

First results of the B-field measurements

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Steffen Krauss, M. Böhm, K. Gumbert, A. Lehmann, D. Miehling

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Reminder of electron recoil in B-field

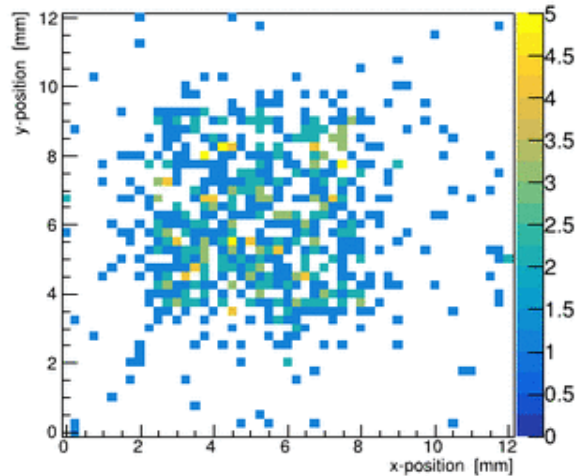


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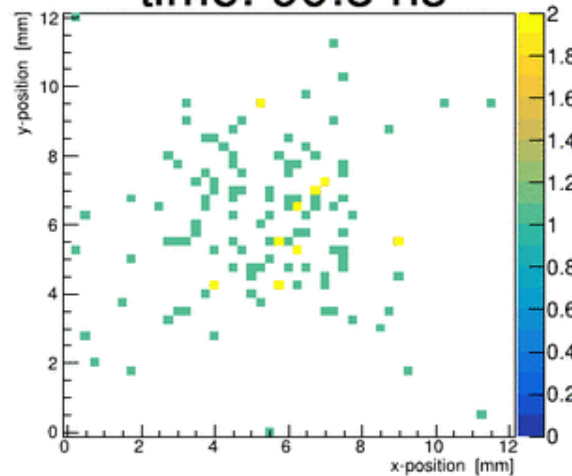


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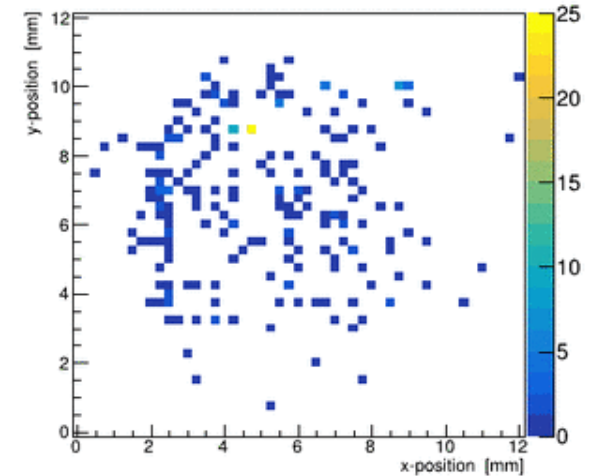
20mT



200mT
time: 99.3 ns



1000mT



- Small reminder from last talk, electron recoil behaviour of Photonis 9002192 at different B-field strengths
- In the following this behaviour will be investigated for 3x100 Photonis MCP-PMT 946P541 (EDD tube)

946P541 recoil distribution

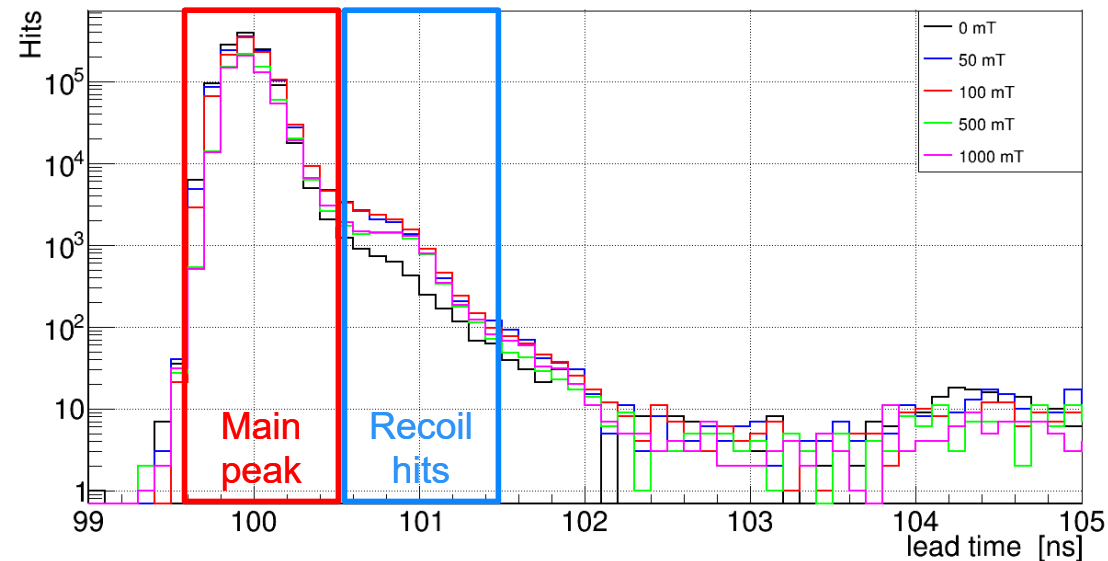


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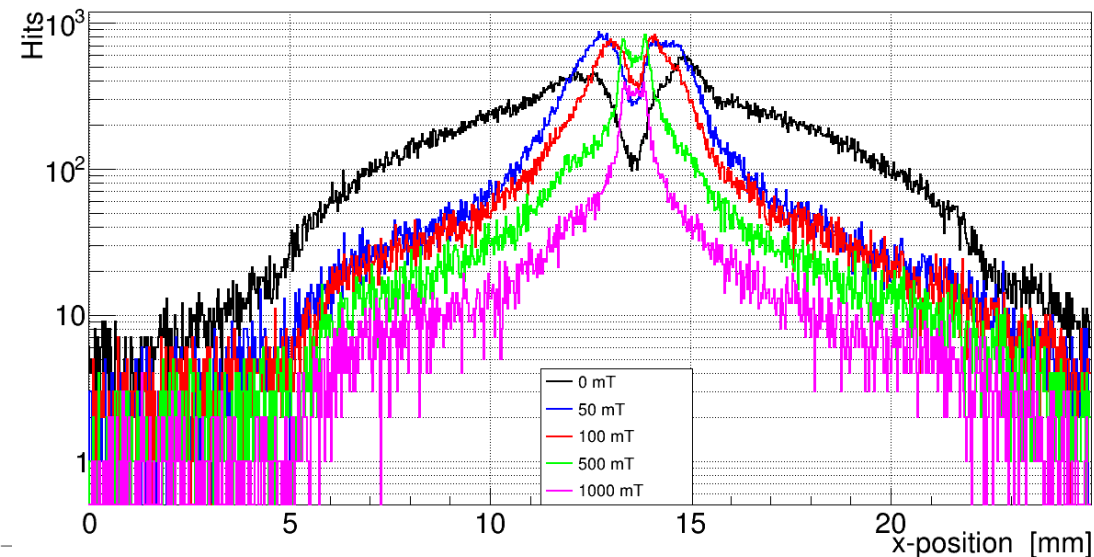


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946P541 x47 time spectra

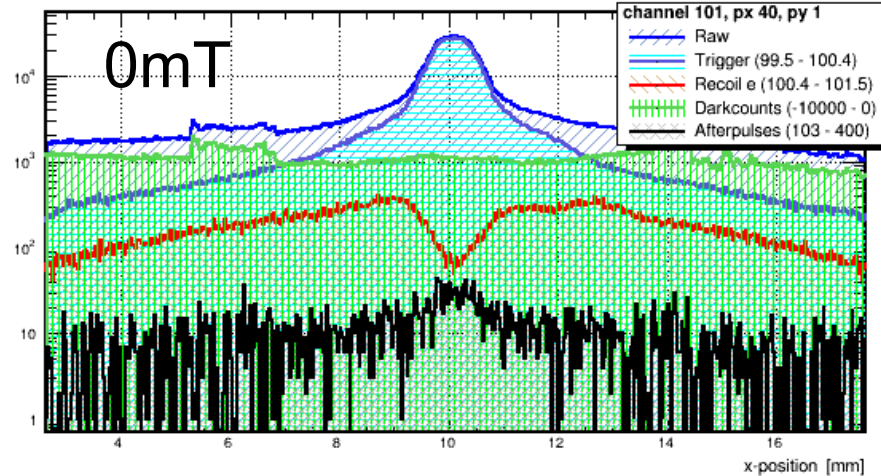


946P541 x47 recoil hits

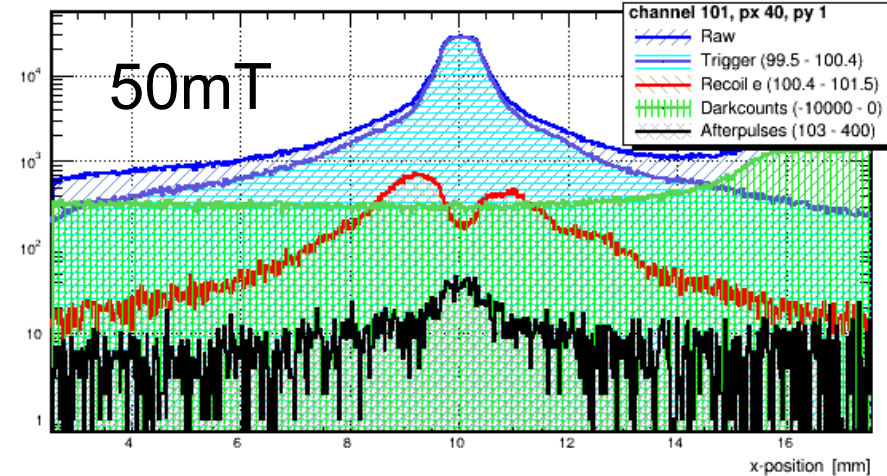


- Top: time spectra for different B-fields from 99 – 105 ns (main signal peak & recoil electrons)
- Only minor changes in time distribution for recoil hits
- Bottom: spatial distribution of recoil hits (hits in time window from 100.6 – 101.5 ns, inside blue box) for varying B-field
- Spatial spread shows strong dependence
 - at higher fields recoil electrons much closer to pixel
 - better position resolution

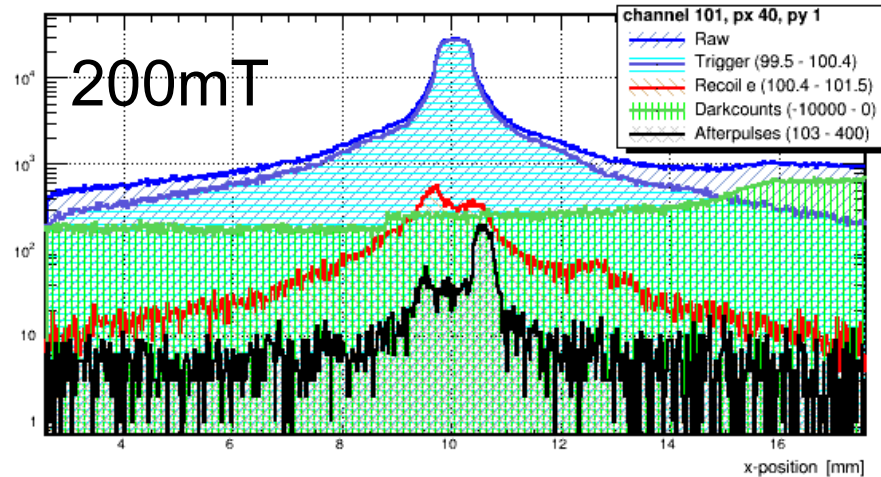
x-position vs y-position (all hits) for (py 1, px 40) channel 101



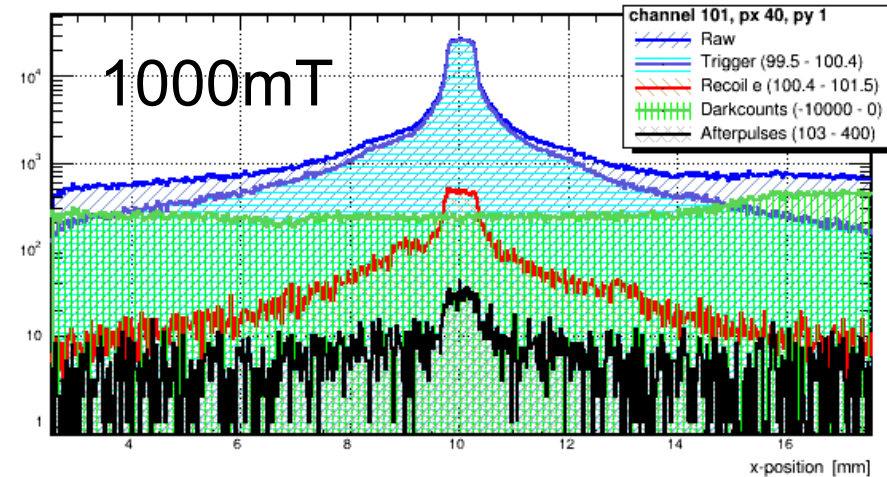
x-position vs y-position (all hits) for (py 1, px 40) channel 101



