BCAL Timing

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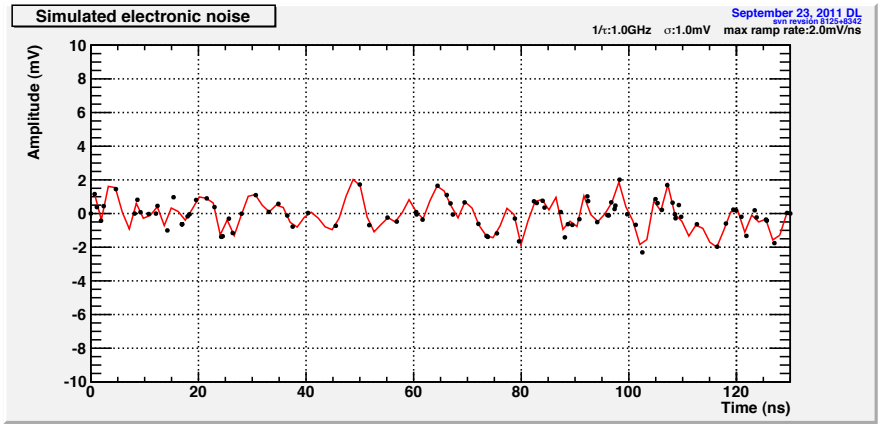
Changes since last time

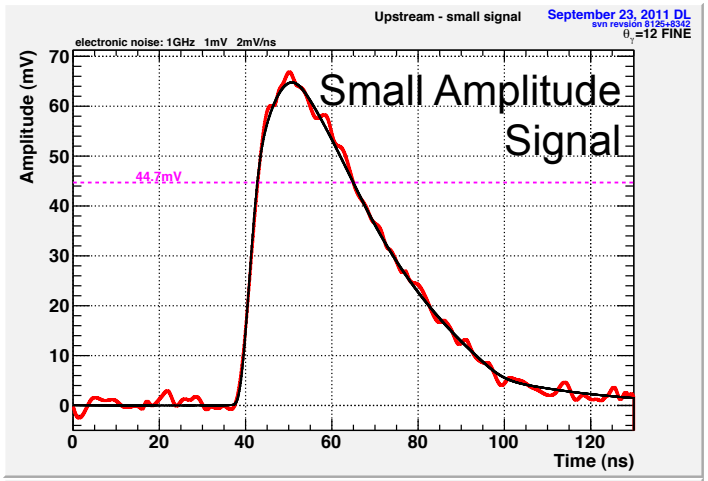
- TDC gain lowered from x10 to x5
- Energy calibration re-done
  - Affects absolute, but not so much relative
- Electronic noise added
  - 1GHz, 1mV
- Energy resolutions extracted
- 244 Segmentation Scheme added

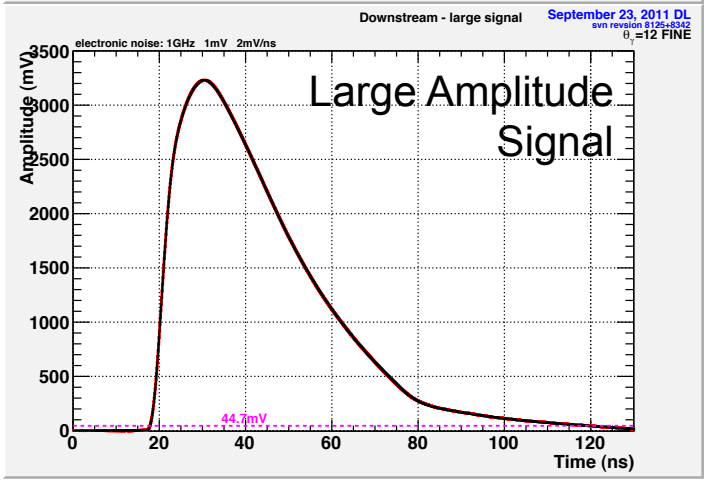
Electronic Noise

Random electronic noise was added to each digitized electronic signal (i.e. *after* any summing)

