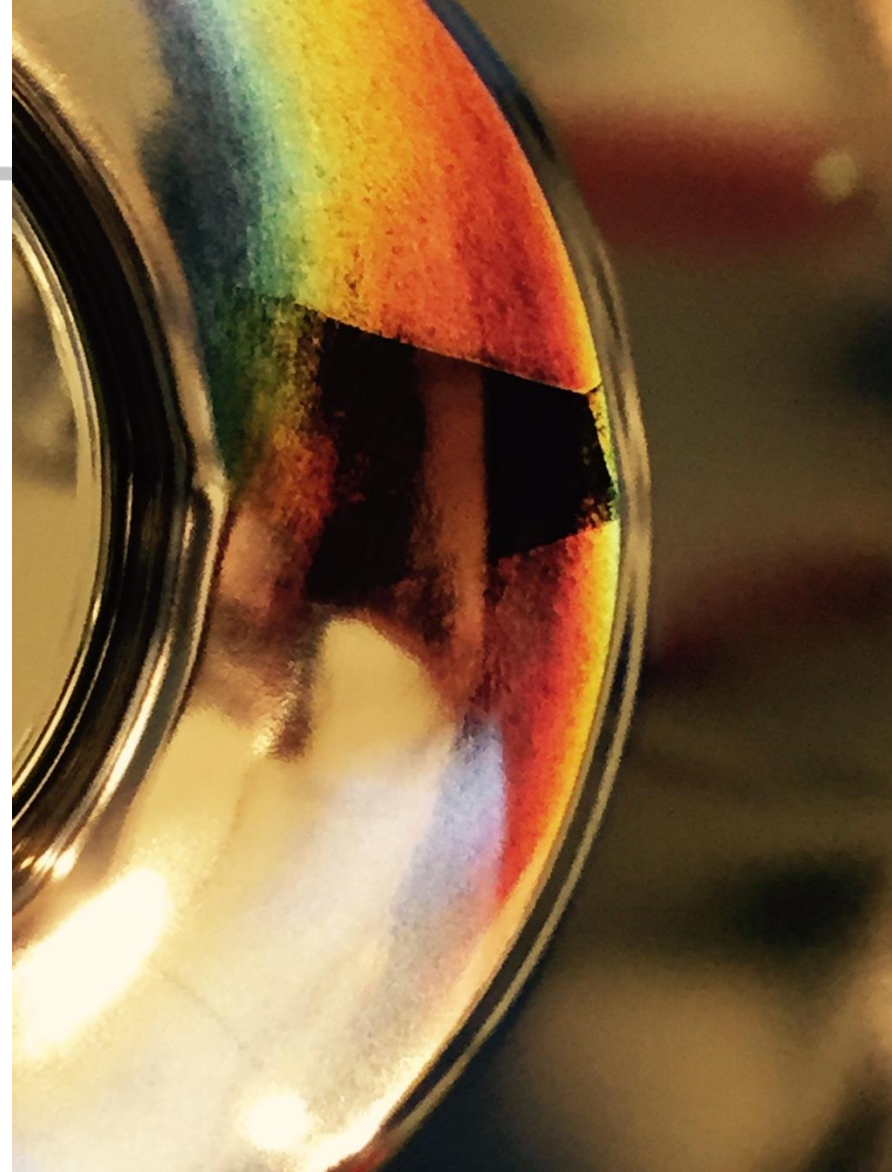


JLab Update

Rongli Geng

March 4, 2015

5th LCC ILC Cavity Group Meeting



Inner surface of large-grain niobium cavity G2 under illumination of white LED light. The rich color is a result of interference of light when reflected from the near surface of the niobium. An outstanding grain in the middle of picture reflects the light differently due to presumably its unique grain orientation. Test data of cavity G2 are presented in slide #6. Photo credit: Pashupati Dhakal.

