

NTUEE DCLAB

Quartus Installation & Design Flow

Graduate Institute of Electronics Engineering

National Taiwan University

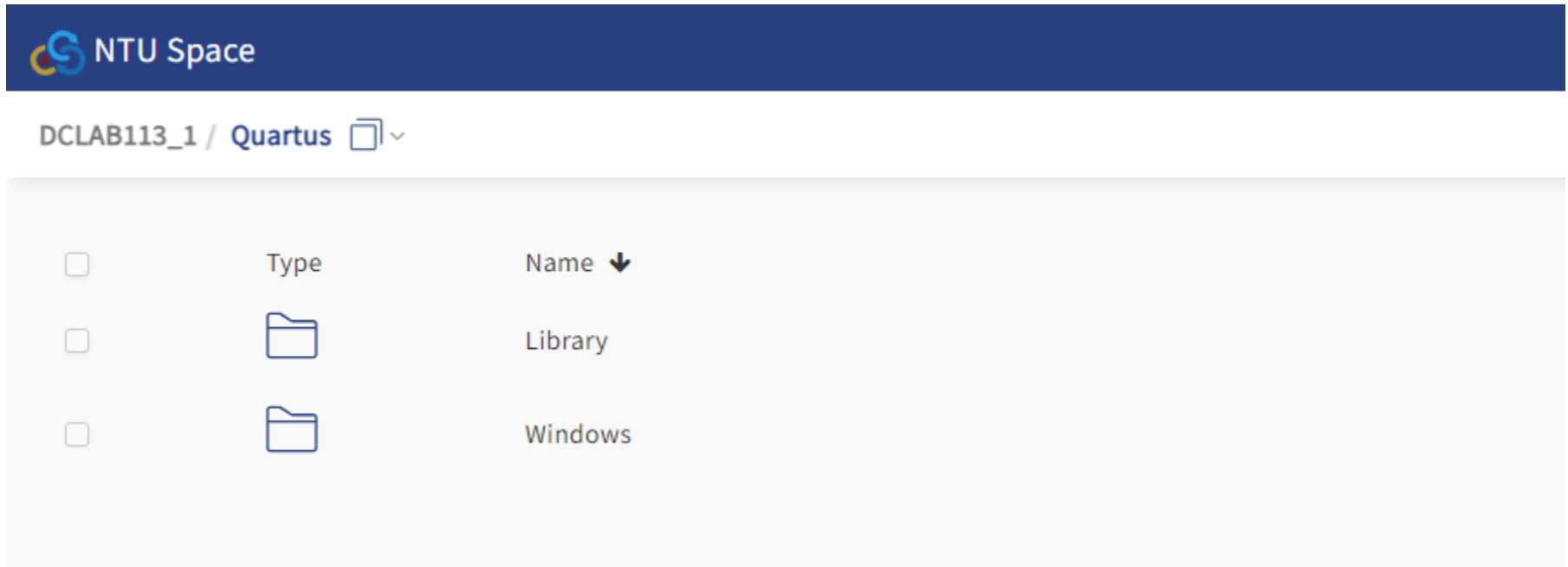


Outline

- Quartus installation
 - Install devices
 - License setup
 - Install USB driver
- Quartus design flow
 - Create new project
 - Import qsf
- Put your code to FPGA
 - Compile and program
- Debugging and compiling FAQ

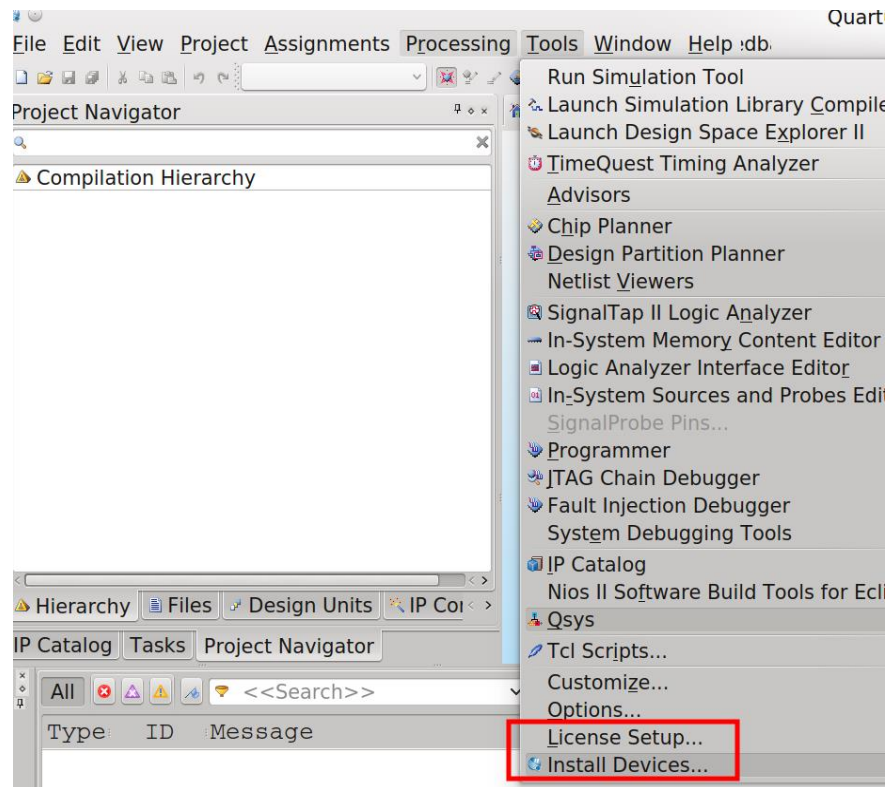
Download & Run Installer

- Download library and installation files
 - Register and download from Altera website
 - Or download from <https://reurl.cc/xvamOe>



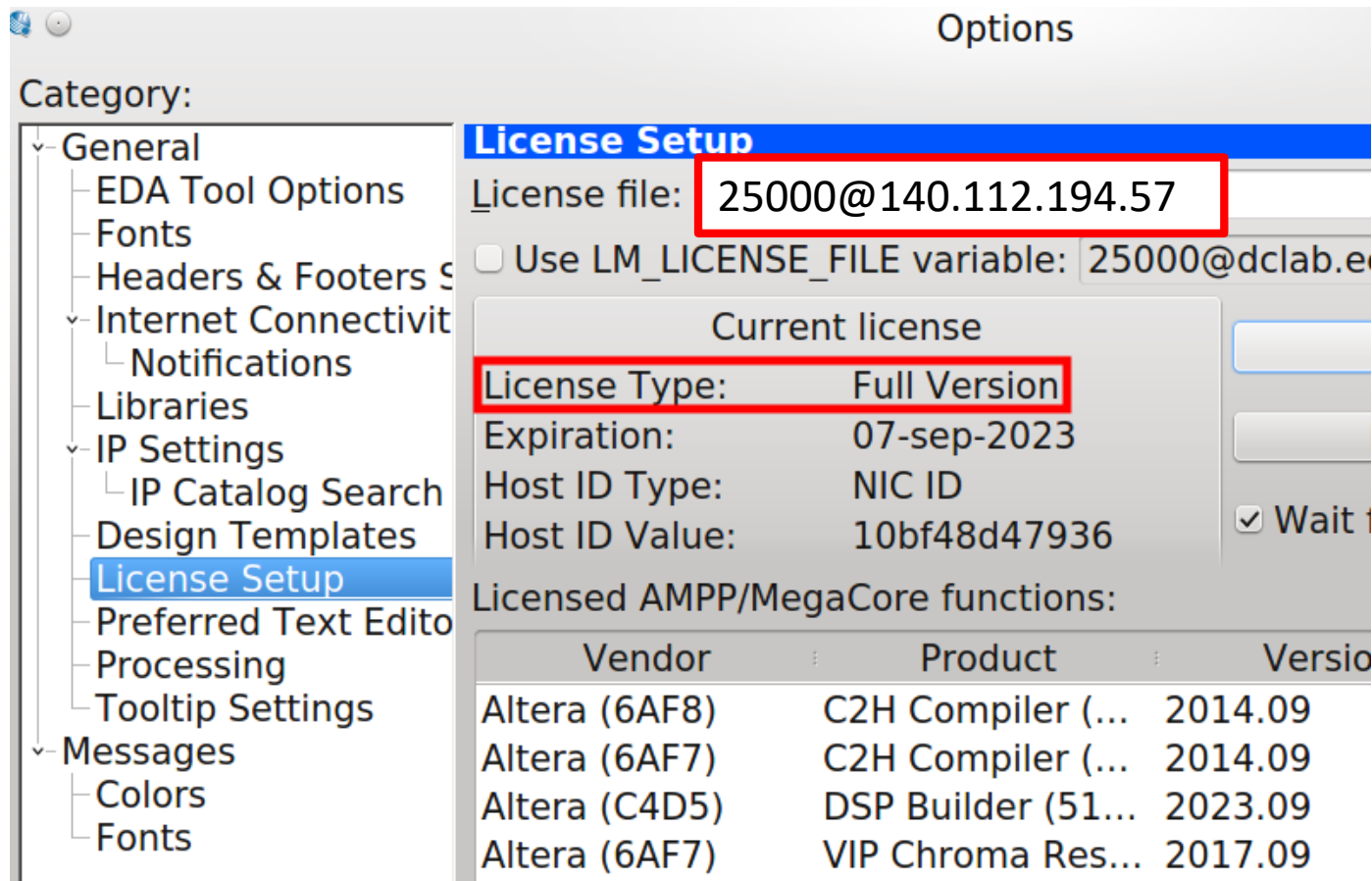
Install Devices

- Tools -> Install Devices
- Choose the library (qdz files) you downloaded
 - Note that DE2-115 belongs to Cyclone IV family



License Setup

- Tools -> License Setup
- This is only available when you are using NTU IP



Install USB Driver for Windows

- The driver is under [drivers/usb-blaster/](#) directory under Quartus installation path
- Plug the USB cable and open following path
 - 我的電腦 -> (右鍵)內容 -> 硬體 -> 裝置管理員
- Choose your device and the driver from the directory

Install USB Driver for Linux

- Create /etc/udev/rules.d/51-usbblaster.rules, then reboot

```
BUS=="usb", SYSFS{idVendor}=="09fb", SYSFS{idProduct}=="6001", MODE="0666"  
BUS=="usb", SYSFS{idVendor}=="09fb", SYSFS{idProduct}=="6002", MODE="0666"  
BUS=="usb", SYSFS{idVendor}=="09fb", SYSFS{idProduct}=="6003", MODE="0666"  
BUS=="usb", SYSFS{idVendor}=="09fb", SYSFS{idProduct}=="6010", MODE="0666"  
BUS=="usb", SYSFS{idVendor}=="09fb", SYSFS{idProduct}=="6810", MODE="0666"
```

- Check the installation
 - Run the library jtagd in bin/directory under Quartus installation path

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Create New Project

- File -> New Project Wizard
- The name of the top-level design is “DE2_115”

New Project Wizard

Directory, Name, Top-Level Entity

What is the working directory for this project?

What is the name of this project?

What is the name of the top-level design entity for this project? This name is case sensitive and must exactly match the entity name in the design file.

