

# $B \rightarrow K^* \mu\mu$ update

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# Propagation from $S_x$ to $P_x$

- ▶ Using MoM we have a direct access to  $S_x$ .
- ▶ Some theorist (we all know who ;) ) like to have instead  $P_x$ .
- ▶ We need to provide them the  $P_x$  or they will do crazy crazy things with the errors.
- ▶ Reminder:

$$P_1 = 2/(1 - F_l), \quad (1)$$

$$P_2 = \frac{2A_{fb}}{3}/(1 - F_l) \quad (2)$$

$$P_3 = \frac{-S_9}{3}/(1 - F_l) \quad (3)$$

$$P_{4568} = \frac{S_{4578}}{3}/\sqrt{F_l(1 - F_l)} \quad (4)$$



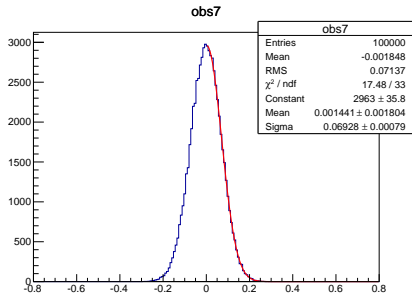
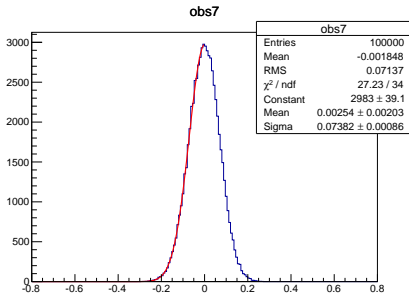
Since we have the full information about the  $S_x$  with errors(assymmetric) and correlations we can make a TOY MC and see how the  $P_x$  behaves. To make a toy we need to simulate a correlated multidimensional Gaussian. I didn't know before hand how to do it so here is the recipe if some one will need it for the future:

- ▶ Simulate multidimensional gauss with with 1 and centred at 0.
- ▶ Correlate the dimensions using Cholesky matrix decomposition.
- ▶ Scale the left and the right tail to the right  $\sigma_{L,R}$ .
- ▶ Now after this scalling you will have a bump at 0 since you have 50:50 events on left and on the right, which is correct only for  $\sigma_L = \sigma_R$ . Reject the  $\frac{\sigma_{SMALLER}}{\sigma_{LARGER}}$  events from smaller  $\sigma$ .
- ▶ Move the mean of each Gauss to the value of  $S_x$  and voila



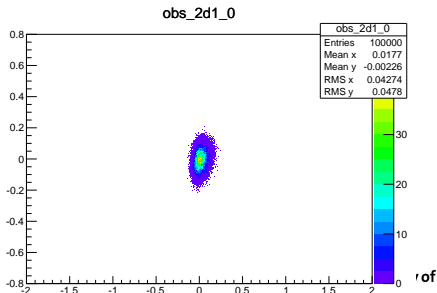
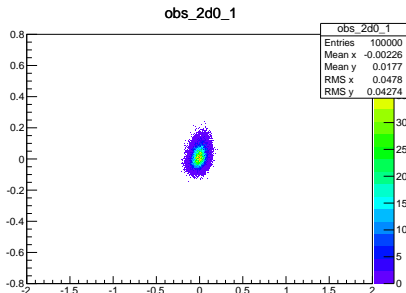
# MC propagation, X-checks 1/2

- ▶ Since this procedure is not from books I wanted to be extra careful and performed super tests.
- ▶ Check that the correlation between  $S_i$  and  $S_j$  in my toys are the same as the one I put in. with 100.000 events the differences that I observed are  $\mathcal{O}(0.001)$  so oki doki.
- ▶ Check that the  $\sigma_{L,R}$  are the correctly simulate. Fitted left and right separately and compare the results. Oki doki.



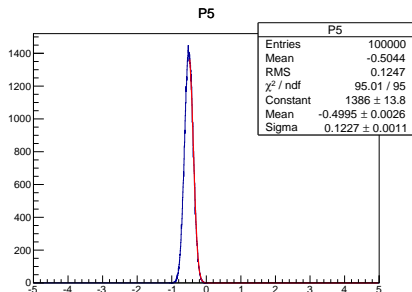
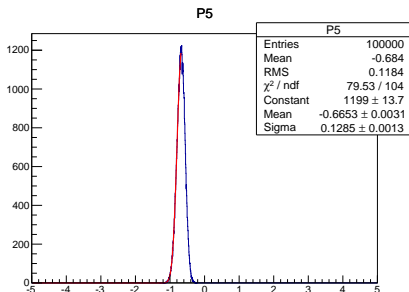
# MC propagation, X-checks 2/2

- ▶ Since this procedure is not from books I wanted to be extra careful and performed super tests.
- ▶ Check that the correlation between  $S_i$  and  $S_j$  in my toys are the same as the one I put in. with 100.000 events the differences that I observed are  $\mathcal{O}(0.001)$  so oki doki.
- ▶ Check that the  $\sigma_{L,R}$  are the correctly simulate. Fitted left and right separately and compare the results. Oki doki.



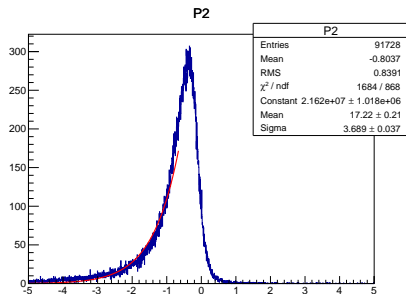
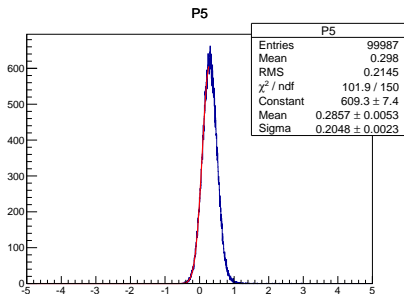
# Now how the $P_x$ look like?

- ▶ Now we can make a  $P_x$  histogram and fit it.



# Huston, we have a problem.

- ▶ The biggest  $F_I$  is observed in 1.1 – 2.5  $\text{GeV}^2$ .
- ▶ This is clearly unphysical! We need a smarter way to determine the  $P_x$  in this bin.
- ▶ Will try bootstrapping.



# $F_S$ pulls, numbers I promised

Bin [ $\text{GeV}^2$ ]	mean	sigma
0.1 – 0.98	$0.038 \pm 0.029$	$0.918 \pm 0.021$
1.1 – 2	$-0.024 \pm 0.031$	$0.998 \pm 0.022$
2 – 3	$-0.025 \pm 0.029$	$0.942 \pm 0.021$
3 – 4	$-0.069 \pm 0.030$	$0.971 \pm 0.022$
4 – 5	$0.062 \pm 0.030$	$0.955 \pm 0.021$
5 – 6	$0.081 \pm 0.032$	$0.992 \pm 0.022$
6 – 7	$-0.031 \pm 0.031$	$0.992 \pm 0.022$
7 – 8	$-0.054 \pm 0.030$	$0.962 \pm 0.021$
11 – 11.75	$0.002 \pm 0.030$	$0.947 \pm 0.021$
11.75 – 12.5	$-0.027 \pm 0.031$	$0.979 \pm 0.022$
15 – 16	$0.011 \pm 0.029$	$0.933 \pm 0.021$
16 – 17	$0.02 \pm 0.029$	$0.929 \pm 0.020$
17 – 18	$-0.054 \pm 0.030$	$0.962 \pm 0.021$
18 – 19	$-0.075 \pm 0.030$	$0.964 \pm 0.021$





- ▶ We are overestimating the error, but we can leave with this.
- ▶ Mean unbiased.