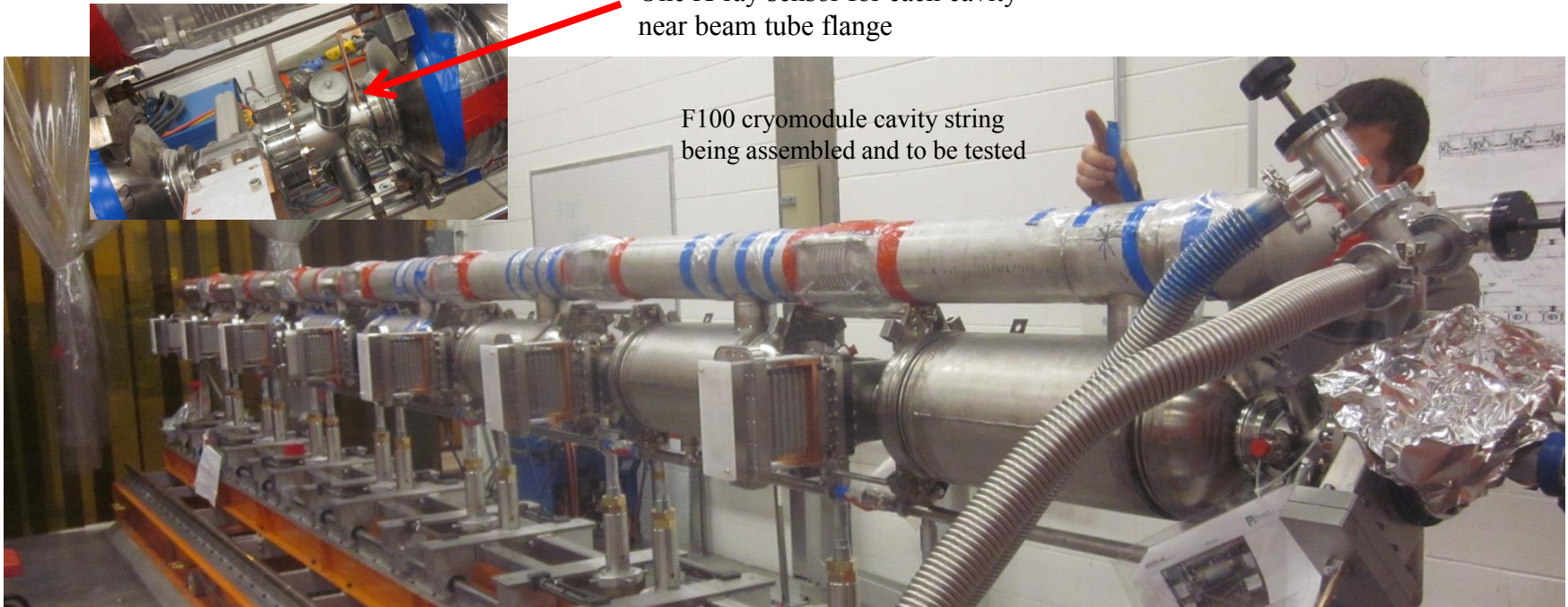
High Gradient SRF Themes

- Understand and reduce field emission
 - Cavity vertical testing at E_{pk} 100 MV/m
 - Gradient and Q_0 degradation due to field emission from vertical testing to operation in cryomodule
 - CEBAF upgrade cavity experiences
- Improve efficiency at high and very high gradient
 - New shape – higher R/Q and lower H_{pk}/E_{acc}
 - Large-grain material
 - Frozen-in flux (and response to thermal cycling)

JLab Status: Field Emission Instrumentation

- **Installation X-ray sensors (Hamamatsu S1223-01) at all cavities in full FEL cryomodule**
 - Compare field emission data at VTA testing with cryomodule testing
 - Establish correlation between FE induced X-ray and FE induced Q0 loss and dark current at end of cryomodule
 - Results reported at TTC meeting at KEK in December 2014.

