

Debugging Multicore StarCore DSP Applications with Eclipse

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With the release of CodeWarrior for StarCore DSPs v10, the Freescale debugging tools are managed by the Eclipse Integrated Development Environment (IDE). This user interface (UI) differs from the UI of the original “Classic” CodeWarrior IDE. In particular, the new multicore debugging interface differs significantly from its predecessor. This document describes the Eclipse interface features that are specific to multicore debugging, and how to use them.

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1 Starting the Debugger with Multiple Cores

After the multicore application is built, the next step is to download/execute it on multiple cores. The CodeWarrior debugger provides two options to accomplish this. The first option is to launch the code on all cores simultaneously with one mouse click. The second option is to launch the code successively on one core after the other. The requirements of the application being debugged determine which option should be used.

1.1 Option One: Starting All Cores Simultaneously

To be able to start and debug a number of cores at the same time, a launch group must be defined. A *launch group* specifies which cores to start and the debugger settings that are used during their execution.

1.1.1 Create a Launch Group

To create a launch group:

1. Open the Debug Configuration dialog by clicking on the arrow next to the green bug icon and selecting **Debug Configuration**, as shown in [Figure 1](#).

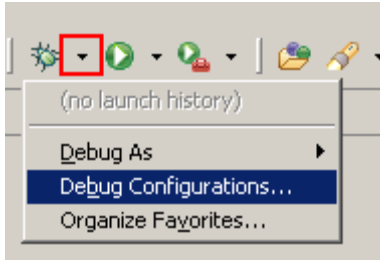


Figure 1. Opening the Debug Configuration dialog

2. In the debug configuration dialog, select **Launch Group** and then click on **New Launch Configuration** icon, as shown in [Figure 2](#).

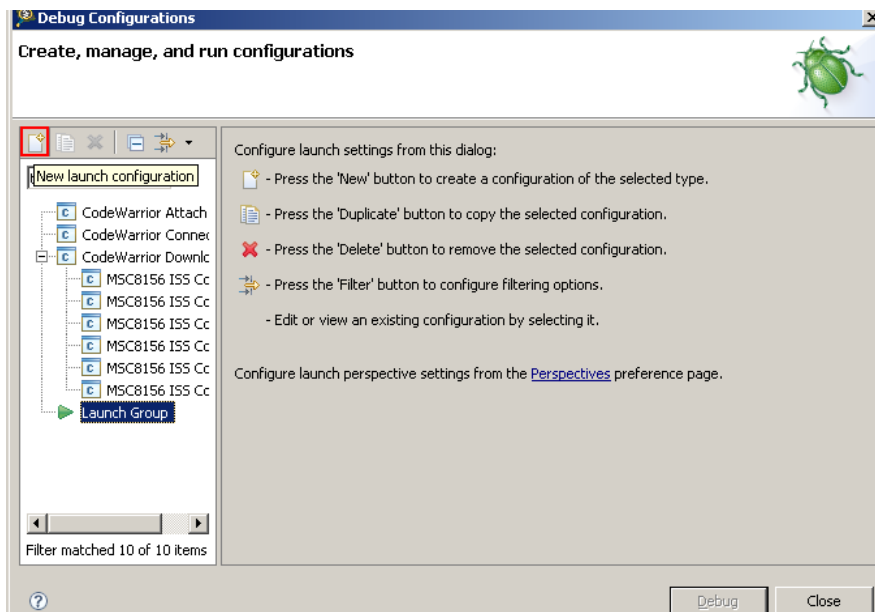


Figure 2. Creating a Launch Group

3. Specify a name for the launch group in the **Name** option (for this example, the MSC8156Launch was used) and click **Apply**.
4. Click **Add**.

5. In the **Add Launch Configuration** dialog that appears, expand the **CodeWarrior Download** group. For a core to execute code, it must have a launch configuration assigned to it. Each launch configuration specifies the debugger settings used while controlling the designated core.
6. Select all of the launch configurations to be associated with this launch group. For example, to have the launch group manage all six processor cores, choose the launch configurations MSC8156 ISS Core 00 through MSC8156 ISS Core 05. See [Figure 3](#).

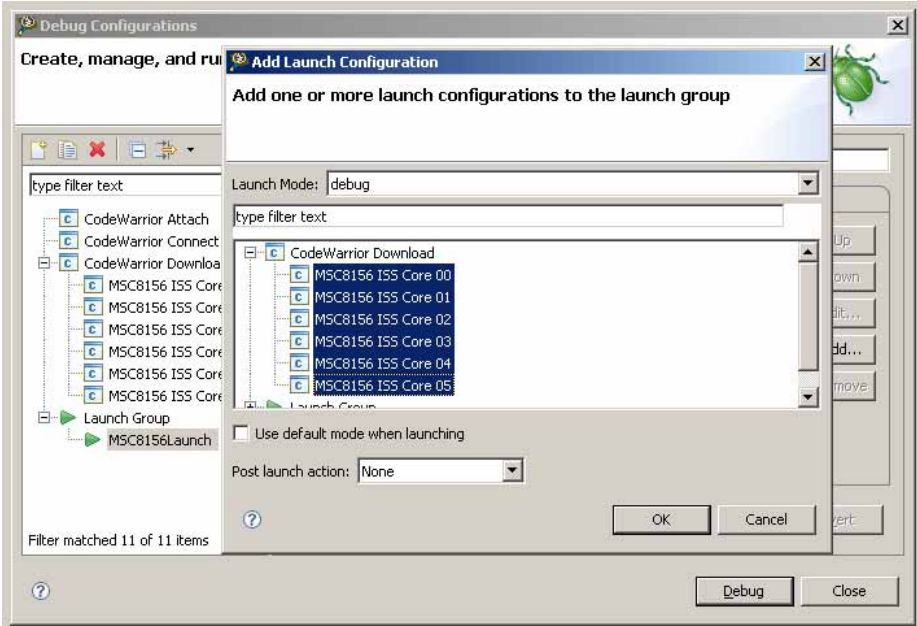


Figure 3. Selecting the Launch Configurations that Belong to a Launch Group

7. Choose a post launch action in the **Post launch action** option, if necessary.
[Table 1](#) summarizes the choices of actions that the debugger can take after it starts the launch configuration for each core.

Table 1. Summary of Post Launch Actions

Option	Description
None	The debugger immediately moves on to launch the next launch configuration. This is the recommended settings in most of the cases.
Wait until terminated	The debugger waits indefinitely until the debug session spawned by the last launch terminates, and then it moves on to the next launch configuration.
Delay	The debugger waits for specified number of seconds before moving on to the next launch configuration.

8. Click **OK**.

A list of the launch configurations associated with the launch group appears, as show in [Figure 4](#).

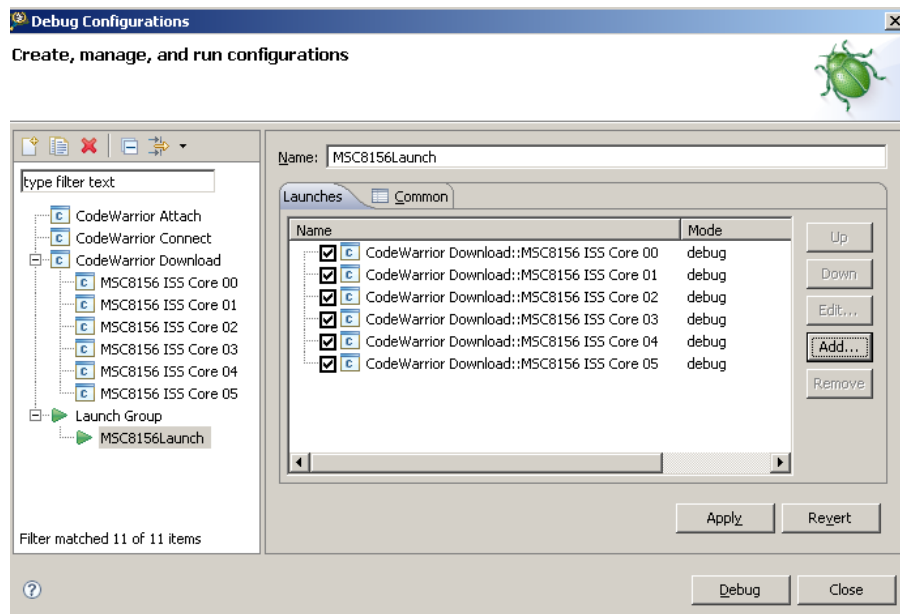


Figure 4. Launch Configurations That Are a Part of the MSC8156Launch Group

NOTE

Make sure that the core that manages any shared code (typically core 0) loads first. This is necessary because the shared code is linked to the core 0 image. Since the startup code and run time library code are shared among all the cores, if core 0 does not load first, none of the other cores can execute any startup code and reach their respective `main()` functions.

