Status of the PMT development for KM3NeT

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VLVnT11, Erlangen
12.10.2011

Friedrich-Alexander-Universität Erlangen-Nürnberg

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KM3NeT

PMT specification

- Quantum efficiency (QE) at 470nm 20%
- Transit time spread (TTS) <2ns (σ)
- Inhomogenity of cathode response <10%
- Gain >2x10^6
- Peak to valley ratio >3
- Supply voltage <1400V
- Dark count rate at 15° C <3 kHz

- Length <12cm
- Convex input window 198mm radius

PMT manufacturers

After Photonis cancelled PMT production:

Companies ET Enterprises, Hamamatsu, and MELZ

Development of new PMTs

Delivery of 50-100 PMTs from each company for optical module prototyping

Possible production of PMTs for KM3NeT, time scale 3-4 years:

~200,000 – ET Enterprises, Hamamatsu

~40,000 – MELZ

ET Enterprises D783FL PMTs

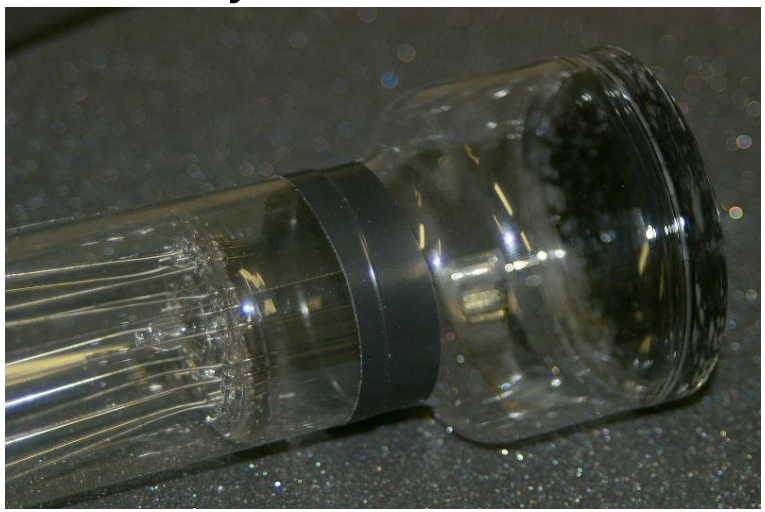
First 2 PMTs tested at KVI and Nikhef

11 PMTs delivered

100 PMTs till end of the year

More detail in talks of Q.Dorosti and A.Cormack

45 dummy PMTs delivered



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MELZ

Amplifiers (dynode structure) produced and successfully tested in another envelope

82mm MELZ PMT under internal tests in the company. Expected delivery – October 2011

Hamamatsu R6233-01MOD PMTs

Three PMTs delivered at the end of January

Next 10 delivered in September

50 PMTs till end of November

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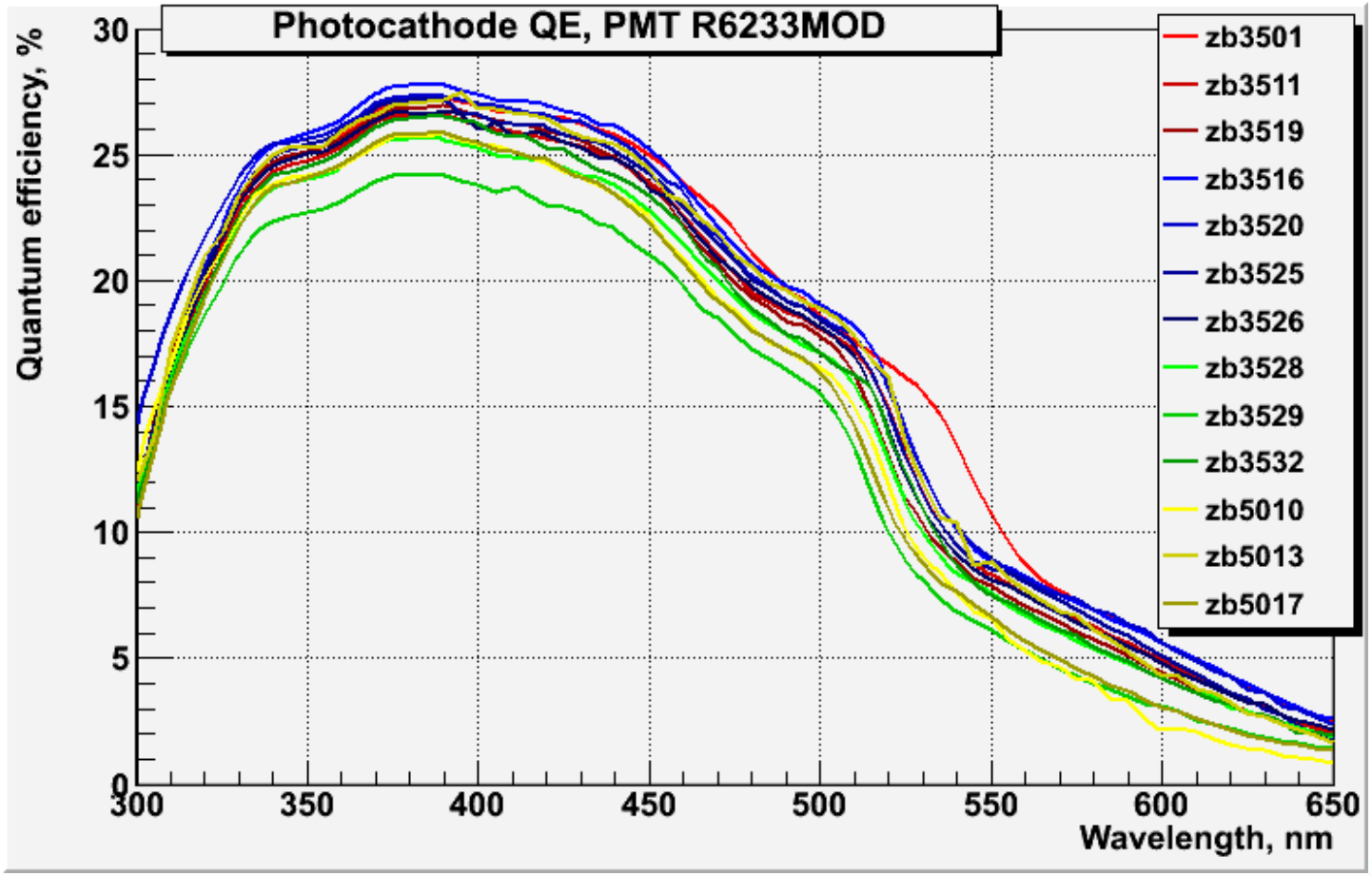
Quantum efficiency

Hamamatsu 3-inch R6233-01mod PMTs

QE: 26-28% @ 380nm, >20% @ 470nm



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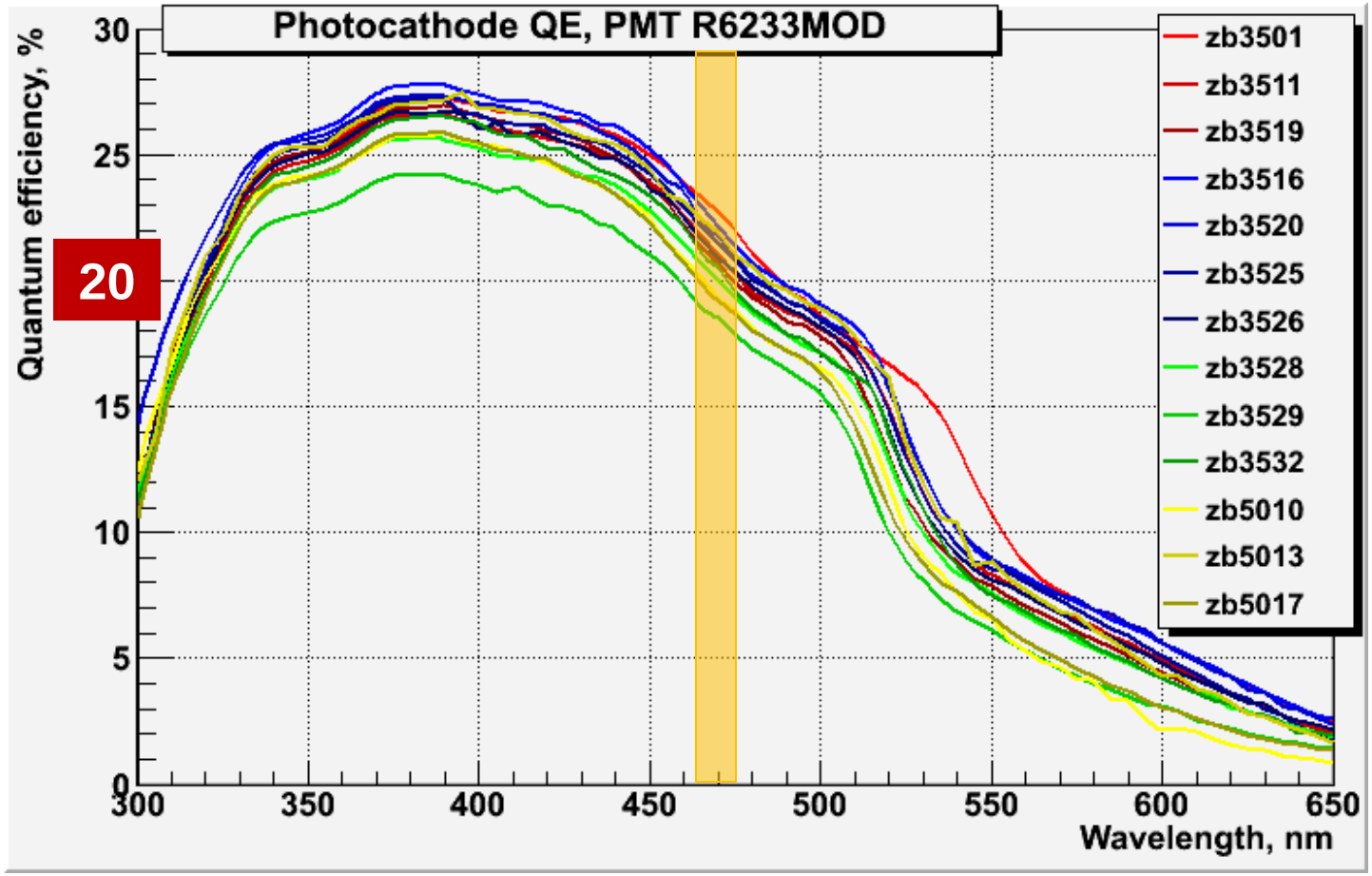

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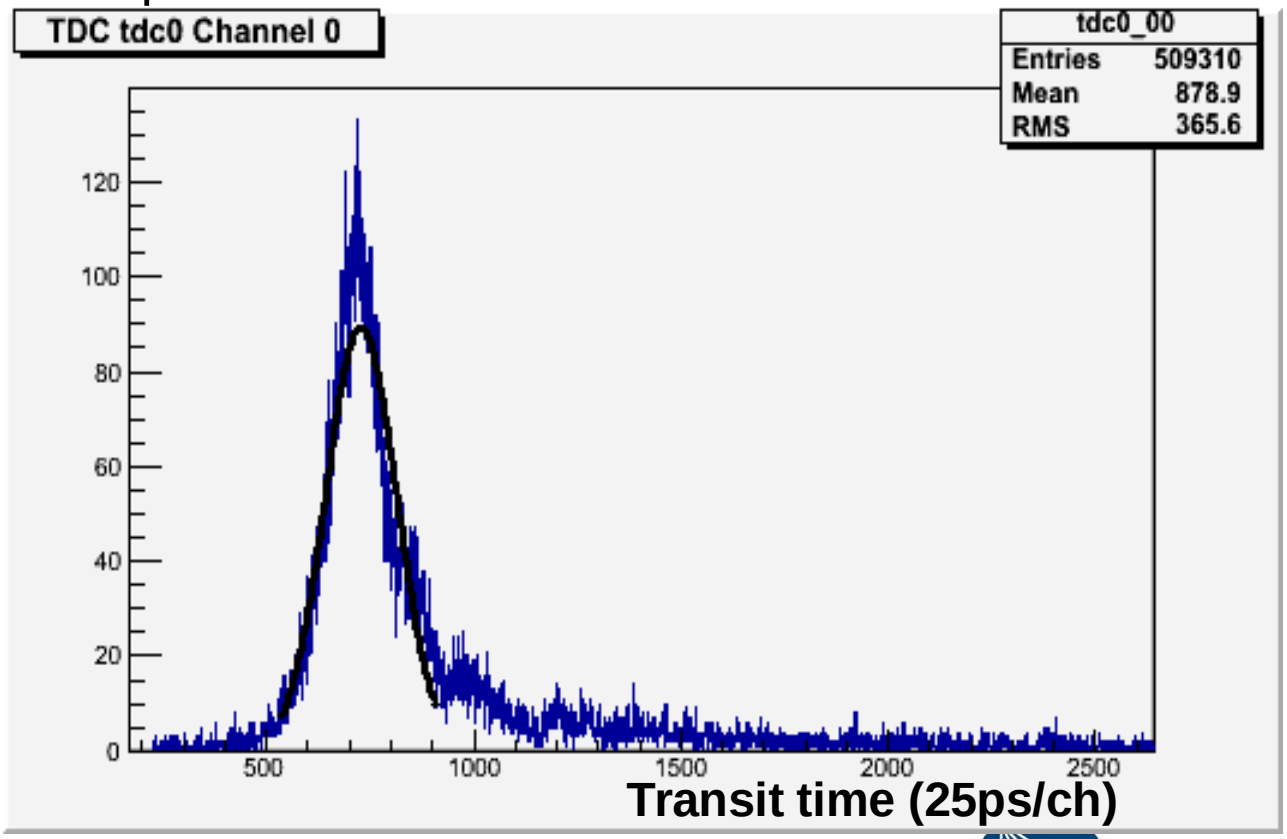
Transit time spread (TTS)

Hamamatsu 3-inch R6233-01mod PMTs

Fast laser, single photoelectron illumination level, diffuser

~0.3 pe threshold, TDC 25ps/channel

SN	TTS,σ (ns)
3519	2.6
3517	2.2
3520	2.5
3525	2.6
3529	2.2
3532	2.3
5010	2.2
5013	2.5



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Summary and outlook

ET Enterprises and Hamamatsu provide new 3-inch PMTs to make first optical modules

Hamamatsu develops new PMT with better time resolution

Mass production of 200,000-400,000 three-inch PMTs on a time scale of 3-4 years possible

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Thank you very much for your attention!

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