Evaluating the best target thickness
for the new ^{13}C target in the boost side (target position 4)

A simulation to evaluate the best ^{13}C target thickness and the possible need of a Mylar degrader has been performed.

The MC geometry of the experiment has been modified to place the ^{13}C target in the correct position (4), different target thicknesses and different Mylar degraders have been considered and simulated. In particular these conditions were take into account: 6, 7, 8, 9 and 10 mm target thickness, 100, 200 and 300 µm of Mylar degrader added to the 10 mm target configuration.

To evaluate the best thickness, the number of K$^-$ stopped in target has been counted.

Clearly an increase of the thickness caused a decrease of the K$^-$ stopped after the target (that is, K$^-$s that crossed the target and stopped inside the target external frame or inside OSIM) and an increase of the K$^-$ stopped before the target (that is, K$^-$s that stopped mainly inside the target internal frame or inside ISIM). The trigger has been simulated requiring back-to-back signals in the TOFINO slabs.

The decay vertex in the (x,y) plane for three different conditions (6 mm, 8 mm and 10 mm target thickness) are shown in Fig.1-3.

The behaviour of the number of K$^-$ stopped in target as a function of the target thickness is shown in Fig. 4 (the last 3 points correspond to a 10 mm target with a degrader of 100, 200 and 300 µm of Mylar respectively).
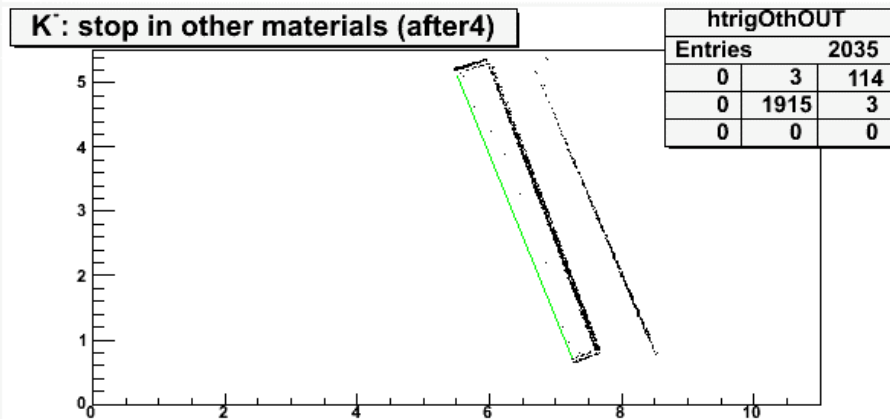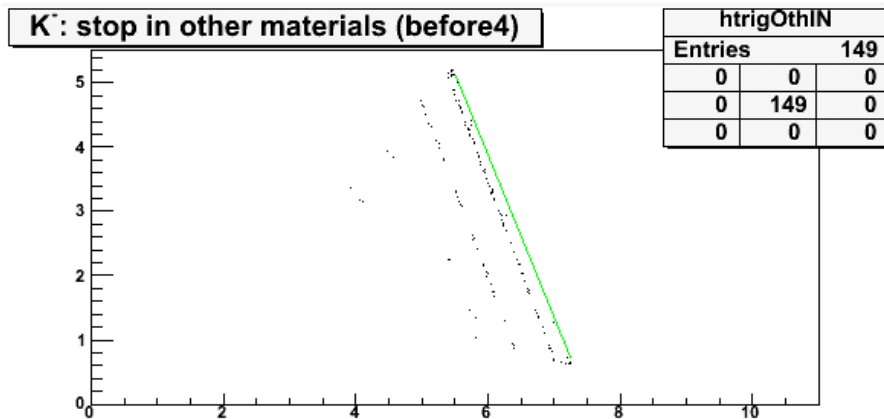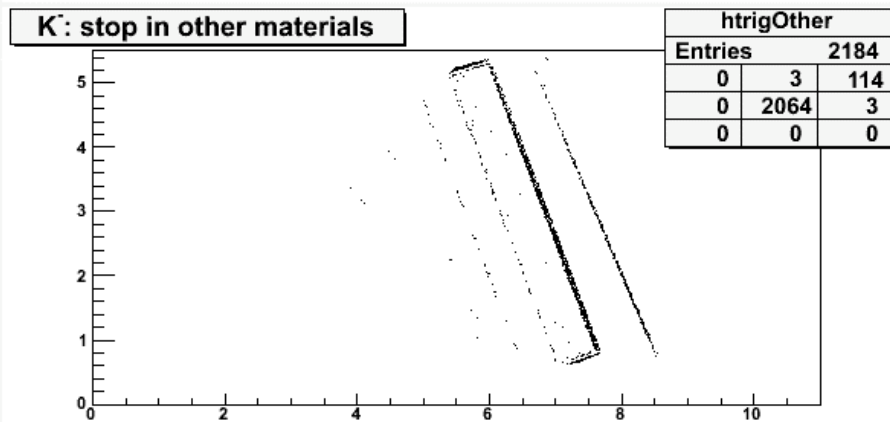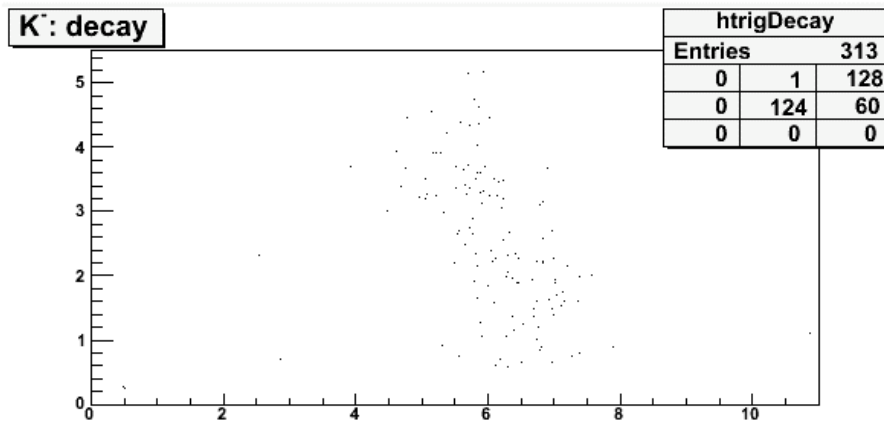
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K-: all

