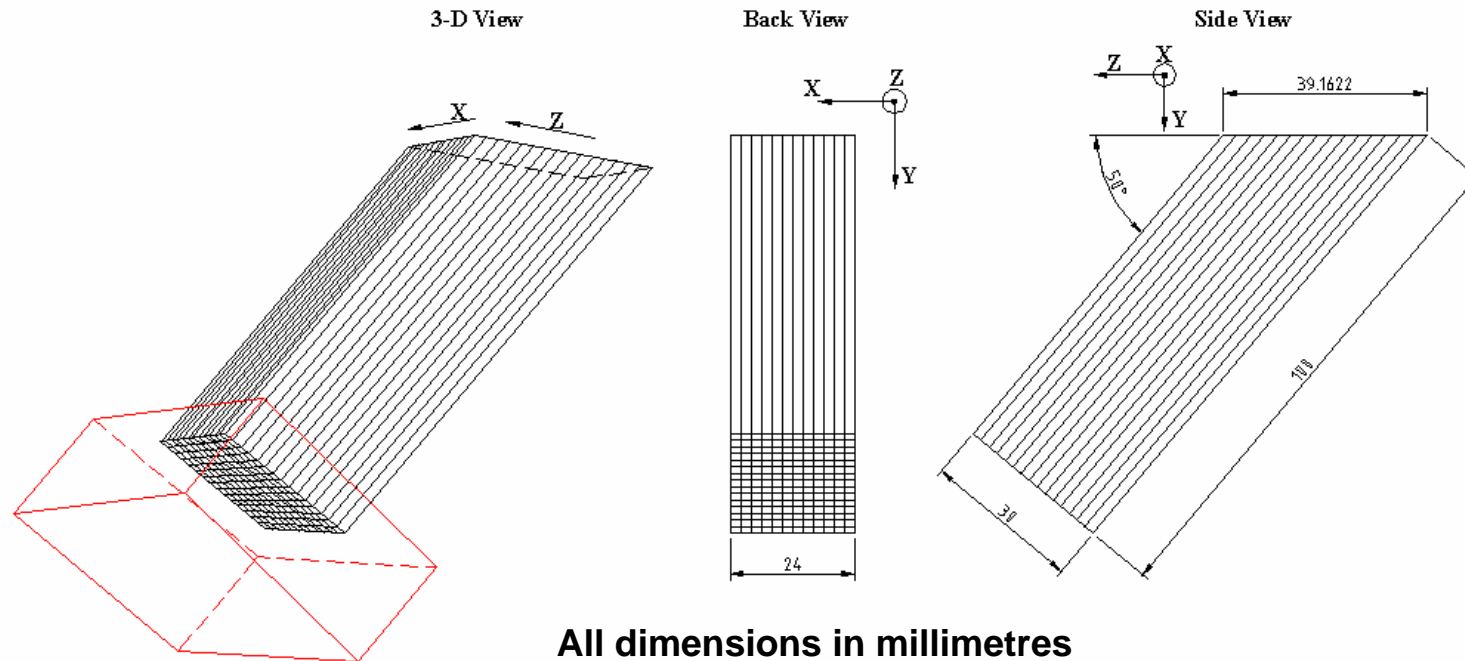


# Simulating Quartic

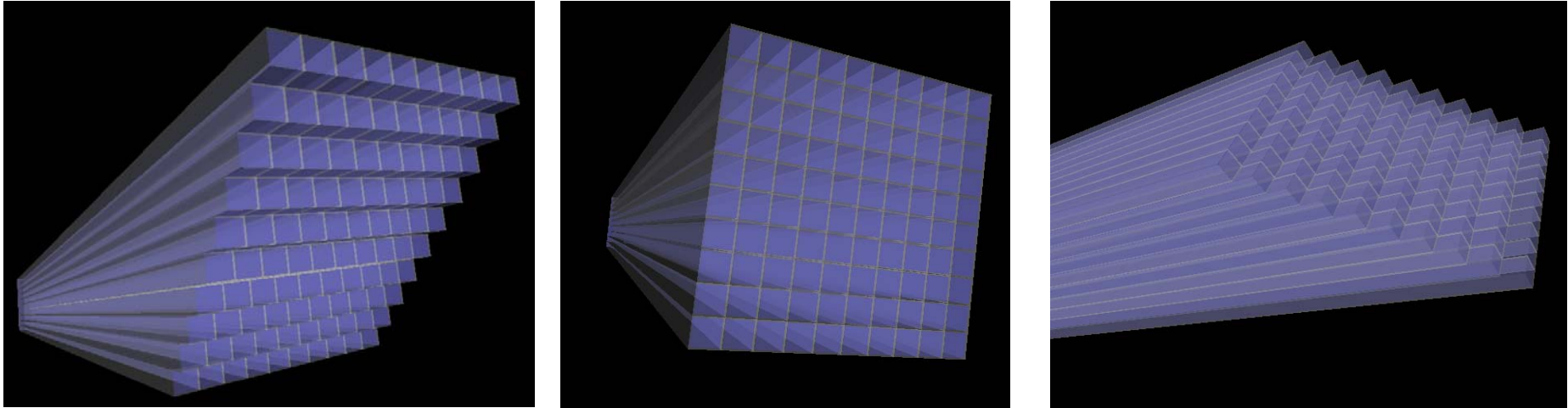
James L Pinfold  
for the Quartic Group

# The First Drawing



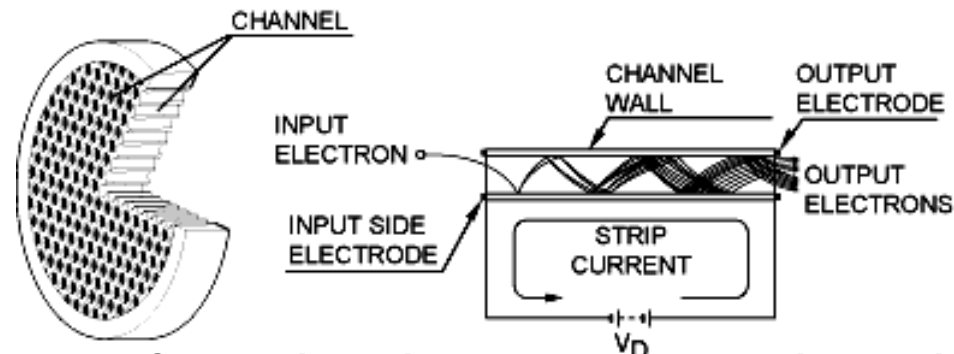
- Each element of Quartic is comprised of a square section fused silica rod.
- Rod cross-section is 2 x 2 mm
- Maximum rod length is 10mm
- Each rod is coated with vacuum deposited aluminium as a reflector and to provide optical isolation for each rod.

# GEANT4 Simulation



- A GEANT4 simulation is well underway (see GEANT4 produced graphics above).
- The detector simulation includes:
  - **Tracking of Cerenkov photons to the MCP-PMT through the medium.**
  - **Wavelength dependent refractive index of the medium**
  - **Wavelength dependent attenuation of the photons**
  - **Wavelength dependent reflectivity of the aluminium reflector**
  - **Timing of photons from generation to the MCP-PMT**
  - **The effects of coupling grease (if necessary)**

# Simulating the MCP-PMT



The MCP-PMT is a micro channel plate equipped with a photocathode and (usually) a multi-anode readout

- Arrival time at the face of the MCP-PMT recorded
- Implement wavelength dependence of the photo-cathode quantum efficiency.
- Simulate PMT transit-time jitter by adding a normally distributed random time jitter with the appropriate standard deviation and to the arrival time
- Simulate the layout of the anode pad readout of the MCP-PMT.
