

# Recent Progress in Vacuum Photon Detectors from Hamamatsu



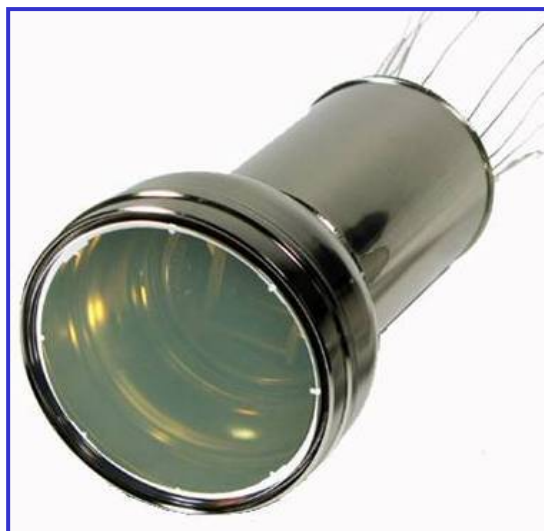
at PhotoDet 2012 on Jun.13 2012

Hamamatsu Photonics  
Electron Tube Division  
Yuji Yoshizawa

# New Products in this talk



**R11780 (12-inch PMT)**  
for Neutrino Experiments



**3-inch Metal Bulb PMTs**  
for Dark Matter Experiments



**Micro PMT**  
for Biomedical

Note: The scale of these pictures are different.

