DØ Fiber Tracker and VLPC's

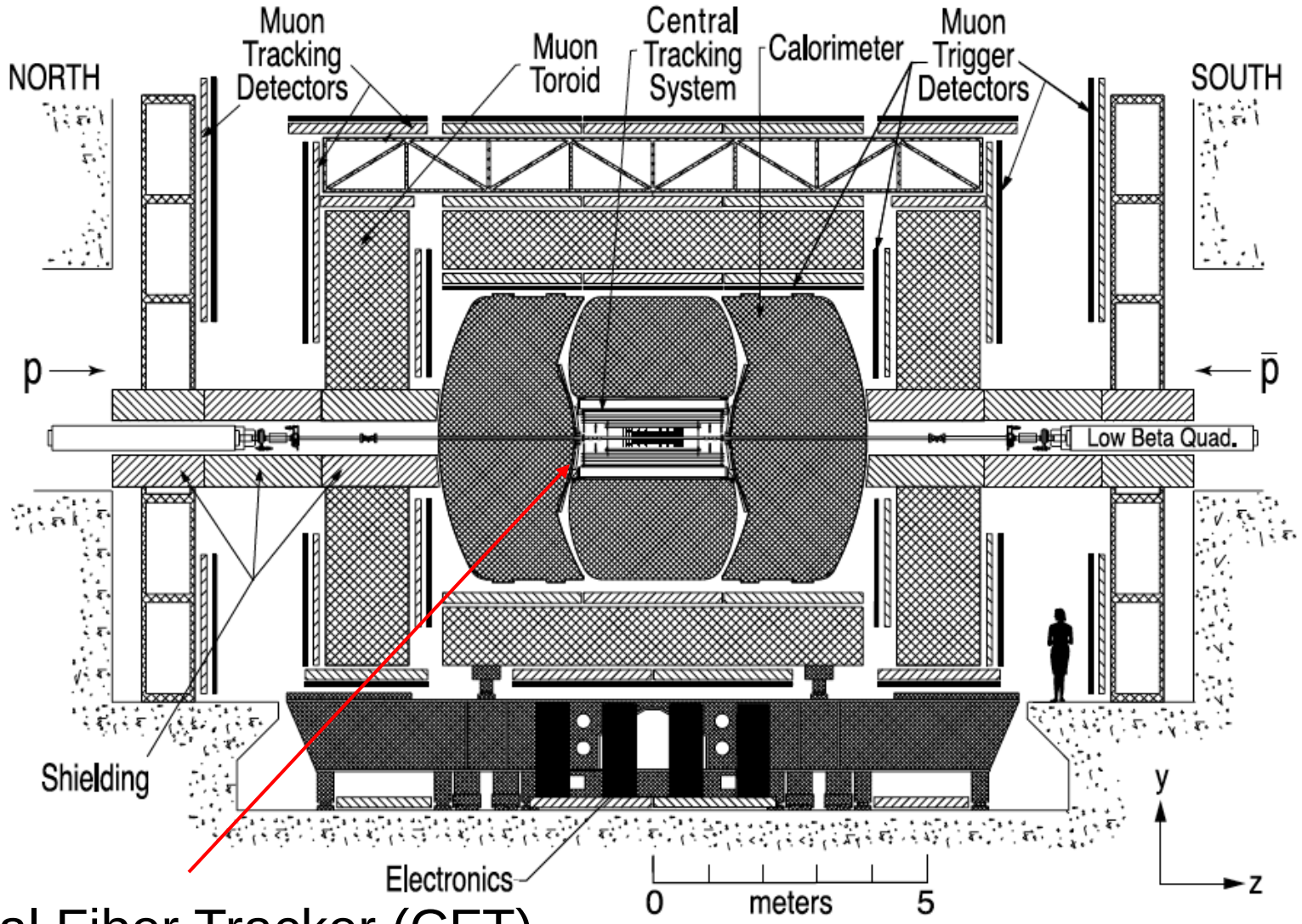
Werner Boeglin

References:

NIM A565 (2006) 463-537

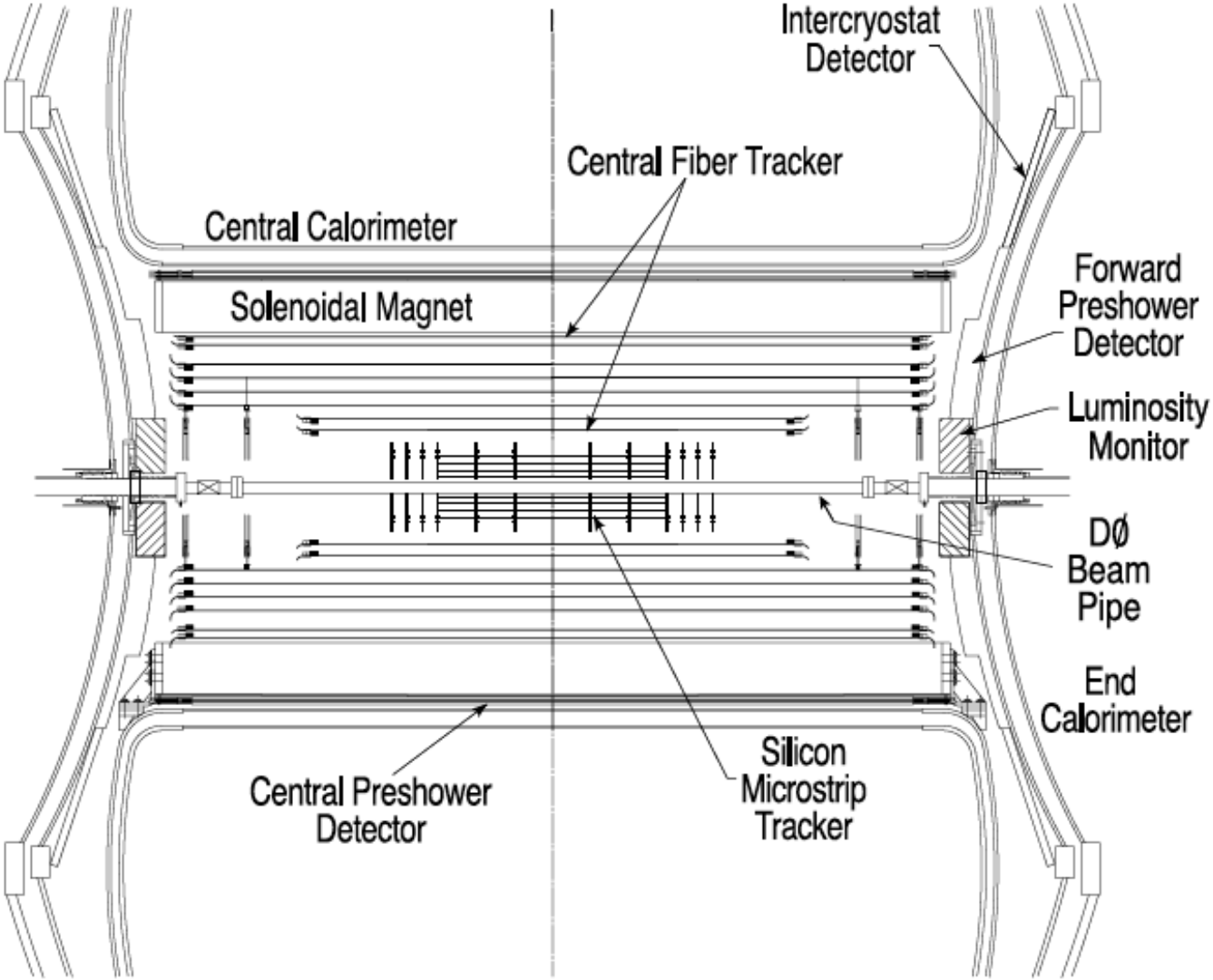
NIM A477 (2002) 172-178

DØ Detector Overview



Central Fiber Tracker (CFT)

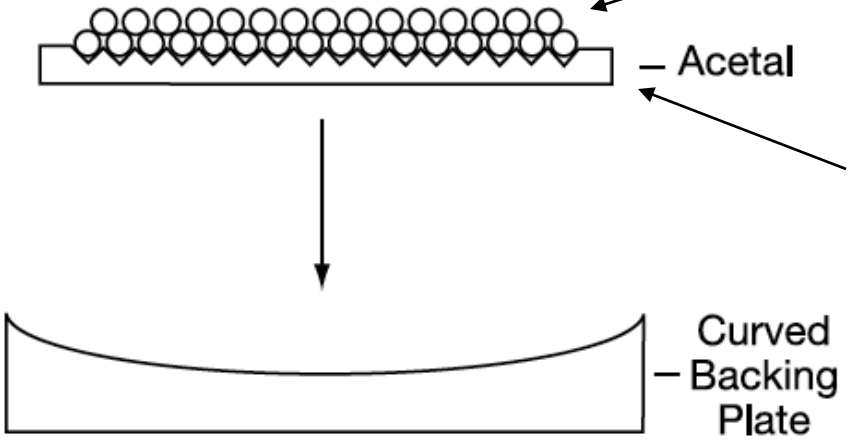
Cross Section CFT



General Parameters

- 8 double layers of fibers on support cylinders (r_{min} = 20cm, r_{max} = 52cm, length 1.66m - 2.12 m)
- scintillating fiber diameter: 835μm coupled to clear fibers
- fibers are doubly clad
- light emission 530nm
- position resolution with doublet layer 100μm (need to know fiber position to about 50μm)
- typical attenuation length: 5 m for SciFi, 8 m for clear fiber
- length of light guides: 7.8 - 11.9 m
- readout with Visible Light Photon Counters (VLPC)
- 76800 channels for CFT
- 22564 channels for central and forward pre-shower detector
- additional channels for spare

