spectrum so that they (and the K_L) are by and large below threshold for the hadro-production of π^0's. The beam region will be evacuated to 10^{-7} Torr to further minimize such production. With a 10m beam channel and this low energy beam, the contribution of hyperons to the background will be negligible. The profile of the beam is ribbon-like to facilitate collimation of the large aperture and to provide an extra constraint for reconstruction of the decay vertex. All possible quantities are measured: in addition to the K_L momentum, the photon angles as well as energies and times. In this way, powerful kinematic rejection of background is made possible.
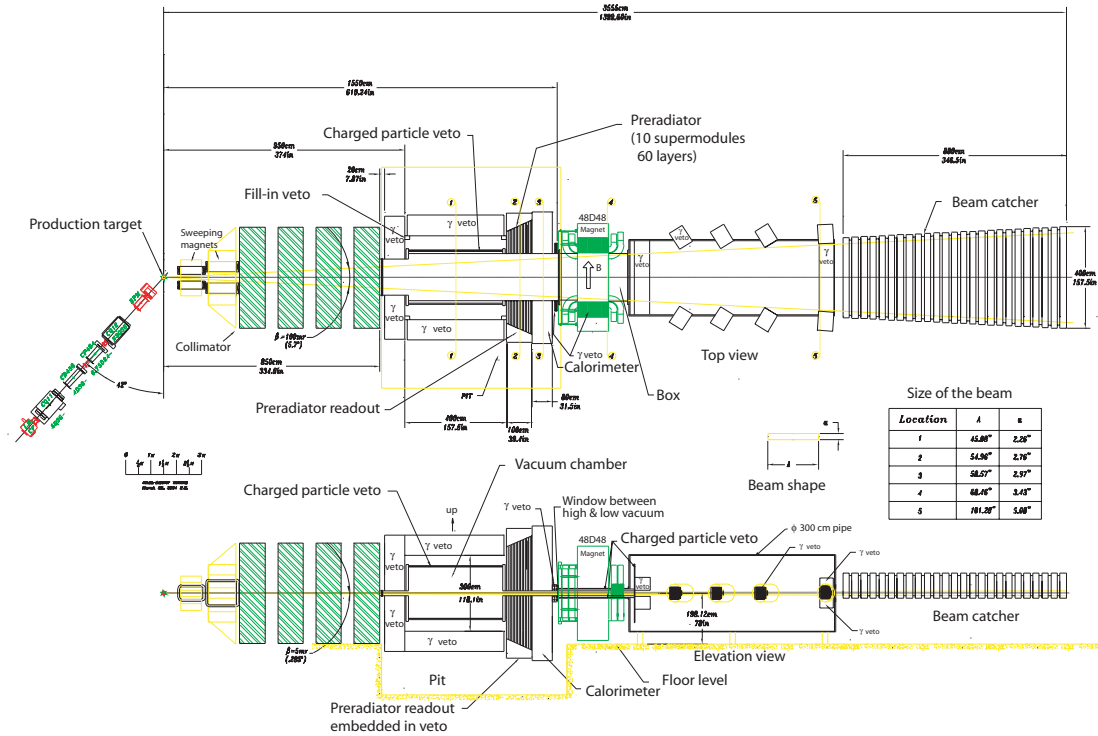

FIGURE 18. Layout of the KOPIO detector.

The layout of the experiment is shown in Fig. 18. K_L decays from a $\sim$ 3m fiducial region will be accepted. Signal photons impinge on a $2\ X_0$ thick preradiator capable of measuring their direction to $\sim$ 30mrad. An alternating drift chamber/scintillator plane structure will also allow good measurement of the energy deposited in the preradiator. A high-precision shashlyk calorimeter downstream of the preradiator will complete the energy measurement. The photon directional information will allow the decay vertex position to be determined. This can be required to lie within the beam envelope, eliminating many potentially dangerous sources of background. Combined with the target position and time of flight information, the vertex information provides a measurement of the K_L 3-momentum so that kinematic constraints as well as photon vetoing are available to suppress backgrounds. The leading expected background is $K_L \to \pi^0\pi^0$, which is initially some eight orders of magnitude larger than the predicted signal. However since π^0's from this background have a unique energy in the K_L center of mass, a very effective kinematic cut can be applied. This reduces the burden on the photon veto system surrounding the decay region to the point where the hermetic veto techniques proven