The Question remains how to nondimensionalize Q_1

$$Q = \frac{Q'}{\langle Q \rangle} \quad \text{since} \quad Q' : L^2 T^{-1} \quad \text{then} \quad \langle Q \rangle : \langle \frac{V}{L^2} \rangle =$$

$$\text{then} \quad \langle Q \rangle = \frac{L^2}{T} = \frac{L^2}{L/u} = Lu \qquad \qquad = \langle \frac{V}{Lu} \rangle$$

$$\Rightarrow Q = \frac{Q'}{Lu}$$