Calculating y_{avg}/y_{int}

De Laval

$$\Pi = \mu = 1 - \sqrt[4]{\frac{p_s}{p_e}} =: 1 - \sqrt{R} \qquad (1)$$

$$\mu = 1 - \sqrt{R}$$
$$\mu - 1 = -\sqrt{R}$$
$$\mu - 2 = -\sqrt{R} - 1 = -(\sqrt{R}+1)$$

$$R = \sqrt{\frac{p_s}{p_a}}$$

$$\frac{y_0}{y_{int}} = \frac{1-\Pi}{2-\Pi} = \frac{1-\mu}{2-\mu} \qquad (2)$$

$$-\frac{y_{avg}}{y_0} = \frac{\Pi - 1}{\Pi} = \frac{\mu - 1}{\mu} \qquad (3)$$

$$(2)\&(3): \frac{y_{avg}}{y_{int}} = \frac{1-\mu}{2-\mu} \cdot \frac{\mu-1}{\mu} = \frac{(\mu-1)^2}{(\mu-2)\mu} = \frac{\sqrt{R}^2}{-(\sqrt{R}+1)(1-\sqrt{R})}$$

$$= \frac{-R}{1-(\sqrt{R})^2} = \frac{R}{R-1} = \frac{\sqrt{\frac{p_s}{p_a}}}{\sqrt{\frac{p_s}{p_e}} - 1} =$$

$$\boxed{\sqrt{\frac{p_s}{p_a}} - 1 = \frac{\sqrt{p_s} - \sqrt{p_a}}{\sqrt{p_e}}} \Rightarrow \sqrt{\frac{p_s}{\cancel{p_a}}} \cdot \frac{\cancel{\sqrt{p_a}}}{\sqrt{p_s} - \sqrt{p_e}} = \frac{\sqrt{p_s}}{\sqrt{p_s} - \sqrt{p_e}}$$

$$\boxed{\frac{y_{avg}}{y_{int}} = -\frac{\sqrt{p_b}}{\sqrt{p_a} - \sqrt{p_b}} = -\frac{B}{A}}$$