# Correlations between $S_x$ and $A_x$ , MC Toys

- ▶ Toys with acceptance, background (the ones we all like).
- ▶ Plots in backups.

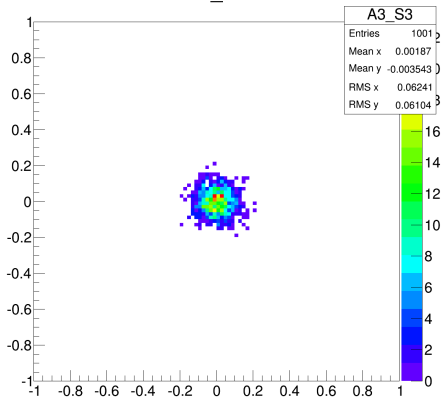
$q^2$	$S_3 A_3$	$S_4 A_4$	$S_5 A_5$	$S_6 A_6$	$S_7 A_7$	$S_8 A_8$	$S_9 A_9$
0	0.049	-0.066	-0.001	0.011	-0.034	0.015	0.022
1	0.029	-0.047	-0.003	0.011	-0.003	0.017	0.052
2	0.004	-0.046	0.026	-0.022	-0.010	-0.036	-0.032
3	0.079	0.032	0.035	-0.028	-0.025	0.037	0.027
4	-0.020	0.074	-0.001	0.008	-0.063	-0.015	0.037
5	-0.019	-0.018	-0.041	0.001	0.025	0.015	-0.014
6	0.000	-0.008	-0.021	0.049	-0.014	-0.04	-0.002
7	0.000	-0.008	-0.021	0.049	-0.014	-0.04	-0.002
8	-0.011	-0.009	-0.013	-0.023	0.047	0.006	-0.004
9	-0.009	-0.015	-0.008	-0.009	-0.010	-0.050	-0.029
10	0.030	0.023	0.084	-0.049	0.030	0.002	0.021
11	-0.016	0.006	0.018	-0.029	0.034	-0.049	0.039

# Things to do for me

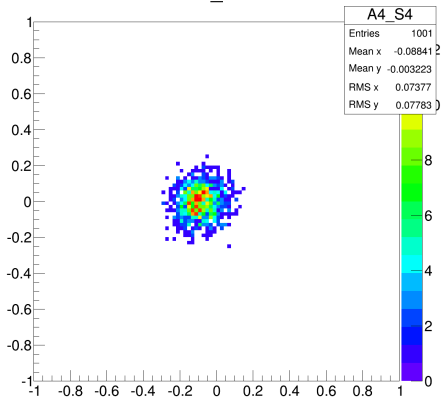
- ▶ Finish systematics (already started).
- ▶ Study combination of  $F_s$  from  $m_{K\pi}$  fit and BW phase shift.
- ▶ There was a discussion with Tom about the errors that we quote: aka do we use Bootstrapping or just weighted error? Need a decision today.

# BACKU

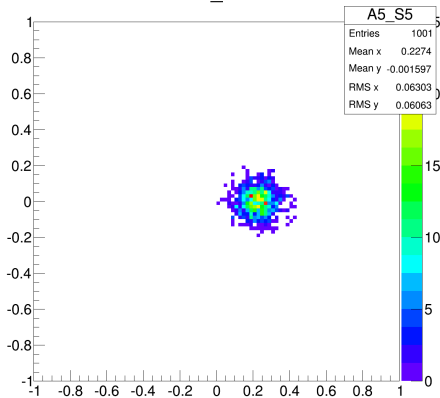
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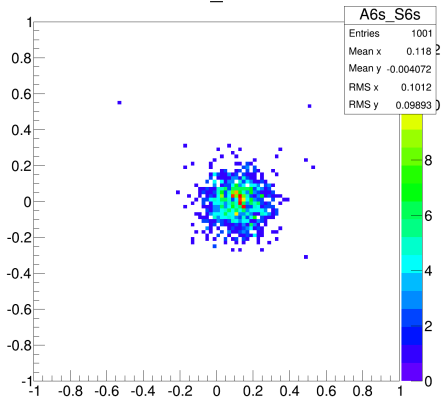
A4\_S4



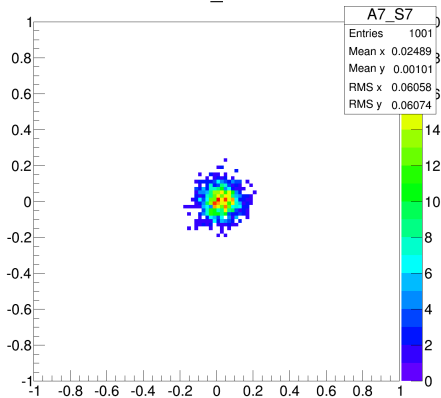
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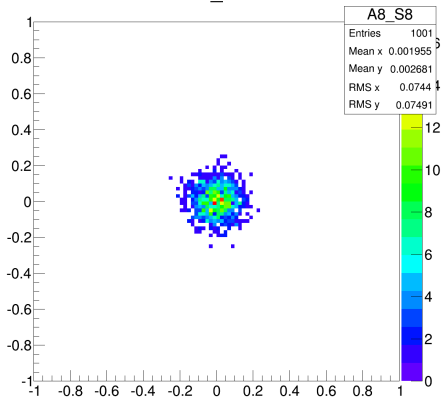
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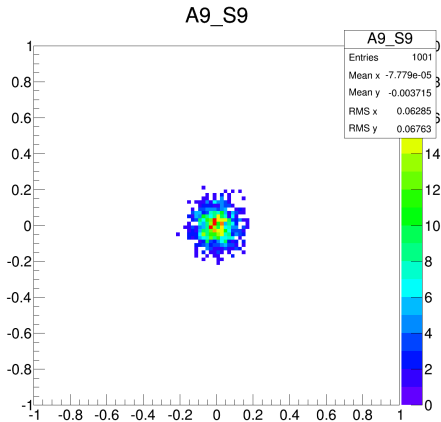


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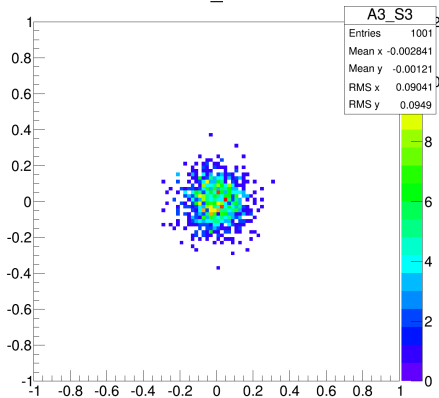
A8\_S8



