Experimento 5 – Difração em fenda simples

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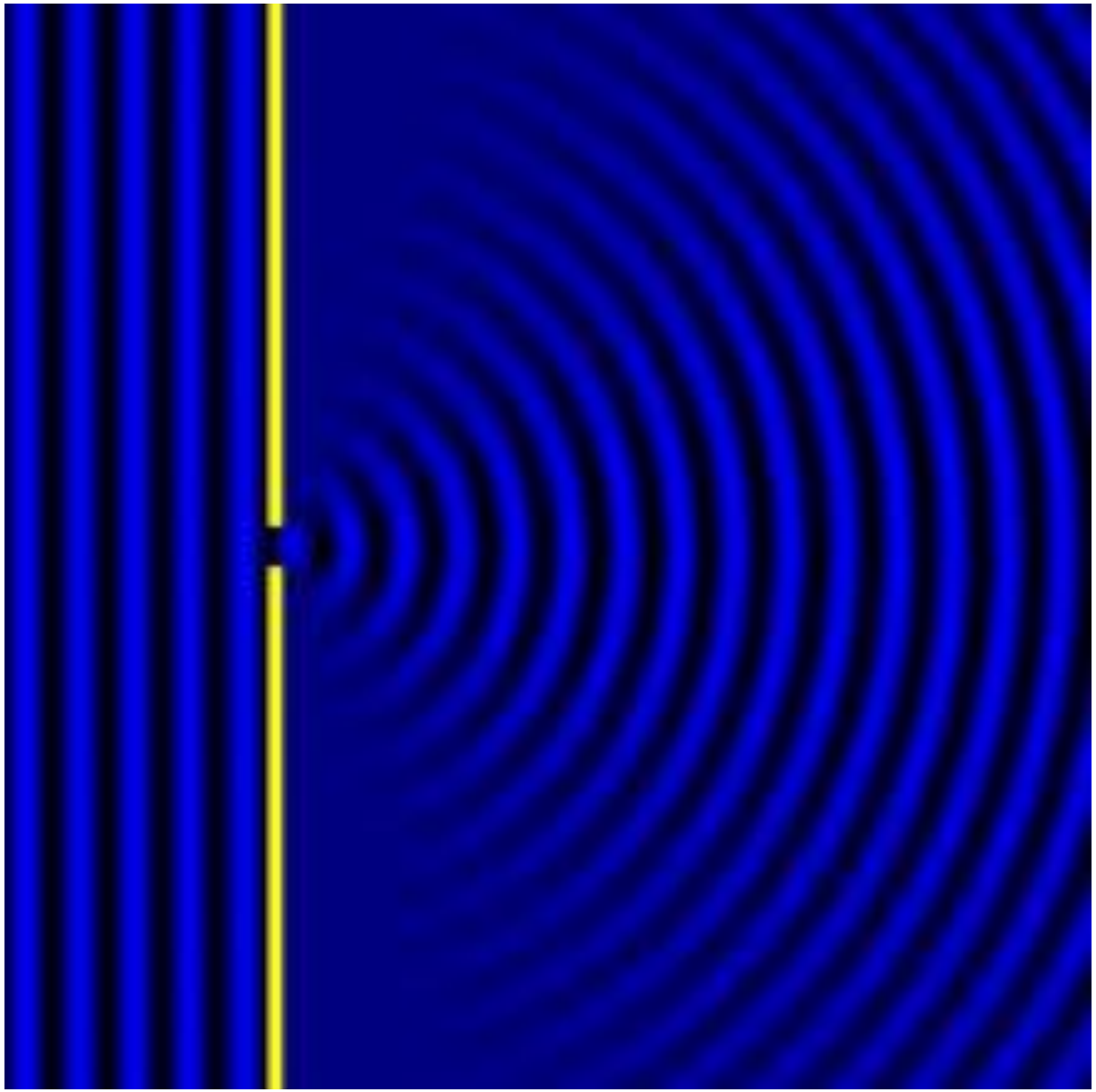
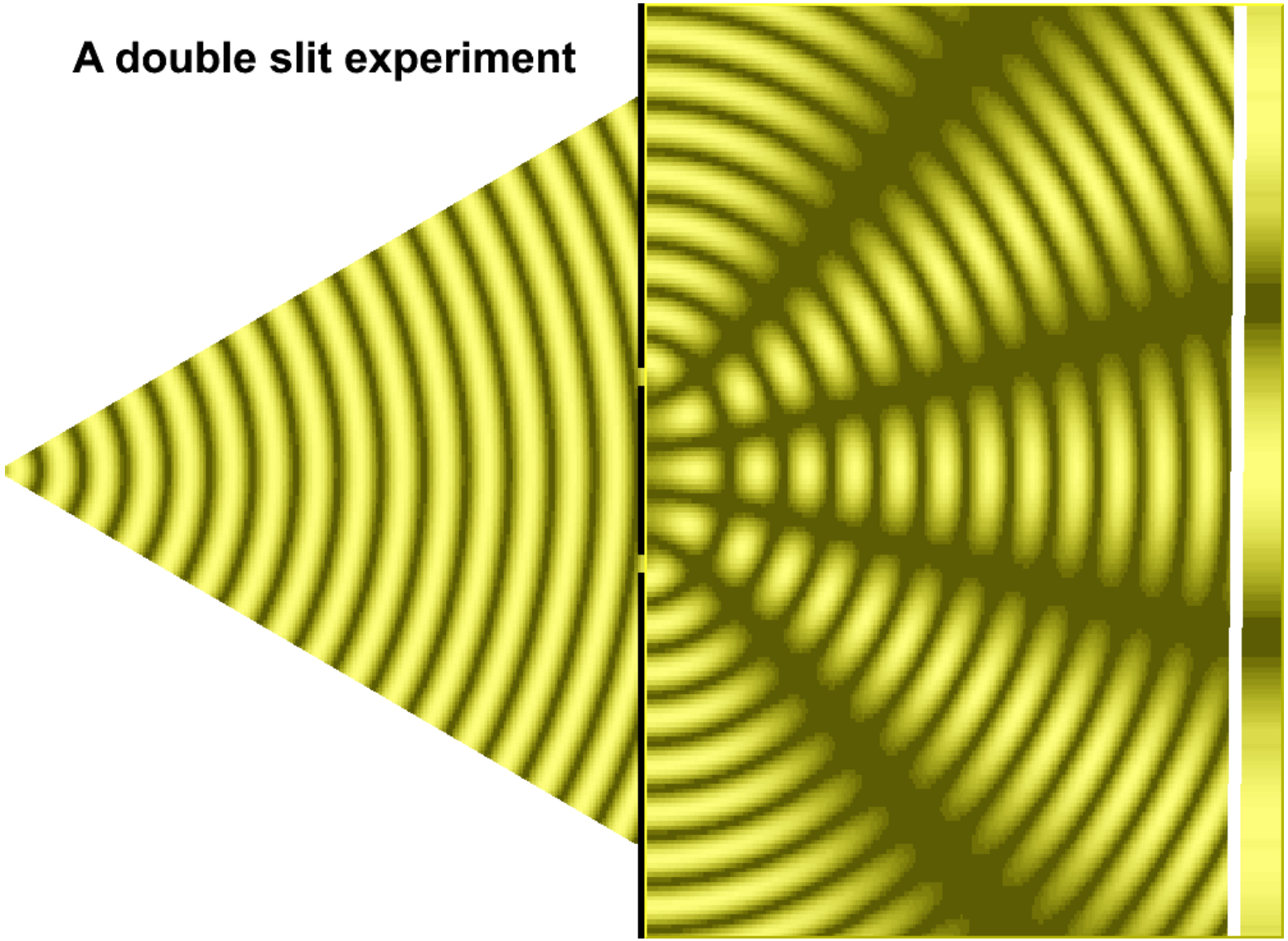


