



KEIL μ Vision getting started

P. Bernardi



KEIL μ Vision 5

MDK-Arm

Version 5.29 (November 2019)

Development environment for Cortex and Arm devices.

- The Development environment for Cortex and Arm devices (aka MDK) includes the μ Vision Tools.
- The μ Vision IDE combines in a single environment:
 - project management,
 - run-time environment,
 - build facilities,
 - source code editing,
 - and program debugging.
- The μ Vision Debugger provides a single environment in which you may test, verify, and optimize your application code. The debugger includes traditional features like simple and complex breakpoints, watch windows, and execution control and provides full visibility to device peripherals.
- <https://www.keil.com/download/product/>

<https://www.keil.com/download/product/>

The screenshot displays the 'Download Products' page on the Keil website. The page features a blue header with the 'armKEIL' logo and a navigation bar with links to 'Products', 'Download', 'Events', 'Support', and 'Videos'. A search bar is also present. The main content area lists four products for download:

- MDK-Arm** (Version 5.29, November 2019): Development environment for Cortex and Arm devices. An orange arrow points to this option.
- C51** (Version 9.60a, May 2019): Development tools for all 8051 devices.
- C251** (Version 5.60, May 2018): Development tools for all 80251 devices.
- C166** (Version 7.57, May 2018): Development tools for C166, XC166, & XC2000 MCUs.

Below the product list, a note states: 'Keil products use a License Management system - without a current license the product runs as a Lite/Evaluation edition with a few Limitations.'

The 'Maintenance Status and Previous Versions' section includes a form to enter a 'PSN or LIC' (Product Serial Number or License Code) and a 'Submit' button. The browser's taskbar at the bottom shows several open files: 'MDK529.EXE' (Operazione annullata), 'license (6).dat', 'lab_06.zip', and 'ITC_2019_Slides.zip'. A 'Mostra tutto' button is also visible in the taskbar.

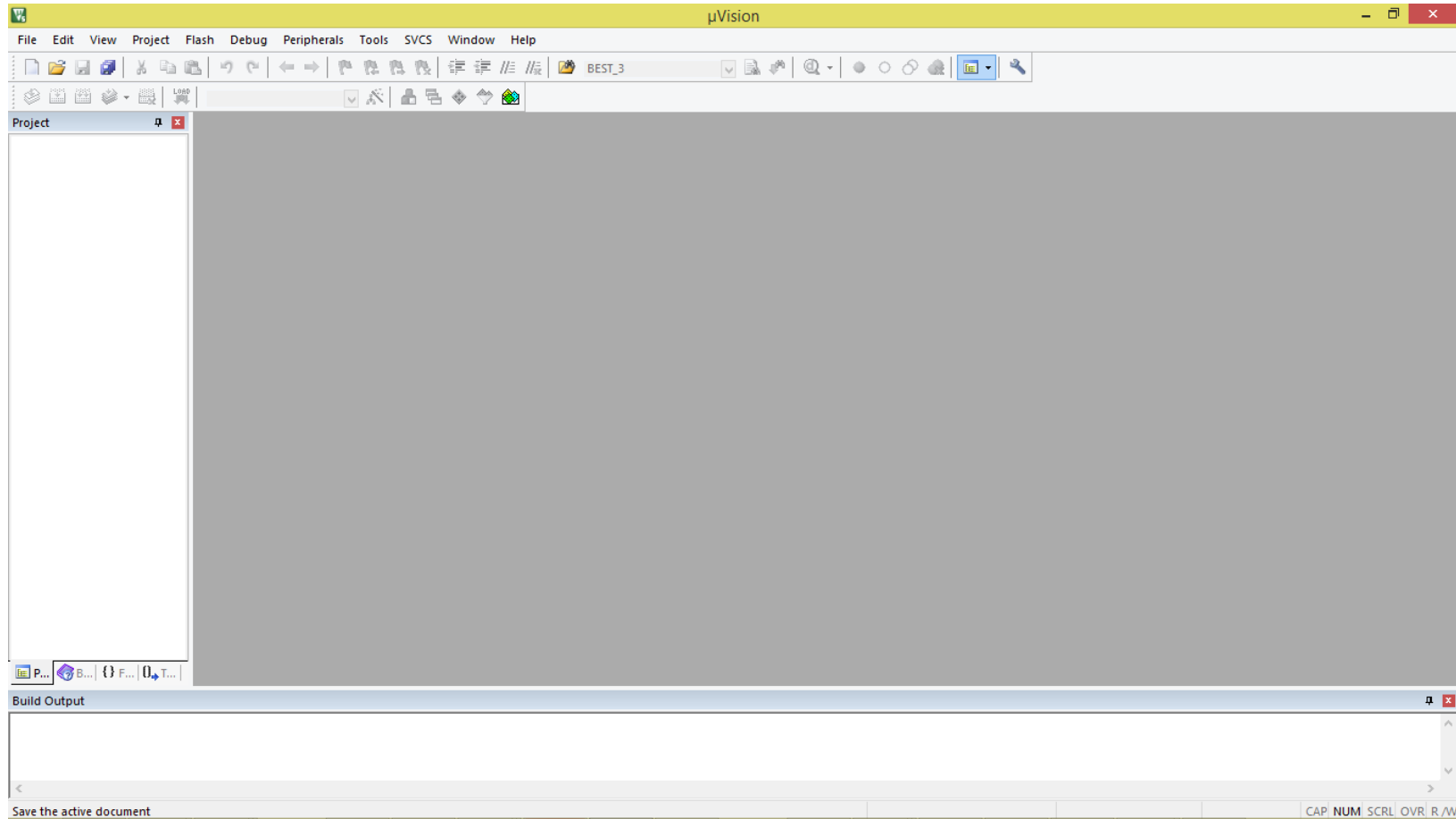
KEIL μ Vision 5 – installation and template

- <https://www.keil.com/download/product/>
- Along the download phase you will be required to enter your affiliation and email address; this is an important information, make sure you enter your institutional account
- <name.surname>@studenti.polito.it
- Affiliation: Politecnico di Torino

