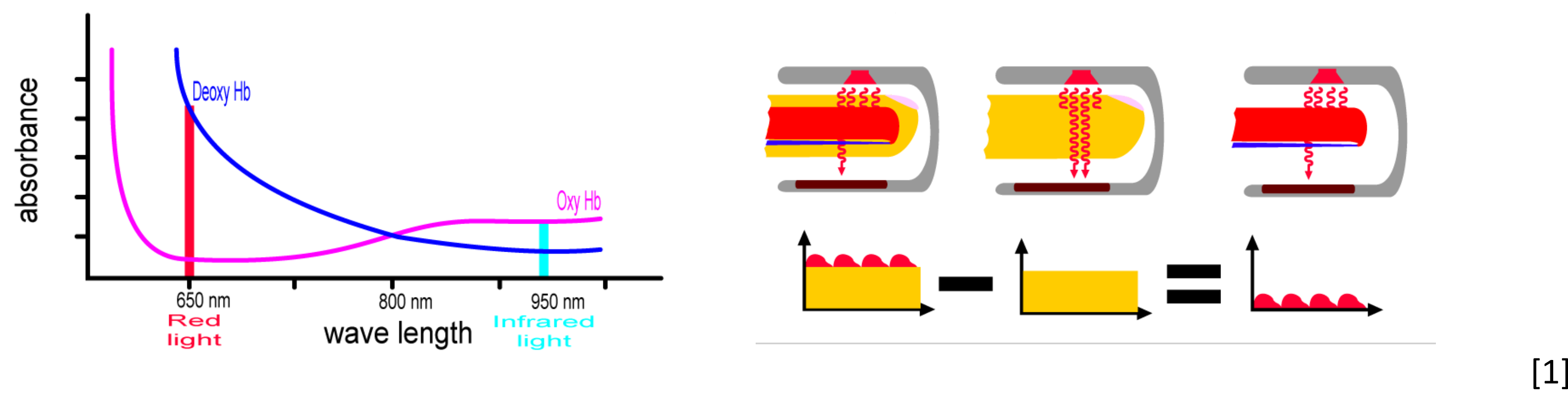


Pulse Oximetry Background



Problem Definition

- Device must read and display the heart rate and blood oxygen saturation inside an MRI chamber.
- Device must be compatible with a variety of animals.
- Researchers will monitor the information outside the chamber.

Solutions

TI MSP-430FG439

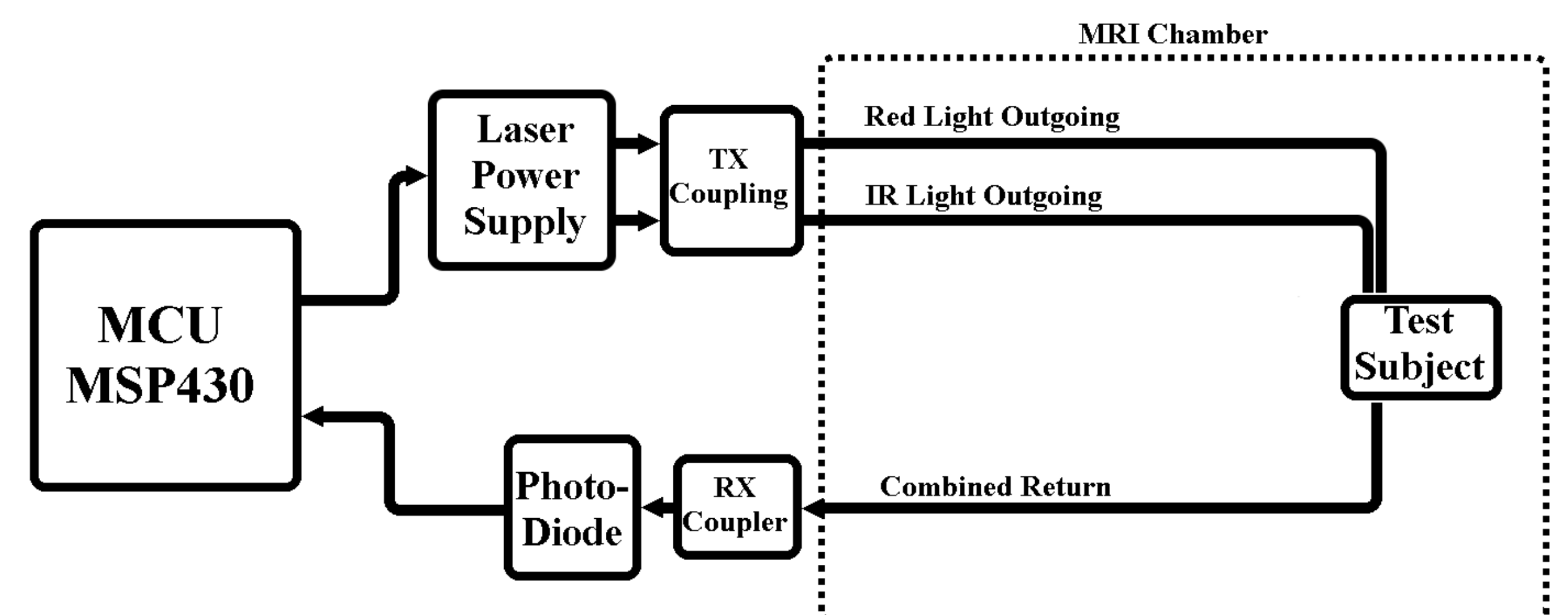
- Olimex's MSP-430FG439 handles laser timing and signal processing, with a maximum frequency input of 5 Hz
- Includes onboard LCD screen for easy monitoring
- Compatible with simple LabVIEW interface
- Can be powered by 5V wall charger

Fiber Optics

- Fiber was attached to a pair of lasers on the microcontroller, to either side of the clip, and back to a photodiode
- Lasers were focused with ball lenses, and fiber was braided for compactness and fit into various wraps and tubing

Animal Interface

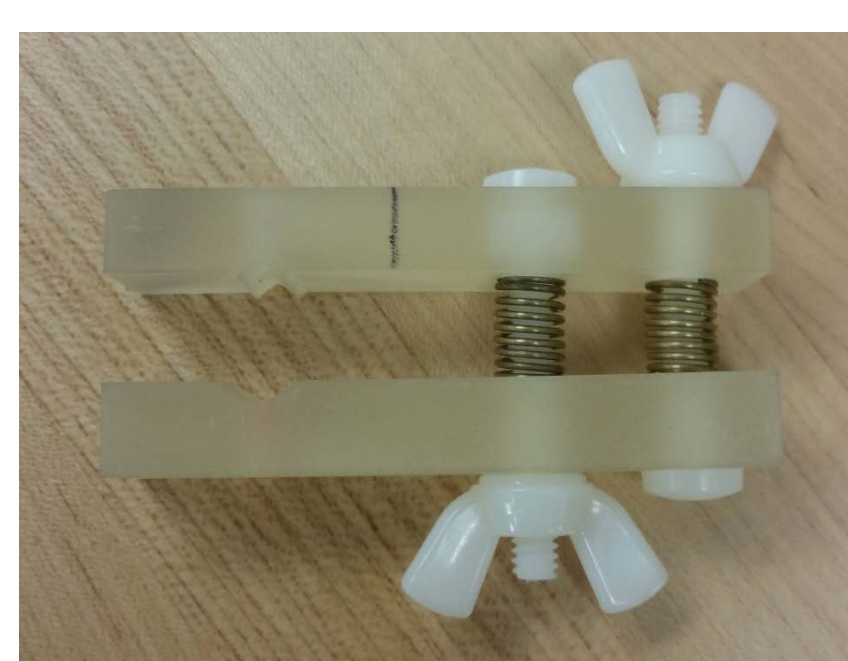
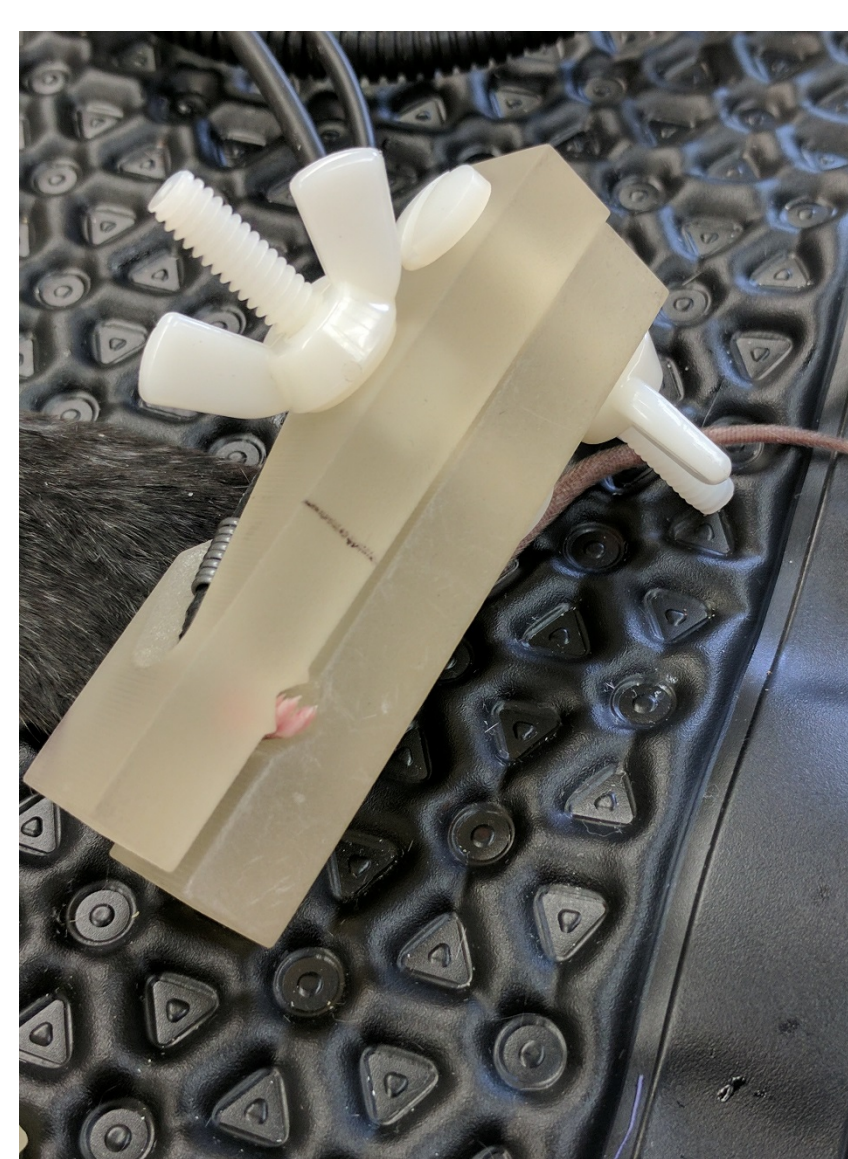
- Clips were 3D printed out of flexible material to more easily conform to varying measurement sites on animals
- Final design includes nylon wingnuts to apply variable force on the measurement site, and snap-in fiber attachments



Testing

Our tests included:

- Accuracy – The device should measure heart rate within 2 BPM and SpO2 within 1% when compared to a control device
- MRI compatibility – The device should not interfere with the MRI or create noise
- Clip availability – The clip should fit easily on multiple species and successfully measure data.
- Dropping/tension/fatigue – The clip, fiber, and housing should be resilient enough to handle light mistreatment that may occur.
- Use/test subject safety – The laser should not injure the subject when turned on during testing duration



Conclusion

- We learned just how much unexpected factors can effect normal pulse-ox functioning. Theory seems to suggest that a powerful enough light (such as a laser) should suffice, but we encountered a number of problems based on force applied by clip and ambient light. The whole process gave us an appreciation for the precision required in commercial pulse oximeters.
- Our design solved the major problems posed by our sponsor: one, that the device is MRI compatible, two, the device is easily readable outside the room, three, the device is compatible with a variety of species, and four, the researchers are able to monitor life signs effectively.

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 Technical Manager: Dr. Patrick Winter

[1] https://www.howequipmentworks.com/pulse_oximeter/