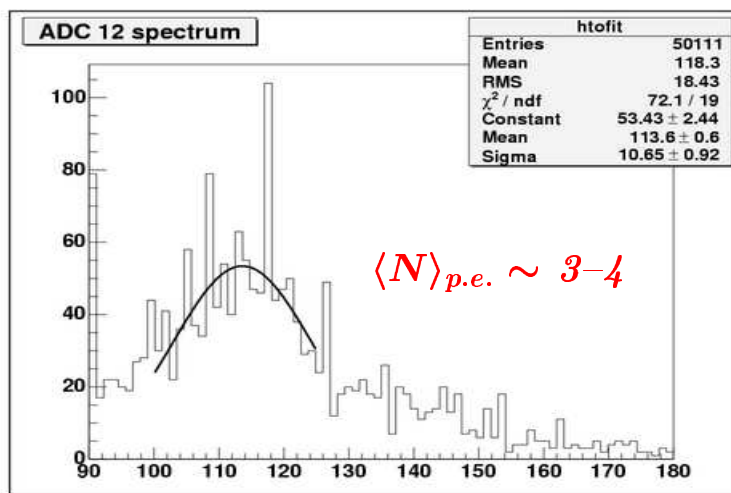


*Forward Tracking Hodoscope
Status Report*

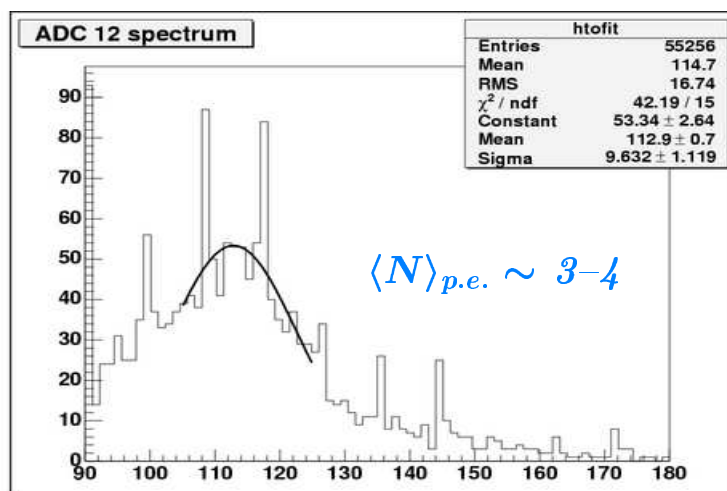
*SANE Collaboration Meeting XI
August 26, 2006*

Quartz Bar Test Results

- *Spectrosil 2000 Quartz ($350 \times 5 \times 3 \text{ mm}^3$) with Cosmics*
- *Study photo-electron yield, attenuation along bar length*
- *Expected number of P.E.'s (from Qweak) $\sim 3-4$ per MIP*
- *Results with R1635 PMT close to Trigger Scintillator*



- *Results with Trigger Scintillator 22 cm from PMT*



- *Very low $\langle N \rangle_{p.e.}$ yield and no noticeable attenuation*

New Design: Quartz → Plastic Scint.

- *Bicron BC-408 Plastic Scintillator ($\lambda_{emit} \sim 425$ nm)
3 mm × 3 mm square bars*
- *Bicron BCF-92 blue-green WLS Fiber
($\lambda_{abs} \sim 415$ nm, $\lambda_{emit} \sim 492$ nm) 1.2 mm \varnothing , 2m long*
- *Located 50 cm downstream of target*
- *Size: 40 cm (vertical) × 22 cm (horizontal)*
- *Position resolution, $\sigma_y \sim 0.9$ mm*
- *133 bars along vertical and 73 along horizontal*
- *Two Y planes offset by 1.5 mm for redundancy (266 bars)*
- *One X plane (73 bars)*
- *Total number of bars, 339*
- *Single-ended readout system*

BC-408 Expected Number of P.E.'s

- *TESLA project forward calorimetry test results*
- *6×6×30 mm³ BC-408 with 1 mm ∅, 210 mm long scintillating fibers*
- *Direct readout: PMT attached directly to scintillator*
 $\langle N \rangle_{p.e.} \sim 390 \pm 50 \text{ per MIP}$
- *Fiber readout: PMT attached to scintillating fiber*
 $\langle N \rangle_{p.e.} \sim 27 \pm 3 \text{ per MIP}$
- *Values for the obtained light yield vary within $\pm 15\%$*
- *Expectation for SANE: WLS fiber attached to PMT*
 $\langle N \rangle_{p.e.} \sim 15 \text{ per MIP}$
 $\sim 10 \text{ per MeV}$