# Comparison of Dimension between R11780 (12") and R7081 (10")

**HAMAMATSU**  
PHOTON IS OUR BUSINESS

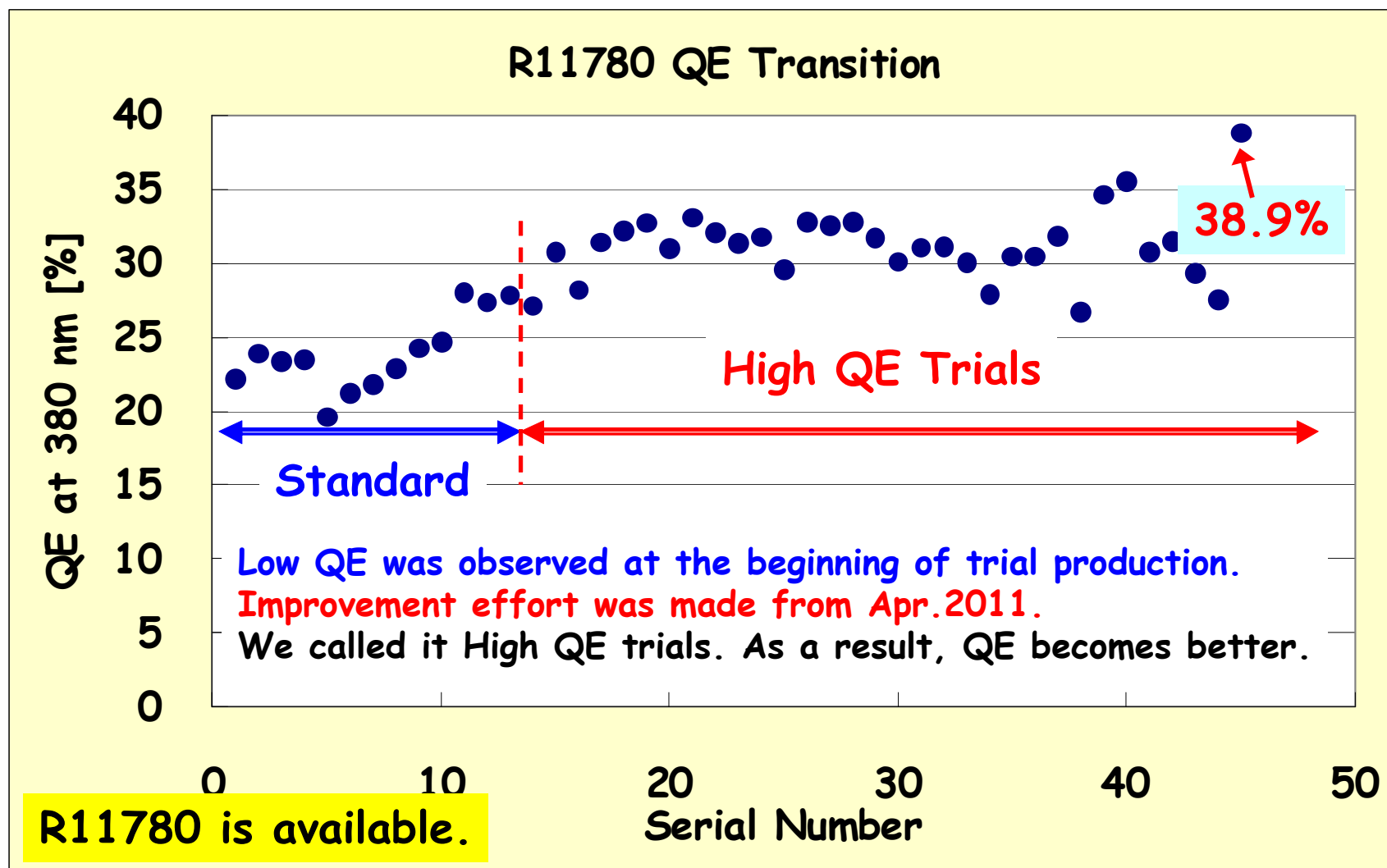
Larger effective area ratio



# Comparison of Characteristics

Items	R11780 12-inch PMT	R7081 10-inch PMT
Diameter	305 mm	253 mm
Effective Area	280 mm min.	220 mm min.
Effective Area Ratio	84.3%	74.6%
Tube Length	385 mm	300 mm
Dynodes	LF/10-stage	LF/10-stage
GAIN	1.0E+07 at2000V	1.0E+07 at 1500V
T.T.S. (FWHM)	2.7 ns	2.9(3.4) ns
P/V Ratio	3.0	2.5(2.8)
Dark Counts	10,000 cps	7,000 cps

# R11780 QE Improvement





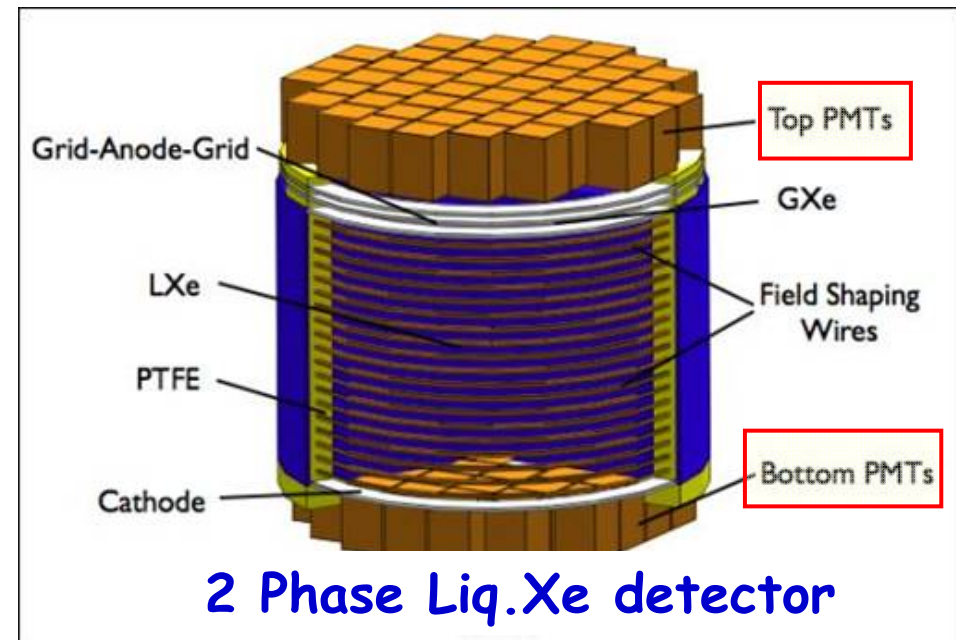
# 3-inch Metal Bulb PMTs for Dark Matter Experiments

## 3-inch Metal Bulb PMT (R11065 / R11410)



Quartz Window with LT-Bialkali

Kovar Metal and Quartz window are used to reduce RI as much as possible.



