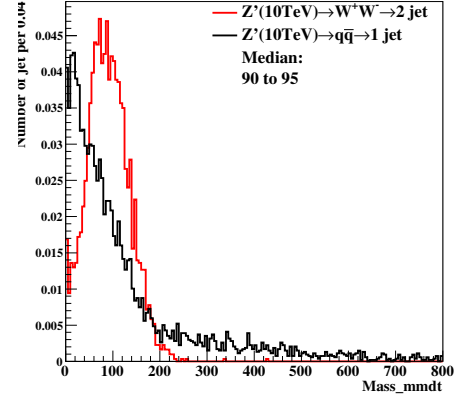
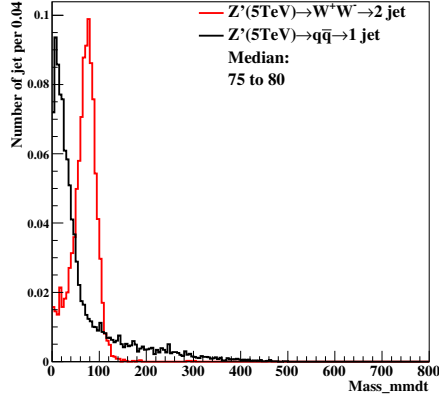


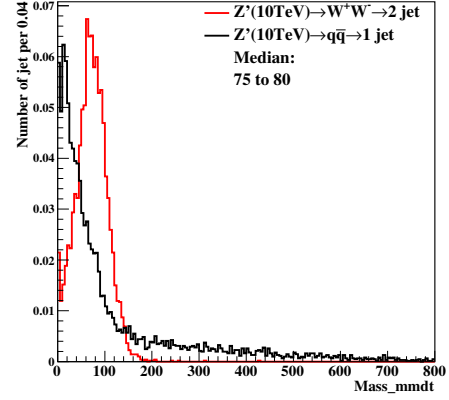
(a) 5TeV at 20×20(cm×cm) in cluster



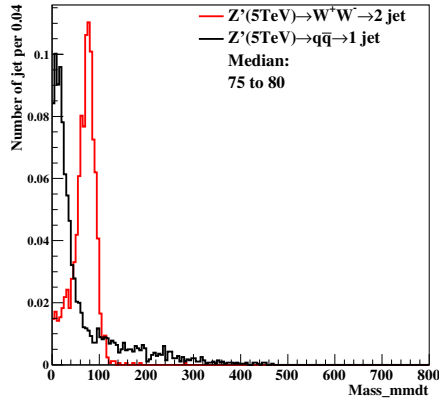
(b) 10TeV at 20×20(cm×cm) in cluster



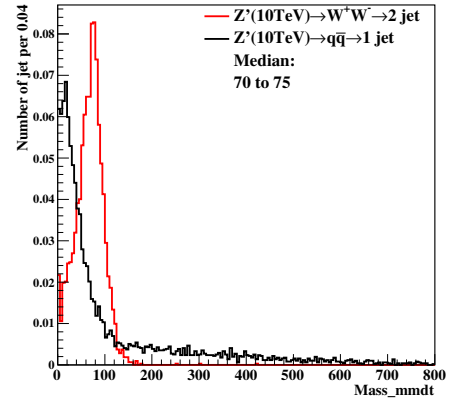
(c) 5TeV at 5×5(cm×cm) in cluster



(d) 10TeV at 5×5(cm×cm) in cluster

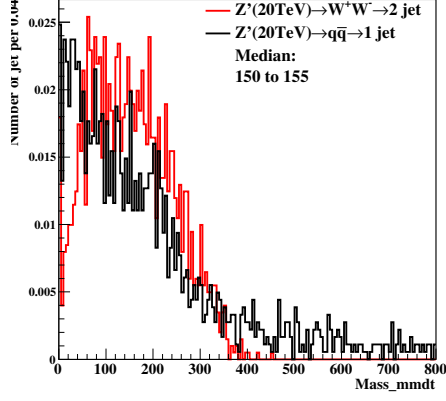


(e) 5TeV at 1×1(cm×cm) in cluster

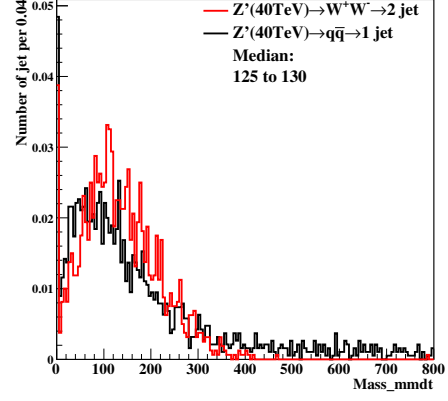


(f) 10TeV at 1×1(cm×cm) in cluster

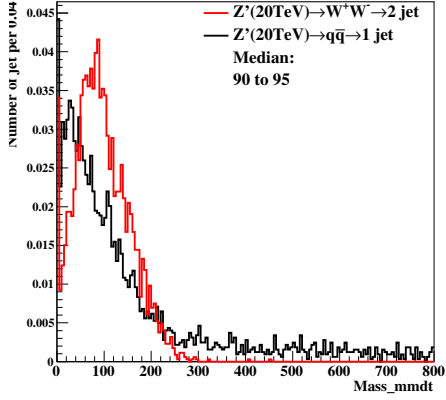
Figure 1: Distributions of mass soft drop at $\beta=0$, signal=ww, in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



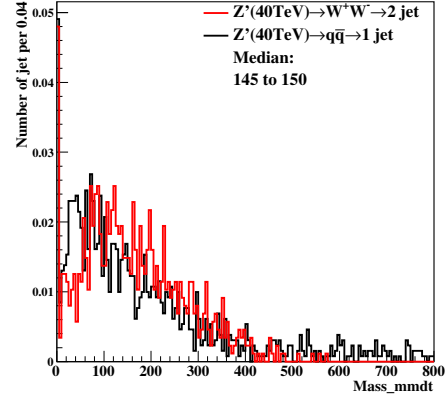
(a) 20TeV at 20×20(cm×cm) in cluster



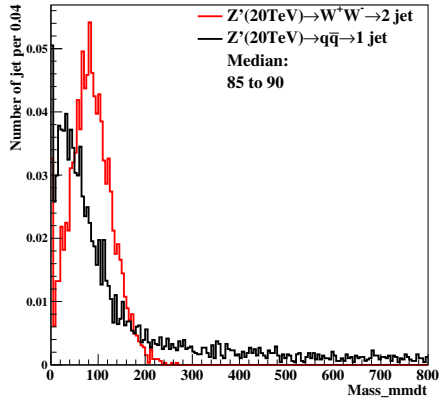
(b) 40TeV at 20×20(cm×cm) in cluster



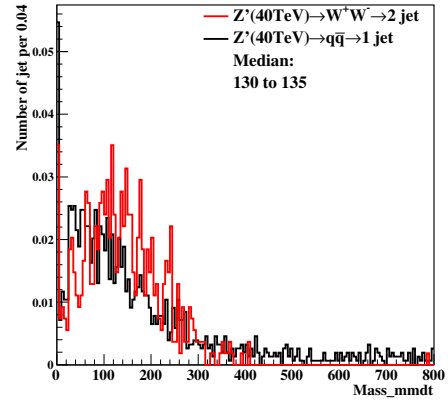
(c) 20TeV at 5×5(cm×cm) in cluster



(d) 40TeV at 5×5(cm×cm) in cluster

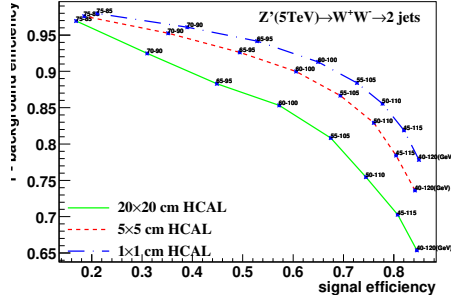


(e) 20TeV at 1×1(cm×cm) in cluster

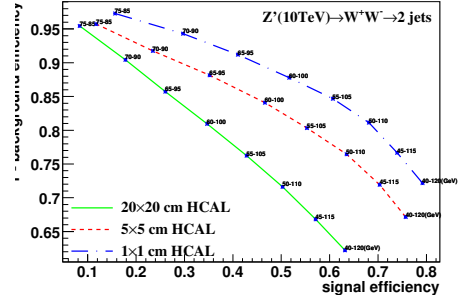


(f) 40TeV at 1×1(cm×cm) in cluster

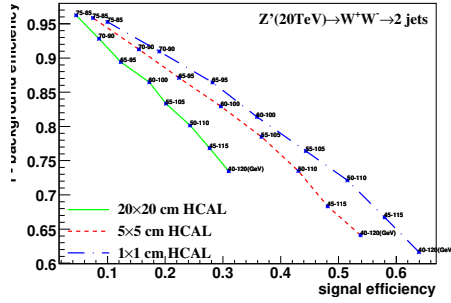
Figure 2: Distributions of mass soft drop at $\beta=0$, signal=ww, in 20,40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



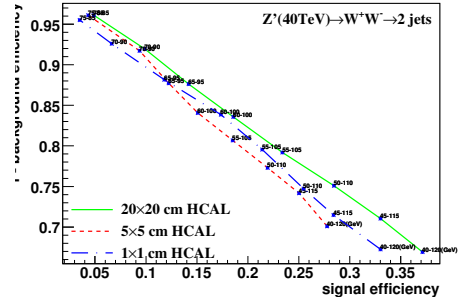
(a) Central at 80TeV change width in cluster at 5TeV



(b) Central at 80TeV change width in cluster at 10TeV

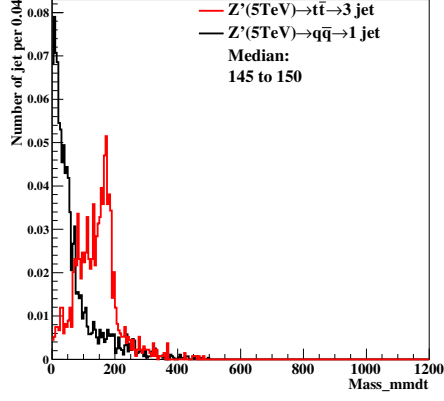


(c) Central at 80TeV change width in cluster at 20TeV

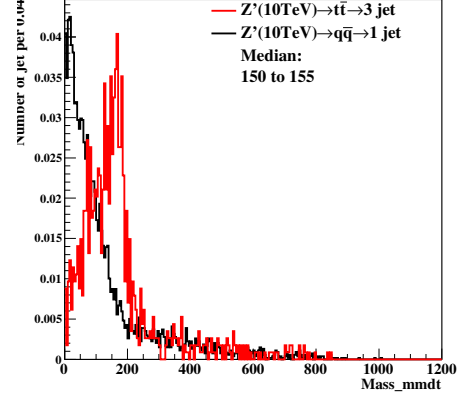


(d) Central at 80TeV change width in cluster at 40TeV

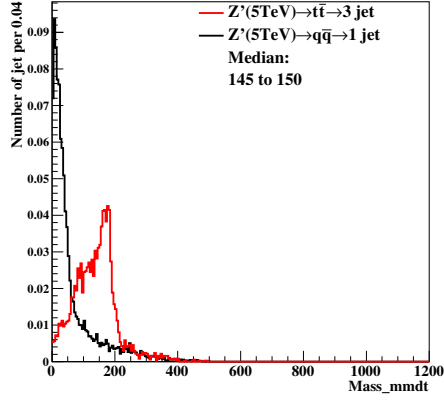
Figure 3: study of "fix central and change width" in mass soft drop at $\beta=0$, signal=ww, in 5, 10, 20, 40TeV energy of collision in different detector sizes. Cell Size in 20x20, 5x5, and 1x1(cmxcn) are shown in each picture.



