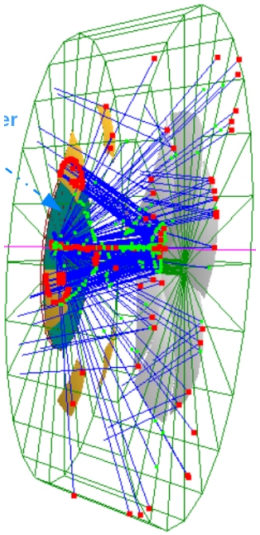


IRT based global reconstruction

Nt : tracks (+ background «dummy track»)
Nh : photon hits

Nr : radiators (aerogel and gas)
Np : potential particle types (e,pi,K,p)

~40% of PYTHIA events have multiple tracks in dRICH

~50% of them overlapping rings;

Simple IRT → contamination>10%

Main goal: reduce the combinations required by brute-force: **(Nt*Nr+1)^Nh**
Our global approach split the problem in two main steps: hits association and then choose the best global hypothesis:

1. For a single event: consider all hypothetical combinations of {particle_types} ↔ {tracks,radiators}
2. For each hypothesis: associate all detected photons, one by one, to the {tracks,radiators} using a sort of "adaptive" likelihood "L1";
3. Choose the best hypothesis based on a second likelihood "L2" that maximize angular correlation and number of expected photons

Example: event with 2 tracks and 15 hits
Brute Force: up to **~488 billion** combinations
Our approach: **1200** combinations

Different L1 expressions considered

$$L_1(p,t,r;h) \equiv G(\theta_h^{t,r}|\theta^{c,r},\sigma_{\theta^{c,r}}) \cdot P_S(N_a^{c,r}+1;N^{c,r})$$

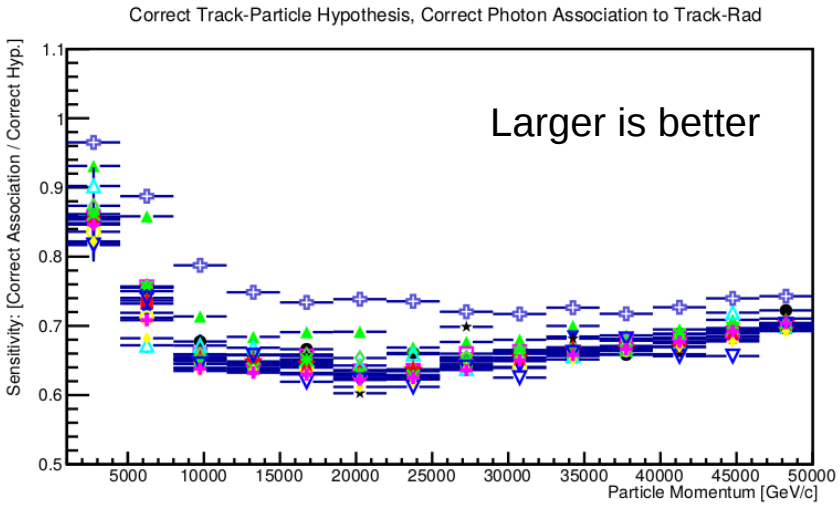
Likelihood on correlation of reconstructed angle

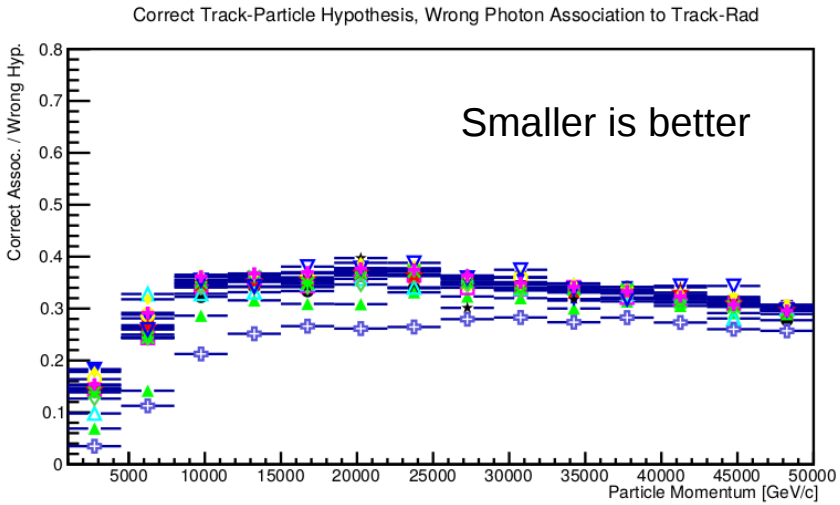
Likelihood on number of assigned photons to the track/rad/part

