

Run-8 Trigger/DCM Rates and Projections (d-Au @ 200 GeV)

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Table 2: Maximum luminosities that can be reached after a sufficiently long running period. All numbers are given for operation at an energy of 100 GeV/nucleon.

Mode	No of bunches	Ions/bunch [10 ⁹]	β^* [m]	Emittance [μm]	$\mathcal{L}_{\text{peak}}$ [cm ⁻² s ⁻¹]	$\mathcal{L}_{\text{store avg}}$ [cm ⁻² s ⁻¹]	L _{week}
Au-Au	103	1.1	0.85	17-35	30×10^{26}	12×10^{26}	350 μb^{-1}
Cu-Cu	111	6	0.9	15-30	12×10^{28}	4×10^{28}	14 nb^{-1}
Si-Si	111	12.5	0.9	15-30	50×10^{28}	17×10^{28}	60 nb^{-1}
d-Au	83	120d/1.1Au	1.0	15-30	30×10^{28}	14×10^{28}	40 nb^{-1}
p \uparrow -p \uparrow *	111	175	0.9	20-25	70×10^{30}	40×10^{30}	14 pb^{-1}

*We expect that an average store polarization of 65% can be reached. If both STAR and PHENIX elect again to have 9 non-colliding bunches, the luminosity is reduced by 9% compared to the numbers stated in the table.

Assume 2.26 barn d-Au inelastic cross section, BBCLL1 firing on 88%, and $|z_{\text{vtx}}| < 30$ cm on 50%....

→ Peak = 300 kHz **→ Average = 140 kHz**

Plan trigger and DAQ throughput based on maximum peak rate.

DAQ Throughput (DCM Perspective)

For d-Au sized events, we believe the DCM's can push 7 kHz through to the EvB.

Key issues FCAL, HBD, noisy DC channels...

- Note that the FCAL was not run last year. If zero suppression / occupancy are issues, this could be a rate limiter. Who is at BNL for FCAL?
- HBD – at last year's noise level it could be a rate issue in d-Au.
- DC has some noisy FEEs that are near the limit. Also, there is a remaining concern about DC FEE issue at higher rates (multi-event buffering)

Matt Wysocki and I have a new DCM code that has a DMA transfer in parallel with the DMA input and processing the next bank. Not yet tested. This could yield some possible speed improvements ? Priority to test... Should we focus on what we have?

DCM support....

- No one from Colorado will be at BNL for the duration of the run.
- Plan is for Alex, Matt and Jamie to be present at startup and then provide remote support. Travel as needed.
- Local support will come from Chi / Columbia group.

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nagle@strange ~mwysoki/dcm]$ more run_115205_fiber_sizes.txt
738.0      ● DCM.FCAL.12:206 16002
738.0      ● DCM.FCAL.11:106 16001
595.1      ● DCM.DC.E.24:4409 3056 3055
398.6      ● DCM.DC.W.13:3106 3126 3125
258.7      ● DCM.MVD.41:1d08 2098
242.7      ● DCM.MVD.52:2d12 2105 2104
219.4      ● DCM.MUTR.N.14:4504 11178 11177
217.6      ● DCM.MUTR.N.42:2507 11198 11197
215.0      ● DCM.PC.E.31:1404 4089 4090
213.4      DCM.EMC.E.TOP.24:4f0d 8087 8088
212.3      ● DCM.MVD.43:3d08 2107 2106
211.6      DCM.3C.TEC.E.71:1a12 5229 5230
209.8      ● DCM.MUTR.N.53:3508 11207 11208
206.7      DCM.3A.TEC.E.72:280a 5074 5073
205.7      DCM.EMC.E.BOTTOM.34:4205 8131 8132
202.1      ● DCM.MVD.62:2d13 2112 2113
202.0      ● DCM.DC.E.23:3409 3054 3053
201.2      ● DCM.MVD.53:3d12 2110 2111
200.7      ● DCM.MVD.54:4d12 2120 2109
199.7      ● DCM.MUTR.N.34:4506 11193 11194
198.0      ● DCM.MUTR.N.12:2504 11173 11174
196.7      ● DCM.MUTR.N.23:3505 11184 11183
195.9      ● DCM.MUTR.N.21:1505 11180 11179
194.9      ● DCM.MUTR.N.31:1506 11187 11188
191.8      ● DCM.MUTR.N.43:3507 11200 11199
190.7      ● DCM.MVD.64:4d13 2116 2117
189.6      ● DCM.MUTR.N.51:1508 11203 11204
188.6      ● DCM.MVD.51:1d12 2103 2102
187.1      ● DCM.PC.E.32:2404 4092 4091
185.3      ● DCM.DC.W.103:3114 3118 3117

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- FCAL was not zero suppressed in Run-4.
- Hot DC packets can limit the rate around 5.0 kHz
- No more MVD issue.
- Lots of MuTr fibers near 200 words, limits around 6 kHz in AuAu.
- This PC packet has bad ROC with bits on (?). It is a rate limitation in proton-proton running at ~ 5.8 kHz.

d-Au Trigger Rejections

Assume rejection is related to collision particles and scale down from proton-proton rejections by d-Au $\langle n_{\text{binary}} \rangle = 7.6$ as a crude first pass rejection (more reliable than using Run 3 d-Au values – many reasons).

Trigger	Rej. in P+P	Projected Rej. d-Au	Rate at 300 kHz
MUID1D1S (North)	14,000	1800	160 Hz
MUID1D1S (South)	23,000	3000	100 Hz
ERT4x4c (~1.5GeV)	75	9	30,000 Hz
ERT4x4a (~2.1GeV)	926	121	2,400 Hz
ERT4x4b (~2.9GeV)	3100	400	750 Hz
ERT_E	190	25	12,000 Hz
MUID1D (North)	670	88	3,400 Hz
MUID1D (South)	950	125	2,400 Hz

First ballpark idea?

	A	B	C	D	E	F
1		PHENIX Trigger Configuration Draft Run-8 Deuteron-Gold 200 GeV : 10-08-2007 Nagle				
2		Use pp Rejections / dAu <nbinary> =	7.6			
3		Assume up to 7 kHz bandwidth through DAO (ignores trigger correlations)				
4						
5		ERT_2x2 with 0.8 GeV threshold				
6		ERT_4x4a with 2.1 GeV threshold				
7		ERT_4x4b with 2.8 GeV threshold			BBCLL1	
8		ERT_4x4c with 1.4 GeV threshold			300000	
9						
10		Trigger	Rejection	Raw	Prescale	Rate
11						
12	0	MUIDLL1_N2D S2D	1.0	300000	9999999	0
13	1	Clock		10000000	999999	10
14	2	BBCLL1	1.0	300000	300	997
15	3	BBCLL1 (noVertexCut)	0.5	600000	2500	240
16	4	ZDCLL1Wide	25.0	12000	100	119
17	5	ZDCLL1Narrow	10.0	30000	2500	12
18	6	Open	99999999.0	0	160	0
19	7	ERTLL1_4x4a	1.4	207273	9999999	0
20	8	ERTLL1_2x2 & BBCLL1	6.6	45600	9999999	0
21	9	ERTLL1_4x4a & BBCLL1 [-2.1 GeV]	121.8	2462	2	821
22	10	ERTLL1_4x4c [1.4 GeV]	99999999.0	0	600	0
23	11	ERTLL1_4x4b & BBCLL1 [-2.8 GeV]	407.9	735	0	735
24	12	ERTLL1_4x4c & BBCLL1 [-1.4 GeV]	9.9	30400	50	596
25	13	ERTLL1_Electron & BBCLL1 [-400 MeV]	25.0	12000	2	4000
26	14	MUID_LL1_N_1Deep & BBCLL1	52.6	5700	10	518
27	15	MUID_LL1_S_1Deep & BBCLL1	52.6	5700	10	518
28	16	MUID_LL1_N_1Shallow & BBCLL1	7.9	38000	200	189
29	17	MUID_LL1_S_1Shallow & BBCLL1	7.9	38000	200	189
30	18	MUID_LL1_N_1D1S & BBCLL1	1842.1	163	0	163
31	19	MUID_LL1_S_1D1S & BBCLL1	3026.3	99	0	99
32	20	MUID_LL1_N_1D & S_1D & BBCLL1	15000.0	20	0	20
33	21	(MUIDLL1_N2D S2D) & BBCLL1	2631.6	114	0	114
34	22	Open	99999999.0			
35	23	ZDCN ZDCS	1.3	230769	1923	120
36	24	ZDCNS			500	
37	25	MPC_4x4a	99999999.0	0	0	0
38	26	MPC_4x4b	99999999.0	0	0	0
39	27	ERTLL1_4x4b	99999999.0	0	0	0
40	28	PPG(Pedestal)			0	1
41	29	PPG(Test Pulse)			0	1
42	30	PPG(Laser)			0	1
43	31	Noise	OFF			0
44						9463

1k Minimum Bias BBCLL1 with 1 PMT on each side. Need to watch background issue.

γ, π^0 is okay with highest threshold.

$J/\psi \rightarrow ee$ (need to raise threshold). Then check rejection carefully.

$J/\psi \rightarrow \mu\mu$ is fine.

A few comments/issues to watch....

0. Need to check all rejections with beam to then re-adjust.
1. We need careful attention to the ERT (matching, hot towers, etc.). The electron 2x2 threshold needs to be raised (? 800 MeV) and check rejections with beam. If rates are lower at the start of the run, do we want to run partially with the lower threshold (?) for other physics.
2. Should be able to push 7 kHz, but near limit with HBD, FCAL and other noisy channels.
3. This run should be less stress on the DAQ, but the trigger needs careful optimization.