Characterization of the photo injector in CTFII

Original plan:

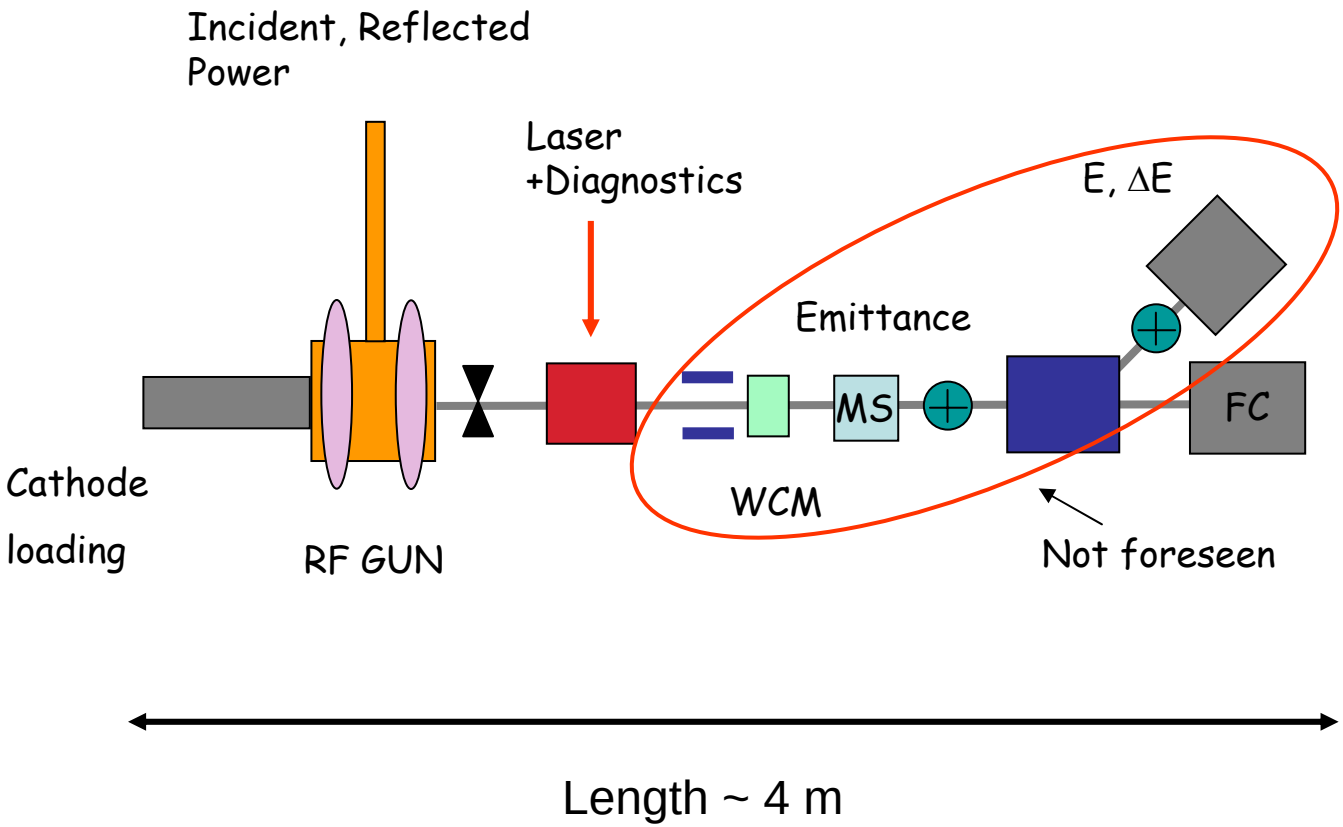
Produce full CTF3 bunch train and measure with a Faraday Cup to verify flatness, stability and cathode lifetime

Additional desirable measurements:

- Energy and energy spread (time resolved?)
- Emittance (time resolved?)
- Parameter optimization (Bench mark simulations)
- Interlock tests
- RF-Gun with pulse compressor (programmed phase profile)

CTF3 collaboration meeting Nov. 30th

RF GUN Test in CTF II



Beam parameters

E = 5.6 MeV

ΔE = 1 % ?

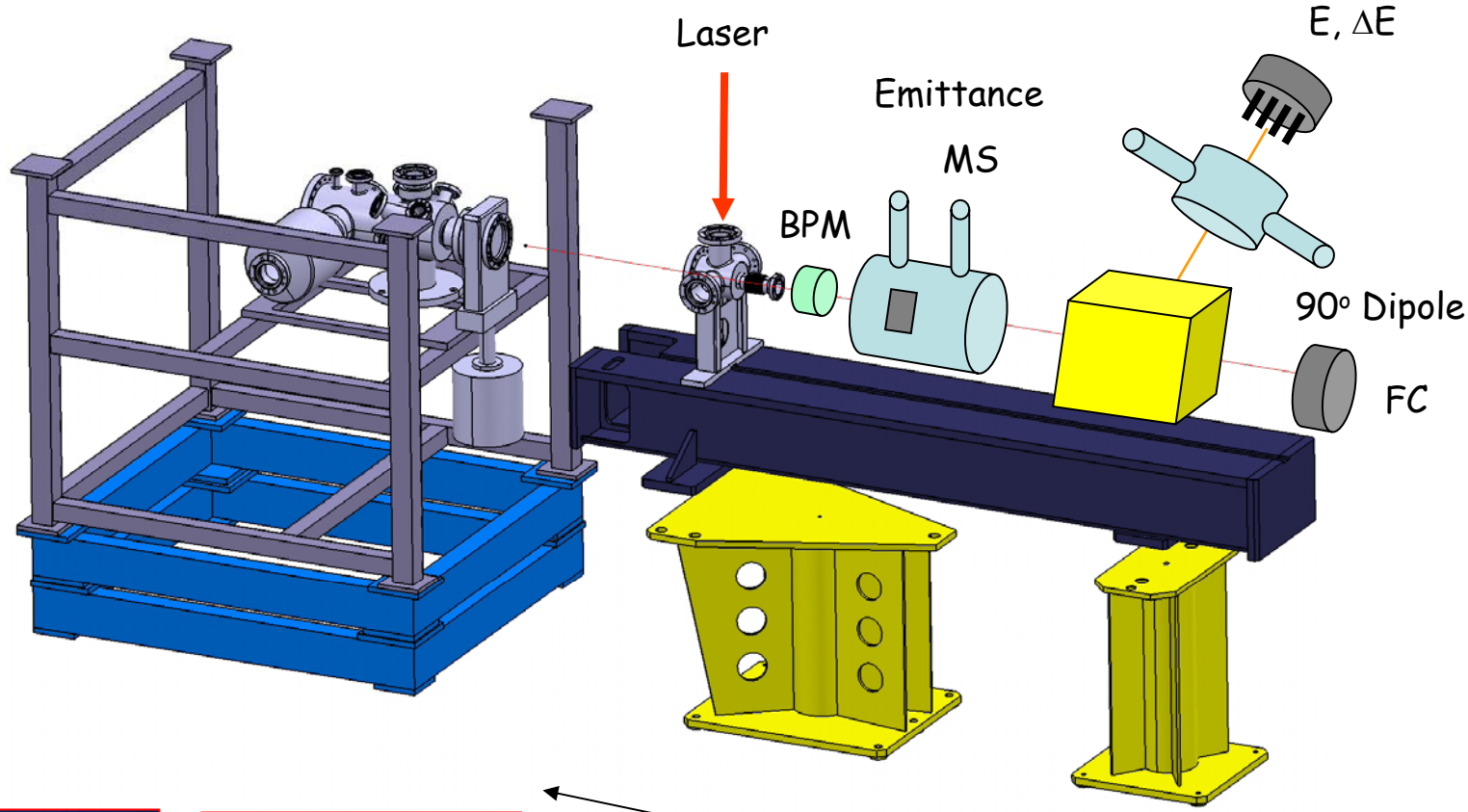
Q = 2.3 nC

T_p = 1.5 μs (1.5 GHz)

ε_N = 20 mm mrad

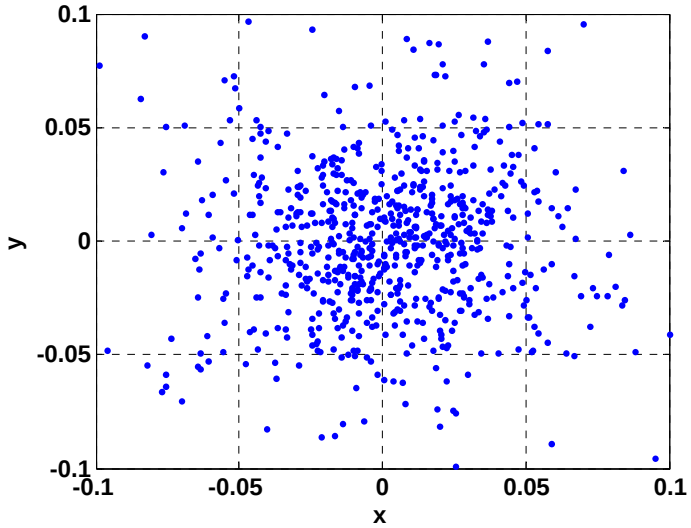
σ_z = 10 ps

RF GUN Test in CTF II

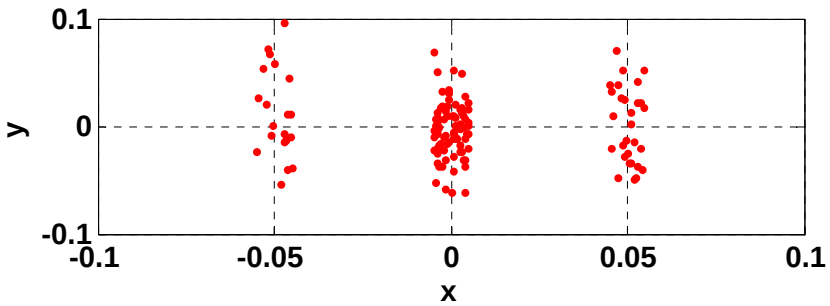


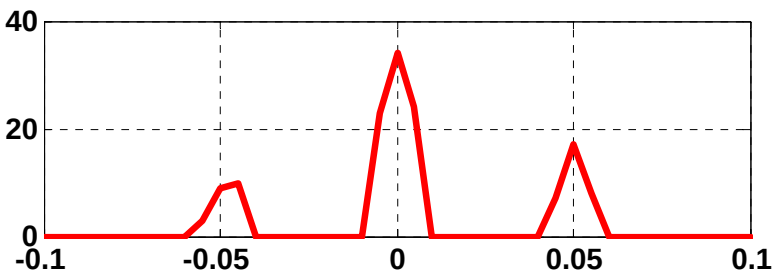
Multi Slit Simulations

Gun exit

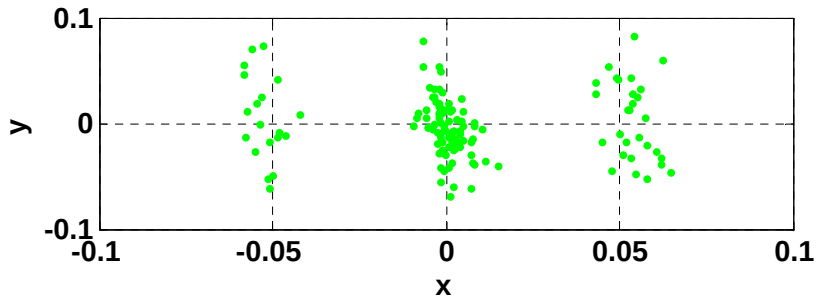


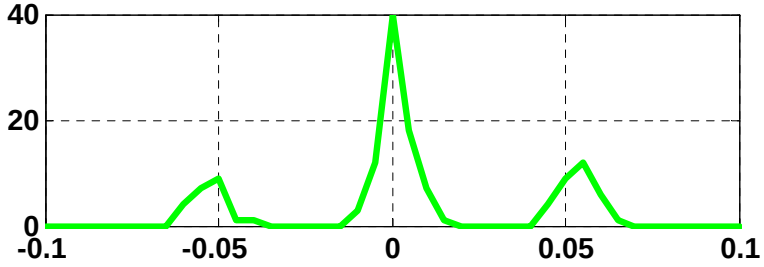
Multi Slit





Screen after Slits





Comments

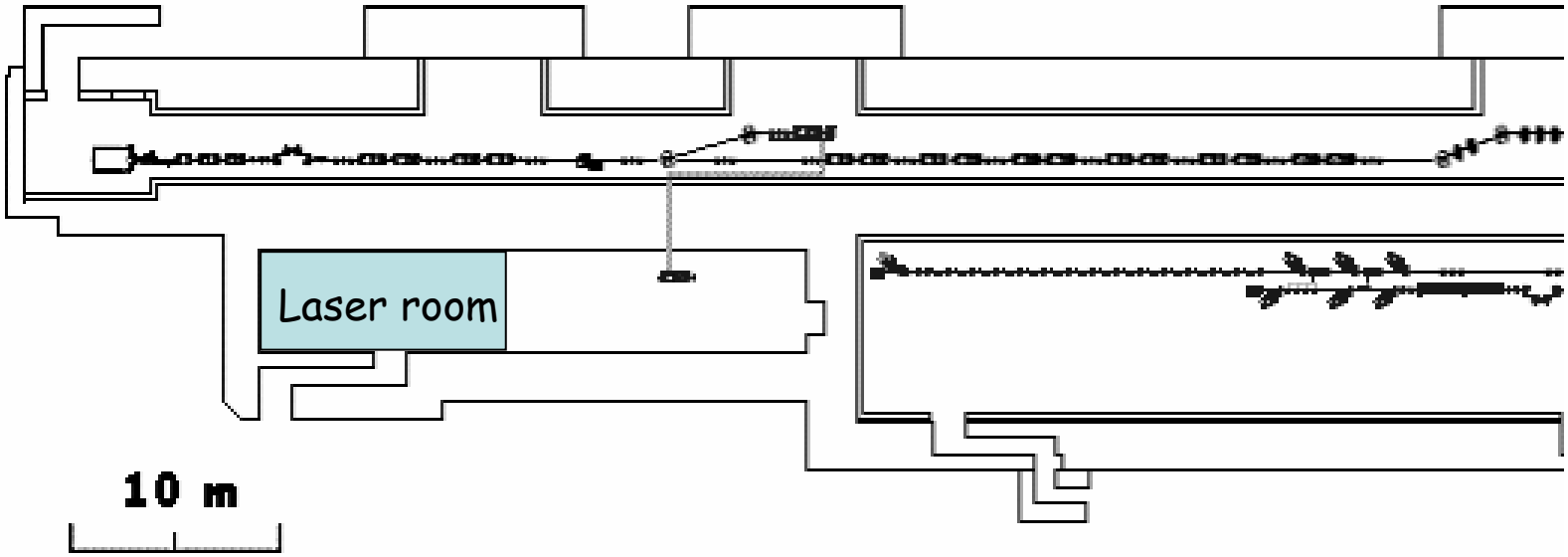
- Schedule of the testing, conflicts with CR commissioning ?
- Multi Slit Mask has to be designed with simulations
  (2 mm Tungsten, 0.1 mm slits, 0.5 mm separation,
  50 mm drift to screen)
- Dipole, Segmented dump, Faraday Cup and Screens existing
- Single bunch – full train compatibility of diagnostics ?
  (aluminum foil with OTR should work, very high sensitivity
  for Multi Slit YAG screen)
- What's missing ?

Integration of the PHIN - Photo injector into CTF3

- Space and Building constraints
- RF power sources constraints
- A conceptual proposal
- Questions to be addressed

CTF3 collaboration meeting Nov. 30th

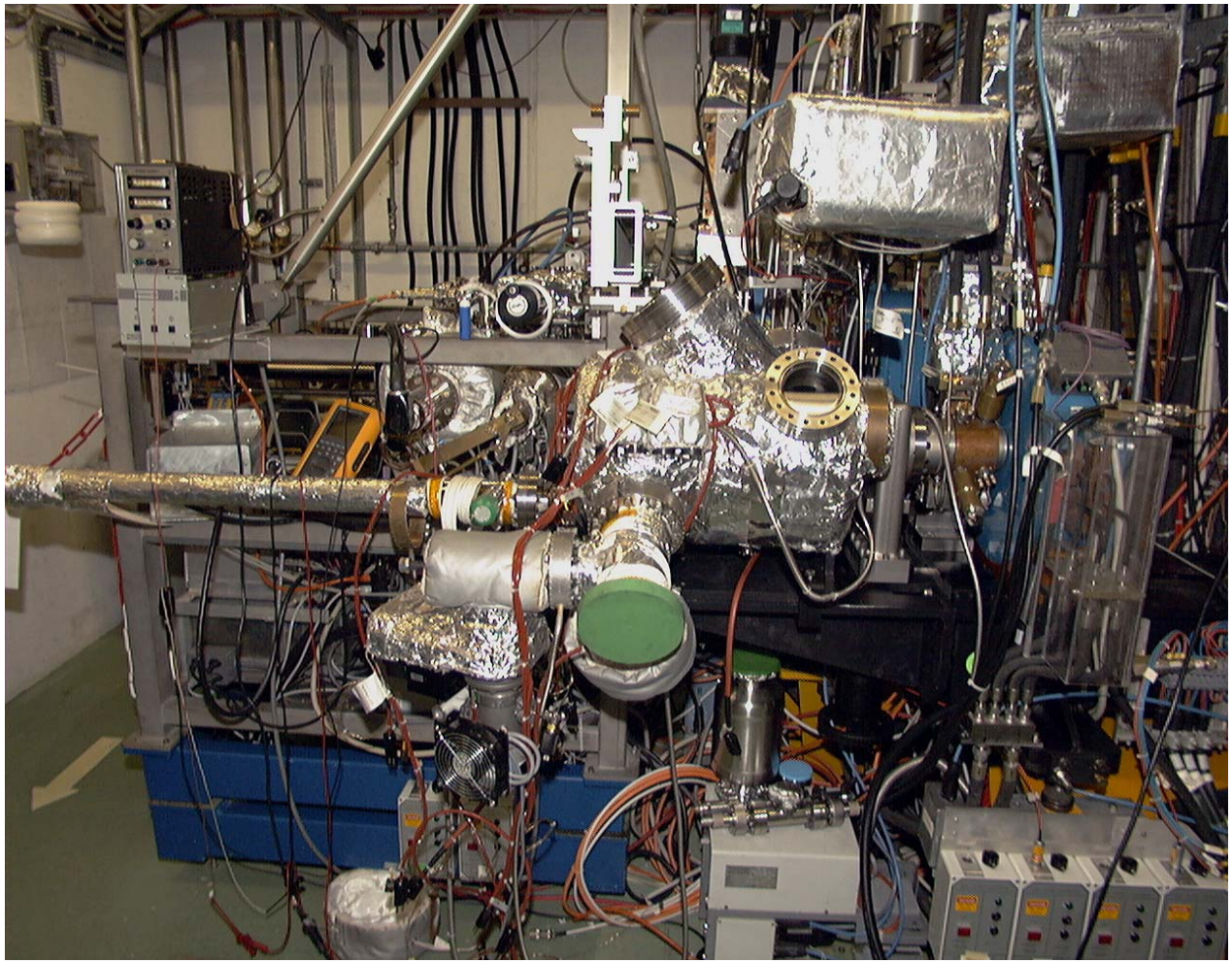
Space and Building Constraints



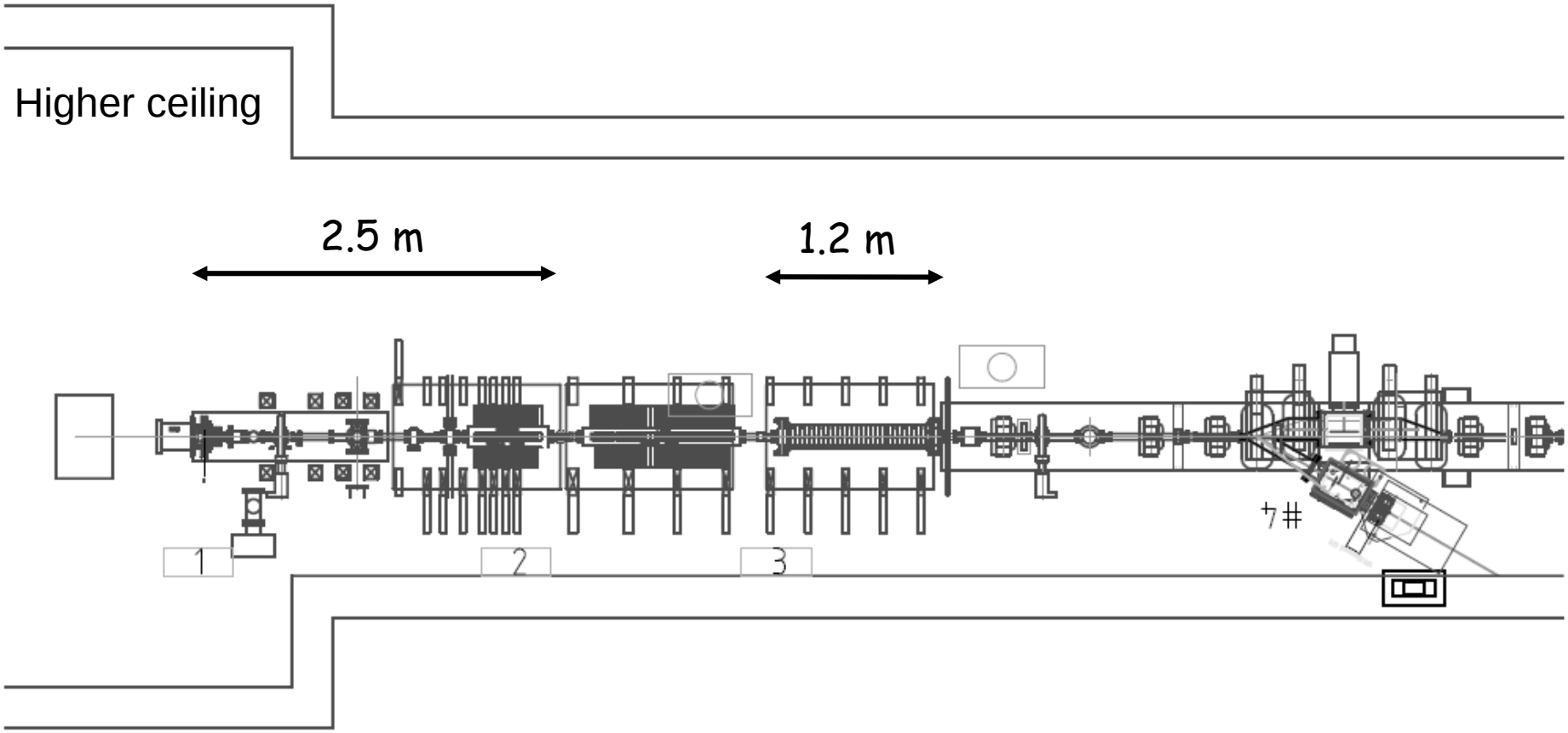
RF-Gun has to be at the beginning of the building due to the cathode loading system

Space and Building Constraints

RF-Gun in CTFII



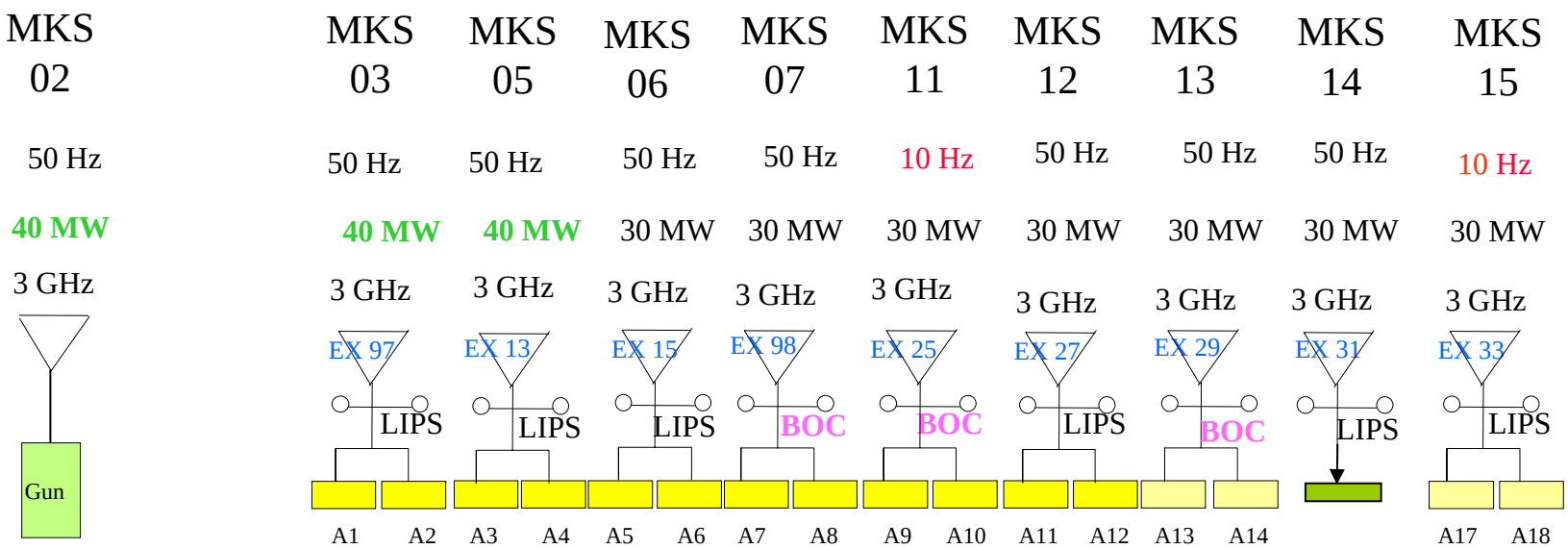
Present injector layout



0,1, or 2 more accelerating structures in the injector ?

RF Power Sources

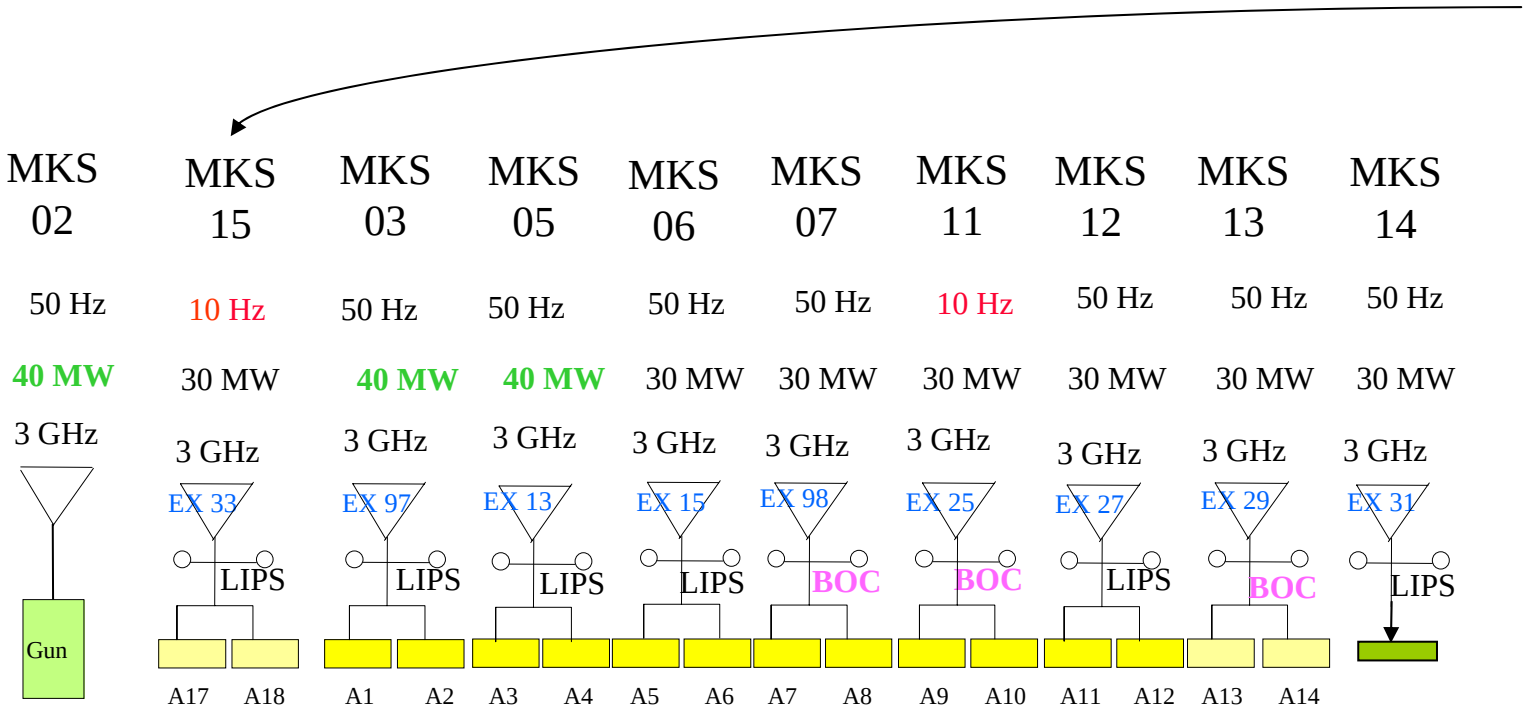
Original plan



Basic Assumption: We can’t afford a new power source !

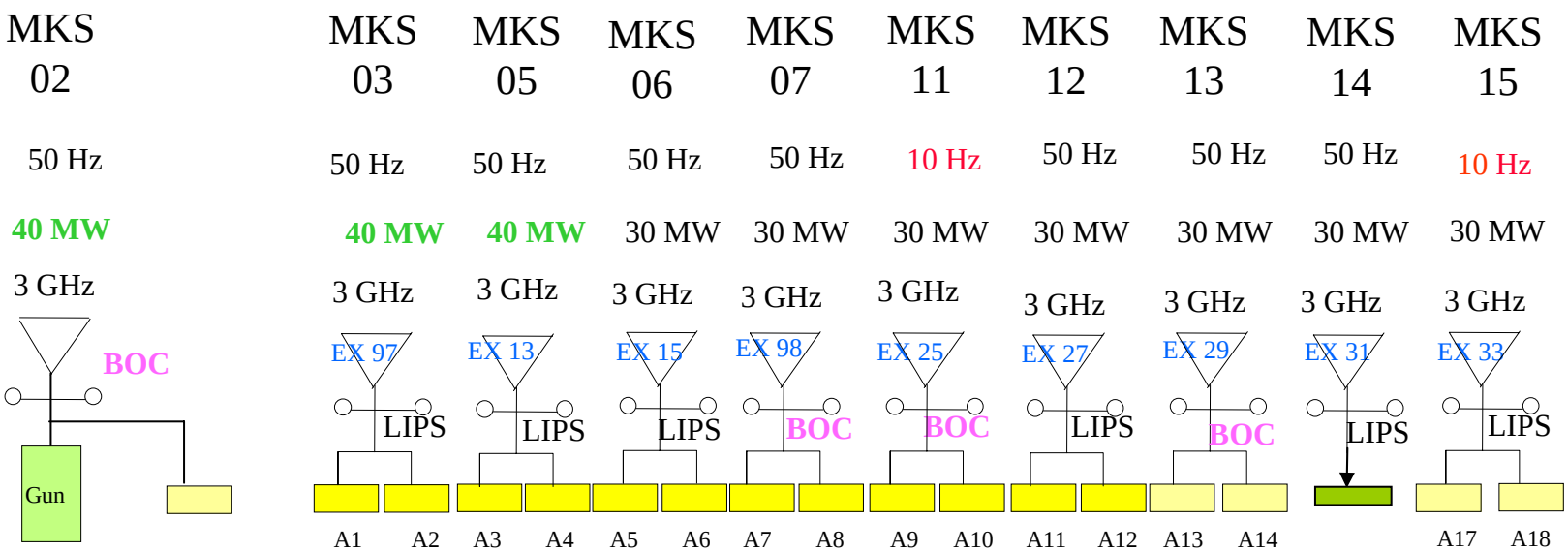
RF Power Sources

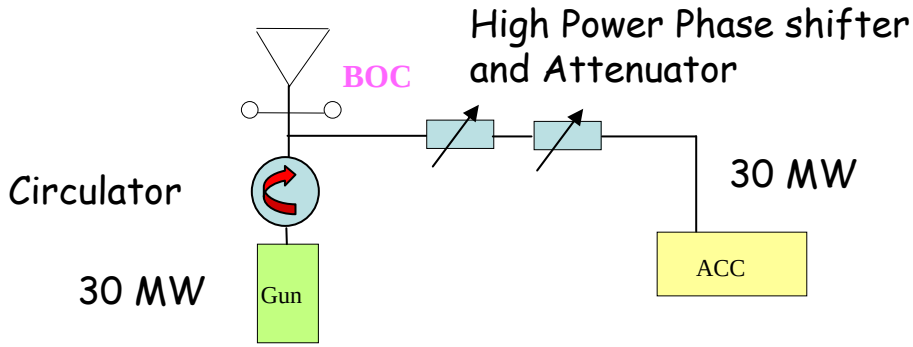
Move two accelerating structures to the injector



RF Power Sources

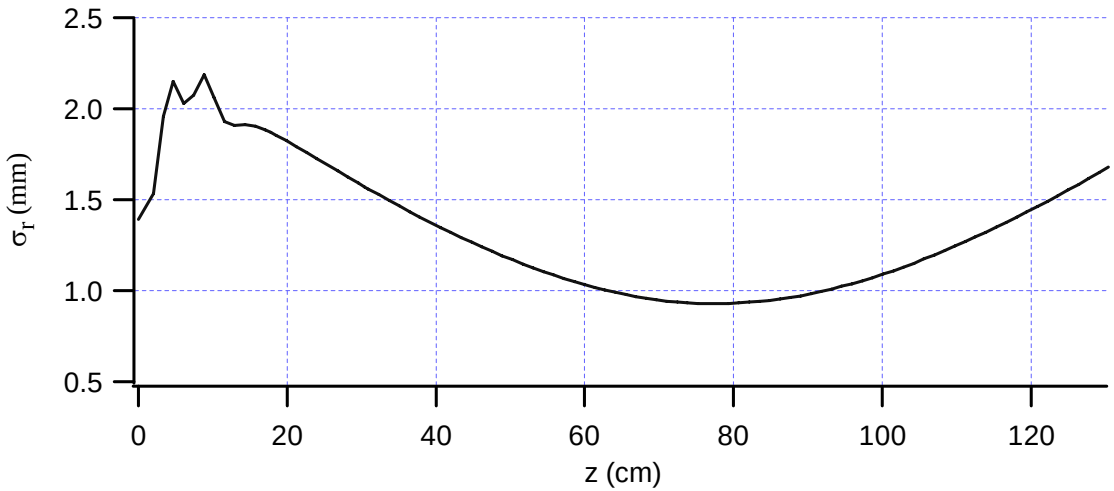
Pulse compressor for Gun and one new structure ?

