Ashra/NuTel Technical Design

Ashra meeting @UHawaii, 1/9/2004

K.Ueno

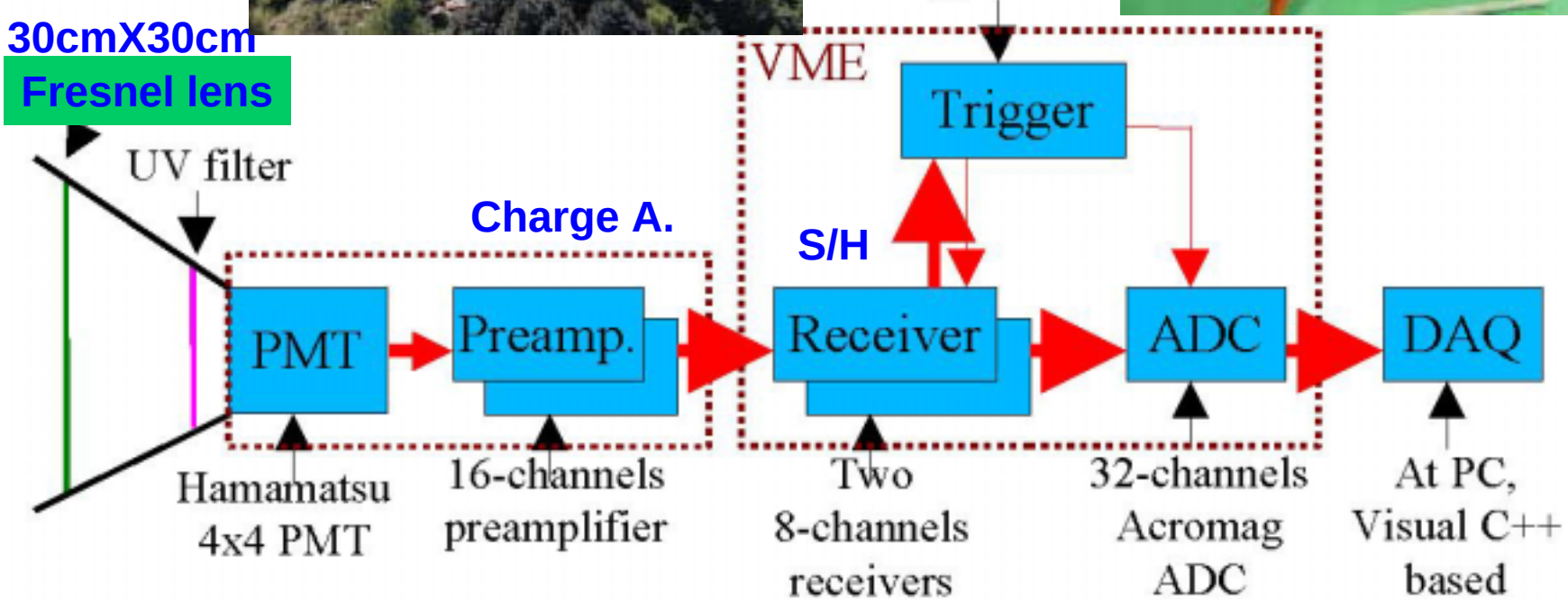
- Electronics chain
- Optics chain
- Schedule/conclusion

Electronics chain

- Analog → Yankun, digital → Yuri, DAQ → JingGe.
- Based on 10bit-40MHz ADC and FPGA.
- System test of the 1st version later this month.
- Preamp: OK in the Lulin test more than a year ago. Charge amp. or current. Basically the same PCB pattern.

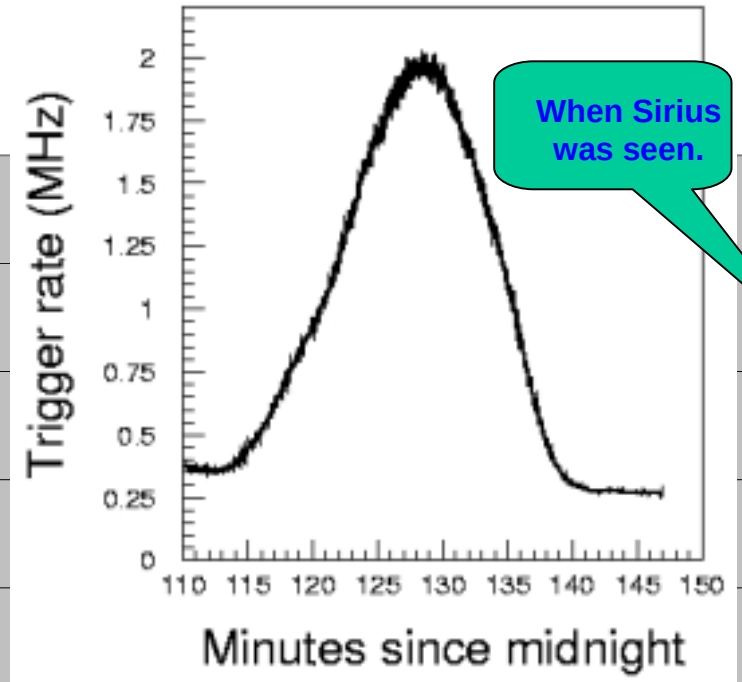
1st Prototype in Night Sky Background Measurement

Made in 5 months from scratch.



Lulin NSB measurement

Looked at a sky, a mountain, a star to see the rates.



When Sirius was seen.

Consistent w. other exp. of 2000 ph/m**2/ns/sr

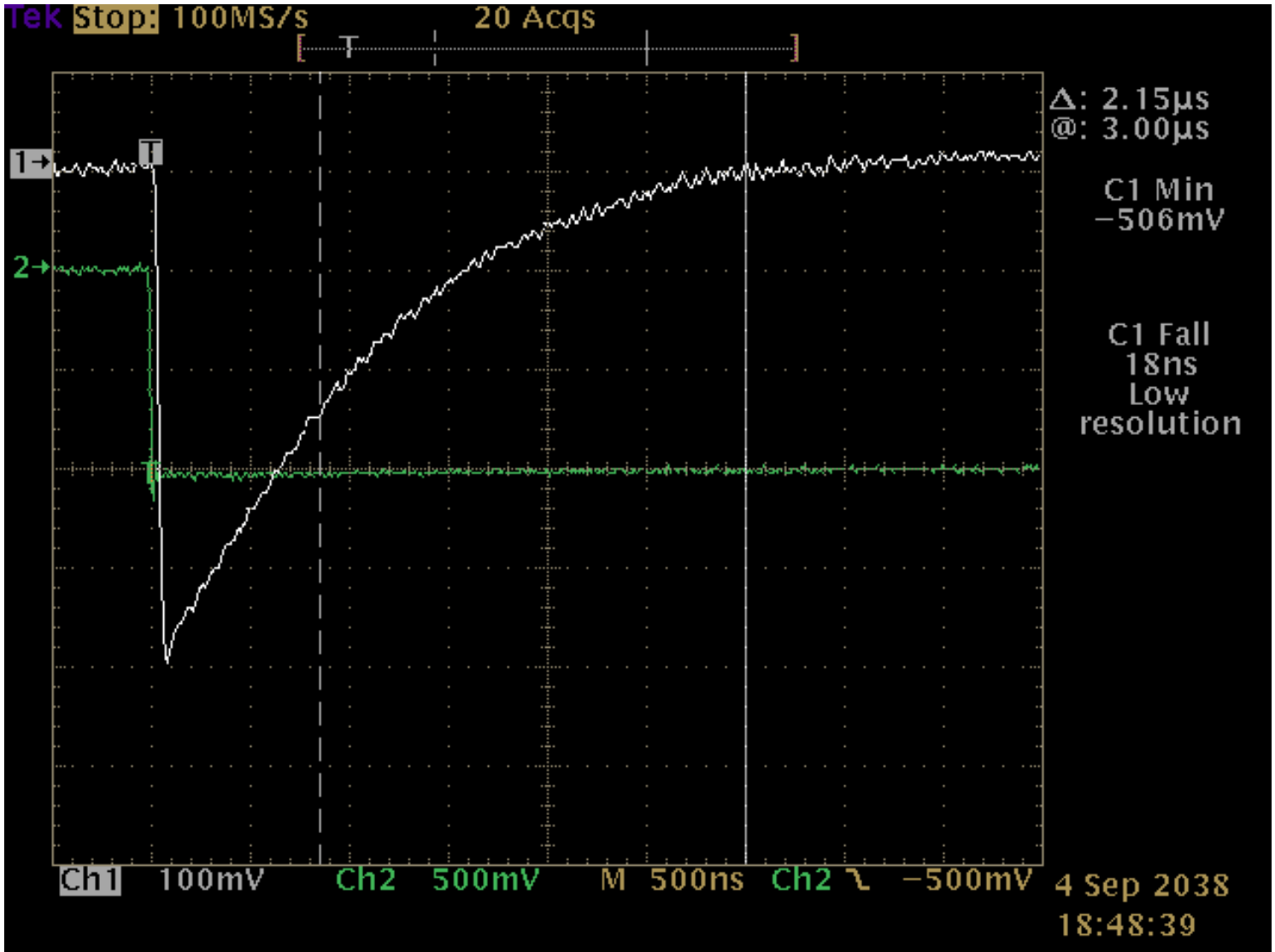
photon flux (K) [cm -2, s -1, sr -1]

800000
700000
600000
500000
400000
300000
200000
100000
0

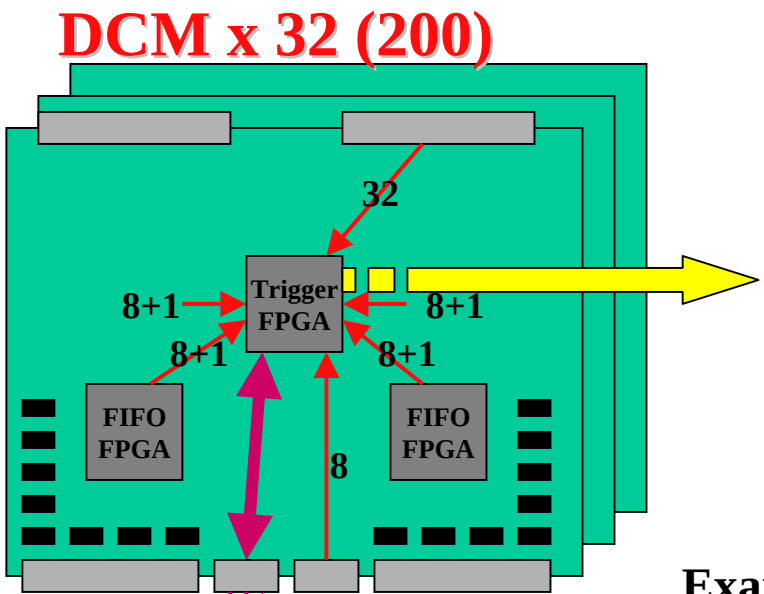
3deg+BG3
3deg
7deg + BG3
7deg
+BG3
15deg
Befire Sirius
Sirius
After Sirius

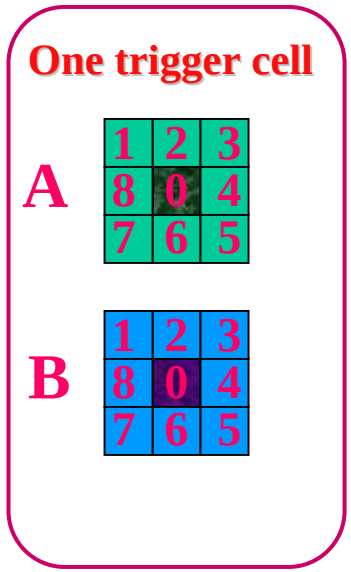
experiments with and without BG3

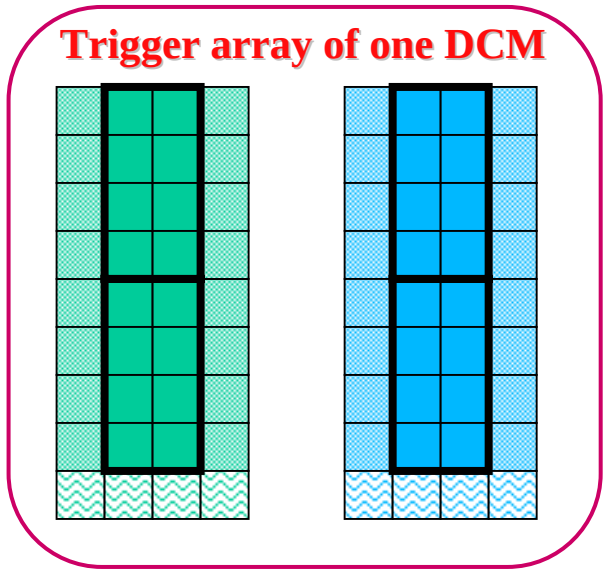
Preamplifier test with test pulse
Q~3*10^7 e (~10 p.e.)



Trigger



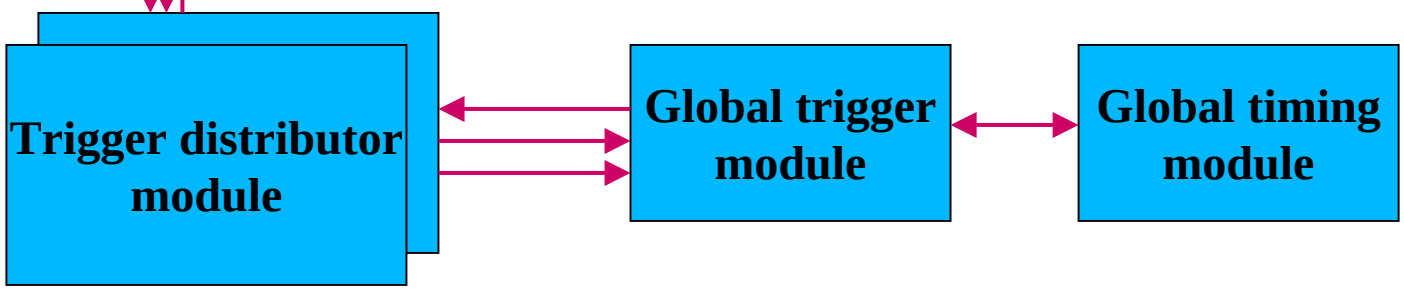




Example of trigger: $A_0 * B_0 * \{\Sigma(A_{1..8}) \geq 2\} * \{\Sigma(B_{1..8}) \geq 2\}$

usual trigger, overflow trigger

stop FIFO



$1m^2$, 0.5^{o2}

NSB Trigger Rate

NSB is manageable.

N=10^7MC, (32x32)Pixels

For 10 Hz order NSB trigger rate, the Trigger Configurations are:

25ns

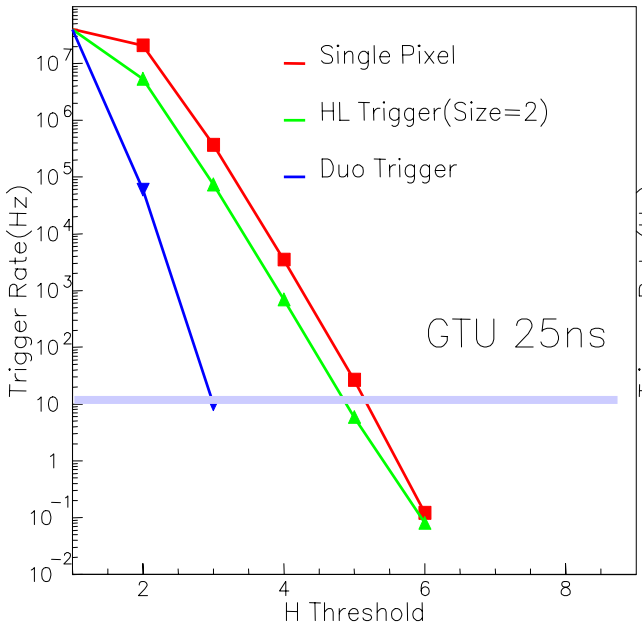
Single Pixel Trigger: H=5
H-L Trigger : (H,L)=(5,1)
Duo Trigger : H=3
Sum Trigger1: (H,A)=(1,7)
Sum Trigger2: (H,A)=(2,6)

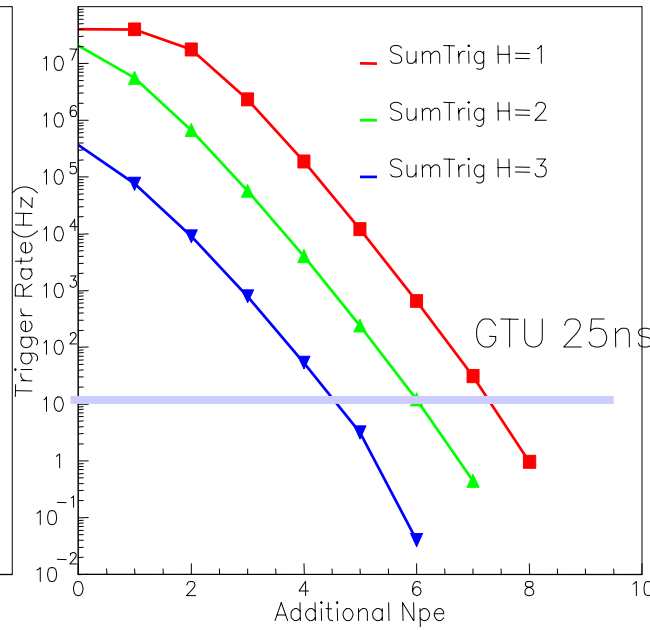
8 Npe

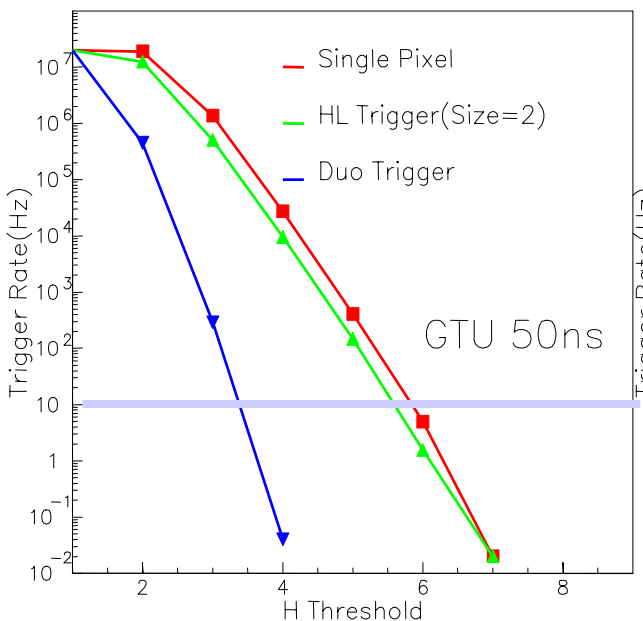
50ns

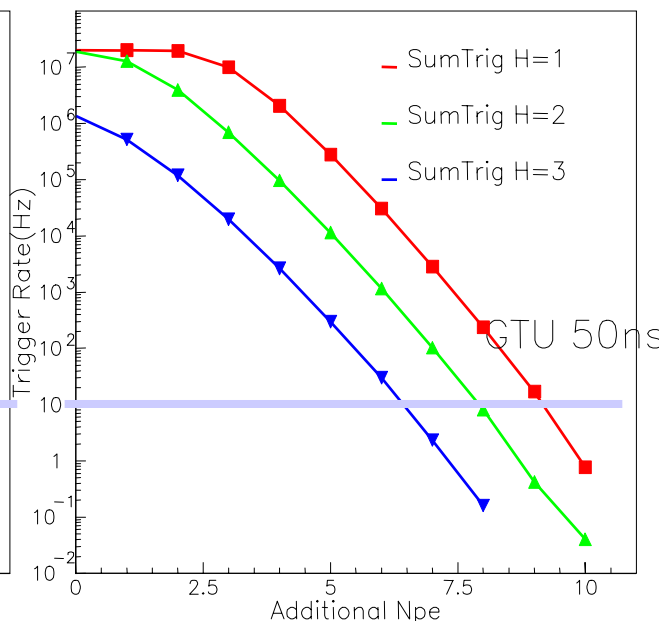
Single Pixel Trigger: H=6
H-L Trigger : (H,L)=(6,1)
Duo Trigger : H=4
Sum Trigger1: (H,A)=(1,9)
Sum Trigger2: (H,A)=(2,8)

10 Npe

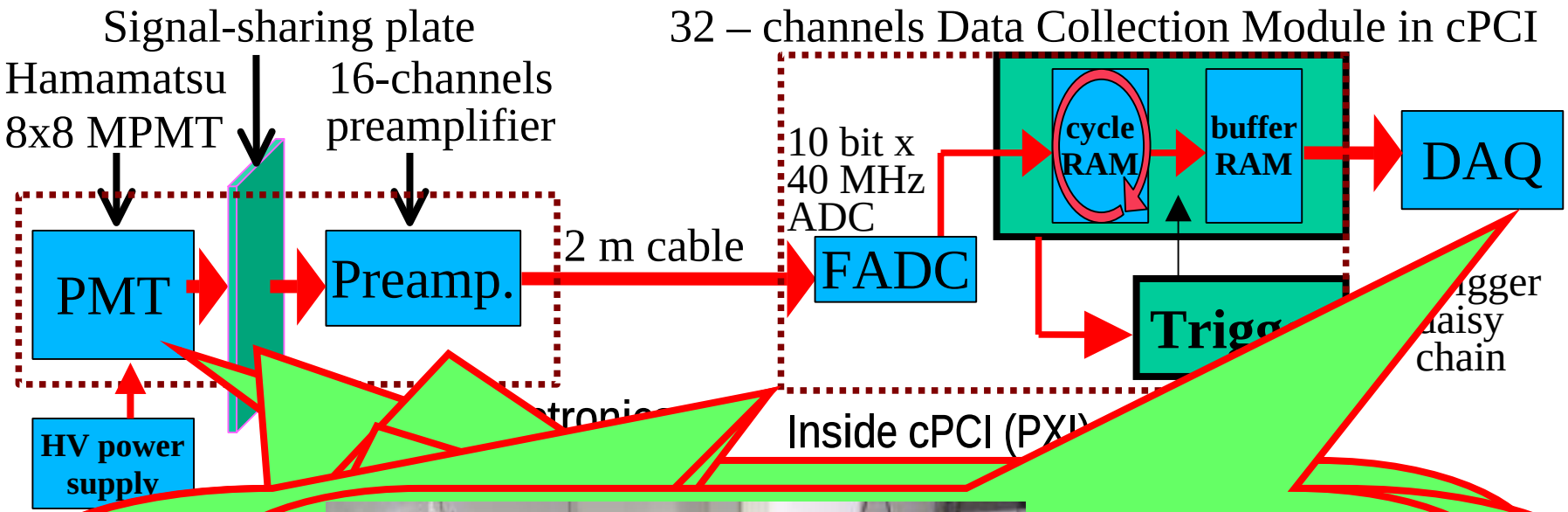








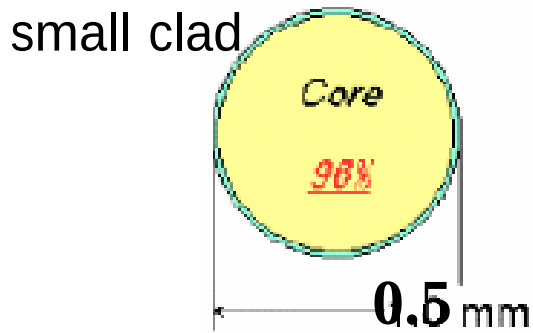
Schematics of electronics



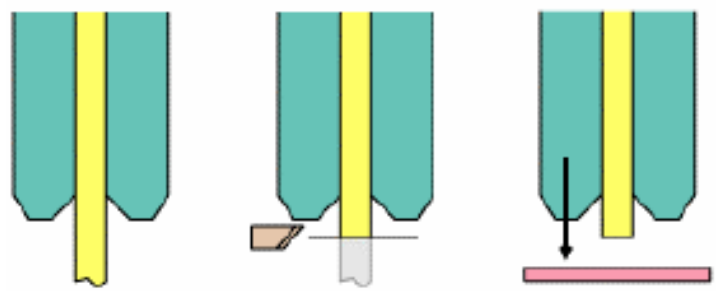
DAQ – in Linux, inside cPCI (PXI) CPU card