Readout System - Multianode PMT

- *Hamamatsu H7546B 64 channel multianode PMT*

HAMAMATSU

MULTIANODE
PHOTOMULTIPLIER TUBE ASSEMBLY
H7546B

**8 × 8 Multianode, High Speed Response, Low Cross-talk
30 mm Square, Bialkali Photocathode, 12-stage, Head-on Type**

GENERAL

Parameter		Description / Value	Unit
Spectral Response		300 to 650	nm
Wavelength of Maximum Response		420	nm
Photocathode	Material	Bialkali	—
	Minimum Effective Area	18.1 × 18.1	mm
Window Material		Borosilicate glass	—
Dynode	Structure	Metal channel dynode	—
	Number of Stages	12	—
Anode Size		2 × 2	mm
Weight		Approx. 60	g
Suitable Socket (Supplied)		SD-108-T-22, SS-101-T-22, ASP-24307-02	—
Operating Ambient Temperature		-30 to +50	°C
Storage Temperature		-30 to +50	°C

MAXIMUM RATINGS (Absolute Maximum Values)

Parameter		Description / Value	Unit
Supply Voltage	Between Anode and Cathode	-1 000	V
Average Anode Output Current in Total		0.023	mA

Hamamatsu H7546B Characteristics

Figure 1: Typical Spectral Response

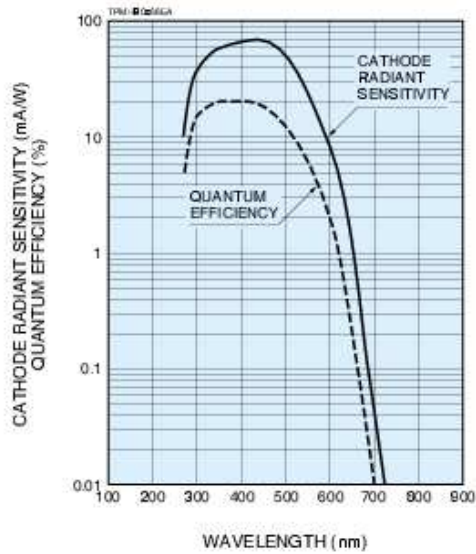


Figure 2: Typical Gain and Anode Dark Current per Channel

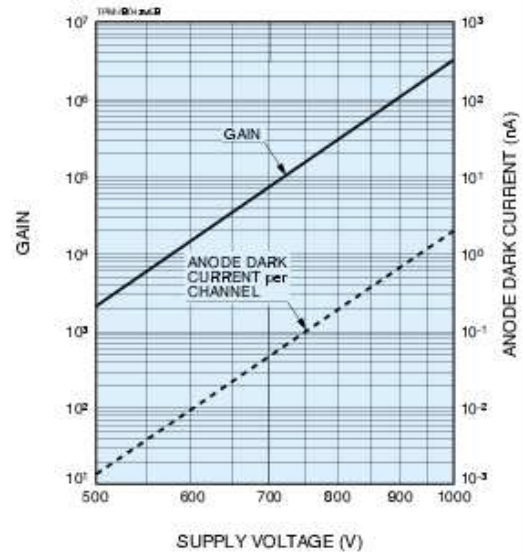


Figure 3: Typical Time Response

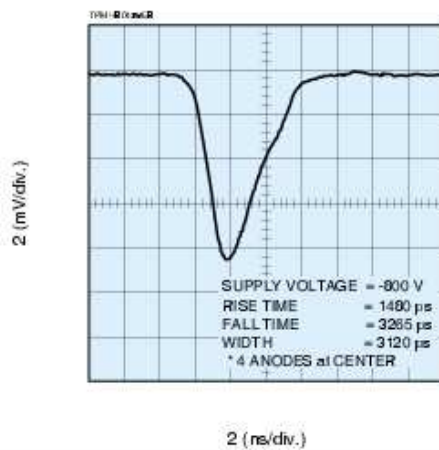
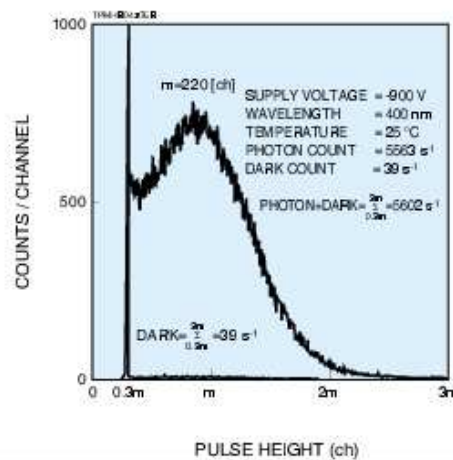
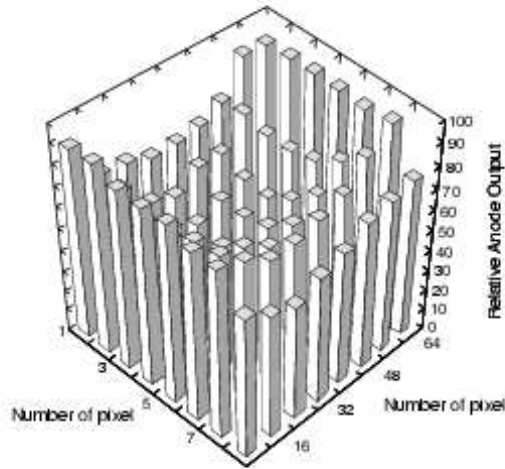