A double slit experiment



Difração dupla

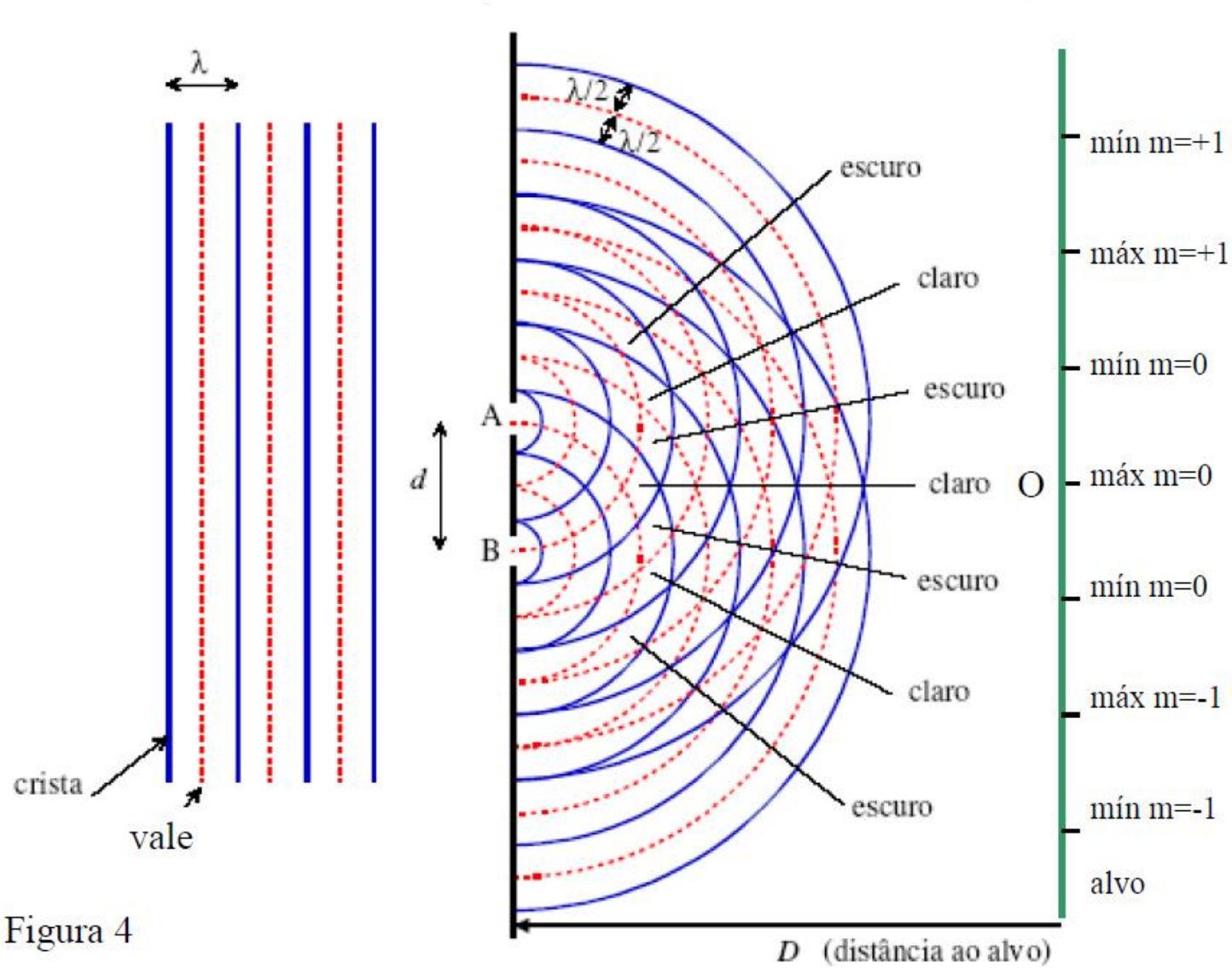
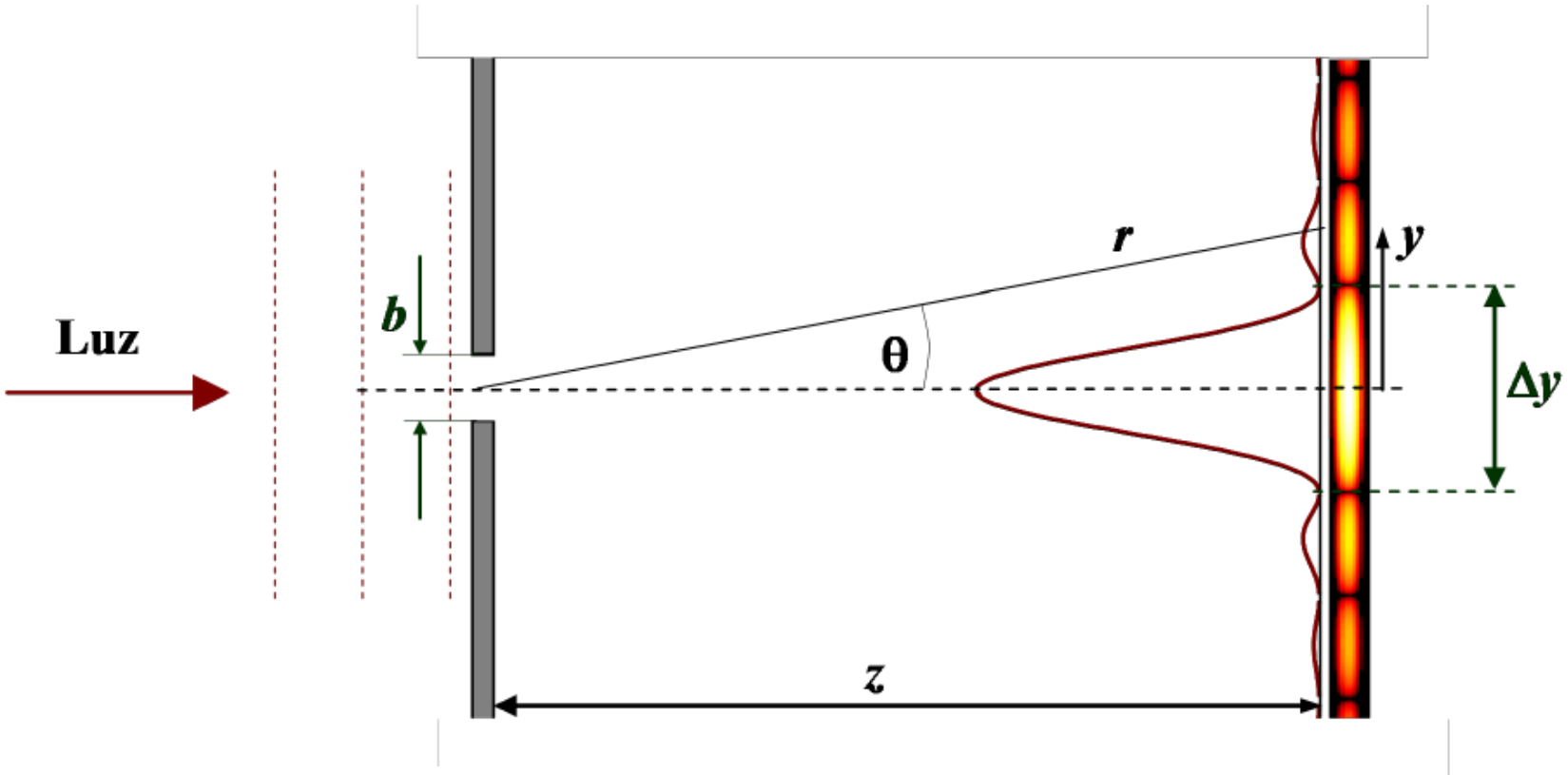


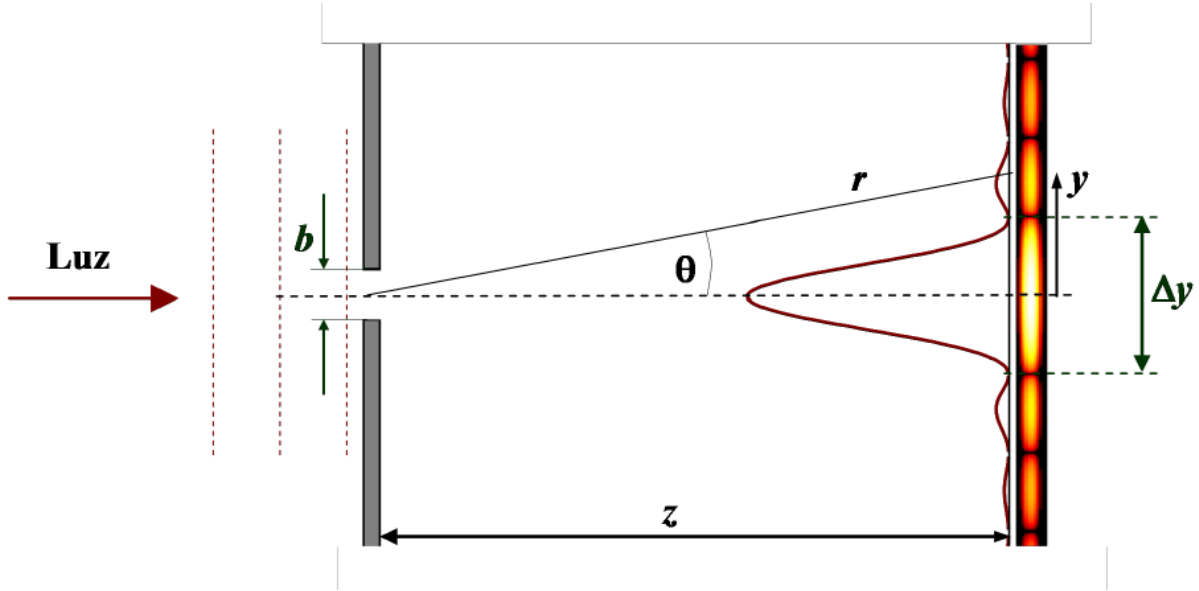
Figura 4

Difração fenda simples



$$I = I_0 \left(\frac{\sin \beta}{\beta} \right)^2, \qquad \beta = \frac{1}{2} k b \sin \theta,$$

Difração fenda simples



$$I = I_0 \left(\frac{\sin \beta}{\beta} \right)^2 ,$$

Se $y \ll z$ podemos usar as aproximações $\sin\theta \approx \theta \approx y/z$ e escrever

$$\beta = \frac{1}{2} kb \sin\theta, \Rightarrow \beta \simeq \frac{\pi b y}{\lambda z}. \Rightarrow$$