htrigAll		
Entries		4853
0	4	242
0	4544	63
0	0	0

K-: stop in target

htrigTarg		
Entries		2356
0	0	0
0	2356	0
0	0	0

K-: decay

htrigDecay		
Entries		313
0	1	128
0	124	60
0	0	0

K-: stop in other materials

htrigOther		
Entries		2184
0	3	114
0	2064	3
0	0	0

K-: stop in other materials (before4)

htrigOthIN		
Entries		149
0	0	0
0	149	0
0	0	0

K-: stop in other materials (after4)

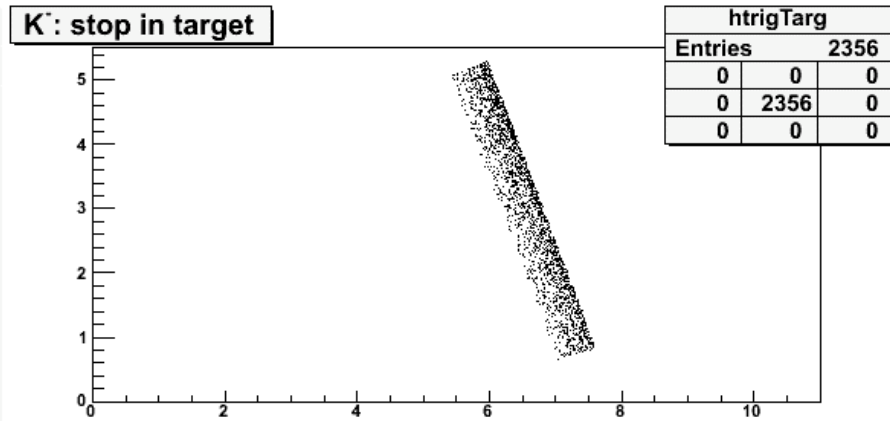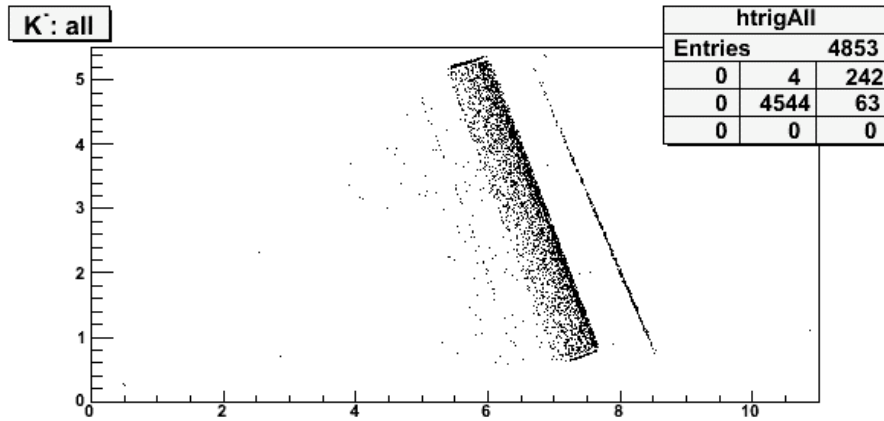| htrigOthOUT		
Entries		2035
0	3	114
0	1915	3
0	0	0

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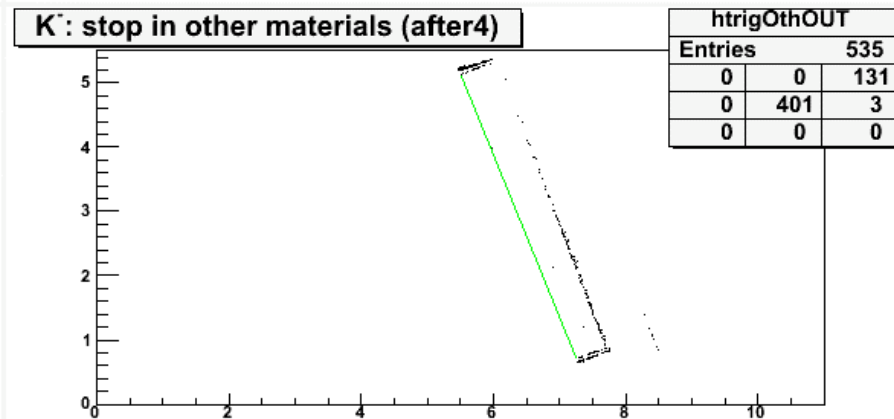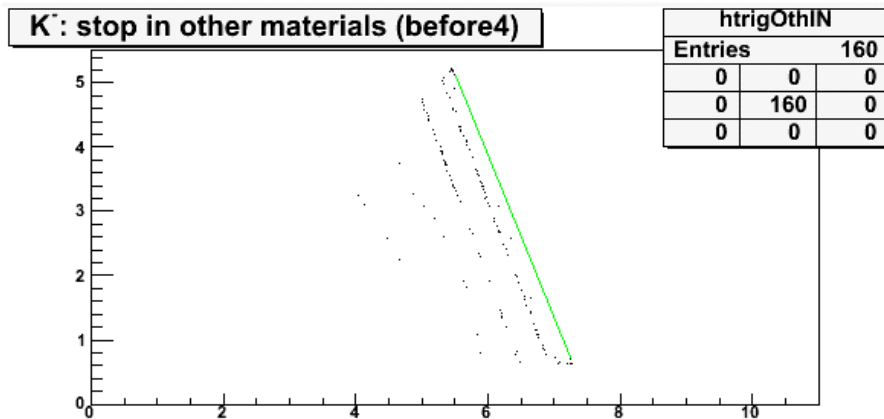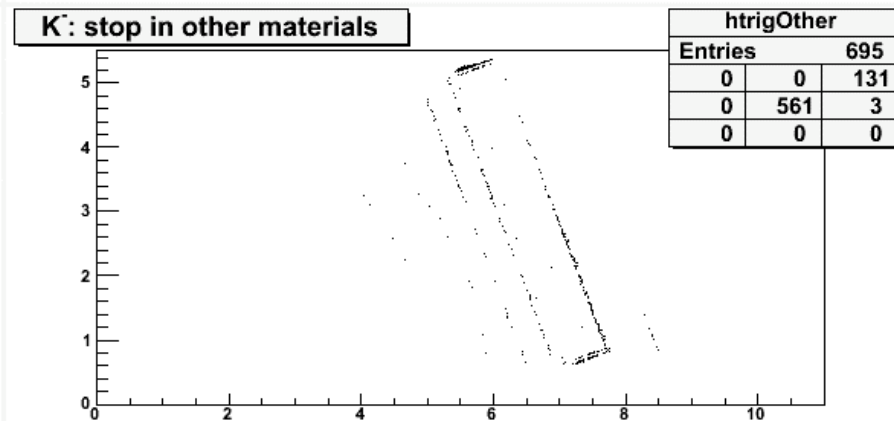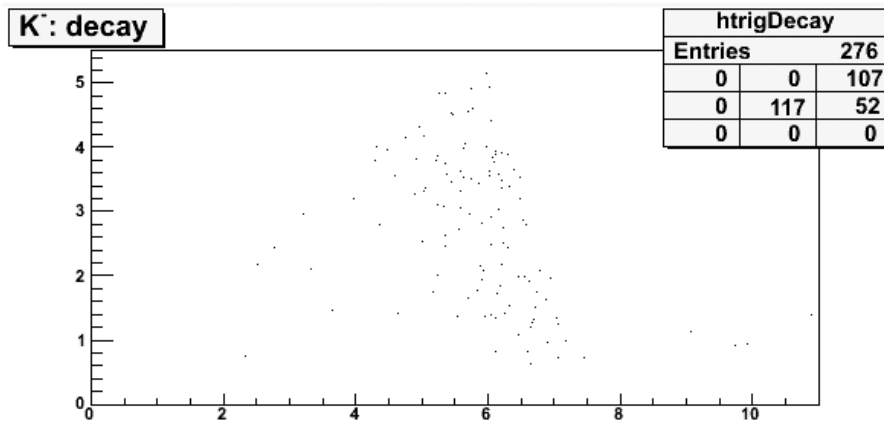**Fig. 1: K- stop vertex (x,y) with a 6 mm thick target**

