1. Soft drop mass in future collider performance

In this section, we use the specific method about the soft-drop to study the performance of the detector in the different detector cell sizes in different center-of-mass(c.m.) energy. In the Figure , , , , are the distribution of the signal and background.

2. The theory of Soft drop

Soft-drop, take literally, is the technique that can drop the soft mass which is smaller than set threshold. The formula is as following:

$$\frac{min(PT_1, PT_2)}{PT_1 + PT_2} > Z_{cut}(\frac{\Delta R_{12}}{R_0}^{\beta}) \tag{1}$$

PT_1,PT_2 are the subjets when jets are declustered. Z_{cut} is soft drop threshold. ΔR_{12} are the subjets distance in the rapidity-azimuth plane. β is the exponent angular.

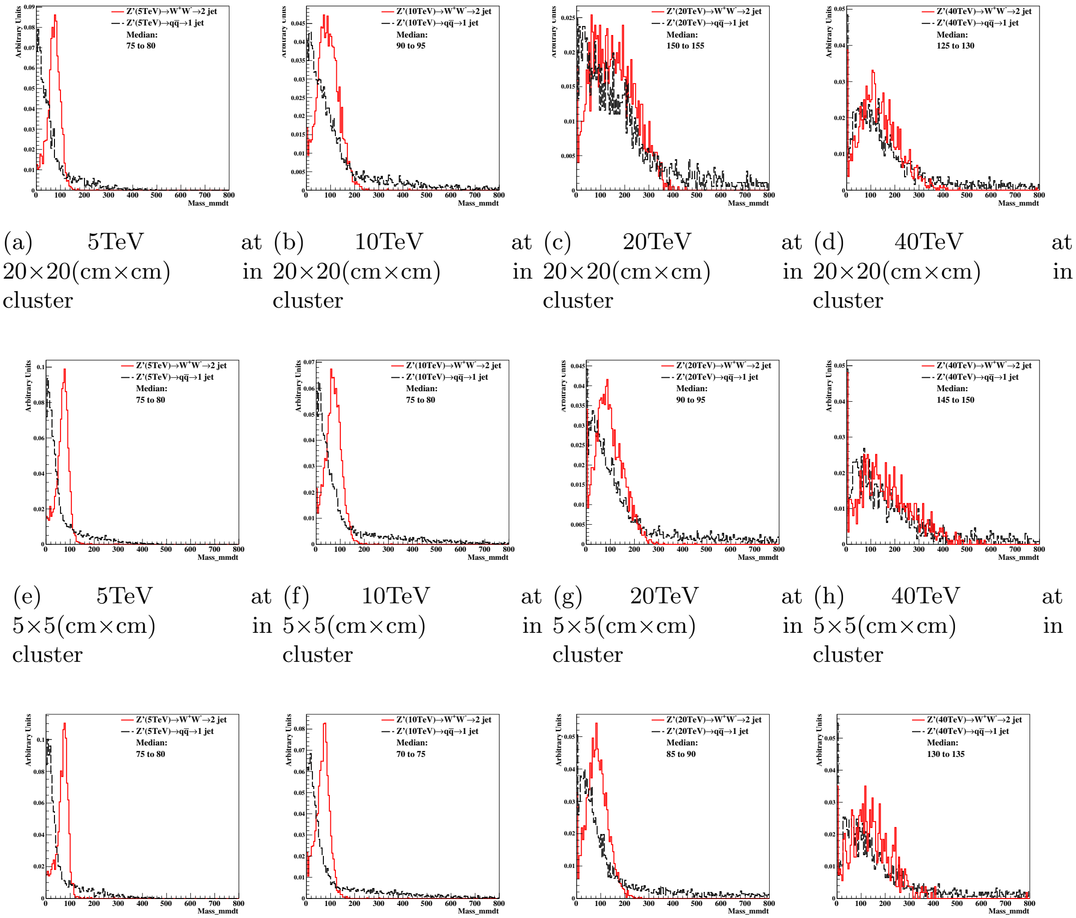
1. First, using the Anti-kt algorithm to reconstruct particles as many jets.
2. Second, starting our soft-drop task. Using the Cambridge-Aachen (C/A) algorithm to decluster the jets to the last step. Two subjets will emerge.
3. Third, comparing this two subjets in the formula **??**, if they pass, the original jets will be conserved. Nonetheless, removing the soft subjet, and using the bigger one to represent the original jet.
4. In the end, when the jets can't decluster to the subjets, it is done.

