



Update background inputs for performance studies and electronics design



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Background Update

OLD VALUES

x5 safety included, correction of area not yet included

Layers	lato	readout pitch	Strip rate kHz	Ratio pairs / total	Ratio rad bhabha / total	Ratio touscheck LER/ total	Ratio touscheck HER/ total
0	1	50	1.21E+03	0.90	0.03	0.06	0.02
0	2	50	1.21E+03	0.82	0.04	0.11	0.04
1	phi	50	7.24E+02	0.58	0.04	0.30	0.07
1	z	100	4.73E+02	0.39	0.04	0.45	0.12
2	phi	55	5.25E+02	0.48	0.05	0.38	0.08
2	z	100	4.54E+02	0.31	0.05	0.52	0.12
3	phi	100	4.19E+02	0.33	0.11	0.47	0.08
3	z	110	2.70E+02	0.23	0.10	0.56	0.11
4	phi	100	9.00E+01	0.35	0.23	0.34	0.08
4	z	210	4.70E+01	0.36	0.20	0.35	0.09
5	phi	100	5.44E+01	0.39	0.21	0.32	0.08
5	z	210	3.08E+01	0.37	0.19	0.35	0.09

- Present (Frascati March 2012) status of background rates shown in the table.
- Beam gas, almost ready, need to be included: first tests indicate beam gas~touscheck
- Need to supply a similar table for the track rate and cluster rate that will be used for fastsim performance studies (in preparation)

- Rates/area in this table estimated with the cylindrical approximation and need to be rescaled to take into account the correct silicon area.
- Correction factors calculated from Bruno results on strip rates in local coordinates → ~ 30%-15% reduction in Layer0-1-2-3, ~ok in Layer4-5

Hit Efficiency

- Need to rerun efficiency study (PV_M1) using new total rates (rescaled by correct area and including beam gas) nominal and x5.

renormalization due to correction of area
0.687
0.690
0.853
0.904
0.870
0.894
0.890
0.880
0.980
0.992
1.059
0.992

Update on average background rates for Electronics design (10/4/2012)

New data include:

1. Cenci files Vs 3 after renormalization fixed for pairs and rad bhabha (24 Feb). $\approx -18\%$
2. Renormalization of area corrected $\sim 30\%$ -15% reduction in Layer0-1-2-3, $\sim$ ok in Layer4-5
3. Beam gas contribution included assume $\sim$ Touschek

Layer0 in simulation is still at $R \sim 1.4$ cm

Cenci is implementing the correct radius (~ 1.6 cm) expect further reduction of about 30% in L0

1+2+ Beam gas included

•To be used for DetGeome try sheet in Electronic Load.xls

Layers	lato
0	1
0	2
1	phi
1	z
2	phi
2	z
3	phi
3	z
4	phi
4	z
5	phi
5	z

Average total strip rate/area from Bruno (safety x5 included) MHz/cm2	Average total strip rate from SuperB dimensions including safety x5 and average ganging in z(Khz)
1.908E+02	1997.86
2.613E+02	1997.86
1.497E+01	803.12
1.031E+01	507.91
8.808E+00	572.37
6.885E+00	480.21
2.348E+00	449.40
2.994E+00	283.24
3.371E-01	98.49
2.180E-01	51.29
1.593E-01	59.78
1.142E-01	33.68

renormalization due to correction of area
0.687
0.690
0.853
0.904
0.870
0.894
0.890
0.880
0.980
0.992
1.059
0.992

Average total strip rate/area from Bruno with corrected: pairs normalization and area (safety x5 included) MHz/cm2
1.130E+02
1.574E+02
1.150E+01
8.678E+00
7.029E+00
5.816E+00
1.950E+00
2.512E+00
3.020E-01
1.982E-01
1.536E-01
1.037E-01

Average total strip rate from SuperB dimensions including safety x5 and ganging (Khz)
1194.83
1194.83
617.22
427.72
456.74
405.69
373.27
237.67
88.22
46.63
57.65
30.58

Average total strip rate/area from Bruno with corrected: 1-pairs normalization 2-area normalization 3-contribution beam gas (safety x5 included) MHz/cm2
1.215E+02
1.807E+02
1.580E+01
1.361E+01
1.028E+01
9.559E+00
3.028E+00
4.193E+00
4.286E-01
2.853E-01
2.162E-01
1.488E-01

Average total strip rate from SuperB dimensions including safety x5 (Khz)
1335.80
1335.80
848.13
670.60
667.97
666.72
579.55
396.67
125.20
67.13
81.13
43.90

Conservative estimate of max strip rate phi from Bruno - for Electronics design (10/4/2012)

- Can assume max strip rate phi is in forward half module (HM) and Forw BaBar and Forw SuperB identical.
- For max strip rate F HM SuperB can take (conservatively) the max strip rate given for F+B BaBar

Data from:

1. Cenci files Vs 3 after renormalization fixed for pairs and rad bhabha (24 Feb). =-20%
2. Renormalization of area does not affect strip rates calculated in Bruno with local coordinates
3. Beam gas contribution included = touschek

• To be used for numlines sheet in ElectronicLoad.xls

Correction 1

1+Beam gas included

Max strip rate for SuperB including safety x5 and average ganging in z (Khz)
1509.27
2525.38
1445.00
726.96
960.00
697.50
775.00
675.78
195.00
203.63
135.00
133.29

Max strip rate for SuperB including safety x5 and ganging (Khz)
1428.88
2021.22
1288.00
655.50
868.50
574.06
703.50
596.85
172.50
182.24
120.50
97.10

Max strip rate for SuperB including safety x5 and ganging (Khz)
1521.61
2302.04
1738.00
809.52
1218.50
864.68
978.50
765.80
232.50
227.49
150.50
118.37

Layers	lato
0	1
0	2
1	phi
1	z
2	phi
2	z
3	phi
3	z
4	phi
4	z
5	phi
5	z

Rates April 12 - for efficiency studies

- New rates include:
- normalization fixed for pairs and rad bhabha
- renormalized area to compensate cylindrical approx.
- Beam gas estimate=touscheck included
- Reduction to 70% of Layer0 rates for new L0 radius (1.6 cm) included

Layers	lato	readout pitch
0	1	50
0	2	50
1	phi	50
1	z	100
2	phi	55
2	z	100
3	phi	100
3	z	110
4	phi	100
4	z	210
5	phi	100
5	z	210

Ratio pairs / total	Ratio rad bhabha / total	Ratio touscheck+ beam gas LER/ total	Ratio touscheck + beam gas HER/ total
0.832	0.027	0.108	0.033
0.711	0.031	0.193	0.065
0.423	0.032	0.438	0.106
0.248	0.028	0.577	0.147
0.331	0.036	0.518	0.115
0.187	0.030	0.635	0.148
0.215	0.074	0.603	0.109
0.140	0.059	0.674	0.128
0.249	0.160	0.480	0.110
0.250	0.139	0.487	0.124
0.274	0.147	0.460	0.119
0.260	0.133	0.487	0.120

renormalization due to correction of area
0.687
0.690
0.853
0.904
0.870
0.894
0.890
0.880
0.980
0.992
1.059
0.992

Strip rate with renormalized area KHz including ganging z and x 5 safety, L0 reduced to 70% of Bruno estimates
9.33E+02
9.37E+02
8.48E+02
6.71E+02
6.68E+02
6.67E+02
5.80E+02
3.97E+02
1.25E+02
6.71E+01
8.11E+01
4.39E+01

Rates April 12 - for performance studies

- New rates include:
- normalization fixed for pairs and rad bhabha
- renormalized area to compensate cylindrical approx.
- Beam gas estimate=touscheck included
- Reduction to 70% of Layer0 rates for new L0 radius (1.6 cm) included

		Total (assuming beam gas=touschek)									Fastsim pairs L0=1.6 cm			
		Track rate per area MHz/cm2	average cluster multiplicit y	cluster rate MHz/cm2	strip rate per area MHz/cm2	average strip multiplicit y (col G/ col H)	renormaliz ation due to correction of area	Total track rate MHz/cm2 (area corrected and Layer0 reduced to 70% R=~1.6 cm)	Total Cluster rate Mhz/cm2 (area corrected and Layer0 reduced to 70% R~1.6 cm)	Total Strip rate Mhz/cm2 (area corrected and Layer0 reduced to 70% R~1.6 cm)	Track rate per area MHz/cm2	cluster rate MHz/cm2	ratio total track rate fullsim/fas tsim pairs L0=1.6 cm	ratio total cluster rate fullsim/fas tsim pairs L0=1.6 cm
0	1	3.38E+00	2.53E+00	8.527E+00	3.528E+01	4.137E+00	0.687	1.625E-01	4.103E+00	1.697E+01	1.230E+00	2.860E+00	0.132	1.435
0	2				5.219E+01		0.690			2.521E+01				
1	phi	2.54E-01	2.49E+00	6.328E-01	3.705E+00	5.855E+00	0.853	2.169E-01	5.397E-01	3.160E+00	7.080E-02	1.910E-01	3.063	2.826
1	z				3.009E+00		0.904			2.719E+00				
2	phi	1.87E-01	2.42E+00	4.518E-01	2.353E+00	5.209E+00	0.870	1.623E-01	3.928E-01	2.046E+00	3.410E-02	8.930E-02	4.759	4.399
2	z				2.134E+00		0.894			1.907E+00				
3	phi	8.92E-02	2.62E+00	2.336E-01	6.772E-01	2.899E+00	0.890	7.939E-02	2.080E-01	6.030E-01	7.180E-03	1.850E-02	11.056	11.245
3	z				9.468E-01		0.880			8.333E-01				
4	phi	2.28E-02	1.65E+00	3.774E-02	8.666E-02	2.296E+00	0.980	2.237E-02	3.699E-02	8.493E-02	5.550E-04	1.410E-03	40.307	26.231
4	z				5.694E-02		0.992			5.646E-02				
5	phi	1.32E-02	1.59E+00	2.110E-02	4.044E-02	1.916E+00	1.059	1.402E-02	2.234E-02	4.282E-02	2.510E-04	8.460E-04	55.876	26.411
5	z				2.980E-02		0.992			2.957E-02				

Rates April 12 - for performance studies

- New rates include:
- normalization fixed for pairs and rad bhabha
- renormalized area to compensate cylindrical approx.
- Beam gas estimate=touscheck included
- Reduction to 70% of Layer0 rates for new L0 radius (1.6 cm) included

Layers	lato	readout pitch
0	1	50
0	2	50
1	phi	50
1	z	100
2	phi	55
2	z	100
3	phi	100
3	z	110
4	phi	100
4	z	210
5	phi	100
5	z	210

Strip rate with renormalized area KHz including ganging z and x 5 safety, L0 reduced to 70% of Bruno estimates	Offline time window (5x time resolution from simulation ratti & bombelli) ns	offline strip occupanc y (x5 included)	offline cluster occupanc y (x5 included)
9.32E+02	50	0.047	0.011
9.32E+02	50	0.047	
8.479E+02	75	0.064	0.011
6.700E+02	75	0.050	
6.649E+02	75	0.050	0.010
6.652E+02	75	0.050	
5.770E+02	100	0.058	0.020
3.942E+02	100	0.039	
1.241E+02	250	0.031	0.014
6.643E+01	250	0.017	
8.034E+01	450	0.036	0.019
4.361E+01	450	0.020	

Input for performance studies

Performance with Fastsim will be evaluated with **nominal background** & **x5** in several configurations:

- Nominal shaping time and offline time window
 - Efficiency (nominal and x5) need to be reevaluated
- Reduced shaping time & offline time window
 - L1-2=50 e 75ns
 - L3=100 e 150 ns
 - L4=350 ns e L5=500-750 ns
 - Efficiency (nominal and x5) need to be reevaluated
 - Reduced time window need to be evaluated

Layer	t_p [ns]	$t_p / T_{CK,TOT}$	$f_{CK,TS}$ [MHz]	σ_{walk} [ns]	σ_{t0} [ns]
0	25	3	30	2.1	9.8
1	100	3	30	8.3	12.7
2	100	3	30	8.3	12.7
3	200	3	30	16.7	19.2
4	500	3	30	41.7	42.8
5	1000	3	30	83.3	83.9

Offline time window (5x hit time resolution from simulation)

ns

50

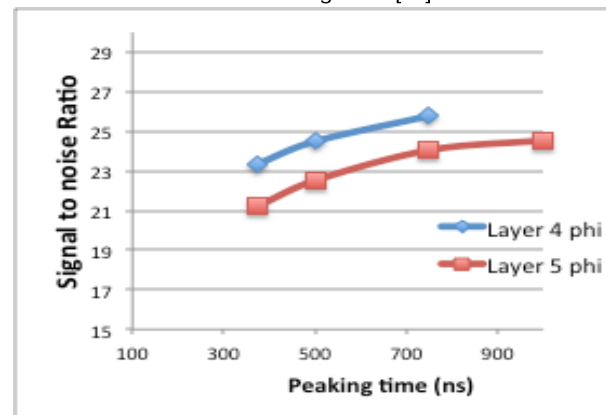
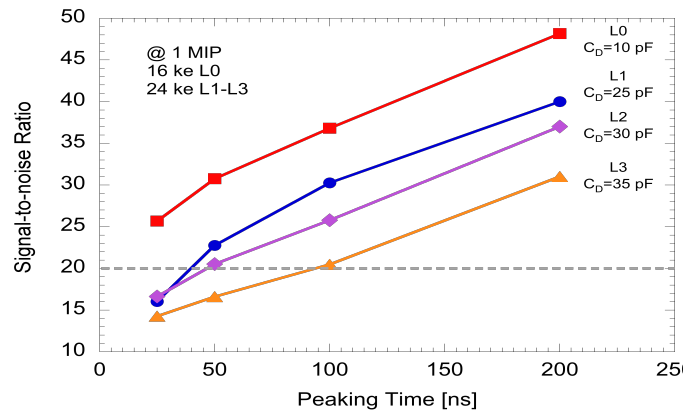
75

75

100

250

450



Nominal time window cut

- From the study on hit time resolution (PV) take the nominal time window cut
- Results from MI simulation on L5 (1 us shaping and 4 bit TOT) indicate 50 ns resolution on time instead of 84 ns obtained by PV with the same conditions.
- Need to understand this discrepancy before accepting the smallest value.
- Possible reduction in layer5 are also possible (25 ns on time walk resolution with 6 TOT bit) according to MI simulation
- Keep the conservative estimate now!

Layer	t_p [ns]	$t_p / T_{CK,TOT}$	$f_{CK,TS}$ [MHz]	σ_{walk} [ns]	σ_{t0} [ns]
0	25	3	30	2.1	9.8
1	100	3	30	8.3	12.7
2	100	3	30	8.3	12.7
3	200	3	30	16.7	19.2
4	500	3	30	41.7	42.8
5	1000	3	30	83.3	83.9

Offline time window (5x hit time resolution from simulation) ns

50
75
75
100
250
450