- Spline with times randomly selected from $e^{-f\Delta t}$ distribution with f=1GHz
- Amplitude of knots randomly selected from Gaussian with σ=1mV
- Limit of 2mV/ns

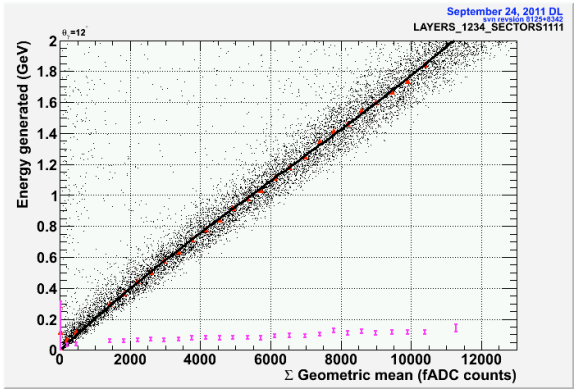


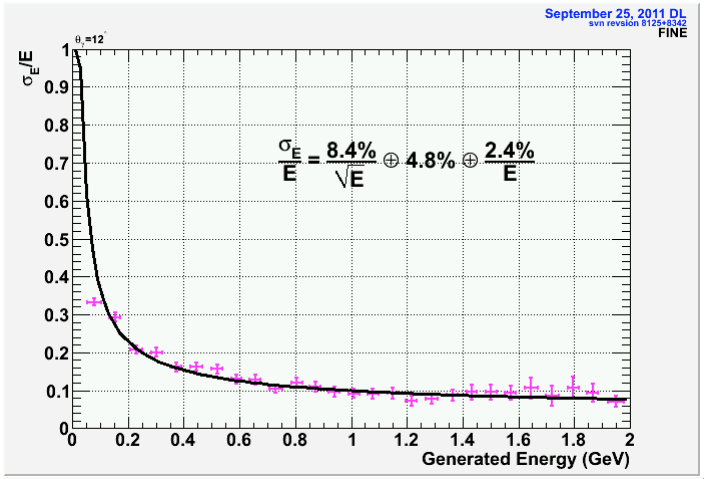


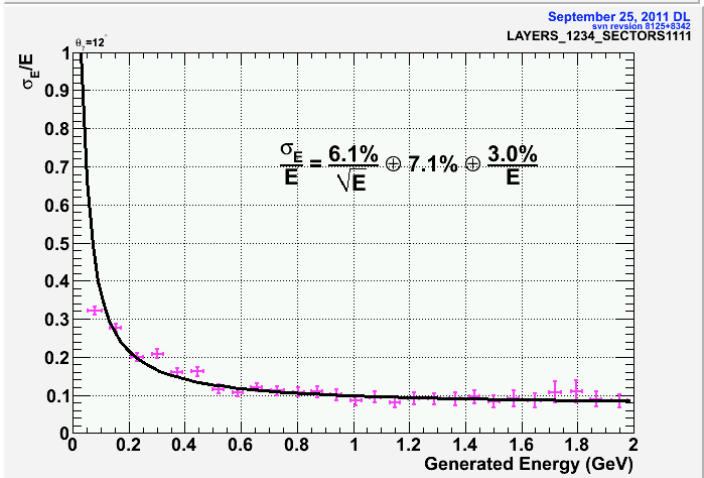


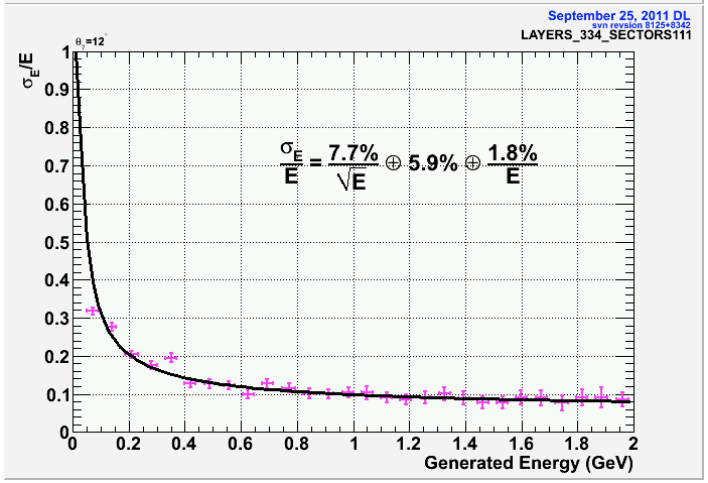
Energy Resolution

Energy resolution calibrated using reconstructed and generated values.

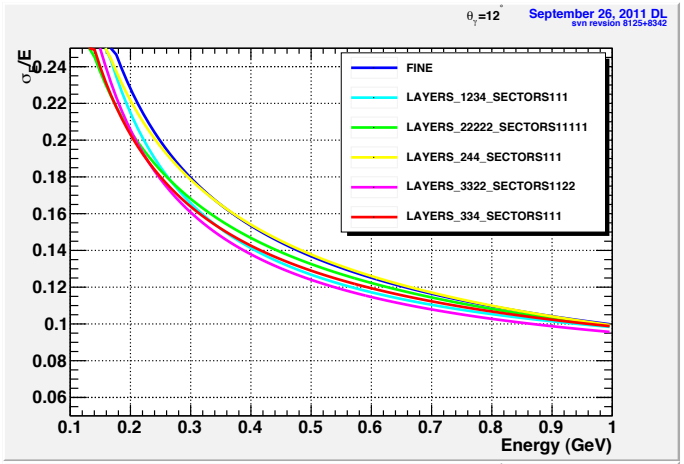


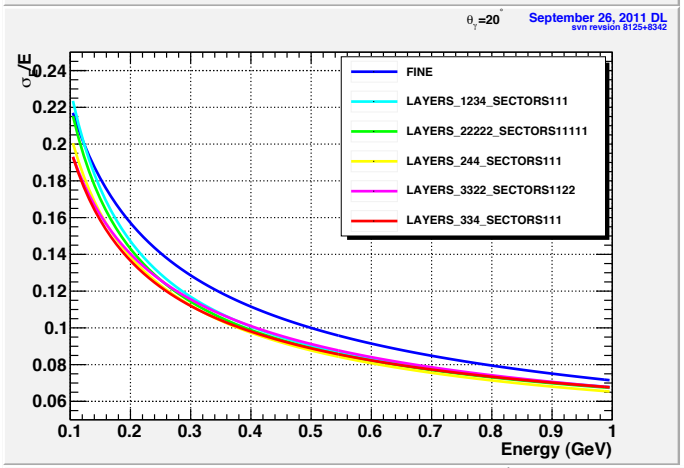


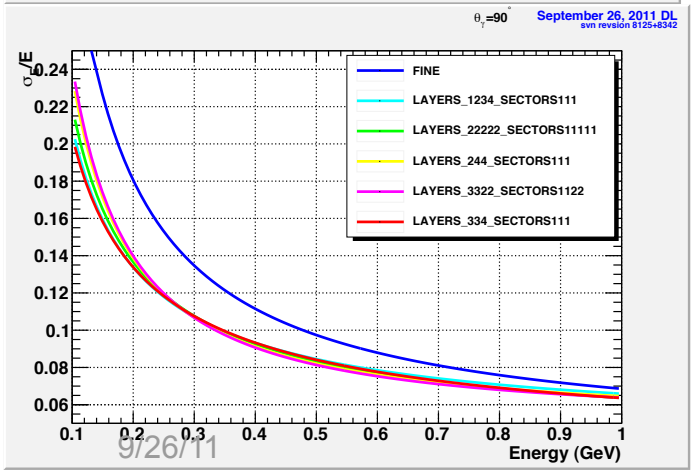




- Calibration done independently for each segmentation scheme and each angle
- Fit to 3rd order polynomial
- Energy resolution largely independent of segmentation scheme
  - Sampling fluctuations and photo-statistics dominate (see 6/17/2011 talk)







Energy Resolution

θ=12°	A	B	C
FINE	8.4%	4.8%	2.4%
1234	6.1%	7.1%	3.0%
334	7.7%	5.9%	1.8%

θ=20°	A	B	C
FINE	7.0%	1.4%	0.0%
1234	5.4%	3.8%	1.5%
334	5.6%	3.7%	0.8%

θ=90°	A	B	C
FINE	5.1%	3.7%	2.7%
1234	4.7%	4.4%	1.4%
334	5.1%	3.6%	1.2%

tdiff						
12 degrees						
Segmentation	**p0**	**p1**	**E=500MeV**	**E=1GeV**	**% better 500MeV**	**% better 1GeV**
FINE	58.4	54.1	98.73	79.61	23.8%	27.7%
1234	63.6	49.3	102.57	80.47	20.8%	26.9%
22222	54.5	89.6	118.19	104.87	8.8%	4.8%
244	66	80.6	123.32	104.17	4.8%	5.4%
3322	67.3	88.9	130.24	111.50	-0.5%	-1.2%
334	68.2	86.5	129.56	110.15	0.0%	0.0%
20 degrees						
Segmentation	**p0**	**p1**	**E=500MeV**	**E=1GeV**	**% better 500MeV**	**% better 1GeV**
FINE	41.5	35.3	68.49	54.48	36.1%	40.7%
1234	42.1	38.3	70.79	56.91	34.0%	38.1%
22222	56.3	42.9	90.44	70.78	15.6%	23.0%
244	52.6	51	90.19	73.26	15.9%	20.3%
3322	61.9	66.7	110.06	91.00	-2.6%	1.0%
334	55.2	73.5	107.22	91.92	0.0%	0.0%
90 degrees						
Segmentation	**p0**	**p1**	**E=500MeV**	**E=1GeV**	**% better 500MeV**	**% better 1GeV**
FINE	26.2	10.8	38.59	28.34	3.4%	11.5%
1234	25.7	19.2	41.10	32.08	-2.9%	-0.2%
22222	26	18.5	41.16	31.91	-3.0%	0.3%
244	24.6	23.9	42.21	34.30	-5.6%	-7.1%
3322	24.1	20.6	39.82	31.70	0.3%	1.0%
334	23.9	21.3	39.95	32.01	0.0%	0.0%

tavg						
12 degrees						
Segmentation	**p0**	**p1**	**E=500MeV**	**E=1GeV**	**% better 500MeV**	**% better 1GeV**
FINE	47	24.3	70.77	52.91	16.0%	21.9%
1234	48.8	20.4	71.97	52.89	14.6%	21.9%
22222	48.9	41.1	80.45	63.88	4.5%	5.7%
244	53.8	37.6	84.87	65.64	-0.7%	3.1%
3322	53.4	41.1	85.98	67.39	-2.0%	0.5%
334	50.1	45.6	84.26	67.74	0.0%	0.0%
20 degrees						
Segmentation	**p0**	**p1**	**E=500MeV**	**E=1GeV**	**% better 500MeV**	**% better 1GeV**
FINE	33	26.6	53.72	42.39	27.7%	33.8%
1234	37.9	24.4	58.89	45.08	20.7%	29.6%
22222	41.4	29.6	65.61	50.89	11.7%	20.5%
244	36.2	53.8	74.27	64.85	0.0%	-1.3%
3322	42.1	48.5	76.79	64.22	-3.4%	-0.4%
334	37.7	51.7	74.27	63.99	0.0%	0.0%
90 degrees						
Segmentation	**p0**	**p1**	**E=500MeV**	**E=1GeV**	**% better 500MeV**	**% better 1GeV**
FINE	32.5	0	45.96	32.50	1.3%	10.0%
1234	29	20.4	45.81	35.46	1.7%	1.9%
22222	27.8	19.6	43.93	34.01	5.7%	5.9%
244	31.4	27.9	52.44	42.00	-12.6%	-16.3%
3322	29.2	21.4	46.51	36.20	0.1%	-0.2%
334	29.4	21	46.58	36.13	0.0%	0.0%

Summary

- TDC gain lowered (from 10) to x5
- Timing resolutions recalculated after correcting energy calibration
  - Qualitative results unchanged
- Electronic noise added (small overall effect)
- Energy resolution largely independent of segmentation scheme