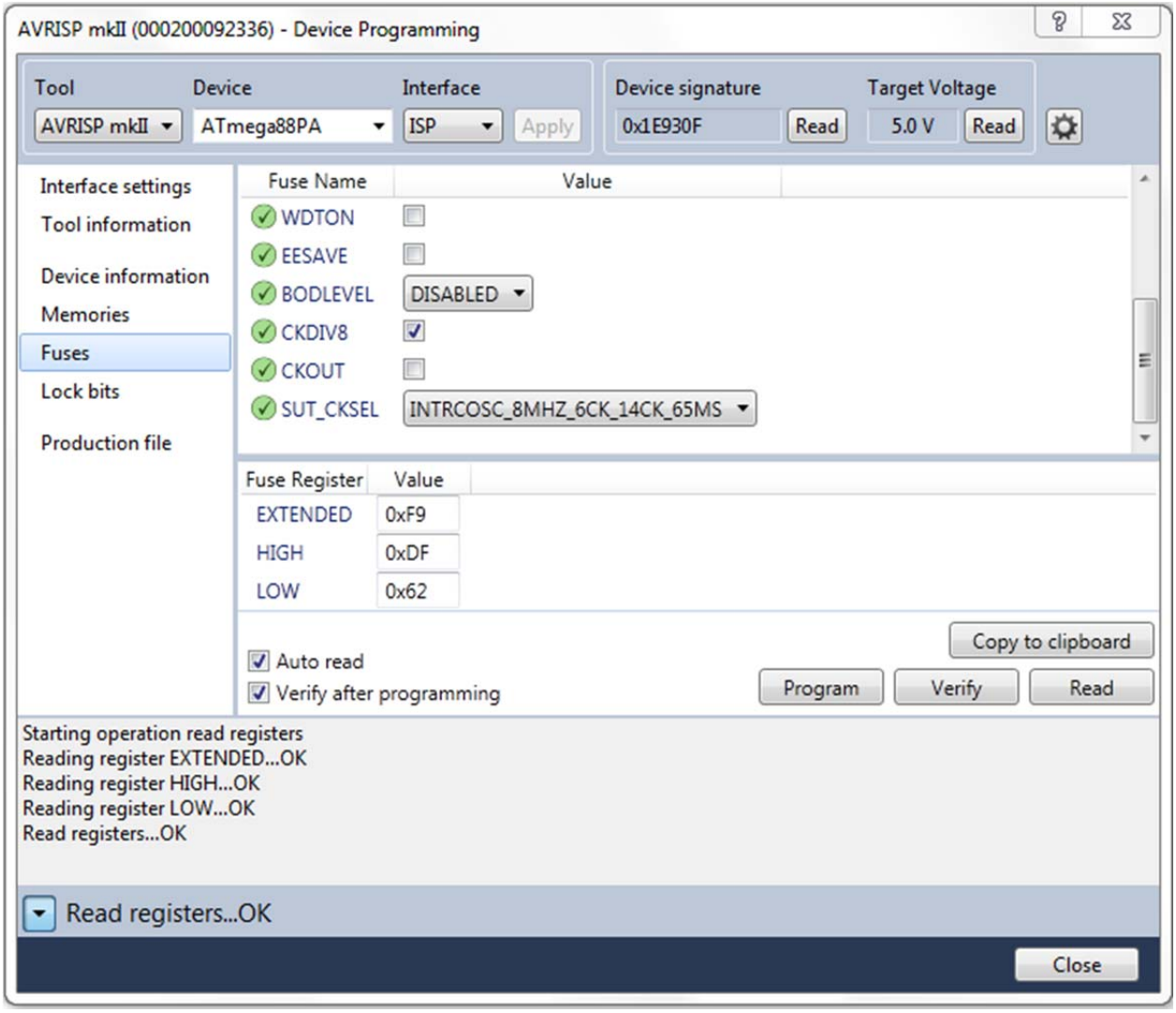
Fuse Bits: Changing the Clock Source and Frequency

The fuse bits in an ATMEL microcontroller are low level settings that tell the microcontroller what to expect in certain situations. So extreme care must be used in changing these fuse bits because if in some instances they are changed incorrectly the microcontroller could be put into a state that would not allow communication through the ISP programming lines. If you are not careful it is very easy to do this rendering the microcontroller useless.

The one and only case that the fuse bits need to be changed is to change the clock source and frequency. This fuse bit is sensitive to incorrect changes so if an incorrect clock source or frequency is selected the correct fuse bit setting cannot be reset easily.

To set the clock frequency and source select the Fuses menu in the Device Programming window.