K⁻: all

htrigAll		
Entries		4778
0	0	238
0	4485	55
0	0	0

K⁻: stop in target

htrigTarg		
Entries		3807
0	0	0
0	3807	0
0	0	0

K⁻: decay

htrigDecay		
Entries		276
0	0	107
0	117	52
0	0	0

K⁻: stop in other materials

htrigOther		
Entries		695
0	0	131
0	561	3
0	0	0

K⁻: stop in other materials (before4)

htrigOthIN		
Entries		160
0	0	0
0	160	0
0	0	0

K⁻: stop in other materials (after4)

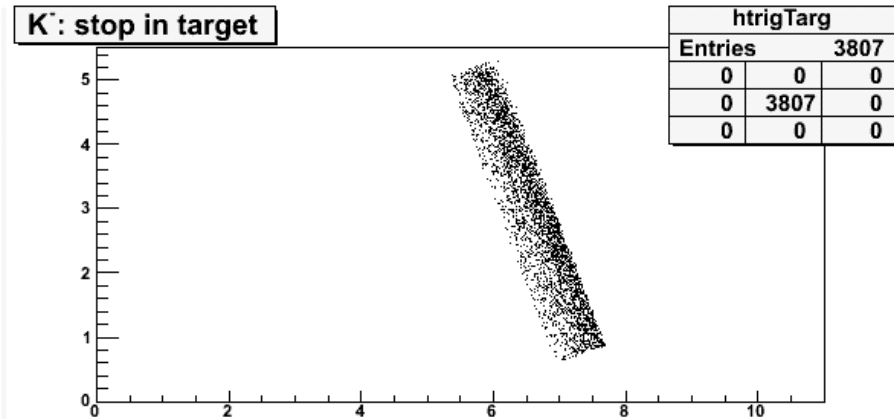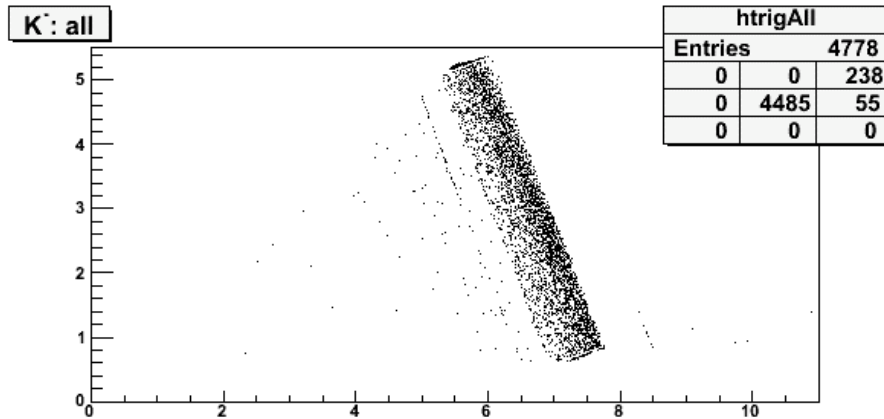| htrigOthOUT		
Entries		535
0	0	131
0	401	3
0	0	0

