Max1000 Companion

Workbook

About this Workbook

The contents of this workbook are created by Adiuvo Engineering & Training, Ltd.

If you have any questions about the contents, or need assistance, please contact Adam Taylor at Support@adiuvoengineering.com.

Pre-Lab

Workshop Pre-requisites

Required Hardware

The following hardware is required to re create this lab

1. Max1000 Board (TEI0001)
2. STM32F723E- Discovery Board
3. Two USB to Micro USB Cable

Downloads and Installations

Step 1 – Download and install the following at least one day prior to the workshop. This may take a significant amount of time and drive space.

Quartus Prime 18.1 Lite Edition	Download
STM32CubeIDE 1.6.1	Download
STM32CubeMX	Download
Arrow USB Blaster	Download

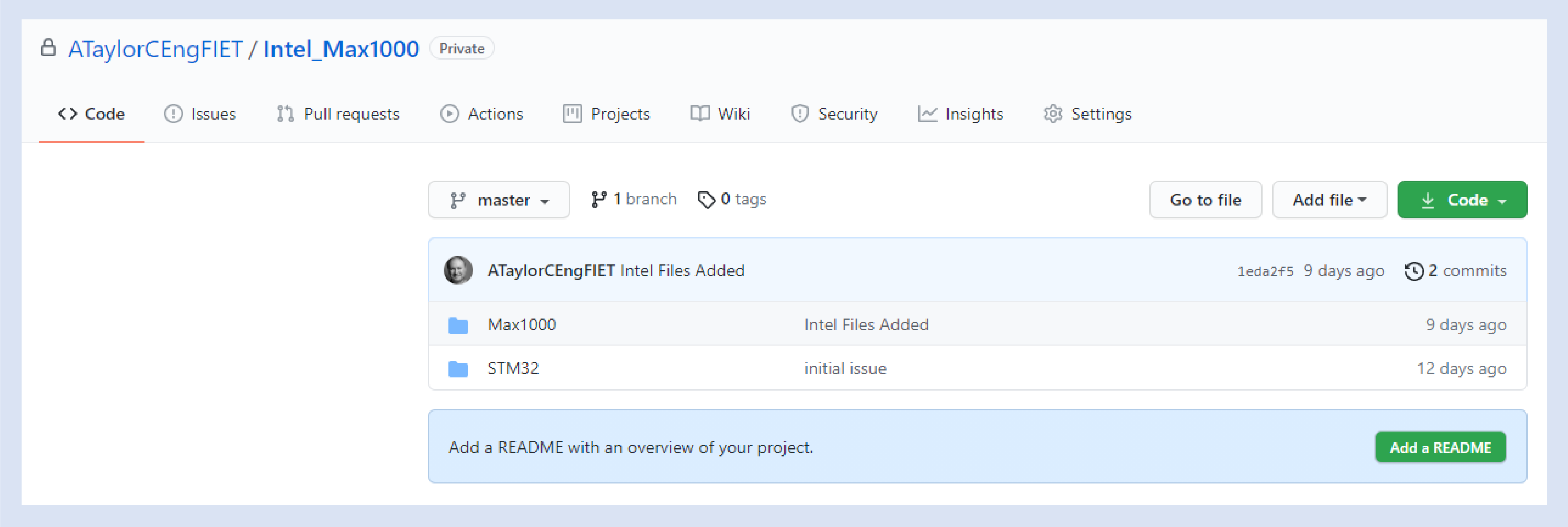
All software used in this lab is free and does not require any licensing costs.

Lab
Max1000 Companion Chip

Section One: STM32F723 Discovery Board Project Creation

Max 1000: Companion Chip

Step 1 – Navigate to https://github.com/ATaylorCEngFIET/Intel_Max1000 and clone or download the zip from the repository.



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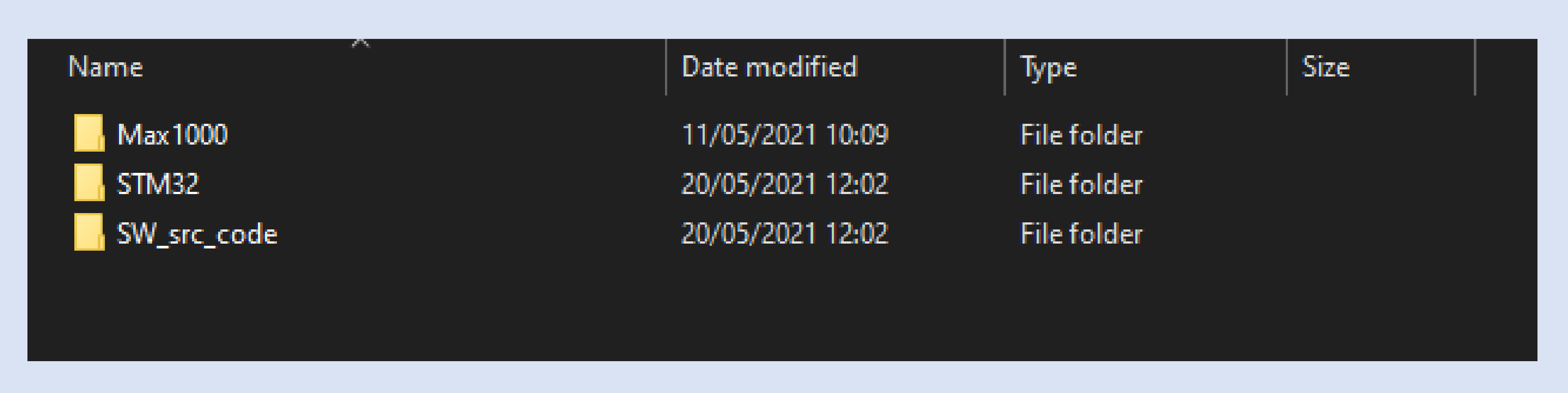
Step 2 – Once the repo is cloned you should see three directories, one for the Max1000, one for the STM32 and a final one for the SW source code.



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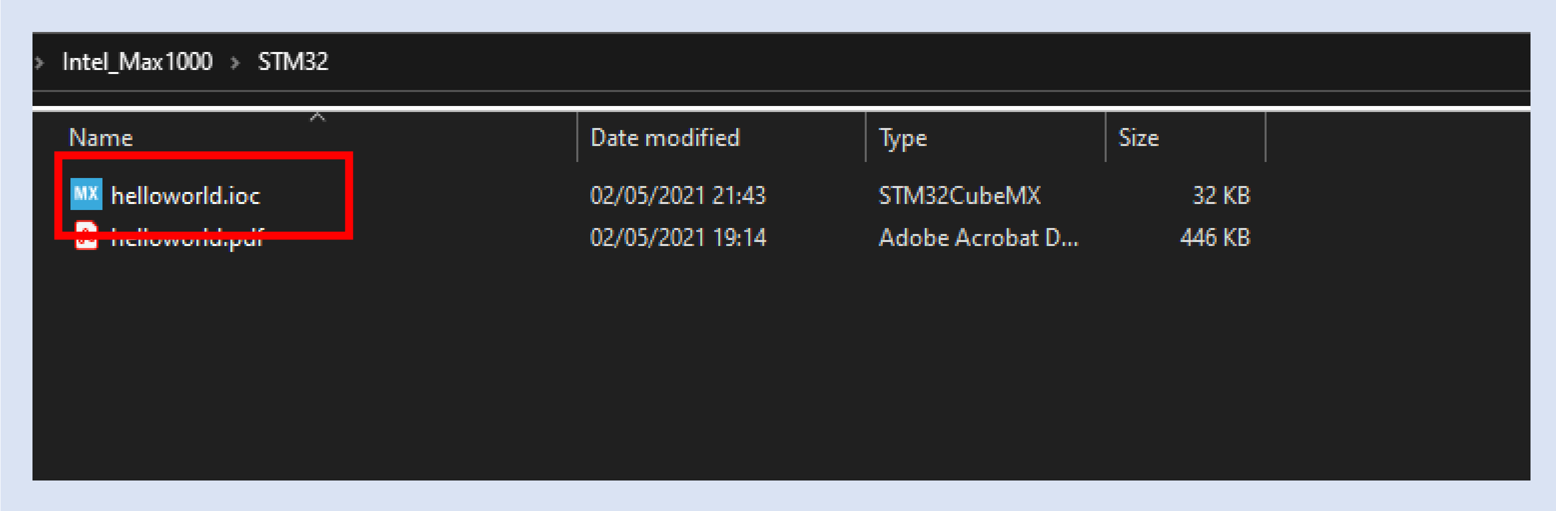
Step 3 – Under the STM32 folder double click on the helloworld.ioc to open the STM32 CubeMX application



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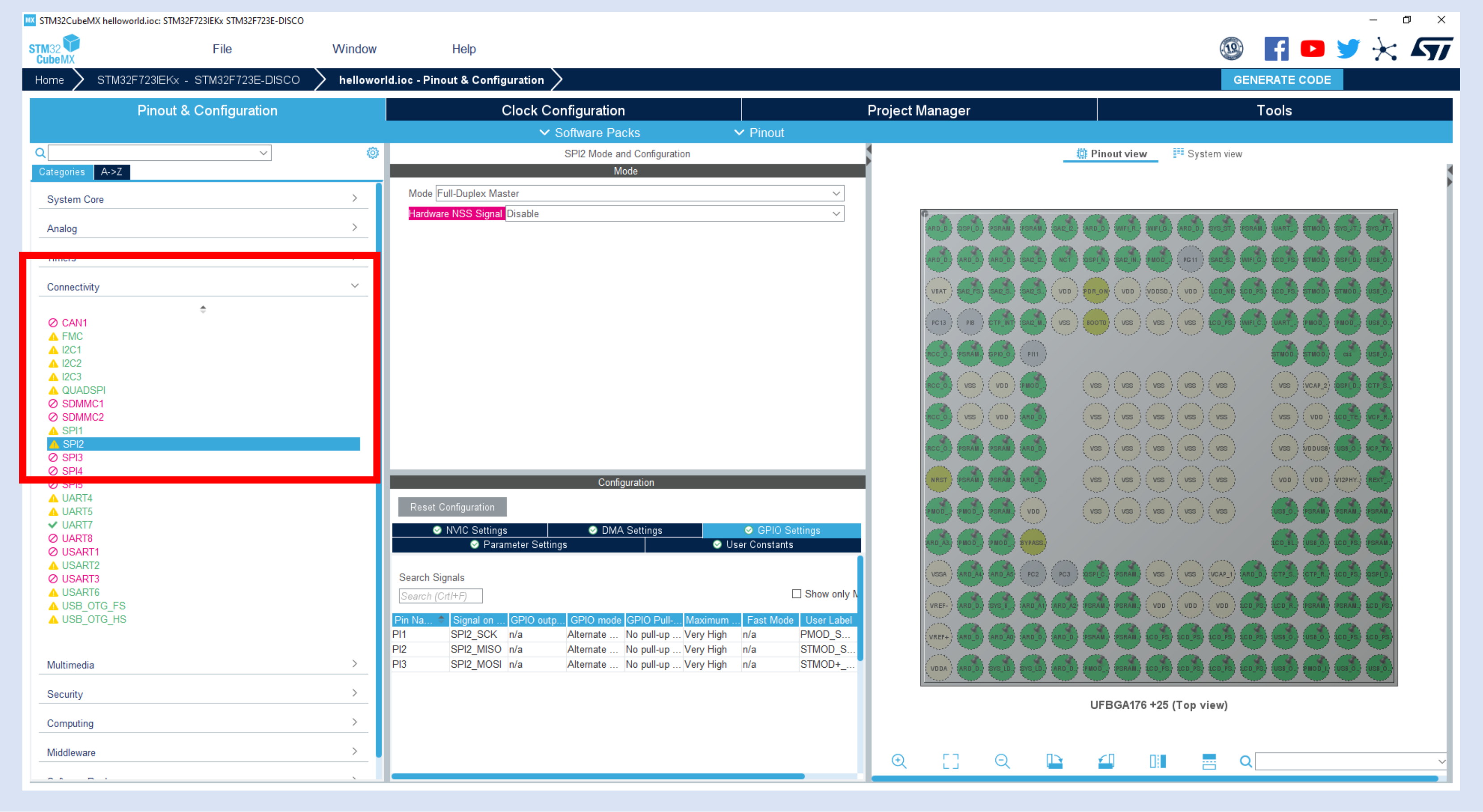
Step 4 – Once the project opens, explore the connectivity and project manager settings, all setting are the default except for the SPI CS pin being made GPIO



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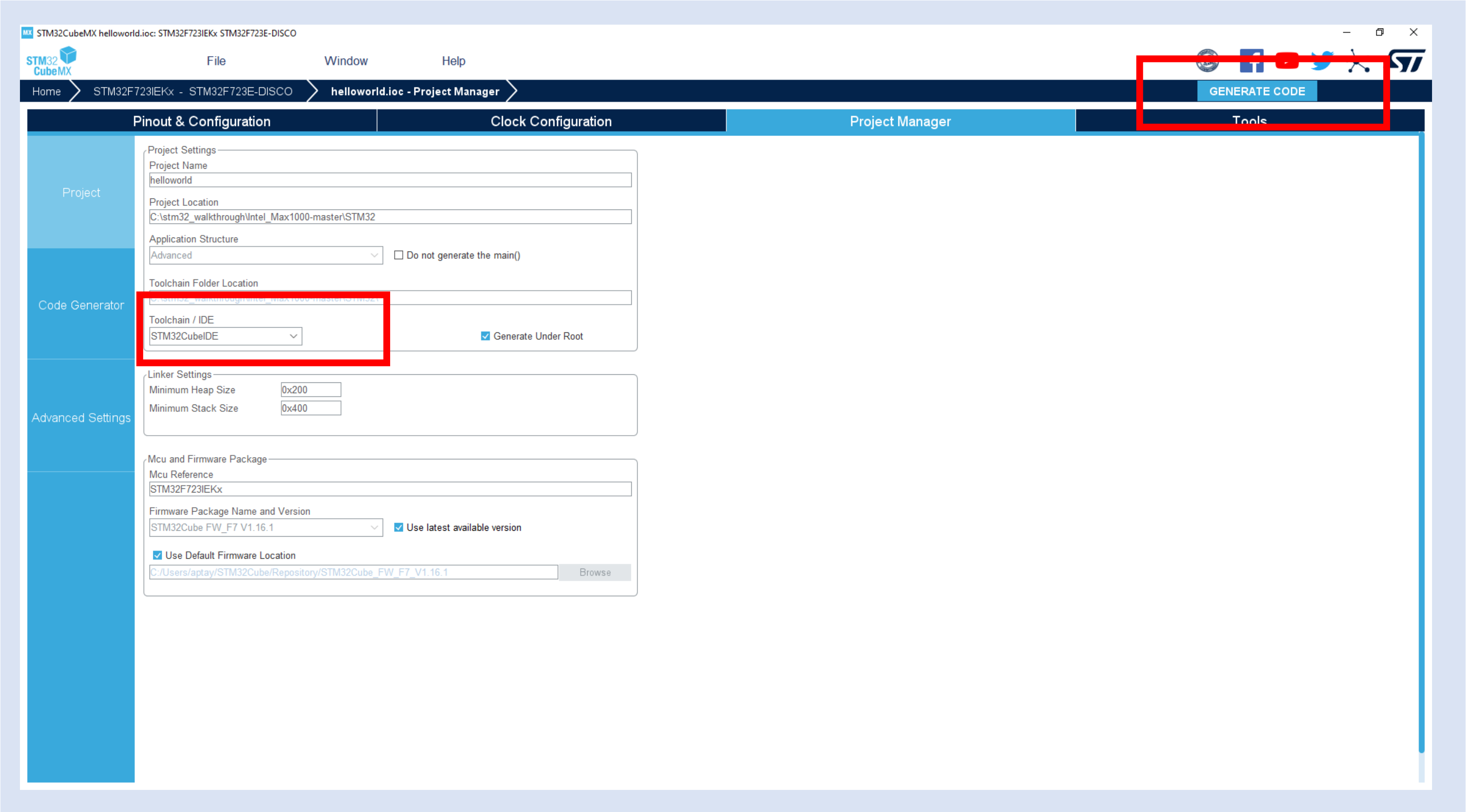
Step 5 – On the project manager tab, ensure the tool chain is set for the STM32Cube IDE and generate the code



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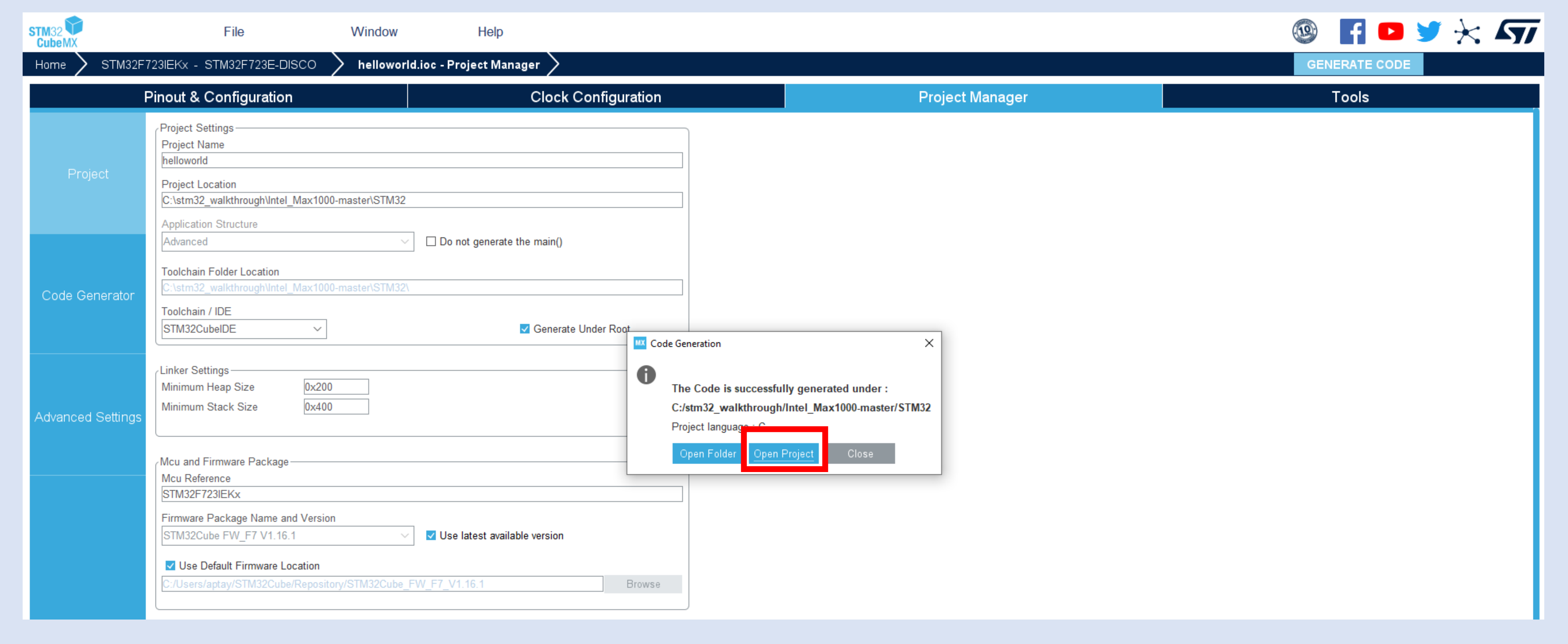
Step 6 – Code generation may take a few minutes, once code generation has completed, click on launch project



