

# **STAR Run 20**

# **TPC QA Features**

BNL Local STAR Group

July 1, 2020

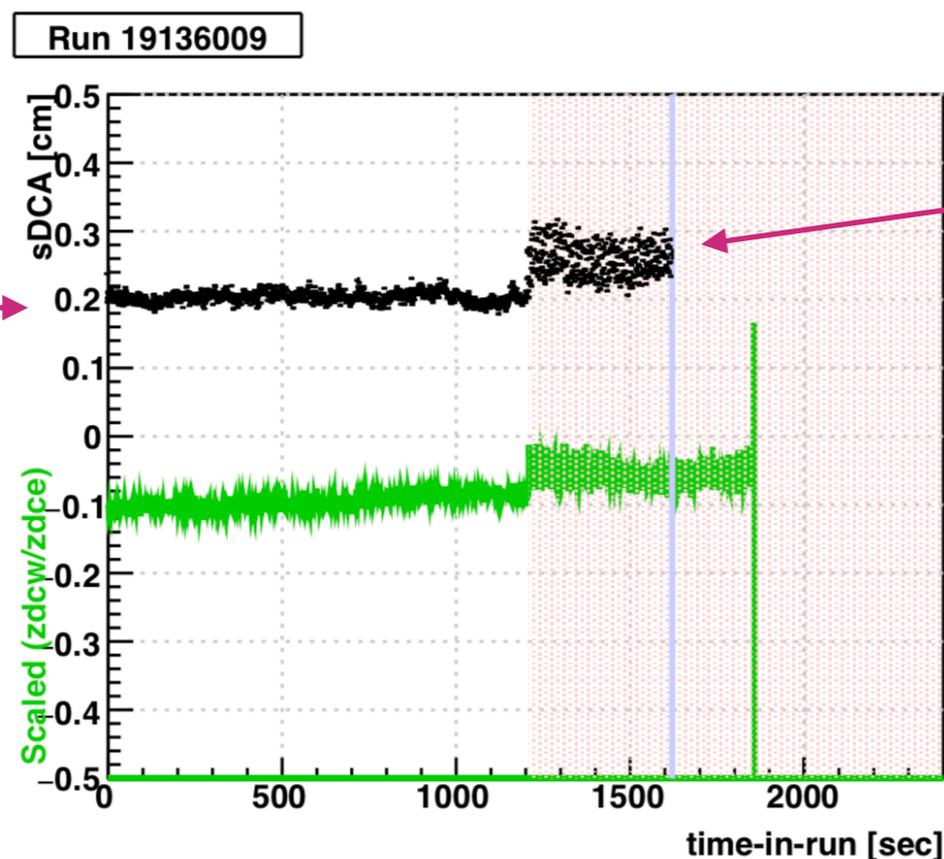
Gene Van Buren

# BMM refresher

- Understood to be a feature of low energy beams in RHIC because they are wide and can easily scrape the collimators
- Also, low rate of good collisions at low energy drives STAR to begin acquisition as soon as we can upon (during?!) injection into RHIC
- I built a catalog for Run 18 AuAu27 on pre-production data:  
<https://drupal.star.bnl.gov/STAR/blog/genevb/catalog-bmm-affects-data>

- Example:

offset from zero is due to un-final calibration; ignore

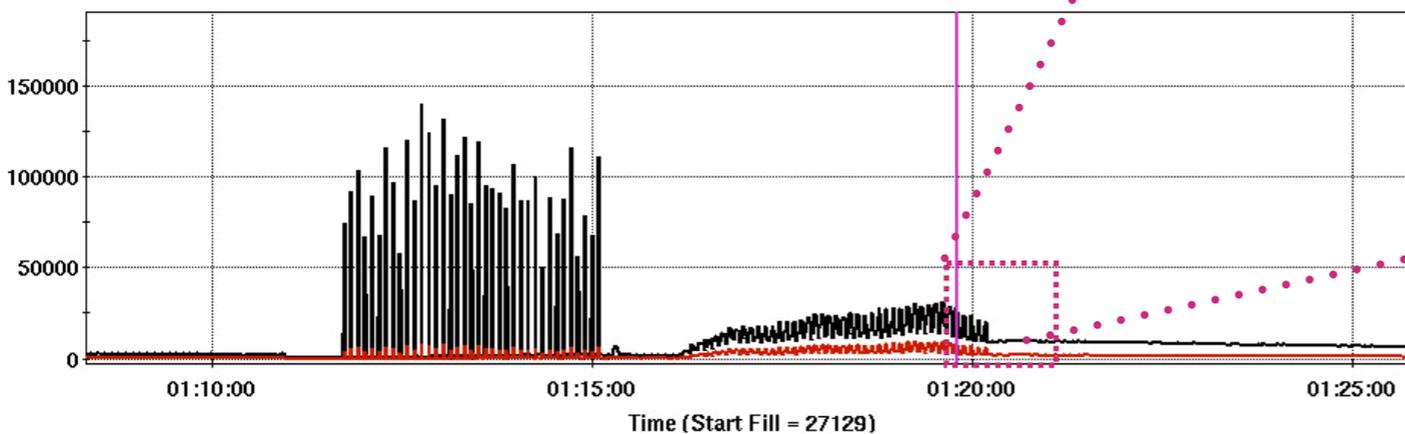
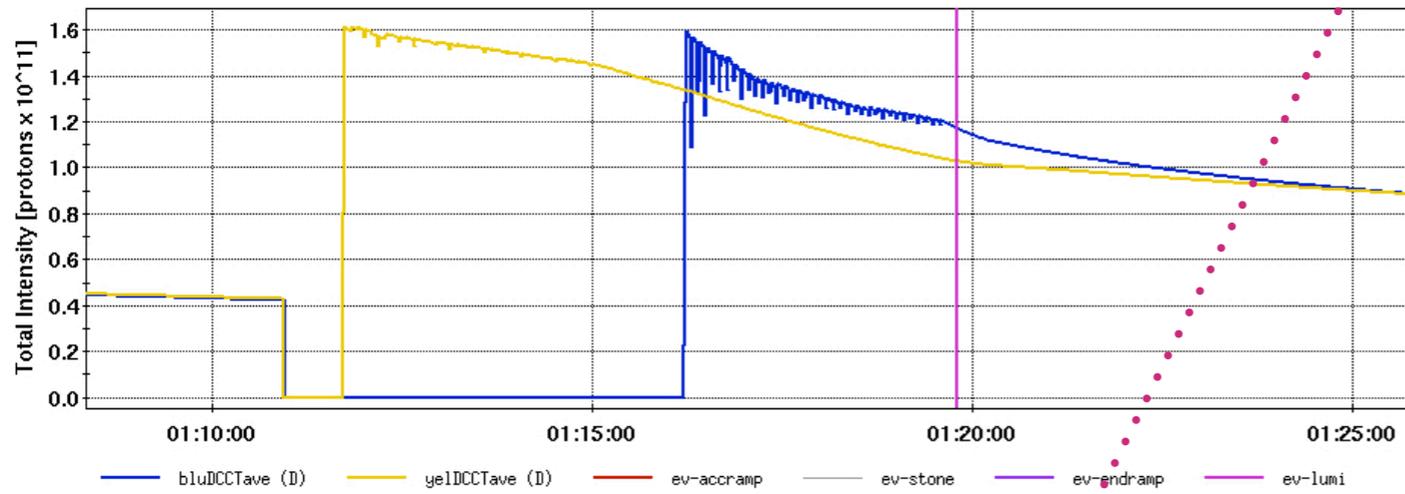
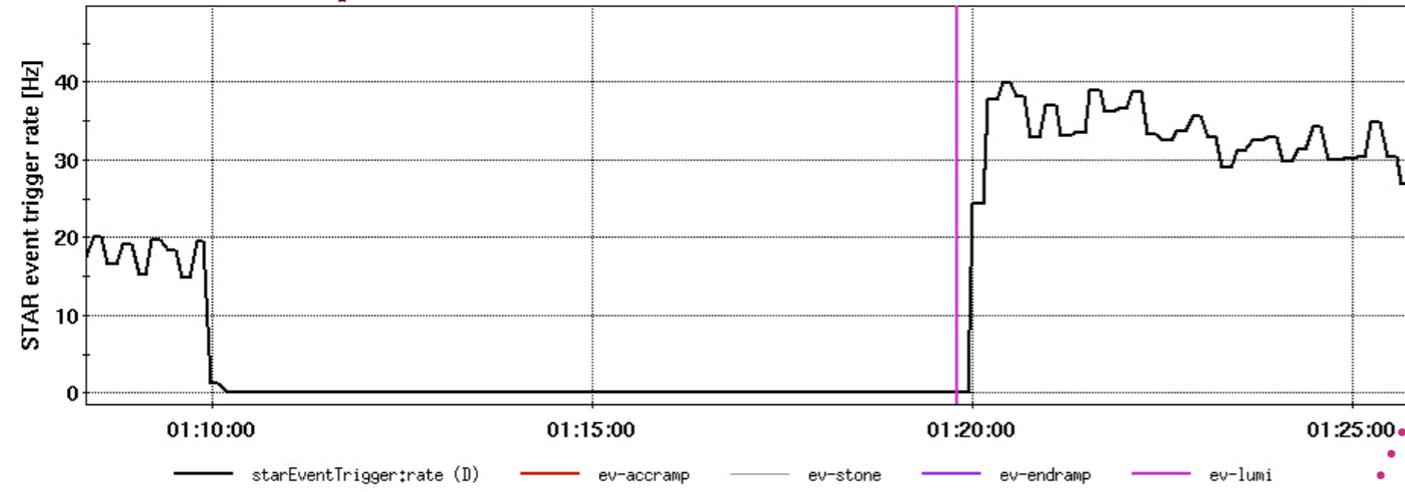


fluctuations are not correctable

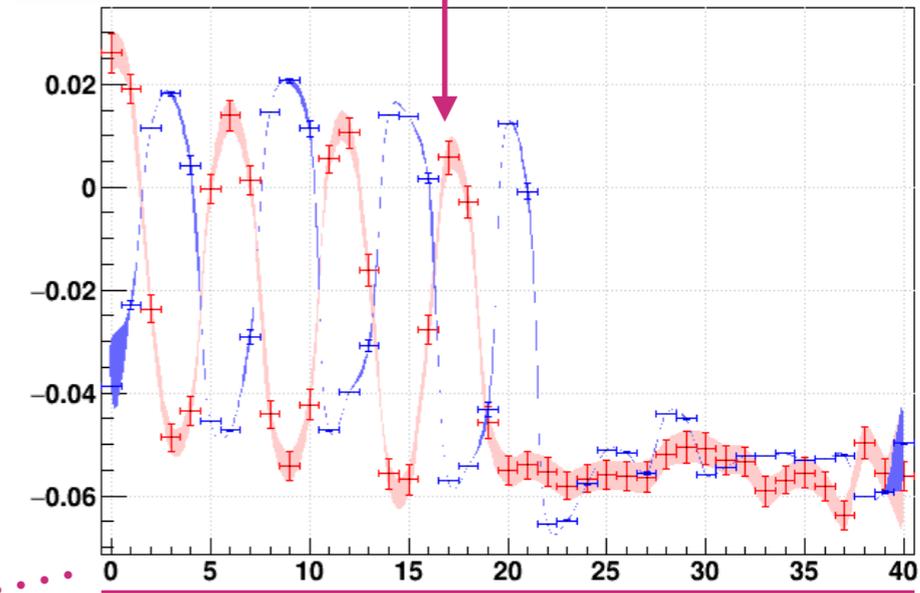
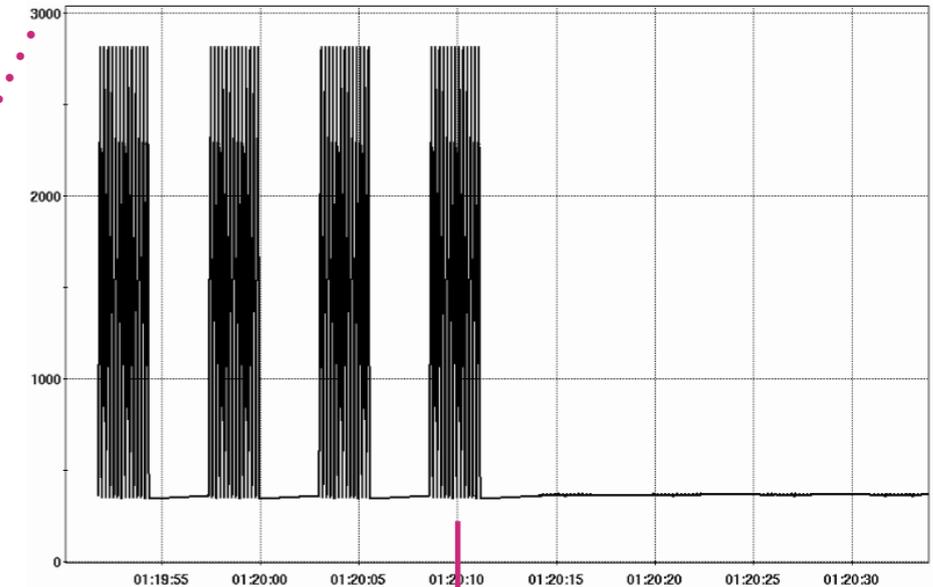
black: signed DCAs  
green: ZDC west/east singles rates ratio  
red shading: BMM on  
blue line: last event time

# BMM in Run 20

- Example with run 21076004



BMM power supply current

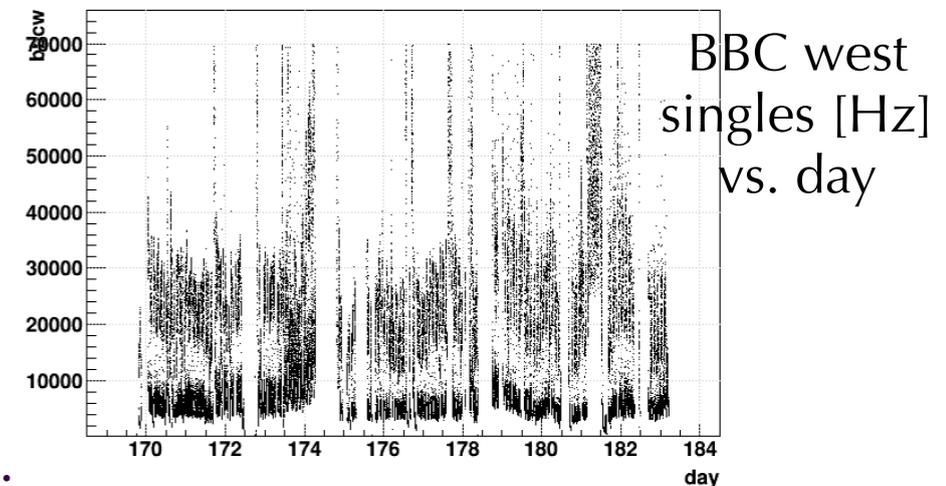


red: signed DCAs  
blue: BBC coincidence rate

# BMM in Run 20

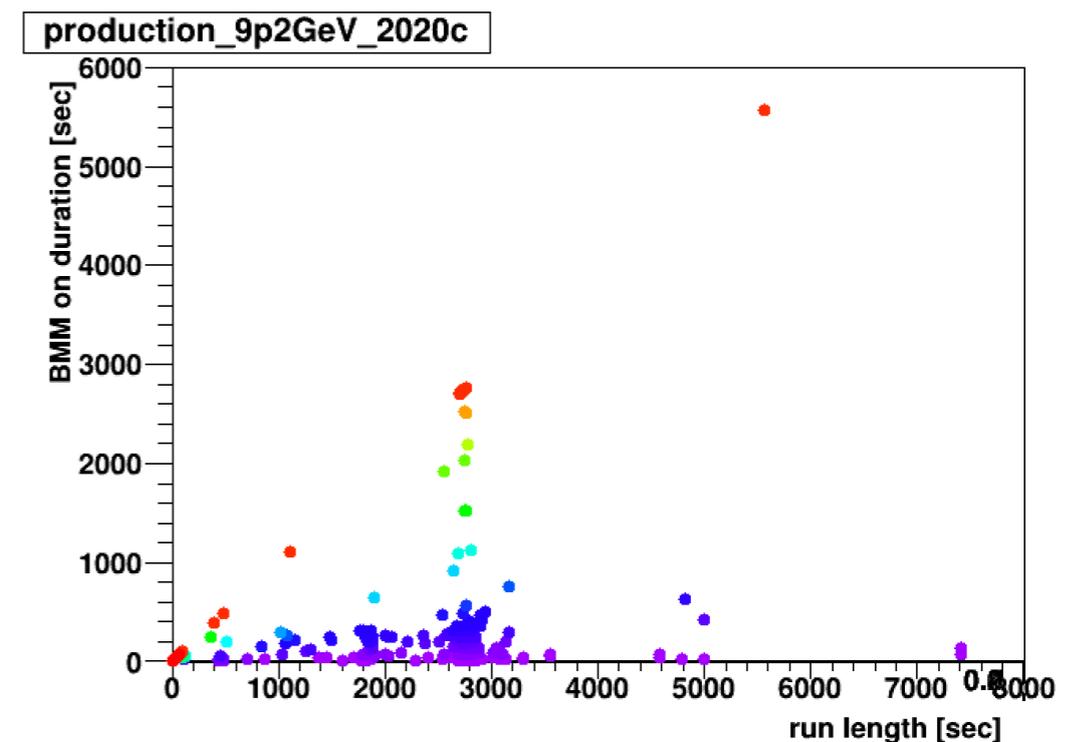
- Excluding BMM on for a few minutes at the end of runs...
- **June 17 - June 30:** 35 instances in 315 production runs of the BMM on for at least 3 minutes; 25 for at least 10 minutes; 11 for the full run (only counting normal length runs)

- On for over 25% of data-taking, but only matters when the beam intensity is high, and I have yet to merge these independent data sources (BBC coincidence rate  $> 300$  Hz or BBC west  $> 10$  kHz for  $\sim 40\%$  of data-taking)



- **Before shutdown\*:** 108 instances in 3282 production runs of the BMM on for at least 3 minutes; 81 for at least 10 minutes; 29 for the full run (only counting normal length runs)

- \* This is incomplete due to C-AD labeling the BMM use differently for a couple weeks in January, but I have yet to correlate other labels besides "u5" with impacts at STAR in Run 20

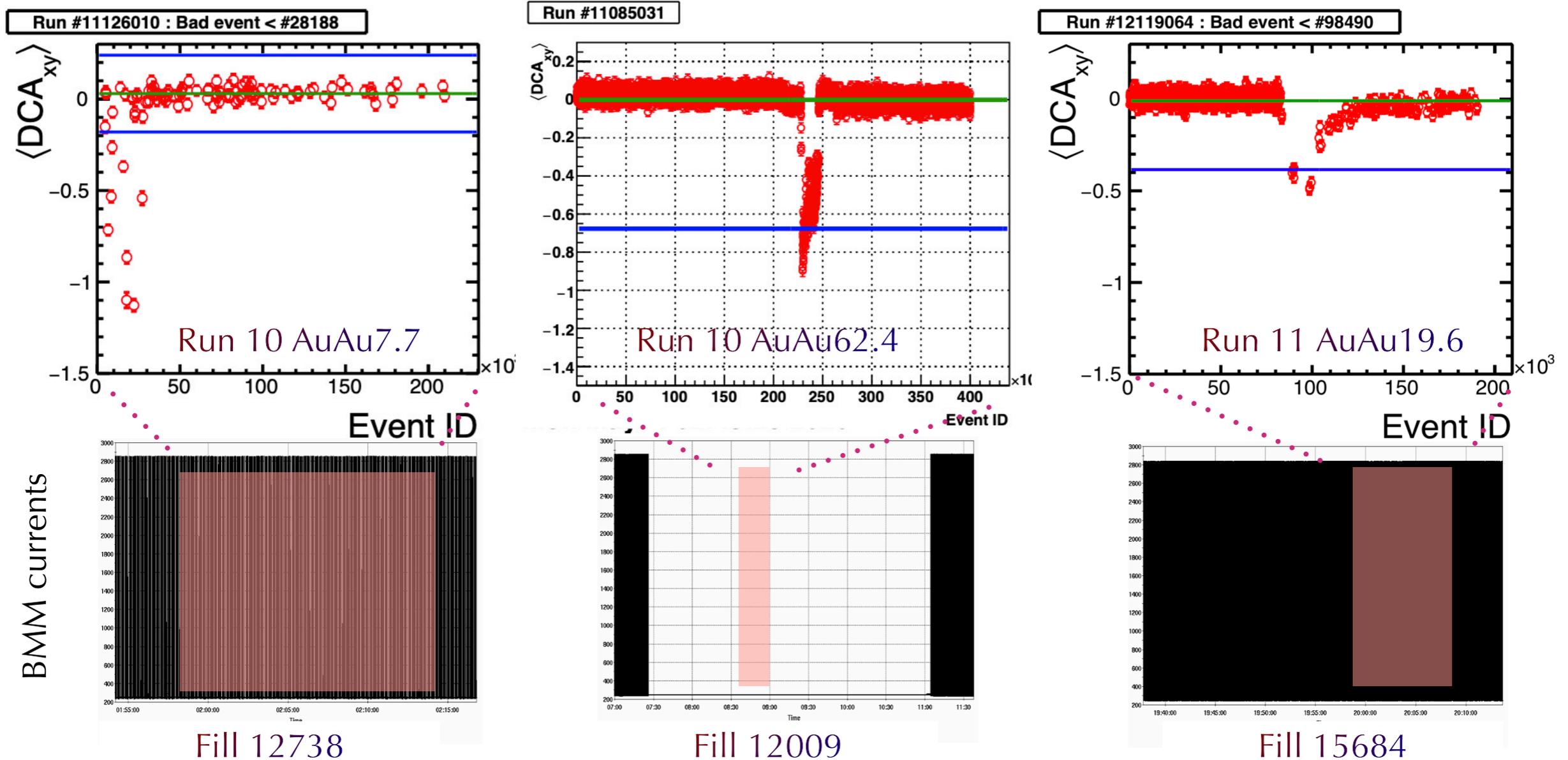


# BMM in BES-I?

- Analyzers are finding similar issues and have had to remove the problematic data themselves:

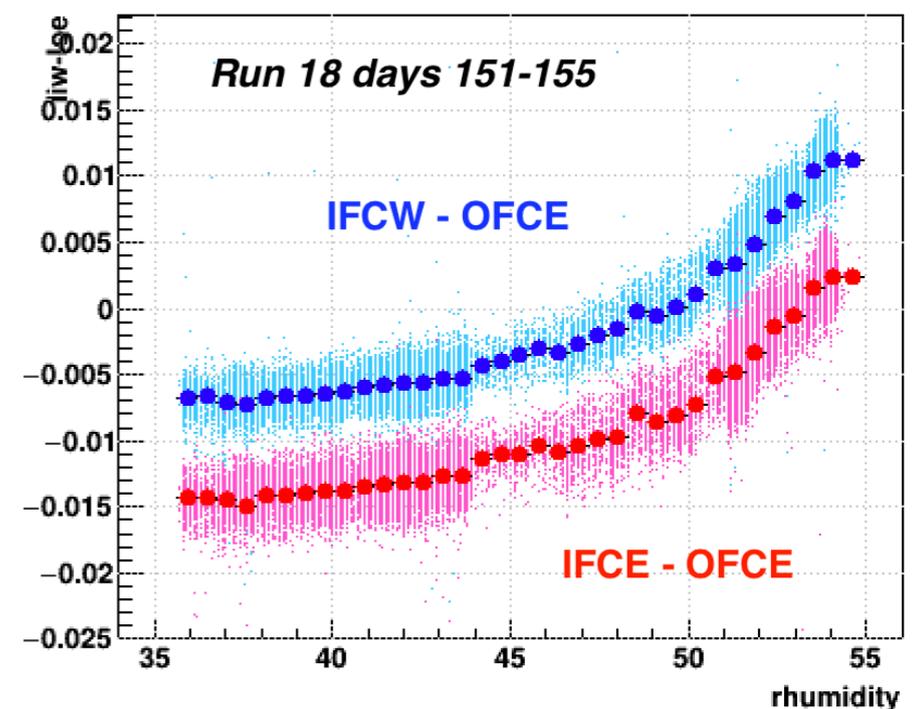
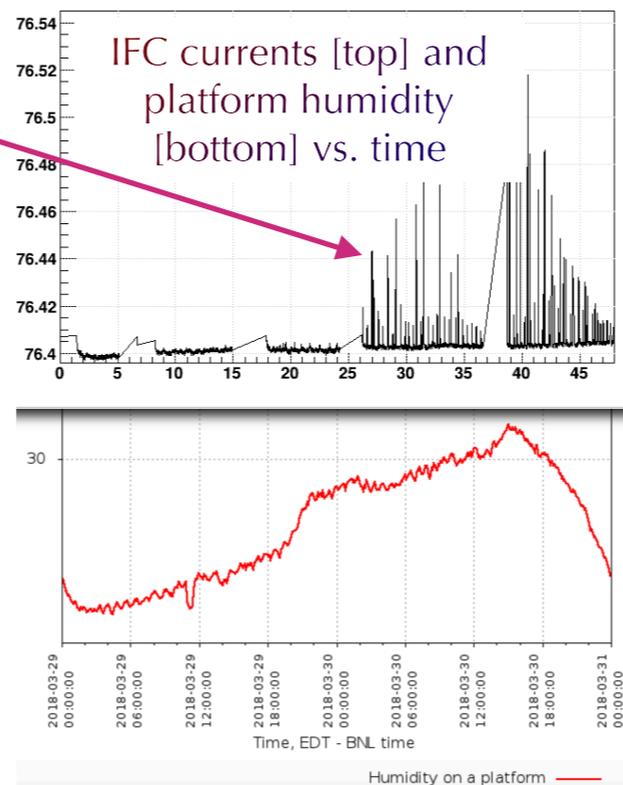
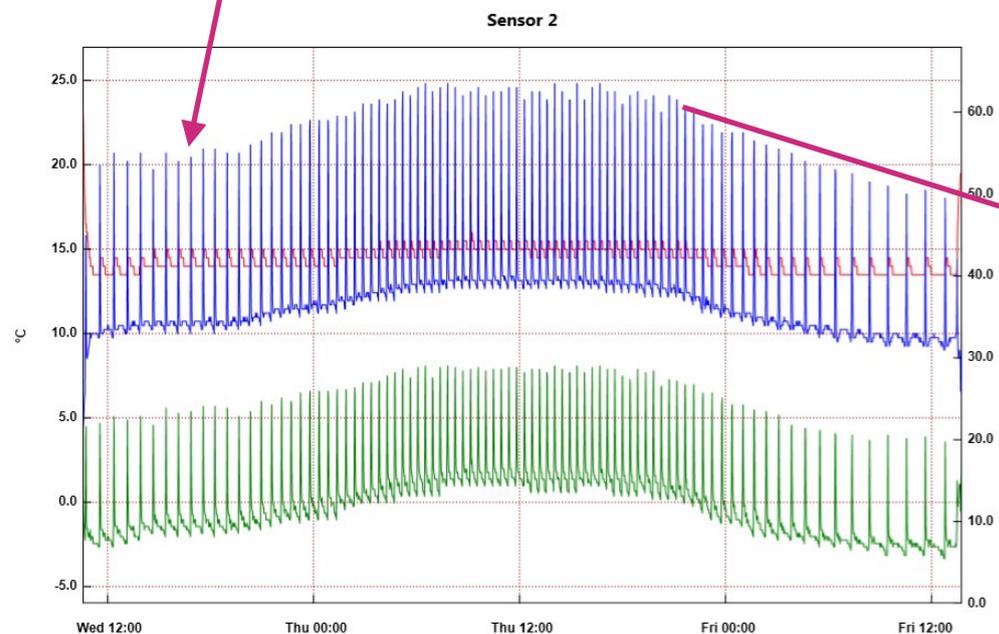
<https://drupal.star.bnl.gov/STAR/blog/tnonaka/strange-events-bes-i-data>

- But...I haven't yet seen clear correlation in random samples



# Humidity refresher

- Moisture is conductive and can reduce resistivity (or increase conductivity) of materials; TPC inner field cage is exposed to blown air
- Two discoveries during Run 18:
  - Old TPC blower was cycling on and off at times, blasting a spray of humidity into the TPC inner field cage each time it turned on [remedied by setting it to blow without cooling]
  - Lack of general humidity control [partially remedied by placing a hall dehumidifier near blower during Run 18, then fully by using a different blower with humidity control - the unused HFT blower - after Run 18]

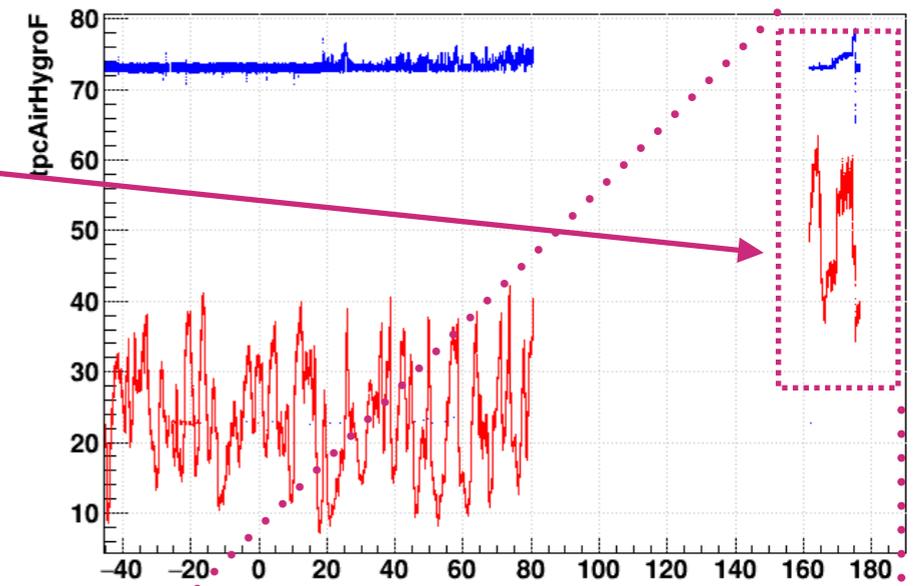


red: blower air dew point  
 blue: blower air humidity  
 green: blower air temperature

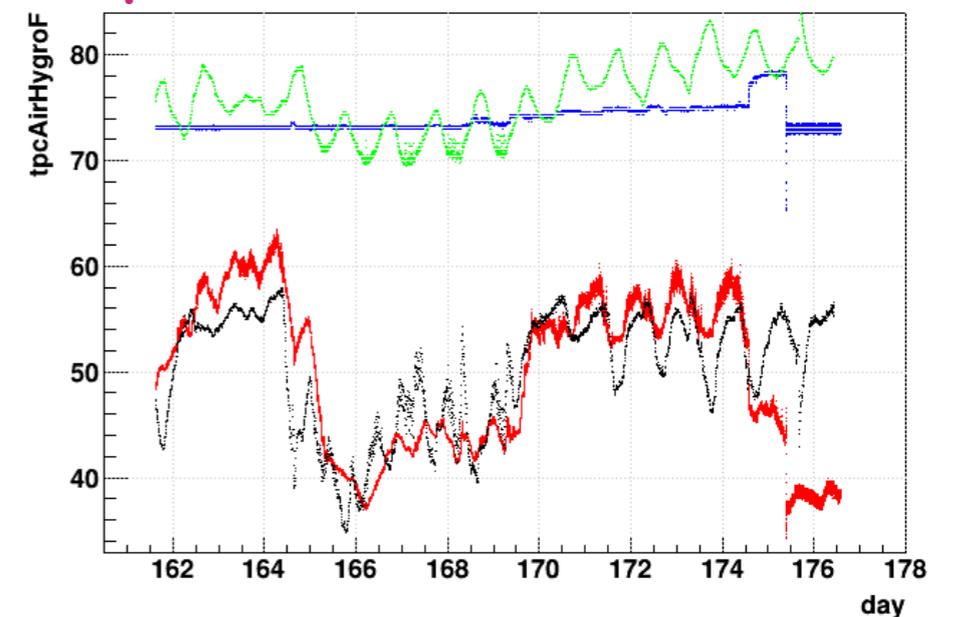
# Humidity in Run 20

- Temperature and humidity of air blown through inner field cage wasn't well controlled during first week of running in June
  - Temp gradient across the TPC can affect TPC drift velocity - not yet analyzed
- Humidity above ~43% increases conductivity of inner field cage, potentially affecting E field uniformity

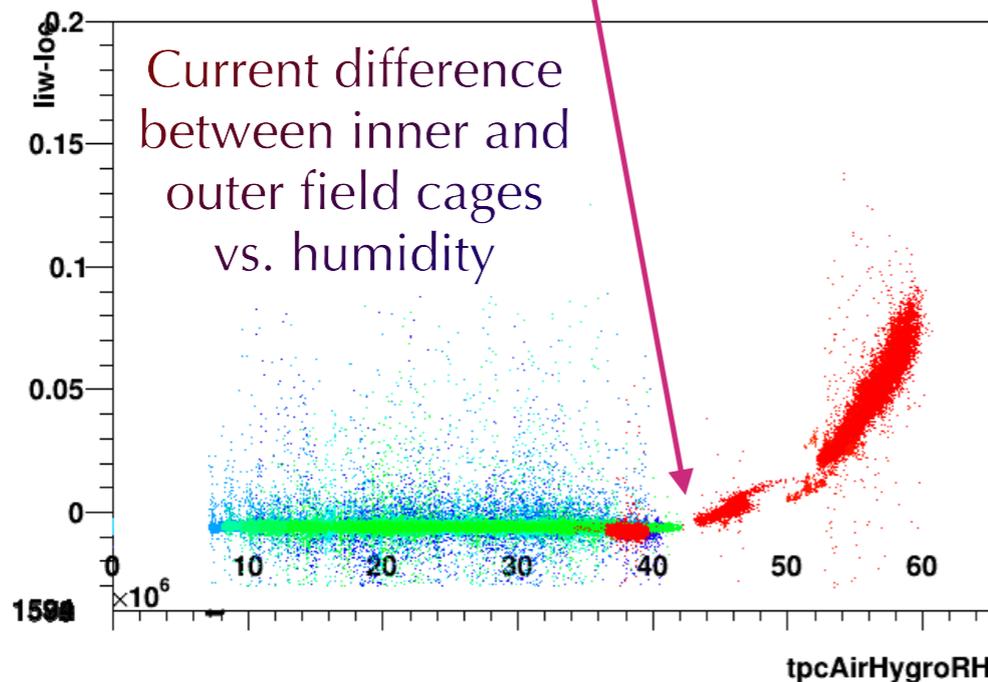
tpcAirHygroF:day {day>-50}



tpcAirHygroF:day {day>150}



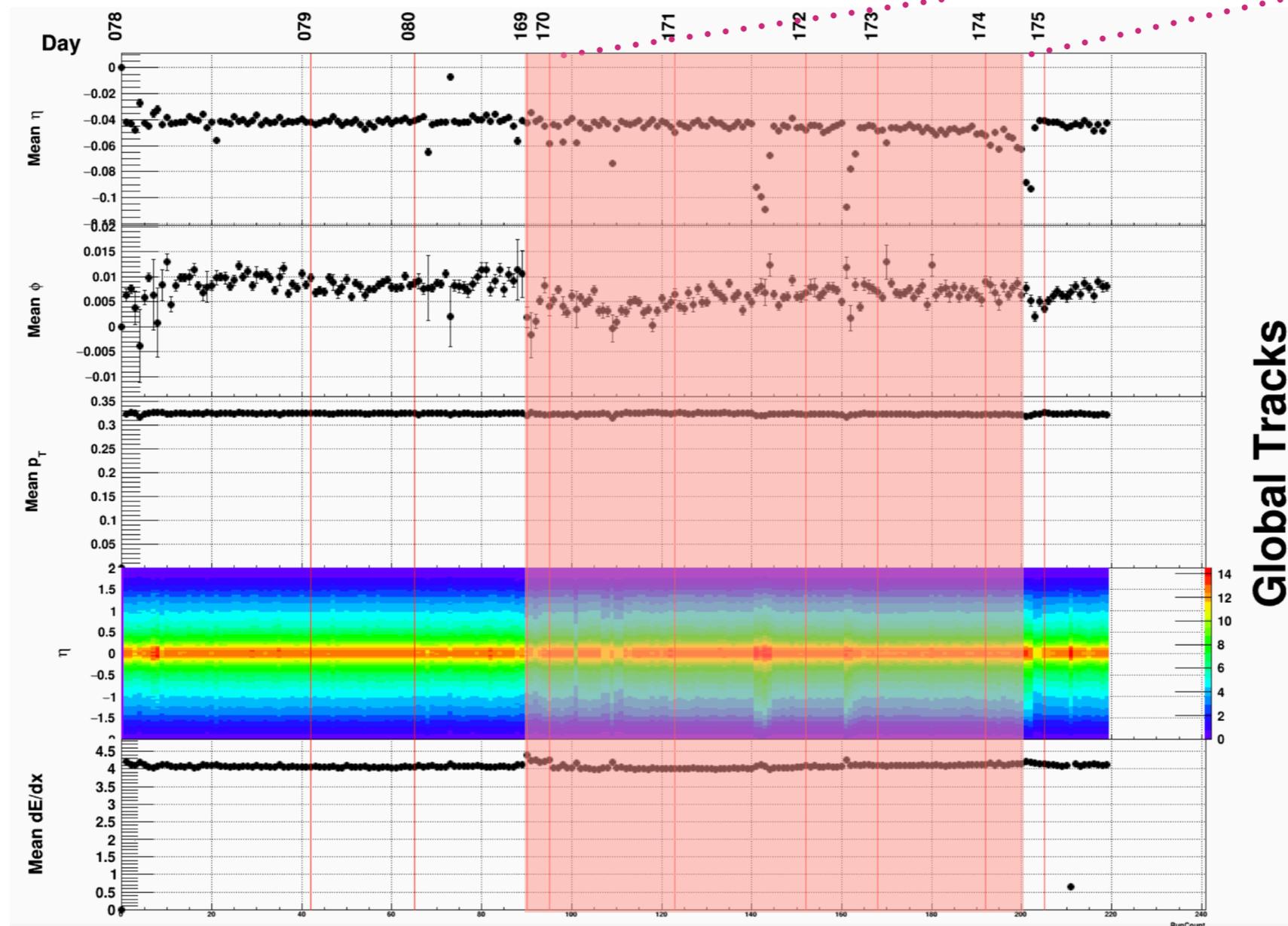
liw-loe:tpcAirHygroRH:t:t {loe>76.2&&liw>76.2&&t>1570e6&&liw-loe>-0.03}



red: blower air humidity  
 blue: blower air temperature  
 green: hall air humidity  
 black: hall air humidity

# Humidity in Run 20

- Careful look for impacts has not yet been done, but no gross impact seen in QA so far
- Impact should be widespread in phase space for days 169-174



# Always something...

- Run 2: SpaceCharge
- Run 4: fluctuating SpaceCharge
- Run 5: GridLeak
- Run 6: field cage shorts, sometimes varying
- Run 7: alignment
- Run 8: asymmetric SpaceCharge; floating gating grid wires
- Run 9: slewing; reduced voltages on some anodes; massive pile-up
- Runs 10-12: alignment again (h-/h+)
- Run 13: field cage current losses to ionized air
- Runs 14 & 16: need to account for SpaceCharge uncertainty for HFT
- Run 17: fill-by-fill SpaceCharge
- Run 18: abort gap cleaning; booster main magnet; humidity-induced field-cage conductivity; disconnected gating grid on a sector
- Run 19: GridLeak-mitigating "wall"
- Runs 19 & 20: iTPC alignment, booster main magnet
- Runs 19 & 20 FXT: event-by-event T0s

I'm sure I've missed several more things!