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MBP

Binned Model Generation and Tweaking in MBP

Application Note

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Binned Model Generation and Tweaking in MBP

Application Note

This application note describes how to generate and tweak binned models in Model Builder Program (MBP).
Note: This document was originally released for MBP V2011.1.0 in July 2011.

Introduction

With process variation or when there is a requirement to fit a specific target, "tweaking" is generally used as a fast way to achieve the corresponding models. For a binned model, the modeling engineer should always pay attention to ensure continuity is kept from bin-to-bin. MBP features an integrated binning tweak capability to meet this need.

In this document, we introduce the steps required to generate and tweak binned models. For more information go to www.agilent.com/find/eesof or contact your local Agilent office. The complete list is available at: www.agilent.com/find/contactus.

Generate Binned Models

First we introduce how to generate binned models from point models. After all the point models are ready, the user can generate the corresponding binned model. To begin, choose *Utilities* -> *Binning* from the main menu, and then click the *Load Point Model* button to load the point models. As shown in Figure 1, a total of 16 point models are loaded.

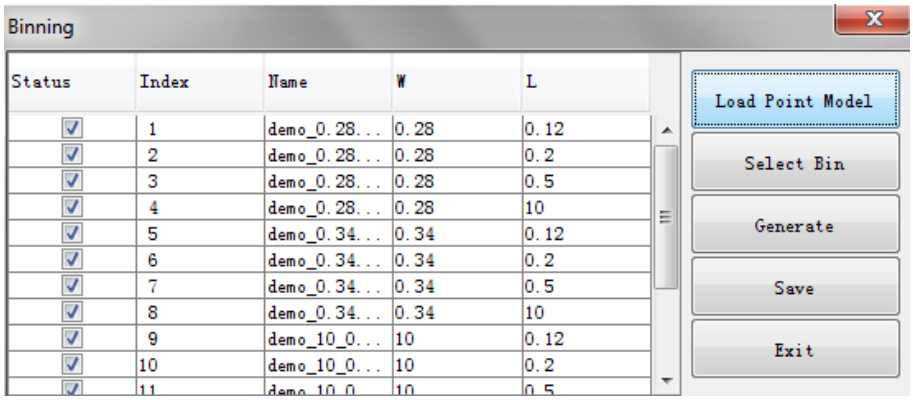

Figure1. Load point model

Binning region selection is done in a geometry plane. Click *Select Bin* and the graphical bin selection window will pop up. Press and hold *Ctrl*, then use the cursor to select the bin region. The user can also click *Auto* to generate the bins automatically. In the example, the 16 devices are divided into nine bins, as shown in Figure 2.

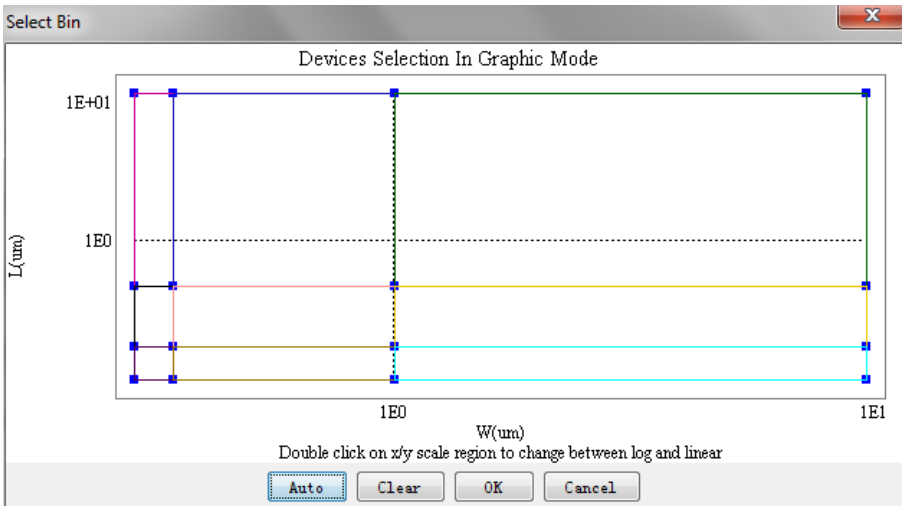

Figure2. Select bin

After the bin selection is done, click *Generate*. The dialog window shown in Figure 3 will pop up and the user must type in the bin model name. The user then has the option to expand the bin boundary by checking the "*Extend Boundary*" box and inputting the ratio value. For example, after checking "*Extend Boundary*" and setting the ratio at 0.01, "LMax" will become 1.01E-5 from 1E-5. "WMax" also becomes 1.01E-5 from 1E-5.

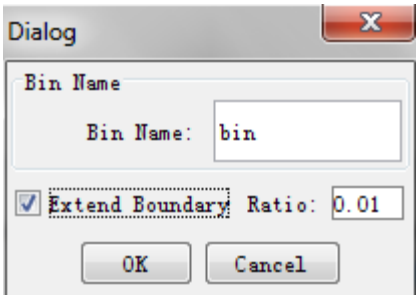

Figure3. Generate binned model

Press the *Save* button to store the generated binned model.

Three Options Regarding Binned Model

Load the binned model just created. Right click to open a new window as shown in Figure4. The user has three options:

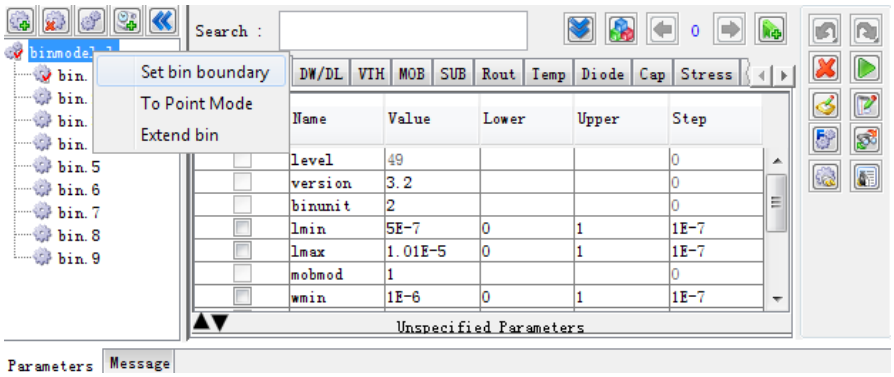

Figure4. Three binned model options

1. Set bin boundary

For a binned model, the user often extends the maximum channel width and length a little to verify that the simulation of the WMax/LMax device is correct. For example, given the setting shown in Figure 5, the model is extracted from WMax/ LMax=10μm/10μm device. However, in the final binned model, the user will obtain a bin boundary of WMax/LMax =10.1μm/10.1μm.

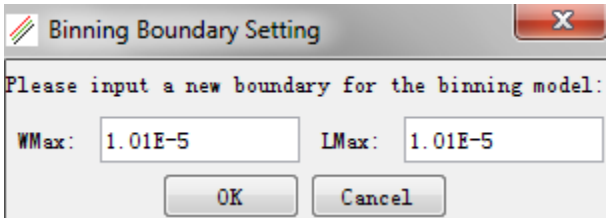

Figure 5. Set binning boundary

2. To point mode

Convert the loaded bin models to point models. The newly generated point models are to the right of the original bin boundary points. After this operation, you can tune the bin boundary point models directly to meet the target. Finally, right click and select *Back to Binning* (Figure 6).

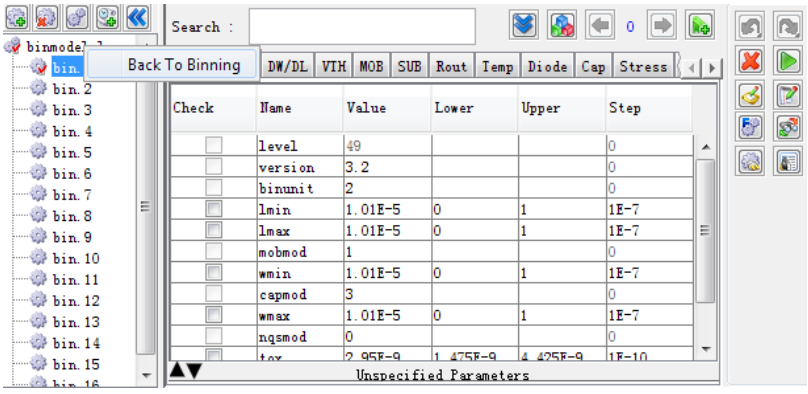

Figure6. Back to binning

3. Extend bin

In the “Extend Bin” dialog window, shown in Figure 7, you can re-scale the bin region or generate a binned

model that incorporates all of the target devices, including the new insertion points, bin boundary point devices.

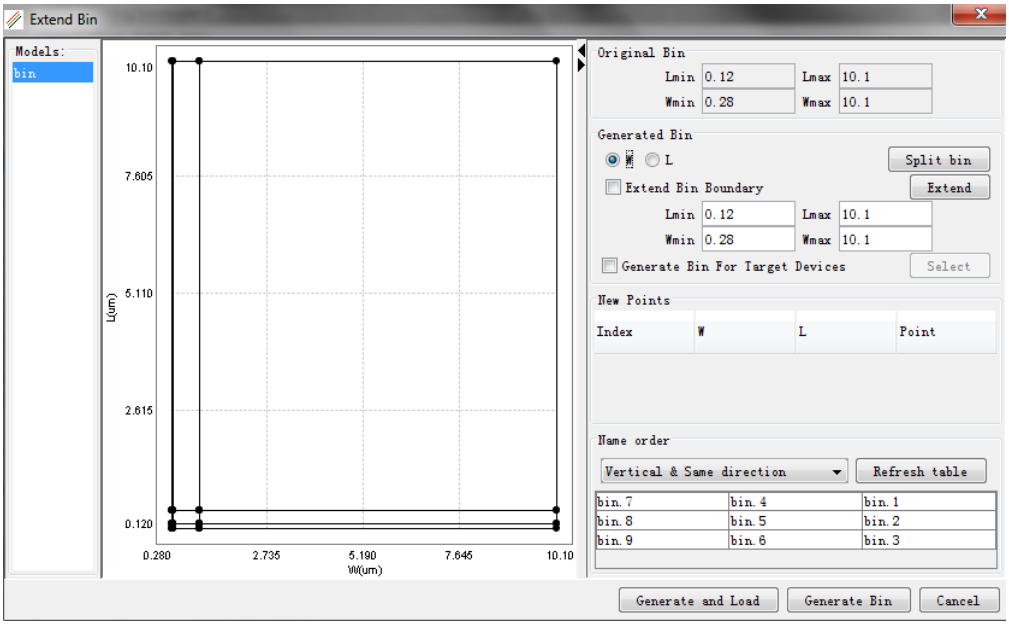

Figure7. Extend bin

Tweak Binned Models

Besides the method of re-extracting the point models and re-generating the binned model, MBP allows you to directly tweak binned models. With this method, you can tweak binned models much like they would tune global models.

To implement this model in MBP choose *Extraction -> Model Tweaking*. The window shown in Figure 8 will pop up.

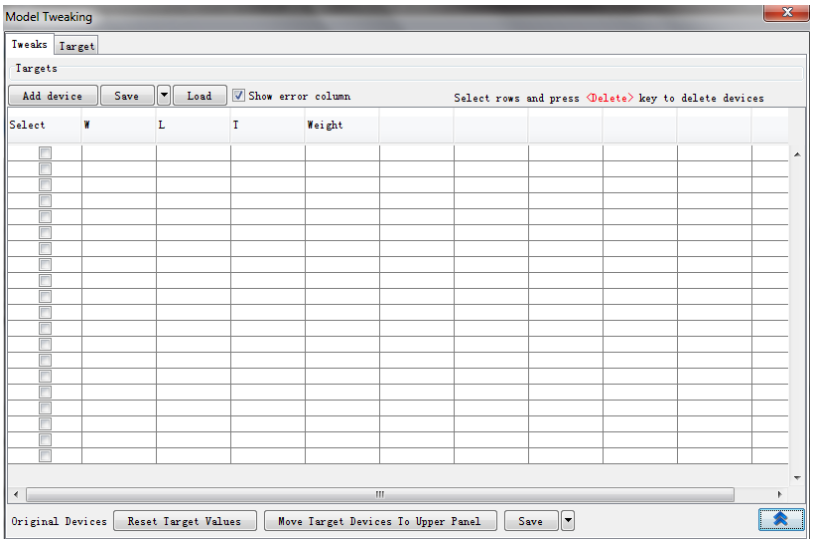

Figure8. Model tweaking window

Click the "*Target*" tab in the window, as shown in Figure 9. Then:

1. Click to add a tweaking target.
2. Assign a name to this target, "vth" for example.
3. Choose one built-in algorithm (to achieve the above target) from the drop-down list. Here "vth_gm" means to calculate the threshold voltage with the maximum transconductance method.
4. Input the bias conditions to perform the algorithm.
5. Click the *Apply* button to confirm.

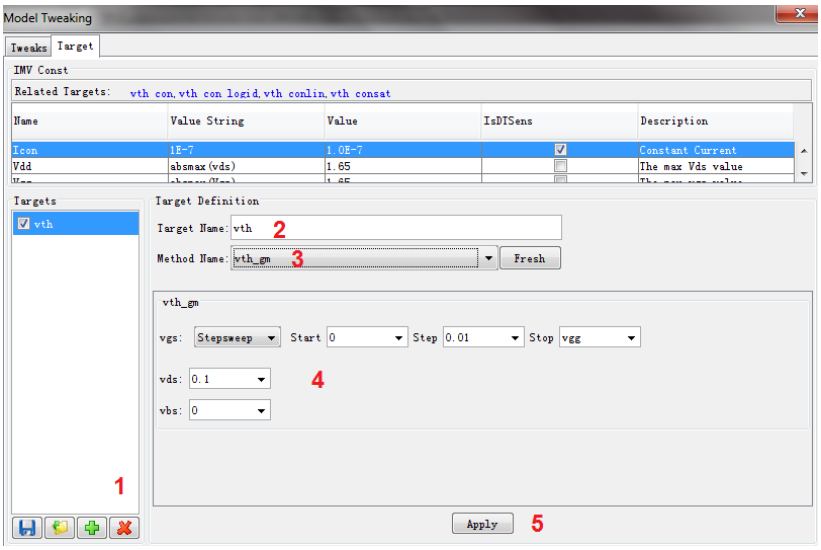

Figure9. Target panel

Next, you can return to the "*Tweaks*" tab. Click the icon to expand the hidden "*Original Devices*" panel. All of the original devices used to generate the binned model are listed in the panel.

Choose the desired target devices by checking the box, and then click the *Move Target Devices to Upper Panel* button. You can also add new target devices by clicking the *Add device* button.

Edit the values of instance parameters (W, L, T, etc.) and set the design targets (e.g., vth_Des), as shown in Figure 10.

