

# Hcal Noise Status

Jian Wang

## HCAL Noise Task Force memebers +

## Tasks

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Roh<sup>(f1)</sup>, Igor Volobouev, Efe Yazgan<sup>(a1e4)</sup>

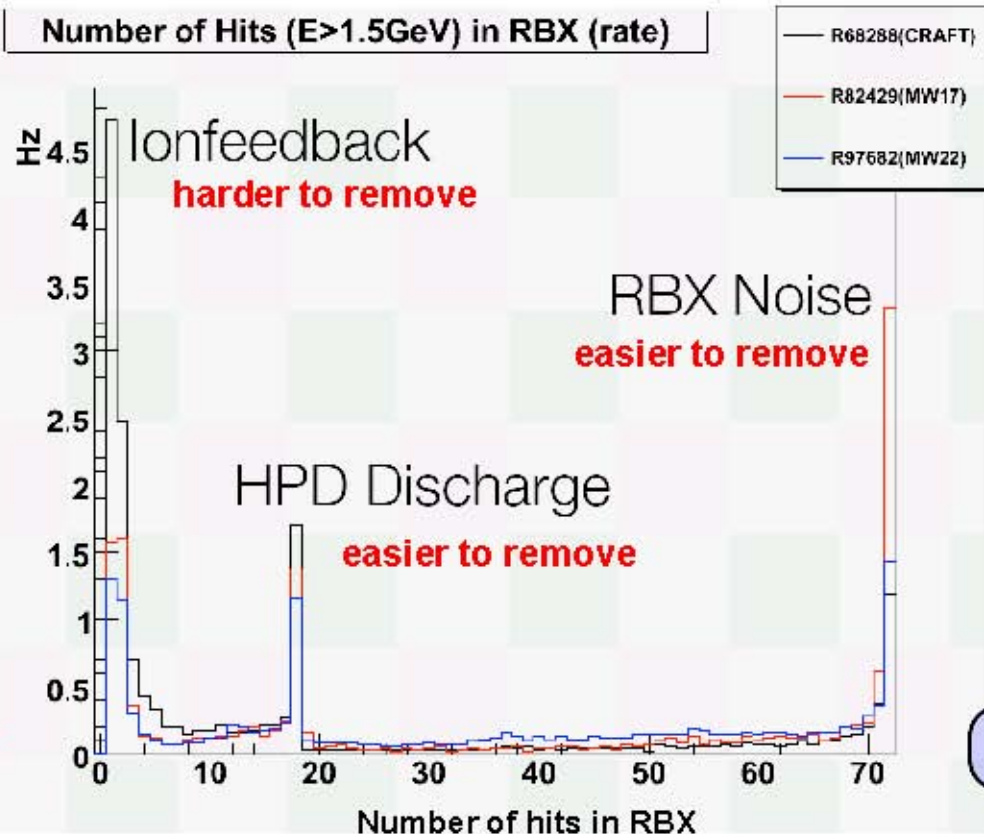
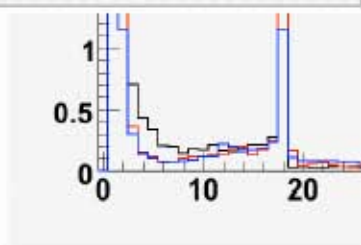
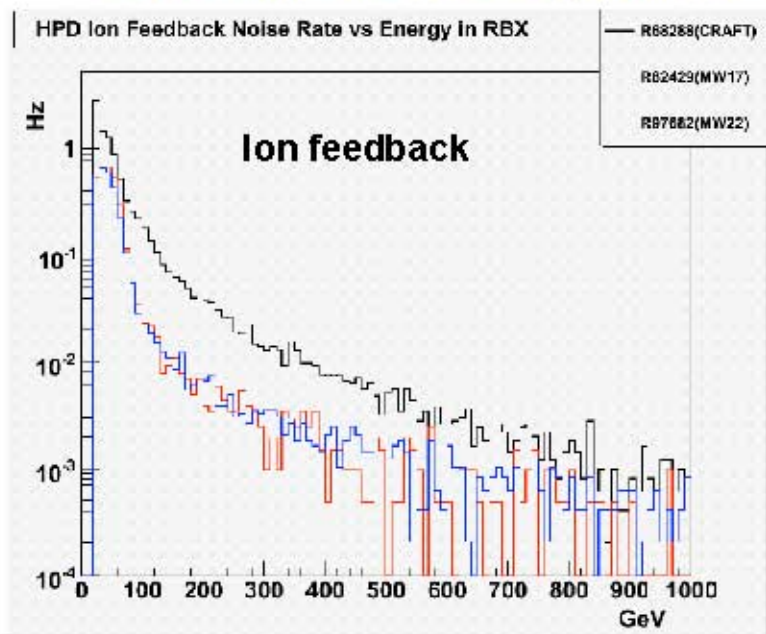
(Caltech) Rick Wilkenson<sup>(d1d3)</sup> (UIC) Leonard  
Apanasevich<sup>(a4)</sup> (Notre Dame) Mike Hildreth<sup>(d1)</sup>

|                             |    |
|-----------------------------|----|
| CMSSW                       | a0 |
| Rechit                      | a1 |
| noise / pulse shape         |    |
| latency / time / saturation |    |
| Noise Summary               | a2 |
| HLT filter                  |    |
| HCAL Noise Selection        | a3 |
| MET Noise Filter            | a4 |
| Offline skim                | a5 |
| DQM/monitoirng              |    |
| HCAL                        | b1 |
| MET                         | b2 |
| Trend                       | b3 |
| Data Flow                   | c0 |
| Express/Alca                | c1 |
| Offline(Skim/Reco)          | c2 |
| Simulation                  |    |
| Data Mixer (code)           | d1 |
| Data Mixer (test)           | d2 |
| HF PMT (code)               | d3 |
| HF PMT (test)               | d4 |
| Algorithms                  |    |
| rhadrans                    | e1 |
| HCAL pulse shape/timing     | e2 |
| EMF, CHF                    | e3 |
| HF                          | e4 |
| Analysis/Test               | f1 |
| Coordination                | x0 |

- Take shifts at Remote Operating Center
  - 5\*6 hours every 3 weeks
  - Trigger/Noise Monitoring (MWGR, CRUZET)
- Template analysis
- Time interval of triggered events analysis
- Hcal noise study

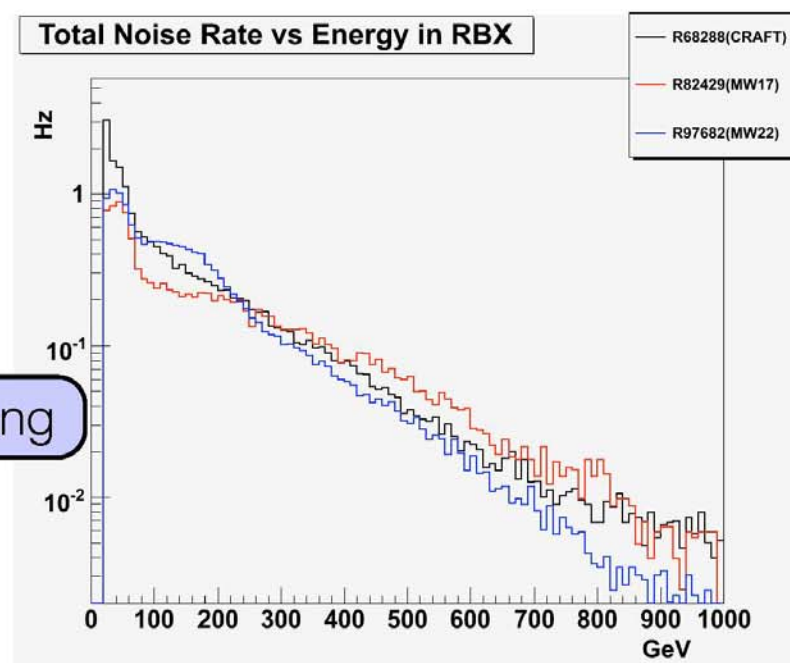
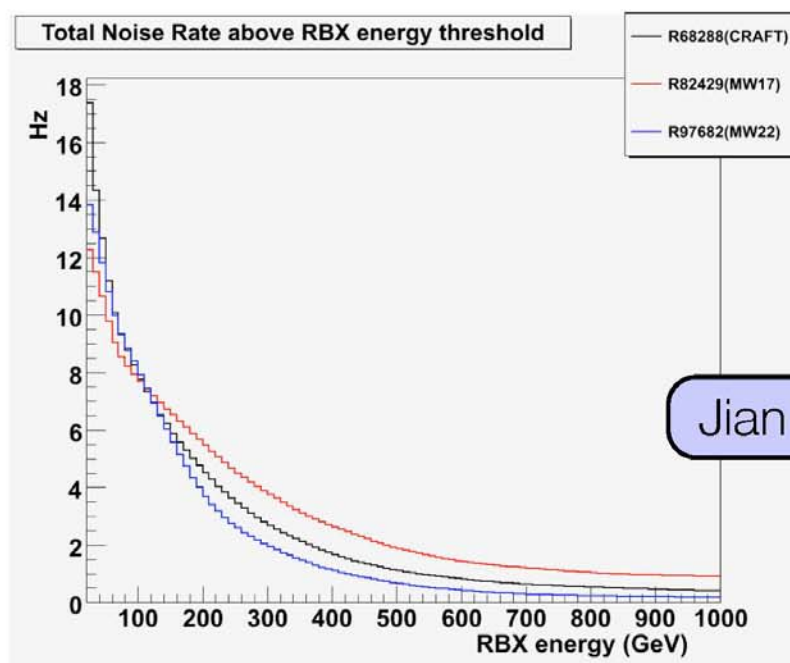
# Anomalous Noise: Characteristics

- Characterize noise by number of hits in RBX



# Anomalous Noise: Rate

- We observe low rate (relative to crossing rate) of anomalous GeV-TeV scale noise in the HCAL
- Overlap with real events should be small
  - However, can constitute modest fraction of jet/MET/MHT trigger bandwidth
  - Recommendation: Attempt to identify and reject *events*, rather than isolate noisy HCAL regions

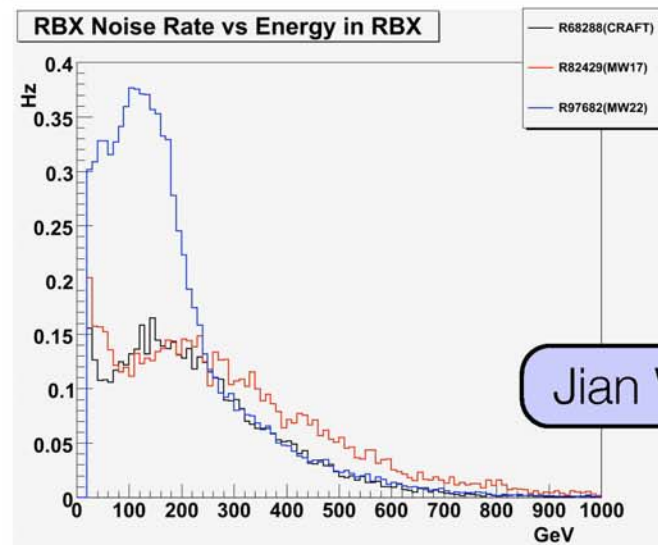
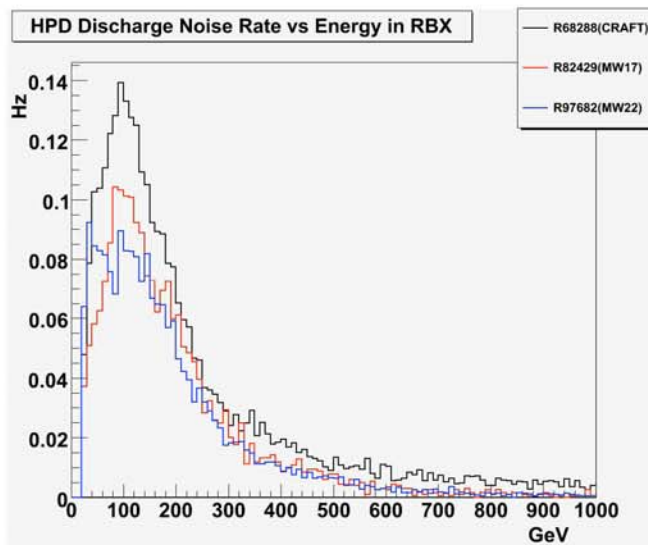
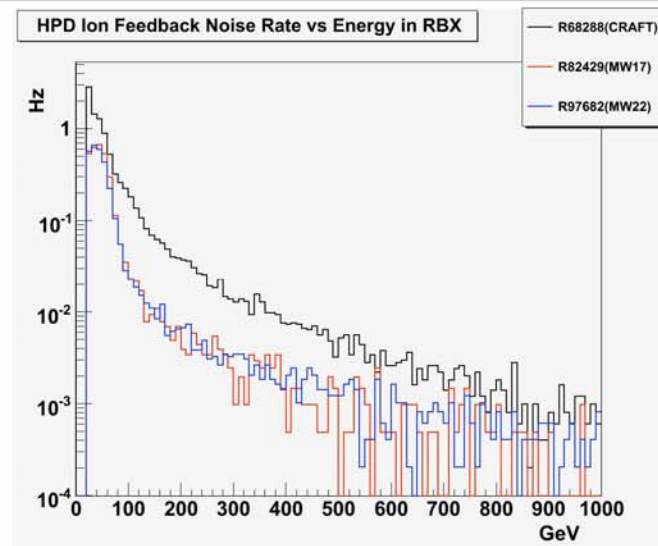


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# Anomalous Noise: Rates by Type

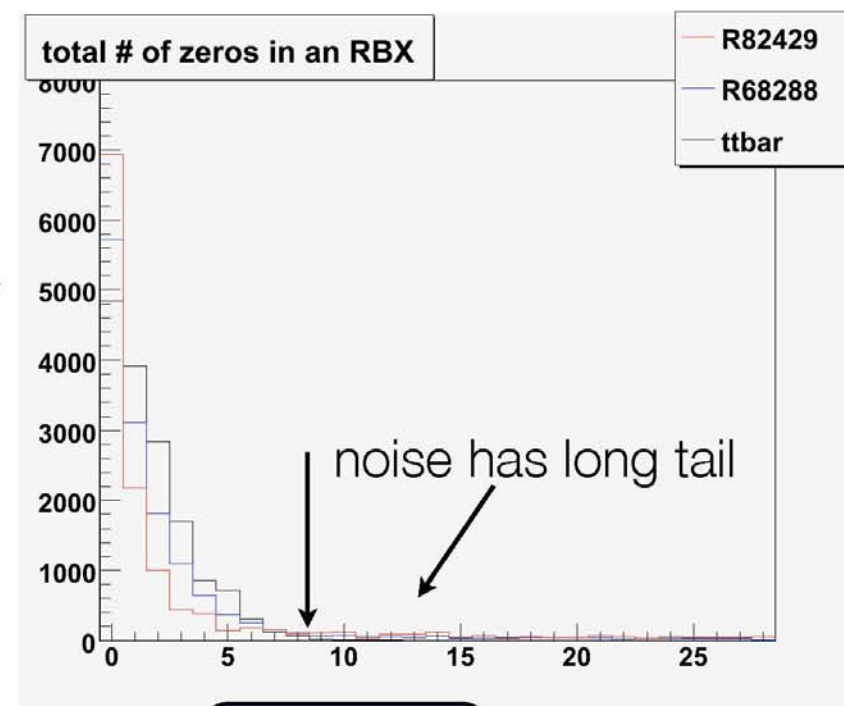
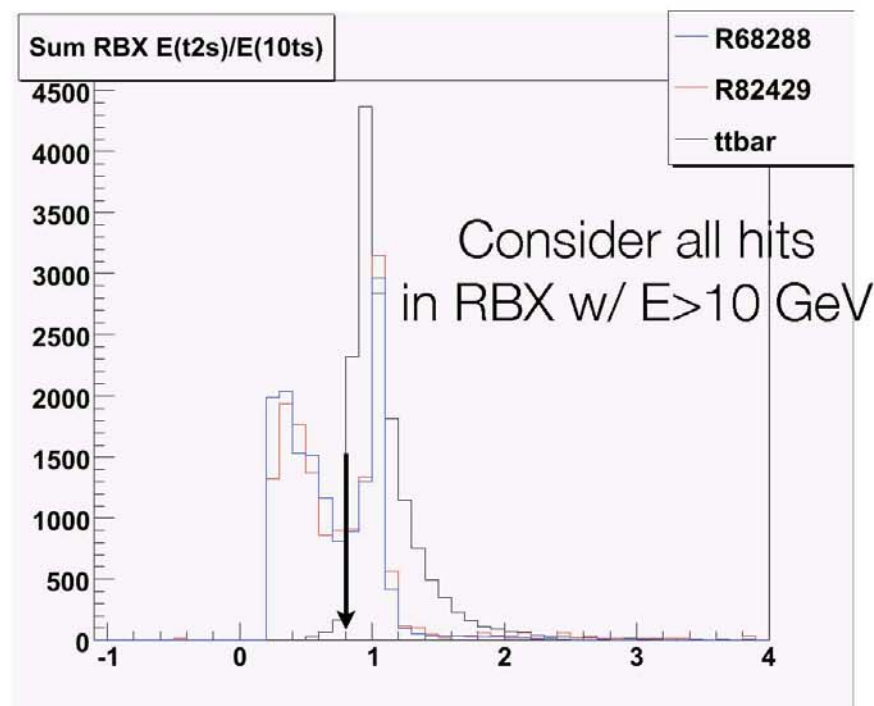
- Ion Feedback Noise: low energy
- HPD Discharge Noise: high energy
- RBX Noise: medium energy



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# Noise Rejection Algorithms: Example (I)

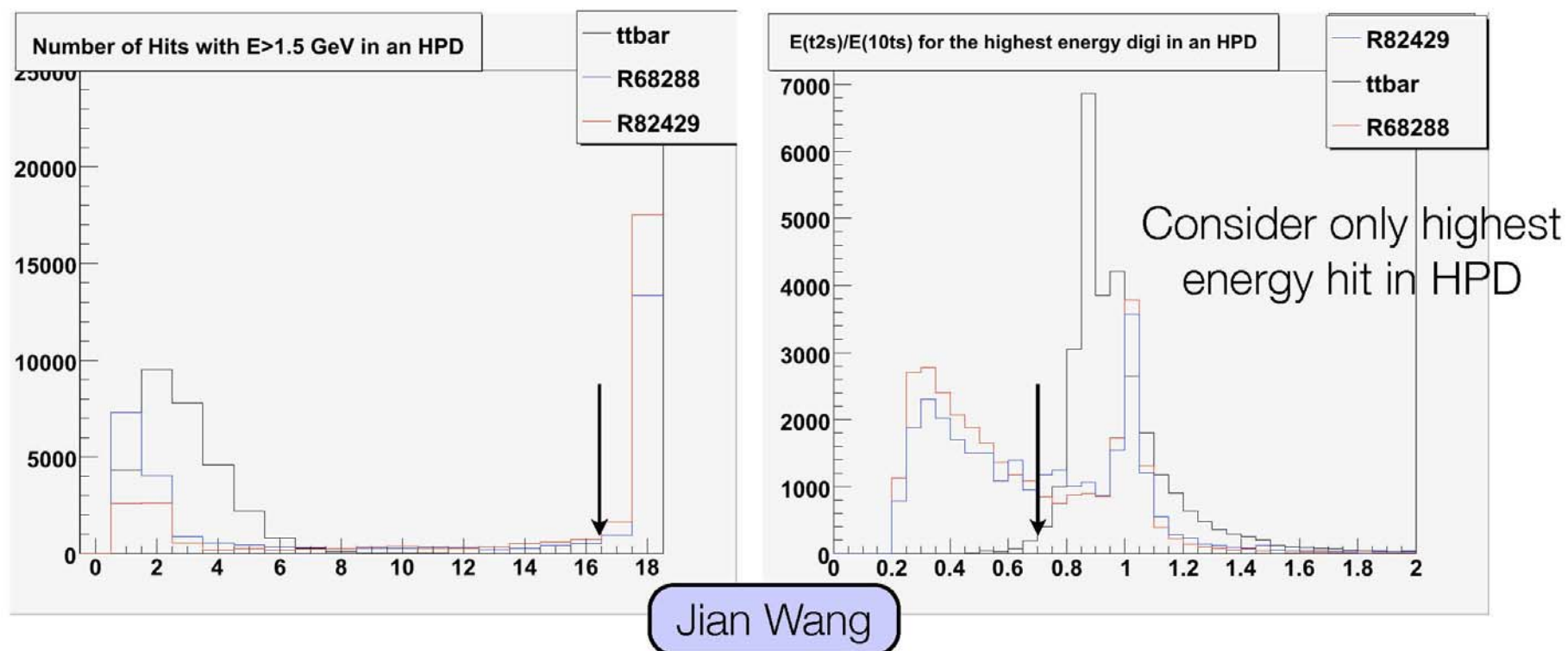
- Compare distributions between CRAFT/MWGR data and  $t\bar{t}$  MC
  - $E(t2s) = \Sigma$  Energy in highest two consecutive time slices
  - $E(10ts) = \Sigma$  Energy in all 10 time slices
  - “zero” = ADC counts 0 in one of the time slices



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# Noise Rejection Algorithms: Example (II)

- Count hits (pixels) in an HPD with  $E > 1.5$  GeV
- Look at pulse shape of highest energy hit in HPD





# Noise Rejection Algorithms: Example (IV)

- $\Sigma E(2TS)/\Sigma E(10TS)$  in RBX  $< 0.8$
- # ADC 0's in RBX  $> 7$
- HPD has  $E > 10$  GeV with both neighbors in phi have  $E < 1.5$  GeV
- # hits  $> 16$
- $E(2TS)/E(10TS)$  for highest hit in HPD  $< 0.7$
- $E(\text{last } 3TS)/E(10TS)$  (Ted's cuts)

