Update on B-field evaluations of DiRICH & MCP-PMTs

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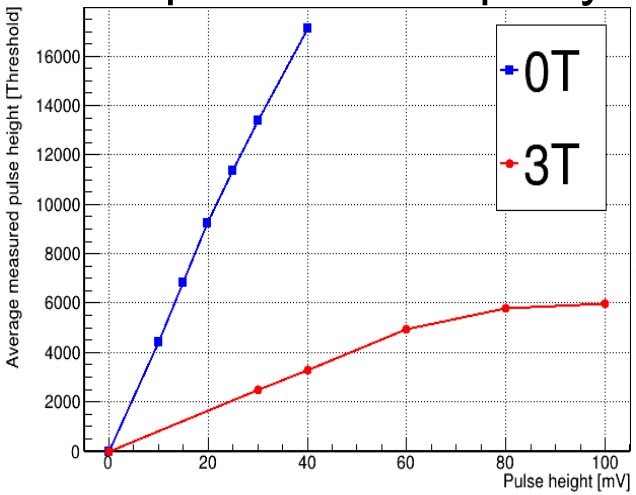
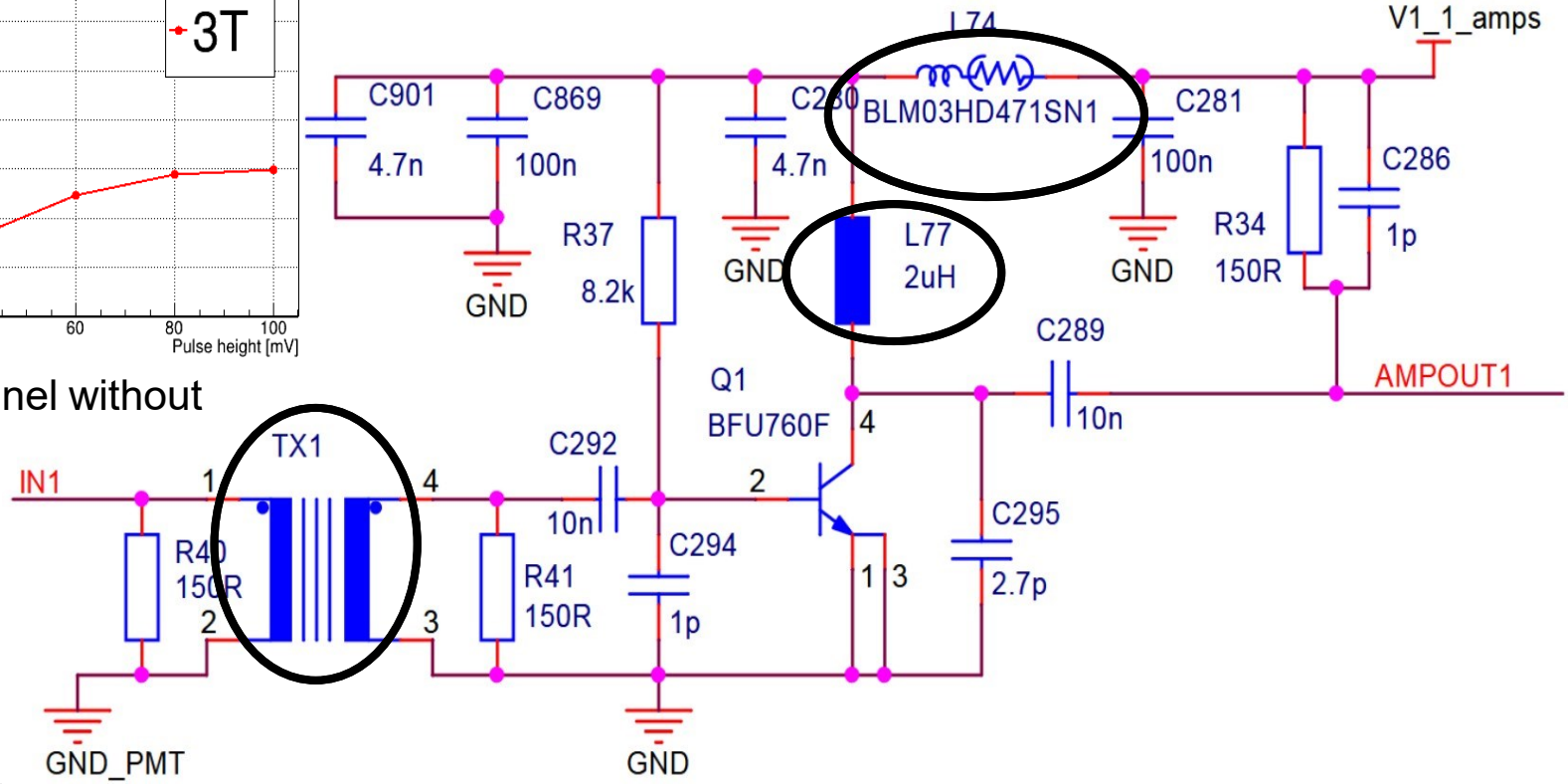
Signal damping concerns with DiRICH in B-Field

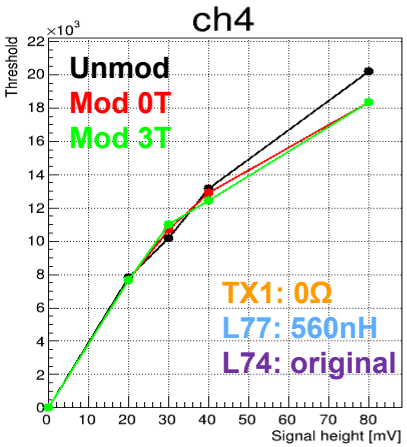
- Last time shown by Merlin Böhm
- Picture below shows input stage of one DiRICH input channel
- Ferrites of the coils (TX1, L77, L74) saturate at above 0.3 – 0.7T
- Amplification drops by factor of ~ 5 – 6 @ 3 Tesla

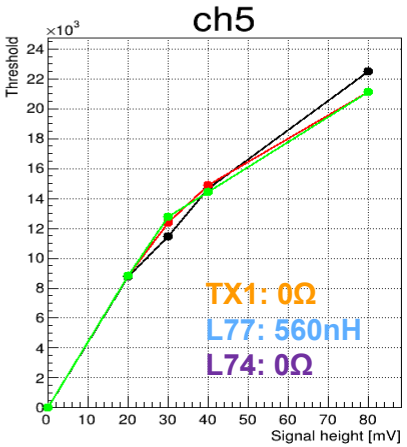


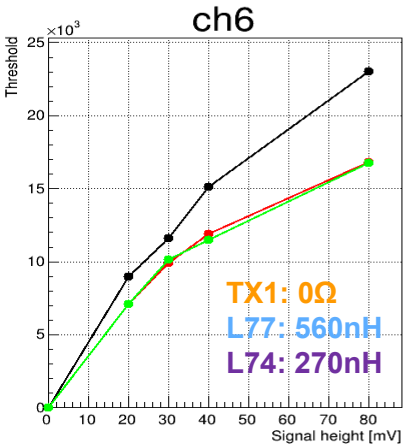
Modified channel without transformer

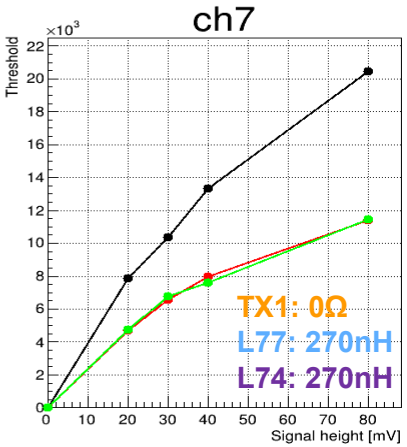


