Impact of the photocathode index on the number of photons detected

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Frenel's laws:

$$r_{\parallel} = \frac{tan(\theta_i - \theta_t)}{tan((\theta_i + \theta_t)}; r_{\perp} = -\frac{sin(\theta_i - \theta_t)}{sin((\theta_i + \theta_t)}$$

$$t_{\parallel} = \frac{2sin(\theta_t)cos(\theta_i)}{sin(\theta_i + \theta_t)cos(\theta_i - \theta_t)}; t_{\perp} = \frac{2sin(\theta_t)cos(\theta_i)}{sin(\theta_i + \theta_t)}$$

Energy conservation:

$$r^2 + t^2 \frac{n_2 cos(\theta_t)}{n_1 cos(\theta_i)} = 1$$

Goal:

- Evaluate the number of photons transmitted between the quartz window and the photocathode.

Methods:

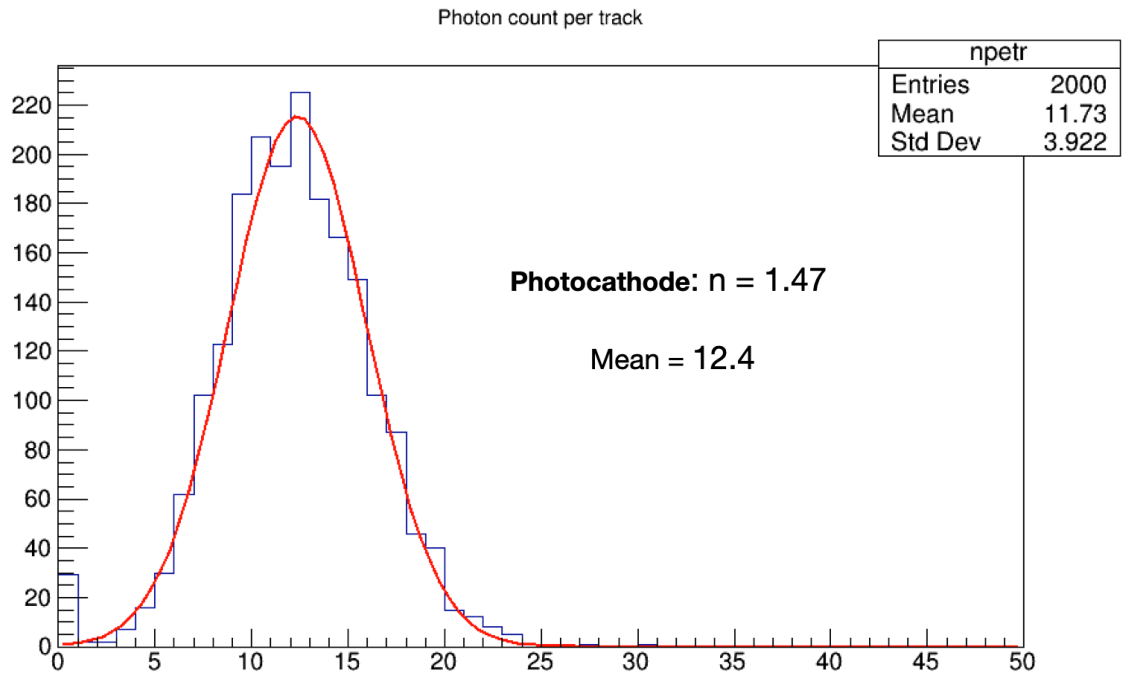
- **Frenel's laws and energy conservation formula**;
- **pfRICH simulation based on GEANT4**.

Simulation results

Simulation information

- 2000 events;
- Pions at P = 10 GeV and $\eta = -2.5$;
- **Photocathode index**: n $\in$ (2.00, 2.50, 3.00, 3.50, 4).

Number of Cherenkov photons for n=1.47:



Comparison

- (i) Gas index: $n_1 = 1$;
- (ii) **Quartz windows index**: $n_2 = 1.45$;
- (iii) **Photocathode index**: $n_3 \in (1.47, 2.00, 2.50, 3.00, 3.50, 4)$;