# Requirements for PXIE MEBT absorber

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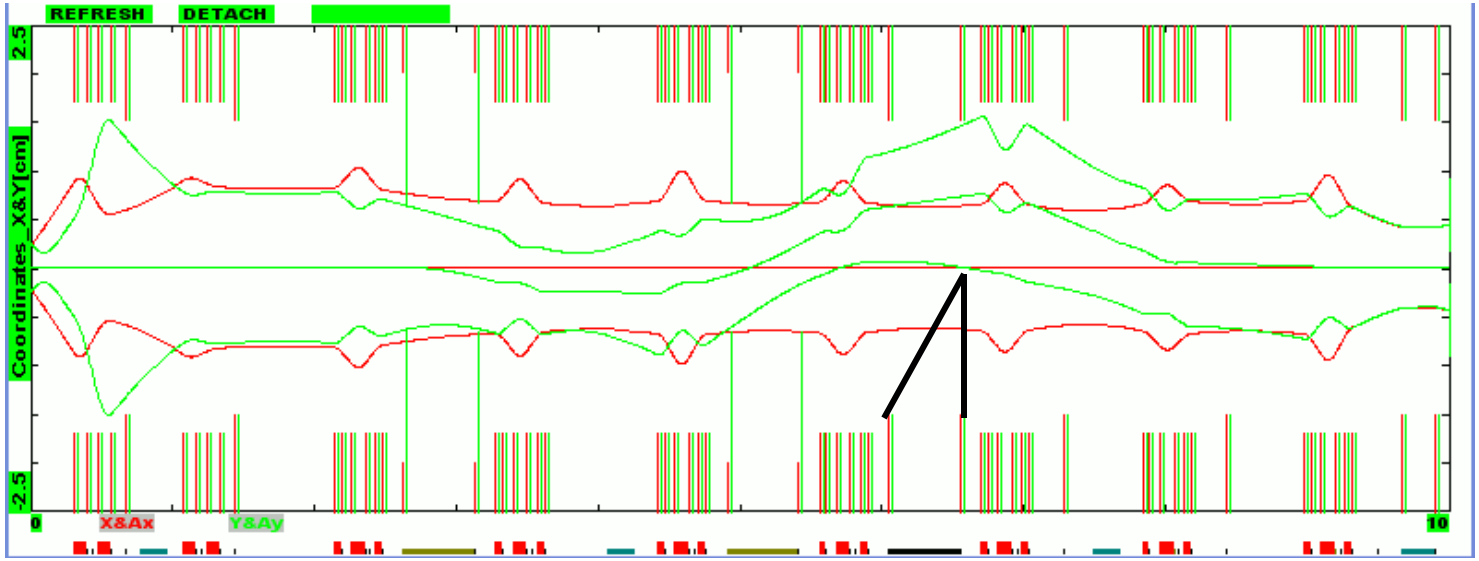
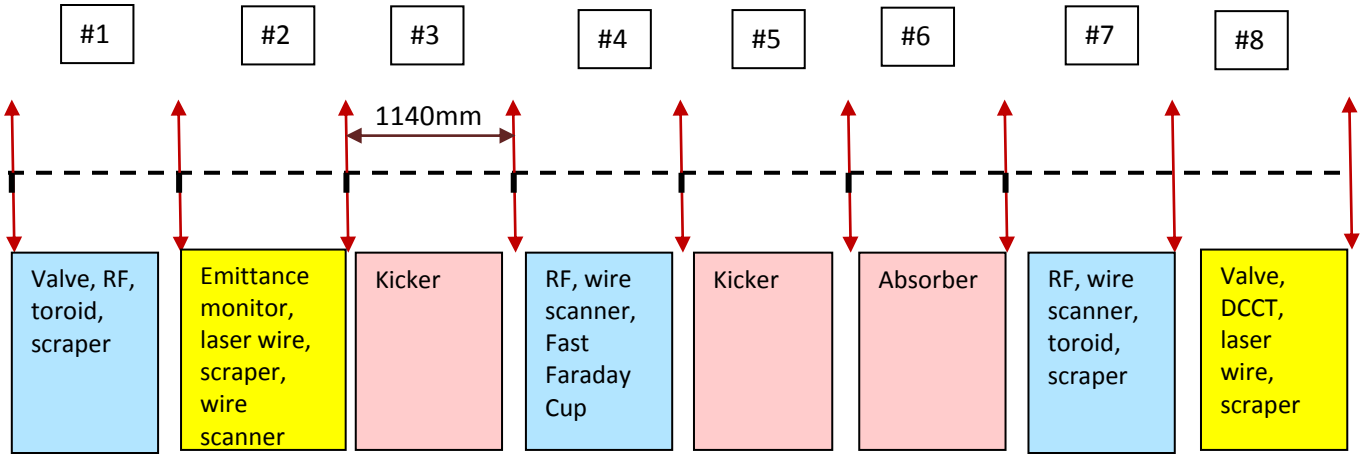
November 15, 2011

Project X Technical Meeting

# PXIE MEBT absorber




All chopped -out bunches will be dumped into the absorber.
Maximum power = 10mA X 2.1 MeV = 21 kW CW.

# PXIE MEBT absorber timeline

- The absorber is the part of the chopping system for PXIE
  - Should demonstrate all features required for Project X
  - Preferably should work at 10 mA (for a possible future upgrade)

- We propose to test a small prototype with an electron beam
  - L.Prost's presentation

- Possible timeline (dates of starting)
  - First beam in PXIE- May 2014
  - Production of the absorber to be installed into PXIE - May 2013
  - Testing the prototype with e-beam July 2012
    - Assemble a test bench well before
  - Fabrication of the prototype - Apr 2012
  - Production design of a prototype - Feb 2012
  - Conceptual design (see C. Baffes' presentation)- Now

# Functional requirements (first draft)

- Ion energy — 2.1 MeV
- Nominal average current — 5 mA
- Maximum average current — 10 mA

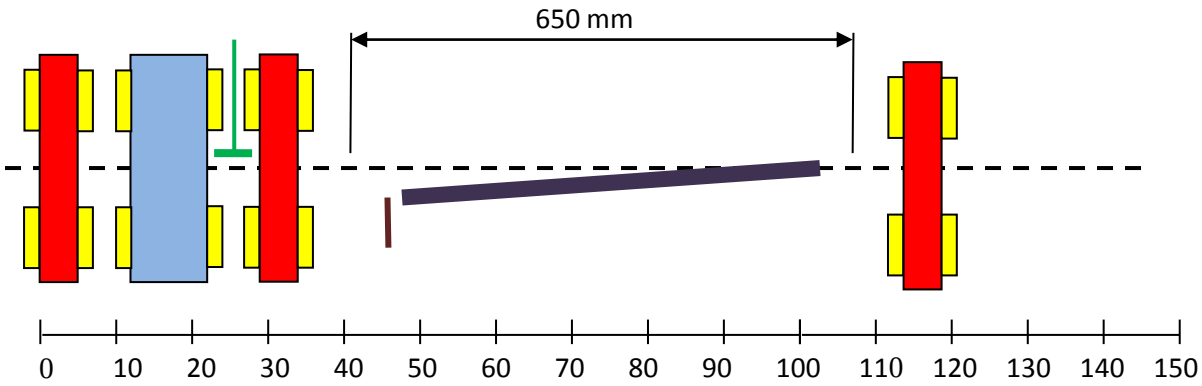
- Beam cross section at the absorber center, sigma (X=Y) — 2 mm
  - Elliptical beam or beam sweeping are under consideration
- Nominal beam angle at the beam center — < 3 mrad
- Angle error at time scale > 1 μs — < 3 mrad

- Beam time structure at time scale > 1 μs:
  - At maximum average power — CW
  - During commissioning, average power < 100W — trains up to 1 ms

- Thermal cycling at maximum power during the lifetime — 10,000
- Expected life time, not less than — 1 year

# Additional restrictions

- Available length, flange-to-flange — 650 mm
- Vacuum with no beam — < 30 nTorr
- Vacuum with full power — < 1 µTorr
  - Needs more careful estimations
- The absorber is to be mounted below the beam axis.



# Challenges

- Very high power density
  - Determines the design (see C. Baffes' presentation)
  - To alleviate:
    - Small incident angle ~ 30 mrad
    - Possible increase of the X- beam size (may cause an emittance growth)
    - Possible sweeping - need ~200 Hz dipole magnets
  - Testing with an electron beam looks useful
  - Need a good control of the spot size
    - Beam optics and emittance measurements should give a good idea
    - Accident scenarios need to be analyzed
      - Operational errors, electronics malfunctioning…
      - If the beam envelope downstream is restricted by isolated scrapers, strong envelope perturbations may be detectable
    - Direct OTR monitoring of the spot may work
- Activation and neutron production
  - Limits the choice of materials for the absorber
    - For copper, the threshold is 2.168 MeV
    - The choice of 2.1 MeV of H- energy (N. Mokhov et al. recommendation)

# Challenges (cont.)

- Possible high outgassing
  - Poor vacuum can affect SRF
  - Increased H- stripping rate
- Sputtering
  - May affect performance of RF and conductance of insulators
- Secondary particles
  - Variety of possible negative effects
    - Load for the neighboring re-bunching cavity
    - Can affect measurements of bunch cleaning
    - Elevated temperature of the vacuum chamber
    - Charging the window for optical measurements
  - Simulations are under way (Yu. Eidelman)