

# MODULE CONCEPTS

Joel Goldstein

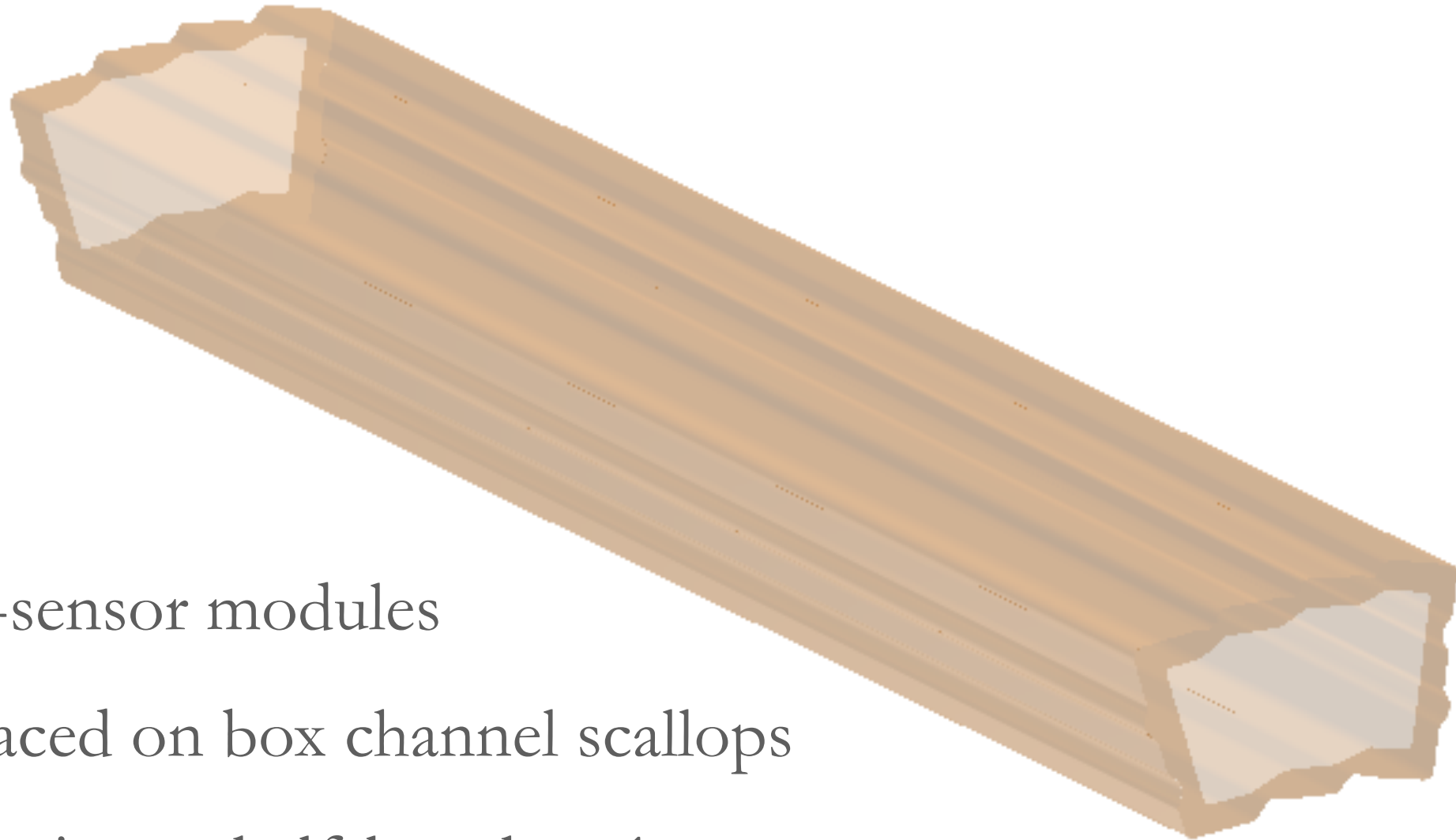
*LCUK Silicon*

28/4/16

# Introduction

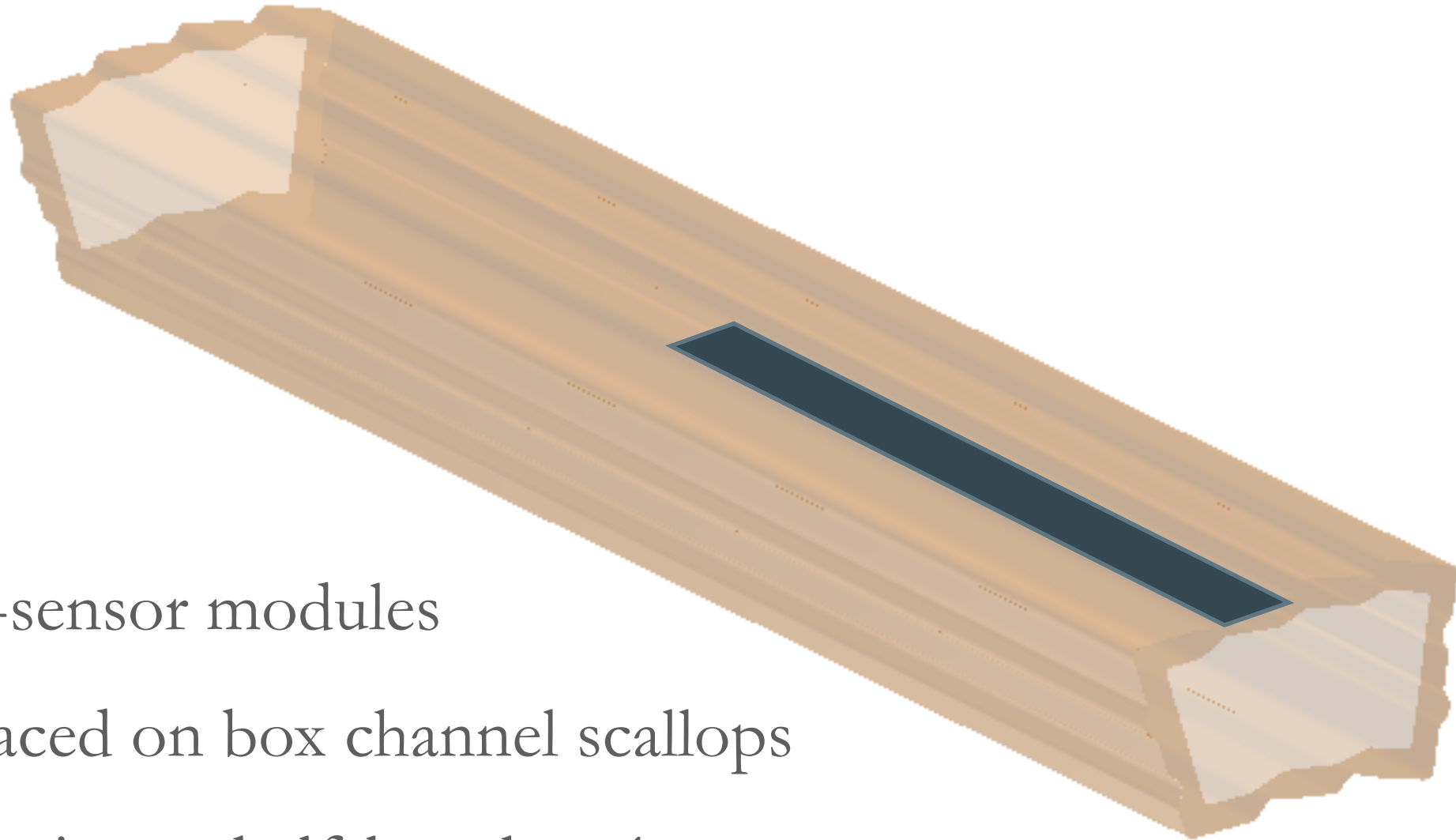
- \* Some first thoughts on straw-man modules
- \* Designed to start discussions
- \* No distinction between timing/tracking layers
- \* Passive cooling assumed

