# *Requirement of the aperture of crab cavity*

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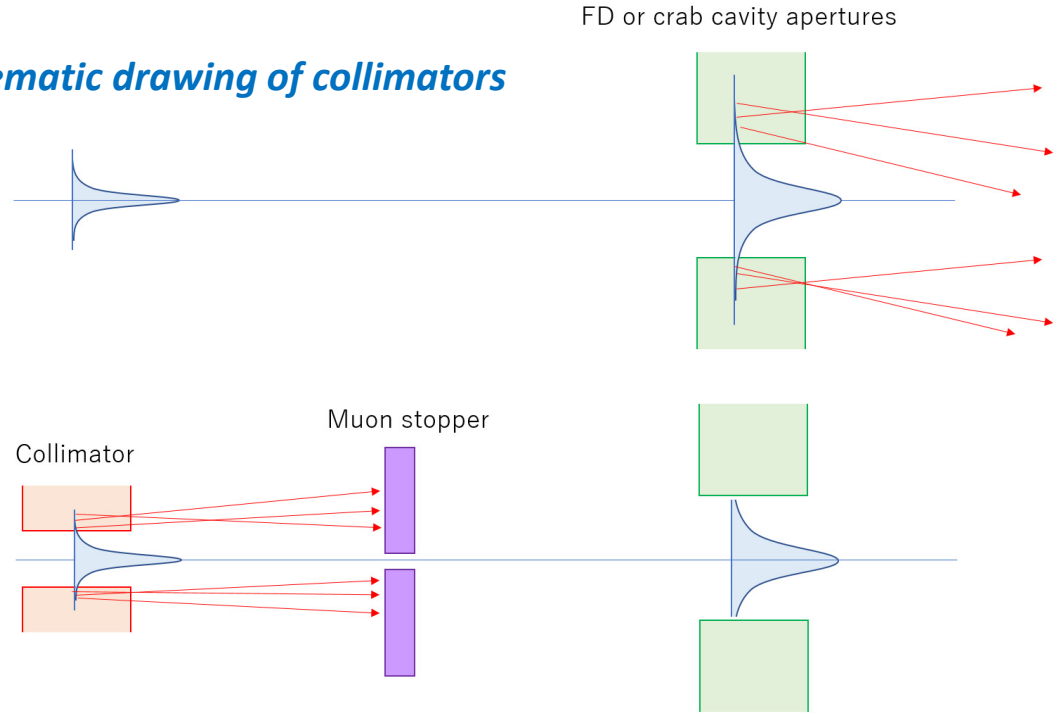
ILC crab cavity design review workshop

