

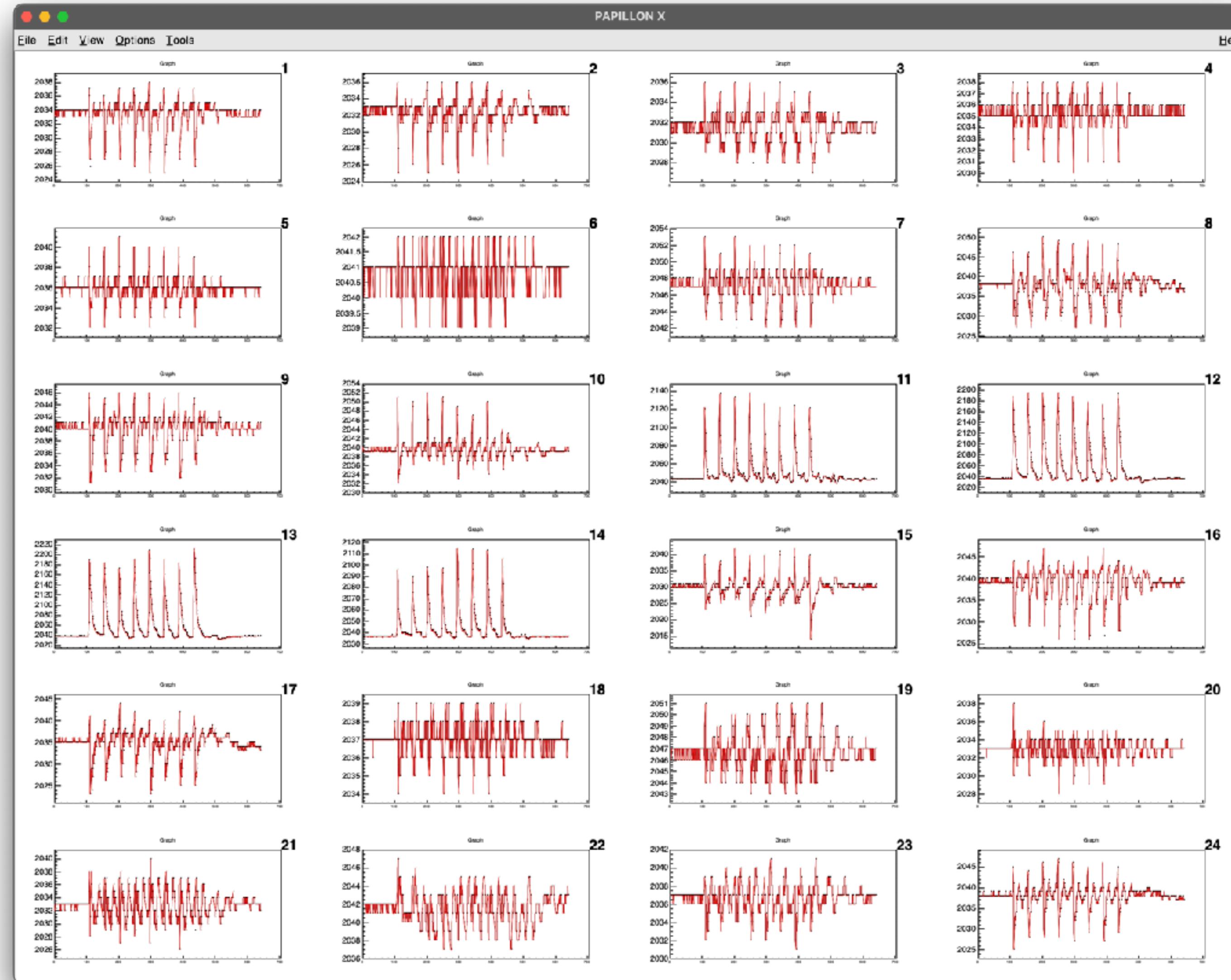


Debug of PAPILLON Firmware

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Input Waveform for Test Bench

PAPILLON run 92 event#: 3



No pedestal subtraction

— adclogX.evt3.txt
(Software analysis用)

— run910247.papillonX.
evt3.chXX.txt
(TB用)

Software analysisで用いている
波形と同じことを確認

Bug was Found!!!



3

Ch.10のpedestal-subtracted waveformが
ch.0のペデスタルを引いていた 😱

```
WD00[12:0] <= RawWD00[12:0] - pedestal00[12:0];
WD01[12:0] <= RawWD01[12:0] - pedestal01[12:0];
WD02[12:0] <= RawWD02[12:0] - pedestal02[12:0];
WD03[12:0] <= RawWD03[12:0] - pedestal03[12:0];
WD04[12:0] <= RawWD04[12:0] - pedestal04[12:0];
WD05[12:0] <= RawWD05[12:0] - pedestal05[12:0];
WD06[12:0] <= RawWD06[12:0] - pedestal06[12:0];
WD07[12:0] <= RawWD07[12:0] - pedestal07[12:0];
WD08[12:0] <= RawWD08[12:0] - pedestal08[12:0];
WD09[12:0] <= RawWD09[12:0] - pedestal09[12:0];
WD10[12:0] <= RawWD10[12:0] - pedestal00[12:0];
WD11[12:0] <= RawWD11[12:0] - pedestal11[12:0];
WD12[12:0] <= RawWD12[12:0] - pedestal12[12:0];
WD13[12:0] <= RawWD13[12:0] - pedestal13[12:0];
WD14[12:0] <= RawWD14[12:0] - pedestal14[12:0];
WD15[12:0] <= RawWD15[12:0] - pedestal15[12:0];
WD16[12:0] <= RawWD16[12:0] - pedestal16[12:0];
WD17[12:0] <= RawWD17[12:0] - pedestal17[12:0];
WD18[12:0] <= RawWD18[12:0] - pedestal18[12:0];
WD19[12:0] <= RawWD19[12:0] - pedestal19[12:0];
WD20[12:0] <= RawWD20[12:0] - pedestal20[12:0];
WD21[12:0] <= RawWD21[12:0] - pedestal21[12:0];
WD22[12:0] <= RawWD22[12:0] - pedestal22[12:0];
WD23[12:0] <= RawWD23[12:0] - pedestal23[12:0];
```

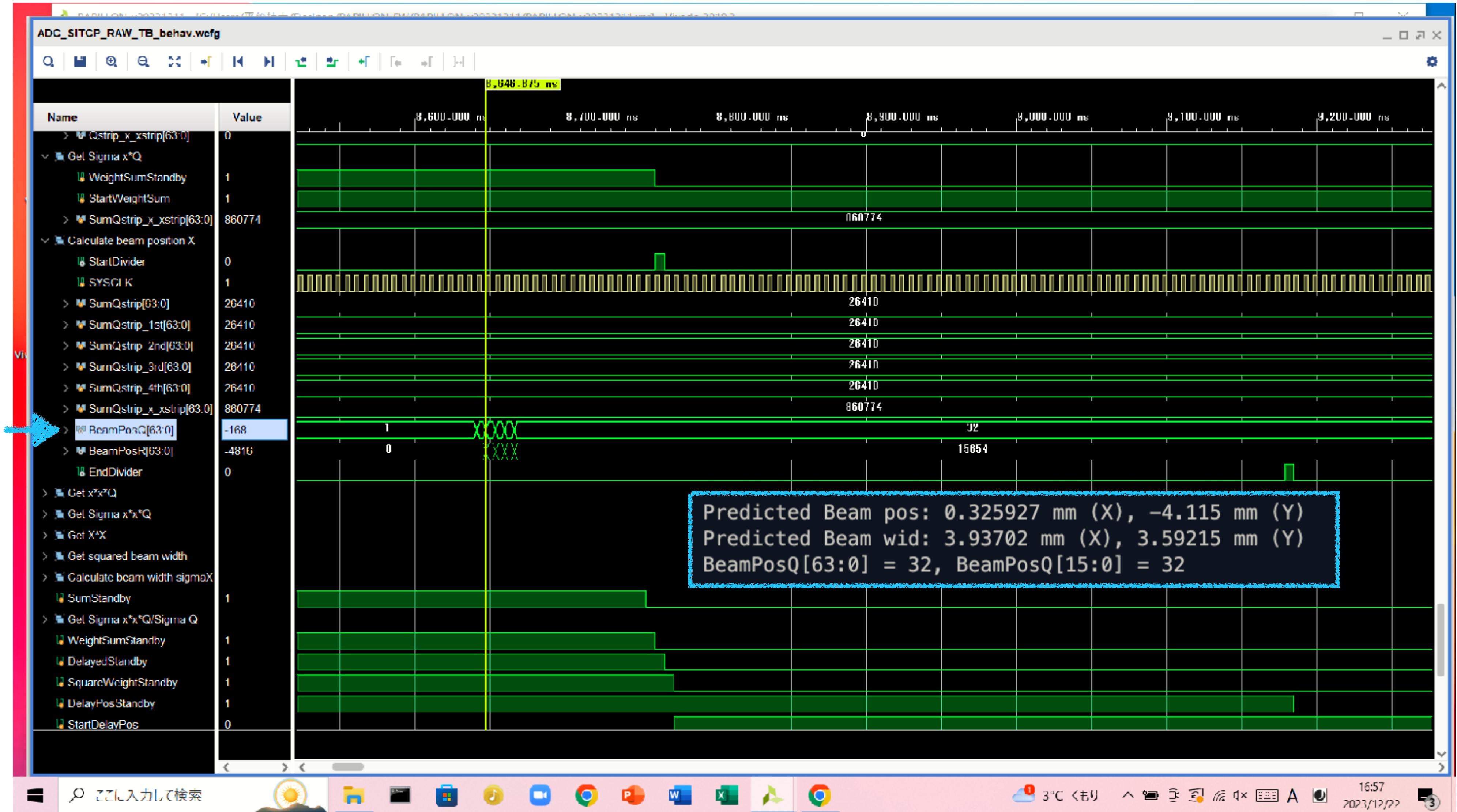
Bug was Defeated!!!