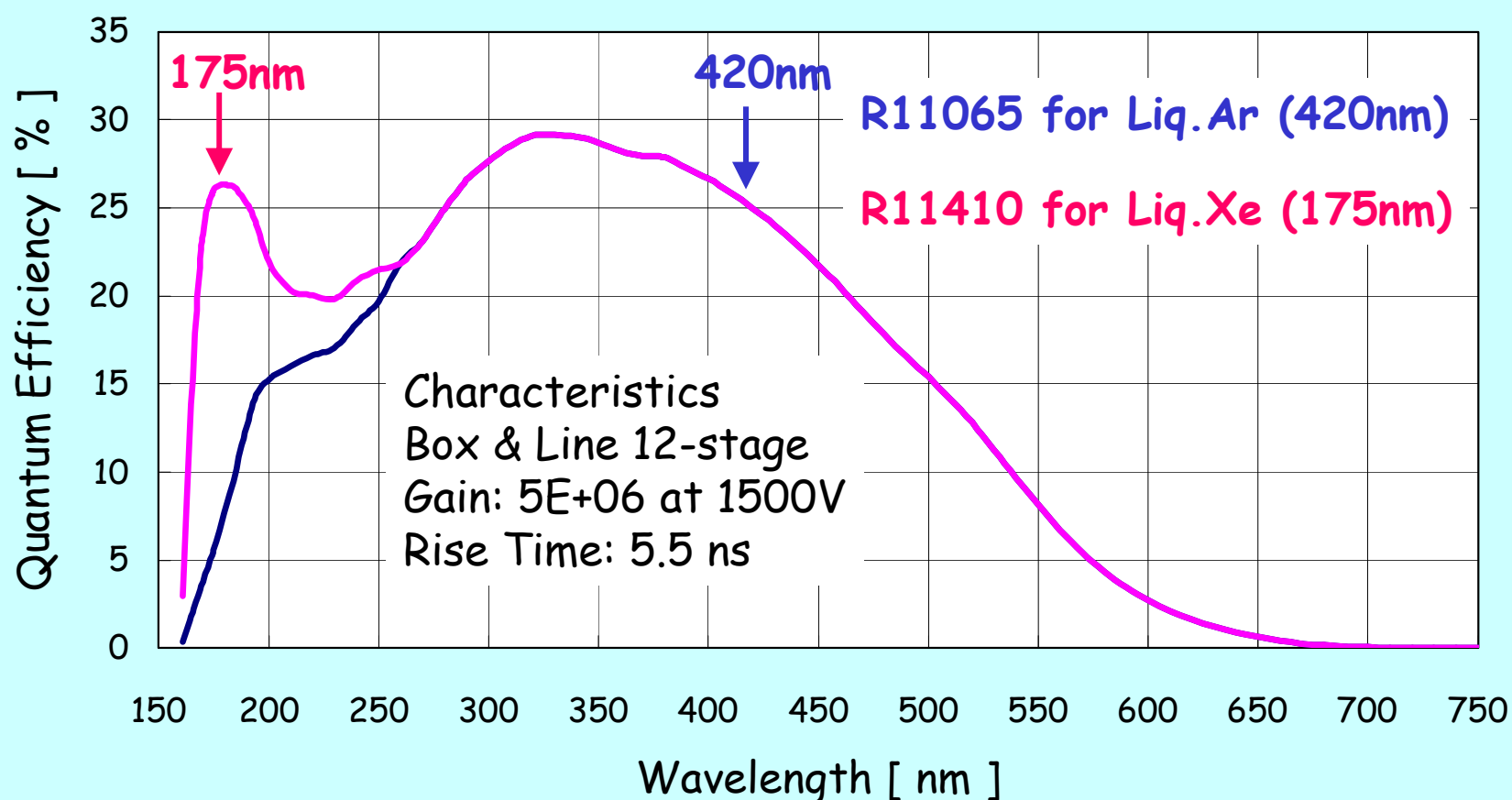
2 Phase Liq.Xe detector

### < Prime Features >

LT-Bialkali for Low Temp.  
High QE, LOW RI (100mBq)  
R11065 for Liq.Ar (-186°C)  
R11410 for Liq.Xe (-110°C)

# Difference of QE Curves

Spectral response is tuned depending on its application.



# Further RI Reduction Plan

**Ceramic Stem**

**Kovar Leads**

**Glass Stem**

**R11410-10**

**R11410**

**Estimated RI 16 mBq/PMT**

**Estimated RI 75 mBq/PMT**

40K	U	Th	60Co	Total
7	6	1	2	16

(mBq/PMT)

**Both tubes are available.**

40K	U	Th	60Co	Total
50	20	3	2	75

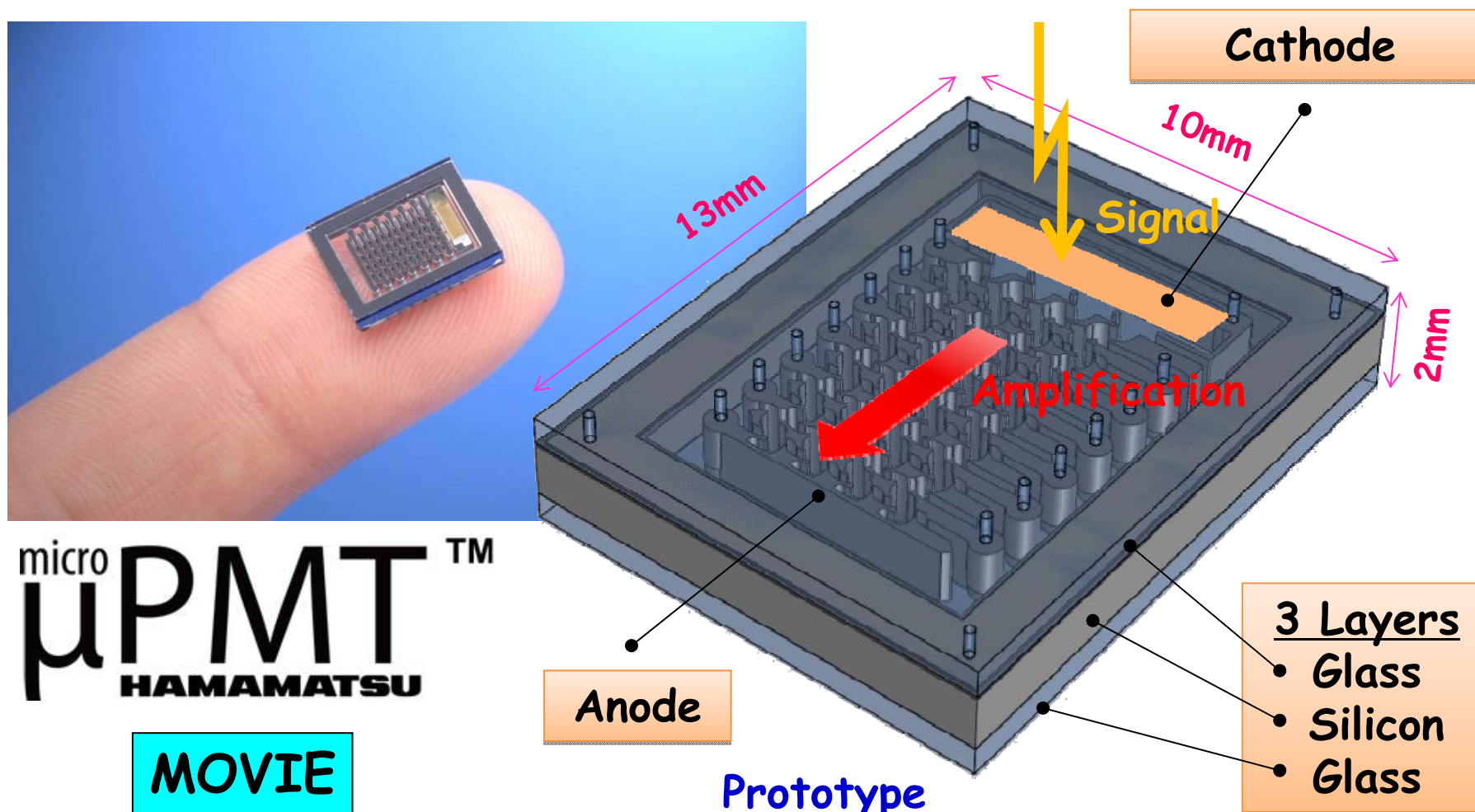
(mBq/PMT)

Kovar metal contains 60Co, its RI is about 2 mBq/PMT.  
Cobalt free metal can reduce it to 0.4 mBq/PMT.