9. Click **Apply** to use the settings, then **Close** to save them and dismiss the Debug Configuration dialog.

1.1.2 Save the Launch Group's Configuration File

By default, the steps in section [1.1.1](#) make a `.launch` file in the directory

```
{workspace}\.metadata\.plugins\org.eclipse.debug.core\.launches
```

This enables the launch group's configuration to be available each time that the workspace loads into the CodeWarrior IDE.

In order to make it easier to package the launch group together with the application, the group configuration file can be saved along with the launch configuration files for each core in the `{Project}\Debug_Settings\` directory.

This is done as follows:

1. Open the Debug Configuration dialog by clicking on the arrow next to the green bug icon and selecting **Debug Configuration**.
2. In the **Debug Configuration** dialog, expand the **Launch Group** folder and select your launch group.
3. Switch to the **Common** tab, as shown in [Figure 5](#).

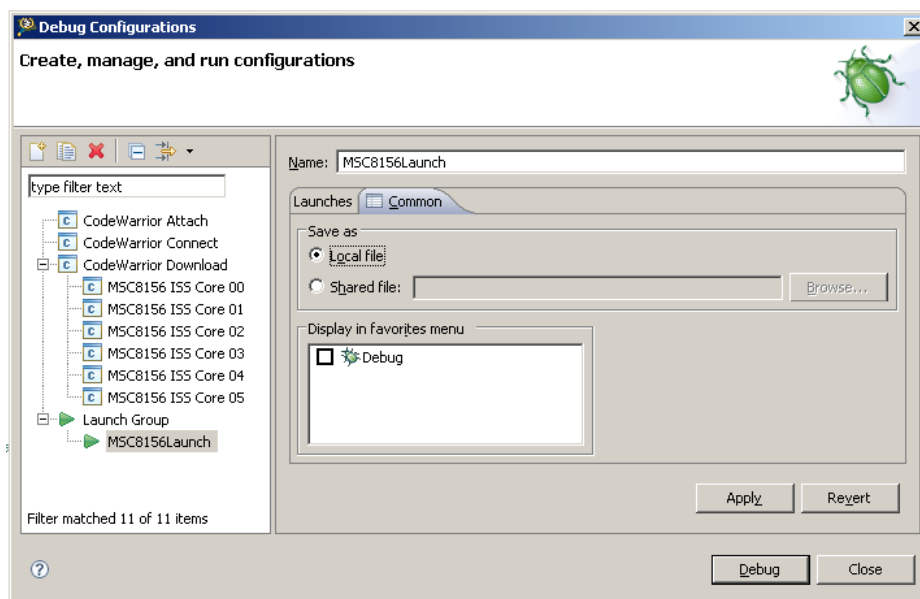


Figure 5. Using the Common Tab to Save the Launch Group Settings

4. Choose the **Shared file** option.

- Click **Browse** and in the **Folder Selection** dialog and navigate to the project's Debug Settings folder. See [Figure 6](#).

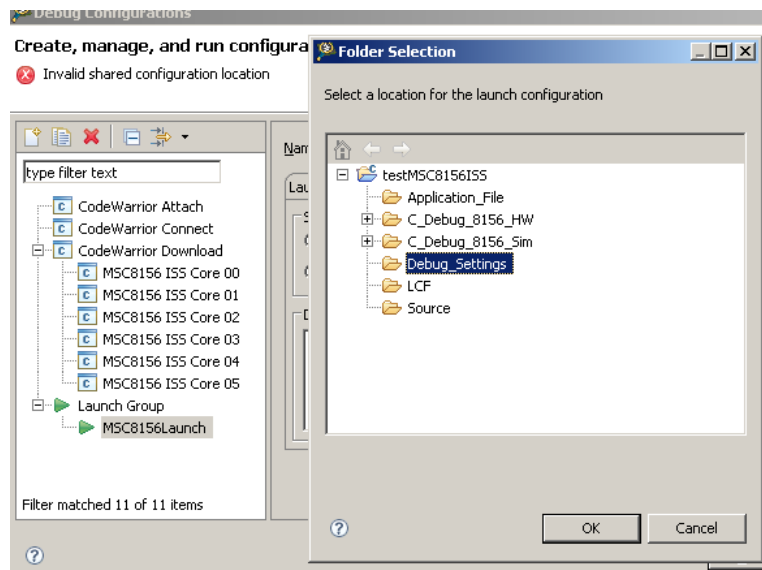


Figure 6. Selecting the Folder to Save the Launch Settings

- Click **OK** to dismiss the **Folder Selection** dialog; then click **Apply** to save the settings.
- Click **Close** to close the **Debug Configuration** dialog.

From now on, the `.launch` file for the launch group is stored in the `{Project}\Debug Settings` folder.

NOTE

If you have already created the launch group in the `{workspace}\.metadata\.plugins\org.eclipse.debug.core\launches` directory, it is good practice to physically delete the file from this location and restart the CodeWarrior IDE. Otherwise you will end up with two Launch groups with the same name in the **Debug Configuration** dialog.

1.1.3 Debugging With the Launch Group

To start debugging using a previously saved launch group:

- Open the Debug Configuration dialog by clicking on the arrow next to the green bug icon and selecting **Debug Configuration**.

2. In the **Debug Configuration** dialog, expand the **Launch Group** folder and select the launch group you want to debug as shown in [Figure 7](#).

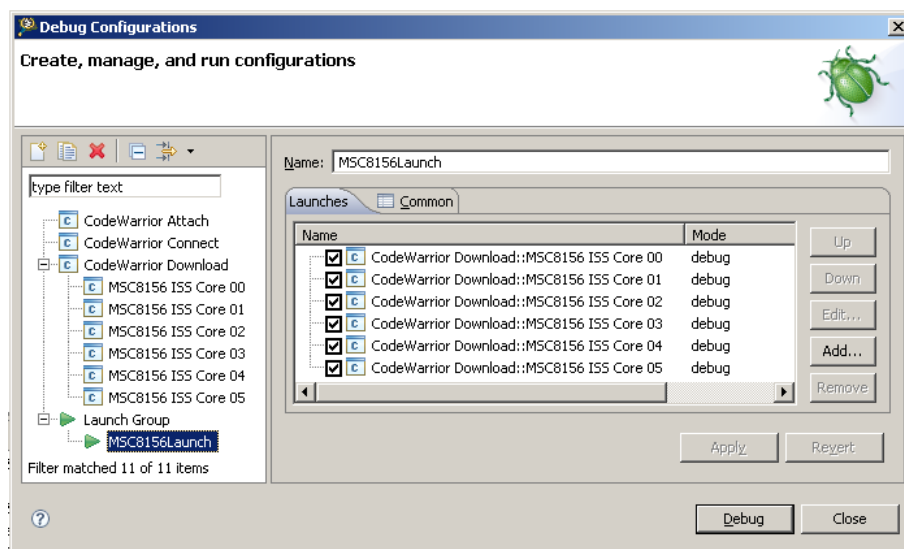


Figure 7. Selecting a Launch Group for Debugging

3. Click **Debug** to start the multicore debug session.

The debugger starts a multicore debug session using the specified launch group(s). Each core executes any startup code and then halts at its `main()` function, unless configured otherwise. For this example, the **Debug** view in [Figure 8](#) shows the six cores halted and awaiting new debugger commands.

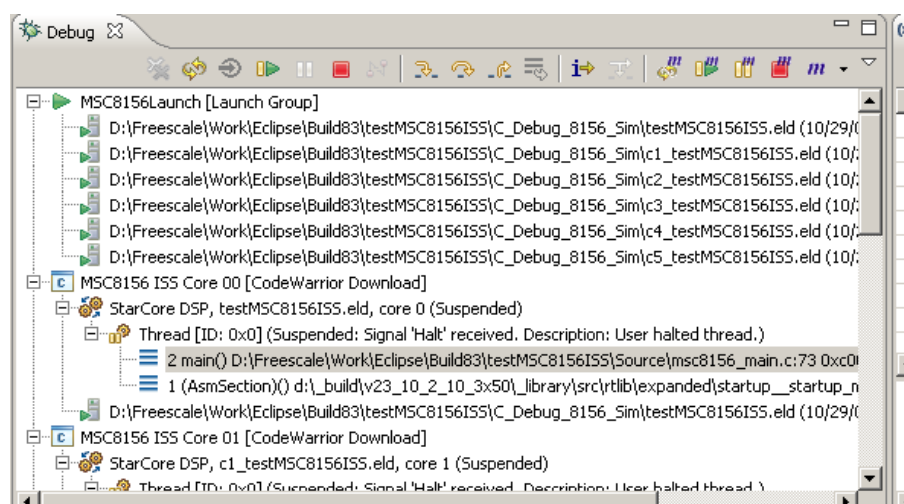


Figure 8. A Multicore Debug Session as Started by the Launch Group

1.2 Option Two: Launch Cores One by One

Certain situations might require the cores to be loaded separately, particularly if something needs to happen between the loadings of the different cores. To do so, follow these steps:

1. Open the Debug Configuration dialog by clicking on the arrow next to the green bug icon and choosing **Debug Configuration**.
2. Expand the **CodeWarrior Download** group.
3. Select the Core 00 launch configuration and click **Debug**.
4. Once the download for core 0 completes, open the **Debug Configuration** dialog, select the Core 01 launch configuration, then click **Debug**.
5. Once the download for core 1 completes, open the **Debug Configuration** dialog, select the Core 02 launch configuration, then click **Debug**.
6. Once the download for core 2 completes, open the **Debug Configuration** dialog, select the Core 03 launch configuration, then click **Debug**.
7. Once the download for core 3 completes, open the **Debug Configuration** dialog, select the Core 04 launch configuration, then click **Debug**.
8. Once the download for core 4 completes, open the **Debug Configuration** dialog, select the Core 05 Launch Configuration, then click **Debug**.

