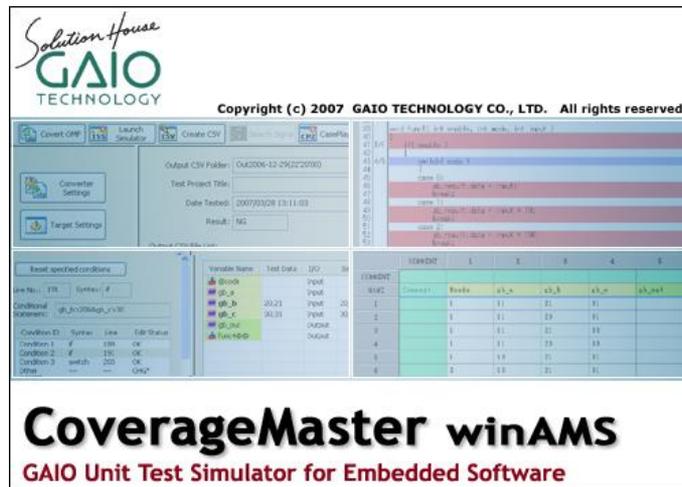


# CoverageMaster winAMS - Coverage Measurement Hook Code (MC/DC) Setup Guide



**Solution House**  
**GAIO**  
TECHNOLOGY

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Convert OMP | Launch Simulator | Create CSV | Search Scope | CaseFile

Output CSV Folder: Out2004-12-092220700

Test Project Title: [Empty]

Date Testbed: 2007/03/28 13:11:03

Result: NG

Variable Name	Test Data	I/O	SI
g_brook	input	input	
g_b_p	input	input	
g_b_b	input	input	20
g_b_c	input	input	30
g_b_out	output	output	
g_b_out2	output	output	

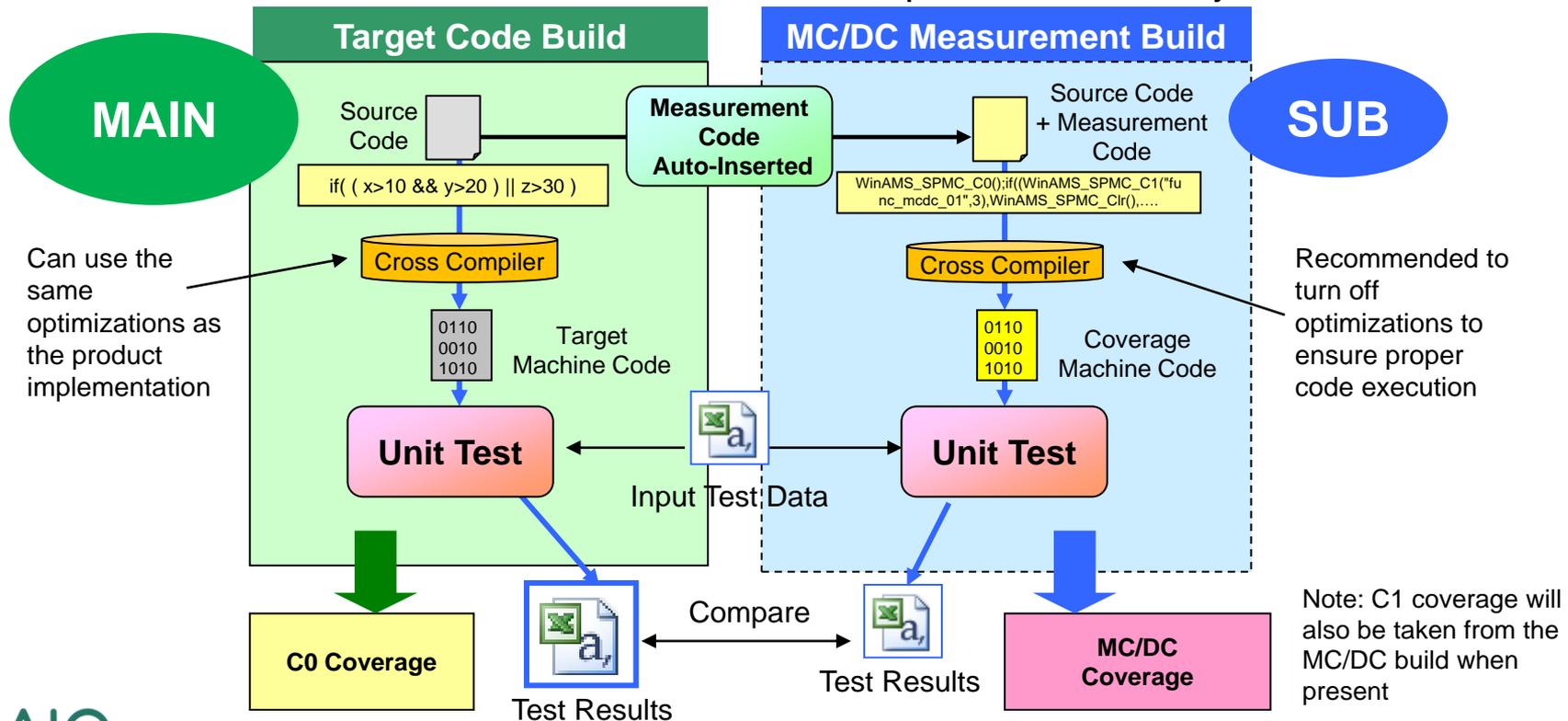
TESTCASE	1	2	3	4	5
TESTCASE1	Pass	Fail	Fail	Fail	Fail
TESTCASE2	Pass	Fail	Fail	Fail	Fail
TESTCASE3	Pass	Fail	Fail	Fail	Fail
TESTCASE4	Pass	Fail	Fail	Fail	Fail
TESTCASE5	Pass	Fail	Fail	Fail	Fail

**CoverageMaster winAMS**  
GAIO Unit Test Simulator for Embedded Software

# How MC/DC is Measured

## ■ In order to measure MC/DC, the test is run twice

- Main run: the unit test results are acquired from the unmodified target source code and compared with the expected results
- Sub run: coverage measurement code inserted into the source code is used for measuring coverage
- The results of the two executions are compared for accuracy



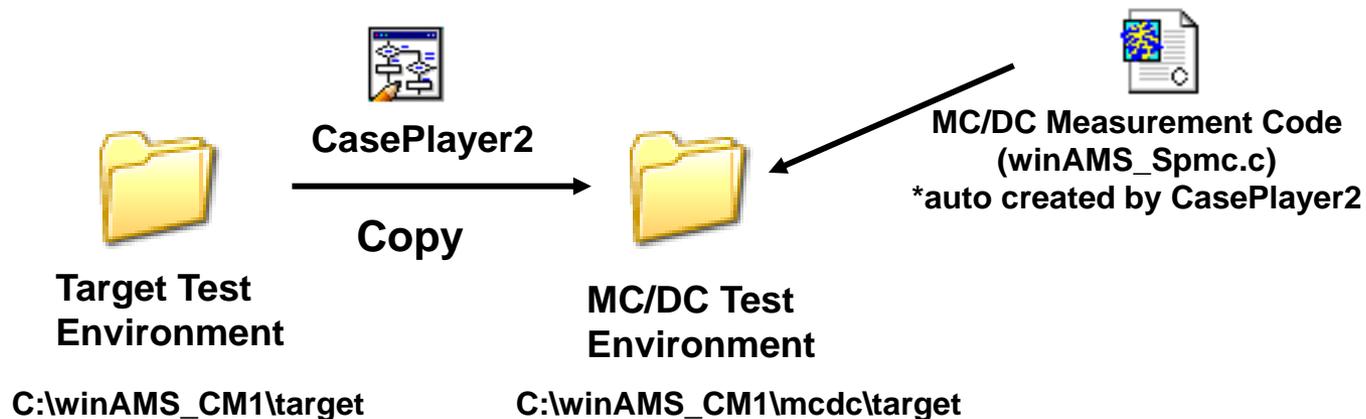
# MC/DC Testing Setup Outline

## ■ MC/DC test environment setup procedure

A full copy of the target test environment including the build project and source files will be made and then configured for MC/DC testing.

1. Create a copy of the test environment using CasePlayer2
  - CasePlayer2 will auto insert the necessary MC/DC measurement code into the copied MC/DC test environment source files.
2. Add the MC/DC measurement code file (winAMS\_Spmc.c) to the MC/DC test environment's build project and rebuild
3. Enable CoverageMaster MC/DC test settings

*\*Note: the CoverageMaster tutorial test environment is used an example for this document. Replace path locations with your project paths if different.*

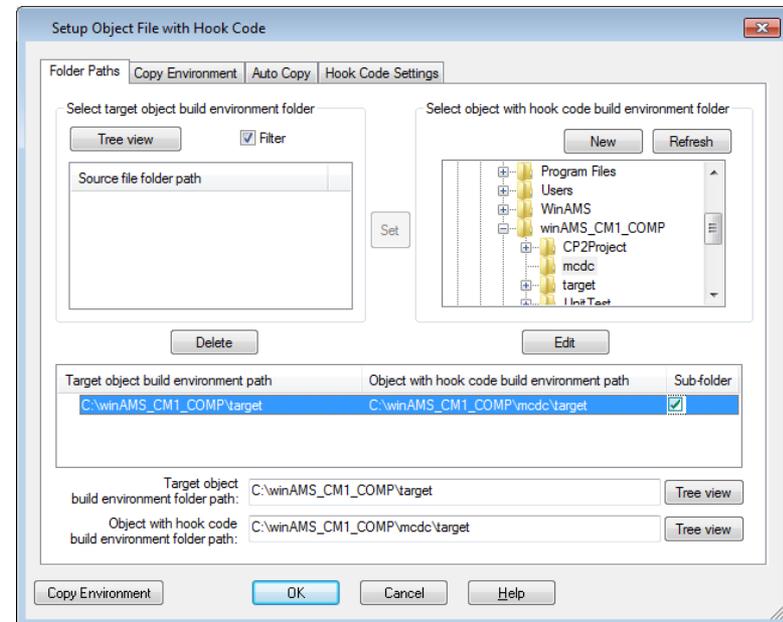
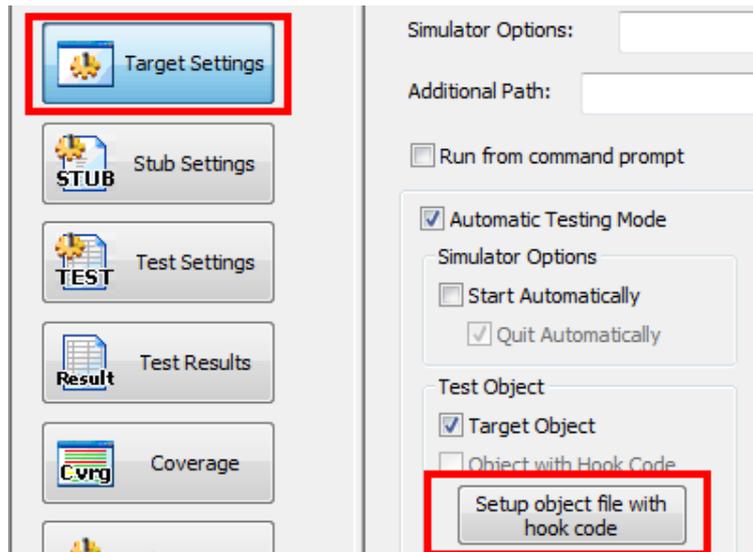


# Copy the target build environment

## ■ Copy the target build environment

1. From the SSTManager main screen click the **Target Settings** button
  - Click the **Setup object file with hook code** button  
(CasePlayer2 opens the **Setup Object File with Hook Code** dialog)
2. Select target object build environment folder: **C:\winAMS\_CM1\target**
3. Select object with hook code build environment folder: **C:\winAMS\_CM1\mcdc**  
(To create a new folder: select the project folder (**C:\winAMS\_CM1**), click the **New** button, then name the folder as **mcdc**)
4. Click the **Set** button (with both original and new build environment folders selected)

[Continue on next page...]

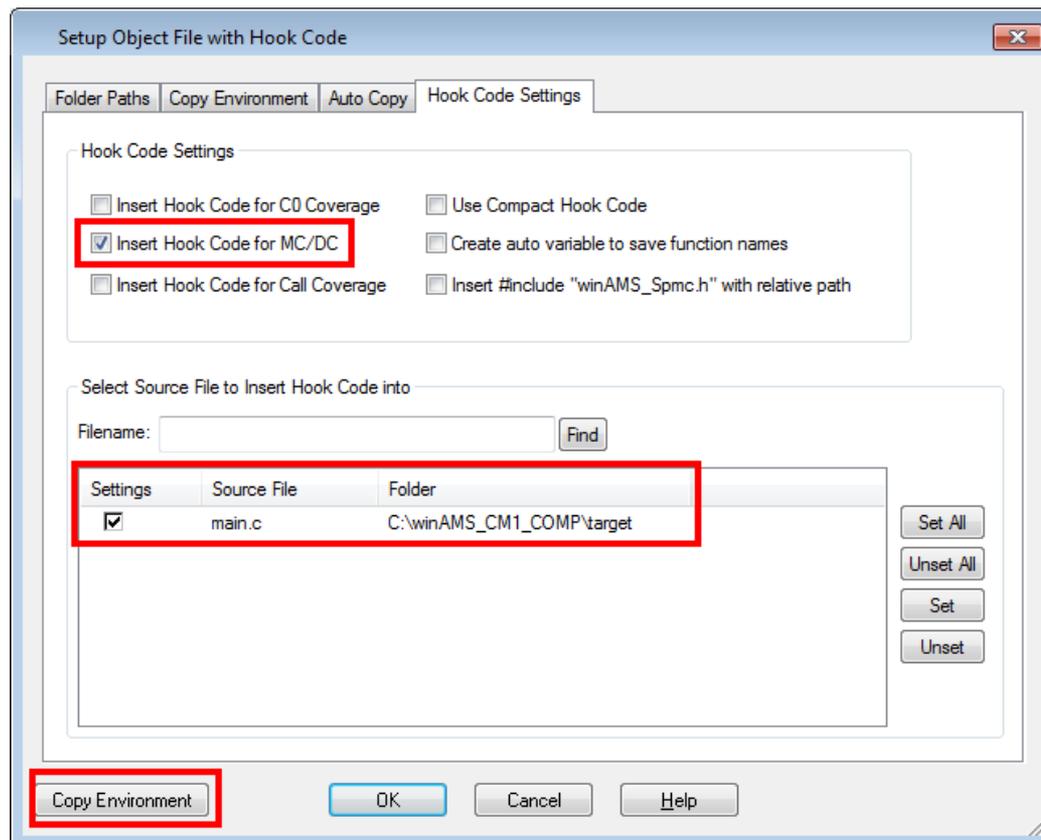


# Copy the target build environment (cont.)

## ■ Copy the target build environment (continued)

5. Click the **Hook Code Settings** tab, check the **Insert Hook Code for MC/DC** option
6. Verify that the source files to insert hook code into (main.c in the tutorial example) are checked
7. Click the **Copy Environment** button

