An open source imaging/ therapy platform for small animals

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Overview

- Background
  - Previous Work
  - Project Plan
- System Design
- Design Matrices
- Mechanical Design
- Timeline & Future Work

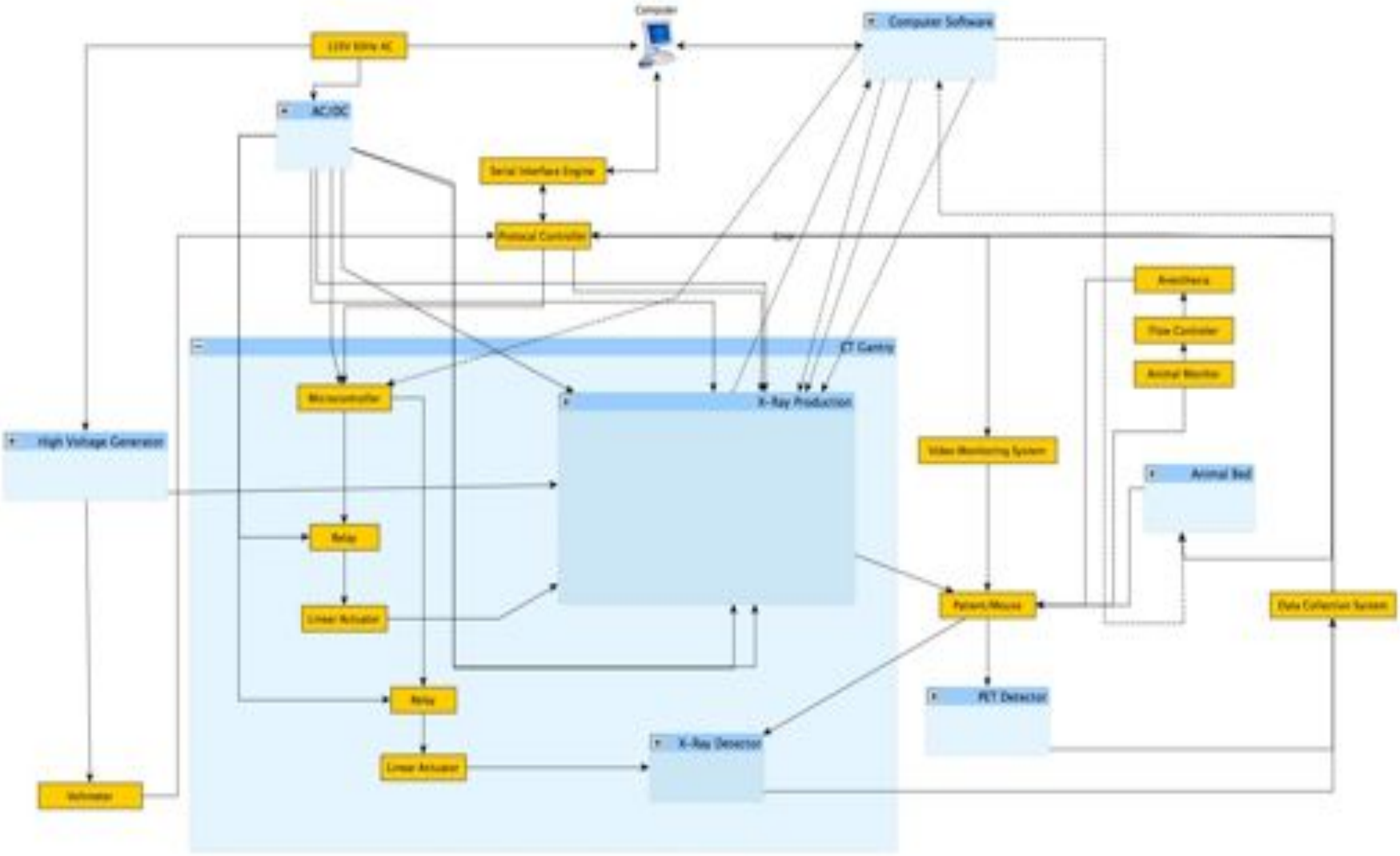
Background-Previous Work

- Project initiated in January 2010
- Open Source Concept & Morgridge Institute
- System Requirements & Specs: Spring 2010
  - Customer Requirements
  - Design Specifications
  - SolidWorks Model, v 1.0
- OSMD Business Plan: Summer 2010
  - Customer Requirements
  - Business Plan
  - SolidWorks Model, v 2.0