By using a different β value, the effect of selecting jets is different. In our study, we use $\beta = 0$ and $\beta = 2$. For $\beta = 0$, the selection only depends on the Z_{cut}. For $\beta = 2$, the selection depends on the angle of subjets and Z_{cut}, and it can remove both "soft" and "wid

2.1. Analysis method

In this analysis, We fix the central at the median bin right boundary in signal distribution, and using the different width to draw ROC curves.

2.2. The conclusion of the results



(a) 5TeV at in 20×20(cm×cm) cluster

(b) 10TeV at in 20×20(cm×cm) cluster

(c) 20TeV at in 20×20(cm×cm) cluster

(d) 40TeV at in 20×20(cm×cm) cluster

(e) 5TeV at in 5×5(cm×cm) cluster

(f) 10TeV at in 5×5(cm×cm) cluster

(g) 20TeV at in 5×5(cm×cm) cluster

(h) 40TeV at in 5×5(cm×cm) cluster

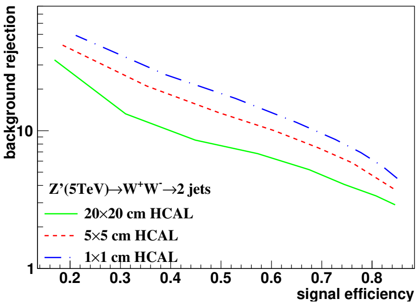
(i) 5TeV at in 1×1(cm×cm) cluster

(j) 10TeV at in 1×1(cm×cm) cluster

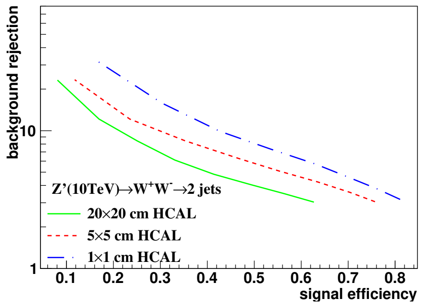
(k) 20TeV at in 1×1(cm×cm) cluster

(l) 40TeV at in 1×1(cm×cm) cluster

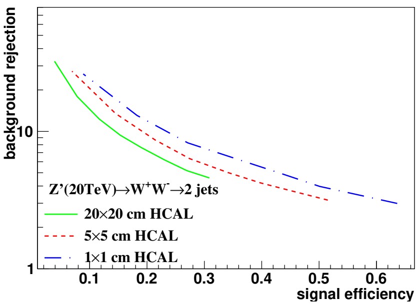
Figure 1: Distributions of mass soft drop at β=0, signal=ww, in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



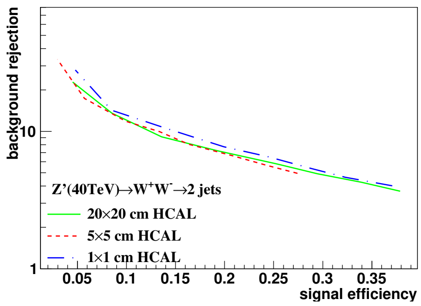
(a) Central at Median(20×20=80,5×5=80,1× 1=80) change width in cluster at 5TeV



(b) Central at Median(20×20=95,5×5=80,1× 1=75) change width in cluster at 10TeV

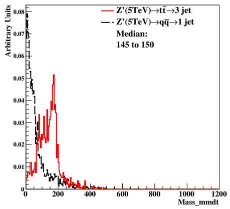


(c) Central at Median(20 × 20=155,5 × 5=95,1 × 1=90) change width in cluster at 20TeV

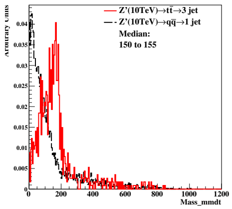


(d) Central at Median(20 × 20=130,5 × 5=150,1 × 1=135) change width in cluster at 40TeV

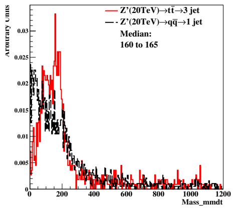
Figure 2: study of "fix central and change width" in mass soft drop at β=0, signal=ww, in 5, 10, 20, 40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown in each picture.



