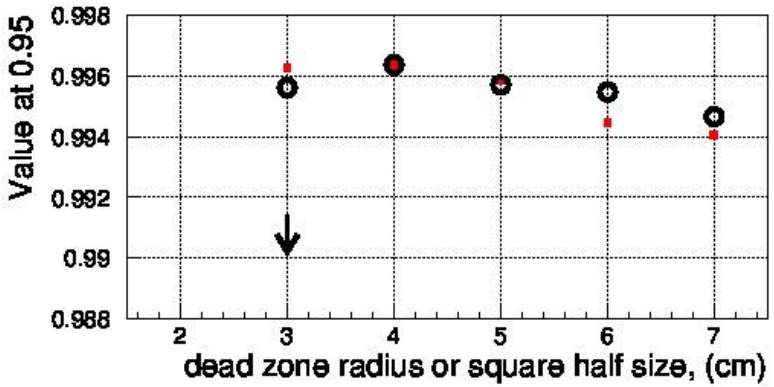
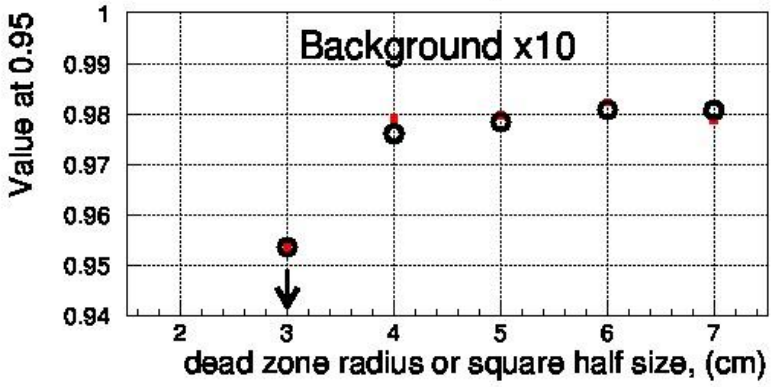
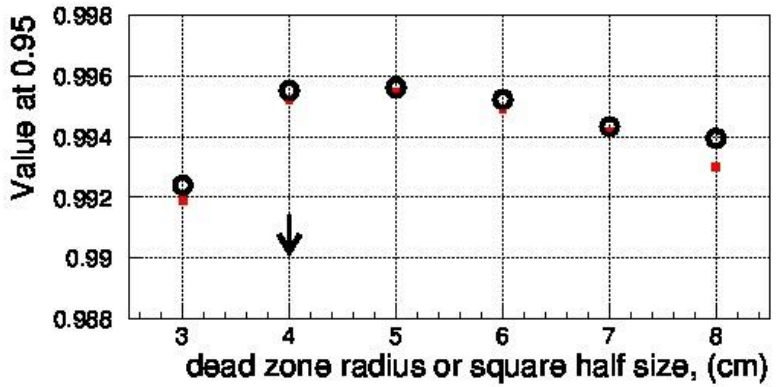
Muon/Pion separation with different absorber hole and dead zone geometry

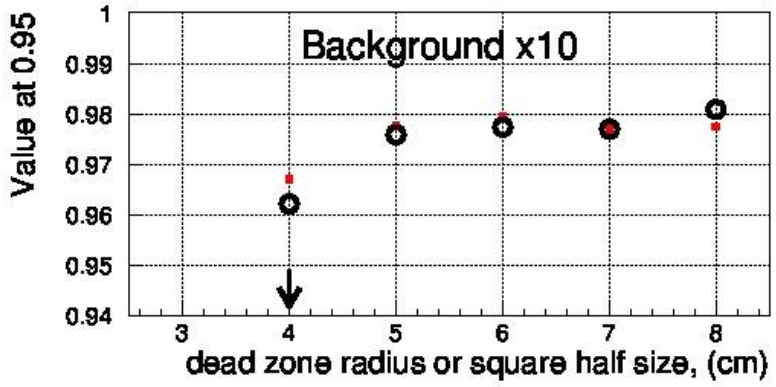
- Square and Round hole shapes have been tested
- Square dead zone for square iron hole shape and round dead zone for round iron hole shape have been taken
- Dead zone radius or half size have been selected in the range between -1cm to +3cm of the iron hole size
- Calculations are done for 8MWPCs with 20cm of iron in between
- Events with “TOF trigger” and Rcut 18cm have been selected
- Same kinematics for pions and muons
- 30% momentum reconstruction and 1% angle reconstruction precision required
- Increased by factor of 10 background added for comparison
- FOM values at 0.95 have been compared

Value at 95% vs dead zone size at certain iron hole size (shown by arrow)







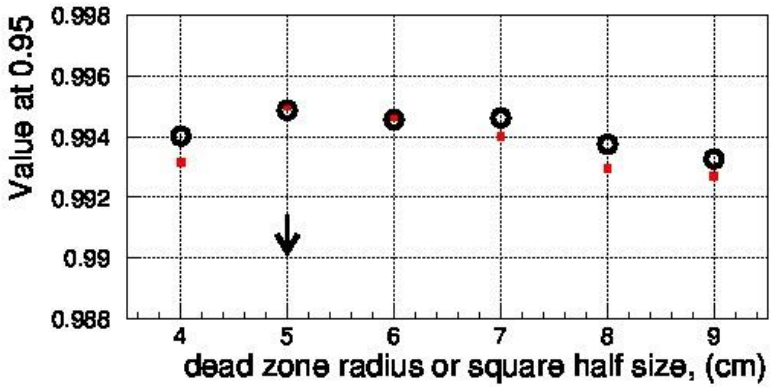


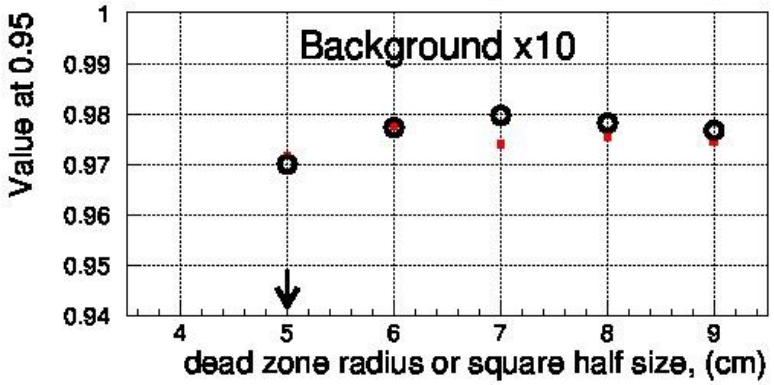
Round shape

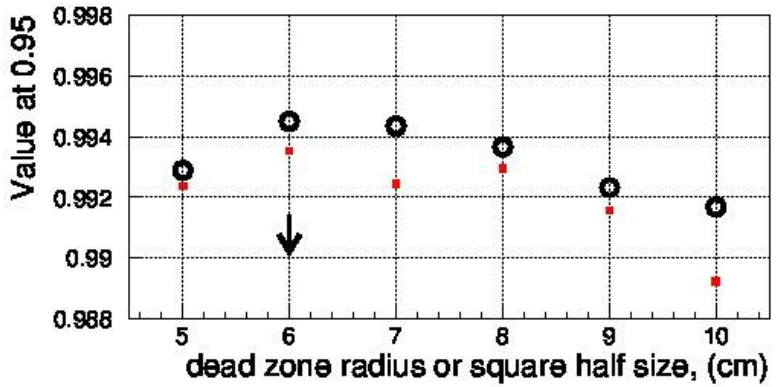
Square shape

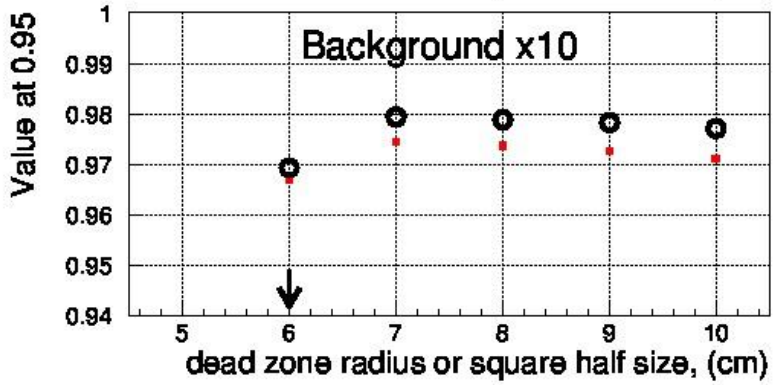
Invisible points are too low

Value at 95% vs dead zone size at certain iron hole size (shown by arrow)







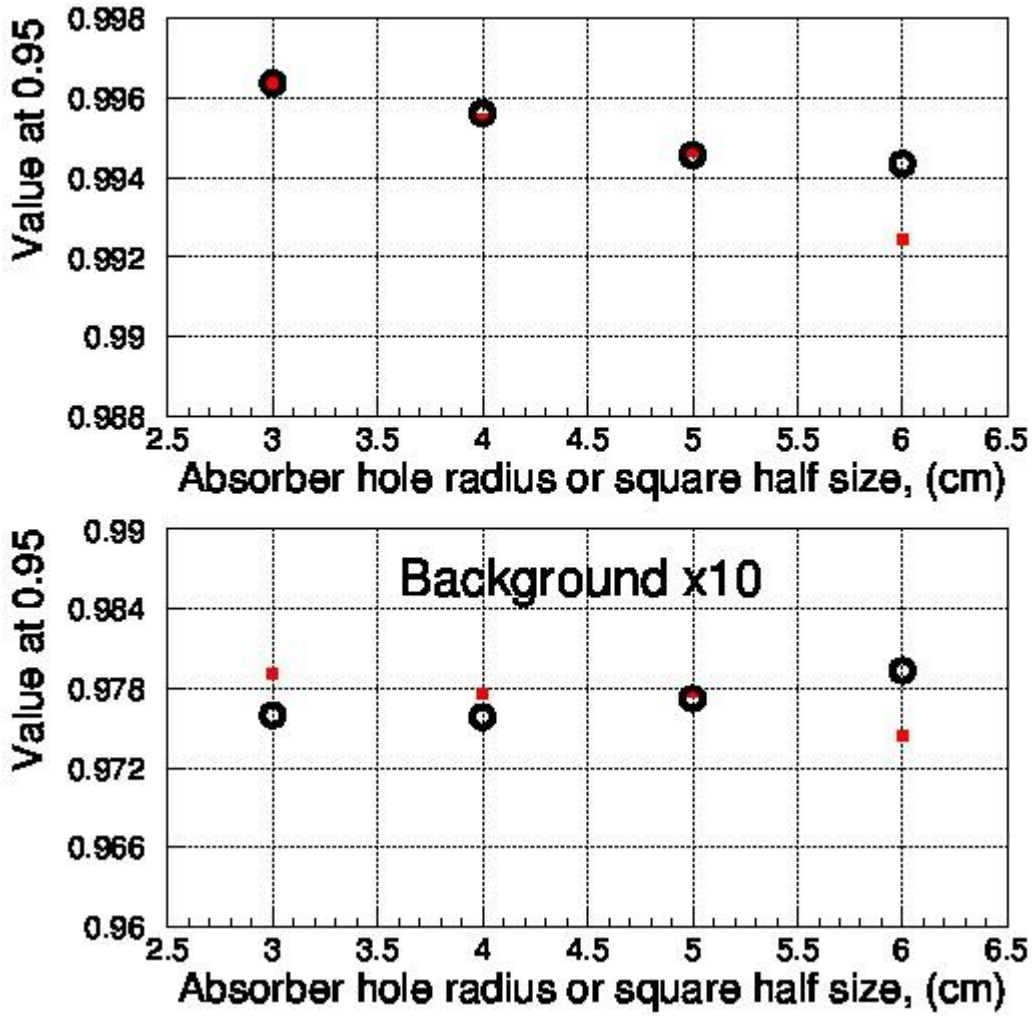


Round shape

Square shape

Invisible points are too low

Value at 95% vs absorber hole size, dead zone size exceeds hole by 1cm



- Round shape
- Square shape

Value at 95% for certain geometries

Background	Shape	Iron hole rad, [cm]	Dead Zone rad, [cm]	Value at 95%
Normal	Round	3	3	0.99561
Normal	Round	3	4	**0.99637**
Normal	Round	4	5	0.99562
Normal	Square	3	3	0.99628
Normal	Square	3	4	0.99637
Normal	Square	4	5	0.99548
Normal	Square	3	6	0.99446
x10	Round	3	3	0.95355
X10	Round	3	4	0.97597
X10	Round	4	5	0.97582
X10	Square	3	3	0.95342
X10	Square	3	4	0.97912
X10	Square	4	5	0.97761
x10	Square	3	6	**0.98228**

Short summary

- Dead zone sizes less than absorber size probably allows too much beam background. Too high dead zone size value reduces MWPC ability for certain angular range.
- Best values are obtained with dead zone size equals iron absorber hole size plus some offset. Offset value ~ 1cm for 3…4 cm hole radius and even smaller for larger hole. For increased x10 background offset values ~2cm
- Square and round shapes give very close values. At larger dead zone sizes, round shape gives better values
- Absorber serves as a filter for beam interaction background. These calculations have been done for 20cm thick iron. Thinner absorber layers (like 5cm) may give slightly different results. Will be double checked after iron thickness optimization.
- Best values obtained for Iron absorber hole R=3cm and dead zone R=4cm. Hole radius 4cm and dead zone R=5cm looks safer and gives close value.

Plans/work in progress

- Iron absorber thickness optimization: all combinations with 5 cm thickness step for 5, 6 and 7 absorbers, total thickness 140 cm, each downstream layer can not be thinner than upstream one. Total 719 combinations (jobs submitted 6 days ago, still in queue on farm)
- Attempt to limit all variables used in MVA (number of hits in TOF, FCAL, MWPC) to only geometrically matched with reconstructed tracks within certain radius. This could reduce background and improve separation quality