Comments on optical system for calibration II.

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Present system: one tile – one optical fibre
complicated system

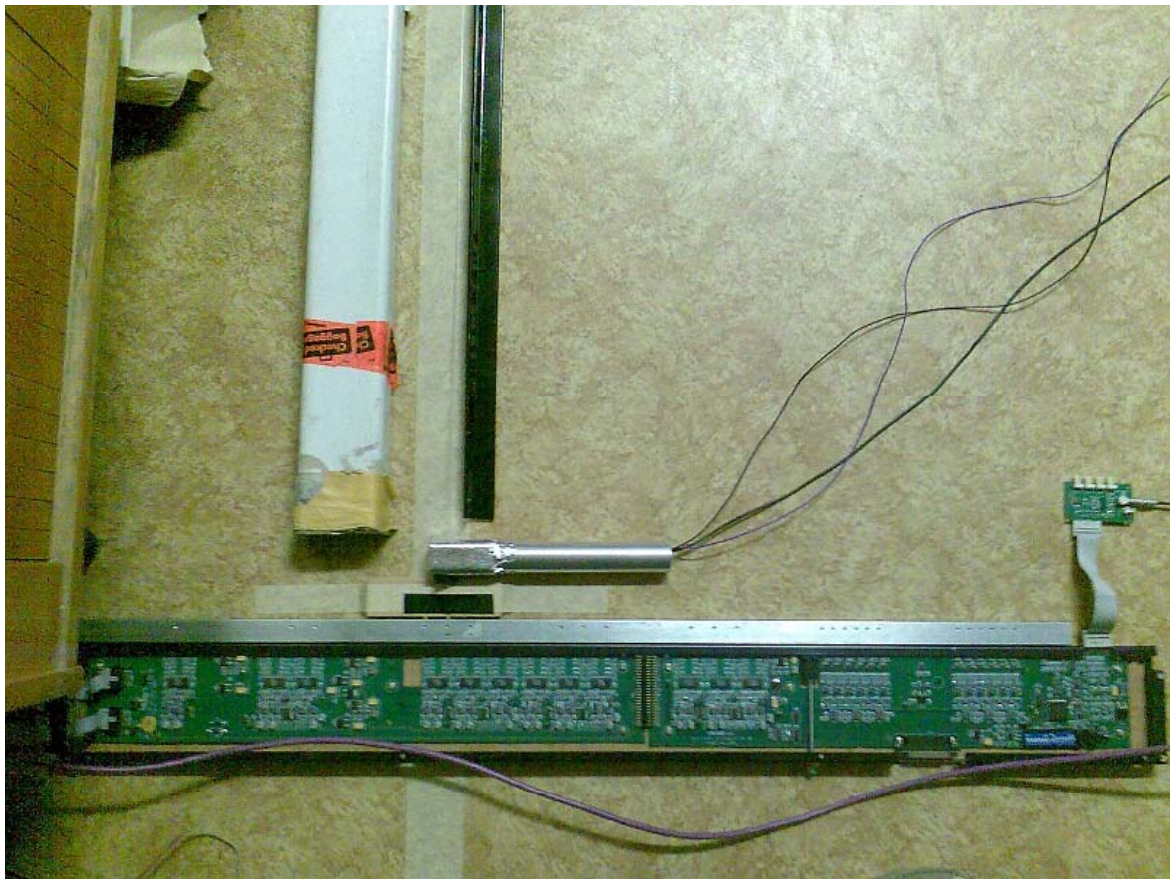
Idea: use one fibre for more tiles, ideally one row of tiles – one fibre

How to do it? Side-emitting fibres

- 'Easy' solution – to buy, lace through tiles and connect to LED driver
- Problems: search thin (~1mm) fibres, unknown parameters, cost
  → *FiberTech* *(SLS600 series)*, *CeramOptec* *(GF400/3T)*, *Mitsubishi* *(CK40)*