4

ビーム位置計算の確認：

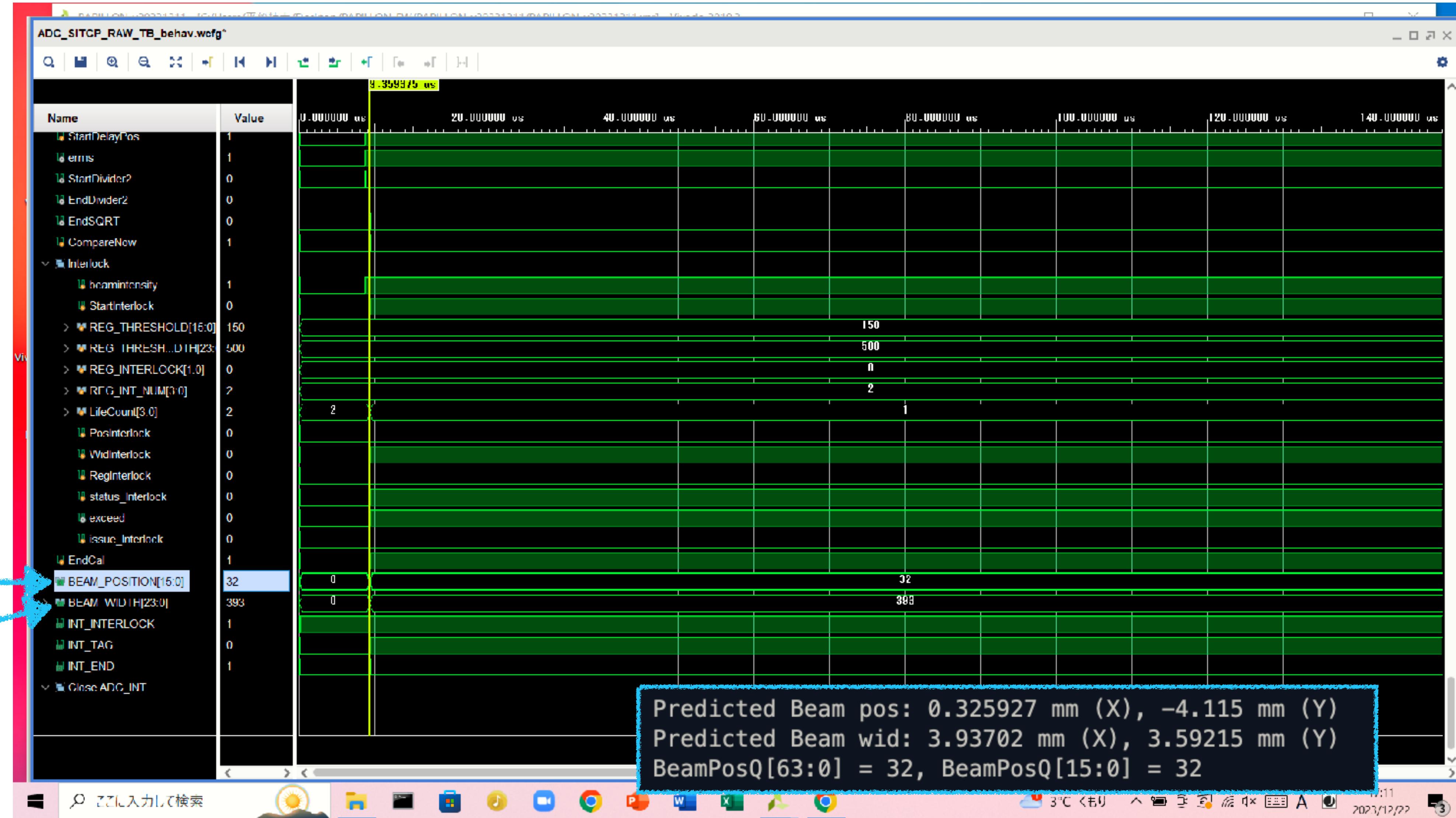
Ch.10のpedestal-subtracted waveformを修正したことと予測と一致したことを確認