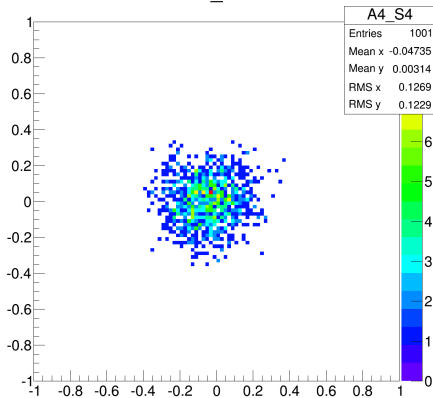




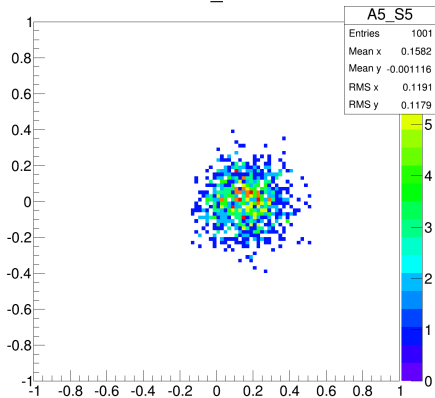
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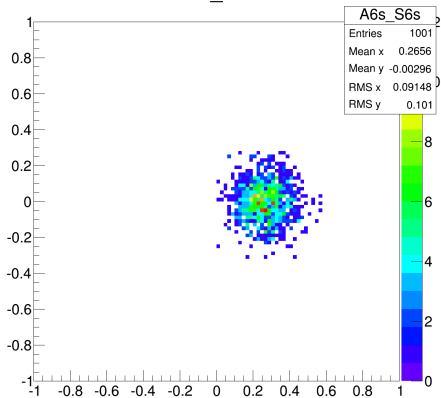
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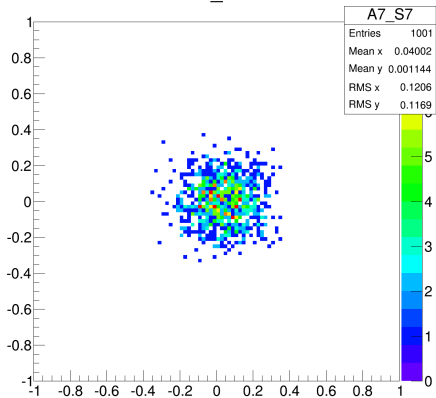
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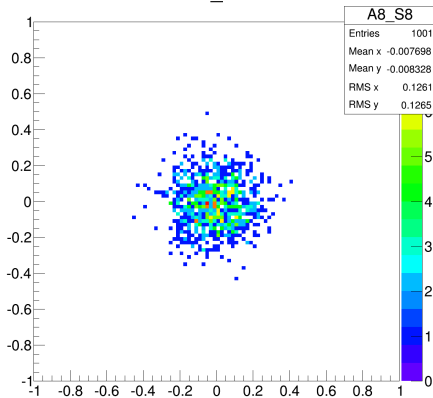
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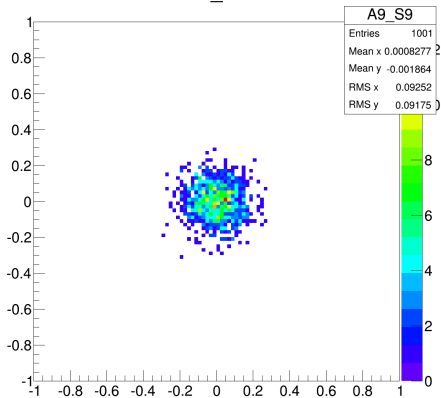
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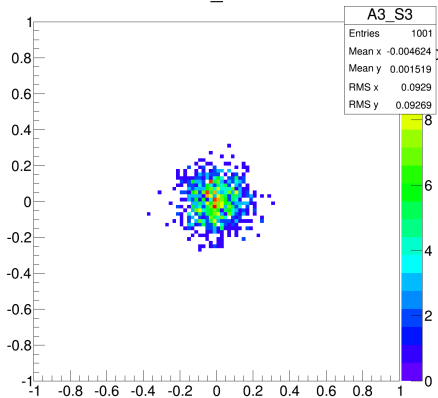
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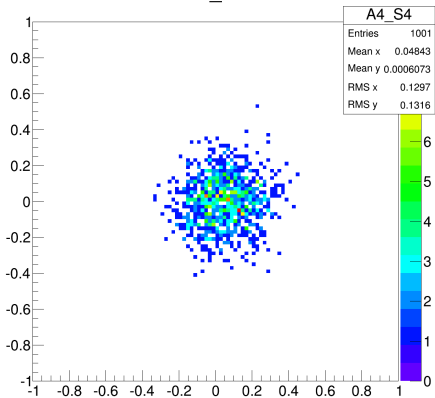
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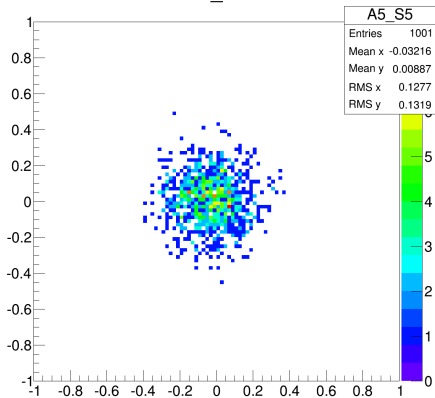
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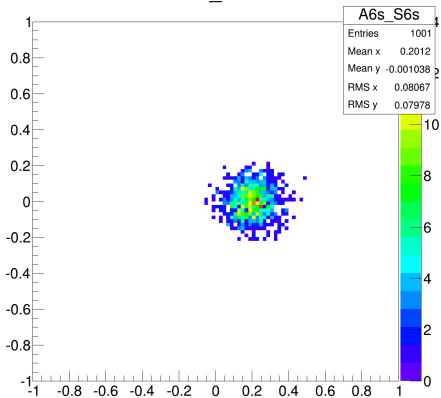
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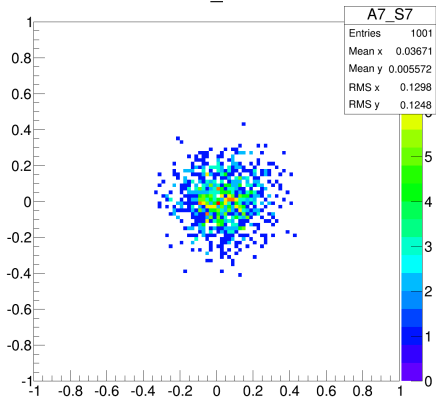
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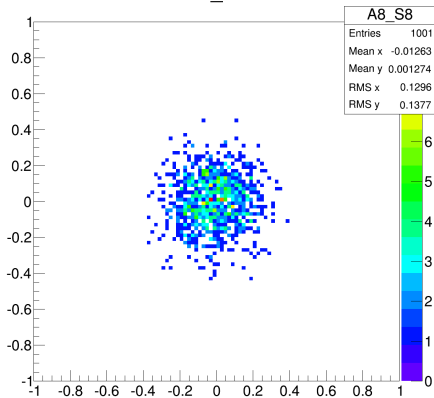
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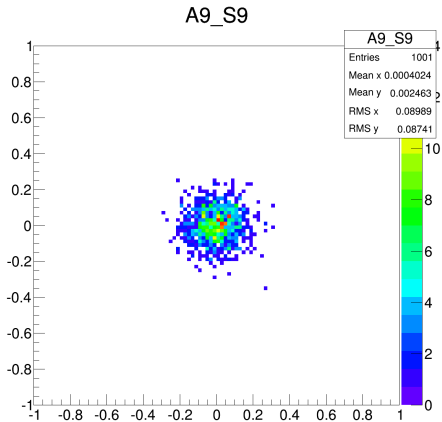


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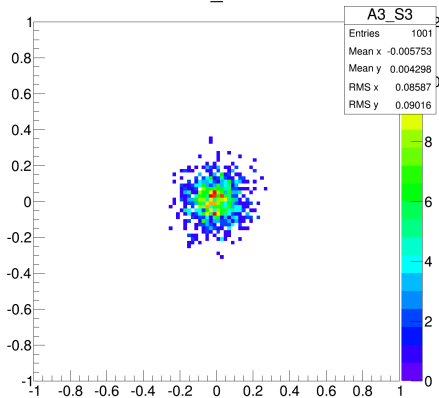
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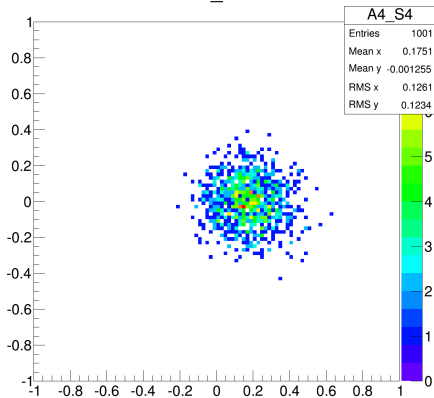




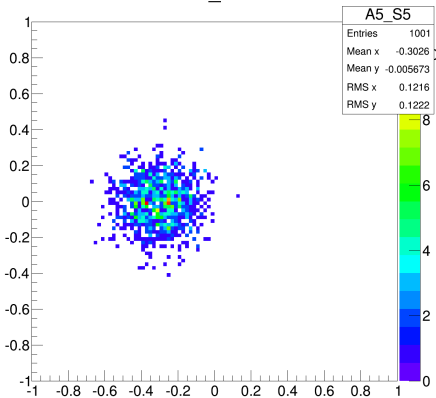
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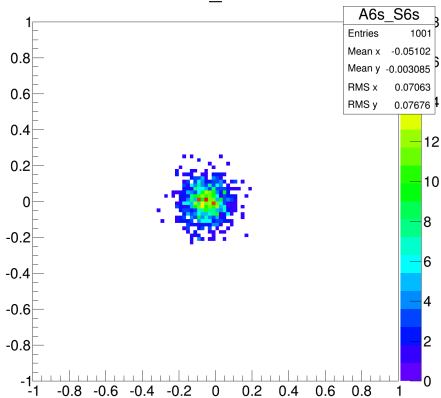
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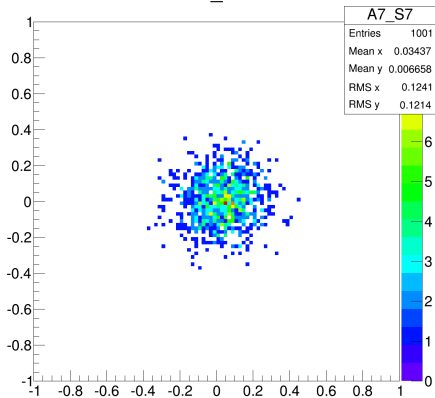
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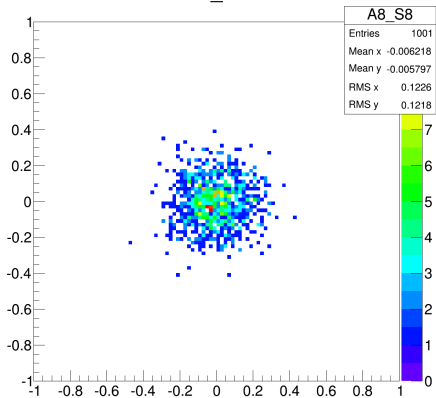
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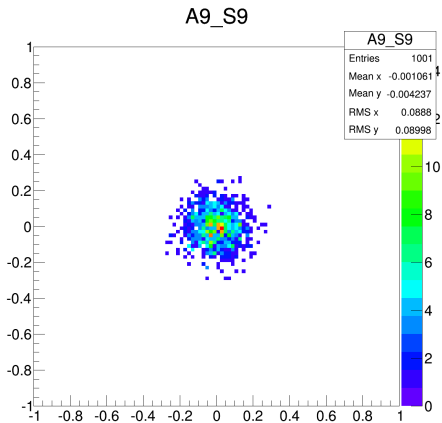


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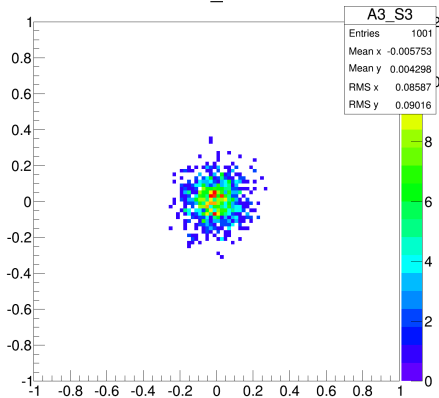


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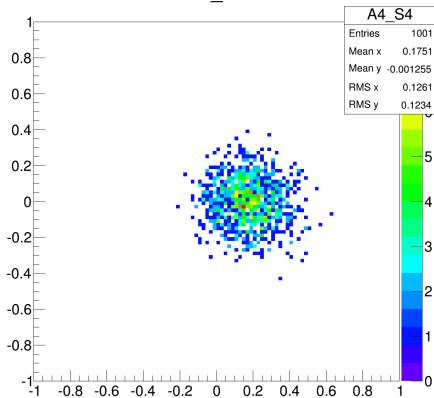




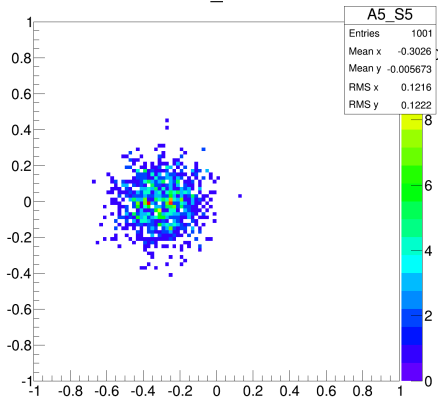
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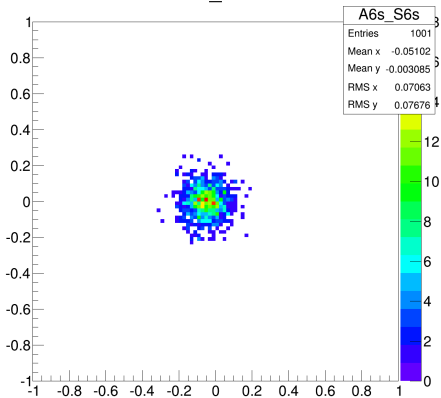
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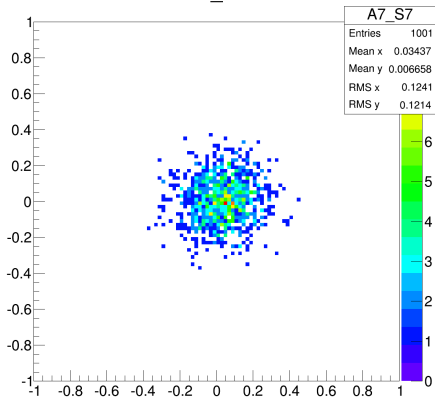
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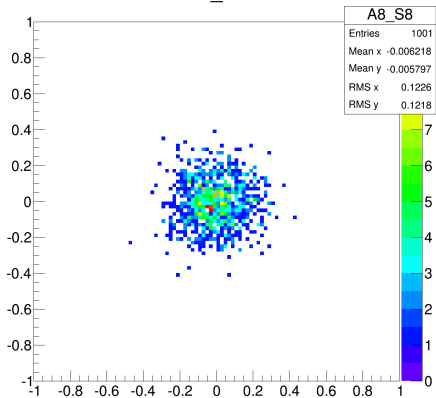
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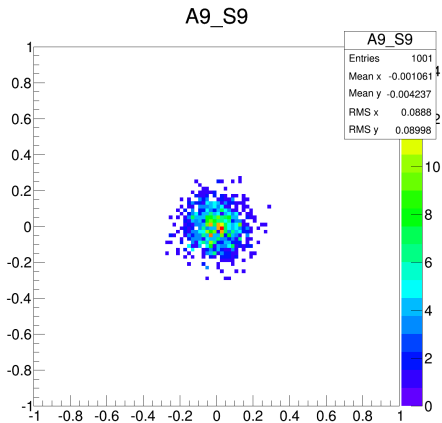