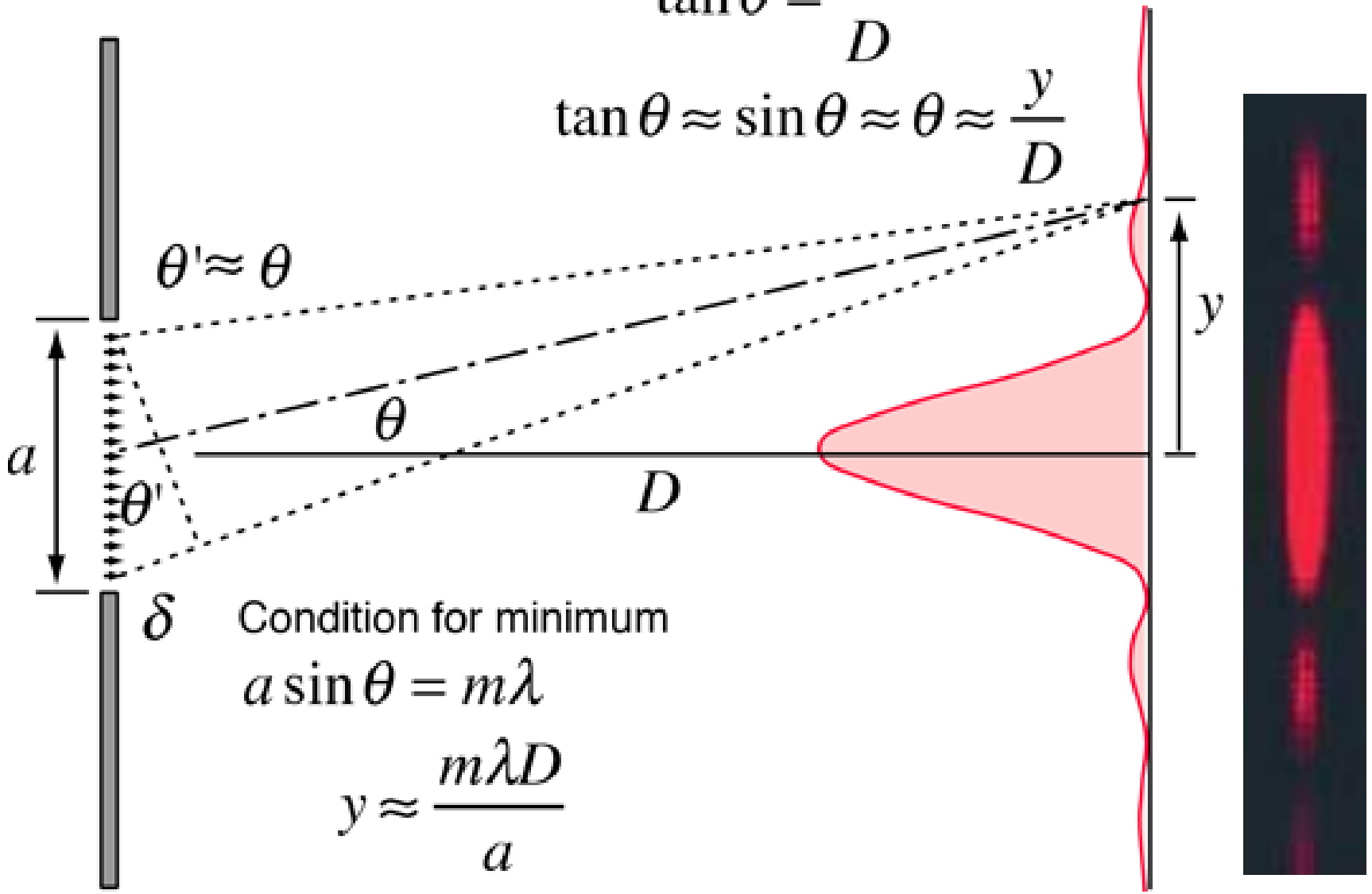
$$\beta = n\pi \ (n = \pm 1, \pm 2, \pm 3, ...)$$