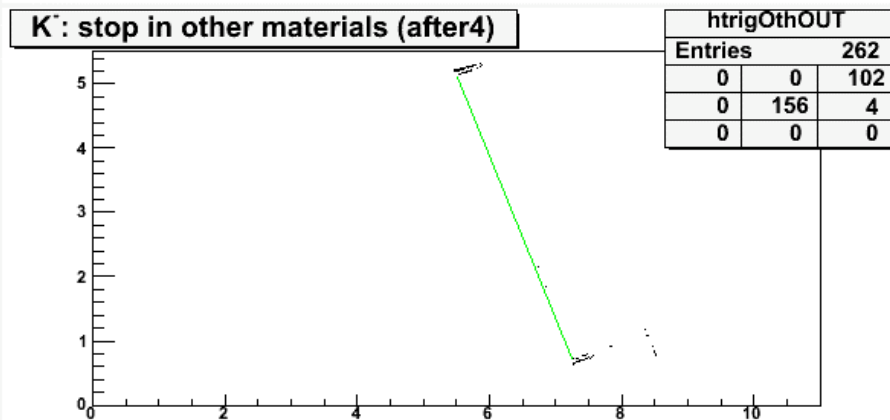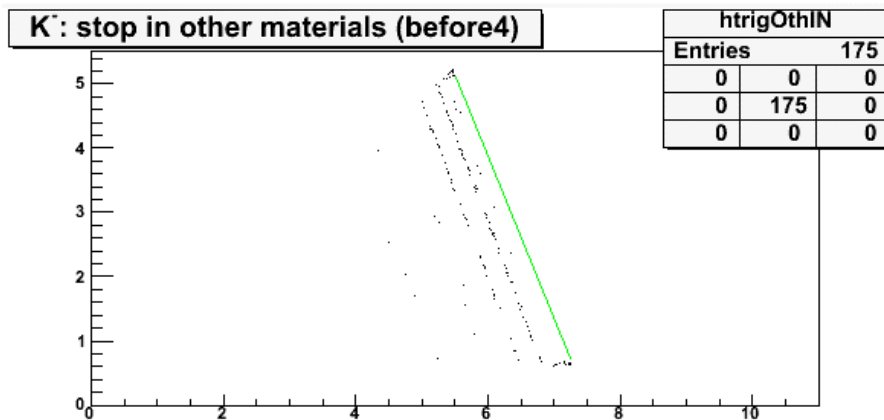**gBonomi, aZenoni**   **Fig. 2: K- stop vertex (x,y) with a 8 mm thick target**

K⁻: all

htrigAll		
Entries		4910
0	0	206
0	4643	61
0	0	0

K⁻: stop in target

htrigTarg		
Entries		4185
0	0	0
0	4185	0
0	0	0

K⁻: decay

htrigDecay		
Entries		288
0	0	104
0	127	57
0	0	0

K⁻: stop in other materials

htrigOther		
Entries		437
0	0	102
0	331	4
0	0	0

K⁻: stop in other materials (before4)

htrigOthIN		
Entries		175
0	0	0
0	175	0
0	0	0

K⁻: stop in other materials (after4)