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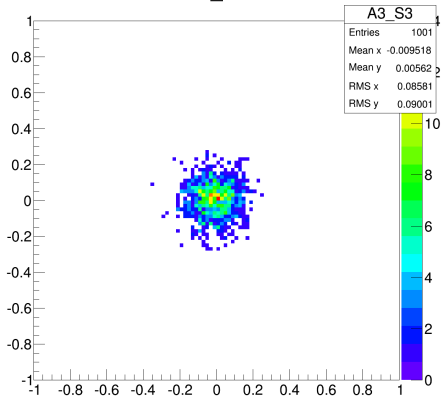
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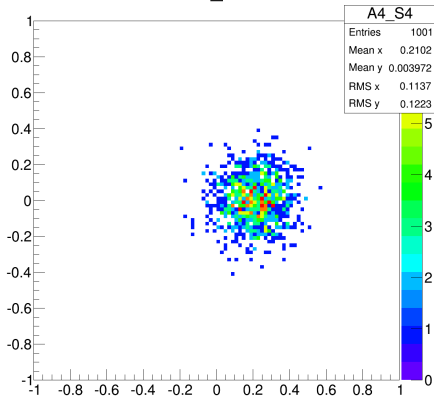




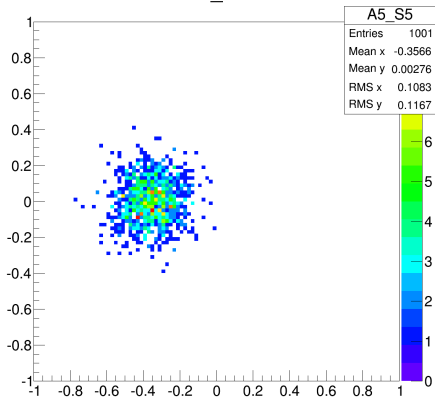
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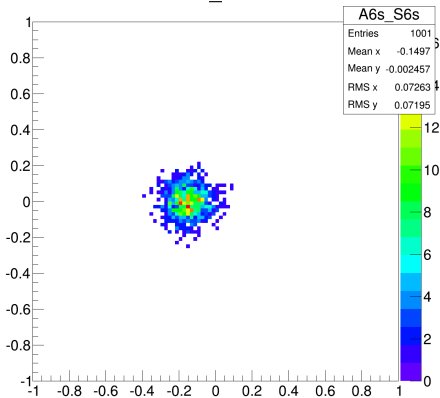
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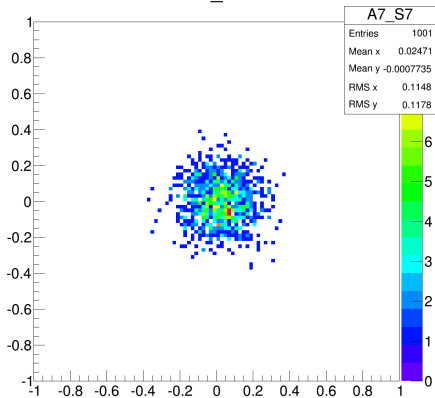
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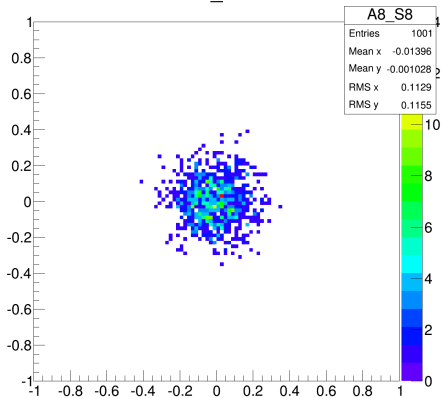
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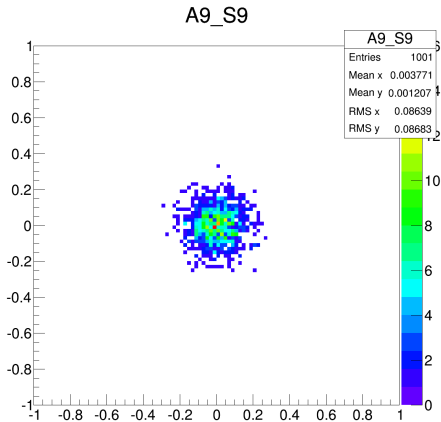


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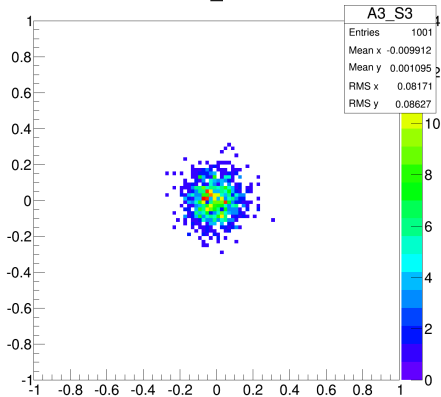


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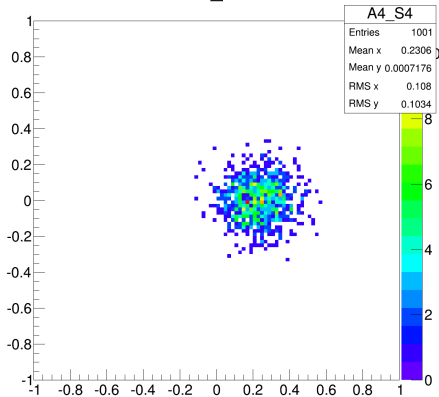




