Sensor Studies in High-B Fields
Summer 2018 Results

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Summer 2018 Tests

Summer Run (2 weeks in July)

- Multi-Anode MCP-PMT: 10-μm pore-size Planacon: Gain Studies, Ion Feedback

- Single-Anode MCP-PMT: 3-μm pore-size Katod: Gain Measurements, Commissioning

Objectives

- PiLas (404 nm): **commissioned**

- Universal High-Voltage Divider: **commissioned**

- Timing Setup: **installed**, **under tests**

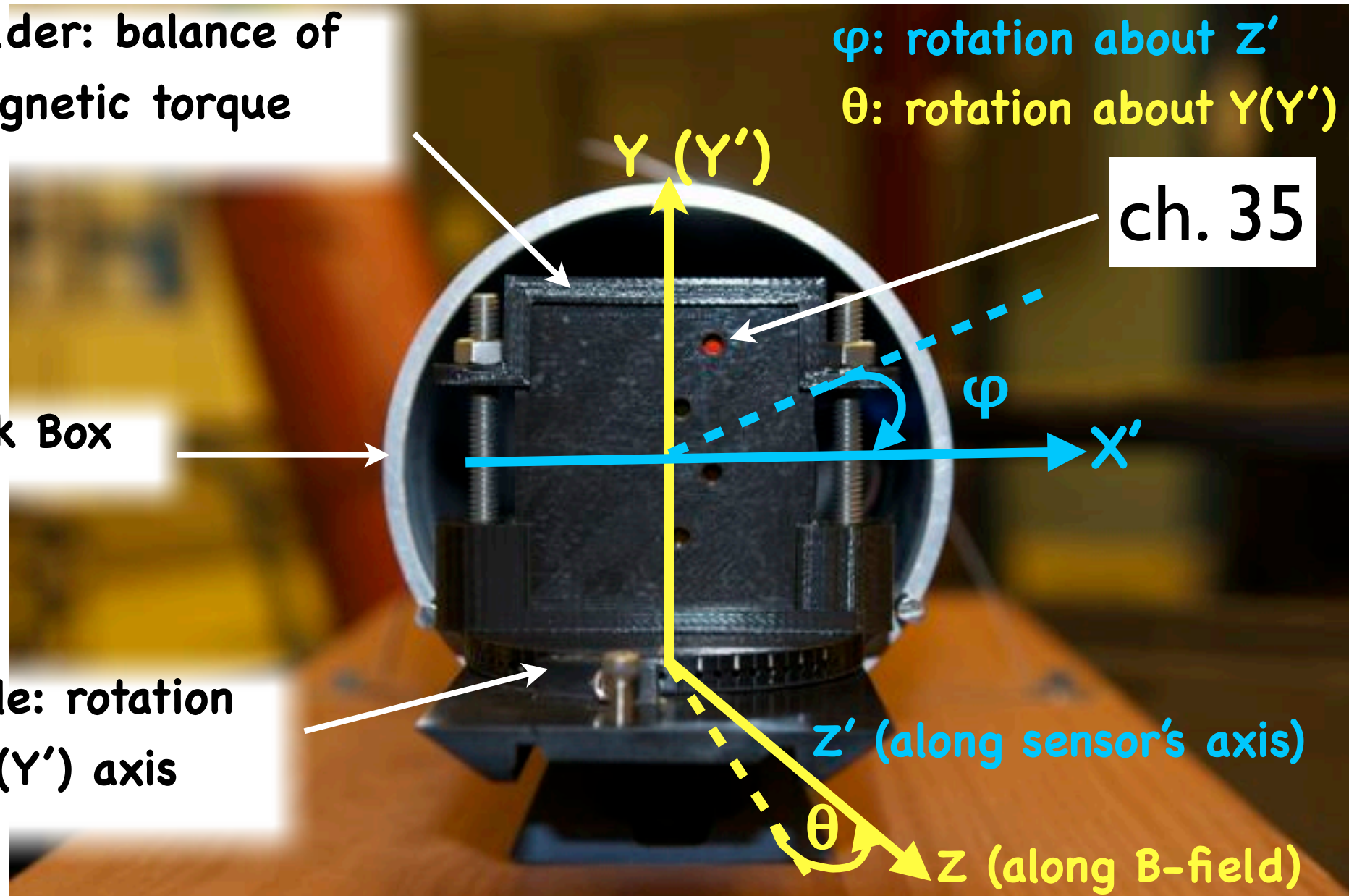# Test Setup, July 2018 Run

Photonis XP85112

Holder: balance of magnetic torque

Dark Box

Turntable: rotation about Y(Y') axis

φ: rotation about Z'
θ: rotation about Y(Y')

Y (Y')

ch. 35

φ

X'

Z' (along sensor's axis)

θ

Z (along B-field)

Read-Out and Light Source, July 2018 Run
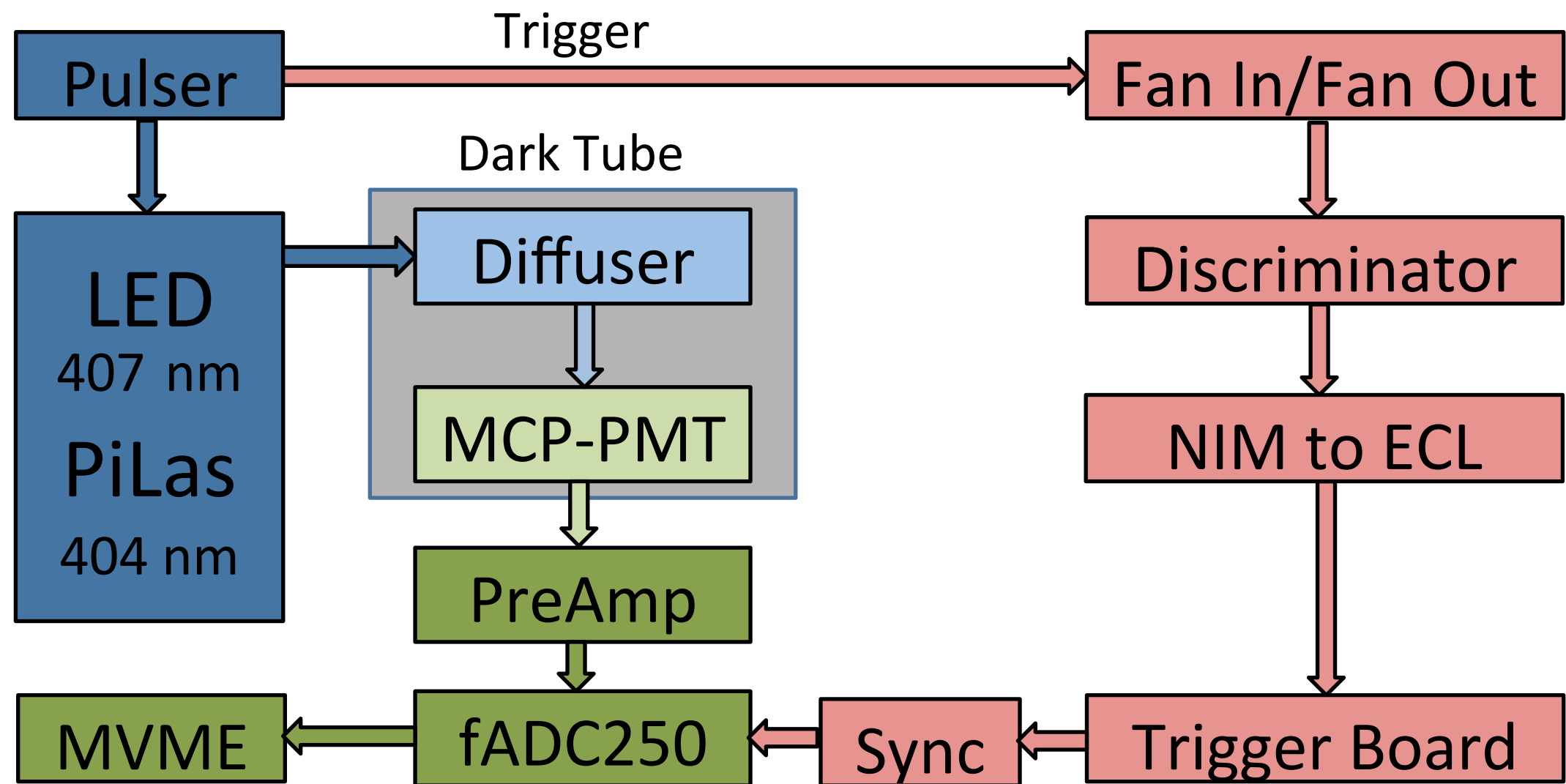
Data and Analysis Methods

χ^2 / ndf 50.9135 / 499
Prob   1.0000
μ 0.0522 ± 0.0094
w 0.0055 ± 0.0016
Q_0 1685.9630 ± 0.3993
Q_1 116.7546 ± 4.7382
α 0.0063 ± 0.0012
σ_0 4.6977 ± 0.1706
σ_1 58.6123 ± 3.8034
Nevents   751412.3125 ± 123579.4766

–2.7 kV
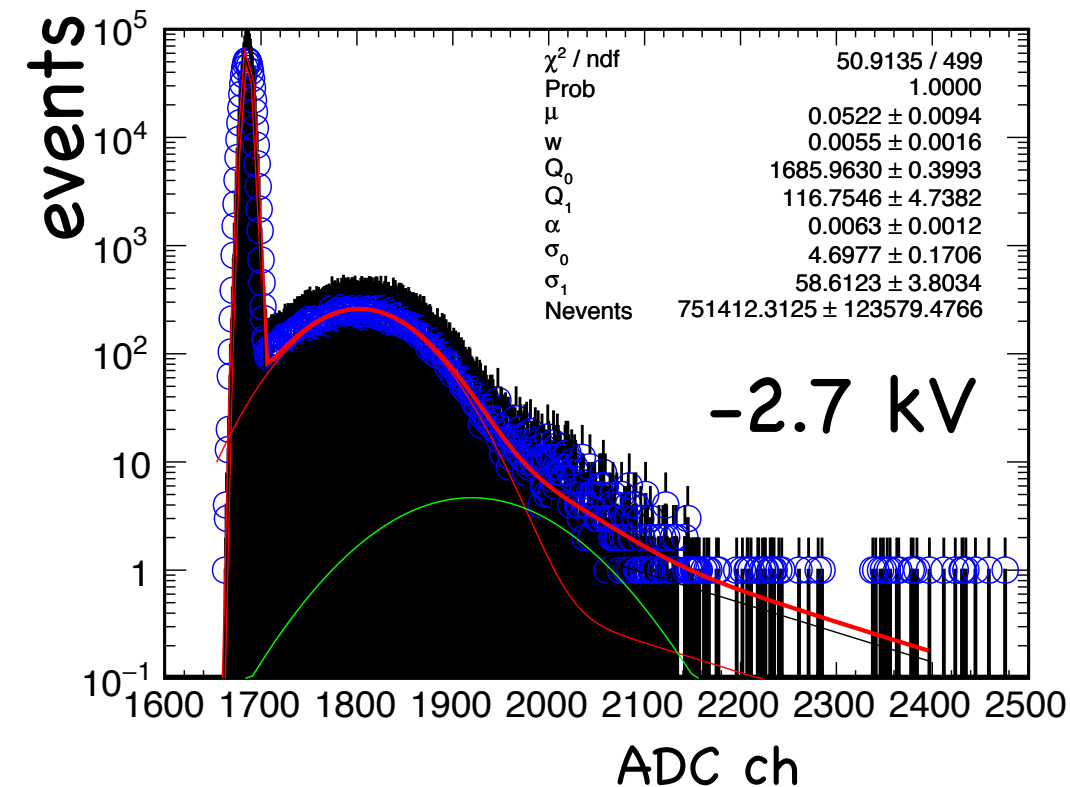
- Unambiguous fits when single ph.e. peak is well separated from pedestal. From fit:

$$G = \frac{f}{A \cdot q} Q_1, \quad \mu = \frac{N_{1phe}}{N_{ped}}$$

- Gain fits work well up to 1 T. Above 1 T, gain must be prorated from average signal area.

- f = 19.1±0.2 fC/ADCch.

$\theta = 0°$

B = 0. T
B = 0.5 T
B = 1.0 T
B = 2.0 T
B = 3.0 T
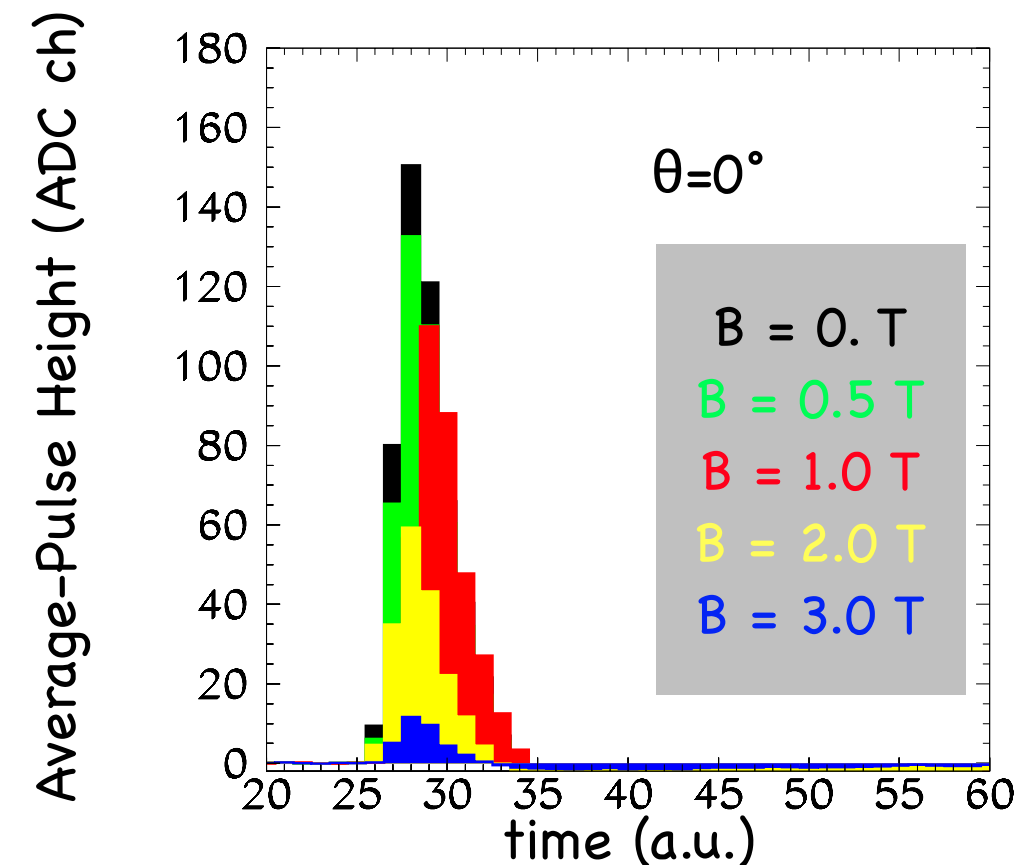
- Above 1 T, gain is prorated from average signal area, based on ratios at B < 1 T.

- Method is subject to bias:
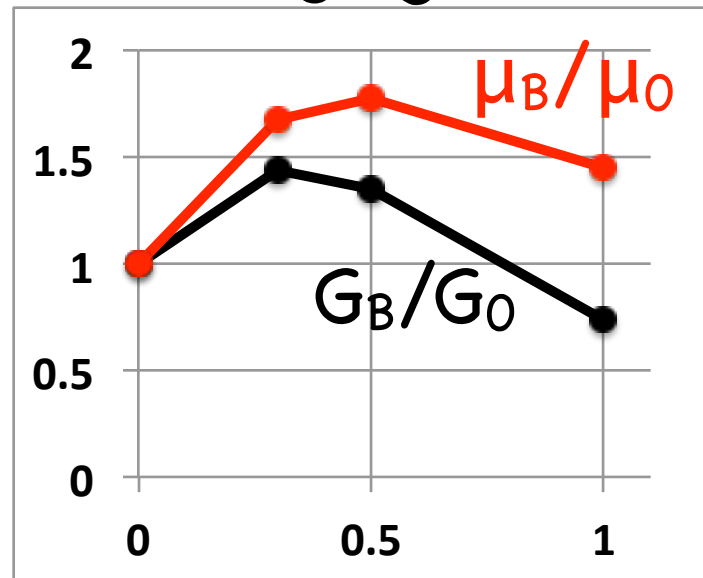
$$A_{signal} \sim G \cdot QE \cdot \varepsilon,$$

$$G \sim \frac{A_{signal}}{QE \cdot \varepsilon} = S \cdot A_{signal} = S(B)$$

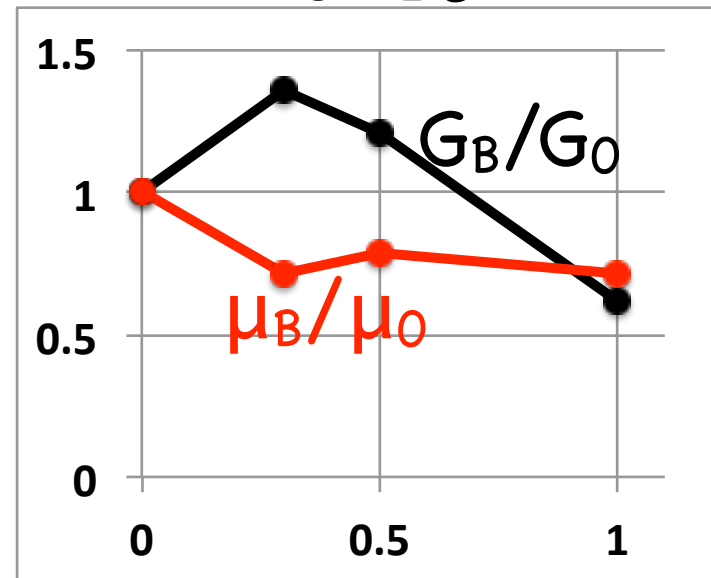# Results, July 2017 Run
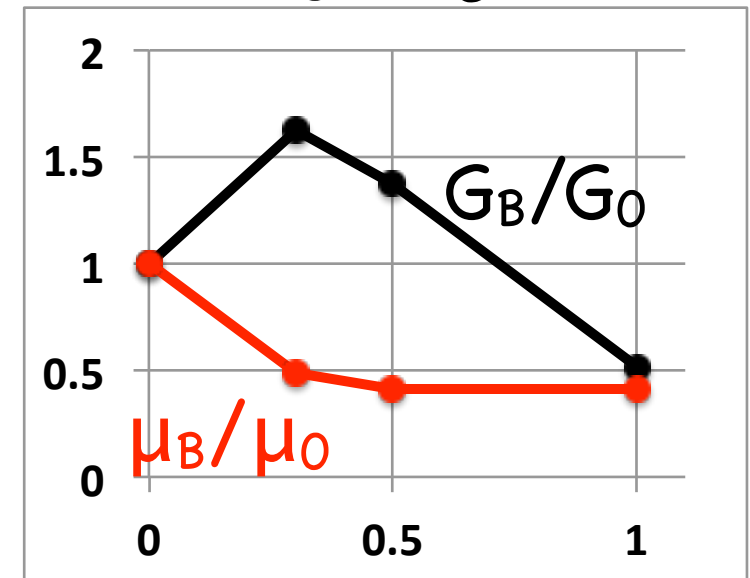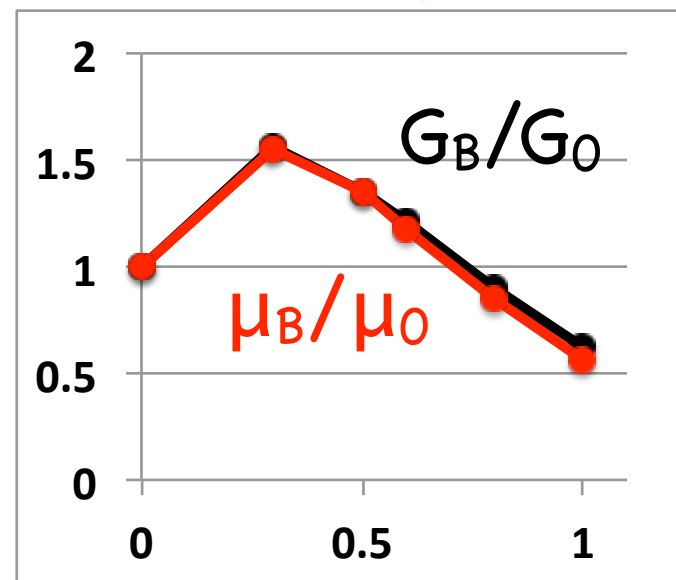## Gain and Efficiency Changes with θ

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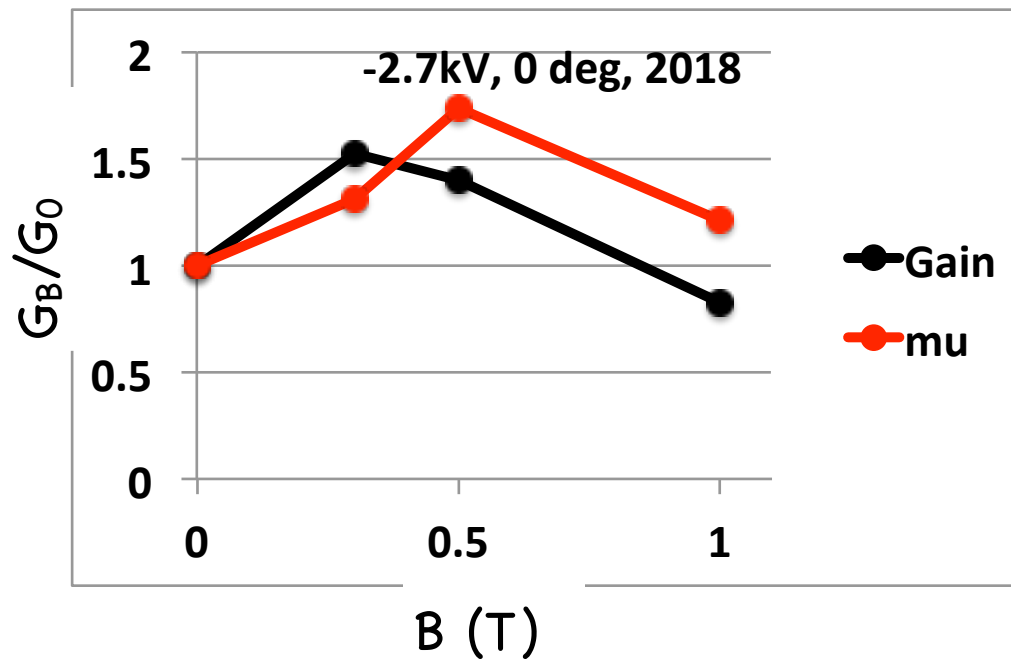

θ=0°

θ=10°
