The background of the slide is filled with various physics equations in white and black text. On the left side, there is a vertical black bar containing white equations. The rest of the slide has a light gray background with faint, overlapping equations in white. Some of the visible equations include: $E_k = \frac{1}{2}mv^2$, $-\frac{\hbar^2}{2m} \frac{d^2\psi}{dx^2} + V\psi = E\psi$, $U_{ef} = \frac{U_m}{\sqrt{2}}$, $\vec{B} = \mu_0 \frac{NI\sqrt{2}}{2\pi r}$, $k = \frac{p^2}{2m} m_0 = \frac{M_p}{N}$, $\lambda = \frac{h}{\sqrt{2eUm}}$, $f_0 = \frac{1}{2\pi} \sqrt{\frac{g}{l}}$, $\oint \vec{B} \cdot d\vec{l} = \mu_0 \int_S \vec{J} \cdot d\vec{S}$, $v_k = \sqrt{\frac{3kT}{m_0}} = \sqrt{\frac{3kTN}{M_m}}$, $\lambda = \frac{\ln 2}{T} F_h$, $\left(\frac{E_t}{E_0}\right)_{\parallel} = \frac{2 \cos \vartheta_1 \cos \vartheta_2}{\cos(\vartheta_1 - \vartheta_2)}$, $E_y = E_0 \sin(kx - \omega t)$, $S = \frac{1}{A} \frac{dW}{dt}$, $2 \operatorname{tg} \vartheta_B = \frac{m_2}{m_1} = m_{21}$, $pV = nRT$, $\vec{\Psi} = \iint \vec{D} \cdot d\vec{S} = AD$, $H_\lambda = \frac{\Delta Me}{\Delta \lambda}$, $\frac{\Delta \varphi}{2\pi} = \frac{\Delta x}{\lambda} = \frac{x_2 - x_1}{\lambda} S_2$, $V = c/\lambda$, $\Phi = NBS$, $k = \frac{2\pi}{\lambda}$, $\omega = \sqrt{\frac{m_0}{m_2}}$, $\vec{F}_m = \vec{B} I l = \frac{\mu_0 I_1 I_2}{2\pi d} l$, $X_L = \frac{U_m}{I_m} = \omega L = 2\pi f L$, $F_g = \frac{m_1 m_2}{(r_2 + r_1)^2}$, $\vec{r}_m = \frac{c}{T} k = \pm \sqrt{\frac{2m}{\hbar^2} (E - V_0)}$, $\vec{E} = \frac{1}{2} \hbar / k / m$, $\beta = \frac{\Delta E}{E} = \frac{\Delta \omega}{\omega} = \frac{\omega_2 - \omega_1}{\omega}$, $\vec{D} \cdot d\vec{S} = Q$, $R = \frac{U}{I}$, $W_2 = U_e I t$, $F_v = \int \frac{F_n}{R}$, $M = F d \cos \alpha$, $\lambda^* T = b$, $\int \vec{E} \cdot d\vec{l} = - \int \frac{\partial B}{\partial t} \cdot d\vec{S}$, $p = \frac{E}{c} = \frac{\hbar f}{c} = \frac{\hbar}{\lambda}$, $u = U_m \sin \omega(t - \tau) = U_m \sin 2\pi \left(\frac{t}{T} - \frac{x}{\lambda}\right)$.

Hledání Higgsova bosonu na ATLAS

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J. Štorek
supervisor: J. Fodorová

Standardní model

Three Generations of Matter (Fermions)

	I	II	III	
mass →	2.4 MeV	1.27 GeV	171.2 GeV	0
charge →	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0
spin →	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
name →	u up	c charm	t top	γ photon
	4.8 MeV	104 MeV	4.2 GeV	0
	$-\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	0
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
	d down	s strange	b bottom	g gluon
	< 2.2 eV	< 0.17 MeV	< 15.5 MeV	91.2 GeV
	0	0	0	0
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	Z weak force
	0.511 MeV	105.7 MeV	1.777 GeV	80.4 GeV
	-1	-1	-1	±1
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
	e electron	μ muon	τ tau	W[±] weak force

Quarks

Leptons

Bosons (Forces)

$$E_k = \frac{1}{2} m v^2$$

$$-\frac{\hbar^2}{2m} \frac{d^2 \psi}{dx^2} + V \psi = E \psi$$

$$U_{ef} = \frac{U_m}{v}$$

$$\vec{B} = \mu_0 \frac{NI \sqrt{2}}{r}$$

$$k = \frac{p^2}{2m} m_0 = \frac{M_p}{N_A}$$

$$\lambda = \frac{h}{p}$$

$$f_0 = \frac{1}{2\pi} \sqrt{\frac{g}{l}}$$

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I$$

$$v_k = \sqrt{\frac{3kT}{m_0}} = \sqrt{\frac{3kTN_A}{M_m}}$$

$$\lambda = \frac{h \nu_2}{T} F_h = S h p g$$

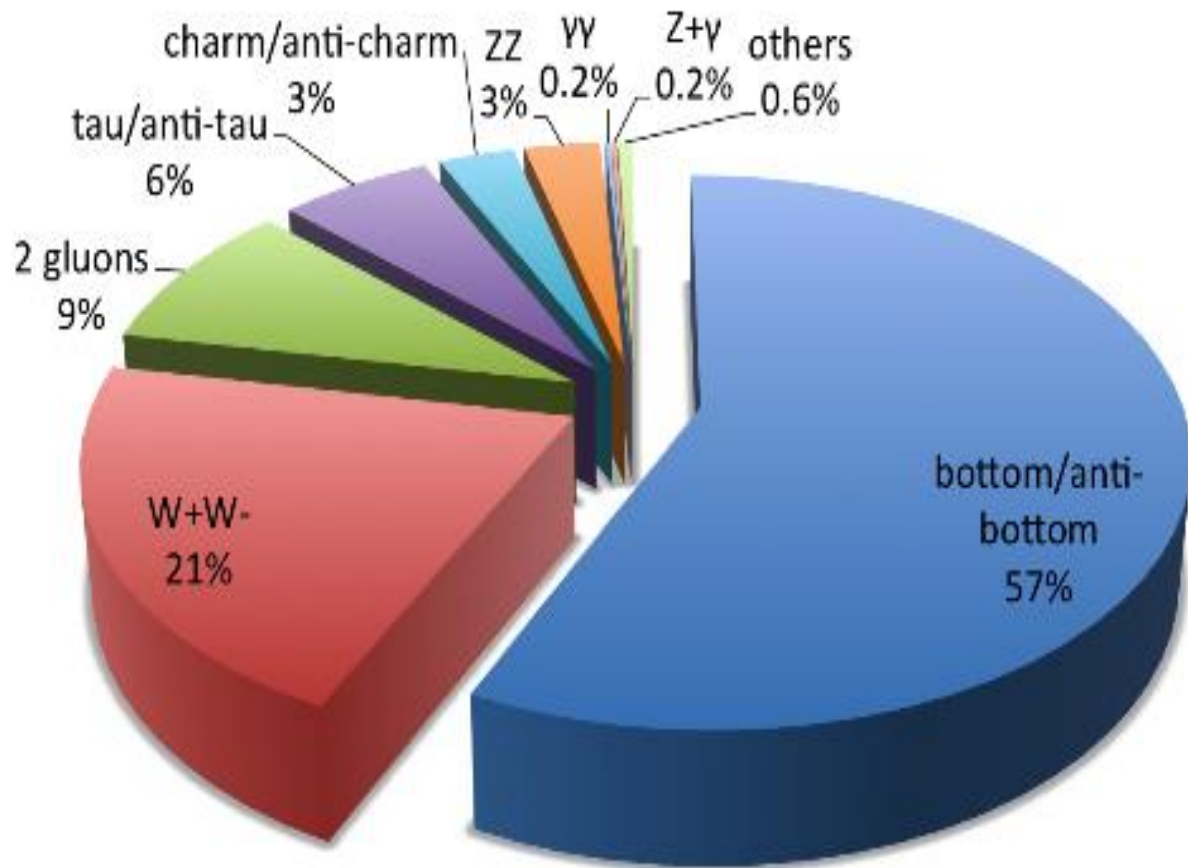
$$\left(\frac{E_t}{E_0} \right)_{\parallel} = \frac{2 \cos \vartheta_1 \cos \vartheta_2}{\cos(\vartheta_1 - \vartheta_2) \sin(\vartheta_1 + \vartheta_2)}$$