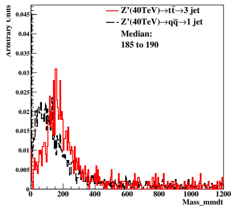
(a) 5TeV at 20×20(cm×cm) in cluster



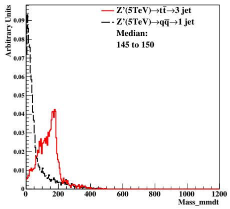
(b) 10TeV at 20×20(cm×cm) in cluster



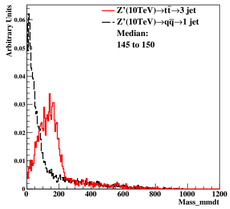
(c) 20TeV at 5×5(cm×cm) in cluster



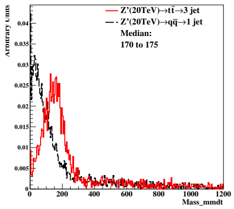
(d) 40TeV at 5×5(cm×cm) in cluster



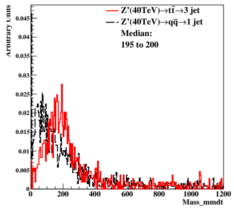
(e) 5TeV at 1×1(cm×cm) in cluster



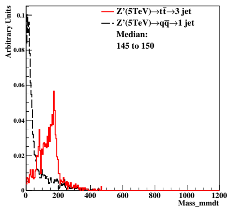
(f) 10TeV at 1×1(cm×cm) in cluster



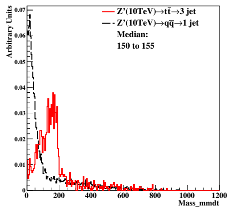
(g) 20TeV at 20×20(cm×cm) in cluster



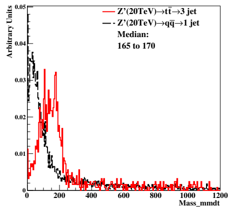
(h) 40TeV at 20×20(cm×cm) in cluster



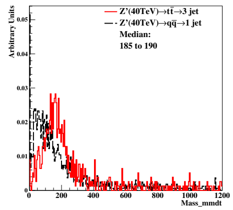
(i) 5TeV at 5×5(cm×cm) in cluster



(j) 10TeV at 5×5(cm×cm) in cluster

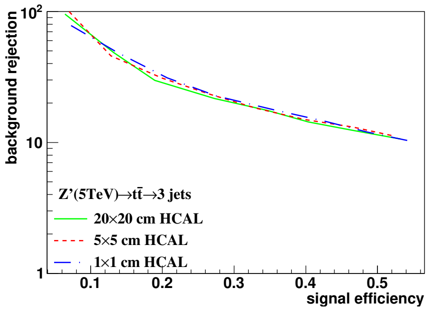


(k) 20TeV at 1×1(cm×cm) in cluster

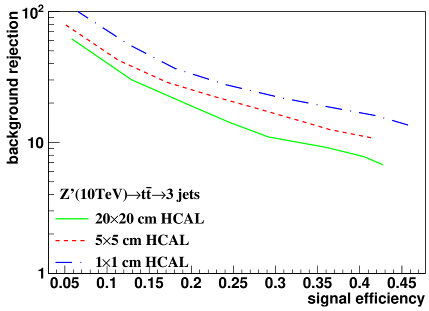


(l) 40TeV at 1×1(cm×cm) in cluster

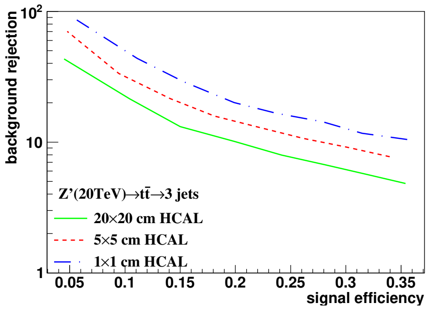
Figure 3: Distributions of mass soft drop at β=0, signal=tt, in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



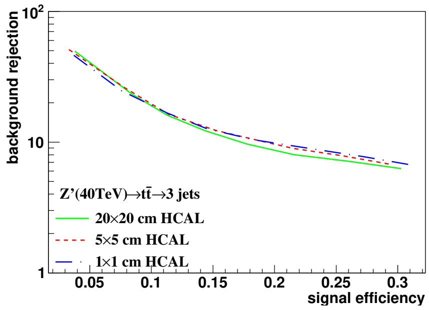
(a) Central at Median(20 × 20=150,5 × 5=150,1 × 1=150) change width in cluster at 5TeV



(b) Central at Median(20 × 20=155,5 × 5=150,1 × 1=155) change width in cluster at 10TeV

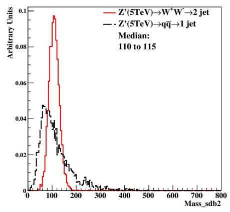


(c) Central at Median(20 × 20=165,5 × 5=175,1 × 1=170) change width in cluster at 20TeV

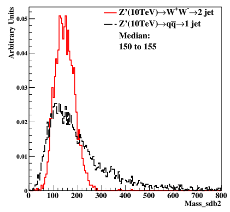


(d) Central at Median(20 × 20=190,5 × 5=200,1 × 1=190) change width in cluster at 40TeV

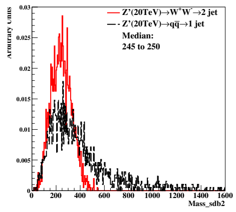
Figure 4: study of "fix central and change width" in mass soft drop at β=0, signal=tt, in 5, 10, 20, 40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown in each picture.



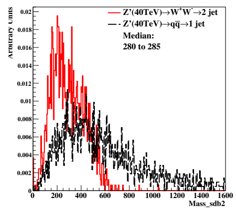
(a) 5TeV at 20×20(cm×cm) in cluster



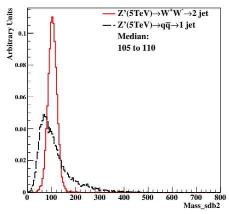
(b) 10TeV at 20×20(cm×cm) in cluster



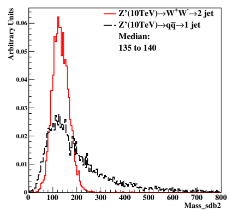
(c) 20TeV at 20×20(cm×cm) in cluster



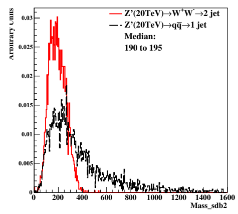
(d) 40TeV at 20×20(cm×cm) in cluster



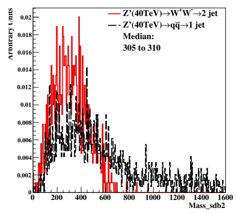
(e) 5TeV at 5×5(cm×cm) in cluster



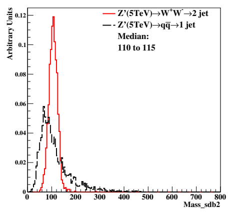
(f) 10TeV at 5×5(cm×cm) in cluster



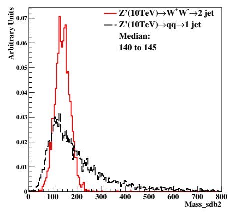
(g) 20TeV at 5×5(cm×cm) in cluster



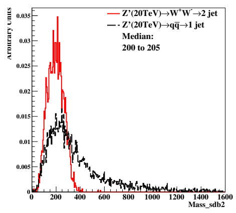
(h) 40TeV at 5×5(cm×cm) in cluster



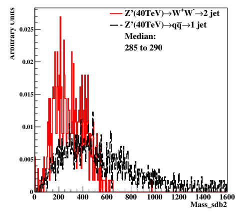
(i) 5TeV at 1×1(cm×cm) in cluster



(j) 10TeV at 1×1(cm×cm) in cluster

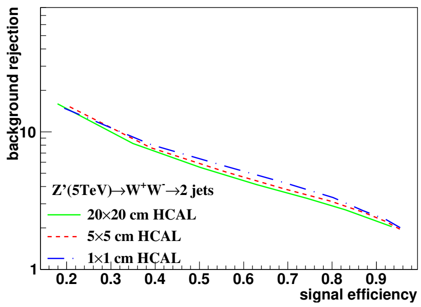


(k) 20TeV at 1×1(cm×cm) in cluster

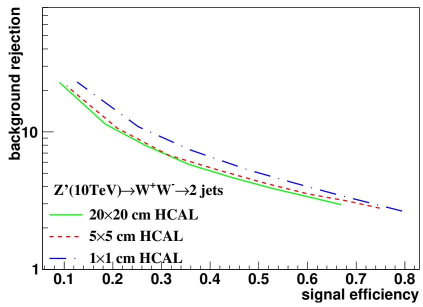


(l) 40TeV at 1×1(cm×cm) in cluster

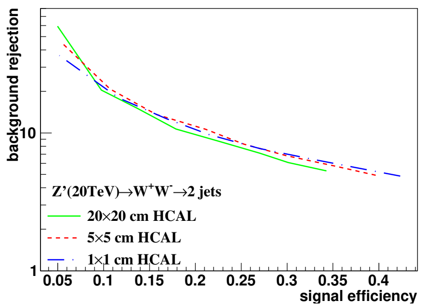
Figure 5: Distributions of mass soft drop at β=2, signal=ww, in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



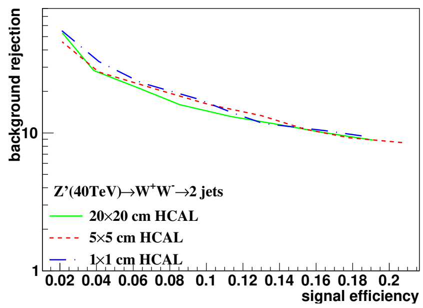
(a) Central at Median(20 × 20=115,5 × 5=110,1 × 1=115) change width in cluster at 5TeV



(b) Central at Median(20 × 20=155,5 × 5=140,1 × 1=145) change width in cluster at 10TeV

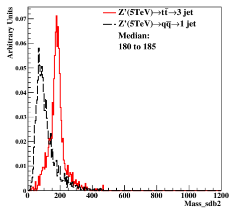


(c) Central at Median(20 × 20=250,5 × 5=195,1 × 1=205) change width in cluster at 20TeV

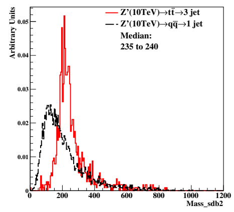


(d) Central at Median(20 × 20=285,5 × 5=310,1 × 1=290) change width in cluster at 40TeV

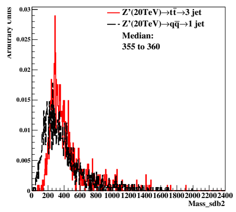
Figure 6: study of "fix central and change width" in mass soft drop at β=2, signal=ww, in 5, 10, 20, 40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown in each picture.