# Modules



- \* N-sensor modules
- \* Placed on box channel scallops
- \* Maximum half length  $\sim 1\text{m}$ 
  - \*  $N \leq 10$
  - \* May need to keep smaller (electrical/mechanical)

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# Mechanics

- \* Thermomechanics drives design
  - \* Possibility of “large” temperature gradients
  - \* Reduce free parameters in alignment fit
- \* Modules should be
  - \* Rigid (*but not structural*)
  - \* Predictable thermal behaviour
    - Thinned silicon attached to stiffener with matched CTE
    - Temperature and/or position monitoring vital
  - \* Attached to allow differential thermal expansion
- \* Alternate models (e.g. direct gluing) less practical

# Components

- \* Sensors assumed to be  $10 \times 10 \text{ cm}^2$
- \* Buttable in  $z$  (overlaps in  $\phi$  are easy for dead areas)
- \*  $50 \text{ }\mu\text{m}$  thick MAPS
- \*  $50 \text{ }\mu\text{m}$  thick analogue HV sensor with 4  $50 \text{ }\mu\text{m}$  ASICS
- \*  $\sim 50$  minimum connections per chip (WLCSP, bump, wire)
- \* Kapton flex circuits
- \* Stiffener with CTE matched to silicon
- \* Doped CF.....?
- \* Temperature/stress sensors integrated in ASICS, flex, (stiffener?)

