

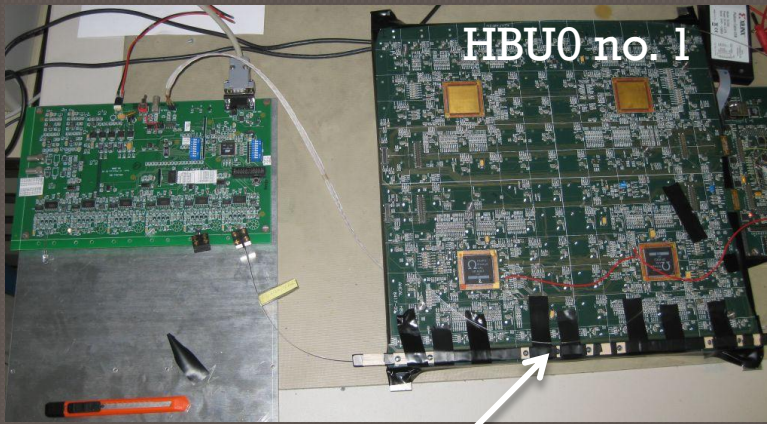
Optical calibration system – recent activities in Prague

1. DESY tests
2. Electronics developments
3. Optical developments
4. Outlook



DESY test 1

ASIC1

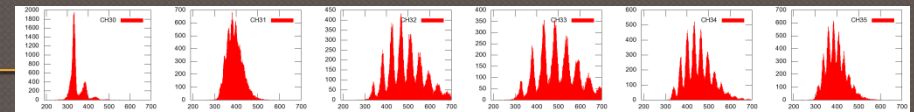
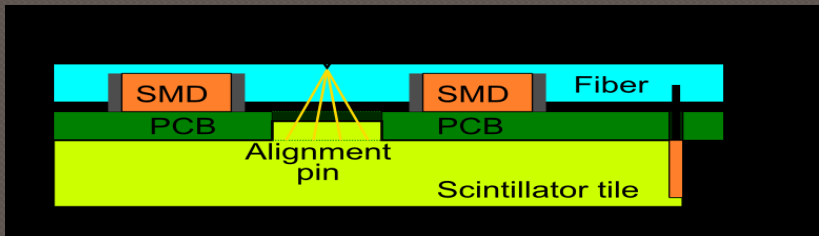


Notched fibre fixed in balsa frame

QMB6 performance on HBU0

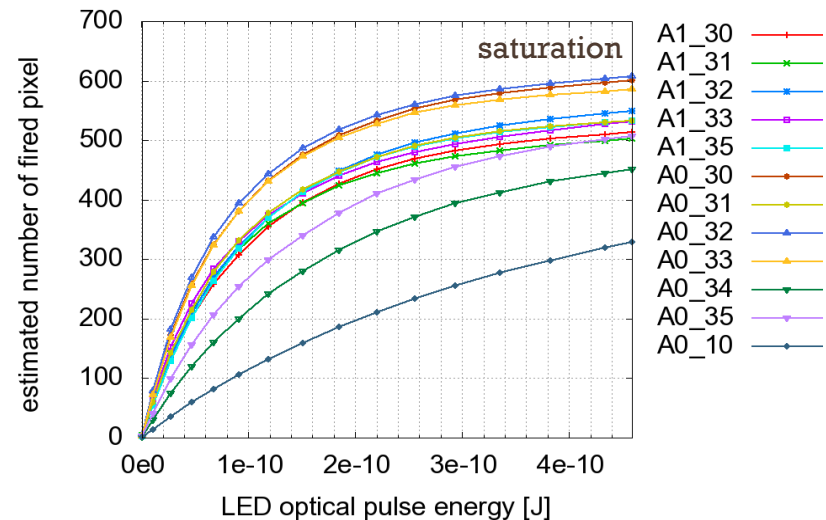
- Single p.e. peaks in HG
- Amplitude scans at LG
- HG vs. LG ratio measurement

Calibration by notched fibre



- Large spread of single_photon_peak distances - SiPM voltage settings?
- Amplitude scan in LG, 400fF
 - Fired pixels in LG estimated using single photon peaks in HG + HG/LG ratio
 - QMB amplitude V1 converted to optical energy output

3mm LED, Estimated number of fired pixels, single PE peak distance & ASIC gain compensated

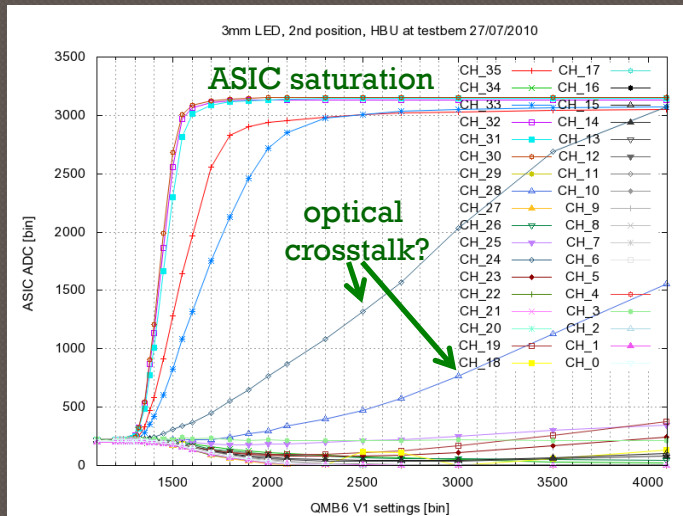
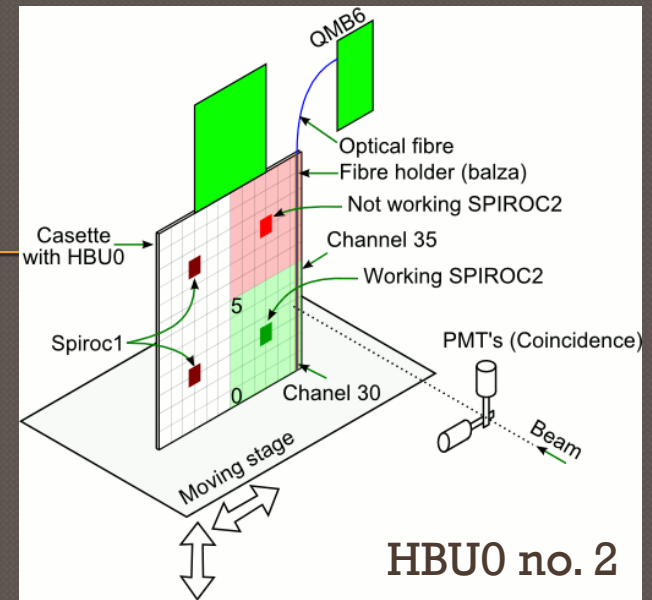


DESY test 2 – in beam

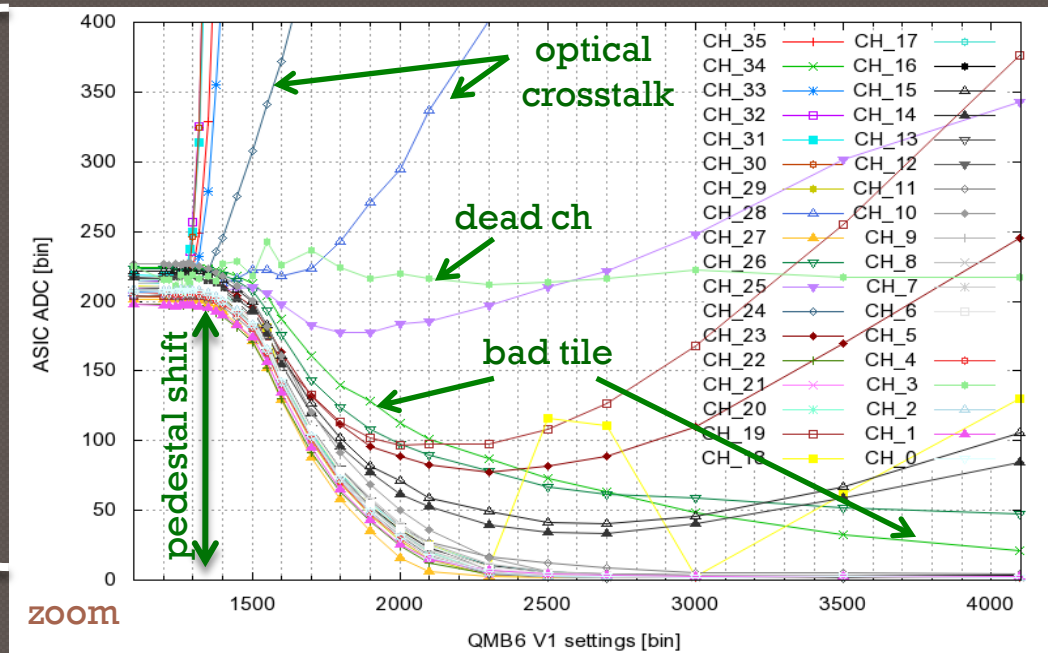
ASIC0 (green) fully working
 ASIC1 (red) problems with programming trigger: beam or internal DIF trigger
 Channels 30..35 were illuminated

Measurements:

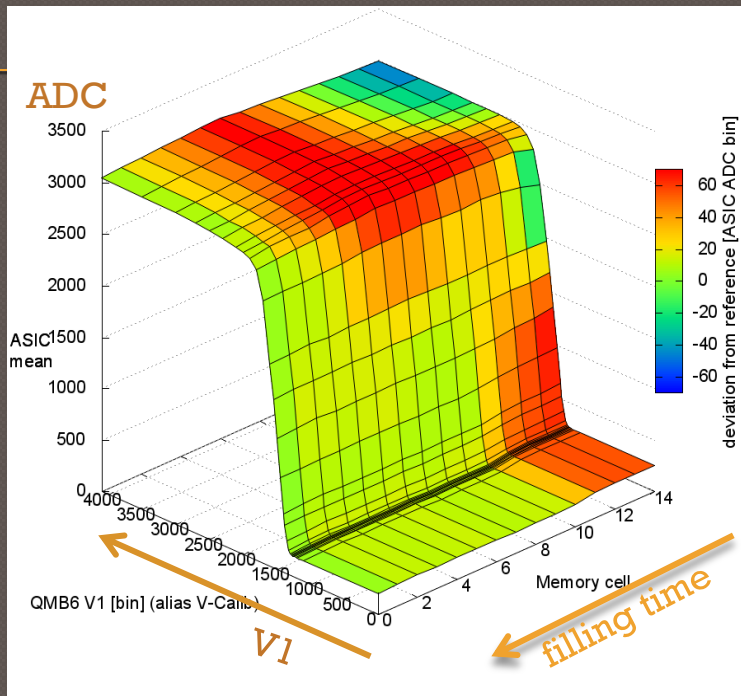
- MIP signal in High Gain and Low Gain
- Gain in HG and LG using MIP signal
- Scan over various V1 setting of the QMB6
- Pedestal shift for non-illuminated cells



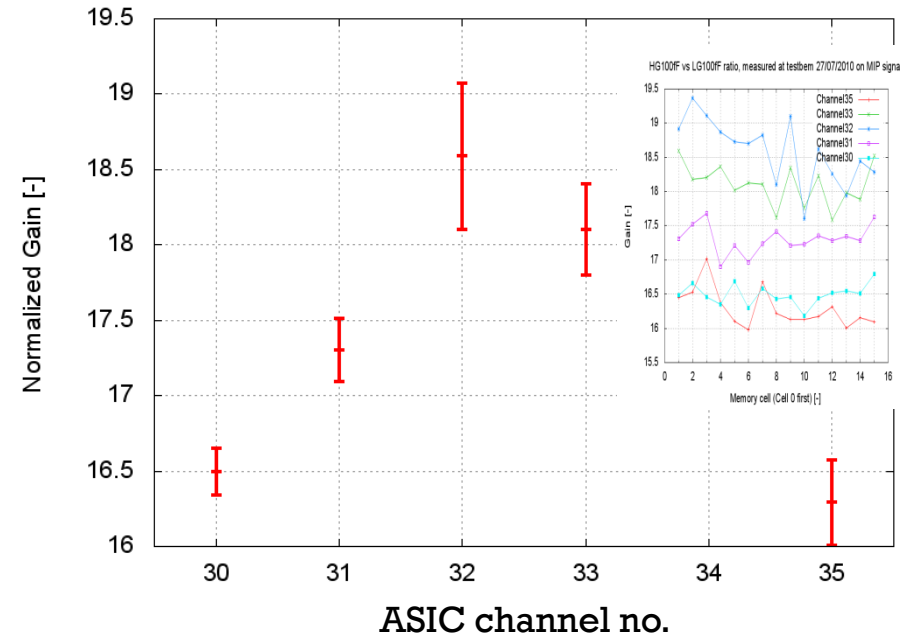
ASIC1, cells 30-35 illuminated, HG



DESY test 2 – preliminary results



HG100fF vs LG100fF ratio, measured at testben 27/07/2010 on MIP signal



Analogue memory cells filling
1 ASIC channel – **high gain**:

- scan over various V1 setting of the QMB6, (0 – 4000)
- ASIC ADC values averaged over a run
- reference value (**green**) - last filled memory cell
- **decrease of pedestal during filling!**

Ratio HG/LG – important for calibration

- MIP signal in High Gain and Low Gain
- **spread over memory cells**
- **spread over ASIC channels**
- **ratio channel dependent and > 10(?)**
- Important parameter for energy scale setting

Electronics developments

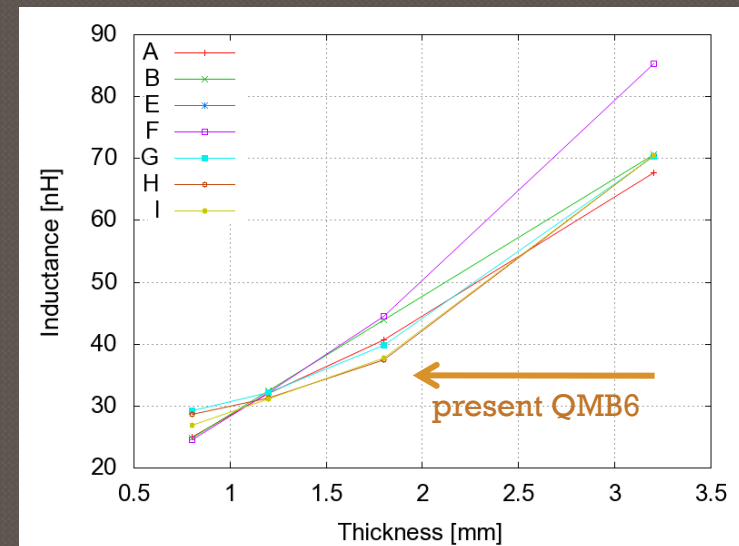
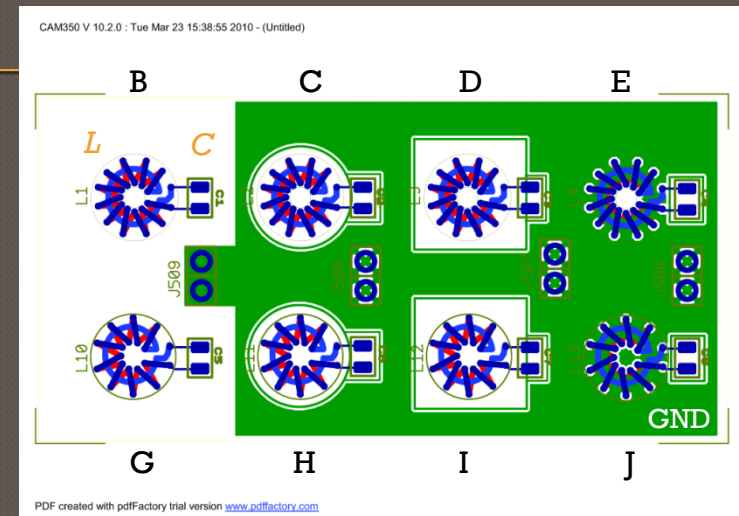
Higher inductance improves linearity behaviour of the of the QRLED driver
How to increase L ?

- toroid size: 11 and 9 coil turns, and diameter
- thickness of PCB: 0.8, 1.2, 1.8, 3.2 mm
- GND-plane geometry

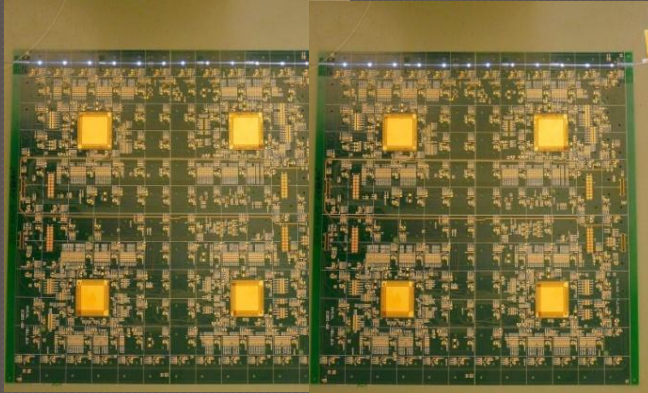
Inductance L measured via resonance frequency with parallel capacitance C (200 pF)

- accuracy needs improvement
- dominant effect of PCB thickness
- impact of the coil diameter? - still to be tested

Next version of the LED driver – modular based on single channel modules



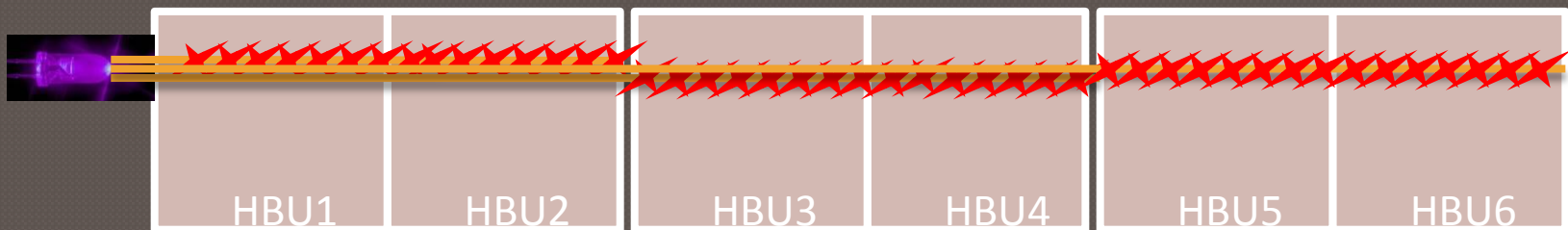
Optical developments



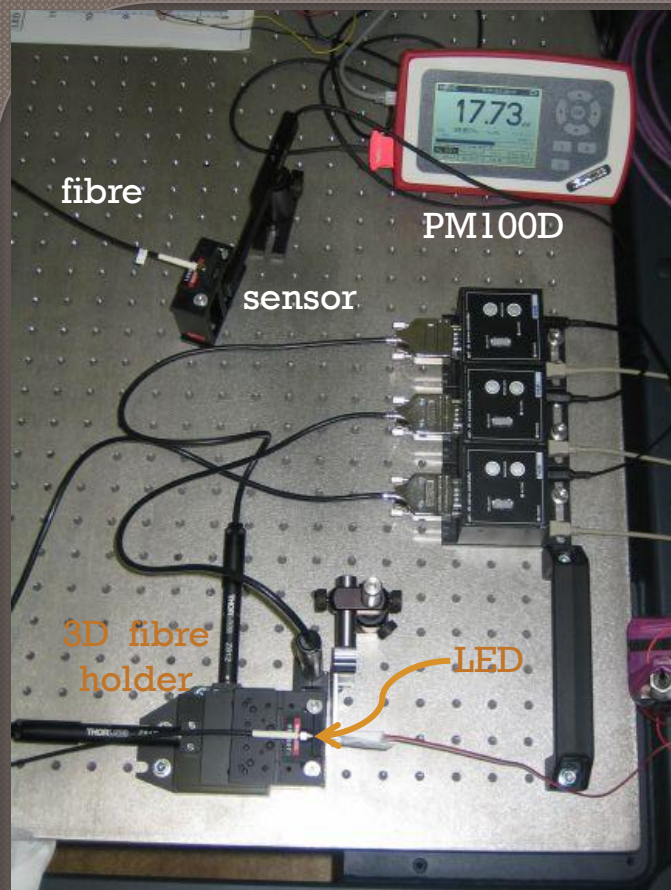
2 HBUs = 1 fibre with 24 notches

- Full length plane = 72 tiles in row
- Production of 1 fibre with 72 notches is tedious and expensive
- Agreement reached: 3 parallel fibres, each with 24 notches (1 fibre for 2 HBUs)
- For final calorimeter we plan to use full length fibre with 72 notches – automation needed
- Order placed to SAFIBRA comp.: by the end of 2010 we shall get and test the first set of 3 fibres, beginning of 2011 – 3 more sets will be delivered