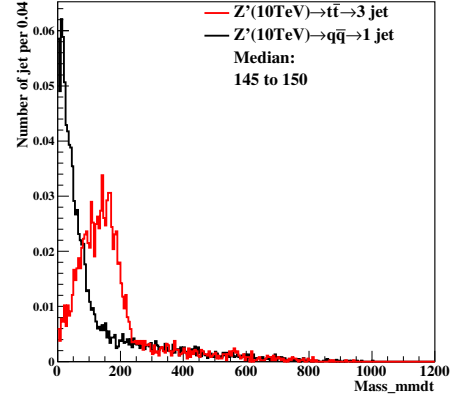
(a) 5TeV at 20×20(cm×cm) in cluster



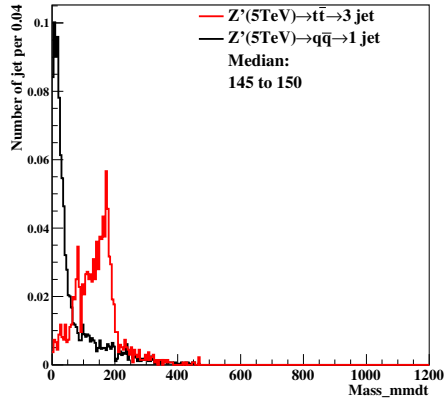
(b) 10TeV at 20×20(cm×cm) in cluster



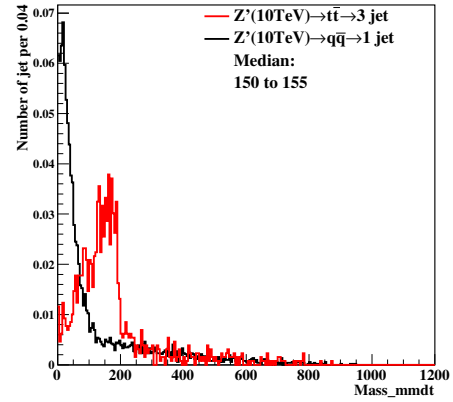
(c) 5TeV at 5×5(cm×cm) in cluster



(d) 10TeV at 5×5(cm×cm) in cluster

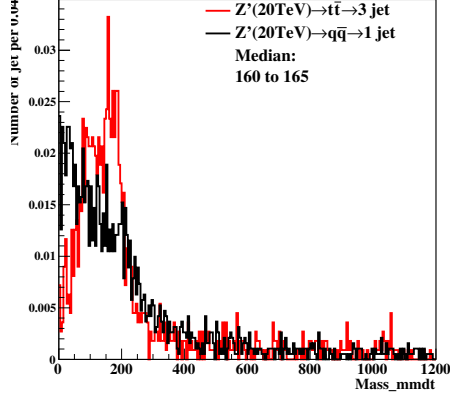


(e) 5TeV at 1×1(cm×cm) in cluster

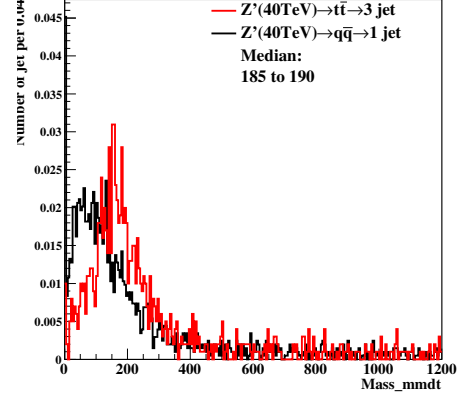


(f) 10TeV at 1×1(cm×cm) in cluster

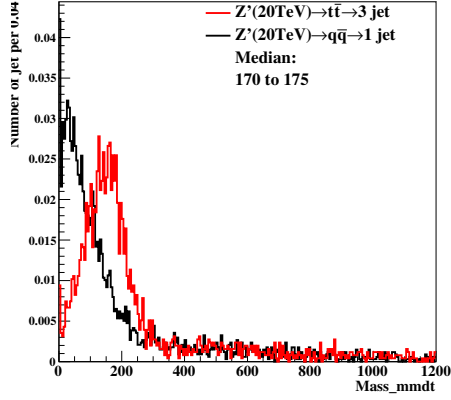
Figure 4: Distributions of mass soft drop at $\beta=0$, signal= tt , in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



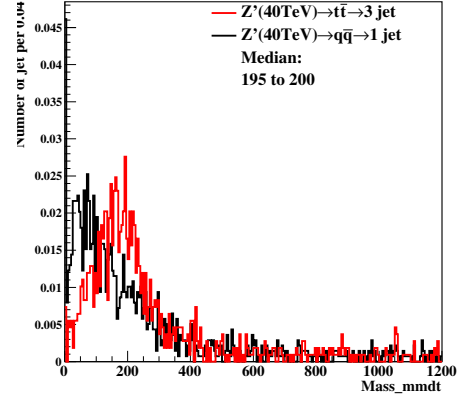
(a) 20TeV at $20 \times 20 (\text{cm} \times \text{cm})$ in cluster



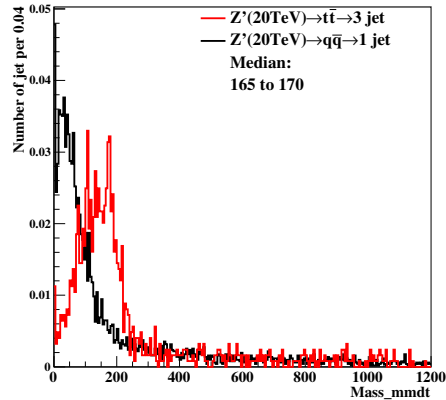
(b) 40TeV at $20 \times 20 (\text{cm} \times \text{cm})$ in cluster



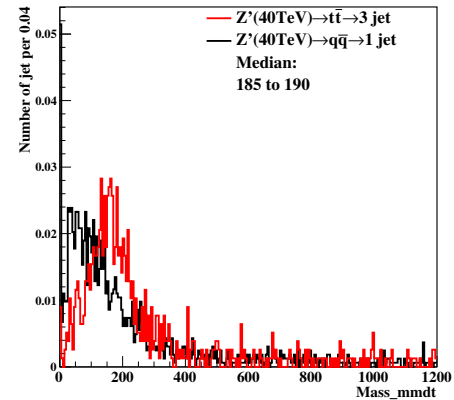
(c) 20TeV at $5 \times 5 (\text{cm} \times \text{cm})$ in cluster



(d) 40TeV at $5 \times 5 (\text{cm} \times \text{cm})$ in cluster

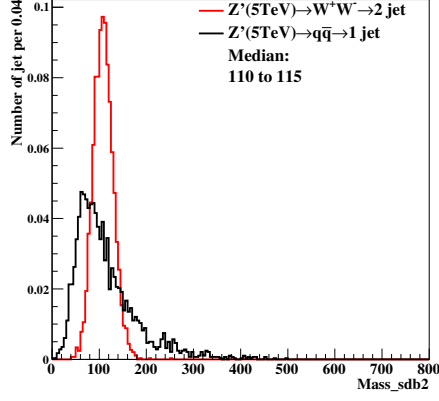


(e) 20TeV at $1 \times 1 (\text{cm} \times \text{cm})$ in cluster

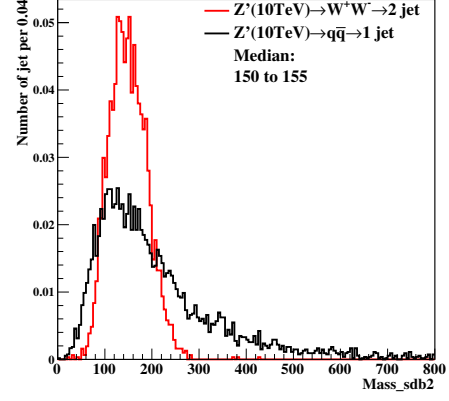


(f) 40TeV at $1 \times 1 (\text{cm} \times \text{cm})$ in cluster

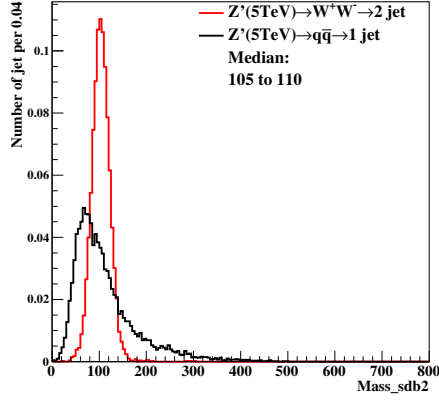
Figure 5: Distributions of mass soft drop at $\beta=0$, signal= $t\bar{t}$, in 20,40TeV energy of collision in different detector sizes. Cell Size in 20×20 , 5×5 , and $1 \times 1 (\text{cm} \times \text{cm})$ are shown here.