After all of the launch configurations are started, the multicore debug session the **Debug** view resembles [Figure 9](#).

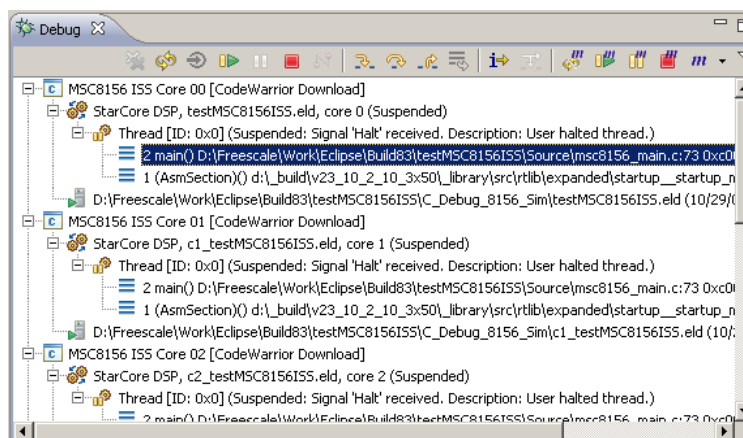


Figure 9. A MultiCore Debug Session in Progress

1.3 Troubleshooting

If problems occur with the multicore sessions, check the following points:

- Make sure that the debug settings on all of the cores are identical. To check these, open the **Debugger Settings** dialog, click on the **Debugger** tab, and study the options in the **Debugger Options** group for differences.

- For the **StarCore** tab shown in [Figure 10](#), the **Target Processor**, **Simulator/Emulator** and **System Type** options should be identical for all cores. The value specified in the **Core Index** option should be different for each core, however.

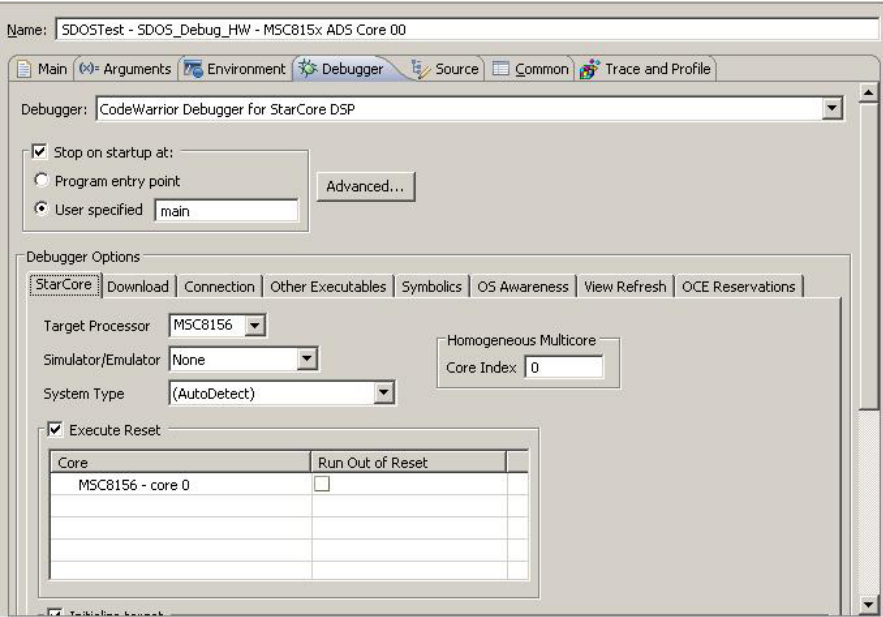


Figure 10. StarCore Tab Options

- For the **Connection** tab shown in Figure 11, the **Connection Protocol**, **Physical Connection**, and **CCS Advanced Settings** should be identical for all cores. You can examine the **CCS Advanced Settings** by clicking on the **Advanced** button within the **Connection** tab.

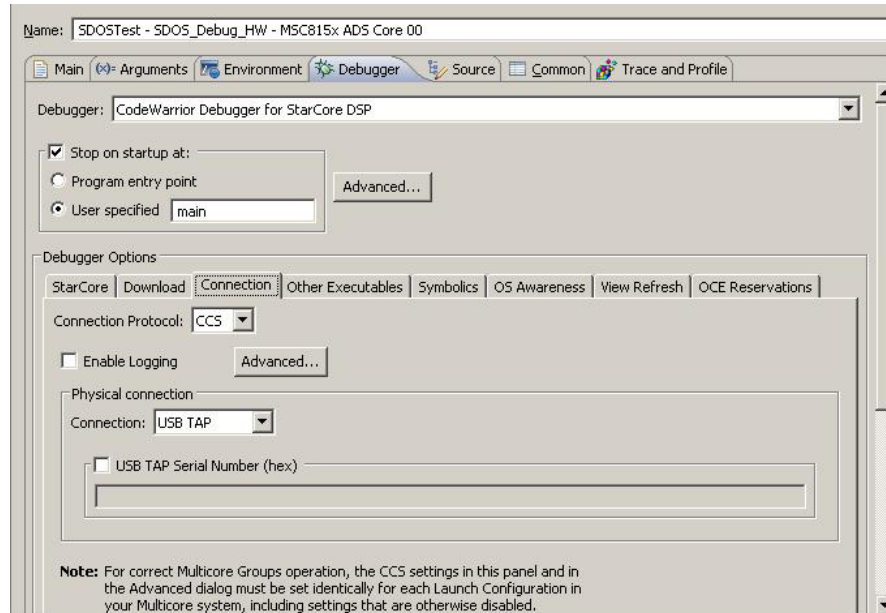


Figure 11. Connection Tab Options

- Always load core 0 (where all shared sections reside) first. The loading sequence for the other cores does not matter, unless the application requires a specific sequence to start the different cores.
- In the **StarCore** tab, the **Execute Reset** option must be checked for core 0 only. It must be unchecked for all other cores. In addition, the **Initialize target** option and the **Use Memory configuration file** option must be checked for core 0 only. It should be unchecked for all other cores.

NOTE

When debugging a multi-device system:

- The **Execute Reset** option must be set for core 0 on first device (processor) only.
- The **Initialize Target** option must be checked, and the **Use Memory configuration file** option must be set for core 0 on each device. (That is, these options should be set for core 0, core 6, and core 12 on a MSC8156AMC board).

- For all cores, the JTAG settings such as the configuration file, CCS executable, JTAG clock speed, and CCS timeout *must* be identical in the **CCS Advanced Settings** dialog, as shown in [Figure 12](#).

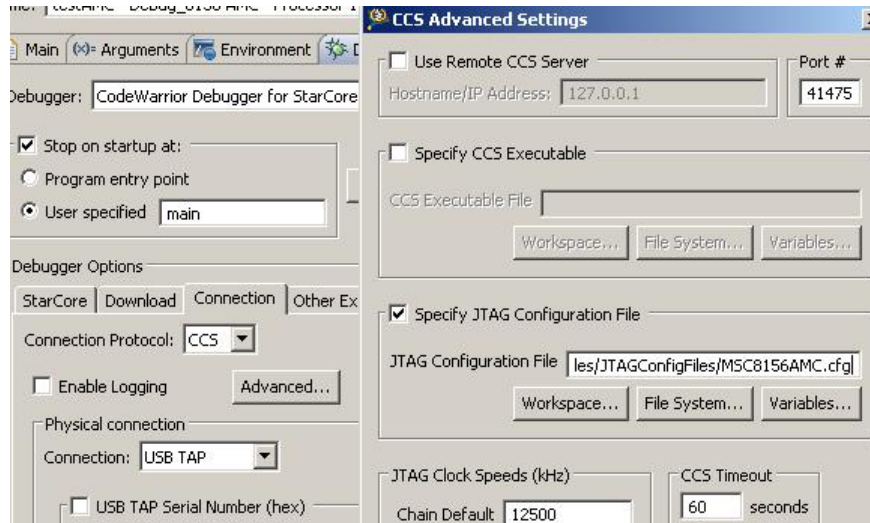


Figure 12. CCS Advanced Settings Dialog

NOTE

For more information on how to configure the hardware and the CodeWarrior IDE's settings for debugging a board with multiple devices, consult the application note, AN3908, "A Guide to Configuring Multiple MSC8156 Devices on a Single JTAG Chain Using CodeWarrior Development Studio for StarCore DSP Architectures v10.0".