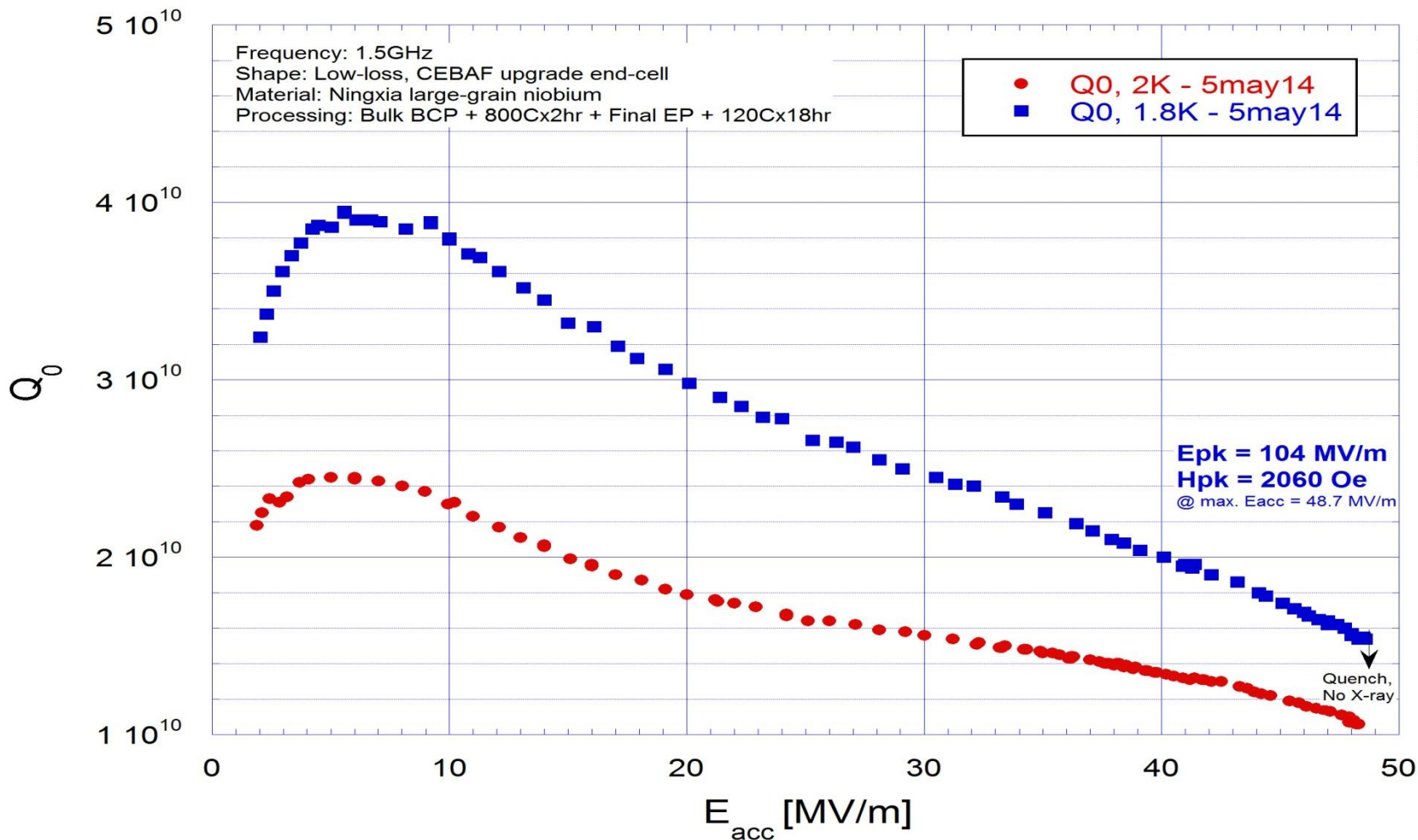
One X-ray sensor for each cavity near beam tube flange



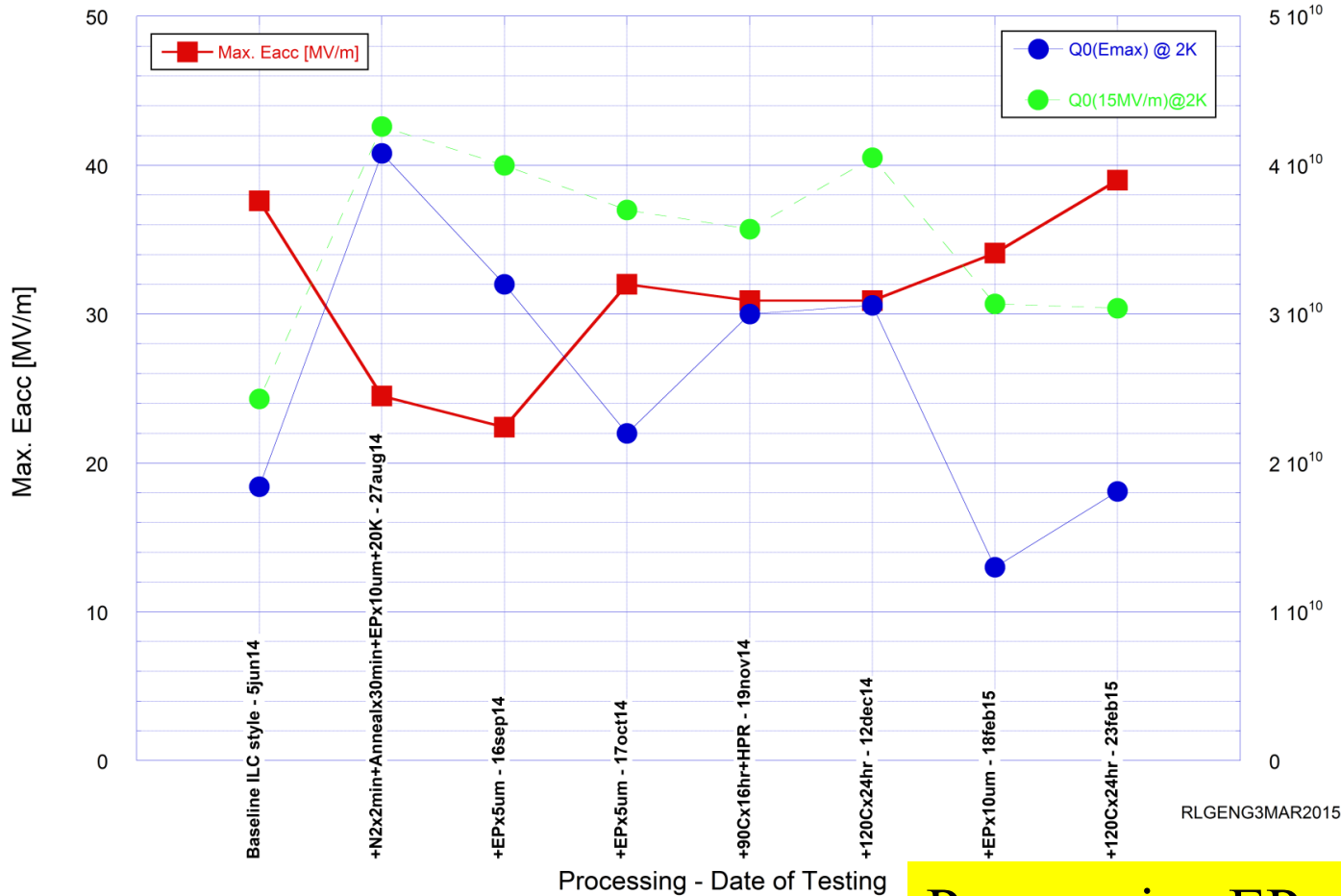
JLab Status: High Q0 at 45 MV/m

- **Two single-cell large-grain niobium cavities under processing and testing for high Q0 at ultra high gradient regime of > 45 MV/m**
 - **New LSF shape 1-cell large-grain cavities (Two each)**
 - In collaboration with Peking University, Ningxia Large grain material.
 - Processing procedure: BCP + 800CX2hr + BCP + 120C bake.
 - Both cavity reached > 35 MV/m and Q0 ~ 2E10 at 2K at max. Eacc.
 - Next step processing using standard ILC recipe: light EP + 120C bake.
- **One new single-cell large-grain niobium cavity under processing and testing**
 - **Cavity PJ1-2**
 - In collaboration with Peking University and OTIC, Ningxia large-grain Nb material and fabrication.
 - CEBAF upgrade cavity Low-loss shape, 1.5 GHz.
 - Processing procedure: BCP60um+800Cx2hr+BCP60um+HPR+120Cx48hr.
 - Final test result see next slide (reported at AWLC14, , May12-16, 2014)
 - On-going testing for ZFC (Zero Field Cooled) test for mitigation of medium field Q-slope (preliminary result reported at LCWS14, October 6-10, 2014)

1-Cell Niobium Cavity PJ1-2 Performance



1-Cell 1.3 GHz Large-Grain Nb Cavity G2 Performance Evolution



Progressive EP after N doping

- The rise and fall of $Q_{0(Eacc,max)}$
- The fall and complete recovery of $E_{acc,max}$
- The necessity of low temperature bake (LTB) for high Q_0 at $E_{acc,max}$
- The residual Q_0 benefit (+25%) at $E_{acc}=15$ MV/m at 30 micron EP, with or w/o LTB