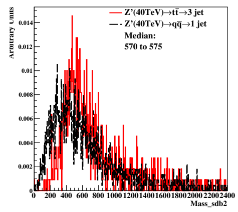
(a) 5TeV at 20×20(cm×cm) in cluster



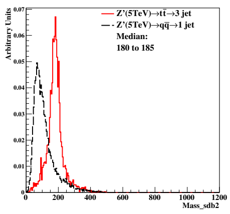
(b) 10TeV at 20×20(cm×cm) in cluster



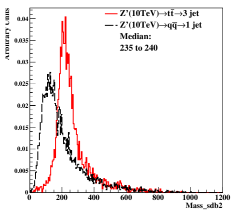
(c) 20TeV at 20×20(cm×cm) in cluster



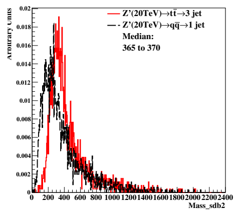
(d) 40TeV at 20×20(cm×cm) in cluster



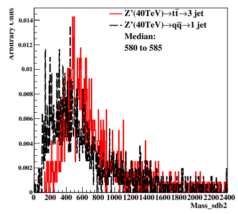
(e) 5TeV at 5×5(cm×cm) in cluster



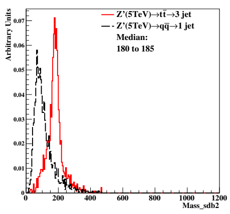
(f) 10TeV at 5×5(cm×cm) in cluster



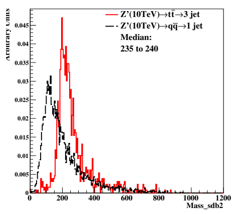
(g) 20TeV at 5×5(cm×cm) in cluster



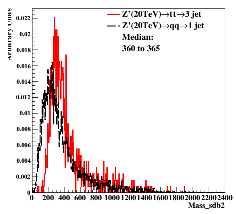
(h) 40TeV at 5×5(cm×cm) in cluster



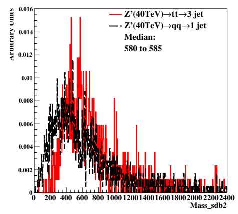
(i) 5TeV at 1×1(cm×cm) in cluster



(j) 10TeV at 1×1(cm×cm) in cluster

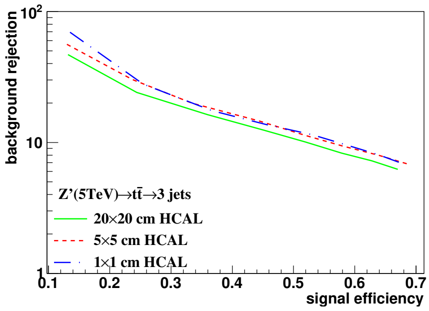


(k) 20TeV at 1×1(cm×cm) in cluster

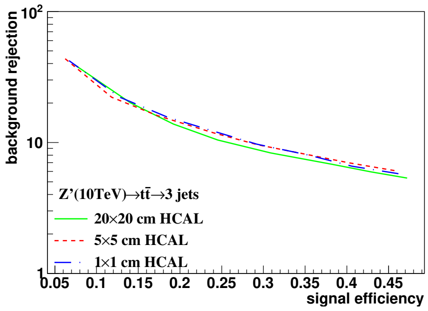


(l) 40TeV at 1×1(cm×cm) in cluster

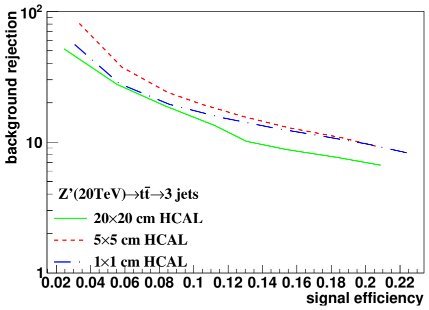
Figure 7: Distributions of mass soft drop at β=2, signal=tt, in 5,10TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown here.



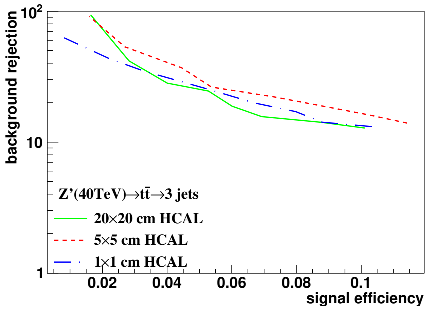
(a) Central at Median(20 × 20=185,5 × 5=185,1 × 1=185) change width in cluster at 5TeV



(b) Central at Median(20 × 20=240,5 × 5=240,1 × 1=240) change width in cluster at 10TeV



(c) Central at Median(20 × 20=360,5 × 5=375,1 × 1=365) change width in cluster at 20TeV



(d) Central at Median(20 × 20=620,5 × 5=625,1 × 1=630) change width in cluster at 40TeV

Figure 8: study of "fix central and change width" in mass soft drop at β=2, signal=tt, in 5, 10, 20, 40TeV energy of collision in different detector sizes. Cell Size in 20×20, 5×5, and 1×1(cm×cm) are shown in each picture.