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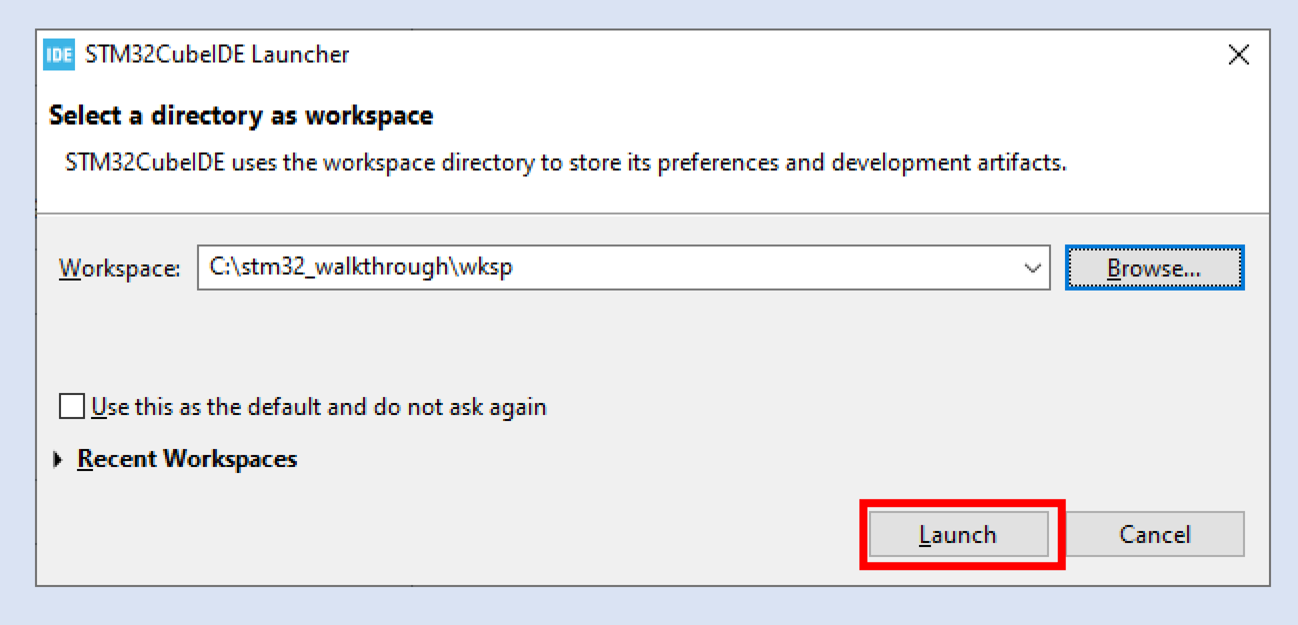
Step 7 – As the STM32CubeIDE opens, you will be asked to select a working directory for the STM32 application. Navigate to an appropriate directory and click launch.



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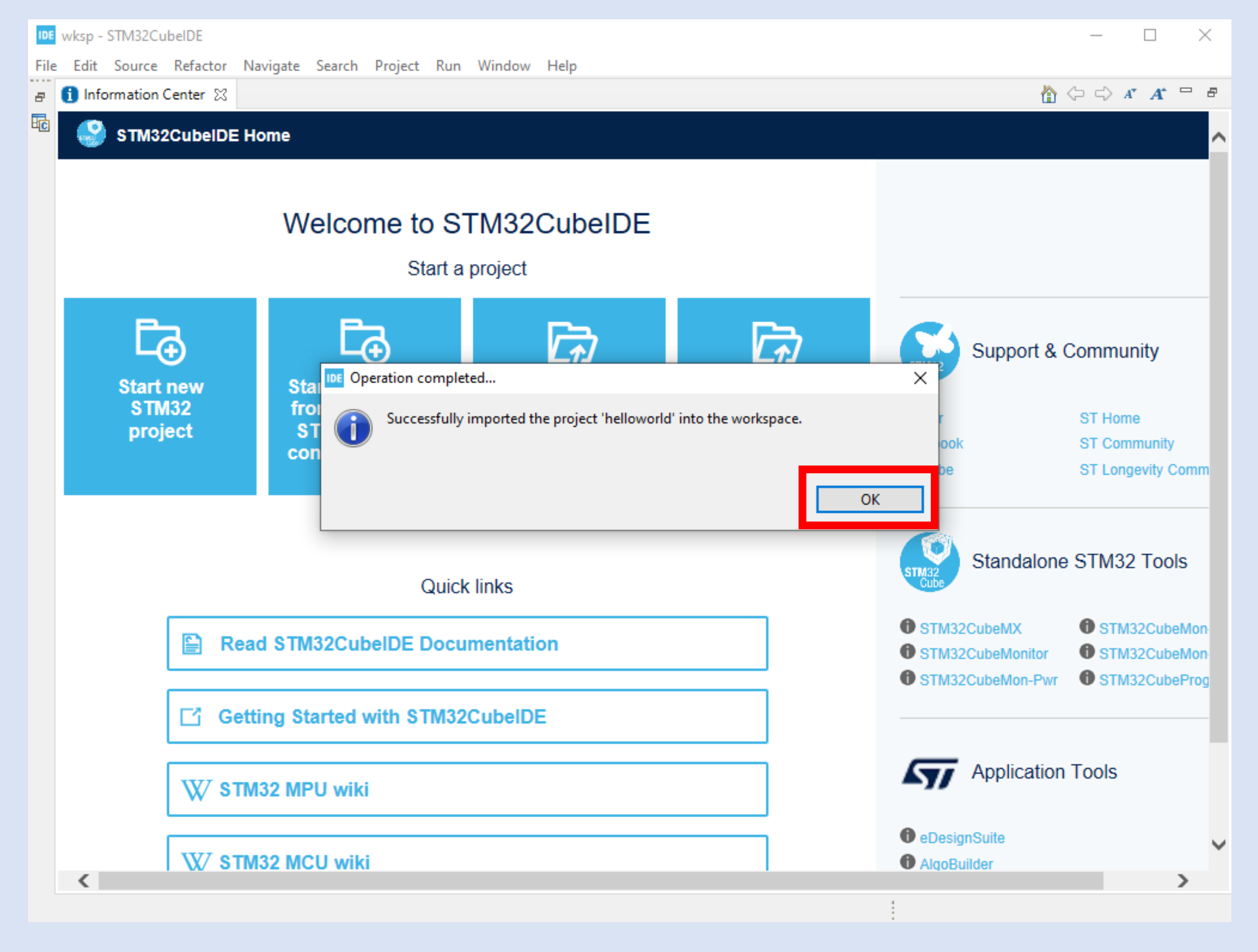
Step 8 – You should see STM32CubeIDE Open and the STM32CubeMX project imported successfully, click OK.



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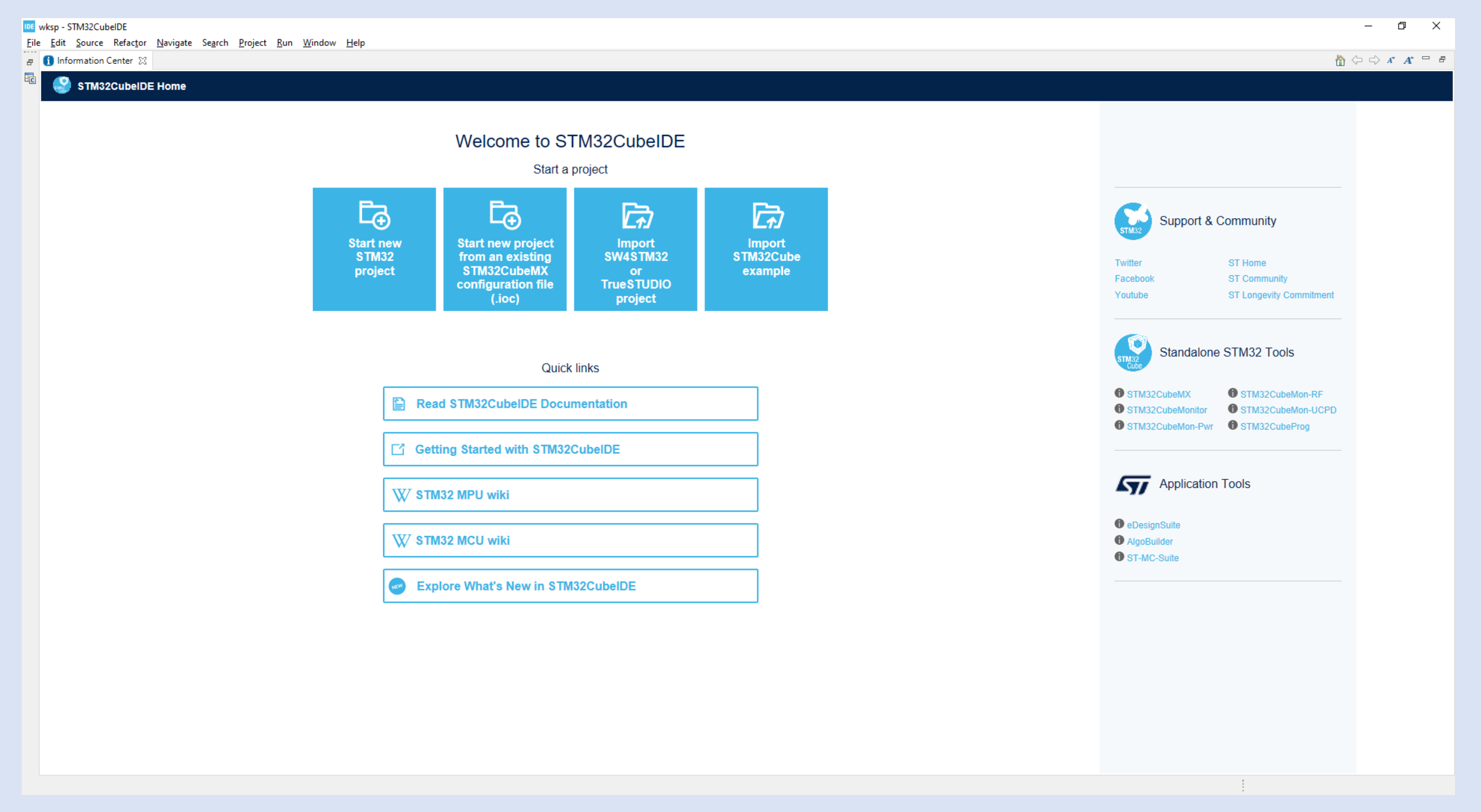
Step 9 – Once STM32CubeIDE is fully open click, close the information center



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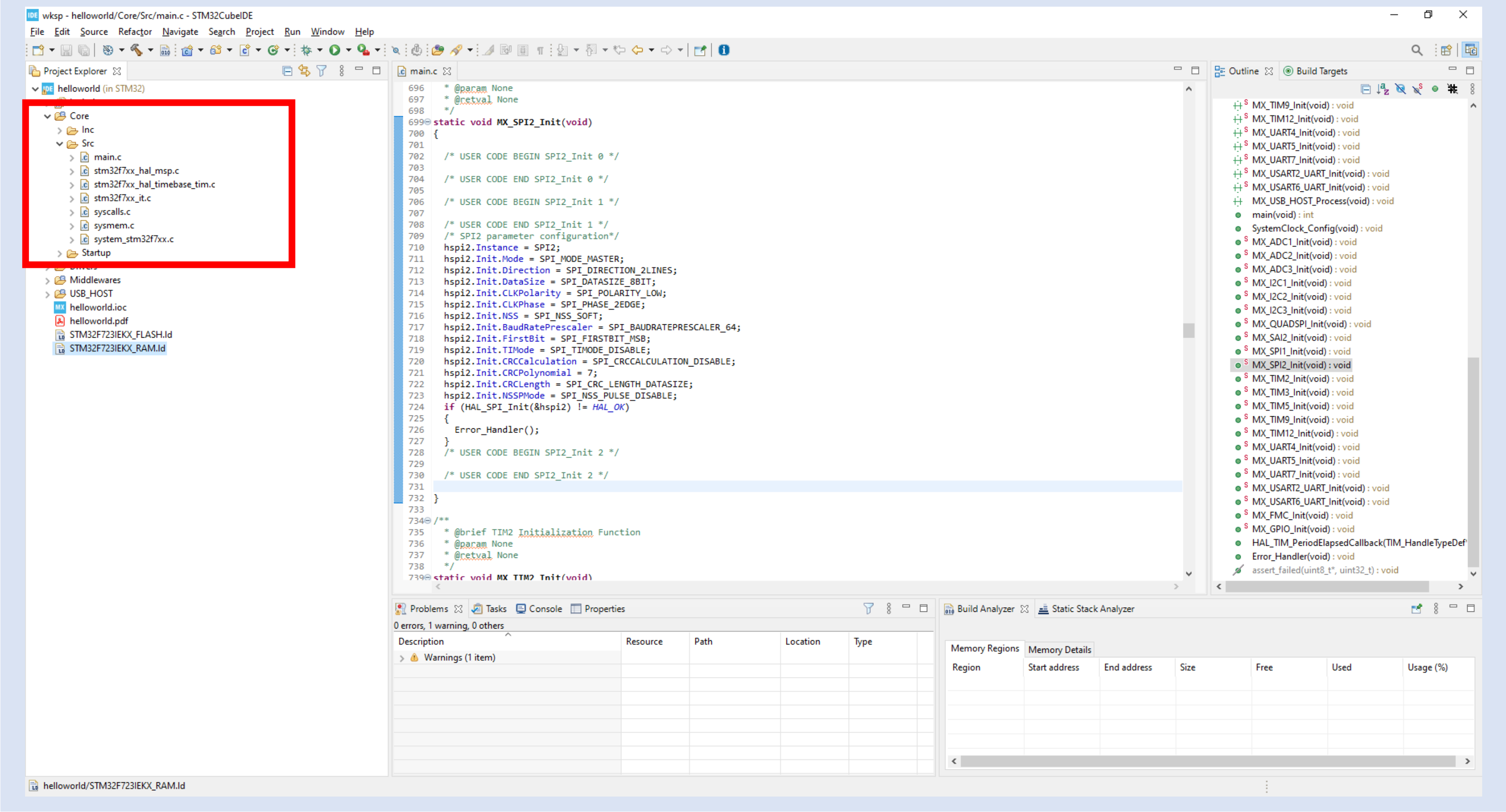
Step 10 – Closing the information center will show the project created in STM32CubeMX. The application we will change is under Core/Src and Core/Inc for include and source files.



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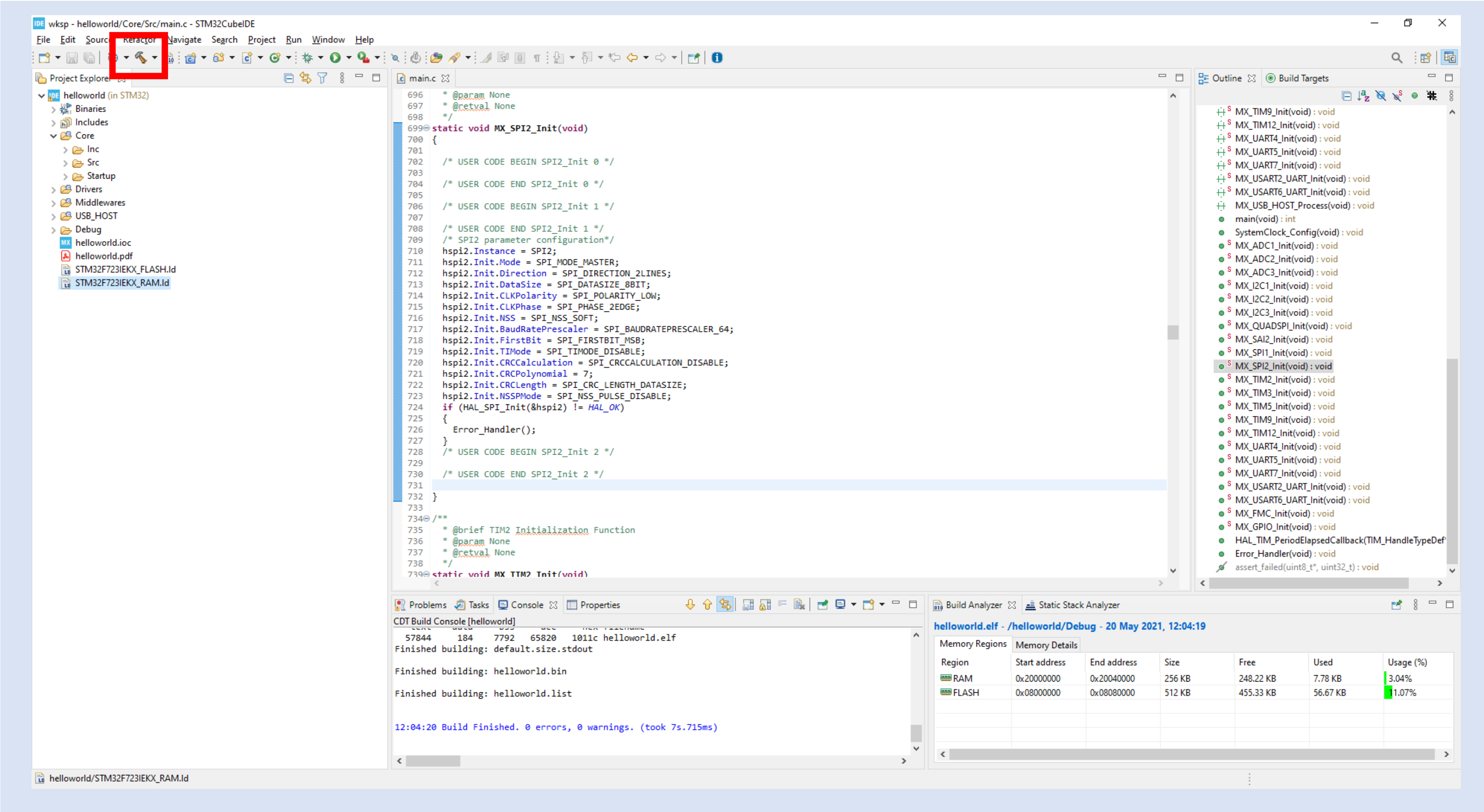
Step 11 – Click on the hammer icon to build the application, this should take a few seconds. Doing this demonstrates the basic project will build with no errors before we update the design.