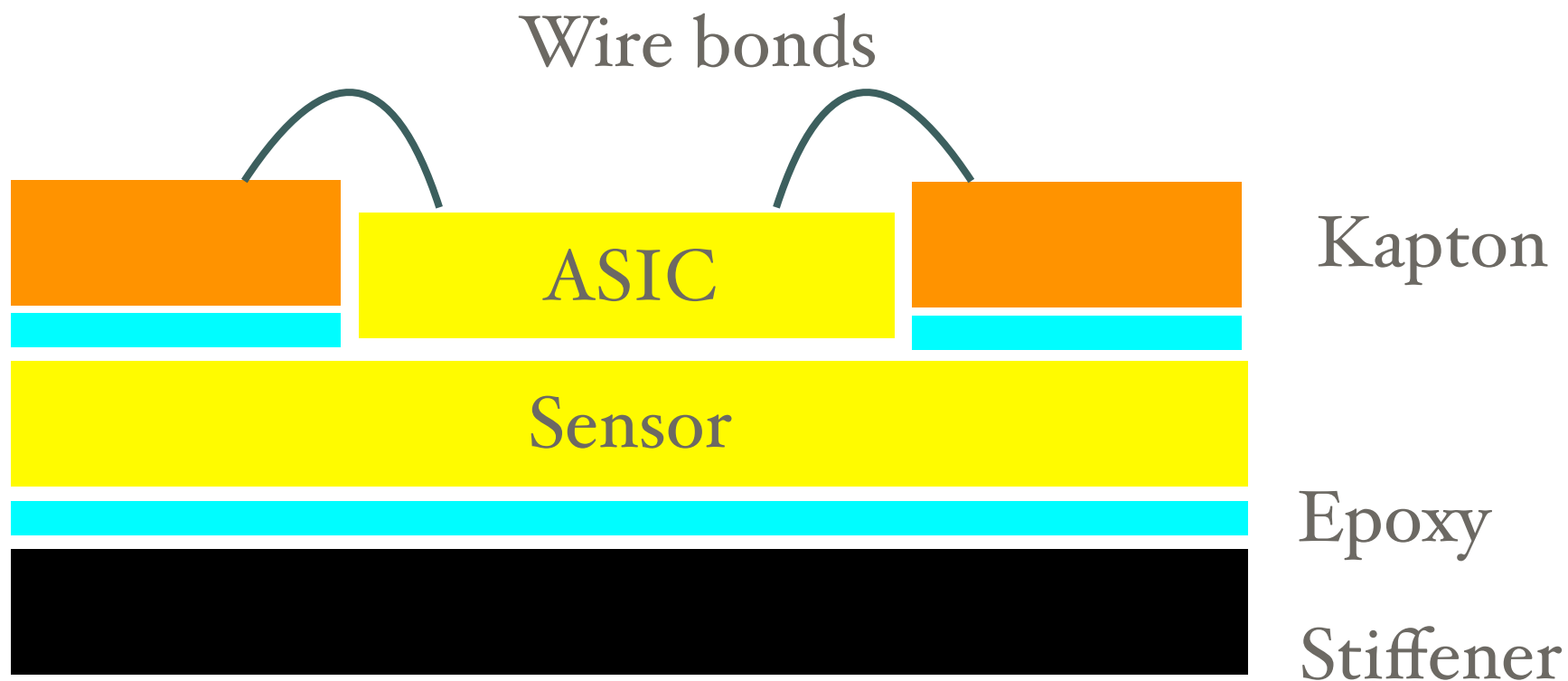
# MAPS Structure



**Layers and connections do not need to cover full area**

**Material 0.2-0.3%  $X_0$**

# HV Structure

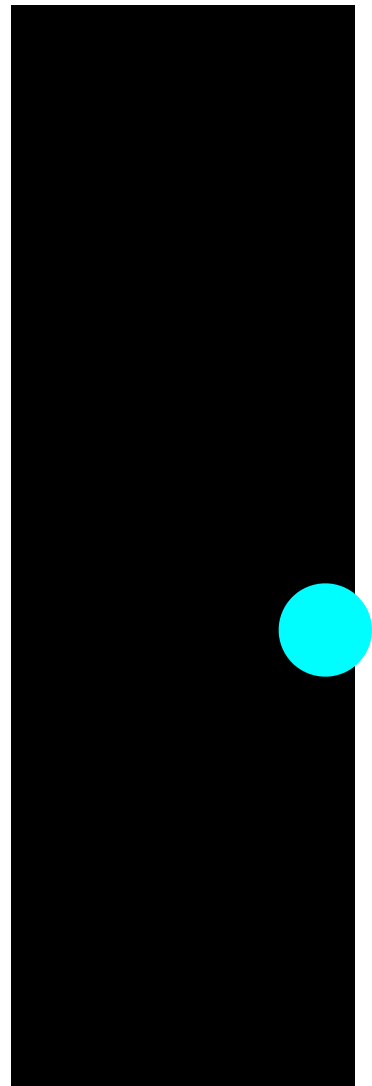


**Layers do not need to cover full area**

NB flex connections inverted compared to MAPS

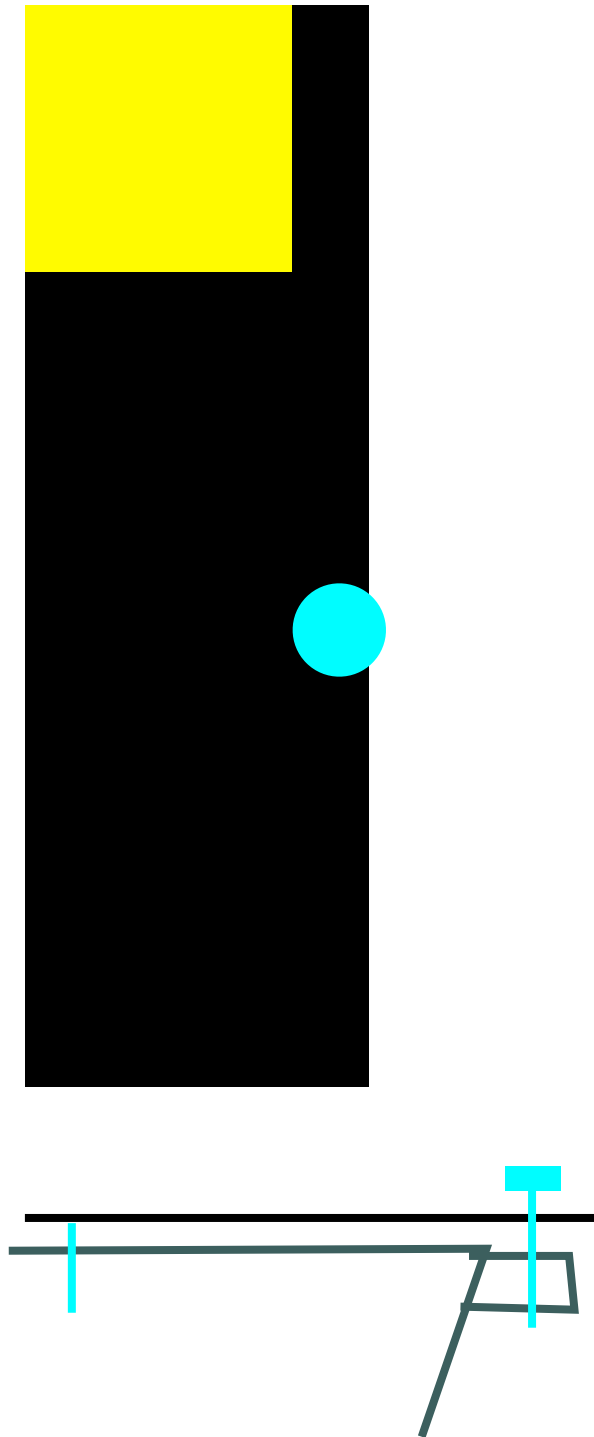