$$y_n = n\lambda z/b \quad \text{(mínimos de difração)}$$

$$\boxed{\Delta y = 2\lambda z/b.}$$

$$\tan\theta = \frac{y}{D}$$

$$\tan\theta \approx \sin\theta \approx \theta \approx \frac{y}{D}$$

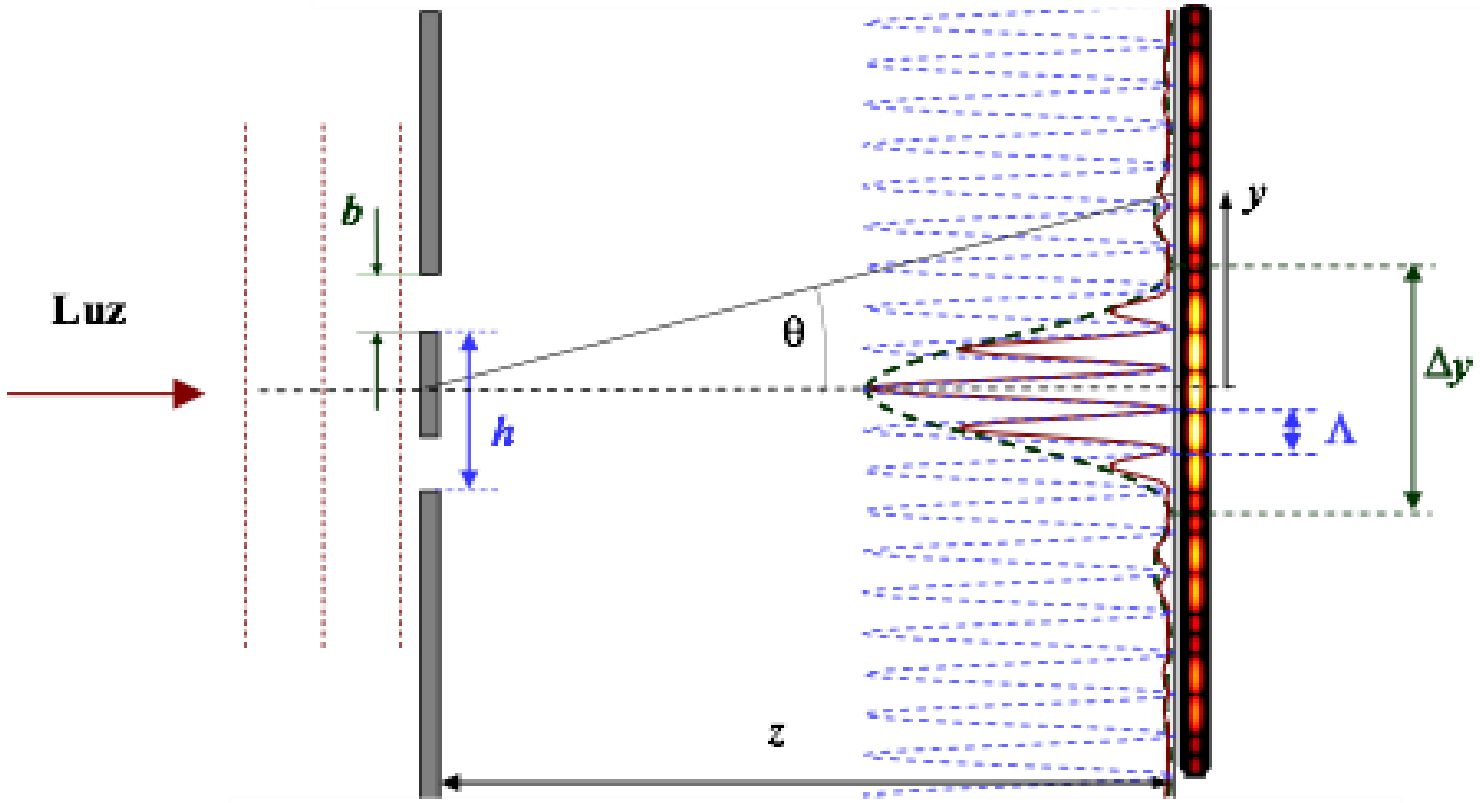


Condition for minimum

$$a\sin\theta = m\lambda$$

$$y \approx \frac{m\lambda D}{a}$$

Difração fenda dupla

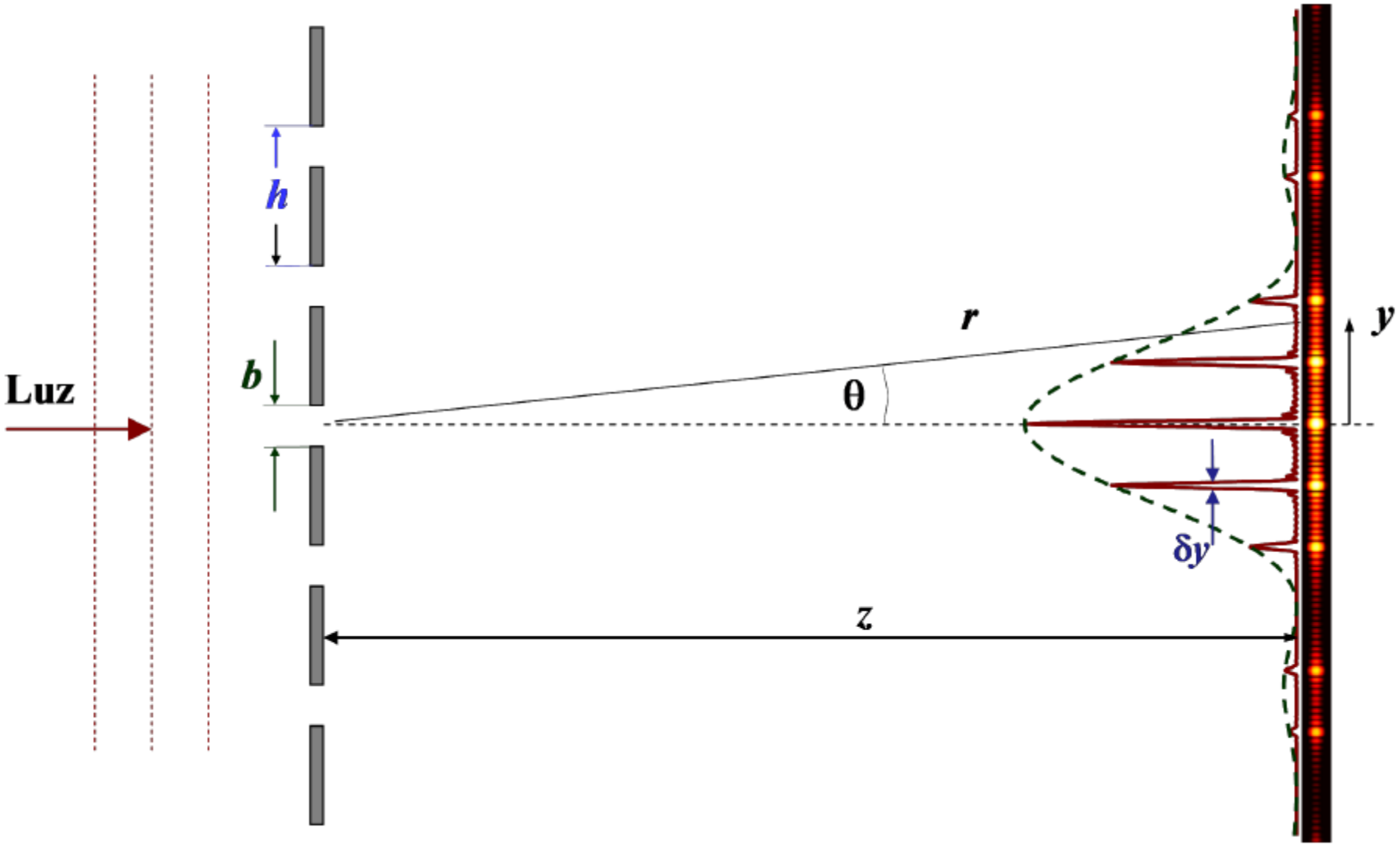


$$I = I_0 \cos^2\gamma \left(\frac{\sin\beta}{\beta}\right)^2$$

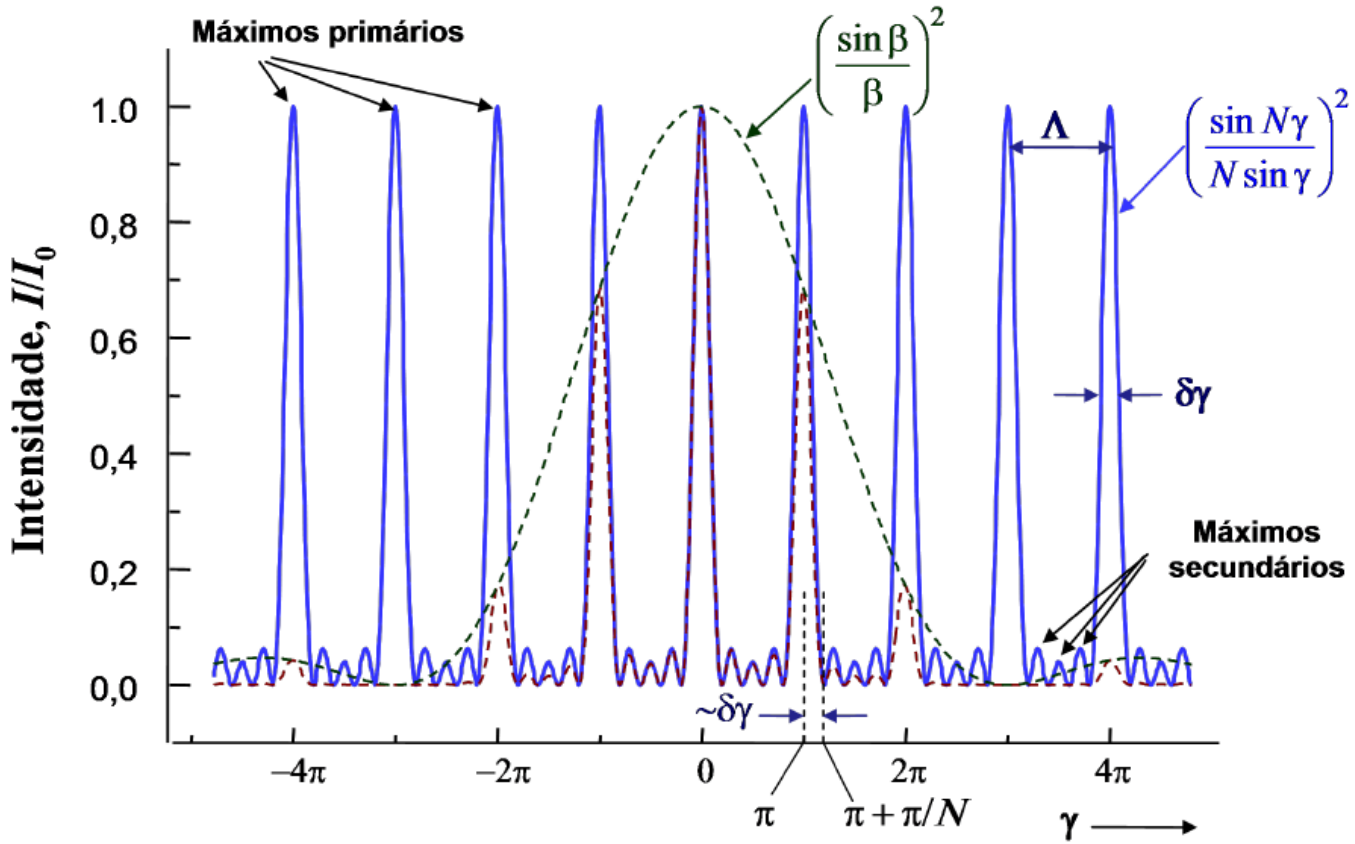
$$\beta = \frac{1}{2} kb \sin\theta \Rightarrow \boxed{\Delta y = 2\lambda z/b.}$$

$$\gamma = \frac{1}{2} kh \sin\theta. \Rightarrow \boxed{\Lambda = \lambda z/h.}$$

Difração fenda múltipla



$$I = I_0 \left(\frac{\sin(N\gamma)}{N\sin\gamma}\right)^2 \left(\frac{\sin\beta}{\beta}\right)^2.$$

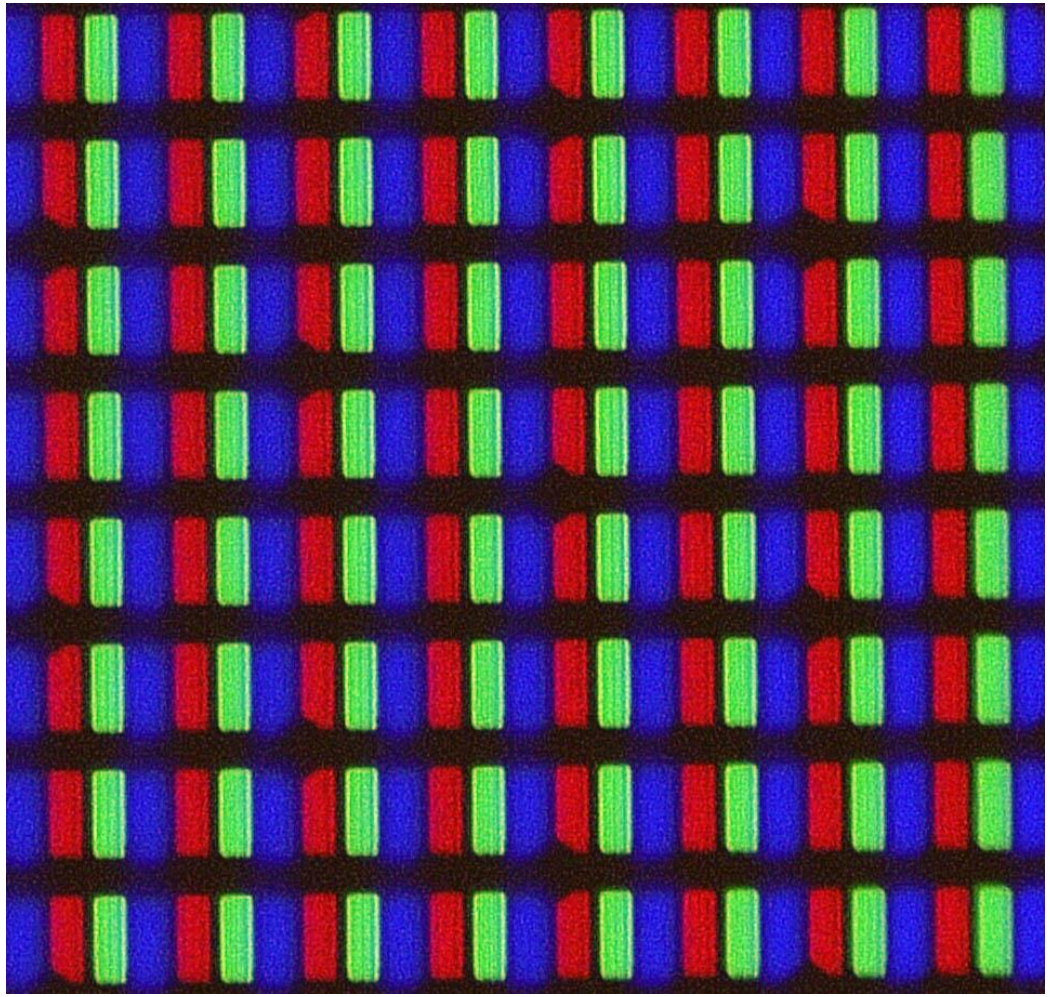


$\gamma = n\pi \quad (n = 0, \pm 1, \pm 2, ...)$ (máximos primários)