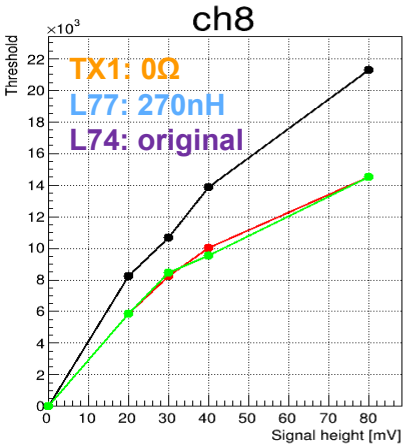
Signal damping concerns with DiRICH in B-Field

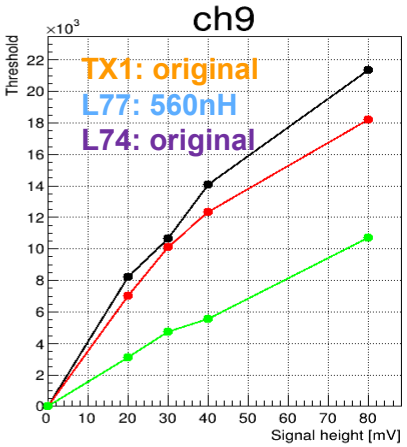


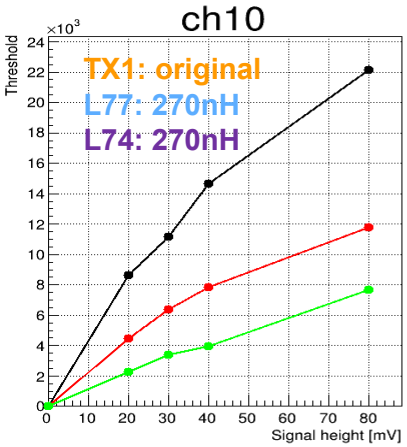


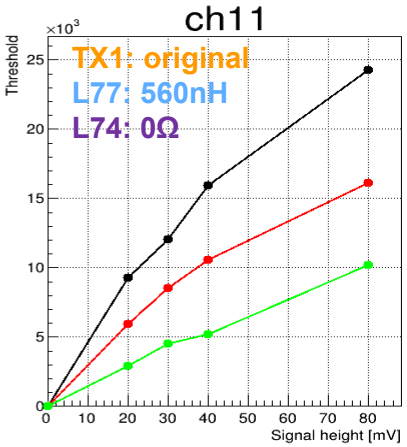


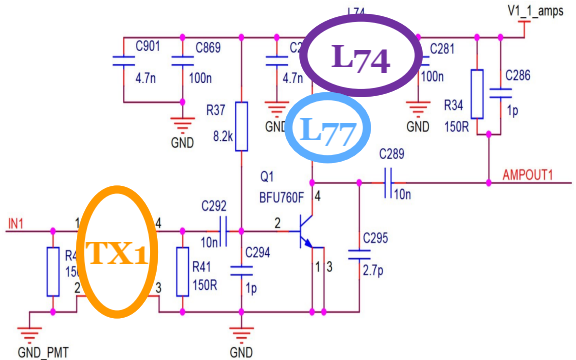












Point at (0;0) artificially added

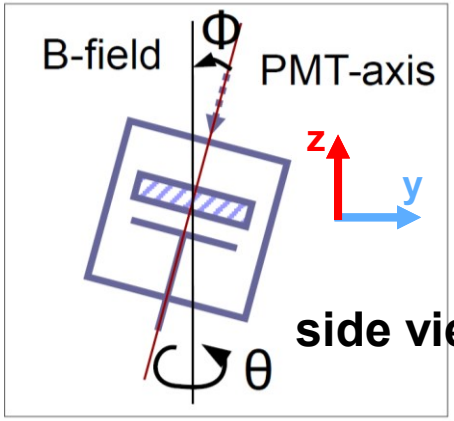
Signal damping concerns with DiRICH in B-Field