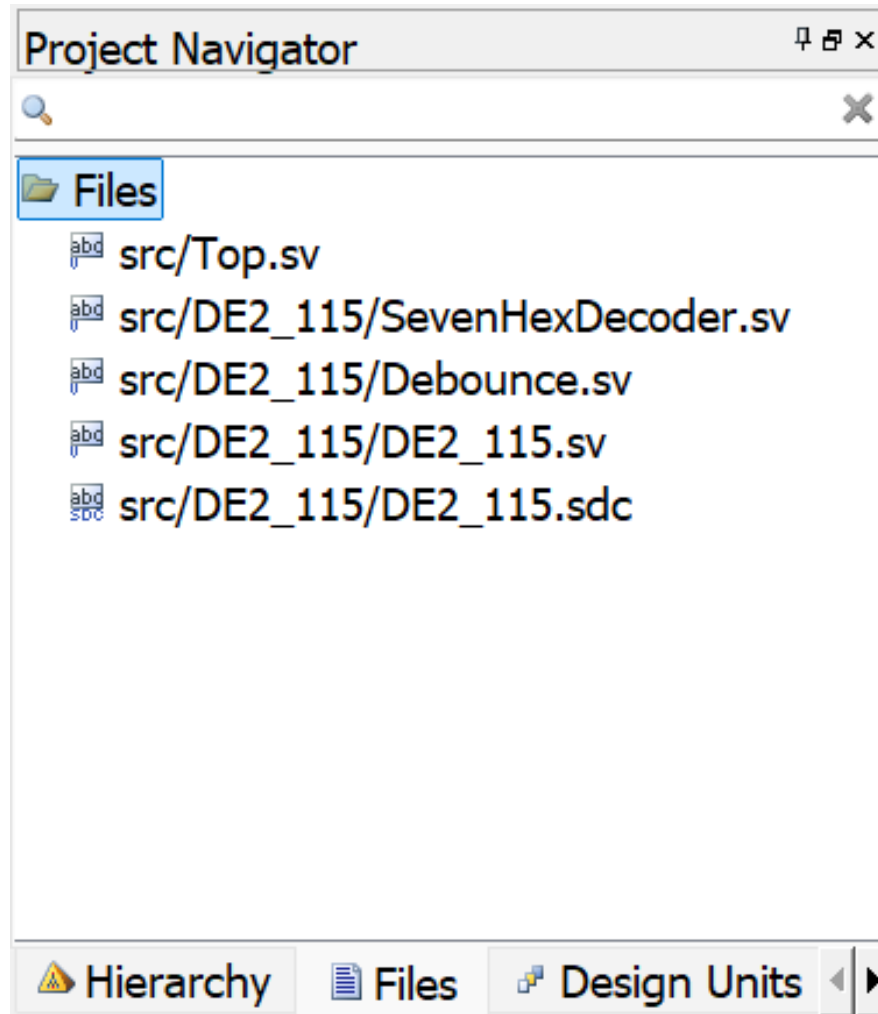
DE2_115

Use Existing Project Settings...

Help < Back Next > Finish Cancel

Add Files

- Add files
 - *.sv
 - *.sdc



Set the Device

- Select EP4CE115F29C7

New Project Wizard

Family & Device Settings

Select the family and device you want to target for compilation.
You can install additional device support with the Install Devices command on the Tools menu.
To determine the version of the Quartus II software in which your target device is supported, refer to the [Device Support List](#) webpage.

Device family

Family: Cyclone IV E
Devices: All

Target device

☐ Auto device selected by the Fitter
☒ Specific device selected in 'Available devices' list
☐ Other: n/a

Show in 'Available devices' list

Package: FBGA
Pin count: 780
Core Speed grade: 7
Name filter:
☒ Show advanced devices

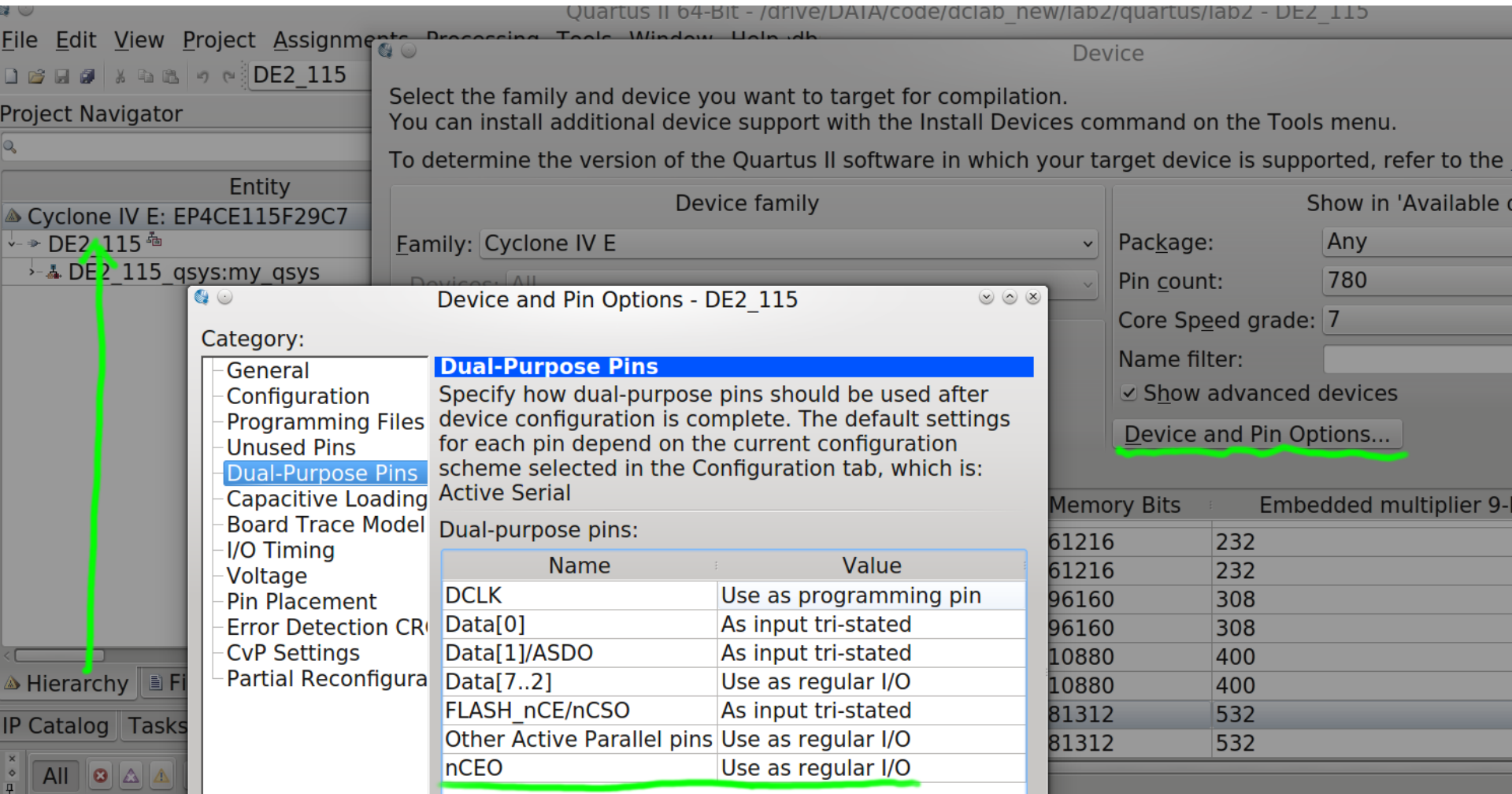
Available devices:

| Name | Core Voltage | LEs | User I/Os | Memory Bits | Embedded multiplier 9-bit elements | PLLs | Global Clocks |
|---------------|--------------|--------|-----------|-------------|------------------------------------|------|---------------|
| EP4CE30F29C7 | 1.2V | 28848 | 533 | 608256 | 132 | 4 | 20 |
| EP4CE30F29I7 | 1.2V | 28848 | 533 | 608256 | 132 | 4 | 20 |
| EP4CE40F29C7 | 1.2V | 39600 | 533 | 1161216 | 232 | 4 | 20 |
| EP4CE40F29I7 | 1.2V | 39600 | 533 | 1161216 | 232 | 4 | 20 |
| EP4CE55F29C7 | 1.2V | 55856 | 375 | 2396160 | 308 | 4 | 20 |
| EP4CE55F29I7 | 1.2V | 55856 | 375 | 2396160 | 308 | 4 | 20 |
| EP4CE75F29C7 | 1.2V | 75408 | 427 | 2810880 | 400 | 4 | 20 |
| EP4CE75F29I7 | 1.2V | 75408 | 427 | 2810880 | 400 | 4 | 20 |
| EP4CE115F29C7 | 1.2V | 114480 | 529 | 3981312 | 532 | 4 | 20 |
| EP4CE115F29I7 | 1.2V | 114480 | 529 | 3981312 | 532 | 4 | 20 |

Help < Back Next > Finish Cancel

A Subtle Configuration

- Some error might occur if this step is skipped



Import qsf

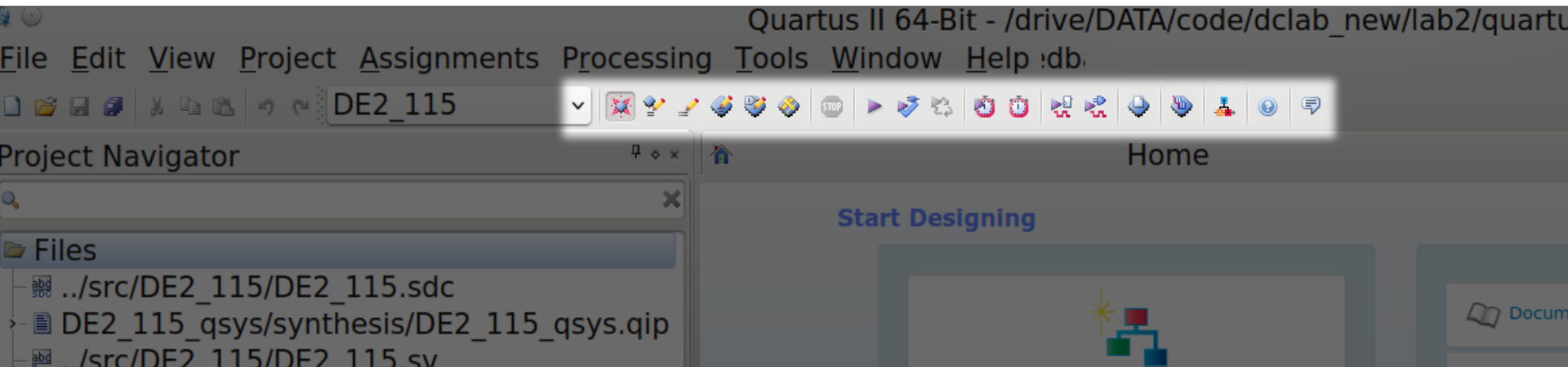
- Assignment -> Import Assignments
 - Select the given qsf file (/src/DE2_115/DE2_115.qsf)