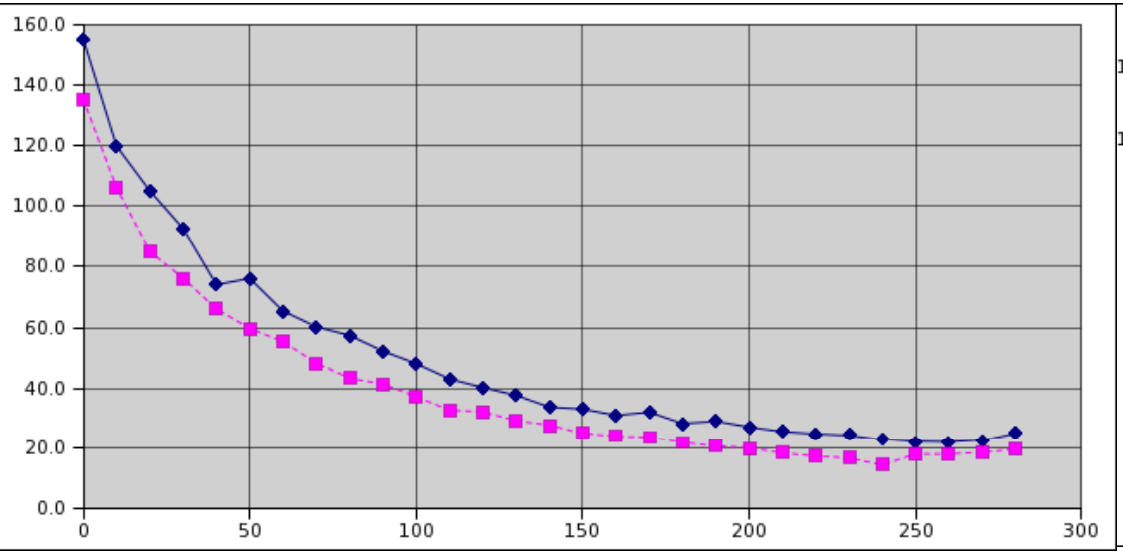
- Non-uniformity of emitting light → ***measurement***
- Need to focus enough LED light into fibre → ***in progress***

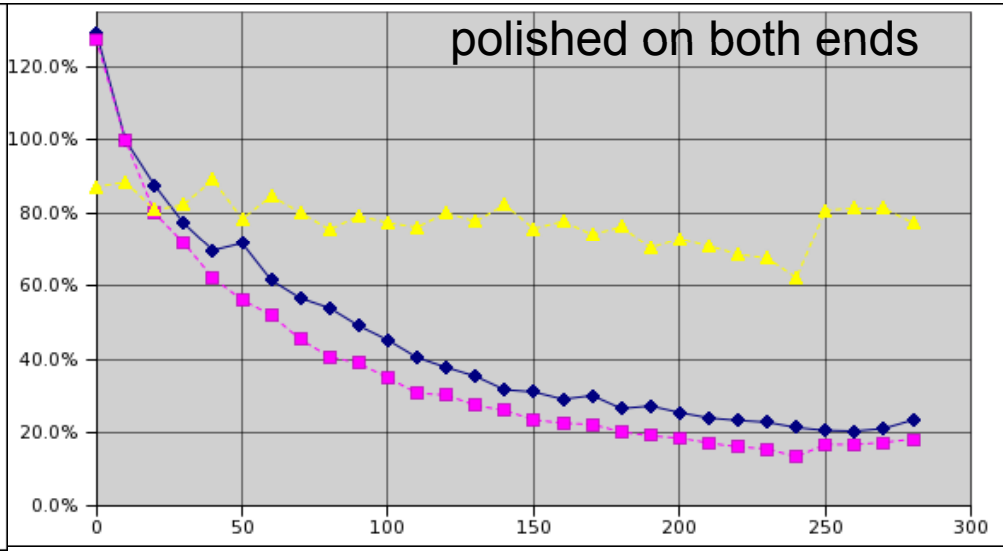
Measurement setup



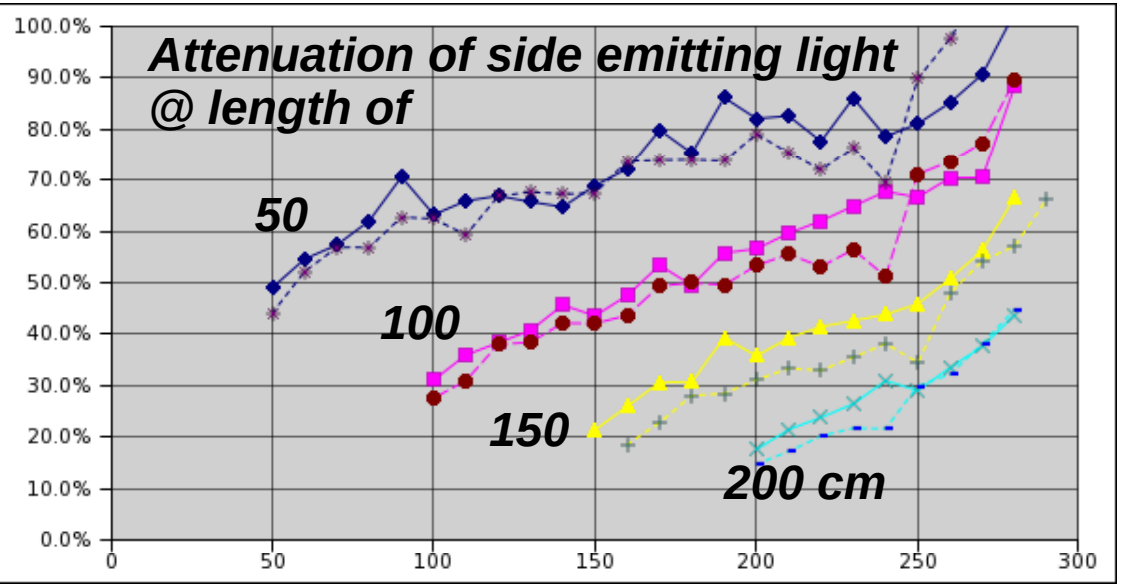
3-meter-long setup to have straight line fiber position (avoid twisting)
CMB + UV LED pulsing light - PMT R647 Hammatsu – Scope Readout

Short emitting FibreTech (SLS600UV)

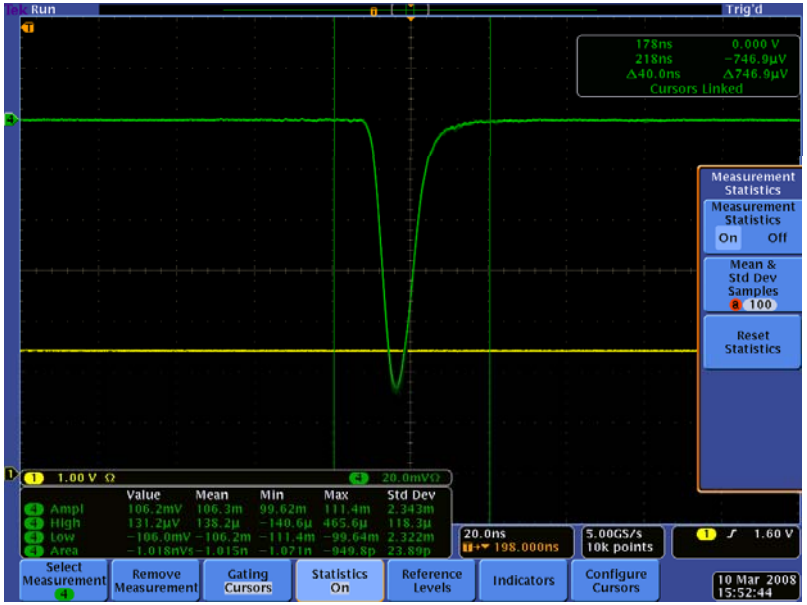




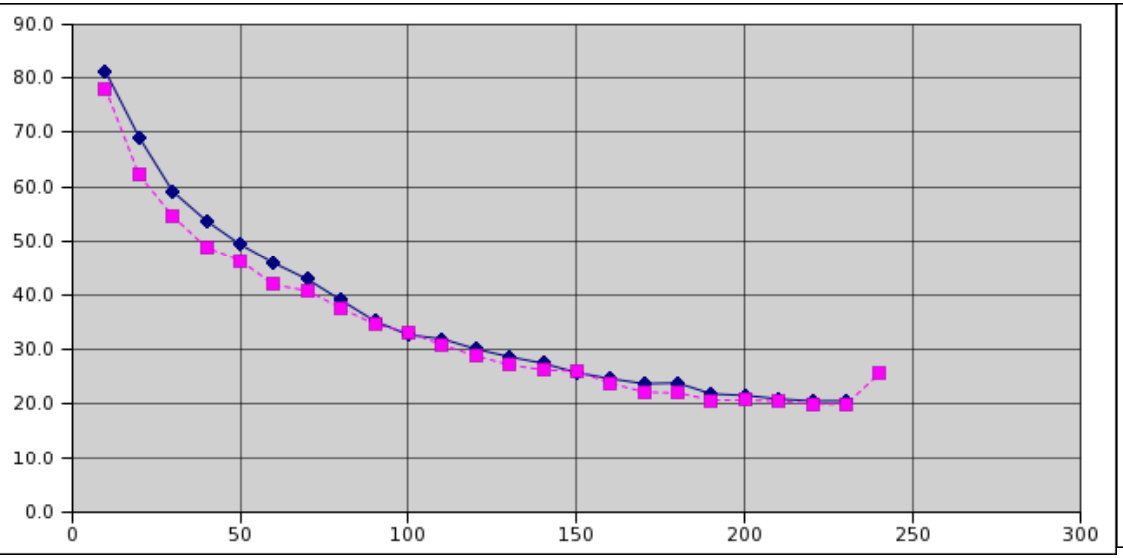
Dependence of signal amplitude [mV] on position of PMT + relative (both direction measurement) position in cm from the UV LED source