# 4-Sensor Module



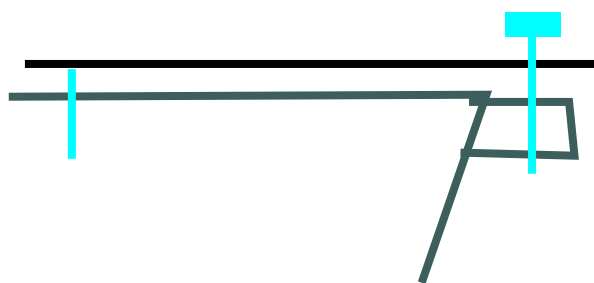
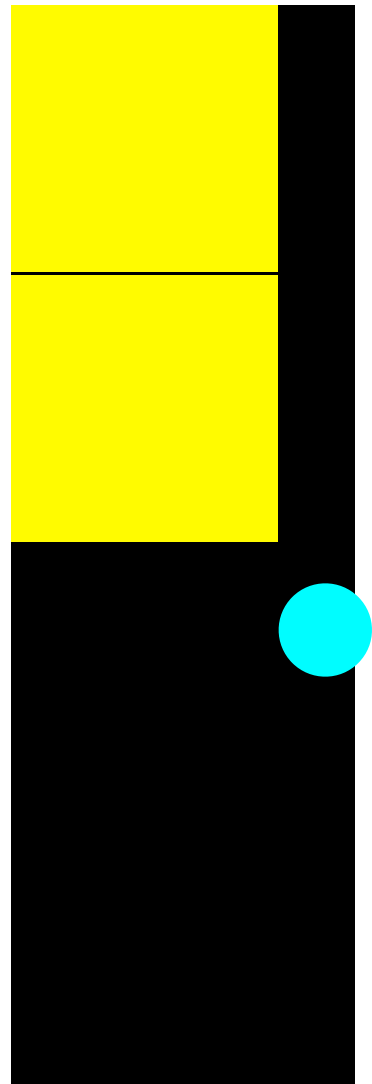
- \* Stiffener “locked” to box channel
- \* Sensors shown separated for clarity
  - \* Butted in reality
- \* Service hybrid contains:
  - \* Control/multiplexer ASICS
  - \* DC/DC converter
  - \* Capacitors
- \* Could be at end if full half-length
- \* External links power and in/out fibres

