* **Detailed explanation**:

All changes related to the new instruction are tagged with comment: *// ADDIUPC* in the soft-core. We must perform the following actions:

* Inhibit “*Reserved Instruction Exception*”:

Change:

*assign maj\_ri\_e = … (mpc\_ir\_e[31:28] == 4'b011\_0) ||*

For:

*assign maj\_ri\_e = ...*

*((mpc\_ir\_e[31:28] == 4'b011\_0) && (mpc\_ir\_e[27:26] != 2'b00)) || // ADDIUPC*

* Change signals:
  + - * ***alu\_sel\_e***: This signal is registered to the next stage through the Main Pipeline Registers. Then, at m14k\_edp, when it is 1, it selects the ALU for output at the M-Stage.

Set this signal to 1 when an addiupc is found:

*((mpc\_ir\_e[31:26] == 6'o30)) || // ADDIUPC*

* + - * ***maj\_vd\_e***: This signal controls the RF write strobe at A/W-Stage. Set to 1 when addiupc found:

*((mpc\_ir\_e[31:26] == 6'o30)) || // ADDIUPC*

* New signal:
  + - * ***addiupc\_instr***: Set to 1 when addiupc found:

*assign addiupc\_instr = (mpc\_ir\_e[31:26] == 6'o30);*

* Change signal ***dest\_e***based on the new signal: We must select Rs as Destination Register:

*assign dest\_e [5:0] = addiupc\_instr ? { 1'b0, mpc\_ir\_e[25:21] } : ((special\_e | spec2\_e | mpc\_cnvt\_e | rwpgpr\_e | dest\_cnvt\_dsp\_e | lx\_e) ? { rwpgpr\_e & ~rdpgpr\_e, pdest\_e } : ((lnk31\_e) ? 6'h1f : { 1'b0, src\_b\_e[4:0] })); // ADDIUPC*

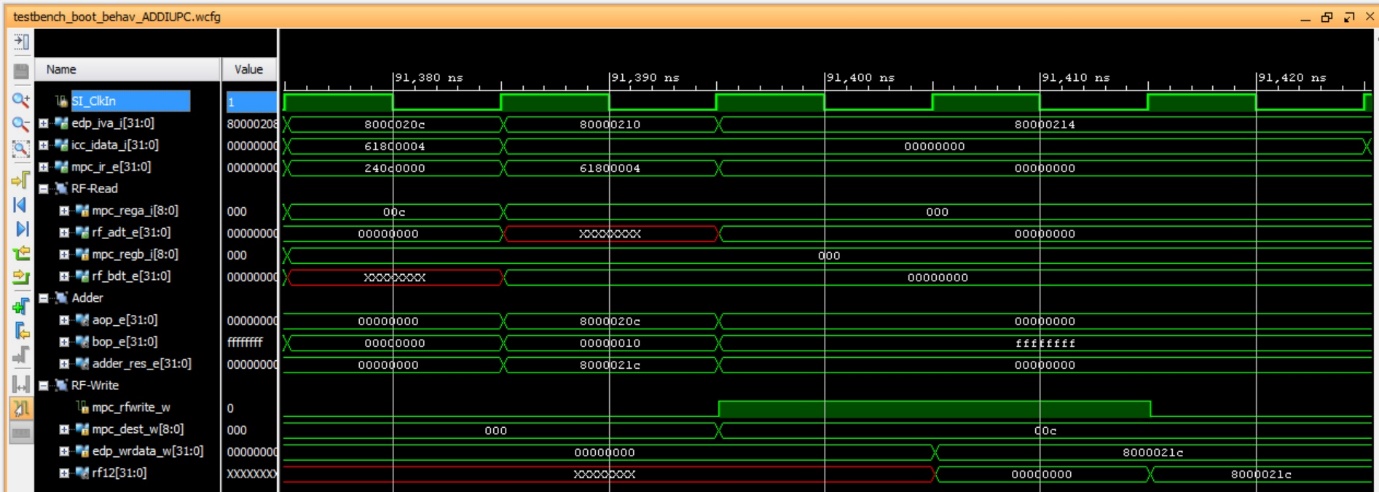
* Incorporate new functionality:
  + - * We must insert the new operands as an input to the “*m14k\_edp\_add\_simple*” adder. ***aop\_e*** and ***bop\_e*** are the inputs to the adder:
        1. ***aop\_e***: Incorporate the PC as an input. The PC is already available at E-Stage in signal ***iva\_e***.

*assign* ***aop\_e*** *[31:0] = addiupc\_instr ? iva\_e : (icc\_pcrel\_e ? (iva\_e & ~{30'b0, {2{icc\_pcrel\_e}}}) : edp\_abus\_e); // ADDIUPC*

* + - * 1. ***bop\_e***: Incorporate the SignExt(Imm<<2) as an input.

*assign* ***bop\_e*** *[31:0] = addiupc\_instr ? { {11{mpc\_ir\_e[18]}}, mpc\_ir\_e[18:0], 2'b0} : {32{mpc\_subtract\_e}} ^ bbus\_imm\_e; // ADDIUPC*

* **EXAMPLE - SIMULATION**:

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Observe that in the 5th cycle rf12($t4)=0x800002ac.

* **EXAMPLE – EXECUTION ON THE BOARD**:

When the program is downloaded on the board, you should see on the 7-seg displays:

* 7-seg displays=$t4, which in our example is 0x8000021c

Then, when you debug the program following the steps stated in the document, you should observe the following:

