



ALLEGRO Meeting at DRD6 kick-off

# Update on PCB studies & plans for CERN PCB prototype v2

Juska Pekkanen

[juska@cern.ch](mailto:juska@cern.ch)

CERN

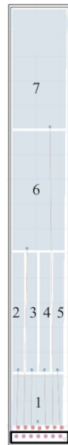
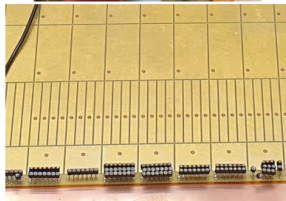
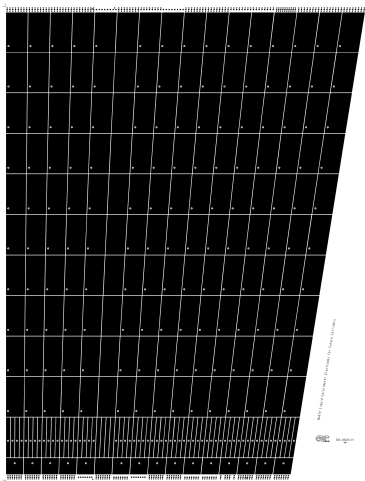
April 10, 2024

# Outline

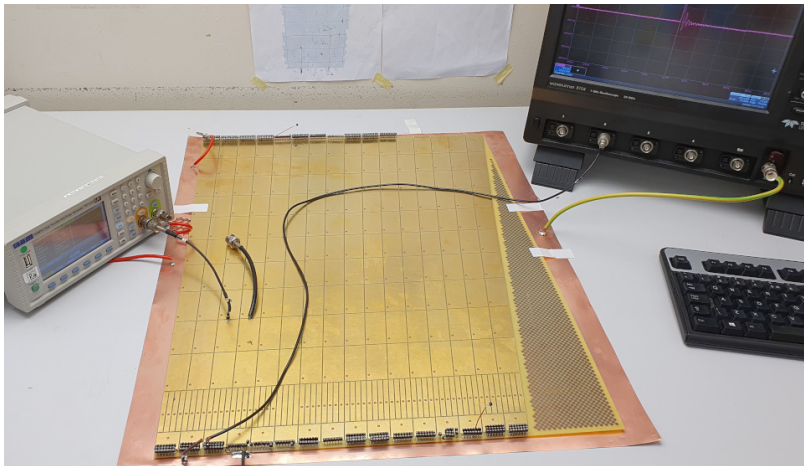
1. Cross-talk from bottom-side of a one-shield tower
2. Cross-talk of strip layer
3. Cross-talk of diagonal neighbors
4. Plans for CERN PCB v2



# Very quick intro to CERN PCB proto v1

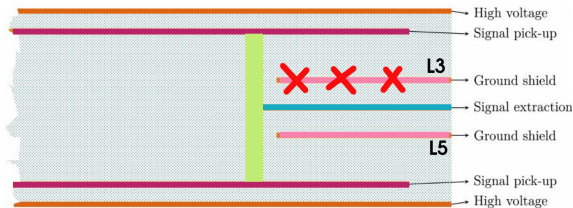


# Very quick intro to PCB measurements



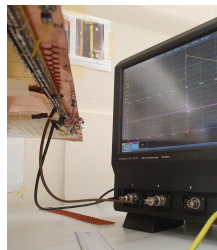
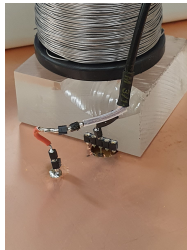
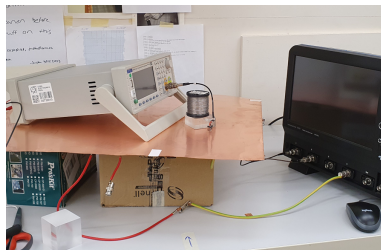
# 1. Cross-talk from the bottom

*Results hot-off-the-press, measurements done on Monday*

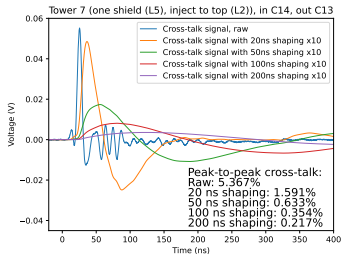
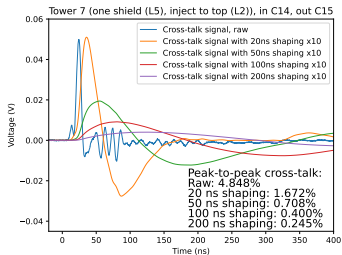


# X-talk from bottom - setup

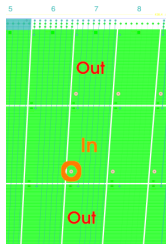
- ▶ Tower 7 with only one shield (in L5 close to "bottom")
- ▶ Needed some creativity to inject to the bottom of the PCB
  - "Top" side full of connectors, can't just turn around
- ▶ Implemented by placing the PCB on cardboard supports and drilling a hole to bottom "absorber"
- ▶ Absorbers on both sides, as is the golden standard



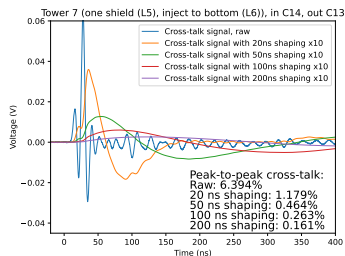
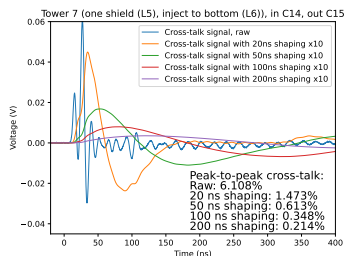
# X-talk from top - the "normal case"



- ▶ Injecting to "top" side of tower 7 through a hole in the absorber
- ▶ Readout from the back - inject to cell 14
- ▶ Readout from C15 (top) and C13 (bottom)
- ▶ Cross-talk down to 0.21-0.25% with 200 ns shaping



# X-talk from bottom - the "new case"



- ▶ Injecting to "bottom" side of tower 7 through a hole in the absorber
- ▶ Readout from the back - inject to cell 14
- ▶ Readout from C15 (top) and C13 (bottom)
- ▶ Cross-talk down to 0.16-0.21% with 200 ns shaping
- ▶ Raw cross-talk higher, but after shaping lower
- ▶ **Injecting to side closer to shield yields slightly lower x-talk**
  - As ~expected..?



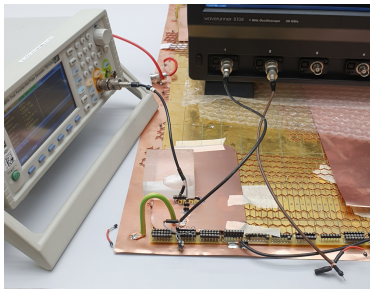
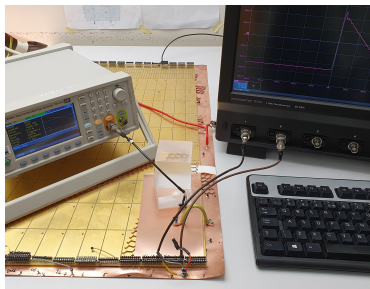
## 2. Cross-talk to neighbors and diagonal neighbors

*Similar results were distributed already in March. These are based on a new set of measurements of the same injection scheme.*

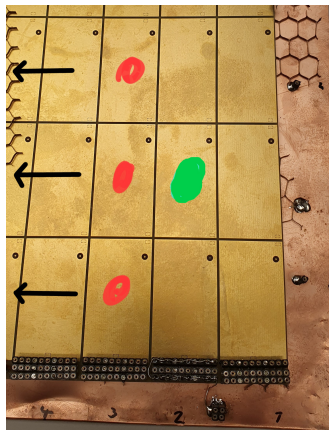
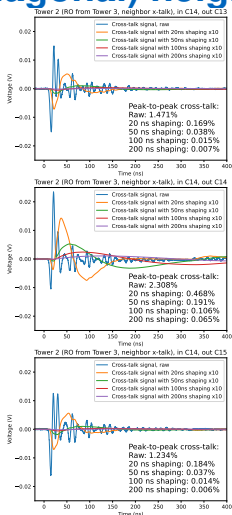


# Neighbor x-talk studies

- ▶ X-talk measured from neighboring and diagonally neighboring cells and neighboring strips
- ▶ "Top absorber" added and used as a near ground for injection probe
- ▶ Using Tower 2 (baseline) and readout from the back; cells 13, 14, 15



# X-talk to (diagonal) neighbor cell



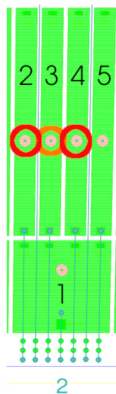
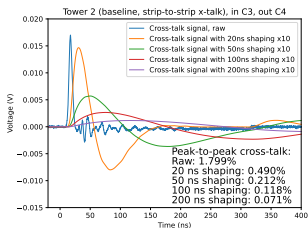
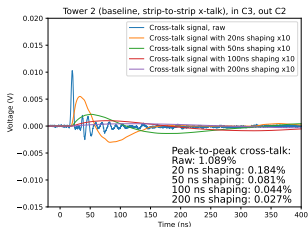
- ▶ At 200 ns shaping, diag. X-talk 0.007%, neighboring 0.07%
- ▶ X-talk signal starts with a dip in all cases

# 3. Cross-talk between strips

*These results are based on new and more careful measurements than those distributed in March.*

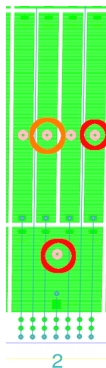
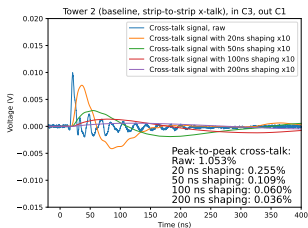
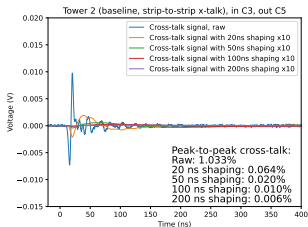


# X-talk to neighbor strip (revisited)



- ▶ X-talk from cell 3 to 2 down to 0.03%, from C3 to C4 2x higher (0.07%).
- ▶ Signal trace of cell 6 acting as a shield?

# X-talk to neighboring strips (revisited)



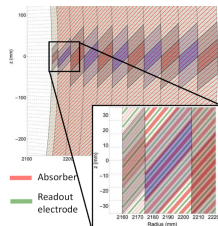
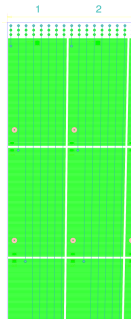
- ▶ X-talk from cell 3 to 5 down to 0.006%, from C3 to down to C1 0.04%
- ▶ X-talk in cell 5 starts with a dip

# 4. Plans for CERN PCB prototype v2



# Plans for next prototype

- ▶ Plan to produce a new PCB in the coming months
- ▶ We try to produce one with 7 and one with 6 copper layers - but with less (half?) towers
- ▶ Readouts only from the outer edge
- ▶ Out-of-the-box connectors (à la Paris proto?)
- ▶ 11 radial layers, cells growing in length ("projective")
- ▶ Ground shields connected inside PCB
- ▶ Some towers with "lateral" shields between signal traces (see strip-to-strip x-talk plots!)
- ▶ CERN PCB lab contacted. No show-stoppers, 6-layer version needs a lot of modifications.
- ▶ Other ideas?





# Back-up