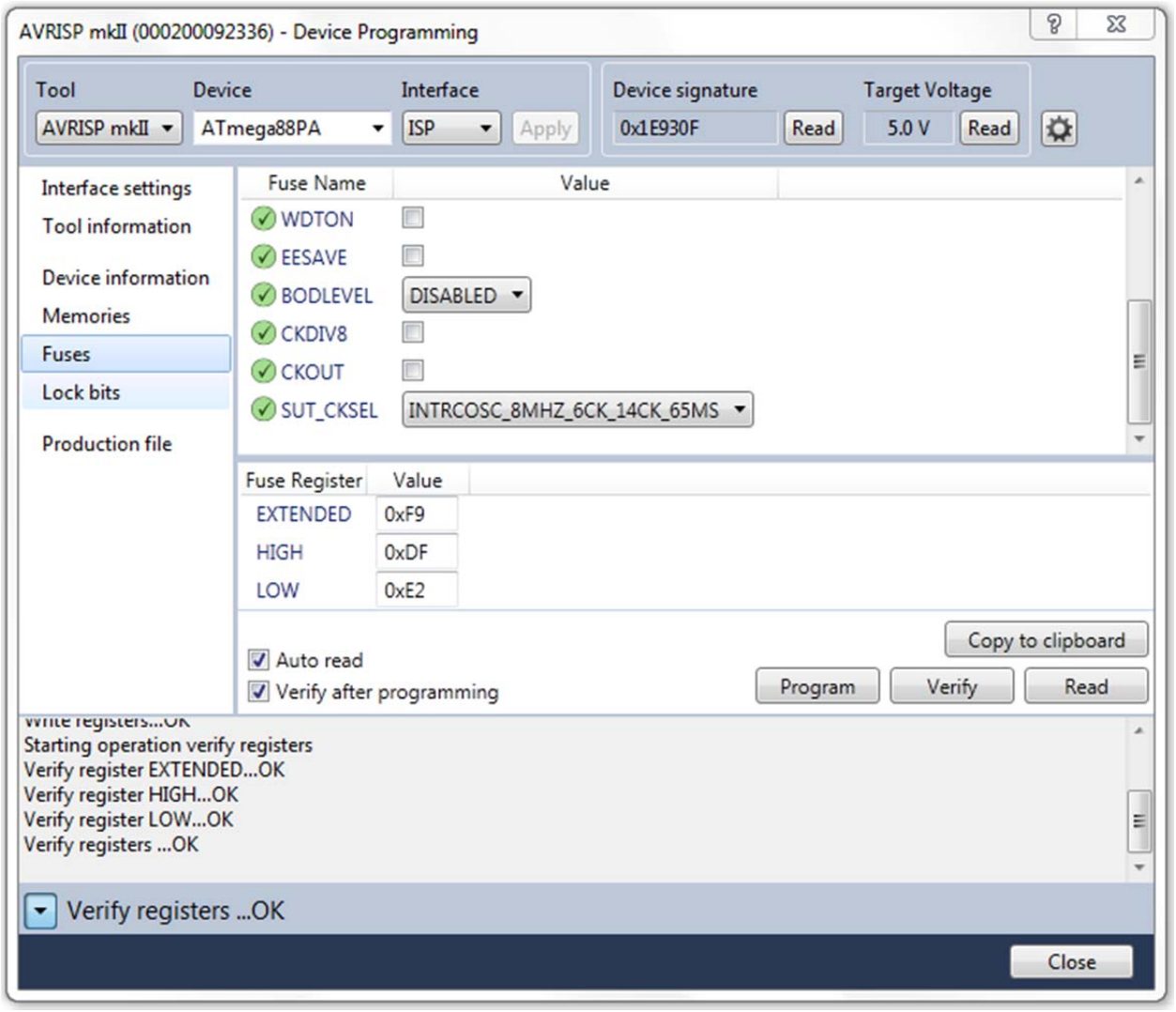
Note that by default the clock selected (SUT_CKSEL) is :

INTRCOSC_8MHZ_6CK_14CK_65MS

This is an internal RC oscillator 8 MHz clock. The rest of the specification is the necessary delays when the microcontroller is powered on or reset (6 clock cycles delay after startup and 14 clock cycles plus 65 millisecond delay after reset)

