PRACTICAL TEST BENCH USED FOR TESTING PHOTOMULTIPLIER TUBES, TYPE MAPMT

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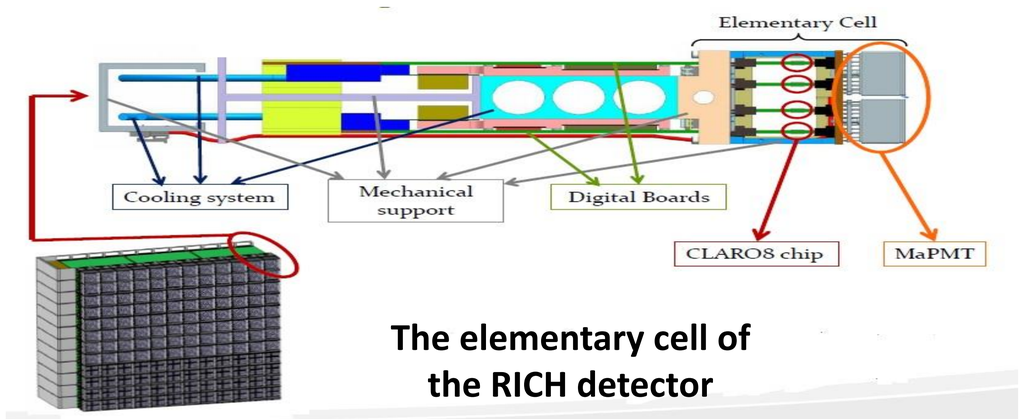
LHCb RICH UPGRADE

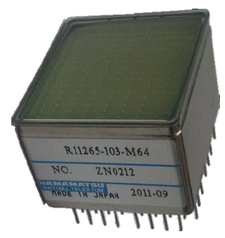


The elementary cell of the RICH detector

During the Upgrade of LHCb most sub detectors will be replaced in order to carry out physics measurements at increased luminosity for proton-proton collisions and an increased read-out speed, 40 times higher then present rate for some detector subsystems. The latter is the case of the RICH subdetectors (Ring Imaging Cherenkov), which are two systems used for particle identification through the measurement of the Cherenkov angle. The baseline technology is the Multi-anode Photomultiplier tube (MaPMT), which can provide a very good single photon sensitivity in a range 200-600 nm, good spatial resolution and a high quantum efficiency.

R11265-103-M64 tube

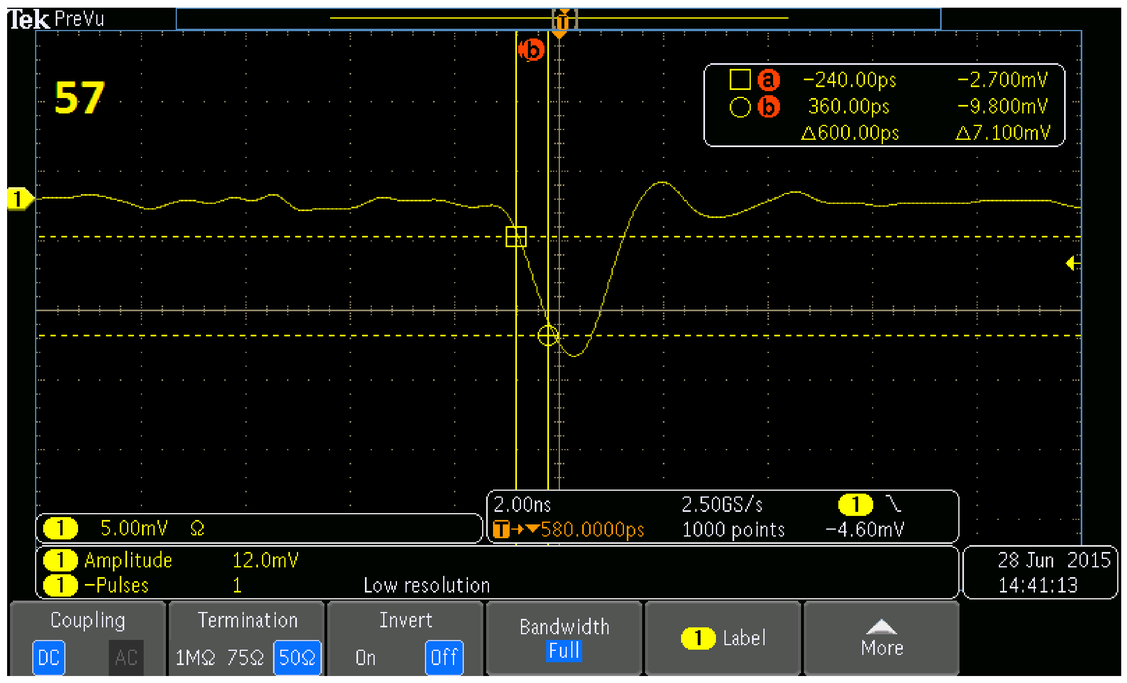
Typical characteristics	R11265-103-M64
Spectral response range	185-650 nm
Window material / Thickness	UV glass / 0.8 mm
Geometrical dimensions	26.2 x 26.2 mm^2
Photocathode minimum effective Area	23 x 23 mm^2
Number of pixels / Dimensions	64 / 2.9 x 2.9 mm^2
Photocathode material	Super Bialkali
Number of dynodes	12
Maximum supply voltage	1100 V
Gain	1 x 10^6 at 1000 V
Anode dark current (each anode)	0.4 nA
Rise / transit time	0.6 / 5.1 ns
Uniformity between each anode	1 :3



R11265-103-M64 tube

The photomultiplier tube assembled with standard socket from Hamamatsu (E11906)

The practical test bench



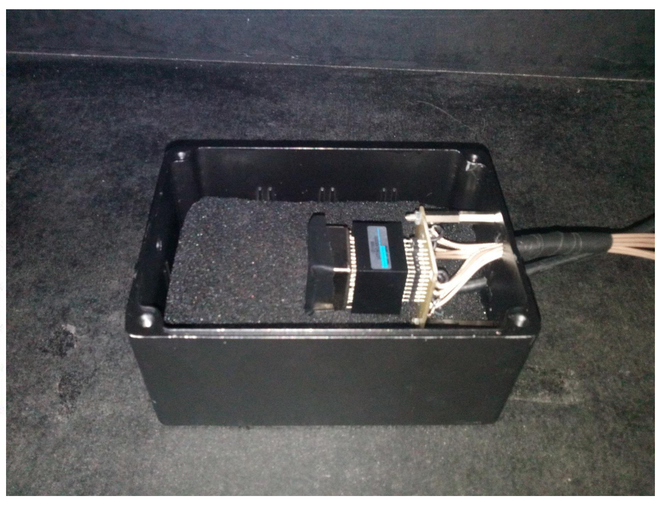
Typical waveform measured directly for a dark current event from an anode of the MaPMT, displays the response time of the tube.

Simple test bench for the measurement of dark current rate and signal trigger rate.

Dark counts

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

10 pixels were used for testing



The R11265-M64-103 mounted inside of the dark box

Currently a software code in C language to count pulses is under development even if preliminary inspection using the oscilloscope shows that the dark current average rate is about 1 Hz pe pixel.

Future Plans

The plans for future are to finish the test bench and to continue the testing of R11265 tube for single photoelectron signals .

The final test bunch will include the R11265 together with ASICs (Appli-cation Specific Integrated Circuit) like MAROC3 or SPACIROC2 produced by Omega micro. The latter front-end chips i.e. MAROC3 and SPCIROC2, were designed exactly to analyse and record the 64 channel photoelectron sig-nals coming from MaPMTs.