Figure 4: Single Photoelectron PHD per Channel



Hamamatsu H7546B Characteristics

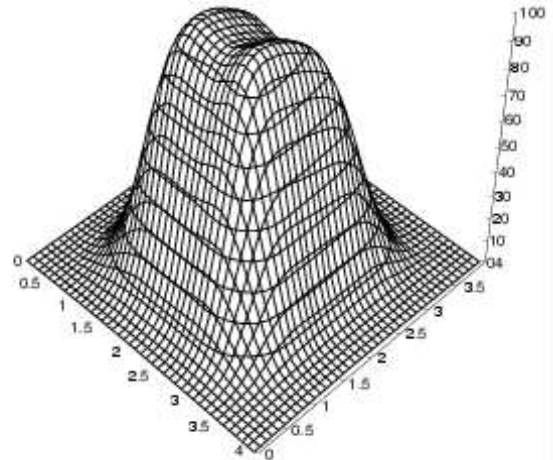
Figure 5: Typical Anode Uniformity



Each pole corresponds to each pixel of 64 anodes.
 APPLIED VOLTAGE = -800 V
 LIGHT SOURCE = W LAMP (DC LIGHT)
 (Full illumination on Photocathode)

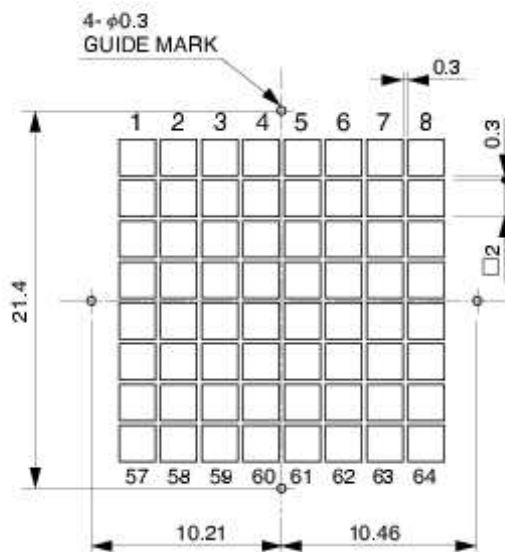
TPH-0072-B

Figure 6: Anode Uniformity of One Pixel



TPH-0072-A

Figure 7: Anode Matrix and Guide Mark



Anode Pattern

TPH-0072-C

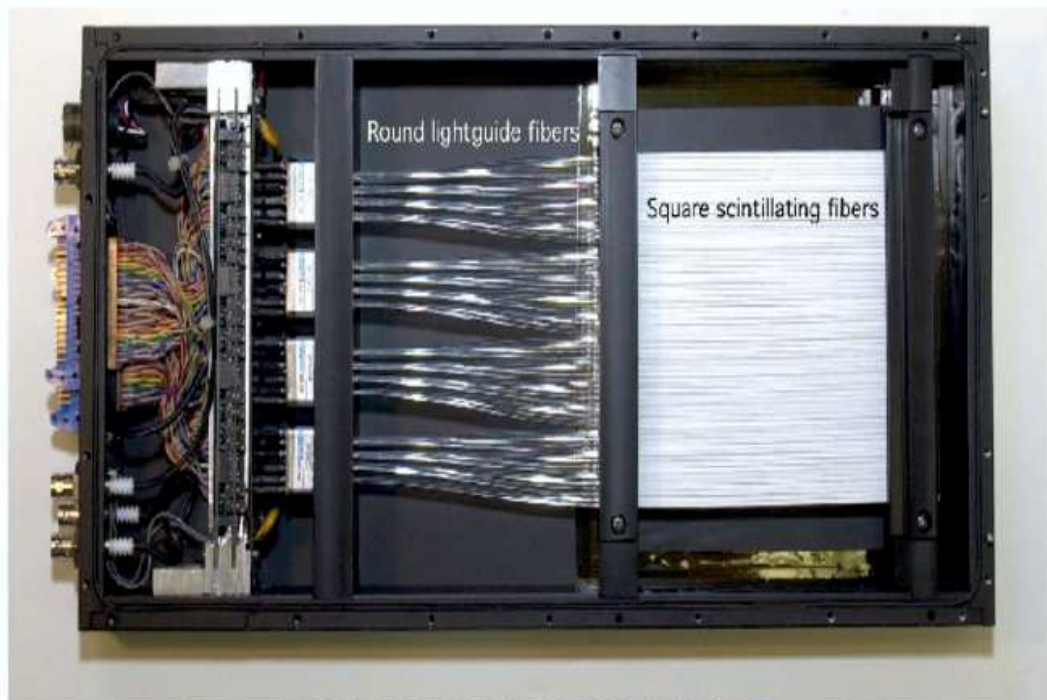
GUIDEMARK

The guide marks are holes of 0.3 mm in diameter on the electrode plate. They can be seen from top of the H7546B through its photocathode. They can be used for positioning when scintillating or optical fibers are coupled to the H7546B.

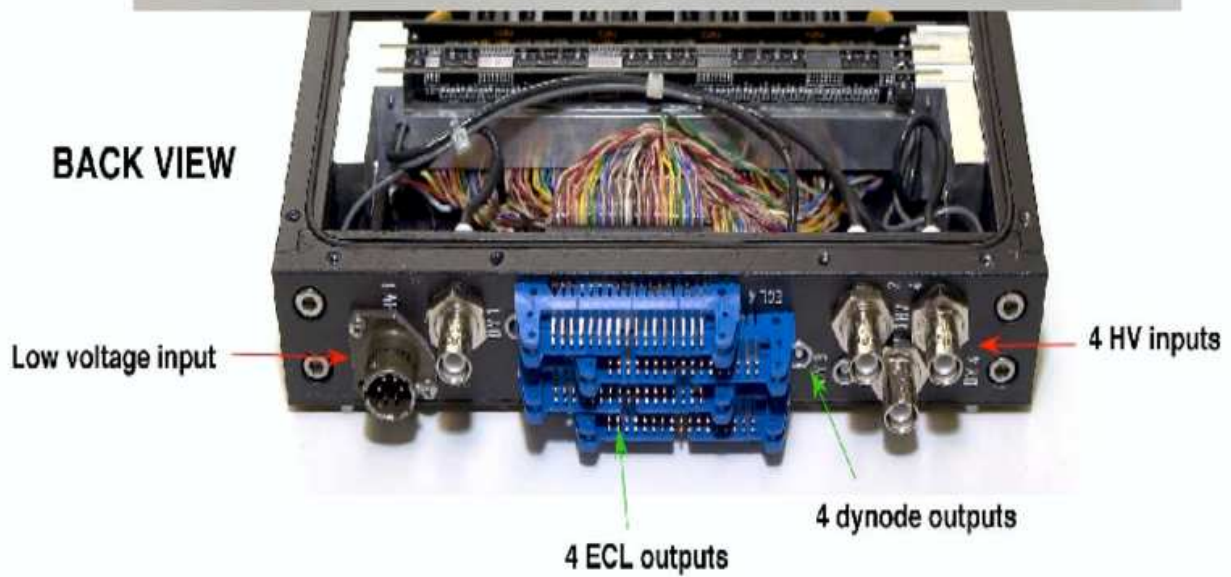
Existing Similar Detector System

- *Hall B photon beam profiler with multianode PMT*
- *2×2 mm² 64 channel scintillating fibers*

TOP VIEW
(interior)



BACK VIEW



Cost Estimate

- *Hamamatsu H7546B PMT*
(\$1800 per unit × 5) ~ \$9.0 k
- *BC-408 scintillator - Y plane*
(\$33 per bar × 133 bars × 2) ~ \$8.8 k
- *BC-408 scintillator - X plane*
(\$60 per bar × 73 bars × 1) ~ \$4.4 k
- *BCF-92 WLS fiber*
(\$4.50 per fiber × 339 fibers) ~ \$1.5 k
- *Total ~ \$24 k*

Current Status

- *Order placed for 1 Hamamatsu H7546B PMT*
- *70 BC-408 scintillator bars for Y plane*
- *70 BCF-92 WLS fibers*
- *Expected delivery by end of September, 2006*
- *Build and test one plane by December, 2006*