- We make the approximation that the MCP-PMT output voltage having reached a certain level triggers a discriminator – this level corresponds to a certain number of photons having arrived.

# Typical MCP-PMT (Burle 85001-501)

## GENERAL

Parameter		Value	Unit
Spectral Response		185 to 660	nm
Wavelength of Maximum Response		400	nm
Photocathode Material		Bialkali	--
Window	Material	UV Grade Fused Silica	--
	Thickness	2.0	mm
Multiplier	Structure	MCP (25 $\mu$ m pore, 40:1 L:D)	--
	Number of Stages	2	--
Anodes	Number	4 (2 $\times$ 2)	
	Size / Pitch	24.4 / 25.4	mm
Voltage Divider Resistance		12	M $\Omega$



## Characteristics (at 25 °C)

Parameter		Min.	Typ.	Max.	Unit
Cathode Sensitivity	Luminous		55	--	$\mu$ A/Lm
	Blue (with CS-5-58 filter)	6.0	8.0	--	$\mu$ A/lm-b
Anode Sensitivity	Blue (with CS-5-58 filter)		5.5	--	A/lm
Gain		$1 \times 10^5$	$7 \times 10^5$	--	--
Anode Dark Current, Total (@ $10^5$ Gain)		--	1	5	nA
Time Response	Anode Pulse Rise Time	--	0.3	--	ns
	Anode Pulse Width (FWHM)	--	1.8	--	ns
Pulse Linearity at 5% Deviation		--	300	--	mA
Anode Uniformity		--	1:1.5	--	--

# Timescale

- Detector simulation has been essentially completed
- On November 14<sup>th</sup> work will continue with the inclusion of the MCP-PMT stage
- By the end of November we should have a full simulation of the QUARTIC for various scenarios
- We will the need to validate the simulation against an prototype.