



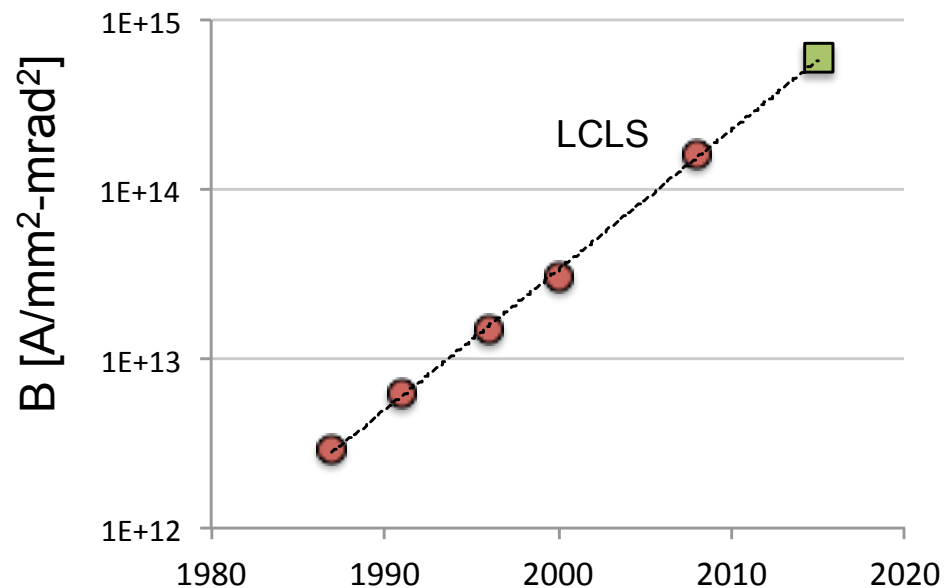
The Next Generation Photoinjector (New Proposal)

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Motivation

- Photoinjectors are critical enabling technology for a broader field of accelerator science and technology.
- If one were to review the last 2 decades progress in the S-band photo-injectors technology and interpolate into 2015, the expectation is to see a gun with the peak current exceeding 120 A, and the normalized emittance $\sim 0.2 \mu\text{m}$.



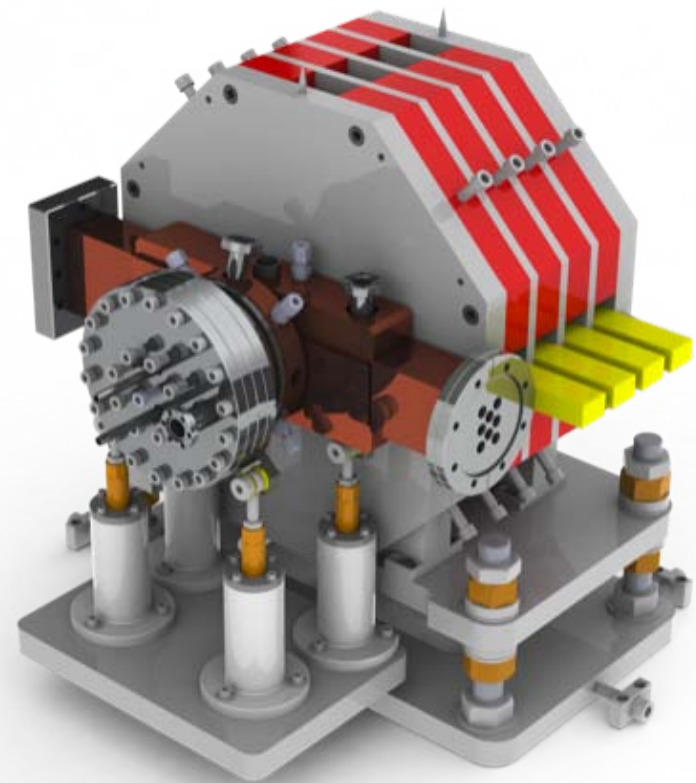
“LCLS type” gun

- LCLS success has in many ways defined the recent progress in photo-injectors (great results + well documented improvements).
- The specific improvements are:
 1. Dual RF feed
 2. A racetrack shape in the full cell
 3. Increased the mode separation from 3 to 15 MHz
 4. The iris between the two cells was reshaped to reduce its surface field
 5. Z-coupling and increasing the radius of the edges.
 6. Reduced size deformation tuners
 7. Improved cooling channels
 8. New cathode mounting
 9. Dipole and quadrupole field correctors in the magnetic solenoid
 10. A bucking coil to cancel the small magnetic field at the cathode

[D.H. Dowell *et al.*, “The Development of the Linac Coherent Light Source RF Gun”, SLAC-PUB-13401, 2008]

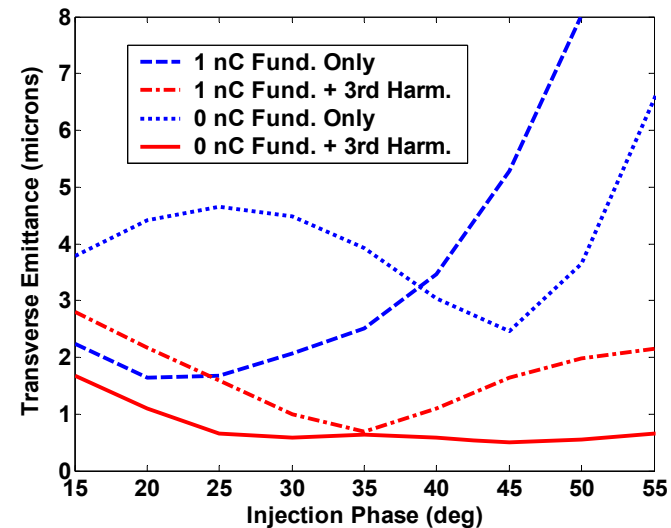
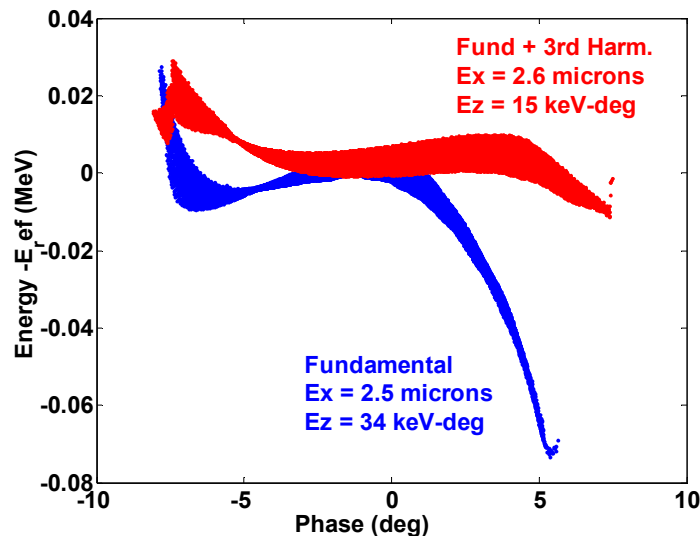
RBT/UCLA version of “LCLS type” gun

- The first prototype is presently under construction (commercial order from FERMI Sincrotrone Trieste)
- Also licensed the design to MAX Lab and building solenoids for MAX Lab and PAL