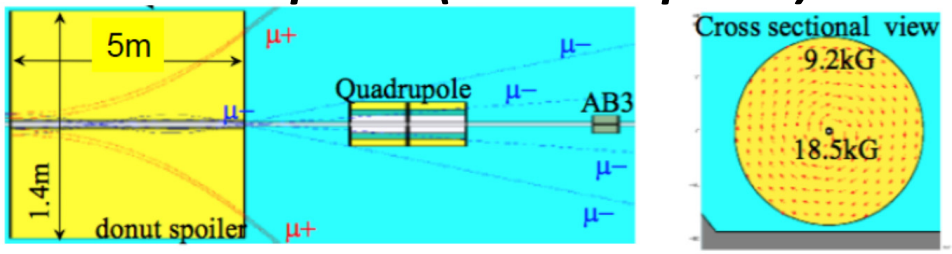
# Concepts of the ILC collimator system

## Schematic drawing of collimators

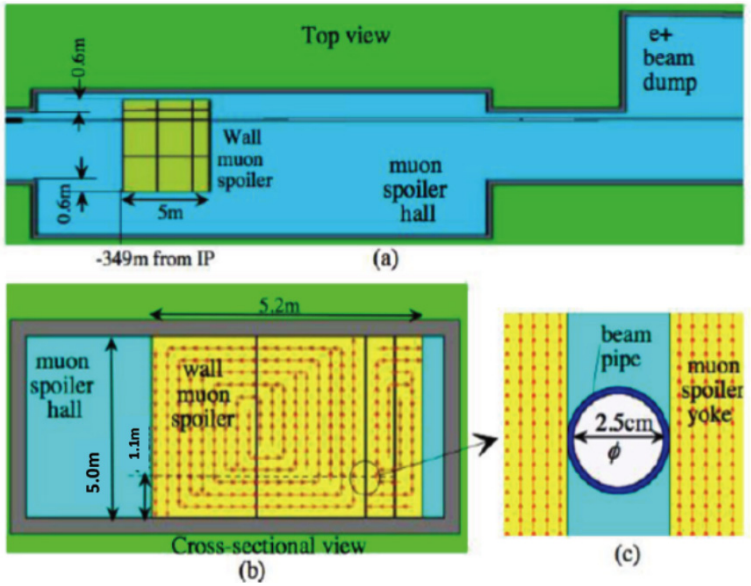



- *In ILC, a collimator is placed upstream to prevent the beam halo from hitting the final doublet or crab cavity.*
- *Since the beam halo hitting the collimator produces a large amounts of secondary particles (muons, etc.), it is necessary to install a large muon stopper to prevent the muons from reaching the detector.*

## Muon spoiler ( donuts spoiler)




## Muon wall

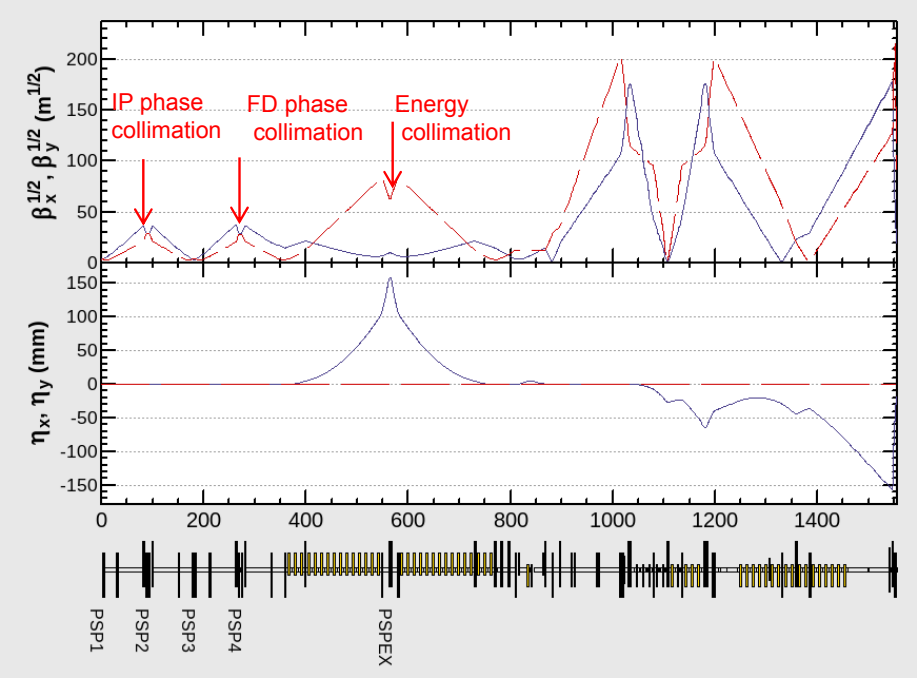


# Consideration of collimation depth

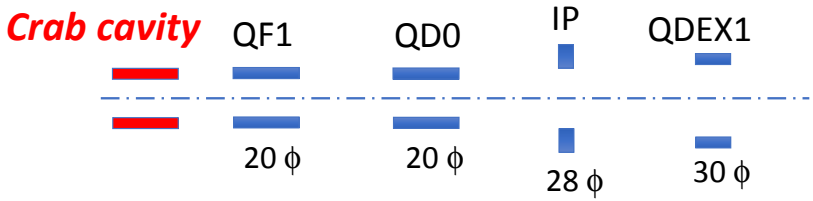
- *The aperture of ILC collimator is determined so that the halo particles and SR generated by the halo particles do not hit the SC device or inner detector.*
- *The collimation depth (aperture of the collimator relative to the beam size) should be larger because the more halo particles are cut at the collimators and much number of the muon background is generated for the smaller aperture of the collimator.*
- *The current design is limited by the aperture of the SC magnets before and after the detector, which is only 6σ of the beam size horizontally.*