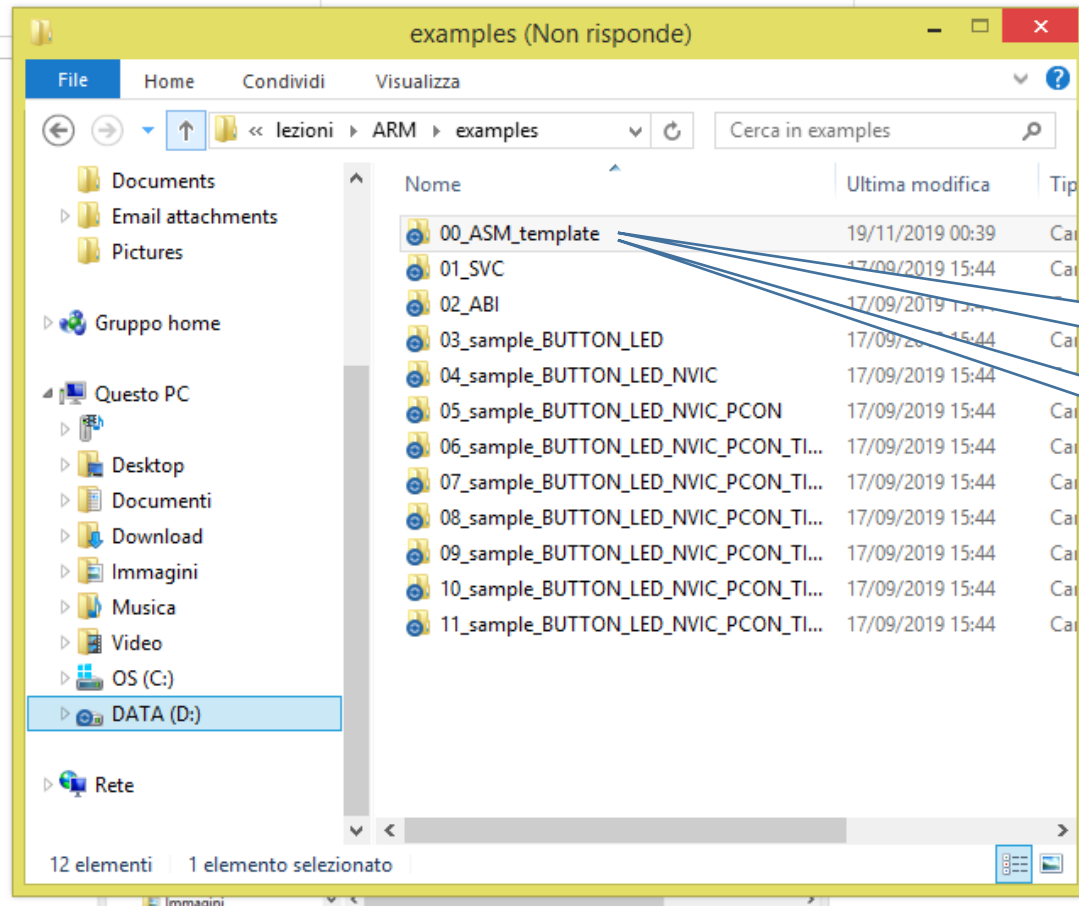
Installation completed



KEIL uVision5



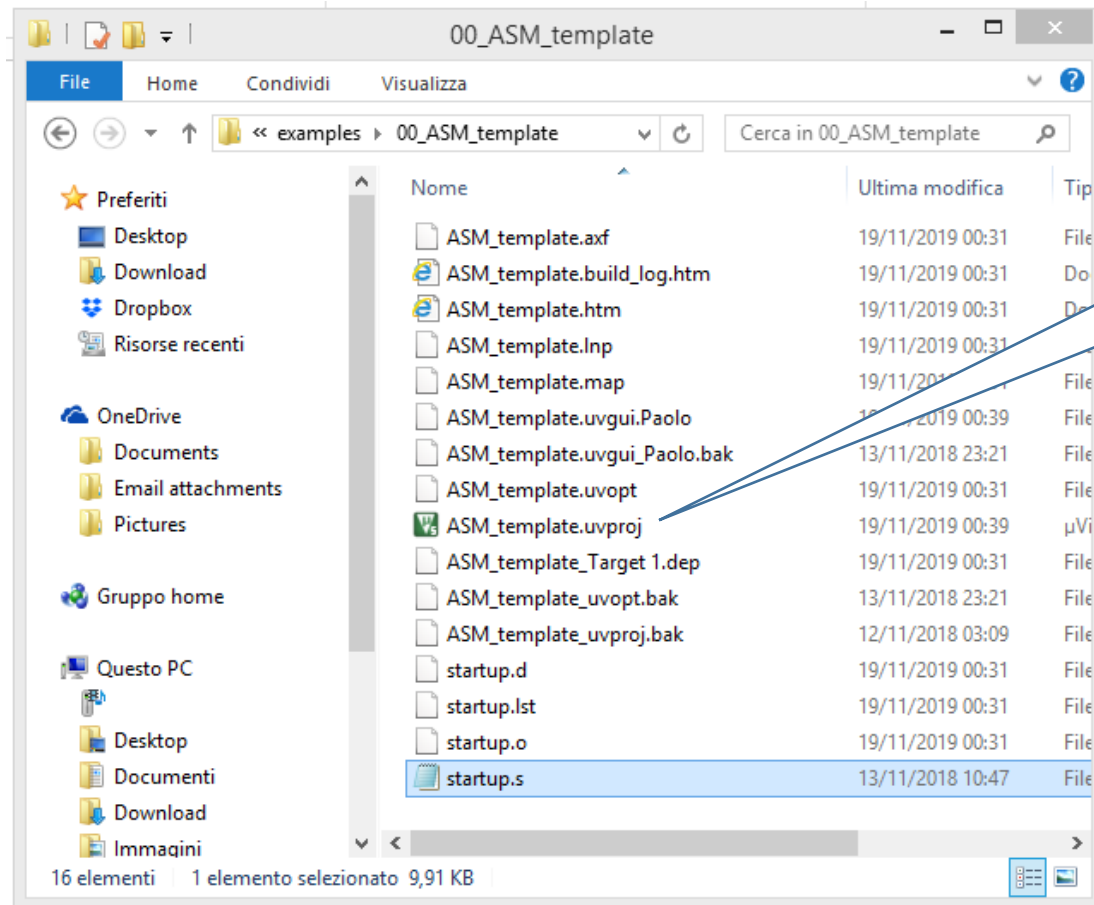
Open the 00_ASM_template project



It includes quite a lot of files

We suggest to create different projects in different folders.

Open the 00_ASM_template project

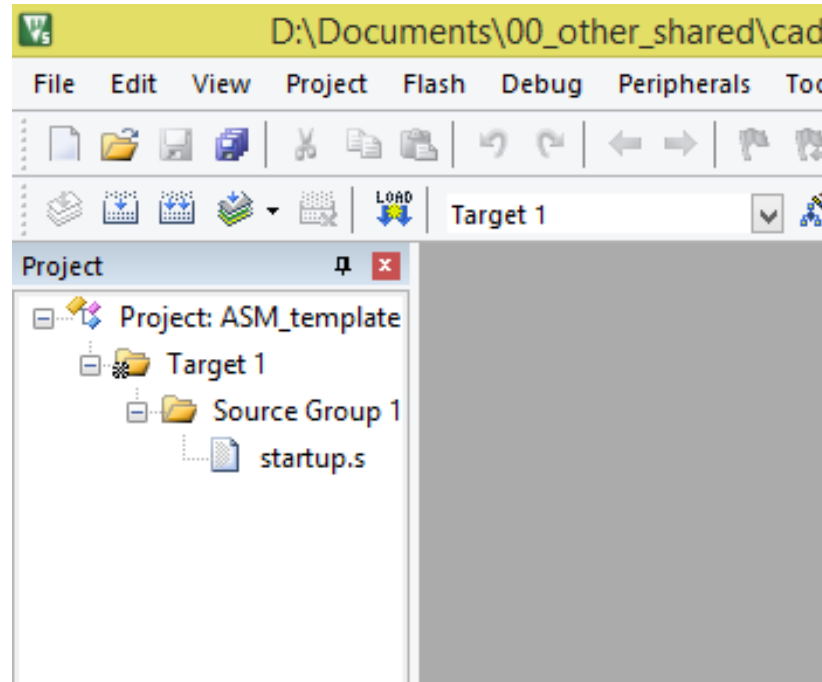


Open the
ASM_template.uvproj file

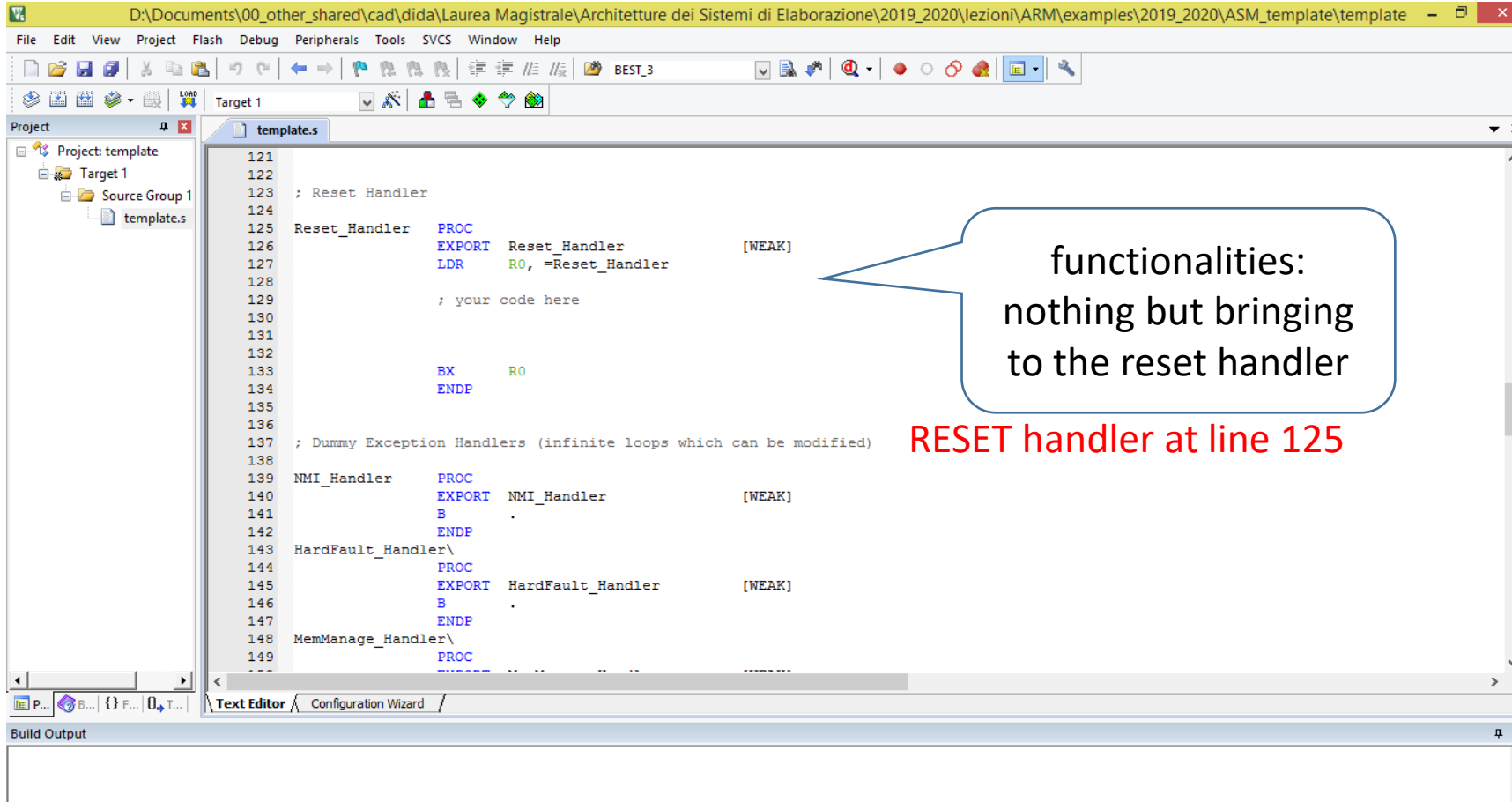
Legacy pack

- Most probably you will not have the correct LPC device environment installed at default
- Dialogs will appear and guide you to the proper website to download installation