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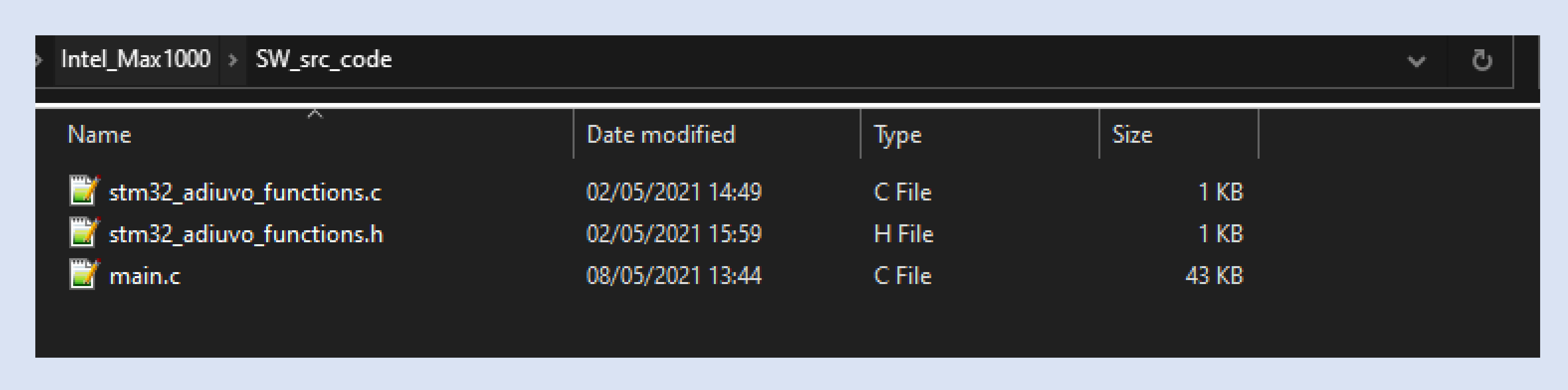
Step 12 – Copy the files from the Repo SW_src_code directory into the STM32CubeIDE project under the src and inc directories as necessary



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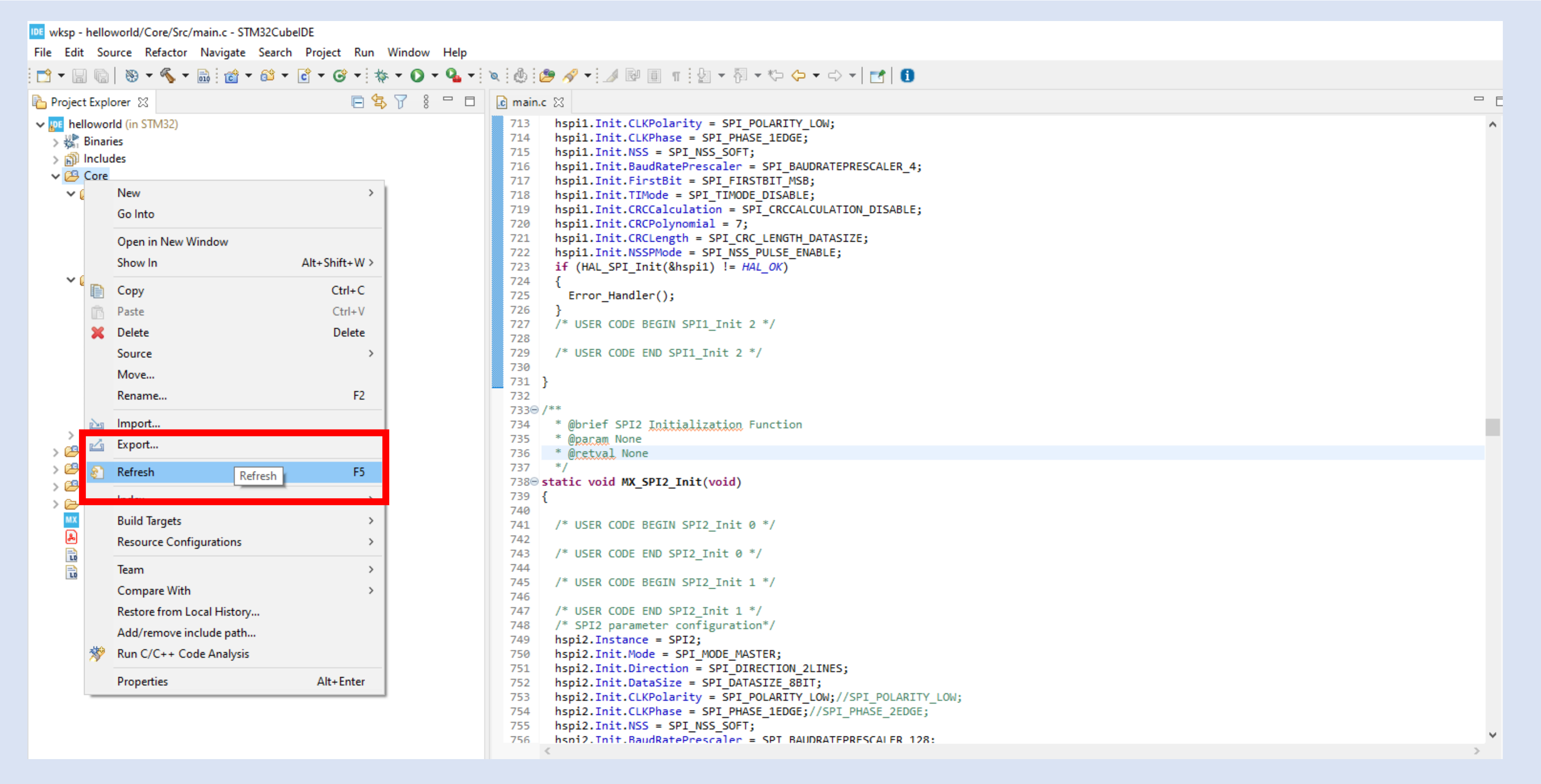
Step 13 – In STM32CubeIDE select the Core directory and right click to refresh, you should now see the new files we added to the project



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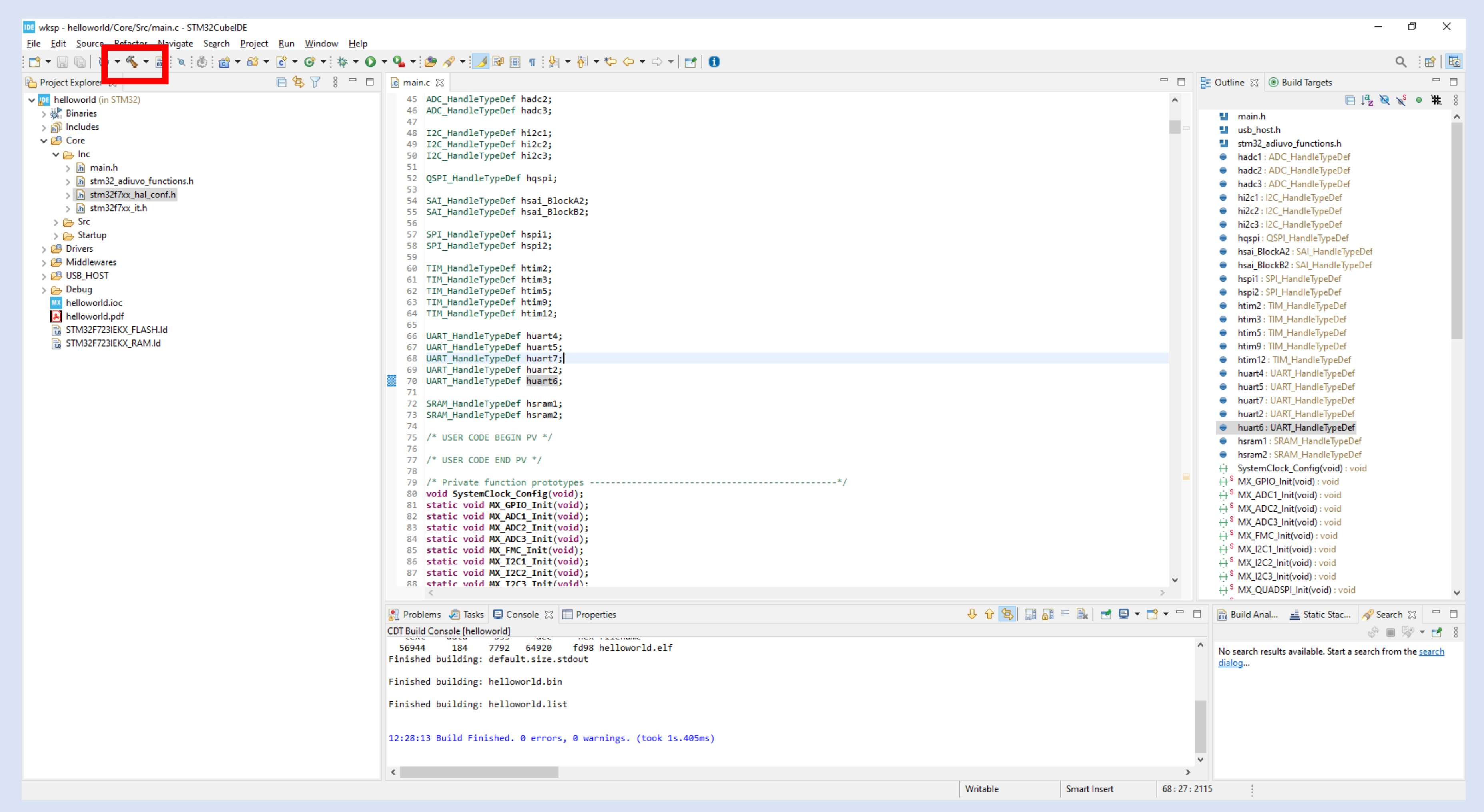
Step 14 – Click the hammer to build the application again there should be no errors



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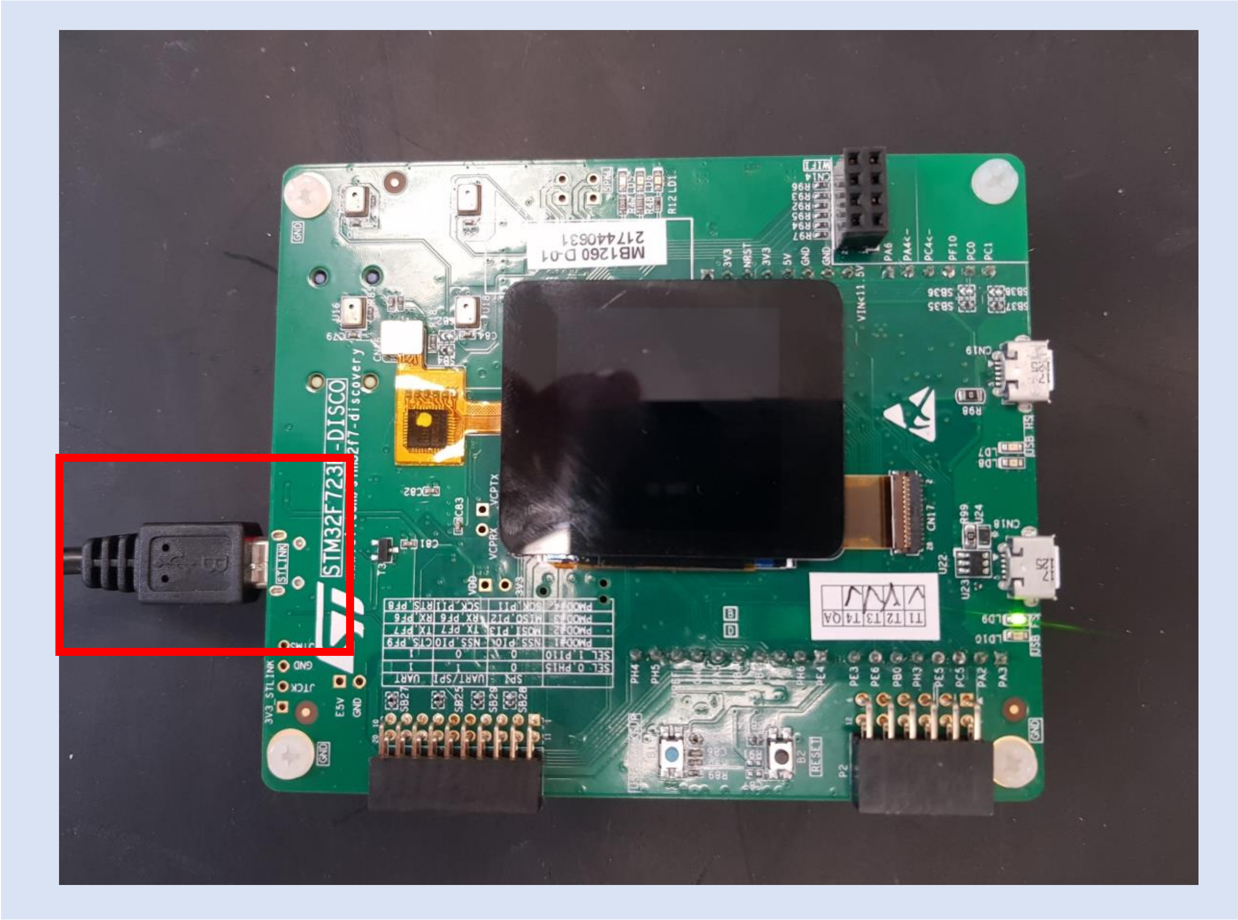
Step 15 – Connect the STM32F723E-Discovery board to the development machine using the STLink connection



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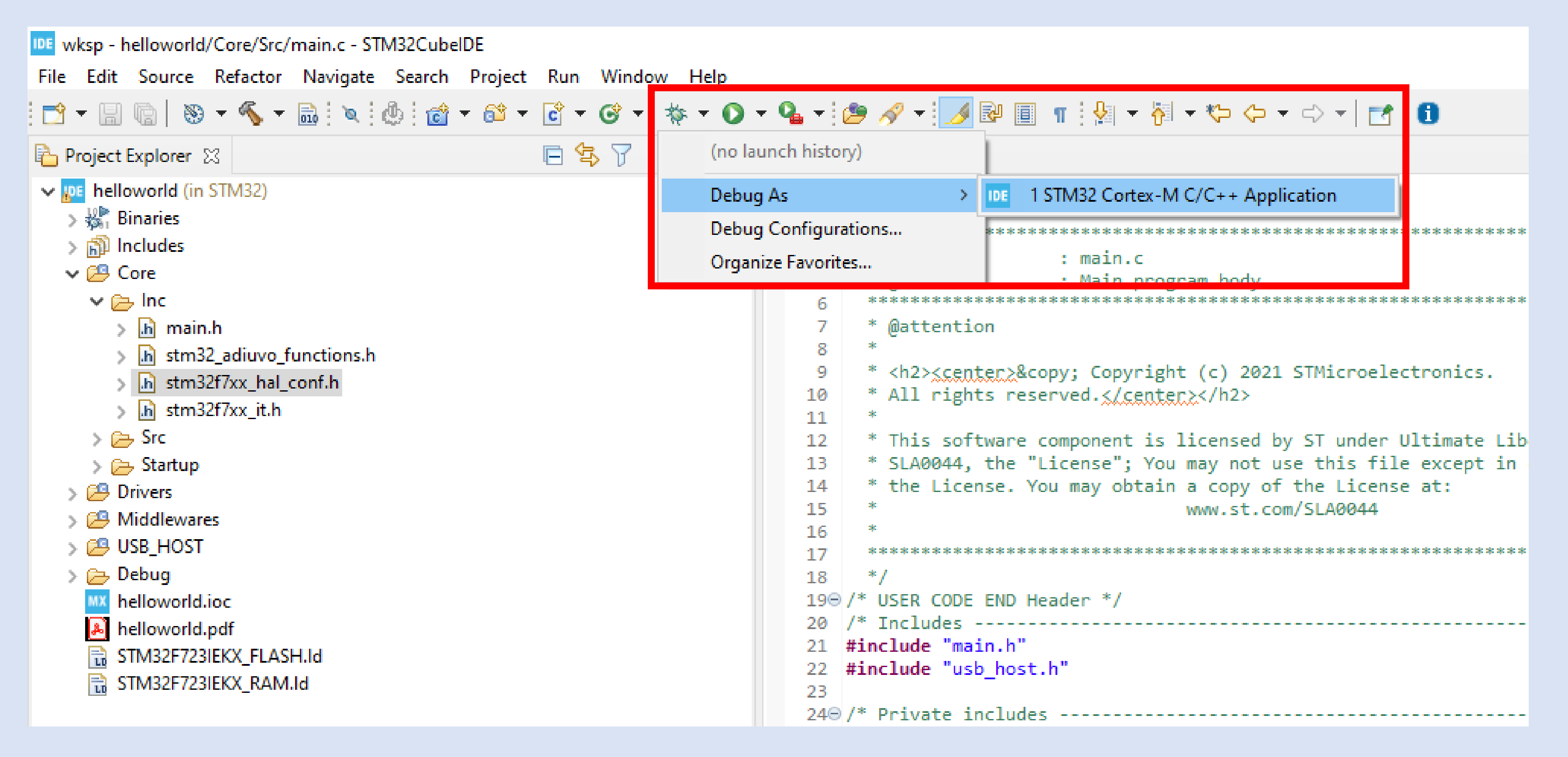
Step 16 – Select the debug icon and select debug as -> STM32 Cortex-M Application



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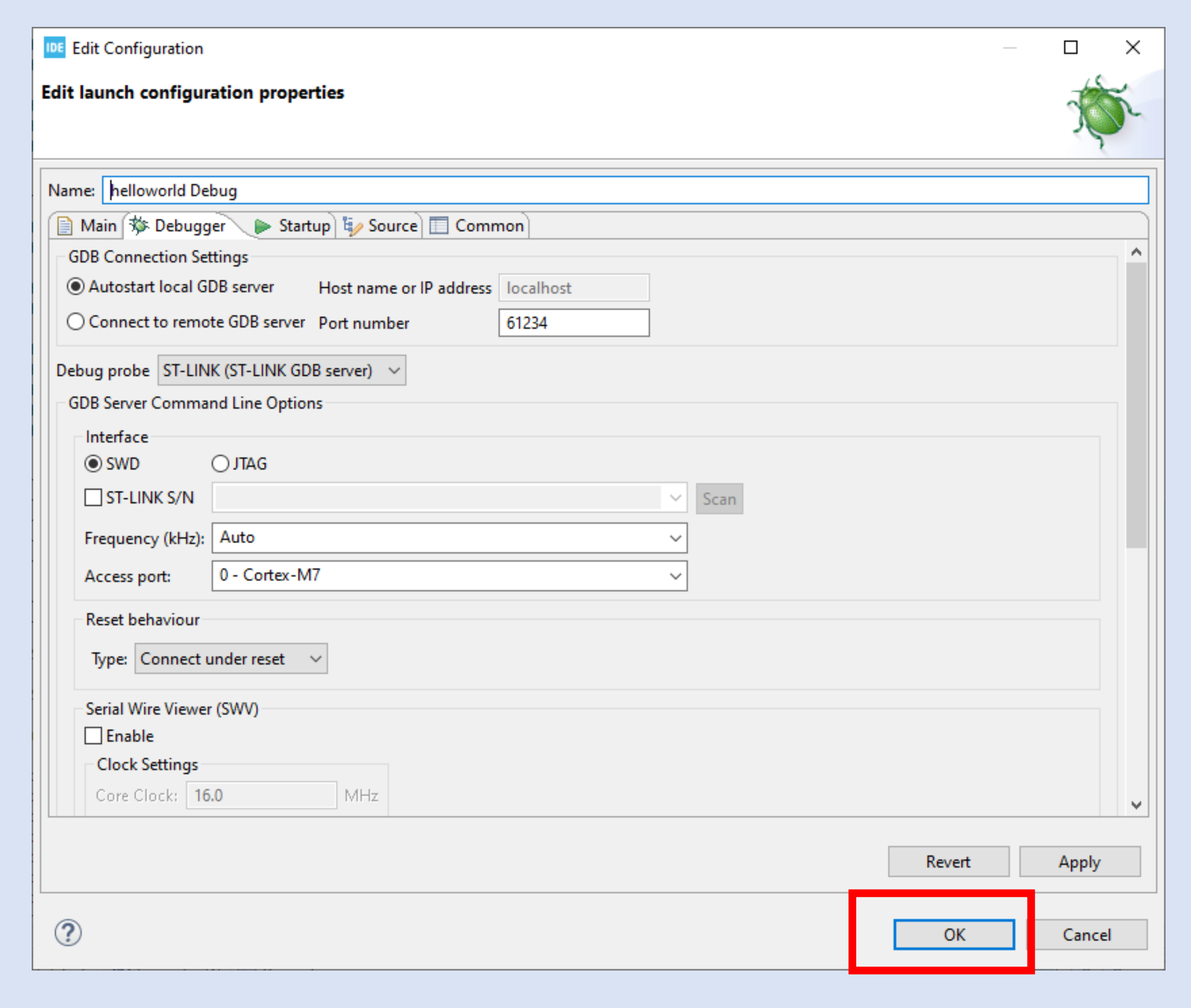
Step 17 – When the Dialog box appears click OK



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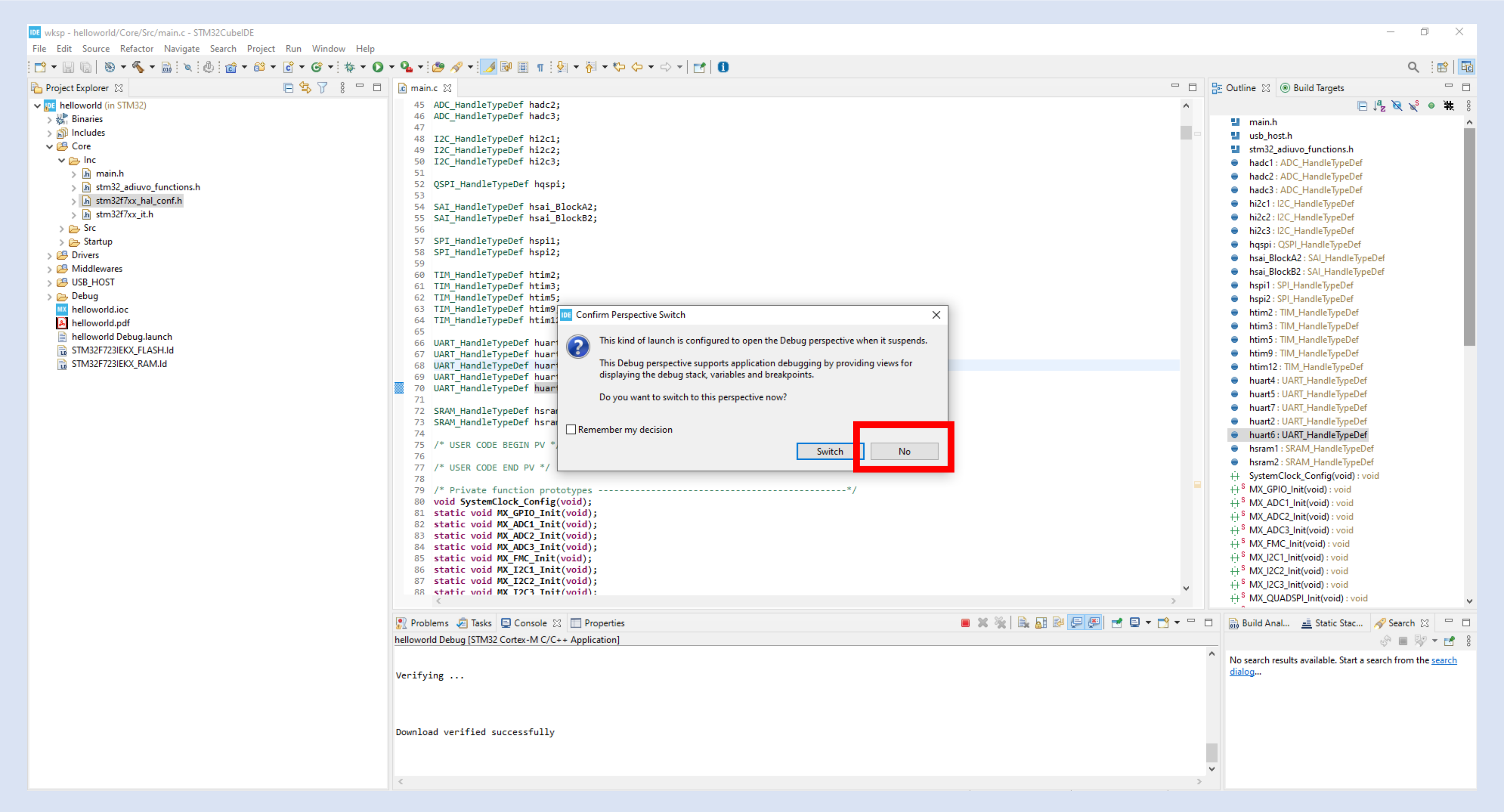
Step 18 – Click on NO when asked to switch perspectives



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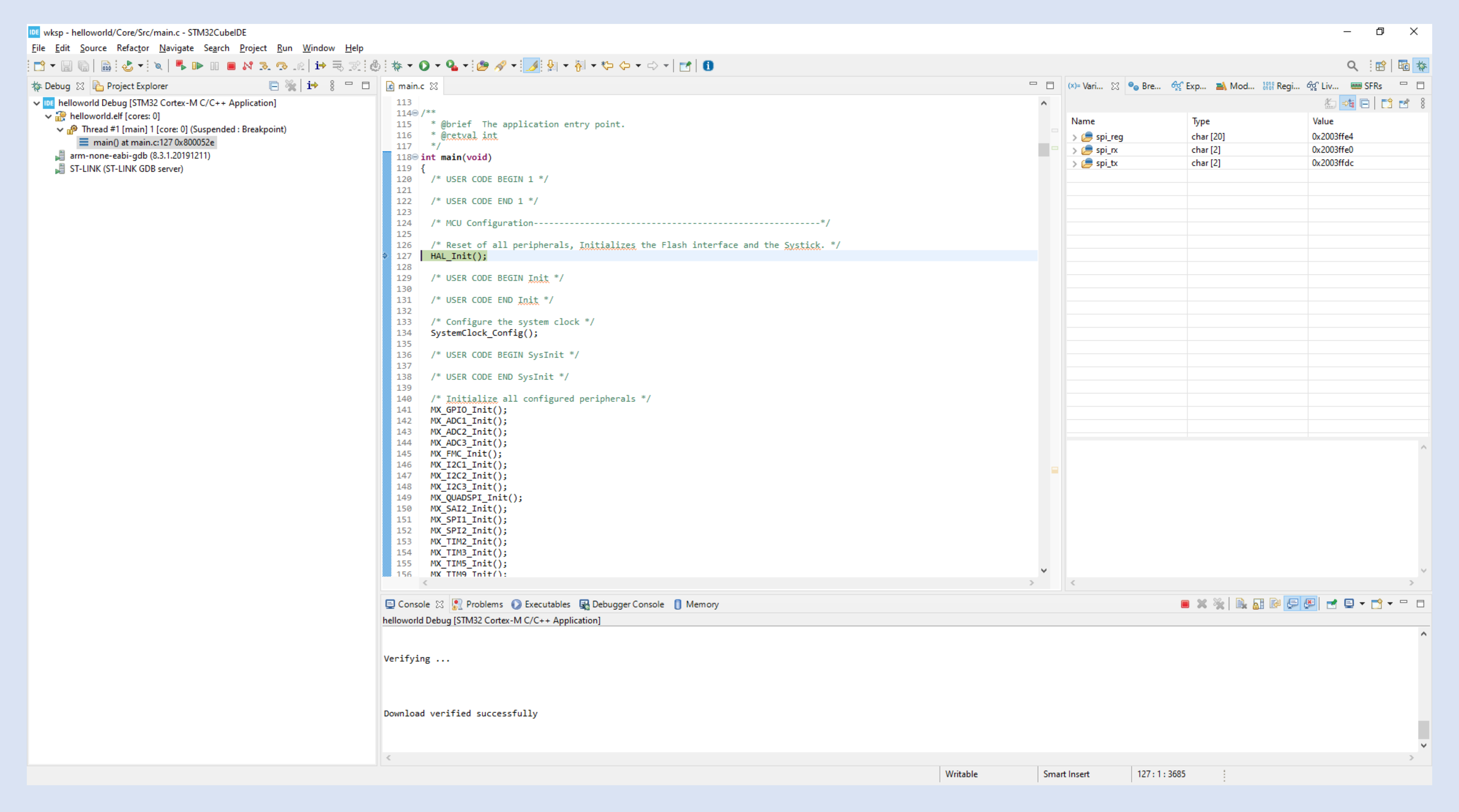
Step 19 – The application will be downloaded in to the STM32F723-Discovery and execution paused at the first instruction. Do not press anything for the moment.



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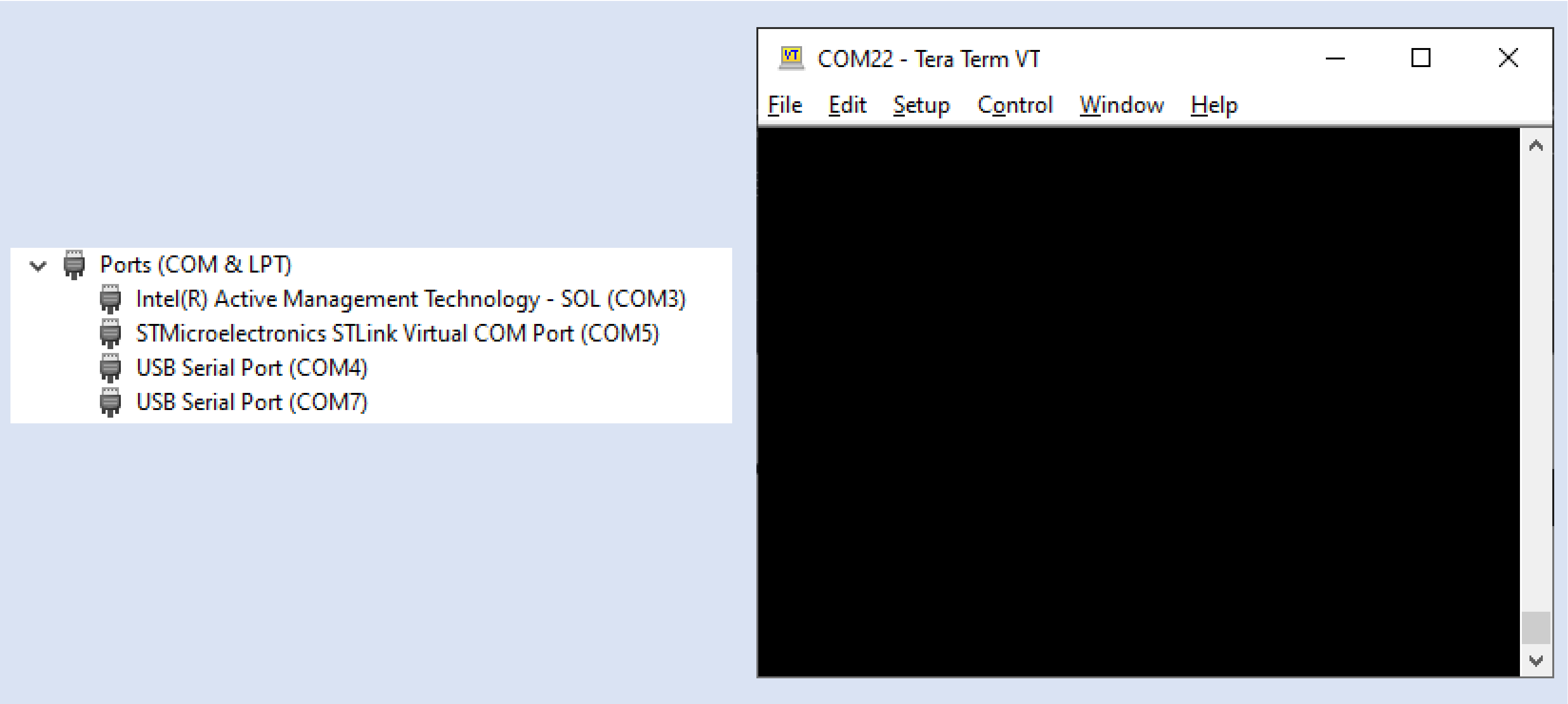
Step 20 – Open a Terminal Program 115200:N:1
If you are unsure of the com port to use open the device manager and select the STLink Com Port



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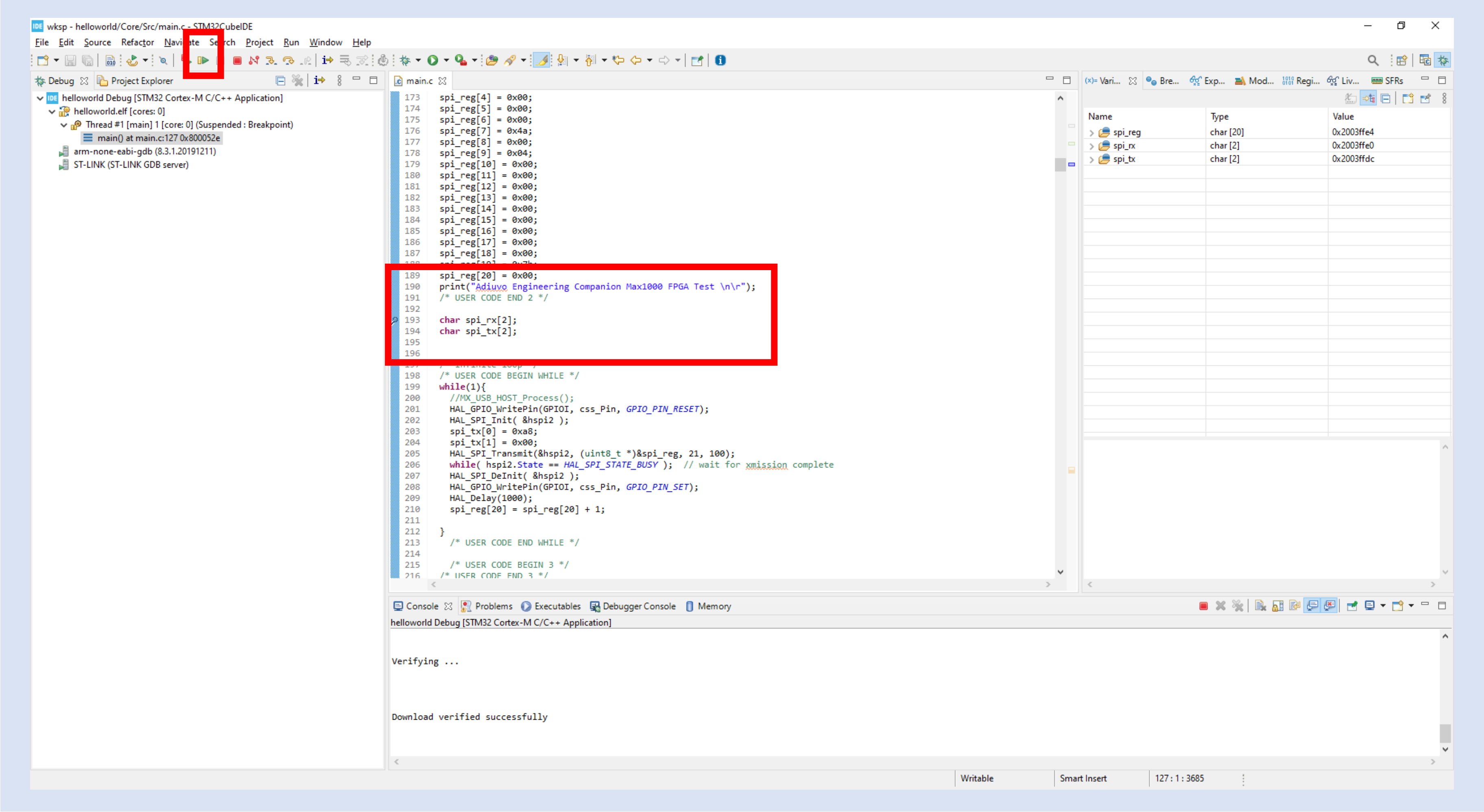
Step 21 – Double click to insert a break point just after the line of code `print("Adiuvo Engineering Companion Max1000 FPGA Test \n\r");`



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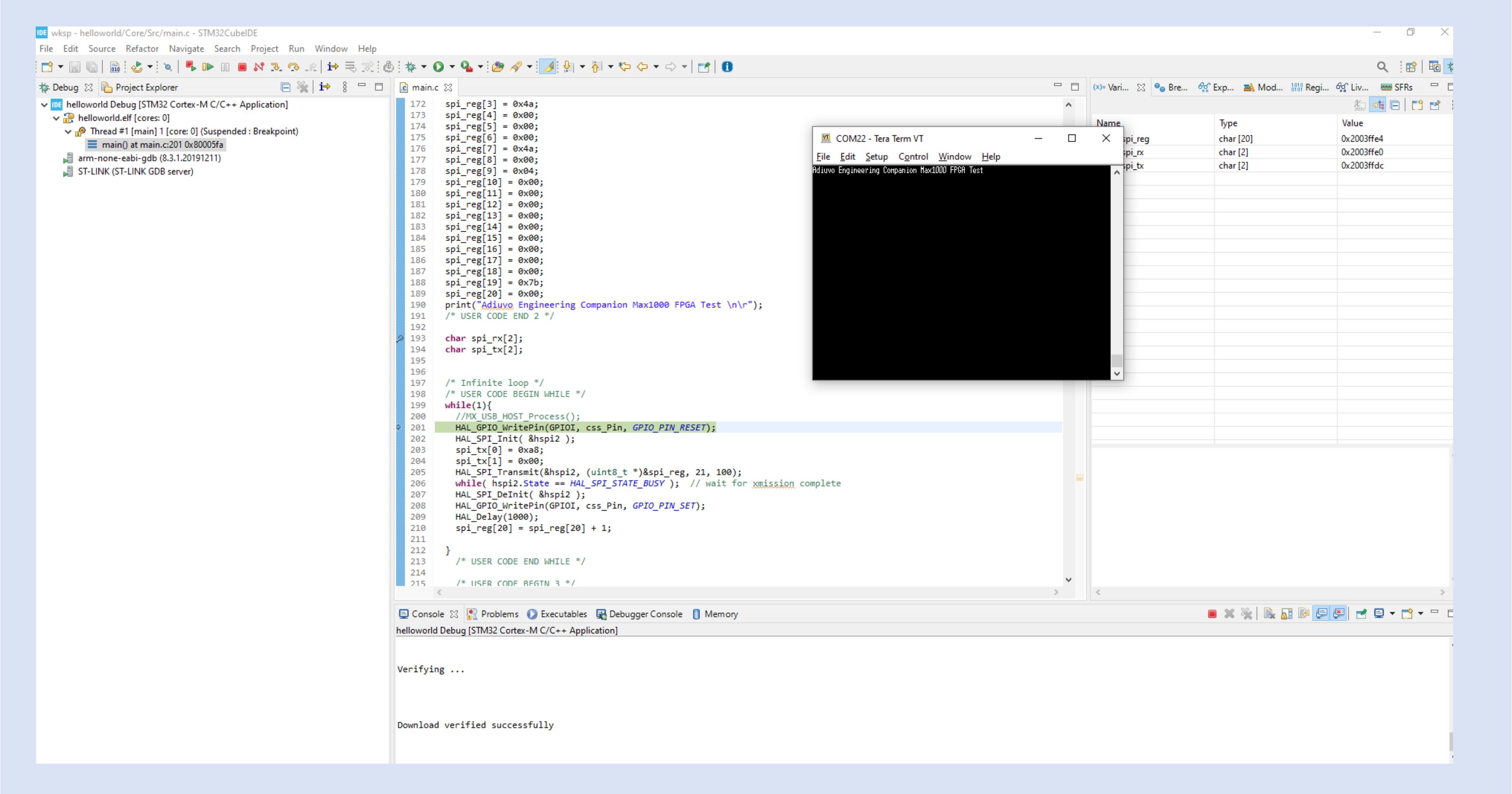
Step 22 – Observe the Terminal program and the STM32CubeIDE, you should see a simple message output on the terminal. This demonstrates we have correctly built the STM32 project and are able to download and run programs.



Section Two: Max1000 Application Creation

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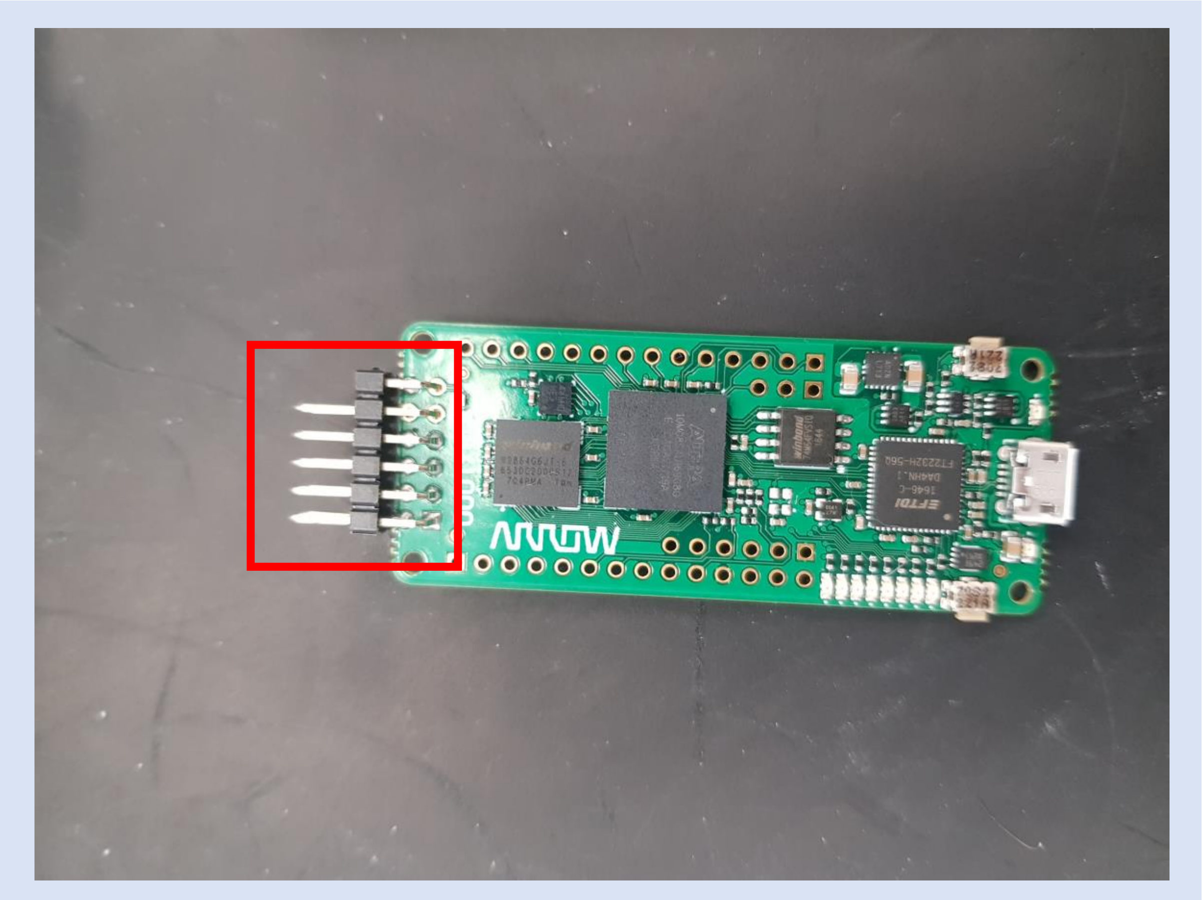
Step 23 – Solder a right-angled Header on to the Max 1000 Pmod header. As both STM32F723 and Max1000 will try to power the Pmod power pins, remove those from the Max1000 Header



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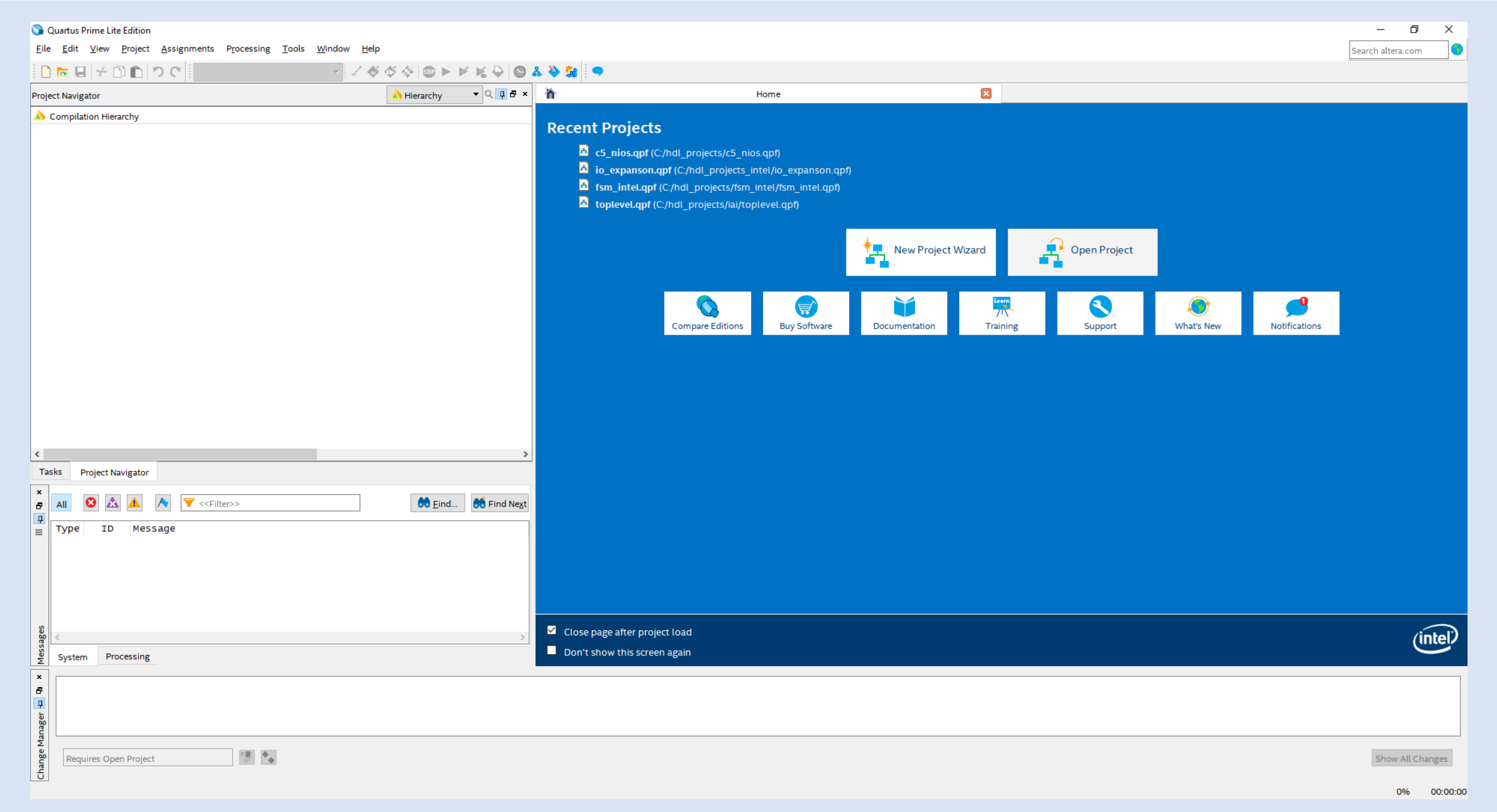
Step 24 – Open Quartus Prime Lite 18.1



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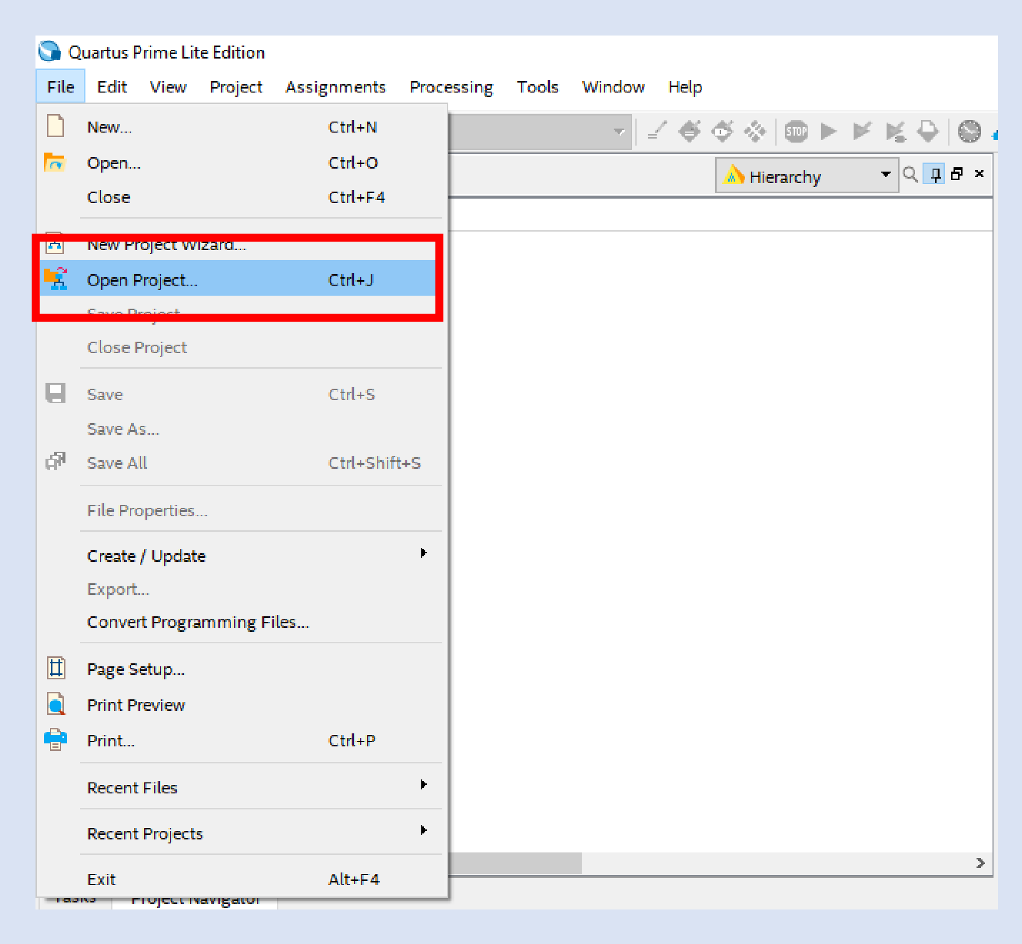
Step 25 – From the File Menu select, Open project



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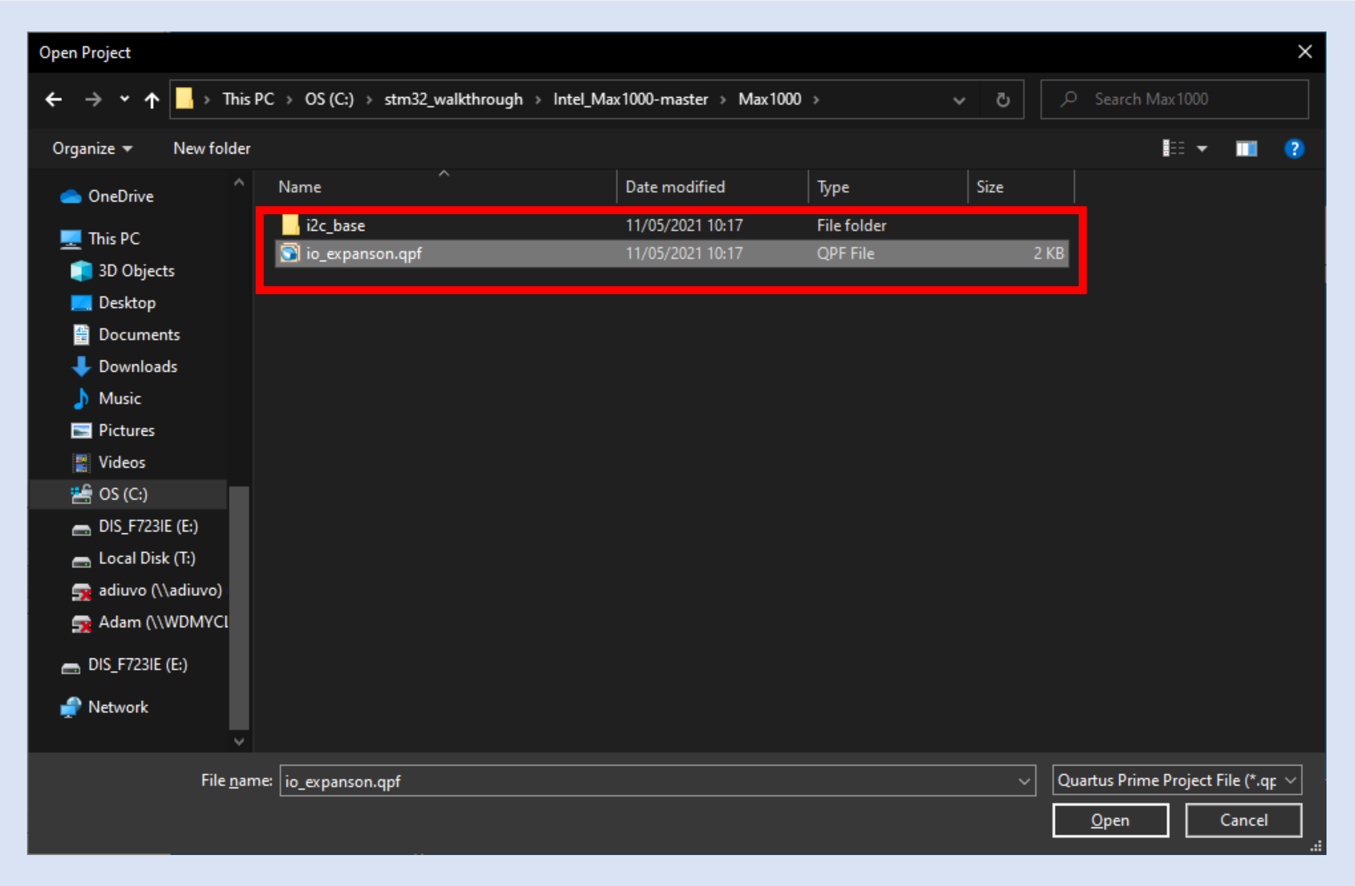
Step 26 – Navigate to the location of the Max1000 Repository and select the IO Expansion project



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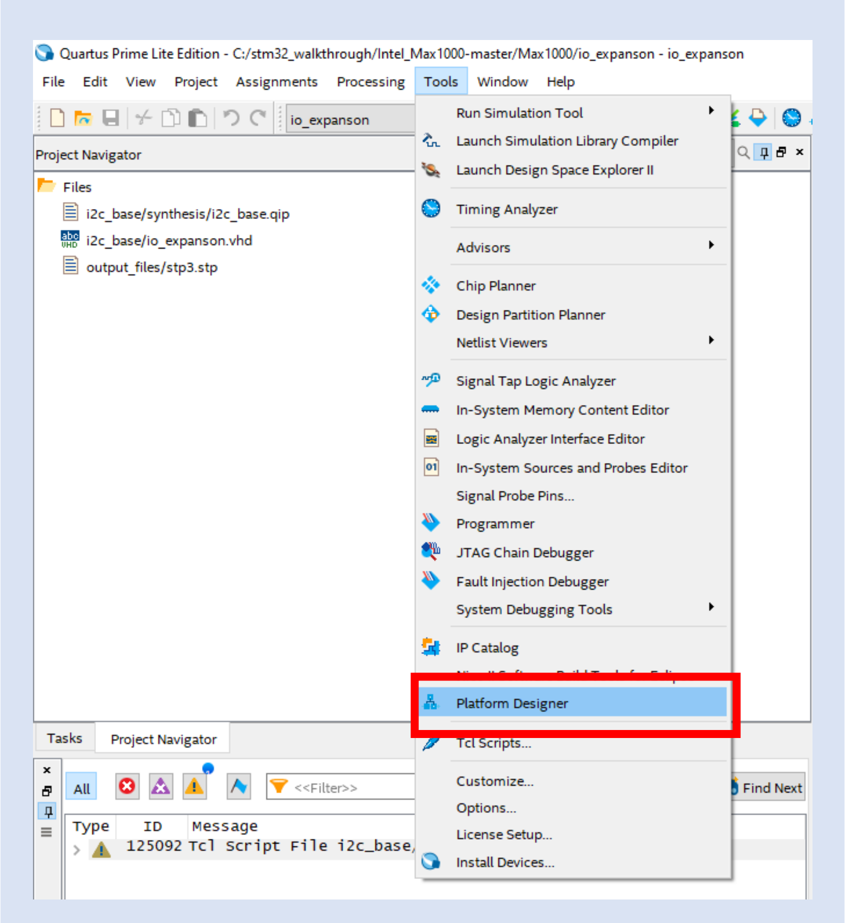
Step 27 – With the project open the next step is to open the Platform Designer. Platform designer contains the complete design except for the simple top level.



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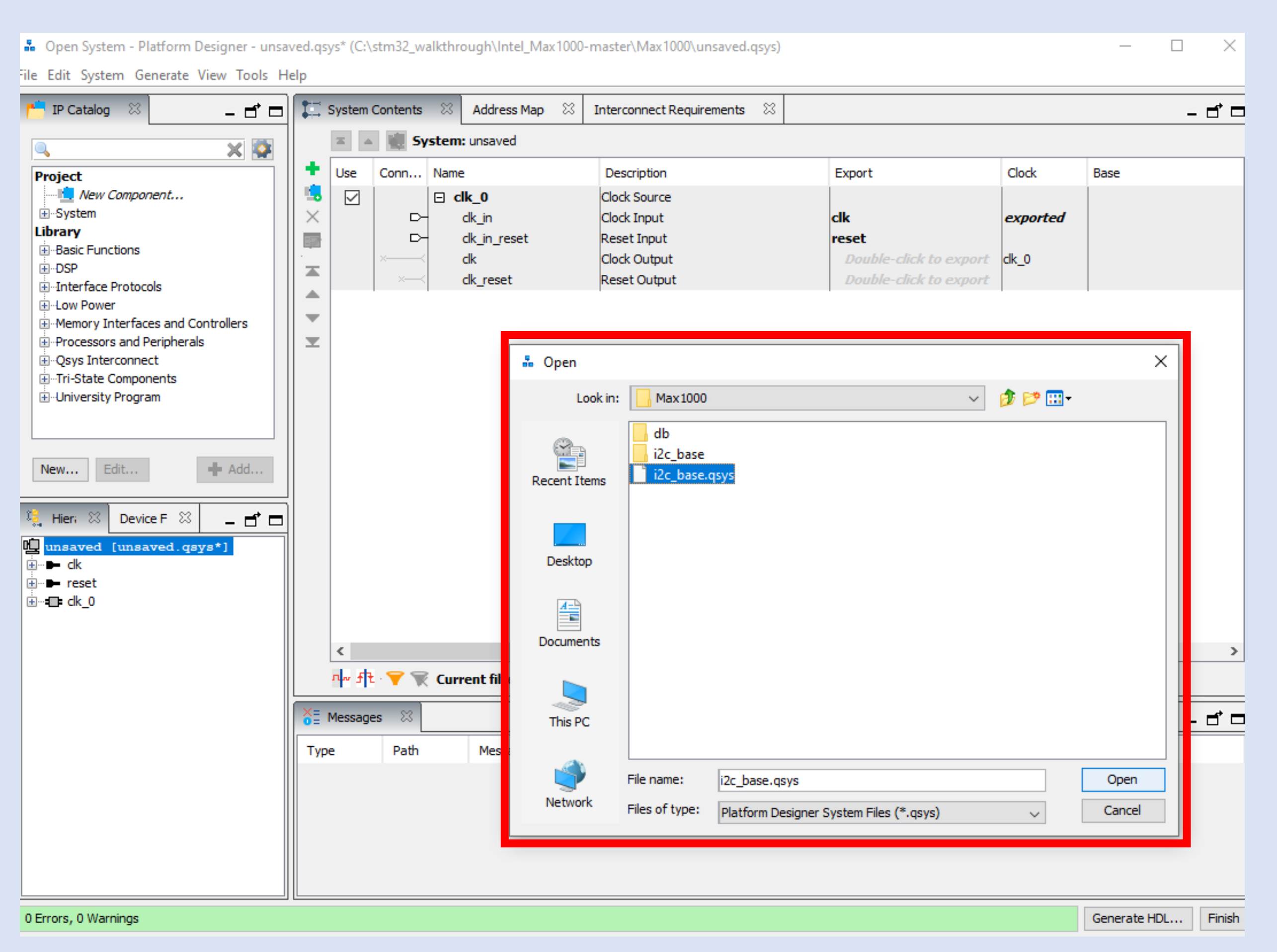
Step 28 – As Platform Designer opens when prompted select the I2C_base.qsys project



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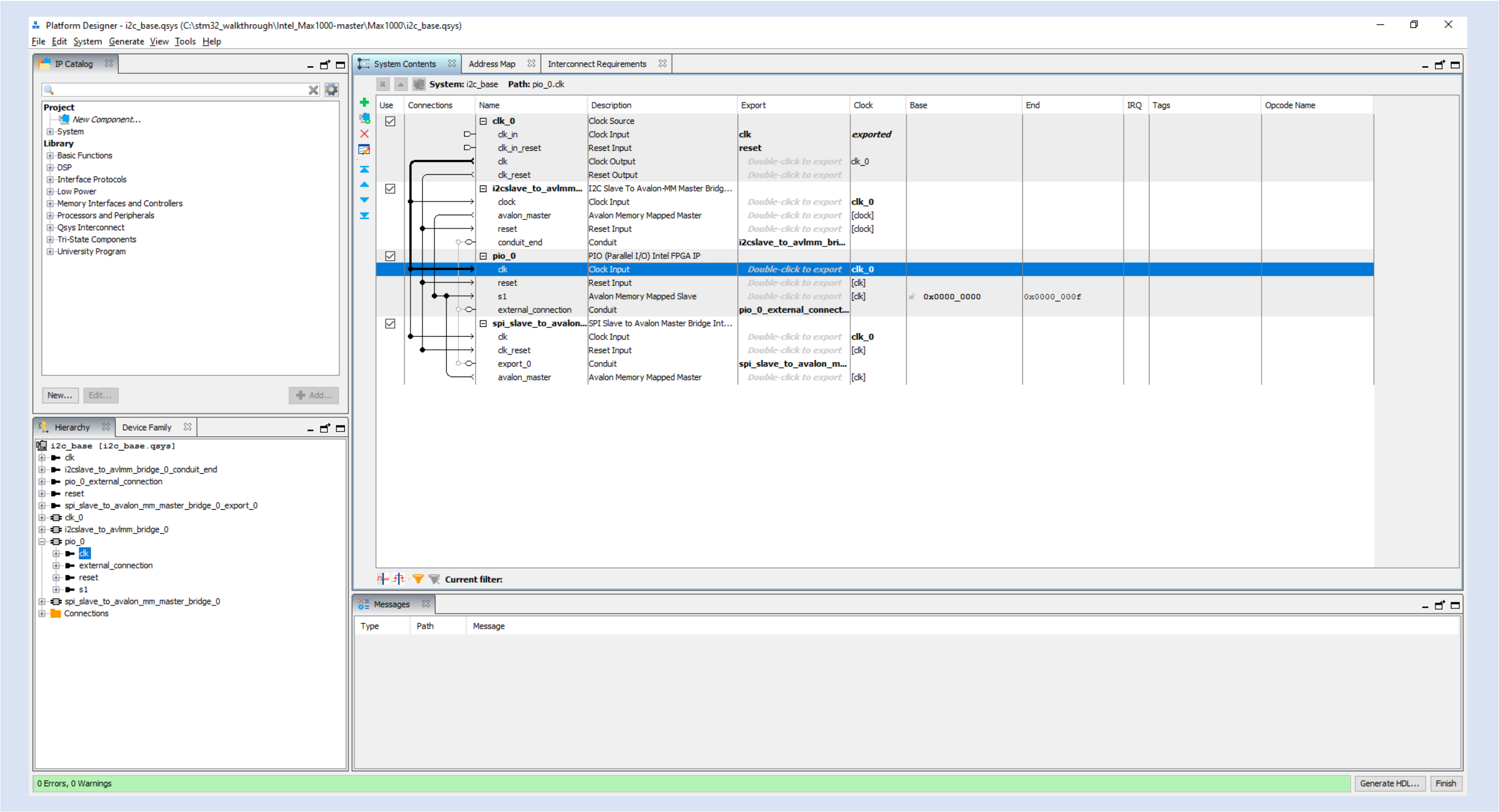
Step 29 – This will open the platform designer which contains the details of our design, note the I2C and SPI Slaves to Avalon Master and the Parallel Input & Output.



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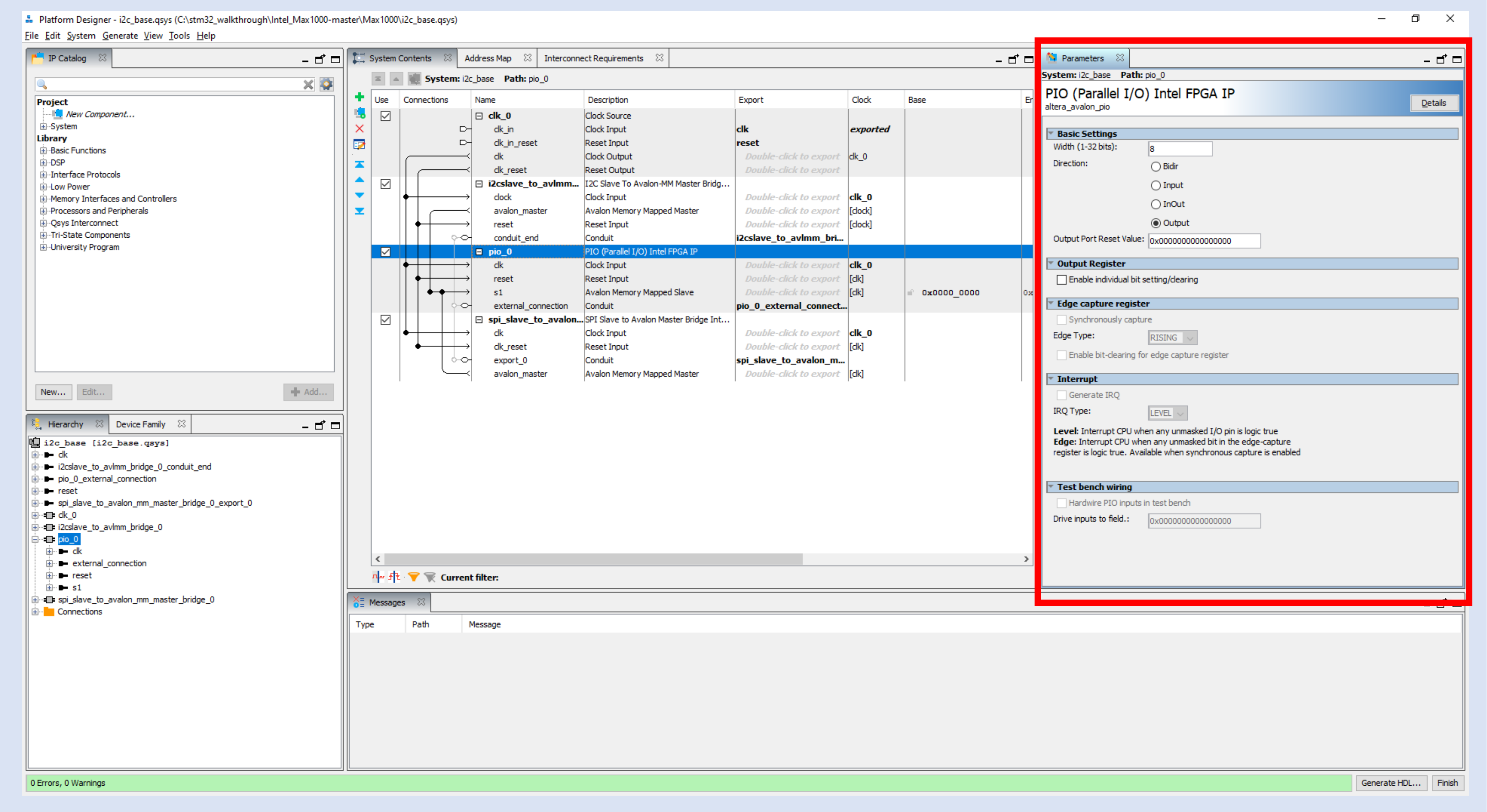
Step 30 – Double click on the PIO and the configuration of the device will pop up on the right hand side, do the same for the I2C & SPI Slaves.



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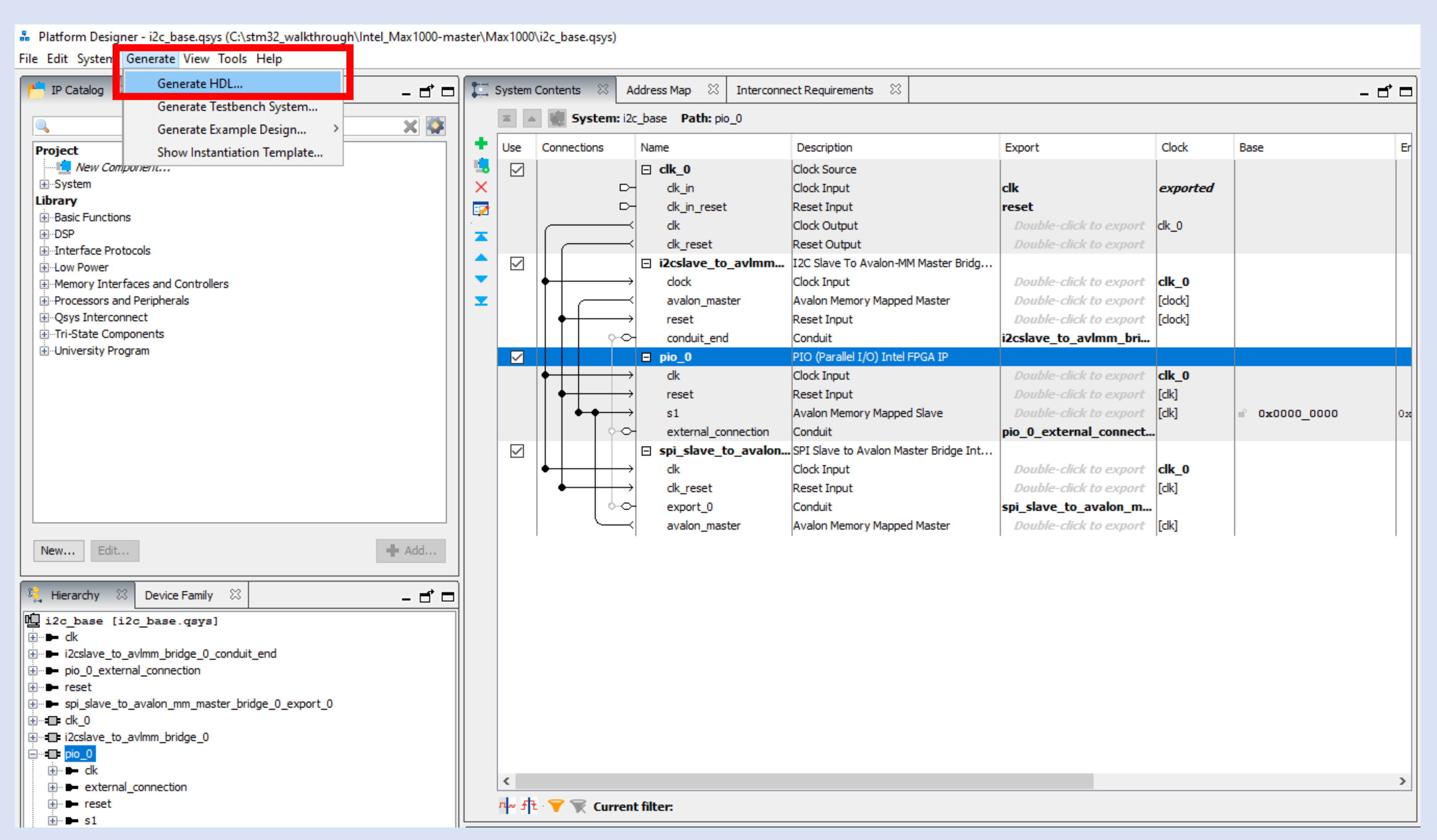
Step 31 – To use the design we need to generate the HDL, from the Generate menu select the Generate HDL Option



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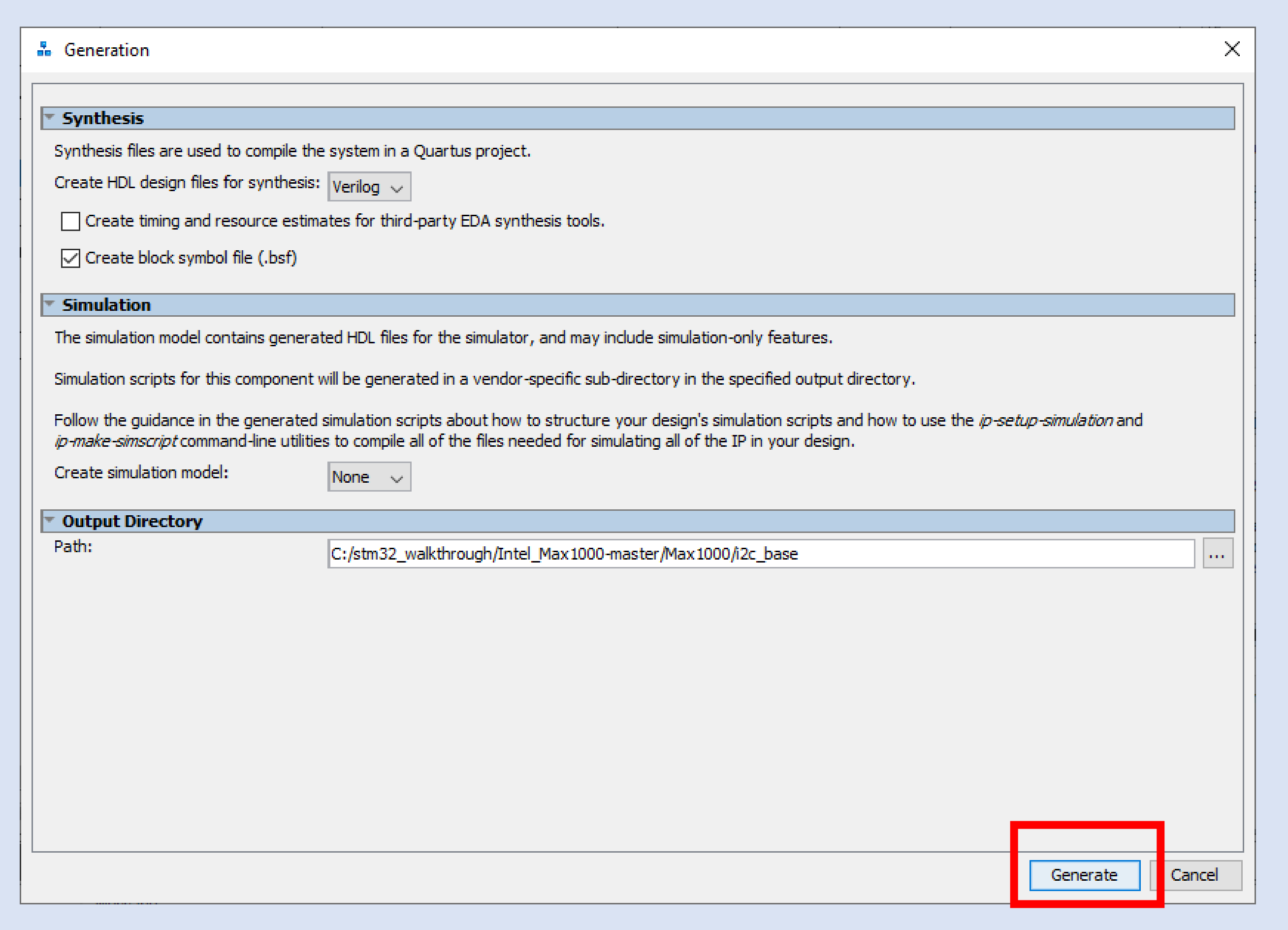
Step 32 – Select the flavor HDL you prefer and click generate; this will generate all the necessary files to implement the design.