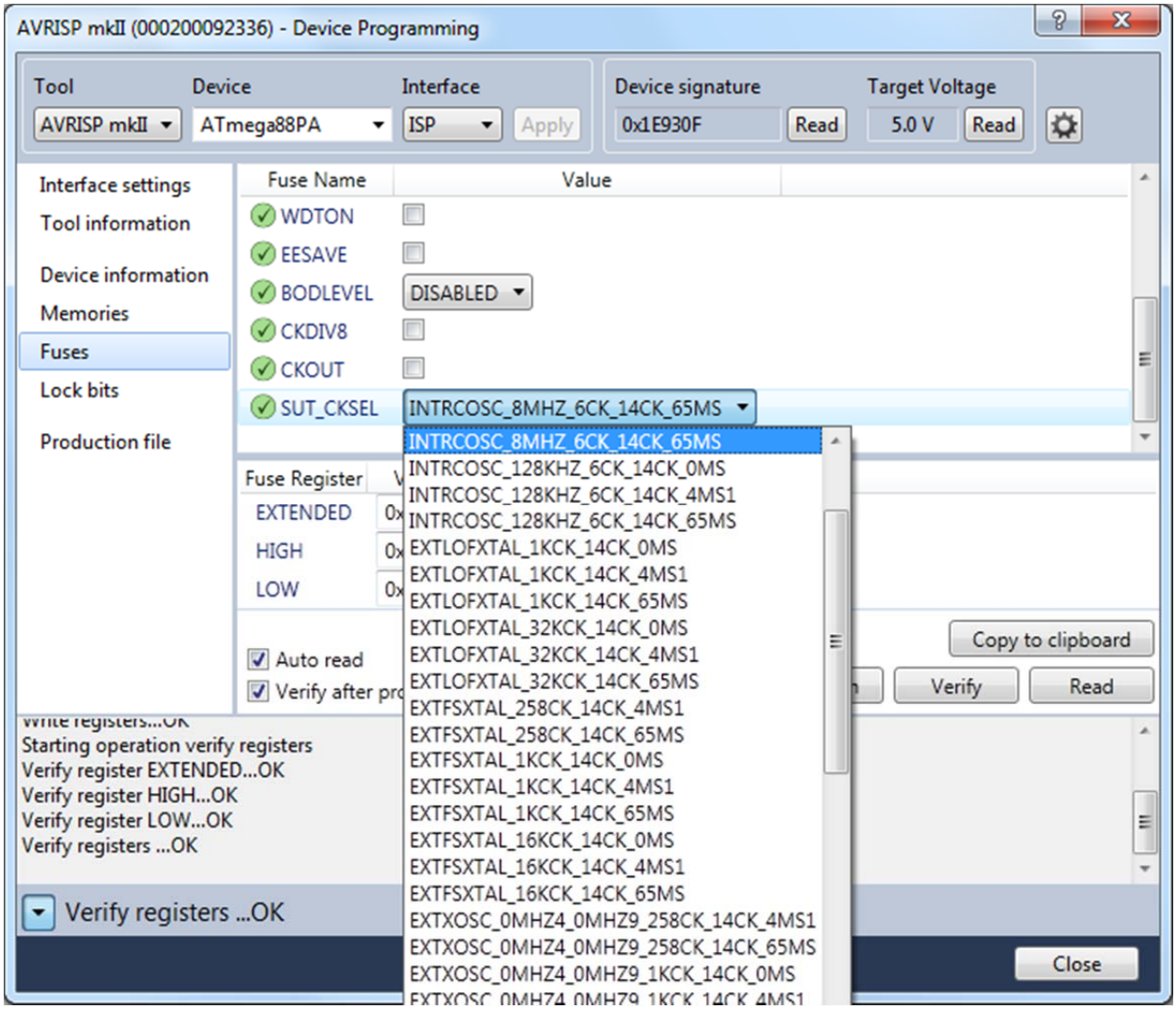
Note also that the CKDIV8 box is checked. So the actual default clock speed is 8 MHz/8 = 1 MHz.

So the first thing we can do to speed things up is to uncheck the CKDIV8 box so the clock speed is 8 MHz. Uncheck the box and select the **Program** button at the bottom of the window. You can then select the **Verify** button to verify the changes. Your light should now blink 8 times faster.



After you have added the external clock to your microcontroller circuit you can speed things up even further by selecting and external clock setting. Note make sure the external clock is implemented and working before proceeding.