$$E_y = E_0 \sin(kx - \omega t)$$

$$S = \frac{1}{A} \frac{dW}{dt}$$

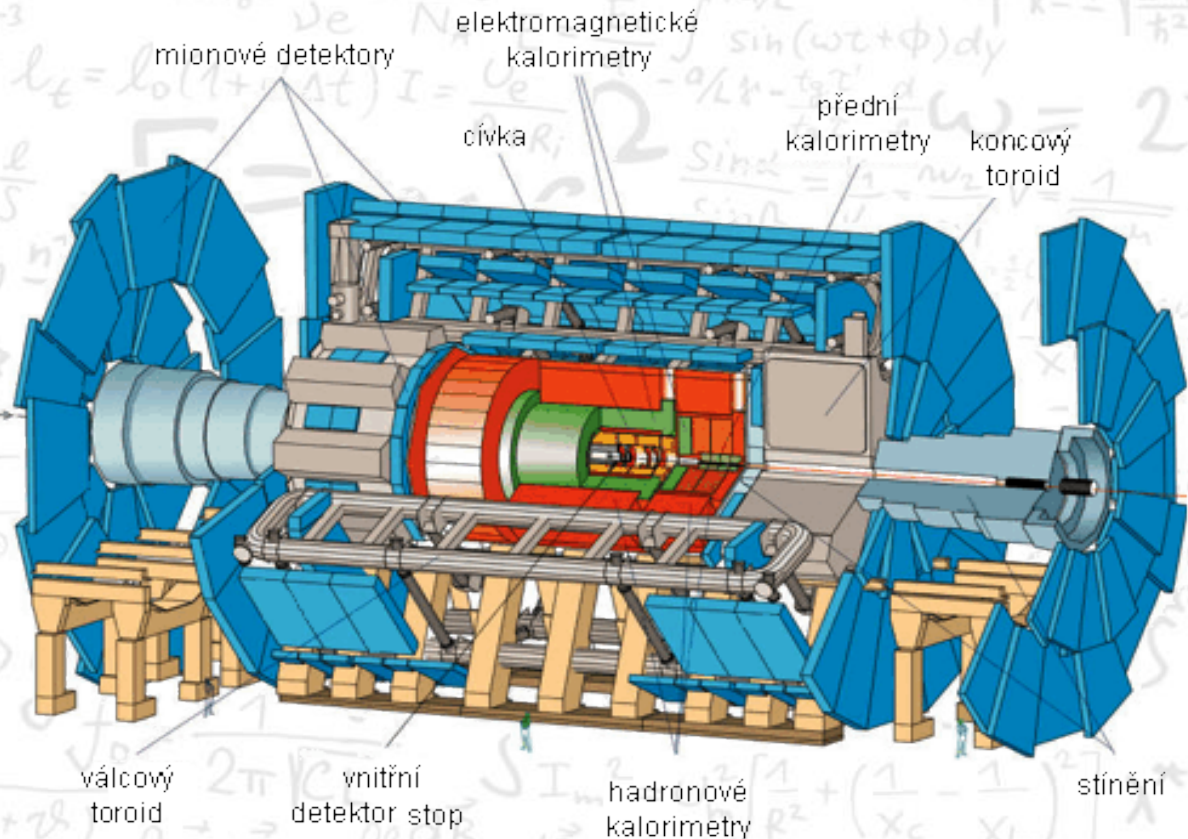
Rozpad Higgse

Decays of a 125 GeV Standard-Model Higgs boson



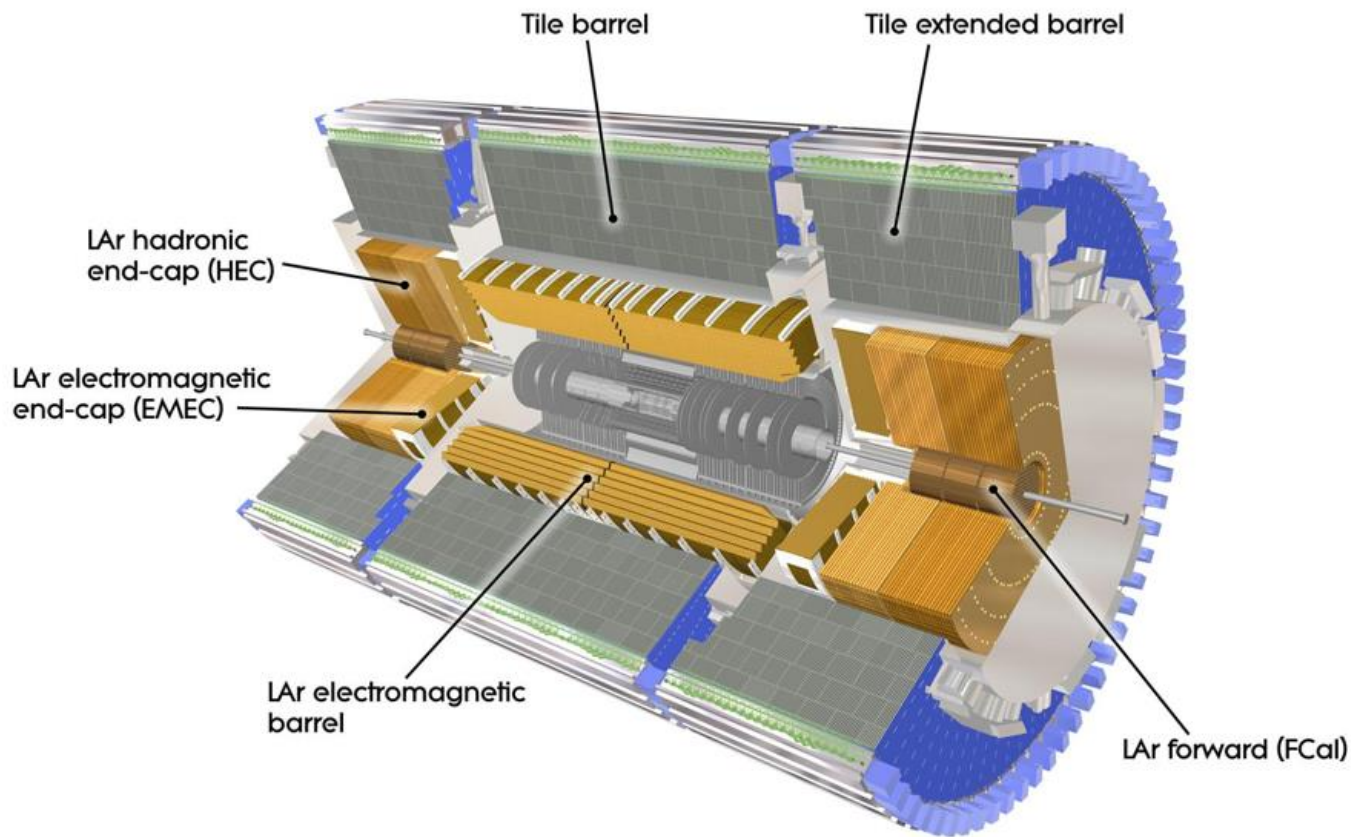
Detektor ATLAS

- 45 × 25 × 25m



Detekce částic

- Pomocí vrstev kalorimetrů



Výpočty

- program HYPATIA
- náboj, zakřivení částice → hybnost
- hybnost, energie → hmotnost

$$E_k = \frac{1}{2} m v^2$$

$$-\frac{\hbar^2}{2m} \frac{d^2\psi}{dx^2} + V\psi = E\psi$$

$$U_{ef} = U_m$$

$$\vec{B} = \mu_0 \frac{NI\sqrt{2}}{2\pi r}$$

$$k = \frac{p^2}{2m} = \frac{M_p}{2m} = \frac{M_p}{M_e} = \frac{1}{\lambda^2}$$

$$\lambda = \frac{h}{p}$$

$$f_0 = \frac{1}{2\pi} \sqrt{\frac{g}{l}}$$

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 \int_S \vec{J} \cdot d\vec{S}$$

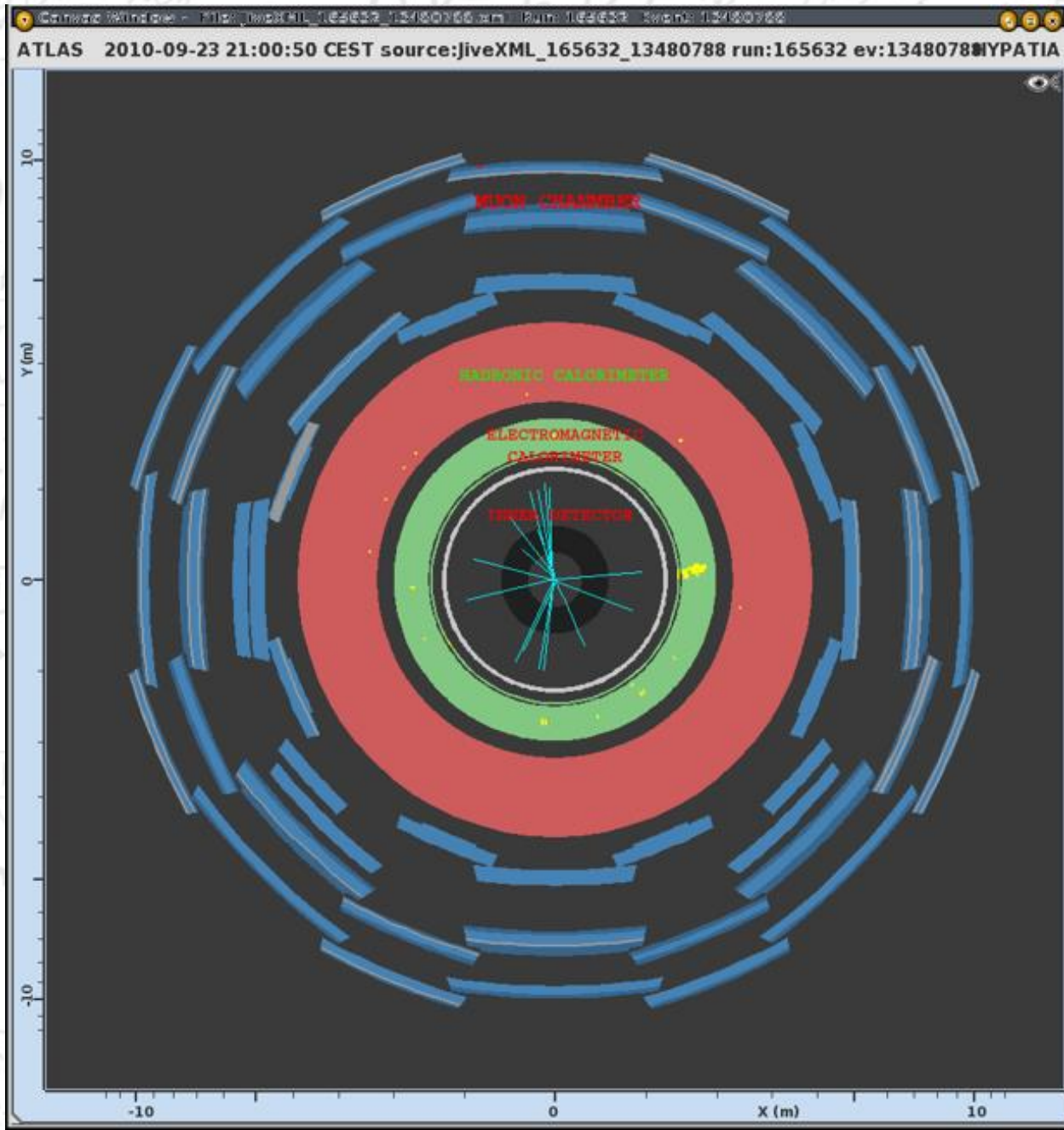
$$v_k = \sqrt{\frac{3kT}{m_0}} = \sqrt{\frac{3kTN_A}{M_m}}$$

$$\lambda = \frac{\ln 2}{T} F_h = S$$

$$\left(\frac{E_t}{E_0}\right)_{\parallel} = \frac{2 \cos \theta_1 \cos \theta_2}{\cos(\theta_1 - \theta_2)}$$

$$E_y = E_0 \sin(k_x x - \omega t)$$

$$S = \frac{1}{A} \frac{dW}{dt}$$



$$4\lambda = \frac{\Delta E_e}{\Delta \lambda}$$

$$\Delta = NBS$$

$$\frac{I_1 I_2}{2\pi d}$$

$$\frac{M}{2} (E - V_0)$$

$$\frac{v_2 - v_1}{v}$$

$$= Q^*$$

$$\frac{F_n}{R}$$

$$T = b$$

$$u = U_m \sin \omega(t - \tau) = U_m \sin 2\pi \left(\frac{t}{T} - \frac{x}{\lambda} \right)$$

Hybnost

$$E_k = \frac{1}{2} m v^2$$

$$-\frac{\hbar^2}{2m} \frac{d^2 \psi}{dx^2} + V \psi = E \psi$$

$$U_{ef} = \frac{U_m}{2}$$

$$\vec{B} = \mu_0 \frac{NI \sqrt{2}}{2\pi r}$$

$$k = \frac{p^2}{2m} = \frac{m_0 v^2}{2}$$

$$\lambda = \frac{h}{p}$$

$$f_0 = \frac{1}{2\pi} \sqrt{\frac{g}{l}}$$

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I$$

$$v_k = \sqrt{\frac{3kT}{m_0}}$$

$$\lambda = \frac{\ln 2}{T} F_h$$

$$\left(\frac{E_t}{E_0}\right)_{\parallel} = \frac{2 \cos \vartheta_1 \cos \vartheta_2}{\cos(\vartheta_1 - \vartheta_2) + \sin(\vartheta_1 + \vartheta_2)}$$

$$E_y = E_0 \sin(kx - \omega t)$$

$$S = \frac{1}{A} \frac{dW}{dt}$$

$$2 \tan \vartheta_B = \frac{m_2}{m_1} = m_{21}$$

$$pV = nRT$$

$$\vec{\Psi} = \iint \vec{D} \cdot d\vec{S} = AD$$

$$H_\lambda = \frac{\Delta Me}{\Delta \lambda}$$

$$V = c/\lambda$$

$$\Phi = NBS$$

$$F_m = \vec{B} I l = \frac{\mu I_1 I_2 l}{2\pi d}$$

$$f = \frac{m_1 m_2}{(m_1 + m_2)^2}$$

$$T = \frac{4 n_1 n_2}{(n_1 + n_2)^2}$$

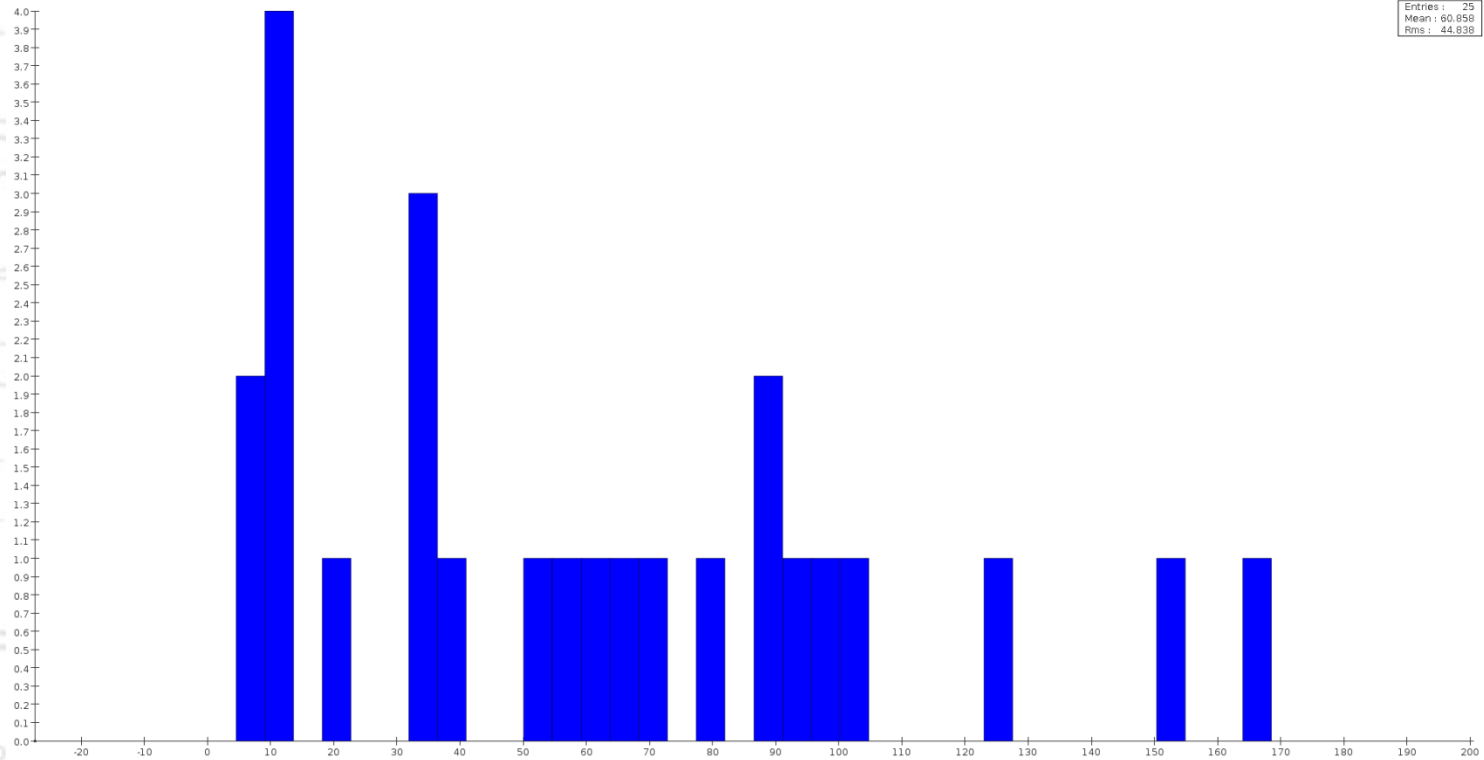
$$W_{AB} = |E_{PA} - E_{PB}| = |V_A - V_B|$$

$$\Phi_E = \frac{q}{\epsilon_0} = k \frac{q}{r^2}$$

$$\Phi = \frac{1}{4\pi r^2}$$

$$X_L = \frac{U_m}{I_m} = \omega L = 2\pi f L$$

$$W = \frac{1}{2} C V^2$$



$$\lambda^* T = b$$

$$R = R_0 \sqrt[3]{A}$$

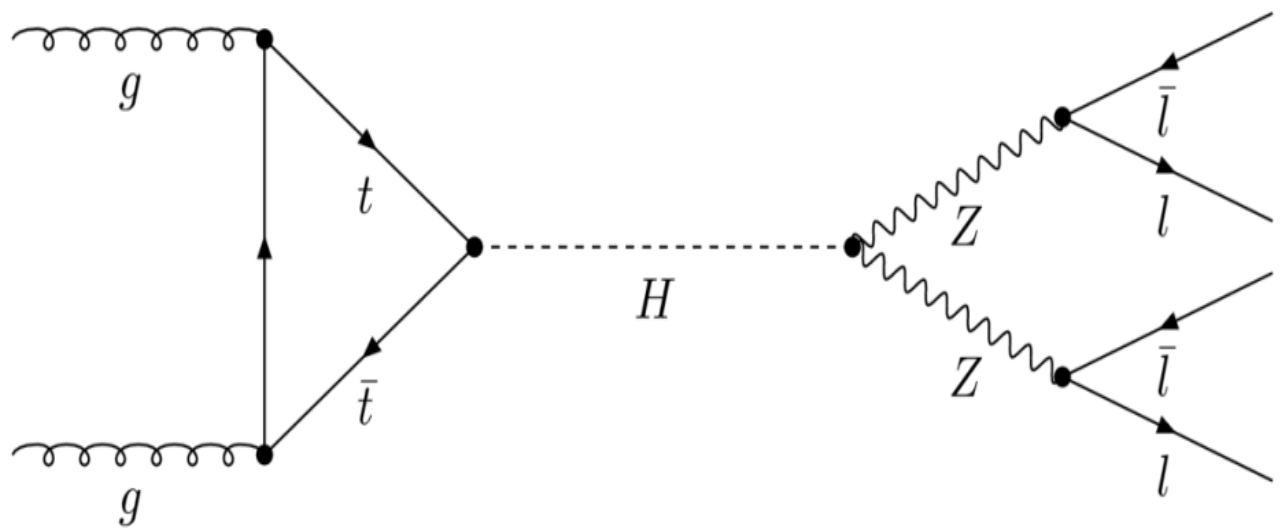
$$\int \vec{E} \cdot d\vec{l} = - \int \frac{\partial B}{\partial t} \cdot d\vec{S}$$

$$p = \frac{E}{c} = \frac{hf}{c} = \frac{h}{\lambda}$$

$$u = U_m \sin \omega(t - \tau) = U_m \sin 2\pi \left(\frac{t}{T} - \frac{x}{\lambda}\right)$$

Výsledky

- Z: $90,7 \pm 0,9 \rightarrow 91,1876$ GeV
- H: $122 \rightarrow 125$ GeV



Poděkování

- Janě Fodorové
- Ing. Vojtěchu Svobodovi
- Vám za pozornost!