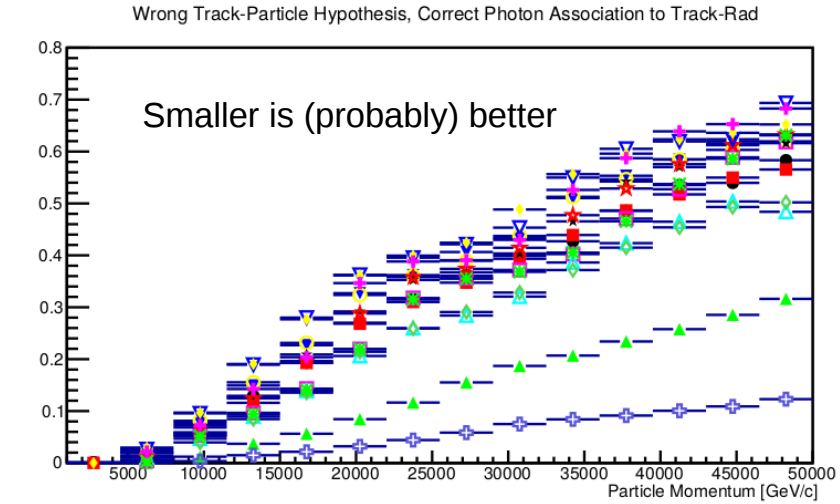
- Gaussian distribution with max=1
- Normalized gaussian (integral = 1)
- ERF function
- =1 (no contribution)
- Combine probability of correlation to a track/rad and anticorrelation to the other tracks

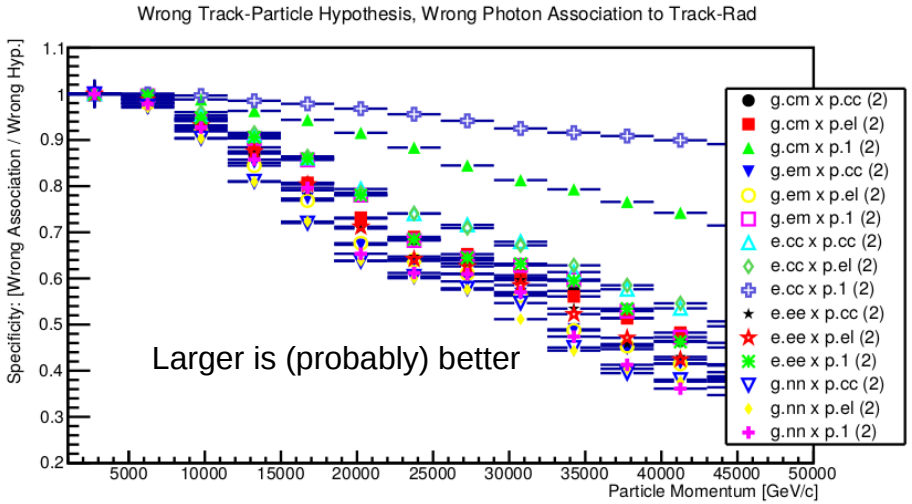
- Cumulated Poisson: sort of probability to assign one or more photon to a given track/rad…)
- Partitioning: enumerate all combinations on “n” photons into “m” partitions (track/rad..);
- =1 (no contribution)

Hit association to {track,radiator} for different L1









Winner: ERF_correlation*ERF_anticorrelation, Poisson=1 ! (no adaptive update)

Next steps

1) Still thinking on how to use the expected number of photons in the hit association (L1); the new results show that only angle is relevant in hit association; the number of photons information is used in L2 only. Want to explore the “very last” idea based on probability to randomly extract photon belonging to a given track/rad.

2) Then update the PID plots (no significant changes expected)

3) Then update the article accordingly