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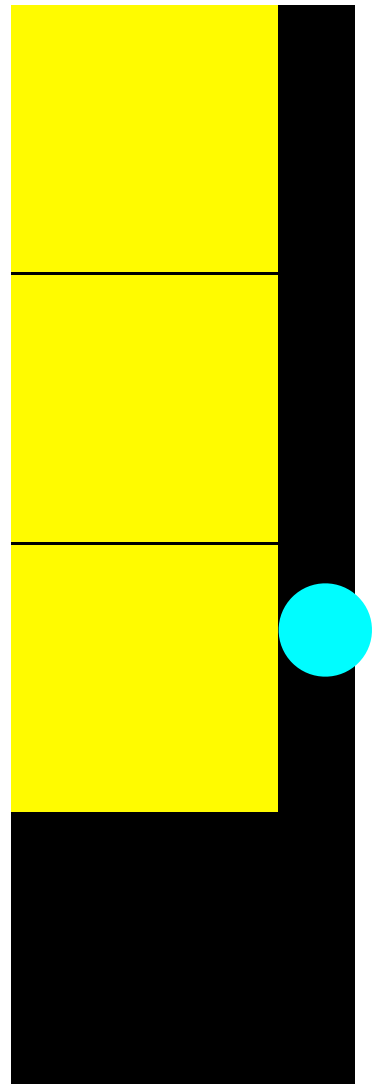
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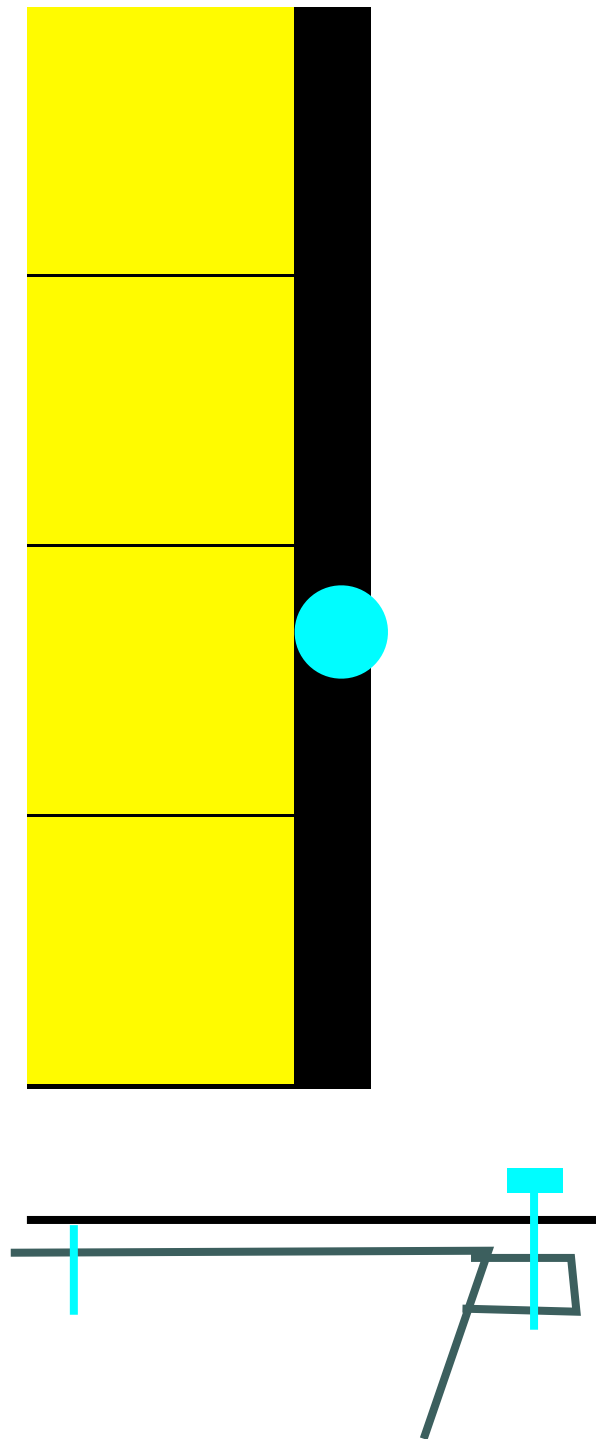
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