Beam Width Calculation

ビーム幅計算の確認：

Ch.10の修正により同様にビーム幅の結果も予測と一致した

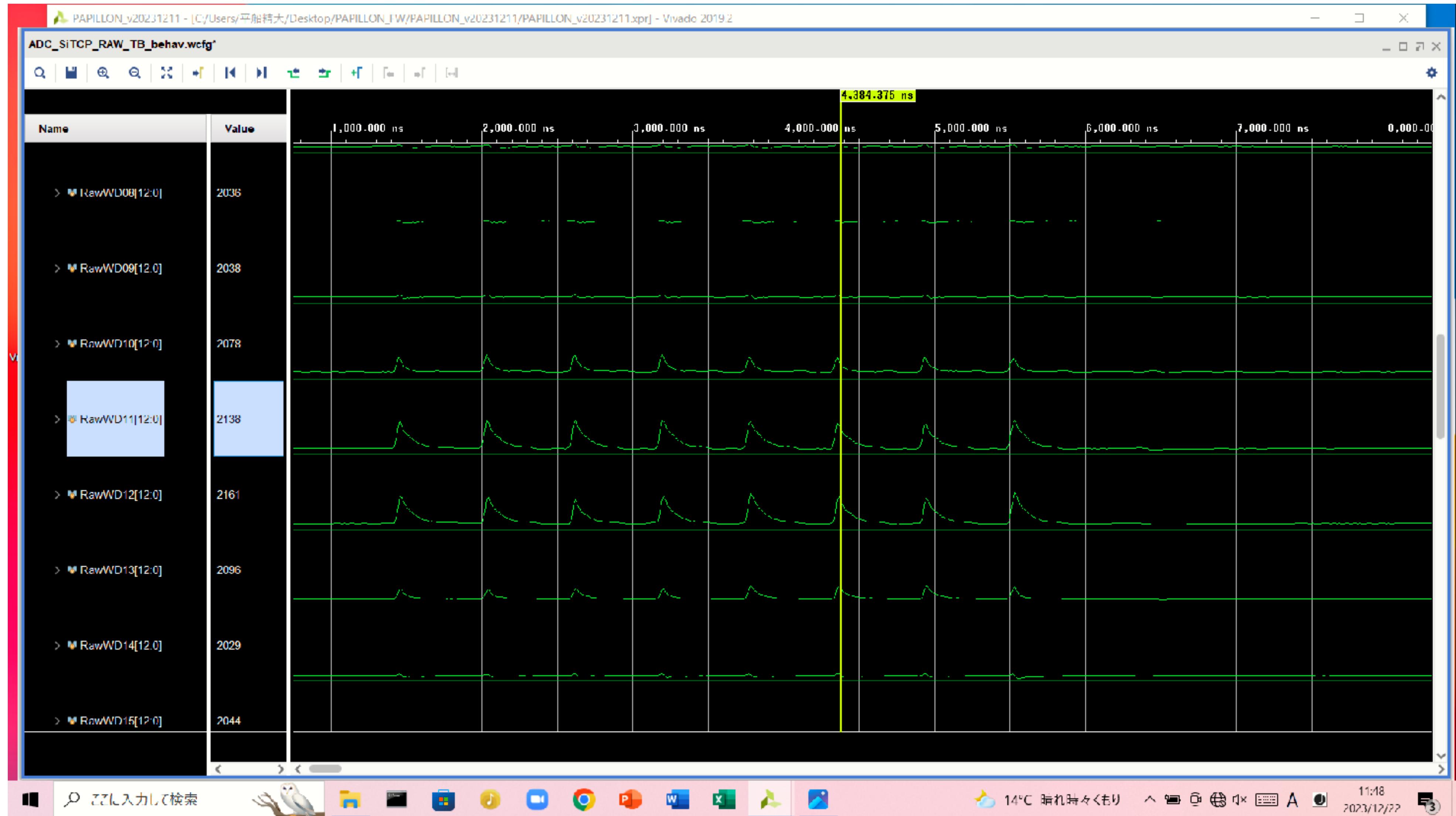




Backup

Read of Waveform

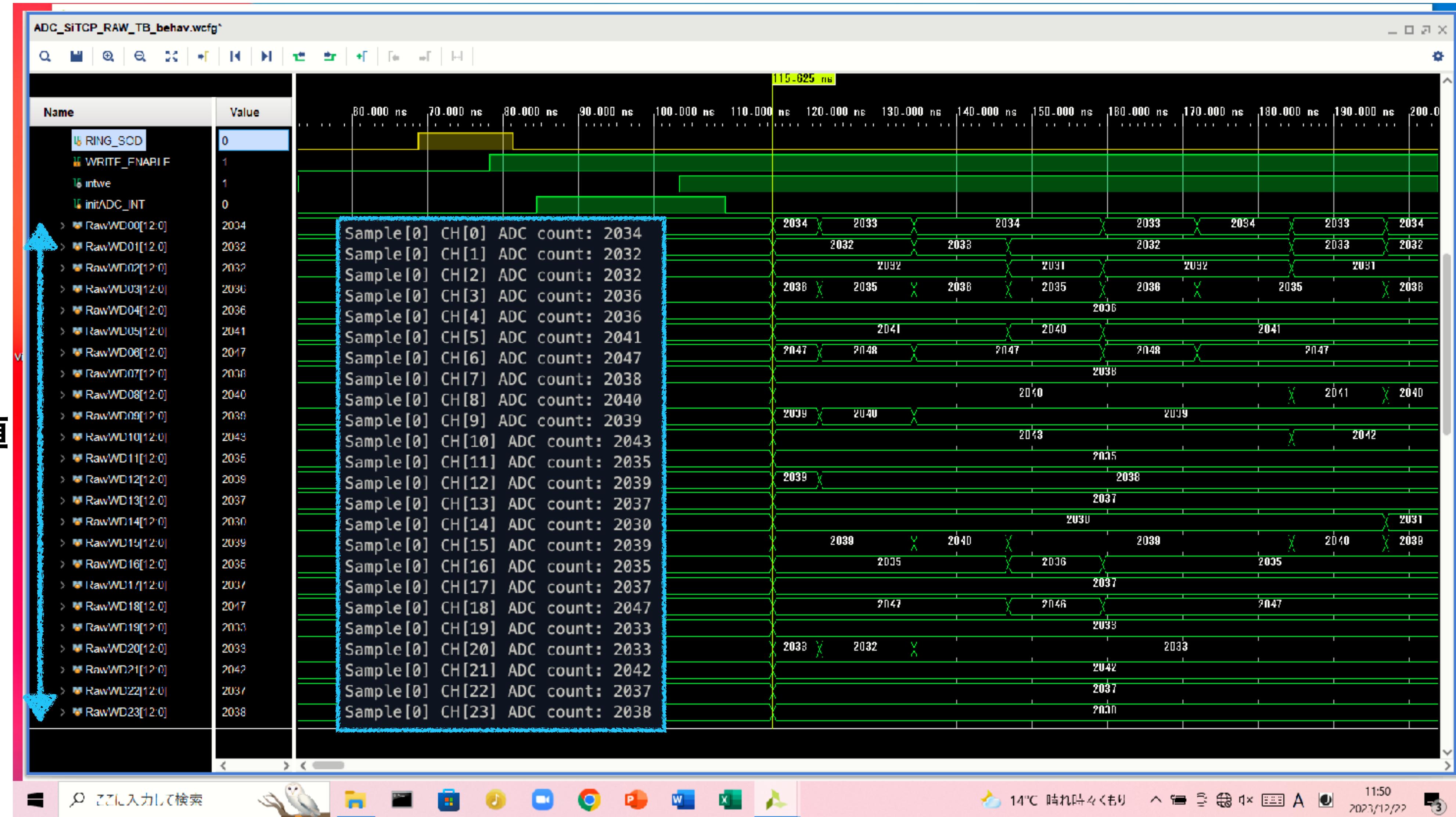
波形読み込みの確認：
中央のchannelで8つのピークが見えている



Read of Waveform

波形読み込みの確認：