x-position vs y-position (all hits) for (py 1, px 40) channel 101

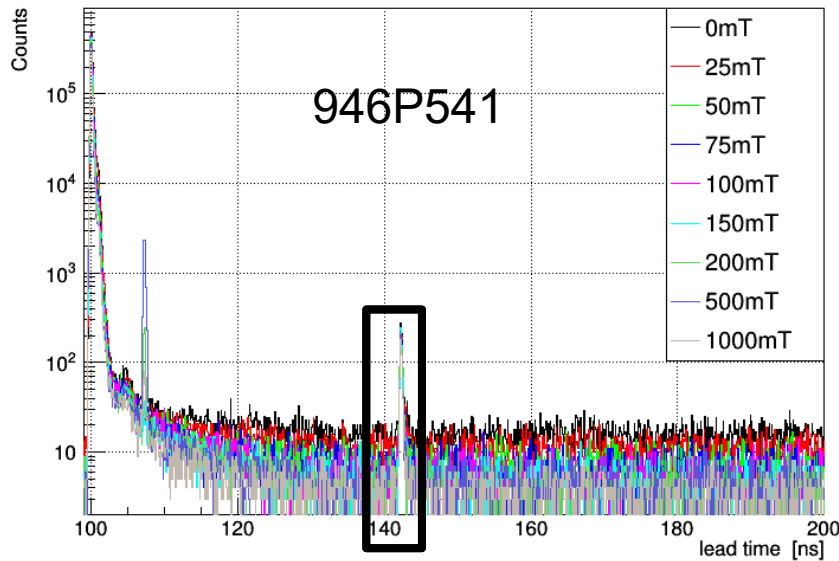


x-position vs y-position (all hits) for (py 1, px 40) channel 101

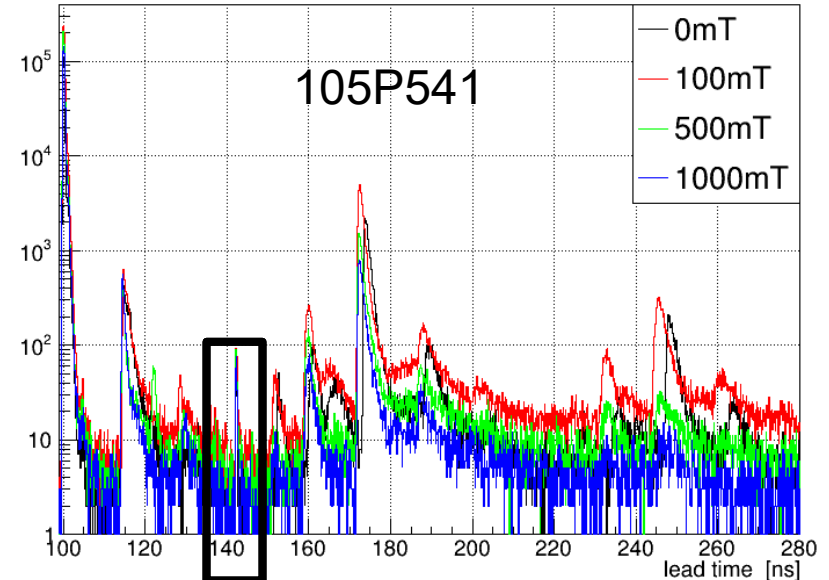


For higher B-fields the charge cloud expands less → **better pixel definition**

afterpulse shifted time whole sensor for (py 1, px 41) channel 68



afterpulse shifted time whole sensor for (py 1, px 62) channel 38



- Hit distribution over time (y axis is on logarithmic scale)
- Peak at 142 ns not a real peak (DAQ caused) → scans measured in Erlangen do not show this peak
- Both plots shown are center pixels at middle row
- 105P541 shows many afterpulse peaks, some considered real others caused by DAQ, which needs further investigation and comparison with Erlangen TRB-scans

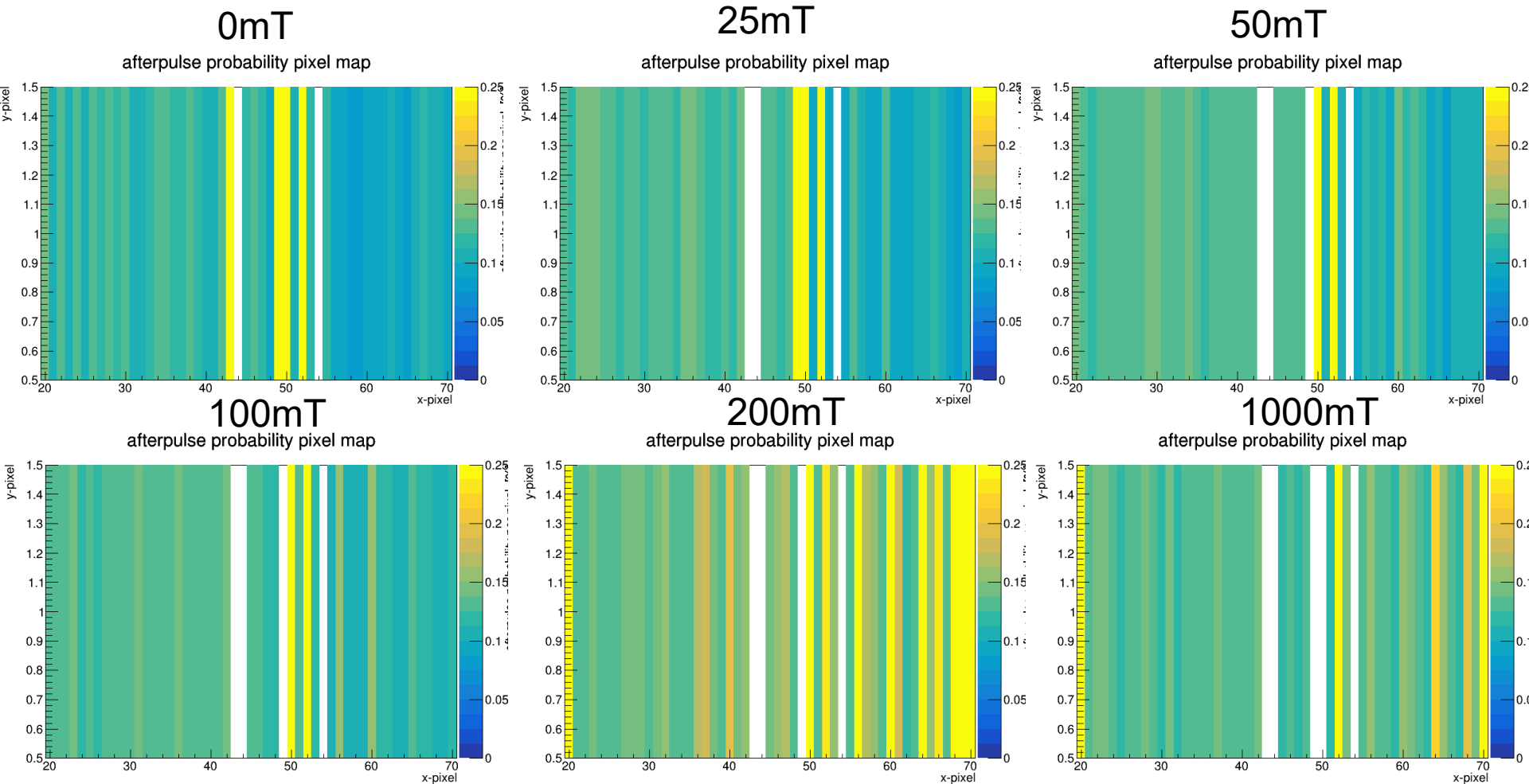
Afterpulsing Photonis 946P541



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- Afterpulse map per pixel for illuminated area
- Mean afterpulse probability per pixel is about 0.15 %
- No significant changes in probability over B-field (not taken 200mT right side into account, due to some not yet investigated effect)

Afterpulsing Photonis 105P541

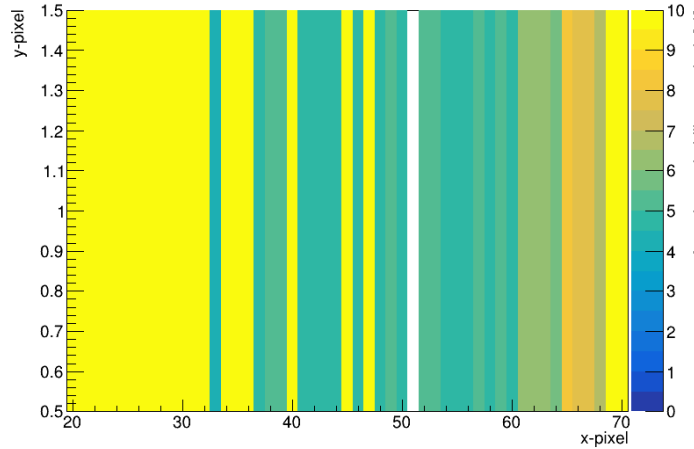


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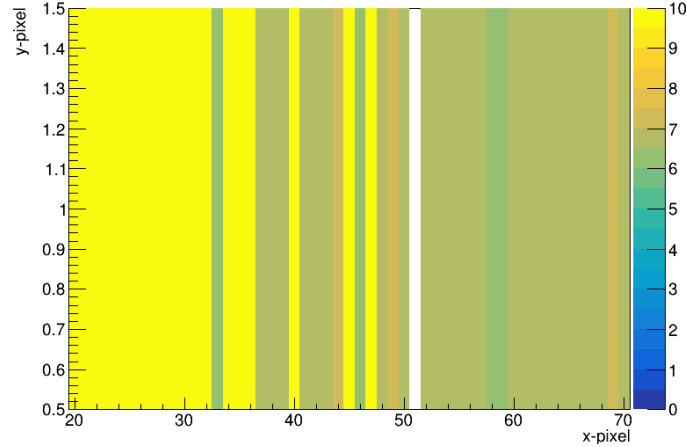
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afterpulse probability pixel map



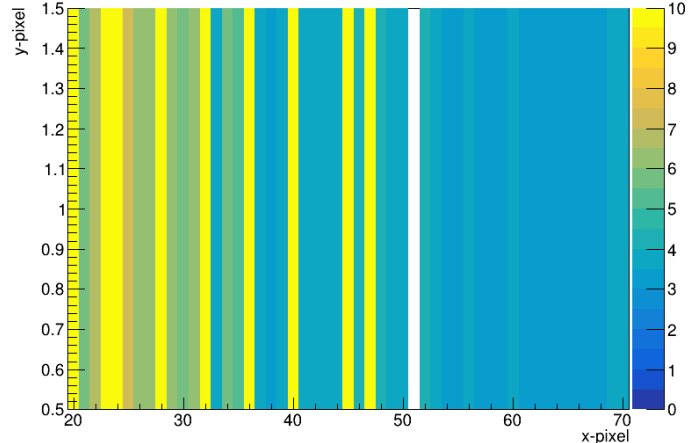
0mT

afterpulse probability pixel map



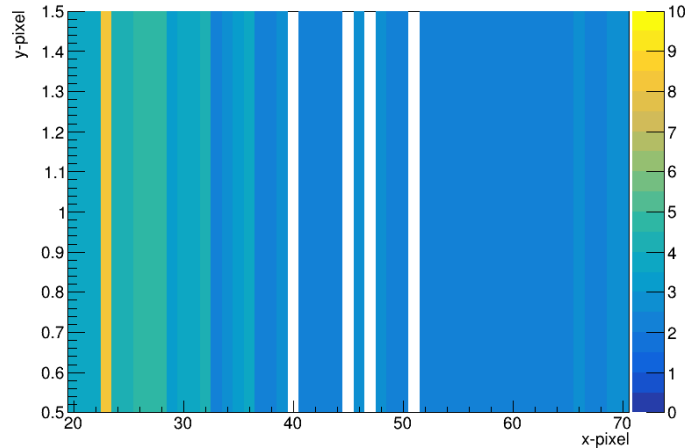
100mT

afterpulse probability pixel map



500mT

afterpulse probability pixel map



1000mT

- Afterpulse map per pixel for illuminated area
- Afterpulse probability differs a lot in one row → need further investigation
- For higher B-field AP ratio decreases, maybe caused by lower gain but same threshold

Afterpulsing Photonis & Photek 8x8

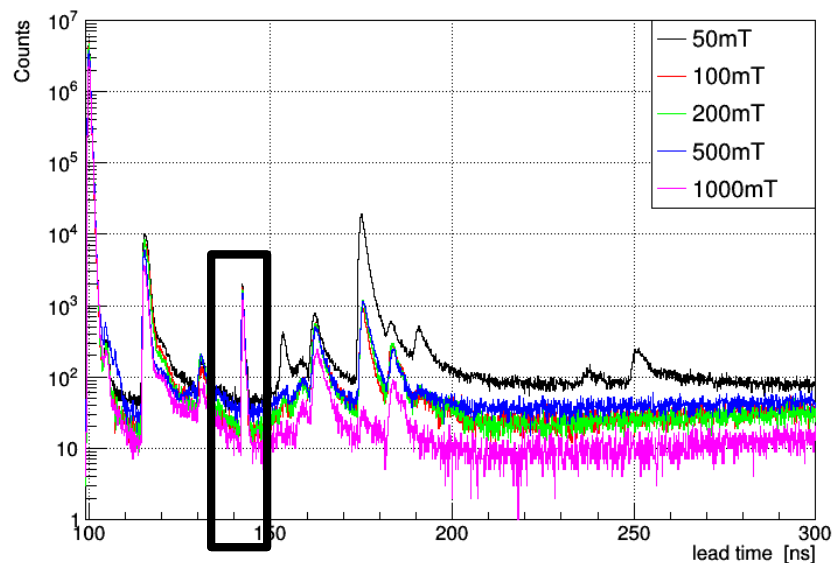


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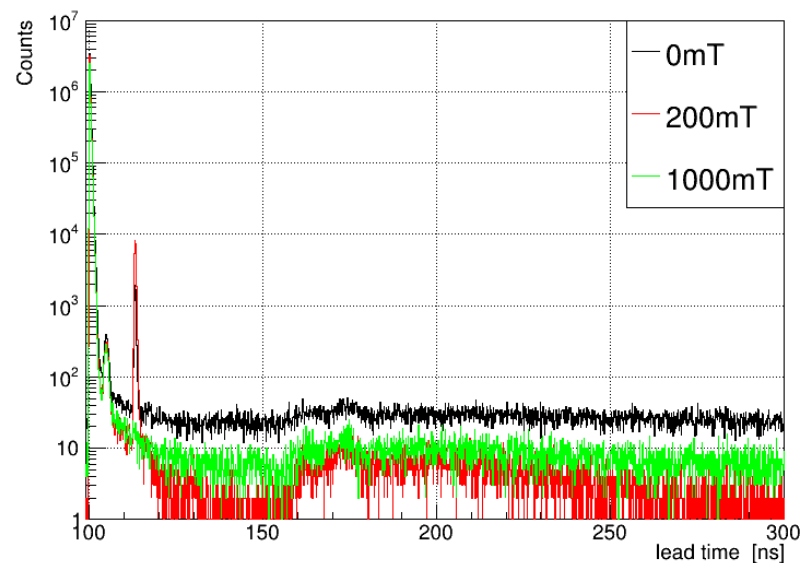


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afterpulse shifted time whole sensor for (py 6, px 4) channel 53



afterpulse shifted time whole sensor for (py 4, px 5) channel 28



- Hit distribution over time (y axis is on logarithmic scale)
- Peak at 142 ns not a real peak (DAQ caused) → scans measured in Erlangen do not show this peak
- Right plot shows Photek A1200116
- 9002192 shows several afterpulse peaks, some considered real others caused by DAQ, which needs further investigation and comparison with Erlangen TRB-scans
- Low AP rate and no significant peaks at Photek A1200116

Afterpulsing Photek A1200116

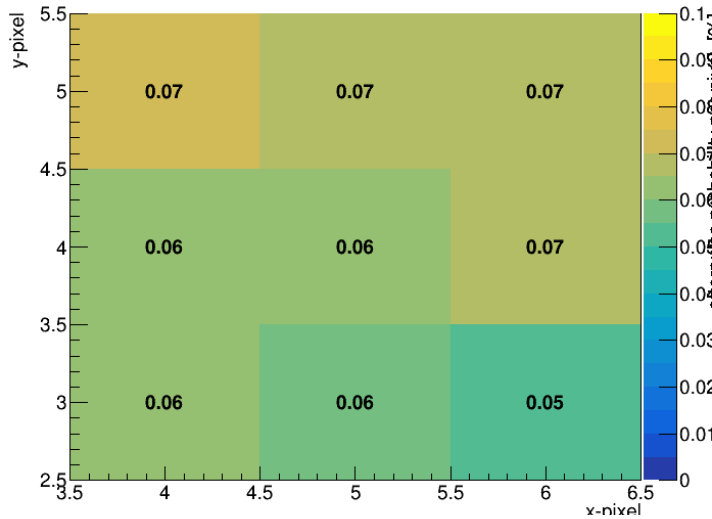


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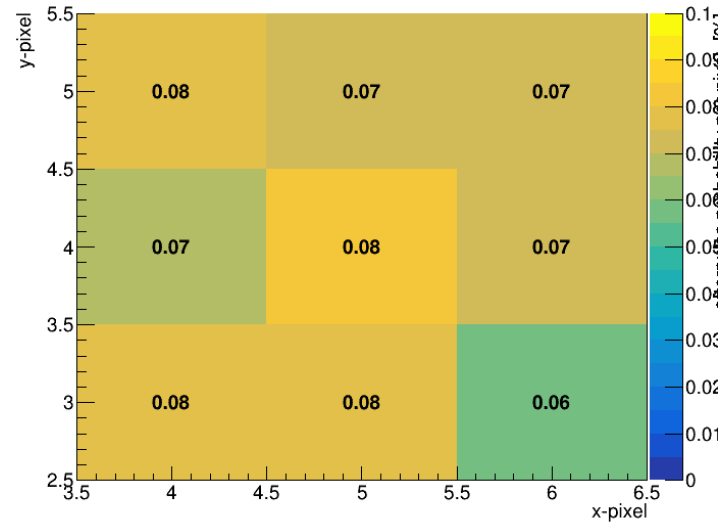


