PLC studies at Padova

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Belle II Italia PID meeting
Torino, October 1st 2015

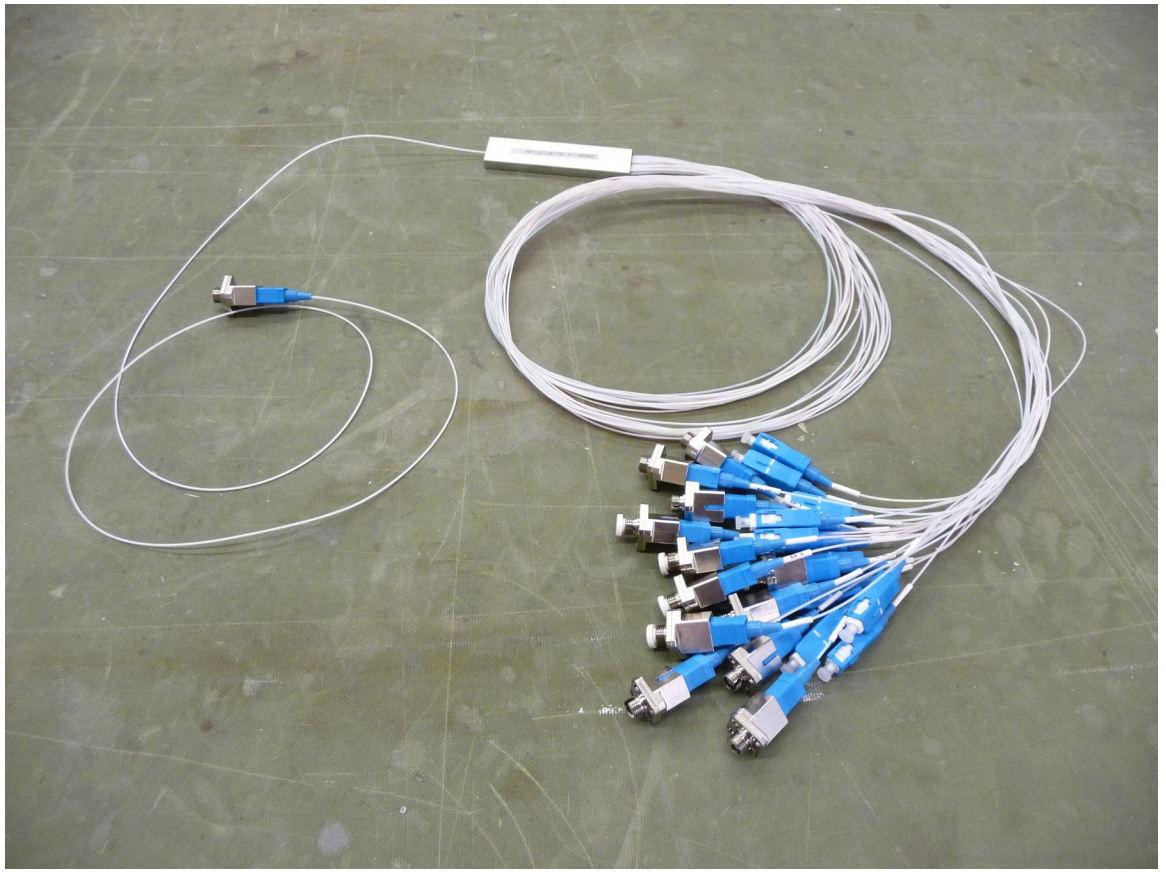
Introduction

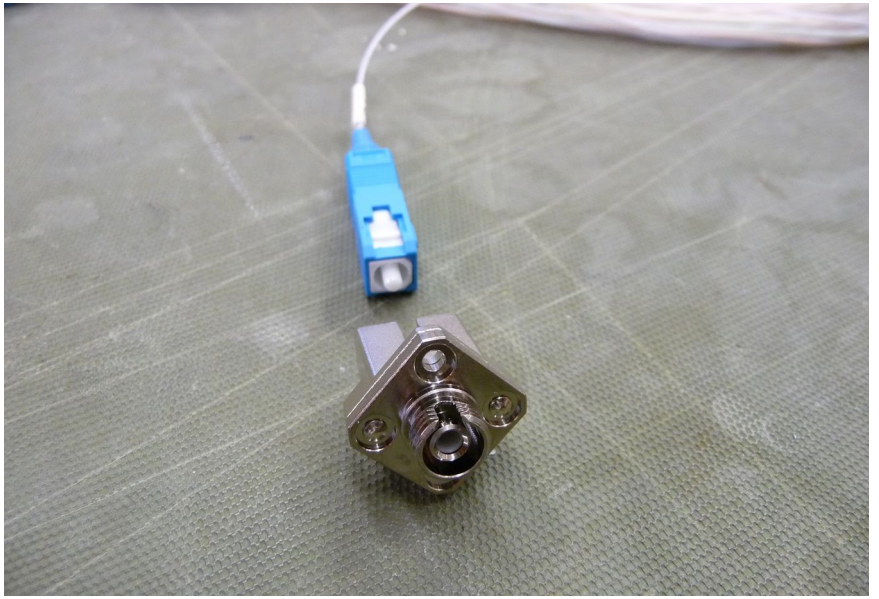
- Two PLC (Planar Lightwave Circuit) have been purchased and we (Padova) have been playing with one of those (the other was sent to Torino) in the last few weeks;

- The PLC's could be alternative to the SM fiber bundle that is in the baseline plan, but a few questions need to be answered:
  - overall quality of the image;
  - light transmission efficiency (especially since this object has not been designed for the near UV);
  - impact on the time resolution;

- We started addressing the questions of the quality of the final image and the overall light transmission efficiency of the system, in sight of a comparison with the original proposed system.

The PLC

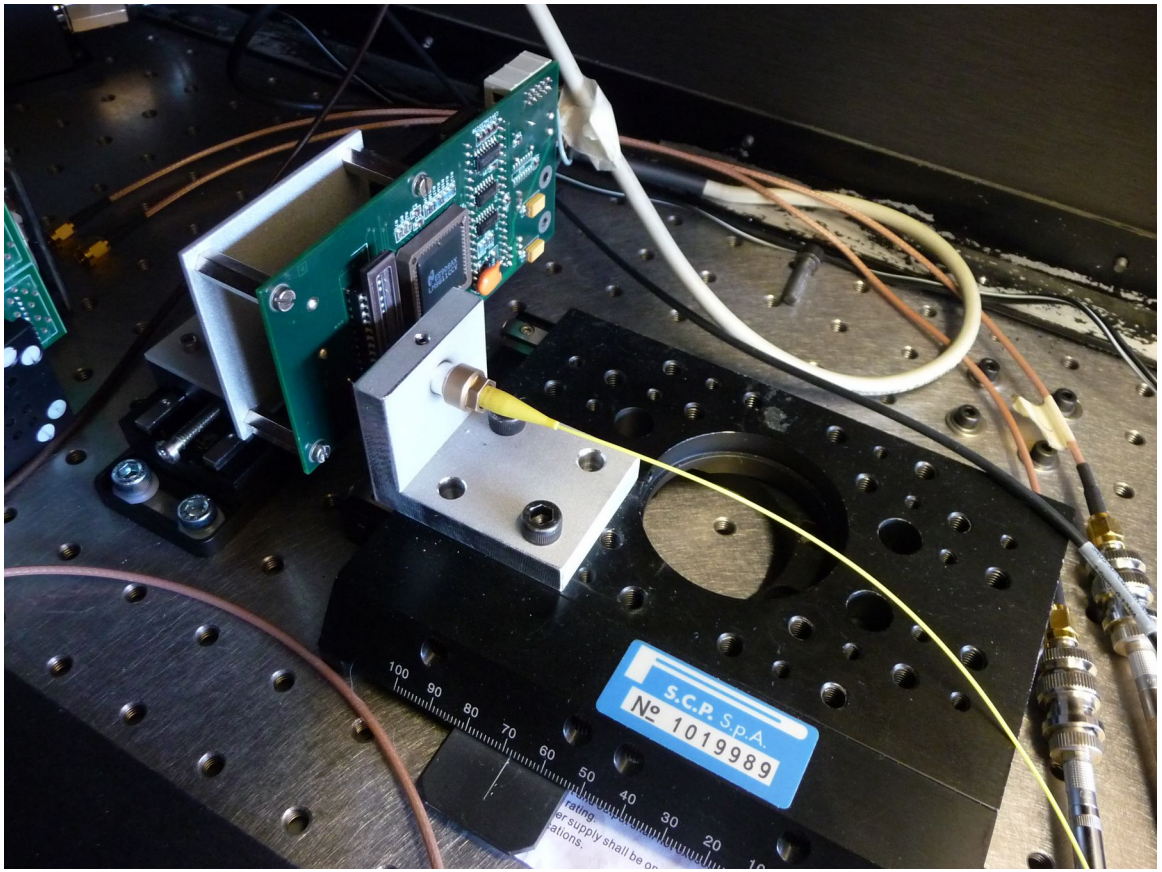




Setup in Padova

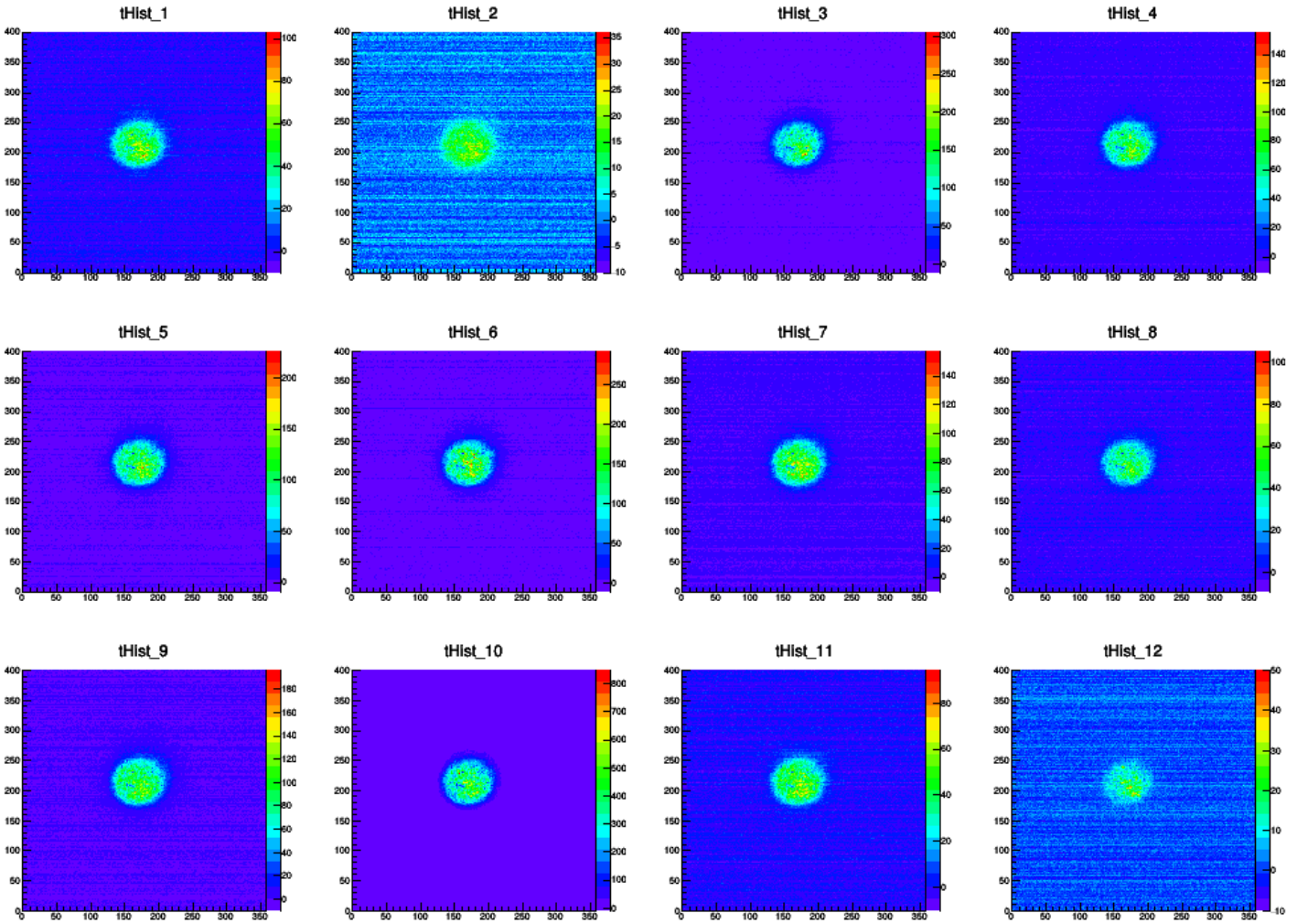
We took our measurements with the setup:

A rough estimate of the transmitted light is derived from the integral of the figure obtained in a scan along the x coordinate (the CCD array covers the y coordinate)



Quality of images

Setup: Laser → PLC (one fiber at the time) → MM fiber → GRIN lense (always the same)



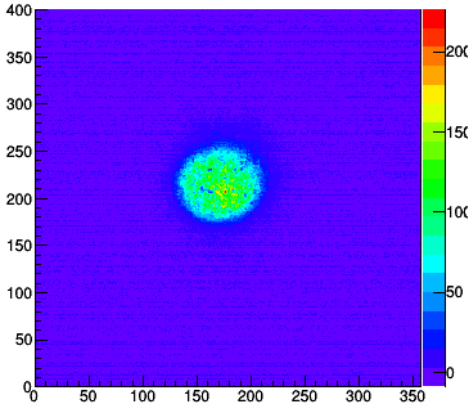
Quality of the image

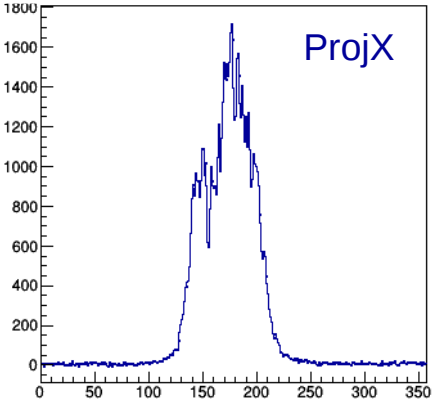
Projections in X and Y are 11 bins wide slices around the maximum of each 2D figure

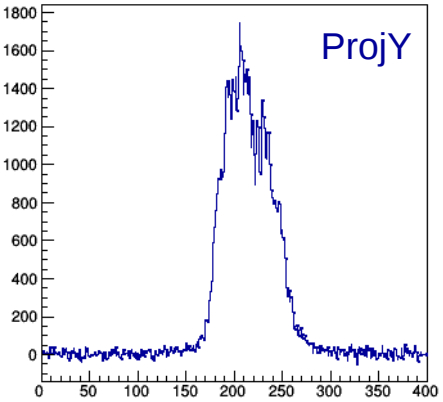
The shapes are compatible with simpler setups (i.e. they are determined mostly by the GRIN lens and the quality of the connections)

The widths are compatible for all the fibers (despite the large differences in the light transmission efficiency)

