## Injector performance with one cavity failure in the first CM

## LCLSII-TN-17-05

F. Zhou

## 2/17/2017

The LCLS-II injector includes RF gun, buncher, and one 8-cavity 1.3-GHz cryomodule (CM) for boosting beam energy up to at least 95 MeV. For the nominal settings, the first cavity (Cav1) in the CM has to be turned on and its gradient set at about half the nominal gradient (*i.e.*, 8 MV/m in Cav1), for beam matching from 0.75 MeV to high energy; the second and third cavity (Cav2 and Cav3) will be turned off for emittance compensation, while all other 5 cavities operate at nominal gradient (16 MV/m).

This note presents a simulation result with one cavity failure (*e.g.*, Cav1, Cav4, and Cav5) for the nominal case of 100 pC, as given in the following Table. For the worst case, with a Cav1 failure, the transverse emittance for the 100 pC beam is increased by a factor of 2, and with a lower peak current in comparison to the nominal case. In the worst case, the beam performance may still be useful for soft x-ray FEL operation. For the case of cav4 or cav5 failure, the emittance is still good enough for FEL operation.

	Nominal (grad/phase)	Cav1 failure	Cav4 failure	Cav5 failure
Cav1 Cav2 Cav3 Cav4 Cav5 Cav6 Cav7 Cav8	7.9/-4° 0 14/0° 16/0° 16/0° 16/1° 16/6°	0 7.1/-8° 0 15/-4° 16/0° 16/0° 16/13°	7.9/-4° 0 16/0° 0 16/0° 16/0° 16/1° 16/6°	7.9/-4° 0 16/0° 15/0° 0 16/0° 16/1° 16/6°
ε (μm) I (A) E (MeV) @100pC	0.29 12 94	0.54 7.5 94	0.4 12 96	0.39 12 95