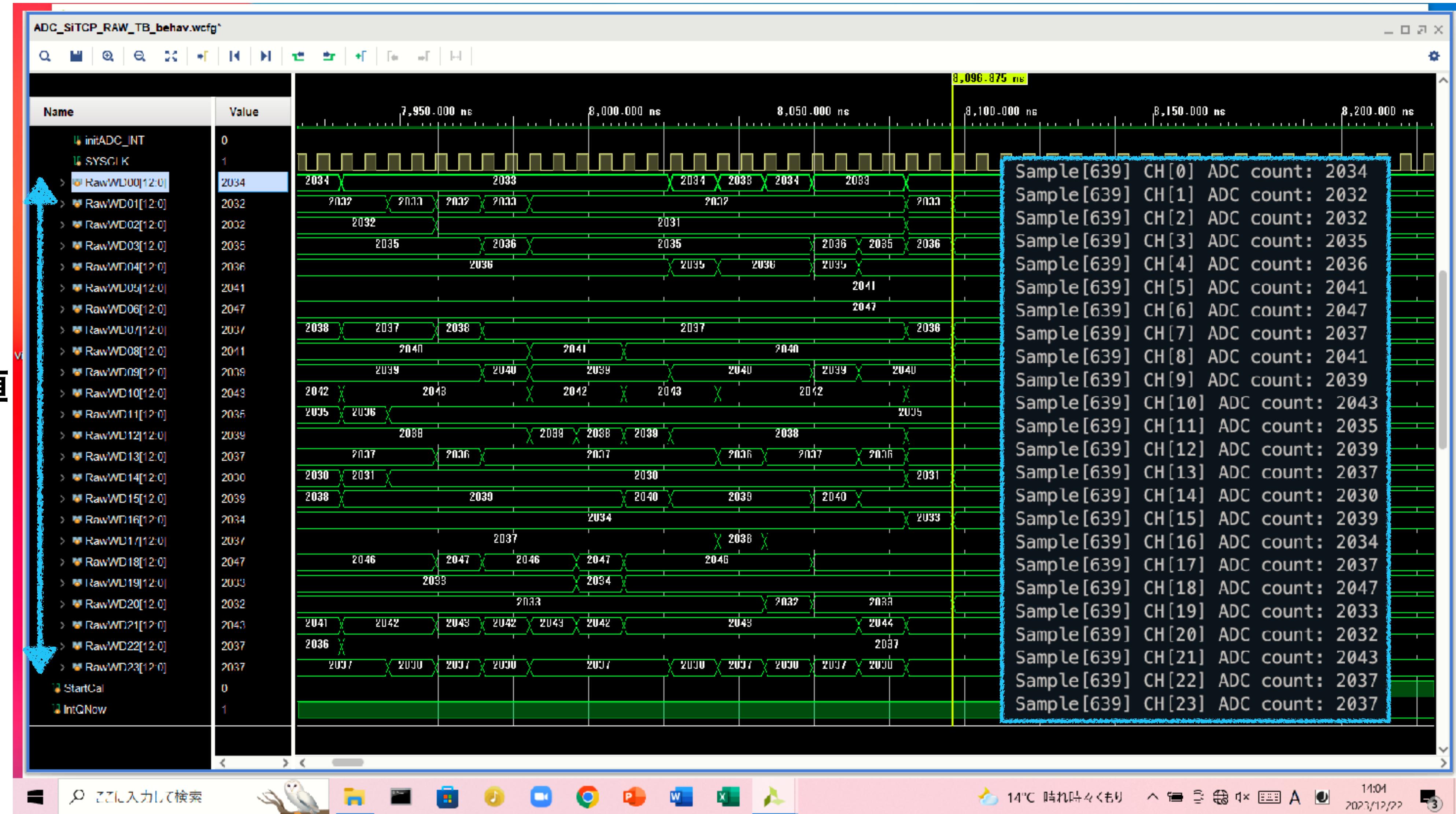
1サンプル目のADC値が24ch全てで正しいことを確認



Read of Waveform

波形読み込みの確認：

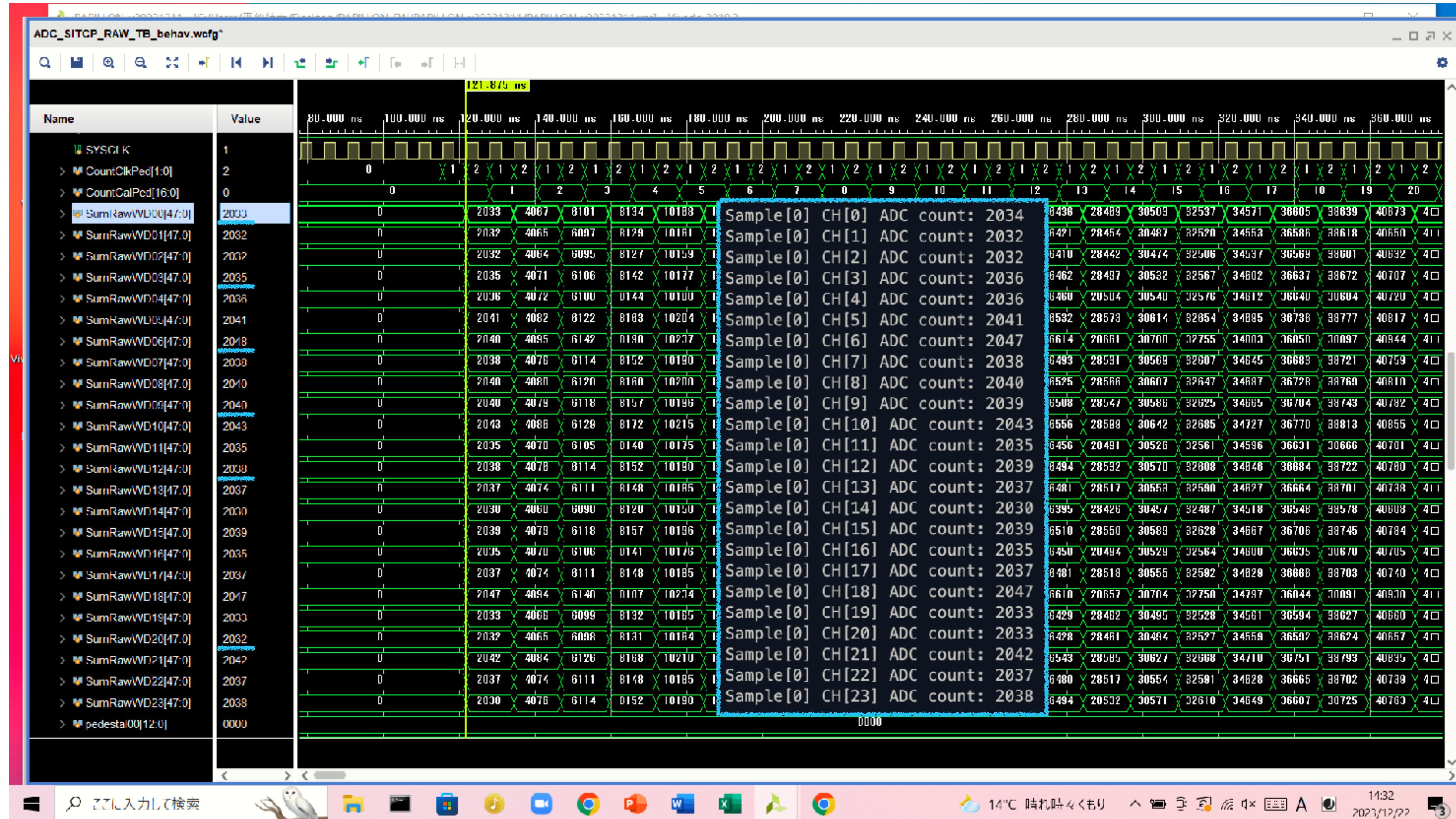
640サンプル目のADC値が24ch全てで正しいことを確認



Pedestal Calculation

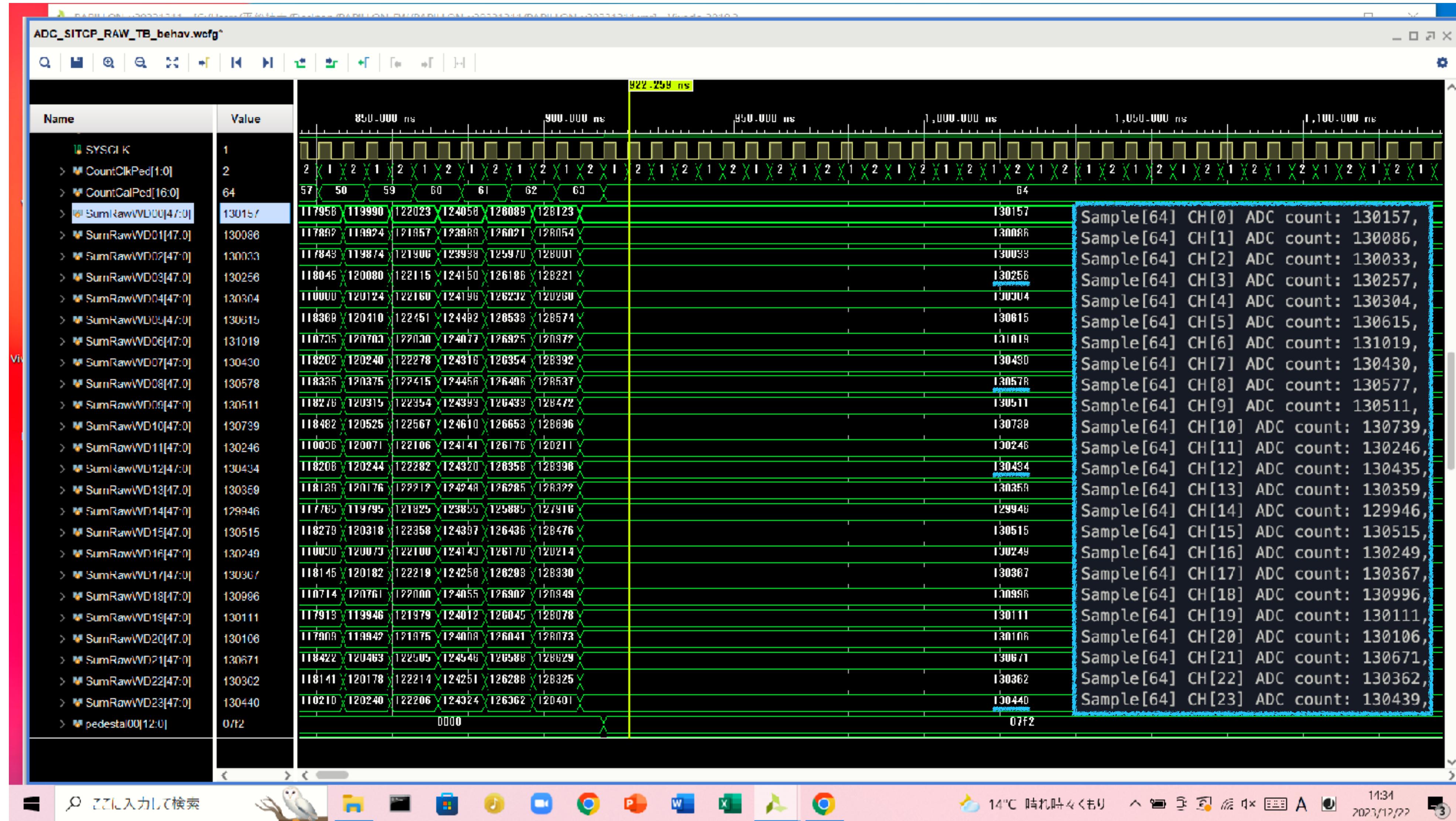
波高足し合わせの確認：

数chでADC値がわずかにずれている (bit幅拡張に問題？)