2 Controlling Execution

The CodeWarrior debugger provides a number of run-control commands that can start, step, stop, and restart a program. Many of these commands can be applied to

- One core
- All cores
- A specific set of cores

NOTE

The stepping command can only be applied to a single core, while the run (resume), stop (suspend), terminate (kill) commands can apply to multiple cores.

2.1 Controlling Execution in One Core

To control the code execution for a specific core, select the core you want to control in the **Debug** view by clicking on one of the lines within its thread. Next, select the control action. Control actions can be specified by clicking on one of the standard icons for **Restart**, **Resume** (Run), **Suspend** (Stop), **Terminate** (Kill), **Step into**, **Step over** and **Step out** (Step Return) in the view's toolbar, as shown in Figure 13.

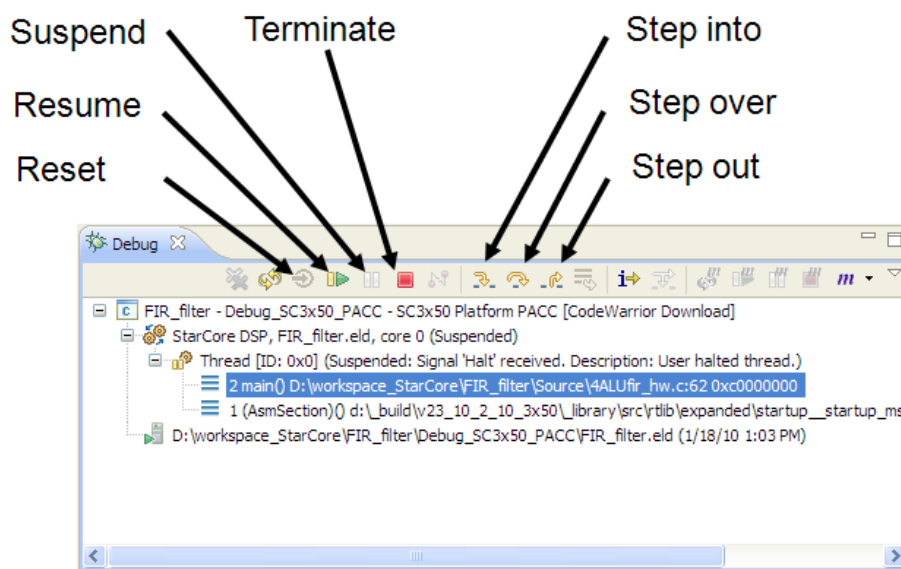


Figure 13. The Code Execution Controls

Alternatively, use the **Run** menu choices of **Restart**, **Resume**, **Suspend**, **Terminate**, **Step Into**, **Step Over** or **Step Return** to issue control commands.

2.2 Controlling Execution on Multiple Cores

In order to apply a run-control command to a specific set of cores, a multicore group must be defined first. There is no need to define a multicore group if you intend to debug on all the cores. Per default, multicore run-control commands apply to all the loaded cores.

2.2.1 Define a Multicore Group

To create a multicore group:

1. Enter the Debug perspective and start a multicore debugging session.

2. At the top of the **Debug** view, click on the blue **M** to expand the **Multicore Groups** menu. Select **Edit Multicore Groups**, as shown in [Figure 14](#).

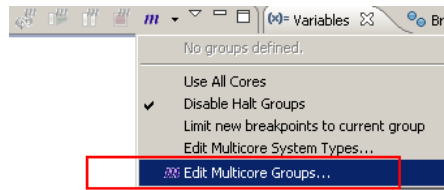


Figure 14. Using the MultiCore Groups Menu to Create a Multicore Group

3. In the **Multicore Groups** dialog, click **New**.
4. In the **New Multicore Group** dialog, select the target device (MSC8156 in this example). Then click **OK**, as [Figure 15](#) shows.

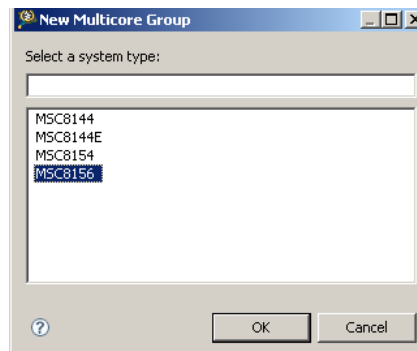


Figure 15. Choosing the Target Processor for a Multicore Group

5. In the **Multicore Groups** dialog, check those cores that should be part of the group, as shown in Figure 16.

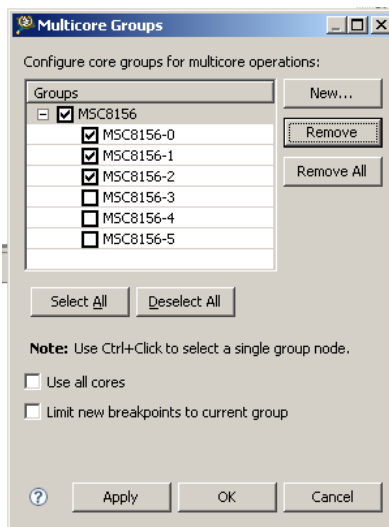


Figure 16. Placing Cores in the Multicore Group

6. Click **Apply**.
7. To define additional multicore groups, repeat steps 4, 5, and 6 for each new group.
8. Click **OK** when done.

Clicking on the arrow adjacent to the **M** icon displays the **Multicore Group** menu choices and the names of available multicore groups, as shown in Figure 17.

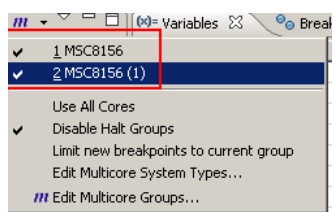


Figure 17. The Multicore Groups Menu Displaying a List of Available Multicore Groups

2.3 Multicore Control Commands

To control the code execution on multiple cores:

1. Select which multicore group to apply the command to. To do this, click on the arrow next to the blue **M** icon.
 - To apply the command to all cores currently in debug mode, make sure the menu choice **Use All Cores** is checked.
 - To apply the command to one or several multicore groups, make sure the menu choices for these groups are checked.

2. Once you have selected the set(s) of cores to apply the command to, click on one of multicore control icons in the **Debug** view's toolbar to issue a **Multicore Restart**, **Multicore Resume** (Run), **Multicore Suspend** (Stop) and **Multicore Terminate** (Kill) command. These icons are shown in [Figure 18](#).

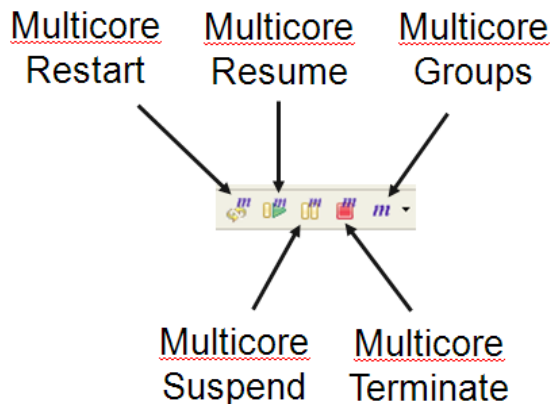


Figure 18. Multicore Code Execution Controls

Alternatively, use the **Run** menu choices of **Multicore Restart**, **Multicore Resume**, **Multicore Suspend** and **Multicore Terminate** to issue run-control commands.

3 Displaying the Context of a Specific Core

When debugging a multicore application, the content of the debugger views always reflect the context of the core that has focus in the **Debug** view, as shown in Figure 19.

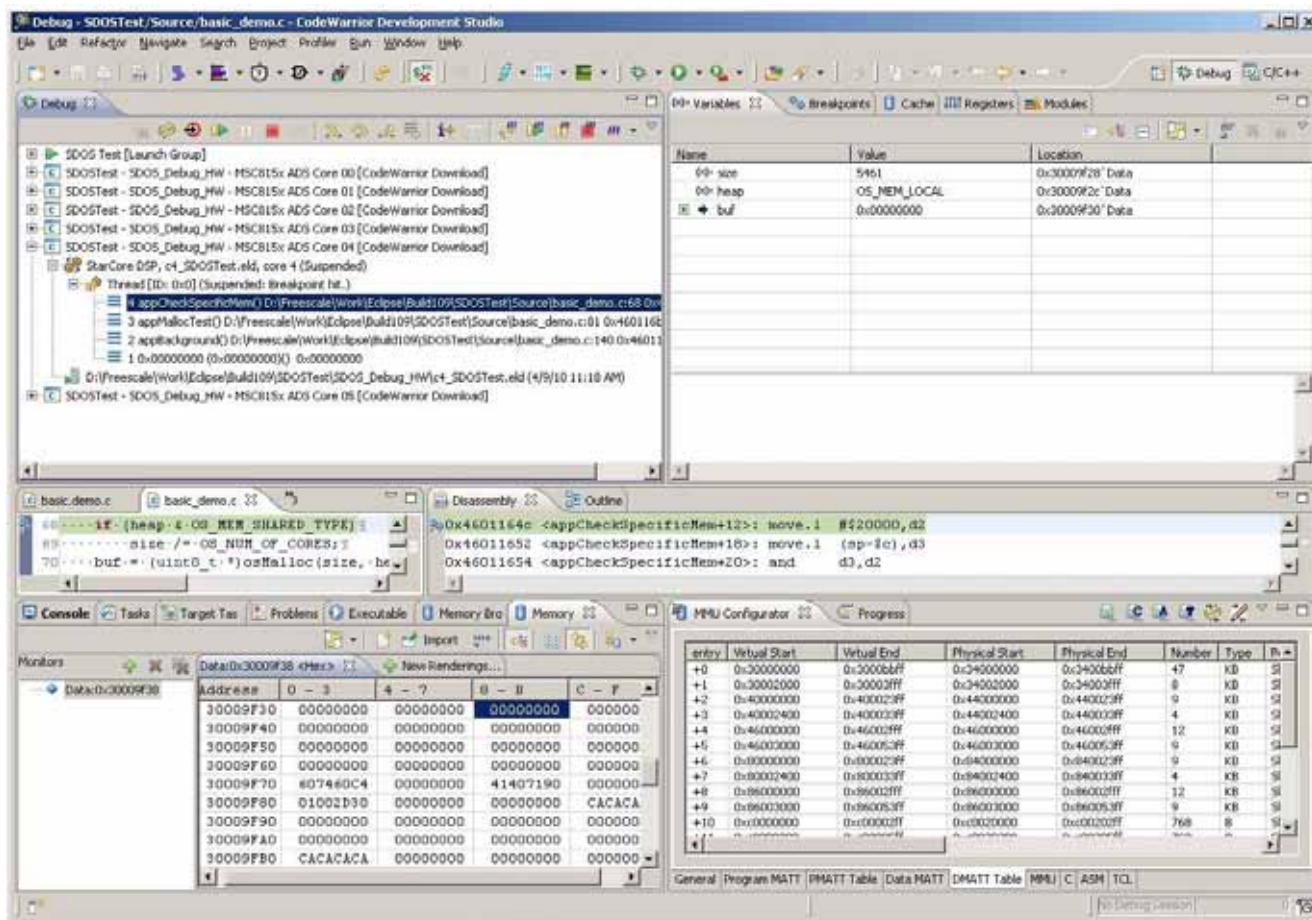


Figure 19. A Multicore Debug Session in Progress

In the figure, the debugger displays the context for core 4, because it is chosen in the **Debug** View. Therefore, the variables displayed in the **Variables** view are those for core 4. Likewise, the **Memory Dump** view shows content of virtual memory for core 4, as does the **MMU Configurator** view for the MMU configuration.

To display the context of a different core:

1. In the **Debug** view, expand the launch configuration of the desired core.
2. Click on one of the lines within its thread in the expanded configuration display.

4 Breakpoints

The CodeWarrior debugger allows you to set two kinds of breakpoints:

- Software breakpoints: The debugger inserts a “debug” instruction at an instruction-aligned address in memory that represents the source code line where a breakpoint is desired.
- Hardware breakpoints: The debugger uses the on-chip emulator (OCE) module, which is a dedicated hardware block that manages breakpoints and their trigger conditions.

In order to set a software or hardware breakpoint:

1. Right-click in the marker bar area on the left side of an editor, beside the source line where the breakpoint should be set.
2. In the drop down menu that appears, select **Set Special Breakpoint** and then select **Software Breakpoint** or **Hardware Breakpoint**, depending on the kind of breakpoint required. See [Figure 20](#).

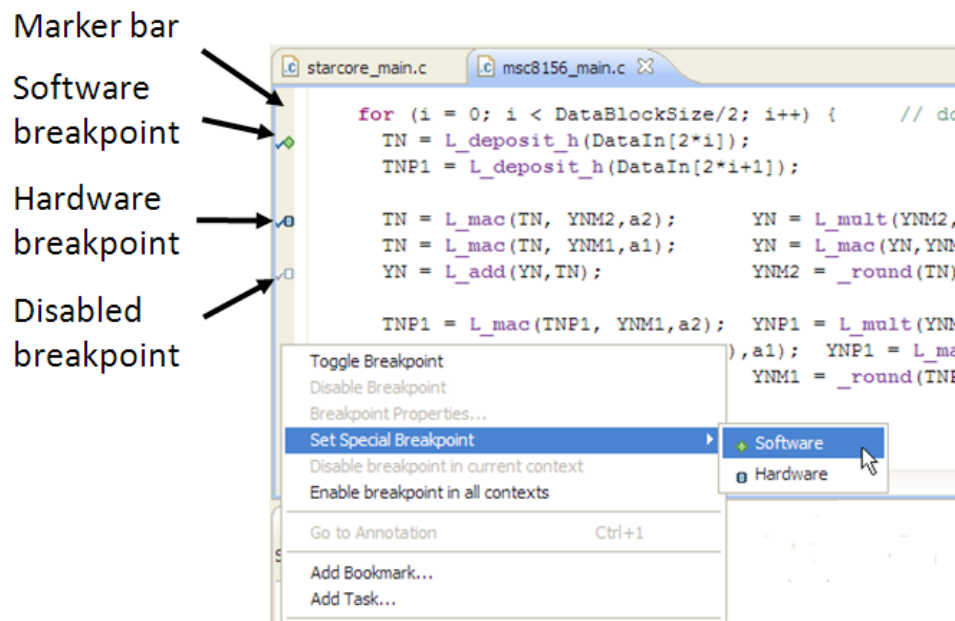


Figure 20: Special Breakpoint Menu

When a breakpoint (software or hardware) is set in shared code, it is activated on all cores by default. That means an application stops in any core as soon as its code execution triggers the breakpoint condition.

4.1 Applying Breakpoints to Selected Cores

The CodeWarrior debugger provides the ability to define the breakpoint on only a set of specific cores. This is done as follows:

1. Set your breakpoint the usual way.

2. Right-click on the breakpoint icon in the marker bar and select **Breakpoint Properties**. The **Breakpoint Properties** dialog opens.
3. Switch to the **Filtering Panel** by clicking on the **Filtering** option, as shown in Figure 21.

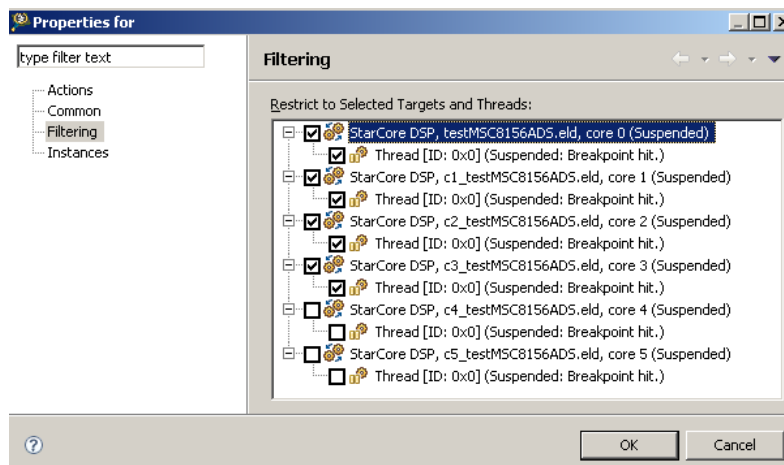


Figure 21. Specifying the Cores That Respond to a Breakpoint

4. Uncheck the cores on which the breakpoint will not apply.
5. Click **OK**.

From now on, the breakpoint affects only to the selected cores. That is, it will be ignored by the unchecked cores.

NOTE

A software breakpoint applied to specific cores that happens to be set in shared code can break the application's real-time execution. This is because a software breakpoint in shared code always temporarily halts every core that executes it. The debugger must check the core's ID and if it is set as disabled, the debugger resumes the core's execution. The overhead of this check has an impact on runtime behavior and the caches if the processor is not running in cache coherency mode.

4.2 Applying a Breakpoint to the Current Core Only

During the debugging of an application, all future breakpoints can be limited to the current debugging context. This is done as follows:

1. Debug the project.
2. Set the focus for the core to be debugged by clicking on one of the lines within its thread in the **Debug** view.
3. Switch to the **Breakpoints** view.

- Click the **Limit New Breakpoints to Active Debug Context** icon from the Breakpoint view, as show in [Figure 22](#).

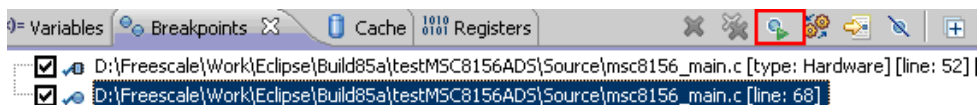


Figure 22. Limiting the Debugging Context of Breakpoints

From now on, all breakpoints are set only in the core being debugged.

Click the same icon in the **Breakpoints** view to return breakpoint activity to its normal behavior. (That is, a breakpoint is set in all of the cores).

NOTE

A software breakpoint applied to specific cores that happens to be set in shared code can break the application's real-time execution. This is because a software breakpoint in shared code always halts every core that executes it. The debugger must check the core's ID and if it is set as disabled, the debugger resumes the core's execution. The overhead of this check has an impact on runtime behavior and the caches if the processor is not running in cache coherency mode.

5 Watchpoints

The CodeWarrior debugger's handling of watchpoints is similar to breakpoints handling. There is one restriction though: the debugger only allows hardware watchpoints. The tools do not support software watchpoints. Therefore, when watchpoint is set, it applies to all of the cores.

Filtering can be specified in the same way as for breakpoints to specify those cores on which the watchpoint should apply, or to limit a watchpoint to the current core. Refer to sections [4.1](#) and [4.2](#) for more information.

6 Command Line Interface

The CodeWarrior debugger provides a command line interface through its Debugger Shell view. This view is a console where you can enter debugger and Tcl commands that control the execution of the cores. There are also commands that display or modify the contents of memory. Tcl scripts can be used to set up complex debugging scenarios or to automate testing.

As the Debugger Shell is not a default view, it must be started manually. This can be done in two ways:

- From the C/C++ Perspective: Choose **Window > Other > Debug > Debugger Shell**.
- From the Debug Perspective: Choose **Window > Show View > Debugger Shell**.

6.1 Starting a Multicore Debugging Session

The Debugger Shell's command line can be used to begin a multicore debug session where all of the cores start at once, or where each core starts separately. For example, given a launch group called `MyAppMSC8156.launch`, a multicore debug session can be started using the following command:

```
debug MyAppMSC8156
```

Alternatively, each launch configuration can be started separately, as follows:

```
debug "testMSC8156 - C_Debug_8156_HW - MSC8156 ADS Core 00"
debug "testMSC8156 - C_Debug_8156_HW - MSC8156 ADS Core 01"
debug "testMSC8156 - C_Debug_8156_HW - MSC8156 ADS Core 02"
debug "testMSC8156 - C_Debug_8156_HW - MSC8156 ADS Core 03"
debug "testMSC8156 - C_Debug_8156_HW - MSC8156 ADS Core 04"
debug "testMSC8156 - C_Debug_8156_HW - MSC8156 ADS Core 05"
```

Starting each core separately is useful when other commands must be issued before starting the next core with a debug command.

6.2 Running/Stopping Multiple Cores

Like the GUI version of the multicore debugging interface, to use multicore commands with the Debugger Shell, a multicore group must be defined first. This is necessary only if you want to apply multicore run control commands to a subset of the cores only. Per default the multicore commands apply to all the cores being loaded.

NOTE

All Tcl commands involved with multicore debugging have the prefix
`mc::`.

6.2.1 Defining a Multicore Group

To determine which architectures/types are supported by the Debugger Shell, enter following command:

```
mc::type
```

The command `mc::group` allows the definition of multicore groups for a specific architecture. For example, to create a new multicore group for a StarCore MSC8156 processor architecture, use the following command:

```
mc::group new MSC8156
```

This command can be used to create multiple groups. After a group is created, entering the command `mc::group` without arguments displays a list of currently defined groups:

```
mc::group
Index      Group
-----
0          MSC8156
0.0        MSC8156
0.1        MSC8156
0.2        MSC8156
0.3        MSC8156
0.4        MSC8156
0.5        MSC8156
```

NOTE

The list shows that a multicore group for a MSC8156 processor type has been assigned an index of 0 (the default). This index number is used in certain multicore commands to reference the group. Also, note that each core in the group has its own sub-index number. That is, core 0 has an index of 0.0, core 1 has an index of 0.1, and so on. The sub-index number provides a reference to a specific core in the group.

The command `mc::group rename` is used to rename the different groups and give them meaningful names. For example, to change the previously created group from MSC8156 to `cores_0_3`, enter:

```
mc::group rename 0 "cores_0_3"
```

In the above command, the 0 refers to the index of the newly-created multicore group. You can obtain group's index using the command `mc::group`.

At the end of a debugger script, it is good practice to delete all multicore groups previously created using the command `mc::group remove` or `mc::group removeall`. For instance, to remove the group generated above, enter the following command:

```
mc::group remove "cores_0_3"
```

6.2.2 Controlling Code Execution on Multiple Cores

To control code execution on several cores:

1. Select the multicore group and cores that the commands are applied to. Use the command `mc::group enable` to select the group and its cores.
 - To enable cores 0, 1, 2 and 3 in multicore group that has an index of 0, enter following commands:

```
mc::group enable 0.0
mc::group enable 0.1
mc::group enable 0.2
mc::group enable 0.3
```

To enable all cores in group with index 0, enter following command:

```
mc::group enable 0
```

2. Once the set of cores is selected, every future multicore control commands issued affects only the chosen cores. For example:

```
#Resume all enabled cores
mc::go
#Suspend all enabled cores
mc::stop
#Terminate all enabled cores
mc::kill
#Restart all enabled cores
mc::restart
```

6.2.3 Controlling Code Execution on a Single Core

The standard commands `restart`, `go` (resume), `halt` (suspend) and `kill` (terminate) are used to control a single core. However, before using the command, the core must be selected. This is done using command `switchtarget`. Like the `mc::group` command, when `switchtarget` is issued without an argument, it displays a list of cores.

For example, suppose a test is to be performed on a core with an index of 1 only. This is done through following commands:

```
# List all targets currently in debug session
switchtarget
--on-the-fly-connection-1-----
Index Status   Thread   Process   CPU           Target
*0 Stopped    0x0      0x8000    cpuSC100Big   testmsc8156.eld
 1 Stopped    0x0      0x8001    cpuSC100Big   c1_testmsc8156.eld
 2 Stopped    0x0      0x8002    cpuSC100Big   c2_testmsc8156.eld
 3 Stopped    0x0      0x8003    cpuSC100Big   c3_testmsc8156.eld
 4 Stopped    0x0      0x8004    cpuSC100Big   c4_testmsc8156.eld
 5 Stopped    0x0      0x8005    cpuSC100Big   c5_testmsc8156.eld

# Set core with index 1 the current core
switchtarget 1
# Resume execution on current core
run
```

NOTE

The `switchtarget` command has no impact on any of the Debug Perspective views outside of the Debugger Shell. That is, after executing a `switchtarget` command, the context of the **Variables**, **Memory**, and other views remain unchanged.

NOTE

When debugging a multicore application with a Tcl command script, it is recommended that the following command be issued before the debug session is started:

```
switchtarget -ResetIndex
```

Issuing the `switchtarget -ResetIndex` command before starting the debug sessions ensures that all of the cores are always associated with the same index. That is, core 0 is associated with index 0, core 1 with index 1, and so on.

6.3 Core-Specific Commands

Those debugger commands that do not start with a `mc :` prefix apply only to the current core. Therefore, it is important to switch to the appropriate core using the command `switchtarget` before issuing a command.

Debugger commands that apply only to the default core are shown in [Table 2](#).

Table 2. Debug Commands That Act on One Core

<code>ca:*</code>	<code>finish</code>	<code>nexti</code>	<code>setpc</code>
<code>caln*</code>	<code>funcs</code>	<code>redirect</code>	<code>stack</code>
<code>change</code>	<code>getpid</code>	<code>reg</code>	<code>step</code>
<code>copy</code>	<code>go</code>	<code>restart</code>	<code>stepi</code>
<code>disassemble</code>	<code>kill</code>	<code>restore</code>	<code>stop</code>
<code>display</code>	<code>mem</code>	<code>run</code>	<code>var</code>
<code>evaluate</code>	<code>next</code>	<code>save</code>	

6.4 Breakpoints

When a breakpoint is set using the `bp` command in the Debugger Shell, it is valid for all cores.

6.5 Watchpoints

When a watchpoint is set using the `watchpoint` command in the Debugger Shell, it is valid for all cores.

6.6 Example Multicore Debugging Script

Here is an example of a simple debugging script for a multicore application:

```
# Reset core index
switchtarget -ResetIndex
```



```
# start debug session
debug TestMsc8156

# clear all breakpoints
bp all off

# Set Breakpoints at entry point of function func1
bp func1

# run till breakpoint is executed
mc::go

#wait till all cores reach the breakpoint
wait 10000

# display all available target
switchtarget

# activate core 1
switchtarget 1

# step twice on core 1
step
step

# print current value of PC
display PC

#switch to core 0
switchtarget 0

# print value of PC
display PC
```

NOTE

More information on how to use Tcl to manage breakpoints and automate testing can be found in the Application Note, AN4114 “CodeWarrior Debugger TCL Scripting by Example”.

7 Tracing and Profiling

While debugging a multicore application, the code’s execution can be profiled for any number of cores: one, a subset of cores, or all of them.

For each of the cores to be profiled, the following configuration must be performed:

1. Open the **Debug Configuration** dialog.
2. Switch to the **Trace and Profile** tab.
3. Check the **Enable Trace and Profile** option, as shown in [Figure 23](#).

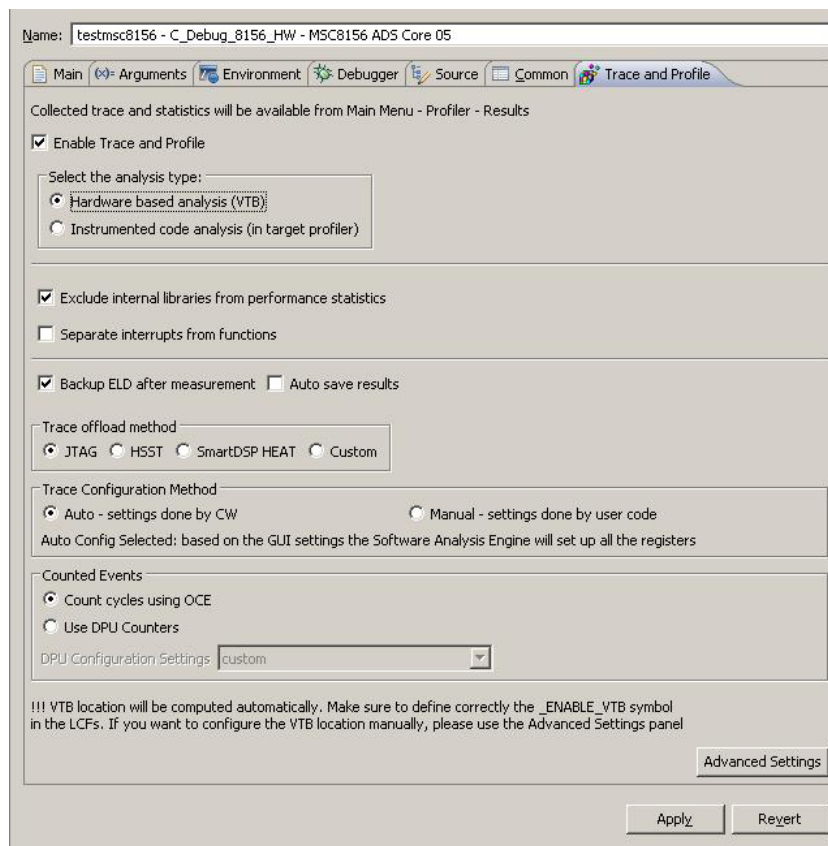


Figure 23. Activating the Code Trace and Profiling Feature

4. Adjust the other settings as required.
5. Click on **Advanced Settings** and check the VTB settings.

6. If **Compute VTB location automatically** is checked, make sure the symbols `_VTB_start` and `_VTB_end` have different values for each core you intend to profile in the application's `application.map` file, as shown in Figure 24.
 - If the project was created by the wizard without SmartDSP OS support, make sure `_ENABLE_VTB` is set to 1, 2 or 3 in `mmu_attr.l3k`. Refer to comments in `mmu_attr.l3k` for information on meaning of the different settings for `_ENABLE_VTB`.
 - If the project was created by the wizard with SmartDSP OS support, make sure `USING_VTB` is set to 1 in `os_msc815x_link.l3k`. This will reserve some memory in DDR1 for VTB with each core.

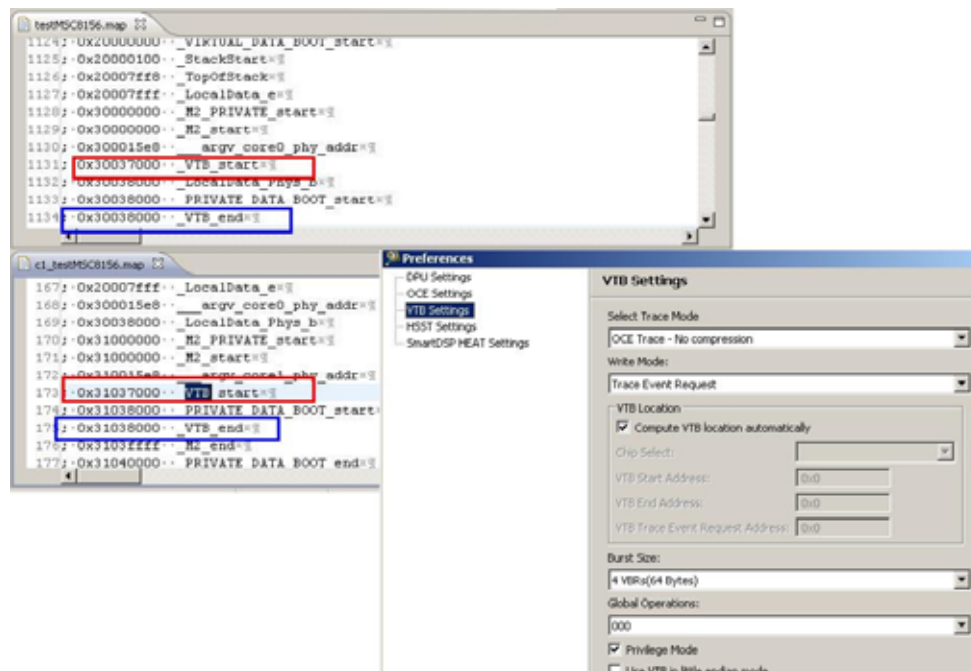


Figure 24. Configuring the VTB settings

7. If **Compute location automatically** is unchecked, a memory region for the VTB must be specified. This memory region needs to be different for each core, and should not overlap with the memory regions for application code and data.
 - For this configuration, it is critical that the VTB buffers occupy separate and unused memory regions.
8. Apply the changes to all of the cores to be profiled.
9. Close the **Debug Configuration** dialog.

10. After the application executes and terminates, for all of the cores that were in use a **Trace and Profile Results** view appears, as shown in [Figure 25](#).

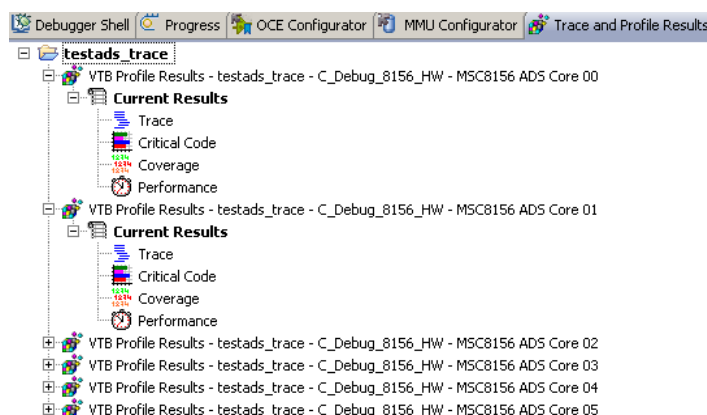


Figure 25. Display to Access the Various Trace Results

The data for each core profiled can be displayed by clicking on the **Trace**, **Critical Code**, **Coverage**, or **Performance** option associated with each core in this view.

8 Multi-Device Considerations

The following section discussed how to configure the CodeWarrior tools to debug a system with multiple devices. That is, the system that has two or more StarCore processors on it.

8.1 Configuring the CodeWarrior Debugger to Use Multiple Devices

The CodeWarrior tools must be configured properly in order to debug multi-device systems without spurious issues appearing. For information on how to do this, refer to the application note, AN3908, “A Guide to Configuring Multiple MSC8156 Devices on a Single JTAG Chain Using CodeWarrior Development Studio for StarCore DSP Architectures v10.0”. This document appears as the file AN3908.Multi-DSP JTAG Chain.pdf, and can be found in the {CodeWarrior installation}\SC\Help\PDF directory.

8.2 Group Hierarchy

When debugging on multiple devices, a group hierarchy can be defined in order to debug all of the device’s cores with a single mouse click.

Section [1.1.1](#) describes how to define a launch group that manages all six cores on a MSC8156 device. If the system has multiple MSC8156 devices in the JTAG chain, a launch group can be defined for each one. A master launch group is then defined that includes the launch group for every device in the system.

8.2.1 Example for a MSC8156AMC Board

The MSC8156AMC board is a system that contains three MSC8156 processors. To have the CodeWarrior debugger manage and control all eighteen cores, define a launch group that starts all eighteen cores with a single mouse click. Proceed as follows:

1. Create a launch group named `testAMC - Processor 1` that manages all of the cores on the first device (cores 00 – 05) by following the steps outlined in section 1.1.1 and 1.1.2. The results appear in Figure 26.

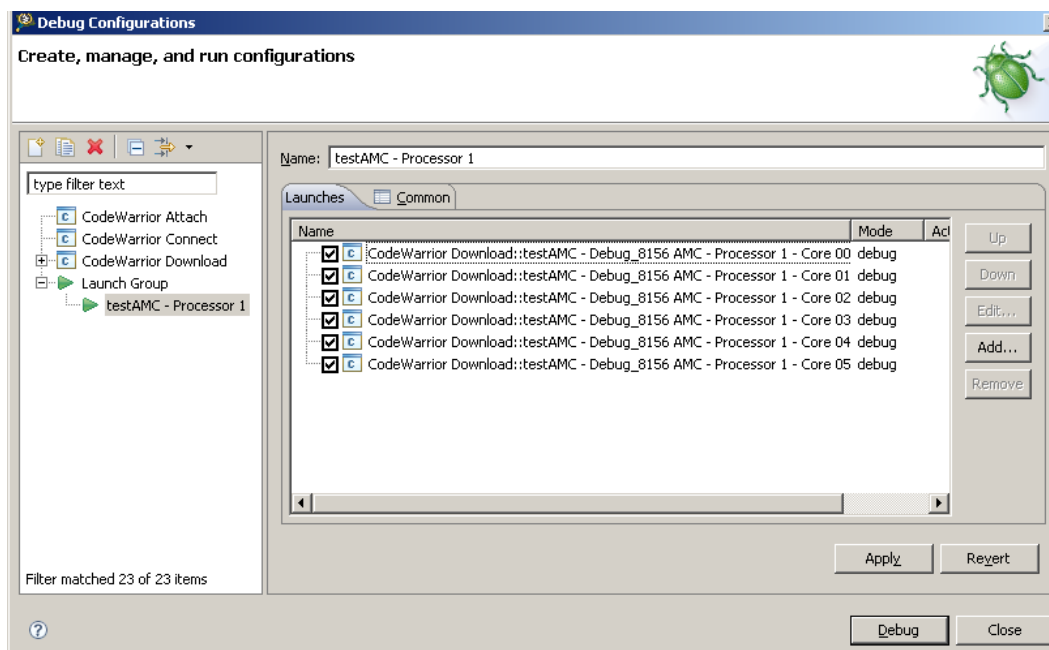


Figure 26. Making the Launch Group Processor 1 That Controls Cores 0 Through 5

2. Create a launch group named `testAMC - Processor 2` that manages all of the cores on the second device (cores 06 – 11) by following the steps in section 1.1.1 and 1.1.2. See Figure 27.

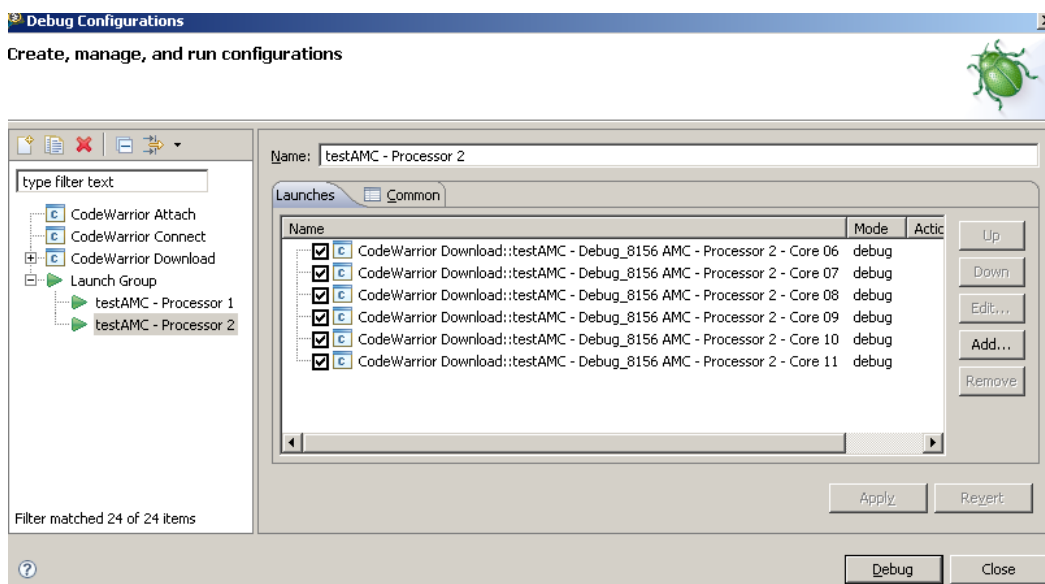


Figure 27. The Launch Group Processor 2 That Manages Cores 6 Through 11

3. Create a launch group named `testAMC - Processor 3` that manages all of the cores on the third device (cores 12 – 17) by following the steps described in section 1.1.1 and 1.1.2. See Figure 28.

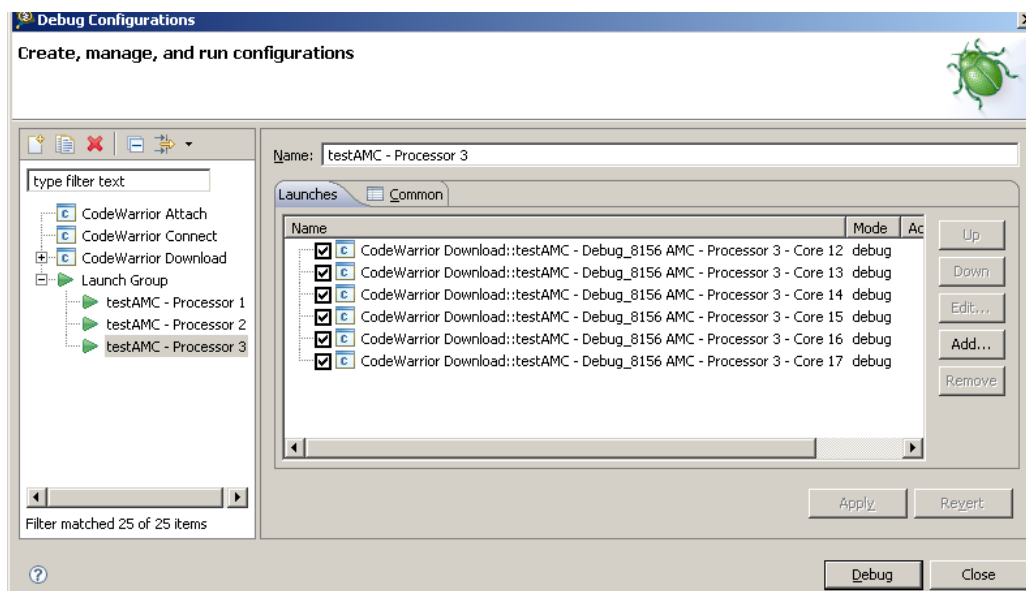


Figure 28. Launch Group Processor 3 That Manages Cores 12 Through 17

- Finally, create a launch group named `testAMC - All Processors` that incorporates the three launch groups just made in steps 1, 2, and 3. The results are shown in Figure 29.

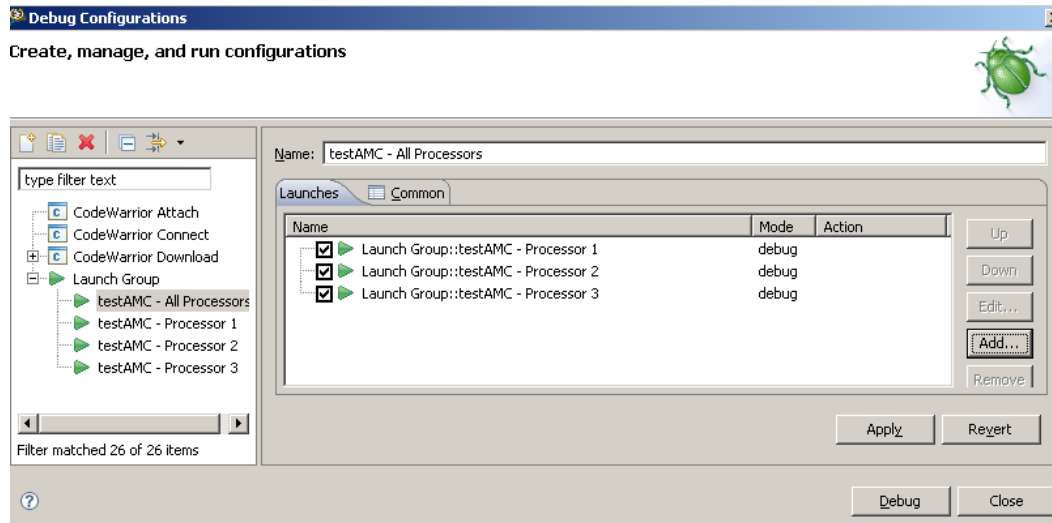


Figure 29. Making the Master Launch Group That Controls the Three Other Launch Groups

To start debugging on all eighteen cores, select the `testAMC - All Processors` launch group in the **Debug Configuration** window and click on **Debug**. To start debugging on processor 1 only, just select the `testAMC - Processor 1` launch group in the **Debug Configuration** window and click on **Debug**.

NOTE

When defining a launch group for multiple devices, the **Execute Reset** option must be checked for only *one core* in the entire system (usually core 0 on Processor 1). Make sure that the launch group for that device is specified first in the All Processors launch group.

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