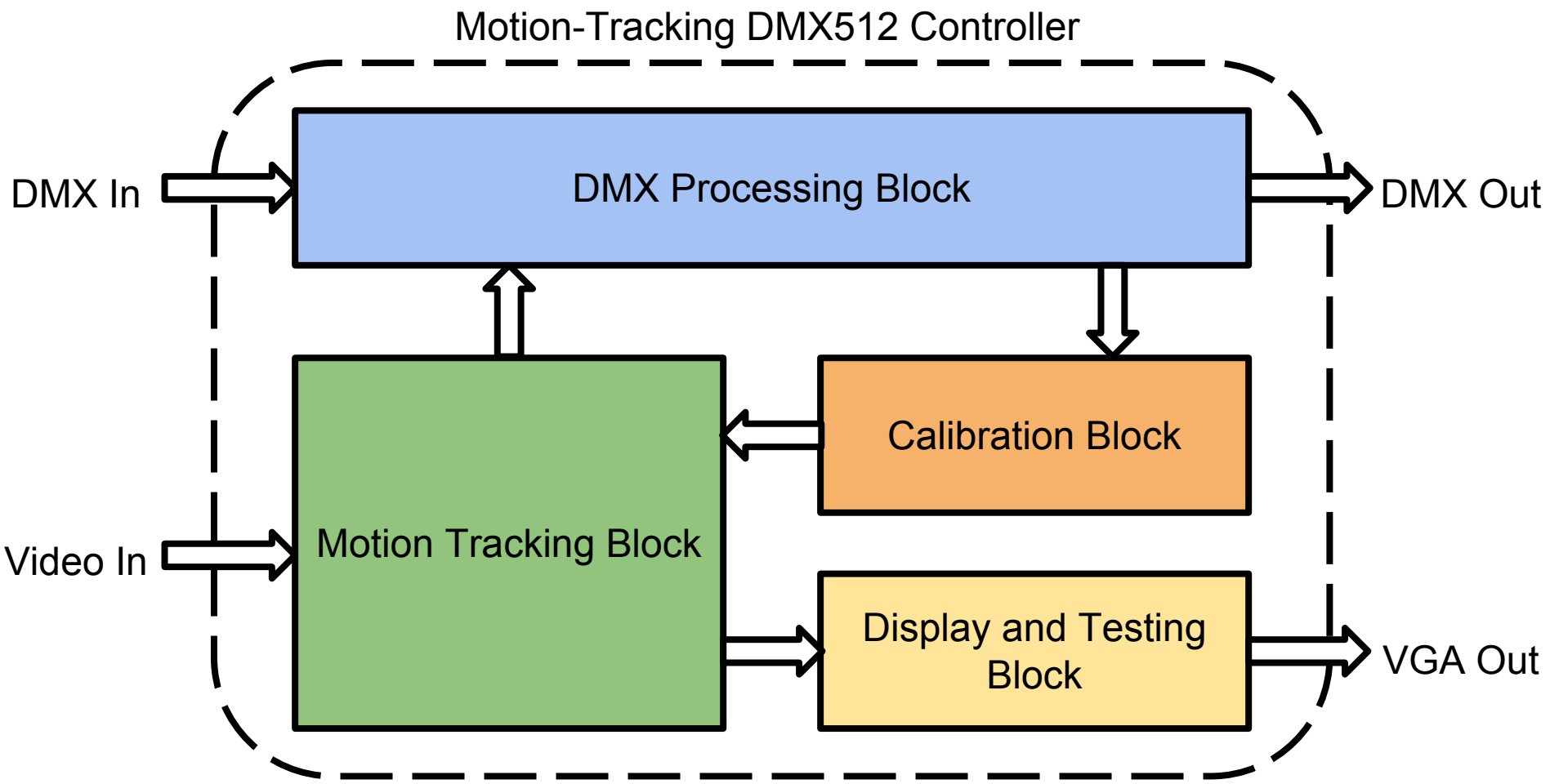
# A Motion-Tracking DMX512 Controller: Using Video for Real-time, Automated Intelligent Lighting Manipulation

Miren Bamforth - 6.111 Project Presentation - Fall 2014

Moving Light Demo

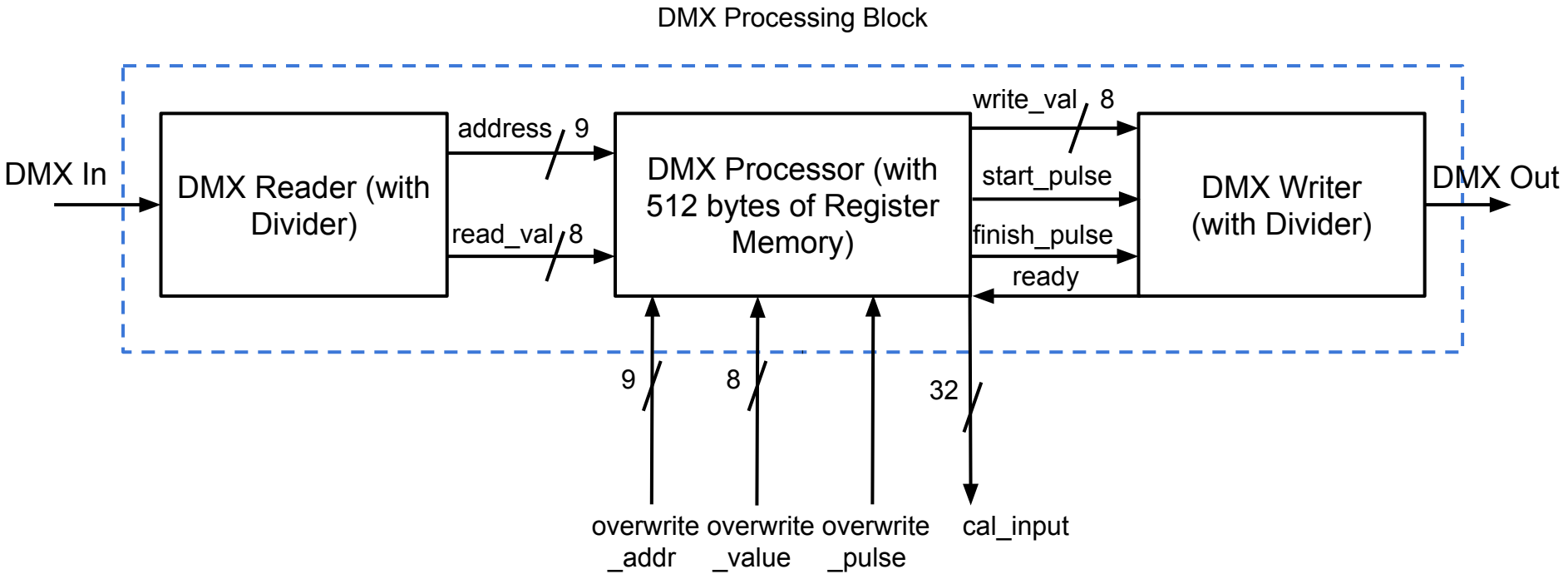
# Overview and Motivation




- Ties into previous research
- Potential for actual use
- Interesting!
- Thesis substitute

# DMX Processing Block

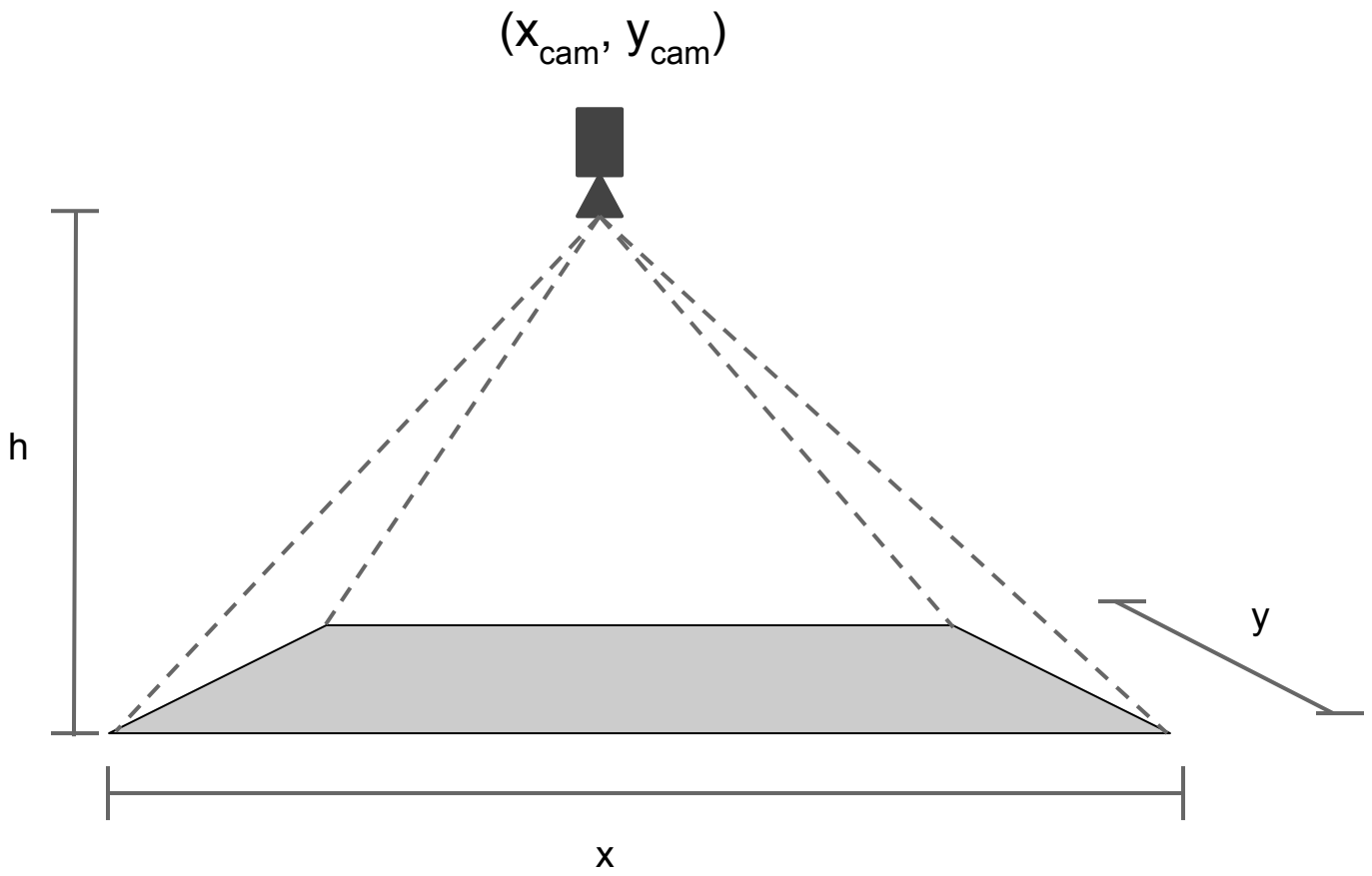
- Serial protocol
- Up to 512 packets
- Maximum refresh rate of 44Hz



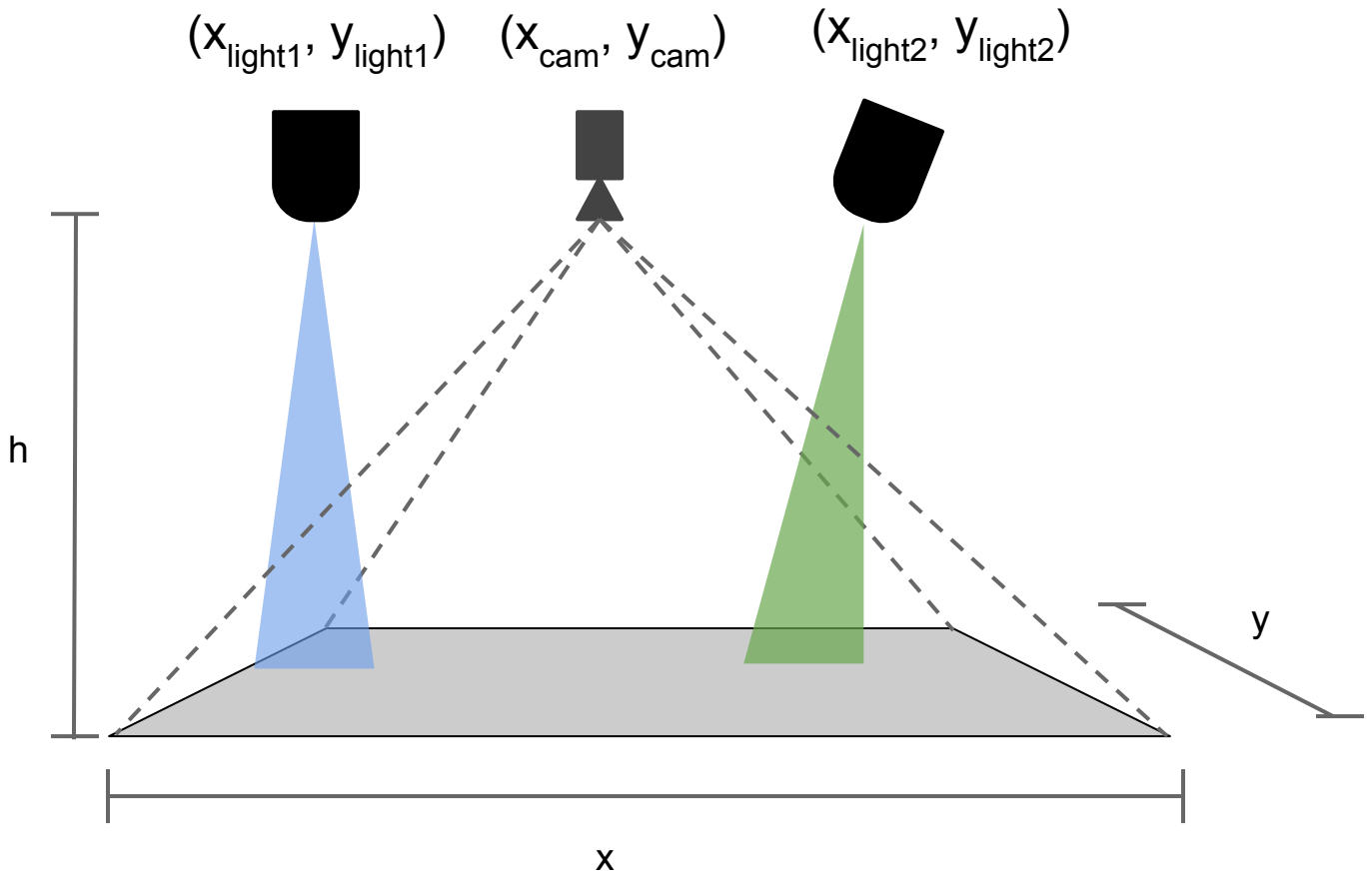
# Addressing

| DMX512 Packet | Significance |
|---|---|
| ... | ... |
| This light's address = 17 | LED intensity |
| 18 | Pan (0° to 540°) |
| 19 | Tilt (-120° to 120°) |
| 20 | Red value |
| 21 | Green value |
| 22 | Blue value |
| ... | ... |

# Calibration Block

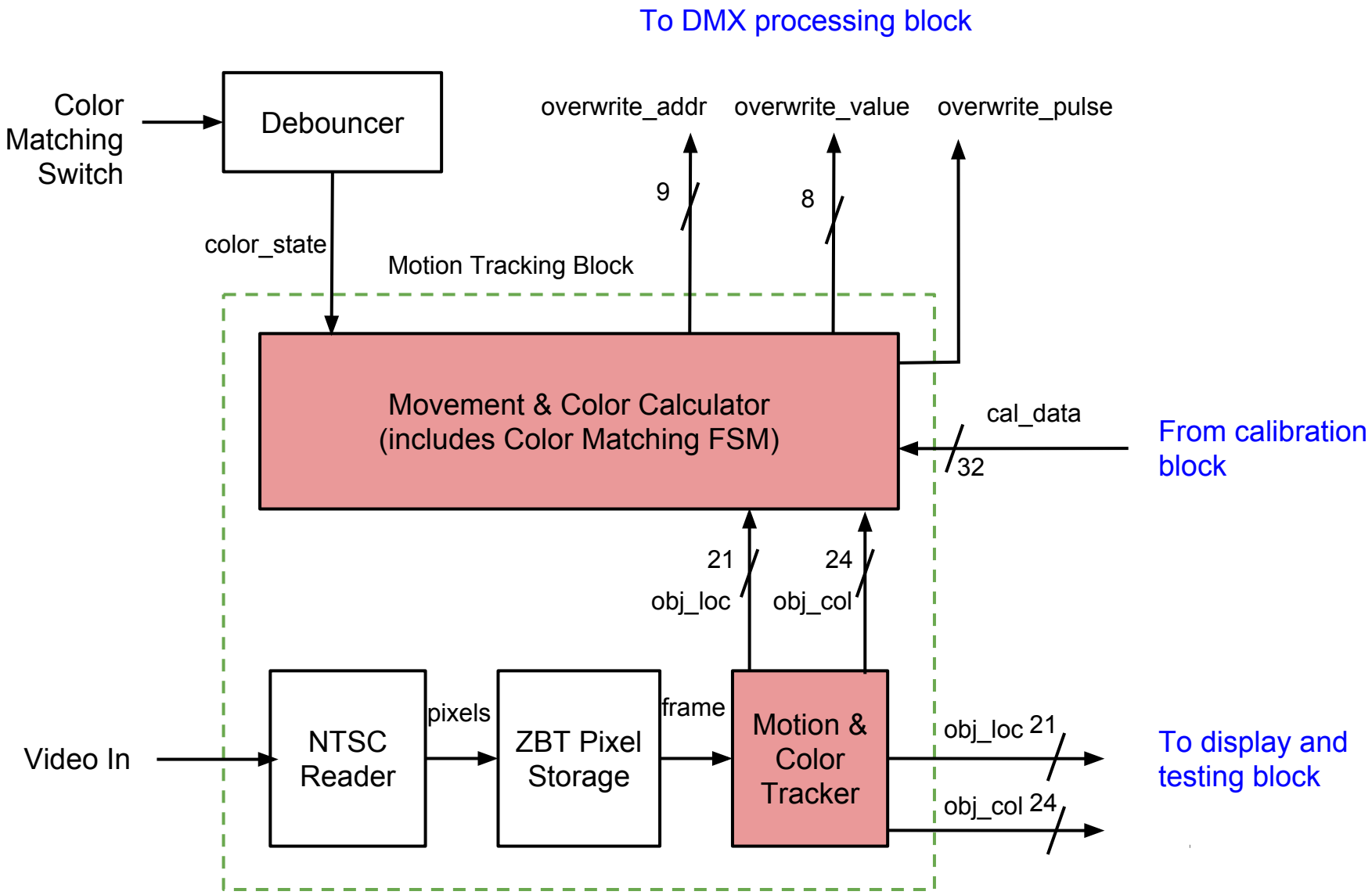


# Calibration Block

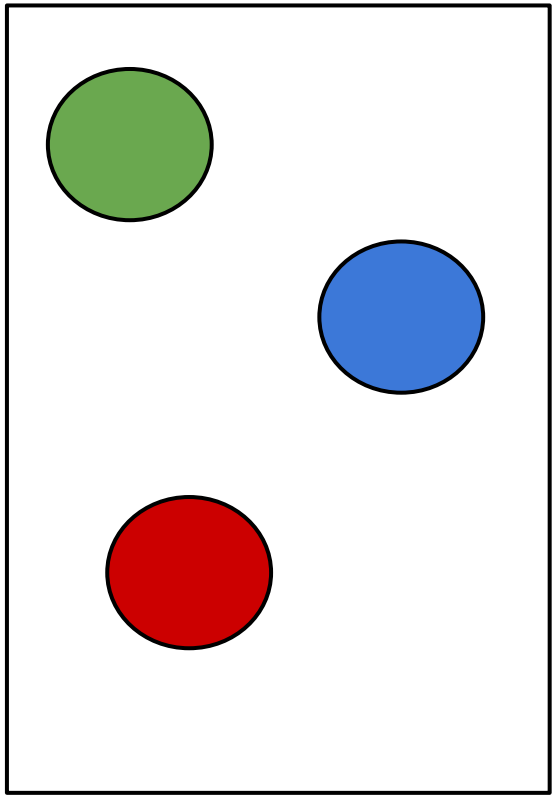



- Pan and tilt DMX addresses depending on light settings
- Calibration without hard-coding is challenging

# Motion Tracking Block



# Motion Tracking



For all pixels:

$H = \sum x_p$ and $V = \sum y_p$ when $hue_p$ is in desired range

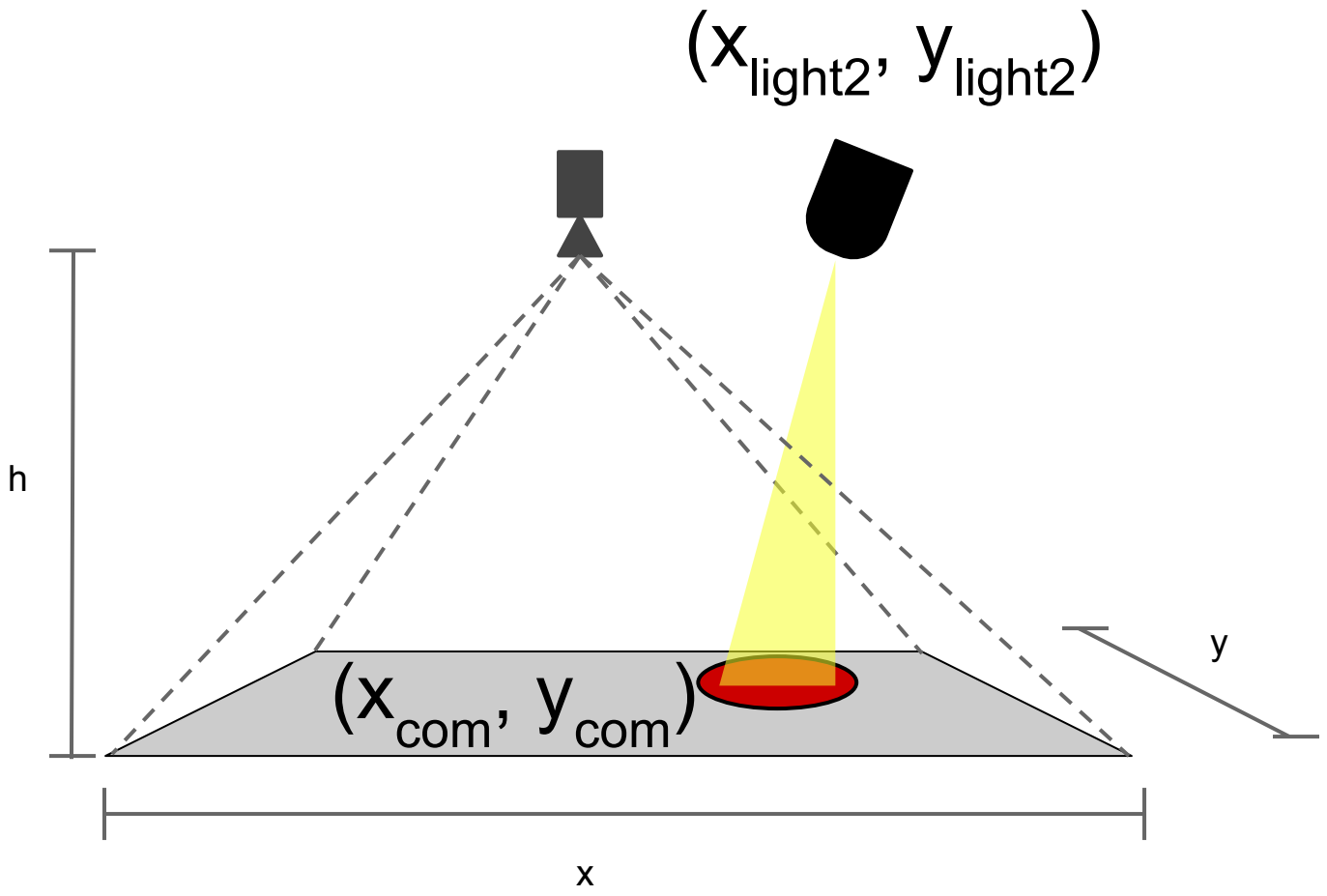
C is count of pixels in desired range

Center of mass location: (H/C, V/C)

Challenges:

- Color conflict with light beam
- Noise from camera
- Simplicity of algorithm
- Restriction to one object

# Motion Calculation

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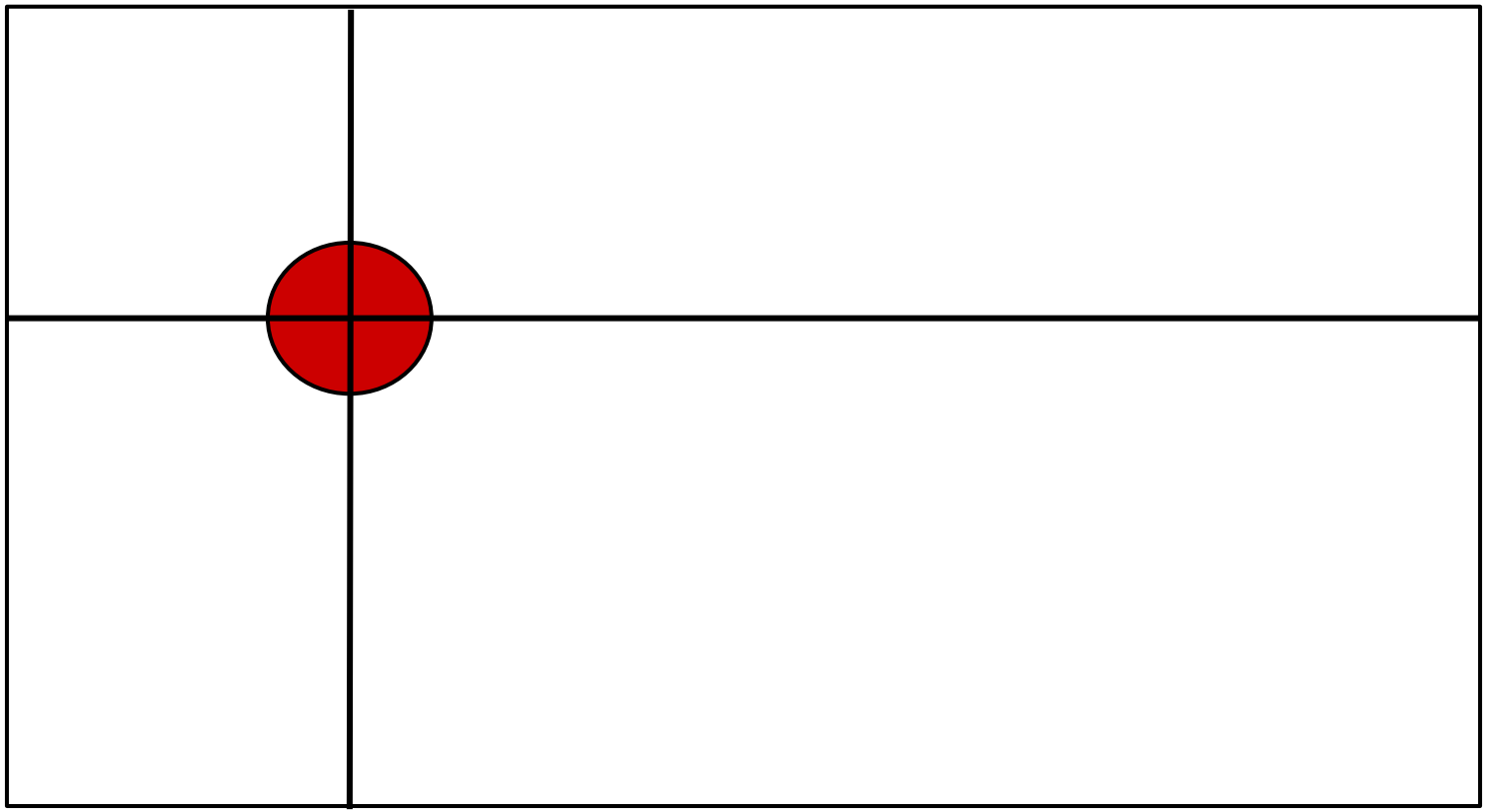
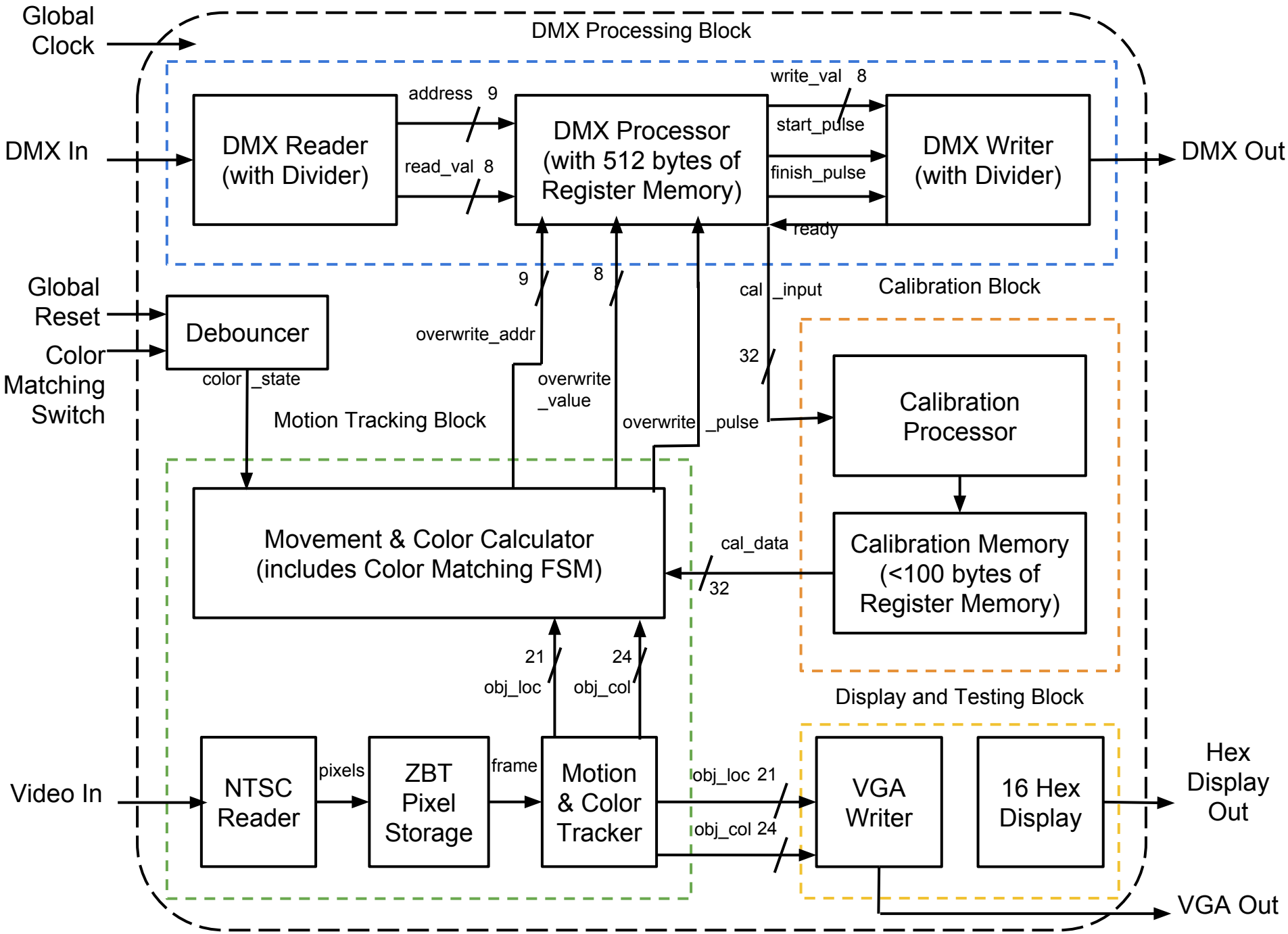
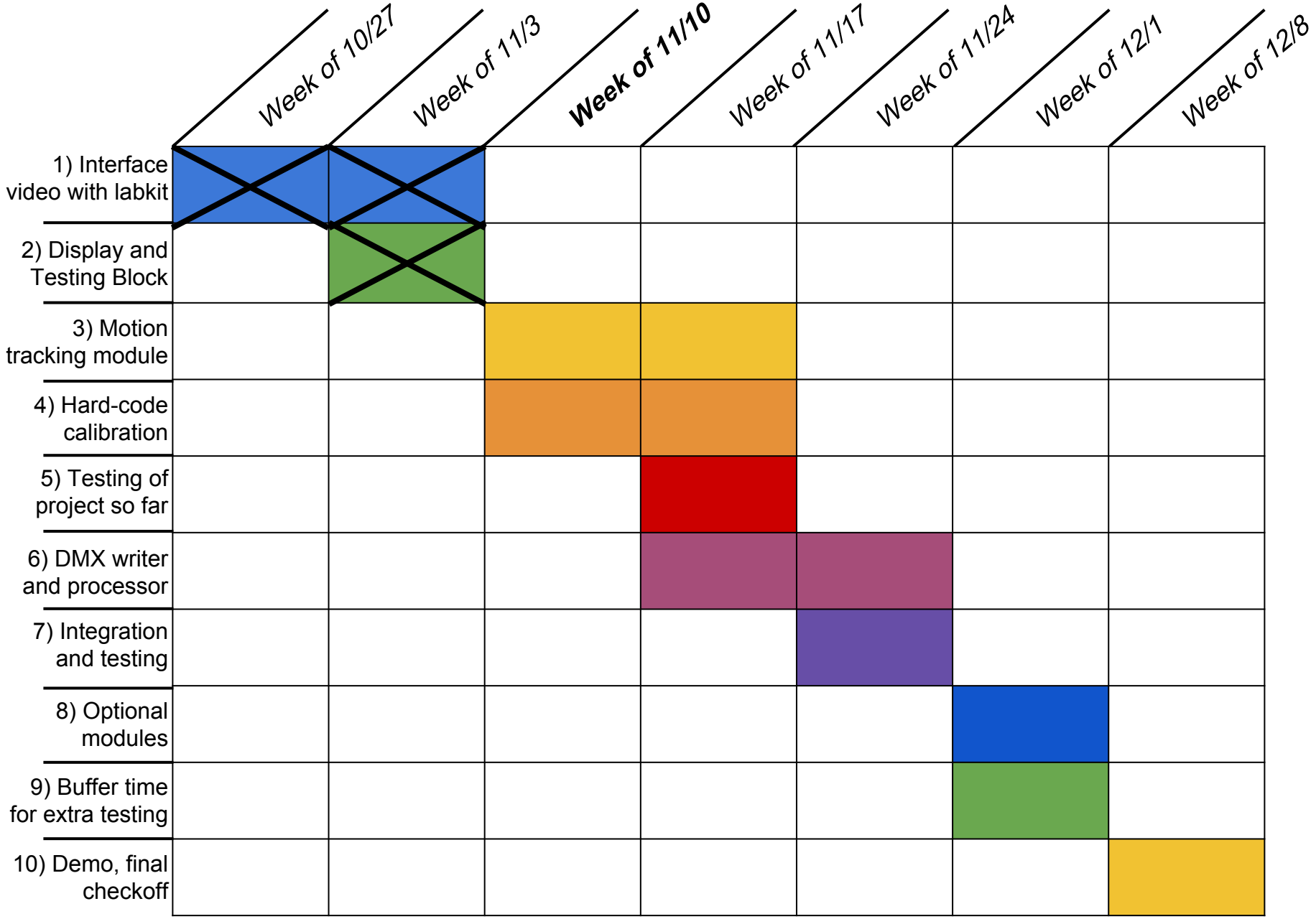
# Display and Testing Block