## Arrangement of the Collimators

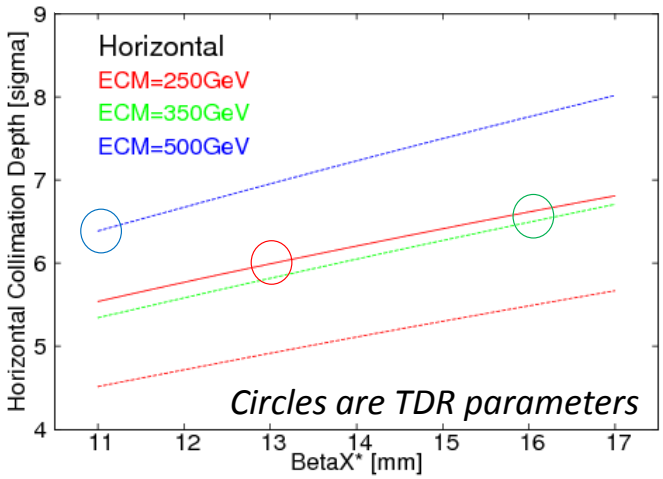
Beta Function at SP2/SP4 = (X; 1000m / Y; 1000m)
Phase Advance (SP2/SP4) = (X; 0.5 pi / Y; 1.5 pi )
Phase Advance (SP4/ IP ) = (X; 5.5 pi / Y; 4.5 pi )
EtaX at SPEX = 0.158m




## Collimation depth are determined by the following apertures




## Present ILC design collimation depth

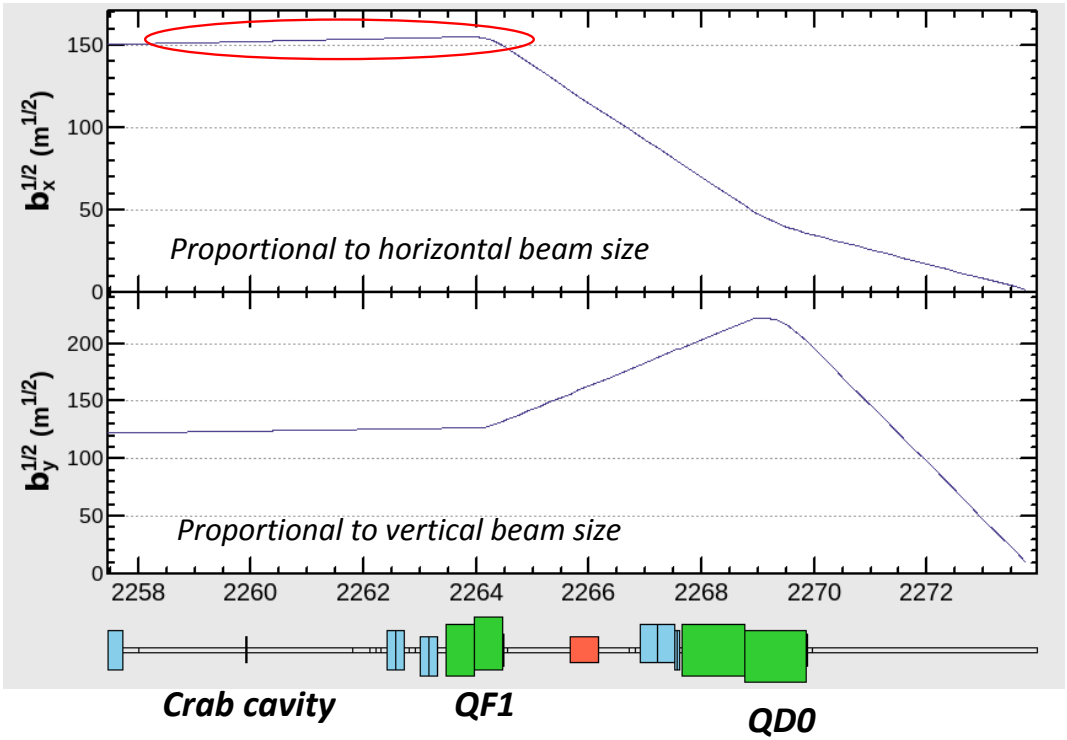


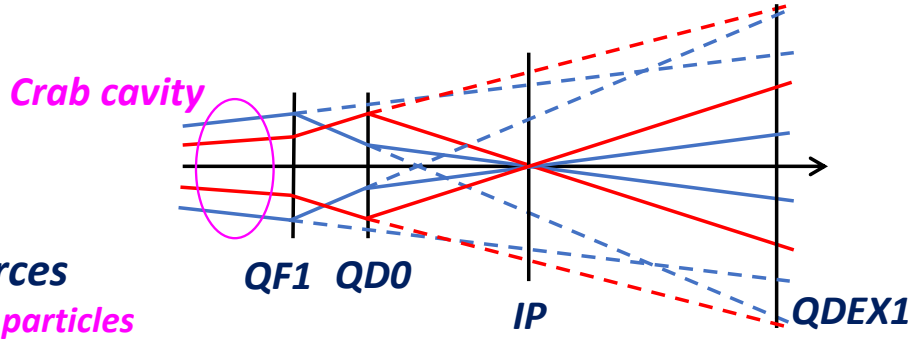
# BG sources around IP area

- *The collimation depth is limited by the aperture of QF1, QD0, and QDEX1.*
- *In QF1, it is limited in the horizontal direction by whether the beam halo hits the pipe or not, and the condition is the same for crab cavity.*
- *Since the beam size is the same in the crab cavity and QF1, if the aperture of the crab cavity is smaller than the 20 mm diameter of QF1, the aperture of the crab cavity limits the collimation depth.*

## Beta functions around IP

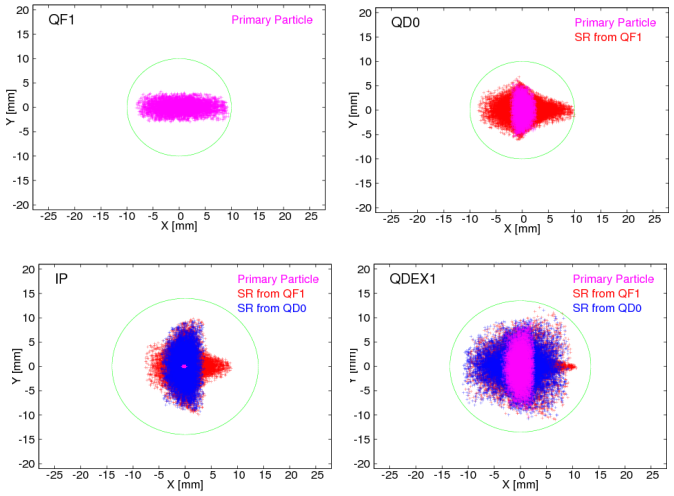
*Horizontal beam size at crab cavity is comparable to that at QF1.*




**BG sources**

1) *Halo particles*
2) *SR, generated by halo particles at QF1*
3) *SR, generated by halo particles at QD0*



# *Summary*

- *The collimation depth (aperture of the collimator relative to the beam size) should be large because the smaller the aperture of the collimator, the more halo particles are cut at the collimators and much number of the muon background is generated at the collimators.*

- *In the ILC present design, it is considered sufficient to install several donut spoilers in the beamline.*

- *However, if the amounts of muons increase more than now, we will need to install a larger muon wall, so the collimator diameter should be as large as possible.*

- *When the horizontal aperture of the crab cavity is smaller than 20mm diameter, the aperture of the crab cavity will limit the collimation depth (**14mm of the vertical aperture is acceptable for crab cavity**).*