



# Status of LCLS II Tuner Warm Cavity/Tuner Study; Piezo Lifetime Study

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# **LCLS II Tuner**



# Outline

- Warm Tuner/Cavity test
  - Slow Tuner ∆F .vs. Steps (long range 0.4mm and short range 2um)
  - Piezo Tuner Study
    - $\Delta F$  .vs. V <sub>piezo</sub>
    - Mechanical resonances of the tuner/cavity system & Transfer function (piezo-to-cavity) measurements
  - Cavity Alignment issues
- Piezo Lifetime R&D Program update

# Setup for WARM Tuner/Cavity (AES027) study



### Warm Slow Tuner hysteresis



#### Warm Slow Tuner –short range hysteresis /backlash



#### **WARM Piezo Hysteresis curve**



Piezo Voltage, V

#### WARM Cavity Transfer Function (Piezo-to-Cavity)



#	f(Hz)	tau(ms)	kappa(Hz/V)	Strength
1	235	49	14.5	0.65
2	168.1	41	6.86	0.1
3	471.2	46	5.79	0.09
4	402.2	17	1.29	0.04
5	232.6	126.4	1.29	0.03

Cavity driven with 3.3Vpp sinusoidal drive signal and frequency was stepped between 1Hz to 1200Hz with increment of 1Hz.

Forward and probe signals feed of an AD8032 analog phase detector. Output digitized for 5sec interval at rate of 10kHz.

## WARM Cavity Transfer Function (Piezo-to-Cavity)



Axel Newmann/ Saclay I (XFEL) Tuner

## **Cavity alignment issues/limited space**



Main lever (when tuner assembled) covered alignments targets installed on the cavity flange.

One of the solution is to swing main lever to allow access to targets during alignment procedure...(need to be confirm with alignment experts)

#### **Cavity alignment issues/limited space**



FNAL alignment experts (Virgil Bocean) confirmed that they do not see any issues to align cavity string with proposed approach.



# Status of the Piezo lifetime R&D program







Capsules (up to 5)with Piezo-stacks Mounted on the copper block



- RTD (Cernox) –to mount on Piezos
- Geophones (to

monitor piezo stroke)

Insert into LHe dewar with cryo/vacuum and electrical connections



## Status of the Piezo lifetime R&D program



# Summary

- Tuner assembled on the first LCLS II cavity
  - no problems during assembly
  - cavity alignment issues resolved
  - small modification in the Tuner design /Tuner must protect (warm) cavity during pressure/ leak checks tests
- Study of the WARM Slow/Coarse and Fast/Fine Tuner conducted

range/hysteresis of the coarse & fine tuner Transfer function (piezo-to-cavity) measured linear response Lowest mechanical resonance at 168Hz

- Piezo lifetime study (at 4K; insulated vacuum environment) *Total number of the cycles accumulated:* 4\*10<sup>8</sup>cycles (V<sub>pp</sub>=10V; f=1kHz) *Warming up piezo* (10V;1kHz) ΔT~5K
- COLD TUNER TEST mid-December (availability of the HTS & priority of Tuner test .VS. .....)