Congratulations, your first project is created



startup.s



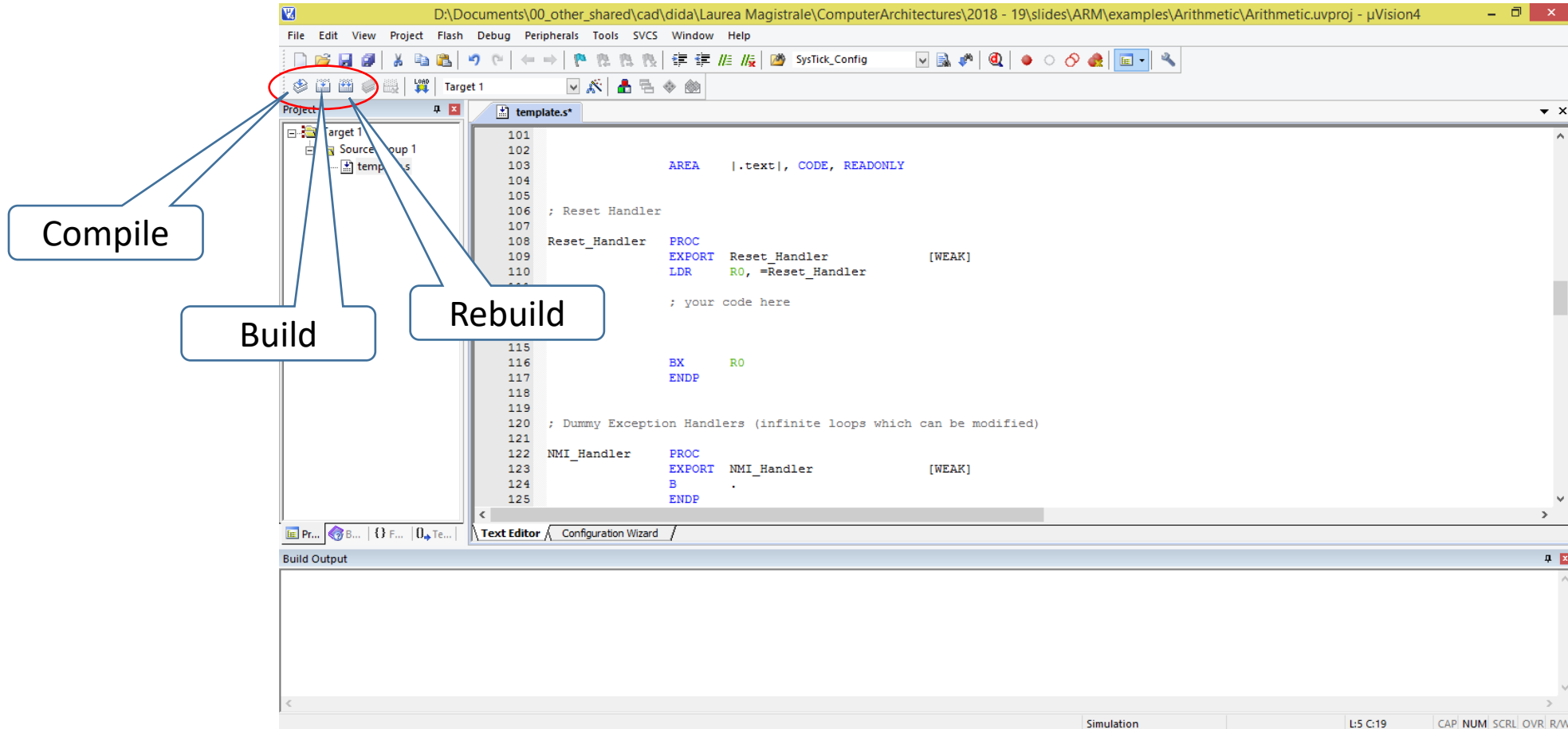
The screenshot shows an IDE window titled "D:\Documents\00_other_shared\cad\did\Laurea Magistrale\Architetture dei Sistemi di Elaborazione\2019_2020\lezioni\ARM\examples\2019_2020\ASM_template\template". The main editor displays the file "template.s" with the following assembly code:

```
121
122
123 ; Reset Handler
124
125 Reset_Handler PROC
126     EXPORT Reset_Handler    [WEAK]
127     LDR     R0, =Reset_Handler
128
129     ; your code here
130
131
132
133     BX     R0
134 ENDP
135
136
137 ; Dummy Exception Handlers (infinite loops which can be modified)
138
139 NMI_Handler PROC
140     EXPORT NMI_Handler    [WEAK]
141     B       .
142 ENDP
143 HardFault_Handler\
144     PROC
145     EXPORT HardFault_Handler    [WEAK]
146     B       .
147 ENDP
148 MemManage_Handler\
149     PROC
150     EXPORT MemManage_Handler    [WEAK]
```

A callout box points to line 125, containing the text: "functionalities: nothing but bringing to the reset handler". Below the callout box, the text "RESET handler at line 125" is written in red.

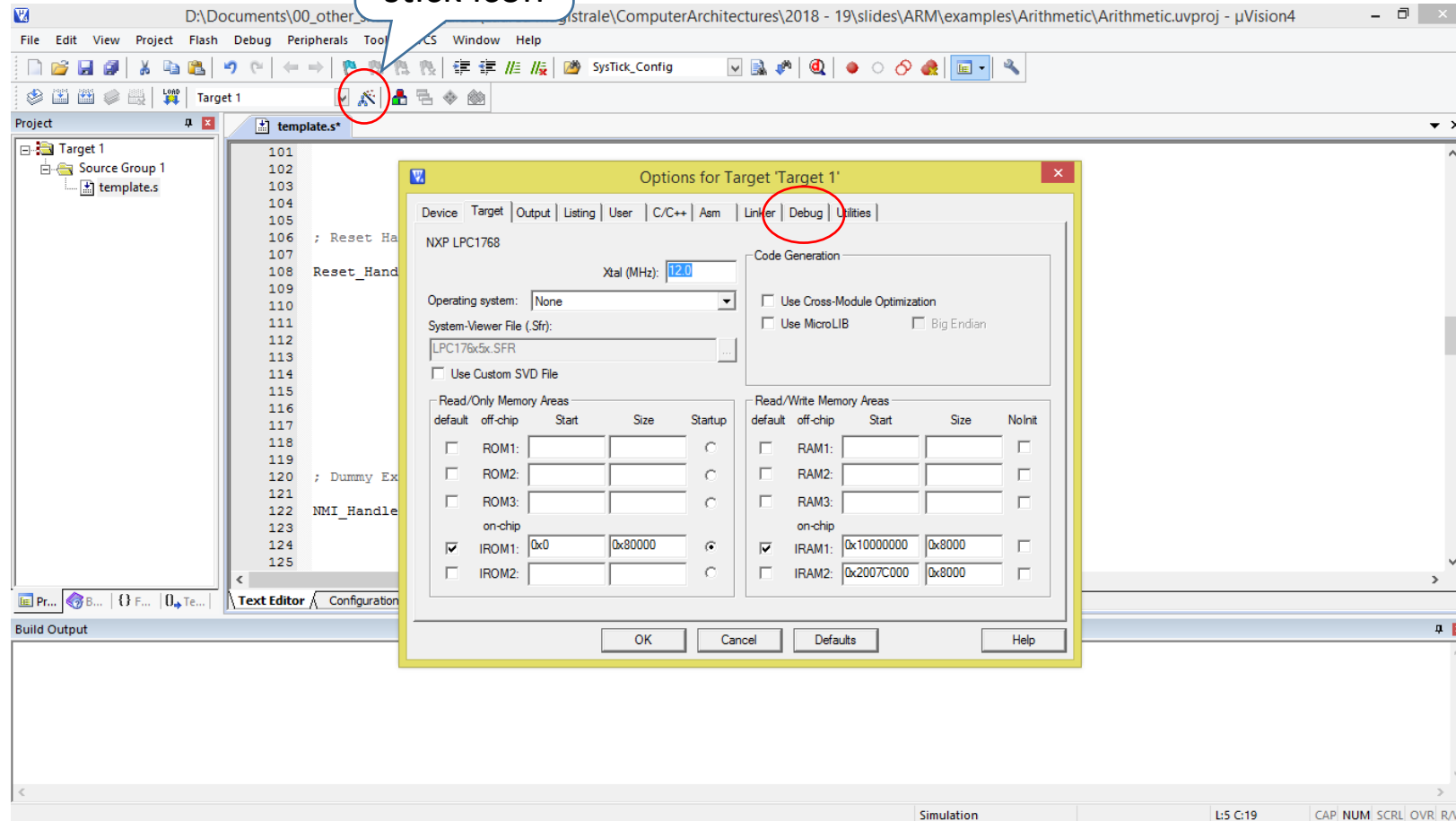
The IDE interface includes a "Project" pane on the left showing the project structure, a "Text Editor" pane at the bottom, and a "Build Output" pane at the very bottom.

Build your code

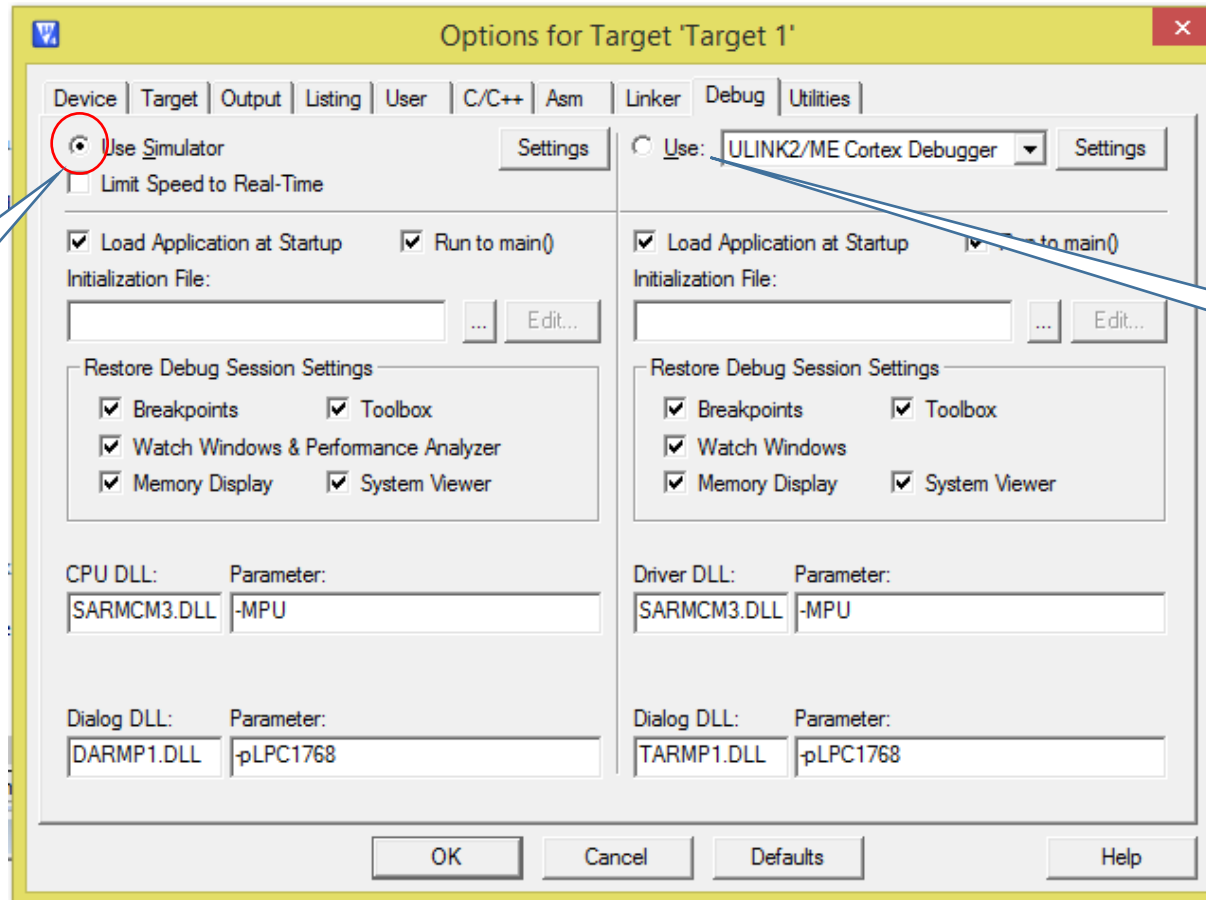


Debug setup

Magical
stick icon



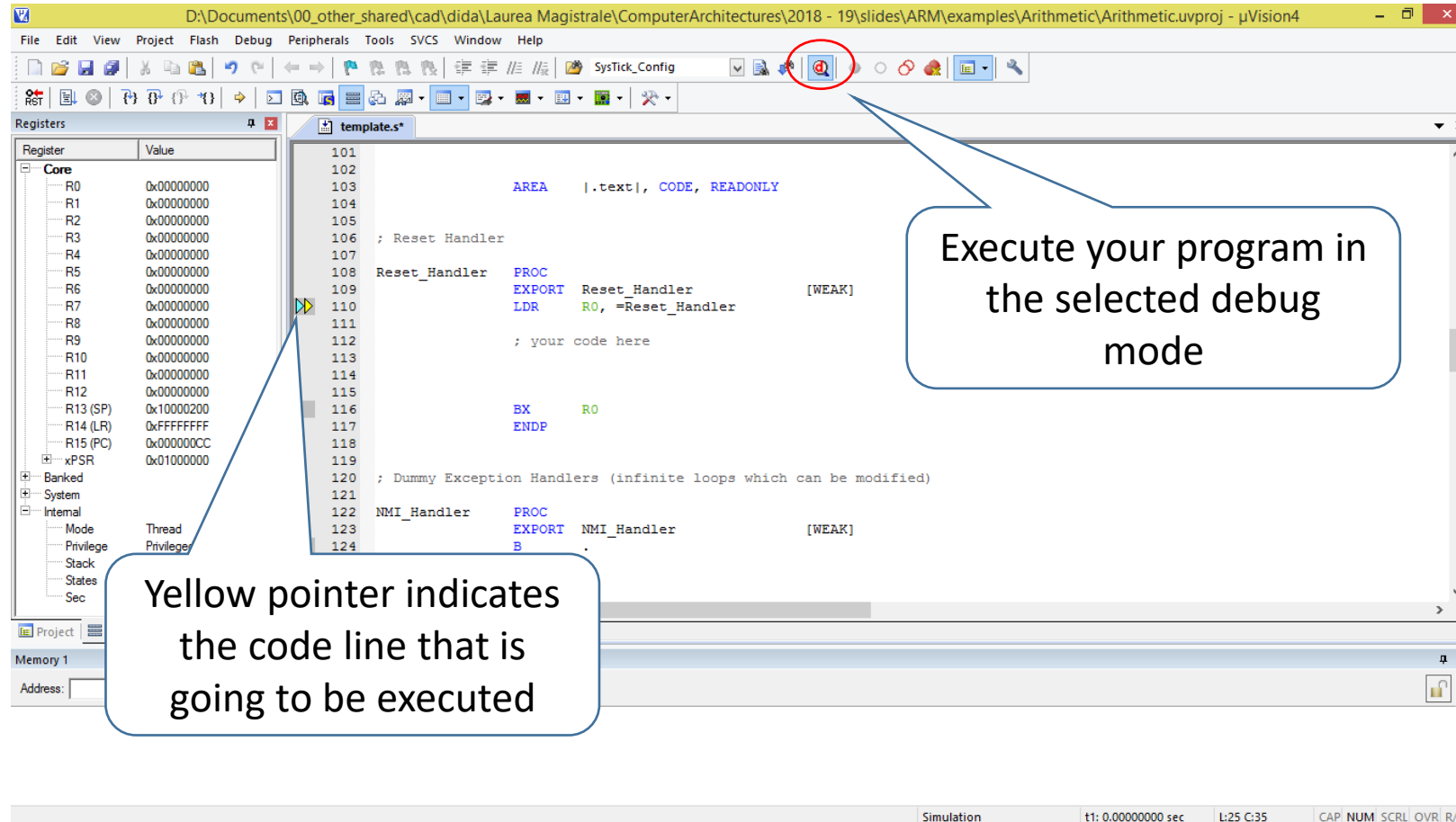
Select type of debug



Software debug
(emulated
functionalities)

Hardware debug
(with board)

Debug: (1) setup breakpoint (2) run debug



Debug execution

The screenshot displays the µVision4 IDE interface with several annotations explaining debugging features:

- RESET: it resets the device**: Points to the 'RESET' button in the top toolbar.
- STEP INTO (F11) STEP OVER (F10)**: Points to the 'Step Into' and 'Step Over' buttons in the top toolbar.
- Breakpoint (set by double click on the gray area close to code line)**: Points to a red dot breakpoint set on line 116 of the code editor.
- RUN TO CURSOR: execution stops only at a breakpoint**: Points to the 'Run to Cursor' button in the top toolbar.
- Execution time**: Points to the 't1: 0.00000000 sec' value in the bottom status bar.

