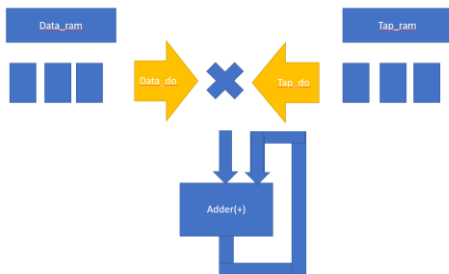


Block diagram:

-control path



-data path



Operator:

一開始，testbench 用 axilite write 寫 tap data 進來 fir，然後我用了一些 register 把 addr 跟 data 都接起來後，寫進 tap bram，之後 tap bram 被 testbench 用 axilite read 把剛剛寫進來的資料都讀回去，做完以上動作後，testbench 用 axilite 寫 ap\_start 為 1，然後我跟 testbench 之間透過 axistream 的方式開始寫值進 data bram，然後我每寫一個值進來，就會用十個 cycle 做 fir 的計算，計算方式如上圖 data path 的 block diagram，每次同時從 data bram 跟 tap bram 各讀一筆資料做法計算後累加，十個 cycle 算完後資料就會用 axistream 的方法丟回 testbench，接著再吃下一個 data 進 bram，再做十個 cycle 的運算。值得注意的是，我每次寫 data 進 bram 的位置都會比前一次加一，然後依次往回數十個數字就是這次 data bram 依次拿來做計算的值。

Resource usage:

Tcl Console		Messages	Log	Reports	Design Runs	Timing	Debug												
🔍		⌵	⌶	⏪	⏩	⏴	⏵	+	%	? _ □									
Name	Constraints	Status	WNS	TNS	WHS	THS	TPWS	Total Power	Failed Routes	LUT	FF	BRAM	URAM	DSP	Start	Elapsed	Run Strategy		
✓ synth_1	constrs_1	synth_design Complete!								230	162	0.0	0	3	10/19/2023 00:01:56	00:01:56	Vivado Synthesis Defaults (Vivado Synth)		
▶ impl_1	constrs_1	Not started															Vivado Implementation Defaults (Vivado Impl)		

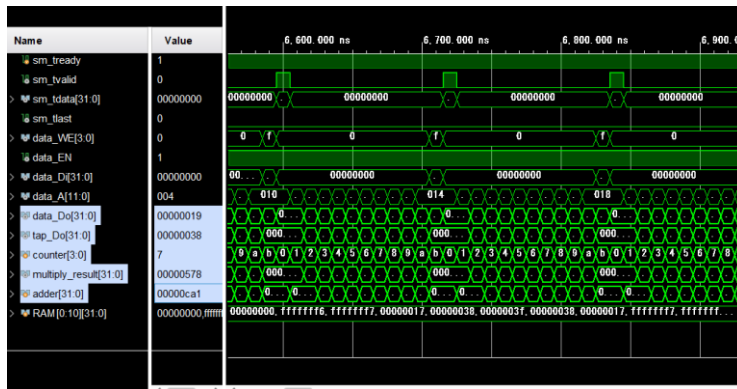
Timing report:

Setup	Hold	Pulse Width
Worst Negative Slack (WNS): 6.051 ns	Worst Hold Slack (WHS): 0.070 ns	Worst Pulse Width Slack (WPPS): 4.500 ns
Total Negative Slack (TNS): 0.000 ns	Total Hold Slack (THS): 0.000 ns	Total Pulse Width Negative Slack (TPWS): 0.000 ns
Number of Failing Endpoints: 0	Number of Failing Endpoints: 0	Number of Failing Endpoints: 0
Total Number of Endpoints: 275	Total Number of Endpoints: 275	Total Number of Endpoints: 163

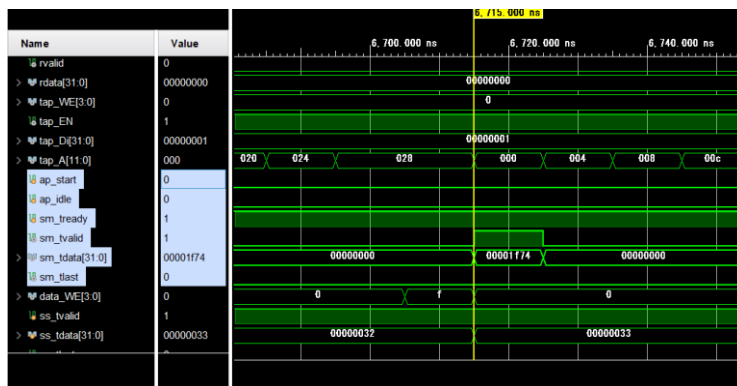
Name	Value	0.000 ns	20.000 ns	40.000 ns	60.000 ns	80.000 ns	100.000 ns	120.000 ns	
axiss_clk	1	[Timing diagram showing a constant high signal for axiss_clk]							
axiss_rst_n	1	[Timing diagram showing a constant high signal for axiss_rst_n]							
awready	1	[Timing diagram showing a constant high signal for awready]							
wready	1	[Timing diagram showing a constant high signal for wready]							
awvalid	0	[Timing diagram showing a constant low signal for awvalid]							
awaddr[11:0]	000	[Timing diagram showing a constant value of 000 for awaddr[11:0]]							
wvalid	0	[Timing diagram showing a constant low signal for wvalid]							
wdata[31:0]	000000001	[Timing diagram showing a constant value of 000000001 for wdata[31:0]]							
tap_WE[3:0]	1	[Timing diagram showing a constant value of 1 for tap_WE[3:0]]							
tap_EN	0	[Timing diagram showing a constant low signal for tap_EN]							
tap_D[31:0]	000000001	[Timing diagram showing a constant value of 000000001 for tap_D[31:0]]							
tap_A[11:0]	028	[Timing diagram showing a constant value of 028 for tap_A[11:0]]							
tap_De[31:0]	ffffff0	[Timing diagram showing a constant value of fffffff0 for tap_De[31:0]]							
awready	0	[Timing diagram showing a constant low signal for awready]							
wready	0	[Timing diagram showing a constant low signal for wready]							

Name	Value	720 000 ns	740 000 ns	760 000 ns	780 000 ns	300 000 ns	320 000 ns	340 000 ns
❏ wvalid	0							
> ❏ wdata[31:0]	00000000					00000000		
❏ wready	1							
❏ ready	1							
❏ arvalid	1							
> ❏ araddr[11:0]	020	xxx		020		024		028
❏ arvalid	0							
> ❏ ardata[31:0]	XXXXXXXXXX	xxx xxxxx				00000000		fffffffg
❏ tap_WE[3:0]	f	g f 0 f				g		
❏ tap_EN	1							
❏ tap_D[31:0]	00000000	fffffffg				00000000		
❏ tap_A[11:0]	028	xxx 024 xxx 028 xxx				900		084
❏ tap_Dc[31:0]	XXXXXXXXXX	xx ff xx 00 xx				00000000		fffffffg
❏ ss_valid	1							
> ❏ ss_data[31:0]	00000001					00000001		

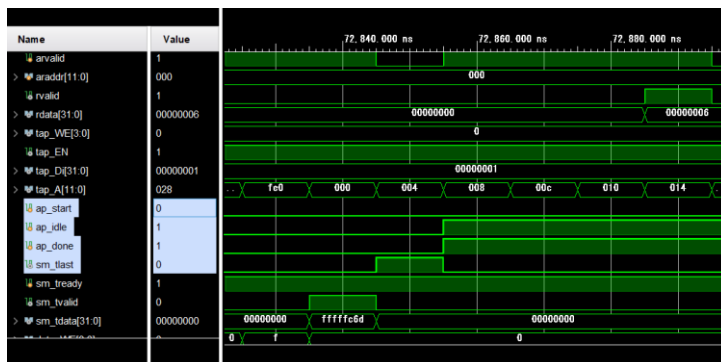
Name	Value	780 000 ns	800 000 ns	820 000 ns	840 000 ns	860 000 ns	880 000 ns	900 000 ns
↳ tap_EN	1							
↳ tap_D[31:0]	00000000	00000000				00000001		
↳ tap_A[11:0]	028	028			000 004 008 00c 010 014 018 01c			
↳ tap_Do[31:0]	XXXXXXXX	00000000			ff... ff... 00... 00... 0...			
↳ ap_start	0							
↳ ap_idle	1							
↳ ss_tvalid	1							
↳ ss_tdata[31:0]	00000001	00000001				00000002		
↳ ss_tlast	0							
↳ ss_tready	0							
↳ sm_tready	1							
↳ sm_tvalid	0							
↳ sm_tdata[31:0]	00000000				00000000			
↳ sm_tlast	1							
↳ data_WE[3:0]	1						0	



Stream read:



做完後 ap\_idle 跟 ap\_done 拉起來



```
[PASS] [Pattern 591] Golden answer: -2379, Your answer: -2379
[PASS] [Pattern 592] Golden answer: -2196, Your answer: -2196
[PASS] [Pattern 593] Golden answer: -2013, Your answer: -2013
[PASS] [Pattern 594] Golden answer: -1830, Your answer: -1830
[PASS] [Pattern 595] Golden answer: -1647, Your answer: -1647
[PASS] [Pattern 596] Golden answer: -1464, Your answer: -1464
OK: exp = 0, rdata = 0
-----End the data input (AXI-Stream)-----
[PASS] [Pattern 597] Golden answer: -1281, Your answer: -1281
[PASS] [Pattern 598] Golden answer: -1098, Your answer: -1098
[PASS] [Pattern 599] Golden answer: -915, Your answer: -915
OK: exp = 2, rdata = 6
OK: exp = 4, rdata = 6
-----
-----Congratulations! Pass-----
```

\$finish called at time : 72945 ns : File "D:/ibex/lab3/fir\_tb.v" Line 391