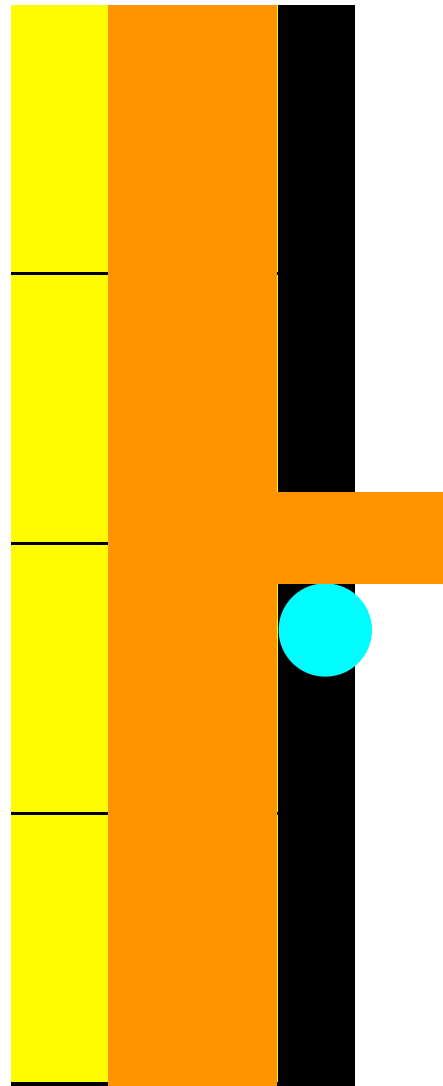
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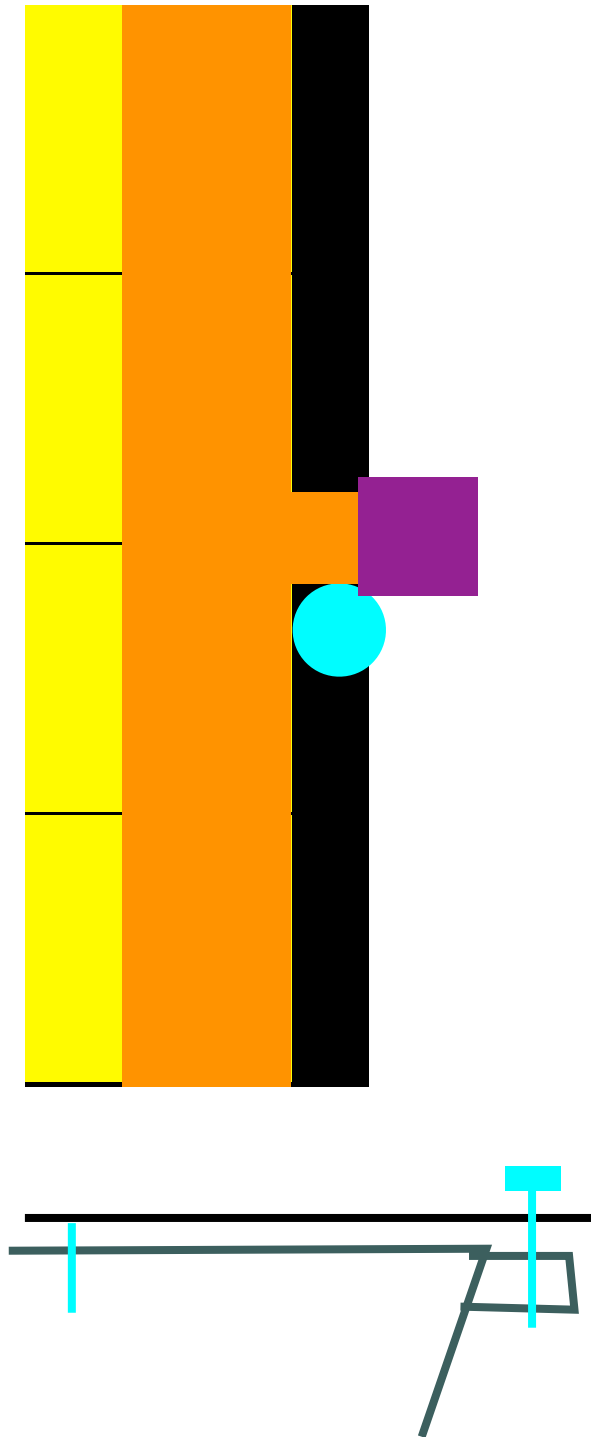
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# And so...

\* Thoughts, comments....?