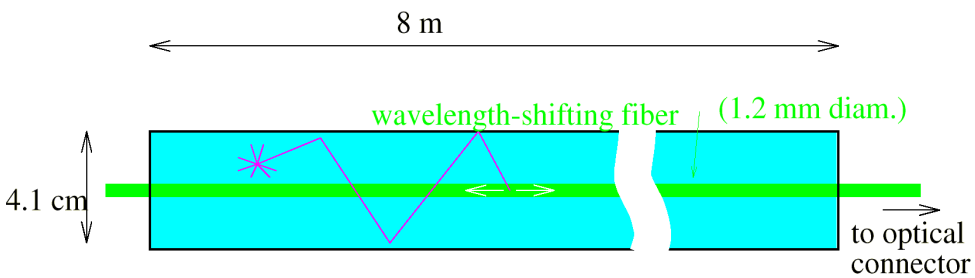
So, you want to buy a solid scintillator detector…

Active Detector

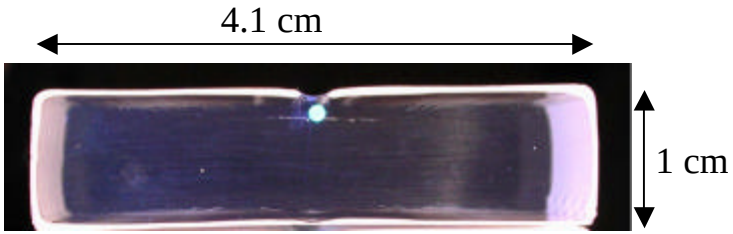


Scintillator strips are extruded polystyrene (Itasca Plastic)

- PPO (1%) and POPOP (0.03%) fluors
- Co-extruded TiO_2 reflective coating
- Fiber groove

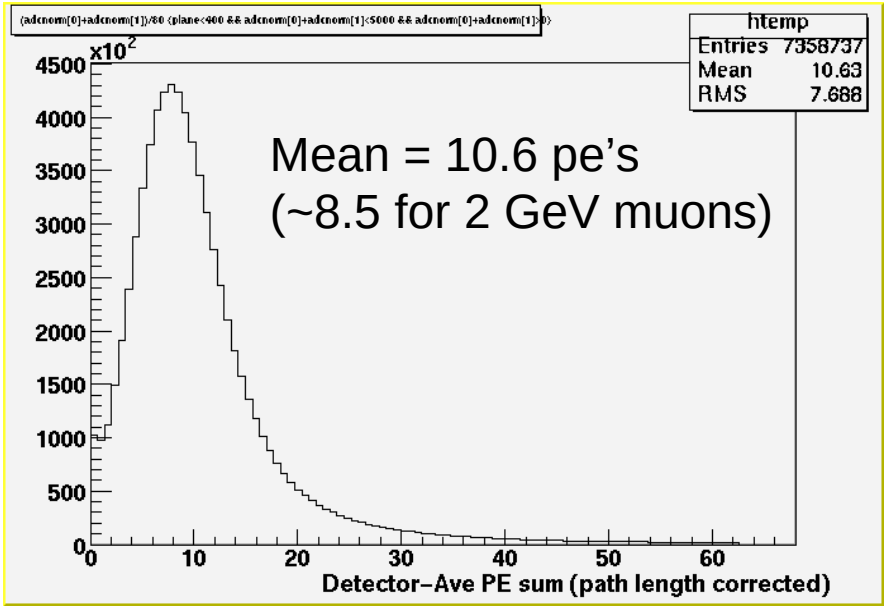
Kuraray 1.2mm WLS Fibers

- (Y-11 175ppm)

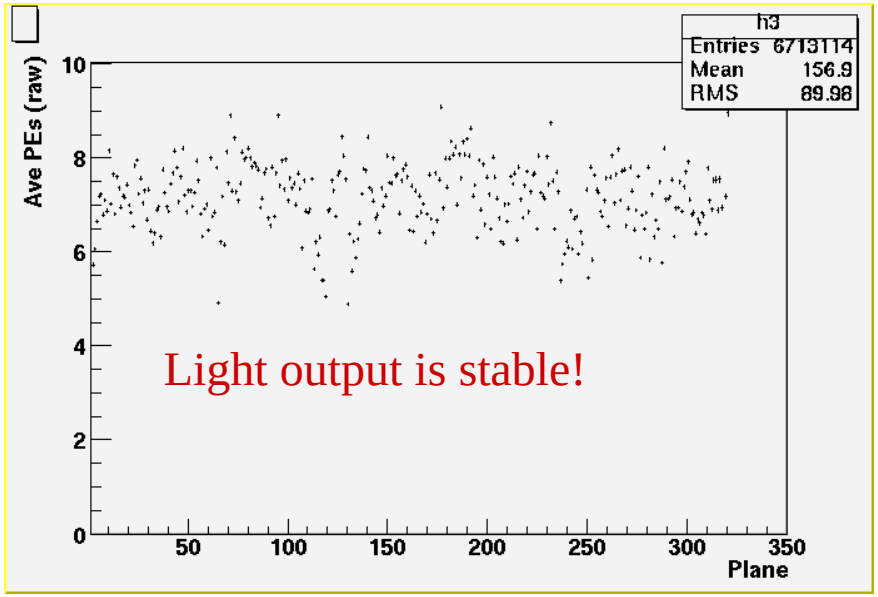


Light output at Far Detector

- The most significant design critereon for the far detector was the light output.
  - >4.7 pe's/muon (2 GeV muons) for the average sum of two strip ends.
- The measured light output is almost a factor of two higher than the design requirement.

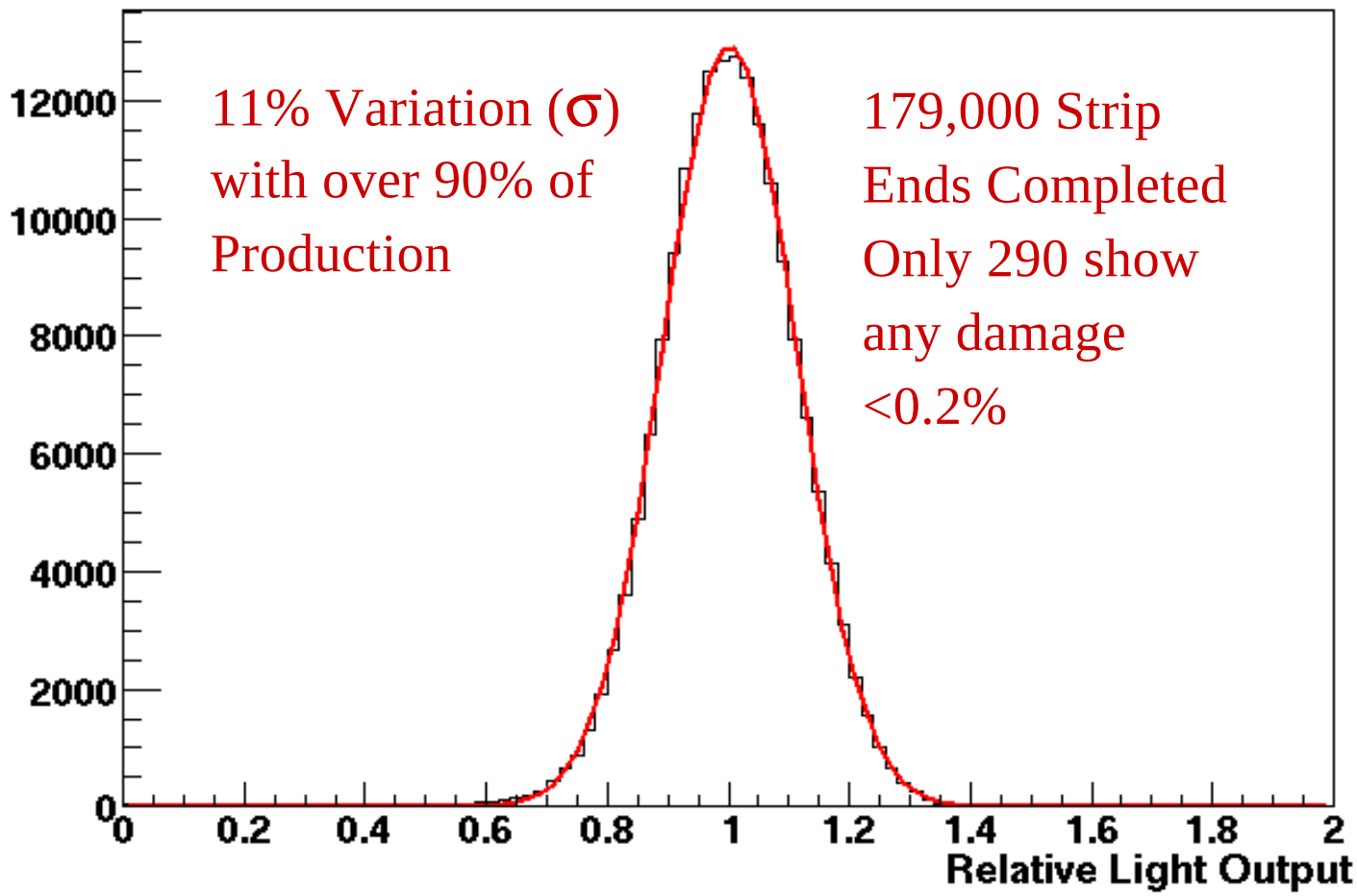


Light output measured for all strips for muons in the far detector. The light output is corrected to 1 cm pathlength per plane but is not corrected for PMT gain variations.

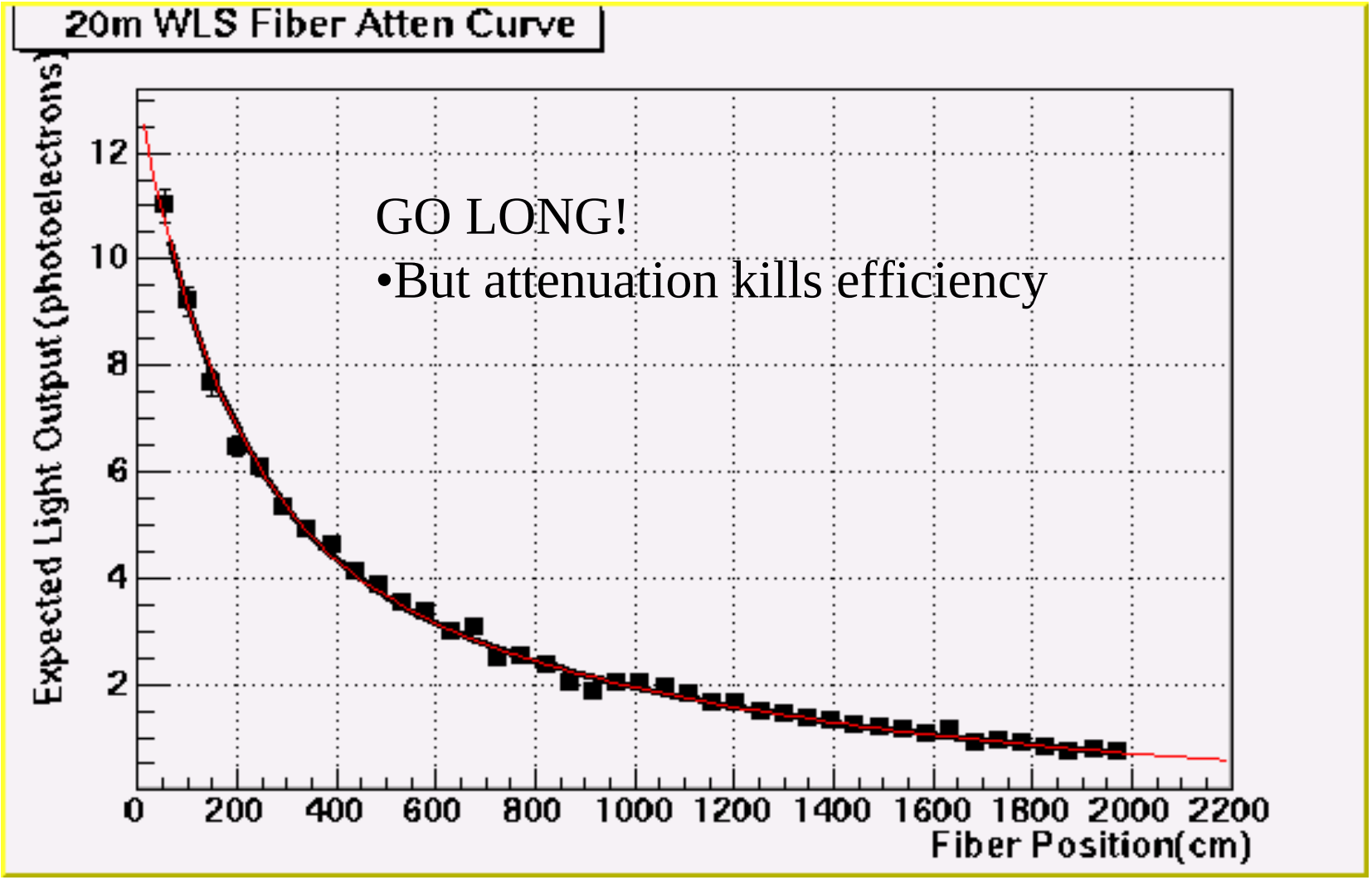


Average light output for one-side of readout vs plane number in the detector. (Not corrected for pathlength or gain variations). This shows the uniformity in the hardware and raw response.

Module Uniformity



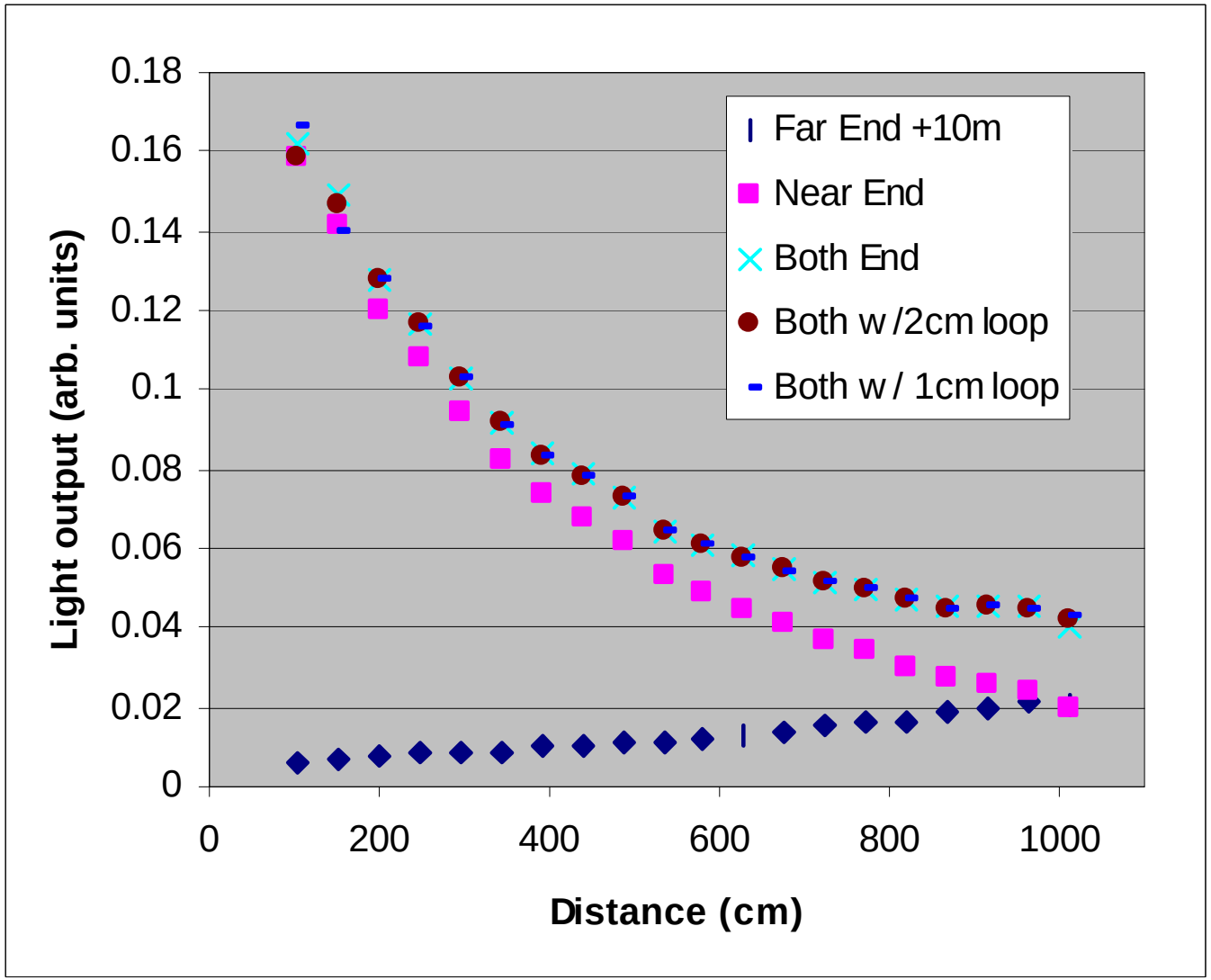
Improvements for off-axis…



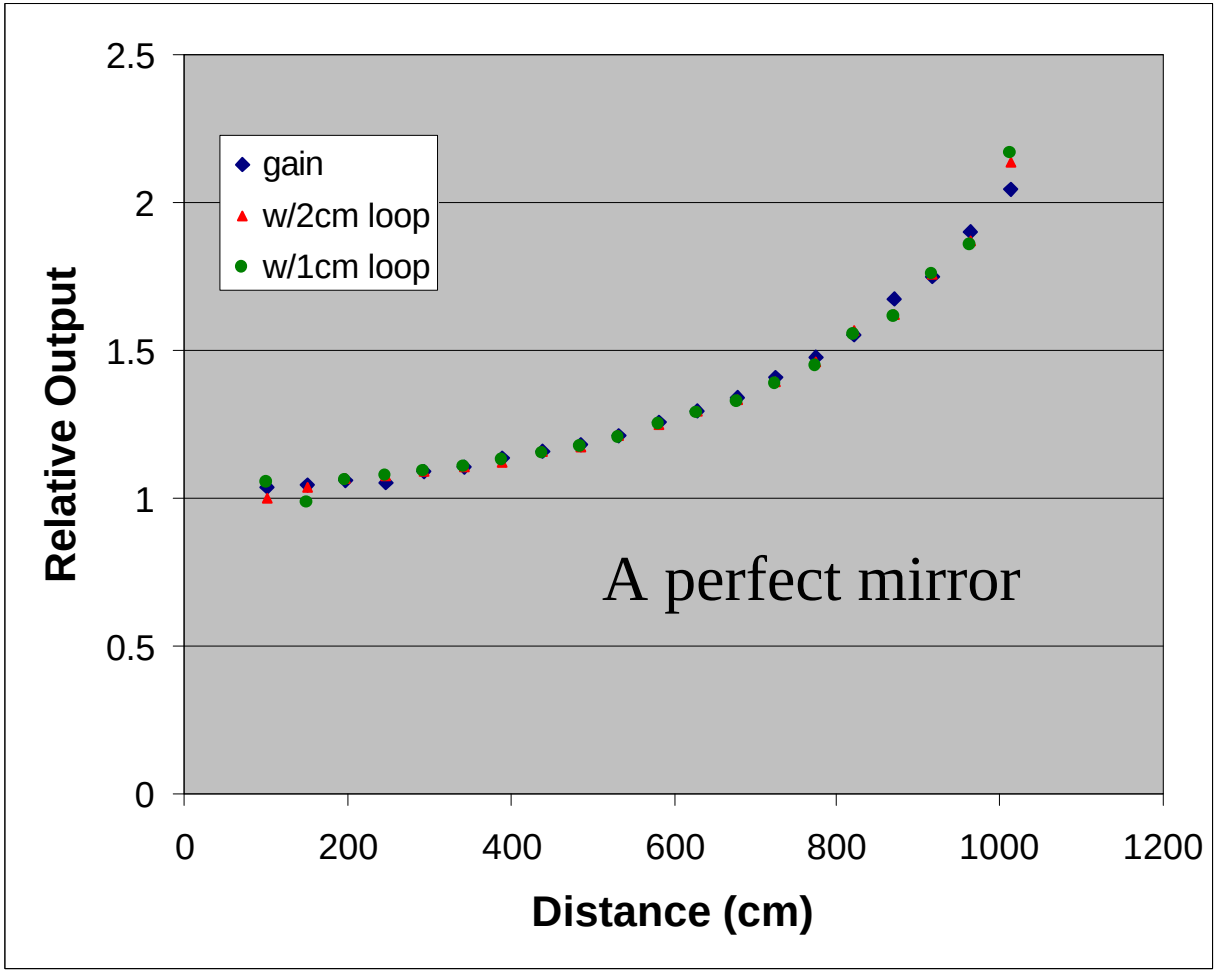
GO LONG!

•But attenuation kills efficiency

Loop fiber back to PMT



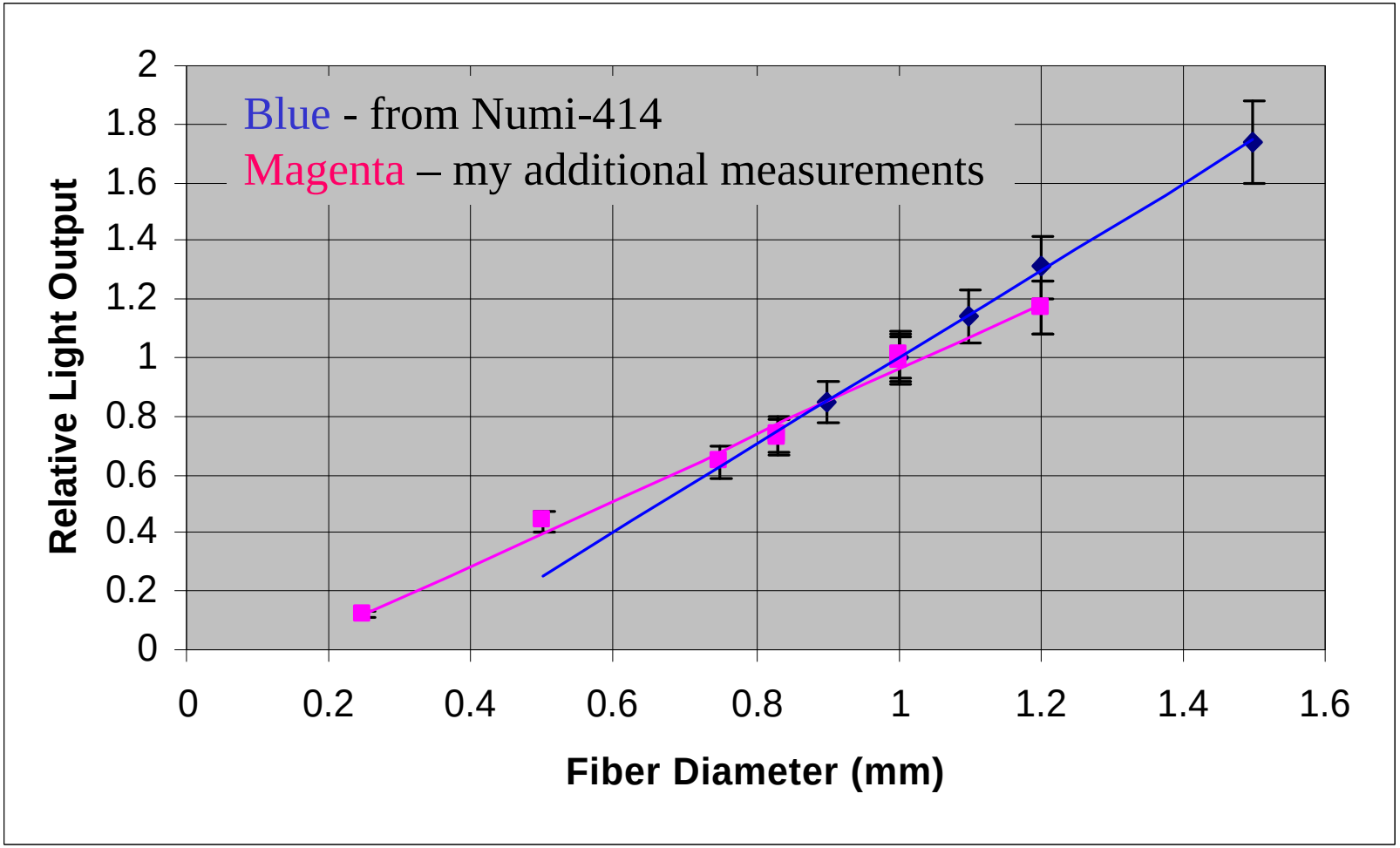
Gain from Looped Fiber for 10m Module

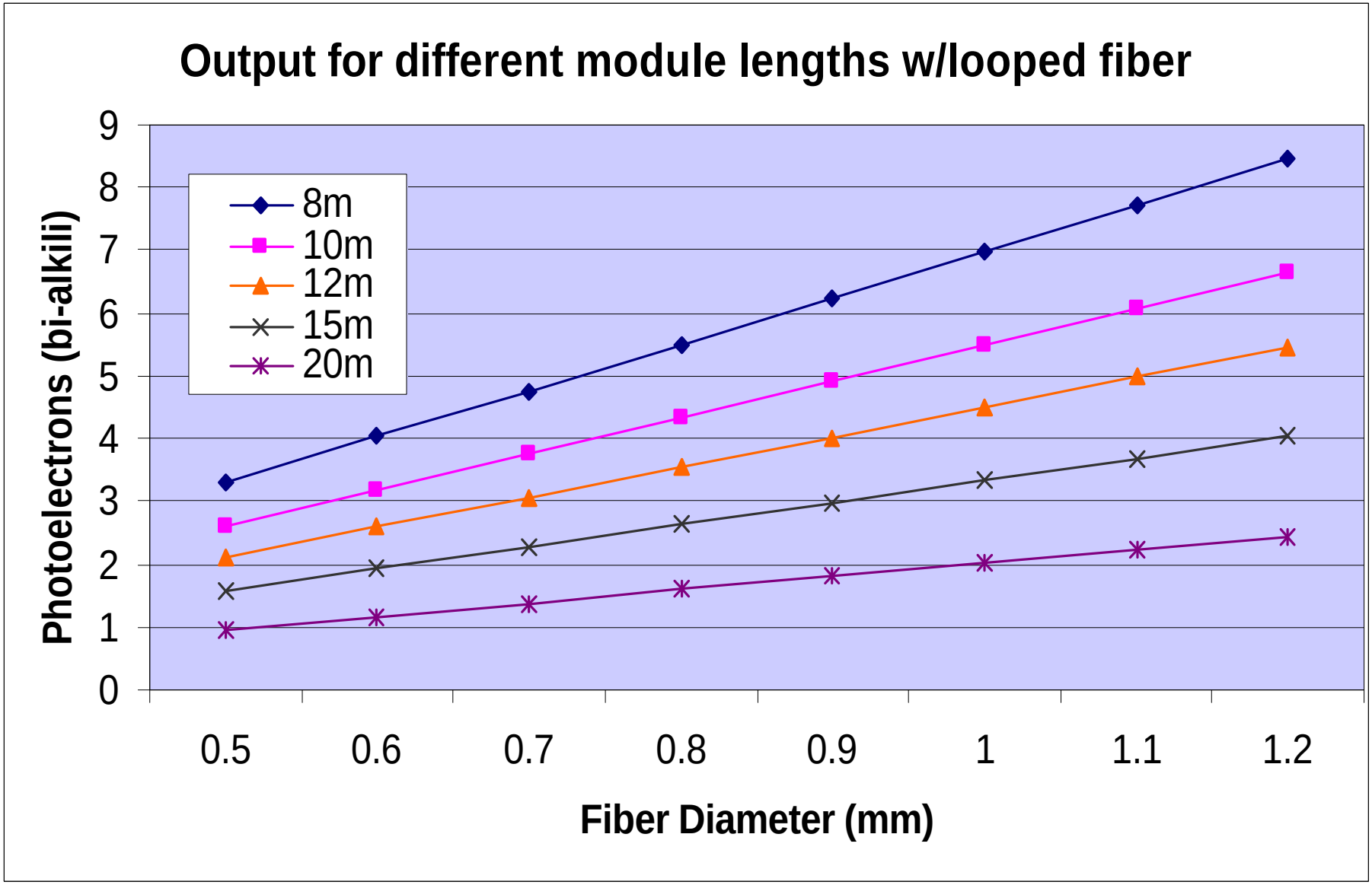


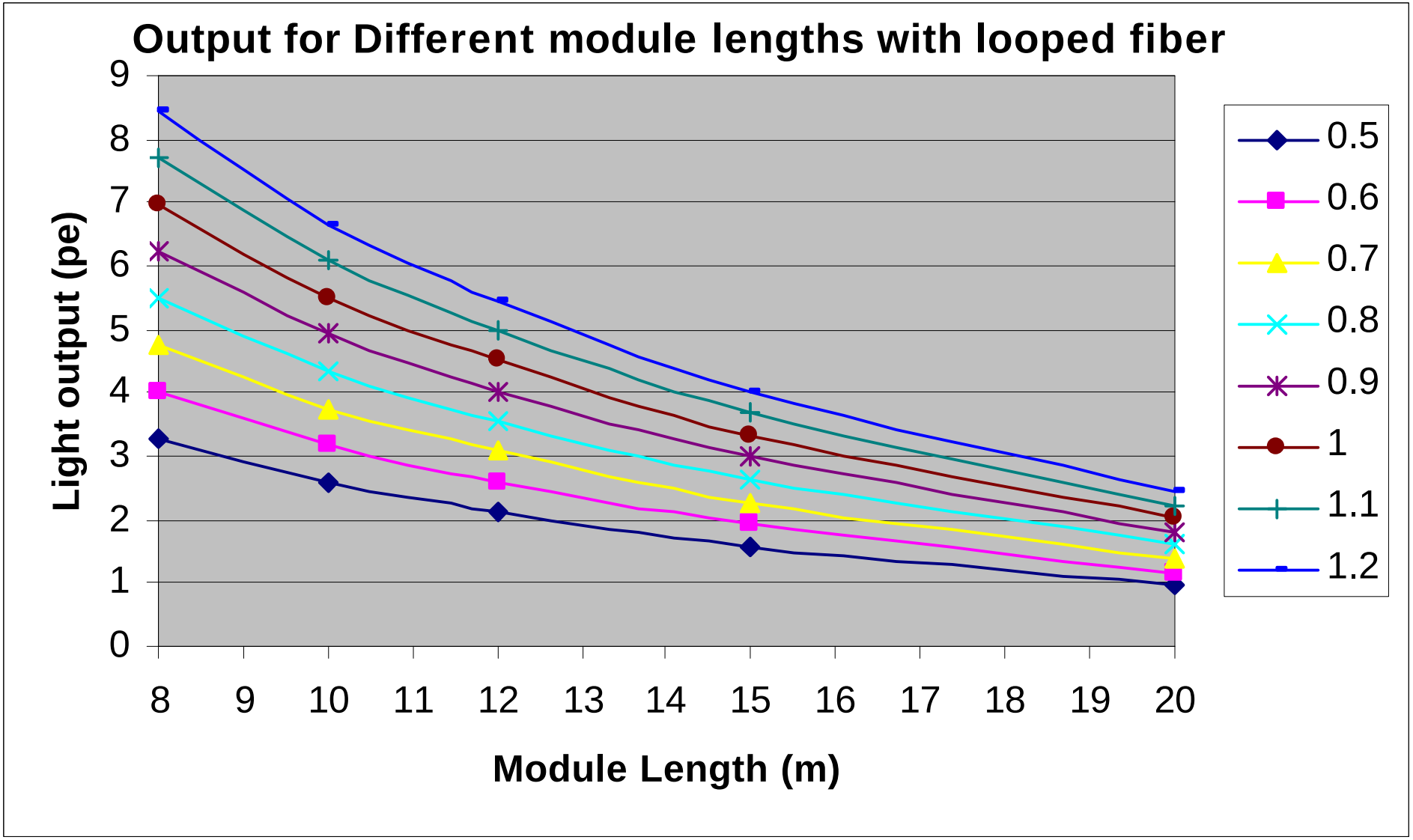
Looped fibers in action

- Commonly used in Shashlik Calorimiter
- In place for 5 years in PHENIX detector
    - No degradation seen over time
- Also planned for KOPIO calorimeter

