Gain Parameter Programming Strategy

- First determine **GSel** based on the desired approximate transfer gain (approx. 50 – 200 mV/fC).
- Then depending on the value of the input capacitance (Cin), program **BWSel** to achieve fast integrator response without ringing.
- For Cin = 2 pF (1.5 pF detector + 0.5 pF parasitic):
  - If **GSel** = 000, set **BWSel** = 00000
  - If **GSel** = 010, set **BWSel** = 00100
  - If **GSel** = 100, set **BWSel** = 01000
  - If **GSel** = 110, set **BWSel** = 01100
- For Cin = 1.5 pF (1 pF detector + 0.5 pF parasitic):
  - If **GSel** = 000, set **BWSel** = 00001
  - If **GSel** = 010, set **BWSel** = 00110
  - If **GSel** = 100, set **BWSel** = 01010
  - If **GSel** = 110, set **BWSel** = 01110
- For Cin = 1 pF (0.5 pF detector + 0.5 pF parasitic):
  - If **GSel** = 000, set **BWSel** = 00010
  - If **GSel** = 010, set **BWSel** = 01000
  - If **GSel** = 100, set **BWSel** = 01110
  - If **GSel** = 110, set **BWSel** = 10101
- Program **Fb1Sel** based on the desired fall time constant
- Then program **N2Sel** to achieve the desired rise time/peaking time (rise and fall times will have some effect on the transfer gain)
- Program **Vref** to the lowest value possible that allows linear response (nominally 00)
- Based on the transfer gain, set the desired comparator thresholds

Physics	Dec	Bin
GSel	2	010
BWSel	4	0100

Relevant setting for INTT Type-B following Hamamatsu (FPHX Default = FVTX)

Physics	Dec	Bin
GSel	2	010
BWSel	6	0110

Relevant setting for INTT Type-A following Hamamatsu

Nevis	Dec	Bin
GSel	2	010
BWSel	8	1000

Relevant setting for KaiYu's Measurement : 0.5 ~ 1.2 pF type-A

From FPHX Operation Manual

Strip Capacitance

Thickness:320 [μm]

Strip	Length [mm]	Pitch [mm]	p+ width [mm]	Al Width [mm]	Meas. [pF] (Kai-Yu)	HPK model [pF]	FVTX NIM
FVTX	2	75	18	28	N/A	0.32	1
FVTX	11				N/A	1.74	2.5
INTT-Type-A	12	78	10	20	0.5 ~ 1.5	1.57	
INTT-Type-B	18				0.4 ~ 1.5	2.35	

- Hamamatsu's a model calculation is consistent with given dimensions.
- The capacitance value found in FVTX NIM is larger than Hamamatsu's calc by factor of 2 to 3.
- Kaiyu's measurement is smaller than Hamamatsu's calc by > 1/3 or so.
- Problem what to be stated in the INTT paper.

Conclusion for Gain Parameter Setting

- GSel=2 (Lowest Gain Setting)

	BWSel Yuka's Measurement	Hamamatsu Calc. [pF]	BWSel	NCU Meas. [pF]	BWSel
Type-A	8	1.57	6	0.5 ~ 1.2	8
Type-B		2.35	4	0.4 ~ 1.2	8

https://indico.bnl.gov/event/19552/contributions/76600/attachments/47583/80738/20230519_sugiyama.pdf

I analyzed MIP peaks for BWSel=4 and 8 to determine the parameter of FPHX chip "BWSel".

- For BWSel=4, there is a large variation in entries, which may affect the accuracy of Fitting.
- For BWSel=8, the distribution is relatively smooth and does not necessarily have small peaks.

Shall we start with BWSel=8 for Type-A,B as default? We'll scan over BWSel anyway. To be judged based on the scan results

From FPHX Operation Manual