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Compile Your Code

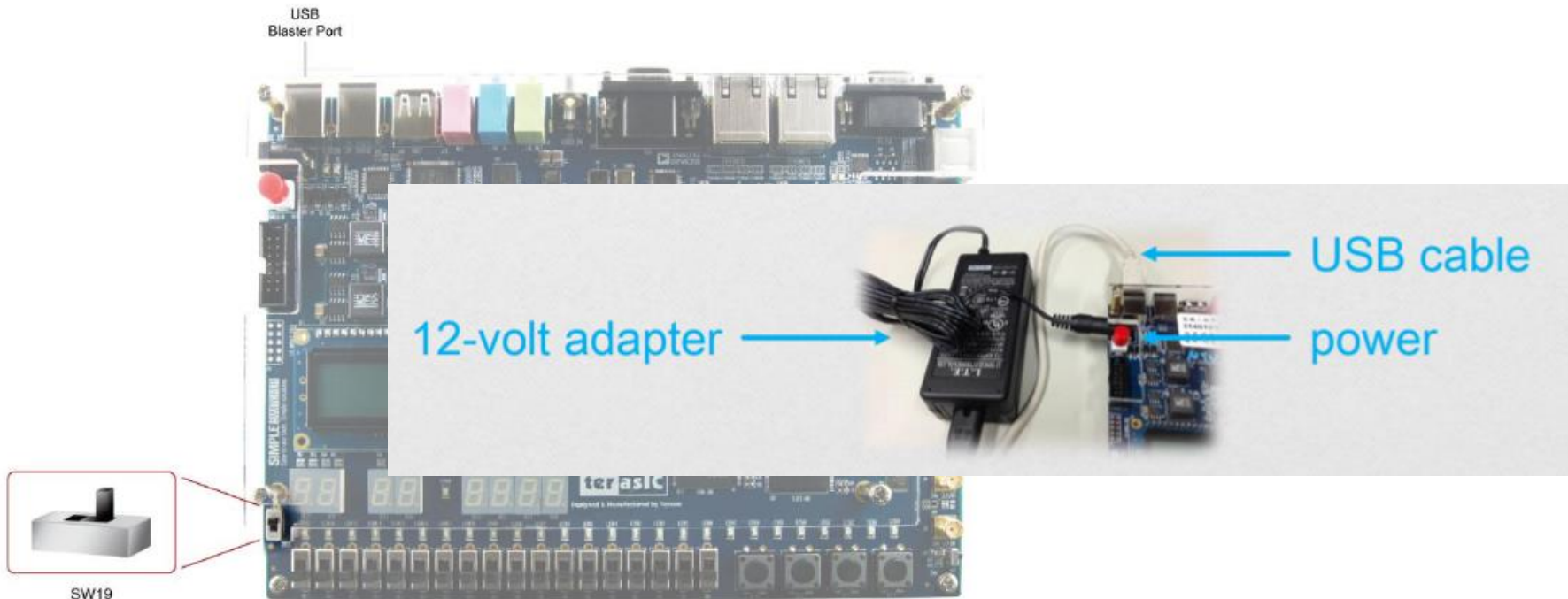
- Press “Ctrl+L” or the purple play button
 - Converts the code to the format that FPGA recognizes
 - Including synthesis, place and route, fitting, etc.
 - Generates a sof file (/output_files/DE2_115.sof)