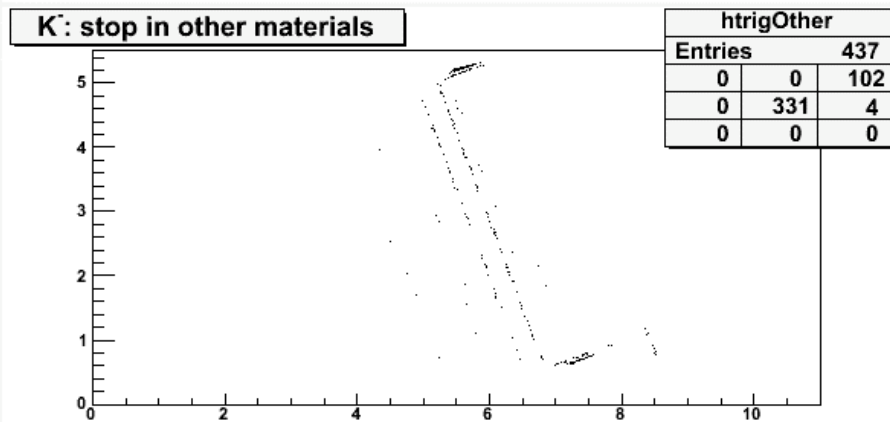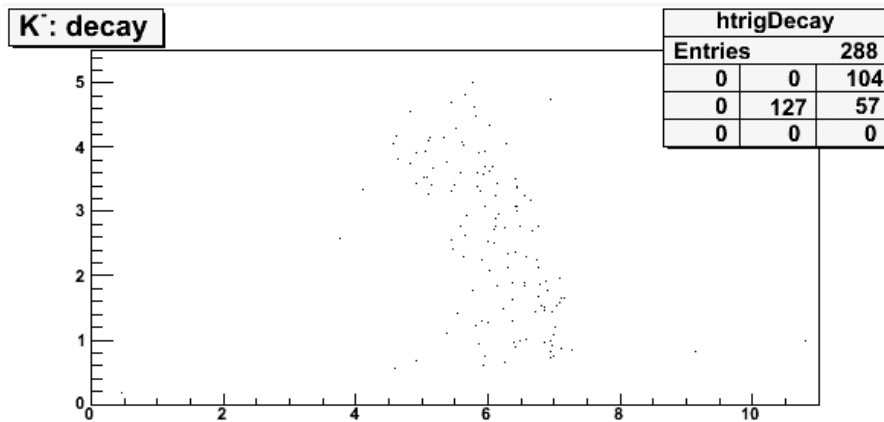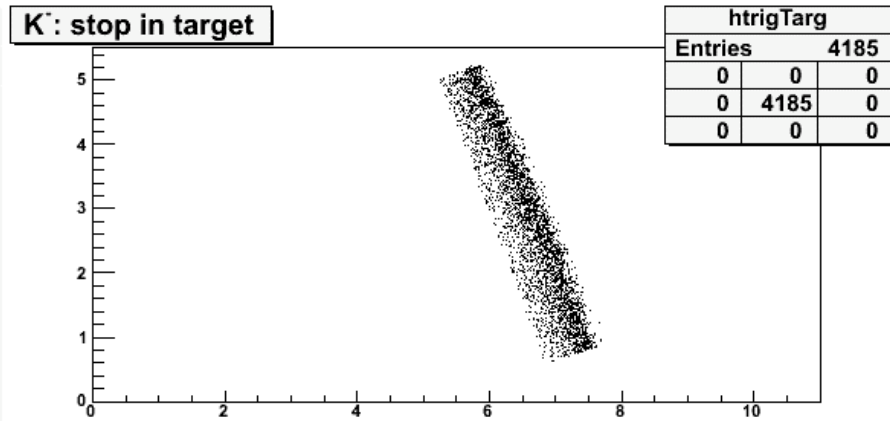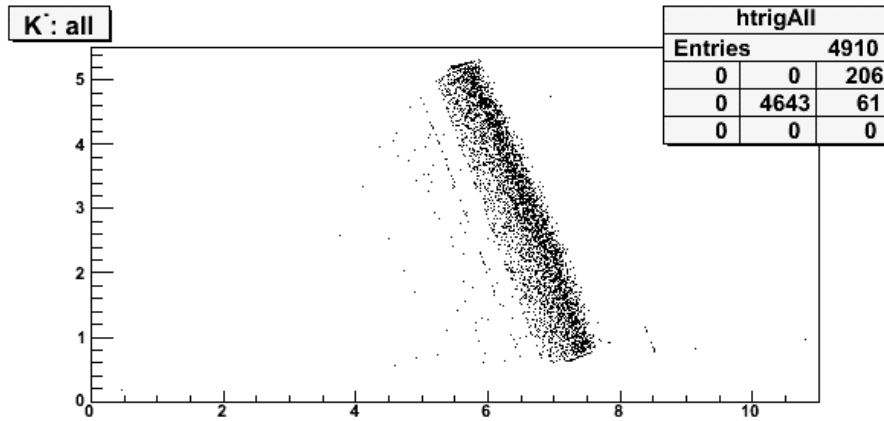| htrigOthOUT		
Entries		262
0	0	102
0	156	4
0	0	0