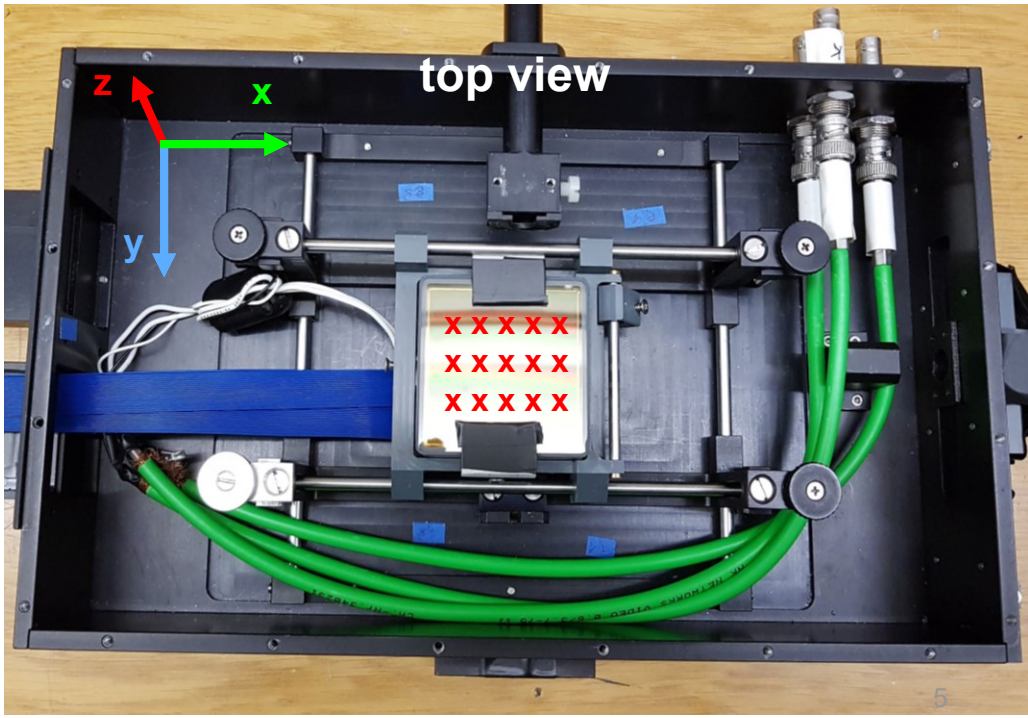
channel	modified/ original	mod 3T / mod 0T	total loss (mod 3T/ original)	L77 [nH]	L74 [nH]	TX1
				Modifications		
4	0.98	0.91	**0.89**	560	original	0Ω bridge
5	1.03	0.92	**0.95**	560	0Ω bridge	0Ω bridge
6	0.79	0.92	**0.72**	560	270	0Ω bridge
7	0.60	0.87	**0.52**	270	270	0Ω bridge
8	0.75	0.88	**0.65**	270	original	0Ω bridge
9	0.91	0.46	**0.42**	560	original	**original**
10	0.57	0.49	**0.28**	270	270	**original**
11	0.70	0.49	**0.34**	270	0Ω bridge	**original**

- Recommended configuration: channel 4 with total loss of **only 11%**
- New idea by Carsten: exchange TX1 with 2 x 10 nF condensators
- not tested yet

shifts of charge cloud centroid in B-field

- Measurement:
  - tilting of the tube in yz plane around x axis, scanning in y direction, B-field in z direction, E-Field along yz plane
- Expectations:
  - **geometrical shift** of charge cloud in y direction
  - ➢ electrons will follow B-field direction, depends on tilt angle, saturates at certain B-field strength
  - **lorentz shift** of charge cloud in x direction
  - ➢ electrons experience Lorentz force perpendicular to E- and B-field depending on **B-field strength** & **tilt angle** (higher Φ increases $E_\perp$ component)

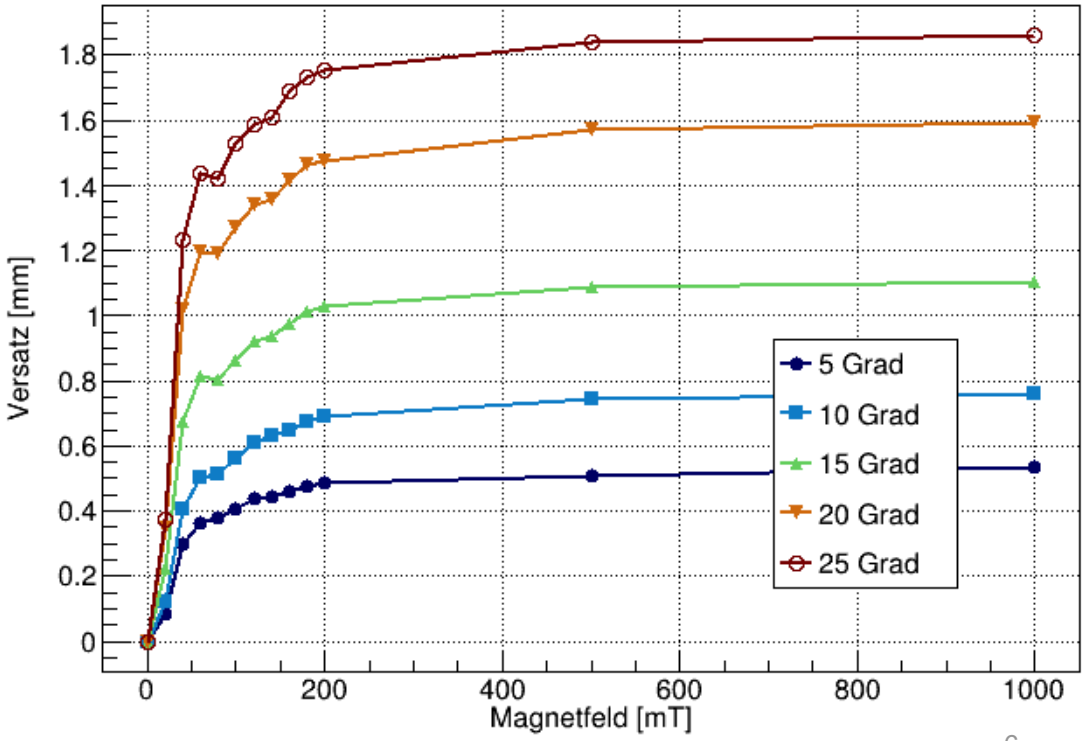




shifts of charge cloud centroid in B-field

- below the **geometrical shift** is shown for different tilt angles
- Measured with Photonis 946P541 (3x100 pixels)
- Saturation starts at a few hundred mT, as expected
- At 25° tilt angle, saturation at ~ 1.8 mm shift → 3 – 4 pixels shift for EDD
- Also at 15° tilt angle & 1 T B-field ~ 1.1 mm shift → geometrical shift not negligible for Barrel DIRC

- Only geometrical shift was measured last time in Jülich
- For Lorentz shift measurement the tube needs to be rotated by 90 ° & scanned in x direction for varying tilt angles
- next time in Jülich, we will try to measure Lorentz shift



Summary

- Signal damping problem of DiRICH is now understood & a solution found
- But still new ideas need to be tested (10 nF condensators)

- Charge cloud centroid gets significantly shifted at high B-fields and tilt angles
  - geometrical shift within E – B plane (here the **yz** plane)
  - Lorentz shift perpendicular to E – B plane (here the **x** axis)
- This needs to be taken into account for simulations & data analysis in the later experiment

- Plan for next Jülich mission is to also measure the Lorentz shift component of the charge cloud centroid