- VGA and hex display for debugging like in labs
- Cursors tracking center of mass
- Hex display has cursor x and y, RGB at intersection
- Testing with a moving light is helpful but not precise




Global Clock
DMX Processing Block
DMX In
DMX Reader (with Divider)
address 9
read_val 8
DMX Processor (with 512 bytes of Register Memory)
write_val 8
start_pulse
finish_pulse
ready
DMX Writer (with Divider)
DMX Out
Global Reset
Color Matching Switch
Debouncer
color _state
9
overwrite_addr
8
overwrite _value
overwrite _pulse
cal _input
32
Calibration Block
Calibration Processor
Motion Tracking Block
Movement & Color Calculator (includes Color Matching FSM)
cal_data
32
Calibration Memory (<100 bytes of Register Memory)
21
obj_loc
24
obj_col
Display and Testing Block
Video In
NTSC Reader
pixels
ZBT Pixel Storage
frame
Motion & Color Tracker
obj_loc 21
obj_col 24
VGA Writer
16 Hex Display
Hex Display Out
VGA Out

# Necessary Resources


Week of 10/27
Week of 11/3
Week of 11/10
Week of 11/17
Week of 11/24
Week of 12/1
Week of 12/8
1) Interface video with labkit
2) Display and Testing Block
3) Motion tracking module
4) Hard-code calibration
5) Testing of project so far
6) DMX writer and processor
7) Integration and testing
8) Optional modules
9) Buffer time for extra testing
10) Demo, final checkoff