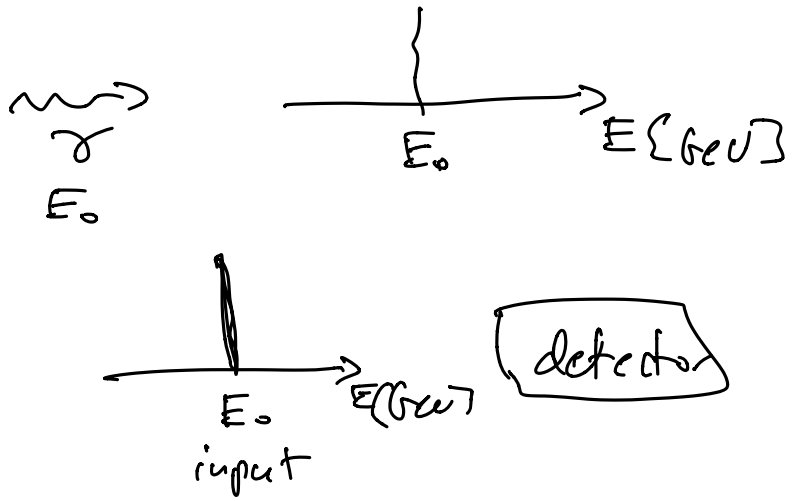
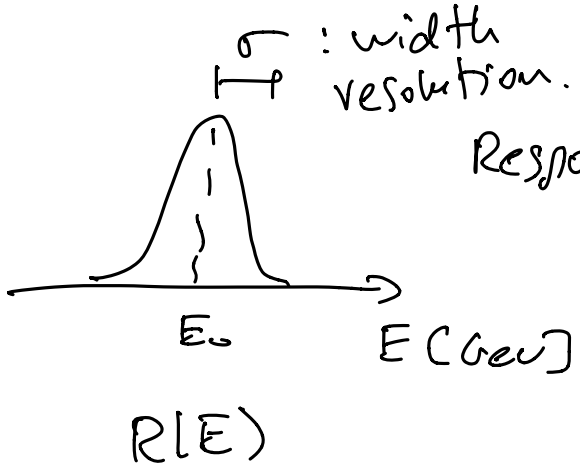




$N(E) = \delta(E - E_0)$ theoretical.

$$N(E) = \begin{cases} N_0 & E > E_0 \\ \emptyset & E \neq E_0 \end{cases}$$

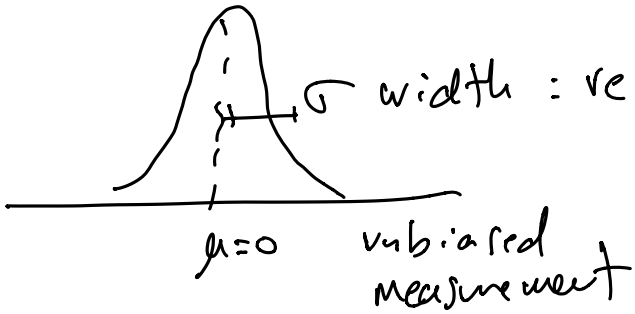
$$N(E) \longrightarrow R(E)$$

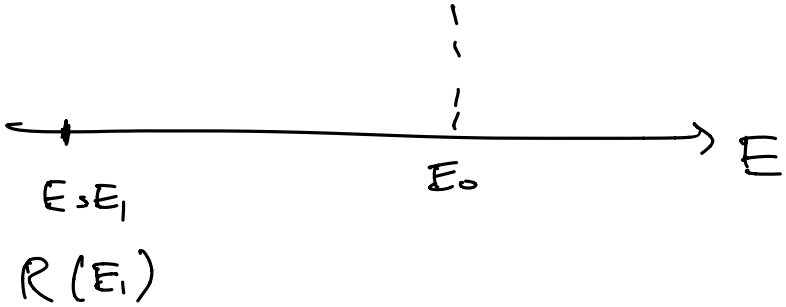
$$R(E) = \int_{-\infty}^{+\infty} N(E')\, G(E - E' \mid \mu = 0, \sigma)\, dE'$$