The code editor shows the following assembly code:

```
101  
102  
103  
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105  
106 ; Reset_Handler  
107  
108 Reset_Handler PROC  
109 EXPORT Reset_Handler [WEAK]  
110 LDR R0, =Reset_Handler  
111  
112 ; your code here  
113  
114  
115  
116 BX R0  
117 ENDP  
118  
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Peripherals modules

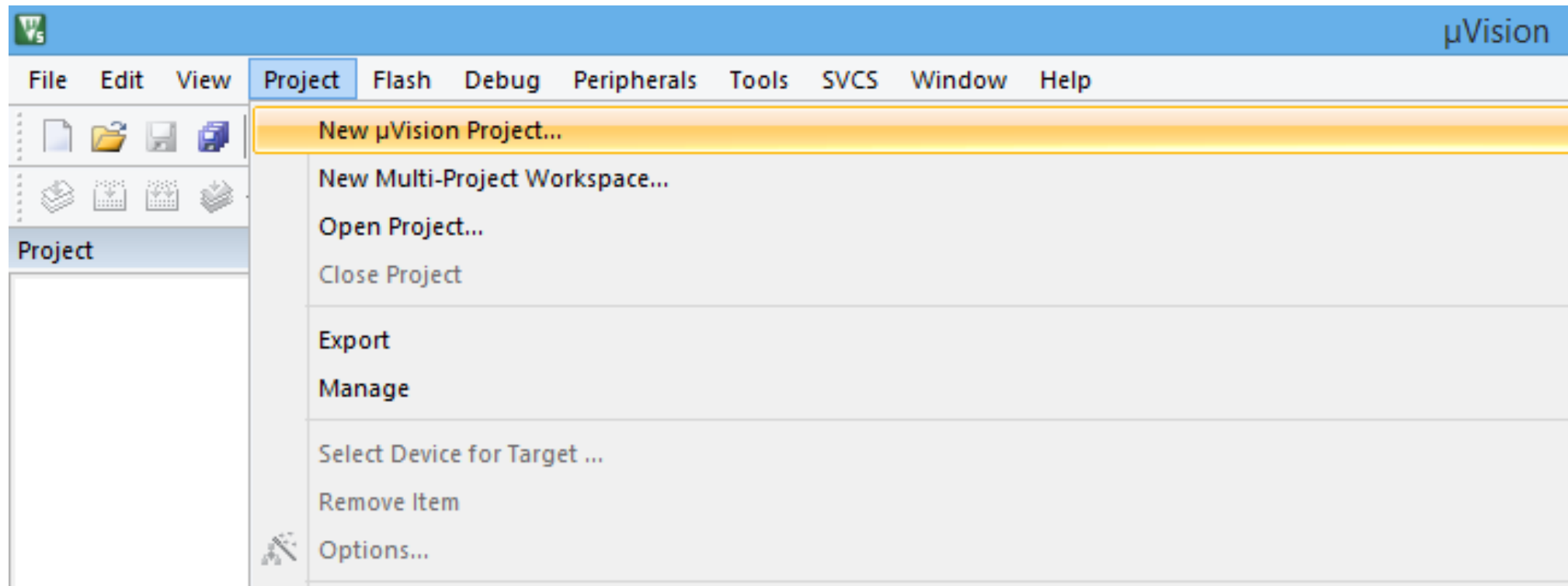
Open the needed peripheral windows

The screenshot displays the Keil uVision IDE interface. The **Peripherals** window is open, showing a list of system components. The **Clocking & Power Control** module is selected, and its sub-components are expanded. The **Clock Generation Schematic** window is also open, showing a detailed block diagram of the clock system. The schematic includes the following components and connections:

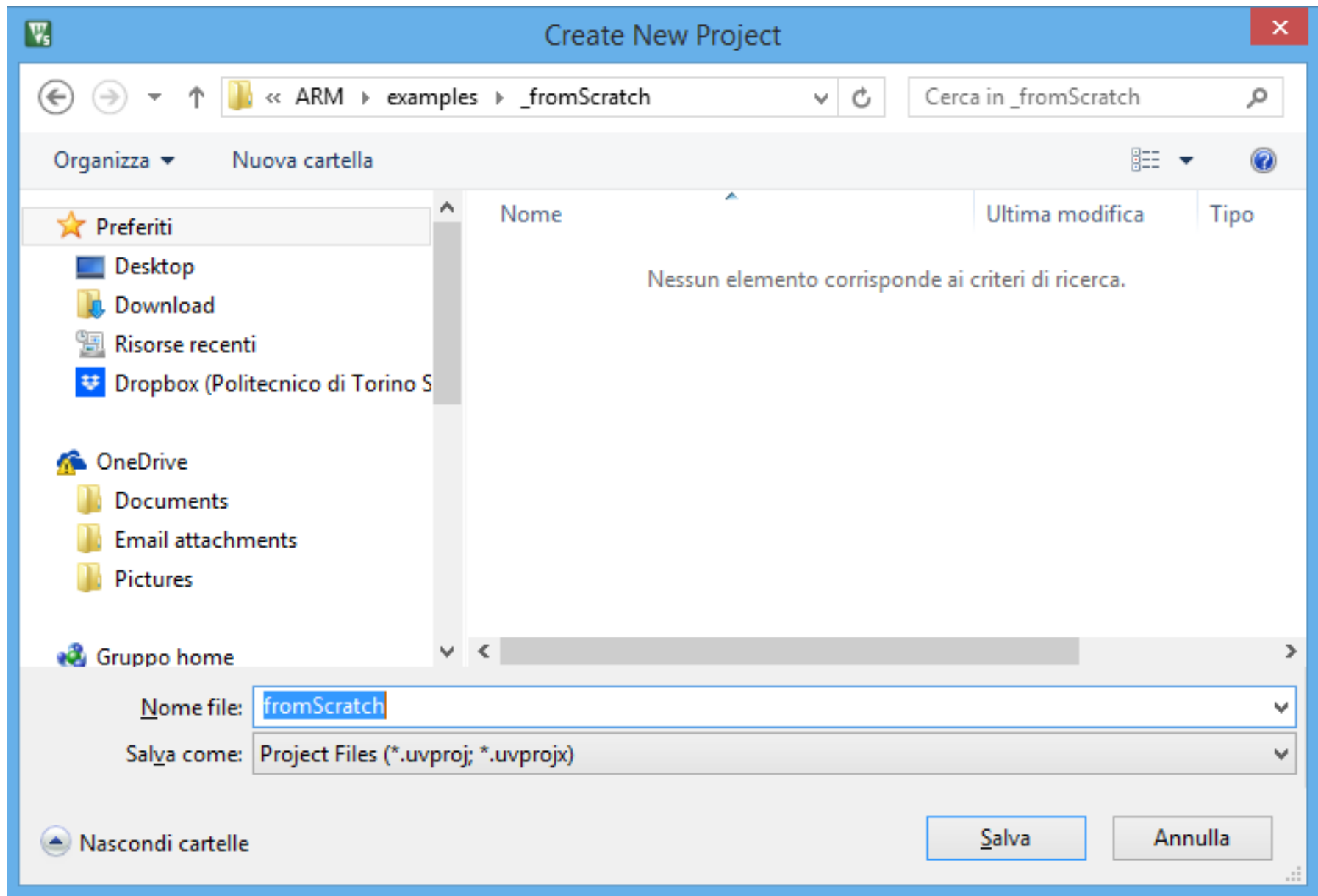
- System clock select (CLKSRCSEL)**: Receives inputs from 4.000 MHz, 0.000 MHz, and 32.768 kHz. Its output goes to the **Main PLL (PL150M)**.
- Main PLL settings (PLL0CON)**: Receives input from the **Main PLL (PL150M)**. Its output goes to the **CPU Clock Divider**.
- CPU clock divider setting (CCLKCFG)**: Receives input from the **CPU Clock Divider**. Its output goes to the **Peripheral Clock Divider**.
- Peripheral Clock Divider**: Receives input from the **CPU clock divider setting (CCLKCFG)**. Its outputs are **PCLK/1** (12.000 MHz), **PCLK/2** (6.000 MHz), **PCLK/4** (3.000 MHz), **PCLK/8** (1.500 MHz), and **wd_clk**.
- USB PLL settings (PLL1CON)**: Receives input from the **USB PLL (PL160M)**. Its output goes to the **USB Clock Divider**.
- USB clock divider setting (USBCLKCFG)**: Receives input from the **USB Clock Divider**. Its output goes to the **USBCLK** (12.000 MHz).
- USB PLL (PL160M)**: Receives input from the **USB PLL settings (PLL1CON)**. Its output goes to the **USB Clock Divider**.
- CPU PLL select (PLL0CON)**: Receives input from the **CPU PLL settings (PLL0CON)**. Its output goes to the **CPU Clock Divider**.
- Watchdog clock select (WDCLKSEL)**: Receives input from the **Watchdog clock select (WDCLKSEL)**. Its output goes to the **watchdog pclk**.

The **Registers** window shows the **Core** registers, including **R0** through **R15** and **xPSR**. The **Command** window shows the command **Load "D:\Documents\00_other_shared\cad\did\Laurea Mag"**.

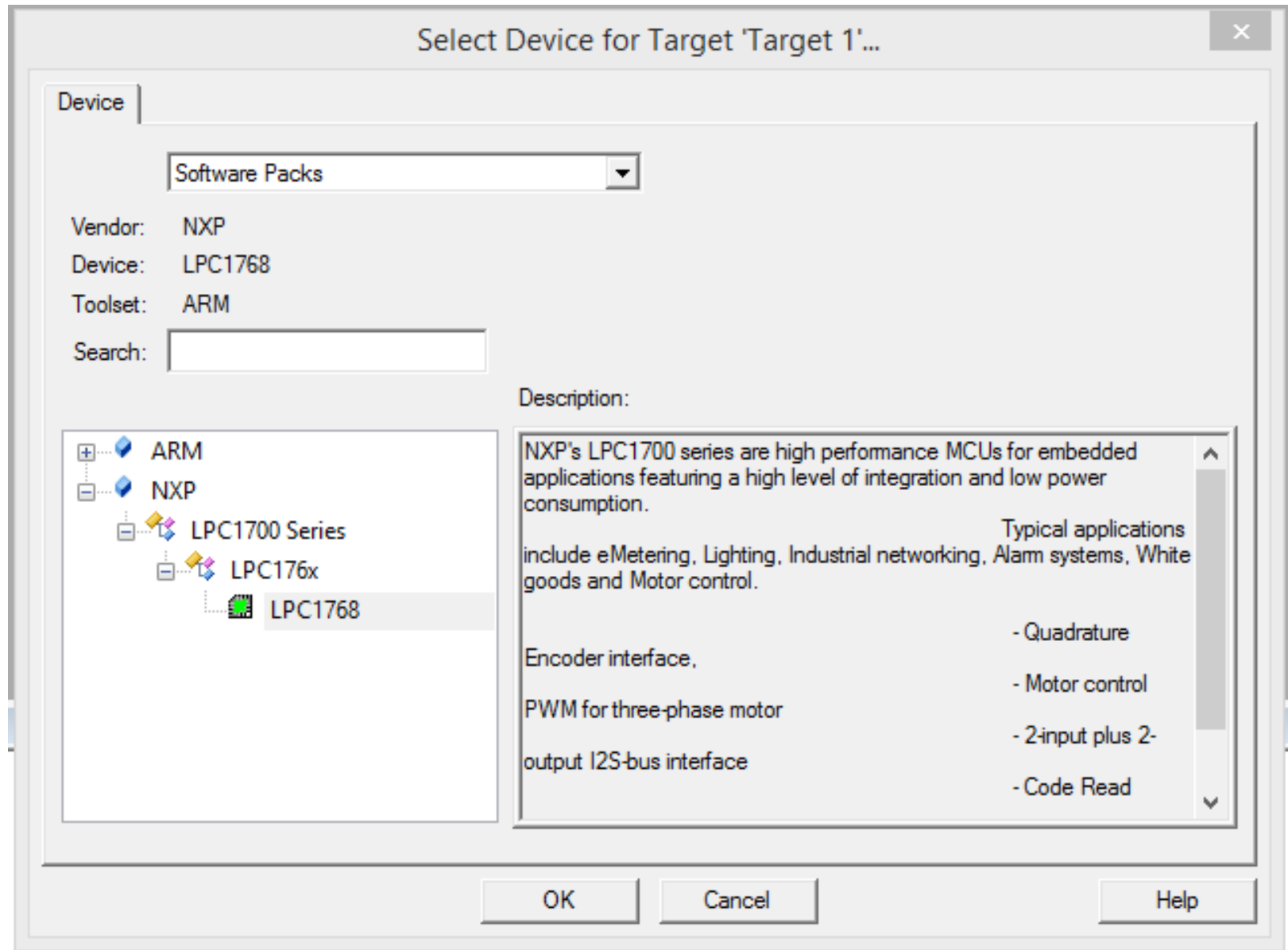
Create your own project from scratch



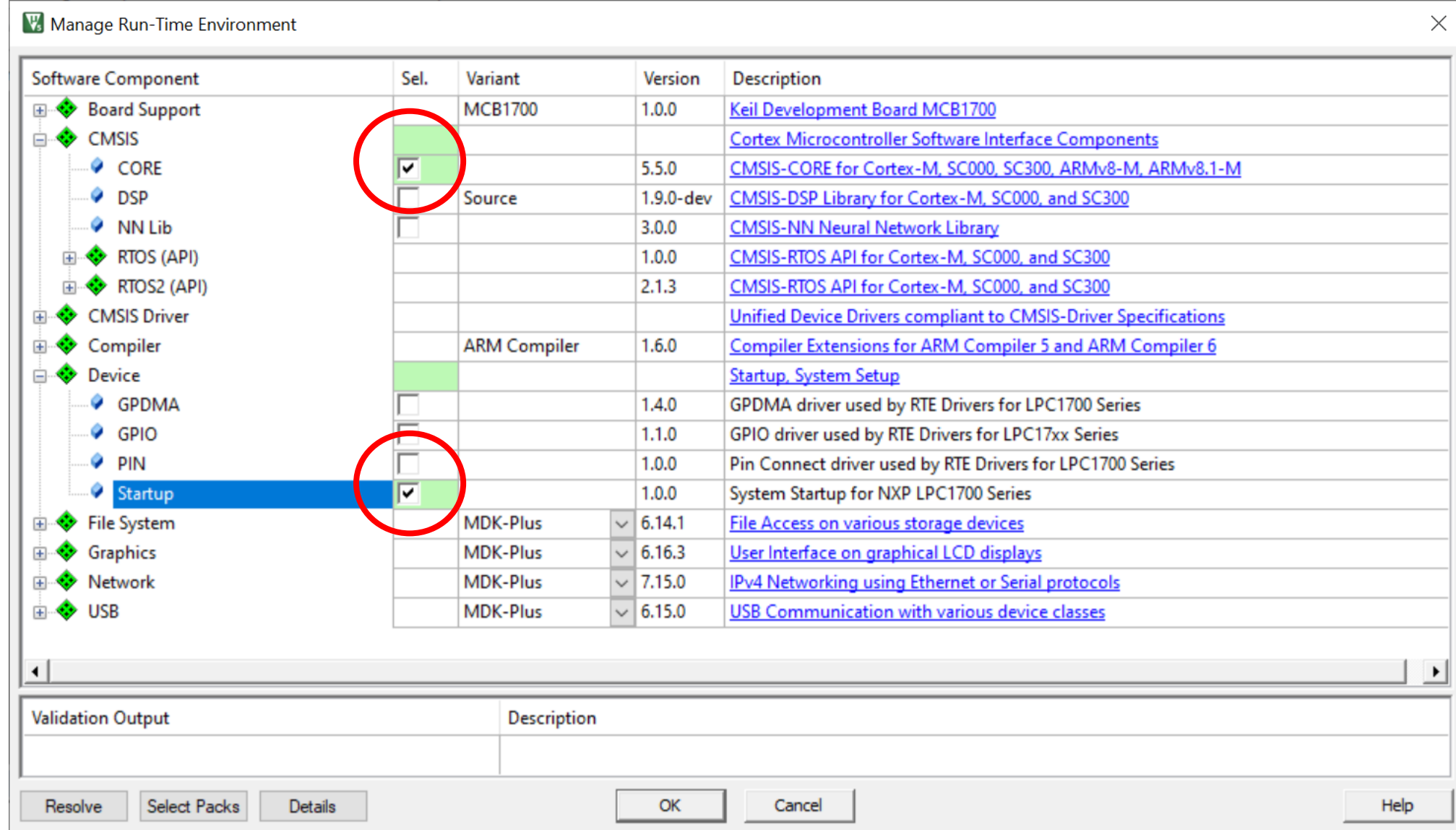
Select a folder and a name



Select the device



Request inclusion of startup files



Request inclusion of startup files

The screenshot shows the µVision IDE interface. On the left, the Project Explorer displays the project structure for 'Project: from_scratch'. Under 'Target 1', there is a 'Source Group 1' containing 'CMSIS' and 'Device'. The 'Device' folder is expanded, showing 'RTE_Device.h (Startup)', 'startup_LPC17xx.s (Startup)', and 'system_LPC17xx.c (Startup)'. A blue callout bubble points to the 'startup_LPC17xx.s' file with the text 'add a main.c'.

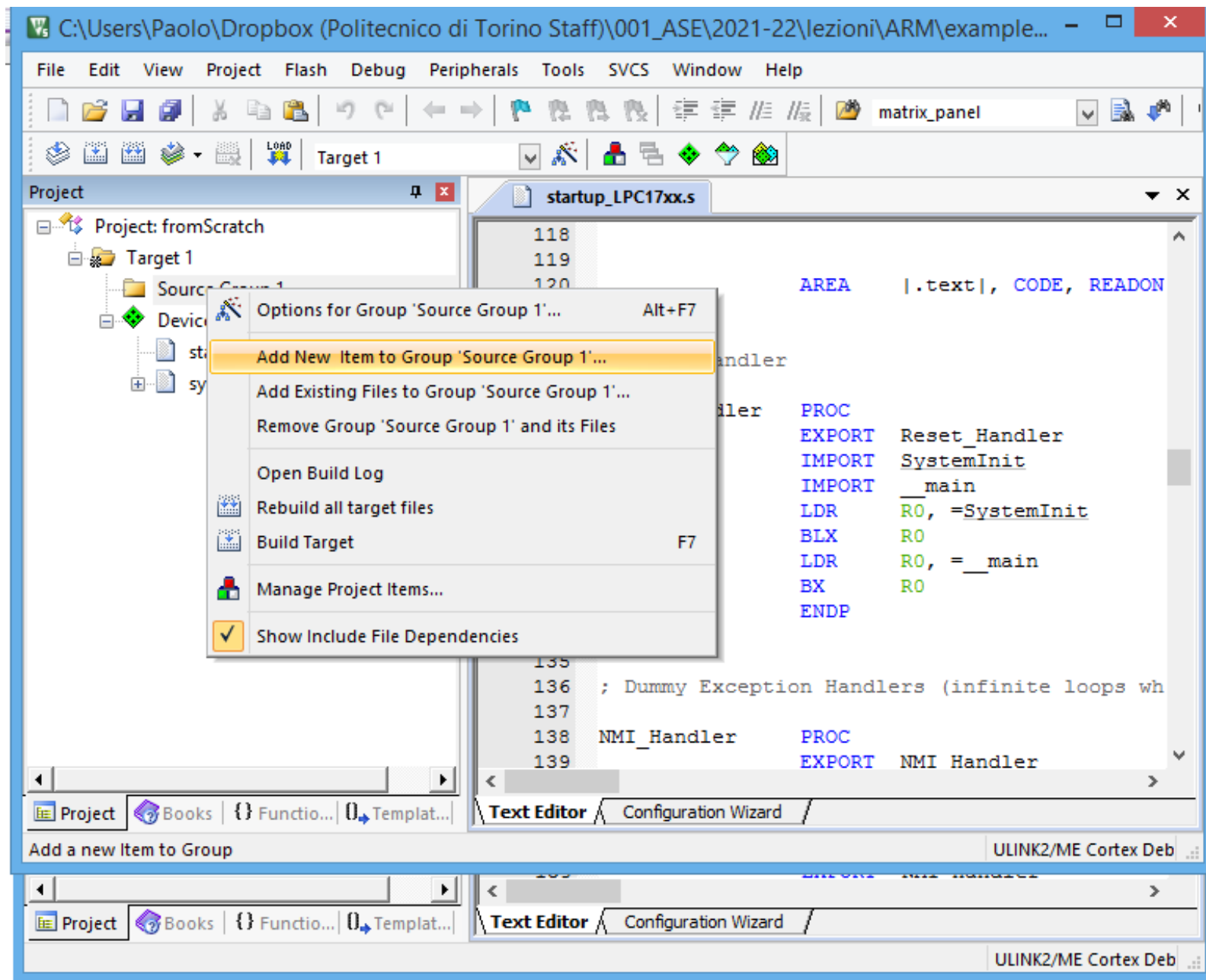
The main editor window displays the assembly code for 'startup_LPC17xx.s'. The code includes a Reset Handler and Dummy Exception Handlers. A blue callout bubble points to the Reset Handler code with the text 'Comment to programming ASM'.

