

# MUON DBD EDITORS REPORT

SID WORKSHOP  
SLAC AUG 2012

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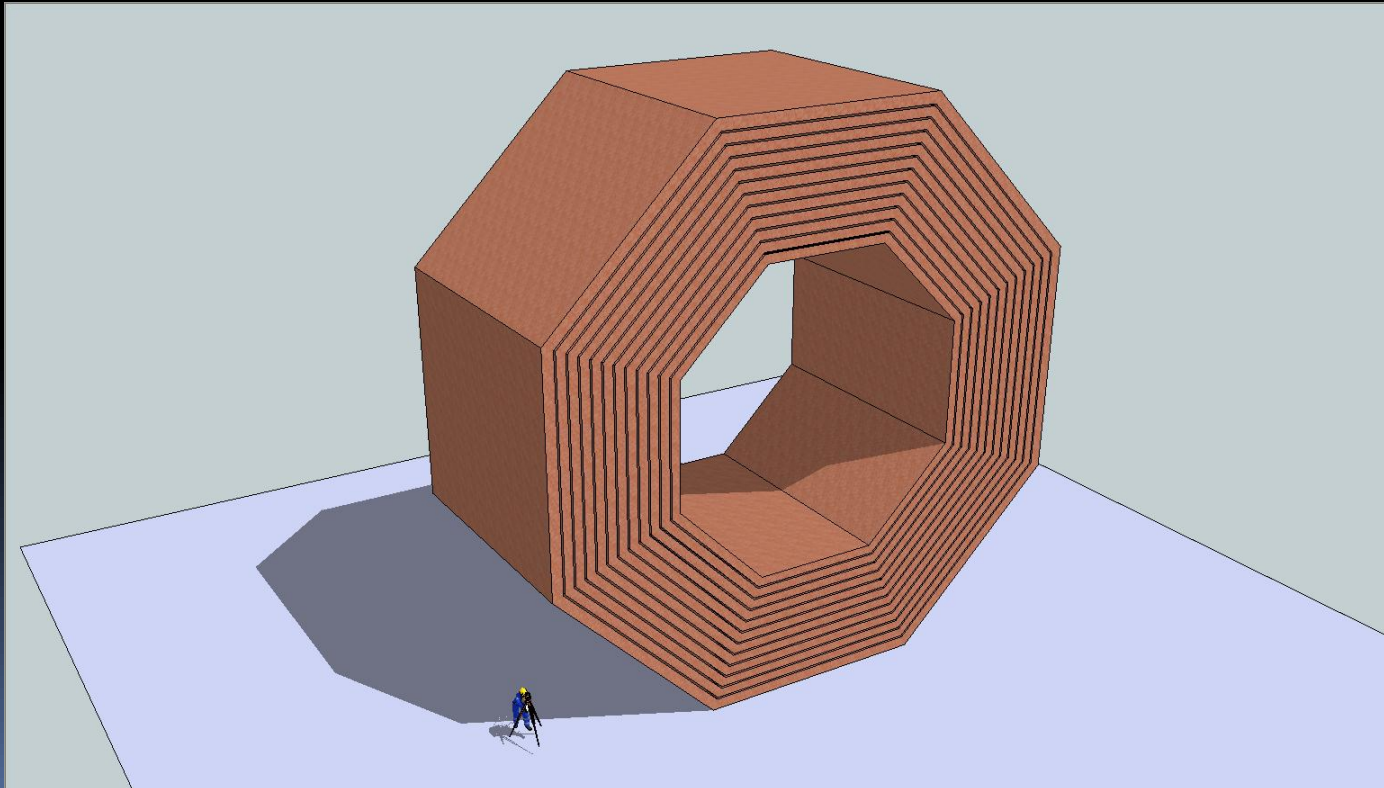
# DBD current status

- Conceptual design for detector baseline
  - Large modules (~30 sq m, depending on radius)
    - Orthogonal strips (width?)
    - WLS fibers (holes? grooves?)
  - SiPM photodetectors
  - Common electronics
  - Some thinking about module assembly
- Costing
  - Parts is easy, labor is hard

# Overall concept

There are slots in the iron. We will insert modules of orthogonal strips of appropriate size into the slots.

