

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.

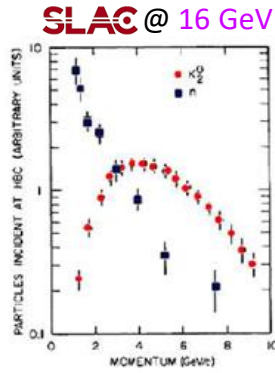
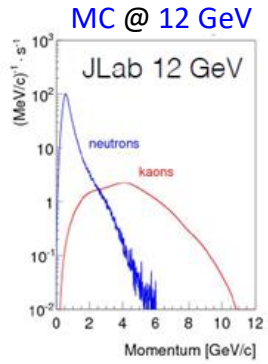




Hall D Beam Line for K-longs

K_L Beam Flux

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



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

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

North LINAC

e beam

No need in tagging photons

γ beam

K_L

Pair Spectrometer

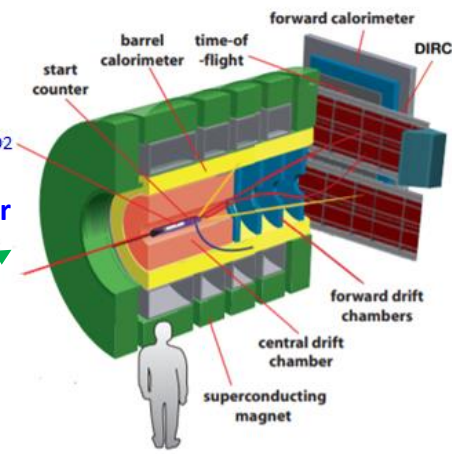
GlueX Spectrometer

LH_2/LD_2

Sweep Magnet

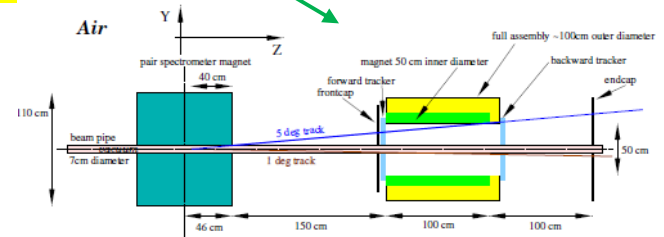
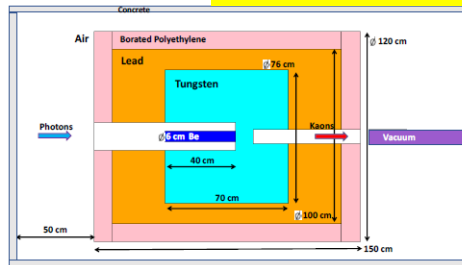
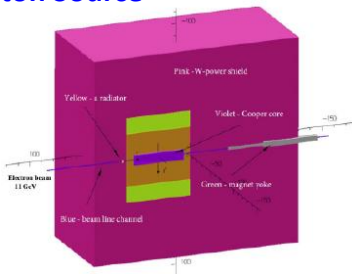
Kaon Production Target

Kaon Flux Monitor



Compact Photon Source

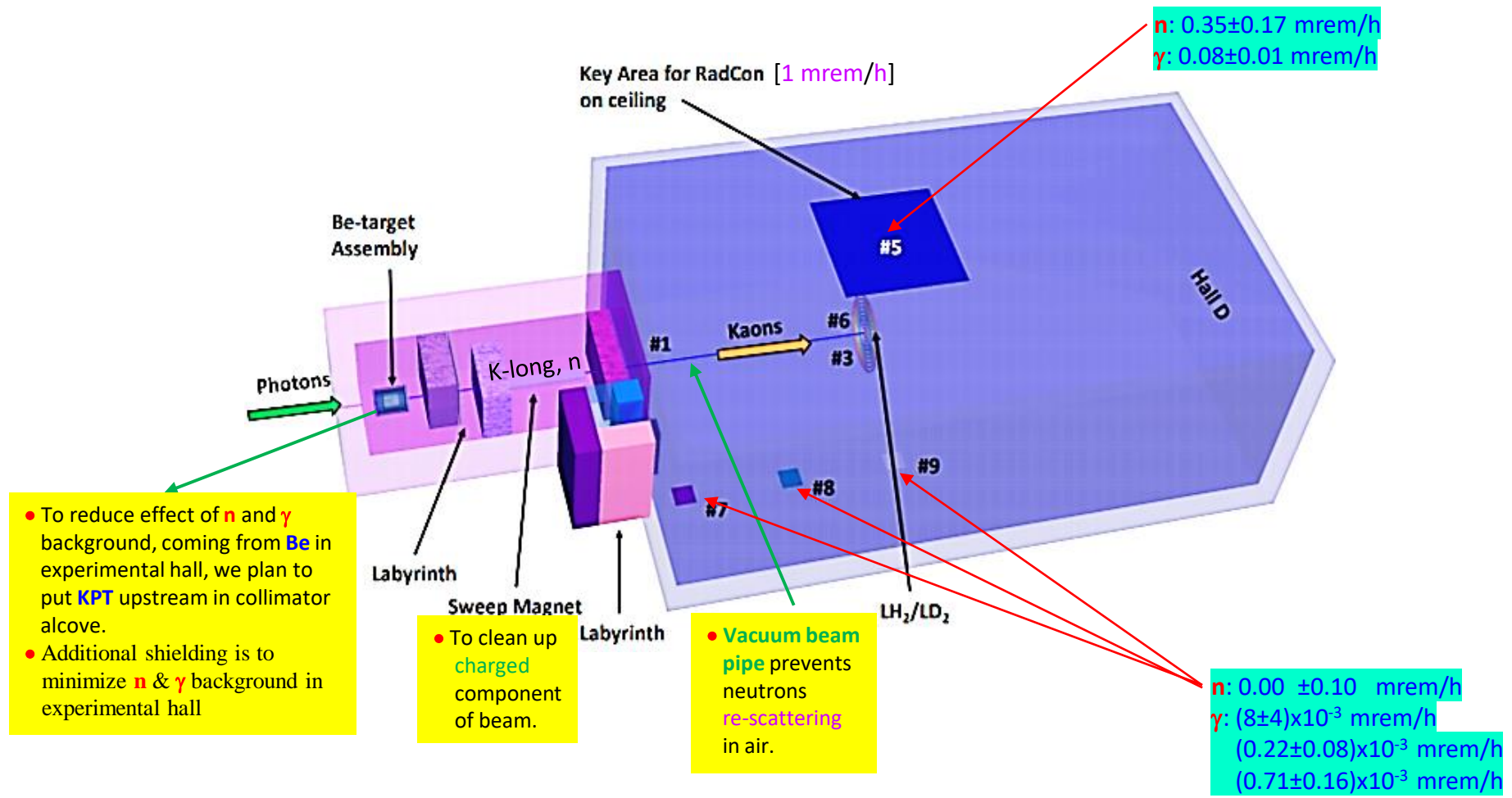
East ARC





Hall D Setting in 3D


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



- 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  complex.
 - Physical models, implemented in MCNP6 code, take into account bremsstrahlung photon production, photonuclear reactions, neutron & photon multiple scattering processes.
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- MCNP model simulates a 12 GeV 5 μ A electron beam hitting Cu-radiator inside CPS.
 - Electron transport is traced in Cu-radiator, vacuum beam pipe for bremsstrahlung photons, Be.
 - Neutrons & gammas will be traced in all components of MCNP model.
 - Media outside concrete walls of collimator alcove & bremsstrahlung photon beam pipe will be excluded from consideration to facilitate calculations. Additionally, we will ignore PS & KFM magnets but took into account 5 SEG-blocks around beam pipe in front of GlueX.
 - For MCNP calculations (in terms of flux [$\text{part}/\text{s}/\text{cm}^2$] or biological dose rate [mrem/h]), several tallies will be placed along beam & at Tagger alcove & experimental hall for neutron & gamma fluence estimation.