```
121
122
123 ; Reset Handler
124
125 Reset_Handler PROC
126     EXPORT Reset_Handler [WEAK]
127     IMPORT SystemInit
128     IMPORT __main
129     LDR R0, =SystemInit
130     BLX R0
131     LDR R0, =__main
132     BX  R0
133     ENDP
134
135
136 ; Dummy Exception Handlers (infinite loops which can be modified)
137
138 NMI_Handler PROC
139     EXPORT NMI_Handler [WEAK]
140     B     .
141     ENDP
142 HardFault_Handler\
143     PROC
144     EXPORT HardFault_Handler [WEAK]
```

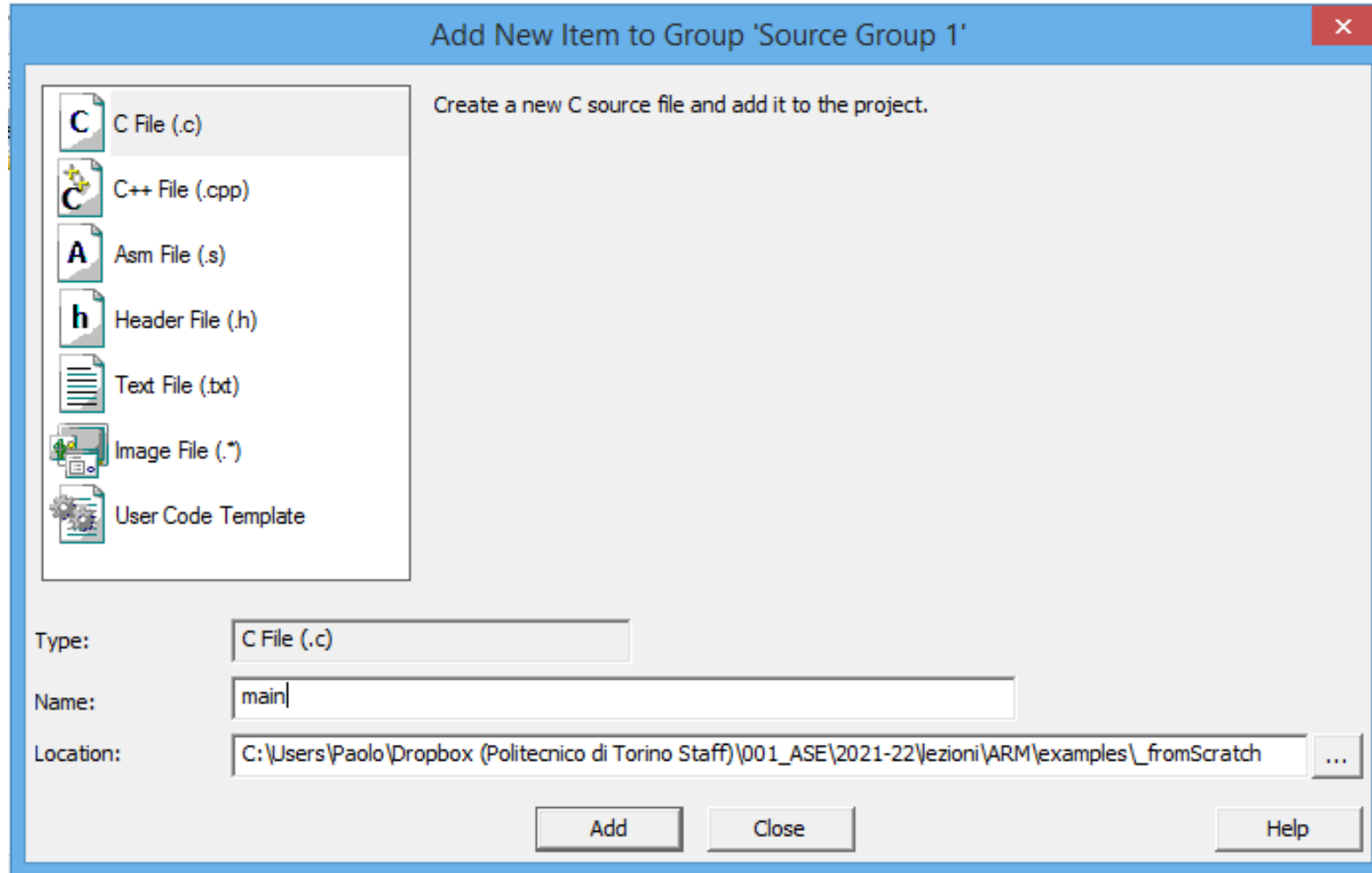
Build Output

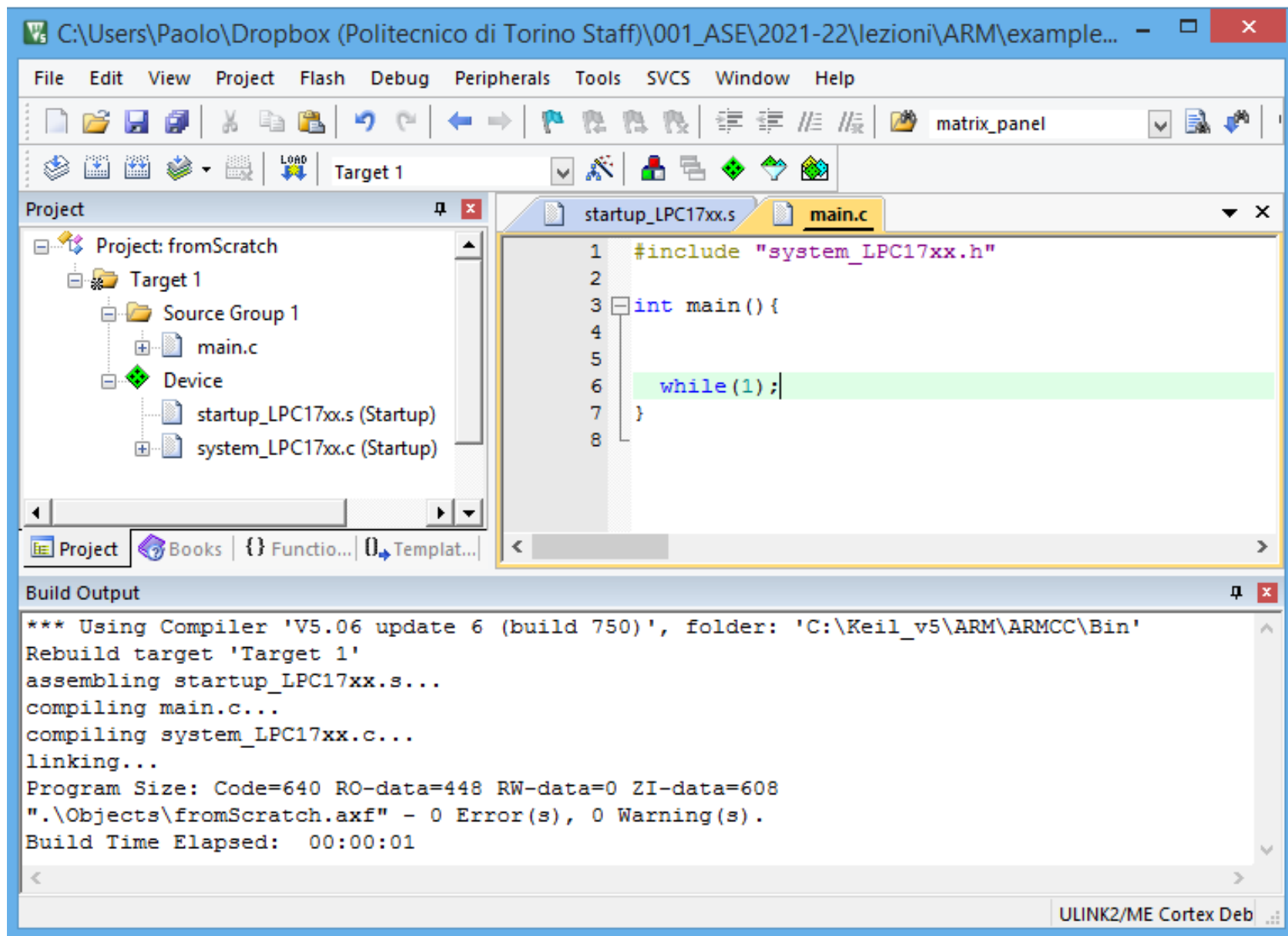
ULINK2/ME Cortex Debugger | L:1 C:1 | CAP NUM SCRL OVR R/W

Add main file

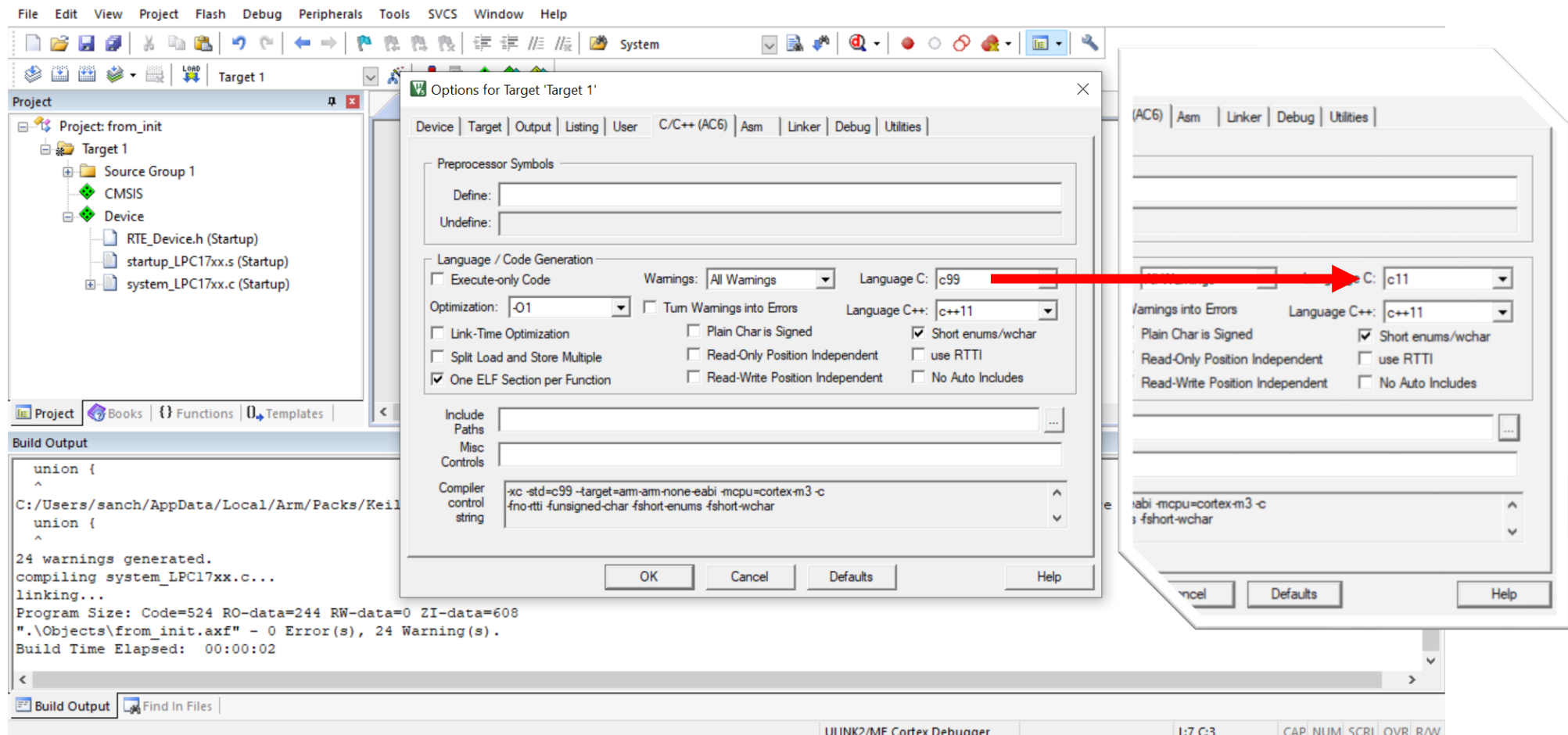


Add main file





Check for correct compilation parameters



Check for correct device peripherals simulation

Change the Dialog DLL and Parameter values as follows:

