

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

Quantitative and Functional Imaging  
Fall 2022

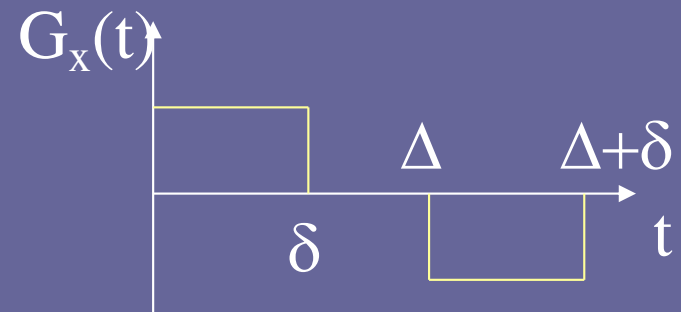
# Phase contrast MRI

- 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

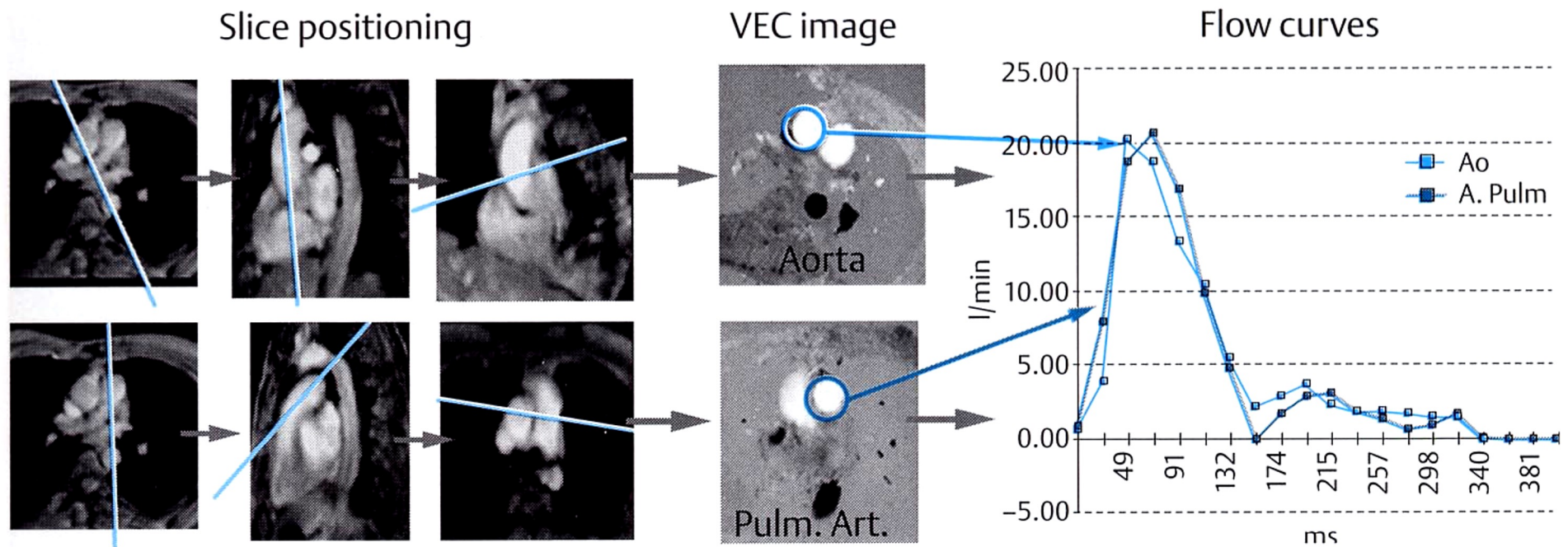
- After the bipolar gradient pulse, the spin phase angle is

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

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?

