MICHAEL PAOLONE EDWARD KACZANOWICZ ZEIN-EDDINE MEZIANI

TEMPLE UNIVERSITY SOLID COLLABORATION MEETING 01/13/16

SOLID LGC UPDATE

RECENT UPDATES

- The LGC GEMC code is now updated to the latest version of GEMC (2.2/2.3) and ready for integration.
- Possible adjustments to reduce accidental backgrounds.
- First steps toward prototype construction just starting.

LGC GEMC 2.3 CHANGES

- Geometries updated.
- MaPMT hit processing updated.
- New MaPMT configuration: Every single pixel is now an individual sensitive detector.



EXAMPLE EVENT:

- On the left is an example track.
 - Blue is 3x3 PMT array
 - White lines are optical photons
 - Green points are interactions with the PMT.



	integrated digitized bank (252, 0)															
	-	(252,	1)	sector:	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
	-	(252,	2)	pmt:	5	5	7	4	2	4	5	4	7	8	2	4
4		5		4	8	1	1	4	5	2	1	7	4	5	2	4
1		1		2	1	1	5	4	5	5	1	4	4	5	4	5
	-	(252,	3)	pixel:	43	12	15	52	33	60	36	44	14	1	41	27
19		20		36	2	38	45	11	28	59	39	7	61	4	51	35
48		46		50	52	60	3	43	44	58	47	26	64	51	62	57
	-	(252,	4)	nphe:	0	1	1	1	0	1	0	0	0	0	0	3
0		0		0	1	0	1	1	2	0	1	0	0	0	1	0
0		1		0	0	1	0	1	0	0	0	0	0	0	0	0
	-	(252,	5)	avg_t:	13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13	551	9 13.	5897	13.556	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13.5806	13.5546
13	568	13.	5596	13.5771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893	13.5681	13.5825
	-	(252,	99)	hitn:	1	2	3	4	5	6	7	8	9	10	11	12
13		14		15	16	17	18	19	20	21	22	23	24	25	26	27
28		29		30	31	32	33	34	35	36	37	38	39	40	41	42
		End o	fin	tegrated	digitize	ed bank.										

	in	tegra	ate	d digitiz	zed bank	(252, 6	0)									
	- (2	52,	1)	sector:	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
	- (2	52,	2)	pmt:	5	5	7	4	2	4	5	4	7	8	2	4
4		5		4	8	1	1	4	5	2	1	7	4	5	2	4
1		1		2	1	1	5	4	5	5	1	4	4	5	4	5
	- (2	52,	3)	pixel:	43	12	15	52	33	60	36	44	14	1	41	27
19		20		36	2	38	45	11	28	59	39	7	61	4	51	35
48		46		50	52	60	3	43	44	58	47	26	64	51	62	57
	- (2	52,	4)	nphe:	0	1	1	1	0	1	0	0	0	0	0	3
0		0		0	1	0	1	1	2	0	1	0	0	0	1	0
0		1		0	0	1	0	1	0	0	0	0	0	0	0	0
	- (2	52,	5) a	avg_t:	13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13	.5519	13.5	897	13.556	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13.5806	13.5546
13	.568	13.5	596	13.5771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893	13.5681	13.5825
	- (2	52,	99)	hitn:	1	2	3	4	5	6	7	8	9	10	11	12
13		14		15	16	17	18	19	20	21	22	23	24	25	26	27
28		29		30	31	32	33	34	35	36	37	38	39	40	41	42
	En	d of	in	tegrated	digitize	ed bank.										

Each row is a collection of information for each integrated hit on a pixel.

The first row (highlighted in red) gives the sector hit: In this case, all 42 hits are in sector 7. Sectors count clockwise from top, looking downstream.

	:	integ	rate	ed dig	gitiz	zed bank	(252, (0)									
	_	(252,	1)	secto	or:	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7		7	7	7	7	7	7	7	7	7	7	7	7
7		7		7		7	7	7	7	7	7	7	7	7	7	7	7
	-	(252,	2)	pmt:		5	5	7	4	2	4	5	4	7	8	2	4
4		5		4		8	1	1	4	5	2	1	7	4	5	2	4
1		1		2		1	1	5	4	5	5	1	4	4	5	4	5
	-	(252,	3)	pixe	.:	43	12	15	52	33	60	36	44	14	1	41	27
19		20		36		2	38	45	11	28	59	39	7	61	4	51	35
48		46		50		52	60	3	43	44	58	47	26	64	51	62	57
	-	(252,	4)	nphe		0	1	1	1	0	1	0	0	0	0	0	3
0		0		0		1	0	1	1	2	0	1	0	0	0	1	0
0		1		0		0	1	0	1	0	0	0	0	0	0	0	0
	-	(252,	5)	avg_1		13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13	551	9 13.	5897	/ 13.	56	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13.5806	13.5546
13	568	13.	5596	5 13.	771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893	13.5681	13.5825
	-	(252,	99)	hitr	:	1	2	3	4	5	6	7	8	9	10	11	12
13		14		15		16	17	18	19	20	21	22	23	24	25	26	27
28		29		30		31	32	33	34	35	36	37	38	39	40	41	42
		End o	of ir	ntegra	ited	digitiz	ed bank.										

PMT number hit:

(top left is always relative to rotation about beam-z-axis. "Down" is defined by z-axis and negative-z.)



	:	integ	rate	ed dig	gitiz	zed bank	(252, (0)									
	_	(252,	1)	secto	or:	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7		7	7	7	7	7	7	7	7	7	7	7	7
7		7		7		7	7	7	7	7	7	7	7	7	7	7	7
	-	(252,	2)	pmt:		5	5	7	4	2	4	5	4	7	8	2	4
4		5		4		8	1	1	4	5	2	1	7	4	5	2	4
1		1		2		1	1	5	4	5	5	1	4	4	5	4	5
	-	(252,	3)	pixe	.:	43	12	15	52	33	60	36	44	14	1	41	27
19		20		36		2	38	45	11	28	59	39	7	61	4	51	35
48		46		50		52	60	3	43	44	58	47	26	64	51	62	57
	_	(252,	4)	nphe		0	1	1	1	0	1	0	0	0	0	0	3
0		0		0		1	0	1	1	2	0	1	0	0	0	1	0
0		1		0		0	1	0	1	0	0	0	0	0	0	0	0
	_	(252,	5)	avg_1		13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13.	.551	9 13.	5897	/ 13.	56	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13 06	13.5546
13.	568	13.	5596	5 13.	771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893		13.5825
	_	(252,	99)	hit	:	1	2	3	4	5	6	7	8	9	10		12
13		14		15		16	17	18	19	20	21	22	23	24	25	\backslash	X
28		29		30		31	32	33	34	35	36	37	38	39			
		End o	f in	ntegra	ted	digitize	ed bank.										
						-									- X		
			_											\sim \setminus			د م
		F	PM	IT n	nır	nber	hit:										\backslash

(top left is always relative to rotation about beam-z-axis. "Down" is defined by z-axis and negative-z.)

MICHAEL PAC

EXAMPLE

		intor	rato	d dia	
		LILLE	Jiace	u uig	•
	-	(252,	1)	secto	l
7		7		7	7
7		7		7	
	-	(252,	2)	pmt:	
4		5		4	
1		1		2	
	-	(252,	3)	pixel	
19		20		36	
48		46		50	
	_	(252,	4)	nphe:	
0		0		0	4
0		1		0	l
	_	(252,	5)	avg_t	
13.	551	9 13	5897	13.5	5
13.	568	3 13.	5596	13.5	
	_	(252,	99)	hitn	
13		14		15	
28		29		30	
		End o	of in	tegra	

PMT n (top le about define In this way, PMT number is counted left to right, up to down, from behind (connector side, not face).

SoLID z-axis

	integrated digitized bank (252, 0)															
	- (252,	1)	sector:	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
	- (252,	2)	pmt:	5	5	7	4	2	4	5	4	7	8	2	4
4		5		4	8	1	1	4	5	2	1	7	4	5	2	4
1		1		2	1	1	5	4	5	5	1	4	4	5	4	5
	- (252,	3)	pixel:	43	12	15	52	33	60	36	44	14	1	41	27
19		20		36 📐	2	38	45	11	28	59	39	7	61	4	51	35
48		46		50	52	60	3	43	44	58	47	26	64	51	62	57
	- (252,	4)	nphe:	0	1	1	1	0	1	0	0	0	0	0	3
0		0		0	1	0	1	1	2	0	1	0	0	0	1	0
0		1		0	0	1	0	1	0	0	0	0	0	0	0	0
	- (252,	5)	avg_t:	13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13	.5519) 13.5	5897	13.556	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13.5806	13.5546
13	.568	13.5	5596	13.5771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893	13.5681	13.5825
	- (252,	99)	hitn:	1	2	3	4	5	6	7	8	9	10	11	12
13		14		15	16	17	18	19	20	21	22	23	24	25	26	27
28		29		30	31	32	33	34	35	36	37	38	39	40	41	42
	E	nd of	f in	tegrated	digitiz	ed bank.										

Pixel number hit:

(again, from behind PMT)

1	2	3	4	5	6	7	8
9							
17							
25							
33							
41							
49							
57							

EXAMPLE BANK OUTPUT:

	integrated digitized bank (252, 0)															
	- (2	252,	1)	sector:	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
	- (2	252,	2)	pmt:	5	5	7	4	2	4	5	4	7	8	2	4
4		5		4	8	1	1	4	5	2	1	7	4	5	2	4
1		1		2	1	1	5	4	5	5	1	4	4	5	4	5
	- (2	252,	3)	pixel:	43	12	15	52	33	60	36	44	14	1	41	27
19		20		36	2	38	45	11	28	59	39	7	61	4	51	35
48		46		50	52	60	3	43	44	58	47	26	64	51	62	57
	- (2	252,	4)	nphe:	0	1	1	1	0	1	0	0	0	0	0	3
0		0		0	1	0	1	1	2	0	1	0	0	0	1	0
0		1		0	0	1	0	1	0	0	0	0	0	0	0	0
	- (2	252,	5)	avg_t:	13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13	5519	13.5	5897	13.556	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13.5806	13.5546
13	.568	13.5	5596	13.5771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893	13.5681	13.5825
	- (2	252,	99)	hitn:	1	2	3	4	5	6	7	8	9	10	11	12
13		14		15	16	17	18	19	20	21	22	23	24	25	26	27
28		29		30	31	32	33	34	35	36	37	38	39	40	41	42
	En	nd of	fin	tegrated	digitize	ed bank.										

How many photoelectrons are detected (considering quantum efficiency and WLS).

EXAMPLE BANK OUTPUT:

	integrated digitized bank (252, 0)														
	- (252,	1)	sector:	7	7	7	7	7	7	7	7	7	7	7	7
7	7		7	7	7	7	7	7	7	7	7	7	7	7	7
7	7		7	7	7	7	7	7	7	7	7	7	7	7	7
	- (252 ,	2)	pmt:	5	5	7	4	2	4	5	4	7	8	2	4
4	5		4	8	1	1	4	5	2	1	7	4	5	2	4
1	1		2	1	1	5	4	5	5	1	4	4	5	4	5
	- (252 ,	3)	pixel:	43	12	15	52	33	60	36	44	14	1	41	27
19	20		36	2	38	45	11	28	59	39	7	61	4	51	35
48	46		50	52	60	3	43	44	58	47	26	64	51	62	57
	- (252 ,	4)	nphe:	0	1	1	1	0	1	0	0	0	0	0	3
0	0		0	1	0	1	1	2	0	1	0	0	0	1	0
0	1		0	0	1	0	1	0	0	0	0	0	0	0	0
	- (252,	5)	avg_t:	13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13	.5519 13.	5897	7 13.556	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13.5806	13.5546
13	.568 13.	5596	6 13. 5771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893	13.5681	13.5825
	- (252 ,	99) hitn:	1	2	3	4	5	6	7	8	9	10	11	12
13	14		15	16	17	18	19	20	21	22	23	24	25	26	27
28	29		30	31	32	33	34	35	36	37	38	39	40	41	42
	End o	fi	ntegrated	digitize	ed bank.										

Time (in ns) of interaction.

EXAMPLE BANK OUTPUT:

	j	integ	rate	d digiti:	zed bank	(252, (0)									
	- (252,	1)	sector:	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
7		7		7	7	7	7	7	7	7	7	7	7	7	7	7
	- (252,	2)	pmt:	5	5	7	4	2	4	5	4	7	8	2	4
4		5		4	8	1	1	4	5	2	1	7	4	5	2	4
1		1		2	1	1	5	4	5	5	1	4	4	5	4	5
	- (252,	3)	pixel:	43	12	15	52	33	60	36	44	14	1	41	27
19		20		36	2	38	45	11	28	59	39	7	61	4	51	35
48		46		50	52	60	3	43	44	58	47	26	64	51	62	57
	- (252,	4)	nphe:	0	1	1	1	0	1	0	0	0	0	0	3
0		0		0	1	0	1	1	2	0	1	0	0	0	1	0
0		1		0	0	1	0	1	0	0	0	0	0	0	0	0
	- (252,	5)	avg_t:	13.5895	13.5877	13.576	13.561	13.5715	13.563	13.5879	13.5579	13.5715	13.5839	13.5725	13.5527
13.	.5519	9 13.	5897	13.556	13.5887	13.5592	13.5577	13.5518	13.5901	13.5836	13.5642	13.5751	13.5643	13.5857	13.5806	13.5546
13	568	13.	5596	13.5771	13.5548	13.5526	13.5844	13.5562	13.5898	13.5876	13.5641	13.5513	13.5798	13.5893	13.5681	13.5825
	- (252,	99)	hitn:	1	2	3	4	5	6	7	8	9	10	11	12
13		14		15	16	17	18	19	20	21	22	23	24	25	26	27
28		29		30	31	32	33	34	35	36	37	38	39	40	41	42
	E	End o	f in	tegrated	digitiz	ed bank.										

Integrated hit index (1 through 42, for this event).

Stray electrons can produce a decent signal:

- Starts here
- Reflects off mirror in different sector than PMT.





BLINDERS

- Blinders could be a solution.
- These blinders are likely too "simple".
 Need to be adjusted for signal tracks that are bent by magnetic field.



ISSUES WITH GEOMETRIC ACCEPTANCE LIMITING

- Open acceptance was designed to pick up signal tracks over a large angular acceptance for two primary configurations.
- For most central tracks, geometric limiting like blinders will not affect efficiency.
- For tracks on the edges of acceptance, efficiency may drop substantially.
- Need to know the background profile better (more accurate pi0 XS) to compare rates between background and signal events to evaluate geometrical acceptance changes.

SOME THINGS TO DO

- Update geometry with support structures and MaPMT dead areas.
- Investigate optical properties in the 180 to 200nm range.
- Investigate acceptance limiting (after new background profiling).



Optical properties of gas and PMTs only defined between 200 and 600 nm for current simulation in GEMC.

BACK-UPS

SOME OPTICAL PROPERTY PLOTS:



SOME OPTICAL PROPERTY PLOTS:

