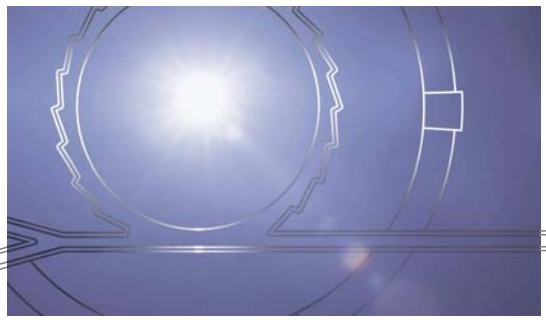

# Design of an improved pre injector for the MAX linac

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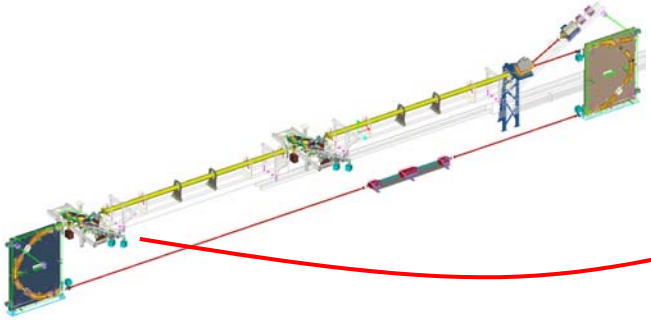
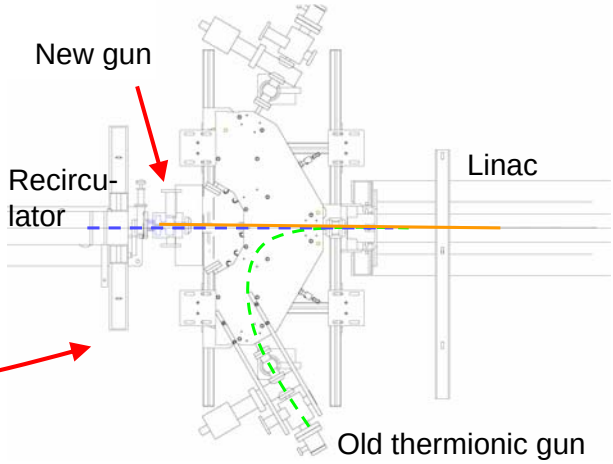
## Introduction

The MAX injector currently uses an RF-gun operating both in thermionic and photocathode mode. The emittance and charge are not sufficient for the tests within EUROFEL. Therefore an improved source has ben elaborated. It consists of an RF-gun structure aimed for short (10ps) pulses with emittance compensation to reach below 3 mm mRad at 1 nC.






The new pre-injector is based on the well known RF-gun structure developed at BNL and already used the world around. (this specific gun is based on the LCLS version [1]). The gun has been adopted in several ways. The frequency is tuned to the ”European 3 GHz”, The cathode surface uses a ½-wavelength choke and a channel for the recirculated beam is added slightly off axis.

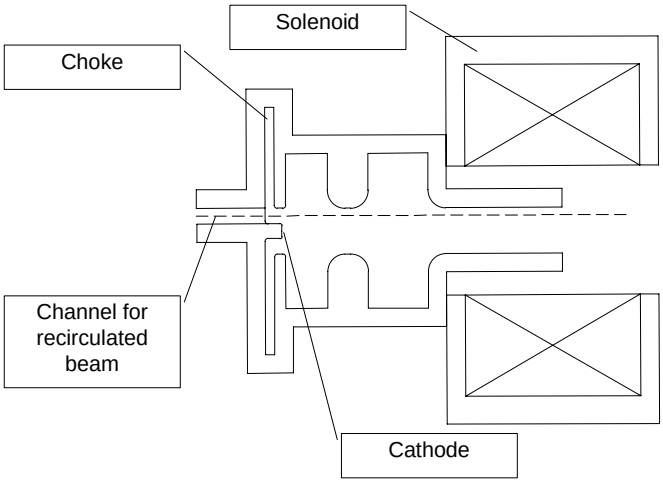
The two beams will also have a small angle (~4mRad) to eachother which is sufficiently small to be corrected without destroying the emittance.

**Design tools**

**Superfish** – to generate the gun geometry and fields

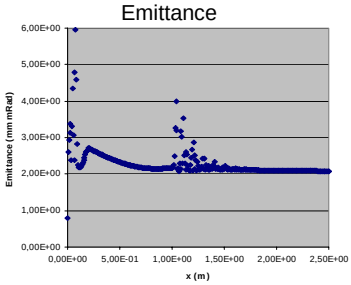
**Poisson** – to generate the solenoid magnet

**Astra** – to track particles in space charge region. No bending magnets, no CSR. Complemented by Elegant (no sp ch) but not using Parmela (no CSR +$$).



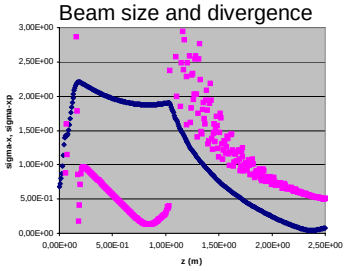

The emittance is compensated [2,3] by a compact strong watercooled solenoid magnet. Beats in the emittance can be seen inside the gun and some ”noise” (probably due to bad statistics) at the linac entrance (@ 1m).
The final emittance is expected to be < 3 mm mRad (@ 1nC)

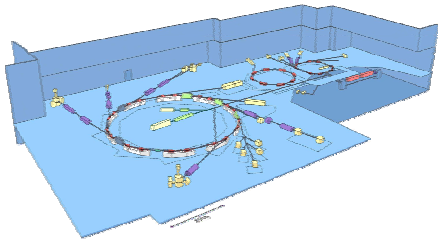
Emittance




The beam size and divergence also experience beatings but the solenoid compensation can clearly bee seen as well as the damping while entering the linac.

Beam size and divergence



References:
1. Design Considerations for the LCLS RF Gun, R. Boyce et al. LCLS TN 04-4,2004
2. Envelope analysis of intense relativistic quasilaminar beams in rf photonijectors: a theory of emittance compensation, L. Serafini, J.B. Rosenzweig, Phys Rev E, vol 55,6, 1997
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