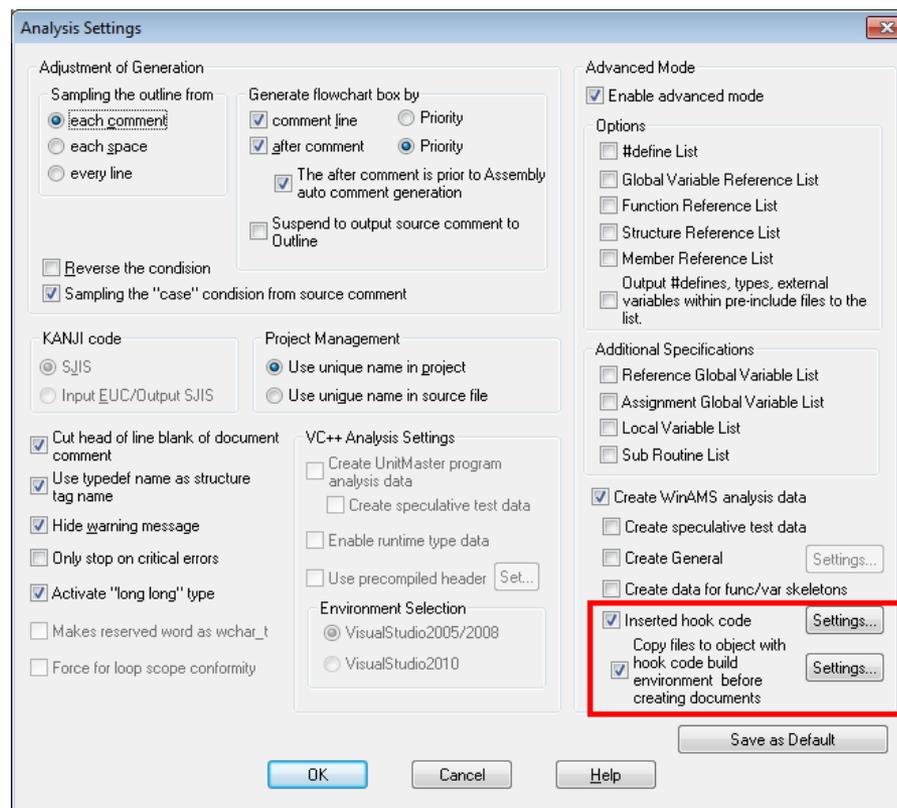
*\*Note: for large build environments this can take some time*



# Insert coverage measurement hook code

## ■ Insert coverage measurement hook code

1. From CasePlayer2 - click the **Settings** tab – double-click on **Analysis Settings**
  - Verify that the **Inserted hook code** and **Copy files to object with hook code build environment before creating documents** options are checked
2. Click **OK** to close the dialog, continue on the next page



# Insert coverage measurement hook code (cont.)

## ■ Insert coverage measurement hook code

1. From the CasePlayer2 menu click:

### Project - Re-create all Documents

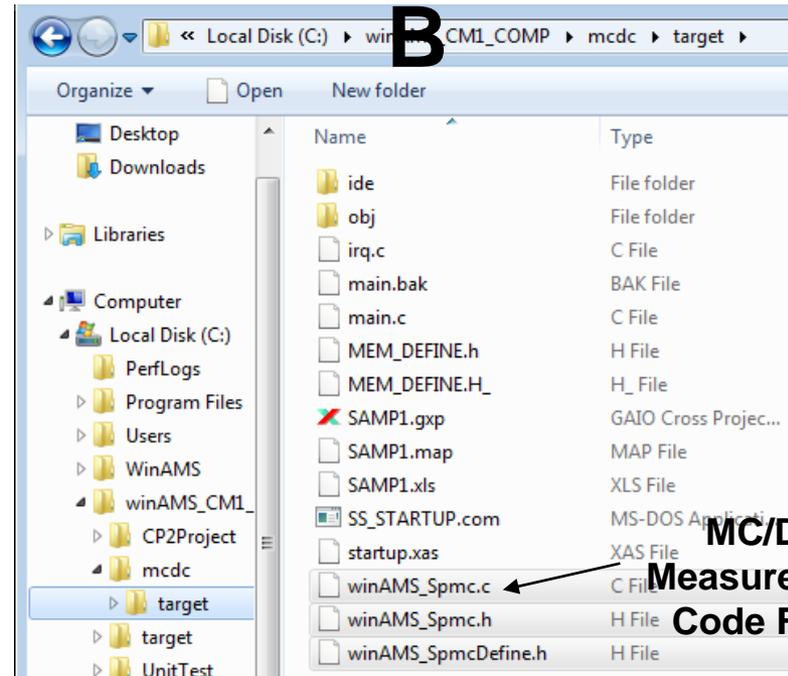
- A. Coverage measurement hook code will be inserted into the MC/DC build environment folder's source files
- B. Additional .c & .h files for MC/DC measurement will appear in the MC/DC build environment folder (**C:\winAMS\_CM1\mcdc\target**)

```
#include "winAMS_Spmc.h"
#line 9 "C:\winAMS_CM1_COMP\target\main.c"
unsigned int *IRQ_COUNT = 0x04000000;
unsigned int *TIM_ENABLE = 0x04000004;
#line 12
void main()
{
#line 15
}
#line 27
struct ST_PARAM
{
int data;
int ret_code;
} gb_result;
#line 33
void func1( int enable, int mode, int input )
{
if((WinAMS_SPMC_C1("func1",3),WinAMS_SPMC_Clr(1),
WinAMS_SPMC_C1("func1",5);switch( mode )
```

**A**

**main.c with coverage measurement hook code.**

**Verify that measurement hook code was inserted into your source files.**



# Build the MC/DC Object File

## ■ Add the MC/DC measurement code file (winAMS\_Spmc.c) to the MC/DC test environment build project and rebuild

1. Double-click **SAMP1.gxp** found in **C:\winAMS\_CM1\mcdc\target\** (for tutorial users using GAIO's cross compiler)

*\*Note: for users using other compilers, you need to open the MC/DC build environment and build using your cross compiler*

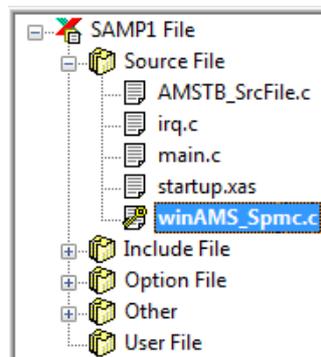
1. From the GAIO Framework menu click:

### **File - Register File in Project**

Select **C:\winAMS\_CM1\mcdc\target\winAMS\_Spmc.c**, click **OK**.

*\*Note: if a message was displayed stating that AMSTB\_SrcFile.c is missing, remove the file from the project (using the right-click menu), then re-add **C:\winAMS\_CM1\UnitTest\AMSTB\_SrcFile.c***

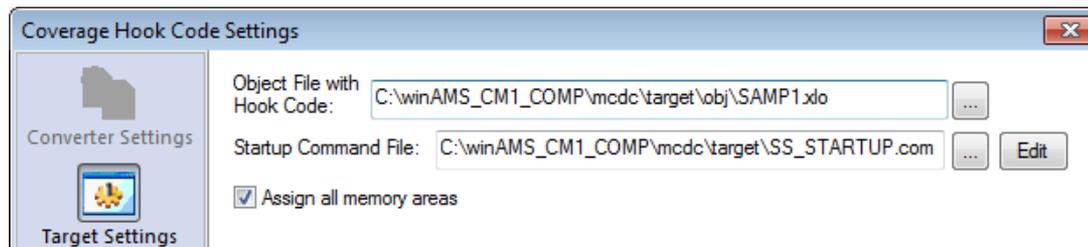
2. From the GAIO Framework menu click: **Build - Rebuild**



# Register the MC/DC Object File for Testing

## ■ Register the MC/DC test object in CoverageMaster (SSTManager)

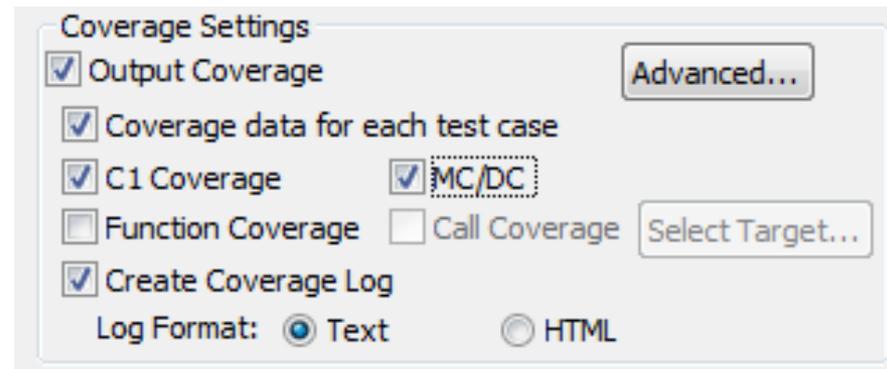
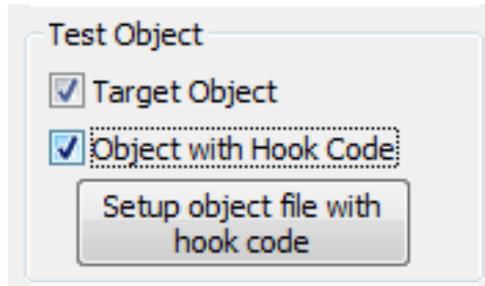
1. From the SSTManager main screen click the **Coverage Hook Code Settings** button (the dialog will appear).
  1. Target Settings - Object File with Hook Code:  
**C:\winAMS\_CM1\mcdc\target\obj\SAMP1.xlo**  
(for tutorial users using GAIO's cross compiler)  
*\*Note: for users using other compilers, you need to register the object file in Converter Settings – Input Object and then OMF Convert*
  2. Target Settings - Startup Command File:  
**C:\winAMS\_CM1\mcdc\target\SS\_STARTUP.com**  
*\*Note: in order to increase simulation speed, the set trace line in the startup command file should be commented out or removed. Refer to Exercise 1 in the tutorial for additional information.*
  3. Check the Target Settings - **Assign all memory areas** box
  4. Click **OK**



# Enable MC/DC Settings

## ■ Enable MC/DC settings in CoverageMaster (SSTManager)

1. From the SSTManager main screen click the **Target Settings** button
  - Under the **Test Object** section, check the **Object with hook code** box (leave **Target Object** box checked as well)
2. From the SSTManager main screen click the **Test Settings** button
  - Under the **Coverage Settings** section, check the **MC/DC** box



# MC/DC Test Results

## ■ Start the test

1. From the SSTManager main screen click the **Start Simulator** button
  - The simulator will run twice for each test CSV file (one for the target object, and again for the Object with Hook Code)
2. From SSTManager main screen click the **Coverage** button in order to view the coverage results

Function	C0	C1	MC/DC
func1	100%	100%	100%
func2	100%	100%	100%
func3	100%	100%	100%
func4	100%	100%	100%

The screenshot shows a code editor with the following code and annotations:

```
183 int func4( int code )
184 {
185     int return_value=FALSE;
186     int i;
187
188
189 T/F 8 if( gb_a > 10 )
    [MC/DC t/f] gb_a>10
190     {
191 T/F 3 if( gb_b > 20 && gb_c > 30 )
    [MC/DC t/f] gb_b>20
    [MC/DC t/f] gb_c>30
192     }
```

At the top of the editor, there are several colored buttons: Run (red), Not-run (yellow), C1-OK (green), C1-NG (blue), MC/DC-OK (light green), and MC/DC-NG (light blue). Below these are buttons for 'Show Disassembled Code', 'Show in Flowchart', 'Show MC/DC', and 'All Tests'.



**END**

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