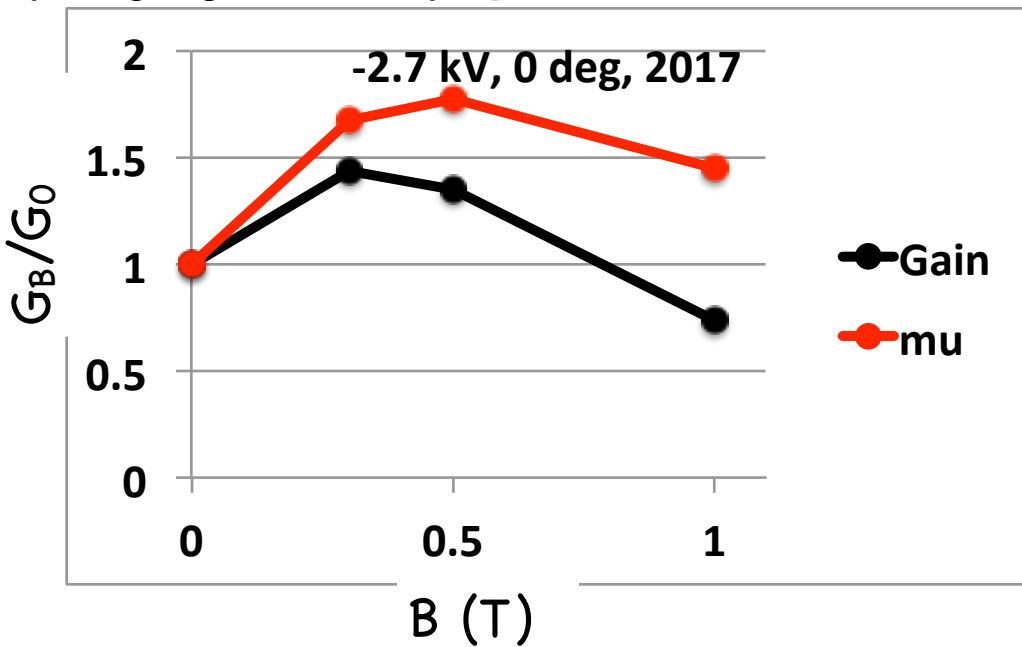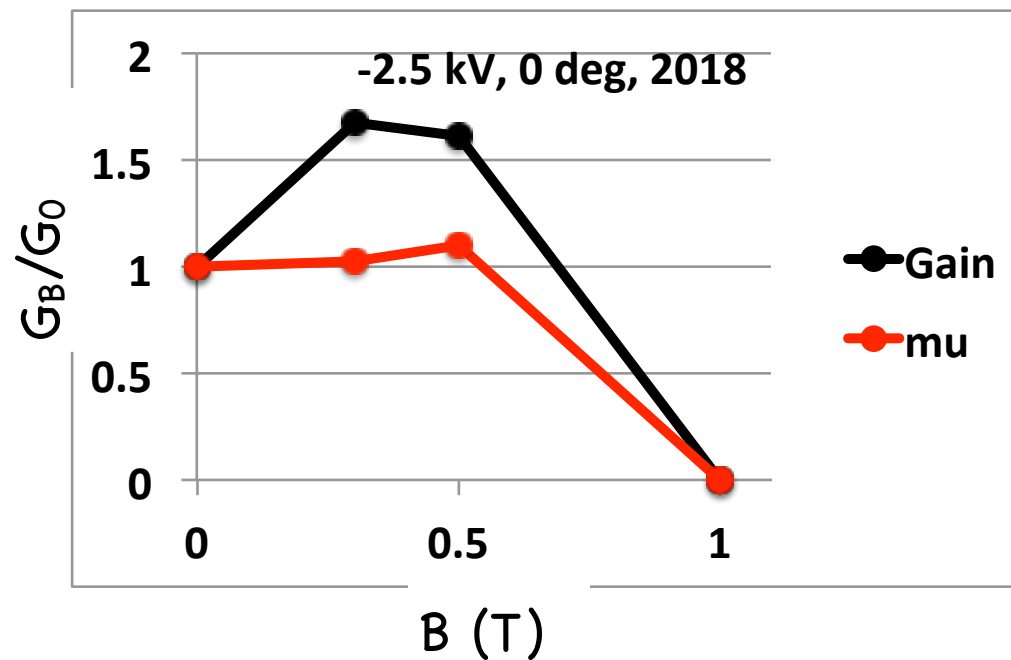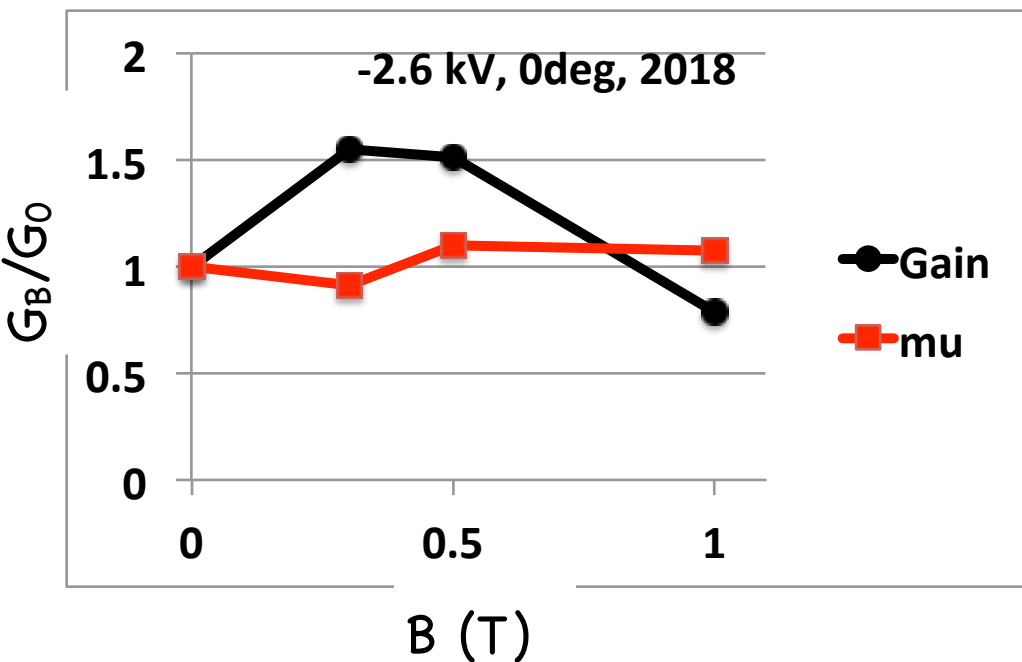
θ=20°

θ=−10°

θ=−20°
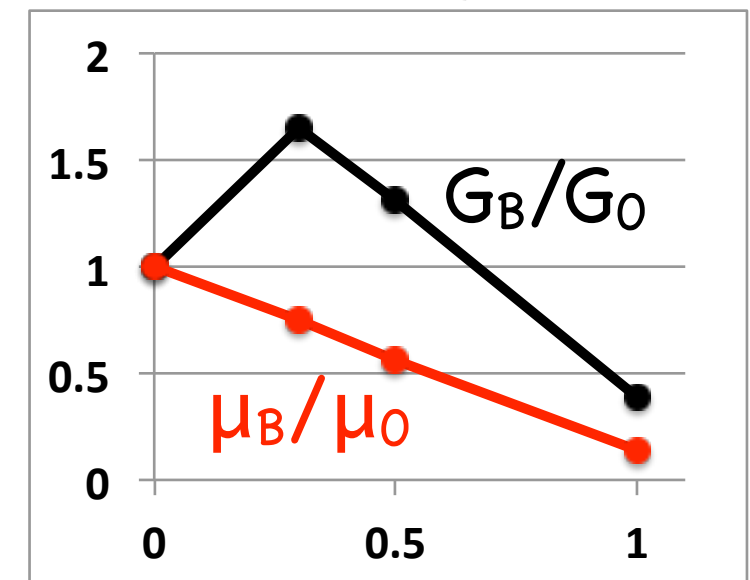
HV=−2.7 kV

Reproduction of Gain and Efficiency from 2017

Photonis XP85112

Relative gain shape at −2.7 kV is nicely reproduced

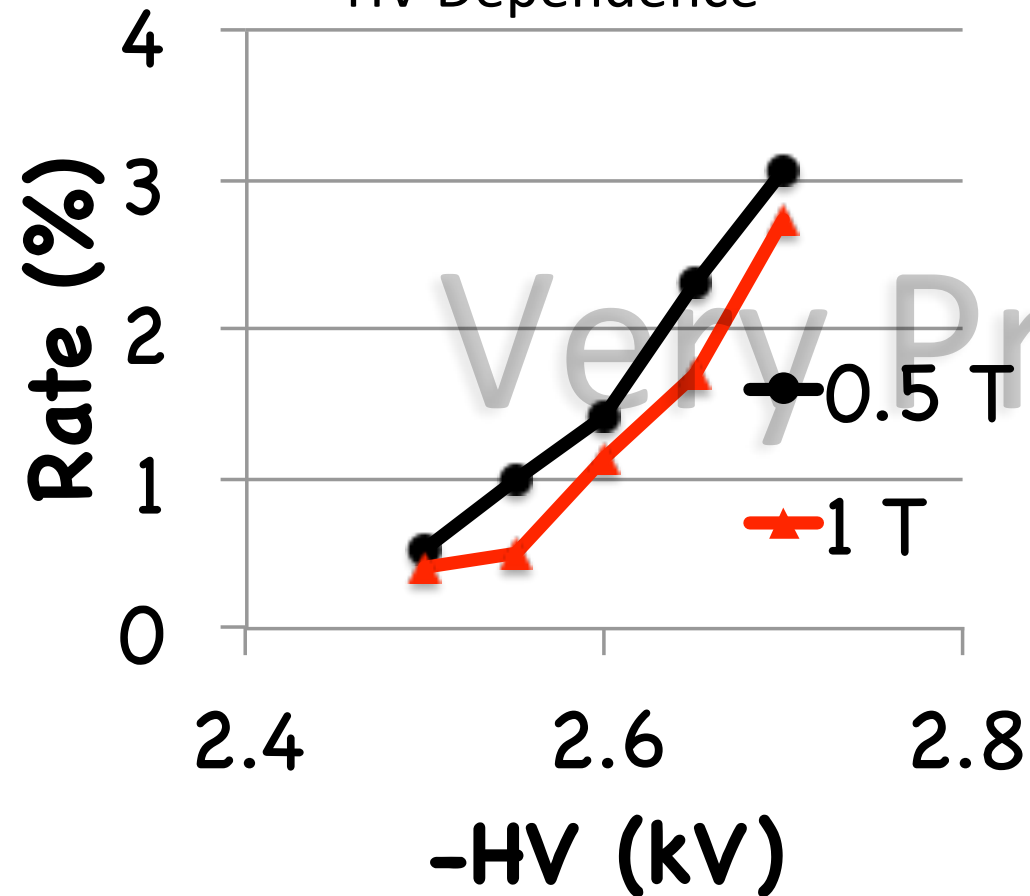The shape of mu (efficiency) shows a discrepancy at 0.3 T

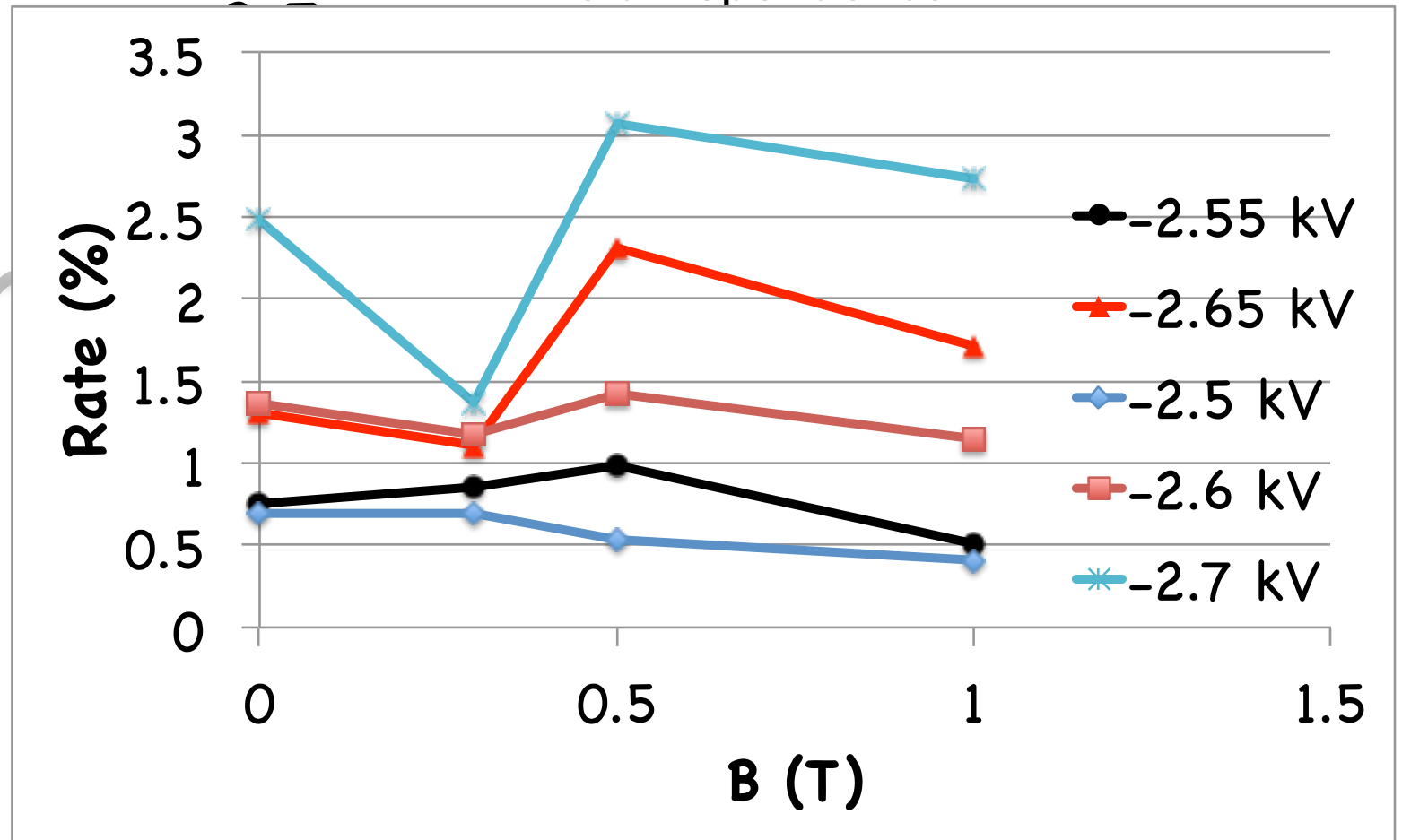Both, the relative gain and efficiency curves seem to depend on the applied HV.

Studies of Gain and Efficiency

Photonis XP85112

Efficiency needs further studies: hardware/DAQ effect?

Relative gain has a very weak dependence on angle at small angles and B < 1T.

Ion Feedback Studies
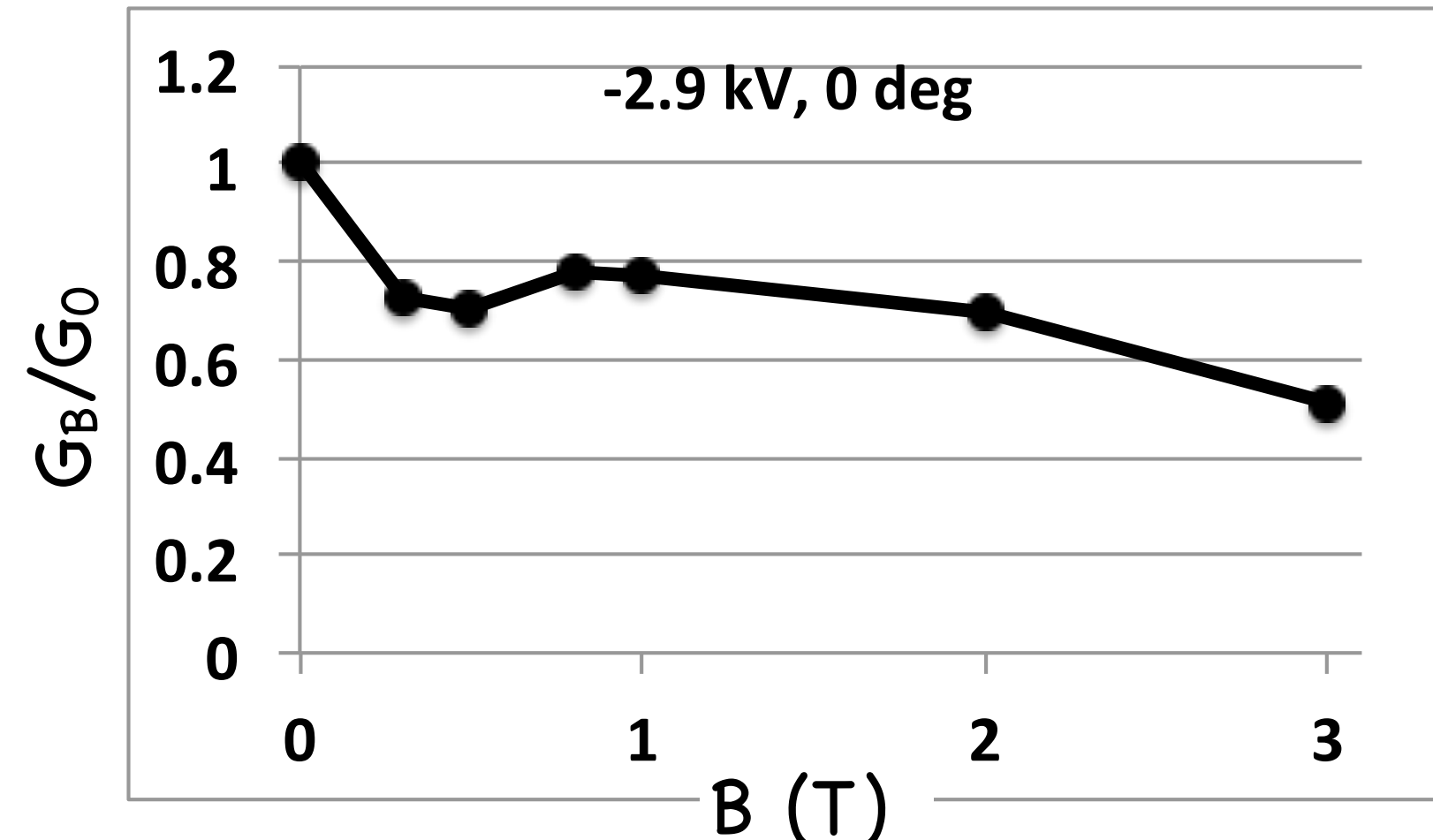
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Strong correlation with HV at all magnetic fields

Shape of dependence on B at fixed HV seems to depend on the HV. Larger variations with B at larger HV.

More precise analysis needed to improve accuracy of estimates.

Studies of Gain

Katod 3-μm pore size

-2.9 kV, 0 deg

Very noisy signal line

Could not be operated in a single phe mode

With pulser at 3.5 V, HV=-2.9 kV, and x200 external amplification, sensor successfully used for commissioning.

Response up to 3 T.

Summer 2018 Summary

Timing Upgrade: partially complete, work in Fall 2018 and Spring 2019

Gain and efficiency: gain stable, efficiency requires more studies

Ion Feedback: data collected at a large set of HV and B

HV Divider: Commissioned. Data from Planacon under studies.

The End