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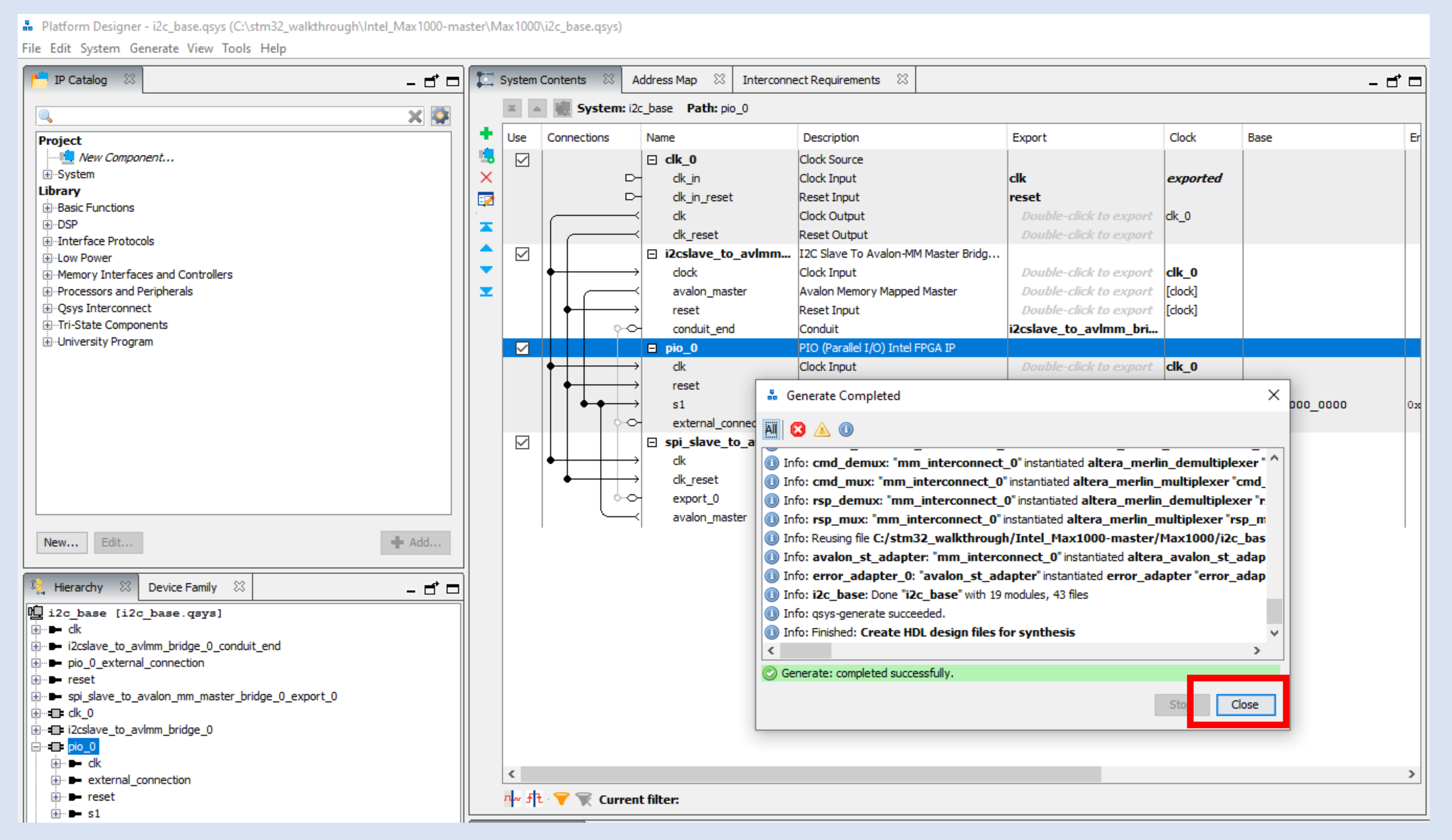
Step 33 – When the generate completed, click close and exit platform designer



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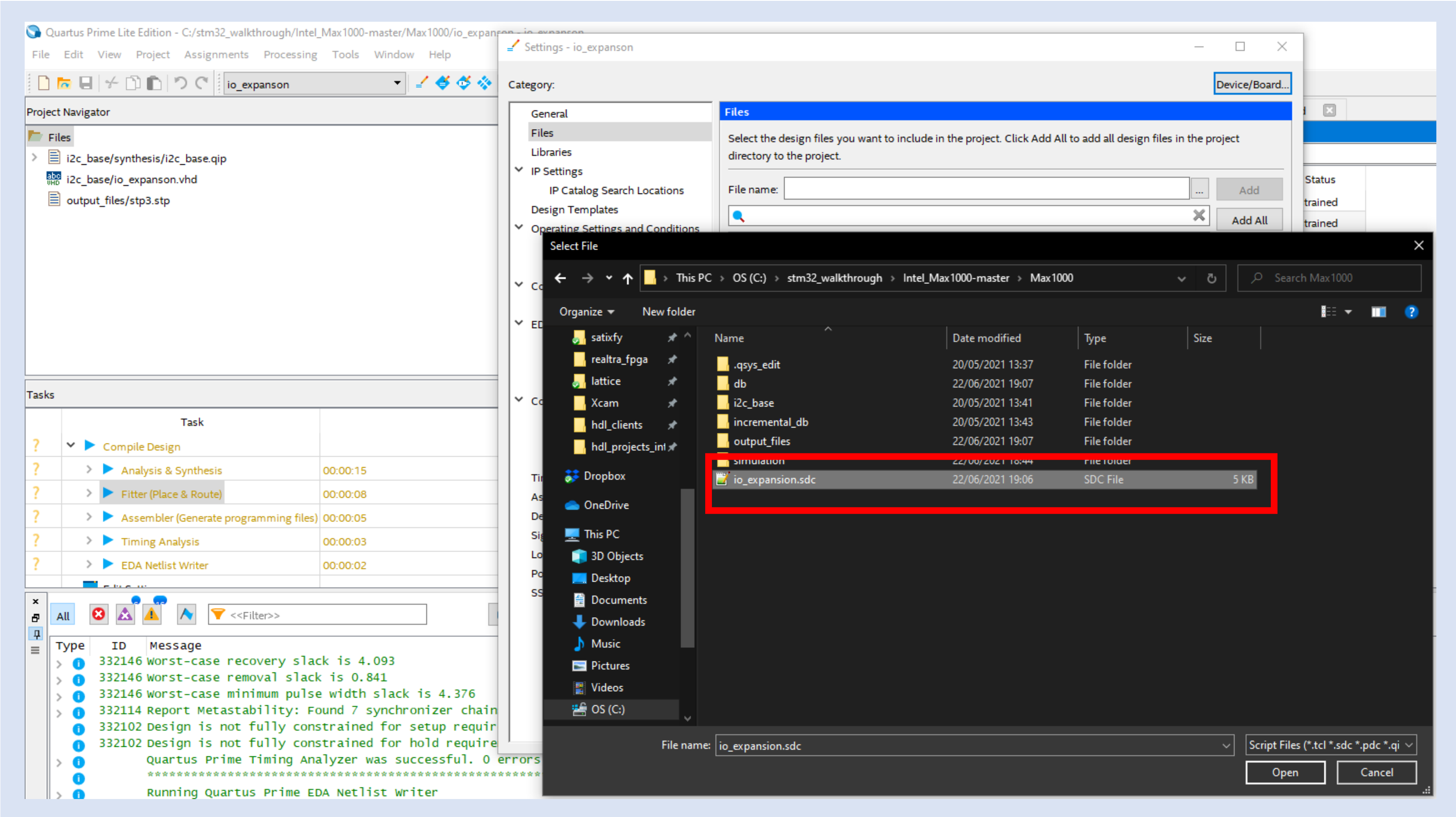
Step 34 – On the files view select, add/ remove files from project. Add in the SDC file to the project.



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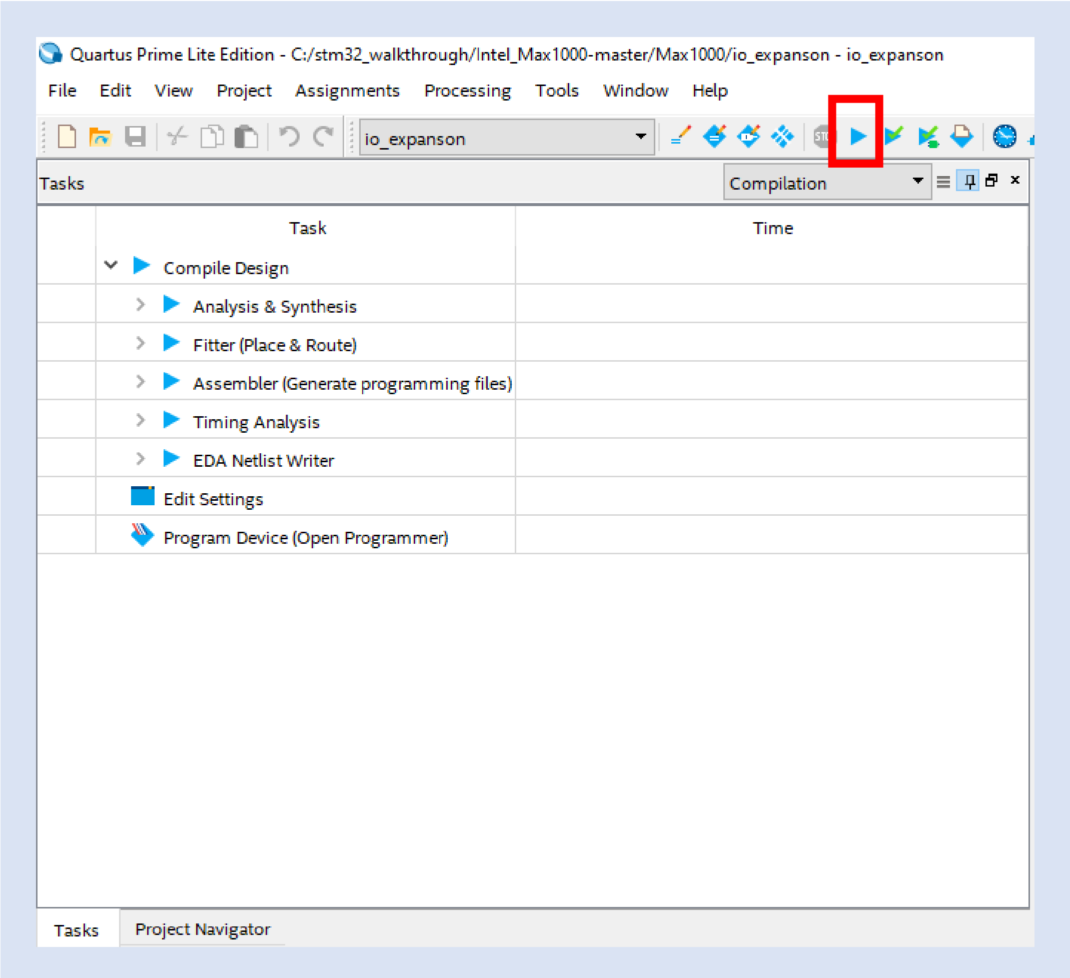
Step 35 – Back in Quartus, click on Start Compilation button, this will start the generation of the bit file. Running the Synthesis, Place & Root and bit file generation



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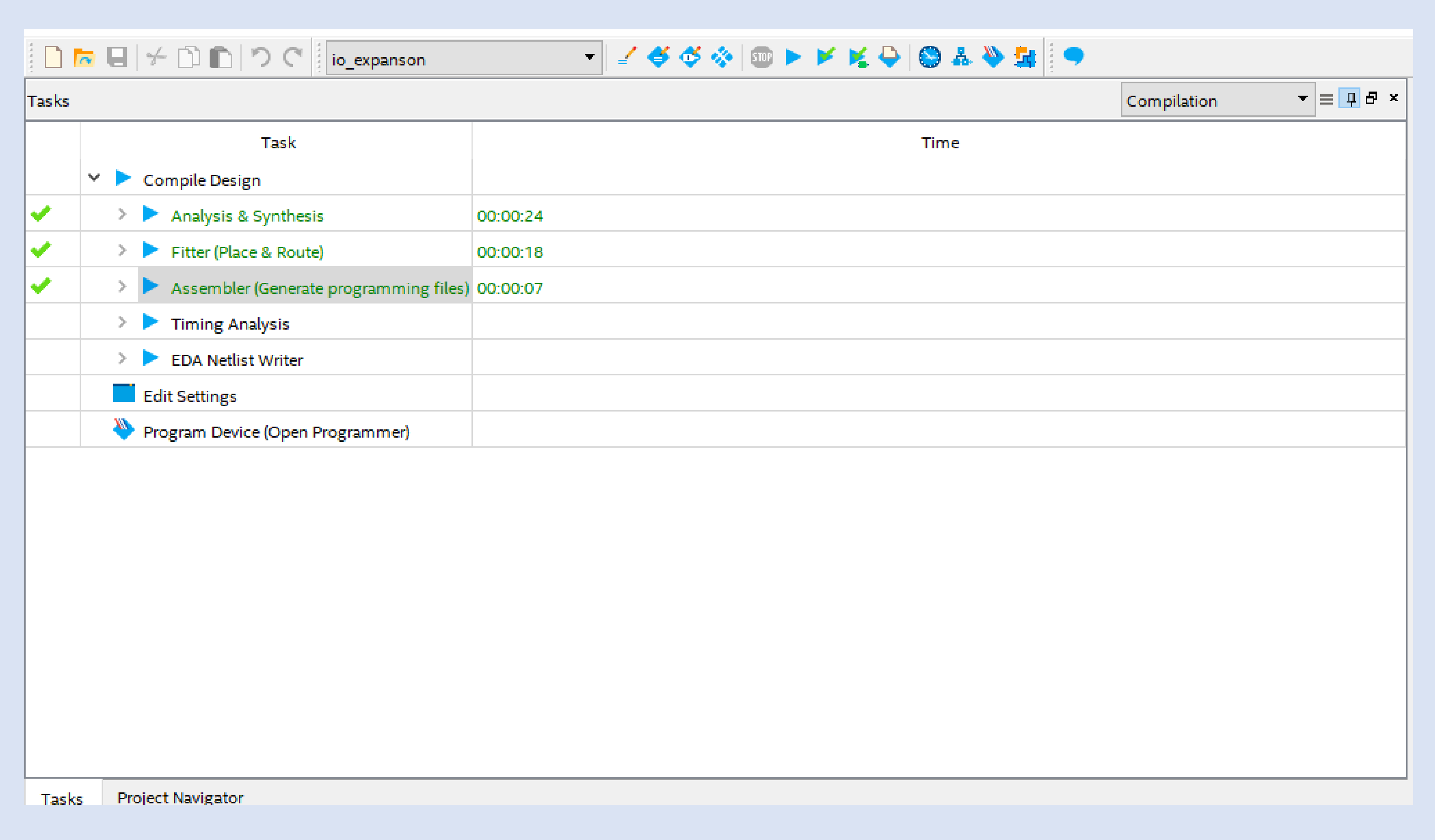
Step 36 – When completed the, analysis & synthesis, Fitter and Assembler will show green Checks.



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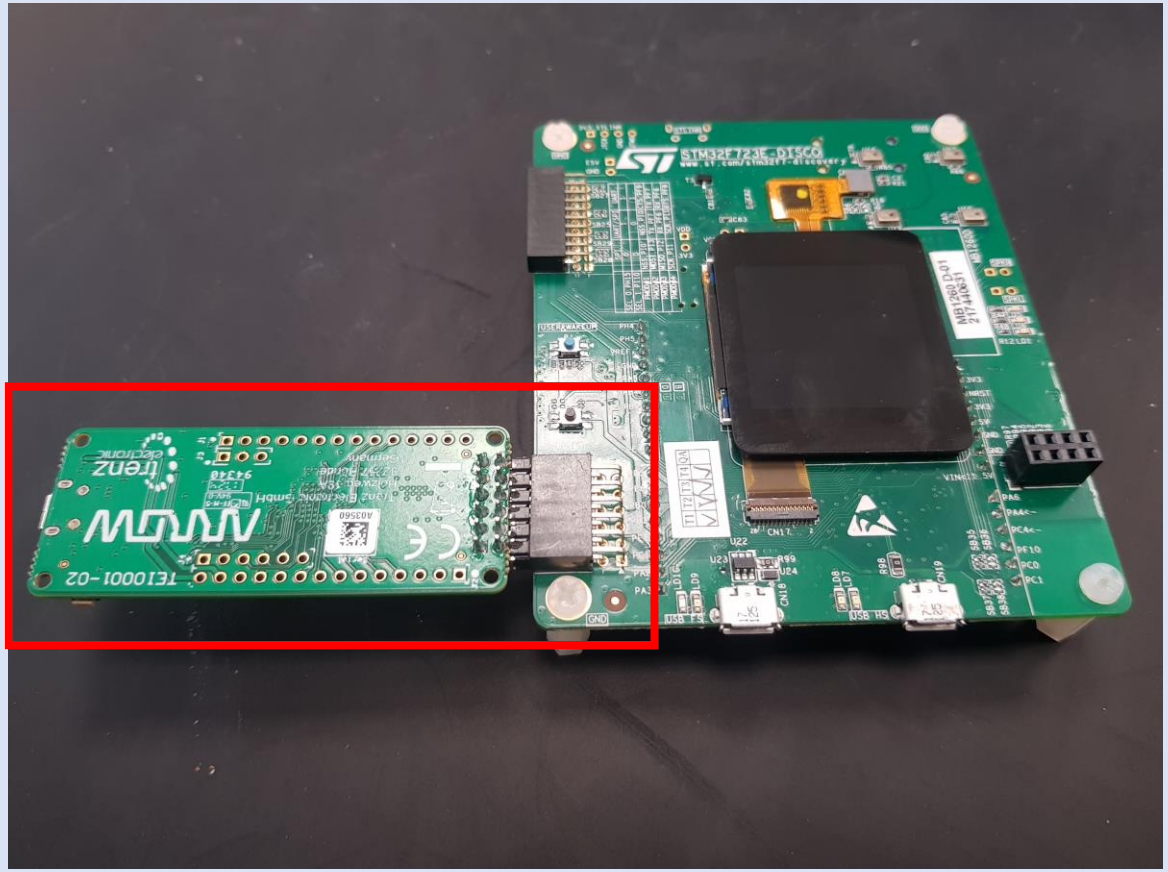
Step 37 – Connect the Max1000 to the STM32F723-Discovery – ENSURE the power is removed from both board when this is the case.



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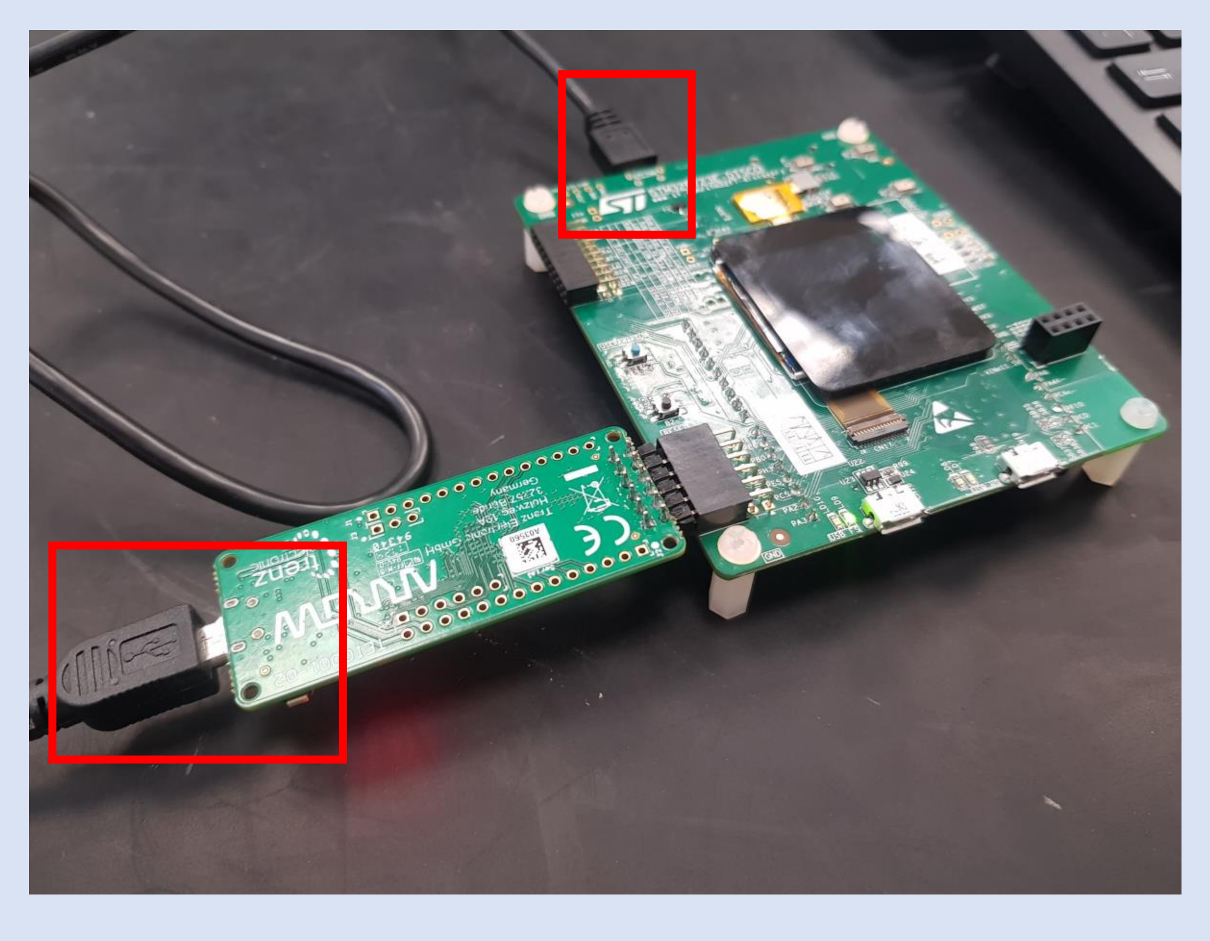
Step 38 – Connect both USB cables to the MAX1000 board and the STM32F723-Discovery board ST-Link connector



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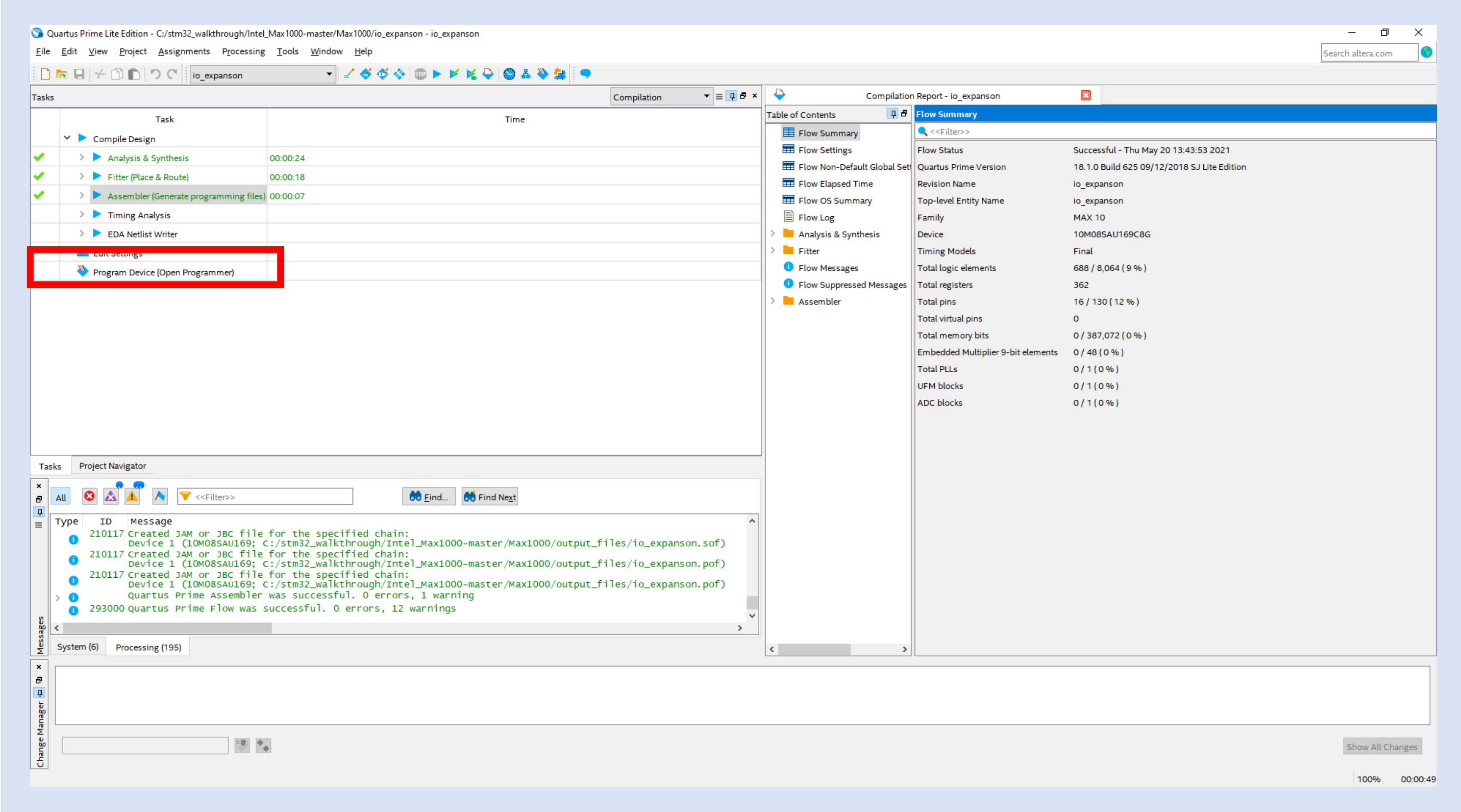
Step 39 – In Quartus double click on the Program Device Icon



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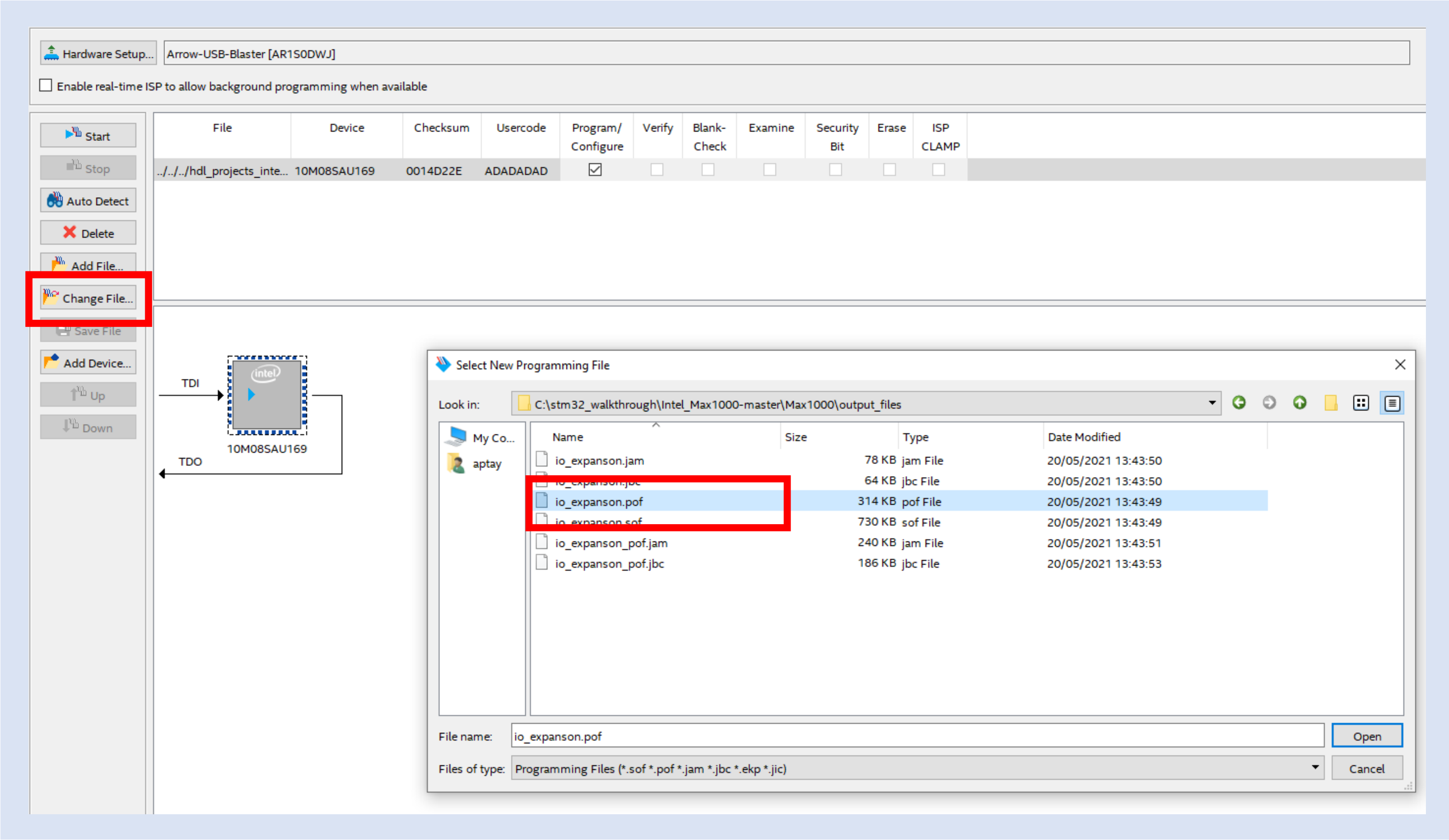
Step 40 – In the programmer ensure the Arrow-USB-Blaster is selected and click on the file and select change file icon – Select the POF file this will be programmed to the configuration memory. If the arrow blaster is not selected, please use the “hardware Setup” button to select the Arrow-USB-Blaster, by double clicking and “Close”



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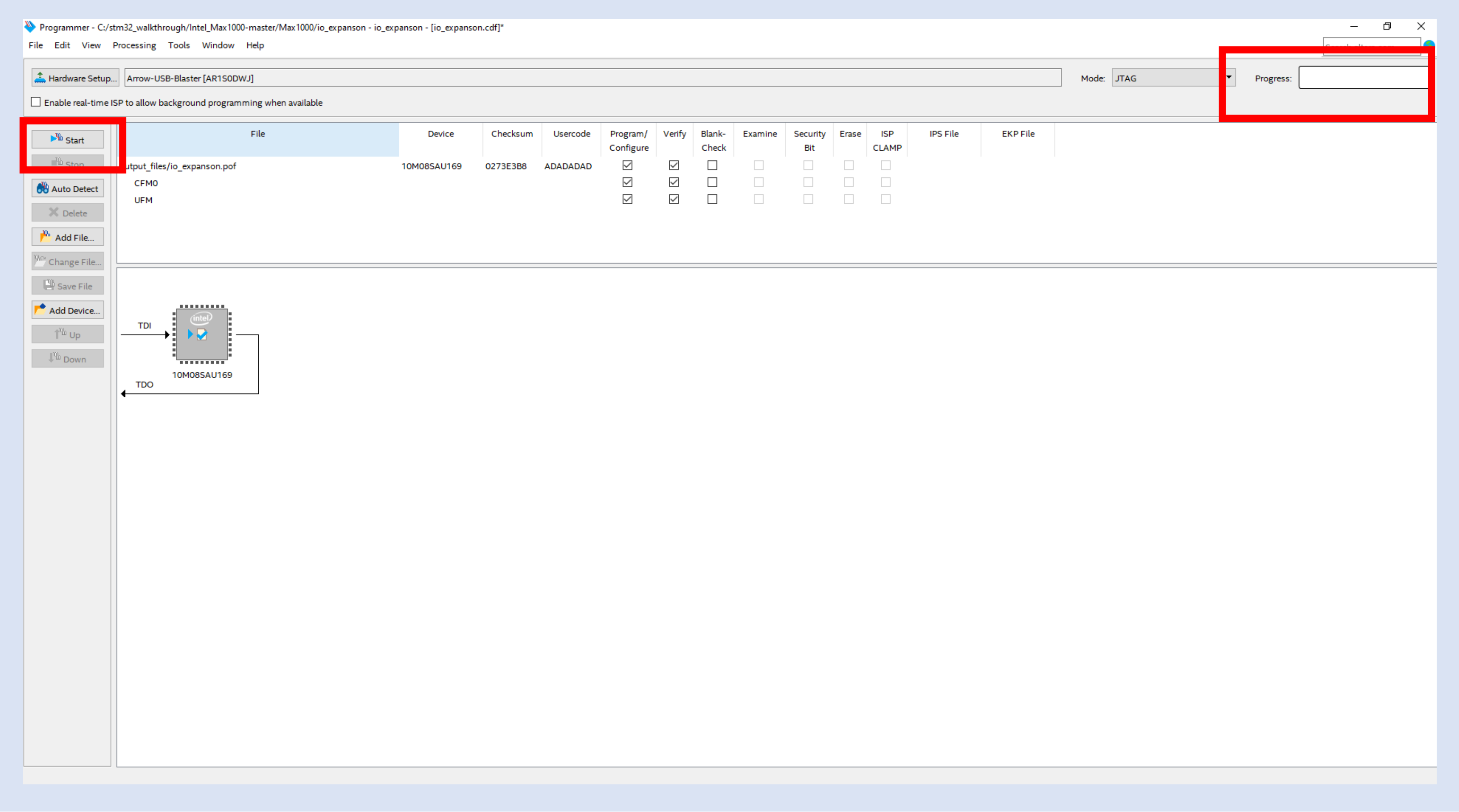
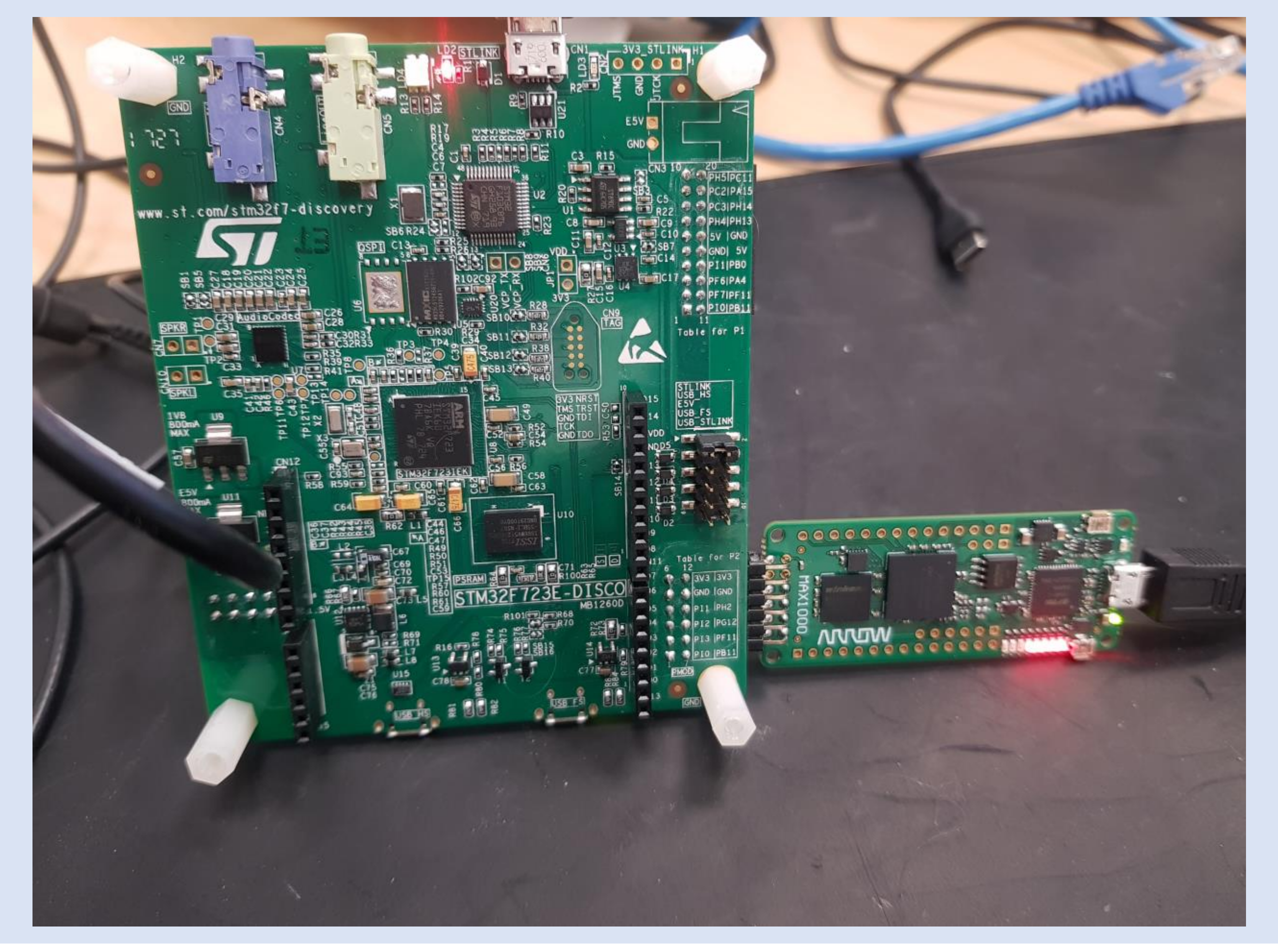
Step 41 – Once the file has been selected click on Start and the device will be programmed, success will be shown in the top right.



Max 1000: Companion Chip

Step 42 – Observe the board and you should see a binary count occurring on the LEDS on the Max1000 board.



Summary

This Lab has demonstrated

1. How to create a project using STMCubeMX
2. How to update the SW application in STMCubeIDE
3. How to create a project in Intel Quartus Prime Lite 18.1
4. How to create and Platform Designer System
5. How to connect the STM32F723-Discoviery and the Max1000 Boards
6. How to program both the STM32F723-Discovery and Max1000 boards

Any questions please email Support@adiuvoengineering.com