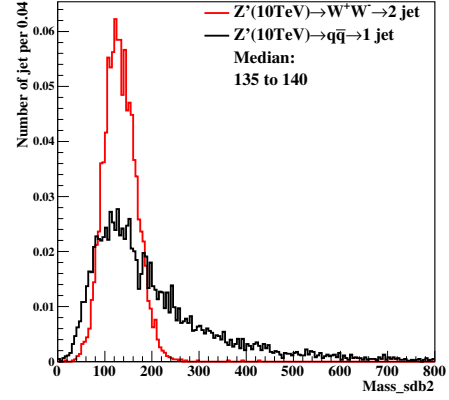
(a) 5TeV at 20×20(cm×cm) in cluster



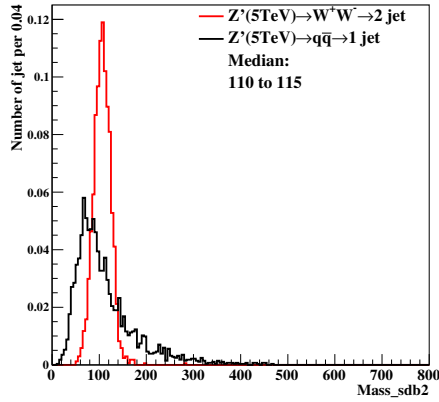
(b) 10TeV at 20×20(cm×cm) in cluster



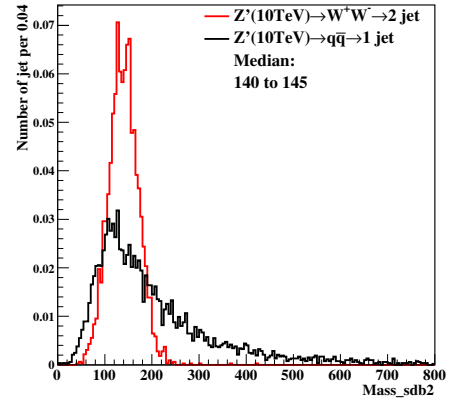
(c) 5TeV at 5×5(cm×cm) in cluster



(d) 10TeV at 5×5(cm×cm) in cluster

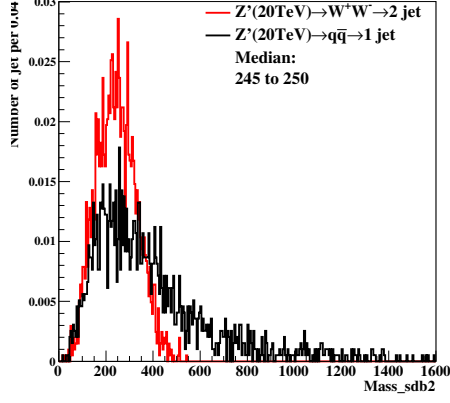


(e) 5TeV at 1×1(cm×cm) in cluster

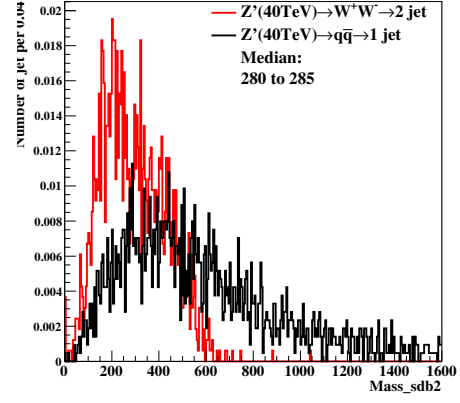


(f) 10TeV at 1×1(cm×cm) in cluster

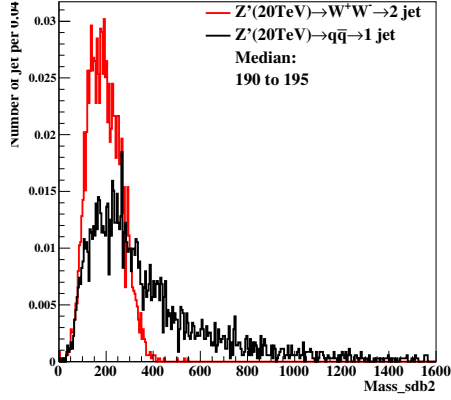
Figure 6: Distributions of mass soft drop at $\beta=2$, signal=ww, in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



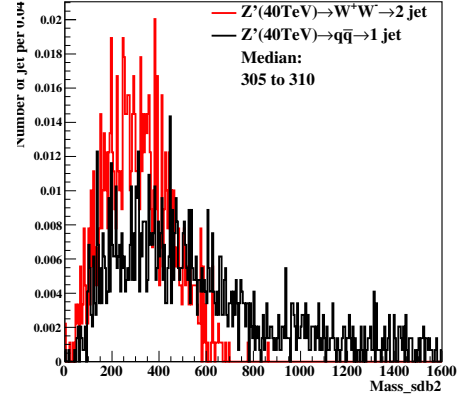
(a) 20TeV at 20×20(cm×cm) in cluster



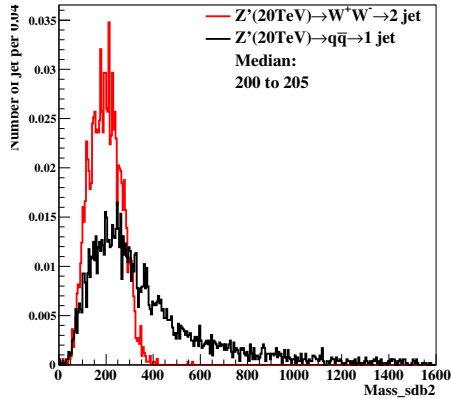
(b) 40TeV at 20×20(cm×cm) in cluster



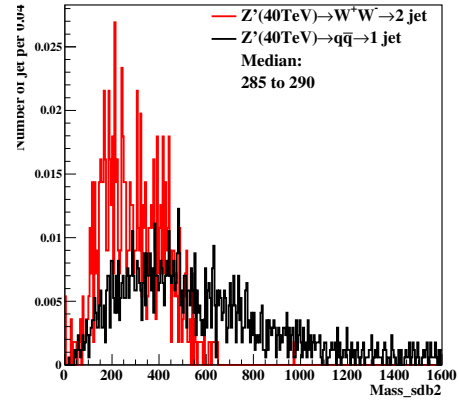
(c) 20TeV at 5×5(cm×cm) in cluster



(d) 40TeV at 5×5(cm×cm) in cluster

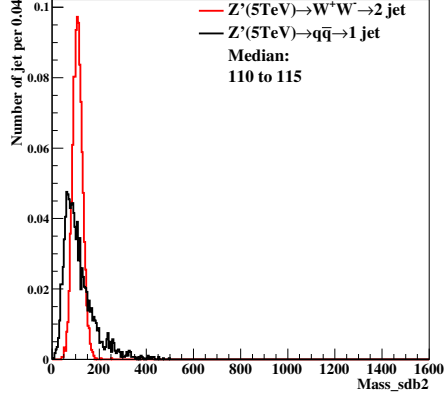


(e) 20TeV at 1×1(cm×cm) in cluster

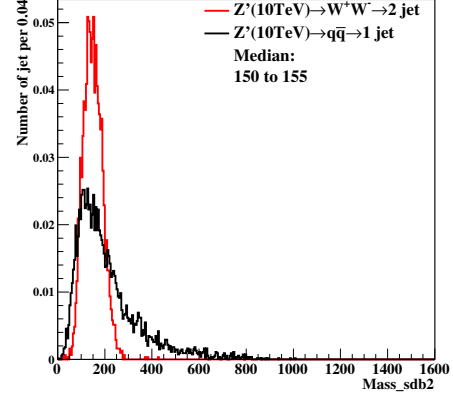


(f) 40TeV at 1×1(cm×cm) in cluster

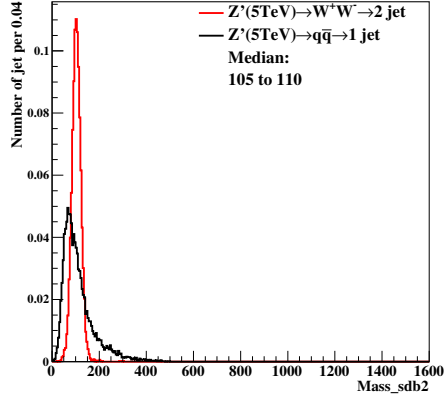
Figure 7: Distributions of mass soft drop at $\beta=2$, signal=ww, in 20,40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



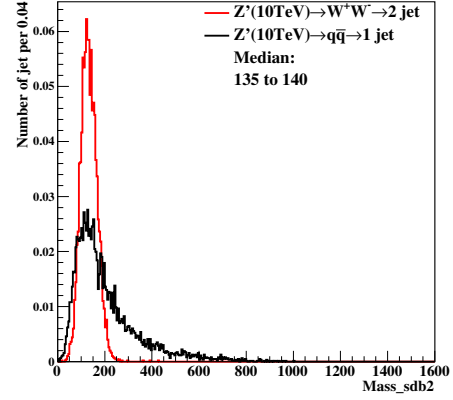
(a) 5TeV at 20×20 (cm \times cm) in cluster



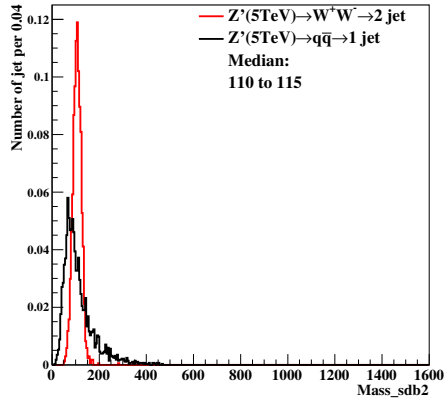
(b) 10TeV at 20×20 (cm \times cm) in cluster



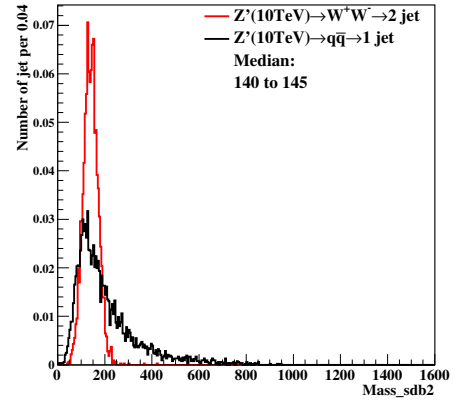
(c) 5TeV at 5×5 (cm \times cm) in cluster



(d) 10TeV at 5×5 (cm \times cm) in cluster



(e) 5TeV at 1×1 (cm \times cm) in cluster



(f) 10TeV at 1×1 (cm \times cm) in cluster

Figure 8: Distributions of mass soft drop at $\beta=2$, signal=ww, in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20 , 5×5 , and 1×1 (cm \times cm) are shown here.

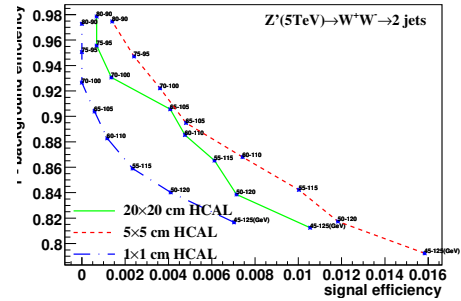


Figure 10 is a plot showing the 1% constant efficiency signal efficiency versus the signal efficiency for the $Z'(5\text{TeV}) \rightarrow W^+W^- \rightarrow 2 \text{ jets}$ process. The plot compares three detector configurations: 20x20 cm HCAL (solid green line), 5x5 cm HCAL (dashed red line), and 1x1 cm HCAL (dashed blue line). Data points are labeled with their corresponding signal efficiency values. The 1x1 cm HCAL configuration shows the highest signal efficiency for a given signal efficiency, followed by 5x5 cm HCAL, and then 20x20 cm HCAL.

