

PFA status

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What's new since RAL

- ... not much!
- But a few things:
 - Added compile-time option to use analog calibration instead of digital
 - Added energy residual plot for ZZ events
 - Code fixes to reduce crashes
 - Ran over some detector variants
 - Re-tuned for scint HCAL

Crashes

- Was getting a LOT of crashes with acme0605 geometries
 - Appeared in MIP-finding routine, but...
 - Root cause turned out to be problems with projective neighbour-cell-list routine.
 - e.g. Cell A is a neighbour of cell B, but cell B is not a neighbour of A
 - acme0605 geometry turned out to be somewhat pathological because barrel z-axis length was an exact multiple of cell width, so rounding errors could affect calculation of # of cells.
 - Fixed some problems at source; catch others and ignore.
 - Crashes from this source now much less frequent but still sometimes happen
- Few crashes from other sources... need to investigate.
 - These are assertion errors, i.e. code has caught an error.

Detector variants

I ran on a bunch of detector variants, though not quite as many as Ron!

I see the same numbers as him (for “MatPFA”), e.g.

Model	HCAL	mean ₉₀ ± rms ₉₀	dM/M
sid01	digital RPC	-1.98 ± 4.37	4.91%
sid01_scint	digital scint	-1.84 ± 4.34	4.87%
sid01_scint	analog scint	-1.58 ± 4.34	4.85%

Re-tuning for scintillator

- ... but the PFA parameters were turned for an RPC HCAL (specifically sid01's steel/RPC HCAL).
- One important cut is minimum cluster size in HCAL (when no internal structure found) -- old value was 15
- This should probably be tighter for scintillator than for RPC, so I re-optimized with digital scintillator HCAL (sid01_scint):

Cut	mean ₉₀ ± rms ₉₀	dM/M
15	-1.84 ± 4.34	4.87%
25	-3.11 ± 4.20	4.78%
35	-3.57 ± 4.15	4.75%
50	-3.70 ± 4.12	4.72%
60	-3.86 ± 4.14	4.75%
70	-3.96 ± 4.13	4.74%

Chosen

Results with new cut

(showing both RPC and scintillator with cut of 50)

Model	HCAL	mean ₉₀ ± rms ₉₀	dM/M
sid01	SS + digital RPC	-2.36 ± 4.36	4.92%
sid01_scint	SS + digital scint	-3.76 ± 4.11	4.71%
sid01_scint	SS + analog scint	-3.43 ± 4.19	4.78%
acme0605_steel_rpc	SS + digital RPC	-2.50 ± 4.54	5.13%
acme0605_steel_scint	SS + digital scint	-4.59 ± 4.17	4.83%
acme0605_steel_scint	SS + analog scint	-3.99 ± 4.15	4.77%
acme0605_W_rpc	W + digital RPC	-4.02 ± 4.79	5.51%
acme0605	W + digital scint	-4.20 ± 4.22	4.86%
acme0605	W + analog scint	-3.98 ± 4.12	4.73%

(c.f. $-1.98 \pm 4.37 \Rightarrow 4.91\%$ for sid01 with old cut of 15)

Bottom line

- Tighter cut improves things noticeably for scintillator HCAL
- It's more or less a wash for RPC HCAL
- => I've gone ahead and put it into CVS as new default.
- After optimizing, PFA performance with scintillator HCAL is now a bit better than for RPC HCAL...
- ... but difference is not large at all, especially compared to confusion.
- Now it's time to start tinkering with the algorithm again...