$$y_n = nz\lambda/h = n\Lambda.$$

$$\delta y = z\lambda/Nh.$$

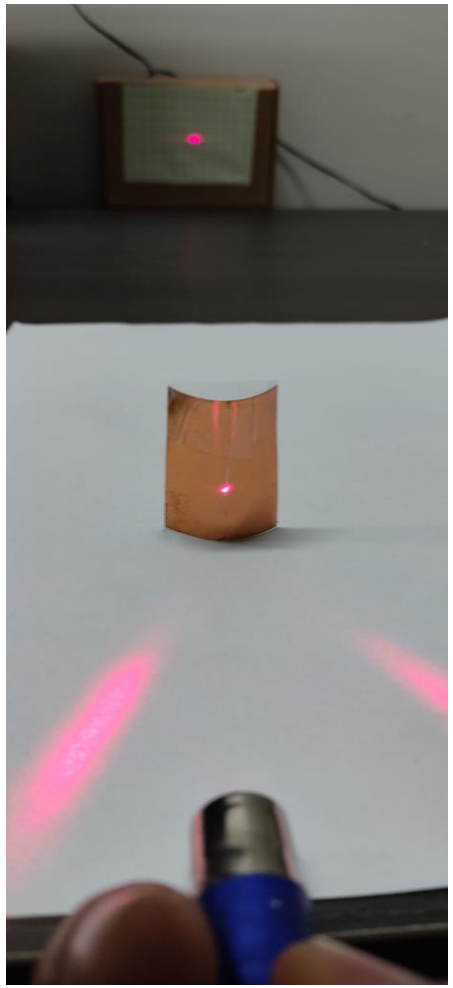
Qual a densidade de pixels do seu celular?