Signal Efficiency	20x20 cm HCAL (1% Eff)	5x5 cm HCAL (1% Eff)	1x1 cm HCAL (1% Eff)
0.001	0.965	0.975	0.945
0.002	0.955	0.965	0.935
0.003	0.945	0.955	0.925
0.004	0.935	0.945	0.915
0.005	0.925	0.935	0.905
0.006	0.915	0.925	0.895
0.007	0.905	0.915	0.885
0.008	0.895	0.905	0.875
0.009	0.885	0.895	0.865
0.010	0.875	0.885	0.855
0.012	0.865	0.875	0.845
0.014	0.855	0.865	0.835
0.016	0.845	0.855	0.825
0.018	0.835	0.845	0.815
0.020	0.825	0.835	0.805

Figure 1 is a plot showing the Z' branching ratio into two jets, $BR(Z' \rightarrow W^+W^- \rightarrow 2 \text{ jets})$, as a function of the signal efficiency for three different detector configurations: 20x20 cm HCAL (solid green line), 5x5 cm HCAL (dashed red line), and 1x1 cm HCAL (dashed blue line). The y-axis ranges from 0.75 to 0.95, and the x-axis ranges from 0 to 0.035. Data points are labeled with p_T values: $p_T=105$, $p_T=110$, $p_T=115$, $p_T=120$, $p_T=125$, $p_T=130$, $p_T=135$, $p_T=140$ (GeV). The branching ratio decreases as signal efficiency increases and as the HCAL size decreases.

Figure 10 is a plot showing the 1-2 angular distribution efficiency versus signal efficiency for the $Z'(5\text{TeV}) \rightarrow W^+W^- \rightarrow 2 \text{ jets}$ process. The plot compares three HCAL configurations: 20x20 cm (solid green line), 5x5 cm (dashed red line), and 1x1 cm (dashed blue line). The x-axis represents signal efficiency from 0 to 0.06, and the y-axis represents 1-2 angular distribution efficiency from 0.7 to 0.95. Data points are labeled with their corresponding signal efficiencies.

Signal Efficiency	20x20 cm HCAL	5x5 cm HCAL	1x1 cm HCAL
0.005	0.95	0.95	0.95
0.01	0.93	0.93	0.93
0.015	0.90	0.90	0.90
0.02	0.87	0.87	0.87
0.025	0.84	0.84	0.84
0.03	0.81	0.81	0.81
0.035	0.78	0.78	0.78
0.04	0.75	0.75	0.75
0.045	0.72	0.72	0.72
0.05	0.70	0.70	0.70
0.055	0.68	0.68	0.68
0.06	0.66	0.66	0.66

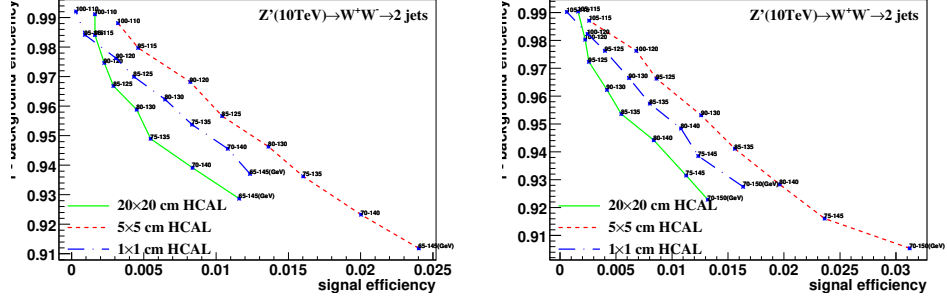
Figure 10 is a plot showing the Z' branching ratio efficiency (Y-axis, ranging from 0.7 to 0.95) versus the signal efficiency (X-axis, ranging from 0 to 0.08). The plot is titled $Z'(5\text{TeV}) \rightarrow W^+W^- \rightarrow 2\text{ jets}$. Three curves are shown, corresponding to different HCAL cell sizes:

- 20×20 cm HCAL (solid green line)
- 5×5 cm HCAL (dashed red line)
- 1×1 cm HCAL (dashed blue line)

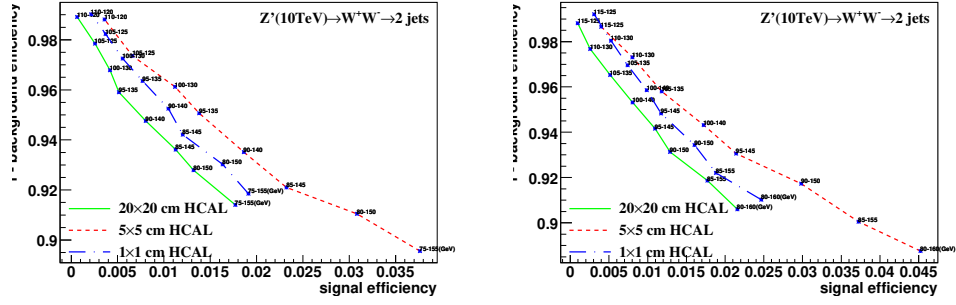
The curves show that the branching ratio efficiency decreases as the signal efficiency increases. The 1×1 cm HCAL curve consistently shows the highest efficiency for a given signal efficiency, while the 20×20 cm HCAL curve shows the lowest efficiency. Data points on the curves are labeled with p_T values (e.g., $p_T=120$, $p_T=130$, etc.).

(g) Central at 110TeV change width in cluster (h) Central at 115TeV change width in cluster

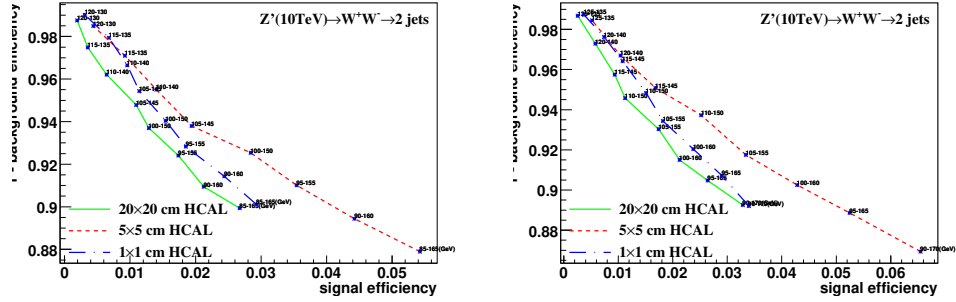
Figure 9: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=ww, in 5TeV energy of collision in different detector sizes. Cell Size in 20×20 , 5×5 , and 1×1 (cm \times cm) are shown in each picture.



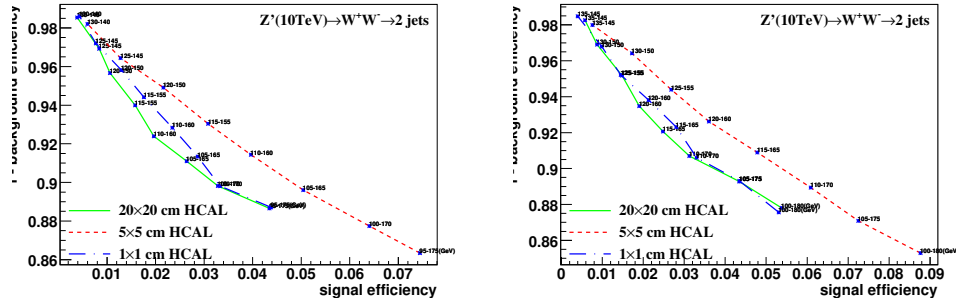
(a) Central at 105TeV change width in cluster (b) Central at 110TeV change width in cluster



(c) Central at 115TeV change width in cluster (d) Central at 120TeV change width in cluster

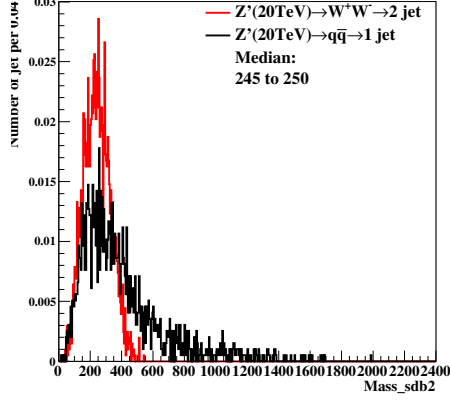


(e) Central at 125TeV change width in cluster (f) Central at 130TeV change width in cluster

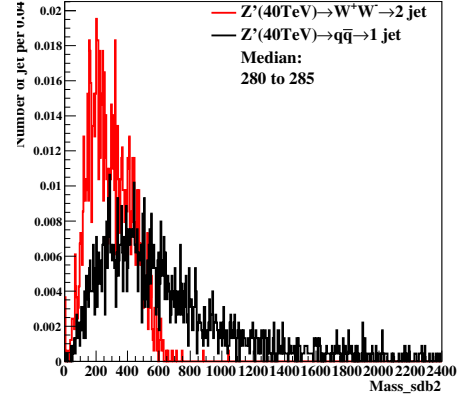


(g) Central at 135TeV change width in cluster (h) Central at 140TeV change width in cluster

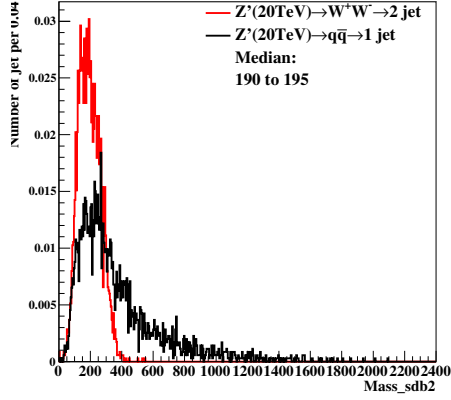
Figure 10: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=ww, in 10TeV energy of collision in different detector sizes. Cell Size in 20x20, 5x5, and 1x1(cm x cm) are shown in each picture.



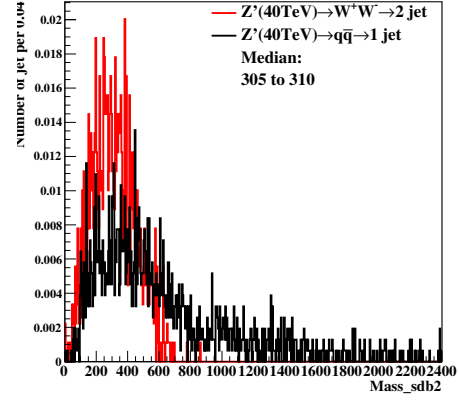
(a) 20TeV at 20×20(cm×cm) in cluster



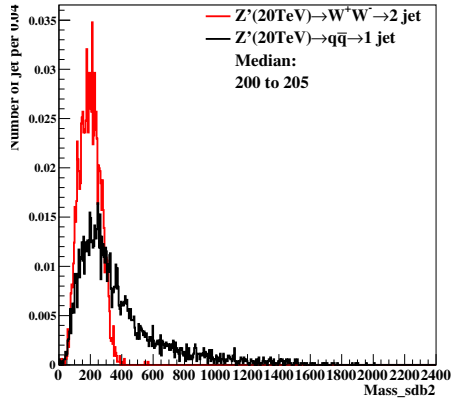
(b) 40TeV at 20×20(cm×cm) in cluster



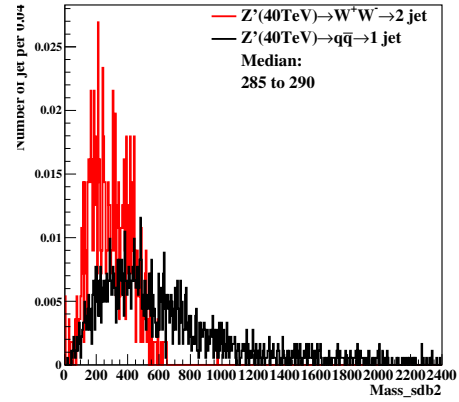
(c) 20TeV at 5×5(cm×cm) in cluster



(d) 40TeV at 5×5(cm×cm) in cluster

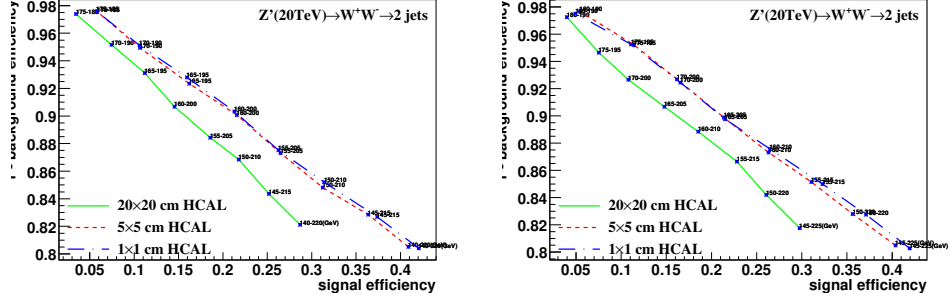


(e) 20TeV at 1×1(cm×cm) in cluster

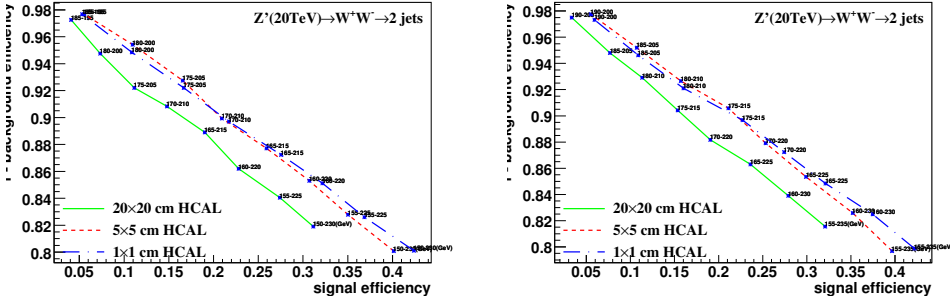


(f) 40TeV at 1×1(cm×cm) in cluster

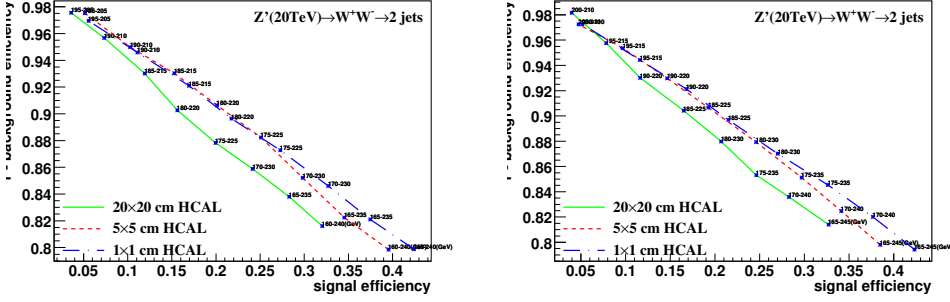
Figure 11: Distributions of mass soft drop at $\beta=2$, signal=ww, in 20,40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



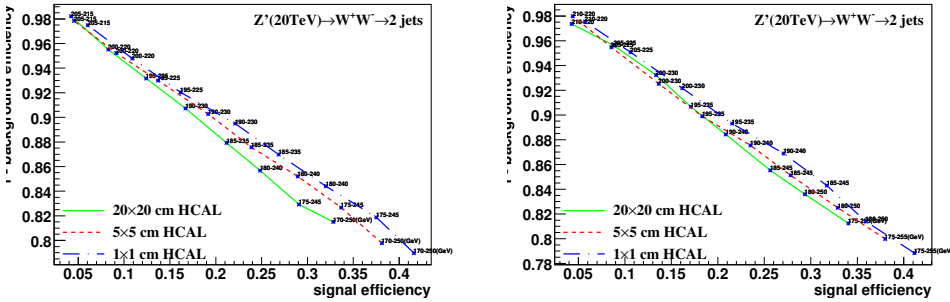
(a) Central at 180TeV change width in cluster (b) Central at 185TeV change width in cluster



(c) Central at 190TeV change width in cluster (d) Central at 195TeV change width in cluster

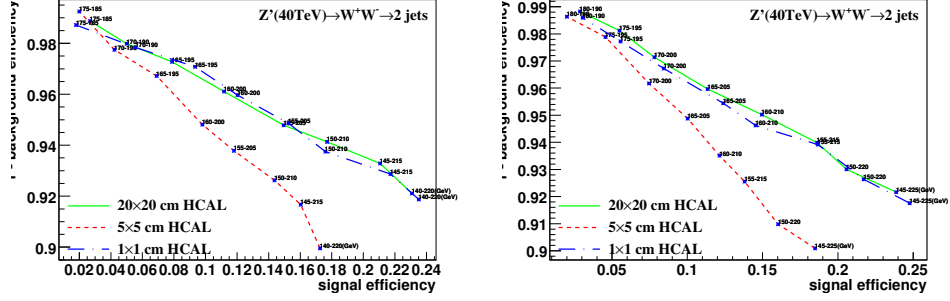


(e) Central at 200TeV change width in cluster (f) Central at 205TeV change width in cluster

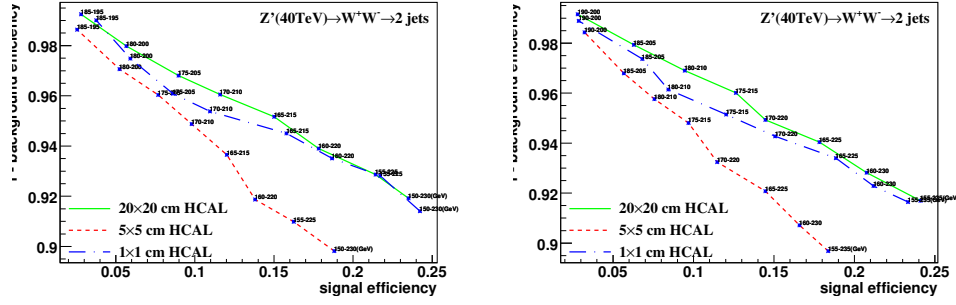


(g) Central at 210TeV change width in cluster (h) Central at 215TeV change width in cluster

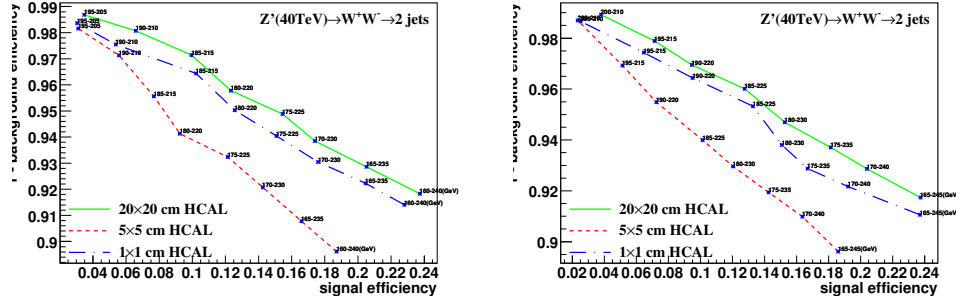
Figure 12: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=ww, in 20TeV energy of collision in different detector sizes. Cell Size in 20x20, 5x5, and 1x1(cm x cm) are shown in each picture.



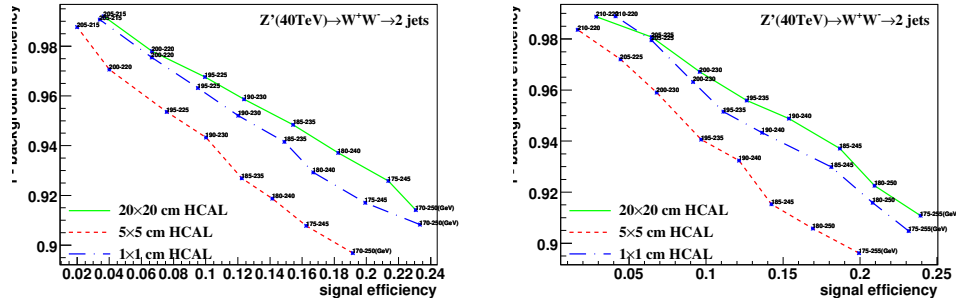
(a) Central at 180TeV change width in cluster (b) Central at 185TeV change width in cluster



(c) Central at 190TeV change width in cluster (d) Central at 195TeV change width in cluster

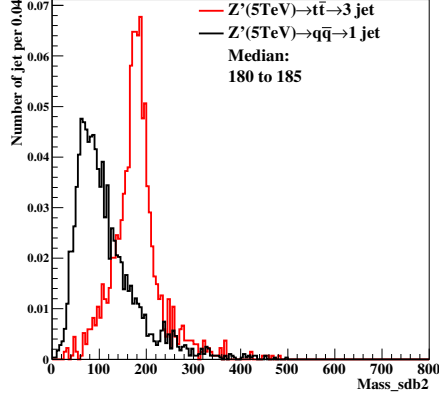


(e) Central at 200TeV change width in cluster (f) Central at 205TeV change width in cluster

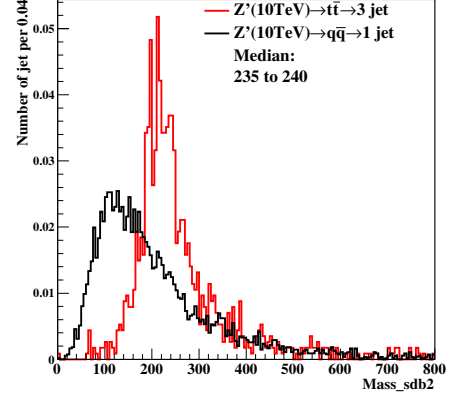


(g) Central at 210TeV change width in cluster (h) Central at 215TeV change width in cluster

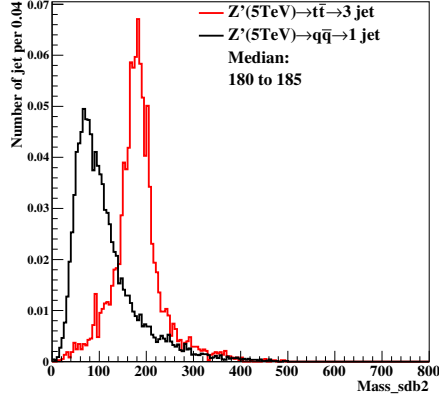
Figure 13: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=ww, in 40TeV energy of collision in different detector sizes. Cell Size in 20x20, 5x5, and 1x1(cm x cm) are shown in each picture.



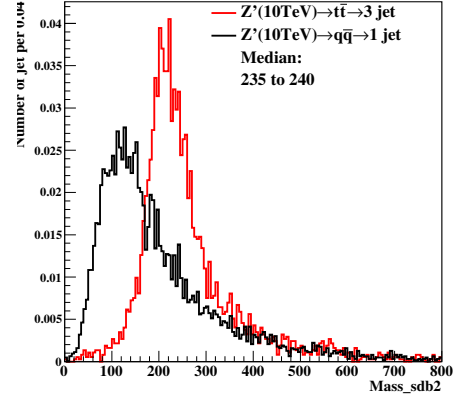
(a) 5TeV at 20×20(cm×cm) in cluster



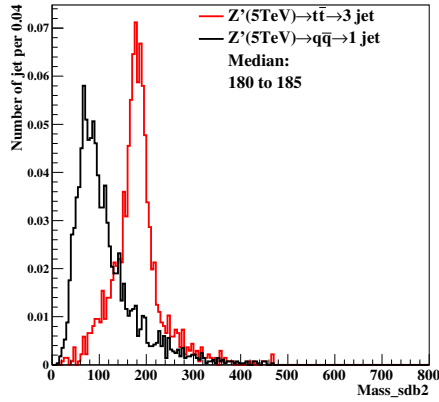
(b) 10TeV at 20×20(cm×cm) in cluster



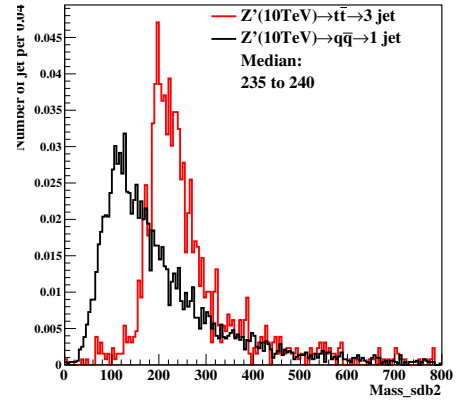
(c) 5TeV at 5×5(cm×cm) in cluster



(d) 10TeV at 5×5(cm×cm) in cluster

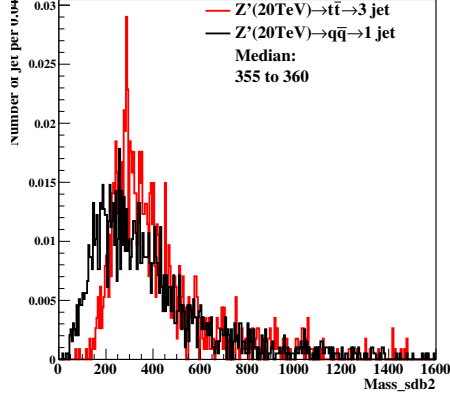


(e) 5TeV at 1×1(cm×cm) in cluster

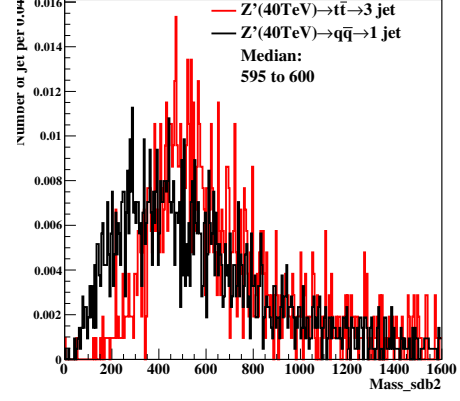


(f) 10TeV at 1×1(cm×cm) in cluster

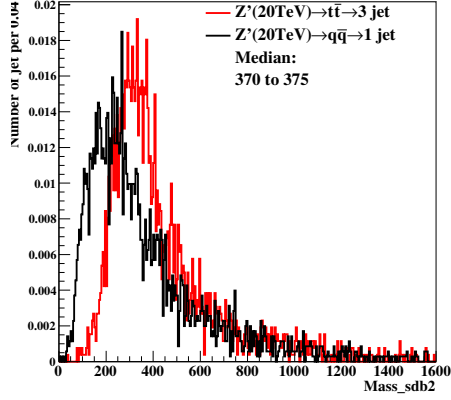
Figure 14: Distributions of mass soft drop at $\beta=2$, signal= tt , in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



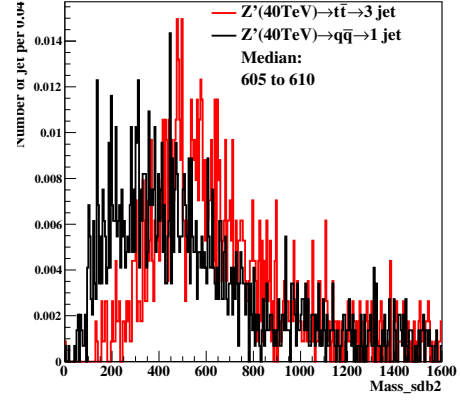
(a) 20TeV at 20×20(cm×cm) in cluster



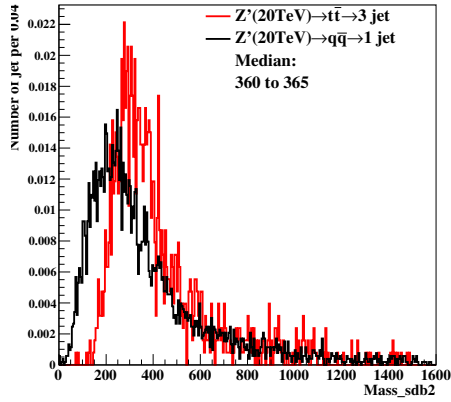
(b) 40TeV at 20×20(cm×cm) in cluster



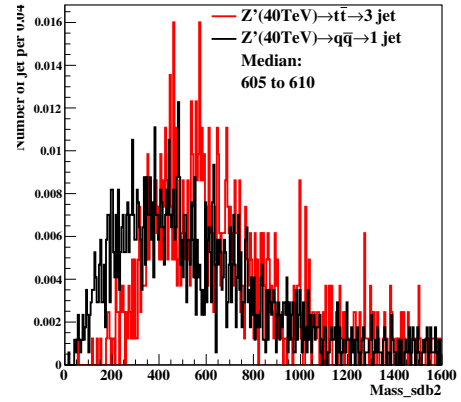
(c) 20TeV at 5×5(cm×cm) in cluster



(d) 40TeV at 5×5(cm×cm) in cluster

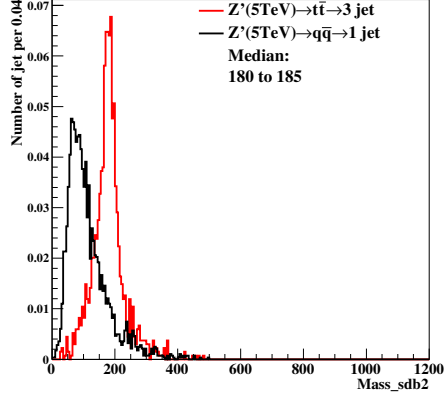


(e) 20TeV at 1×1(cm×cm) in cluster

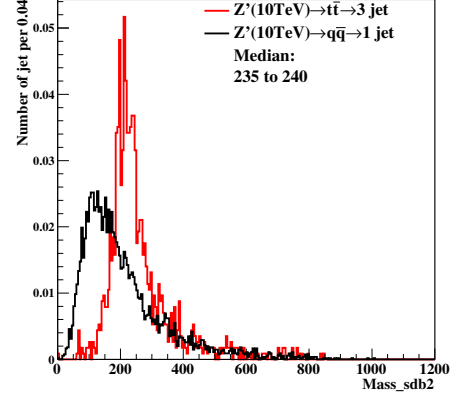


(f) 40TeV at 1×1(cm×cm) in cluster

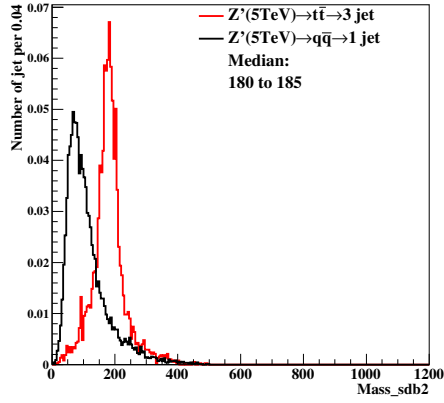
Figure 15: Distributions of mass soft drop at $\beta=2$, signal= $t\bar{t}$, in 20,40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



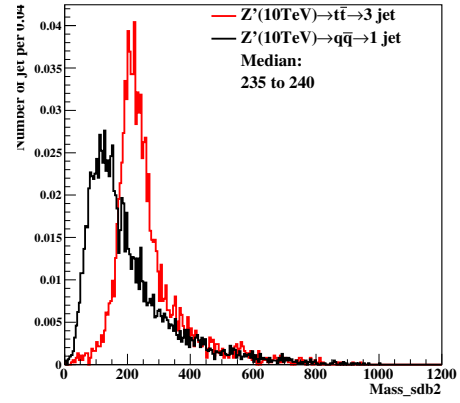
(a) 5TeV at 20×20(cm×cm) in cluster



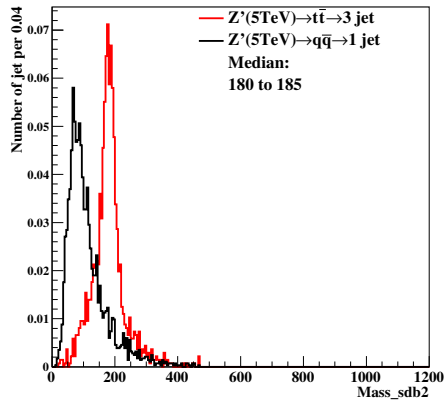
(b) 10TeV at 20×20(cm×cm) in cluster



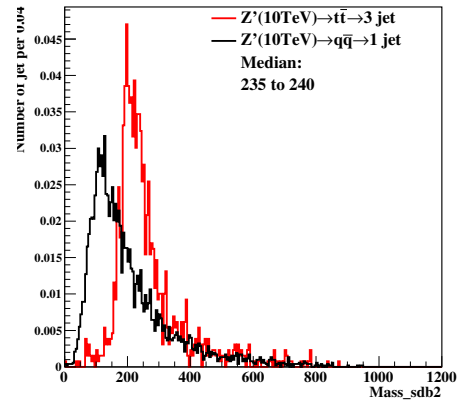
(c) 5TeV at 5×5(cm×cm) in cluster



(d) 10TeV at 5×5(cm×cm) in cluster

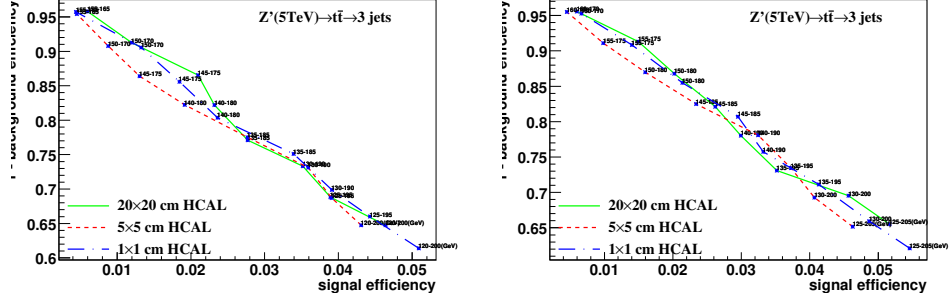


(e) 5TeV at 1×1(cm×cm) in cluster

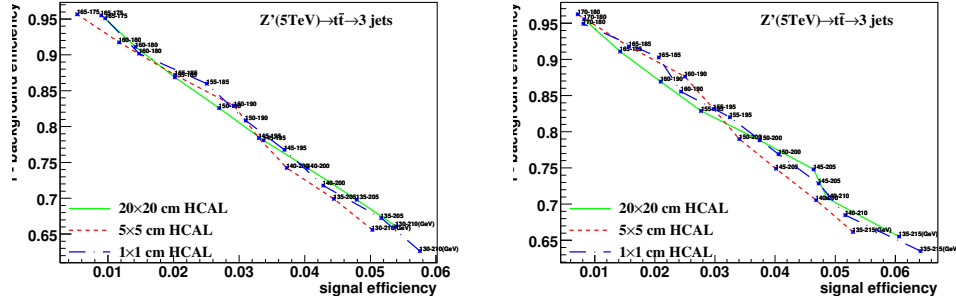


(f) 10TeV at 1×1(cm×cm) in cluster

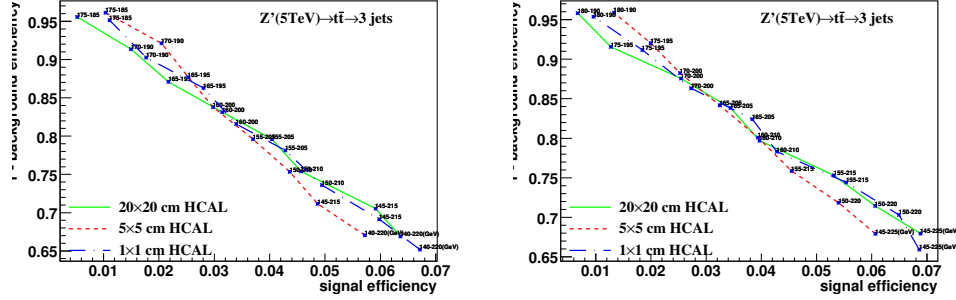
Figure 16: Distributions of mass soft drop at $\beta=2$, signal= tt , in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



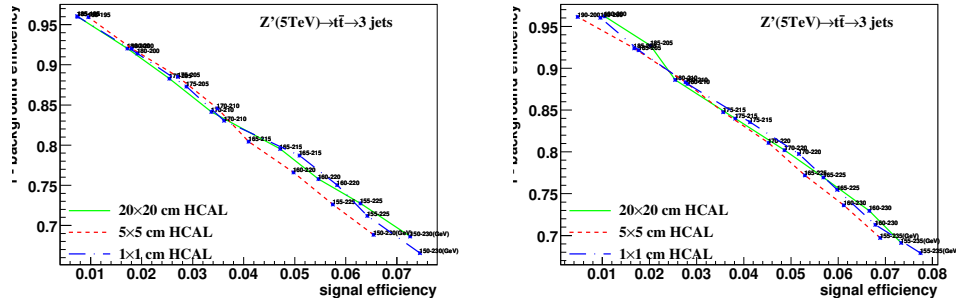
(a) Central at 160TeV change width in cluster (b) Central at 165TeV change width in cluster



(c) Central at 170TeV change width in cluster (d) Central at 175TeV change width in cluster

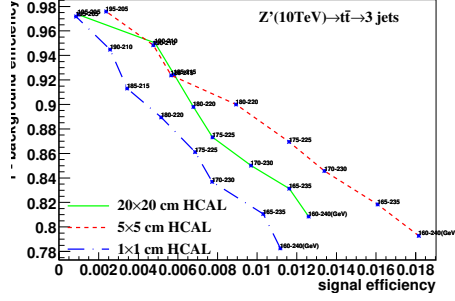


(e) Central at 180TeV change width in cluster (f) Central at 185TeV change width in cluster

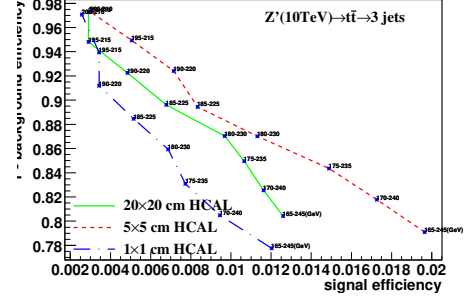


(g) Central at 190TeV change width in cluster (h) Central at 195TeV change width in cluster

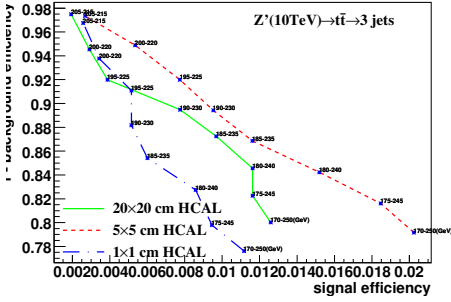
Figure 17: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=tt, in 5TeV energy of collision in different detector sizes. Cell Size in 20×20 , 5×5 , and 1×1 (cm \times cm) are shown in each picture.



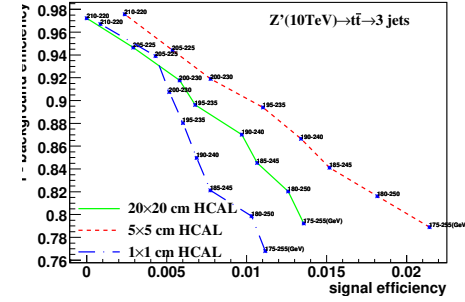
(a) Central at 200TeV change width in cluster



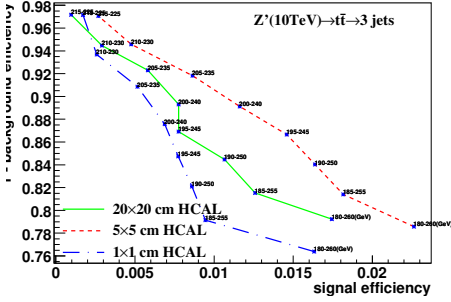
(b) Central at 205TeV change width in cluster



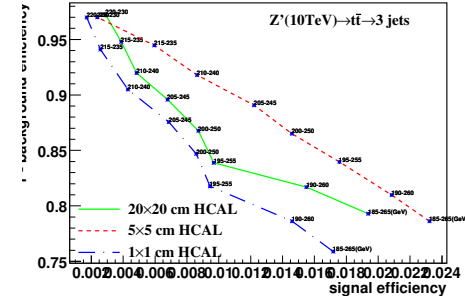
(c) Central at 210TeV change width in cluster



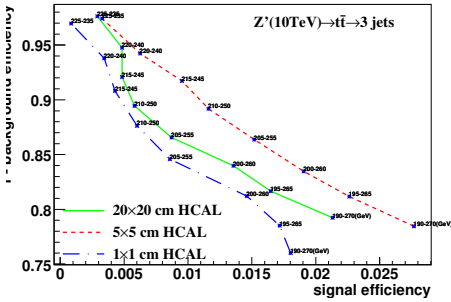
(d) Central at 215TeV change width in cluster



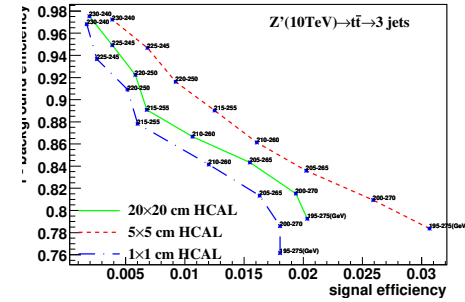
(e) Central at 220TeV change width in cluster



(f) Central at 225TeV change width in cluster

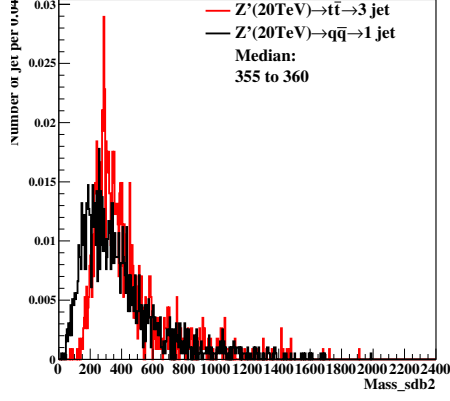


(g) Central at 230TeV change width in cluster

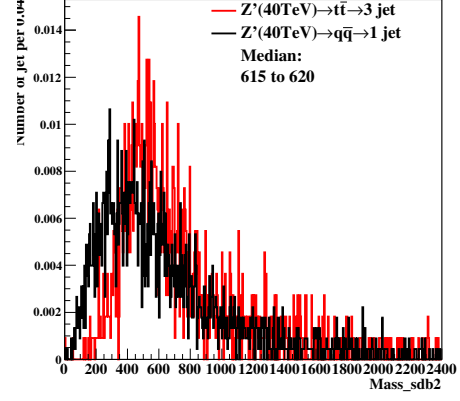


(h) Central at 235TeV change width in cluster

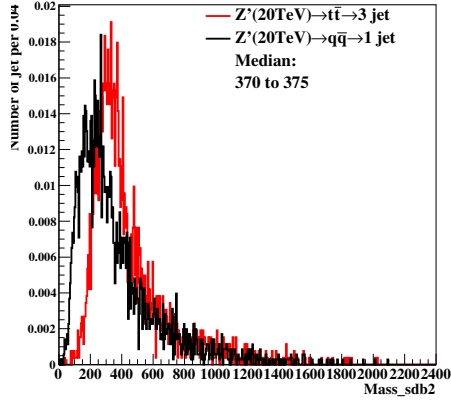
Figure 18: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=tt, in 10TeV energy of collision in different detector sizes. Cell Size in 20x20, 5x5, and 1x1(cm x cm) are shown in each picture.



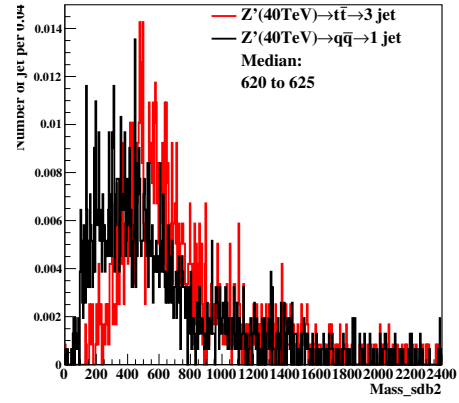
(a) 20TeV at 20×20(cm×cm) in cluster



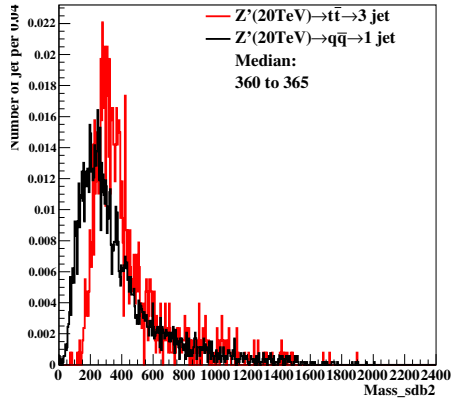
(b) 40TeV at 20×20(cm×cm) in cluster



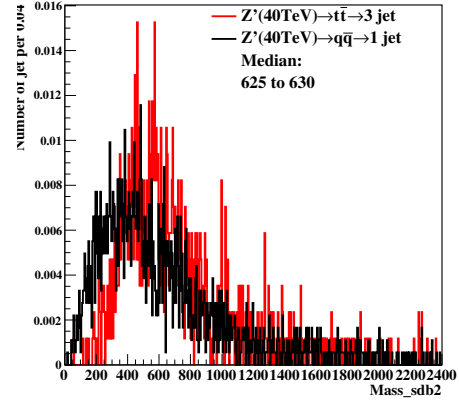
(c) 20TeV at 5×5(cm×cm) in cluster



(d) 40TeV at 5×5(cm×cm) in cluster

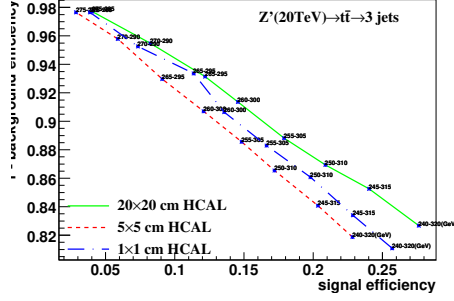


(e) 20TeV at 1×1(cm×cm) in cluster

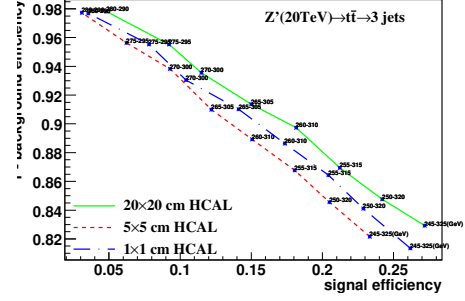


(f) 40TeV at 1×1(cm×cm) in cluster

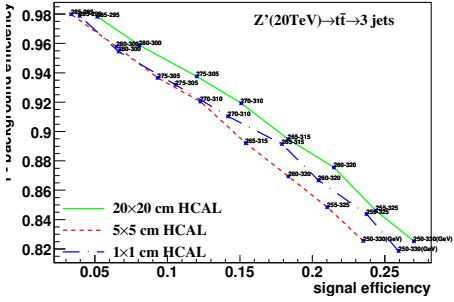
Figure 19: Distributions of mass soft drop at $\beta=2$, signal= $t\bar{t}$, in 20,40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



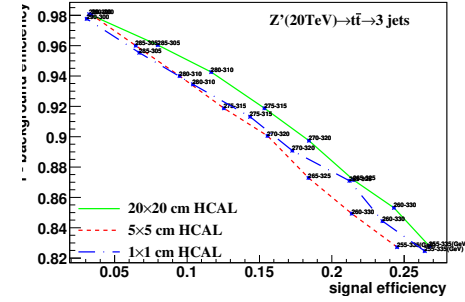
(a) Central at 280TeV change width in cluster



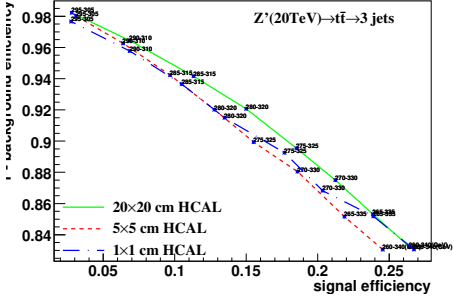
(b) Central at 285TeV change width in cluster



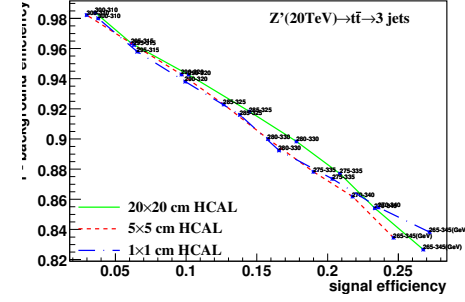
(c) Central at 290TeV change width in cluster



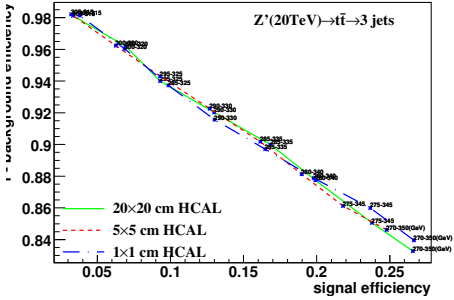
(d) Central at 295TeV change width in cluster



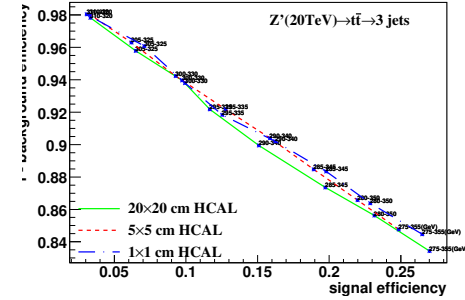
(e) Central at 300TeV change width in cluster



(f) Central at 305TeV change width in cluster

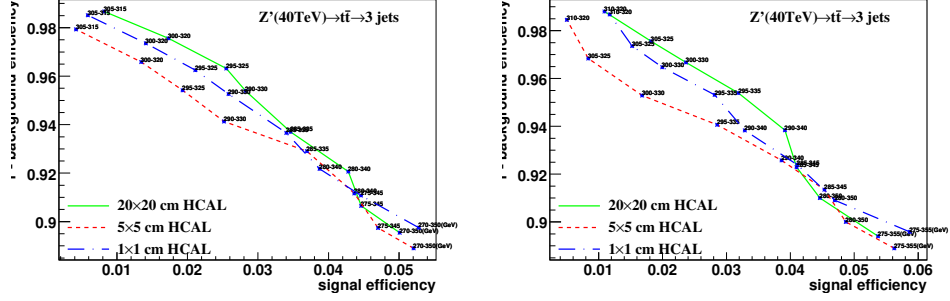


(g) Central at 310TeV change width in cluster

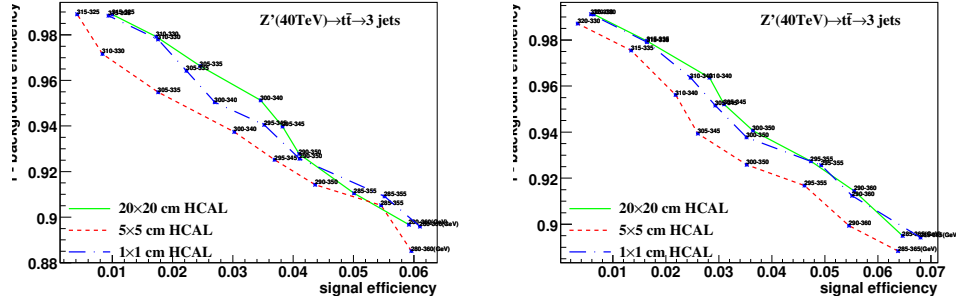


(h) Central at 315TeV change width in cluster

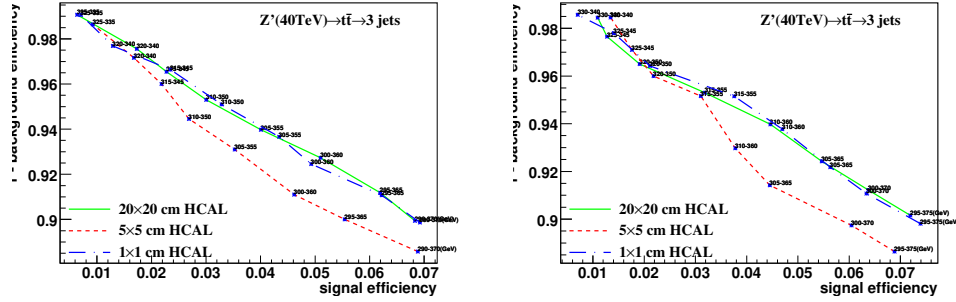
Figure 20: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=tt, in 20TeV energy of collision in different detector sizes. Cell Size in 20×20 , 5×5 , and 1×1 (cm \times cm) are shown in each picture.



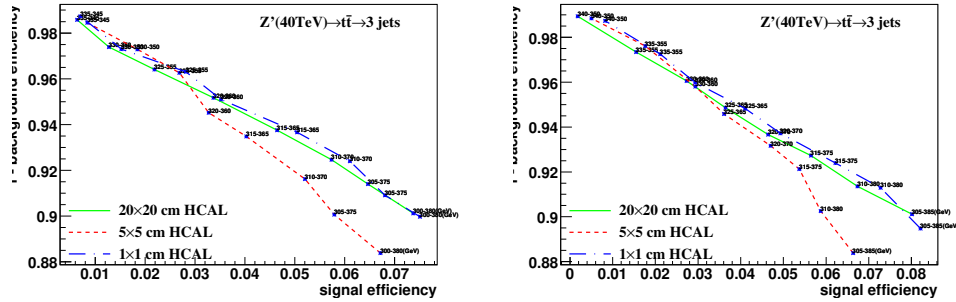
(a) Central at 310TeV change width in clus- (b) Central at 315TeV change width in cluster
ter



(c) Central at 320TeV change width in cluster (d) Central at 325TeV change width in cluster



(e) Central at 330TeV change width in cluster (f) Central at 335TeV change width in cluster



(g) Central at 340TeV change width in cluster (h) Central at 345TeV change width in cluster

Figure 21: study of "fix central and change width" in mass soft drop at $\beta=2$, signal=tt, in 40TeV energy of collision in different detector sizes. Cell Size in 20×20 , 5×5 , and 1×1 (cm \times cm) are shown in each picture.