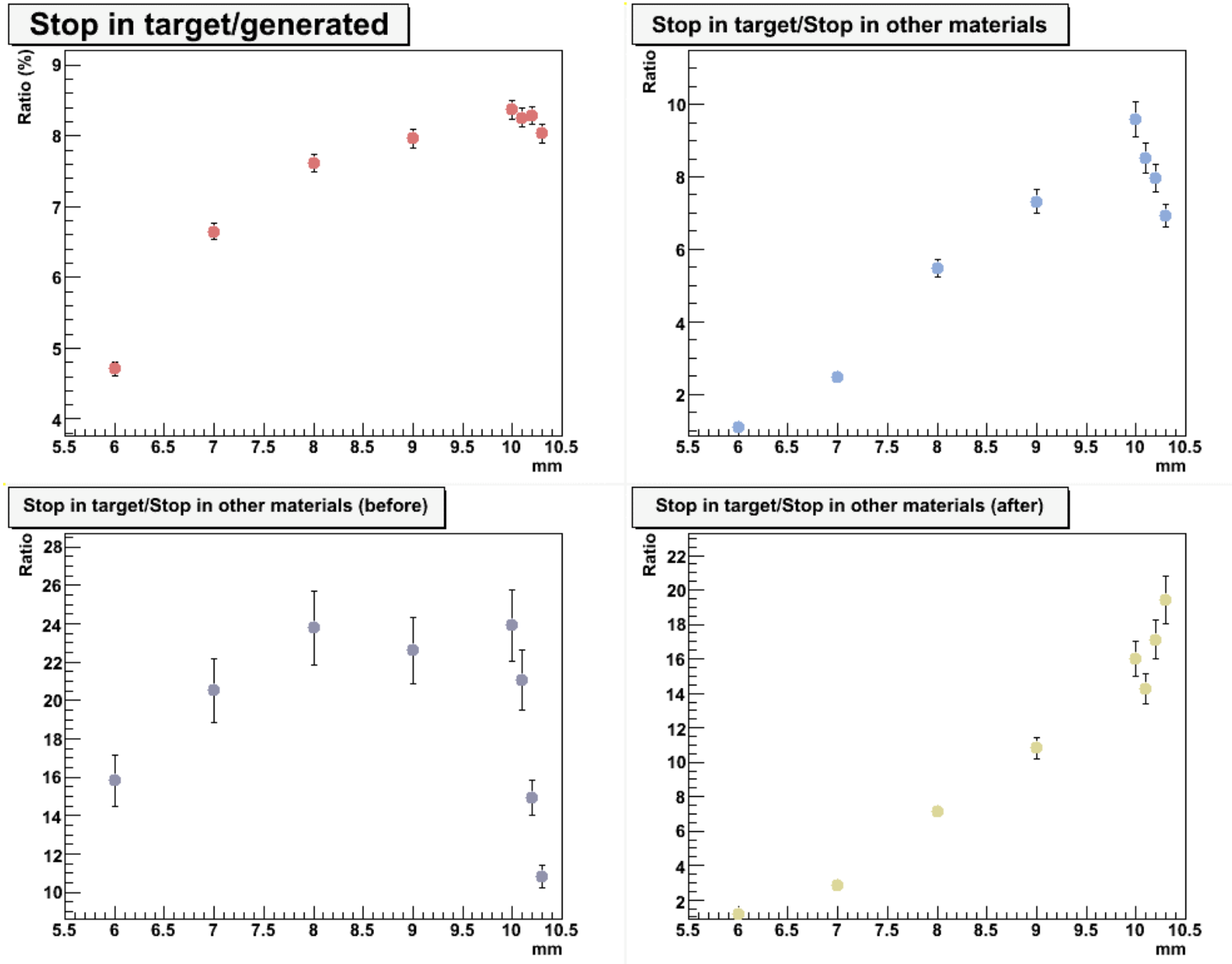**gBonomi, aZenoni** **Fig. 3: K- stop vertex (x,y) with a 10 mm thick target**

Fig. 4: K- stop in target as a function of the target/degrader thickness
(the last 3 points correspond to a 10 mm target with a degrader of 100, 200 and 300 μm of Mylar respectively).

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Conclusions

According to our Montacarlo a 10 mm thick ^{13}C target maximizes the number of K$^-$ stopped inside the target positioned in the boost side (position 4). A further degrader doesn't seem to be needed.

This result would be more sound if our Montecarlo would have been validated with a comparison with real data. Nevertheless it proved to be quite reliable given the results of the previous data taking.