- Check if there are errors or warnings
 - Modify your code if necessary

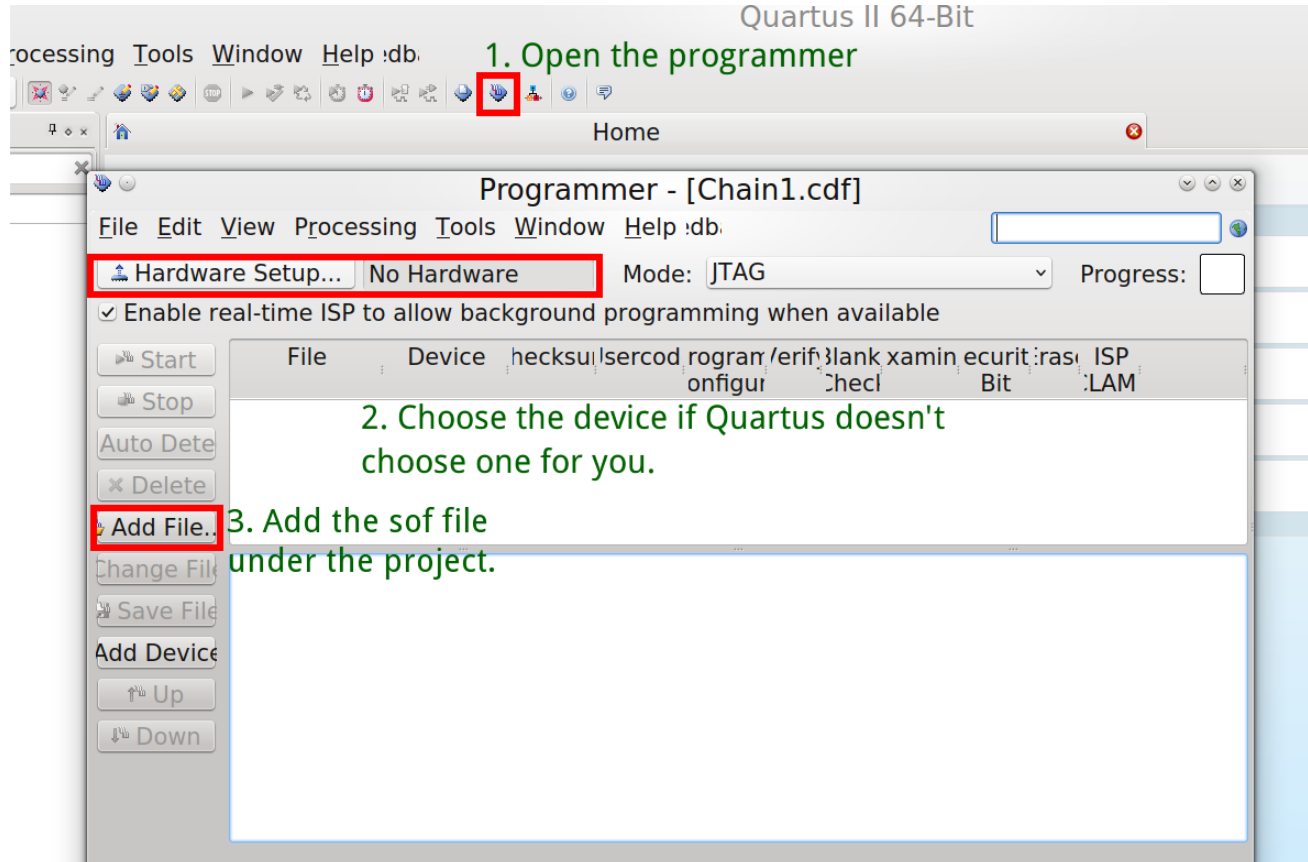
Before Programming FPGA

- Make sure
 - Blaster USB cable is connected
 - Power of FPGA is on
 - The switch on the bottom left is set to RUN



Program the FPGA

- Hardware Setup -> Add File -> Run -> Success



- If you prefer CLI, check this [link](#)

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My Verilog Pass Simulation but Don't Work on FPGA

- Some code can not be compiled to hardware
 - Modify your code if there is any **WARNING** about *Combinational Loop* or *Inferred Latch*
- Common warnings/errors of code that is not synthesizable
 - 22011 Combinational Loop
 - 22013 Asynchronous Loop
 - 22014 Synchronous Loop
 - 22051 (Verilog) Generated Reset
 - 22052 (Verilog) Generated Clock
 - 22082 Port Not Connected
 - 23003 Inferred Latch
 - 23006 (Verilog) Incomplete Case Expression with Default Clause
 - 23007 (Verilog) Case Statement Not Fully Specified
 - 25001 Signal with No Driver

