Status on ECL Trigger Software

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Update for Release 04-00

- Unpacker Update
 - Add ecl-burst bit
- Condition DB update
 - Modify ADC conversion factor(int -> double)
 - Selection bhabha condition
 - $\mu\mu$ bit condition
 - ECL burst bit
 - The number of Cluster exceeding 300 MeV
- Calibration Module
 - Timing calibration module
- QAM
 - Basf2 base QAM
 - Add few variables
 - ECLTRG Total Energy peak and width
 - ECLTRG Cal-timing peak and width
 - ECLTRG Cluster Energy peak and width

- Low Hit TC (Less than 0.1 x Average) in Forward, Backward endcap and Barrel Add executing scripts in examples dir.

To do list for ECL Trigger software

Simulation

- Background Overlay
- Realistic timing resolution in MC
 - Crystal base shaping module has been prepared.
 - Need more study in FAM and ShaperDSP.
- Integer version
- Firmware version
- ECL Trigger Unpacker
 - Update with ETM firmware.
- Calibration Module
 - Energy calibration Module.
- Condition DB update
 - Configuration DB \rightarrow Condition DB system is needed

Back up

Physics efficiency with Hadron skim(w/o bhabha)



- Data : Hadron skim && fff ==1
- ECL TRG Physics condition : $(E_{total} > 1 \text{ GeV or ICN} > 1)$

Bhabha efficiency with Bhabha skim



- Sample : Bhabha skim (Bhabha2Trk ==1)
 - Veto Bhabha bit
 - $160^{\circ} < \Delta \phi(CM) < 200^{\circ} \text{and} \ 165^{\circ} < \text{sum} \ \theta(CM) < 190^{\circ}$
 - Both $E_{Cluster}(CM) > 3 \text{ GeV}$ and $(E_{Cluster2}(CM) > 4.5 \text{ GeV} \text{ or } E_{Cluster2}(CM) > 4.5 \text{ GeV})$
 - Selection Bhabha bit
 - $140^{\circ} < \Delta \phi(CM) < 220^{\circ} \text{ and } 160^{\circ} < \text{sum } \theta(CM) < 200^{\circ}$
 - Both $E_{Cluster}(CM) > 2.5 \text{ GeV}$ and $(E_{Cluster2}(CM) > 4.0 \text{ GeV} \text{ or } E_{Cluster2}(CM) > 4.0 \text{ GeV})$
- 2D Bhabha : ~85%
- 3D Bhabha : Selection bit ~90% , Bhabha bit: ~80 %

ECL Trigger $\mu\mu$ bit with 2 tracks muon skim

Exp#8



- **ECL Trigger** μμ bit
 - Before run3900 140 < $\Delta\phi({\rm CM})$ < 220 and 160 < sum $\theta({\rm CM})$ < 200, each cluser E< 2GeV
 - From Run# 3900 : $160 < \Delta \phi({\rm CM}) < 200$ and $165 < {\rm sum}~\theta({\rm CM}) < 190$, each cluser E< 2GeV
- Efficiency
 - Before run 3900 : ~60 %
 - After r3900 : ~50 %

Exp#7

Large TC timing resolution

Simulation shows TC timing resolution is around **1ns** for Bhabha sample
Off line eventT0 shows around 5ns. Why ?



- •Timing differences btw 16ch in one TC are not negligible
- •Plan to check timing variation using beam data, and
- •Plan to compare timing differences with ECL time calibration constants
- •Anyway, no way to avoid in trigger level.
- Need to update tsim-ecl to take into account this effect...



Timing Study with ECL Timing Calibration factor

- In order to consider the crystal timing difference in one TC
 - 1. Current Tsim (Defult)
 - 1. Add raw(true) crystal E and T into one TC.
 - 2. Shaping waveform TC by TC
 - 2. Tricky method for execution timing
 - 1. Adjust raw crystal timing based on ECL timing calibration factor.
 - 2. Add crystal E and T(adjusted) into one TC.
 - 3. Shaping waveform TC by TC
 - 3. Crystal by Crystal waveform shaping.
 - 1. Adjust raw crystal timing based on ECL timing calibration factor.
 - 2. Shape waveform crystal by crystal.
 - 3. Add crystal waveforms into TC waveform

	Bhabha + bkg	Y4s +bkg
1	0.80 +- 0.01	3.67 +-0.04
2	1.17 +- 0.01	3.82 +- 0.04
3	1.21 +- 0.02	4.50 +- 0.04

	Execution time				
1	191 ms /event				
2					
3	964 ms /event				

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Software configuration (Fast Simulator)









- Core modules (For MC generation)
 - GSim part (8736 Xtals + PD + preAmp)
 - Use ECLHit table in ECL software package
 - TrgECLFAM module (ShaperDSP + FAM)
 - Shaping and digitization
 - 3 types noise generation(serial, parallel, pile-up)
 - Measure energy and timing(1 method + 2 backup methods)
 - TrgEcl module (TMM+ETM)
 - Decide trigger conditions(Physics, Bhabha, beam-background) and event-timing.
 - Belle trigger logics decision method are implemented.
 - New event-timing logic is implemented with resolution $\sigma \sim 3.7$ ns.

TC Map



							← TC θ ID					
15	14	13	12	11	10	9	8	7	6	5	4	
92	91	90	89	88	87	86	85	84	83	82	81	1
104	103	102	101	100	99	98	97	96	95	94	93	2
116	115	114	113	112	111	110	109	108	107	106	105	3
128	127	126	125	124	123	122	121	120	119	118	117	4
140	139	138	137	136	135	134	133	132	131	130	129	5
152	151	150	149	148	147	146	145	144	143	142	141	6
164	163	162	161	160	159	158	157	156	155	154	153	7
176	175	174	173	172	171	170	169	168	167	166	165	8
188	187	186	185	184	183	182	181	180	179	178	177	9
200	199	198	197	196	195	194	193	192	191	190	189	10
212	211	210	209	208	207	206	205	204	203	202	201	11
224	223	222	221	220	219	218	217	216	215	214	213	12
236	235	234	233	232	231	230	229	228	227	226	225	13
248	247	246	245	244	243	242	241	240	239	238	237	14
260	259	258	257	256	255	254	253	252	251	250	249	15
272	271	270	269	268	267	266	265	264	263	262	261	16
284	283	282	281	280	279	278	277	276	275	274	273	17
296	295	294	293	292	291	290	289	288	287	286	285	18
308	307	306	305	304	303	302	301	300	299	298	297	19
320	319	318	317	316	315	314	313	312	311	310	309	20
332	331	330	329	328	327	326	325	324	323	322	321	21
344	343	342	341	340	339	338	337	336	335	334	333	22
356	355	354	353	352	351	350	349	348	347	346	345	23
368	367	366	365	364	363	362	361	360	359	358	357	24
380	379	378	377	376	375	374	373	372	371	370	369	25
392	391	390	389	388	387	386	385	384	383	382	381	26
404	403	402	401	400	399	398	397	396	395	394	393	27
416	415	414	413	412	411	410	409	408	407	406	405	28
428	427	426	425	424	423	422	421	420	419	418	417	29
440	439	438	437	436	435	434	433	432	431	430	429	30
452	451	450	449	448	447	446	445	444	443	442	441	31
464	463	462	461	460	459	458	457	456	455	454	453	32
476	475	474	473	472	471	470	469	468	467	466	465	33
488	487	486	485	484	483	482	481	480	479	478	477	34
500	499	498	497	496	495	494	493	492	491	490	489	35
512	511	510	509	508	507	506	505	504	503	502	501	36

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	10	
516	515	1
513	514	2
520	519	3
517	518	4
524	523	5
521	522	6
528	527	7
525	526	8
532	531	9
529	530	10
536	535	11
533	534	12
540	539	13
537	538	14
544	543	15
541	542	16
548	547	17
545	546	18
552	551	19
549	550	20
556	555	21
553	554	22
560	559	23
557	558	24
564	563	25
561	562	26
568	567	27
565	566	28
572	571	29
569	570	30
576	575	31
573	574	32

BE

BR

1 - 7

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