$N(E')$: physics input

$G(E - E' \mid \mu = 0, \sigma)$: Detector resolution

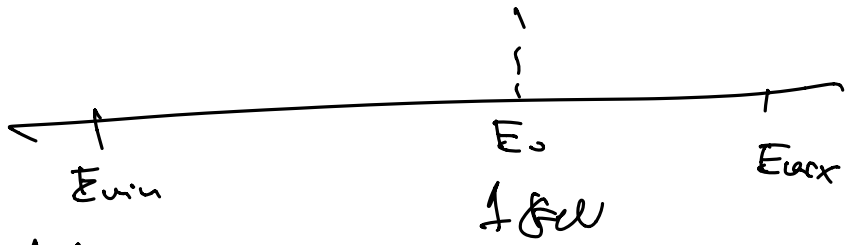
Best case scenario: Gaussian.





$$R(E) = \sum_{E_i} N(E_i)\, G(E - E_i \mid \mu = 0, \sigma)$$

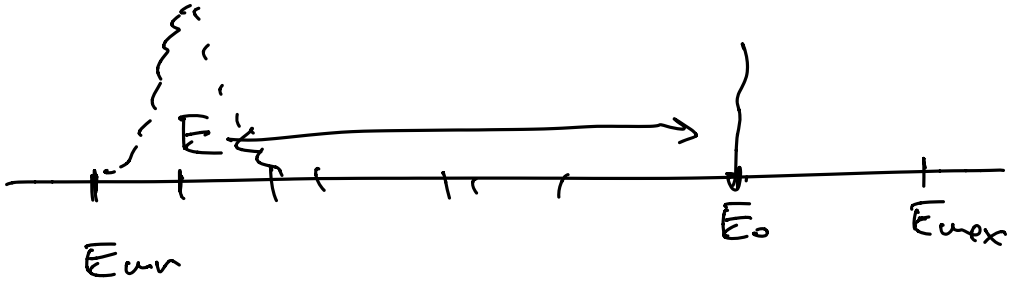
$E_i \in [E_{min}, E_{max}]$



E_{min}, E_{max} → best estimator of $+\infty$

↙ best estimator of $-\infty$

$E_{min} = E_0 - 5\sigma$, $E_{max} = E_0 + 5\sigma$



$G(E - E_0)$ $\quad E - E_0 \simeq 5\sigma$

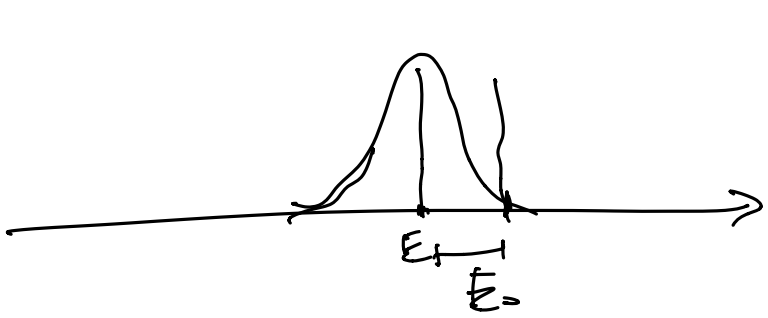
$$G(E - E_0) = e^{-\frac{(E-E_0)^2}{2\sigma^2}} \simeq 0$$

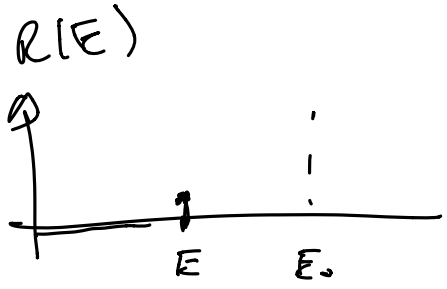
$N(E) \neq 0 \quad E \leq E_0$

$E' \leq E_0$

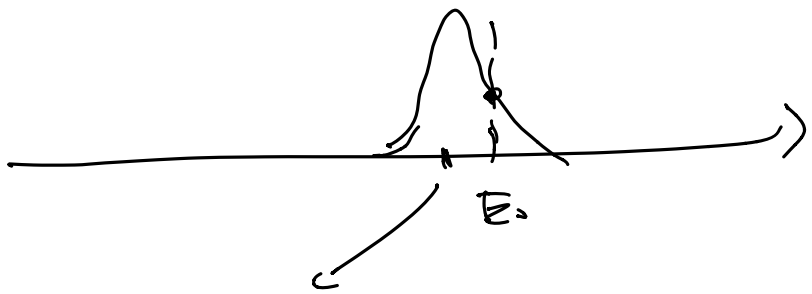
$$R(E) \simeq G(E - E_0)\, N(E_0)$$

$R(E) \simeq 0$.

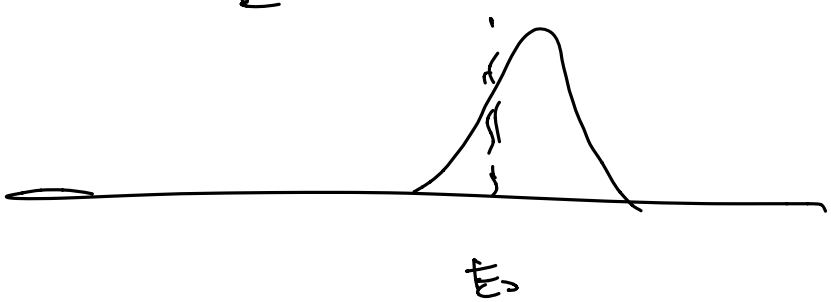


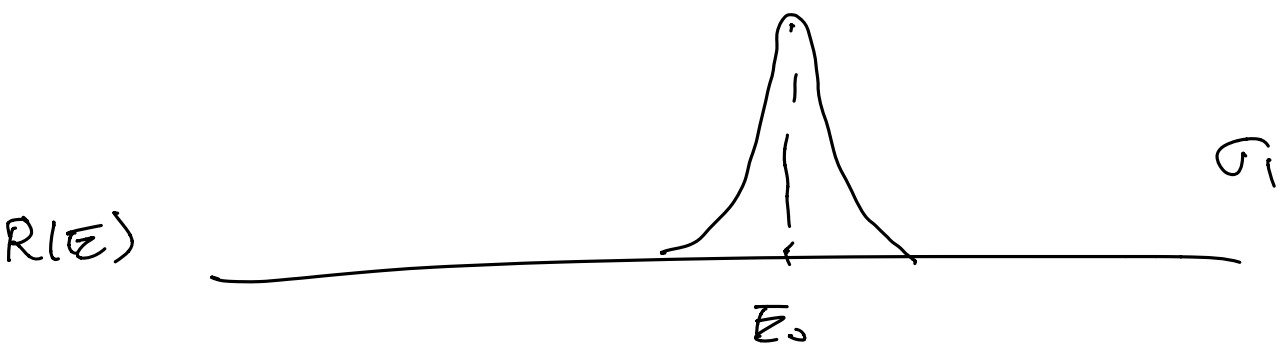


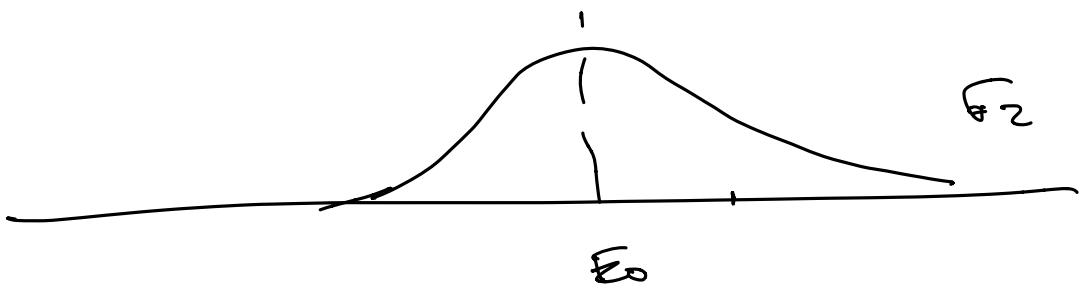
$E - E_0 \simeq 3\sigma \Rightarrow G \neq 0$

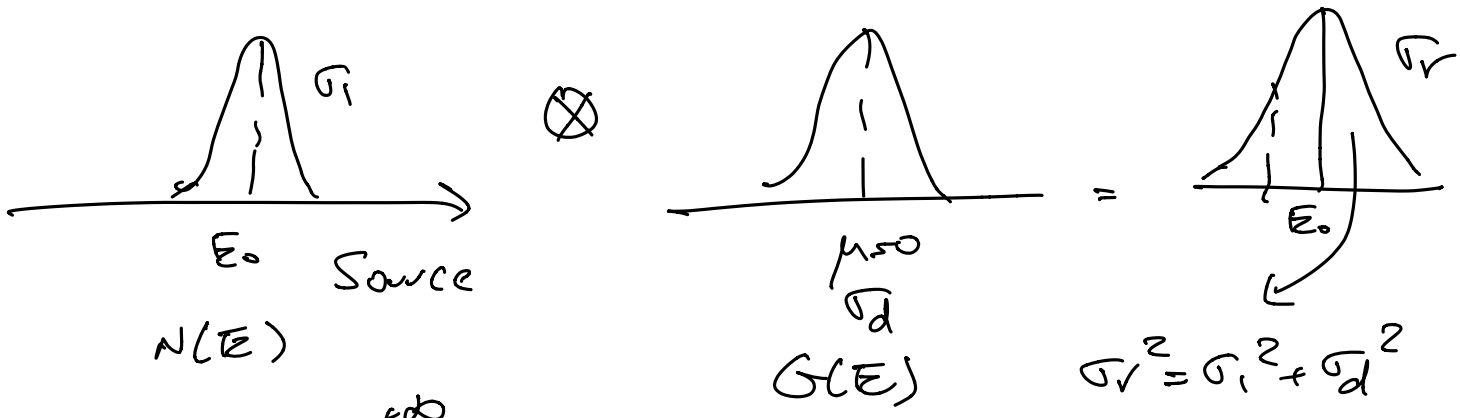


E









$\sigma_r^2 = \sigma_i^2 + \sigma_d^2$

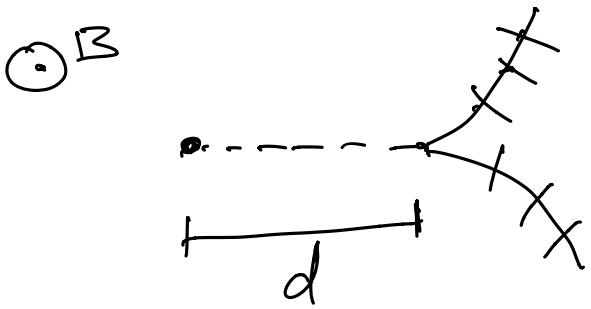
$$N \otimes G \equiv \int_{-\infty}^{+\infty} N(E')\, G(E - E' / \mu = 0, \sigma)\, dE'$$

Lifetime of particles

unsteble particles: lifetime τ

$$N(t) = N_0 e^{-t/\tau}$$

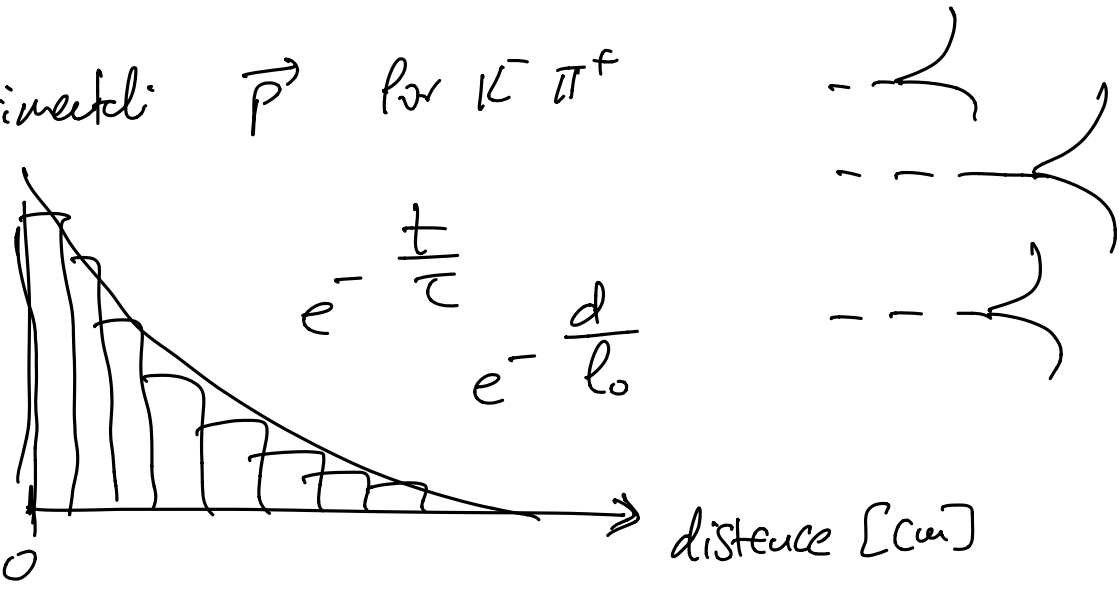
$D^0 \longrightarrow K^- \pi^+$

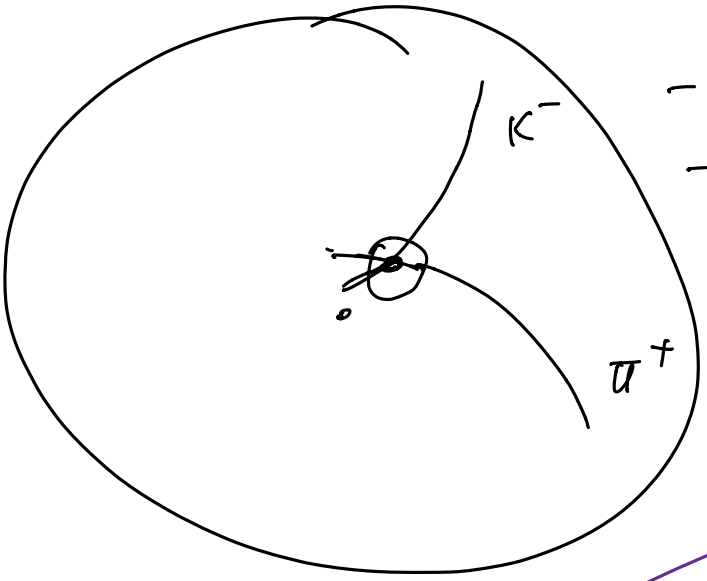


$d = \beta\gamma c\tau$

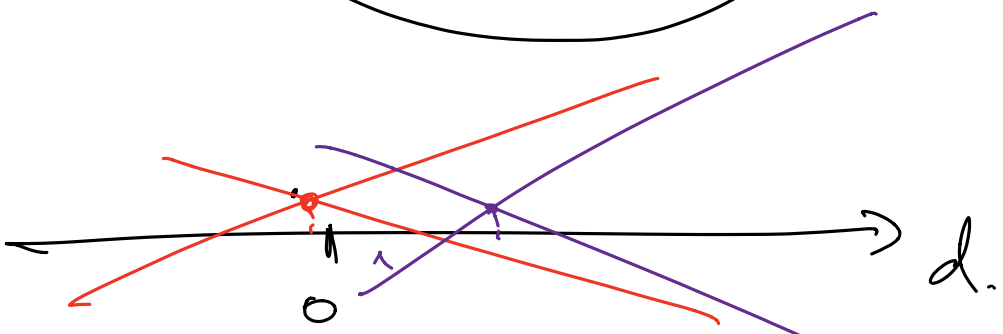
Br of D^0

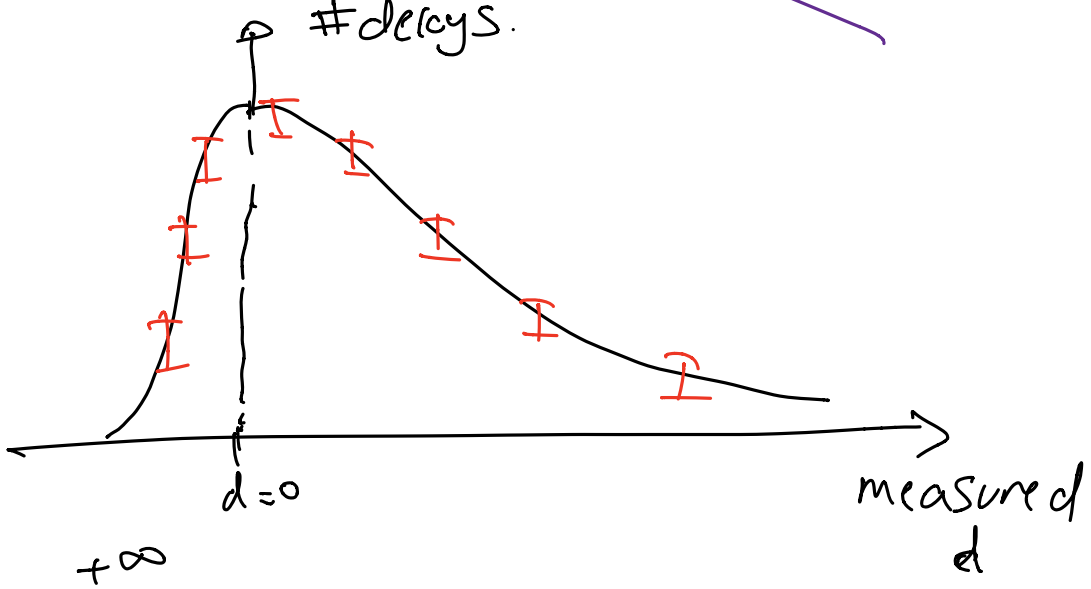
Experimentali $\vec{p}$ for $K^- \pi^+$



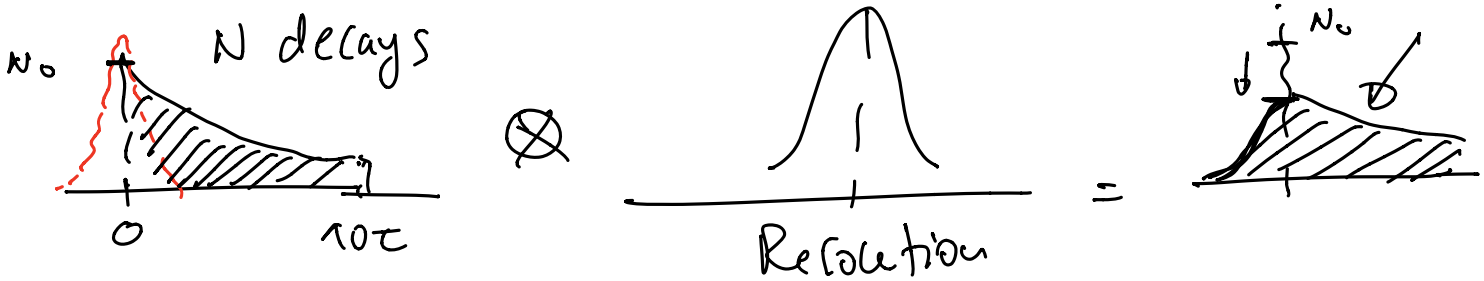


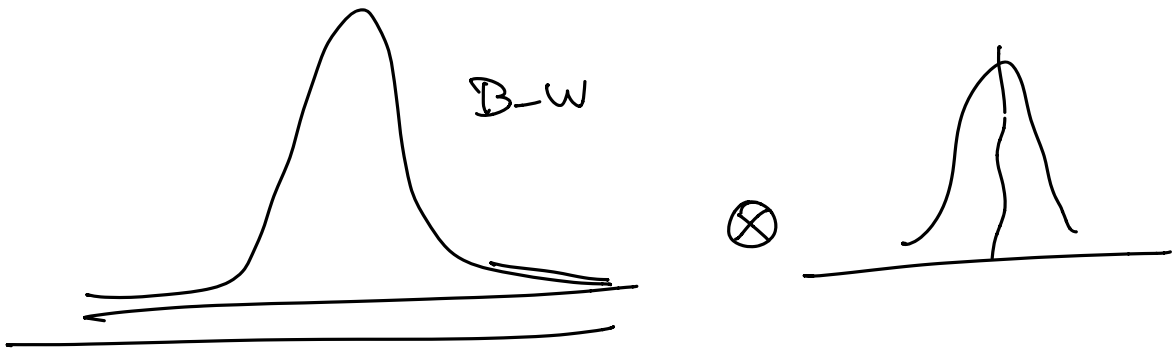
- First identify K^-, π^-
- estimate decay vertex





$$\text{Decay}(x) = \int_{-\infty}^{+\infty} \text{Real Decay}(x')\, G(x - x' \mid \mu = 0, \sigma)\, dx'$$





Voigtian function

$$\frac{1}{(E-E_0)^2 + \Gamma^2}$$

Detector with resolution 10%

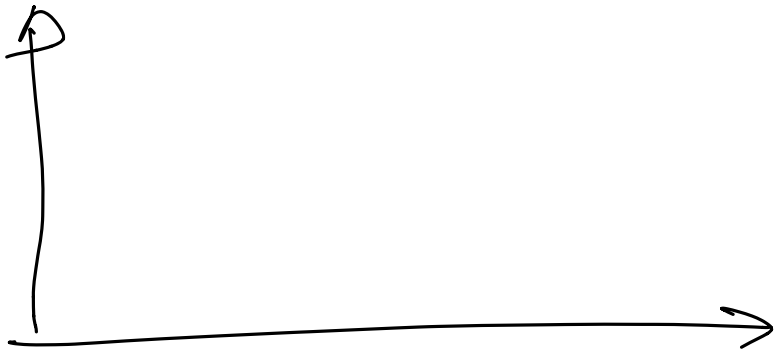
Focus energy of $3\ GeV = E_0$

$$\sigma = 10\% \times E_0 = 300\ MeV = 0.3\ GeV$$

3 ± 0.1 ERROR

⊗

G( )



Draw TH1F before and after

```
TH1F h1("h1", "before conv", --)
TH1F h2("h2", "after conv", --)

h1.Draw()
h2.Draw("same")
```