Light output vs. Fiber Diameter

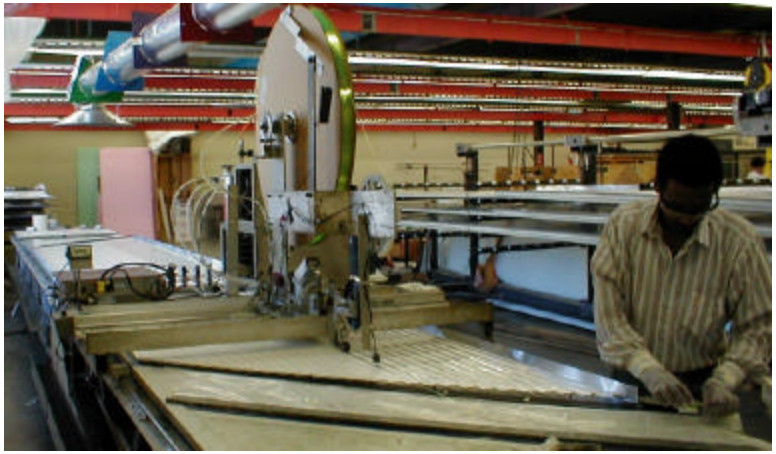


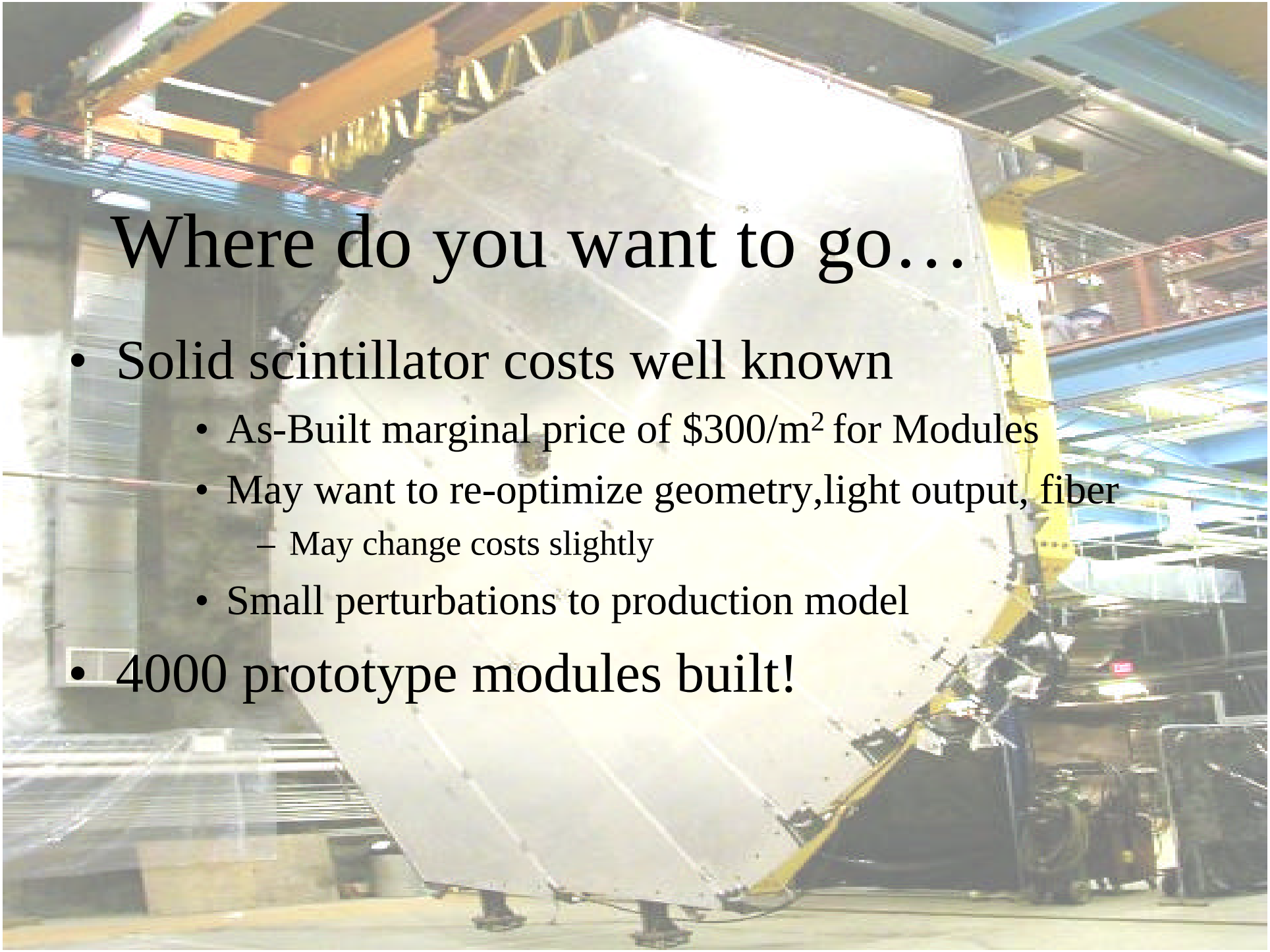

Output for different module lengths w/looped fiber
Photoelectrons (bi-alkili)
9
8
7
6
5
4
3
2
1
0
8m
10m
12m
15m
20m
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
Fiber Diameter (mm)


Output for Different module lengths with looped fiber
Light output (pe)
0
1
2
3
4
5
6
7
8
9
8
9
10
11
12
13
14
15
16
17
18
19
20
Module Length (m)
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2

Production differences

- Automate forming of case, glue dispensing
  - Cost/Benefit
- Need to spool fiber before gluing
  - Double glue nozzle, push stick





Where do you want to go…

- Solid scintillator costs well known
  - As-Built marginal price of $300/m^2 for Modules
  - May want to re-optimize geometry,light output, fiber
    - May change costs slightly
  - Small perturbations to production model
- 4000 prototype modules built!