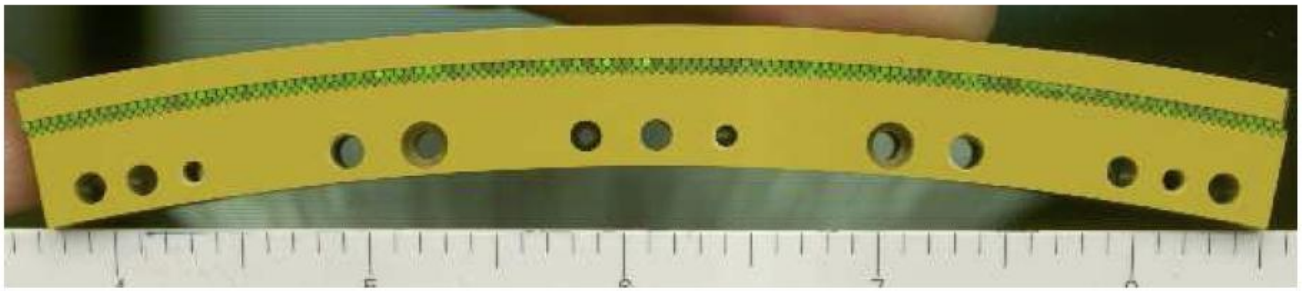
SciFi Ribbon Construction



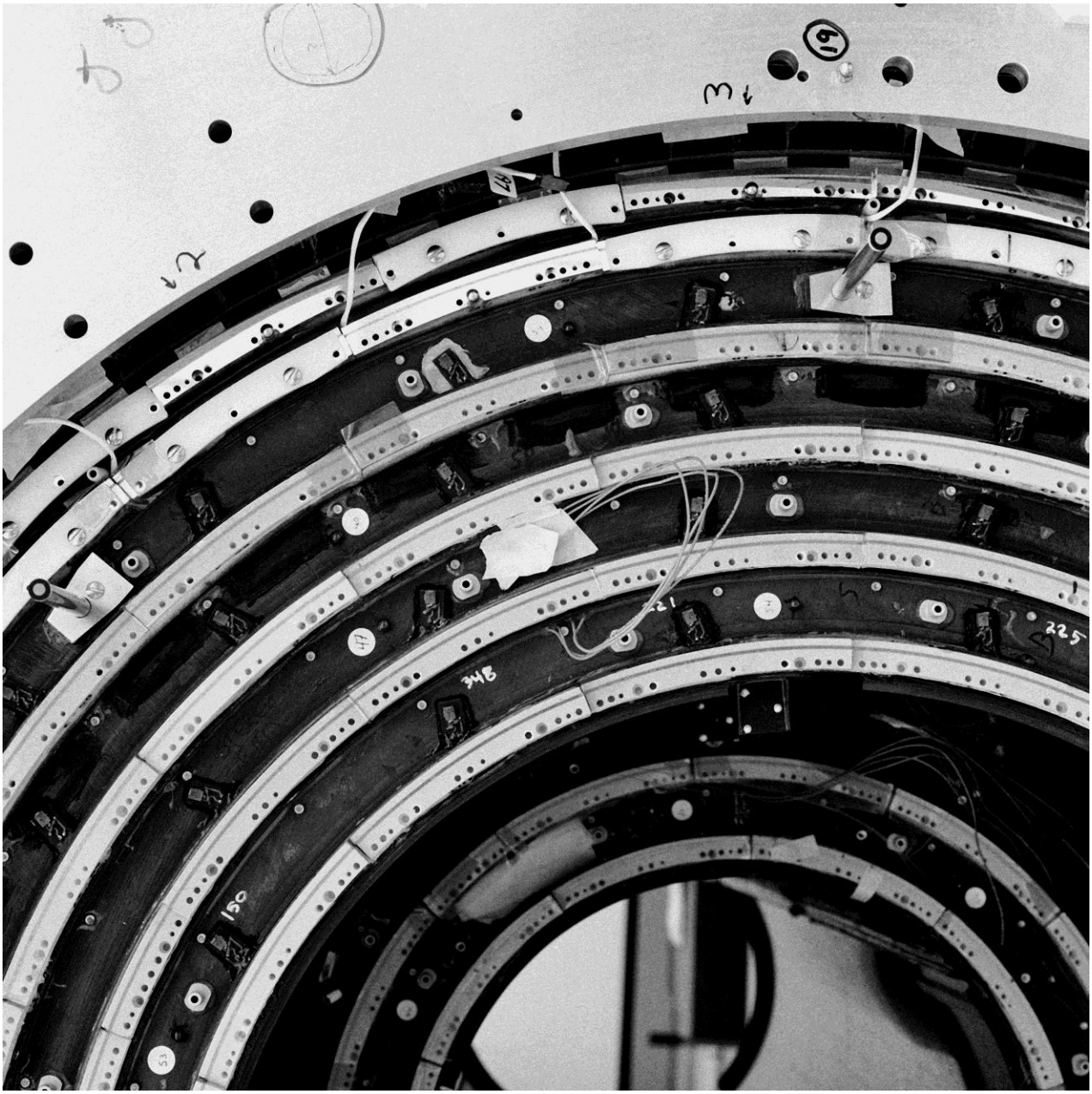
double layer of fibers

precision grooved Acetal mold

assembly is pressed into a backing plate and glued

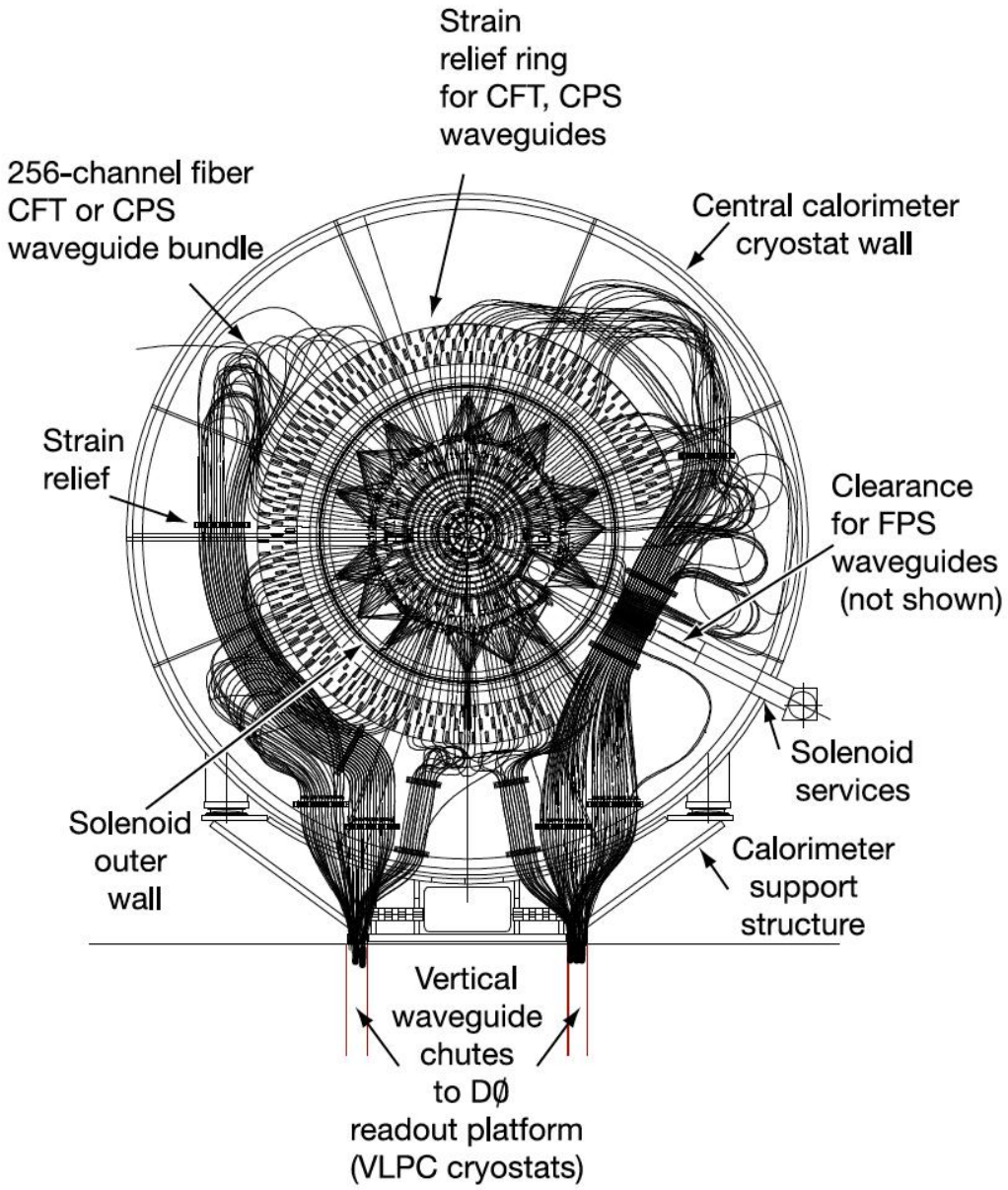


double layer ribbon with connector for light guides


348
225

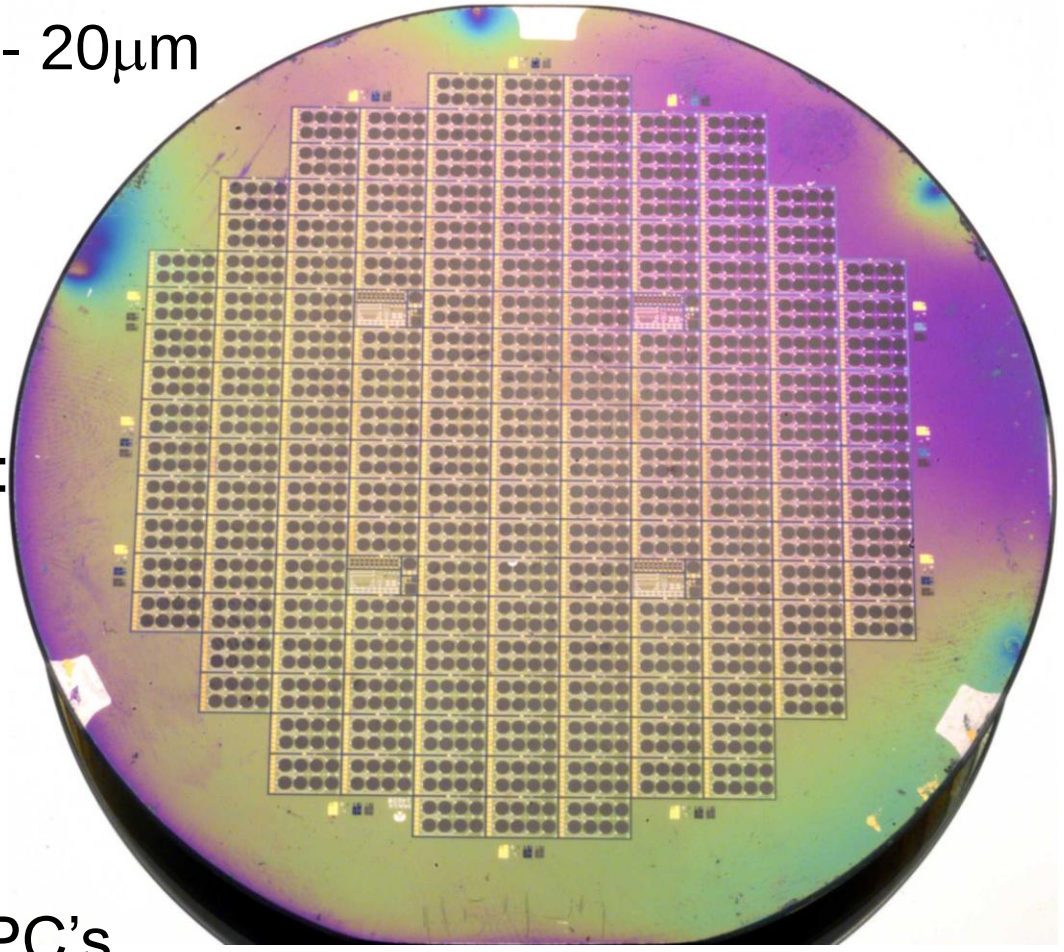

HC-
HC-

Light Guide Routing



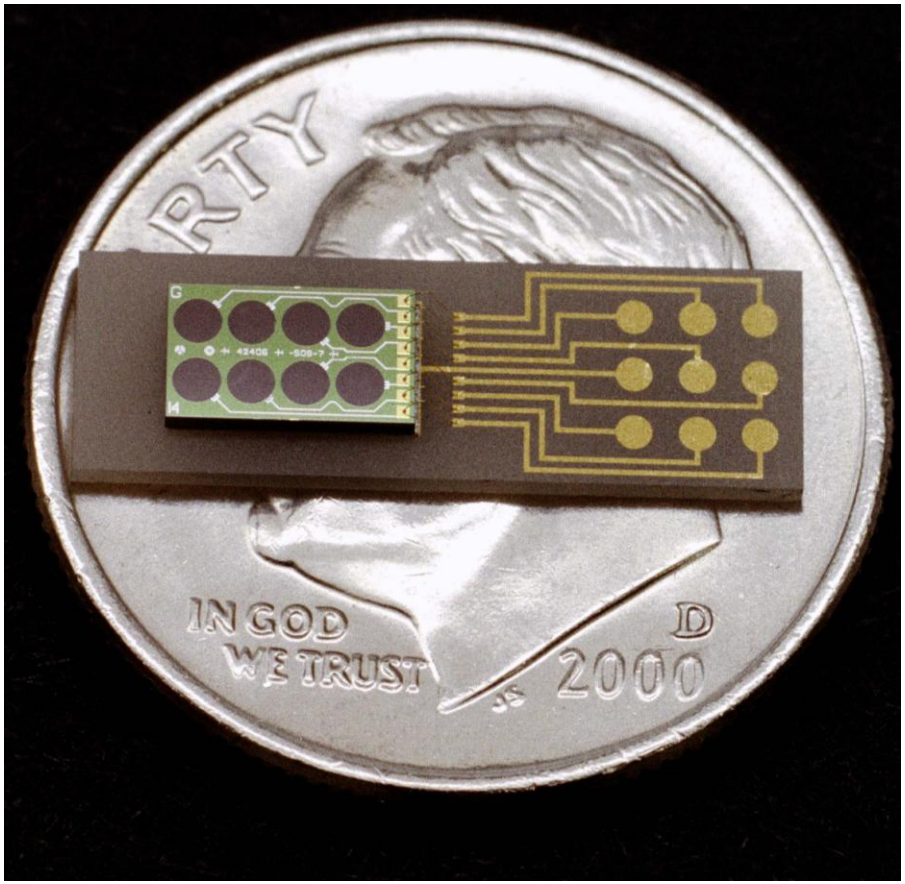
VLPC Properties

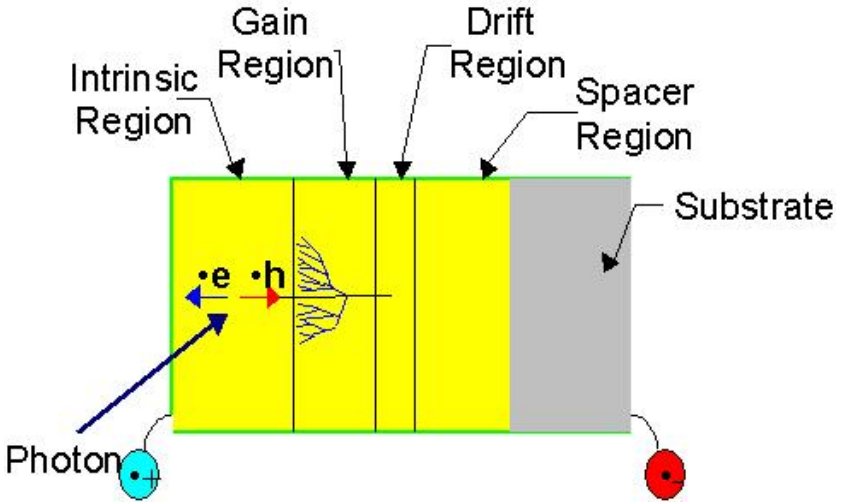
- quantum efficiency: > 75%
- spectral range 400nm - 20μm
- gain 22000 - 65000
- optimal bias voltage
  6 - 8 V
- operating temperature:
6 - 8 K
- operated at rates :
2.5 - 10 MHz PE



