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**Agilent Technologies**

**MBP**

**MBP Script**

*Application Manual*

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# Overview

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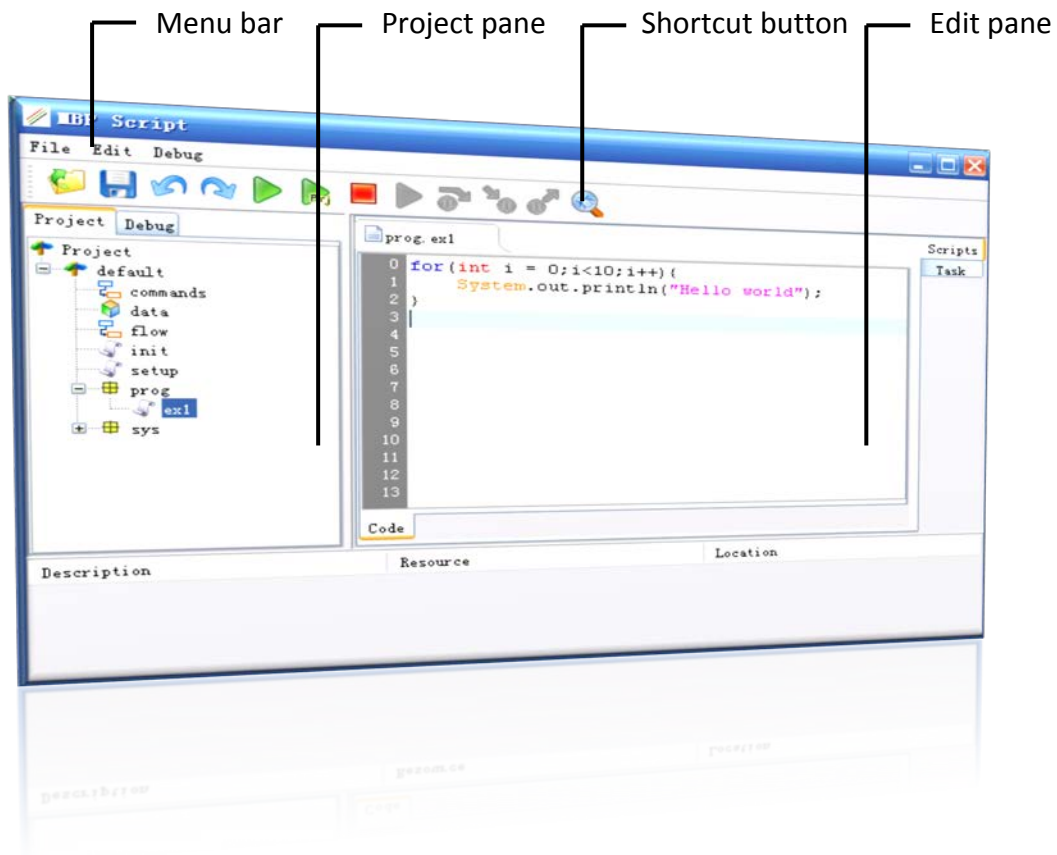
MBP Script is based on Java language, and supports most of the Java expressions (jdk1.4), except class definition. With this script, you can transform data, define plots, do optimization, and build extraction flow.

MBP Script is tied to project. Thus, for any modification and customization, save your MBP project in the beginning. After customization, the MBP script can be reused for other project or shared with others.

This document describes the MBP Script application in detail. For more advanced application, refer to the MBP Script Programming Manual.

# Script Editor

MBP provides an editor for users to create or modify their own script. Click MBP main menu "Script→Script Project" to start the editor.



## Menu Bar

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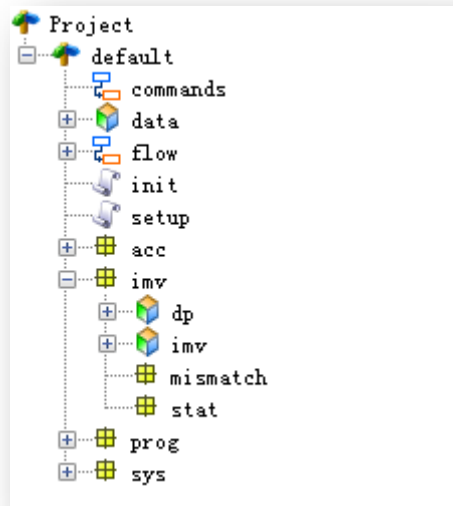
There are three main items in the Menu Bar of script project editor.

- File
  - ✧ Save: Saves current code to current project
- Edit:
  - ✧ Undo: Undoes function for text input.
  - ✧ Redo: Redoes function for text input.
- Debug
  - ✧ Run
  - ✧ Continue
  - ✧ Step Over
  - ✧ Step In
  - ✧ Step Return

## Project pane

Script in MBP is organized by project.

On the left of MBP script project window, the project pane has a hierarchical tree structure. You can create script file for different kinds of usability on different nodes.



Some frequently used usability includes:

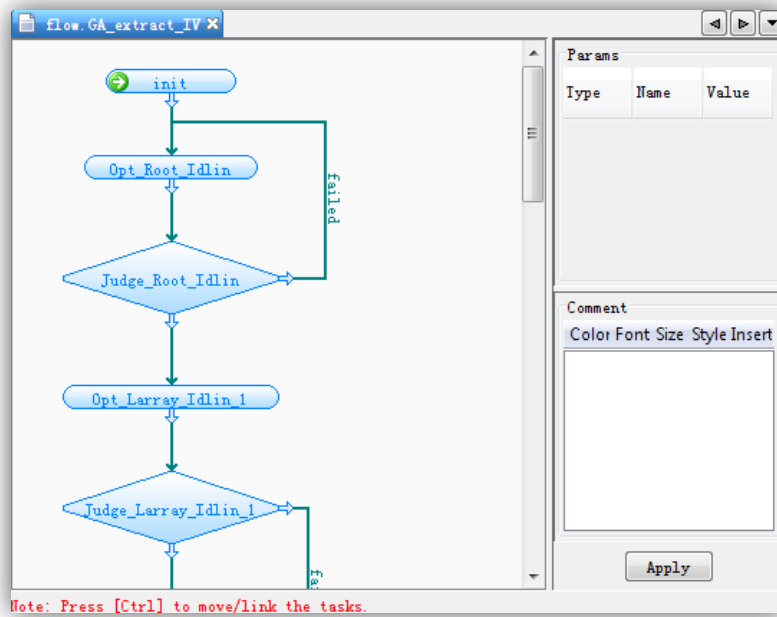
- ✧ Commands: Plots selection and organization in MBP GUI
- ✧ Data: Data manipulation, can be output to GUI or just used in extraction flow
- ✧ Flow: Model extraction flow
- ✧ IMV: Configurations for different targets: DP, IMV Mismatch, or global statistical model.
- ✧ Sys – gui – navigator: To add new navigator in the GUI.



## Edit pane

Edit pane is the main pane for all the modifications. It can be displayed in different styles according to different usability selected. For example, see the following displays in the Edit pane:

Edit pane of extraction flow:



Edit pane of IMV configuration:

The screenshot shows a window titled 'imv.imv.idsat\_id\_vd'. The configuration is as follows:
 

- IMV Type**:
  - ☒ Java Algorithm
  - ☐ Script Algorithm
  - ☐ Expression
  - ☐ Auto Refer
  - ☐ Local Param
  - ☐ Trans to Point
- Page Name**: Ids\_vds\_vgs
- Restrictions**: device, vds=vdd, vgs=absmax(vgs), vbs=absmin(vbs)
- Algorithm Class**: acc/Current
- Attached Targets**: (empty)
- Algorithm Parameters**: ids
- Parameter**: (checkbox) (empty)

 At the bottom, there is a table with two columns: 'Name' and 'Value'.

At the bottom of the window, there are tabs: 'IMV\_PROP' and 'Whole Code'.

All the script code should also be created and entered in the Edit pane.

For more details, refer to the subsequent chapters and MBP Script Programming Manual.

## Application Samples

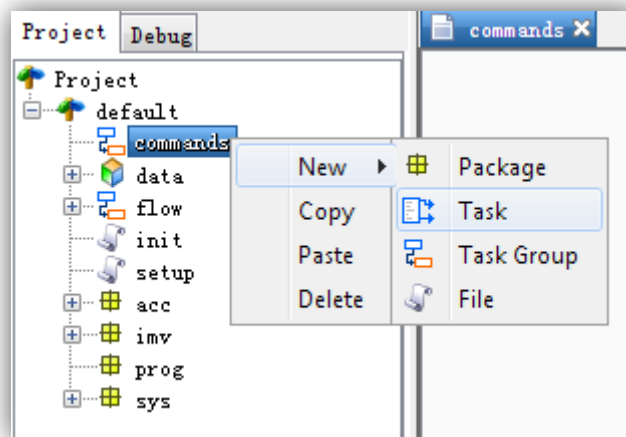
The most frequently used applications with MBP Script will be presented in this chapter.

### Commands

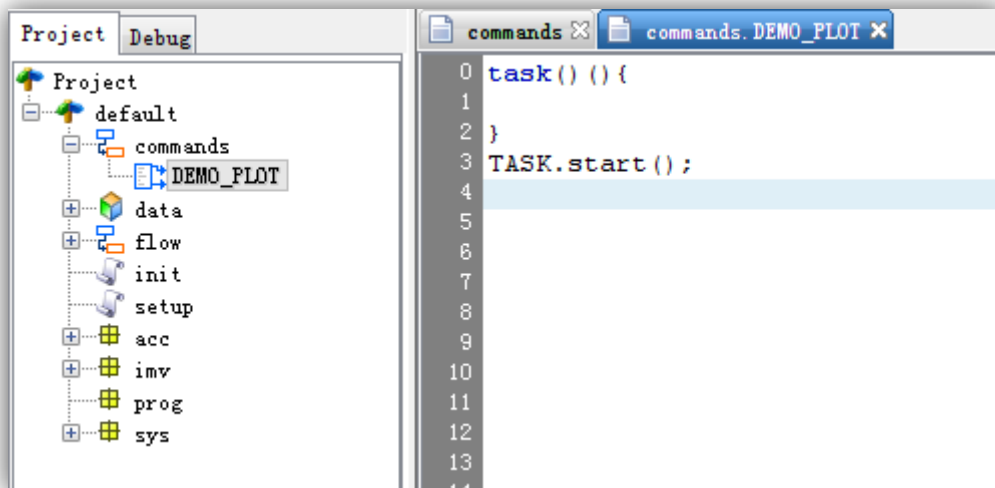
Commands project is designed to select and organize MBP plots by scripting. It can help to standardize the extraction flow (together with parameter group function), or help to easily generate report (together with report function).

To create a new command file to show some selected plots:

1. Right click on **commands** → **New** → **Task**



2. Input the task name and MBP will generate the template.



3. If data is already loaded in MBP, you can define some output plots. Here is an example.

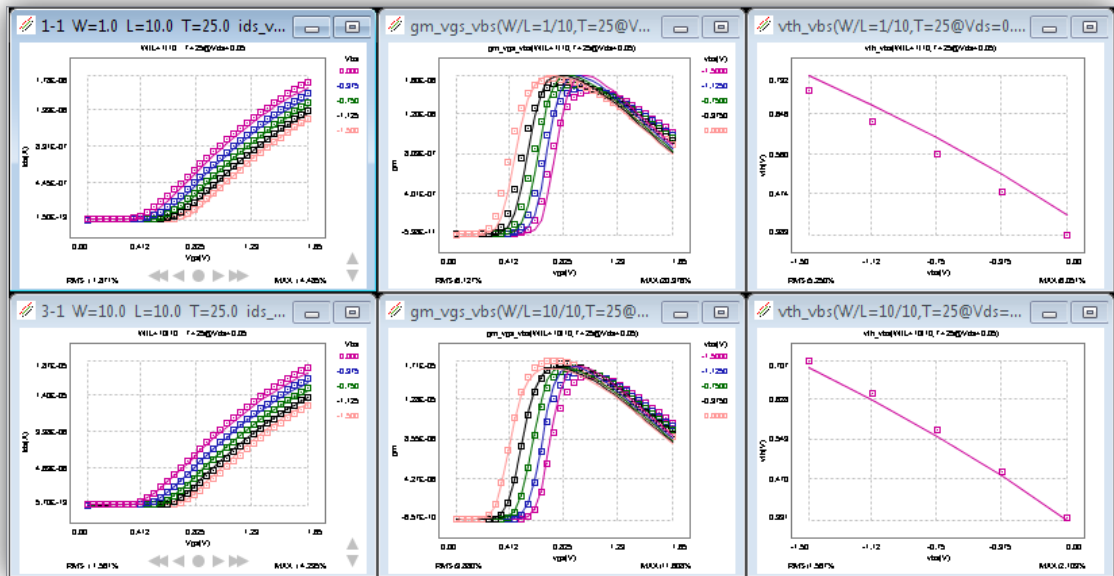
```
task() () {
    cmd.clearPlots();
    cmd.setPlotLayout(2,3);
    show(1.0u,10.0u);
    show(10.0u,10.0u);
}
TASK.start();

void show(double w,double l){
    cmd.plot("ids_vgs_vbs@vds=0.05&&w="+w+"&&l="+l);
    cmd.plot("imv.imv.gm/gds.gm_vgs_vbs@vds=0.05&&w="+w+"&&l="+l);
    cmd.plot("imv.imv.vth.vth_vbs@vds=0.05&&w="+w+"&&l="+l);
}
```

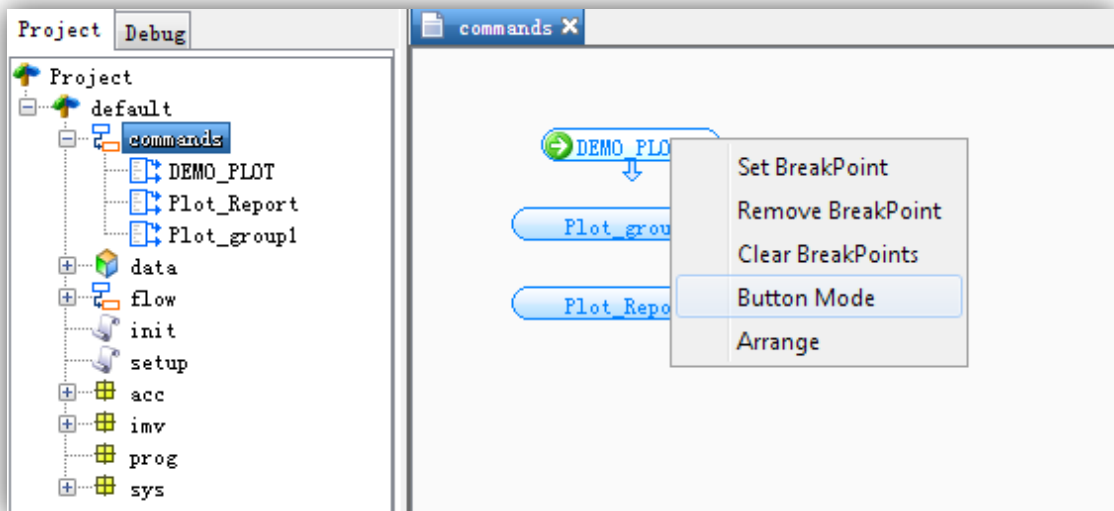
In this example, a function called **show** was defined, and plots (ids\_vgs\_vbs, IMV plot gm\_vgs\_vbs, and vth\_vbs) were selected in the function. The plots were selected by placing several restrictions with logic expressions **&&**.

The task changes the MBP layout to 2 by 3 plots, and then shows two devices with pre-defined plot selections.

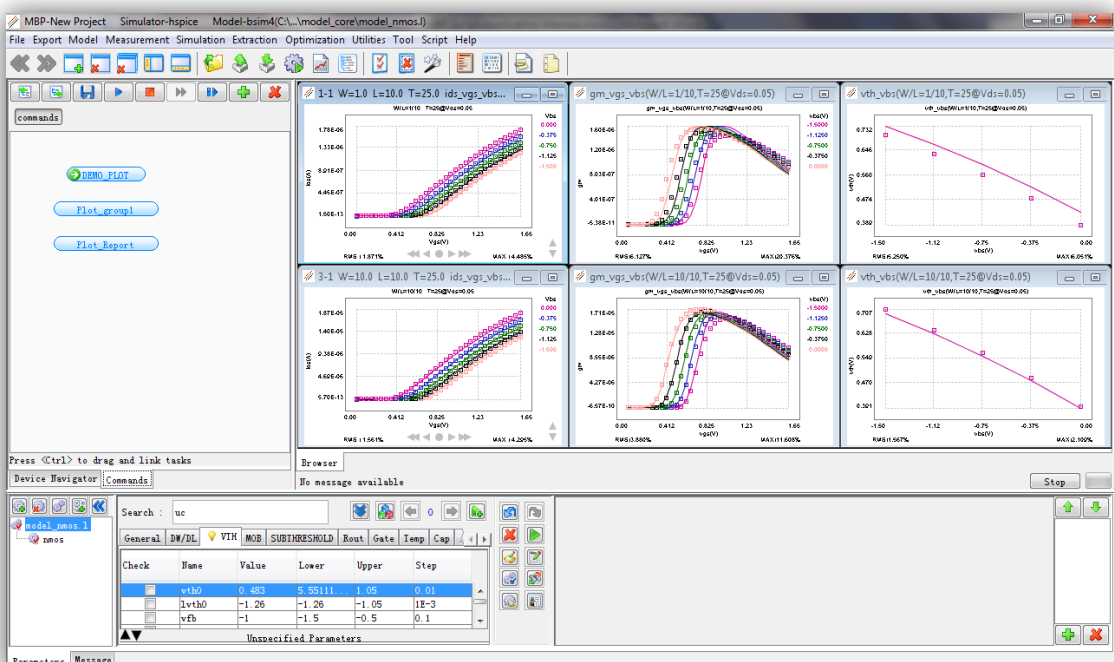
4. Click **Run**. The output appears in the MBP main GUI.