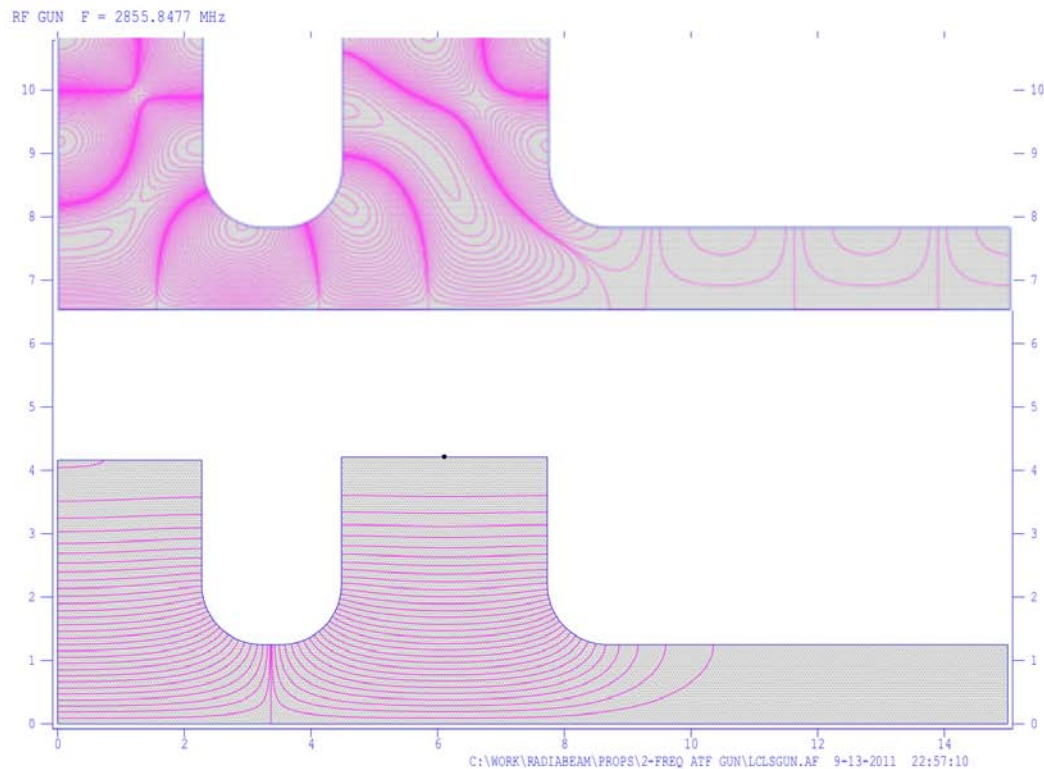
Two frequencies gun

- So far RadiaBeam/UCLA gun is at best the cost efficient version of the LCLS gun (with some minor and yet to be proven improvements).
- A dramatic performance improvement requires bolder steps in departing from the existing designs.
- Revisited the 1992 idea by L. Serafini to use extra harmonic to linearize the fields (additional analysis is given by D. Dowell *et al.* at SLAC-PUB-10851, 2003)



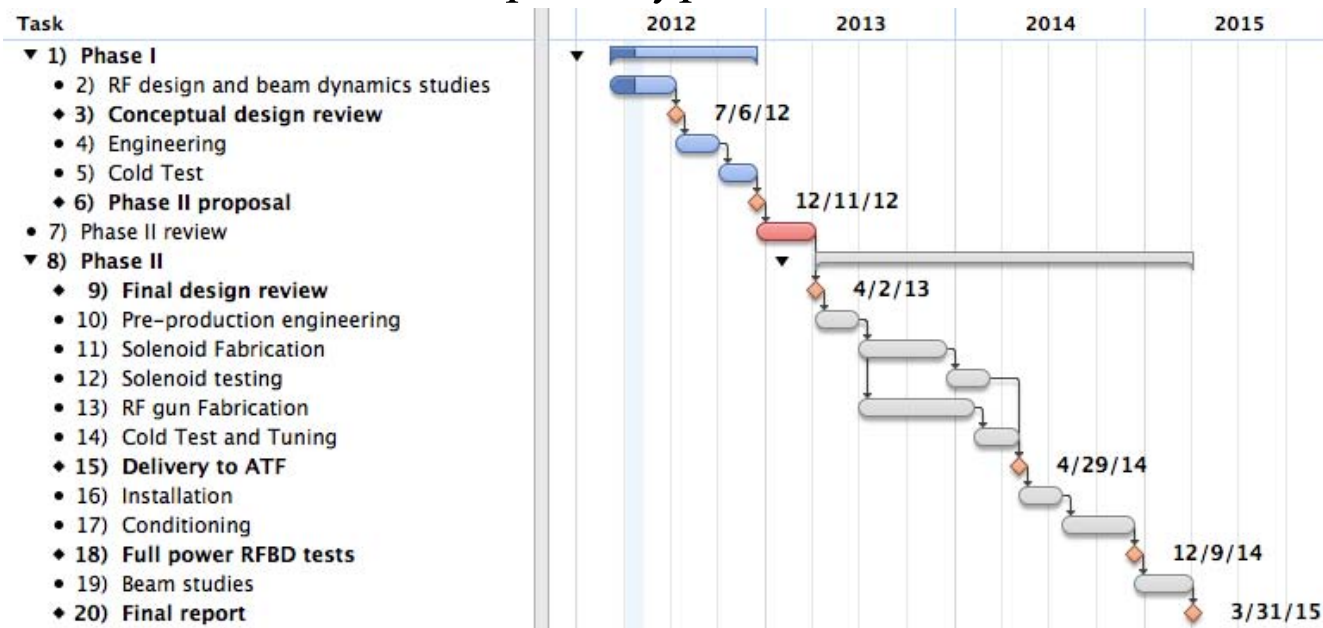
4th harmonic

- Since ATF is in the process of obtaining X-band power, using the 4th harmonic is more practical.



Proposed project

- Phase I SBIR award No. DE-SC0007704
- Phase I objectives: design study of 2 harmonics gun (fundamental +4th), and a cold test
- In the Phase II, build the prototype, install and commission at ATF.



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