



# HKROC Test bench

*Status*

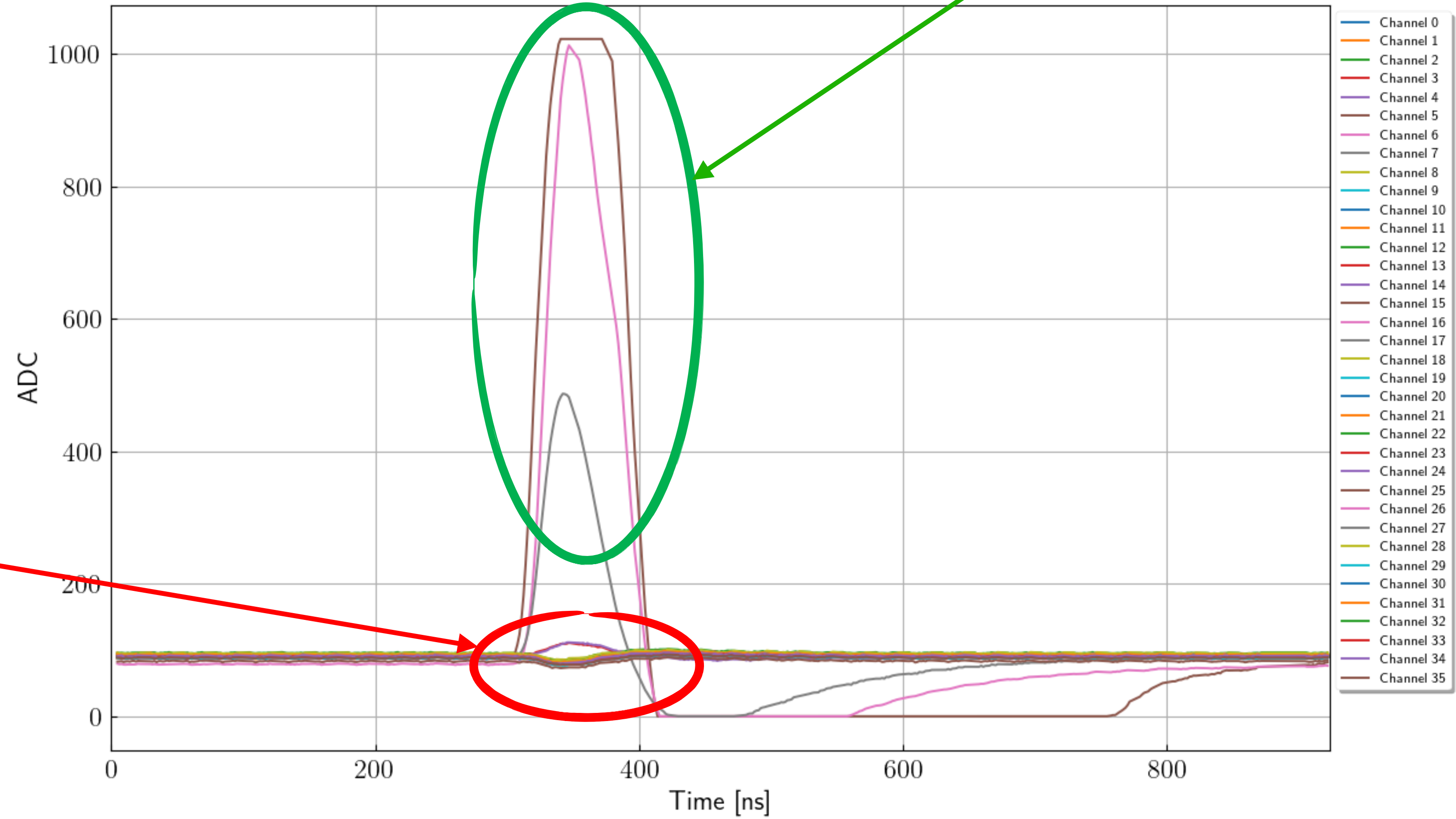
# Introduction

*Crosstalk Measurements*

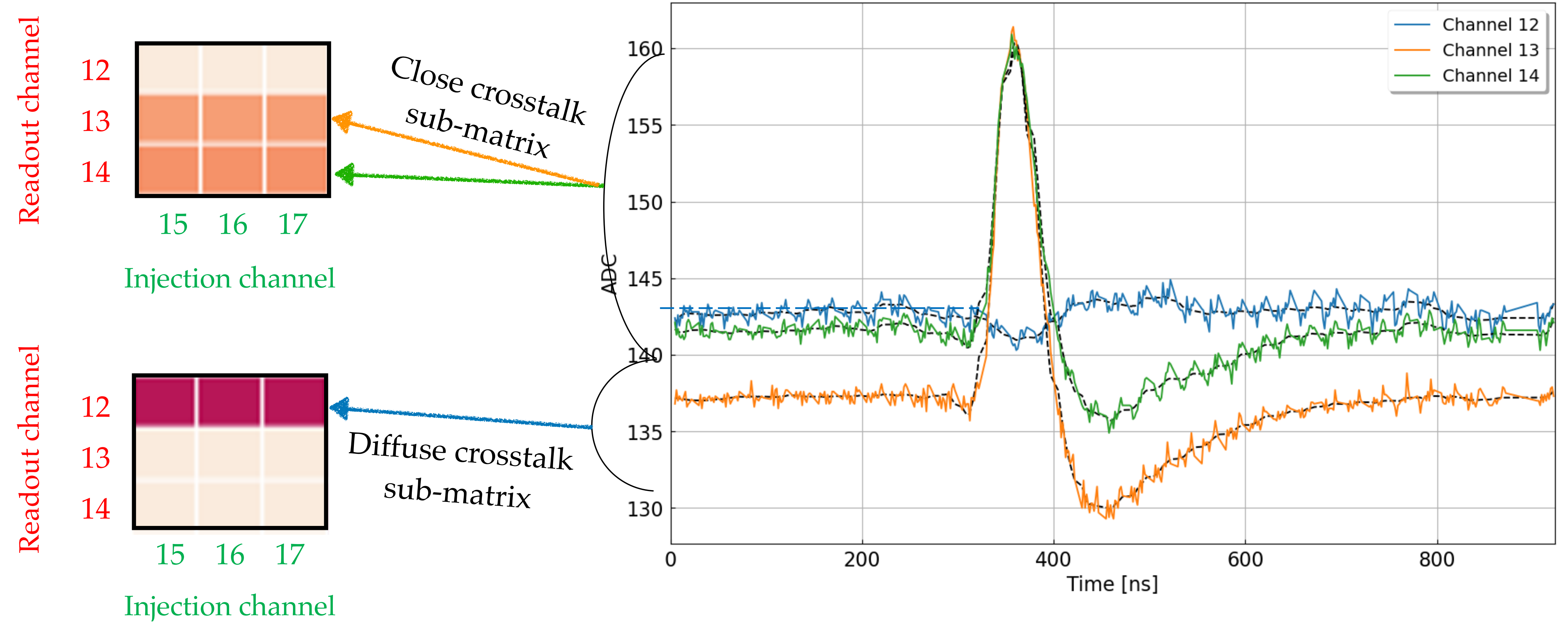
## Measurement Principle

~ 800 p.e. input signal in the injection pin (HG, MG and LG channels)

Measure the output signal in the other channels



## Example

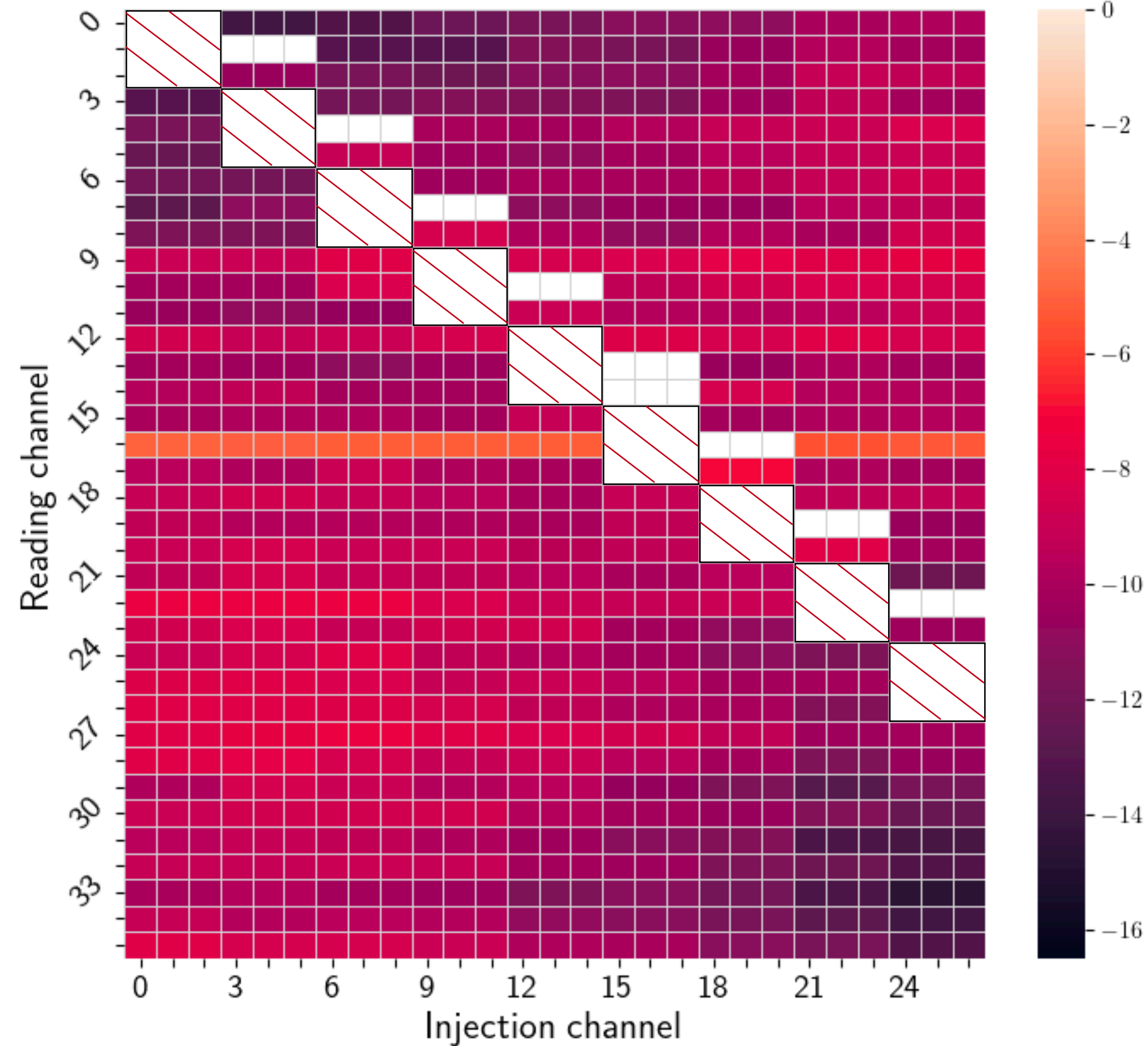


# Diffuse Crosstalk Reduction

*Chip-to-Chip Comparison*

## (Negative) Diffuse Crosstalk Matrices – Board v2 (BGA)

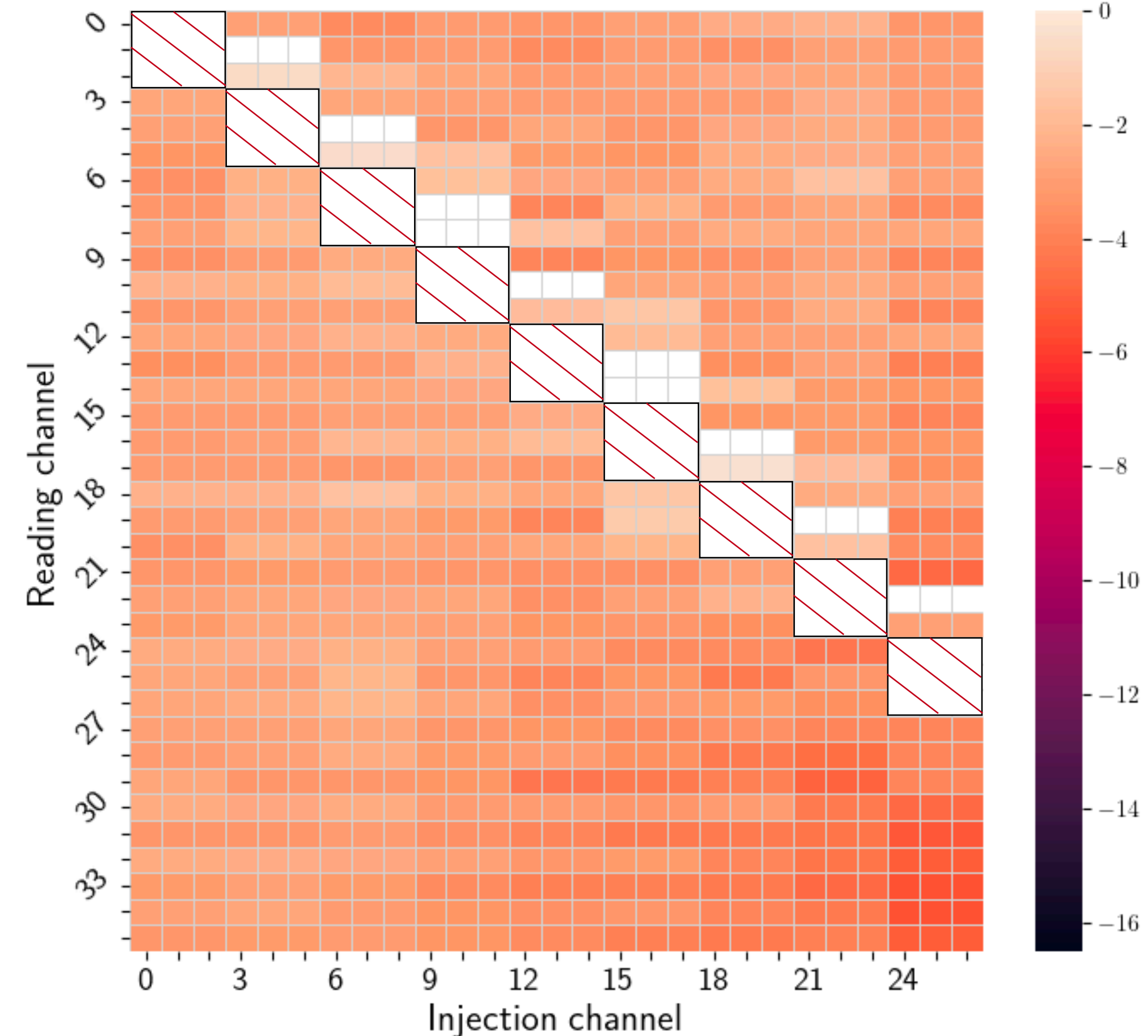
Chip v0 [ADC units]



Diffuse XT Reduction  
from v0 to v1b  
(chip-to-chip)

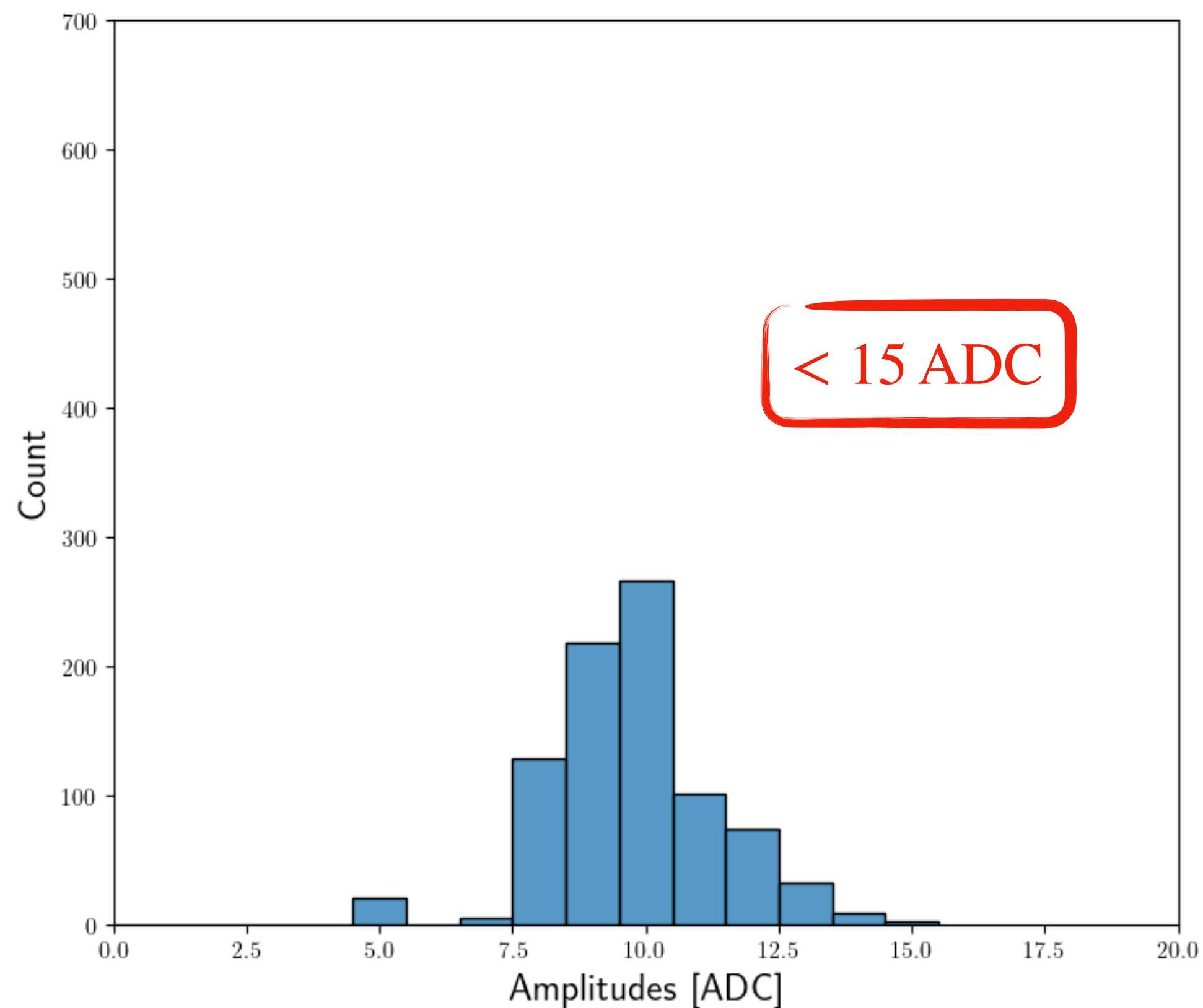


Chip v1b [ADC units]



## (Negative) Diffuse Crosstalk Histograms – Board v2 (BGA)

Chip v0

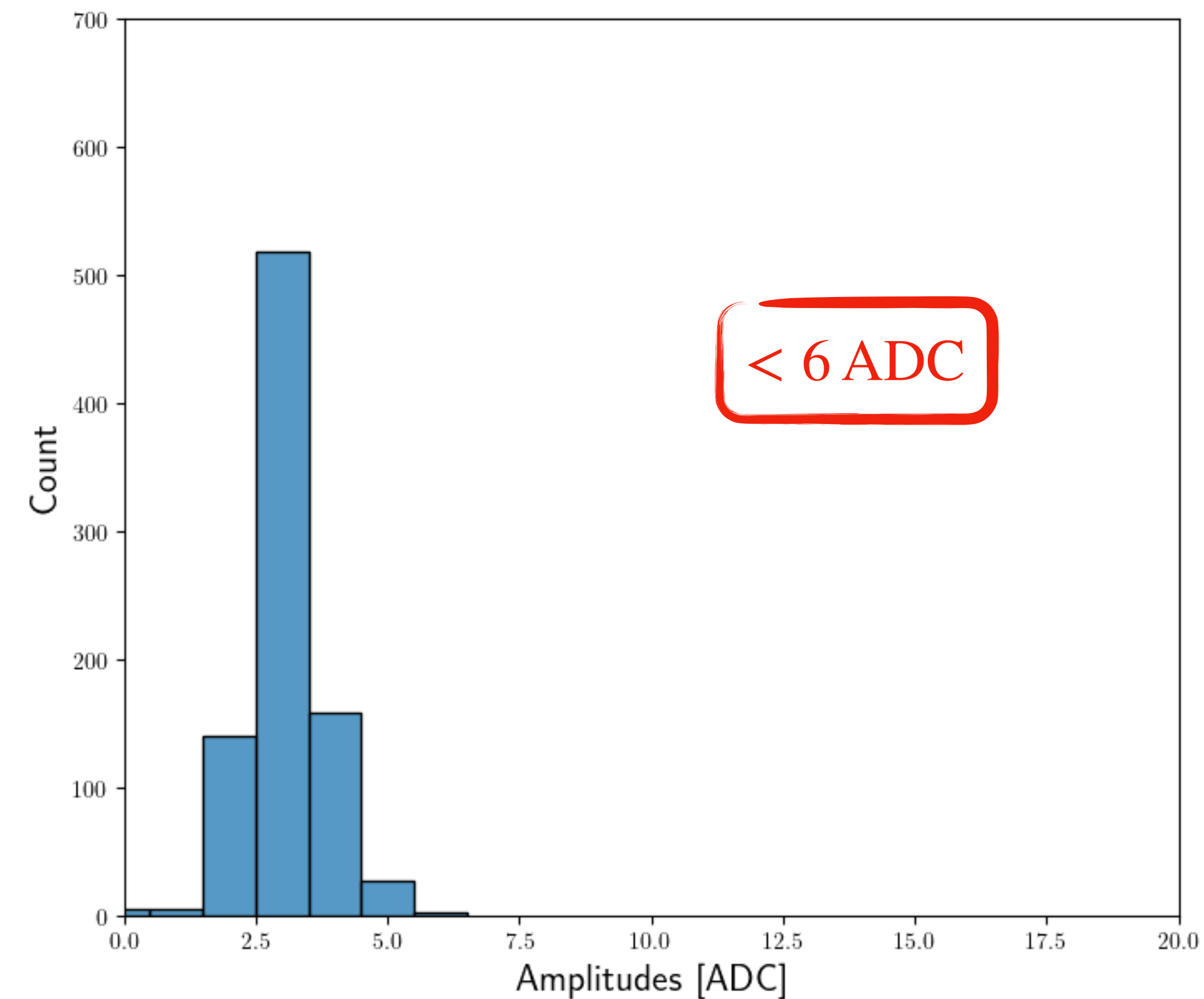


Diffuse XT Reduction



by a factor  $\sim 3$

Chip v1b



From Chip v0  $\rightarrow$  v1b: **Factor  $\sim 3$  reduction** of diffuse cross-talk, kept at  $\leq 1.5\%$  level.

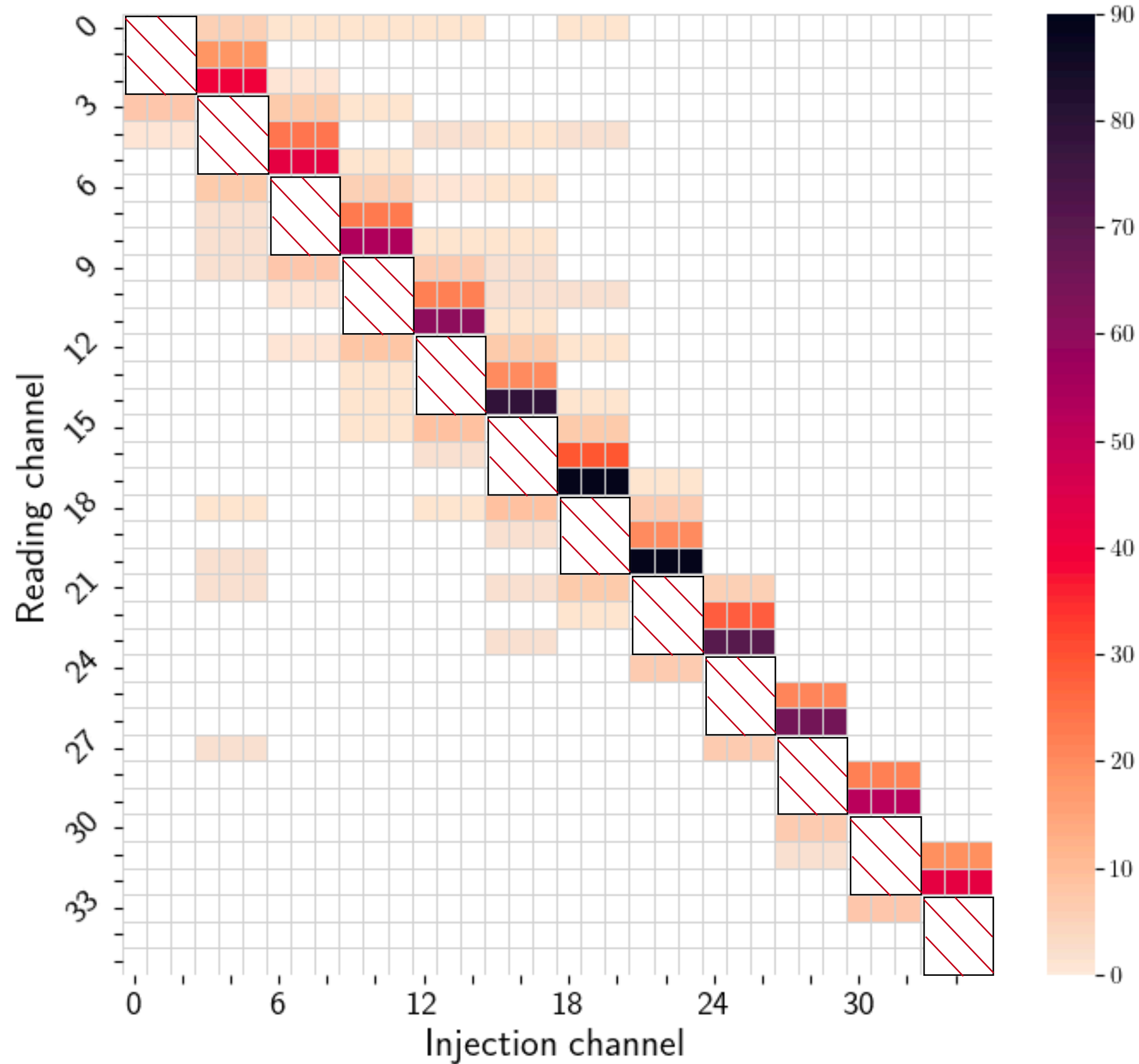
# Close Crosstalk Reduction

*Board-to-Board Comparison*



## Close Crosstalk Matrices - Chip v1b

Board v1 (Mezzanine) [ADC units]

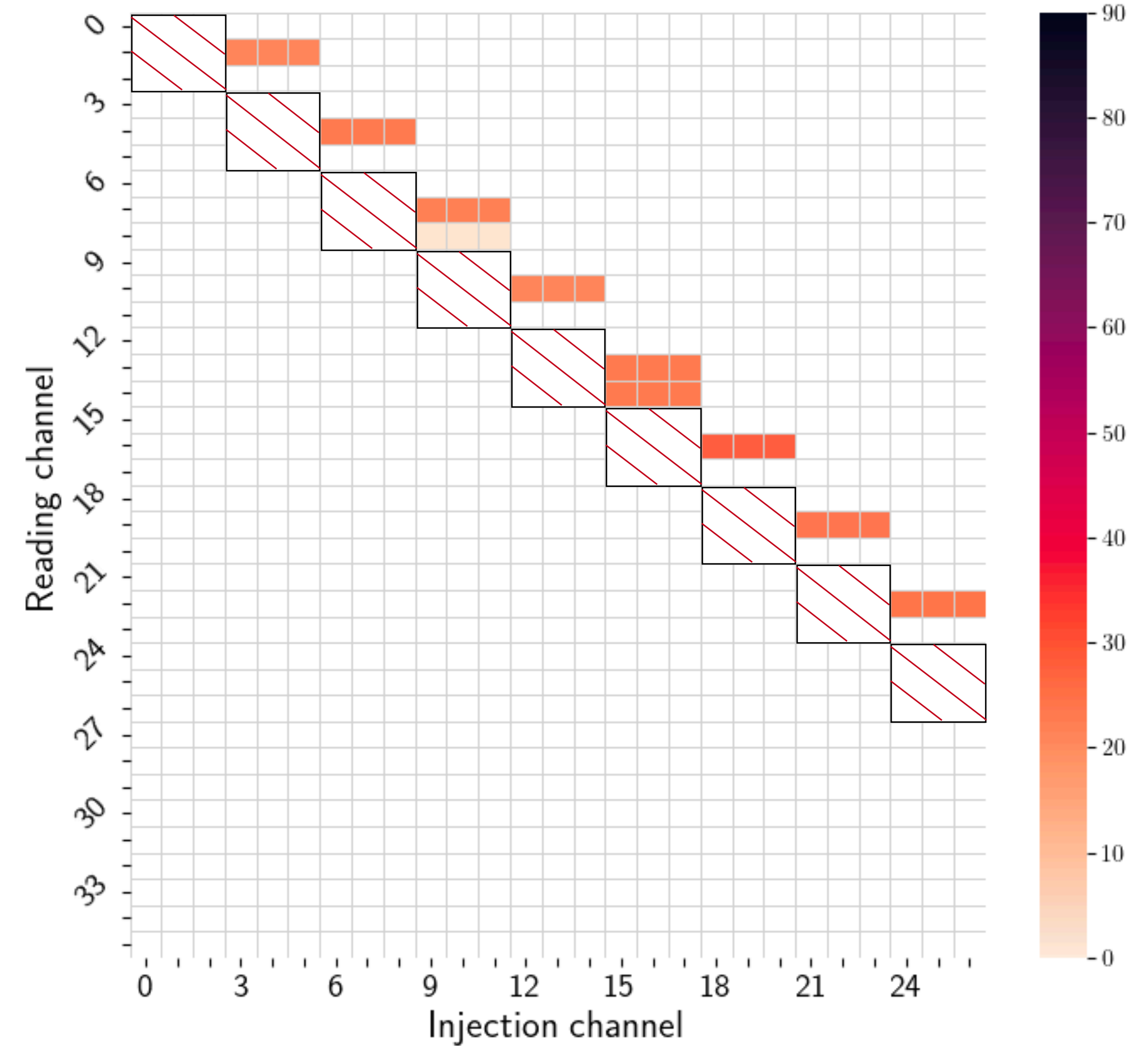


Close XT Reduction



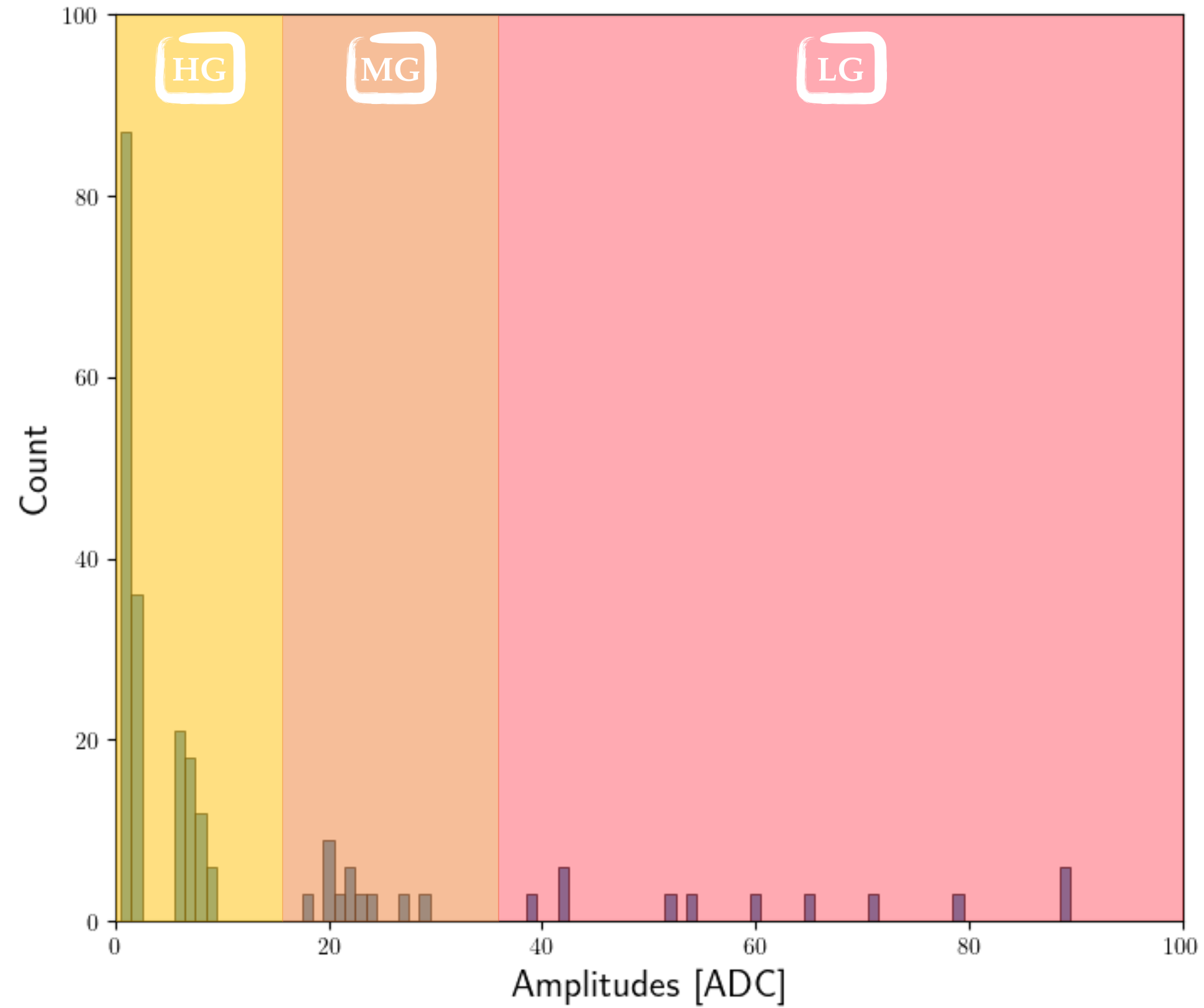
from v1 to v2  
(board-to-board)

Board v2 (BGA) [ADC units]



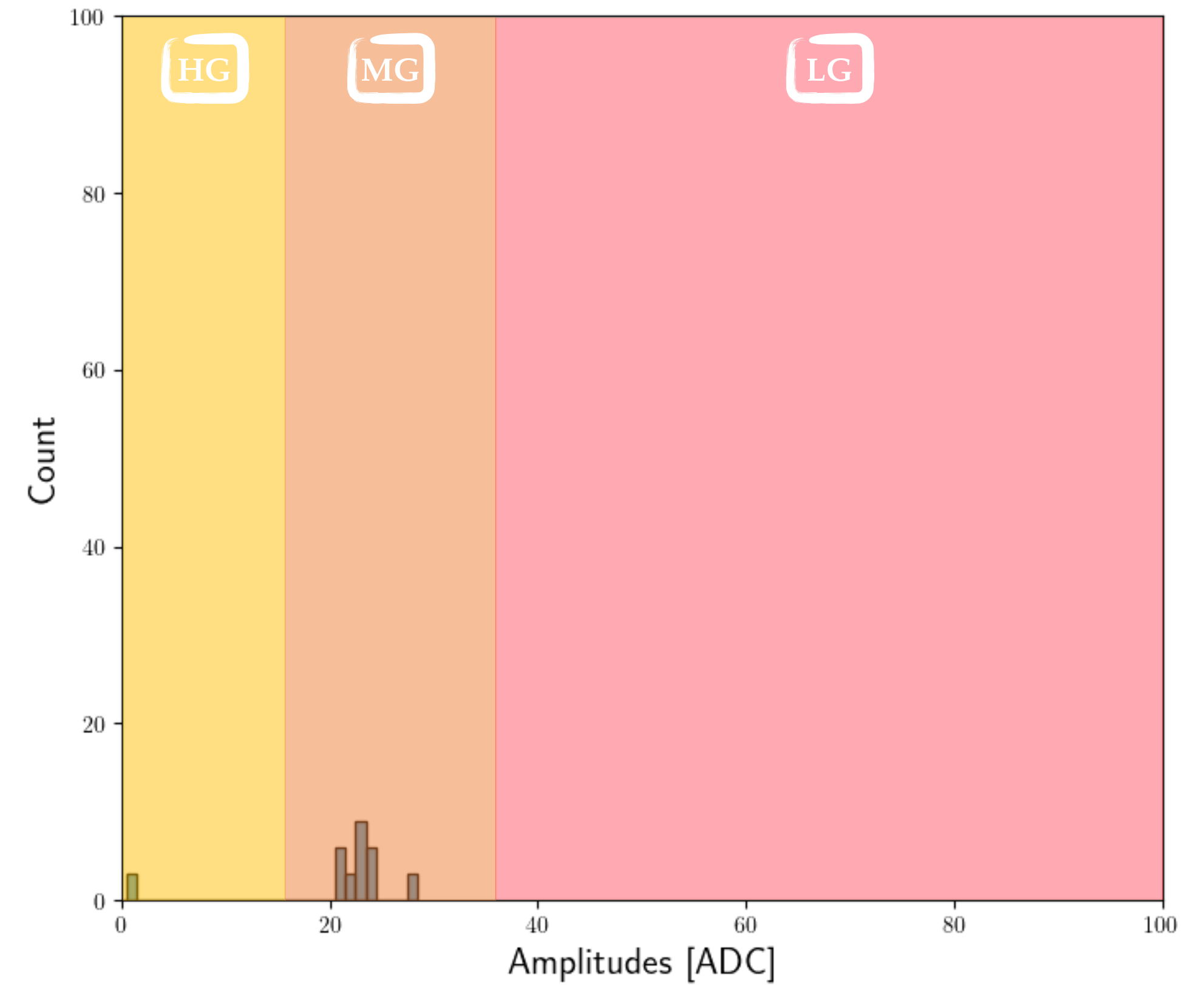
## Close Crosstalk Histograms - Chip v1b

Board v1 (Mezzanine)



Close XT Reduction  
→  
on HG and LG ch.

Board v2 (BGA)



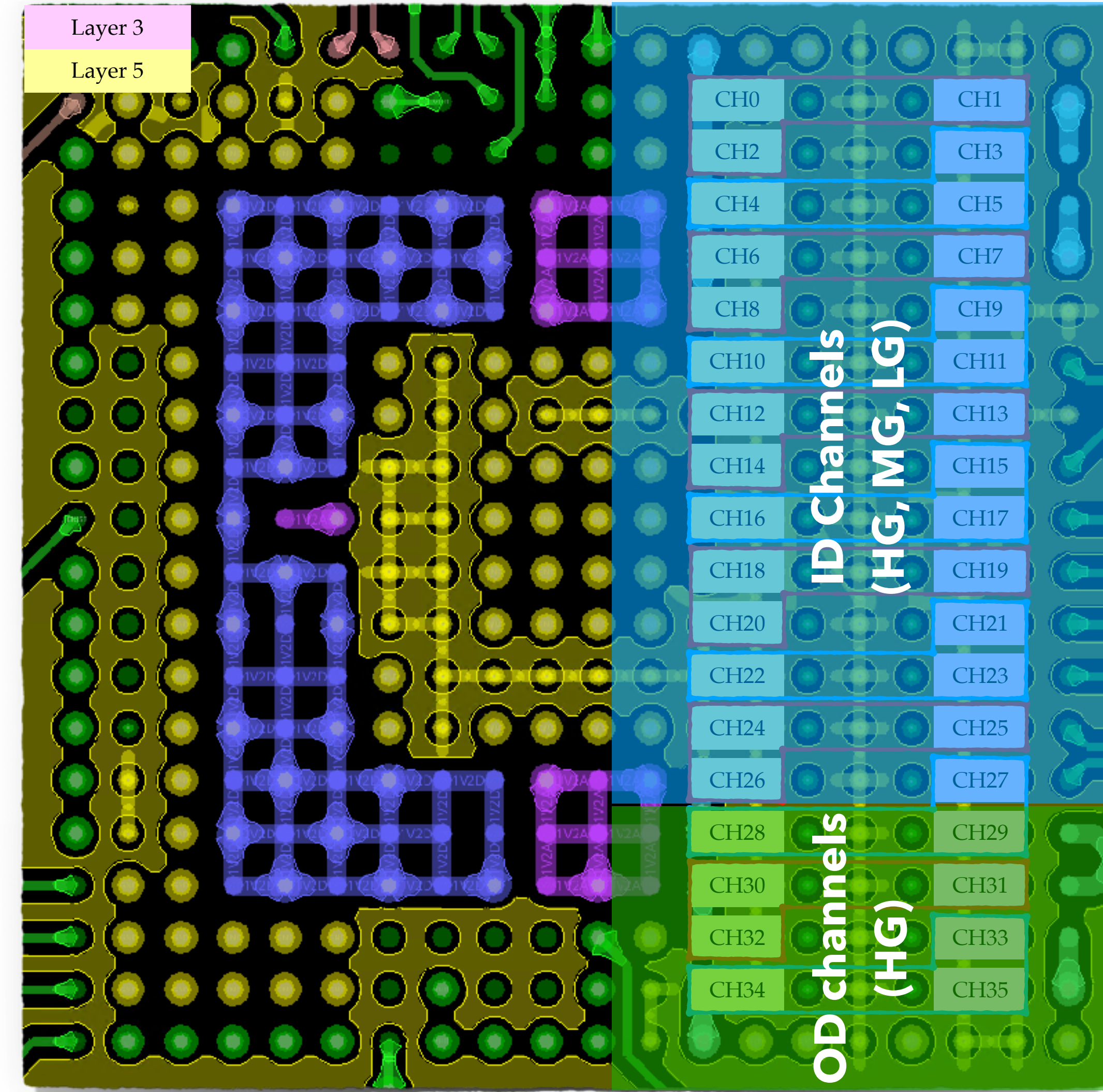
## Conclusion

- From Board v1 → v2:
  - ➔ Suppression of the close cross-talk : **HG ch.** → **HG + LG ch.**
  - ➔ Survival  $\sim 1 - 2\%$  close cross-talk **HG ch.** → **MG ch.**
  - ➔ Abnormal  $\sim 5 - 6\%$  close cross-talk **HG ch. 15** → **LG ch. 14.**

# Close Crosstalk

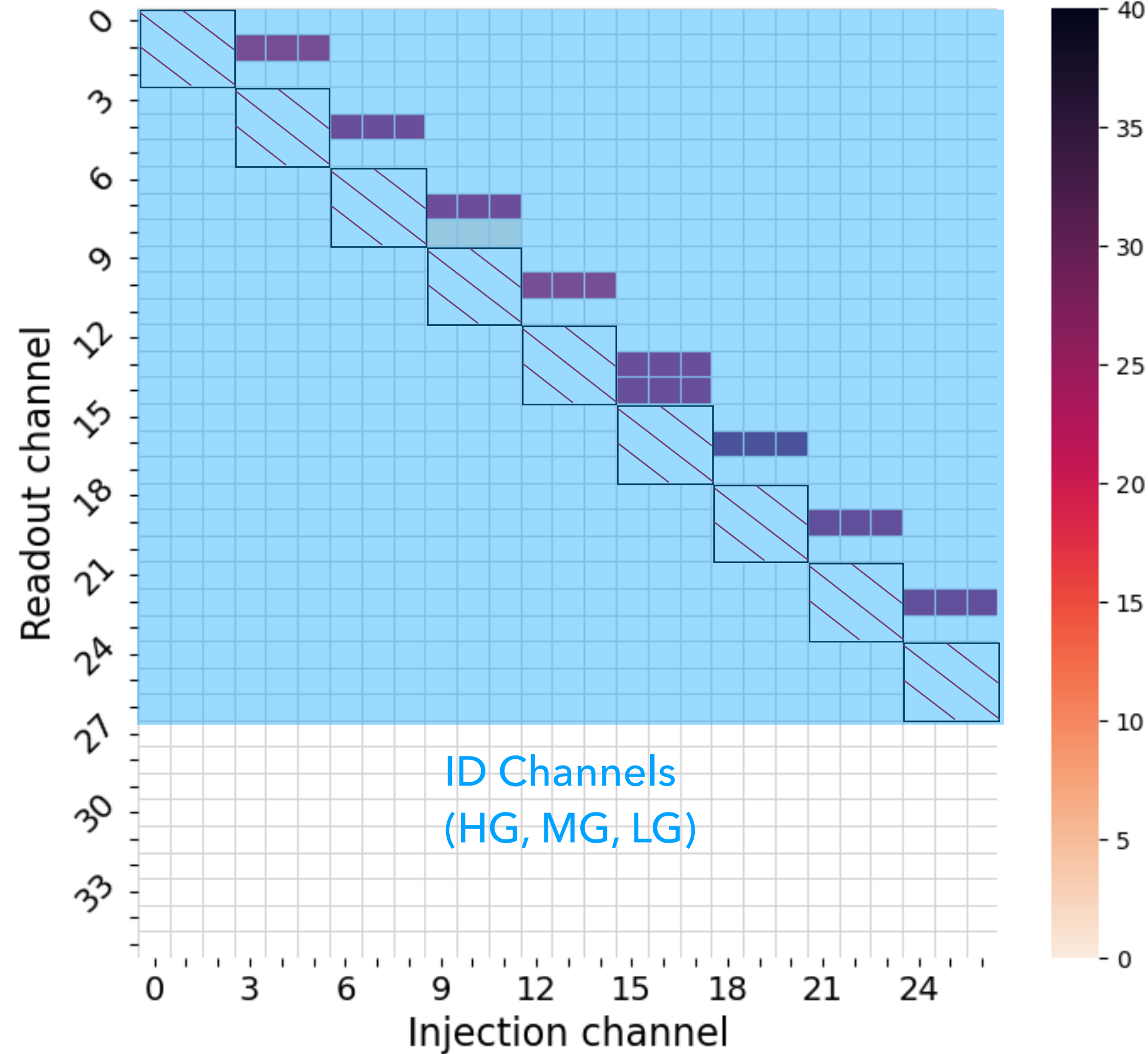
*Chip v1b + Board v2 (BGA)*

- Previously:
  - ➔ Inject signal only in the ID channels for X-talk measurements.
- Now:
  - ➔ Inject signal in both ID and OD channels.

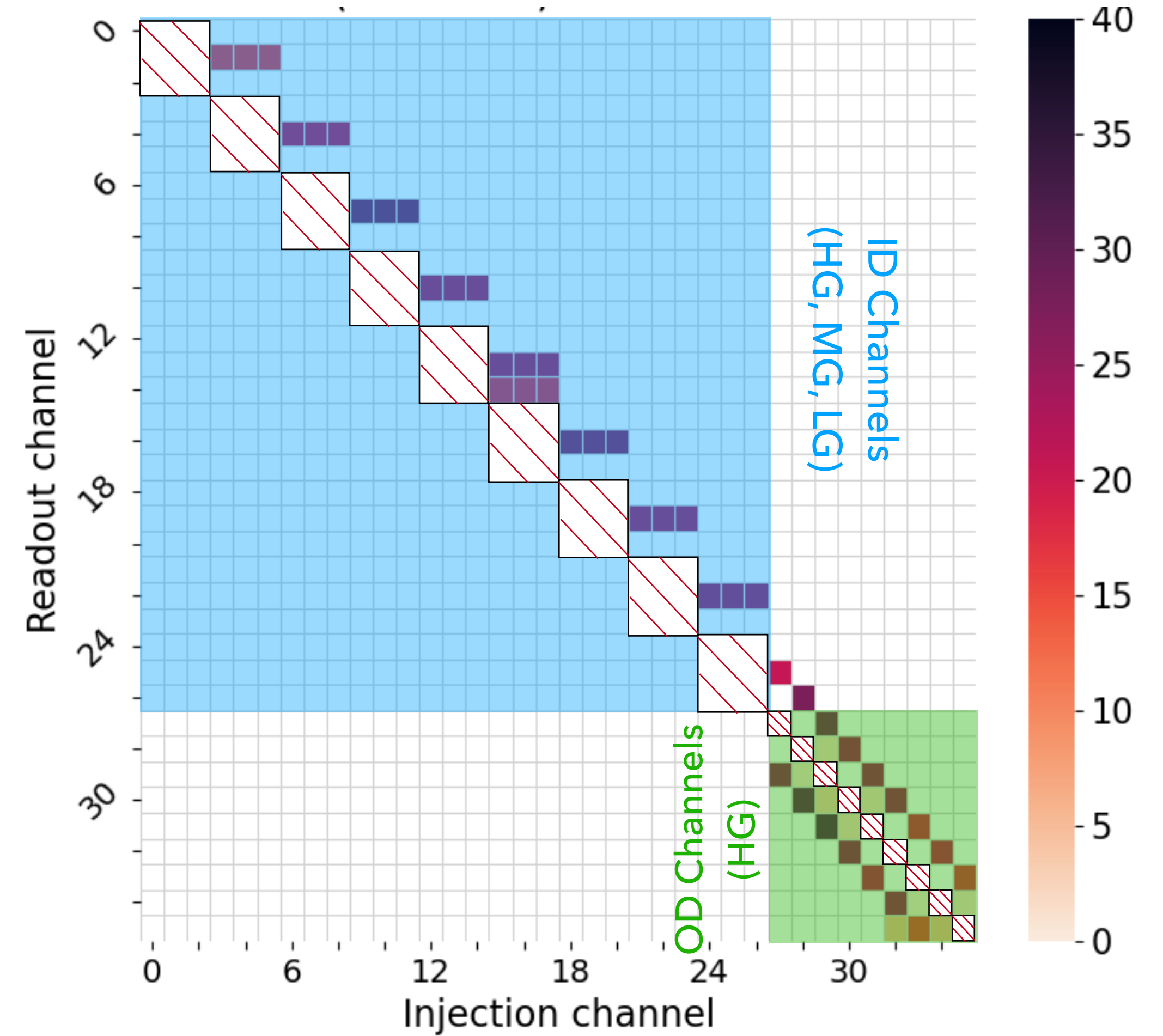


## Close Crosstalk Matrix - Chip v1b + Board v2 (BGA)

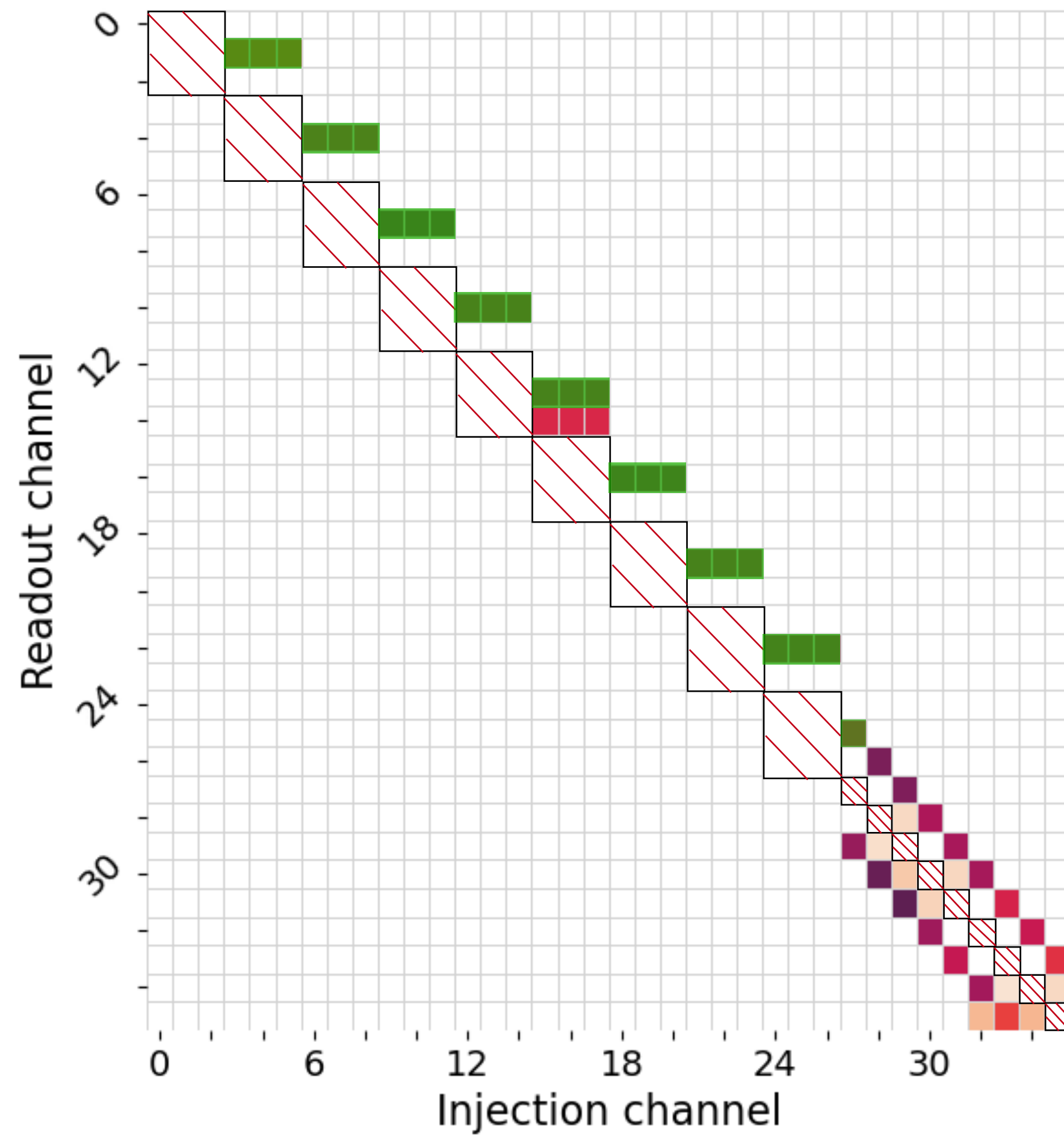
Two weeks ago...



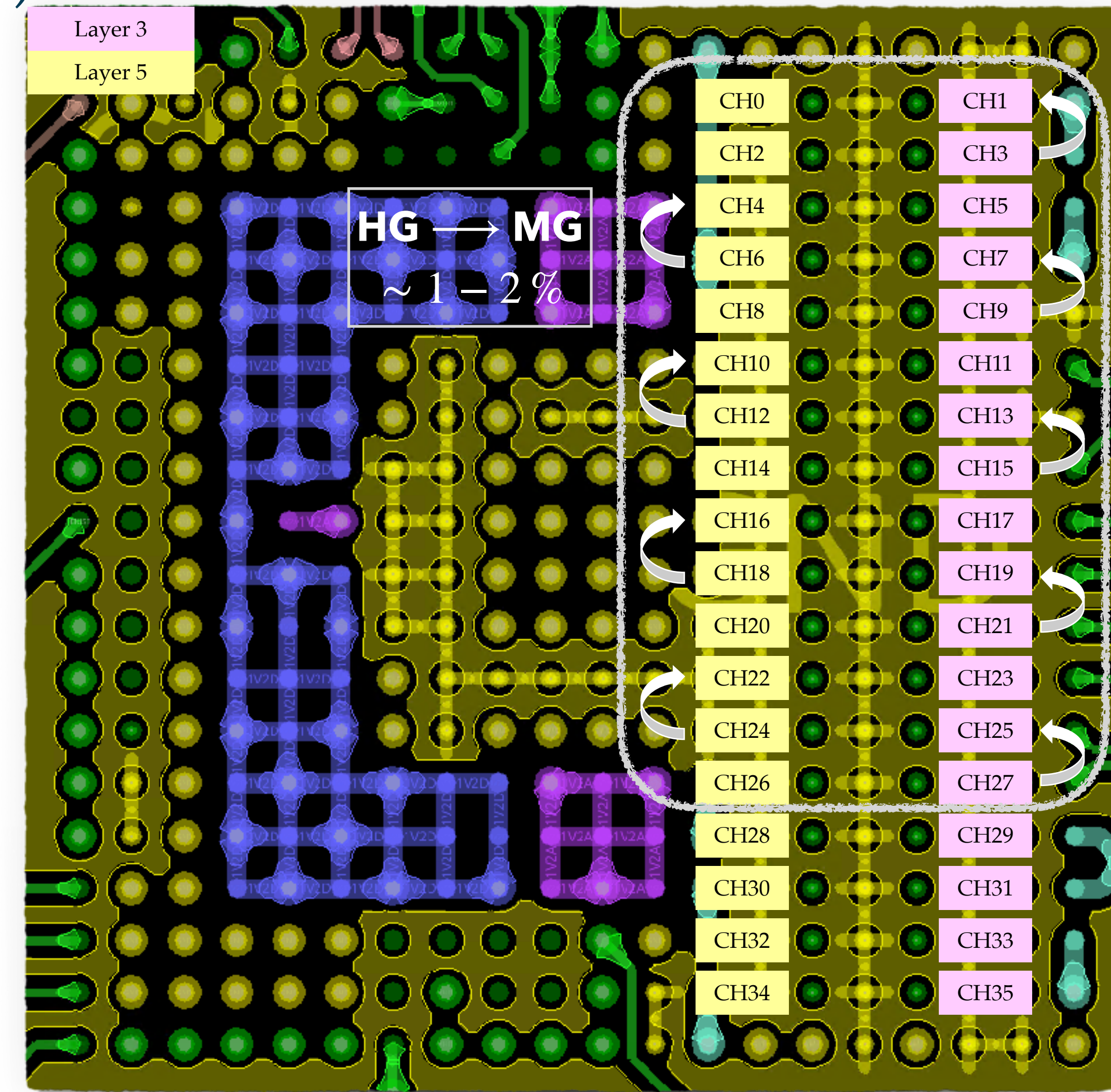
Now...



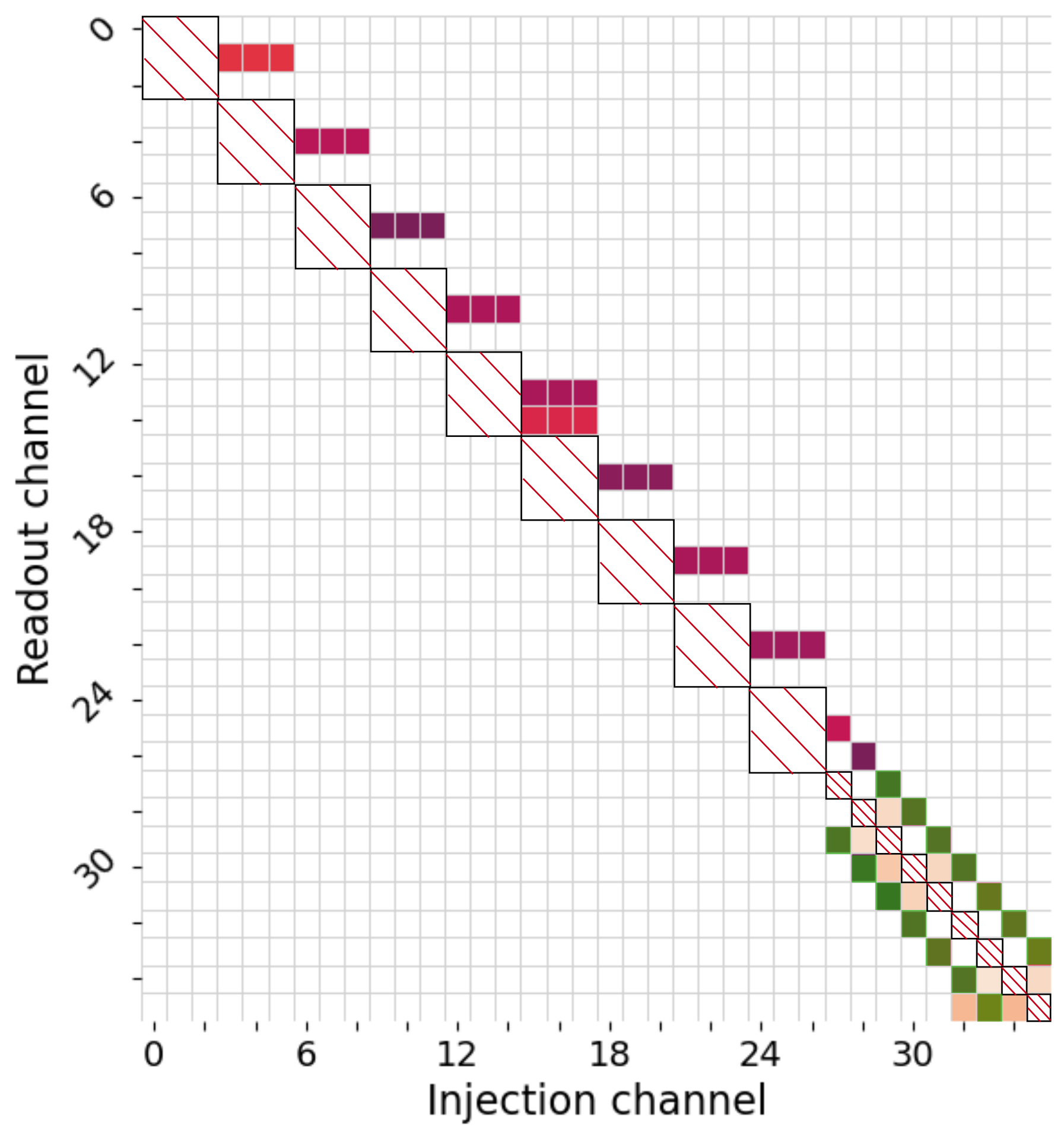
## Close Crosstalk Matrix - Chip v1b + Board v2 (BGA)



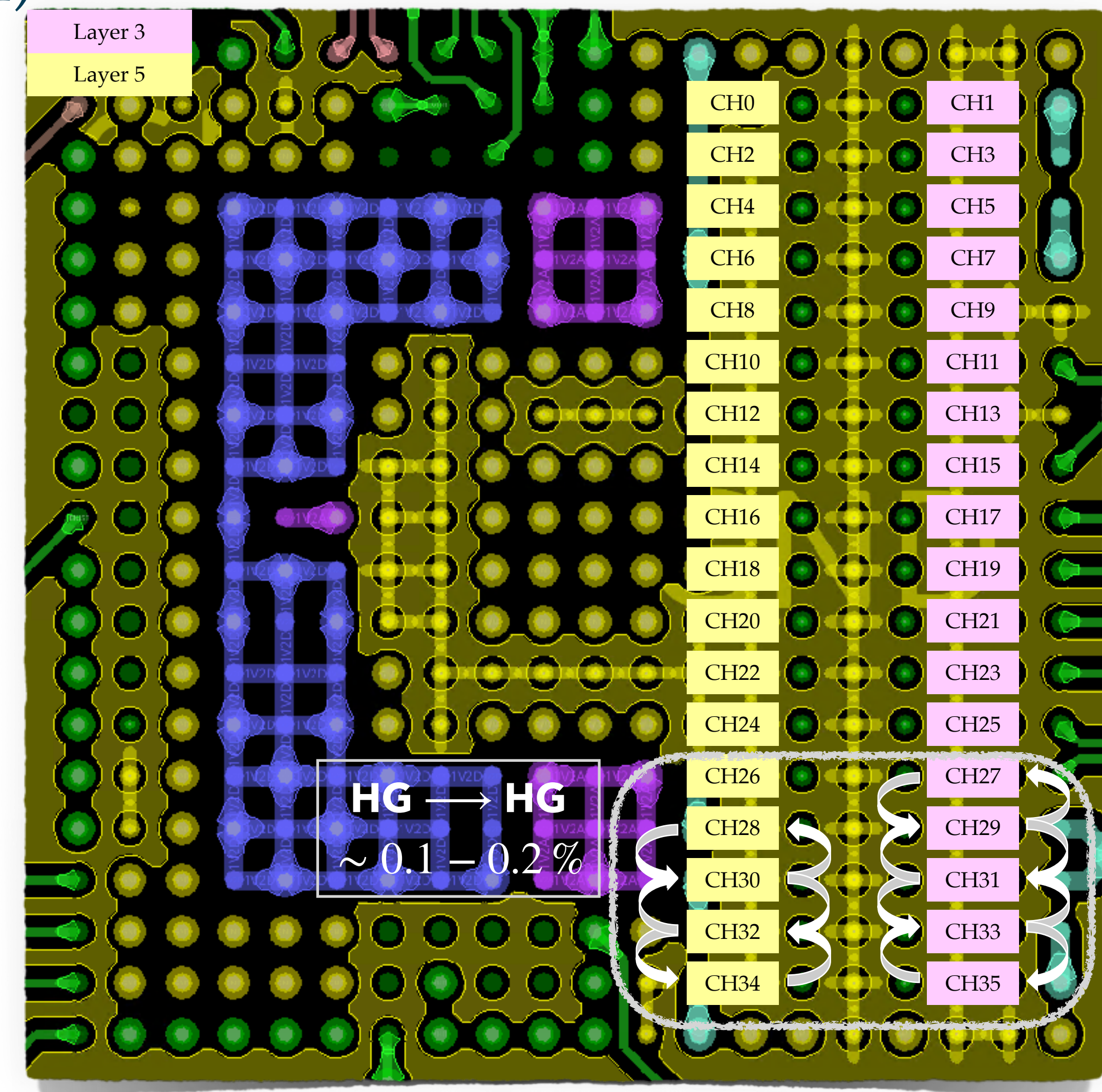
*Expected in-layer  
cross-talk*



## Close Crosstalk Matrix - Chip v1b + Board v2 (BGA)

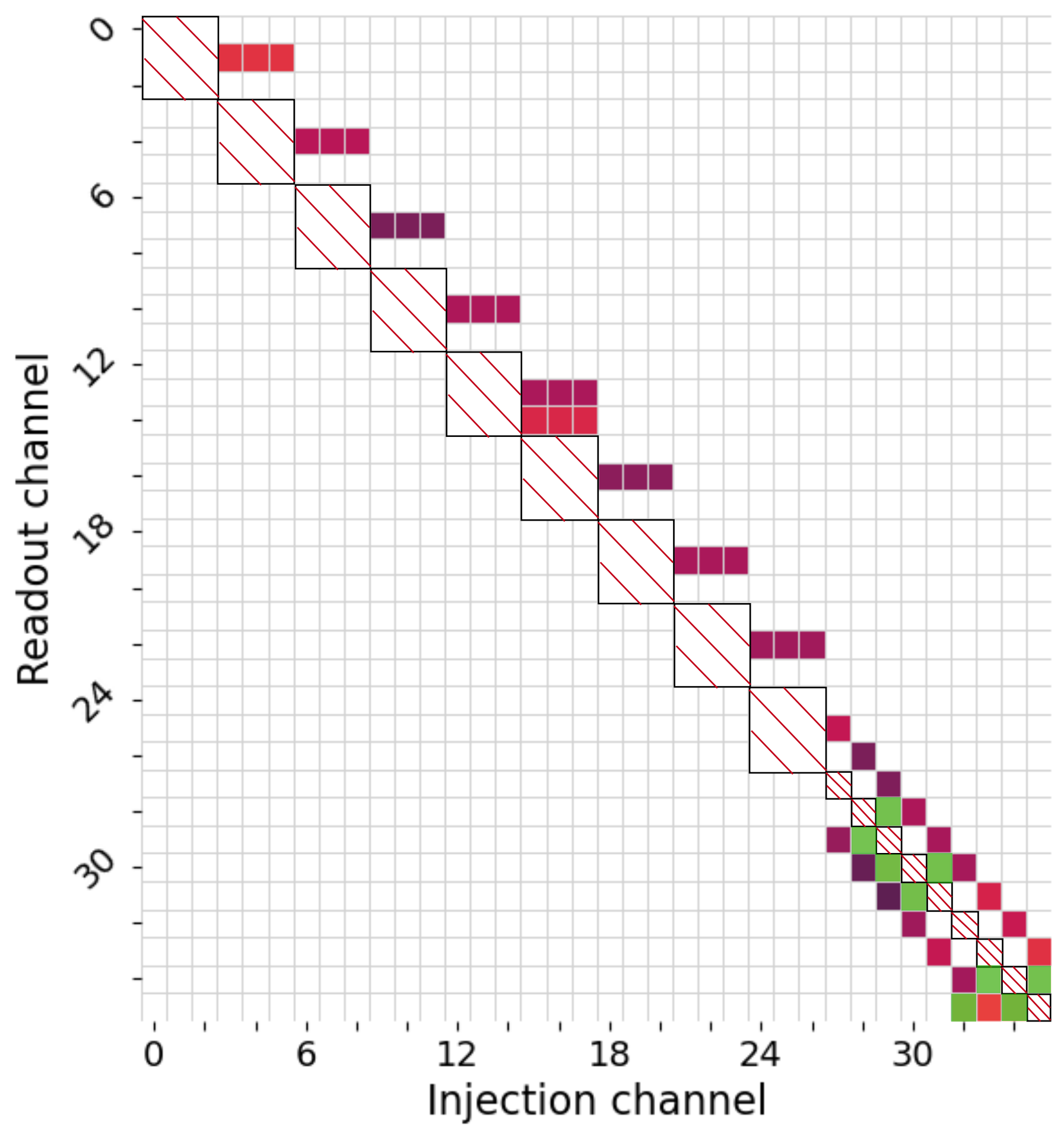


*Expected in-layer  
cross-talk*

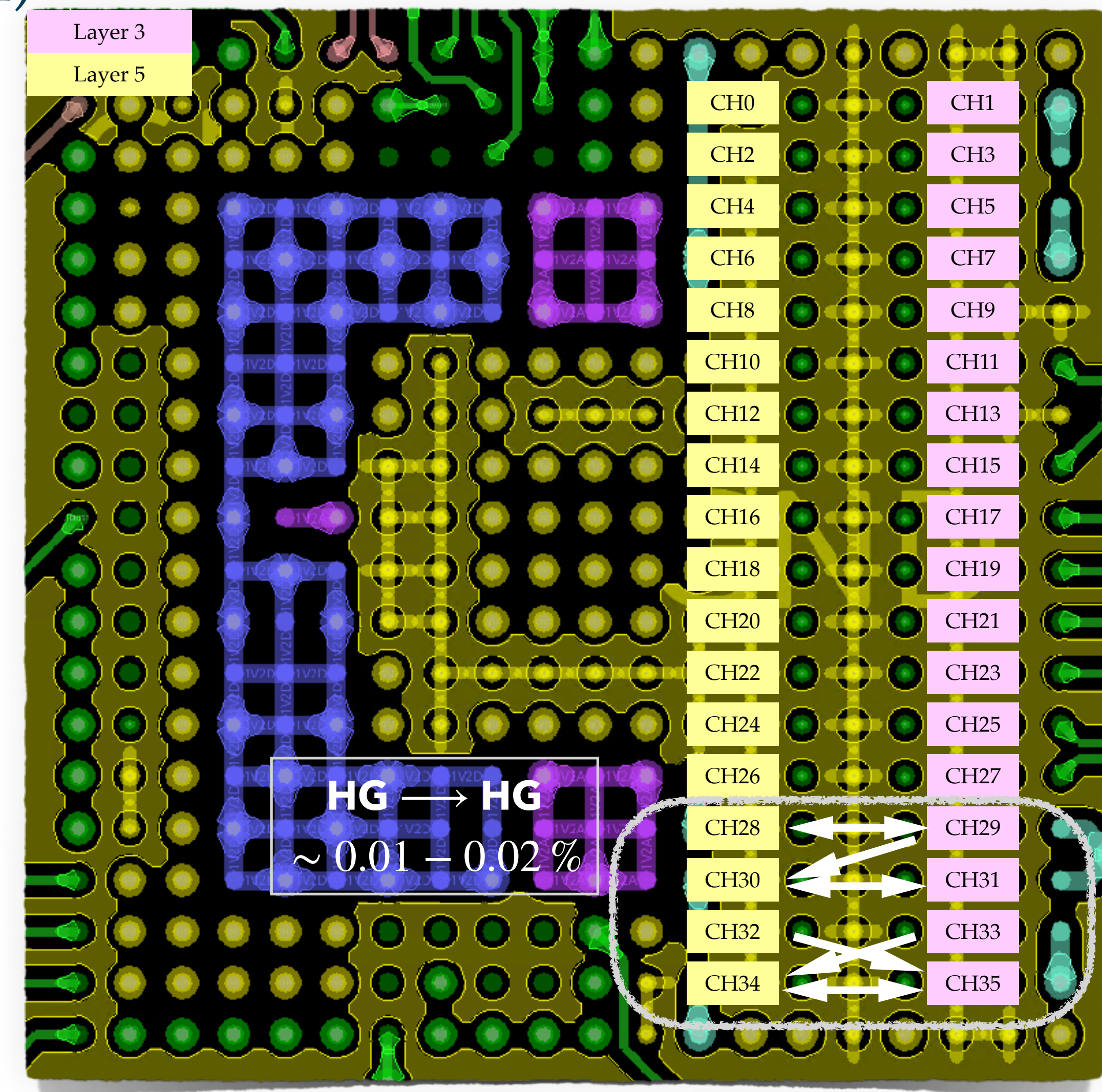




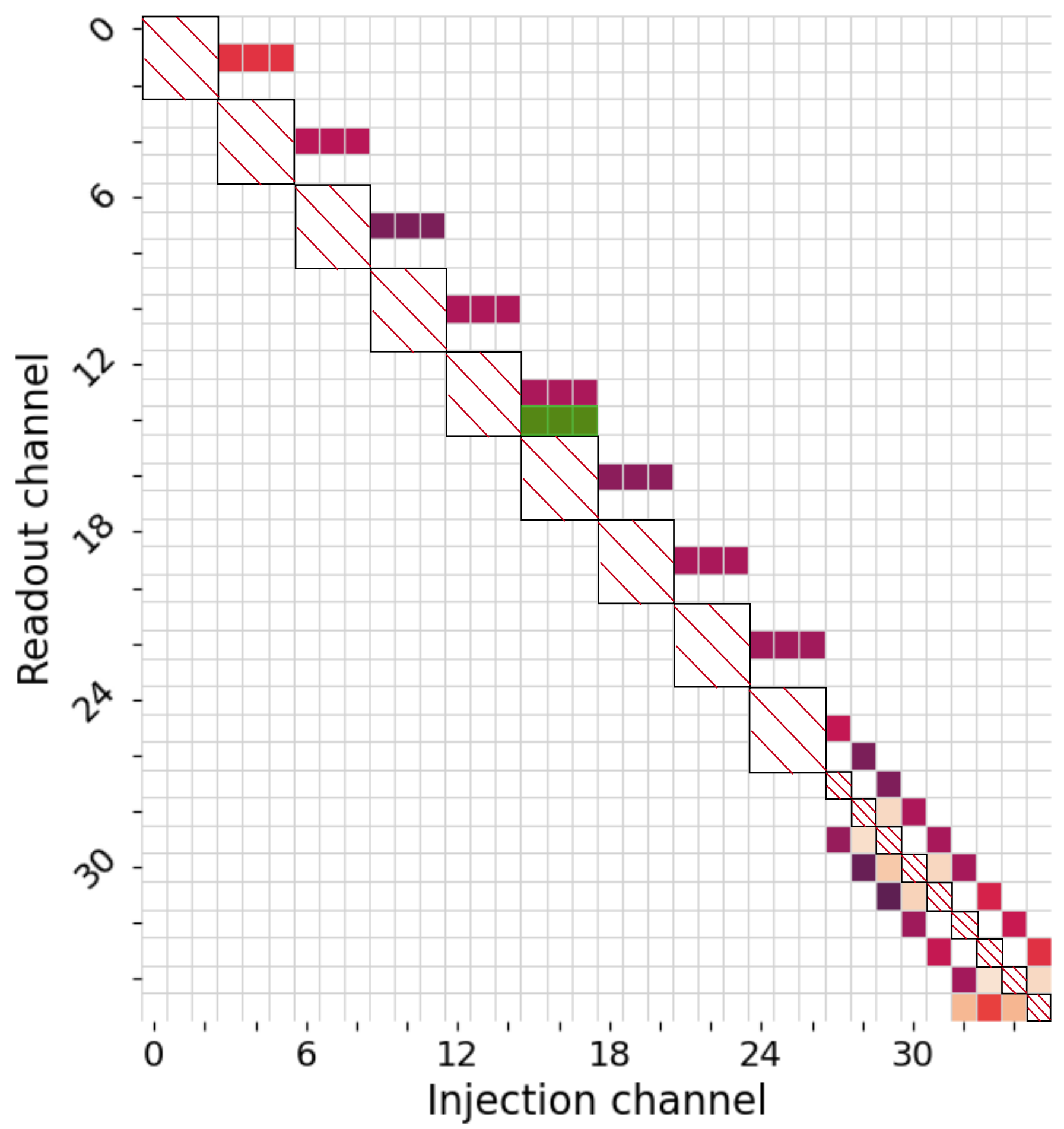
## Close Crosstalk Matrix - Chip v1b + Board v2 (BGA)



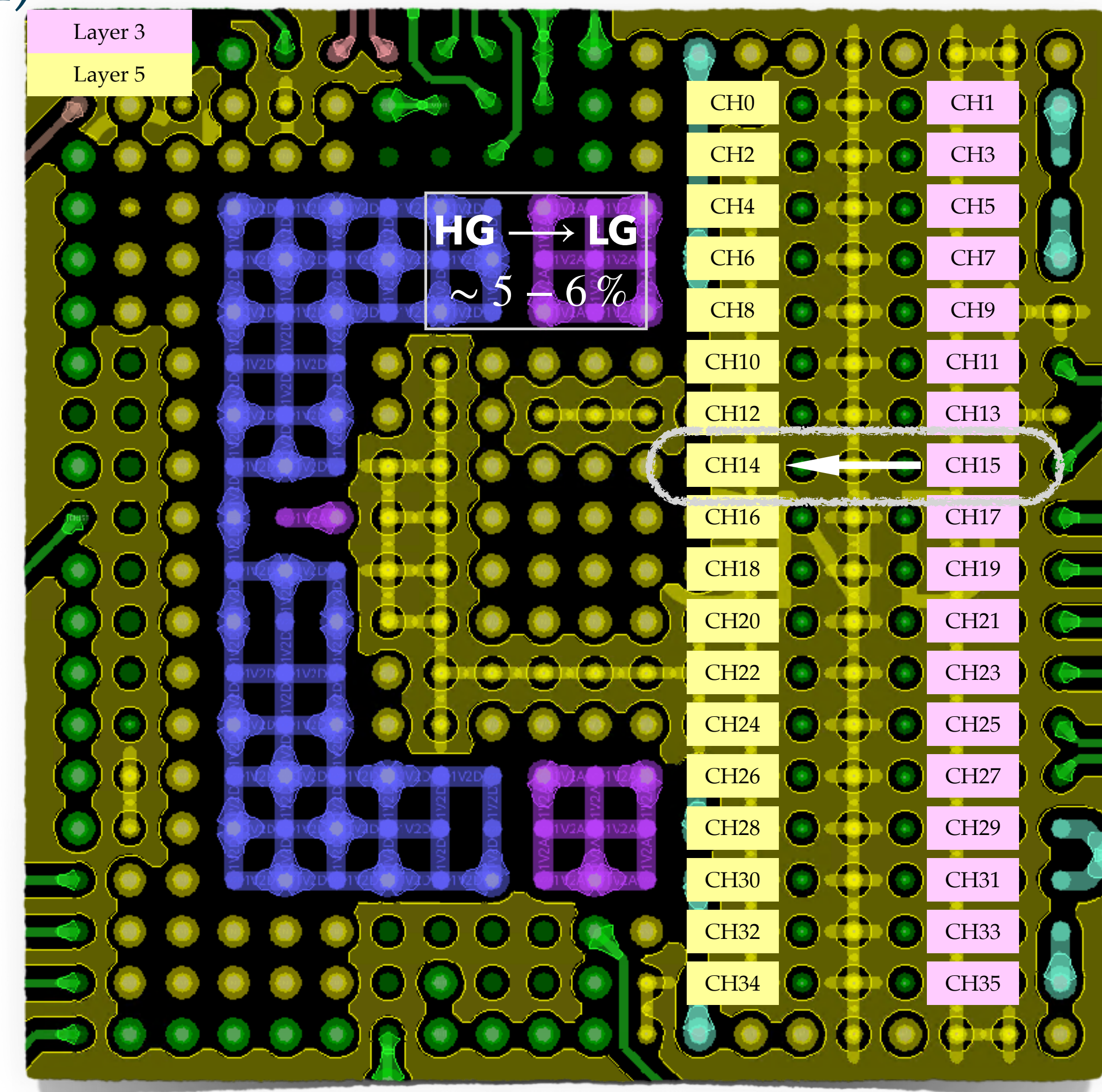
**Abnormal cross-layer cross-talk**



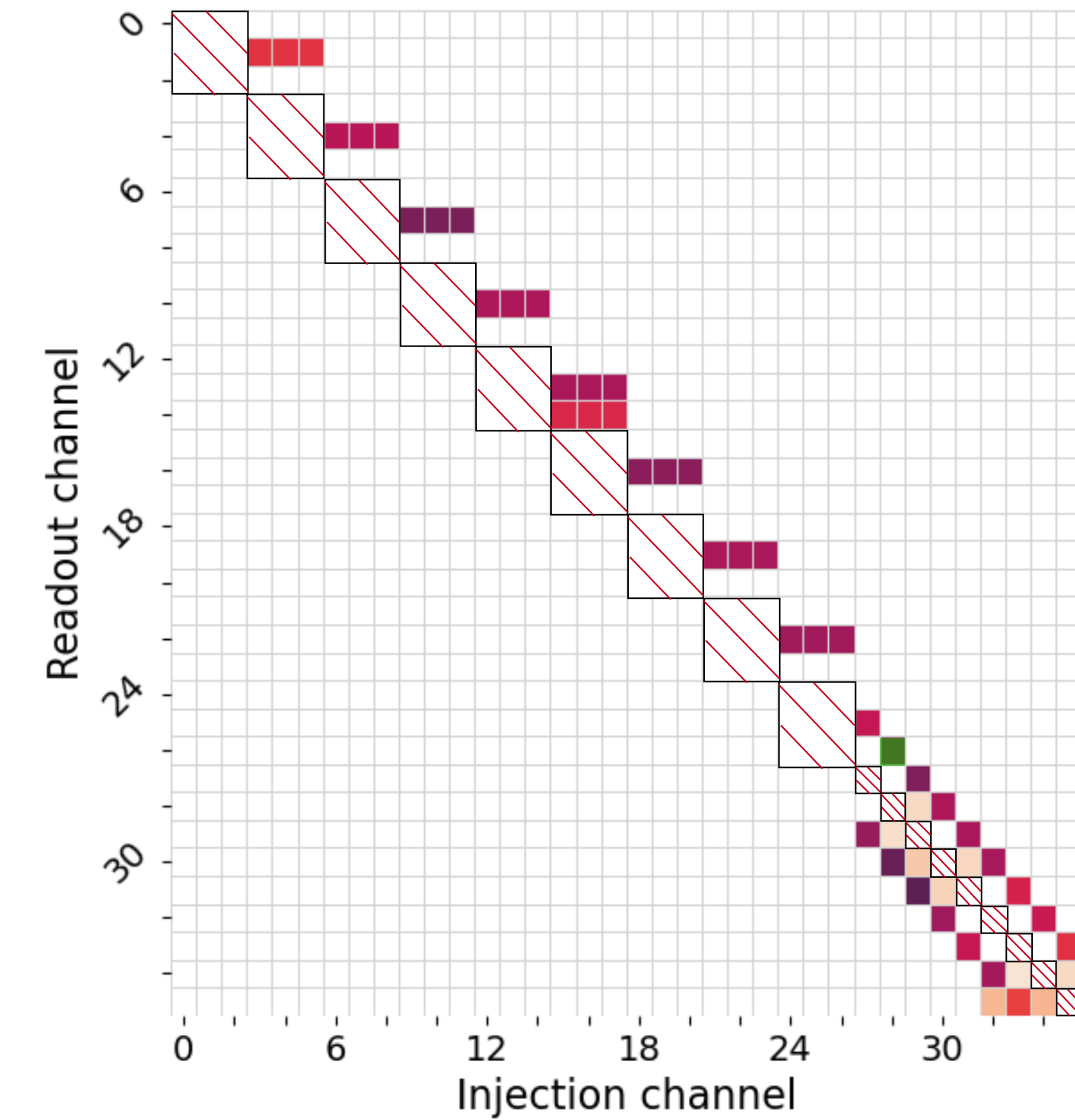
## Close Crosstalk Matrix - Chip v1b + Board v2 (BGA)



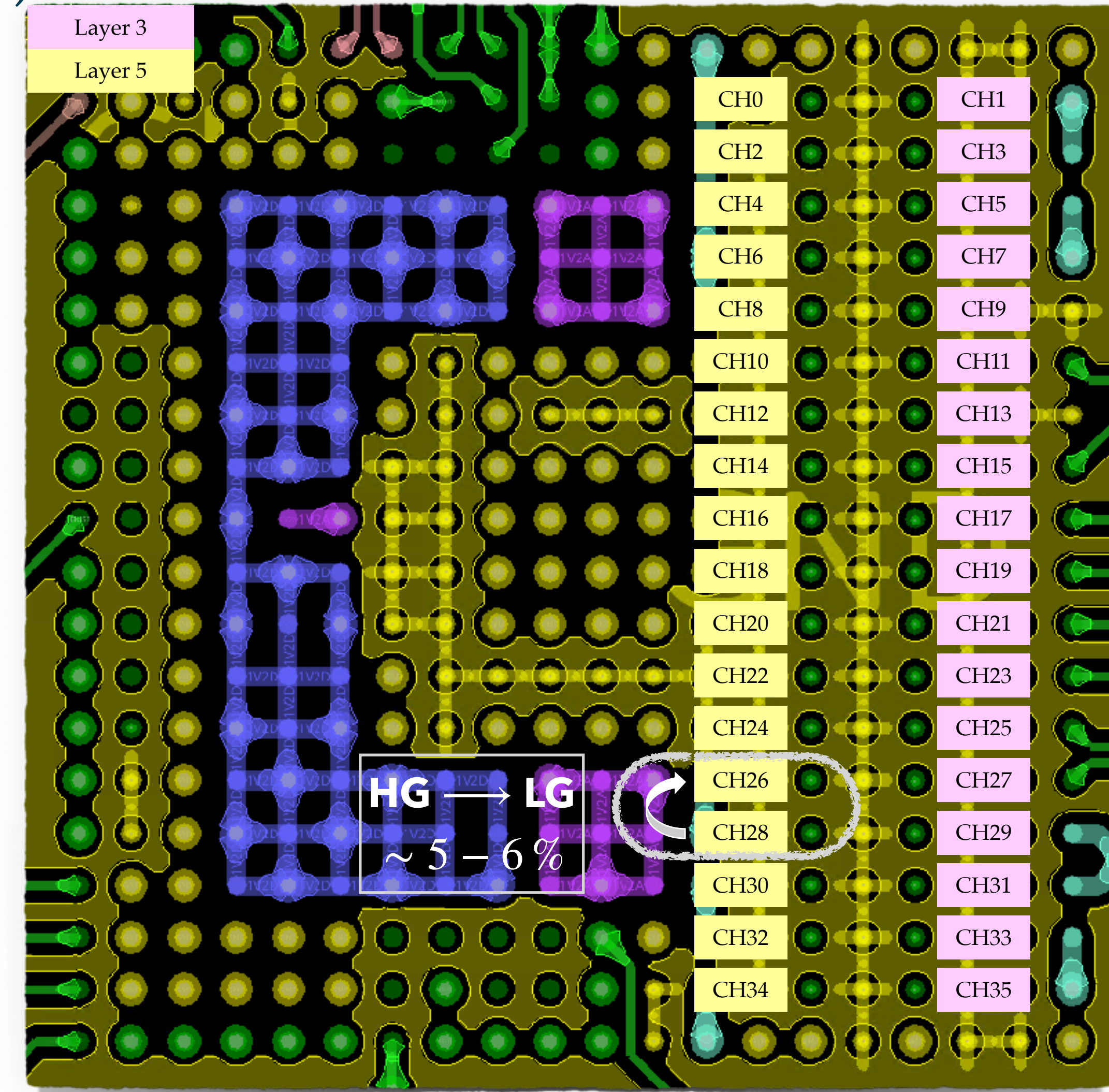
**Problematic cross-layer cross-talk**



## Close Crosstalk Matrix - Chip v1b + Board v2 (BGA)

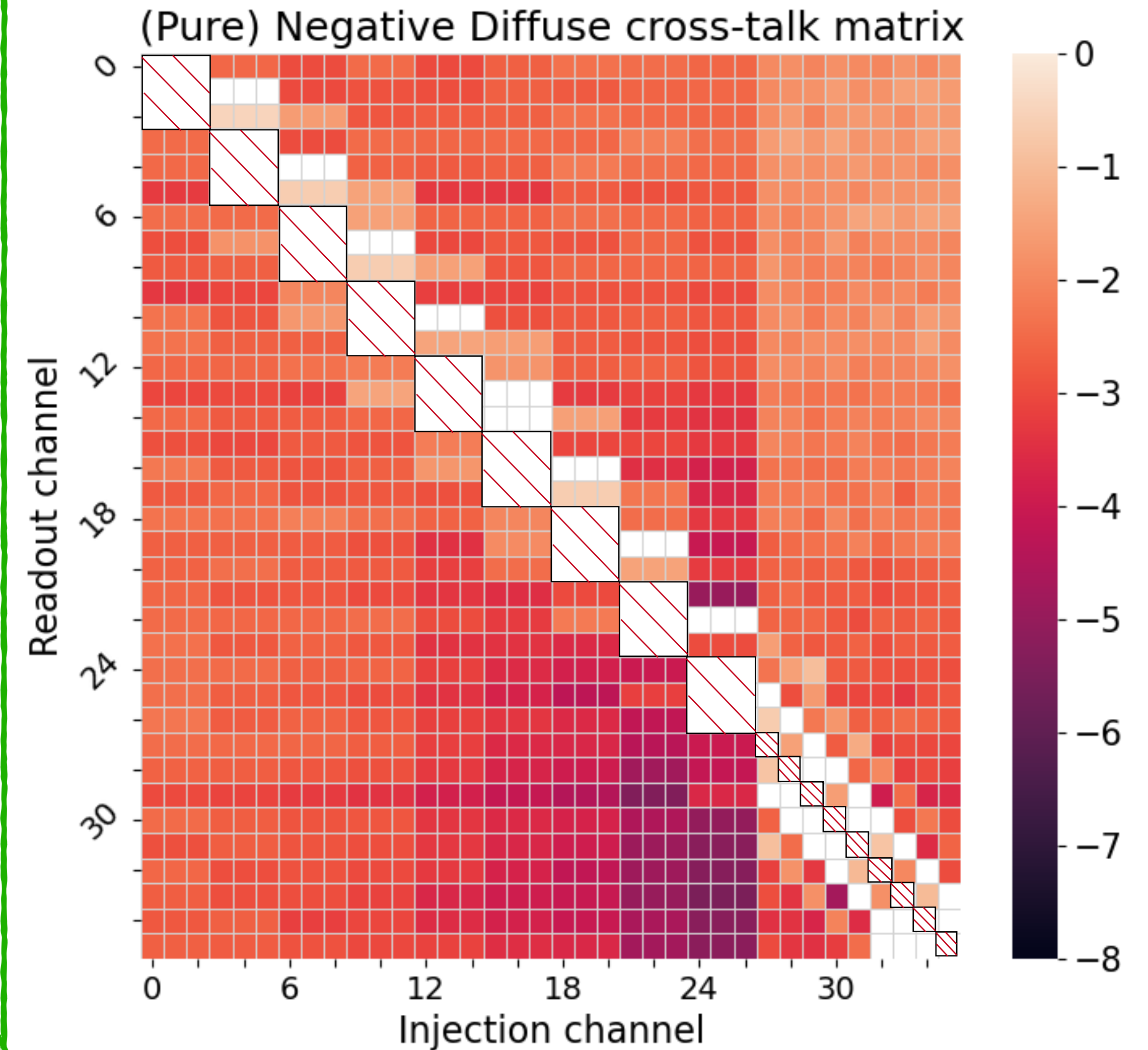
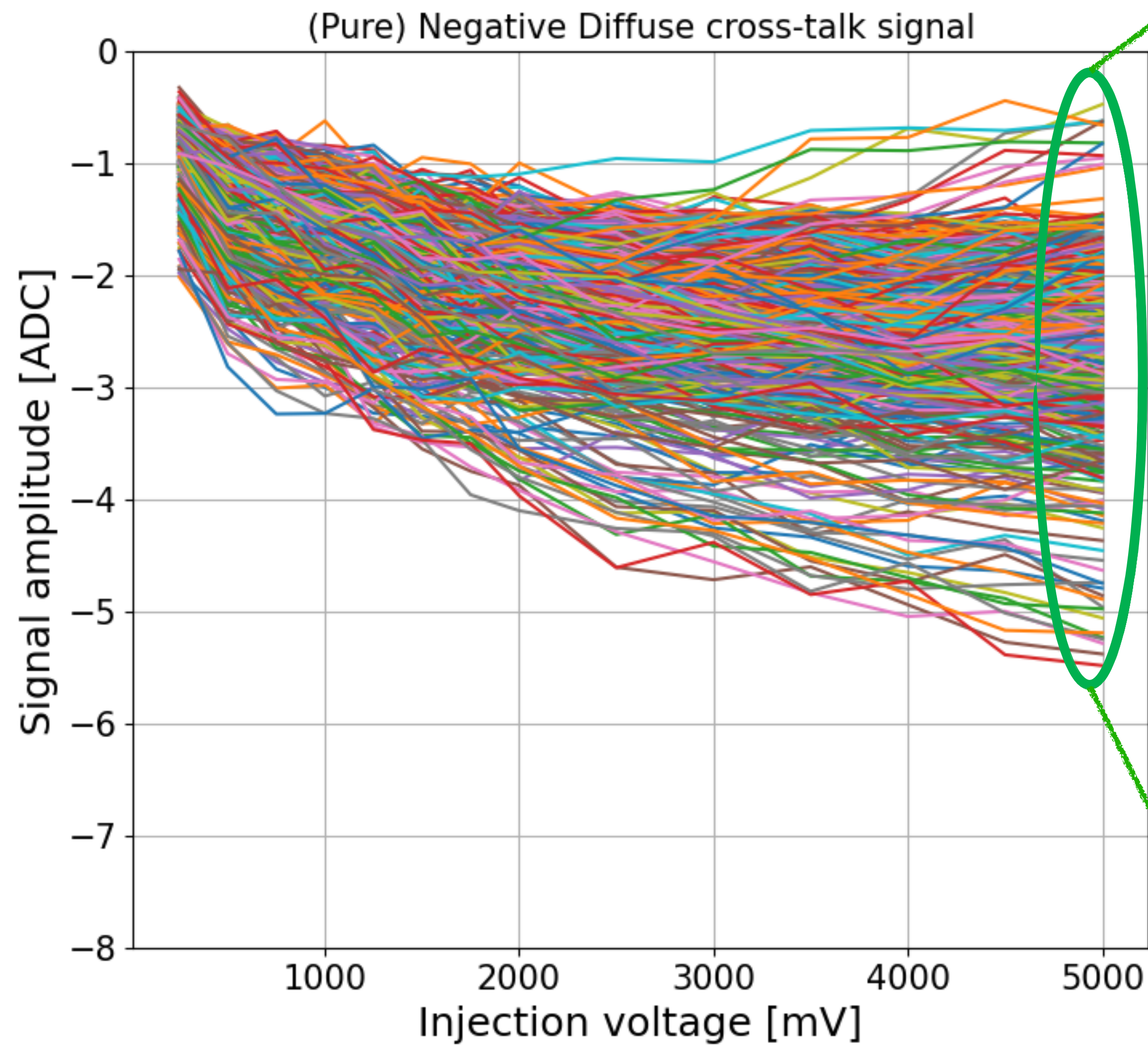


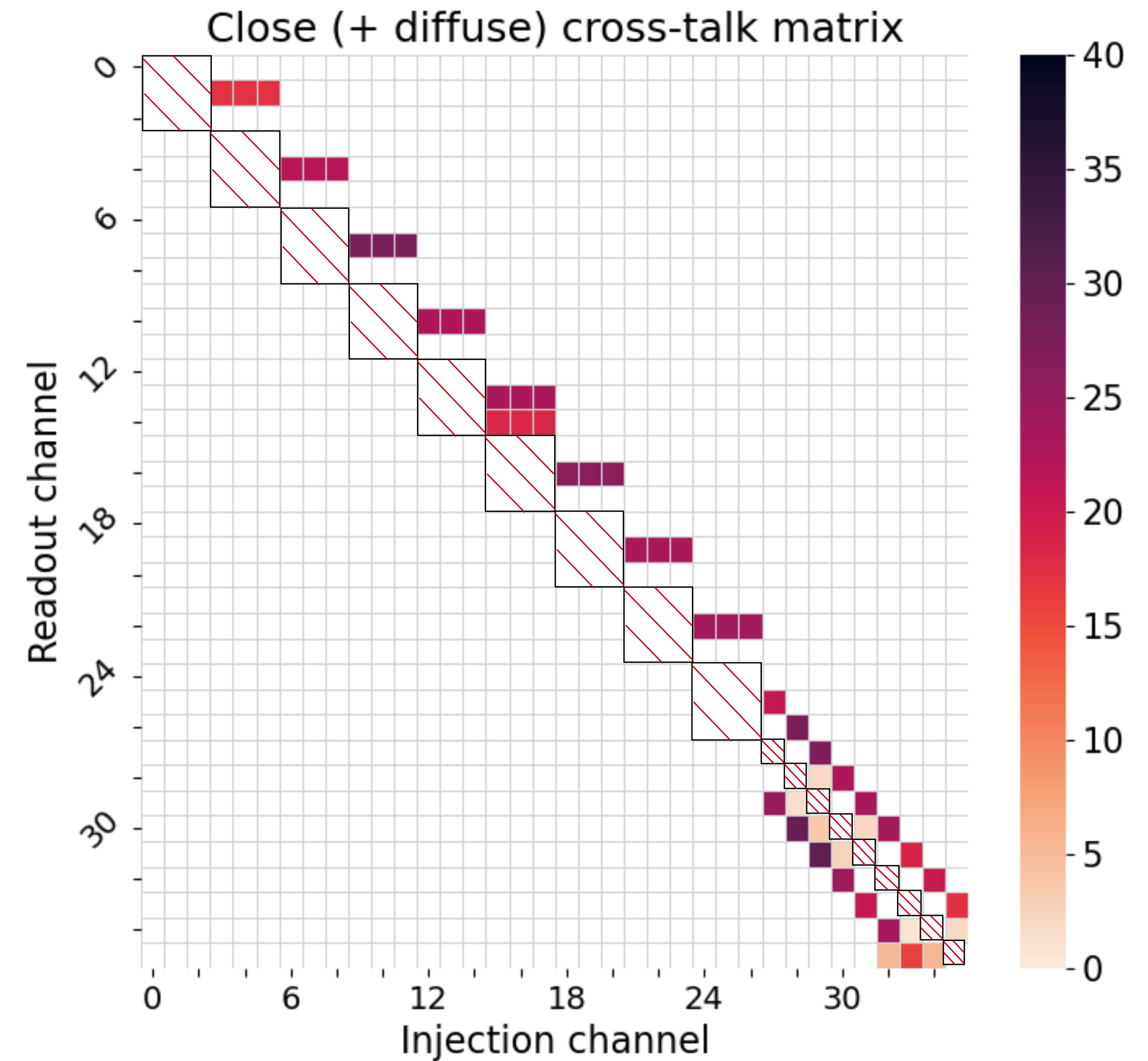
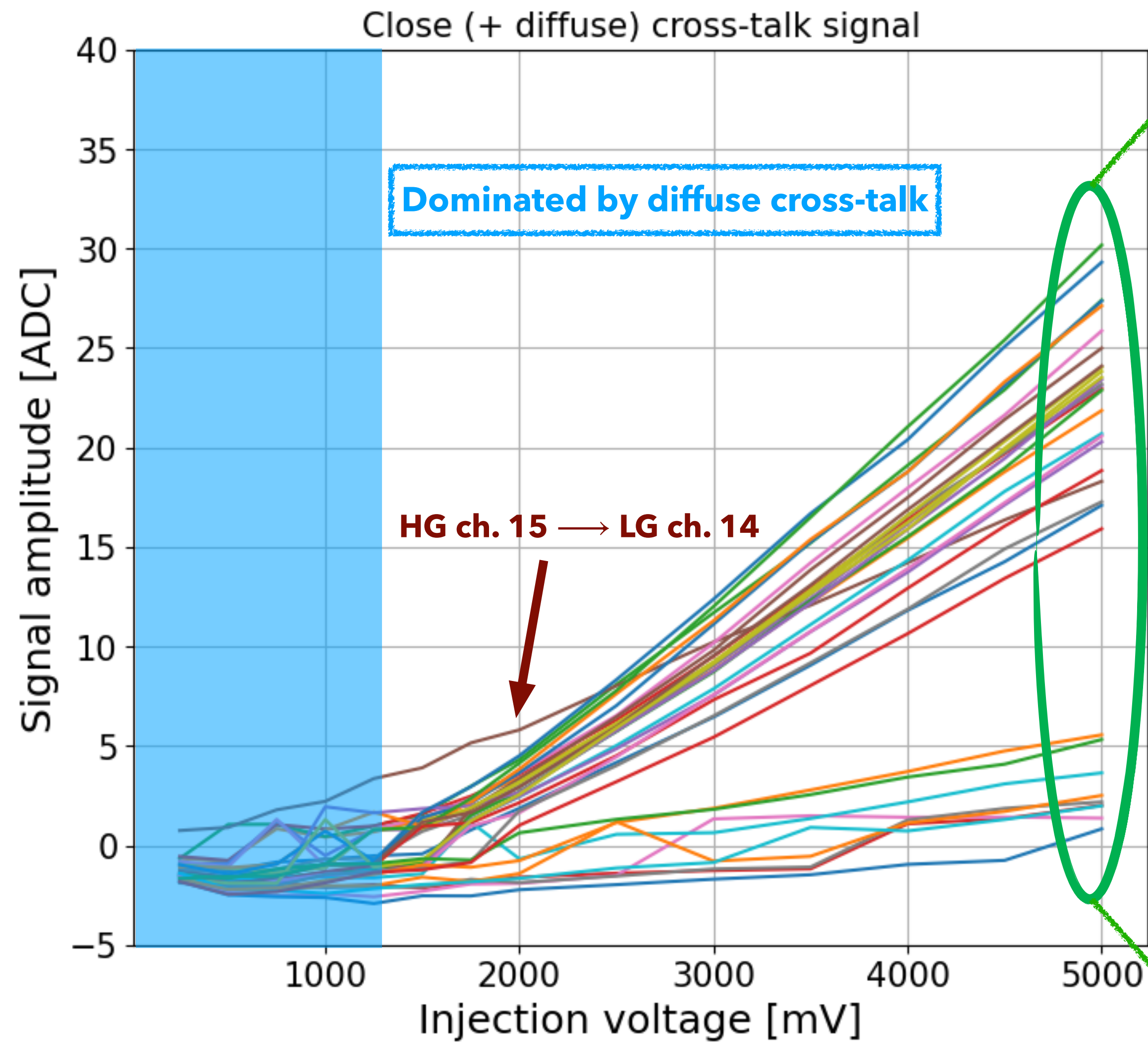
**Problematic in-layer  
cross-talk**



# Linearity measurements

*Chip v1b + Board v2 (BGA)*





## Conclusion

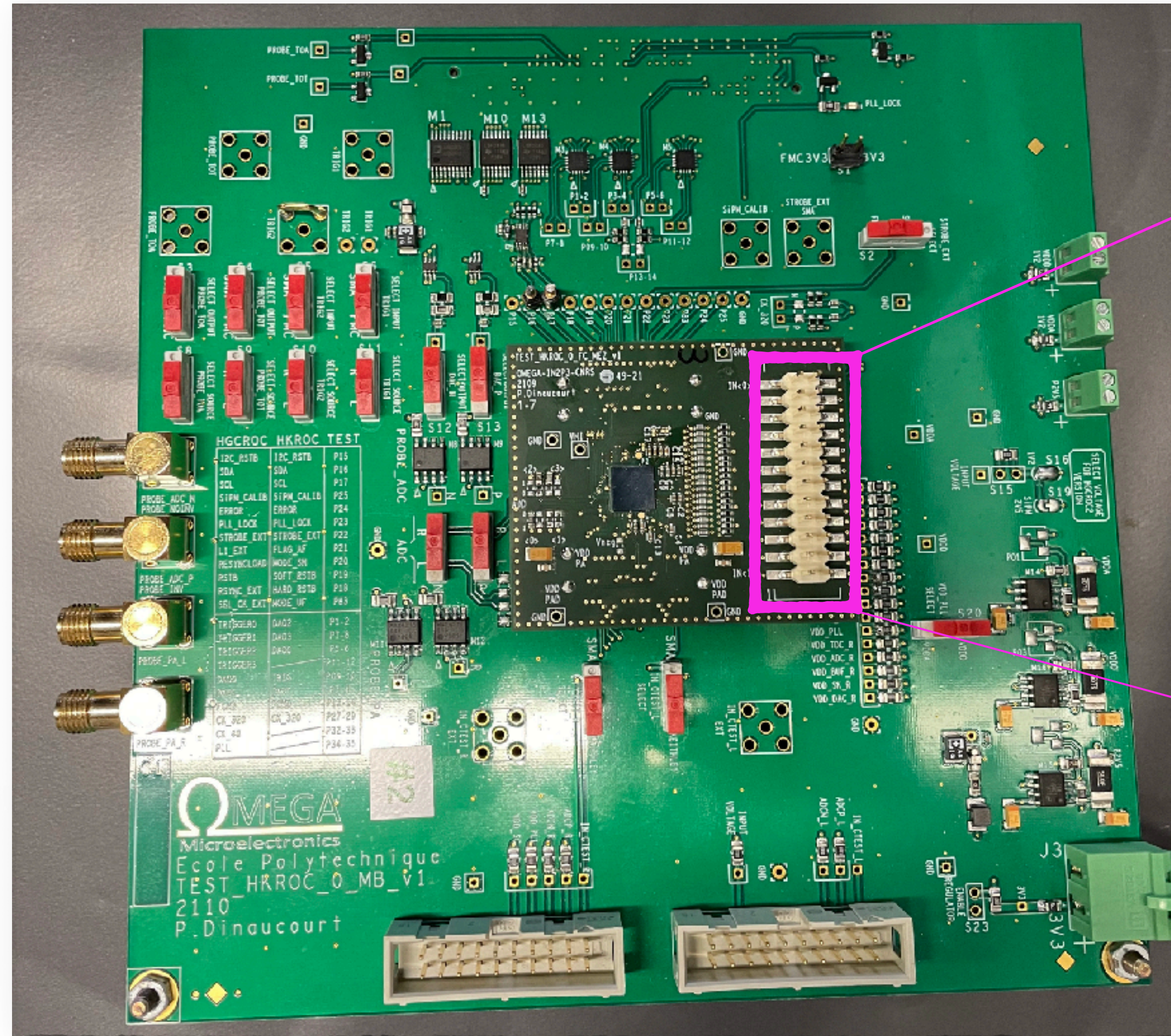
- ➔ Mild dependence of the diffuse cross-talk with injected charge.
- ➔ Linear dependance of the close cross-talk with injected charge.
- ➔ Threshold effect at  $\sim 1200$  mV ( $\sim 200$  p.e.) for the close cross-talk ?