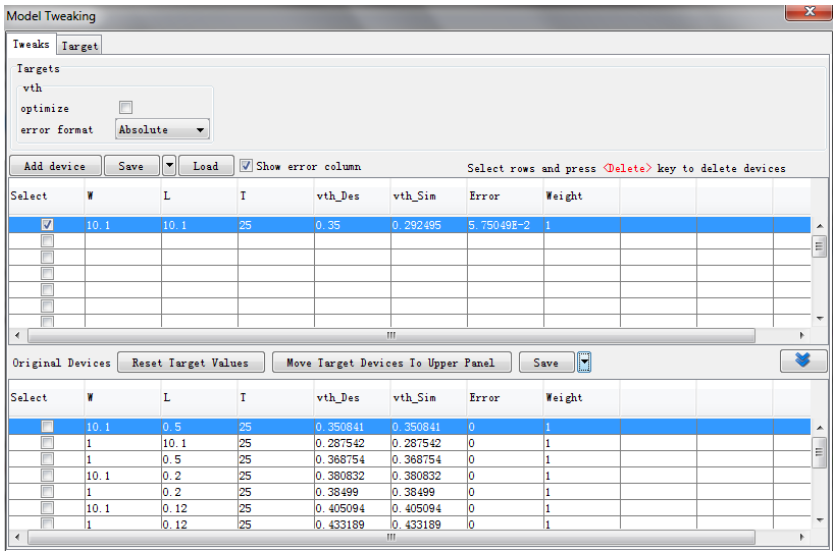

Figure10. Binned model tweaking

Next, determine the bins to be tweaked. Obtain the geometry of the target devices (the devices selected to be optimized) and check which bins contain these devices. These bins are the ones that will be tweaked later.

According to the target values and the bins to be tweaked, you can select the parameters with which to tweak the binned model. In the process of selecting tweaking parameters, you can add, remove and parameterize the non-binable parameters (e.g., tox), bin-core parameters (e.g., vth0) and L/W/P parameters (e.g., lvth0, pvth0 and pvth0).

After selecting the parameters, checking the "*optimize*" box and the "*Select*" items for the target devices (as shown in Figure 11), you can perform automated optimization. Click the "*optimize*" button in the "*Optimization*" window and MBP will invoke the internal optimizer to proceed.

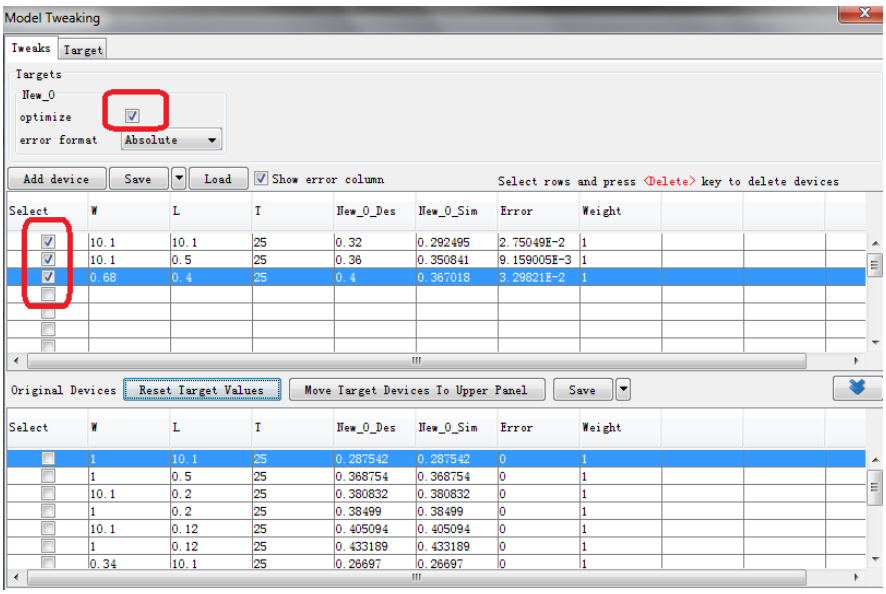

Figure11. Automated optimization

After optimization, you can check if the tweaking binned model meets their requirement. If “Yes,” you can save the newly generated model directly. If “No,” then, you can either manually tune the parameters or change the conditions and re-run the optimization.