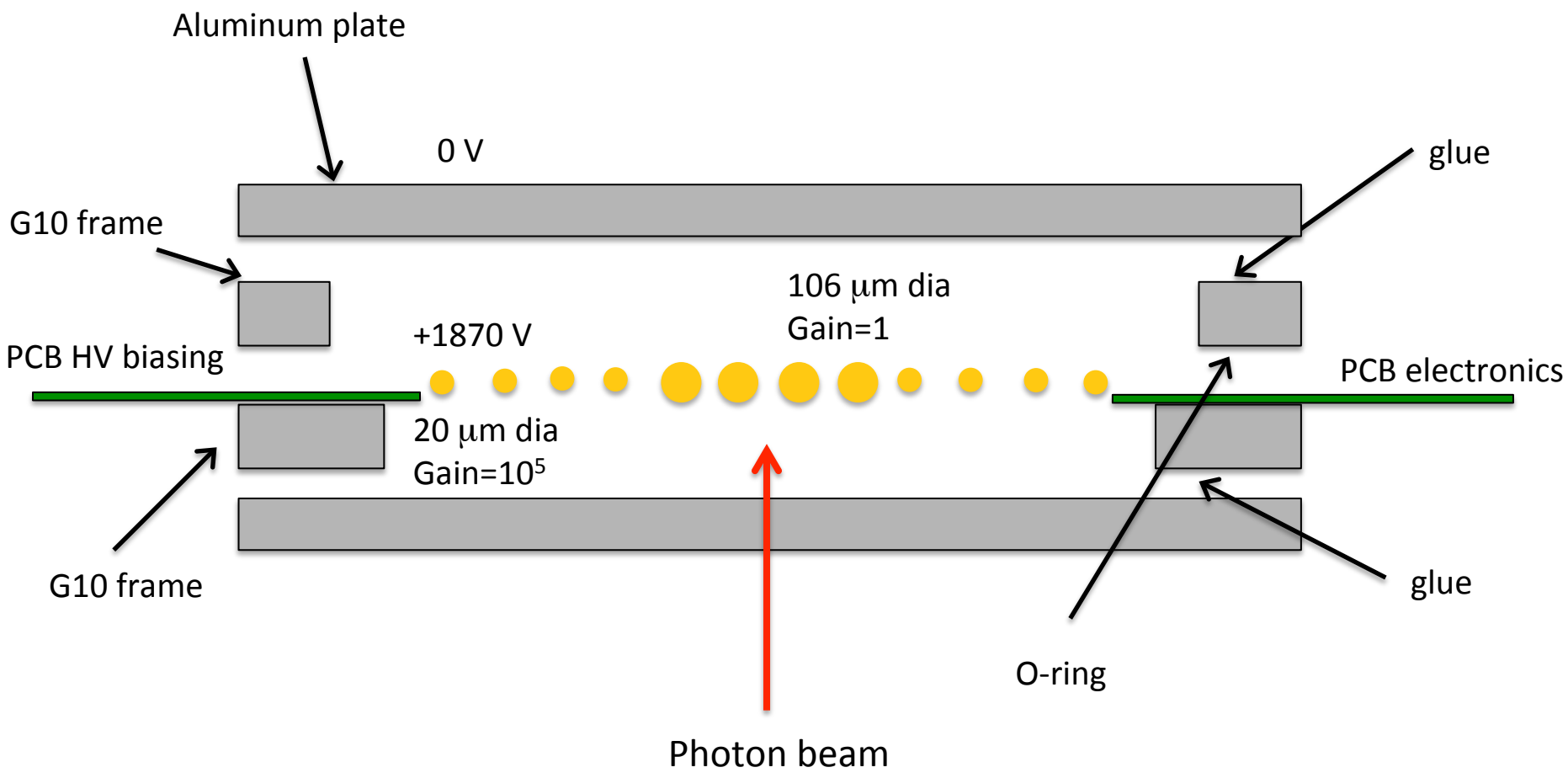
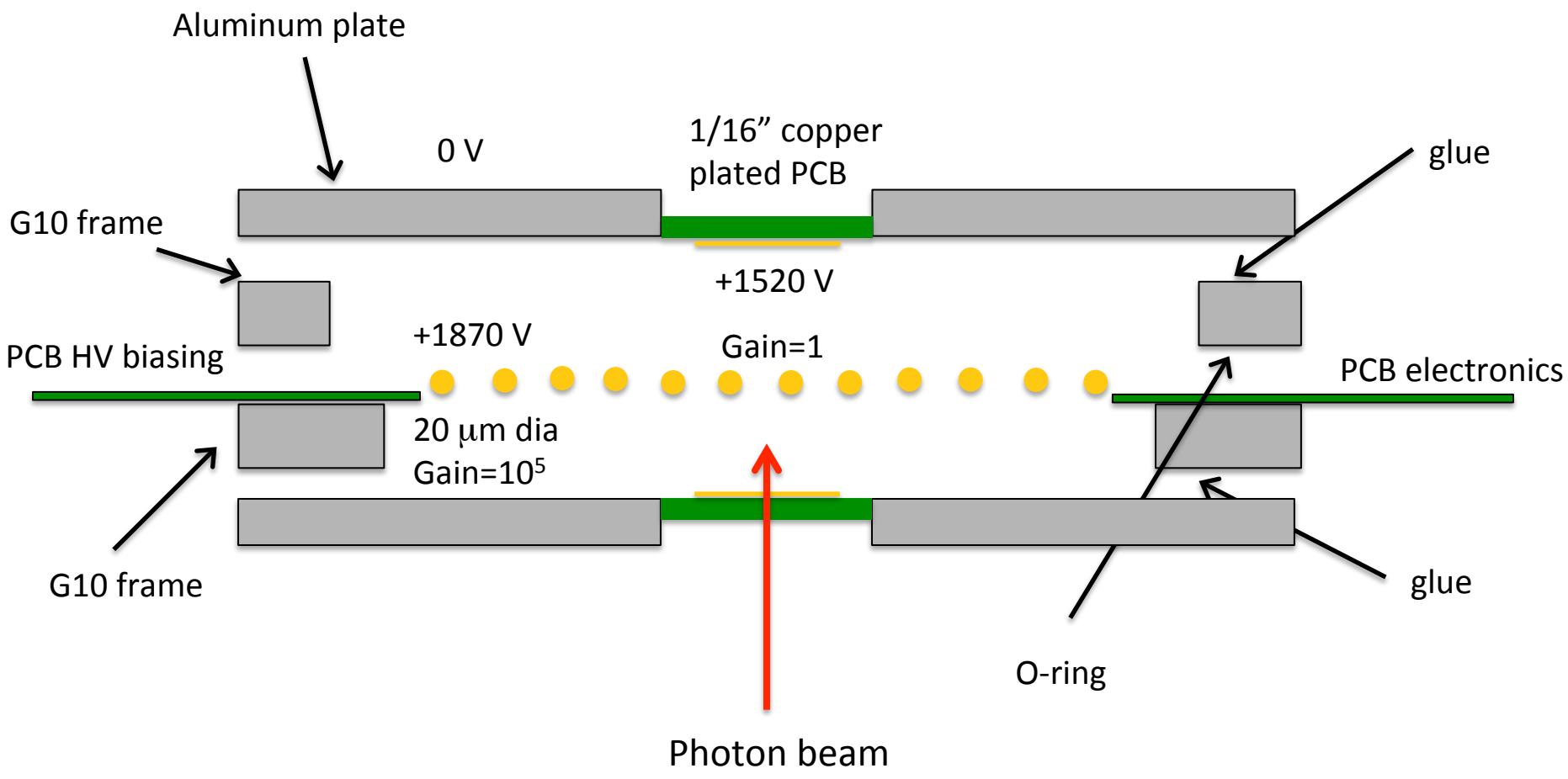
Sense wire “deadening” near the photon beam-line

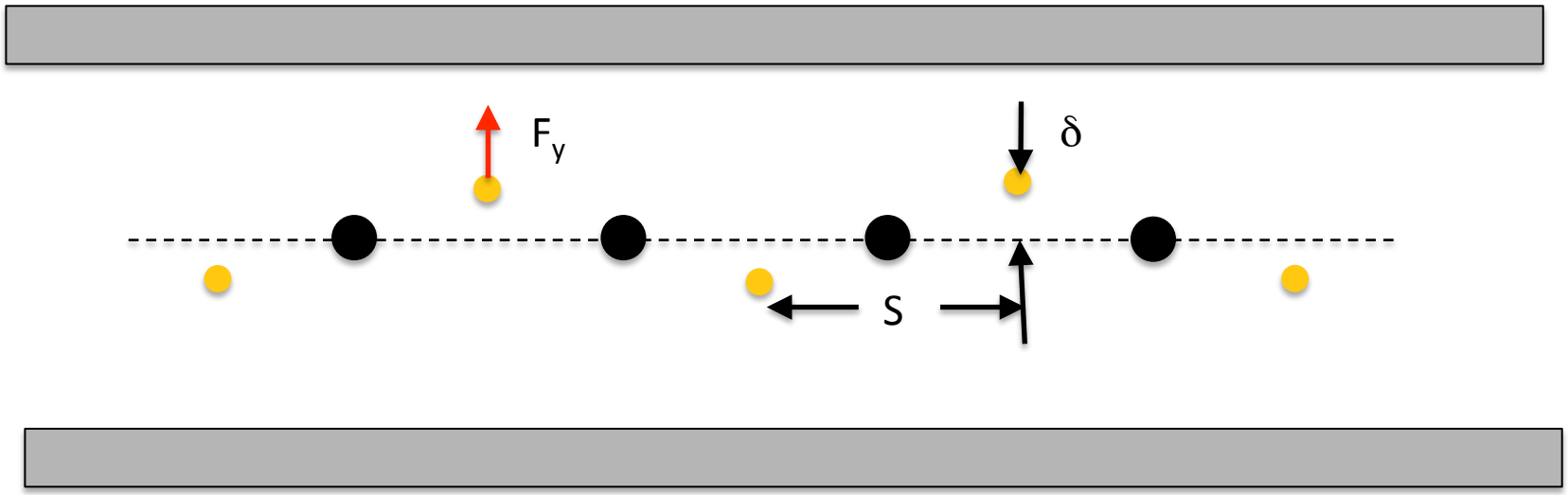


FDC’s used $CuSO_4$ plating to thicken the sense wires to 80 μm

Sense wire “deadening” near the photon beam-line



Wire tension to overcome electrostatic repulsion



$$F_y = 2\frac{Q_S^2}{2\pi\varepsilon_0}\left[\frac{1}{s}\frac{2\delta}{s}+\frac{1}{3s}\frac{2\delta}{3s}+\frac{1}{5s}\frac{2\delta}{5s}+\ldots\right]+2\frac{Q_S Q_F}{2\pi\varepsilon_0}\left[\frac{1}{s/2}\frac{\delta}{s/2}+\frac{1}{3s/2}\frac{\delta}{3s/2}+\frac{1}{5s/2}\frac{\delta}{5s/2}+\ldots\right]$$

$$F_y = \delta\frac{\pi Q_S^2}{4\varepsilon_0 s^2}\left[1+2\frac{Q_F}{Q_S}\right]$$

$$F_{net-y} = T\frac{d^2\delta}{dx^2}+\delta\frac{\pi Q_S^2}{4\varepsilon_0 s^2}\left[1+2\frac{Q_F}{Q_S}\right]$$

For positive δ, the net restoring force must be negative

$$0 \geq T\frac{d^2\delta}{dx^2} + \delta\frac{\pi Q_S^2}{4\varepsilon_0 s^2}\left[1 + 2\frac{Q_F}{Q_S}\right]$$

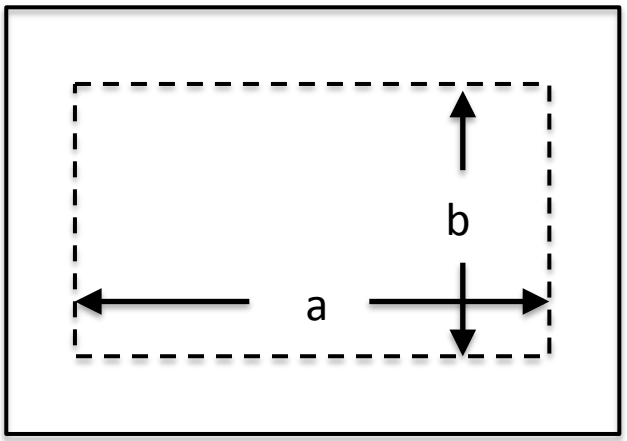
Assume $\delta = \delta_0 \sin\frac{\pi}{L}x$

$$0 \geq -T\left(\frac{\pi}{L}\right)^2 + \frac{\pi Q_S^2}{4\varepsilon_0 s^2}\left[1 + 2\frac{Q_F}{Q_S}\right]$$

$$T \geq \frac{Q_S^2 L^2}{4\pi\varepsilon_0 s^2}\left[1 + 2\frac{Q_F}{Q_S}\right]$$

Take:
L=2 m, s=1 cm, and Voltage = +1800 V
T > 2.4 g

Maximum deflection of a plate under pressure

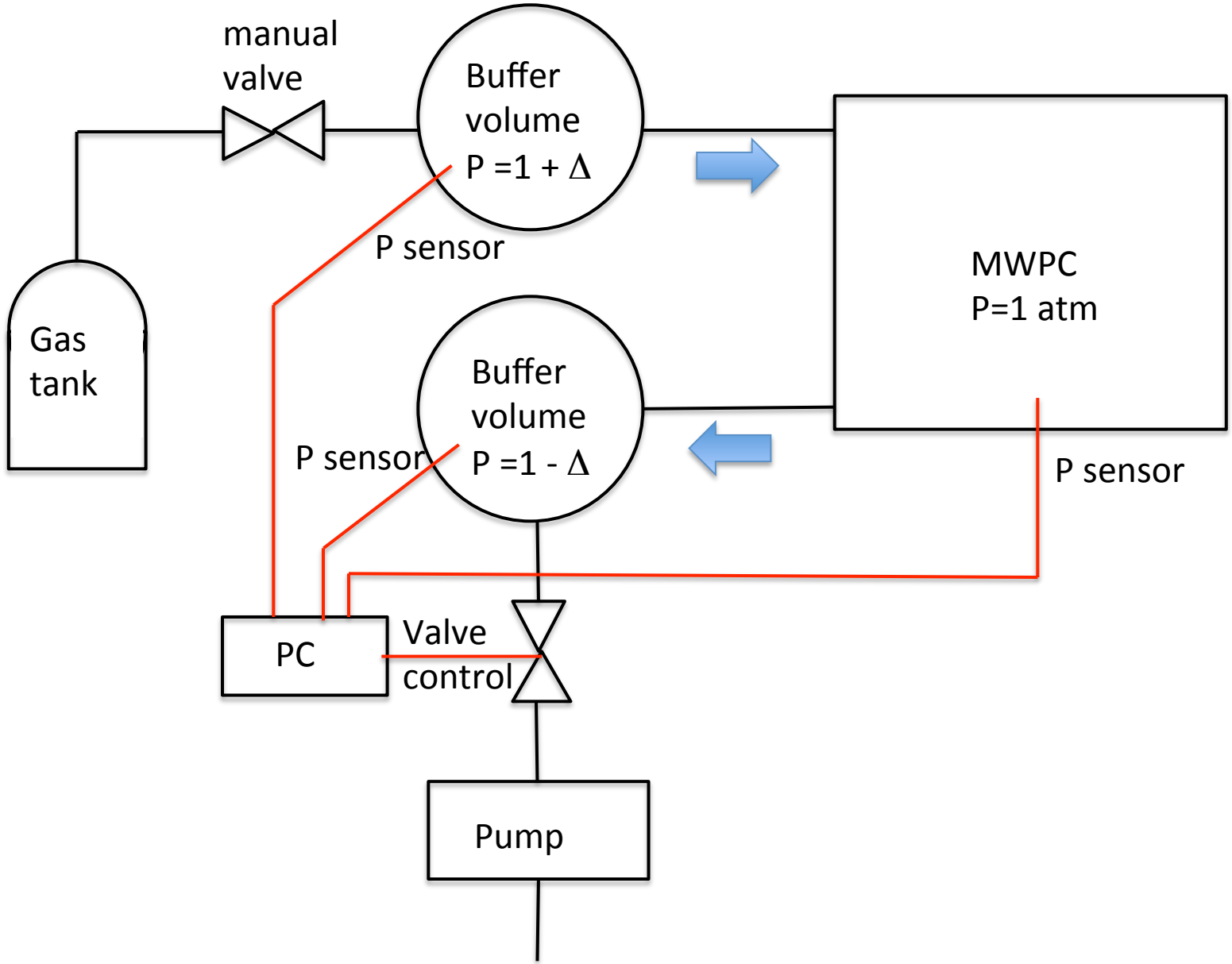


Maximum deflection at the center of the plate:

$$Y_m = \frac{0.142 P b^4}{\varepsilon t^3 \left[2.21 \left(b/a \right)^3 + 1 \right]}$$

P= 2” H_2O, t = 0.25”, a=b=2 m

Y_m = 2 cm !


manual
valve
Buffer
volume
P =1 + Δ
P sensor
Gas
tank
MWPC
P=1 atm
Buffer
volume
P =1 - Δ
P sensor
P sensor
PC
Valve
control
Pump