Be-Target Design: Progress & Plans

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(for KLF Collaboration)

- Hall D beam line for KLF.
- Hall D setting.
- MCNP transport code.
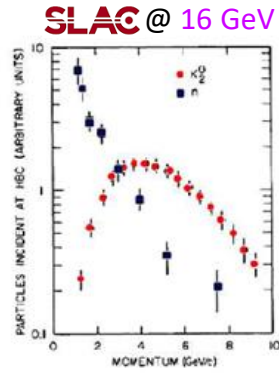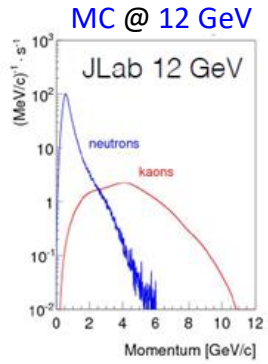- Be-target assembly.
- Where to go.

Hall D Beam Line for K-longs

K_L Beam Flux

MC @ 12 GeV

SLAC @ 16 GeV

- Electrons are hitting Cu-radiator @ CPS located in Tagger alcove.
- Photons are hitting Be-target located in collimator alcove.
- K_Ls are hitting the LH_2/LD_2 target within GLueX setting.

$N(K_L)/sec \sim 10^4$

$\dfrac{N(K_L)_{JLAB}}{N(K_L)_{SLAC}} \sim 10^3$

GlueX Spectrometer

Pair Spectrometer

North LINAC

e⁻ beam

No need in **tagging** photons

γ beam

Sweep Magnet
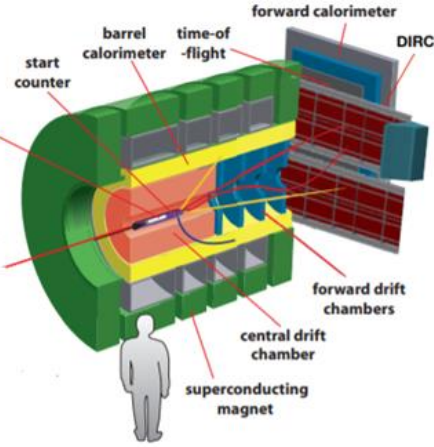
East ARC

Compact Photon Source

Kaon Production Target

Kaon Flux Monitor
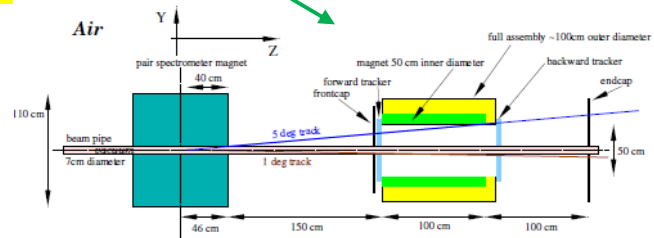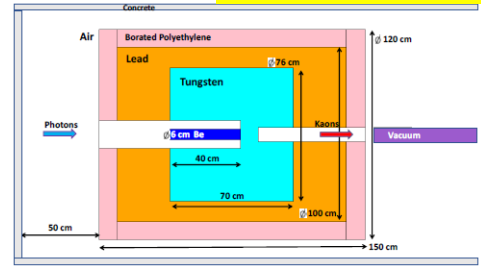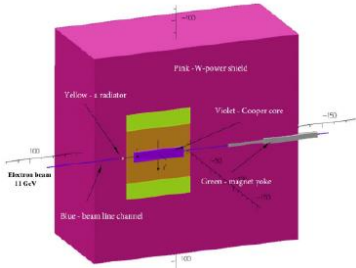
Hall D Setting in 3D

- For neutron & gamma calculations, we will use MCNP6 transport code.

n: 0.35±0.17 mrem/h
γ: 0.08±0.01 mrem/h

Key Area for RadCon [1 mrem/h] on ceiling

Be-target Assembly

#5

Hall D

Photons

K-long, n

#1 Kaons #6
              #3

#9

#8

#7

LH₂/LD₂

- To reduce effect of **n** and **γ** background, coming from **Be** in experimental hall, we plan to put **KPT** upstream in collimator alcove.
- Additional shielding is to minimize **n** & **γ** background in experimental hall

Labyrinth

Sweep Magnet   Labyrinth

- To clean up charged component of beam.

- **Vacuum beam pipe** prevents neutrons re-scattering in air.

n: 0.00 ±0.10   mrem/h
γ: 0.008±0.004 mrem/h
   0.022±0.008 mrem/h
   0.071±0.015 mrem/h

- Most important & unpleasant background for K_L comes from neutrons.

- Realism of MCNP simulations is based on advanced nuclear cross section libraries created and maintained in national laboratories of [logo] complex.

- Physical models, implemented in MCNP6 code, take into account bremsstrahlung photon production, photonuclear reactions, neutron & photon multiple scattering processes.

- MCNP model simulates a 12 GeV 5 μA electron beam hitting **Cu**-radiator inside CPS.

- Electron transport is traced in **Cu**-radiator, vacuum beam pipe for bremsstrahlung photons, & **Be**-target.

- Neutrons & gammas will be traced in all components of MCNP model.

- Media outside concrete walls of collimator alcove and bremsstrahlung photon beam pipe will be excluded from consideration to facilitate calculations.

- For MCNP calculations (in terms of flux [part/s/cm^2] or
  biological dose rate [mrem/h]),
  several **tallies** will be placed along beam & at Tagger alcove &
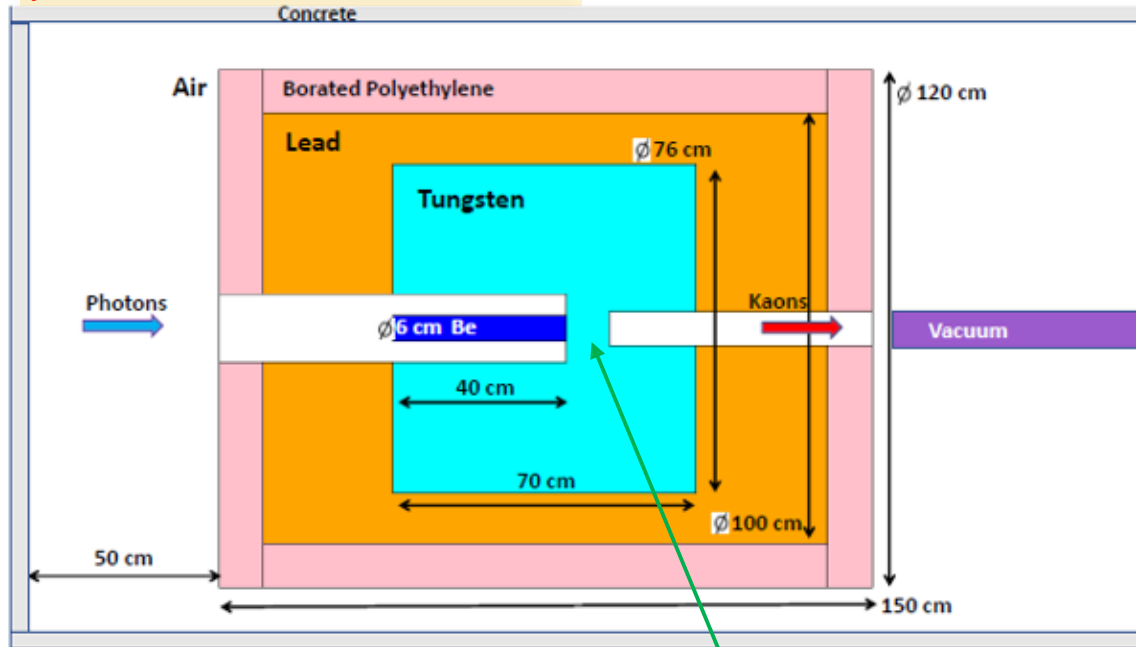 experimental hall for neutron & gamma fluence estimation.

Be-Target Assembly

- **Be**-target assembly will weigh **14** tons & has estimated cost of **$1.2M**.

xy-cross section, x-dimension

- Collimator alcove has enough space (with 4.52 m width) for **Be**-target assembly to remain far enough from beamline.

- Water cooling would be required around **Be** & **W**-plug.

