SoLID LGC and Cherenkov pre-R&D update December 16th 2021 Michael Paolone



Absorption Length calculation of CO2

• Absorption Length calculation of CO2



		-		
my	<pre>@CO2_1atm_Abs</pre>	sLen = (
	"700098*m",	"621110*m",	"549013*m",	"429102*m
	"379366*m",	"315353*m",	"278796*m",	"246465*m
	"192638*m",	"170300*m",	"150566*m",	"133107*m
	"117667*m",	"104040*m",	"86859.2*m",	"72648.8
	"64602.3*m",	"50820.3*m",	"45166.2*m"	, "37776
	"31595.7*m",	"24868.1*m",	, "19629.5*m"	, "16382
	"12804.8*m",	"9408.47*m",	, "7355.16*m"	, "5748.
	"4500.65*m",	"3490.25*m",	, "2919.16*m"	, "2437.
	"1921.68*m",	"1607.26*m",	, "1267.31*m"	, "1124.
	"997.48*m",	"886.521*m",	"697.766*m",	"584.64
	"139.958*m",	"4.88192*m",	, "0.239667*m	
);				
	And the second			





Latest coordination with ANL (Kevin Bailey)

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Telecommuting - Cell 630-776-5737

• Simulation updates.

- Simulation updates.
 - General movement of PMT array and mirror plane to take more advantage of extra space.





- Simulation updates.
 - General movement of PMT array and mirror plane to take more advantage of extra space.

LGC updates



The location of the PMT array is constrained by how the array + cone is supported.

The small angle physics is contained by how mirror will be supported (with rotation mechanism)





- Simulation updates.
 - General movement of PMT array and mirror plane to take more advantage of extra space.

LGC updates



Central (11.5 deg) angle electron

- Simulation updates.
 - General movement of PMT array and mirror plane to take more advantage of extra space.

Passes outside tank?

SIDIS configuration

LGC updates



Large (15 deg) angle electron

- Simulation updates.
 - General movement of PMT array and mirror plane to take more advantage of extra space.

LGC updates



Small (7.5 deg) angle electron

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LGC updates



Small (7.5 deg) angle electron

- Simulation updates.
 - Alternate geometries: parabolic mirror.







- Simulation updates.
 - Alternate geometries: parabolic mirror.





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Central (11.5 deg) angle electron

SIDIS configuration

- Simulation updates.
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Large (15 deg) angle electron

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 - Alternate geometries: parabolic mirror.



Small (7.5 deg) angle electron

- Simulation updates.
 - Alternate geometries: parabolic mirror.



Bottom Line:

A parabolic mirror (as expected) will impact efficiencies at the edges of acceptance.

It does, however, provide a slightly more "vertical" mirror, which might ease engineering contraints.

SIDIS configuration



- Mirror R&D lacksquare
 - Use Lexan film to attach to "unpolished" mirror blanks.
 - Need to test reflection uniformity.
 - Need to develop methods for attaching film.
 - Use 3D printed blanks

 - Need to optimize structural integrity vs minimizing radiation length.
 - Could save \$\$:
 - Estimated printing cost (materials) per mirror blank: \$100 to \$200
 - Estimated Lexan cost (from ECI) per mirror: \$1000 to \$2000.
 - Could be reduced with Lexan film coating done at SBU.
 - Additional R&D: Test radiation durability of Lexan coated film.

A tentative meeting has been agreed upon with DOE to discuss funding opportunities will happen hopefully early next year.

• Can print with continuous carbon-fiber (MarkForged Mark2 and X7, DesktopMetal Fiber X)

Initial discussions with SBU indicate lexan (or other material) film coatings can be studied with in-house coating facility.









- Summary:
 - Good CO2 absorption lengths have been implemented in GEMC

 - Progress has been made between NMSU and ANL to generate more realistic engineering design. • Some optimization of optics has been performed:
 - Parabolic mirror design was tested, but show no increase in efficiencies.
 - Continued engineering design is necessary to contain optics optimization.
 - A mirror R&D plan has been developed.
 - A meeting with DOE to possibly obtain funding will happen soon.

Cherenkov pre-R&D updates:



- Ran at two configurations:
 - High rate & low rate.
- Tested response of:
 - MaPMTs with simple sum board with CO2 gas.
 - LAPPDs with CO2 and CO2 + C4H8 gas.





Cherenkov pre-R&D updates:

- Status:
 - 5th quarterly report was submitted to DOE.
 - Next report is expected to be final report.
 - Low and high rate analysis of MaPMTs with a simple summing board is complete.
 - Analysis of LAPPD in low/high rate is in final stages.
 - Recent re-analysis of CO2 low rate data, with SPE determined from bench tests, shows very similar results to prior analysis in Q3.
 - Bench test of MAROC electronics is nearing completion
 - See Bishnu's talk after this one.