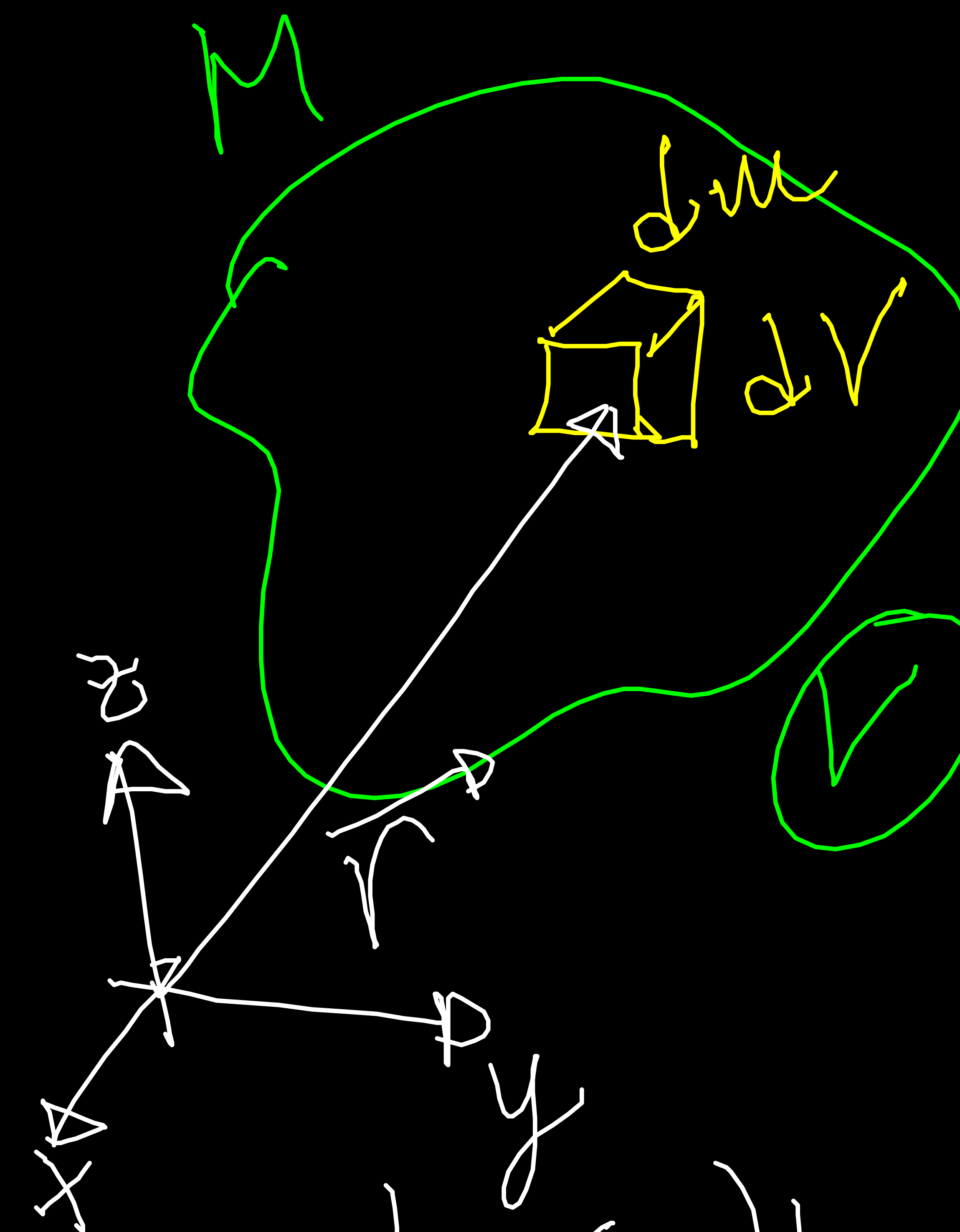
PROPRIETÀ DEI FLUIDI



PREMESSA

DENSITÀ ASSOLUTA per corpo omogeneo

$$\rho = \frac{\text{massa}}{\text{Volume}} = \frac{[kg]}{[m^3]} = \frac{M}{V} = \frac{dm}{dV}(\text{pos. nel corpo})$$

(Vale per solidi, liq. e aeriformi)

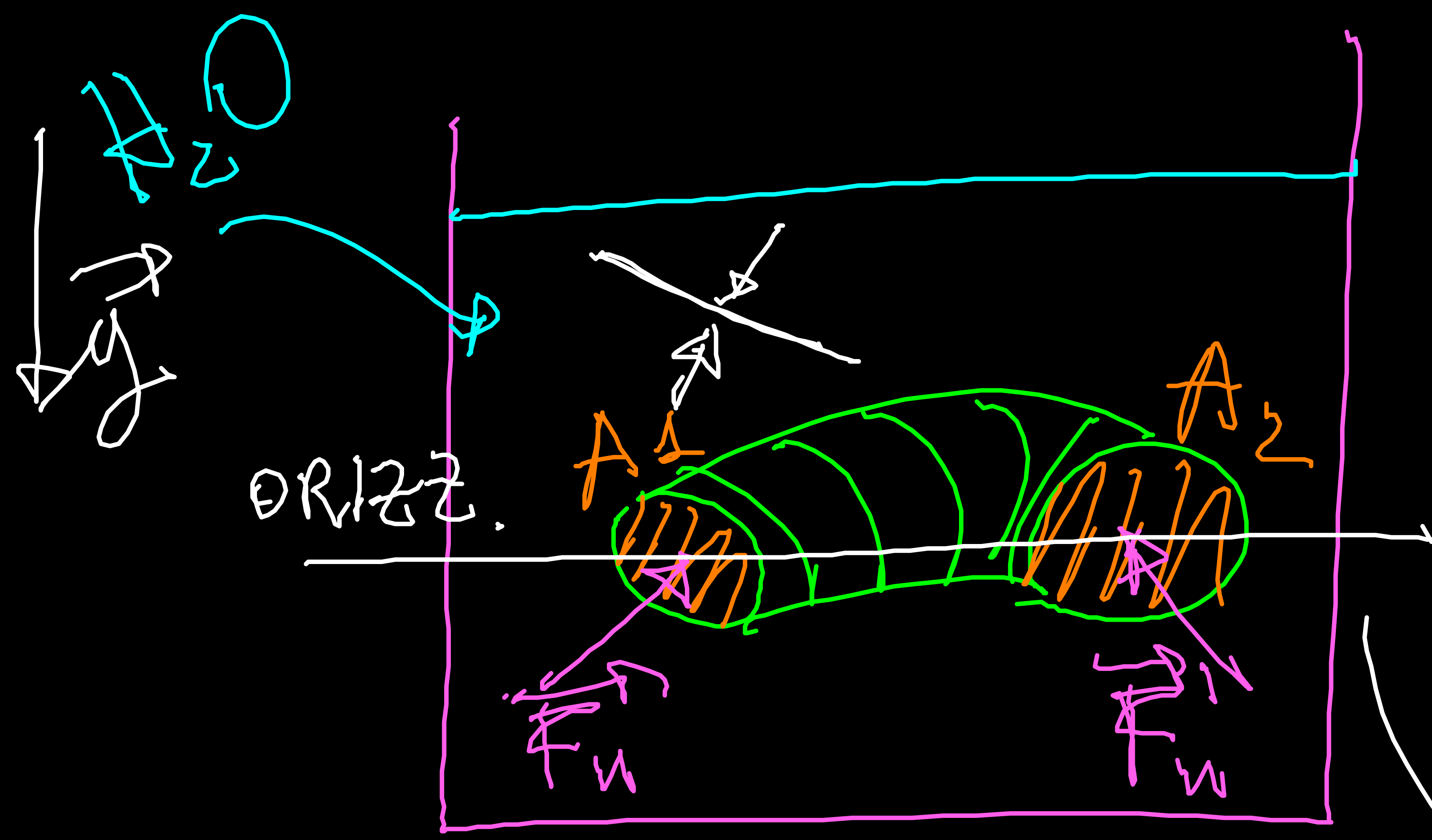
$$\rho = \frac{dm}{dV}(\vec{r}) \qquad \vec{r} \in \text{corpo}$$

DENSITÀ RELATIVA $\rho_r = \dfrac{\rho}{\rho_{H_2O}}$; $\rho_{H_2O} = 10^3 \dfrac{kg}{m^3}$

PESO SPECIFICO $\sigma = \dfrac{mg}{V} = \rho g \; \dfrac{[N]}{[m^3]}$

(P.S. REL $\sigma_r = \dfrac{\sigma}{\sigma_{H_2O}}$)

FLUIDI IN EQUILIBRIO (FLUIDOSTATICA)



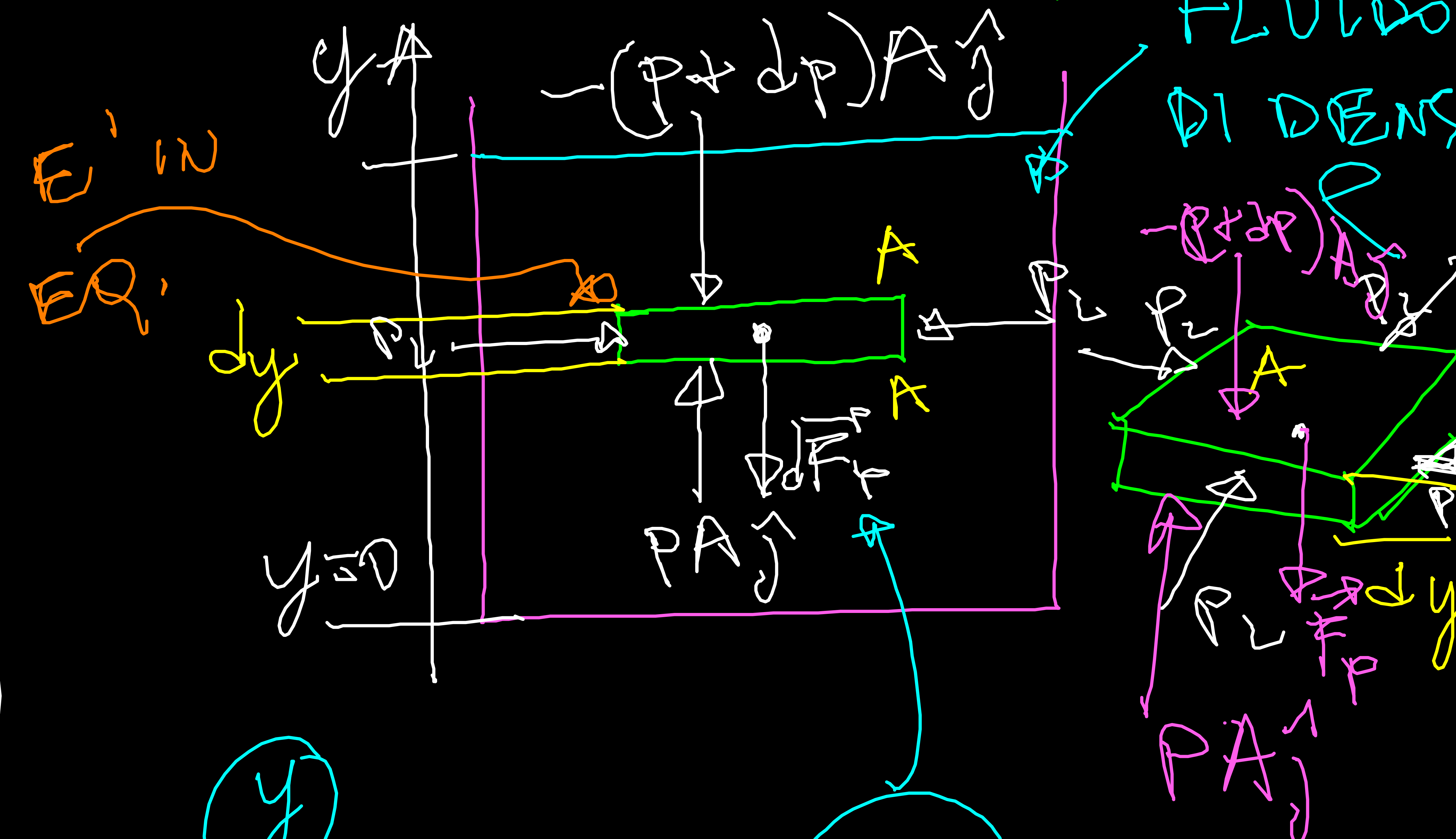
H_2O IN EQ.

$$\frac{F_1}{A_1} = \frac{F_1'}{A_2}$$

$$p_1 = p_2 \; ?$$

SI SE ORIZZ.

$\eta_{H_2O} = 0$ (NO SF. DI TAGLIO)

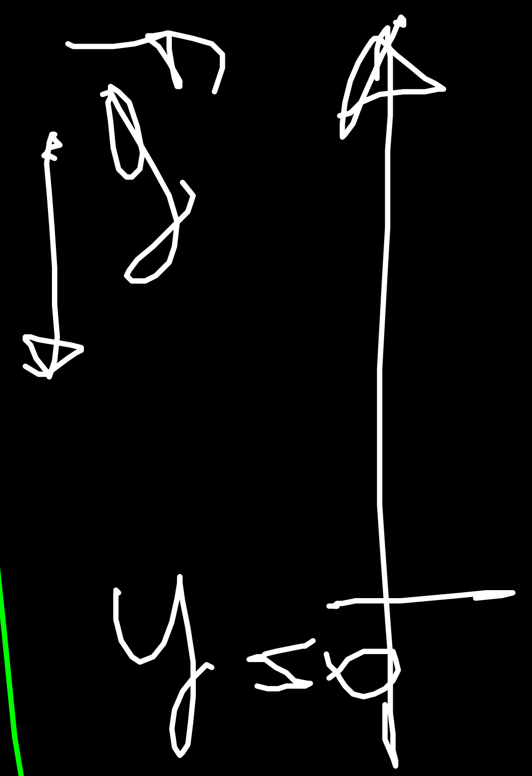


y

$$pA-(p+dp)A-\rho A\,dy\,g=0$$

$$\boxed{dp=-\rho g\,dy}$$

$$p_2-p_1=\int_{p_1}^{p_2}dp=\int_{y_1}^{y_2}-\rho g\,dy=\rho g(y_1-y_2)$$



$$dp = -\rho g\, dy$$

DIFF. DI P TRA DUE LIVELLI 1 E 2

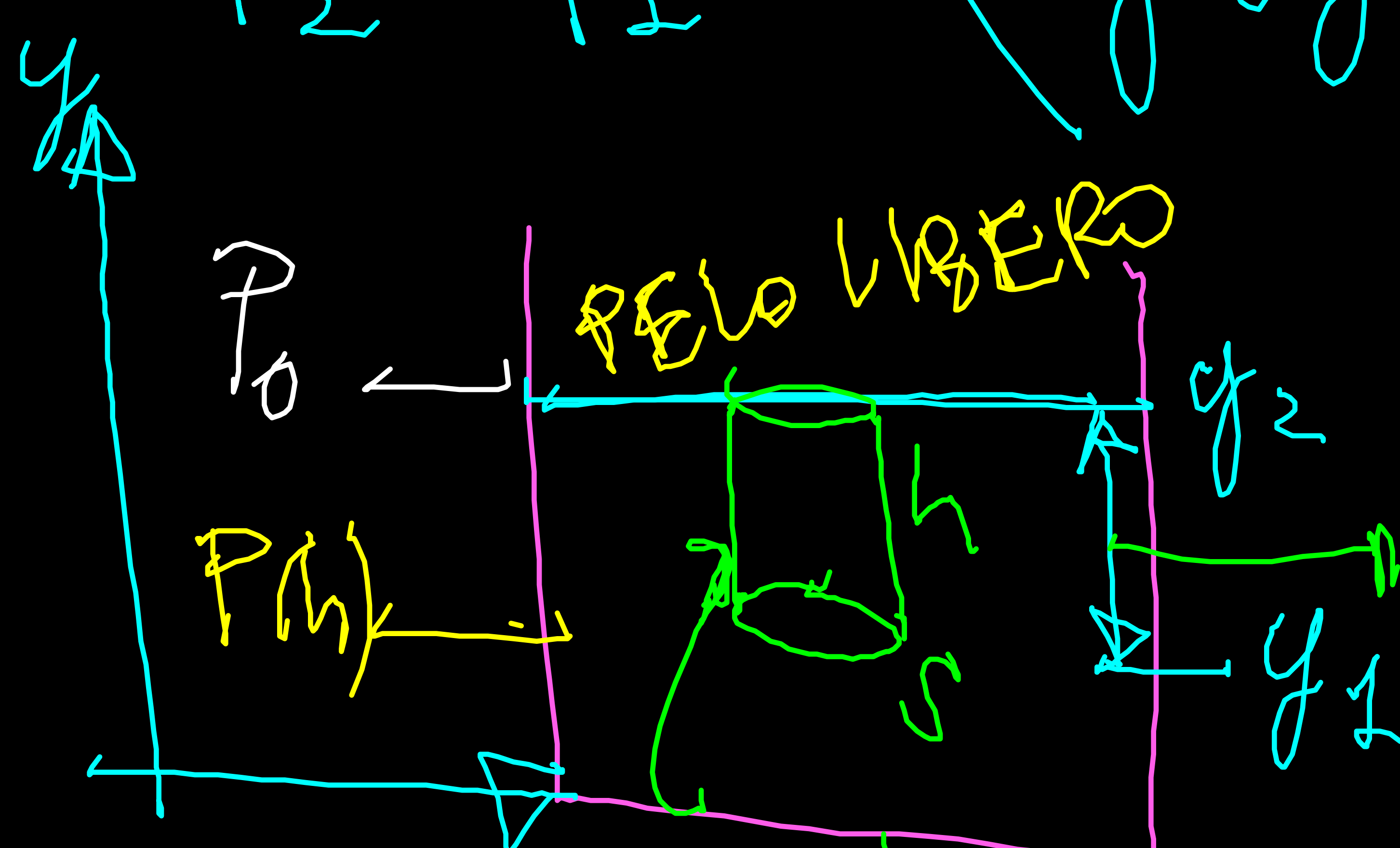
$$\int_{P_1}^{P_2} dp = \int_{y_1}^{y_2} -\rho g\, dy = P_2 - P_1$$

VALIDITÀ GENERALE

FLUIDO INCOMPRIMIBILE $(\rightarrow$ LIQUIDO$) \Rightarrow \rho$ COST.

$$P_2 - P_1 = -\rho g (y_2 - y_1)$$

$$P_0 - P(h) = -\rho g h$$



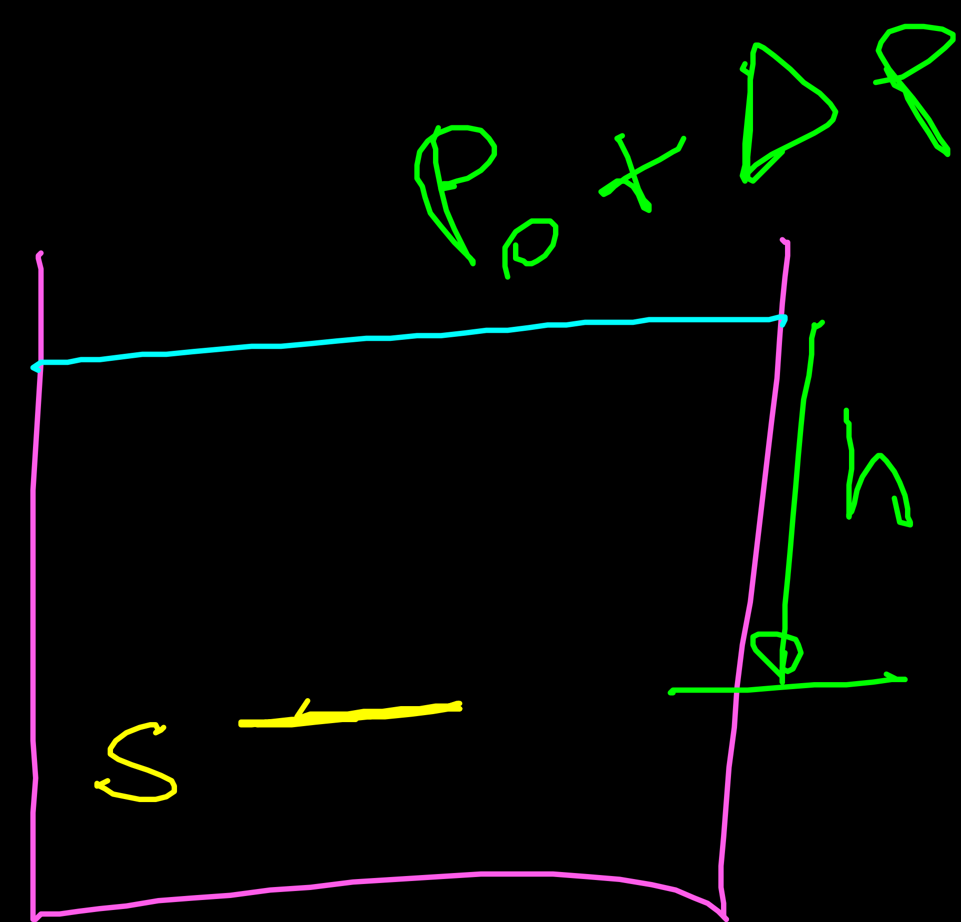
$S \rho g h \Rightarrow$ peso

$h =$ profondità $= y_2 - y_1$

$$\boxed{P(h) = P_0 + \rho g h}$$

PRESS. IN FUNZ. DELLA PROF.
FLUIDO INCOMPR.

(FLUIDO INCOMPRIMIBILE)



$P_0 + \rho g h = P(h)$
$+ \Delta P$

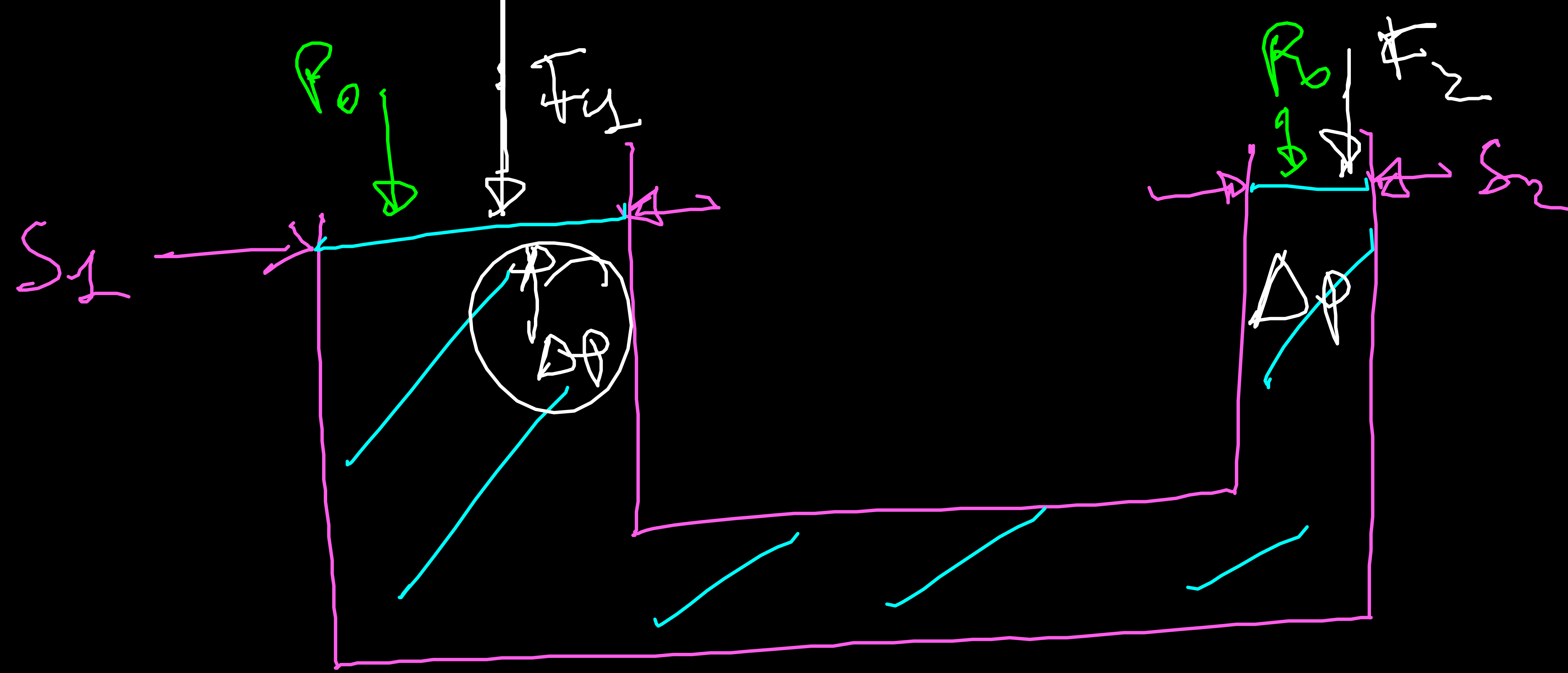
$$P(h) = P_0 + \rho g h + \Delta P$$

$$P(h) \to (P_0 + \Delta P) + \rho g h$$

PRINCIPIO DI PASCAL

SE P_0 AUMENTA DI ΔP, $P(h)$ PURE AUMENTA DI ΔP $\forall h$

PRINCIPIO DI PASCAL $\longrightarrow$ PRESSA IDRAULICA

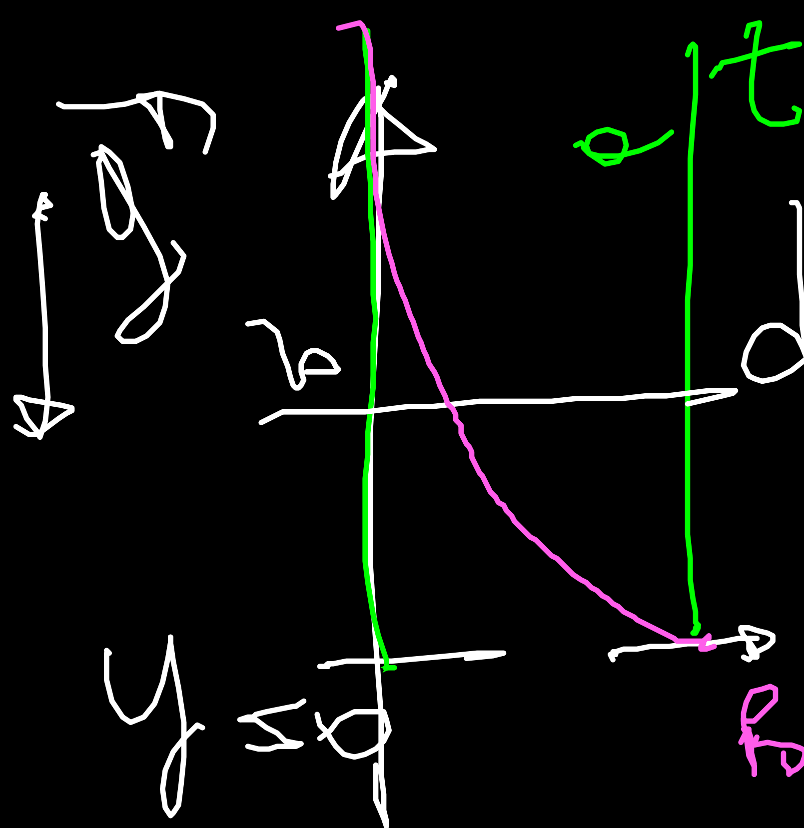


$$\Delta P = \frac{F_2}{S_2} \qquad S_2 < S_1$$

$$\Delta P = \frac{F_1}{S_1}$$

$$\frac{F_2}{S_2} = \frac{F_1}{S_1} \Rightarrow F_2 = \frac{S_2}{S_1} F_1$$

$$\frac{S_2}{S_1} < 1 \Rightarrow F_2 < F_1$$



ρ costante

$$dp = -\rho g \, dy$$

→ LIV. DEL MARE ρ_0, P_0

FLUIDO COMPRIMIBILE

ρ NON COSTANTE

→ DEVO CONOSCERE COME VARIA ρ IN F. DI P

Esempio: atmosfera isoterma

GAS (aria) a temp. costante

$$\boxed{\frac{\rho}{\rho_0} = \frac{P}{P_0}}$$

$$dp = -\frac{\rho_0}{P_0} P g \, dy$$

$$\ln P(h) - \ln P_0 = -\frac{\rho_0}{P_0} g (y - y_0)$$

$$\int_0^{P(h)} \frac{dp}{p} = -\int_0^{h} \frac{\rho_0}{P_0} g \, dy \Rightarrow \ln \frac{P(h)}{P_0} = -\frac{\rho_0}{P_0} g h \Rightarrow \boxed{P(h) = P_0 e^{-\frac{\rho_0}{P_0} g h}}$$

$$P(h) = P_0 e^{-\frac{\rho_0}{P_0} g h}$$

h tale che $P(h) = P_0/2$

$$\frac{P_0}{2} = P_0 e^{-\frac{\rho_0}{P_0} g h}$$

$$\ln \frac{1}{2} = -\frac{\rho_0}{P_0} g h \Rightarrow h = \frac{P_0}{\rho_0 g} \ln 2 \simeq 5500 \text{ m}$$