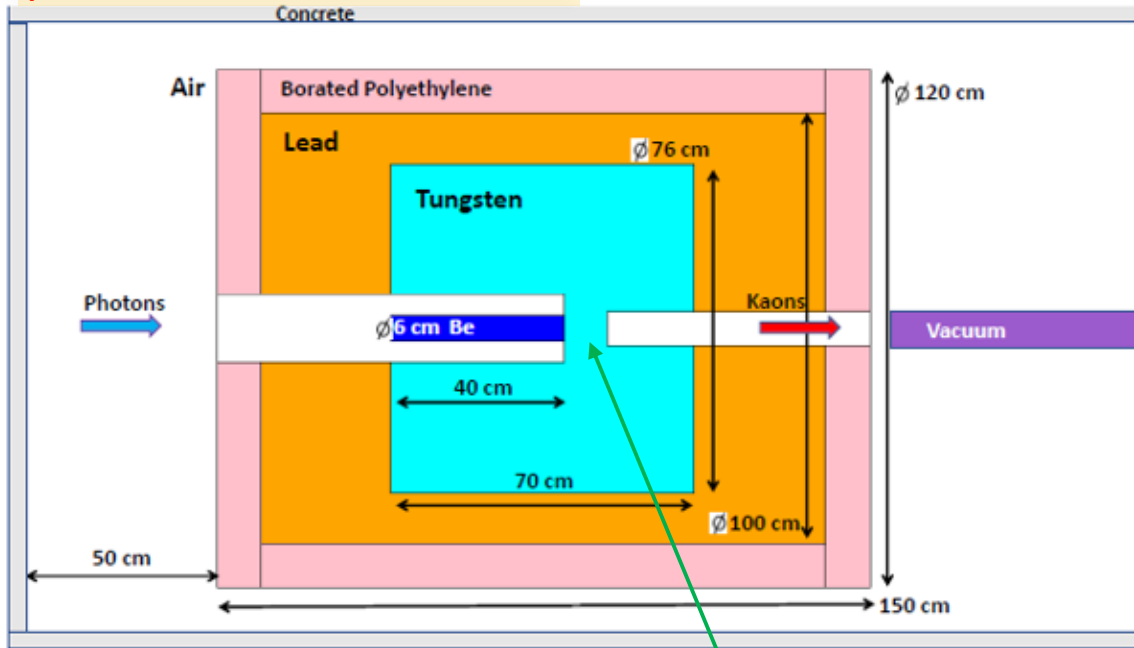




Be-Target Assembly

- 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

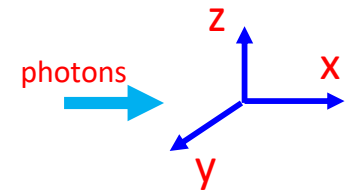
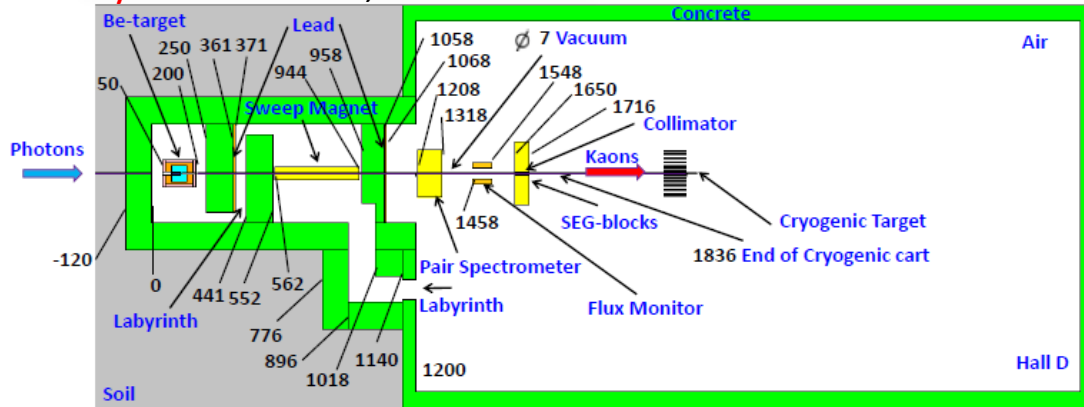
Concrete walls are out of scale



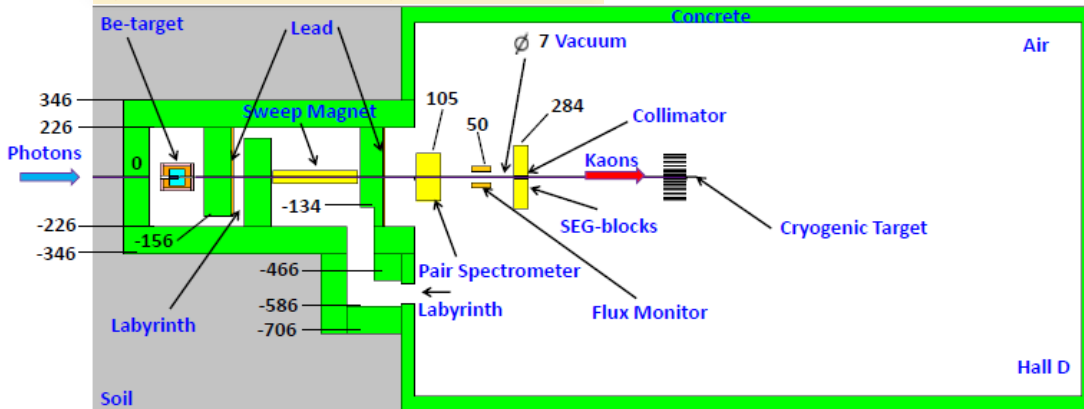


Collimator Alcove & Experimental Hall

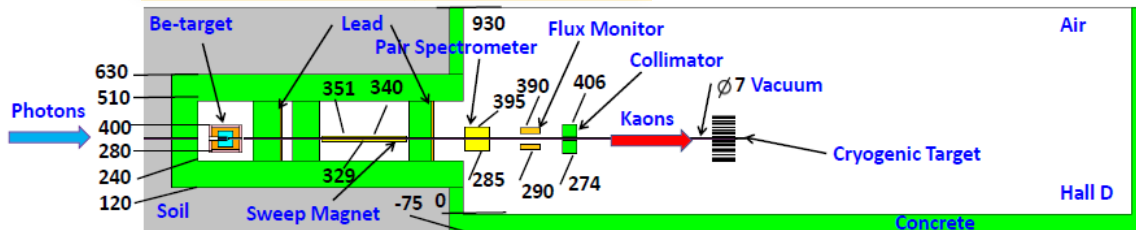
xy-cross section, x-dimension



xy-cross section, y-dimension



xZ-cross section, z-dimension



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





- 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 **LH₂/LD₂** 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 **LH₂/LD₂** target, & **BCAL** is also important to study.
- Engineering design is in order ?