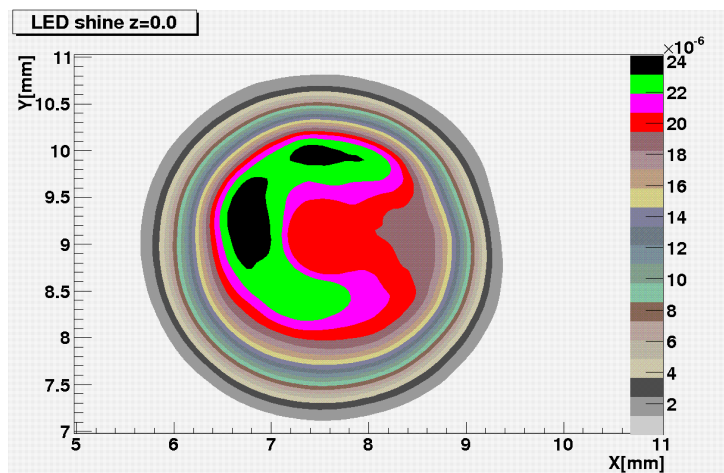
3 fibres receive light from 1 LED



Optical developments 2



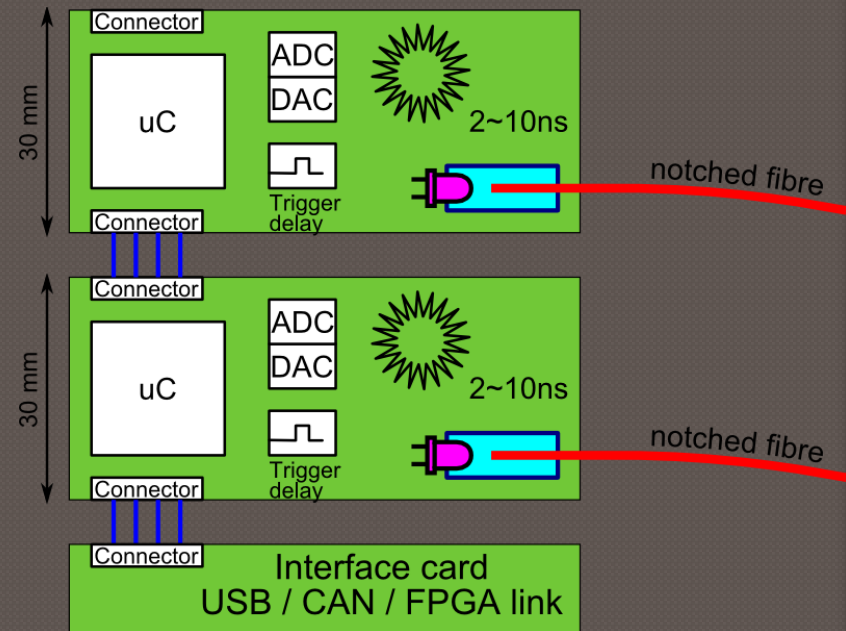
Light intensity – surface 3 mm LED



- 1 LED for more fibres – distribution of light intensity on the LED surface?
- We scanned a 3 mm LED S130VC by the THORLAB set up + PM100D
- Light intensity shows asymmetry (chip position) – inhomogeneity $\pm 10\%$
- $\pm 15\%$ observed for 5 mm LEDs used in 1m^3 HCAL calibration system
- Not a problem - inhomogeneity from notched fibres on $\pm 20\%$ level

Outlook

- Focus: increase of the optical performance:
 - increase of the pulse width from the current 3.5 ns
 - Improvement of the optical coupling from LED into the fibre
 - Improvement of the transmission to the scintillation tile
- New QR LED driver prototype envisaged
 - only 1 electronic channel per board
 - different onboard inductors for different pulse width in range of 4 ~ 10 ns
 - 3cm PCB width to match the tile size
- Notched fibre production (Q4/10-Q1/11)
 - 4 sets by 3 notched fibres each with 24 notches



*Thanks to my Prague colleagues
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Smolík and M. Reinecke, M. Terwort
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