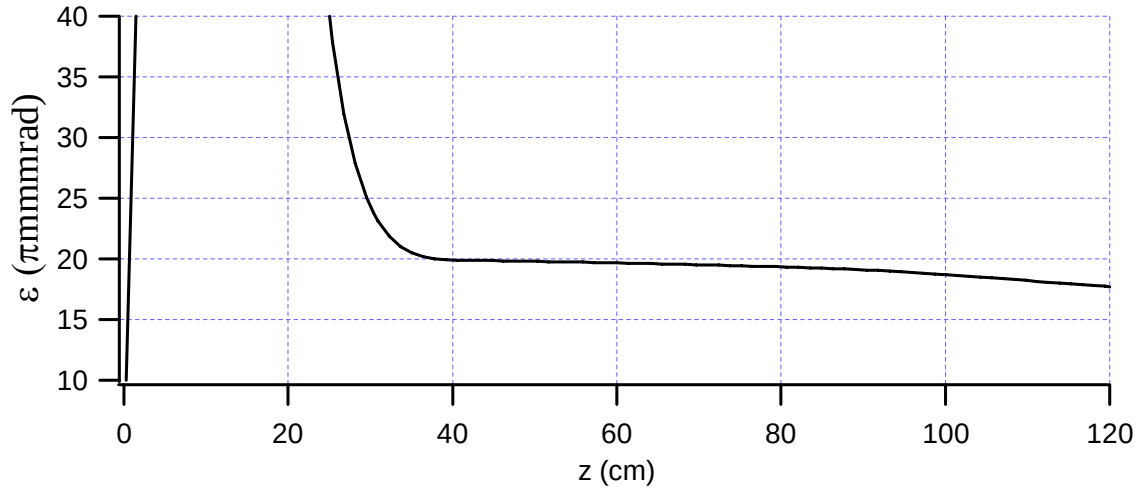




Power Gain of 1.5 needed

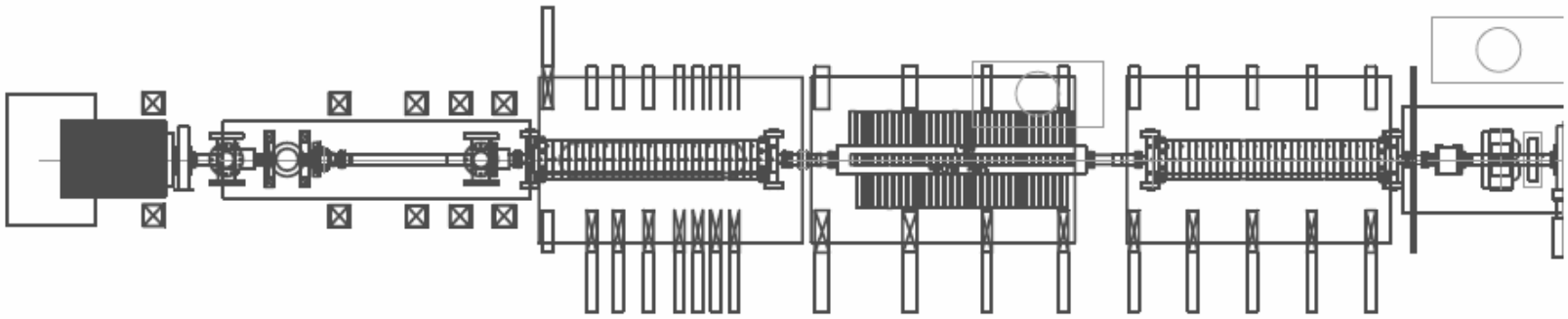
RF-gun optics and emittance compensation





Conceptual proposal

- Add one accelerating structure
- Add a pulse compressor to MDK 2 and power RF-Gun and new structure with the same Klystron
- Allow for emittance compensation before acceleration (~ 1.5 m drift)
- Install RF-Gun at the location of existing DC Gun



Start of the higher ceiling

Conceptual proposal

Advantages:

- Operational flexibility
- Better Beam Quality !
  - Higher Energy
  - Better Emittance through further compensation
  - Smoother bunching, less energy spread (velocity bunching)
- Interesting beam dynamics of general interest
- Synergy with probe beam and other projects

Questions, Problems

- Pulse compressor with RF Gun (also important for probe beam)
- Spectrometer in Girder 4 doesn't work anymore (32 MeV limit)
- Lot's of simulations needed to understand and optimize this injector:
  - -Optimum distance Gun-first structure
  - -'velocity bunching' , 'ballistic bunching' or 'no bunching' at all
  - - Solenoids; where, how many
  - - Diagnostics

- Need successful tests and characterization of the gun in CTF II
- Laser path, Laser location
- Investigate other options (0 or 2 accelerating structures)
- Rearrange Girder 4 for better emittance measurements
- Schedule and commissioning