  Cooling water, available in experimental hall, is sufficient to dissipate 6 kW of power delivered by photon beam to **Be**-target.
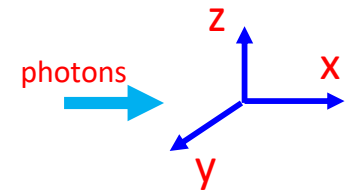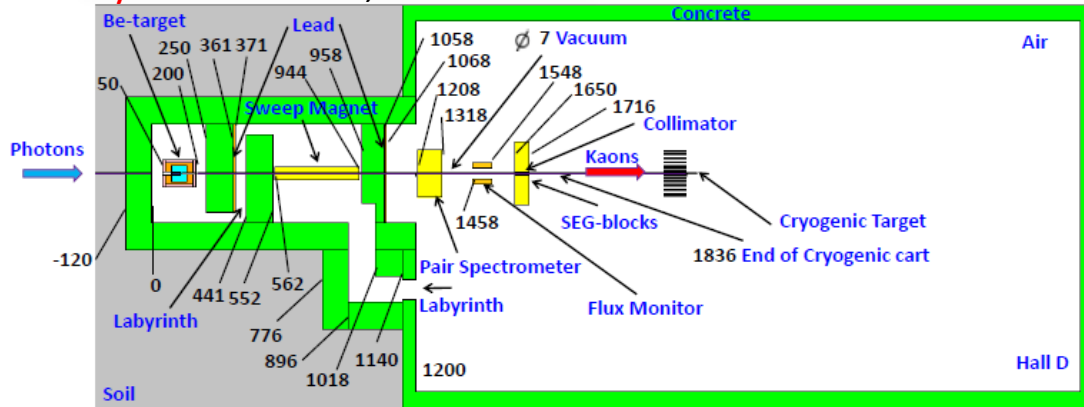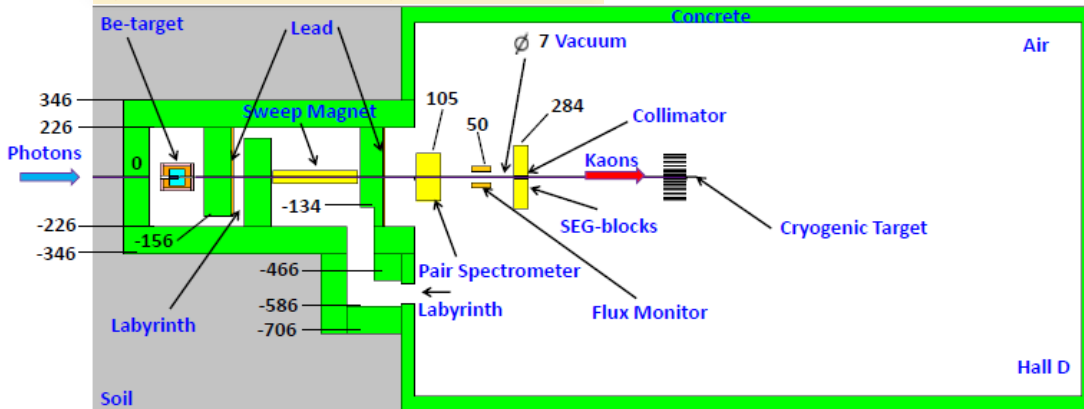
W-plug
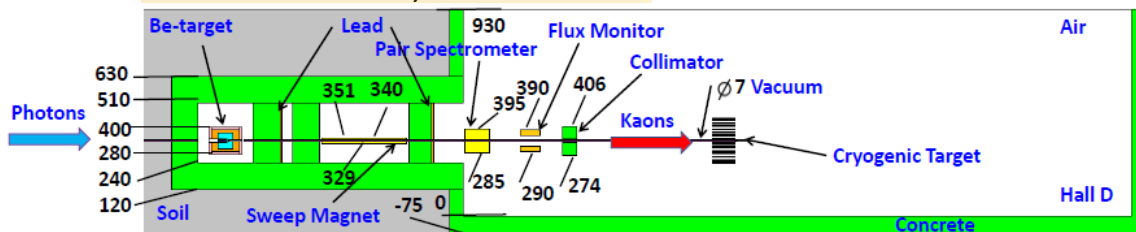
Concrete **walls** are out of scale

xy-cross section, x-dimension

xy-cross section, y-dimension

xz-cross section, z-dimension

Be-target assembly is **cylinder**, then there is no difference between x & y dimensions.

photons

- Calculations for KPT will be performed for different shielding configurations to minimize neutron & gamma dose rate & reduce price of KPT.

- Neutron flux & energy distribution on face of LH_2/LD_2 cryogenic target is important to validate physical background in case of np or nd interactions in cryogenic target.

- Neutron dose rate for SiPM of Start counter, surrounded cryogenic LH_2/LD_2 target, & BCAL is also important to study.

- Engineering design is in order ?