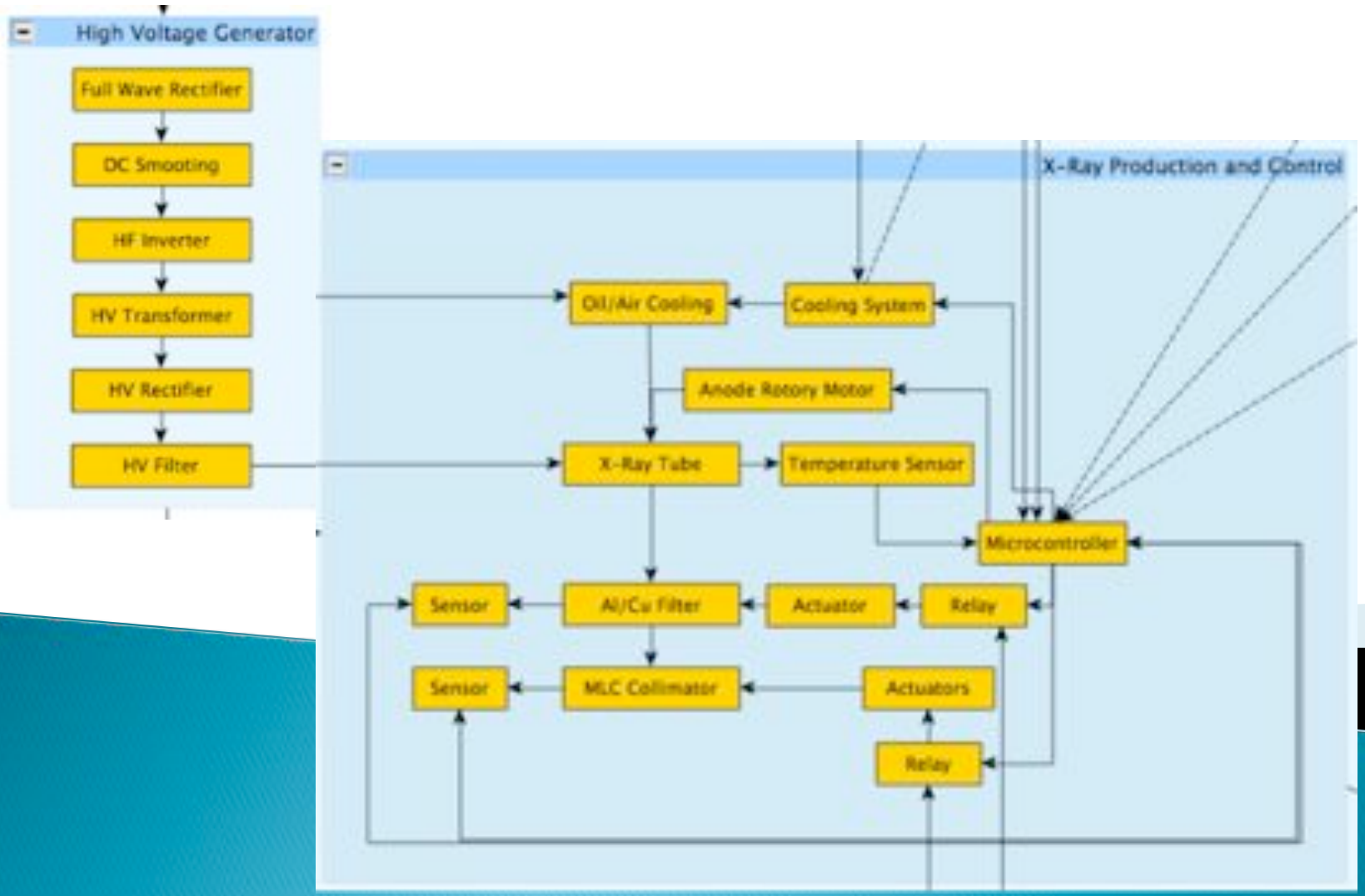
Background-Project Plan

- Combination of CT, PET, and RT
- User-defined implementation
- Online database of parts
- Can order components and DIY
- Order pre-built from Morgridge
- Modularity

