


Wild ideas on photon detection

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Conditions:

- 3000 m under water at least
- ^{40}K background of single photons at $300\text{Hz}/\text{cm}^2$
- Some bioluminescent background
- Signal depends on energy and distance
 - Low energy muon : R~50m photon flux = $0.02/\text{cm}^2$
 - High energy muon : R~50m photon flux = $0.2/\text{cm}^2$
 - Hadronic shower: R~50m photon flux = $1.0/\text{cm}^2$
 - Electron shower E=1TeV close by flux $> 100/\text{cm}^2$
 - Electron shower E=1PeV close by flux $> 10^5/\text{cm}^2$



Background can become very large, but
Probability of having two photons from one decay is small
First approximation background is single photon
Signal is coherent
Signal has enormous dynamic range
Want to look in all directions, no dead areas

Requirements:

- Large area
- High quantum efficiency
- Good single photon resolution
- High dynamic range
- 4π solid angle

Has to fit in a transparent pressure vessel

Most efficient way of removing background :
Pulse Height

Pulse height spread of single pe must be small

Typical PMT ~25% \longrightarrow 2.5% register $ph > 1.5 pe$

If 10% \longrightarrow 10^{-4} register $ph > 1.5 pe$

Large reduction of bkg. Some
efficiency loss at low energy

Increase of Quantum efficiency

Increases number of coincidences from signal

5 photons	QE=0.2	27% ≥ 2 p.e.
	QE=0.4	67% ≥ 2 p.e.

2500 cm² for low energy

Background for	QE=0.2	1%
	QE=0.4	2%

How can one increase QE?

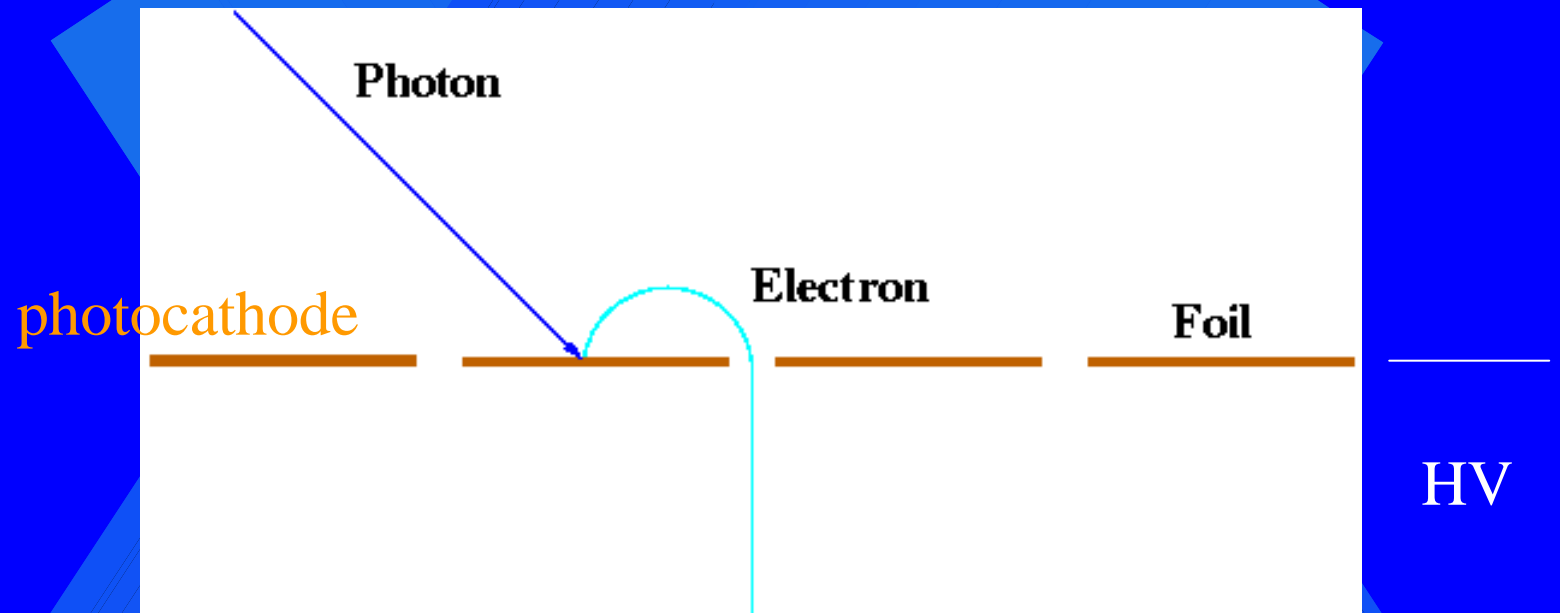
Very good results are being obtained for
Reflective cathode arrangements

But configuration with Winston cone is hard
to incorporate.

Possible new type of arrangement

Use a “GEM” foil but not in gas??

Only use the foil to focus produced pe's



APD or multiplication dynodes

Reflective cathode and HPD type device combined
Hard to make in a sphere shape, but maybe foil is not necessary. Could be more solid.

Is a sphere the optimal shape for detector?

Needs to stand pressure.....plane has to be solid

How about a cylinder?

Would this give an advantage

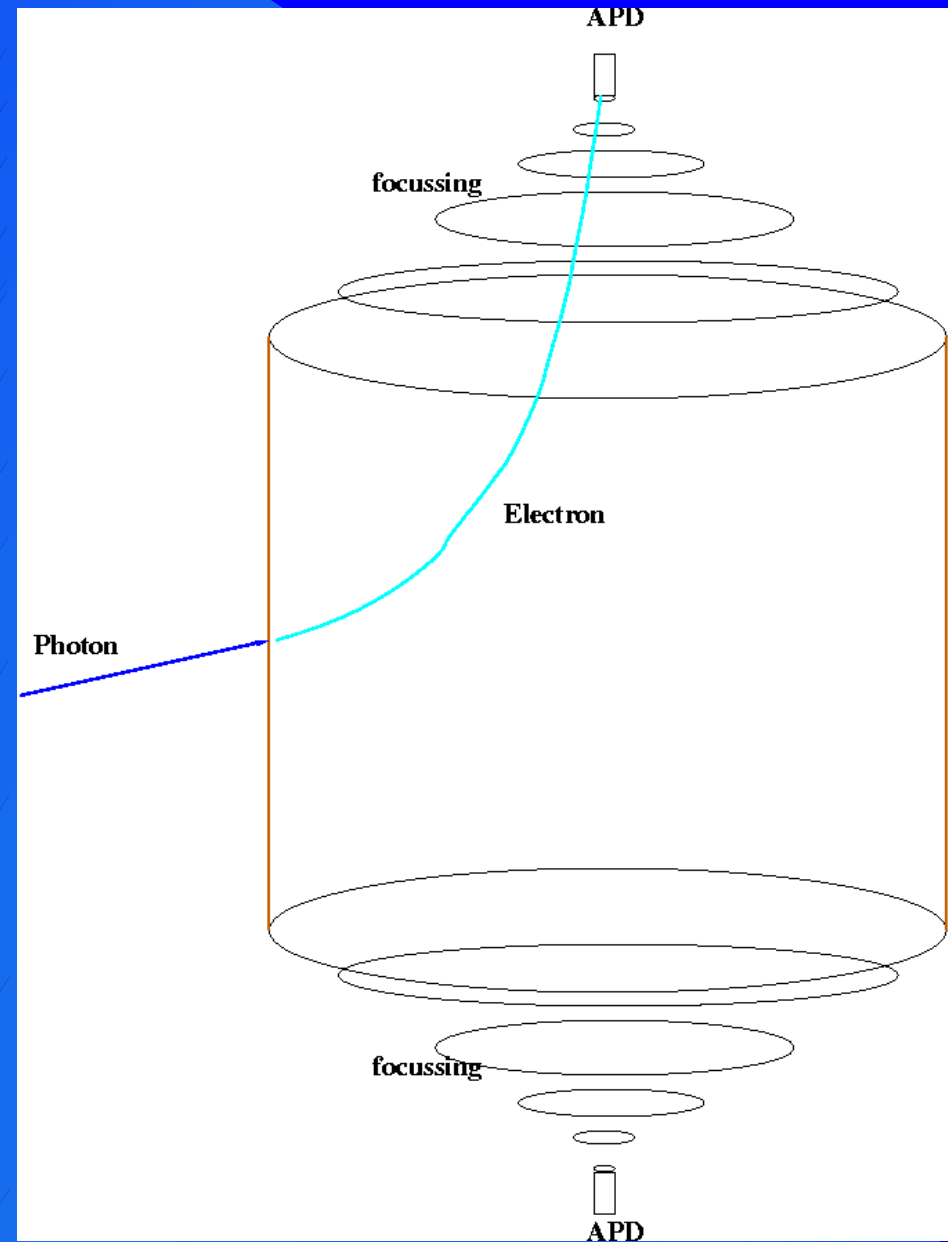
Maybe, After all Sphere is maximum volume
for minimal area!

How could this be accomplished

Quite reasonable focussing
is possible. Combination
with APD and “GEM”

TTS is poor

Is this a problem for 1km
long tracks?



Even wilder....

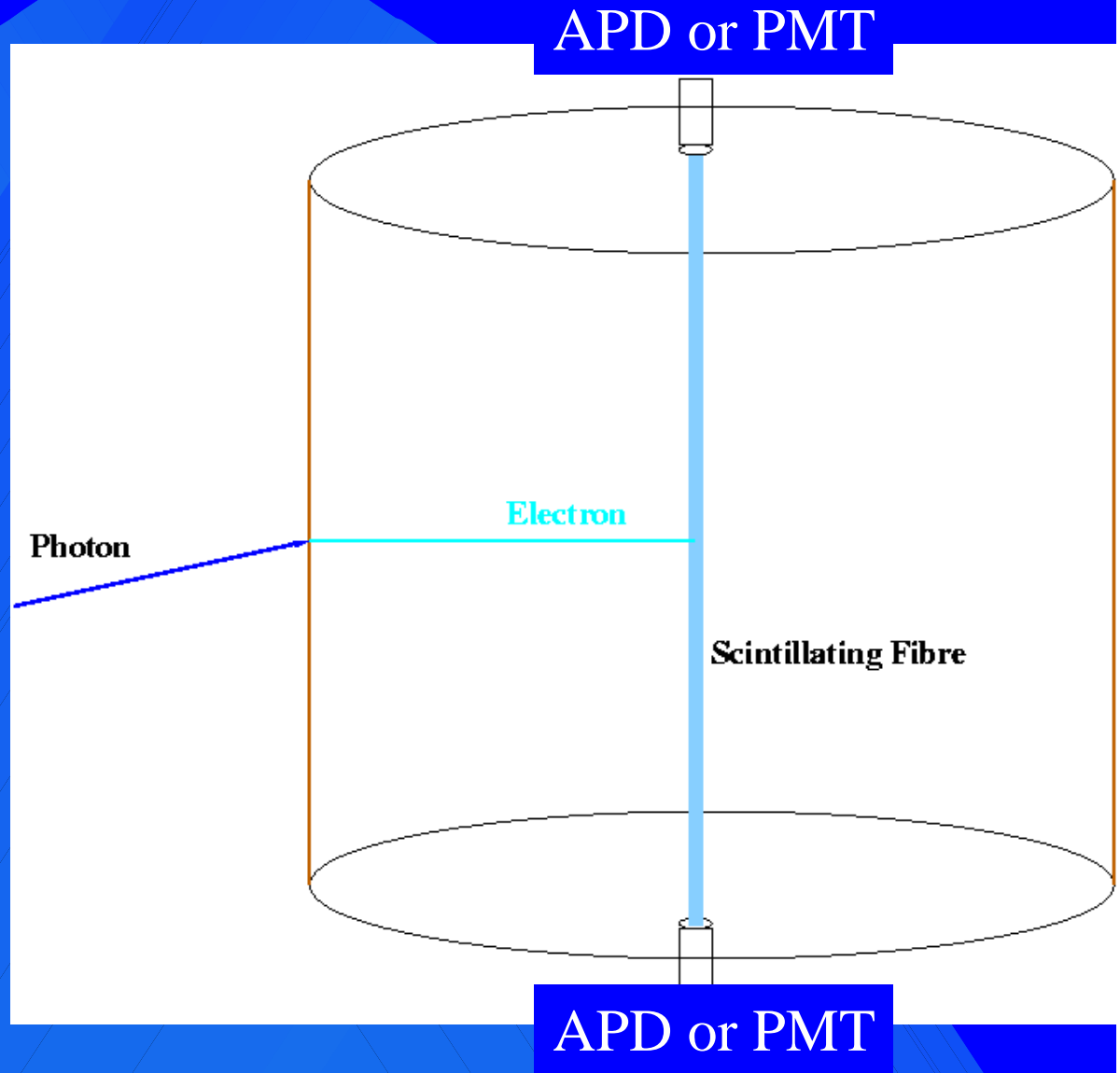
A la BAIKAL PMT

Could be made
quite long

Double readout
gives good timing

Obviously 30 kV is
not easy.

Fairly simple device



Conclusions

Can one exploit Hybrid and GEM technology

Interesting to try

Going away from sphere might give very big advantages.

Fibre chamber??????

The background is a solid blue color. Overlaid on this are several geometric shapes. A large, light blue triangle points downwards from the top center. Within this triangle, there are two smaller, darker blue triangles pointing upwards towards the center. Additionally, there are several thin, parallel lines in a slightly darker shade of blue, running diagonally across the lower half of the image.

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