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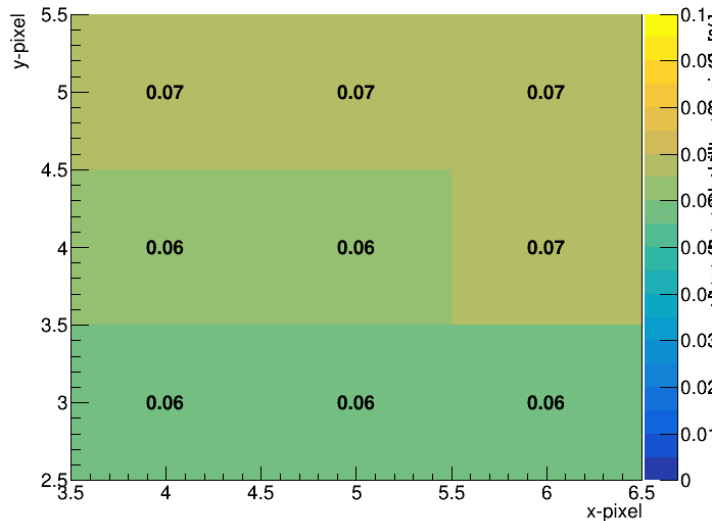
apmap_A12_0mT



apmap_A12_200mT



apmap_A12_1000mT



- Afterpulse map per pixel for illuminated area
- Very low AP rate
- Illuminated area about 0.07% afterpulse probability per pixel
- No significant changes in probability over B-field

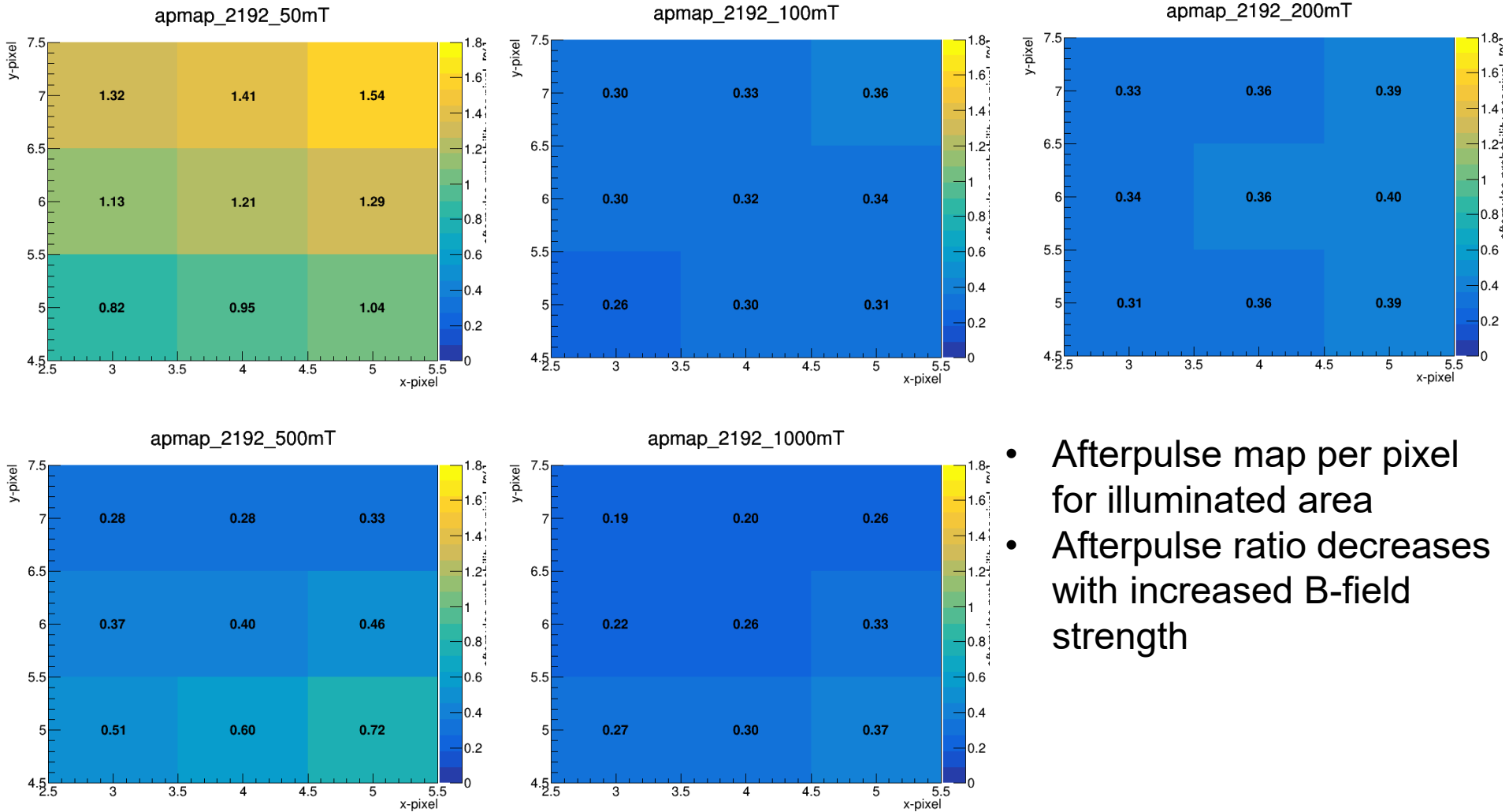
Afterpulsing Photonis 9002192



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- Afterpulse map per pixel for illuminated area
- Afterpulse ratio decreases with increased B-field strength

Afterpulsing: Oscilloscope vs TRB

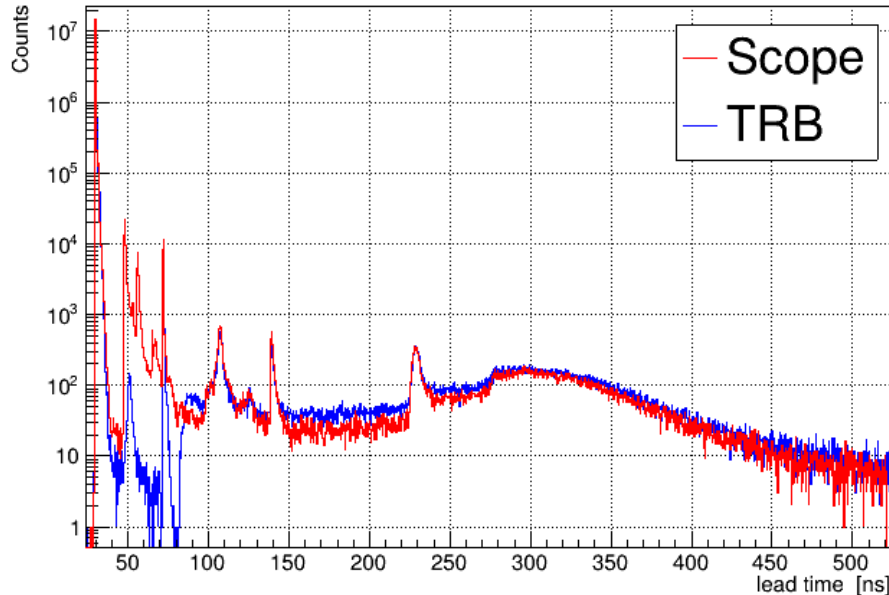


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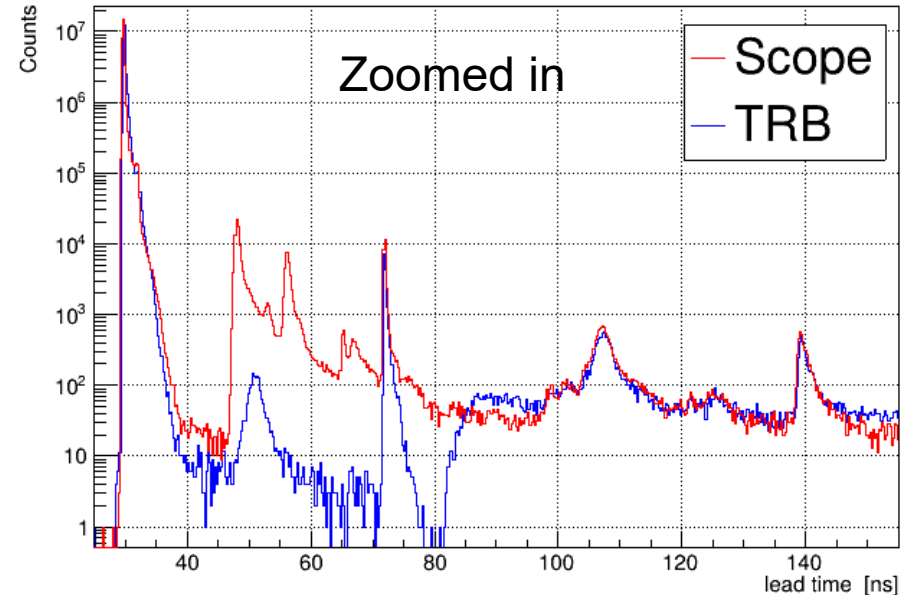


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raw time no cut for (py 4, px 5) channel 23



raw time no cut for (py 4, px 5) channel 23



- Measured time spectra with oscilloscope (red) and TRB DAQ (blue) of center pixel of Photonis 9002085
 - Goal is to find out, how many hits get lost in TRB due to deadtime in TDC
 - After main peak (30 – 40 ns) the count rate of TRB measurement drops significantly compared to scope
 - Both measurements taken with similar threshold
 - Measured AP-ratios:
 - Scope: **1.03 %**
 - TRB: **0.45 %**
- ➡ Factor 2 deviation

Summary

- Recoil distributions change significantly at high B-fields (less spatial expansion, timing not affected) → pixel position better defined
- Afterpulse behaviour is different for different tubes → further investigation is ongoing
- Afterpulse ratio between Oscilloscope & TRB DAQ different of about factor 2, due to deadtime of TDC after main peak
- Further investigation will be done