5. Double-click **Commands**, and drag the existing task to the **Edit** pane. It is possible to create multiple tasks based on different applications. You can set the task to button mode by right clicking the task. Under the button mode, the task icon performs like a button and runs with a single click.



6. After all the scripting work, open the **Commands** tab in the MBP main GUI by **Script → Commands**. It has the same function as the one in the script project window.



## Flow

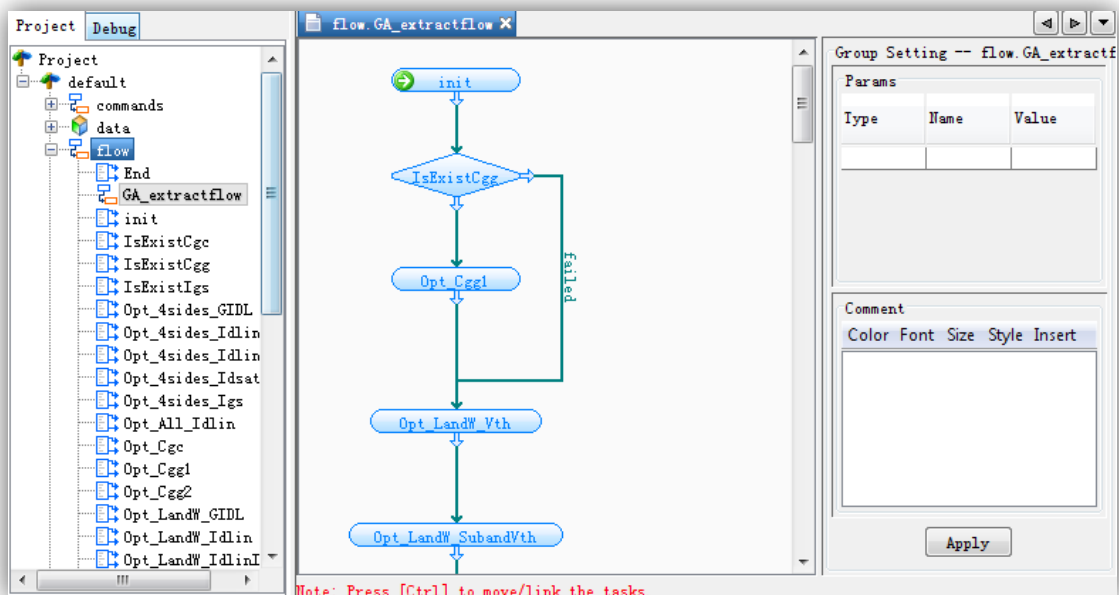
Model extraction flow can be found under the **flow** node.

You can create a new **task**  or a **task group**  by right clicking **flow** → **new**.

Double-click the task flow name, and the graphic extraction flow is shown in the **Edit pane**. Dragging the task to the **Edit pane** will generate the task icon. Hold ctrl to move the task icon or link between two tasks.

To move the tasks or connections in the flow, highlight the task or connections and press **Delete** in keyboard.

To run the task, highlight the starting task and click **Run**.

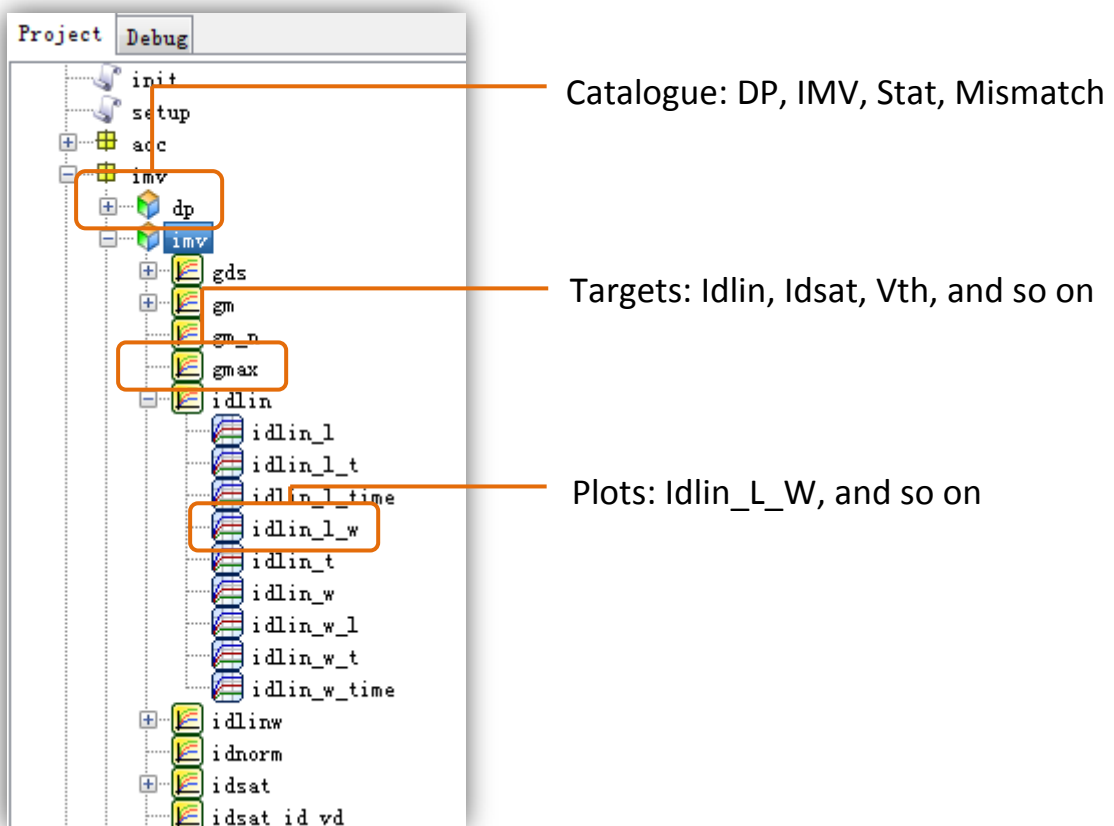


The extraction flow has hierarchical structure. You can create several task groups in one flow and make the flow clearer and more readable.

The tasks need to be written by script. For more details, refer to the MBP Script Application Manual.

## IMV

IMV includes four catalogs of configurations: DP, IMV, stat, and mismatch. Old MBP IMV and DP configurations are still compatible with the new versions. However, when loading them into MBP, the tool will convert them automatically to the new script format. Both the new and old versions of the IMV configuration can be saved or loaded separately with other script projects by **Extraction → IMV → Save/Load IMV configurations**. (Note: when saving the configurations, all old formats are converted to new script format.)



The hierarchical structure of **IMV** is shown above. For each catalog, there are different targets defined by users (MBP provides default settings and the configurations are fully open to users.)

## How to add a new IMV plot

In MBP, IMV stands for intermediate variable such as  $V_{th}$ ,  $I_{dsat}$ , etc. IMV plots show the scaling plots of IMV targets versus different instance parameters, such as  $V_{th\_L}$ ,  $V_{th\_T}$ , and so on. In MBP script, **IMV** catalog is organized by different targets.

To show how to customize a new IMV plot with MBP script, here is an example of  $I_{off}$  vs.  $L$ .

1. Right click **IMV** → **New** → **IMV**.
2. Input the target name **loff**, and MBP generates a target definition template in **Edit** pane.
3. Modify the template to input all the related information.

The screenshot shows the MBP IMV editor window titled 'imv.imv.Ioff'. The window contains the following fields and controls:

- IMV Type** section:
  - ☒ Java Algorithm
  - ☐ Script Algorithm
  - ☐ Expression
  - ☐ Auto Refer
  - ☐ Local Param
  - ☐ Trans to Point
- Page Name**: Ids\_vgs\_vbs
- Restrictions**: device, vbs=0, vgs=0, vds=absmax(vds)
- Algorithm Class**: acc/Current
- Attached Targets**: (empty field with a help icon)
- Algorithm Parameters**: ids
- Parameter** section:
 

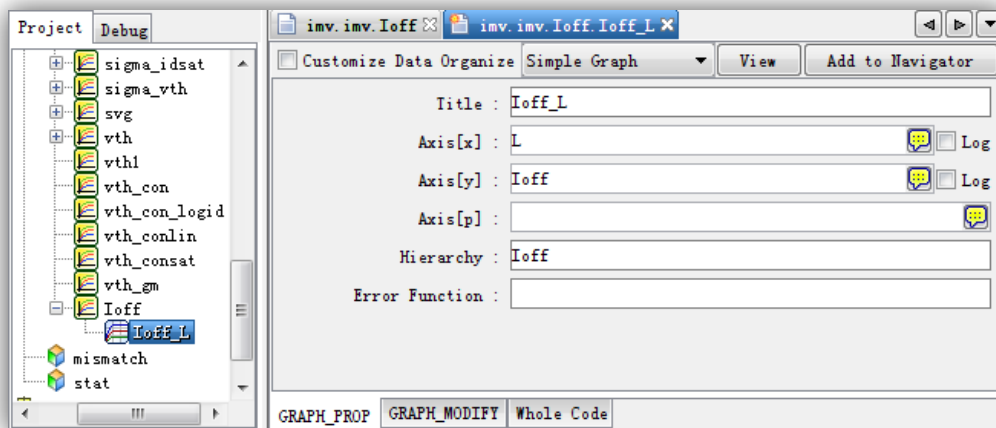
Name	Value
vgs	[start=0; stop=vgg; step=0.01]
vds	vdlin

At the bottom of the window, there are two tabs: **IMV\_PROP** and **Whole Code**.

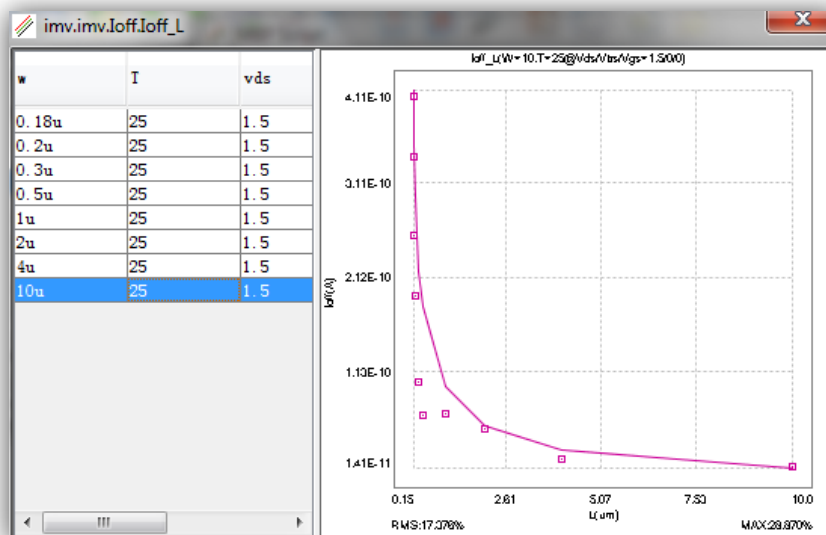
4. Right click the new created target **loff** and select **New** → **Graph**.
5. Enter the Graph title such as  $I_{off\_L}$ . MBP generates the graph setting template.



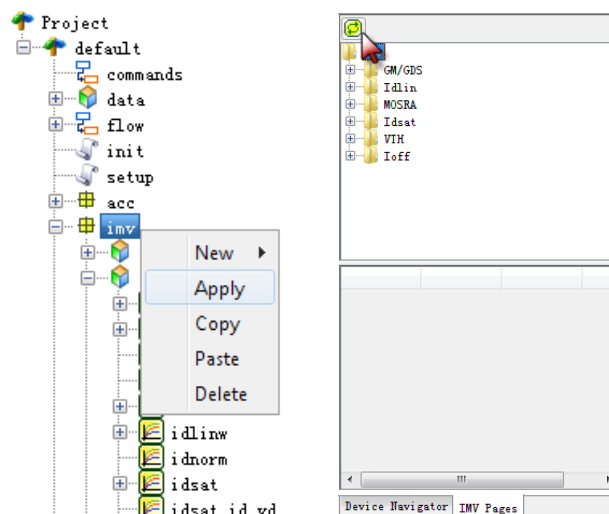
6. Select **Simple Graph** and enter Title, X, Y, and Hierarchy information.



7. Click **View** to check the graph.



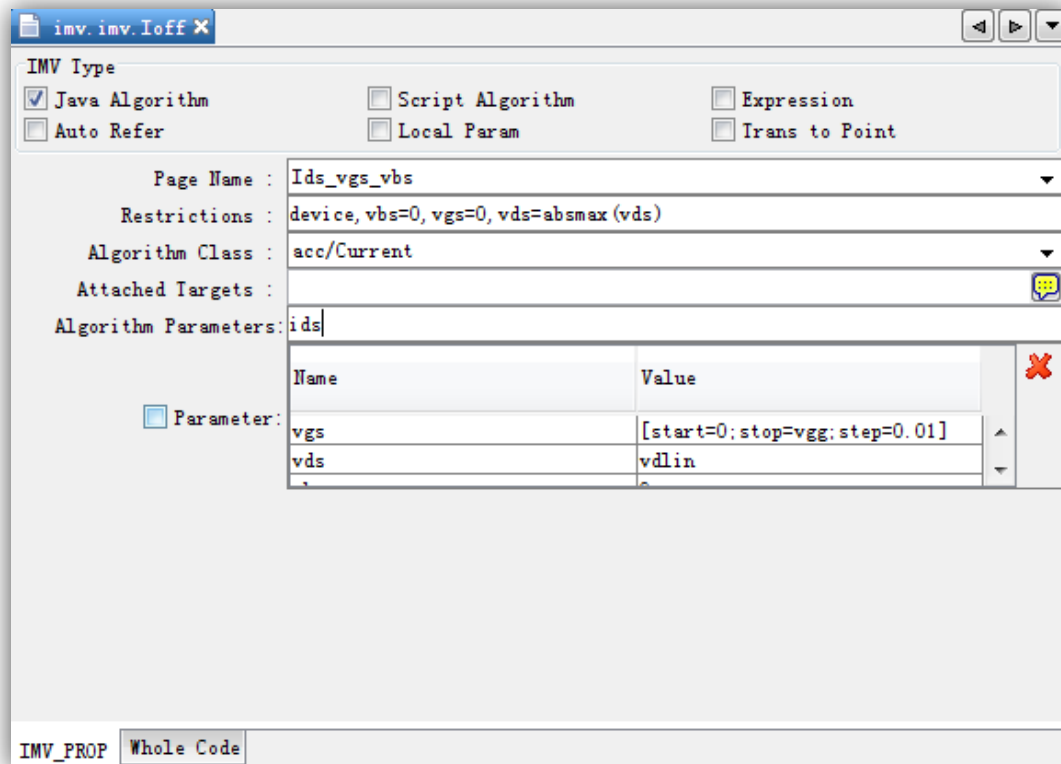
8. To apply the new settings, right click **IMV** and select **Apply**, or on the MBP main GUI > IMV tab, click on the **refresh** button.



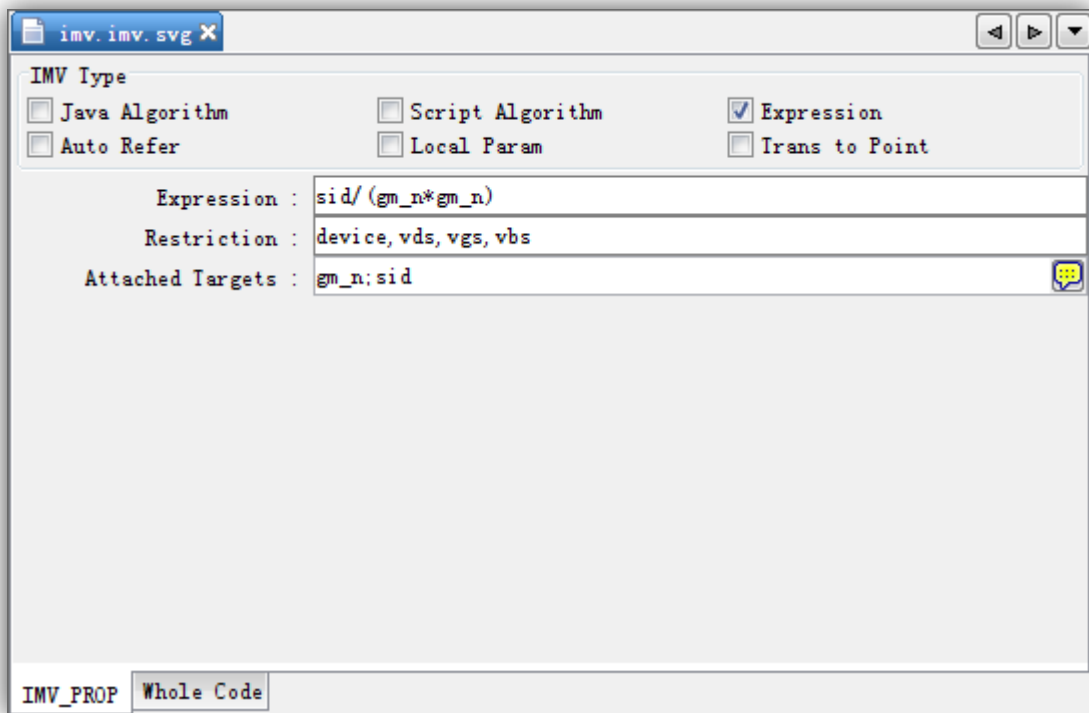
## Target definition

In the previous section, a new target loff was defined using the default target definition template. There are different methods to define a target in the MBP script project.

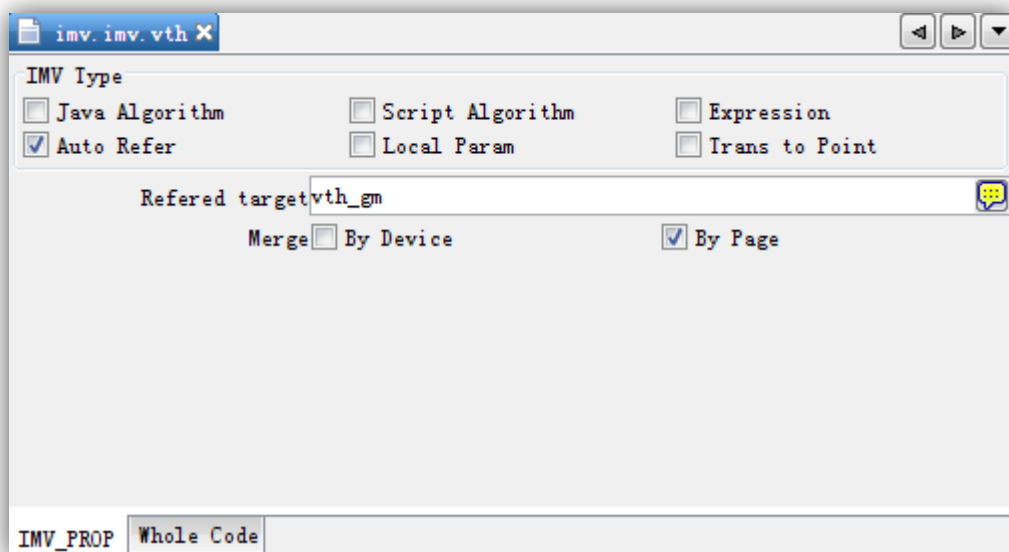
- Use built in algorithm (Check **Java Algorithm**)



- ✧ Page Name: Plot to calculate the targets from. Page name should be matched strictly to the one shown in MBP device navigator.
- ✧ Restrictions: Restrictions of instance and bias conditions. Device stands for all the instance parameters and bias conditions can be defined here.
- ✧ Algorithm Class: MBP has built-in algorithm to use. For example, acc/Current gets the Y axis value from a specific page and bias, thus this algorithm can be used to define all the targets like Idsat, Idlin, loff, Cgg, Sid, and so on.
- ✧ Attached Targets: It is possible to use the result from other targets by attaching the targets to calculate the current one.
- ✧ Algorithm parameters: It is tied to the algorithm.
- ✧ Parameter: Check to enable the parameter settings. For example, to set vgs sweep step for Vth\_gm calculation (The step is the same as measured data by default).

➤ Use expression (Check **Expression**)

- ✧ Expression: Supports mathematic expressions between targets and constants.
- ✧ Restrictions: Restrictions of instance and bias conditions.
- ✧ Attached Targets: It is possible to use the result from other targets by attaching the targets to calculate the current one.

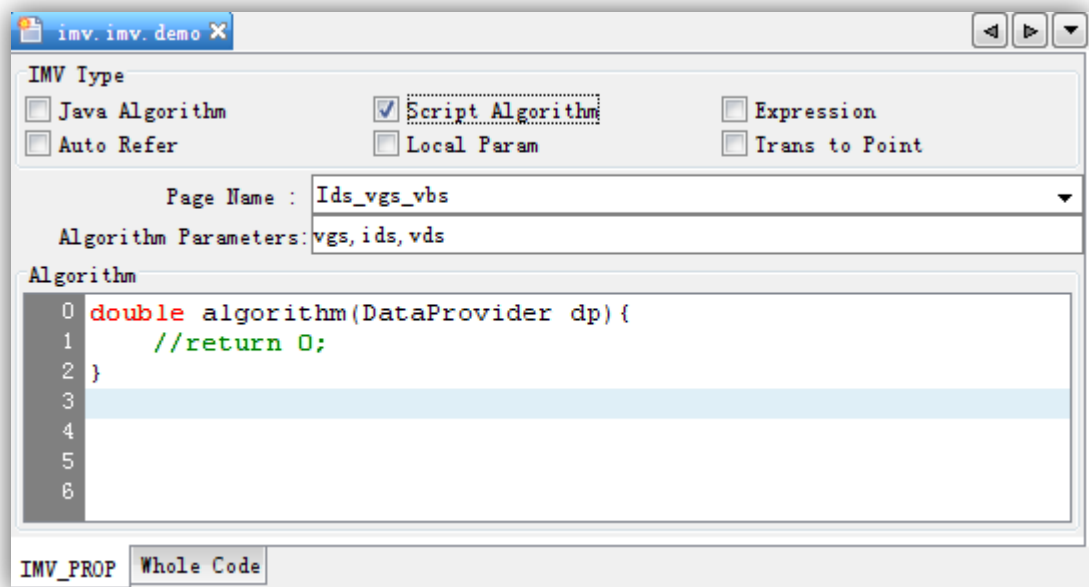
➤ Choose from existing targets (Check **Auto Refer**)

Some targets like Vth have different calculation methodologies such as vth\_gm, vth\_con, and so on. They do not need to repeat the same plot definition, but

need to only define a new target Vth and refer to specific pre-defined Vth targets such as vth\_gm, or vth\_con.

If you input more than one target in the Referred target text box, the tool will try to choose the first one. If the first target does not exist, it will auto refer to the second one, third one, and so on.

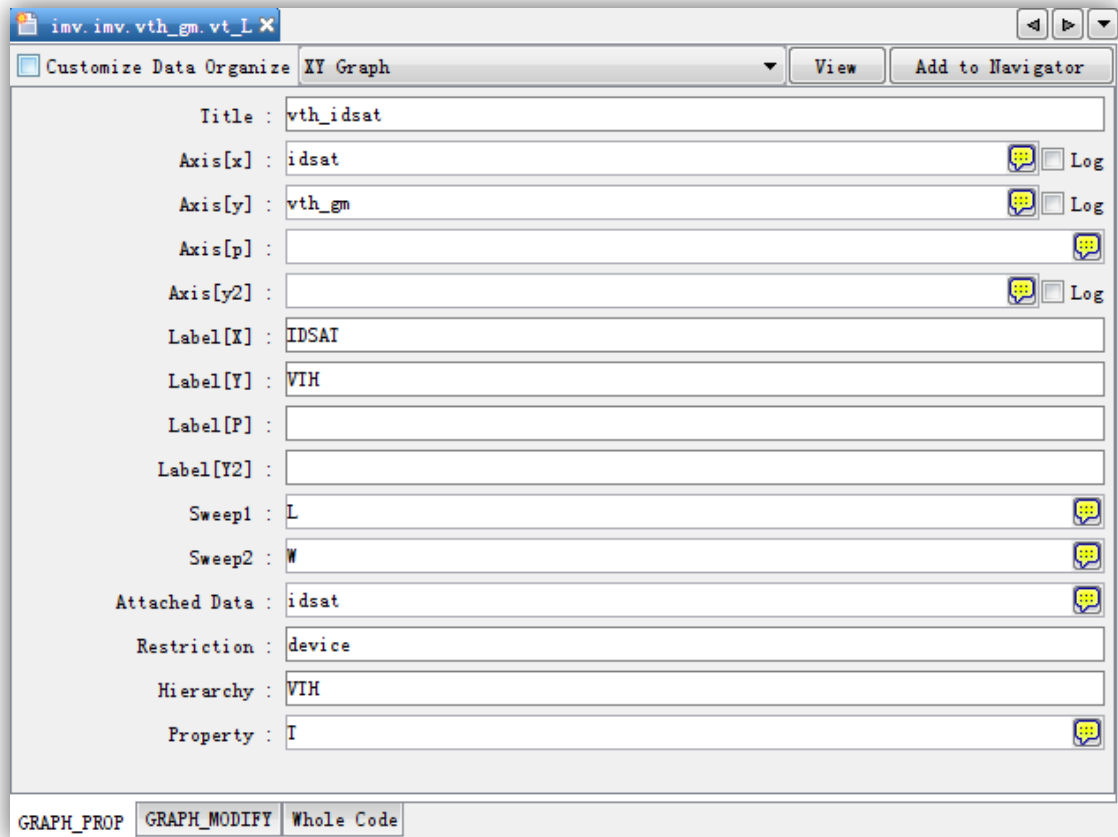
✧ Customize new algorithm (Check **Script Algorithm**)



To program your own algorithm using MBP script, select **Script Algorithm**. The new algorithm will be independent of MBP default Java Algorithm. For more details, refer to the MBP Script Programming Manual and contact Agilent support team ([mbp\\_pdl-eesof@agilent.com](mailto:mbp_pdl-eesof@agilent.com)).

## Plot definition

In the first section of this chapter, a new plot Ioff vs. L was defined using a **Simple Graph** template. In this section, you will be able to define the plot using a more complex template named XY graph.



- ✧ Title: Plot title
- ✧ Axis[x]: X-axis variable, can be instance parameter or target
- ✧ Axis[y]: Y-axis variable, normally is target. MBP Script supports more than one target in one plot.
- ✧ Axis[p]: P axis variable, normally is instance
- ✧ Axis [y2]: Second Y axis variable, normally is target. The second Y value is put on the right side of plot.
- ✧ Label[x(y, p, y2)]: X(Y, P, Y2) axis label in the plot
- ✧ Sweep1&Sweep2: Normally these two options are used for target vs. target plots. Different values of the instance parameters in Sweep1 and Sweep2 are put in the same plots, and the instance in Sweep1 is connected by curves.
- ✧ Attached Targets: Shows other targets in the plot by attaching the targets
- ✧ Restriction: Restriction of multiple targets
- ✧ Hierarchy: Hierarchy name shown in MBP GUI
- ✧ Property: Instance parameters shown in the title of plots

## Statistical and Mismatch

MBP script supports user-defined targets. The target definition of statistical and mismatch is similar to IMV configuration. There is an additional option for both of them, **Use Internal Algorithm**. Uncheck this option to enable the setting in IMV, else, MBP will use internal algorithm for the targets. Compared to customized targets, the internal algorithm is faster when using MBP internal engine.

imv.mismatch.ids

DP Type

☐ Expression ☒ Java Algorithm ☐ Script Algorithm

Page Name: Ids\_vgs\_vbs

Algorithm Class: acc/Current

Algorithm Parameters: ids

Name	Value
vgs	vgs
vds	vds
vbs	0

Parameters:

Mismatch Expression: ☐ Absolute ☒ Relative ☐ Customize

$2 * (t1 - t2) / (t1 + t2)$

Use Internal Algorithm ☒

DP\_PROP Whole Code

For mismatch, there is another option, **Mismatch Expression**. This option allows you to define the mismatch calculation methodology. By default, all the currents like Idsat, Idlin use relative method and vth uses absolute method. Check **Customize** to define a new mismatch method by using t1, t2, which stands for target value for a pair of devices.

## *DP*

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The DP configuration is also similar to IMV configurations. The only difference is DP data will get bias sweep conditions from DP settings instead of measurement data. Thus, the parameter sweep setting configuration is obligated and always enabled.