# Dimensional Outline of Micro-PMT

*The world's tiniest, thinnest, and lightest PMT !*



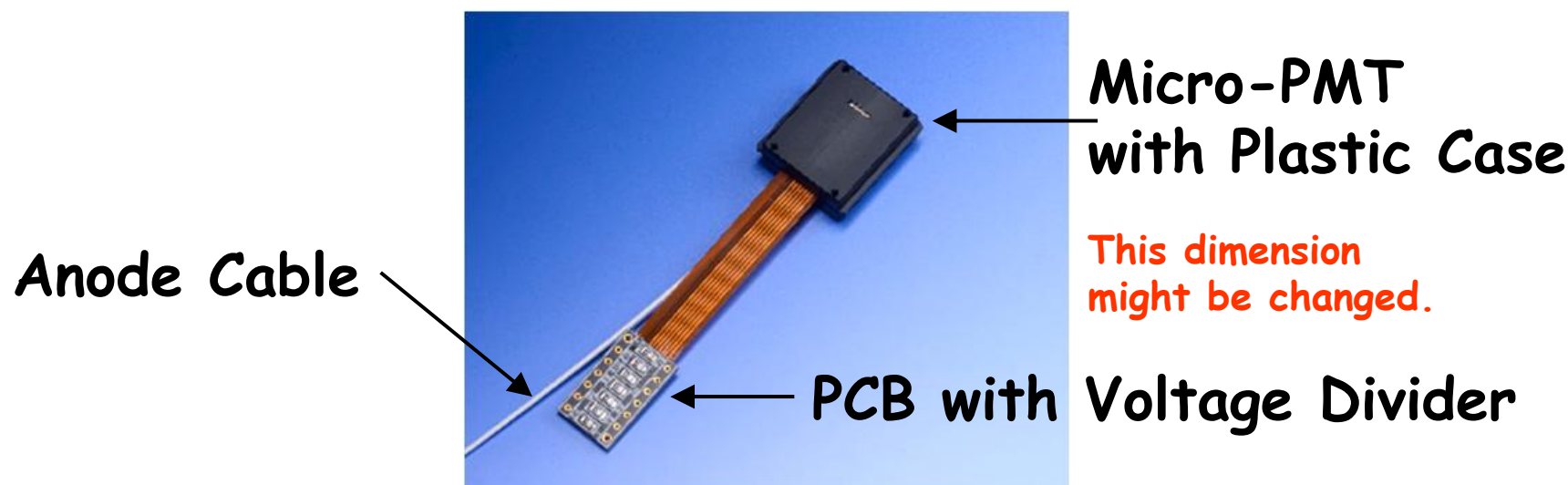
micro  $\mu$ PMT™  
HAMAMATSU

MOVIE

# Product Release Plan for Micro-PMT

**From Autumn 2012**

Micro-PMT assembly with Bialkali Photocathode



## Next Steps

Multi Alkali Photocathode

Module with Compact High Voltage Power Supply

# Summary

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Hamamatsu developed following products,  
which are available right now.

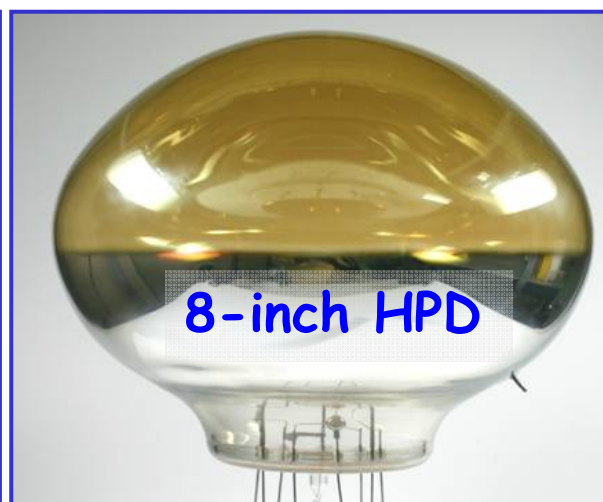
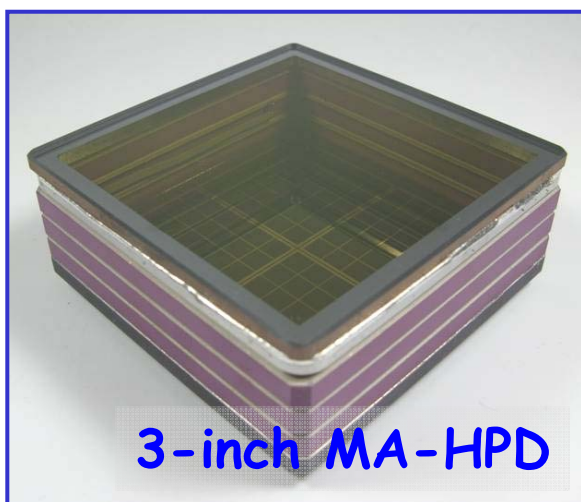
1) 12-inch PMT / R11780

2) 3-inch Metal Bulb PMT series  
R11410 for Liq.Xe & R11065 for Liq.Ar

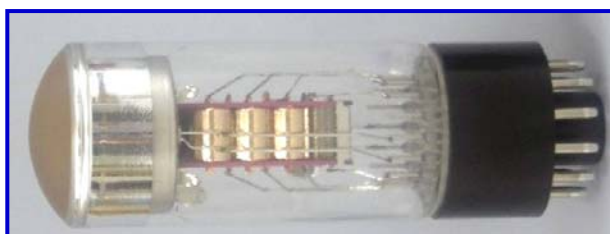
3) The Micro-PMT is still under development.  
Its sample will be available in this summer.  
Product release could be from Autumn 2012.

# Other Developmental Products

*These products are under development.*



These products are available right now.



R11920-100 (1.5-inch)



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**Thank you for your attention !!**

[www.hamamatsu.com](http://www.hamamatsu.com)



# Hamamatsu Photonics K.K.

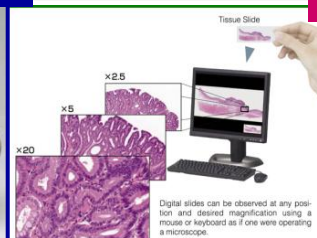
## Solid State Division



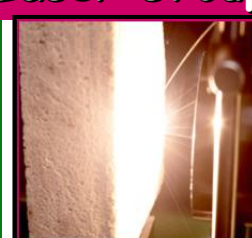
## Electron Tube Division



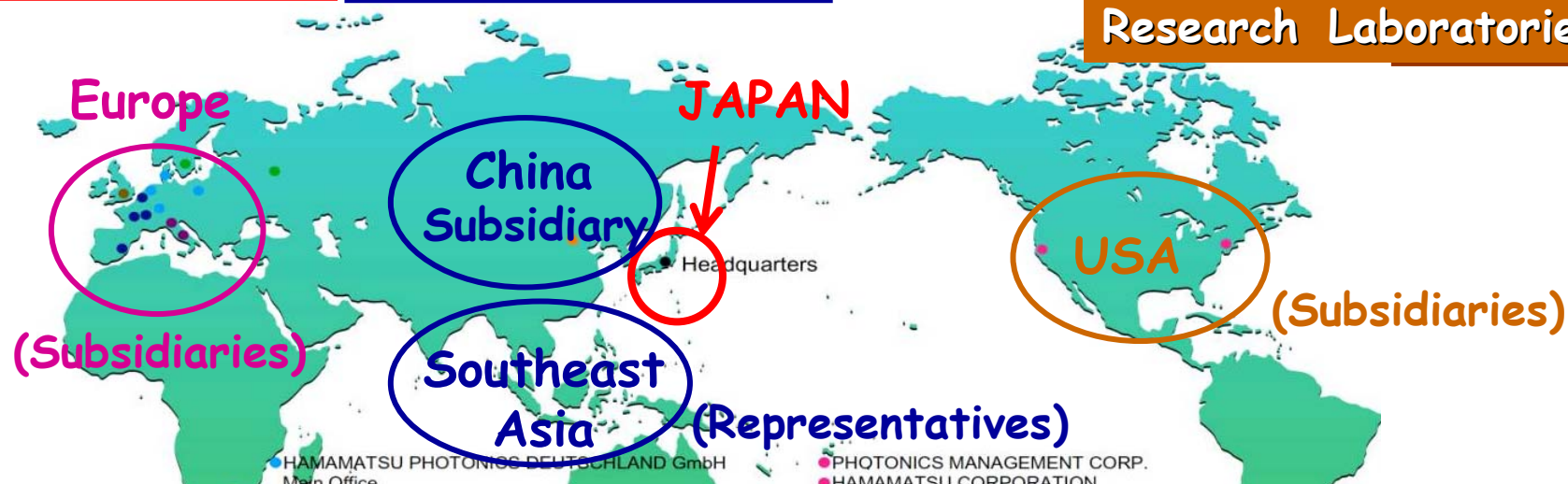
## Laser Group



## Systems Division



## Research Laboratories



**Established : Sept.29.1953**

**Net Sales : (FY 2011) Yen 100B (\$1.25B / €900M)**

**Employees : 4,000 (Group) (As of Sept.2011)**

¥80/\$

¥110/€



# Picture of ETD (bird's-eye view)