We assume slots are  $\sim 32\text{mm}$  and Fe is about  $200\text{mm}$ , with 10 slots instrumented.





# Status

- DBD current status
  - Conceptual design parameters for costing

Inputs:

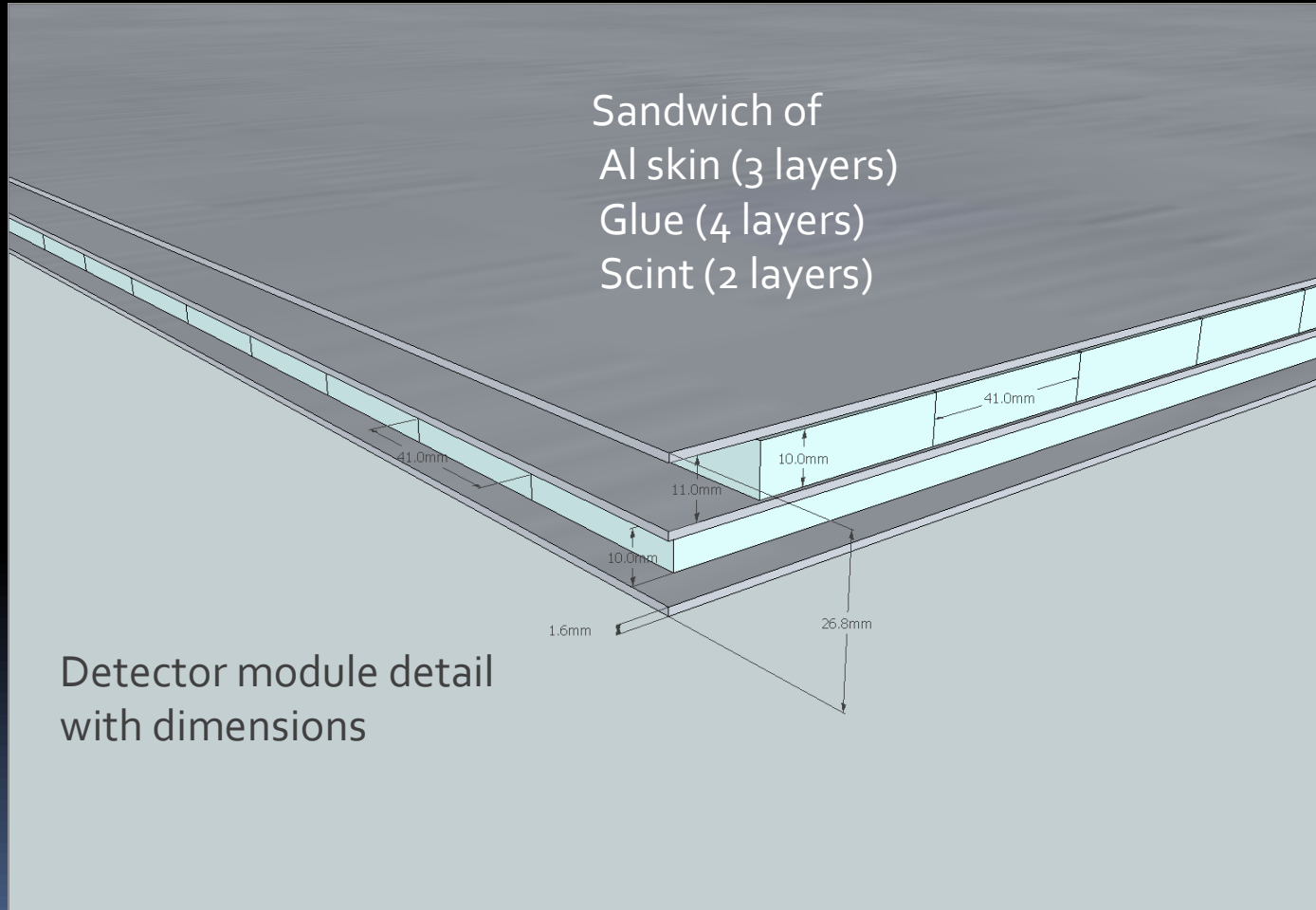
- number of instrumented slots
- radius of instrumented slots
- double or single ended readout