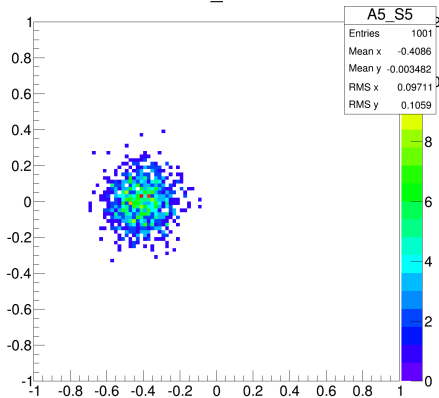
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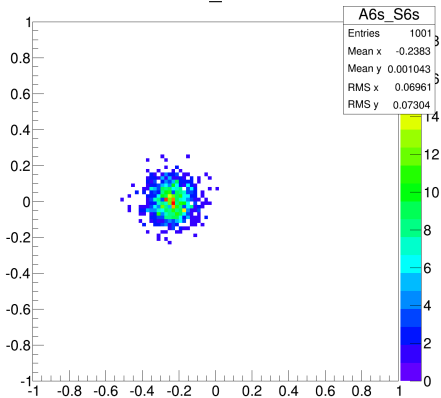
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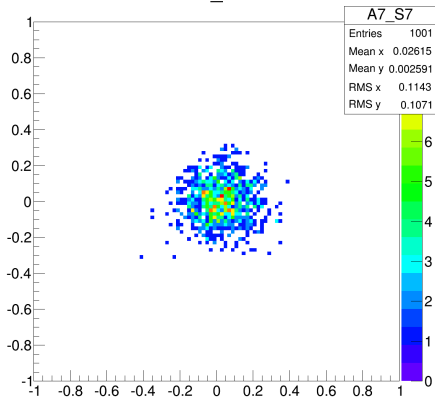
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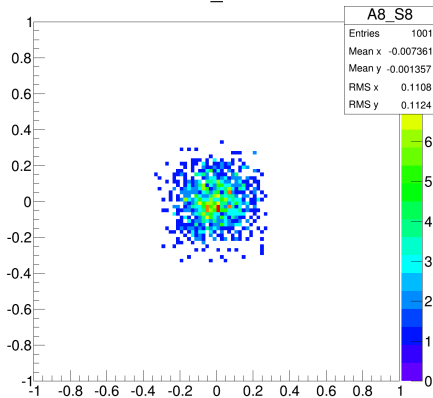
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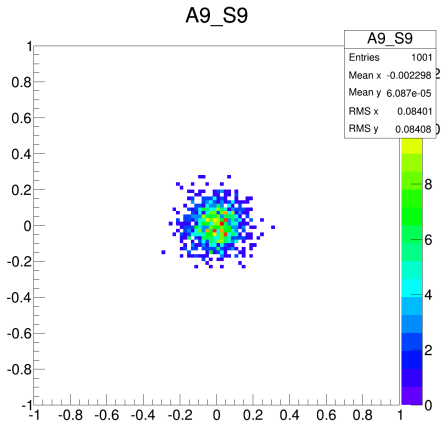


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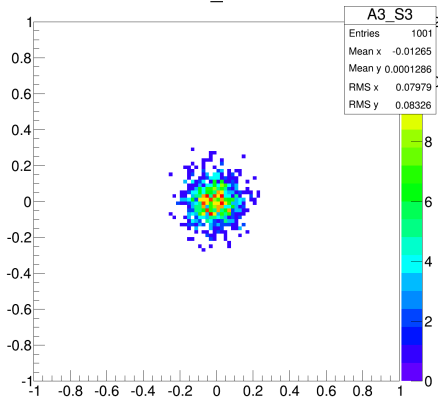
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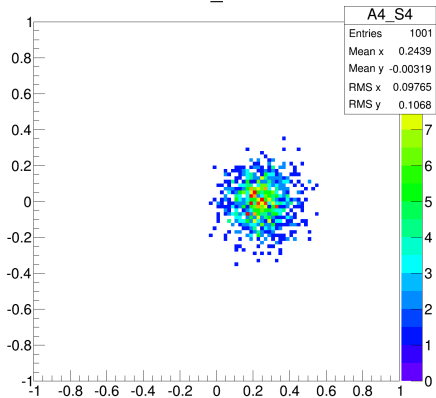




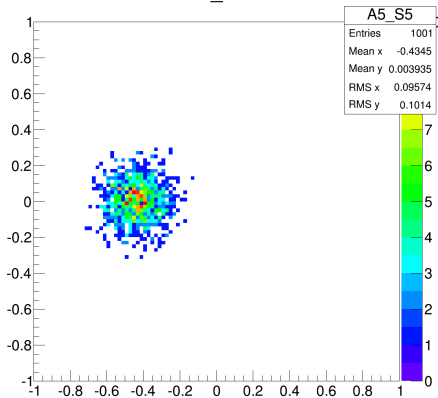
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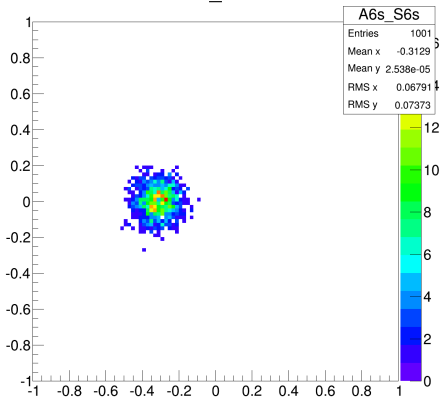
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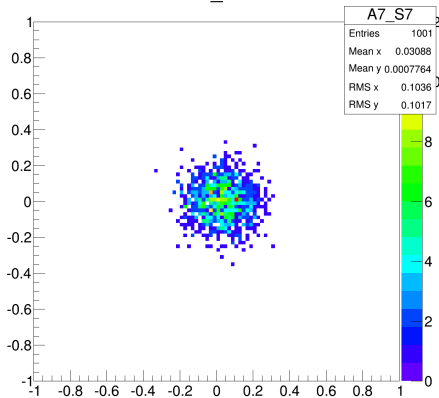
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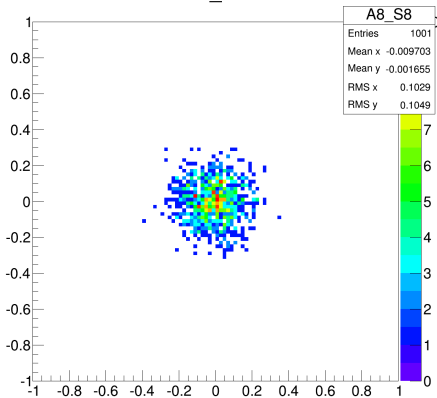
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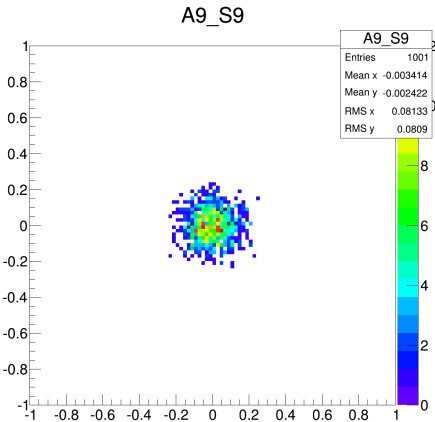


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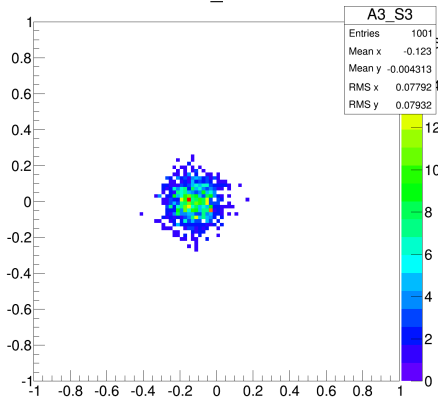


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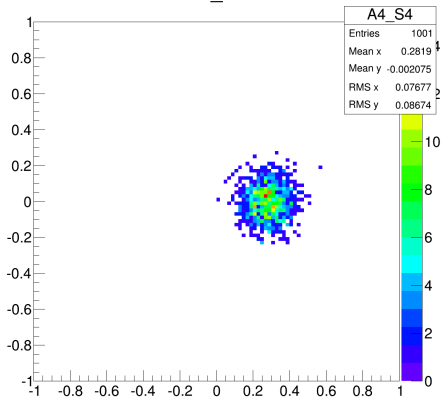