- ➔ Unstable initialization for FIFO 2 and 3 with Chip v1b : *Settled (?)*
- ➔ Impact of cross-talk on charge reconstruction : *Next step...*
- ➔ ToA measurements : *Next-to-next step...*
- ➔ Charge linearity measurements : *Next-to-next-to-next step...*



# Appendix

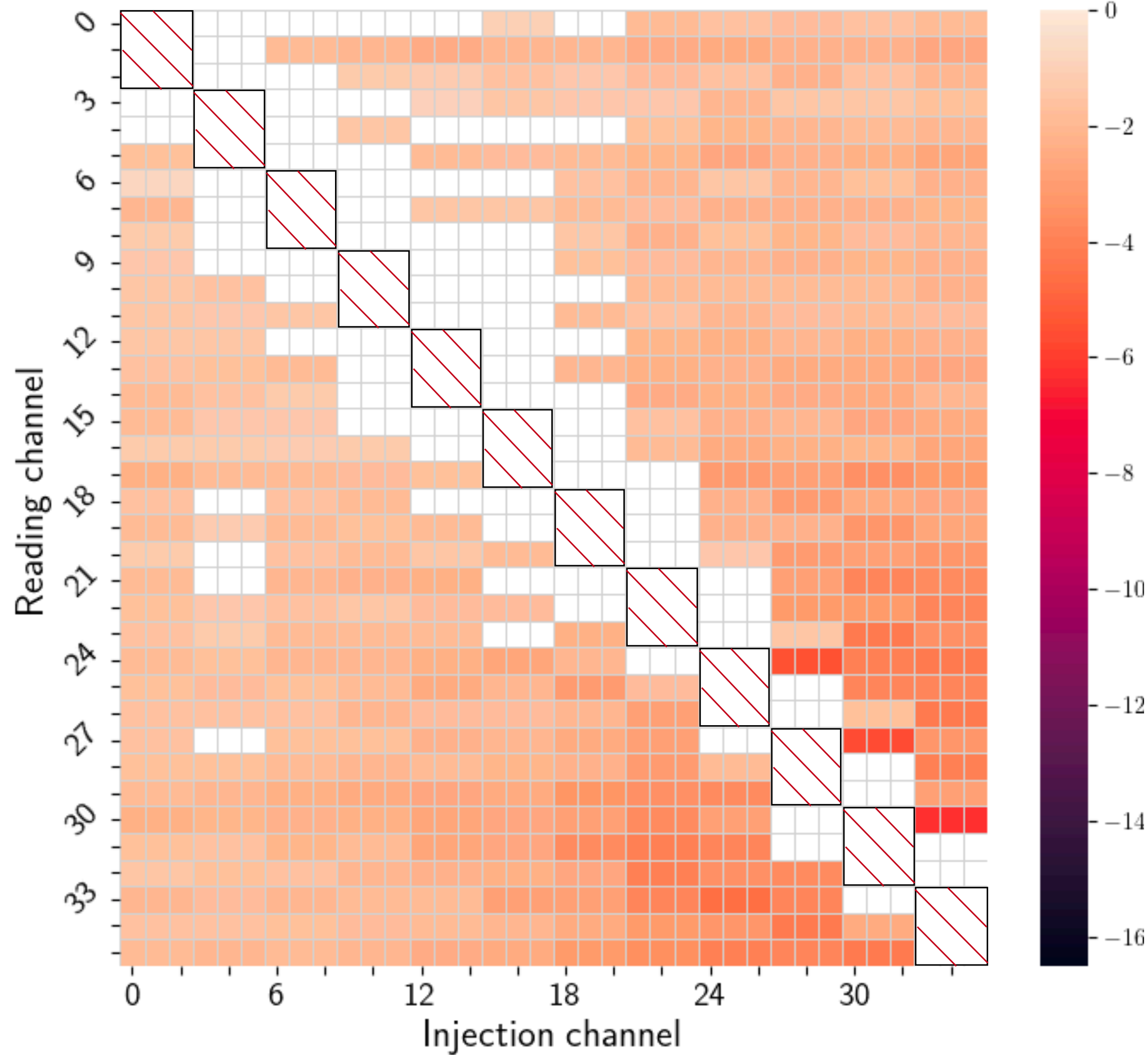
## Board v1 (Mezzanine)



- Pin 0 ↔ Ch. 0-1-2
- Pin 1 ↔ Ch. 3-4-5
- Pin 2 ↔ Ch. 6-7-8
- Pin 3 ↔ Ch. 9-10-11
- Pin 4 ↔ Ch. 12-13-14
- Pin 5 ↔ Ch. 15-16-17
- Pin 6 ↔ Ch. 18-19-20
- Pin 7 ↔ Ch. 21-22-23
- Pin 8 ↔ Ch. 24-25-26
- Pin 9 ↔ Ch. 27-28-29
- Pin 10 ↔ Ch. 30-31-32
- Pin 11 ↔ Ch. 33-34-35

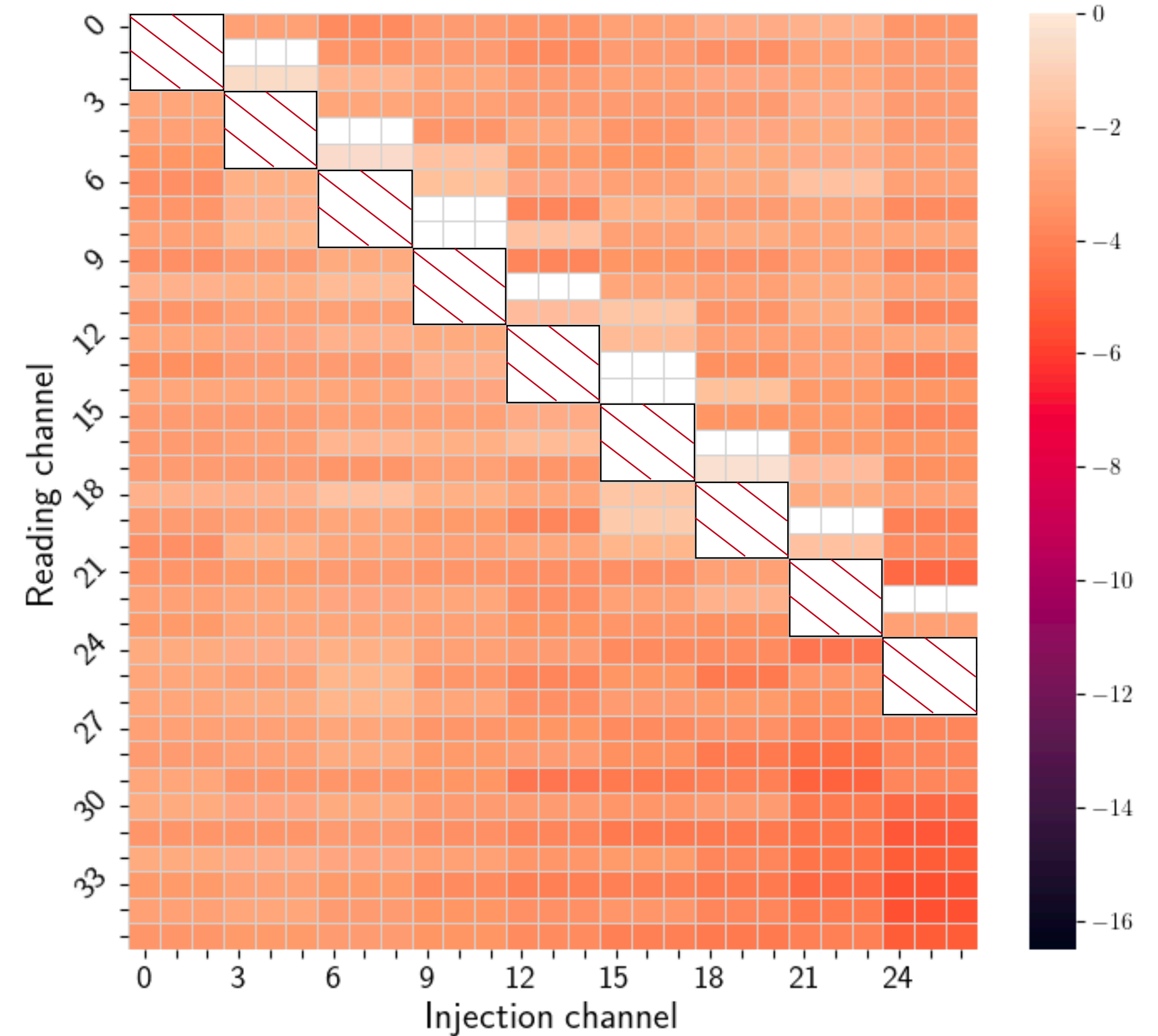
## (Negative) Diffuse Crosstalk Matrices – Chip v1b

Board v1 (Mezzanine) [ADC units]

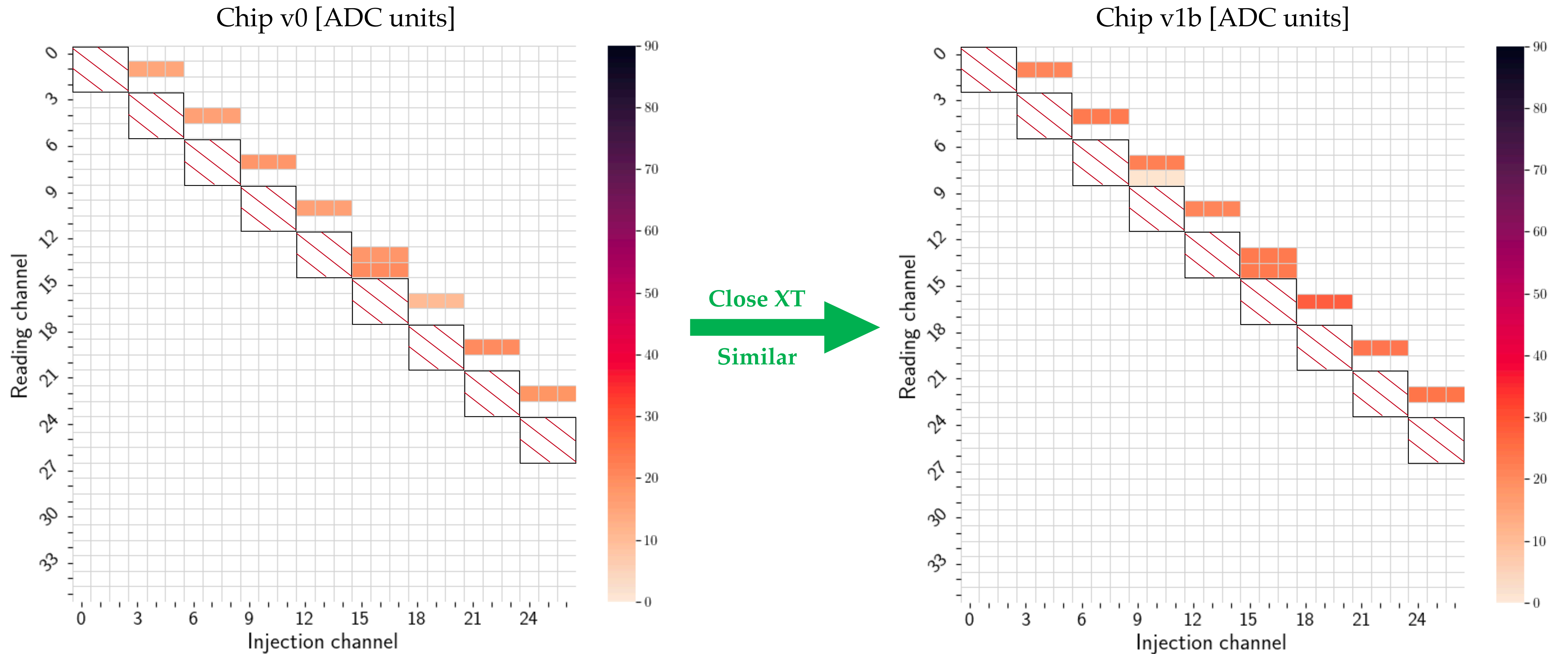


Diffuse XT  
Similar

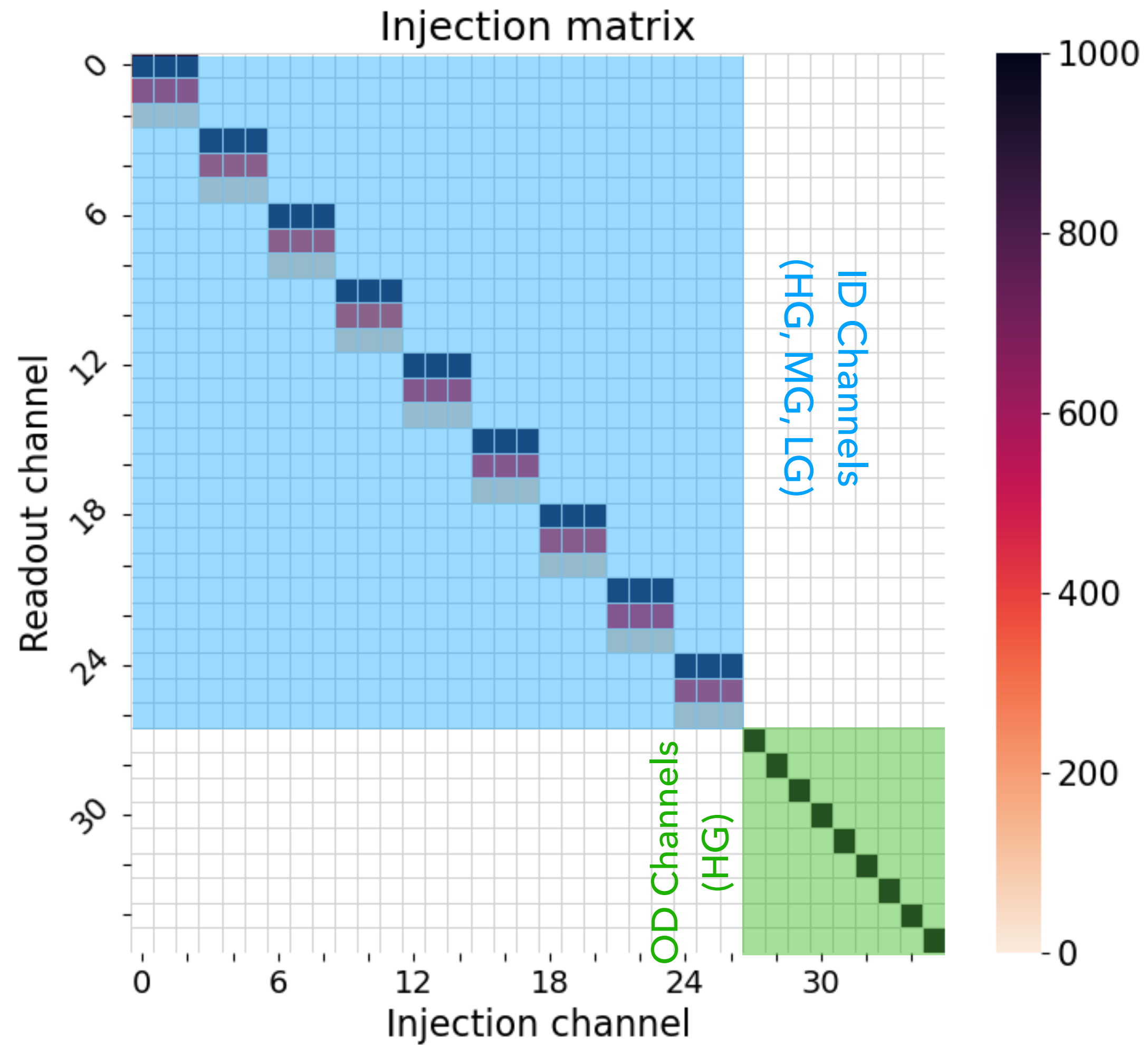
Board v2 (BGA) [ADC units]



## Close Crosstalk Matrices - Board v2 (BGA)



## Injection Matrix - Chip v2 + Board v2 (BGA)



*Input signal ~ 200 p.e.*