- Calibration constant calculated ~0.0026(μm)$^{-1}$
- Check with theory, is this correct?

According to Molley: $V_1 \propto \frac{1}{\left(1-\frac{x}{R}\right)}$ $\qquad V_2 \propto \frac{1}{\left(1+\frac{x}{R}\right)}$

According to Colin: $V_1 \propto \frac{1}{\left(1-\frac{x}{R}\right)^2}$ $\qquad V_2 \propto \frac{1}{\left(1+\frac{x}{R}\right)^2}$

- Taking most general case: $V_1 \propto \frac{1}{\left(1-\frac{x}{R}\right)^n}$ $V_2 \propto \frac{1}{\left(1+\frac{x}{R}\right)^n}$

$$\frac{V_{diff}}{V_{sum}} = \frac{nx}{R}$$

- BPM signals go through processor, difference and sum channels have different gains, so:

$$\left(\frac{V_{diff}}{V_{sum}}\right)_{proc} = \frac{g_{diff}}{g_{sum}}\frac{nx}{R}$$

- So, theoretical calibration constant is:

$$C_{cal} = \frac{ng_{diff}}{Rg_{sum}}$$

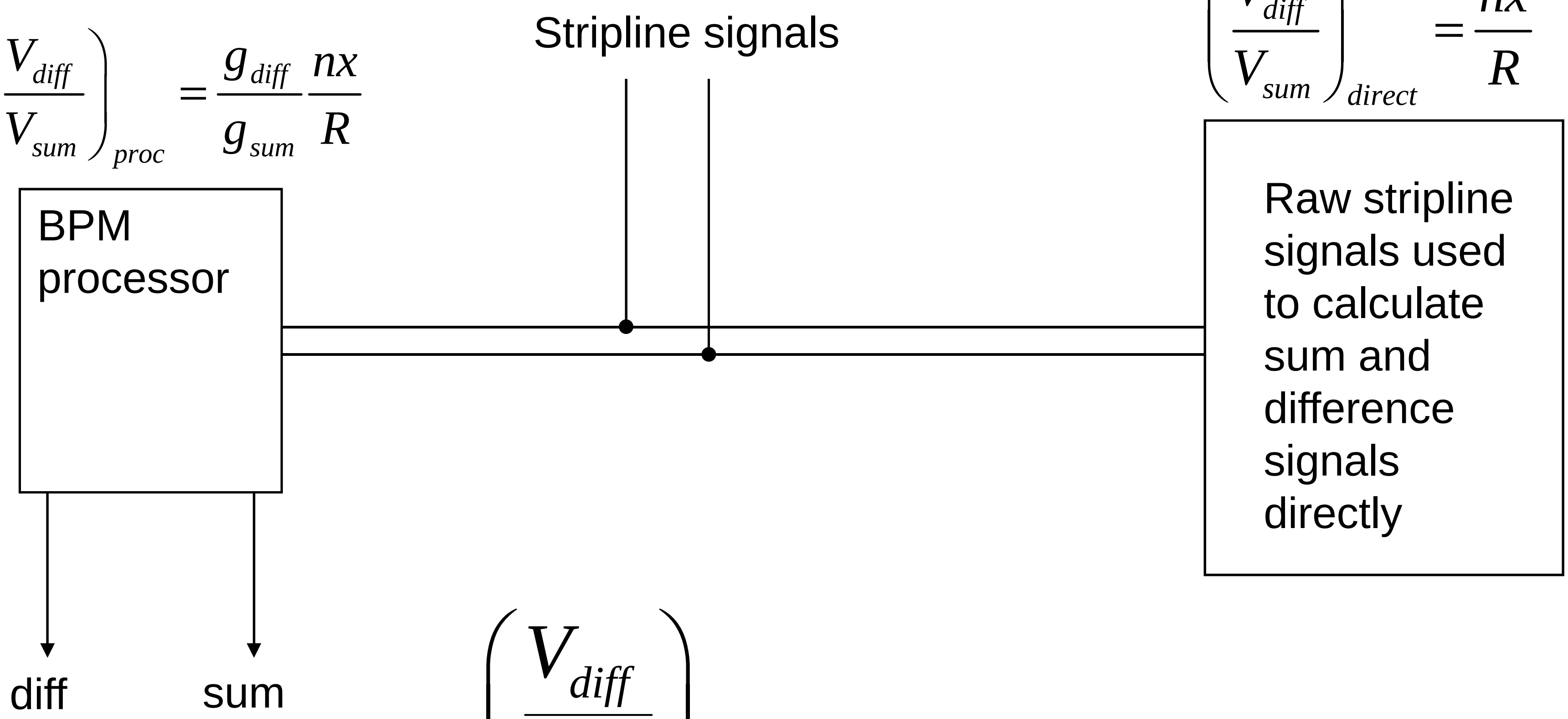
- According to colin, gain ratio = 20, but measured to be ~16
- R = 14mm (according to Naito-san) =14000μm

$$C_{cal} \sim 0.00114n\left(\mu m\right)^{-1}$$

- So, according to Molloy: $C_{cal} \sim 0.00114(\mu m)^{-1}$
- According to Colin: $C_{cal} \sim 0.00229(\mu m)^{-1}$
- Measured value: $C_{cal} \sim 0.0026(\mu m)^{-1}$

$$\left(\frac{V_{diff}}{V_{sum}}\right)_{proc} = \frac{g_{diff}}{g_{sum}}\frac{nx}{R}$$

$$\left(\frac{V_{diff}}{V_{sum}}\right)_{direct} = \frac{nx}{R}$$



$$\therefore \frac{\left(\frac{V_{diff}}{V_{sum}}\right)_{proc}}{\left(\frac{V_{diff}}{V_{sum}}\right)_{direct}} = \frac{g_{diff}}{g_{sum}}$$

- Data taken at end of day shift 24/04/08 has been analysed, but gain ratio calculated to be ~0.02
- Further investigations needed

Spare slides

$$V_1 \propto \frac{1}{\left(1-\frac{x}{R}\right)^n} \qquad V_2 \propto \frac{1}{\left(1+\frac{x}{R}\right)^n}$$

$\frac{x}{R} \ll 1$ so $\left(1\pm\frac{x}{R}\right)^n \approx 1 \pm \frac{nx}{R} + \ldots$

$$V_{diff} \approx \frac{\left(1+\frac{nx}{R}\right)-\left(1-\frac{nx}{R}\right)}{1-\left(\frac{nx}{R}\right)^2} = \frac{2\left(\frac{nx}{R}\right)}{1-\left(\frac{nx}{R}\right)^2} \qquad V_{sum} \approx \frac{\left(1+\frac{nx}{R}\right)+\left(1-\frac{nx}{R}\right)}{1-\left(\frac{nx}{R}\right)^2} = \frac{2}{1-\left(\frac{nx}{R}\right)^2}$$

$$\therefore \frac{V_{diff}}{V_{sum}} = \frac{nx}{R}$$