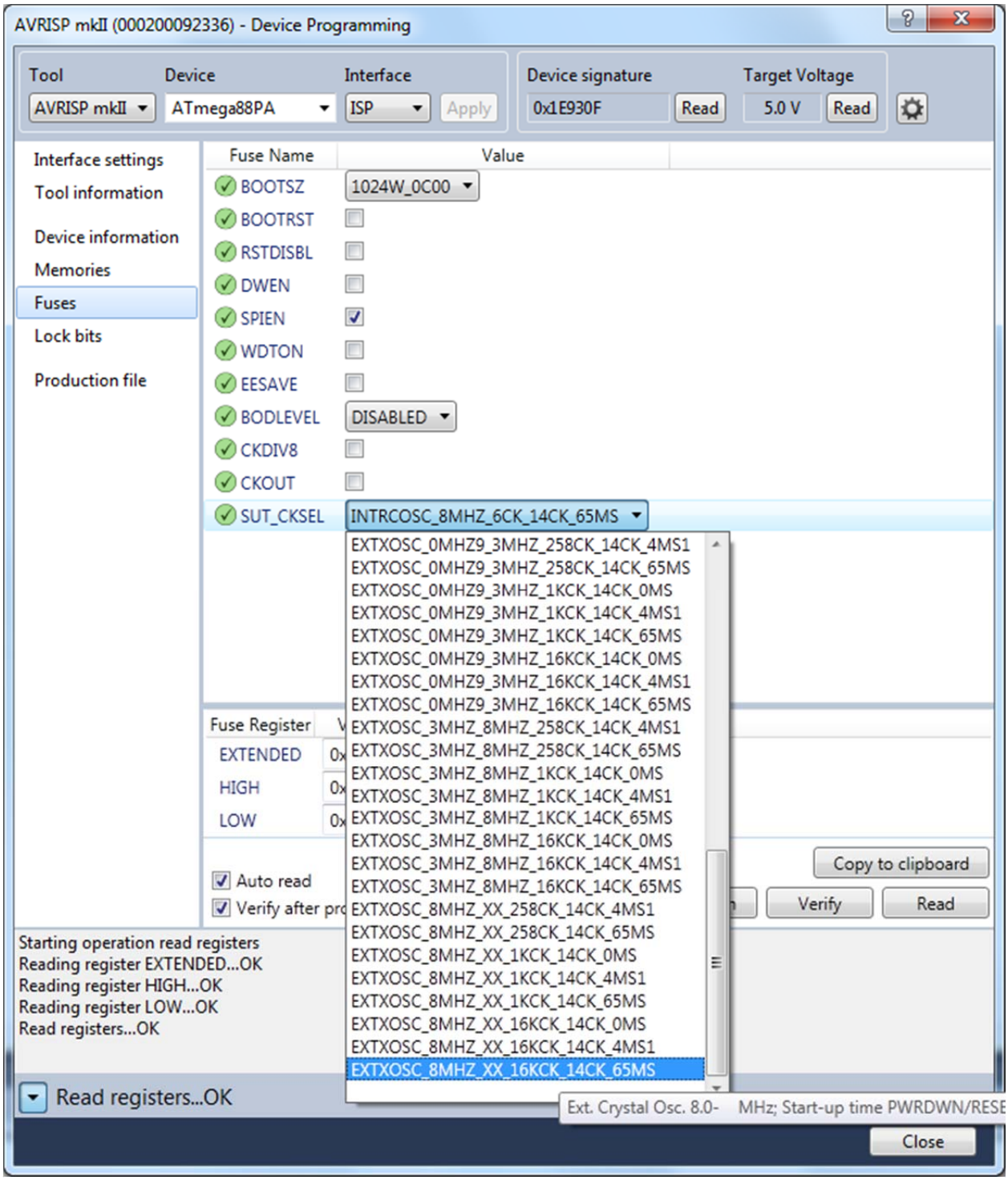
Select the drop down menu for the SUT_CKSEL selection:



The window above shows the default clock setting.

The drop down menu shows the various selections for the clock source (internal RC Oscillator, external RC Oscillator or external Crystal Oscillator), and the clock speeds. The drop down menu also allows selection of the startup time or delay to allow the clock to reach a reliable state before the microcontroller starts.

The ATmega8 can run at a speed up to 20MHz by using an external crystal oscillator. The external crystal oscillator selections are at the bottom of the drop down menu (shown below).



The settings we want are at the bottom the drop down menu. Choose the last selection from the drop down menu:

EXTXOSC_8MHZ_XX_16KCK_14CK_65MS

This specifies an external oscillator of 8 MHZ or faster, 16k clock cycles delay after startup and 14 clock cycles plus 65 millisecond delay after reset. Note the external oscillator needs much more delay at startup than the internal oscillator.

Now select the **Program** button at the bottom of the window. You can then select the **Verify** button to verify the changes. Your light should now blink 16 times faster.

Be careful with these settings. What can happen is that the fuse bit can be set to a clock that is inconsistent with the physical clock and then the fuse setting cannot be changed because the chip cannot be reprogrammed because of the inconsistent clock setting.

Appendix A: Basic Microcontroller Schematic with External Clock and Serial Port Connection