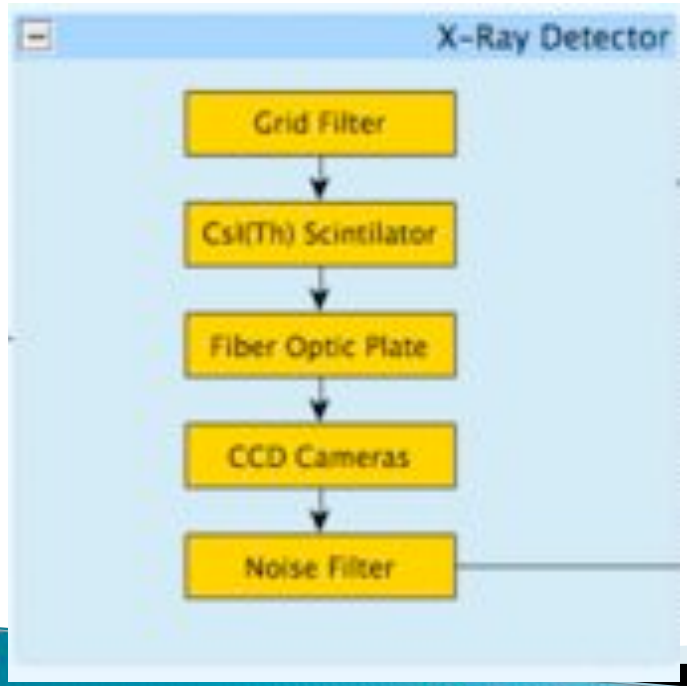
System Design

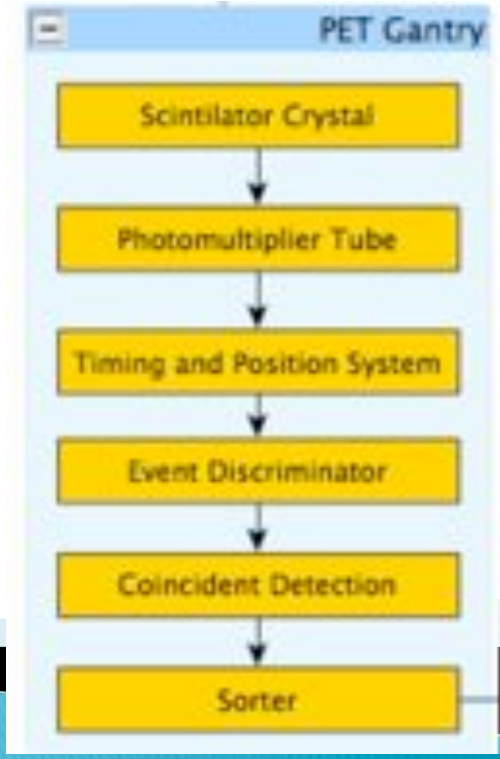


High Voltage Generation and X-ray Production



Detectors


X-Ray Detector
Grid Filter
CsI(Th) Scintilator
Fiber Optic Plate
CCD Cameras
Noise Filter


PET Gantry
Scintilator Crystal
Photomultiplier Tube
Timing and Position System
Event Discriminator
Coincident Detection
Sorter

CT Camera Systems

Design Matrix 1

	Weight	CCD	CMOS	Photodiode Array
Precision	40	32	25	20
Cost	10	7	5	5
Durability	25	20	20	20
Ease of Implementation	15	9	13	6
Speed of Operation	10	7	8	9
TOTAL	100	**75**	**71**	**60**

X-Ray Scintillator Crystals

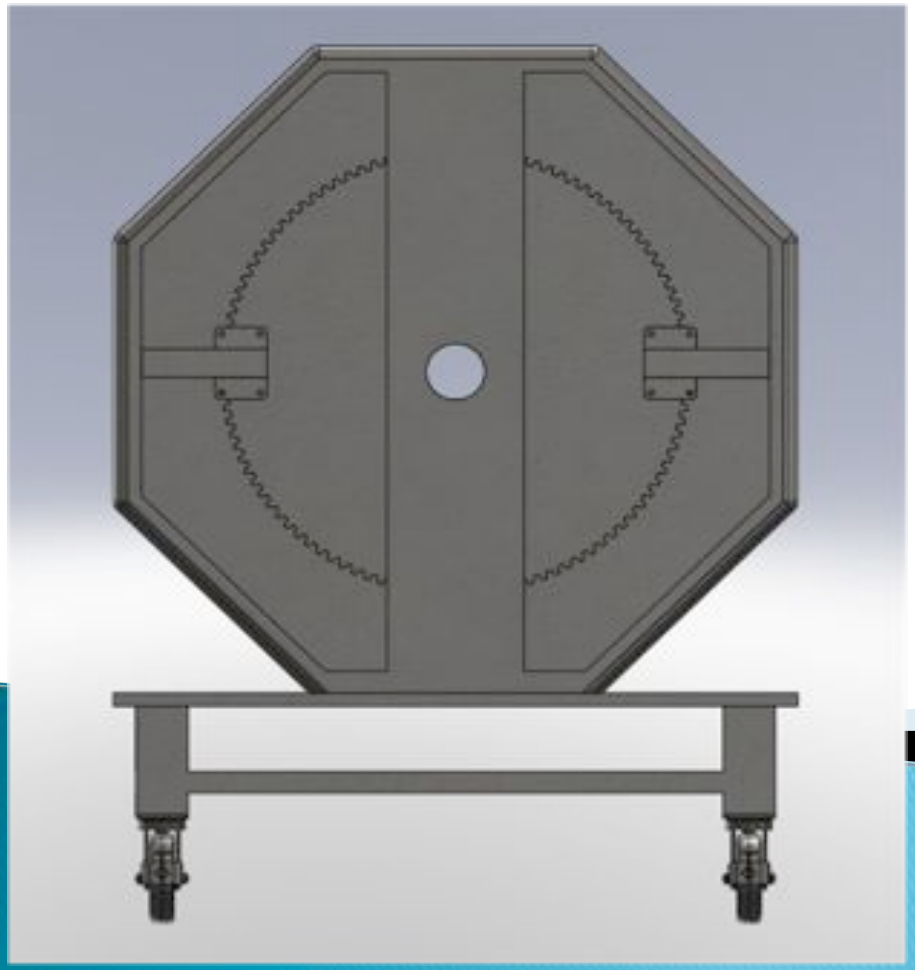
Design Matrix 2

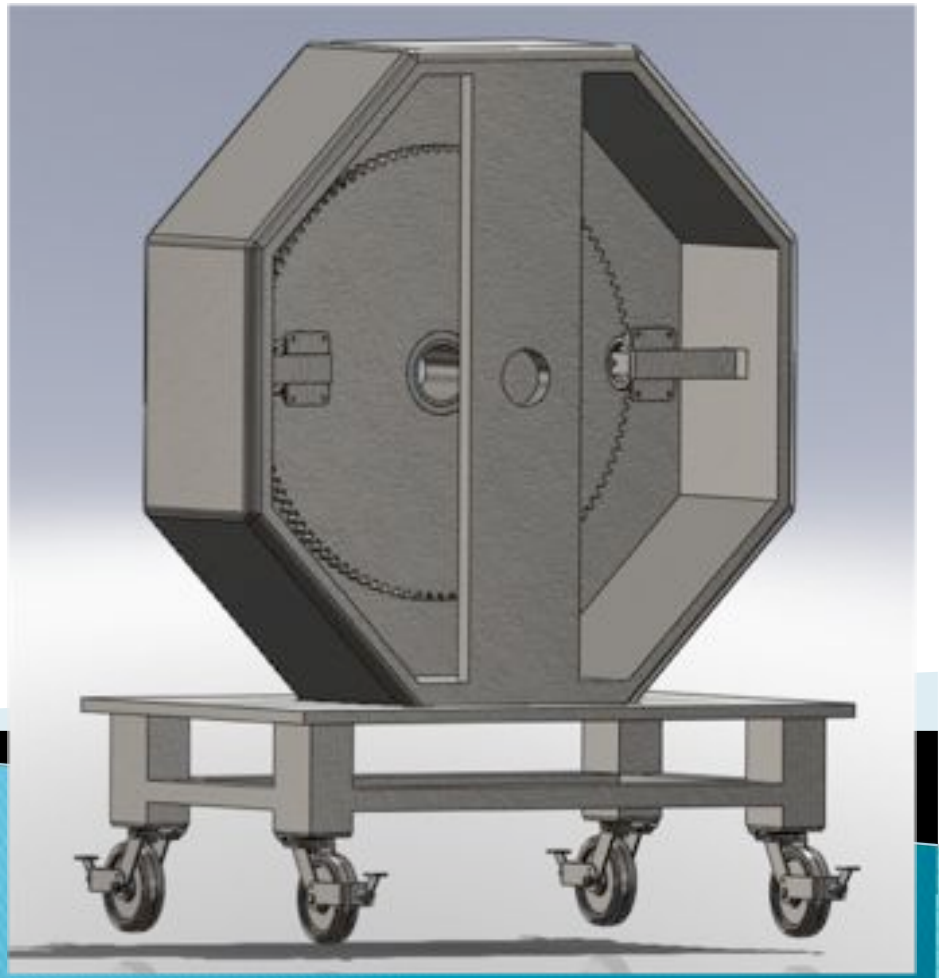
	Weight	Csi(Tl)	Organic Plastic	NaI(Tl)
Emission Maximum	25	23	21	18
Cost	10	7	4	7
Durability	15	12	14	7
Conversion Efficiency	25	20	18	23
Decay Constant	25	19	22	17
TOTAL	100	**81**	**79**	**72**