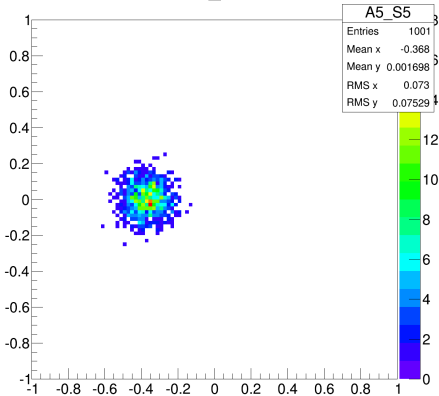
A3\_S3



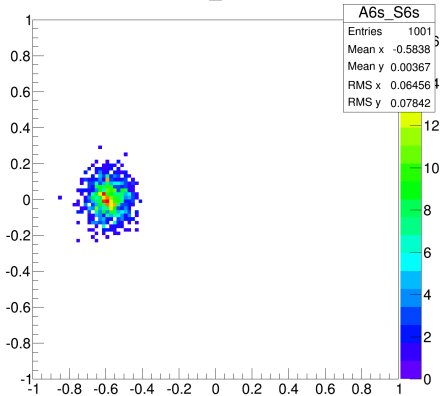
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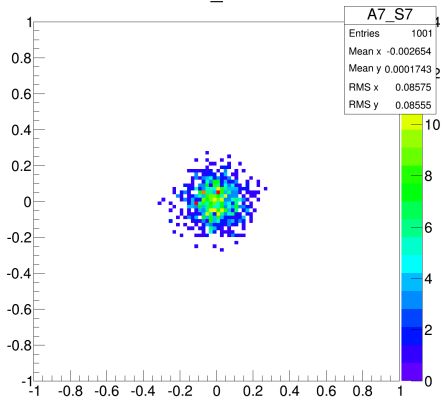
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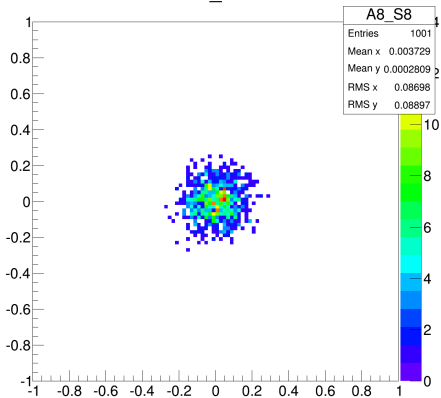
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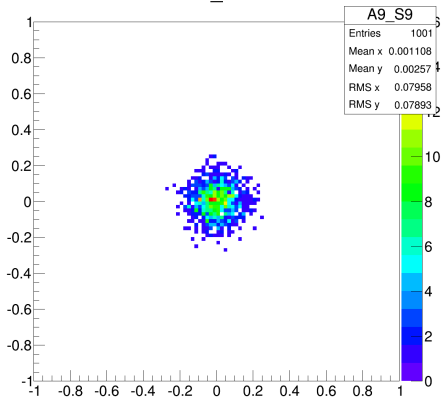
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A8\_S8

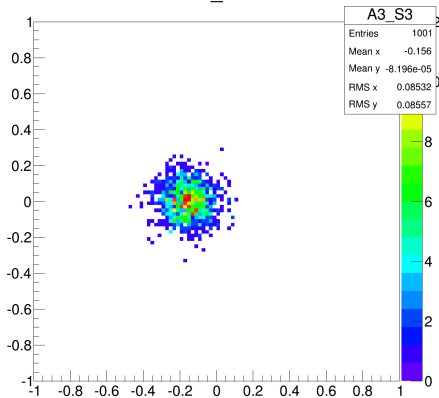


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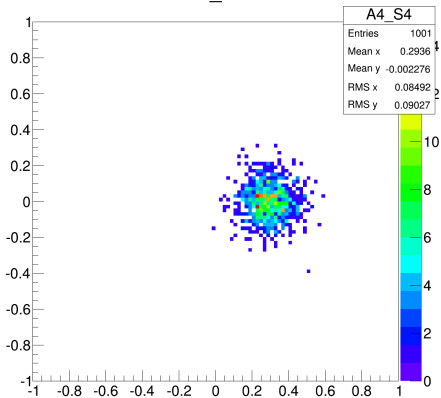




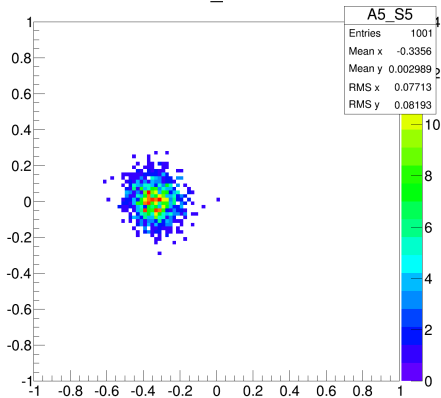
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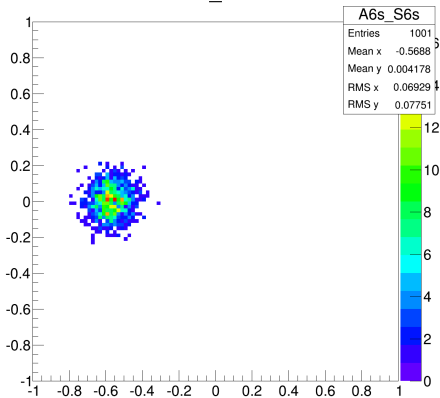
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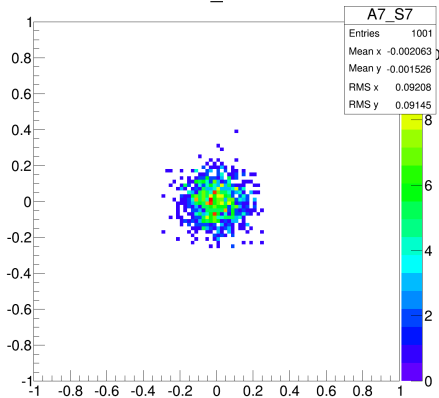
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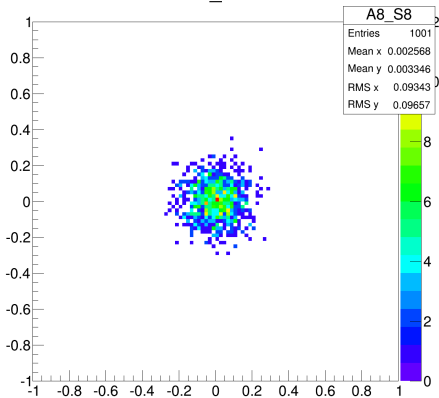
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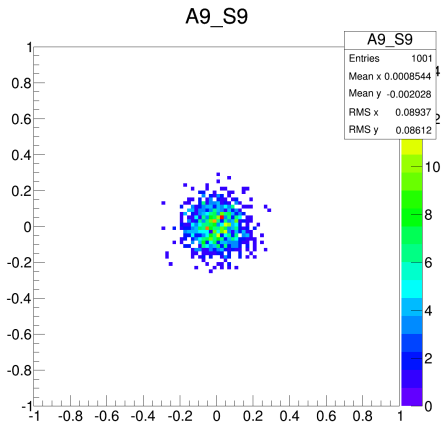


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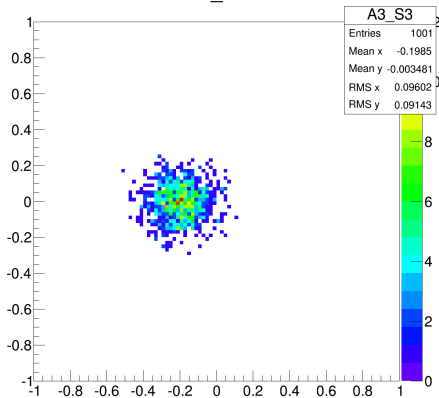


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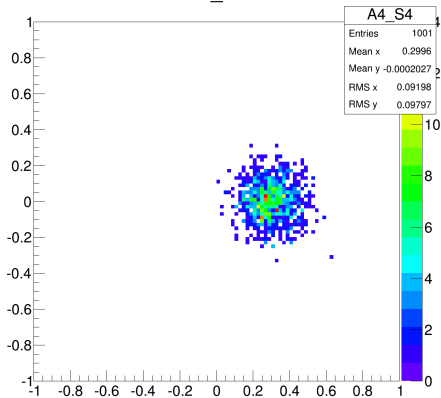




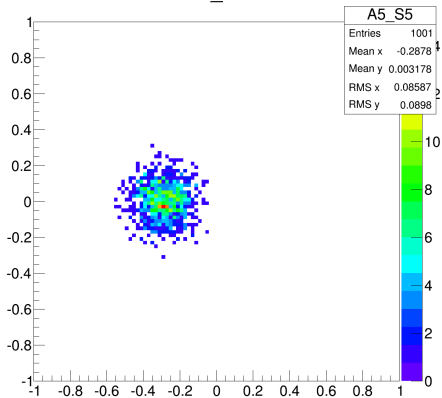
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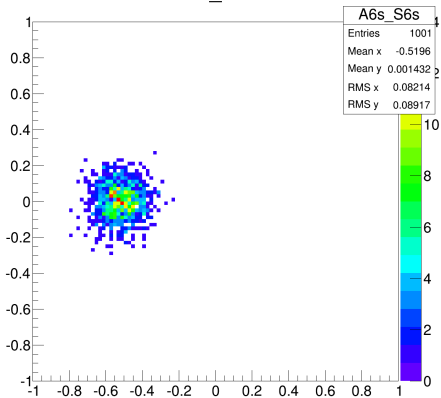
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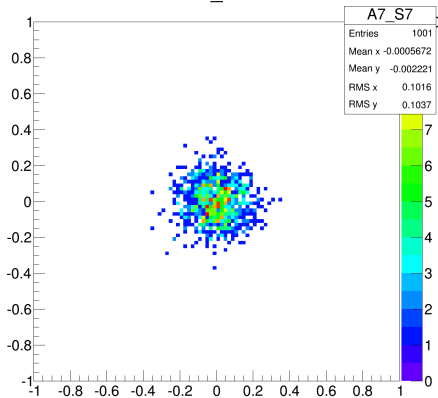
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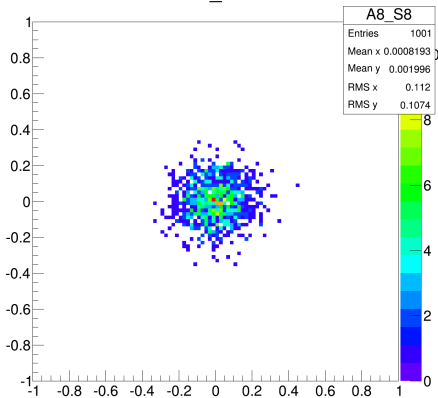
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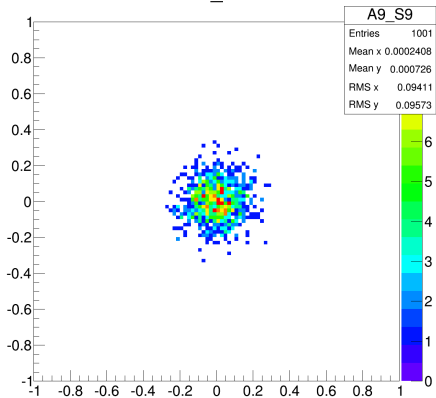
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A8\_S8

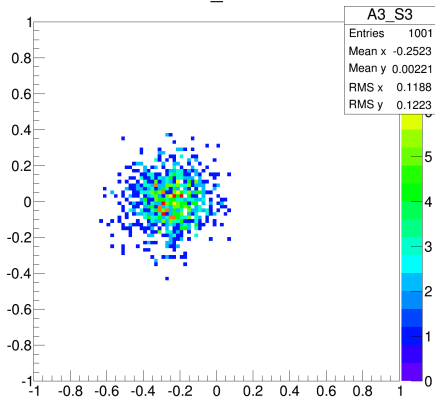


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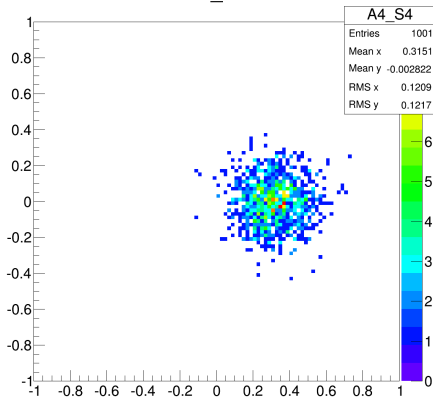




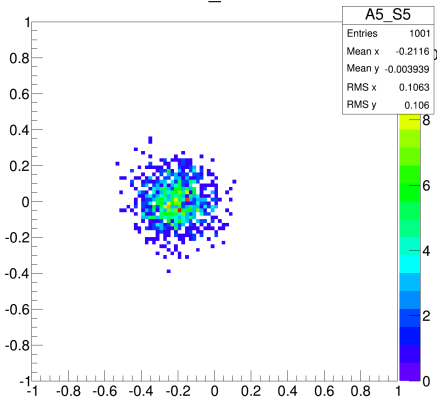
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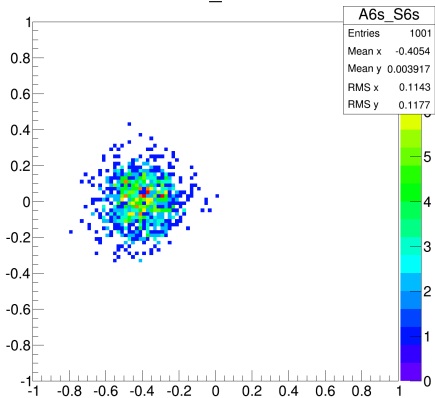
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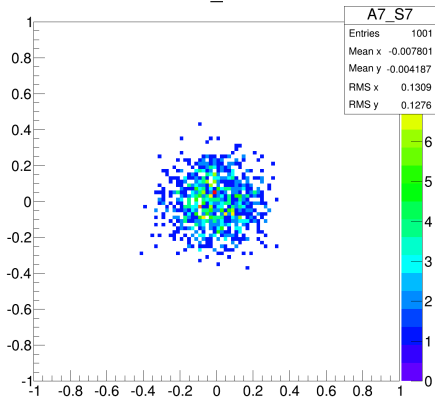
A5\_S5



A6s\_S6s



A7\_S7



A8\_S8

