Louis	Romain
5 days a week	More experience Maybe several semesters

Table 1

1 Organization

Github and Calendar.

Workshop Guru.

2 Intro

Worked a lot, didn't achieve much.

3 Motivation Mismatch

I don't see it as a problem.

4 Github, Calendar

5 Optics

Use Raspberry Pi HQ Camera.

I want a Didinium ($0.1 \times 0.1\text{mm}^2$) to span 3×3 pixels.

pixel size = 1.55µm.

Magnification (Negative for real images, because they are inverted)

$$M = -\frac{3 \times \text{Pixel size}}{\text{Didinium size}} = -0.0465 \approx -0.05. \tag{1}$$

5.1 Field of View

pixel size: 1.55µm.

pixel count for square image: 1520.

sidelength of image on sensor

$$l = 1.55\mu\text{m} \times 1520 = 2.356\text{mm} \tag{2}$$

$$FOV = \frac{l}{M} = 47.12\text{mm} \tag{3}$$

Make a chamber that is 5×5cm and have just a bit less than 3×3 pixel per Didinium.

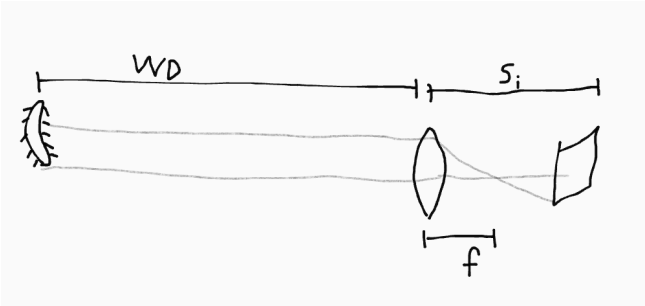

Figure 1

5.2 Focal length

$$M = \frac{f}{f - \mathrm{WD}} \implies f = \mathrm{WD}\frac{M}{M-1} = \mathrm{WD} \times 0.0476... \approx \mathrm{WD} \times 0.05. \tag{4}$$

Working Distance: Paper has WD $= 60 - 100$mm.

Things to consider: vibrations from the pump, having space to add filters etc

Things to ignore: Depth of view, blurriness is not a problem for tracking. Distortion, can be corrected digitally.

5.3 Lens choice

I got lost. Depth of field is badly explained. s_i is not given in online shops.

$$M = -0.05 \tag{5}$$

$$f = 8\mathrm{mm} \tag{6}$$

$$\mathrm{WD} = f\frac{M-1}{M} = 168\mathrm{mm} \tag{7}$$

$$s_i = -\mathrm{WD} \times M = 8.4\mathrm{mm} \tag{8}$$

$WD = 168$mm is good, edmund optics says that $WD \approx 3 \times FOV$ is good.

6 Tank

Peltier plate would work for 1 cm^2. But to have (5cm)^2 without convection we need millikelvin thermometer, not possible. Use external tank and pump.

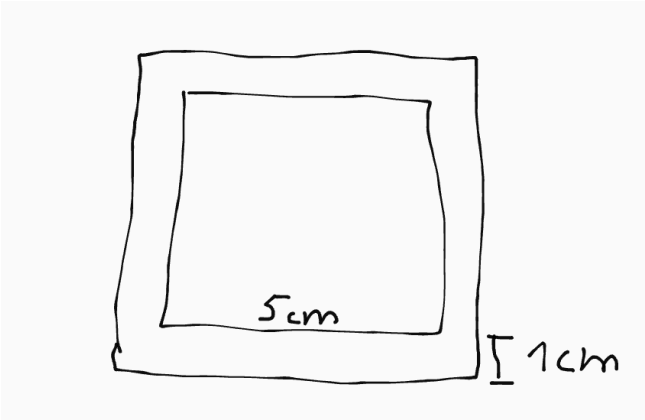

Figure 2