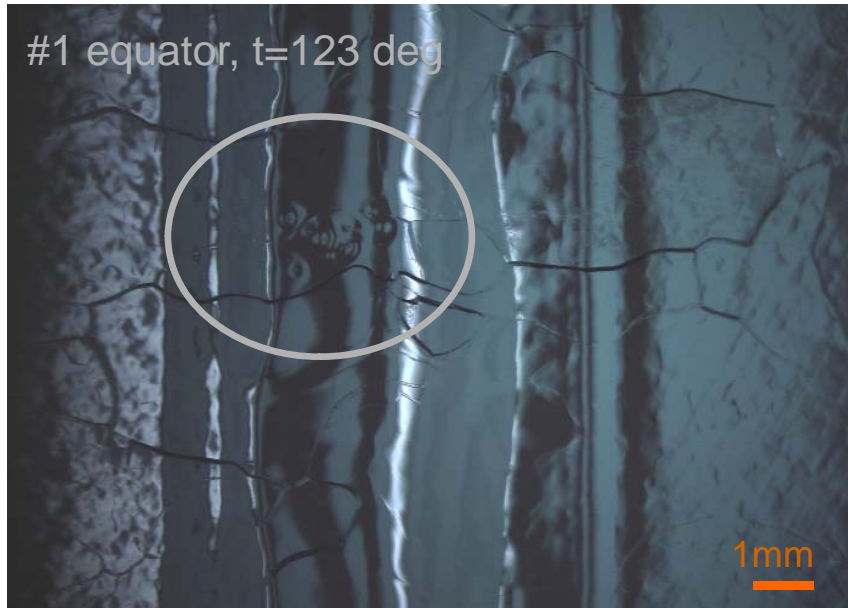
	Technical Choices	Location	Remark
Fabrication	XFEL-like	Company	Might include optical inspection already
Rough Surface Preparation	XFEL-like	Company	
Optical Inspection I	XFEL-like	Company	
Furnace	XFEL-like	Company	
Final Surface Preparation	XFEL or ILC recipe	Company, DESY, CEA	QC Argument would necessitate 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



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**
 - **XFEL Cavities as well defined tool to start from**
- Model for a cavity production has been presented
 - **CEA and DESY are the key institutes**
 - Need some discussion on available infrastructure

Z110: group of beads(?) (1)



Z110: group of spot(?), scratch iris (1)