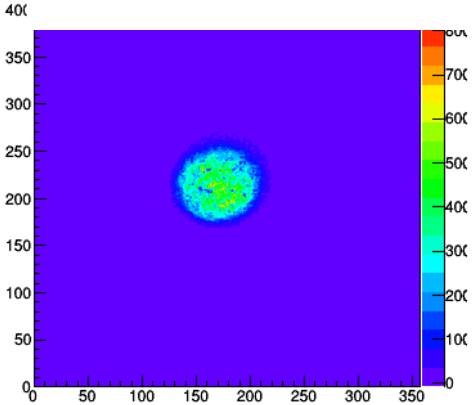
Fiber 5

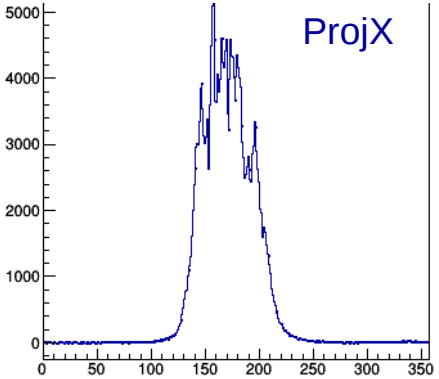


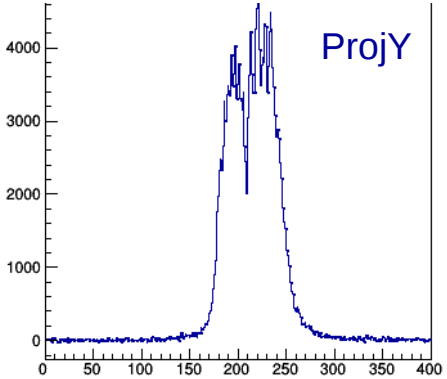




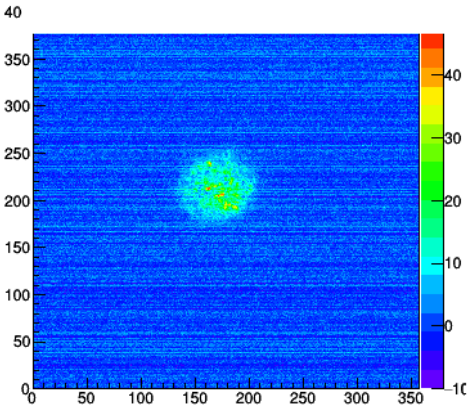
Fiber 10

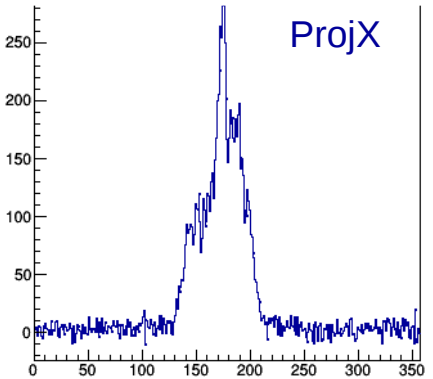


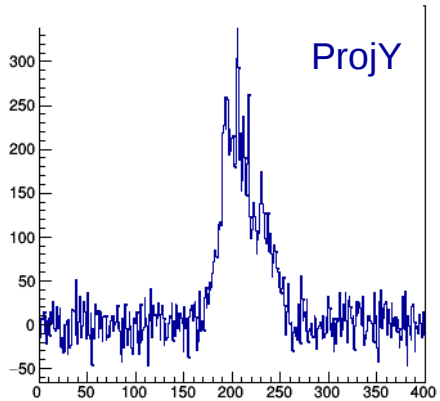




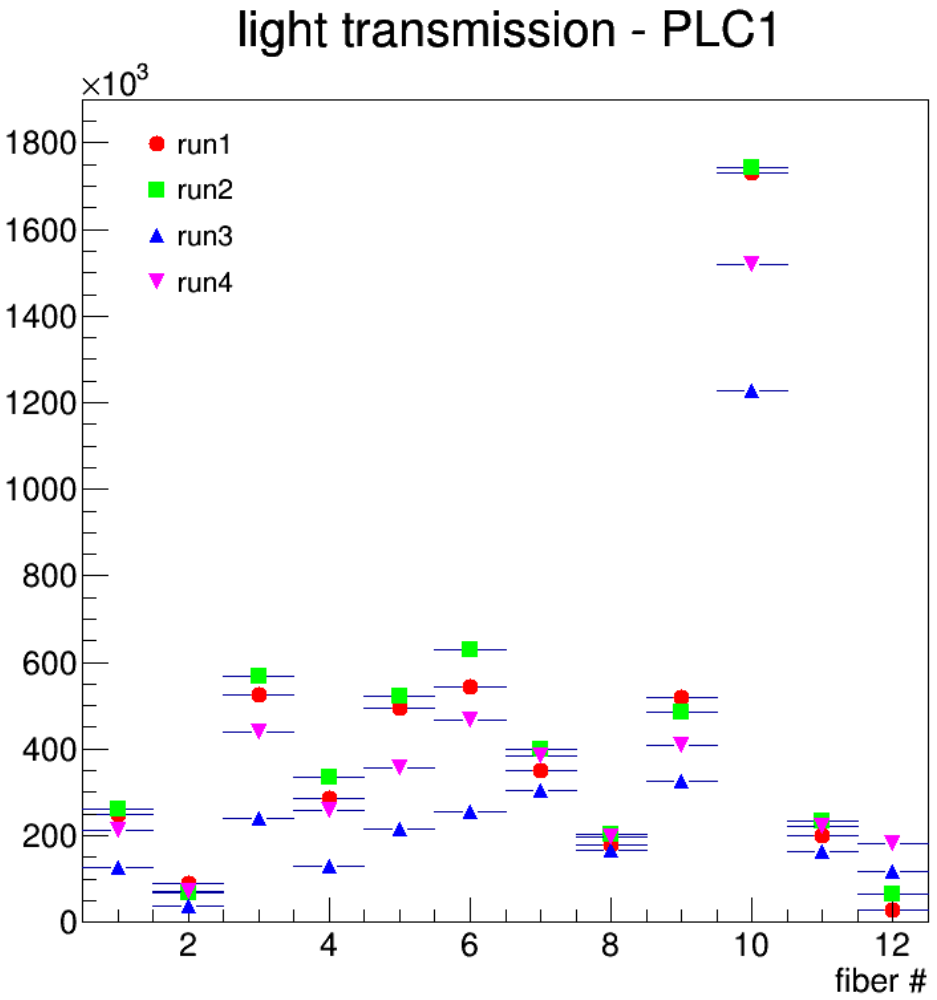
Fiber 12

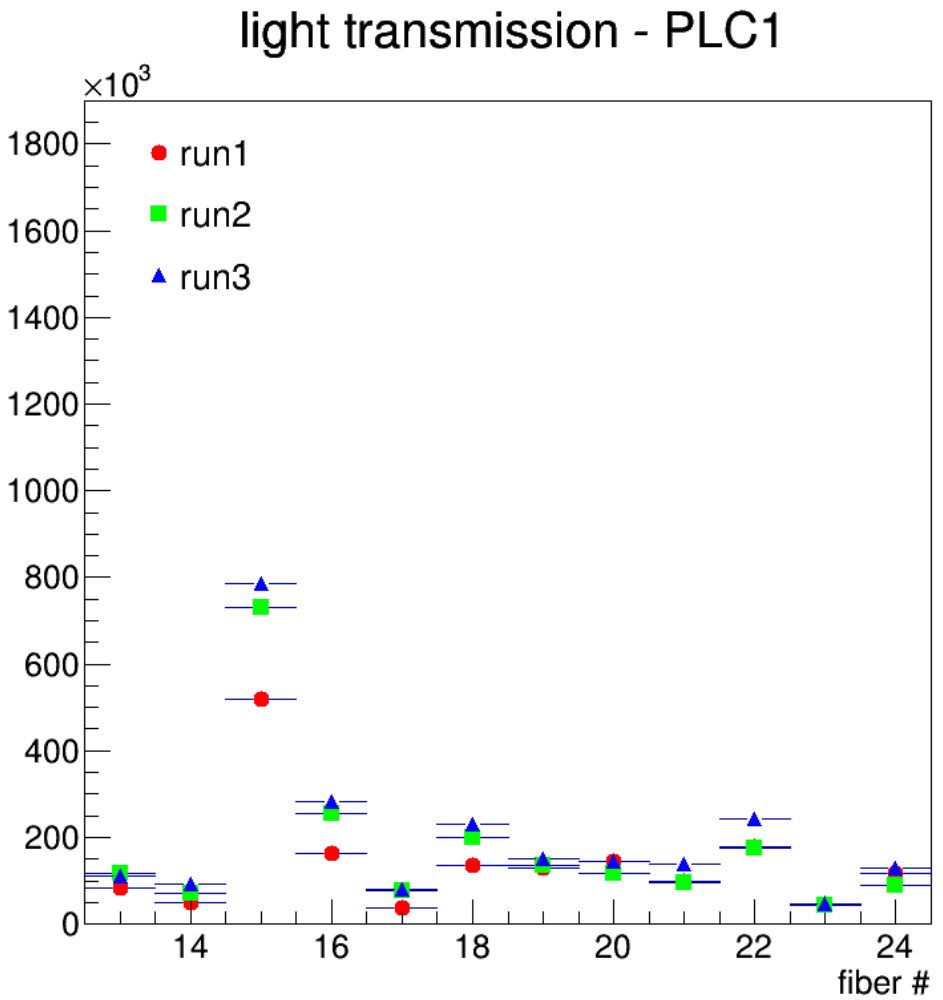






Uniformity

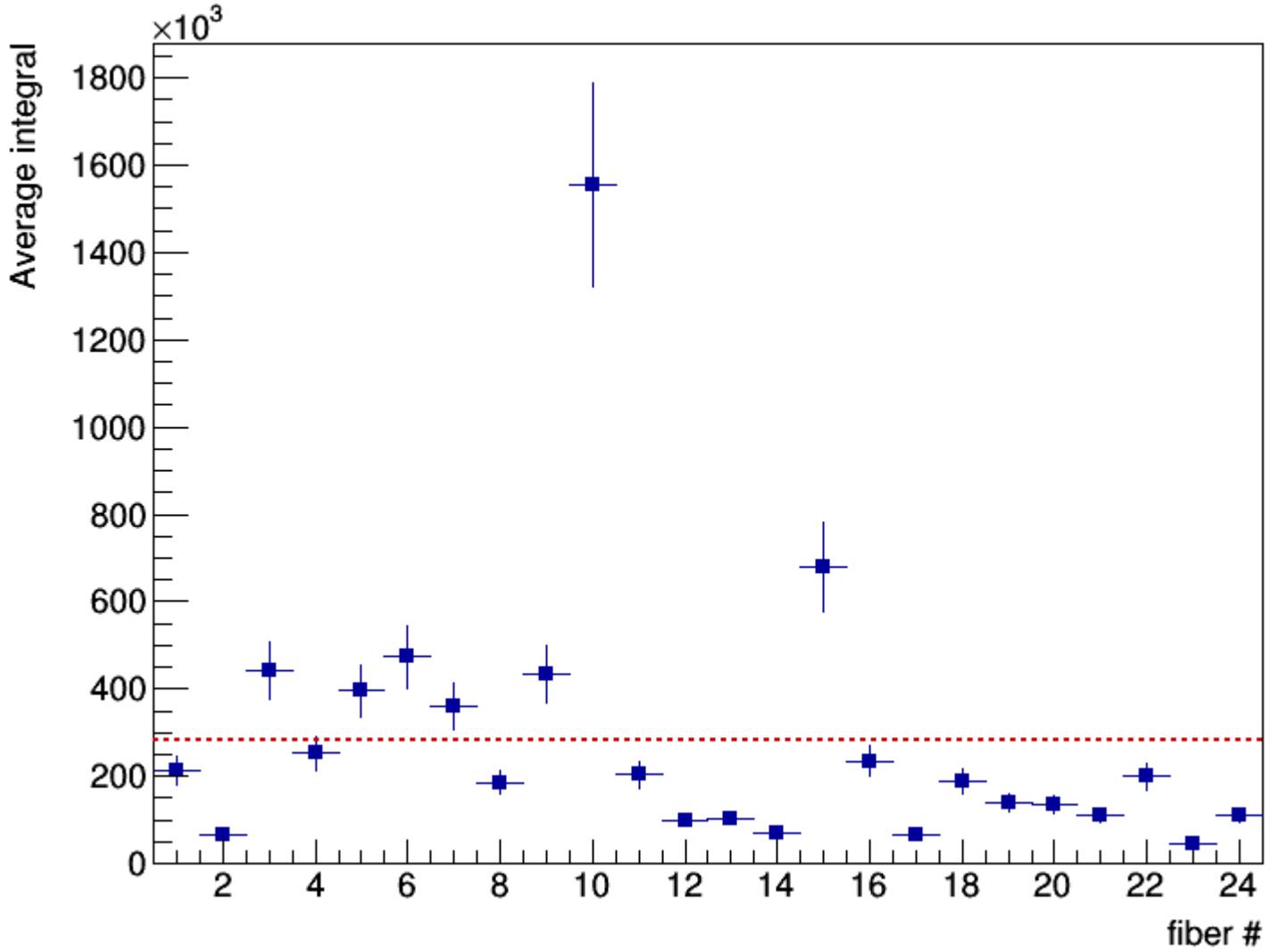




The measurements have been repeated a few times, to evaluate the impact of opening/closing the connections between the elements, laser stability, ...

Uniformity

Taking the averages of the runs taken:



Uniformity

Average integral (in arbitrary units) is **281.1**

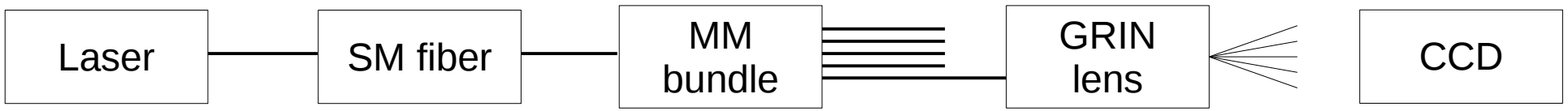
The 16 fibers closest to the average (in blue in the table) have integrals between **104.6** and **443.0**

This range is in the same ballpark we observed for the MM bundles.

Fiber#	Integral	Diff. wrt Average
1	212.407	-69.5402
2	66.094	-215.853
3	442.972	161.025
4	252.314	-29.6332
5	396.779	114.832
6	473.265	191.318
7	359.601	77.6543
8	186.3	-95.6469
9	434.382	152.436
10	1555.74	1273.79
11	204.673	-77.2734
12	98.3905	-183.556
13	104.644	-177.303
14	71.1987	-210.748
15	678.089	396.142
16	234.167	-47.7803
17	65.5913	-216.356
18	188.218	-93.7293
19	139.053	-142.894
20	135.569	-146.378
21	110.65	-171.297
22	199.43	-82.5166
23	45.1857	-236.761
24	112.014	-169.933

Light transmission

- We do not have the setup to perform a precise measurement of the light transmission efficiency, however we can perform a preliminary rough estimate;
- The measurements I presented so far have been obtained using the laser with tune **83**;
- We obtained a similar light output with the configuration:

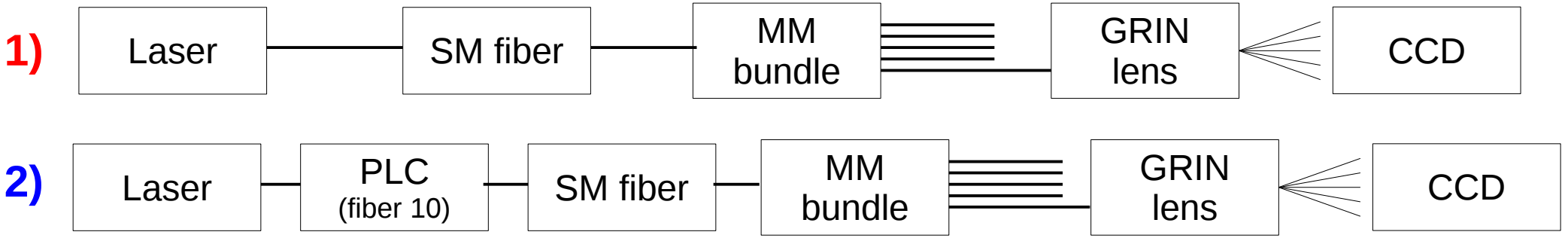


but using the tune 0 of the laser;

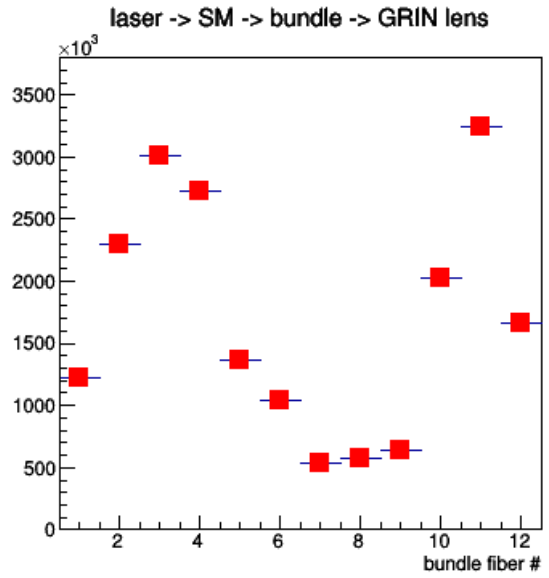
- The ratio of the laser intensity between tune 0 and tune 83 is **~17** (see backup slides).

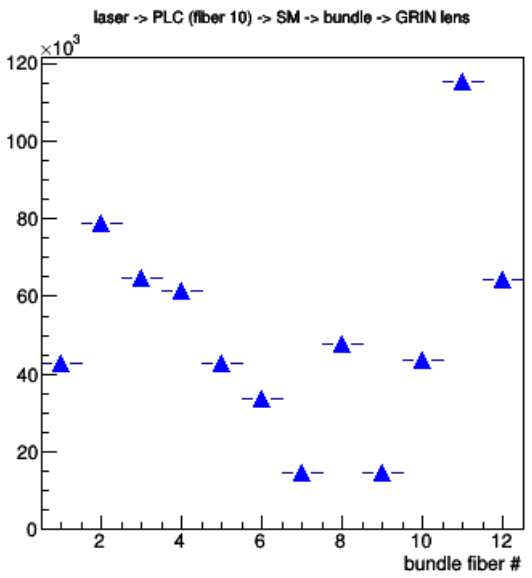
Light transmission

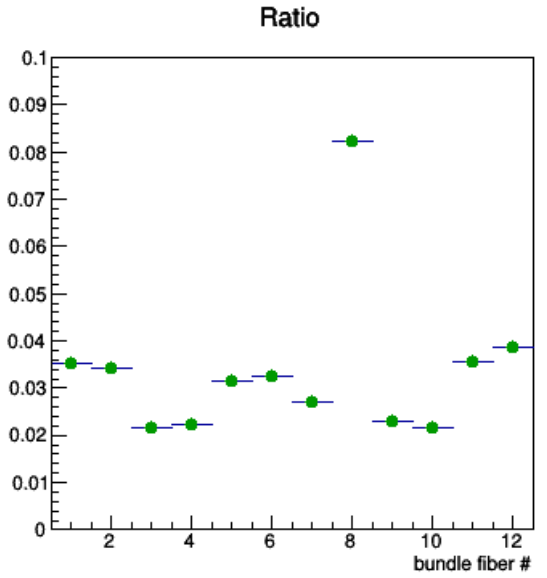
- To estimate the efficiency of the PLC, we compare the output in the two configurations:



- The average attenuation of PLC fiber 10 is a factor **~30** (a factor **~165** for the average PLC fiber)







Conclusions

- We started working with PLC's, initial results are very encouraging:
  - The PLC does not introduce distortions to the final image produced by the GRIN lens;
  - The light is split among the different output fibers in a reasonably uniform way;
  - The light at the output is reasonably high;

- Bottom line: PLC's seem to have a much higher light transmission efficiency than the SM fiber bundle that was originally envisaged.

Backup Slides

Light vs tune