

Introduction to Project 6: Measuring Arterial Blood Flow with Phase Contrast MRI

Quantitative and Functional Imaging
Fall 2022

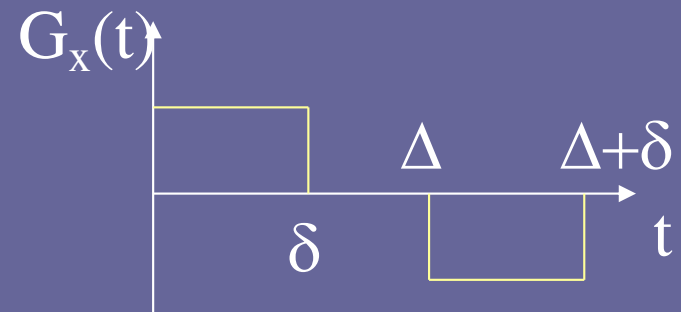
Phase contrast MRI

- Suppose spins move along x with constant velocity, v_x



- Field gradient is applied to the spins

$$G_x(t) = \begin{cases} G_0, & 0 < t \leq \delta \\ 0, & \delta < t \leq \Delta \\ -G_0, & \Delta < t \leq \Delta + \delta \end{cases}$$



Phase contrast MRI

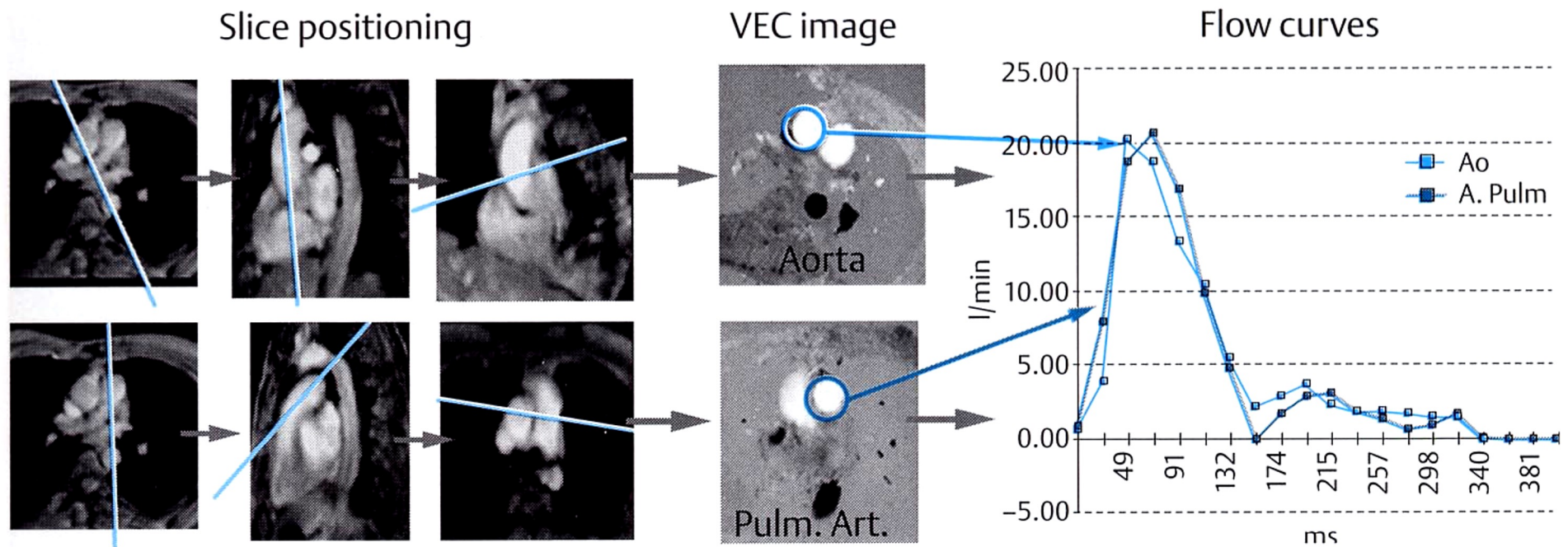
- After the bipolar gradient pulse, the spin phase angle is

$$\varphi = (\gamma G_0 \Delta \cdot \delta) \cdot v_z$$

This can be expressed as

$$v_z = v_{enc} \cdot \left(\frac{\varphi}{\pi/2} \right)$$

Measures of cardiac output



Didier (2003)

Goals of the project

- Measure blood velocity in the ascending and descending aorta
- Calculate the volume of blood traveling through each segment during the cardiac cycle
- For graduate credit (undergrad extra credit):
 - Measure **blood velocity versus distance** from the center of the vessel—is it parabolic?

