Terminology in Event Counting

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In the context of the DSelector, what means?

- Event
- Trigger
- Final State
- Beam Photon
- Combo
- Final-State-Combo
- Accidental

Event

- A beam photon interacts with a target particle and results in Final State particles.
- Any analysis looks for events with a specific number AND type of Final State particles.
- Detecting all Final State particles of the reaction in a given event is an "Exclusive Event"

Trigger

- A trigger is generated when the sum of the total deposited energy in the two calorimeters FCAL and BCAL are above a certain threshold.
- At this point all detectors report their measured quantities to the DAQ system.
- This requires timing: $\Rightarrow$ rate dependence (dead time).

Final State

- This is the event topology of your analysis. It is the number and type of particles in the reaction of your specific analysis.
- This does NOT include the beam photon! That is an "Initial State" particle!
- Any "reconstructed" event has to have at least the number and types of required Final State particles for YOUR particular analysis (reaction).
- Number of reconstructed particles and types (N_r) is always $\geq$ Number and type of Final State particles (N_{FS}) in YOUR reaction/analysis.

Beam Photon

- Is part of the "Initial State" NOT the "Final State".
- Each tagger hit in the time window of the trigger represents a beam photon.
- The number of beam photons is rate dependent!!!!!
- A "Prompt Beam Photon" or "In Time Beam Photon" refers to a photon with the same RF timing as the Event.
- An "Out Of Time Beam Photon" refers to a photon (tagger hit) with a timing that precedes or trails the Event RF bunch.

Combo

- A "Combo" constitutes a combination of "Final State" particles, required and defined by YOUR analysis(reaction), AND a "Beam Photon" that is subjected to the kinematic fitter.
- By this definition, a "combo" always involves a "beam photon" AND the kinematic fitter!
- A "Combo" is **NOT** an "Event"! Stop using these two words for the same thing!!!!

Final-State-Combo

- NEW term used by me! You should use it too!
- If $N_r \geq N_{FS}$, then there is MORE than one possible way to combine reconstructed particles into a Final State as required by the analysis/reaction.
- There is NO beam photon required/involved at this stage.

Accidental

- A beam photon we can identify as such.
- Meaning it is "out-of-time", it belongs to a beam bunch "out-of-time"
- It refers to an "accidental tagger hit" resulting in a reconstructed beam photon that did NOT initiate/cause the event/trigger/readout.
- The number of accidental beam photons IS RATE DEPENDENT!

Technical Facts

- Two Beam Bunches are separated by 4.008 ns. (Beam RF structure, 1497MHz 1/6)
- Two Beam Photons with the same energy are separated in time by at least 25 ns. (due to Detector/Discriminator/Electronics dead time!)

Most Simple Event

- $N_r = N_{FS}$ AND only one single "prompt" beam photon.
- This event has exactly ONE combo.
- The single combo will have weight 1.
- We do NOT know if the beam photon is the ONE that caused the reaction! It could be an accidental!

Still kind of Simple Event

- $N_r = N_{FS}$
- There are $N_\gamma > 1$ beam photons (any timing)
- There will be "at most" N_γ combos for this event in the DSelector tree.
- If a combo survives all cuts it will receive a weight of 1 if a "prompt" beam-photon was used and -1/B if an "out-of-time" beam photon was used.

More complicated Event

- $N_r > N_{FS}$
- There are $N_\gamma > 1$ beam photons (any timing)
- There will be potentially multiple different final states (NOT ALL THE SAME FS PARTICLES) in combination with some beam photons with which the kinematic fitter will converge.
- Multiple Final-State-Combos (this does NOT involve the beam photo yet) are a potential cause for over counting!

Mass Constraints

This is regarding the kinematic fitter:

- Combining 2 neutral showers into a π^0 and fix its mass is a mass constraint.
- Assign a particle type to a charged track: π^+ for a positive charged track is a mass constraint.