Magnet Considerations

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- From CPS conceptual design document Chudakov et al.
- A quick way to evaluate the spread of the longitudinal spot for parallel beam in a dipole.
- The longitudinal spot size is proportional to the square root of the track radius.

shift of the electron trajectory by just 1-3 mm is already sufficient for the start of the shower. At the same time, such a deflection needs to be accomplished at a relatively short distance (much shorter than the size of the radiation shielding) after the beam passes through the radiator to keep the source compact. Indeed, with a deflection radius, R, a vertical size of the channel, $2a$, and a vertical raster size, $2b$, the trajectory enters the channel side after traveling in the magnetic field a distance, p, which varies from $p = \sqrt{2\,R\,(a-b)}$ to $p = \sqrt{2\,R\,(a+b)}$ (see the scheme in Figure 5). In the currently

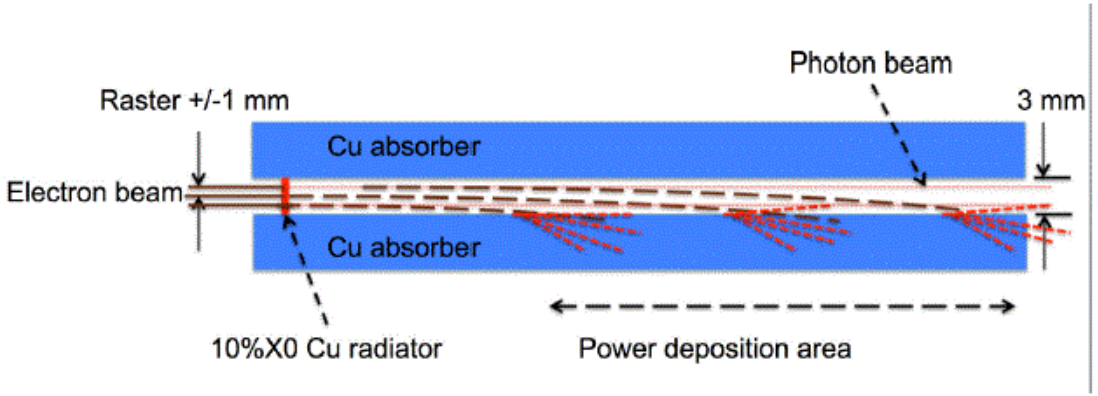

Figure 5. The scheme of beam deflection to the absorber/dump.

proposed CPS magnet the trajectory radius R is about 10 m for 11 GeV electrons, the channel size is 0.3 cm, and the raster size is 0.2 cm, so the distance p has an average value of 17 cm with a spread of 12 cm. A total field integral of 1000 kG-cm is adequate for our case, which requires a 50 cm long iron dominated magnet.

The above concept of the combined magnet-dump allows us to reduce dramatically

- Need to minimize the energy deposition density first (a few of KW/cm^3?)
  - Afterwards, carefully evaluate prompt radiation and activation
- Beam constraints
  - σ_x and σ_y cannot be larger than 2mm, even that needs testing.
    - Nominal GlueX beam is 1mmx0.5mm in σ_x and σ_y .
  - Current rastering skim in Hall D needs to be tested , but we should be able to get 1mmx1mm on the radiator.
- Beam-hole (a.k.a. channel) size is only restricted by the radiation leaks.
  - Should be wide to accommodate the beam size.
- Track radius at 12 GeV beam is restricted by the space in the hall.
- The length of the magnet should not be much longer than the maximum depth of the track in the channel, plus the EM shower depth.
- The option of variable gap size can provide larger longitudinal spot size, but compared to what? It needs to be check in simulations.
  - For wide magnet gap there is no gain in protecting the poles by spreading the gap downstream.
- Need a procedure to estimate the temperature for given FLUKA model output.
  - Not existent.