Pedestal Calculation

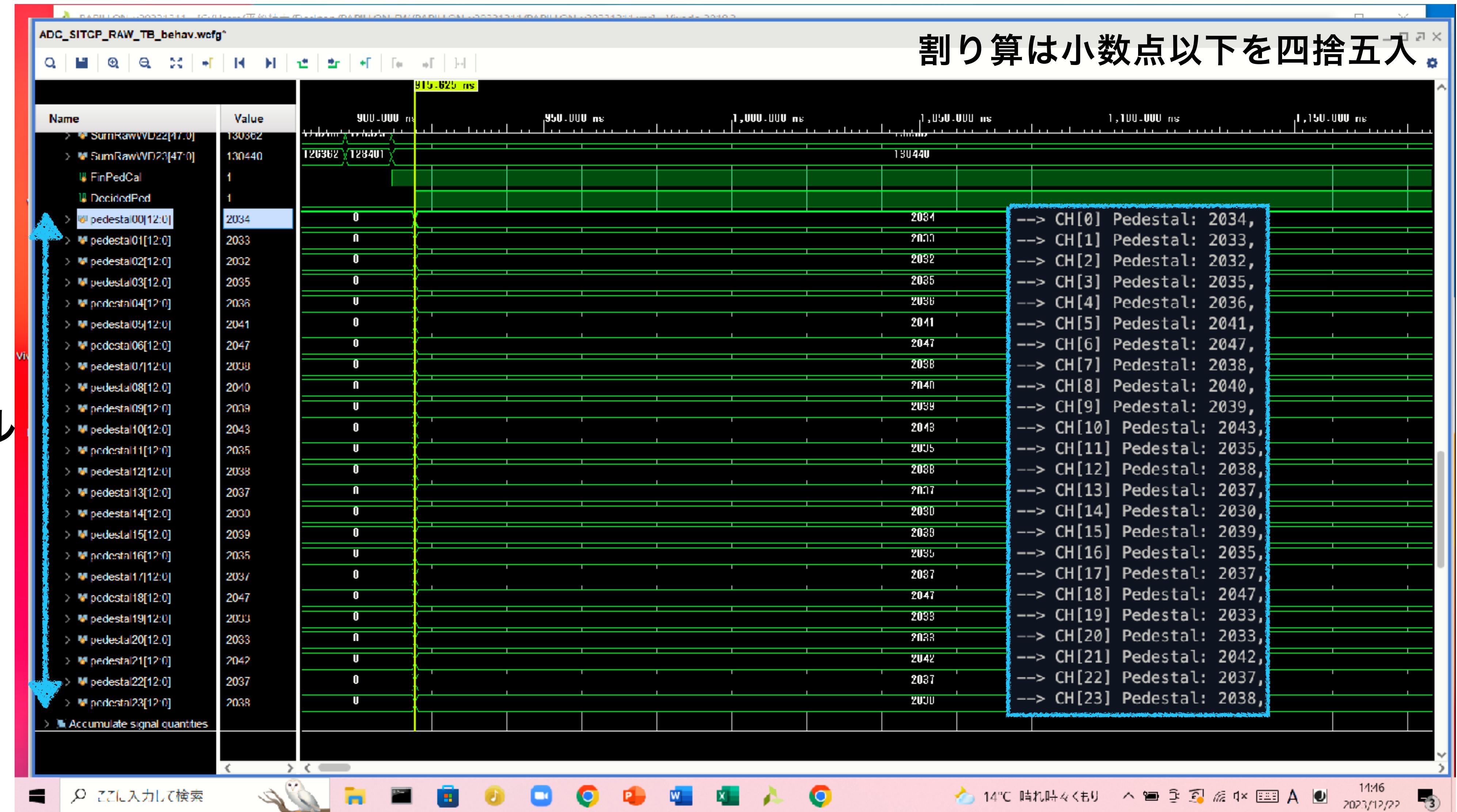
波高足し合わせの確認：
64サンプルの合計値も数chでわずかにずれている



Pedestal Calculation

信号量の割り算の確認：

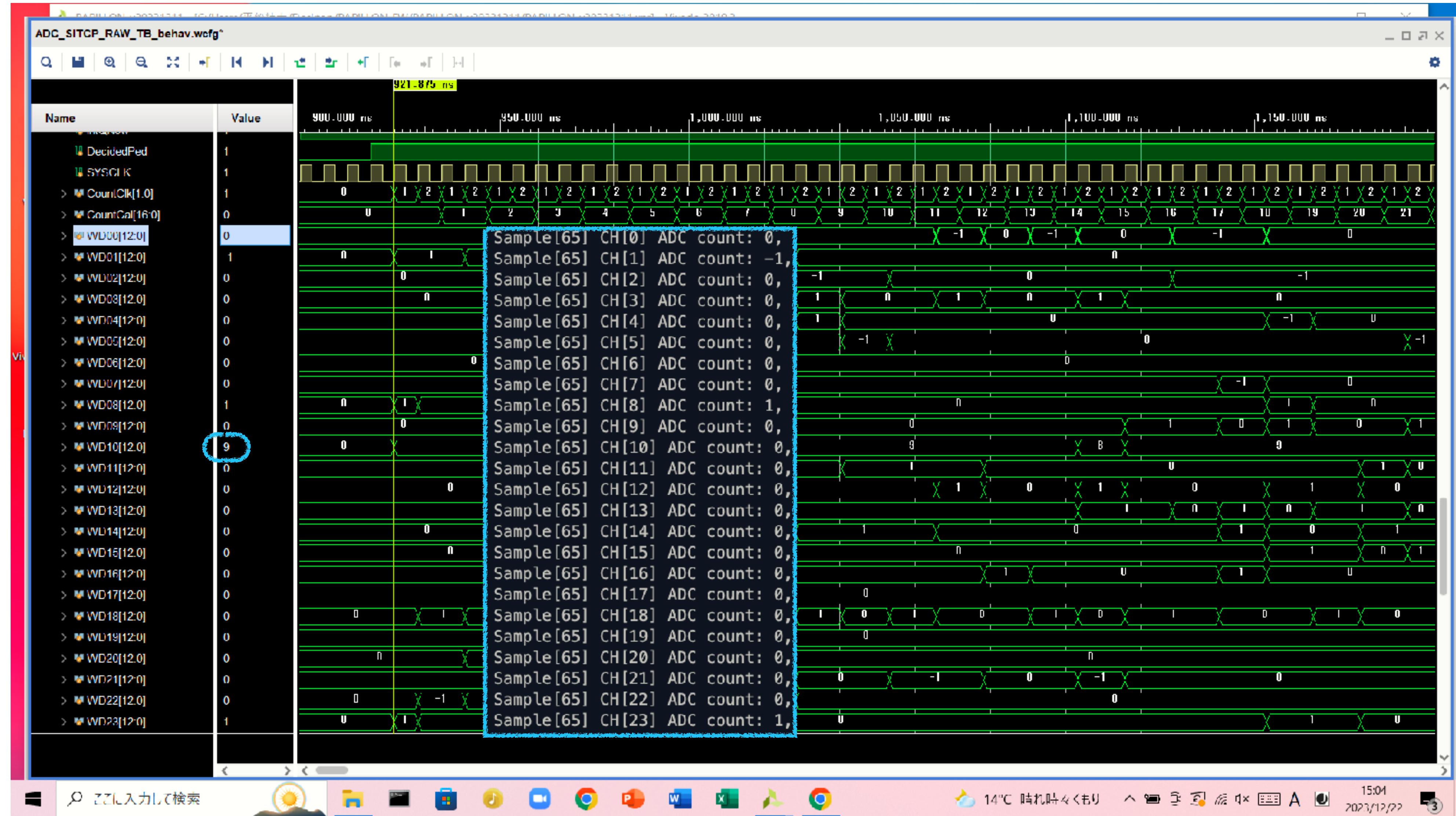
24ch全てで割り算の結果が予測と一致することを確認



Pedestal-subtracted Waveform

波高の確認：

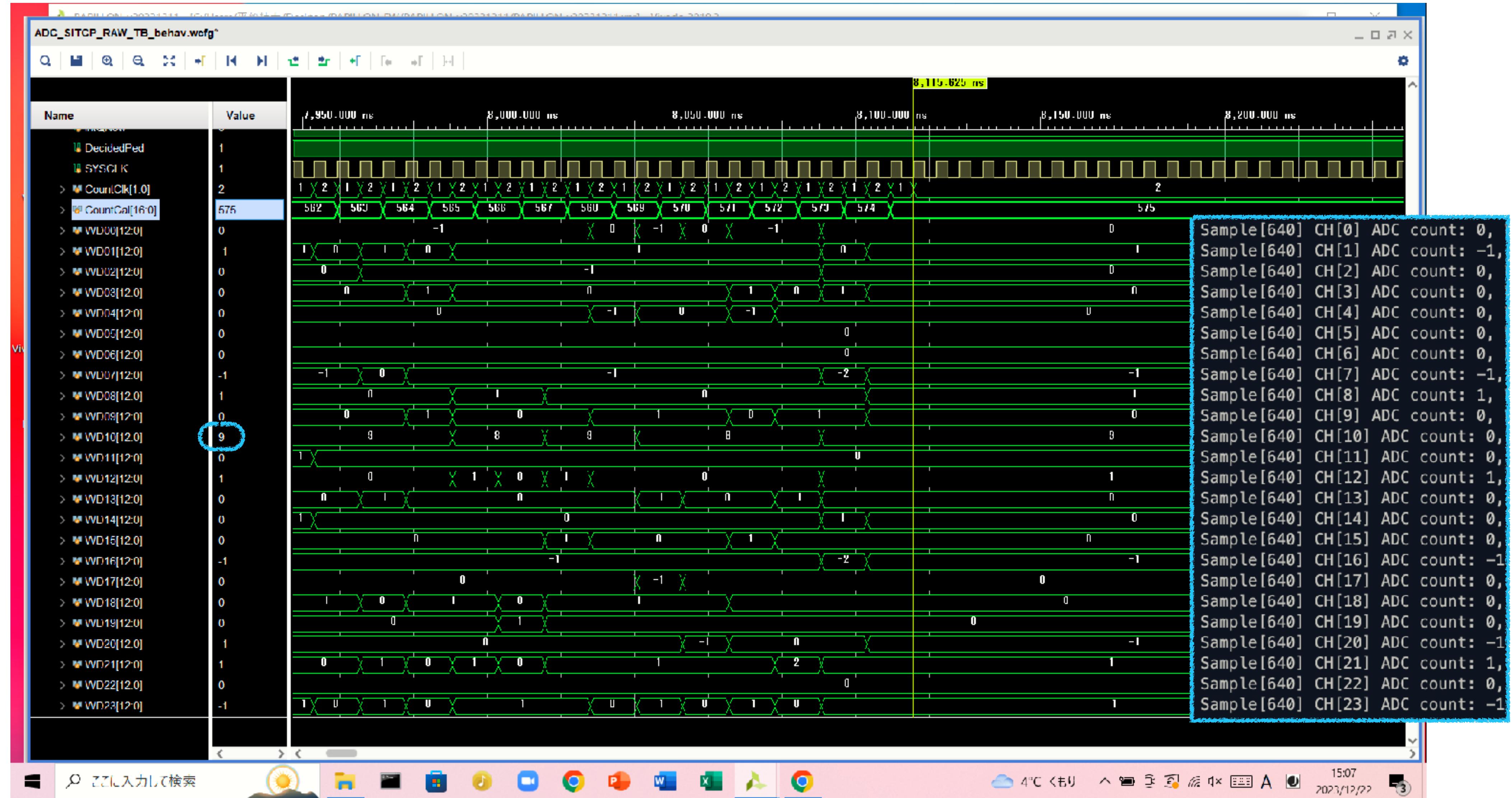
65サンプル目、Ch10のみ値が変？



Pedestal-subtracted Waveform

波高の確認：

640サンプル目もCh10のみ値が変？



Bug was Found!!!



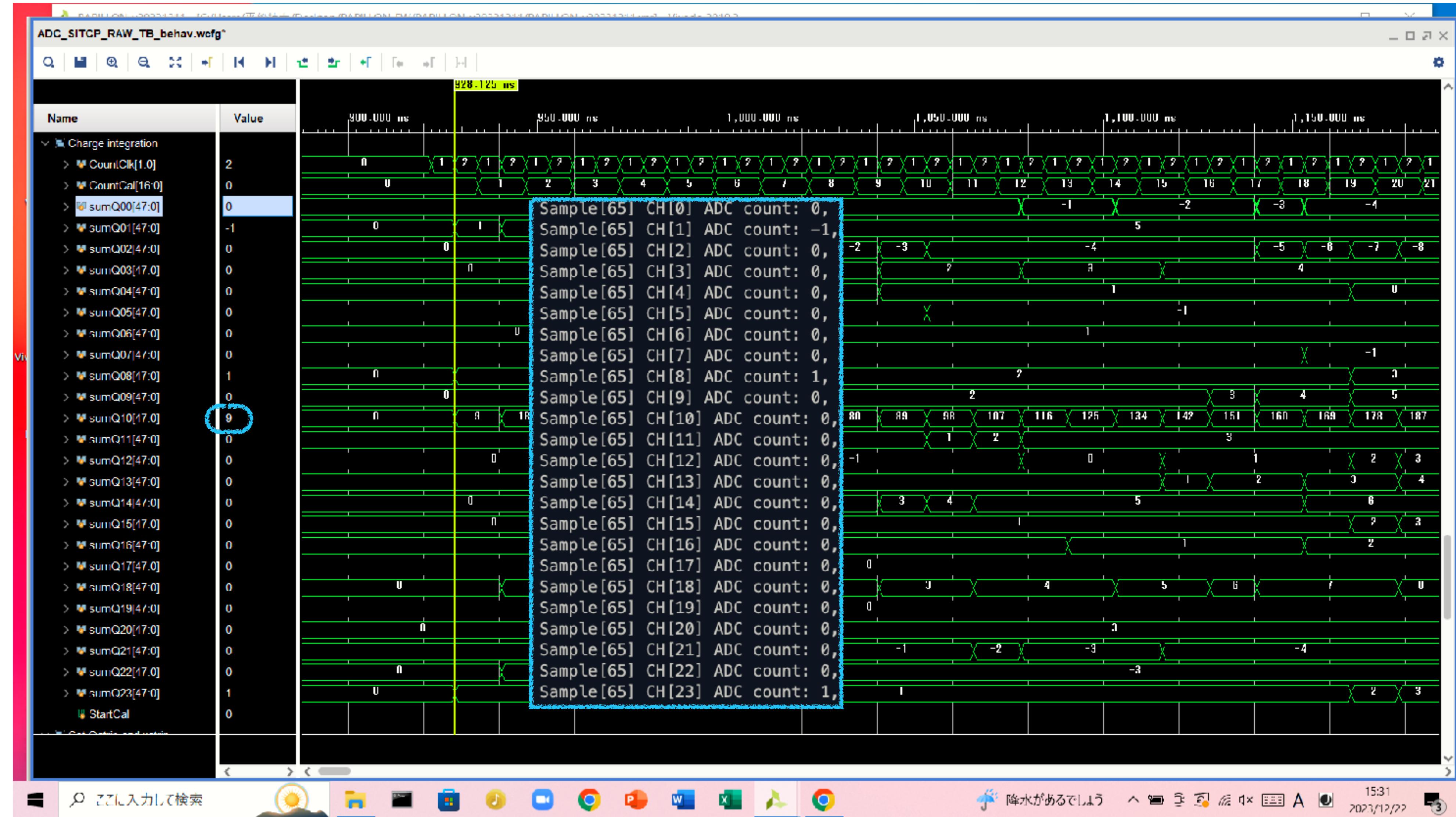
Ch.10のpedestal-subtracted waveformが
ch.0のペデスタルを引いていた 😱

```
WD00[12:0] <= RawWD00[12:0] - pedestal00[12:0];
WD01[12:0] <= RawWD01[12:0] - pedestal01[12:0];
WD02[12:0] <= RawWD02[12:0] - pedestal02[12:0];
WD03[12:0] <= RawWD03[12:0] - pedestal03[12:0];
WD04[12:0] <= RawWD04[12:0] - pedestal04[12:0];
WD05[12:0] <= RawWD05[12:0] - pedestal05[12:0];
WD06[12:0] <= RawWD06[12:0] - pedestal06[12:0];
WD07[12:0] <= RawWD07[12:0] - pedestal07[12:0];
WD08[12:0] <= RawWD08[12:0] - pedestal08[12:0];
WD09[12:0] <= RawWD09[12:0] - pedestal09[12:0];
WD10[12:0] <= RawWD10[12:0] - pedestal00[12:0];
WD11[12:0] <= RawWD11[12:0] - pedestal11[12:0];
WD12[12:0] <= RawWD12[12:0] - pedestal12[12:0];
WD13[12:0] <= RawWD13[12:0] - pedestal13[12:0];
WD14[12:0] <= RawWD14[12:0] - pedestal14[12:0];
WD15[12:0] <= RawWD15[12:0] - pedestal15[12:0];
WD16[12:0] <= RawWD16[12:0] - pedestal16[12:0];
WD17[12:0] <= RawWD17[12:0] - pedestal17[12:0];
WD18[12:0] <= RawWD18[12:0] - pedestal18[12:0];
WD19[12:0] <= RawWD19[12:0] - pedestal19[12:0];
WD20[12:0] <= RawWD20[12:0] - pedestal20[12:0];
WD21[12:0] <= RawWD21[12:0] - pedestal21[12:0];
WD22[12:0] <= RawWD22[12:0] - pedestal22[12:0];
WD23[12:0] <= RawWD23[12:0] - pedestal23[12:0];
```

Integration of Charges

積算信号量 Q_{ch} の確認：

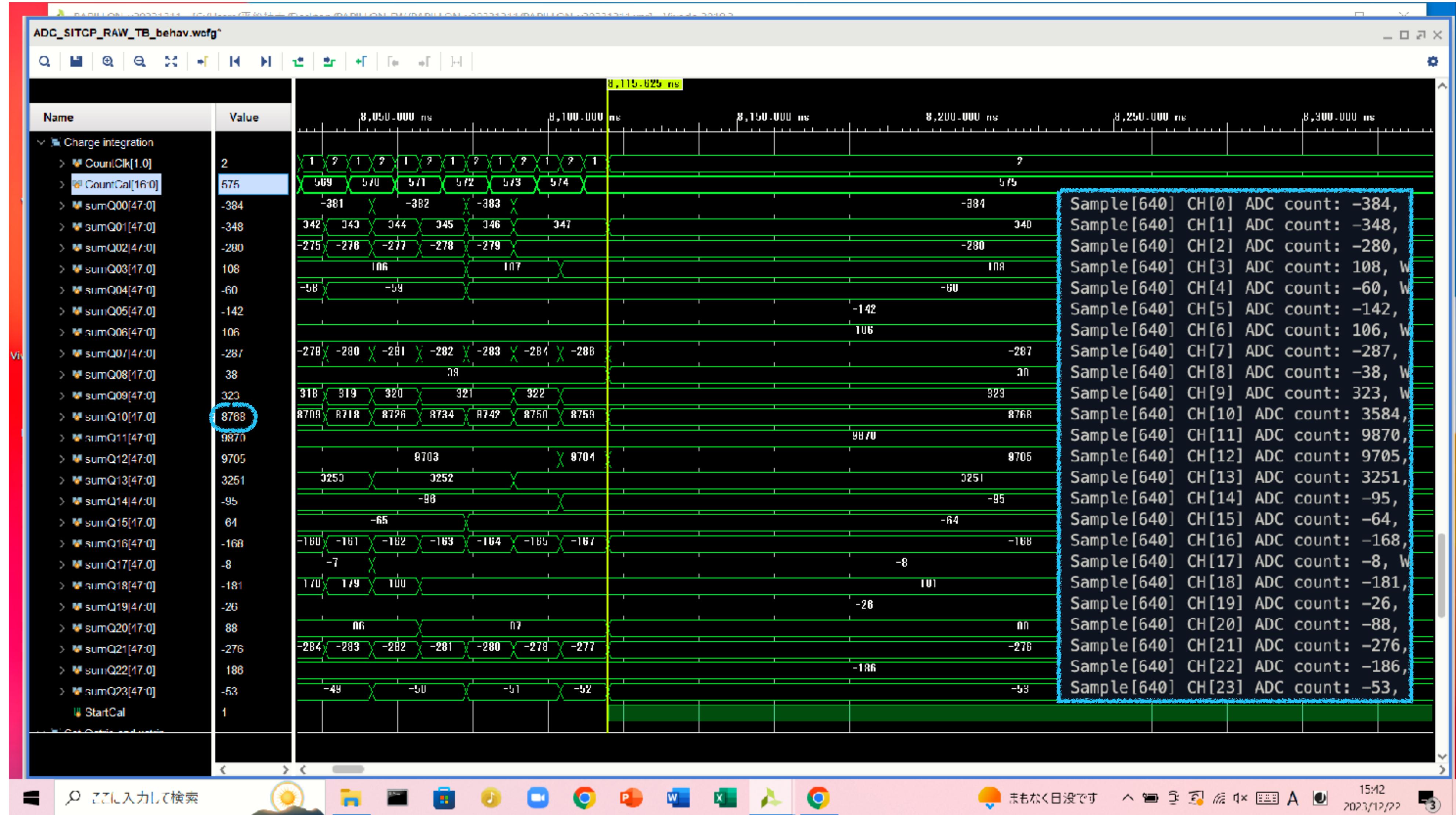
最初の65サンプル目は同様にCh10のみ値が変



Integration of Charges

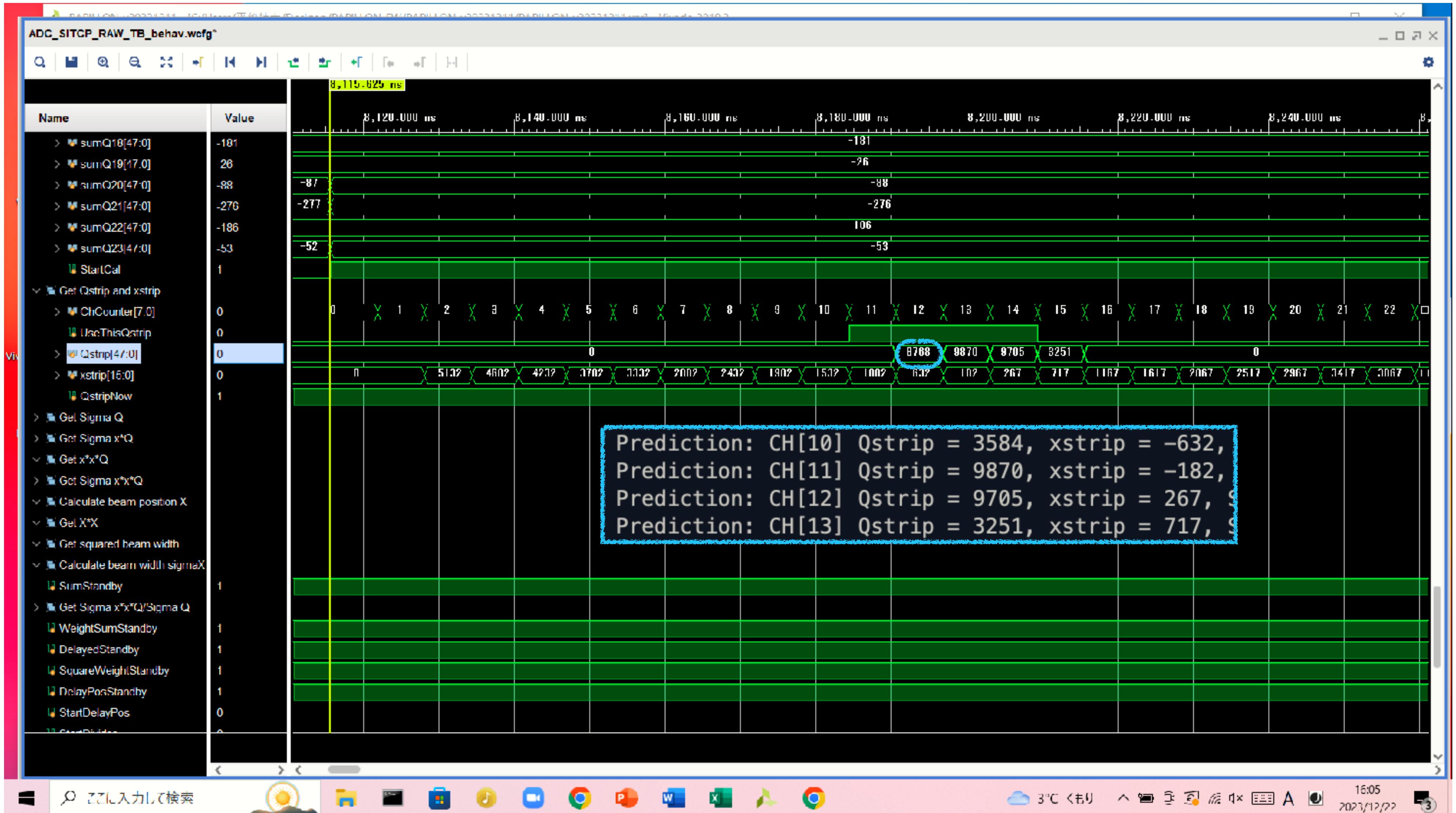
積算信号量 Q_{ch} の確認 :

Ch10以外は予測と一致することを確認



Applying Q_{ch} Cut & Getting Strip Position

積算信号量Q_{ch}のカットとx_{ch}取得の確認：
Ch10以外は予測と一致することを確認

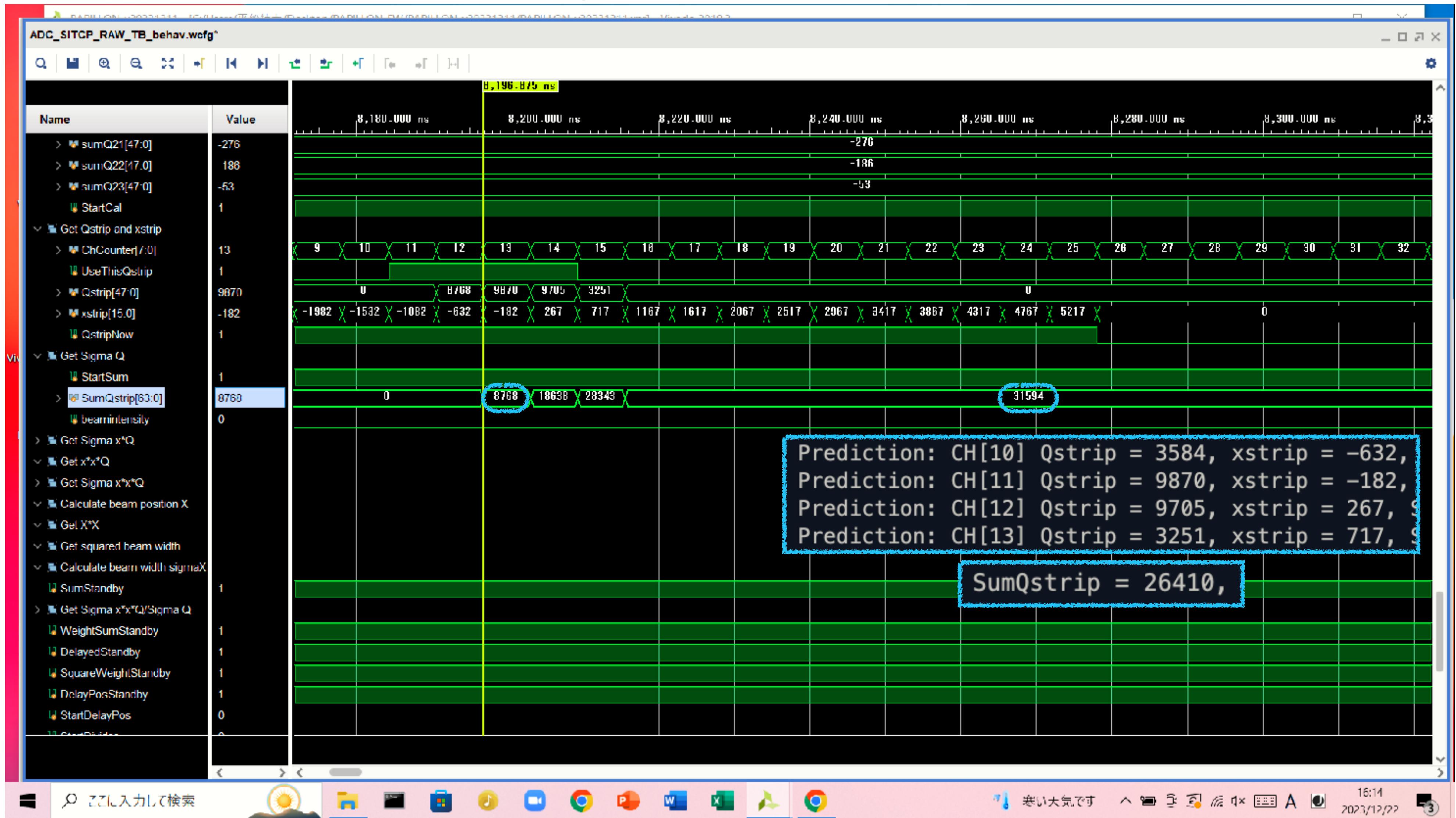


SSEM19X
00 -51.329 -5132 0xebf4
01 -46.829 -4682 0xedb6
02 -42.329 -4232 0xef78
03 -37.829 -3782 0xf13a
04 -33.329 -3332 0xf2fc
05 -28.829 -2882 0xf4be
06 -24.329 -2432 0xf680
07 -19.829 -1982 0xf842
08 -15.329 -1532 0xfa04
09 -10.829 -1082 0xfbcb
10 -6.329 -632 0xfd88
11 -1.829 -182 0xff4a
12 +2.671 267 0x010b
13 +7.171 717 0x02cd
14 +11.671 1167 0x048f
15 +16.171 1617 0x0651
16 +20.671 2067 0x0813
17 +25.171 2517 0x09d5
18 +29.671 2967 0xb97
19 +34.171 3417 0xd59
20 +38.671 3867 0xf1b
21 +43.171 4317 0x10dd
22 +47.671 4767 0x129f
23 +52.171 5217 0x1461

Calculation of ΣQ_{ch}

ΣQ_{ch} の確認：

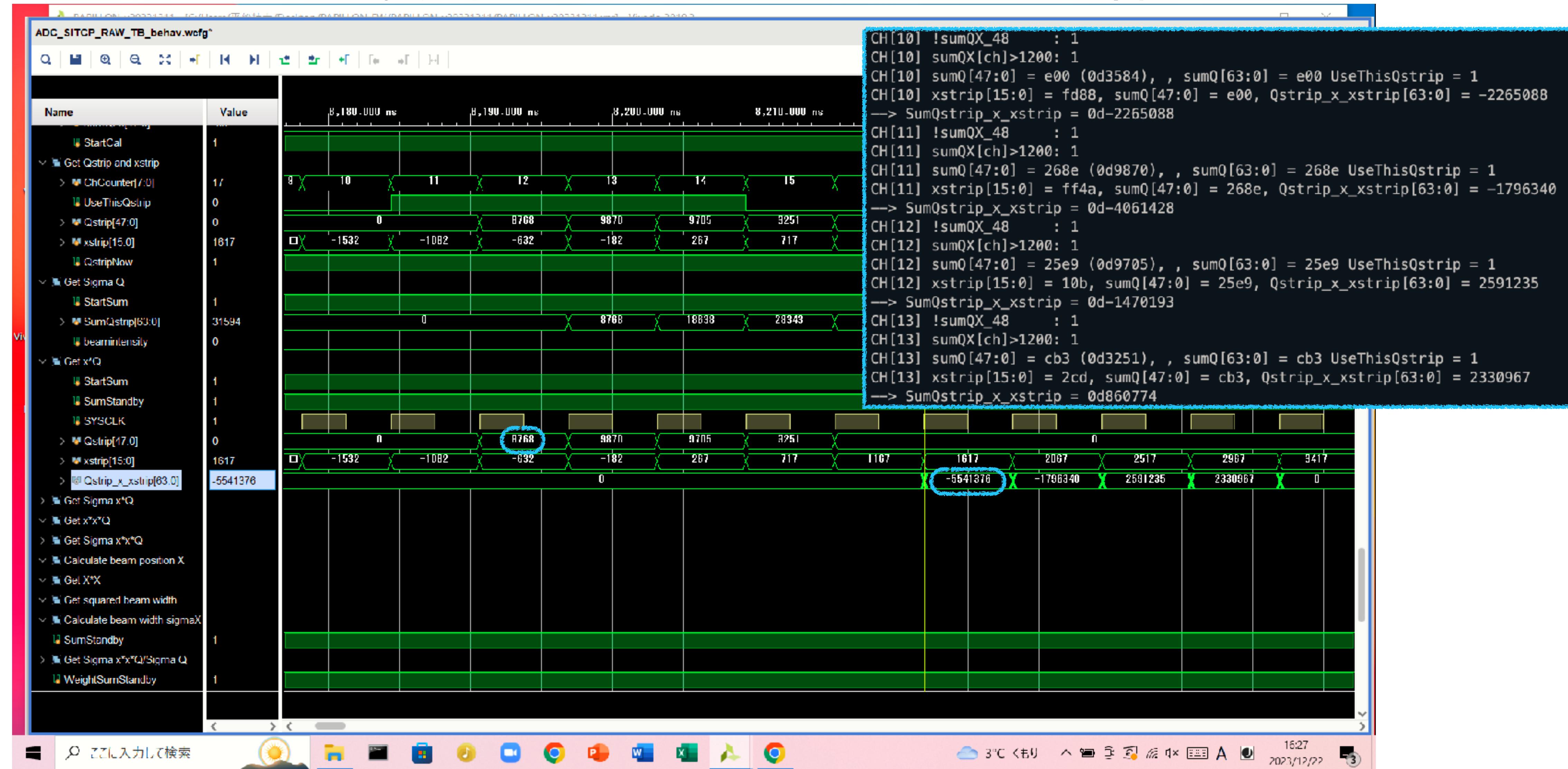
Ch10の Q_{ch} が直れば予測と一致する



Calculation of Q_{ch} X_{ch}

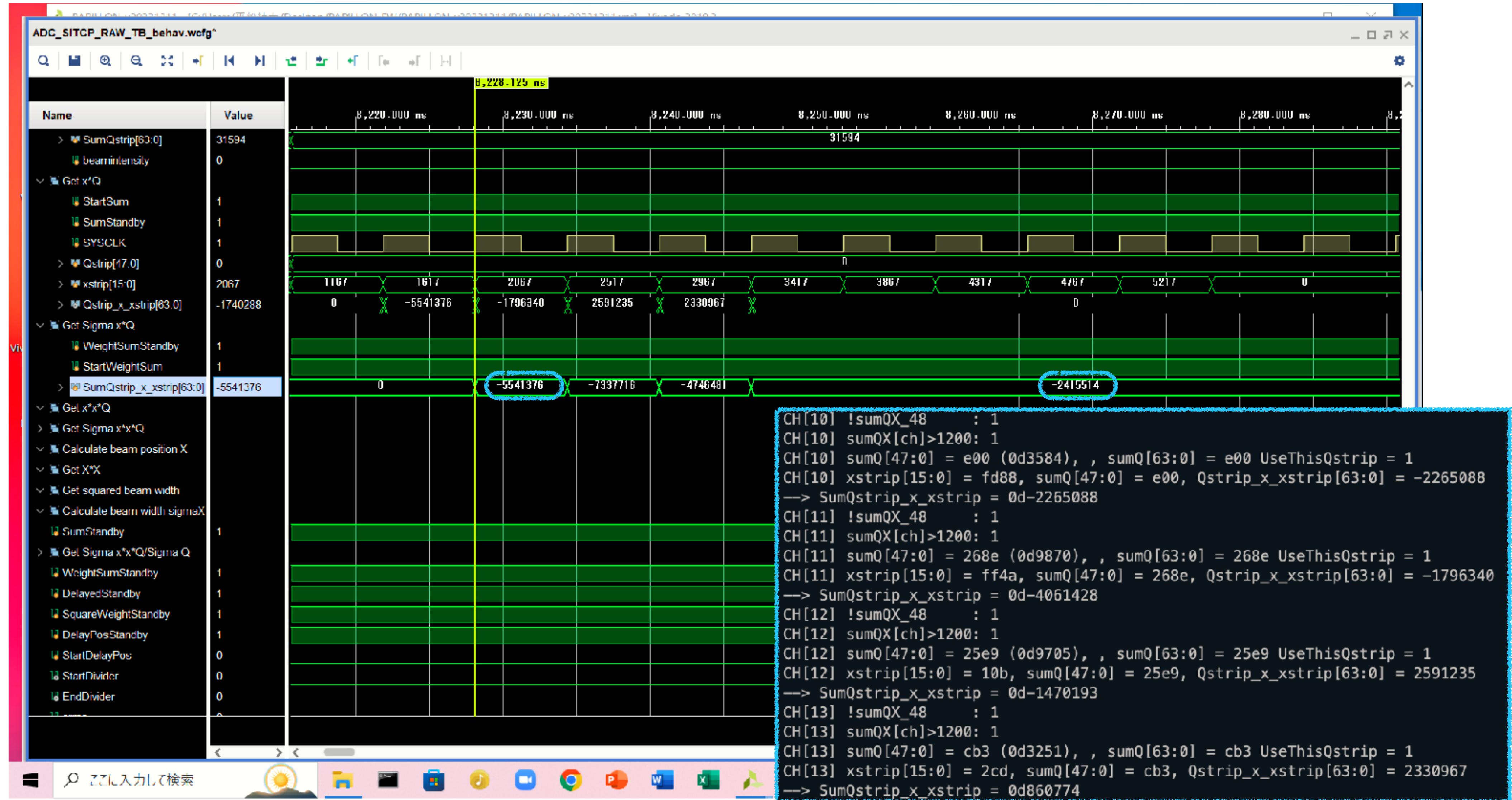
Q_{ch}X_{ch}の確認：

Ch10のQ_{ch}以外のchannelは予測と一致することを確認



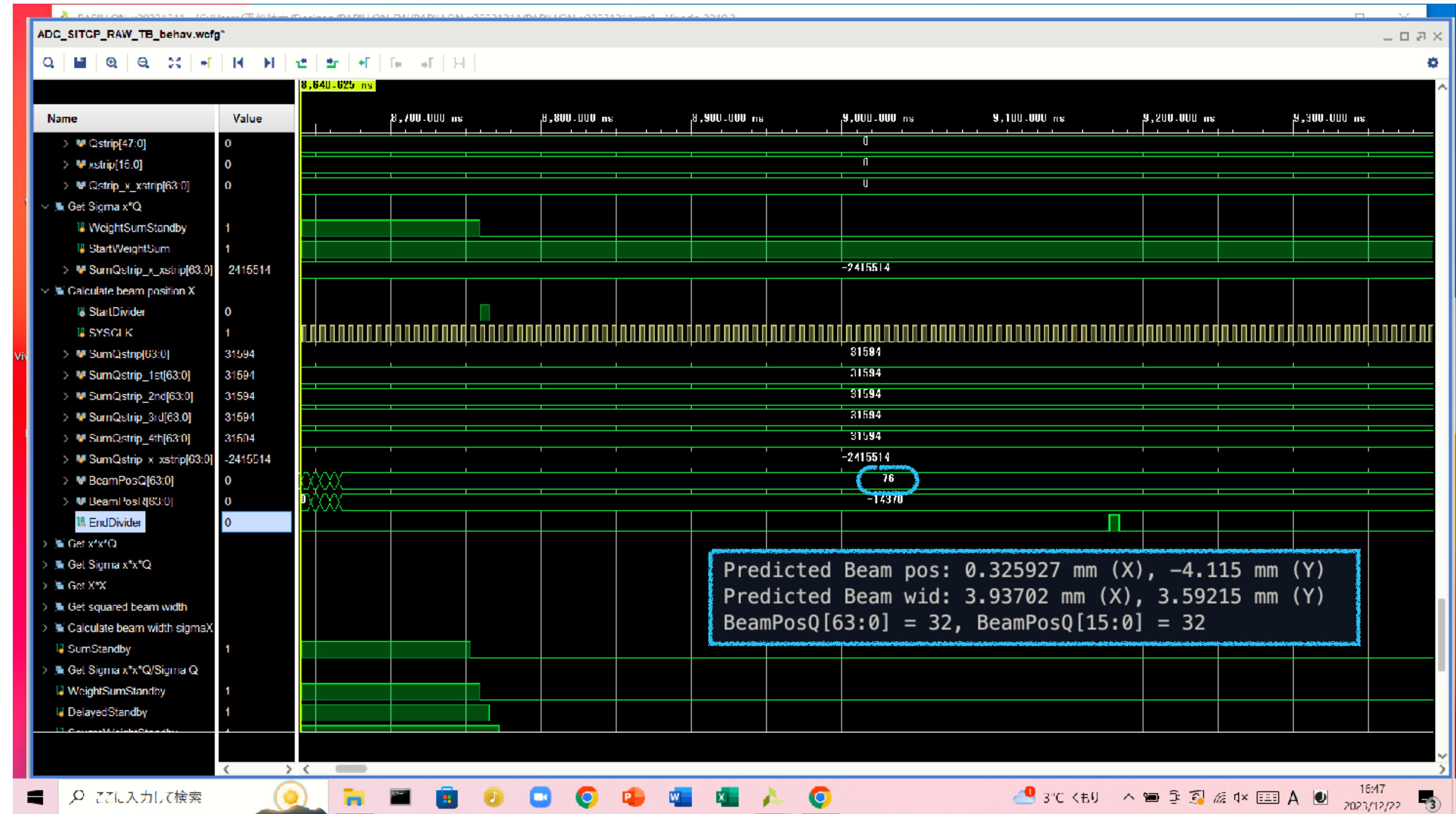
Calculation of $\sum Q_{ch} X_{ch}$

$\Sigma Q_{ch} X_{ch}$ の確認：
Ch10が直れば予測と一致する



Calculation of Beam Position

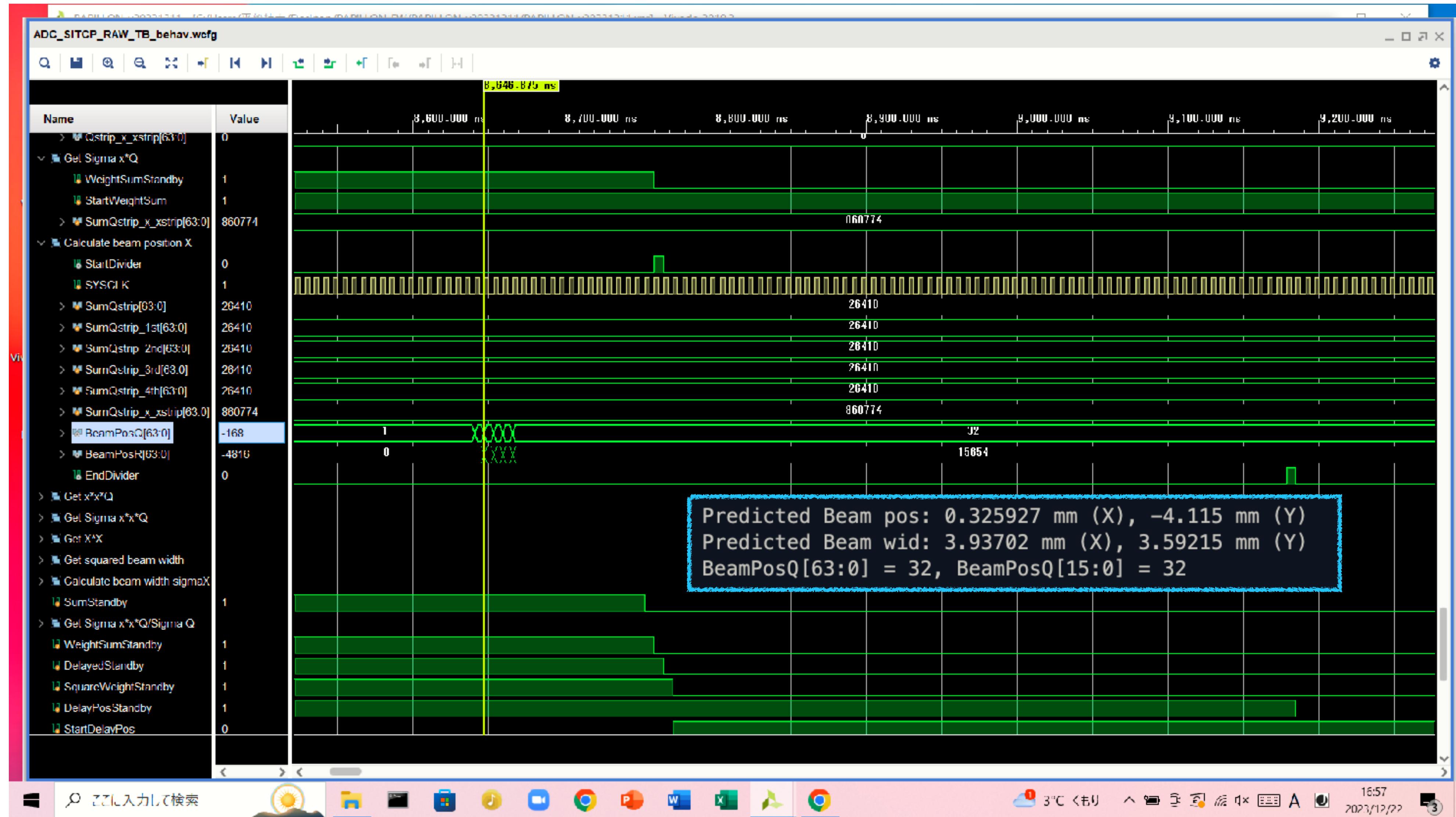
ビーム位置計算の確認：
実際のPAPILLONの結果と一致、Ch10が直れば予測と一致する



Bug was Defeated!!!



ビーム位置計算の確認：
Ch.10のpedestal-subtracted waveformを修正したことと予測と一致したことを確認



Beam Width Calculation

ビーム幅計算の確認：

Ch.10の修正により同様にビーム幅の結果も予測と一致した