Mechanical Design 1

- Physical Structure
  - 150 cm internal diameter for optimal imaging distances
  - Movable table that sets the animal table to 3 ft.
  - 100 cm gantry wheel to hold the components
  - 13 cm diameter clearance for the animal table and animal
  - Load bearing members must have suitable yield stress
  - Will design with A-36 Steel
  - Support rollers to keep gantry wheel spinning uniaxially
- Gantry Motor
  - Maximum of 10 revolutions per minute
  - Proper torque and gear ratio to spin 10,000 N (2250 lbs)
  - Precise position control

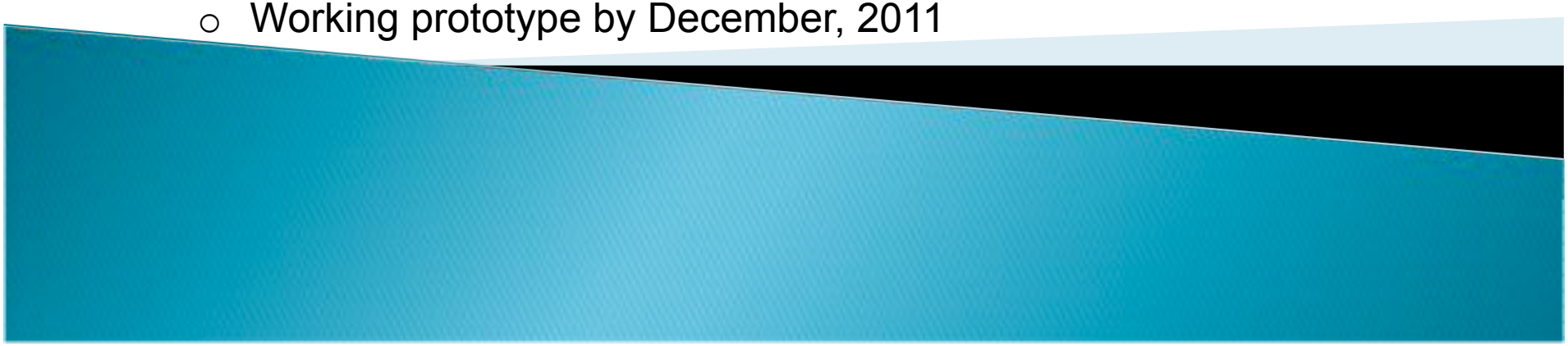
Mechanical Design 2





Timeline & Future Work

- Spring 2010
  - Research in underlying technology and specifications
  - Narrowing down to possible components
- Summer 2010
  - Developments in Open Source Medical Device (OSMD) program
  - Market analysis
  - Gathering ISO standards, check intellectual property conflicts
- Fall 2010
  - Mechanical design of enclosure
  - Decisions for components
  - Find vendors for frame construction
  - Begin prototype assembly
- Future
  - Working prototype by December, 2011



Acknowledgements & Questions