NuTel Optics

- Use *ASHRA* optics up to 1st **Image Intensifier (II)**
- **II** image → **MAPMT** via ***plastic*** **optical fiber**
- 0.5^{o} ⇔ 0.3 mm at **II**



Treatment of end of plastic fiber



- Match MAPMT pixel size of 2mm
- Contacted **Taiwan Fiber Optics Co.** for assembly
  Will be made in 4 to 5 months

60cmϕ

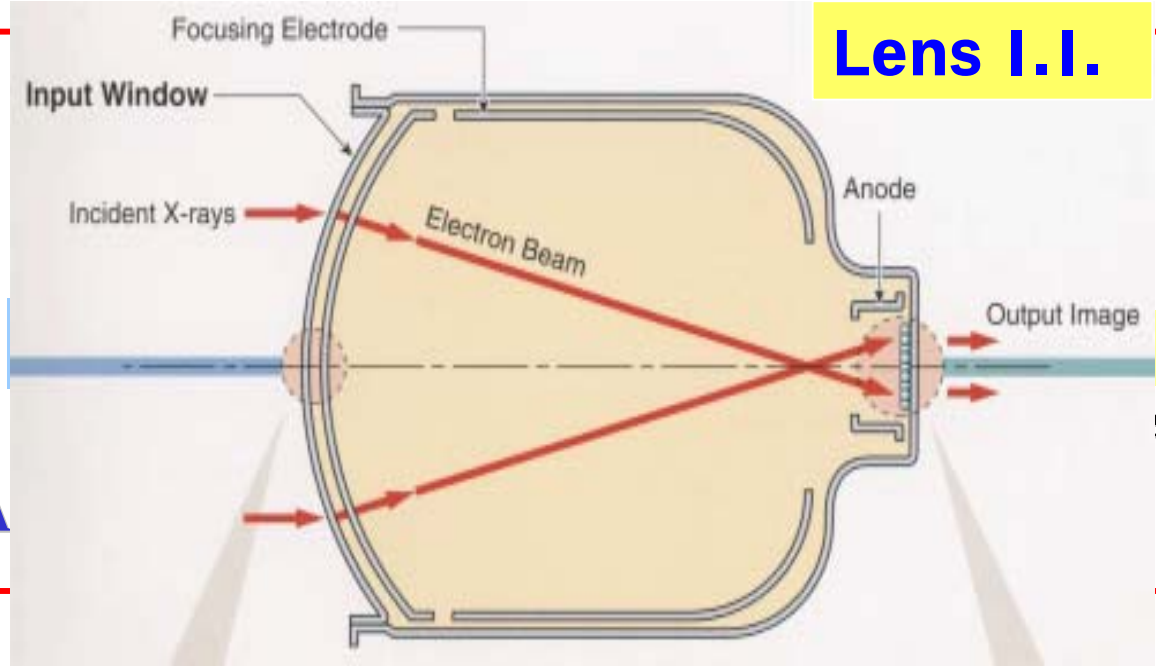
4cmϕ

Lens II

A

ensor

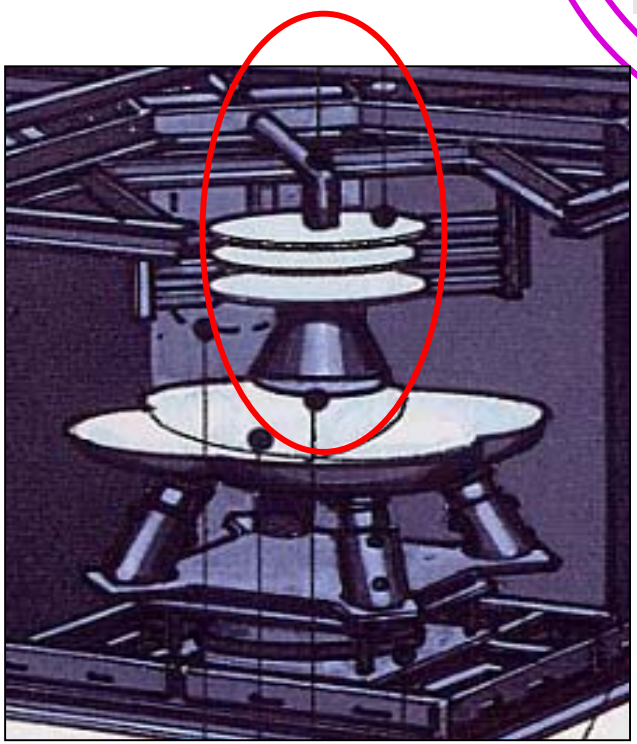
Lens I.I.



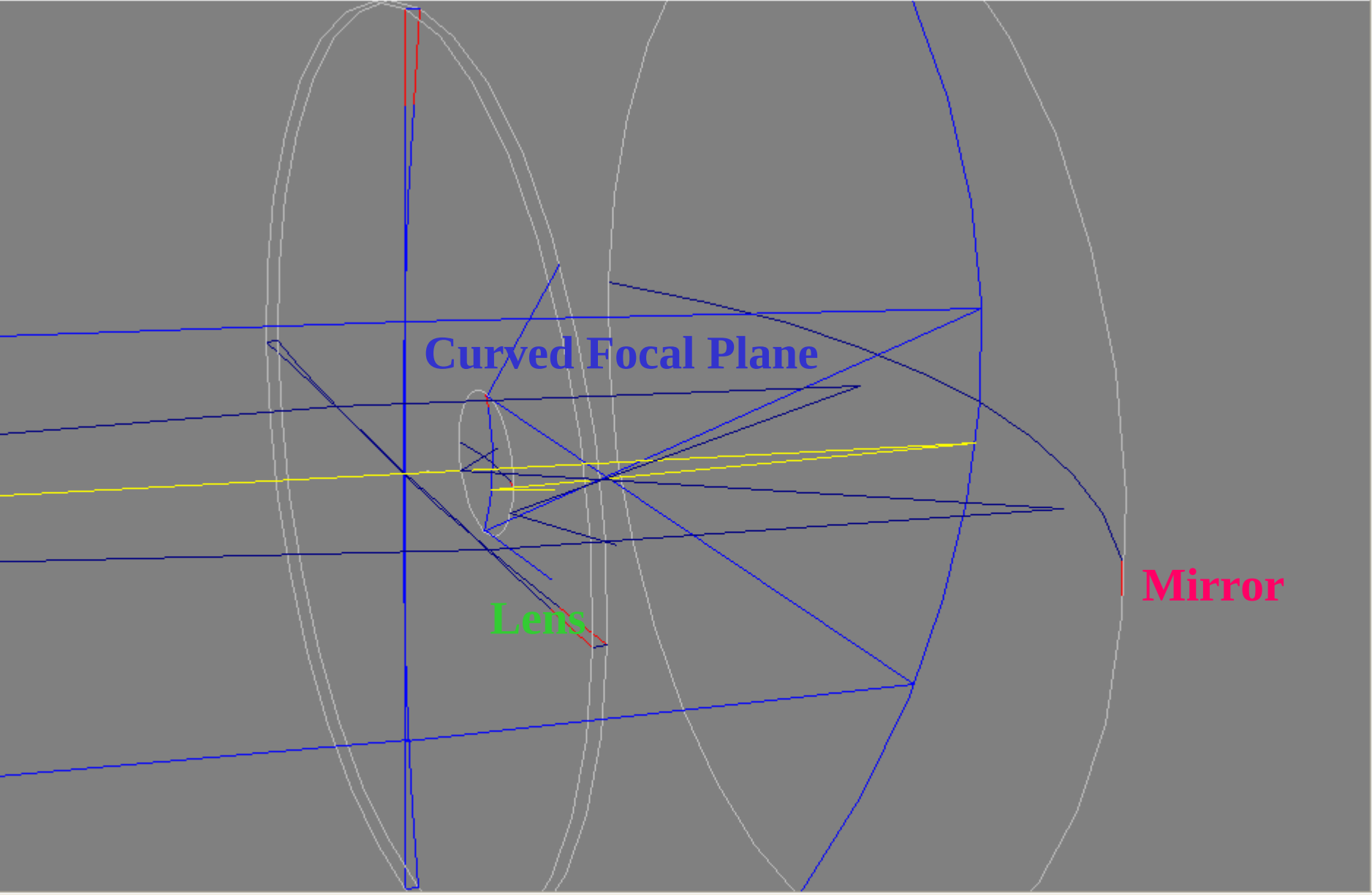
Plastic fiber

(e.g. Mitsubishi Eska)

MAPMT



Simple Modification from ASHRA Subtelescope



輪郭のみ

6.4

X軸 20

Y軸 20

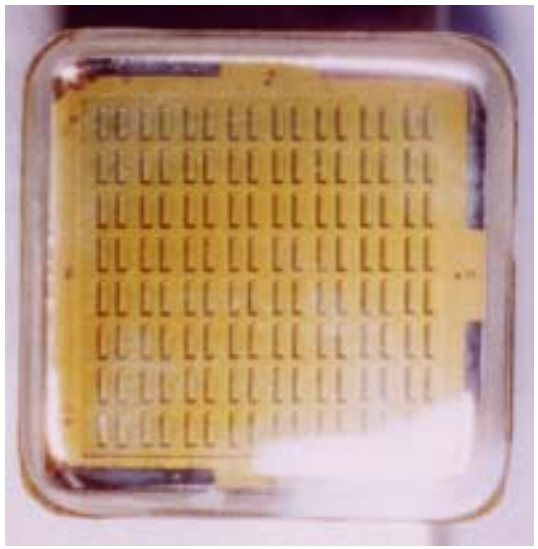
Z軸 0

角 4 0

子午光線 球欠光線 再表示

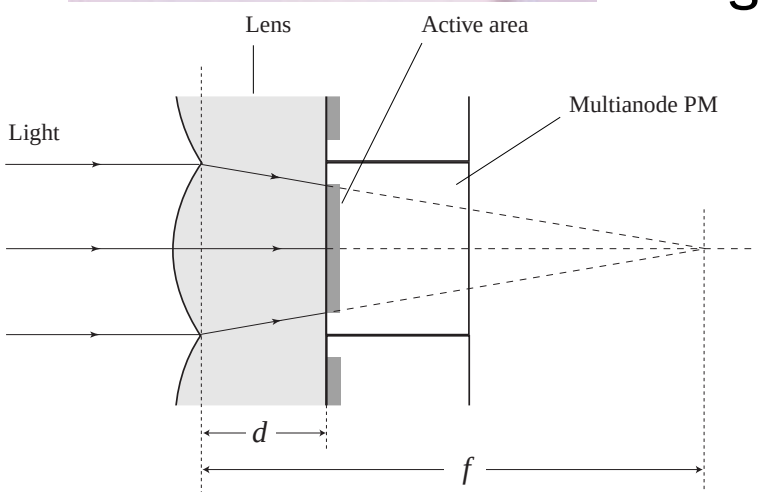
Before Zemax is use

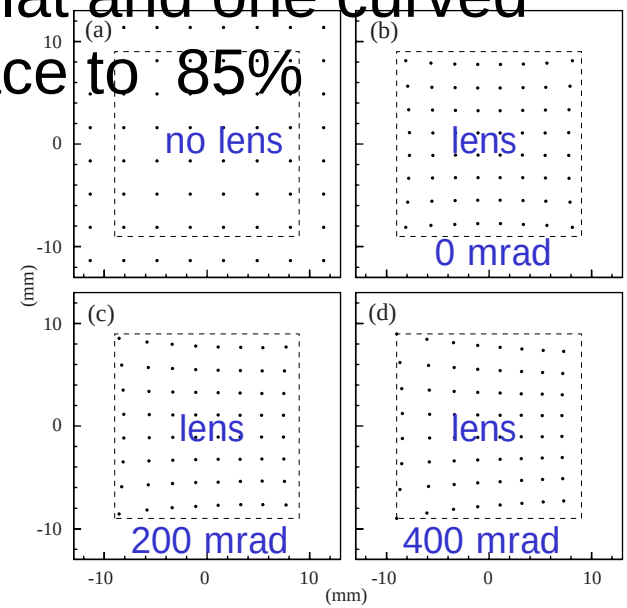
Quartz Lenses



APMT active area fraction:
38% (includes pixel gap)

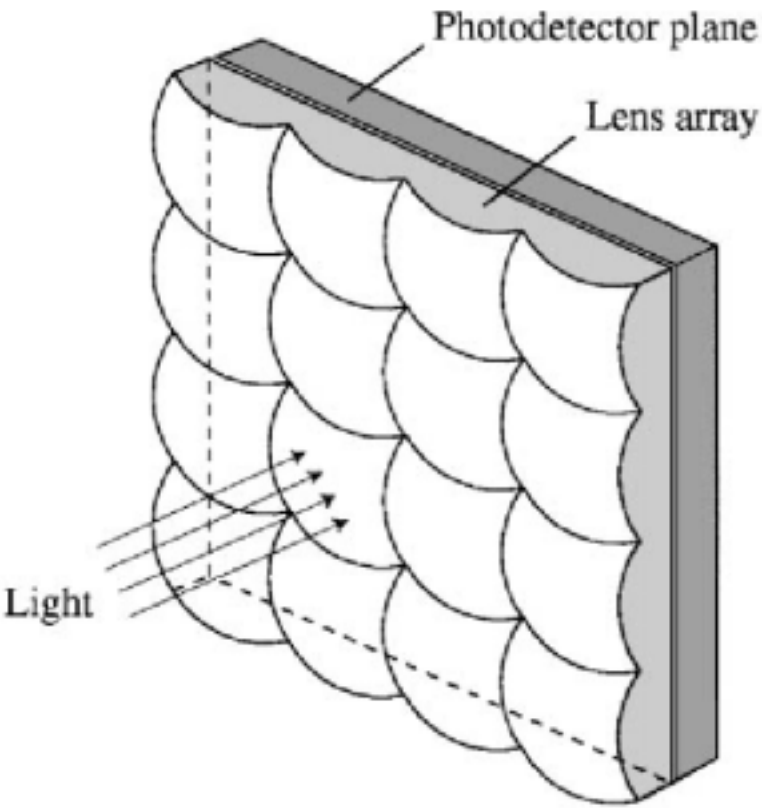
ncrease with quartz lens with one flat and one curved surface to 85%

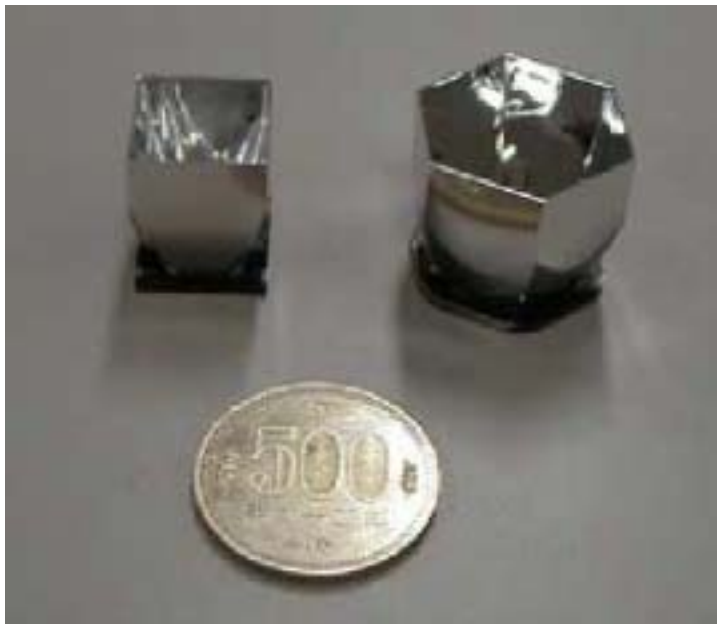




Cangaroo's Winston Cone

LHCB Lens



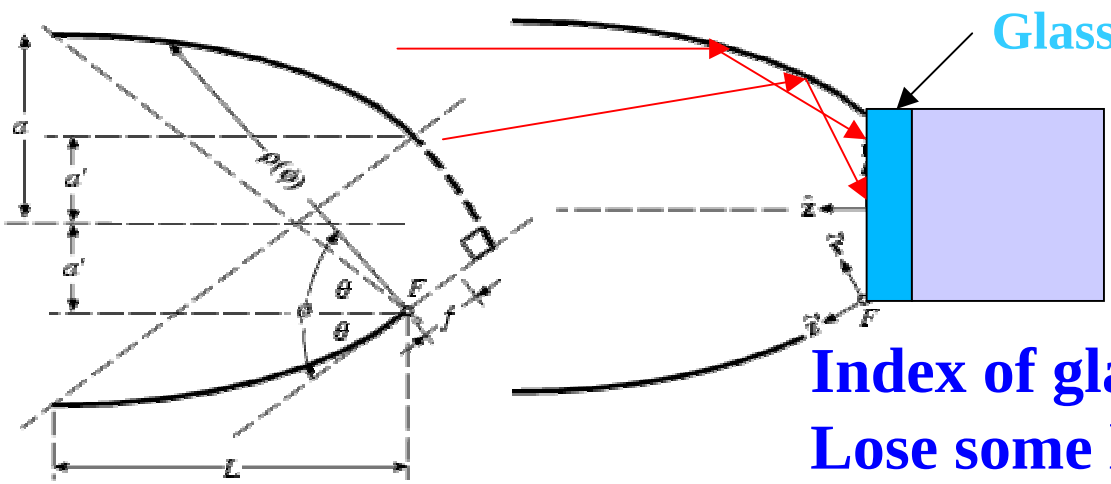


Liouville's theorem: "phase space is conserved" Hard to beat.

$dx d\theta = const.$

$dx dp_x$

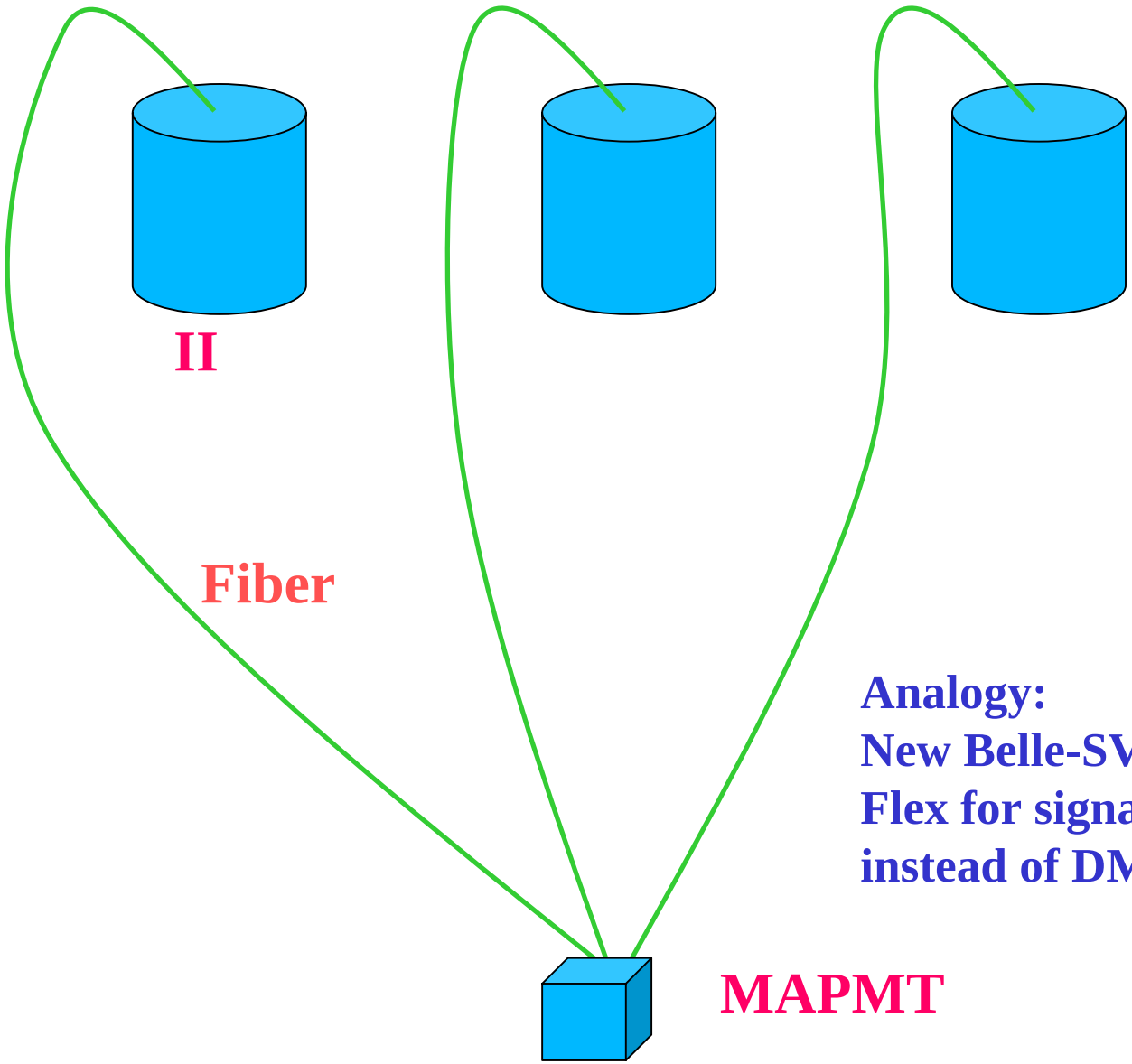
	Input	Output
dx	large	small
dθ	small	large



Winston cone

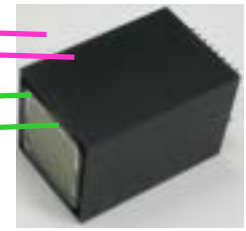
Index of glass n > 1.
Lose some light
w. incident angle > critical angle.

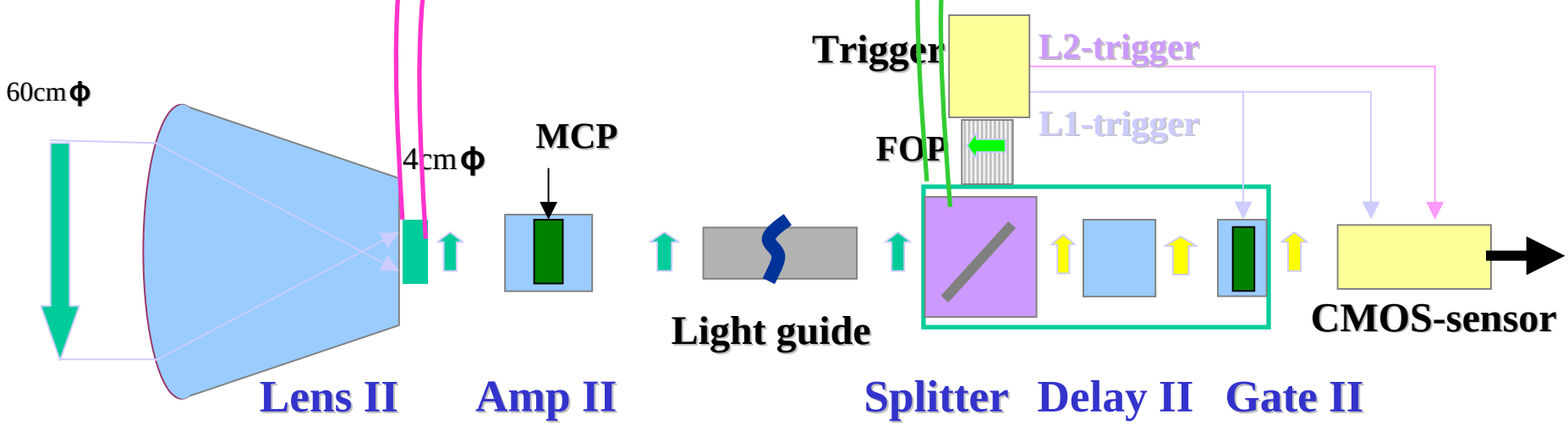
“Ganging” of IIs or mirrors in the same pixel of MAPMT increasing an effective mirror size.



Analogy:
New Belle-SVD uses
Flex for signal ganging
instead of DMS in silicon

NuTel system can be used for ASHRA trigger.
Poor-man's macro cell w. fiber instead of silicon.





Conclusion

- Electronic chain will be ready in March. It is being tested now.
- Optical chain will be hopefully ready in April or May. We just started.
- Will try a bench test of the whole system around May. Some small-scale test will be possible earlier.
- Need more thought on trigger, calibration, alignment etc.