wafer with VLPC's

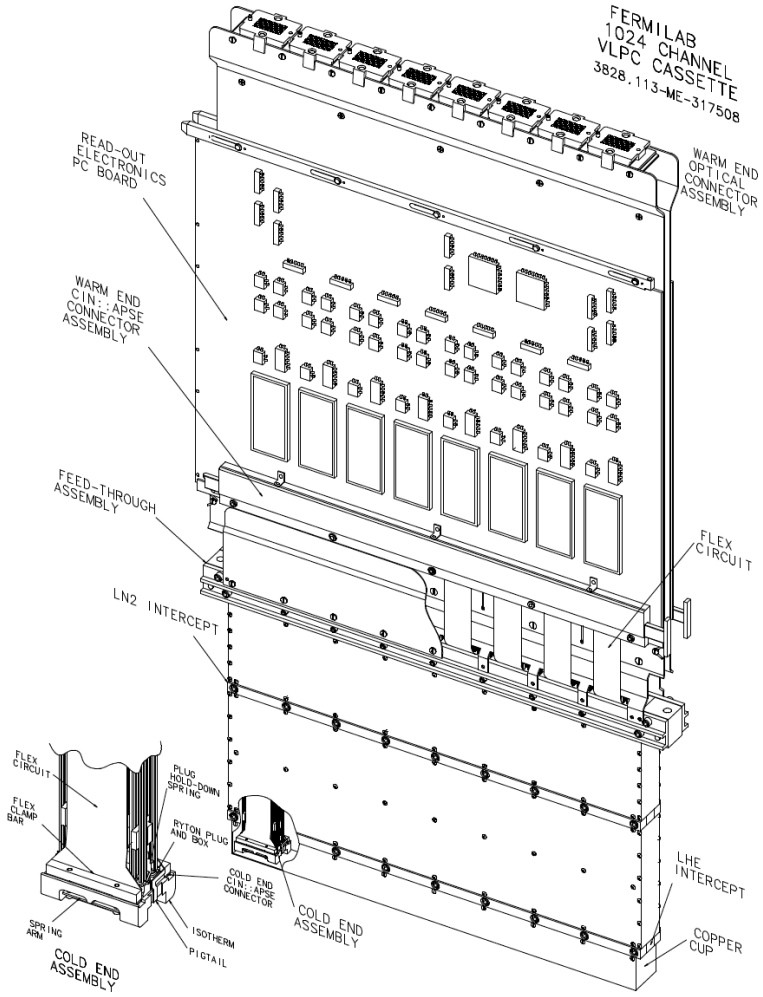
VLPC

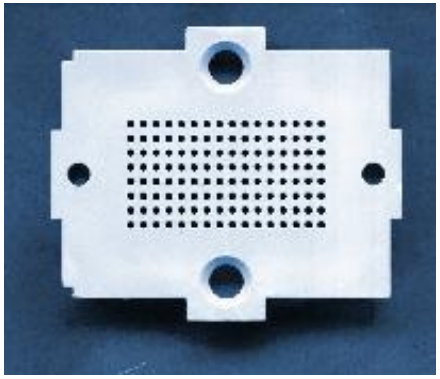




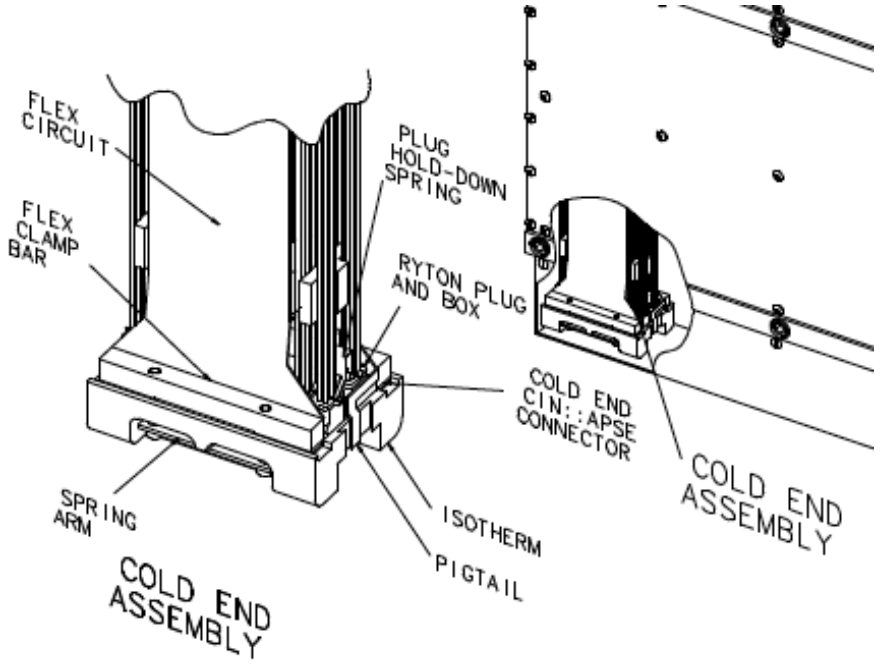
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

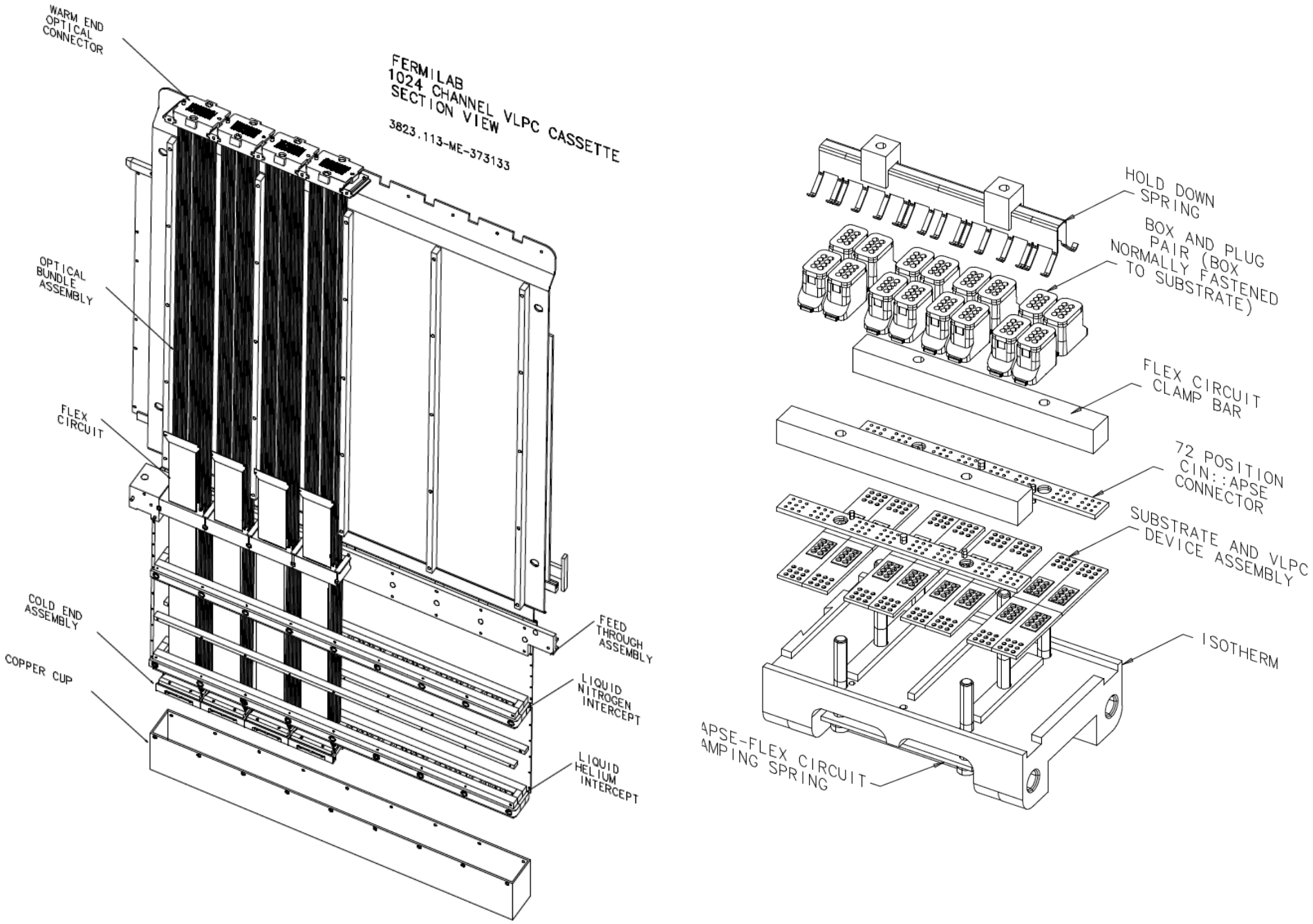
Cassette for 1024 Channels



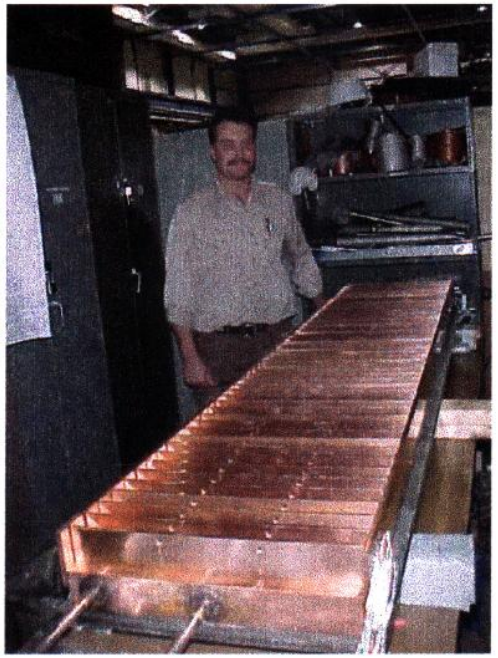


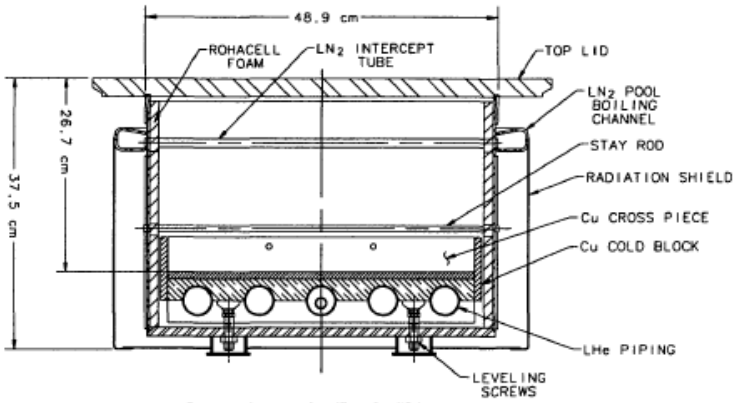
connector for 128 channel bundle



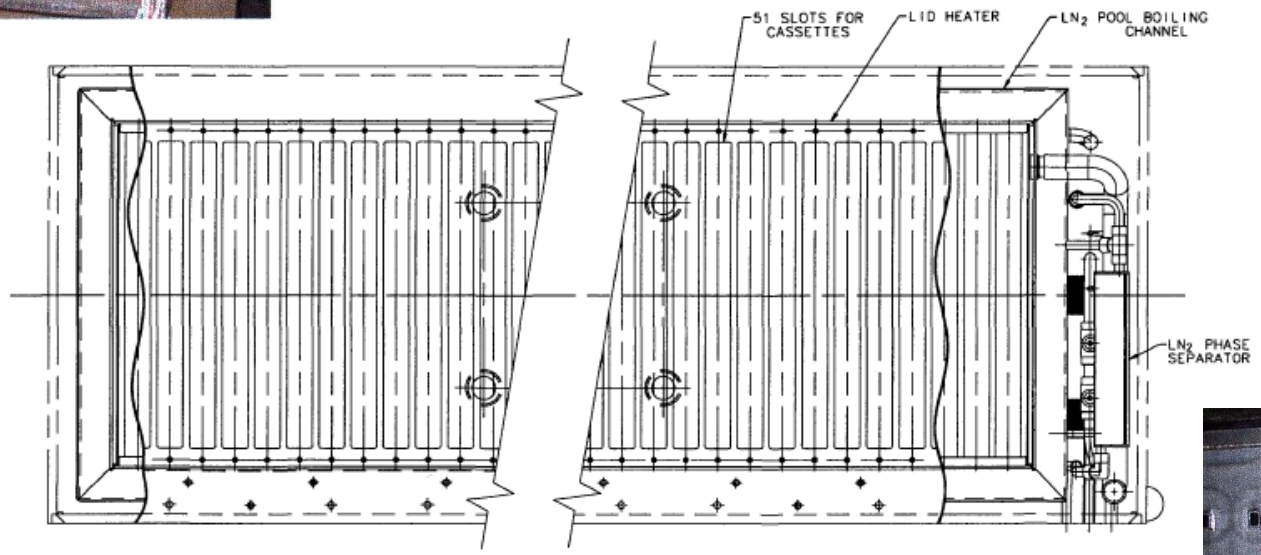

FERMILAB
1024 CHANNEL VLPC CASSETTE
SECTION VIEW
3823.113-ME-373133
WARM END OPTICAL CONNECTOR
OPTICAL BUNDLE ASSEMBLY
FLEX CIRCUIT
COLD END ASSEMBLY
COPPER CUP
FEED THROUGH ASSEMBLY
LIQUID NITROGEN INTERCEPT
LIQUID HELIUM INTERCEPT
HOLD DOWN SPRING
BOX AND PLUG PAIR (BOX NORMALLY FASTENED TO SUBSTRATE)
FLEX CIRCUIT CLAMP BAR
72 POSITION CIN::APSE CONNECTOR
SUBSTRATE AND VLPC DEVICE ASSEMBLY
ISOTHERM
APSE-FLEX CIRCUIT
AMPING SPRING

Crvostat

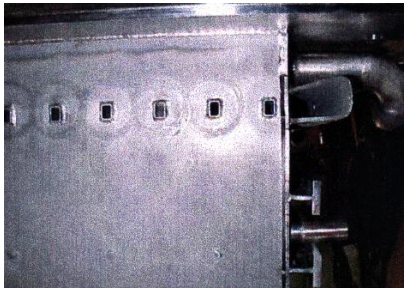




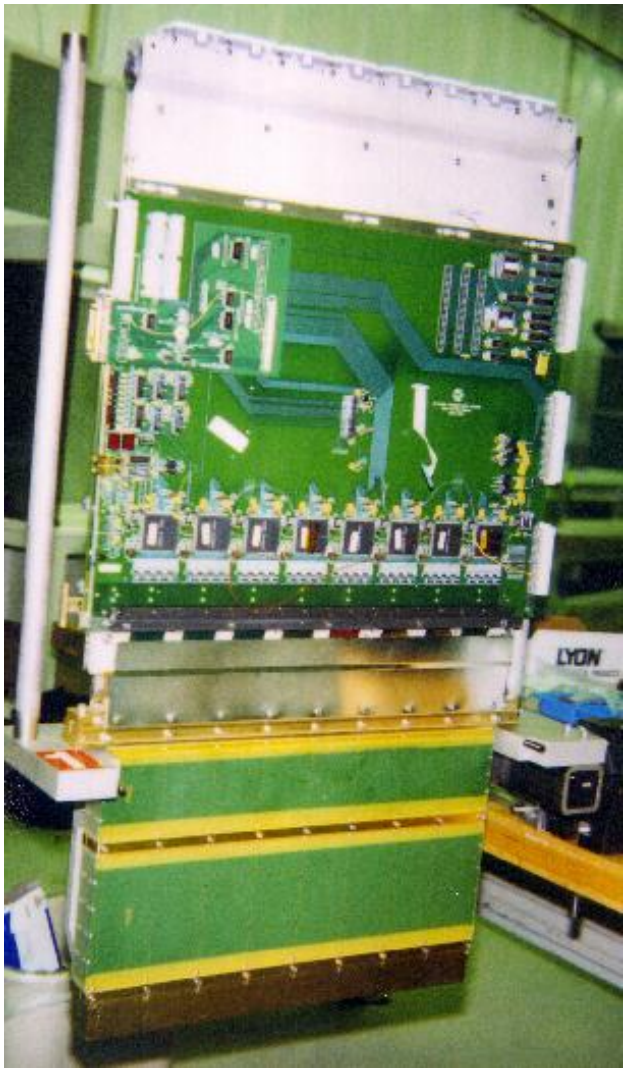
Sectional End View
(VACUUM VESSEL NOT SHOWN)



Sectional Top View

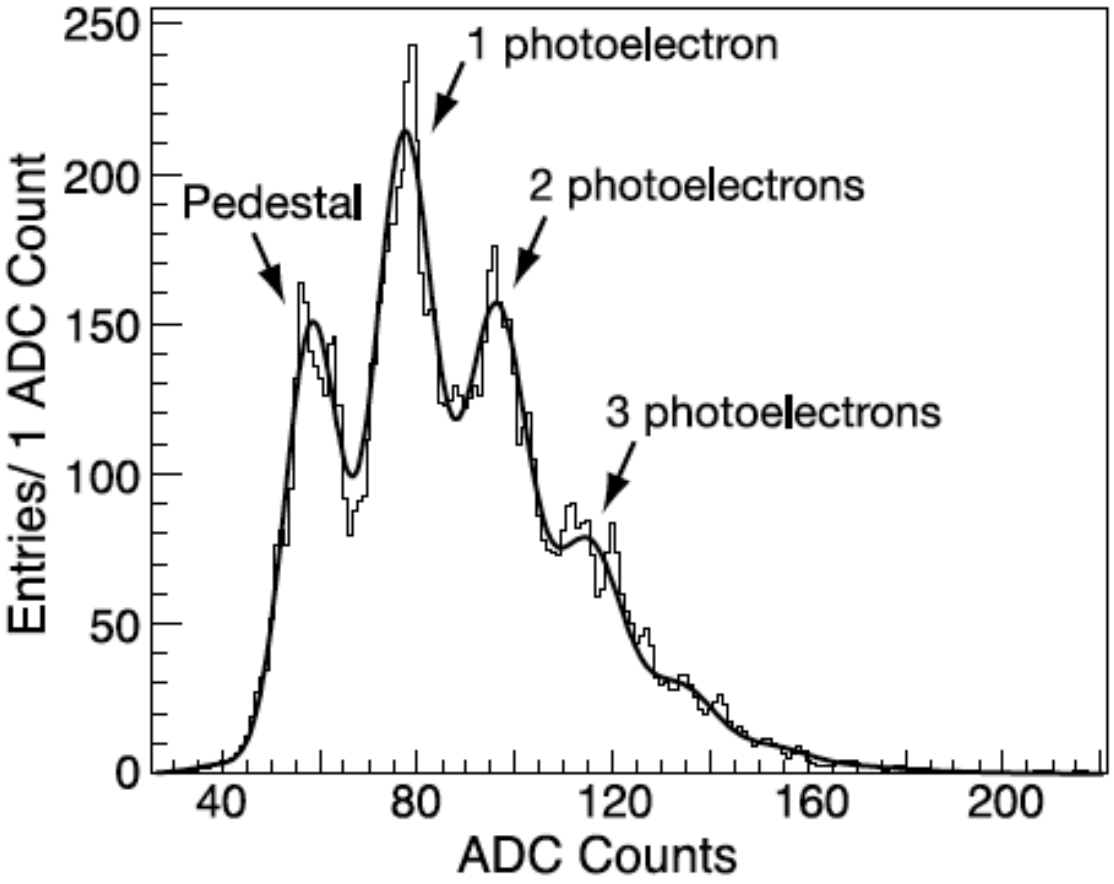


Cassette



Cryostat

Typical ADC spectrum



LED spectrum for a single VLPC and an axial CFT fiber

Summary

- DØ experiment scheduled to finish in 2010
- VLPC readout system seems to be ideal for a tracking detector based on SciFi
- cryostat and cassettes should be available in time for experiments at 12 GeV
- construction of dedicated cryostat needs to be investigated.
- light guides and couplings to VLPC modules need to be built