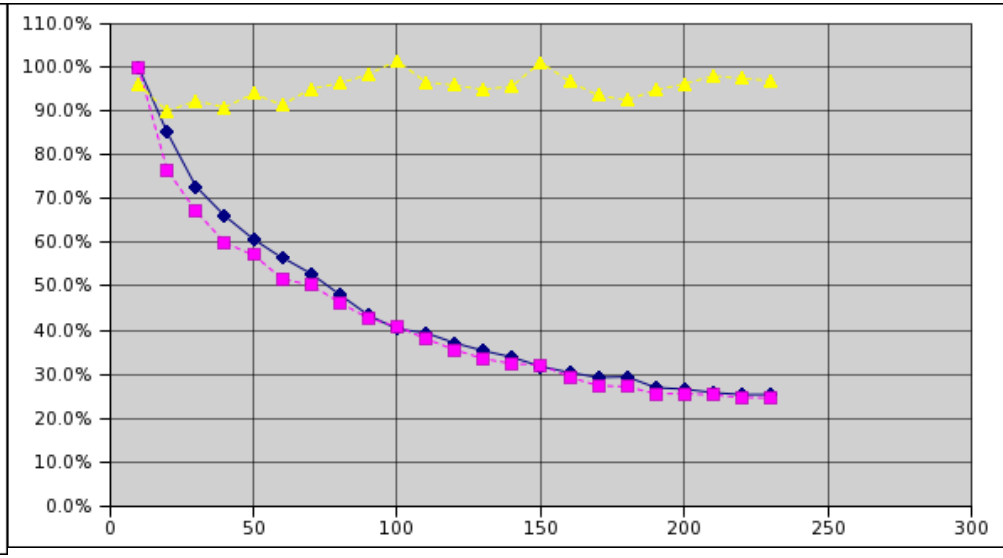


normalized to 10cm' position

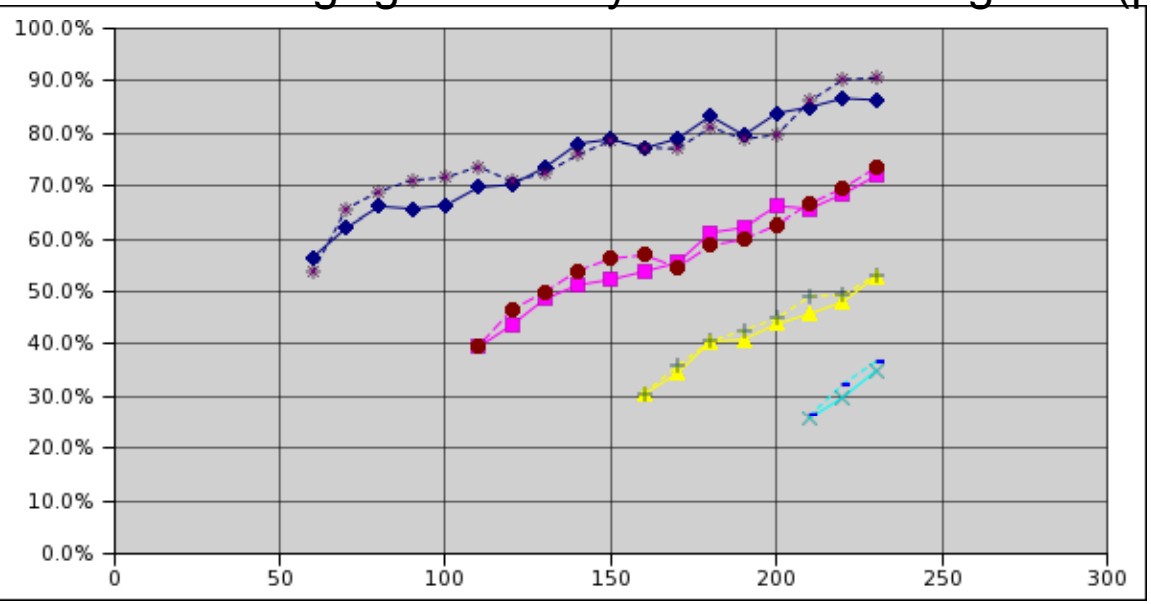


Long emitting FibreTech (SLS600T)





Side emitting light intensity decreases along fiber (position in cm from the UV LED source)



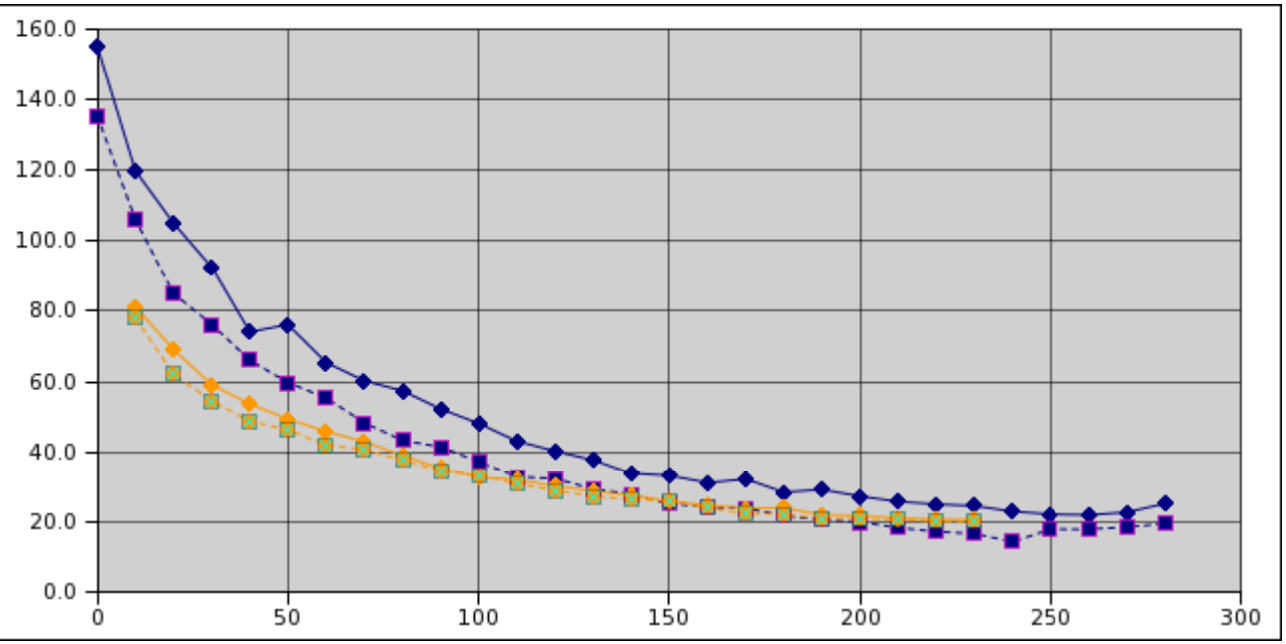
Attenuation of side emitting light
@ length of 50, 100, 150 and 200 cm
averaged of 75%, 55%, 40% and 30%

Exponential decrease expectation
softly violated
(At beg and end fiber pos. problematic measurement)

Short x Long

eff. length

2m .vs. >10m



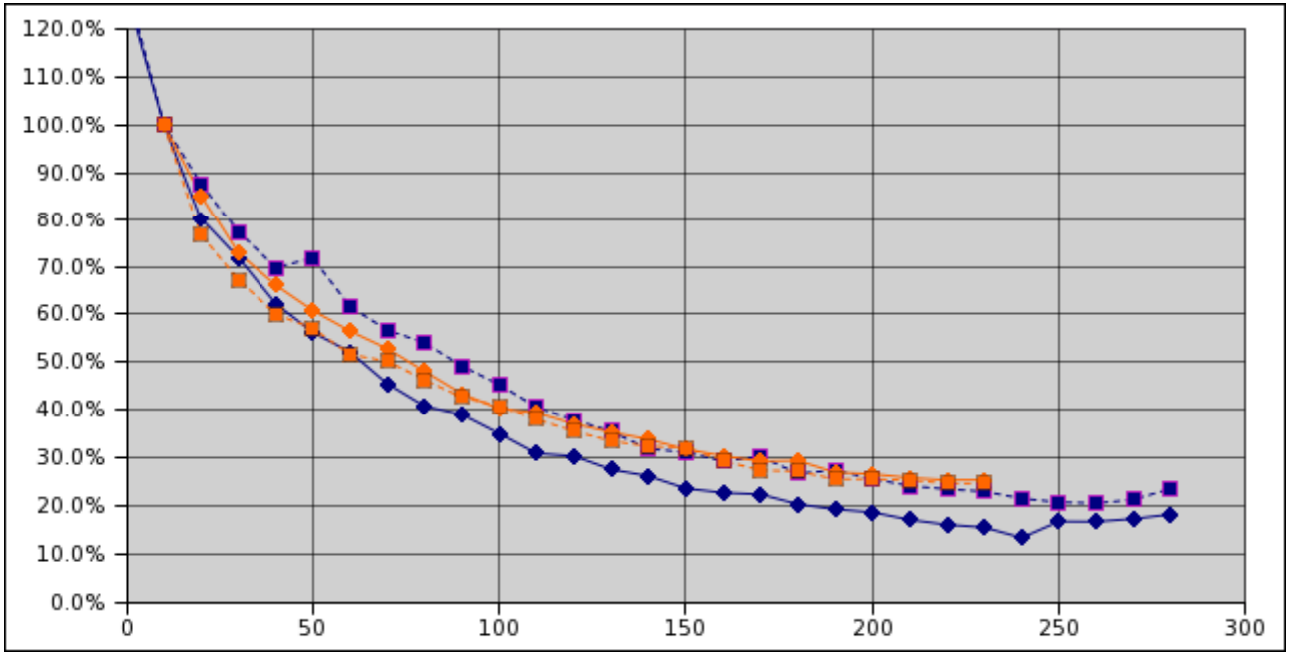
Absolute measurement:
Intensity of side-emitting light

- at front side of fiber up to 50% higher
- at rear side at same level down to 20-30%

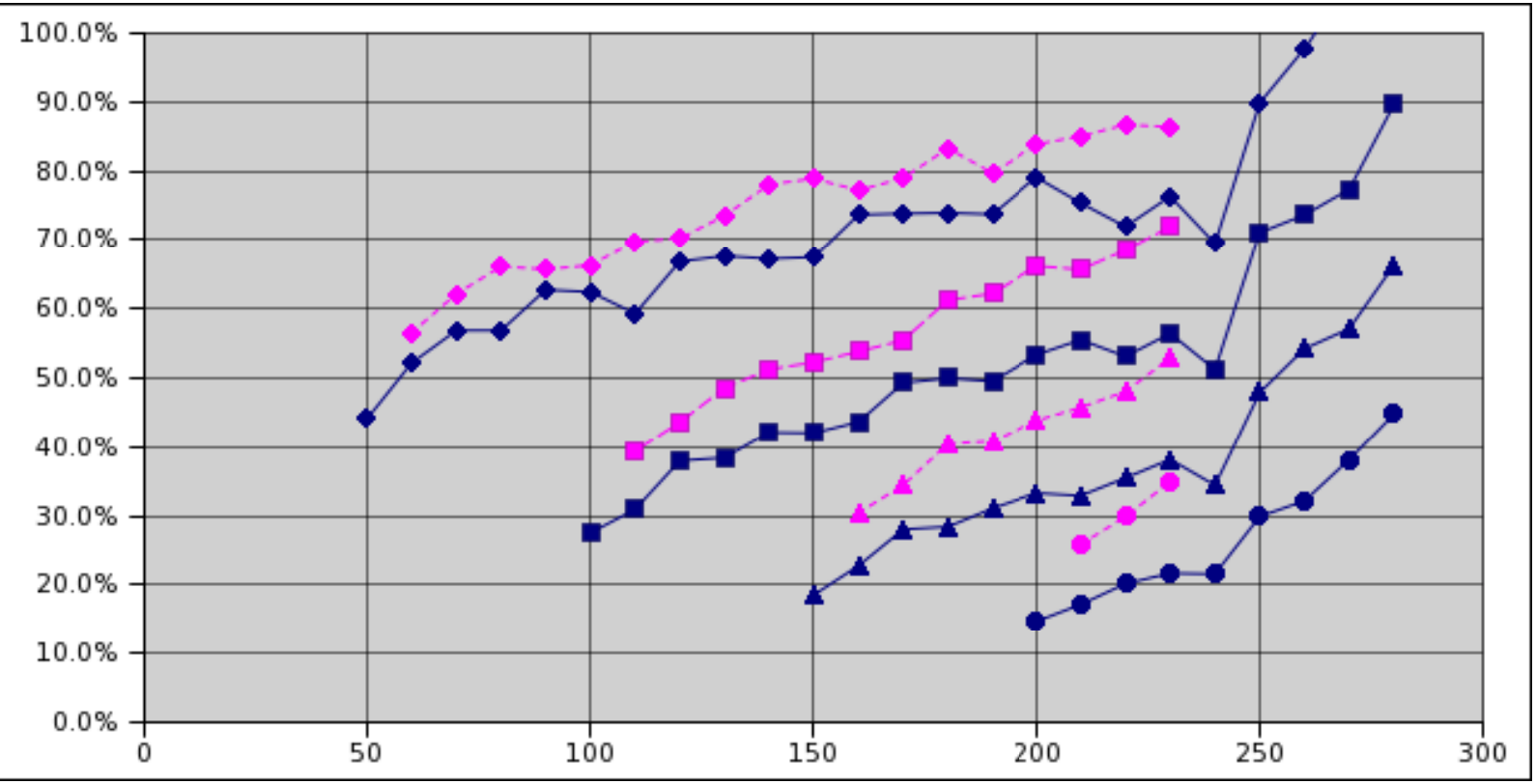
‘Short’ fiber radiates absolutely more than ‘Long’ as expected

But

Relative decrease of intensity is smaller, more homogenous for ‘long’ fiber



Attenuation Short x Long



Exponential decrease expectation softly violated

Attenuations of side emitting light @ length of 50, 100, 150 and 200 cm are similar,
Slightly better for long side-emitting fiber in averaged by 5-10%
(At beg and end fiber pos. problematic measurement)

Conclusion I

- All found and measured fibers show same results within systematic uncertainties
- Side-emitting light intensity decreases along the fiber going from UV LED light source to the free end of fiber

  down to 20-30% at position > 2.5 m from source
- Attenuation of side-emitting light at length of 1m and 2m are approx. level of 55% and 25%, resp.

  slightly depending on position of the detection

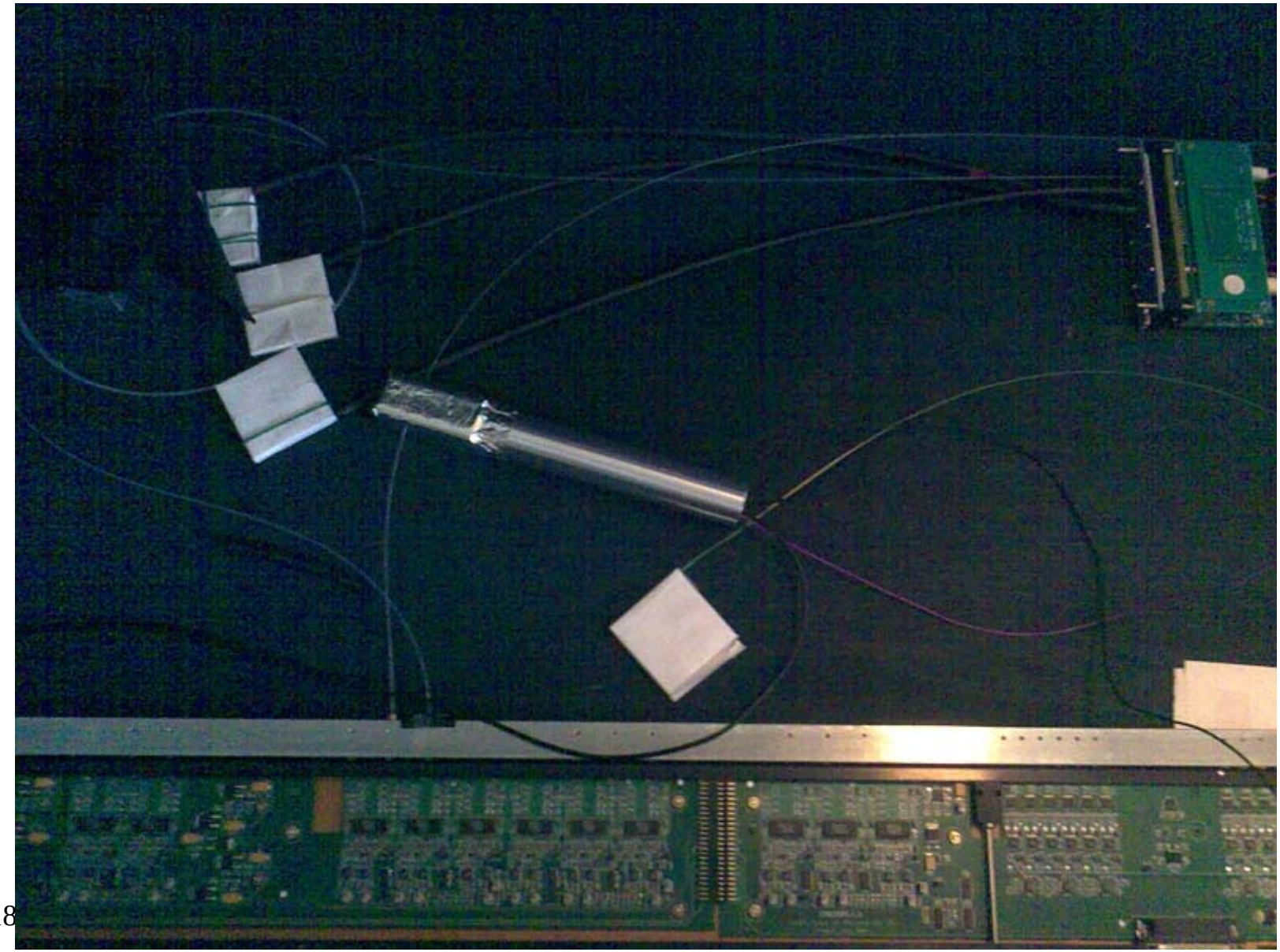
Conclusion II

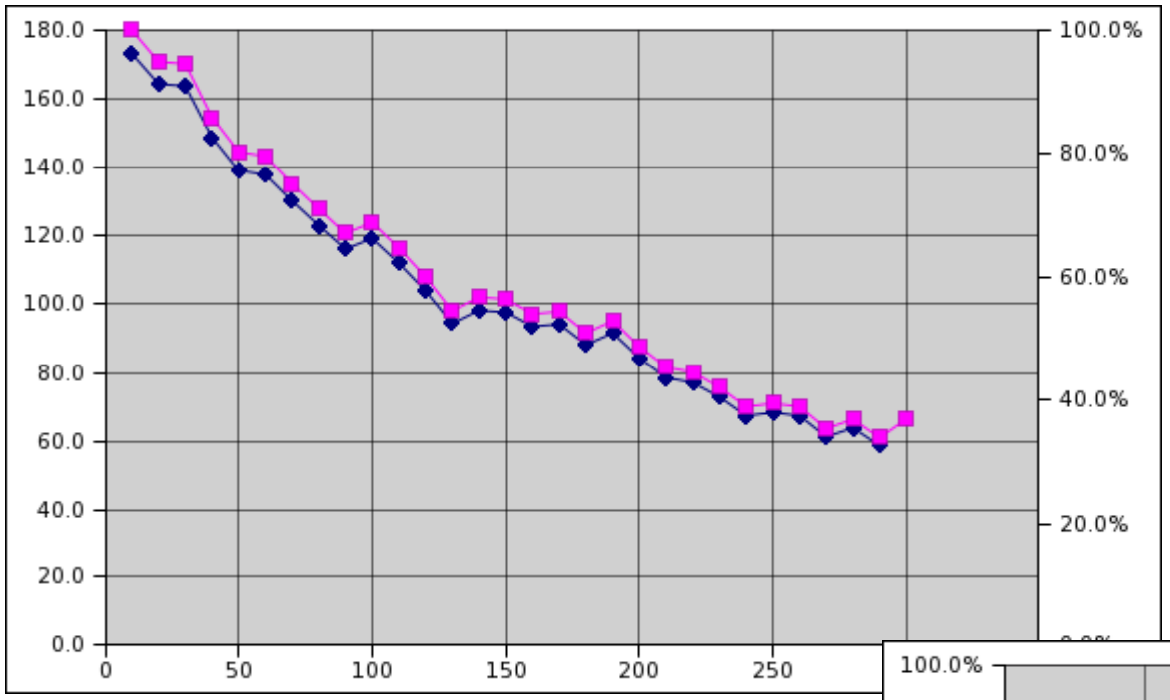
- We certainly need more absolute light intensity
  → focusing enough LED light into one fiber

  We estimate ratio of light intensity going directly from fiber end to side-emitting one at level of 20-50 more

- This is currently being done by optical colleagues

For further developing of system for new prototype of TileHCAL we need several (~10) tiles with SiPMs

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140.0
120.0
100.0
80.0
60.0
40.0
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0
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100
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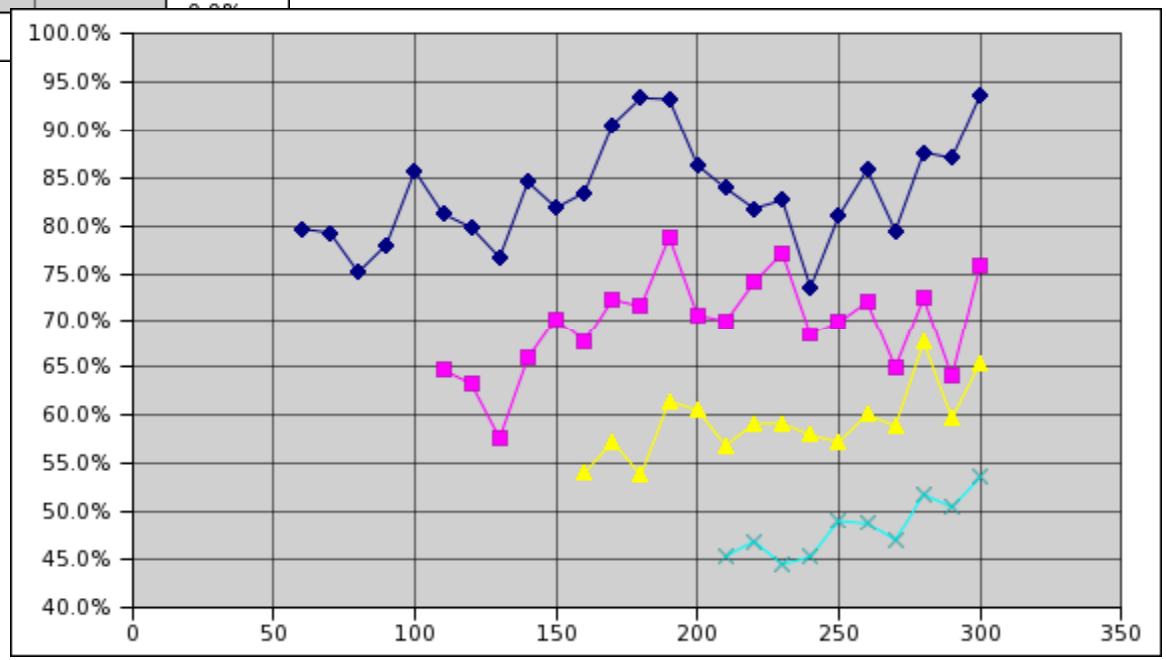
200
250
100.0%
80.0%
60.0%
40.0%
20.0%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