Outputs:

- number of channels
- length of WLS
- volume of scintillator extrusions



# Module concept





## Detector totals

Number of modules	<b>160</b>	ea
Number of strips	<b>43427</b>	ea
Total area of strips	<b>8603</b>	sq m
Total area of modules	<b>4301</b>	sq m
Length of WLS	<b>209827</b>	m
Number of SiPMs	<b>50875</b>	ea
Front ends (32 ch)	<b>1590</b>	ea
L1 concentrators	<b>160</b>	ea
L2 concentrators	<b>16</b>	ea

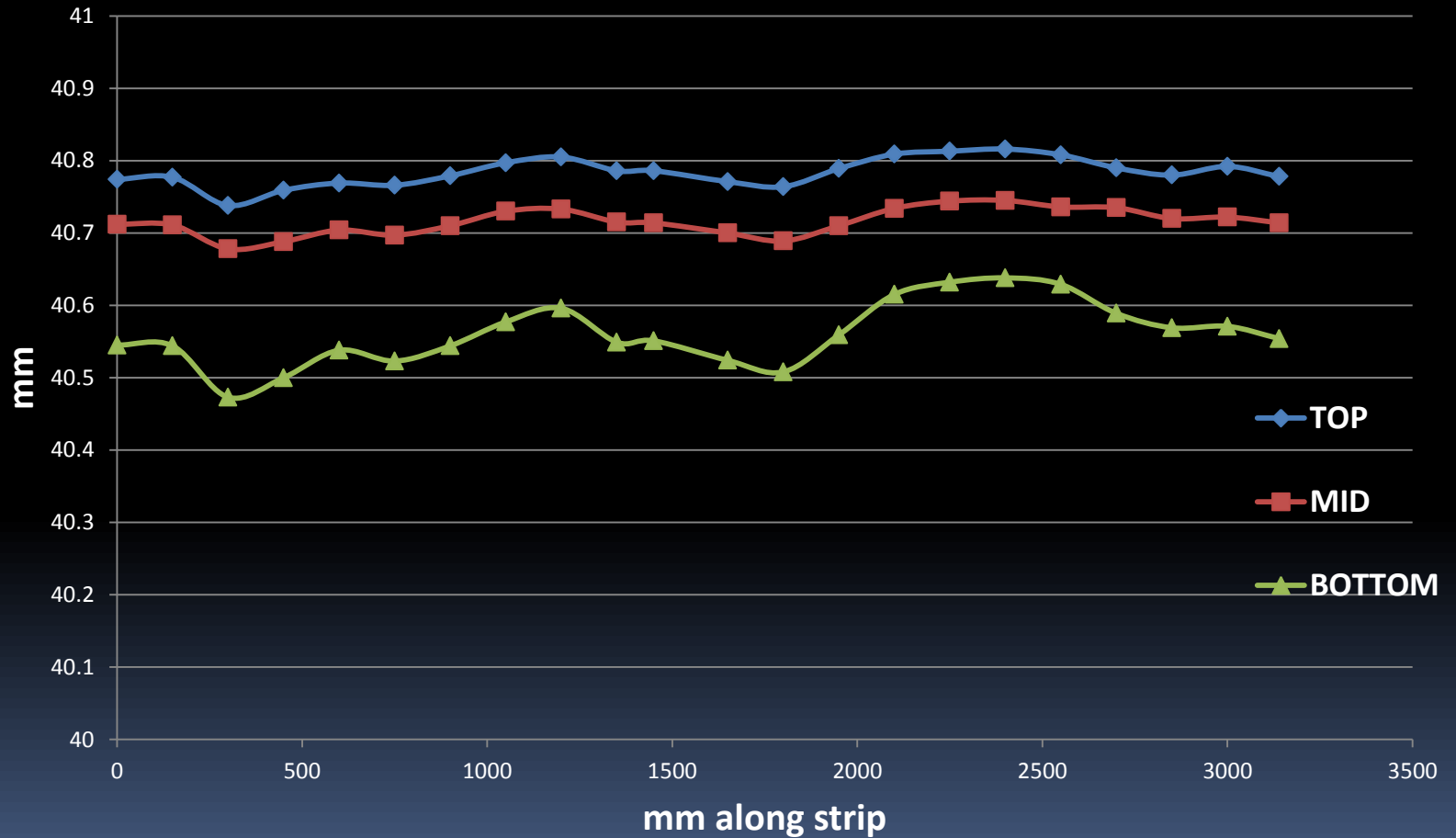


# A word about gaps between bars

- Scintillator extrusions vary slightly
- There will be cracks between extrusions
- Gene has measured 140 Minos type bars (360cm long, 4.1cm wide, 1cm tall)
- Assembly procedures take account of variability
- Measured effective crack for two bars in test beam: effective crack  $< 0.5\text{mm}$ ,  $\sim 1\%$  loss



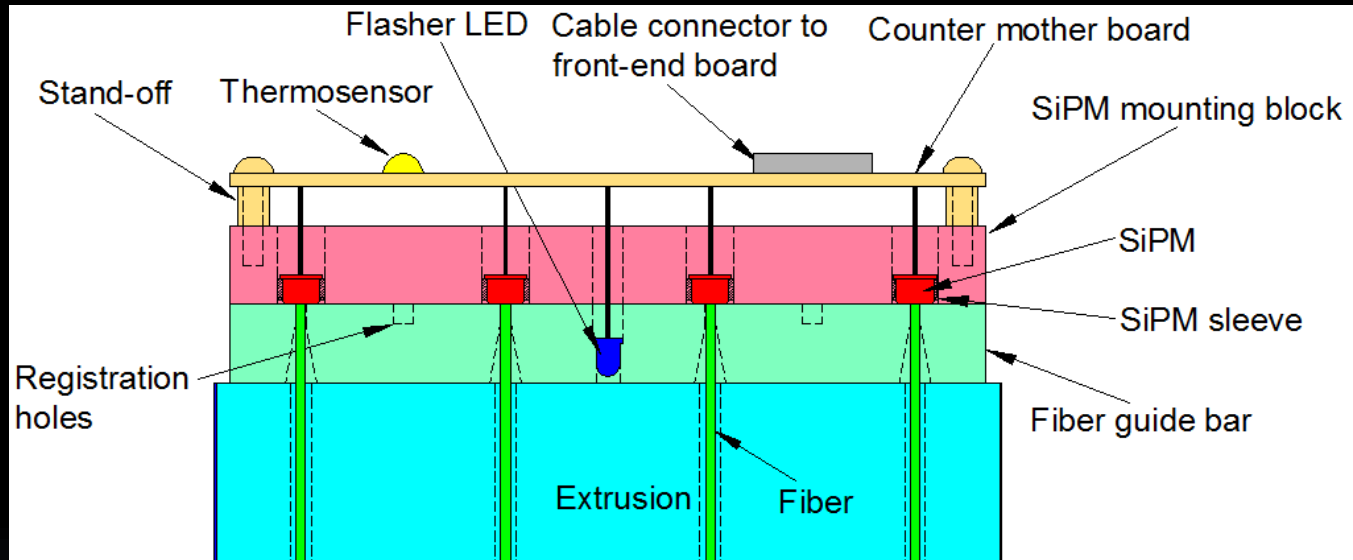
# typical







# Conceptual design for SiPM to fiber coupling



Flycut after fiber guide bar is attached to the extrusion  
 Works for either single sided or double sided readout



# WLS fiber & photodetectors

- No active efforts for SiD, but active efforts for muze cosmic ray veto

## Addressing

- cost,
- “value engineering”
- QA
- Radiation hardness
- Coupling, assembly
- Cost based on current quotes for muze (18k ch)



# Electronics

- Should not be driven by muon tracker
  - Large signals
  - No discharges
  - KPIX should work fine
- Issue is channels are physically spread out
  - Reduce number of channels used for each chip



# Assembly

- Thinking about module assembly in some detail
  - 17 steps (so far)
  - Measuring strips
  - Aligning the strips and holes
  - Doing a dry layup
  - Installing the fibers
  - Gluing everything together

# Costing

Materials Labor Rates

Component	Number	Unit	Comment	Materials	MConti...	Labor	LConti...	Total
Muon Tracker	1	each	@CF=Muons, up...	8,299,900	3,038,965	2,271,296	779,604	14,389,...
Muon System ED&I	1	each		0	0	2,039,930	698,628	2,738,558
Mechanical Engineer	4	man year		0	0	140,000	49,000	756,000
Mechanical Designer	4	man year		0	0	91,520	32,032	494,208
Alignment Engineer	1	man year		0	0	102,320	20,464	122,784
Mechanical Tech	10	man year		0	0	101,153	35,404	1,365,566
Muon System Mechanical & Detectors	1	each		8,299,900	3,038,965	231,366	80,976	11,651,...
Muon System Misc Tooling & Accessories	1	lot		1,000,000	500,000	0	0	1,500,000
Muon Module	4,300	each	Module = 1 m <sup>2</sup>	1,621	567	54	19	9,722,248
Level 1 Concentrator Production	160	each		1,600	500	0	0	336,000
Level 2 Concentrator Production	16	each		4,600	1,210	0	0	92,960
Electronics	1	each	@CF=Elects	4,899,907	1,649,917	5,468,567	1,598,125	13,616,...
Vertex Electronics	1	each		308,400	184,600	380,406	95,100	968,506
Tracker Electronics	1	each		100,000	20,000	380,406	95,100	595,506
EMCal Electronics	1	each		100,000	20,000	380,406	95,100	595,506
HCal Electronics	1	each		100,000	20,000	380,406	95,100	595,506
Muon Tracker Electronics	1	each		100,000	20,000	380,406	95,100	595,506
Preliminary Engineering	0	each		500,000	100,000	253,602	63,400	0
R&D	1	each		500,000	100,000	126,801	31,700	758,501
Design & Prototype	1	each		0	0	126,801	31,700	158,501
Final Engineering	1	each		100,000	20,000	380,406	95,100	595,506
Production Costs	0	each		0	0	0	0	0



# Conclusions

- Moving very slowly
  - But moving
  
- Not great shape
  - But has a shape, and can be improved



# BACKUPS



Layers	10 ea
Number of modules	80 ea
Number of axial strips	7448 ea
Number of R-phi strips	10808 ea
ave # of axial/module	93.1
ave # of R-phi/module	135.1
Strip dimensions	
L (axial)	554 cm
W (all)	4.1 cm
T (all)	1 cm

Total number of strips	<b>18256</b>	
Total area of strips	<b>3383</b>	sq m
# of R-phi strips	<b>10810</b>	
# of Rphi str/mod	<b>135</b>	
# of Z strips	<b>7451</b>	321.4
# of Z str/mod	<b>93</b>	228
# of sensors per R-phi strip	1 ea	
# of sensors per Z strip	2 ea	
#of ch	<b>25704</b>	ea
Length of WLS	<b>82524</b>	m
Area of an average single module	<b>21</b>	sq m





## End caps (both)

Layers	10 ea	
Number of modules	80 ea	
Outer radius	645 cm	
Inner radius	26 cm	
Area of 1 layer, 1 quad	<b>32.6</b> sq m	
Num of strips per quad	<b>157</b> ea	
Ave strip length	<b>506</b> cm	
Total number of strips	<b>25171</b> ea	F and B
Total area of strips	<b>5219</b> sq m	X and Y
# of sensors per strip	1 ea	
#of ch	<b>25171</b> ea	single ended readout
Length of WLS	<b>127303</b> m	
Area of a single module	<b>33</b> sq m	