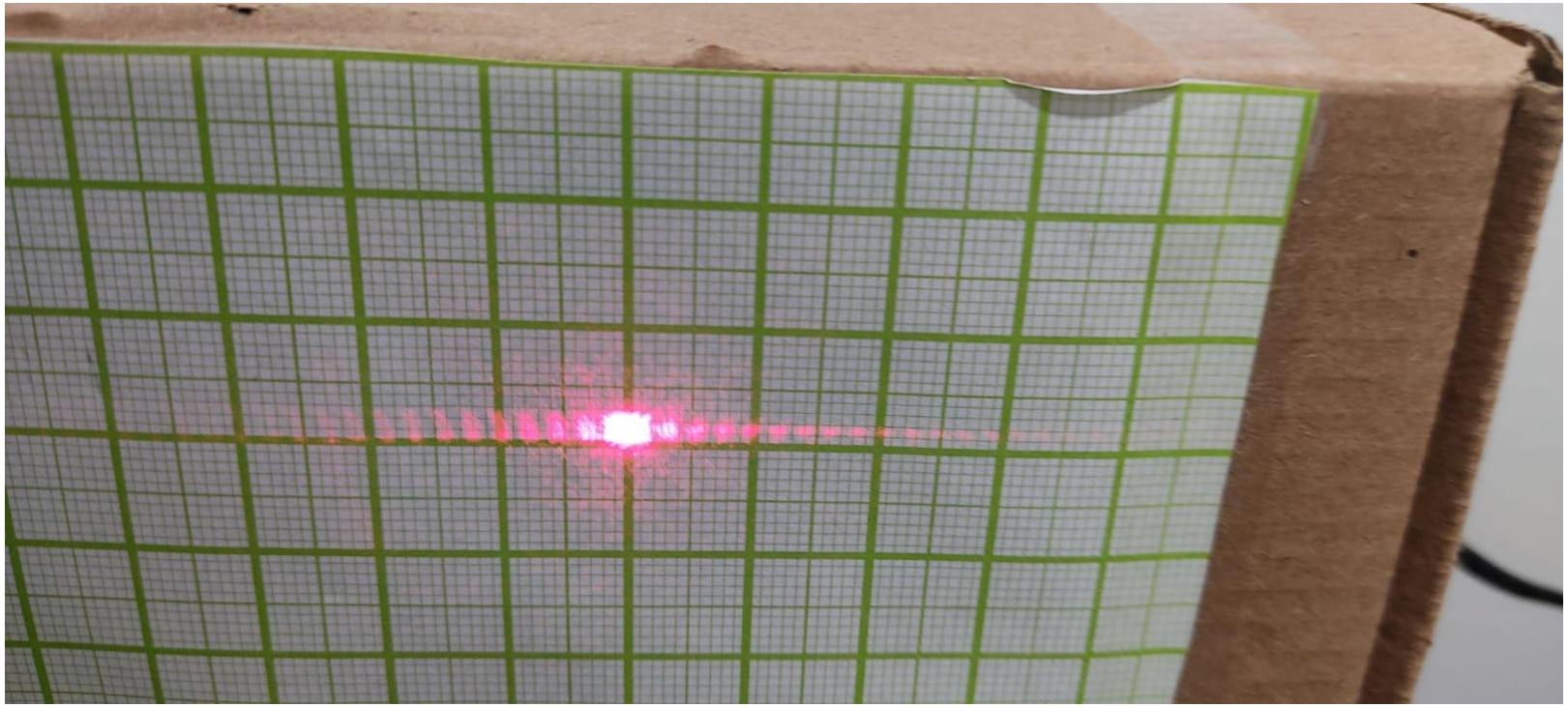


Objetivos

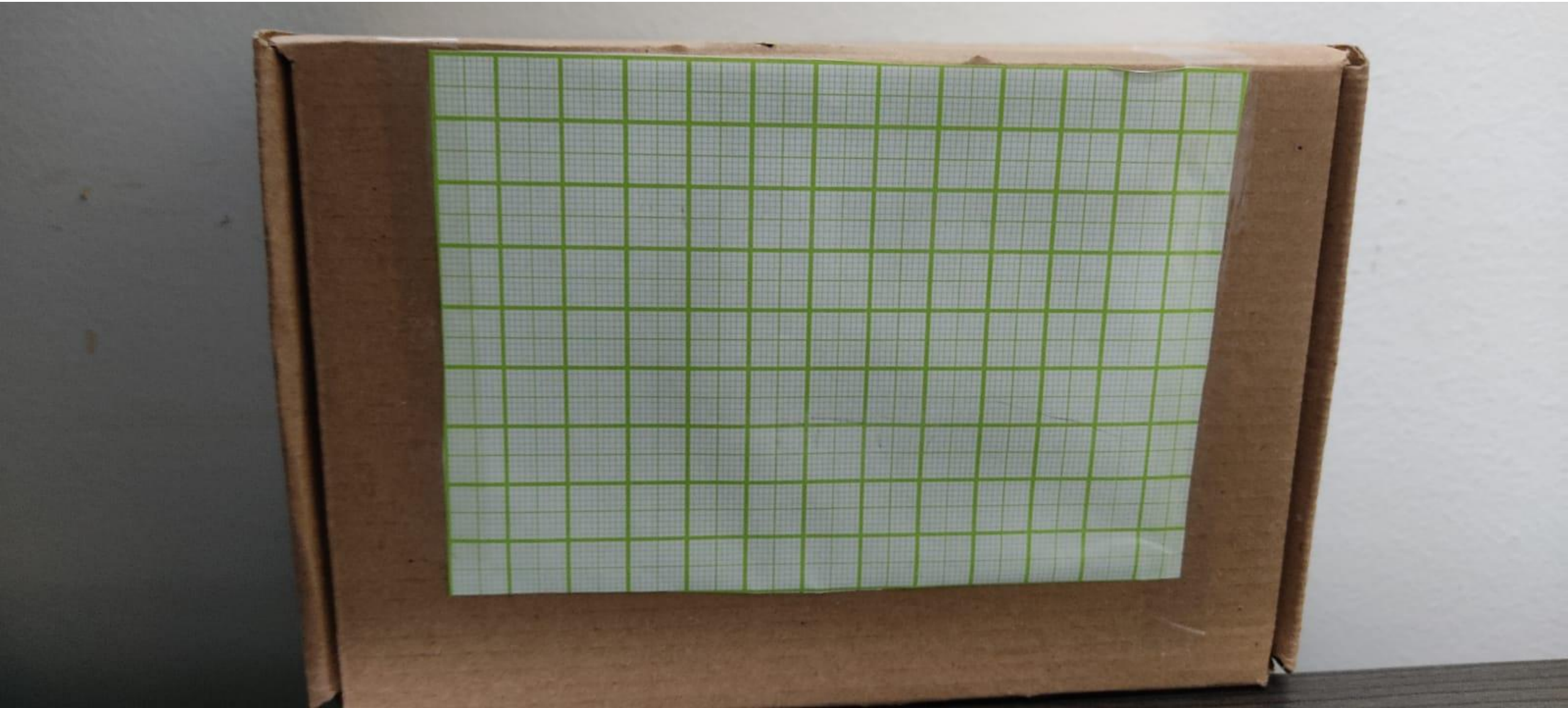
- Observar o fenômeno de difração em fenda simples
- Quantificar largura da fenda através da medida do máximo central de difração para 3 larguras de fenda
- Verificar modelo através da comparação da largura obtida experimentalmente com medida feita diretamente no microscópio
- Identificar principais fontes de incertezas

Medida do padrão de difração em fenda simples feita em folha cobreada com gilete:

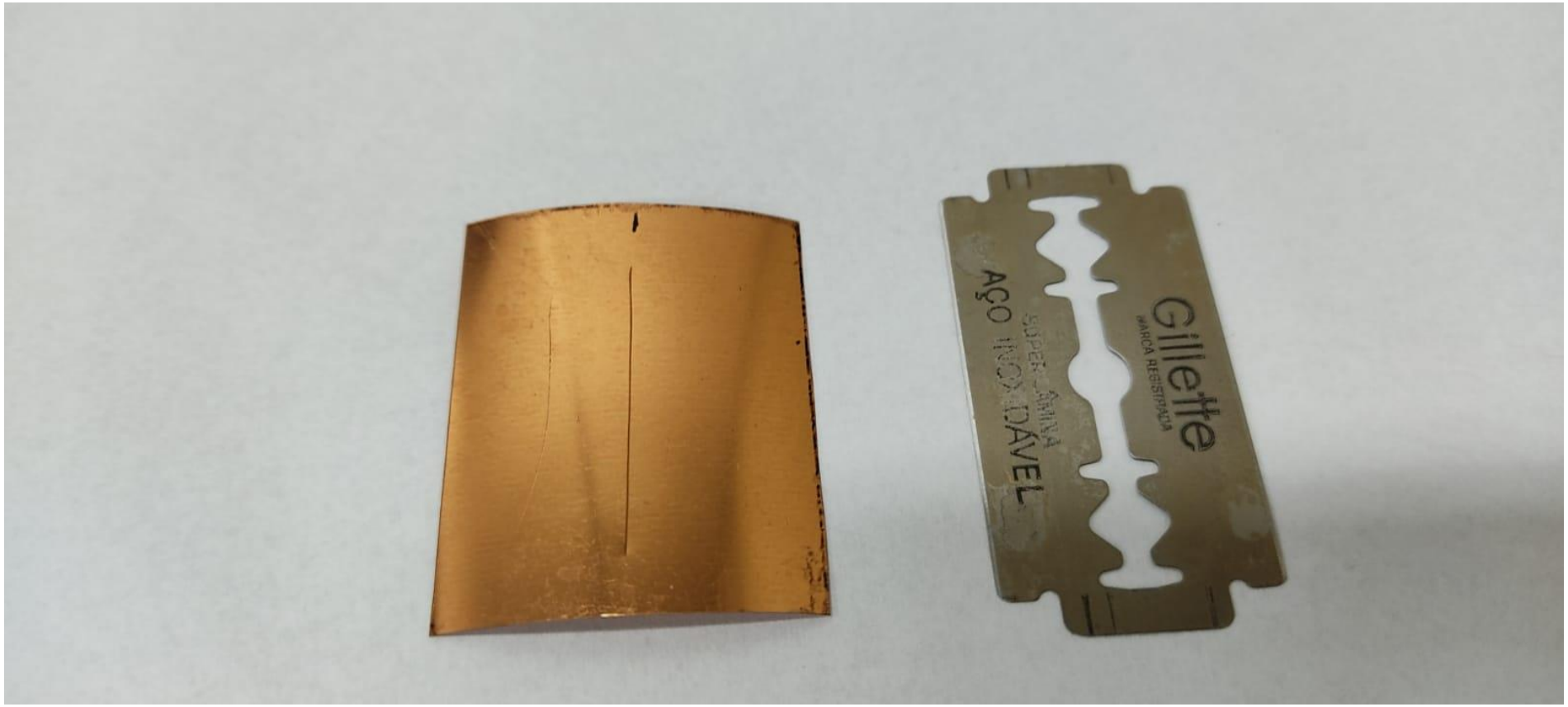




Anteparo milimetrado



Fenda com largura controlável: folha cobreada, gilete e fita adesiva

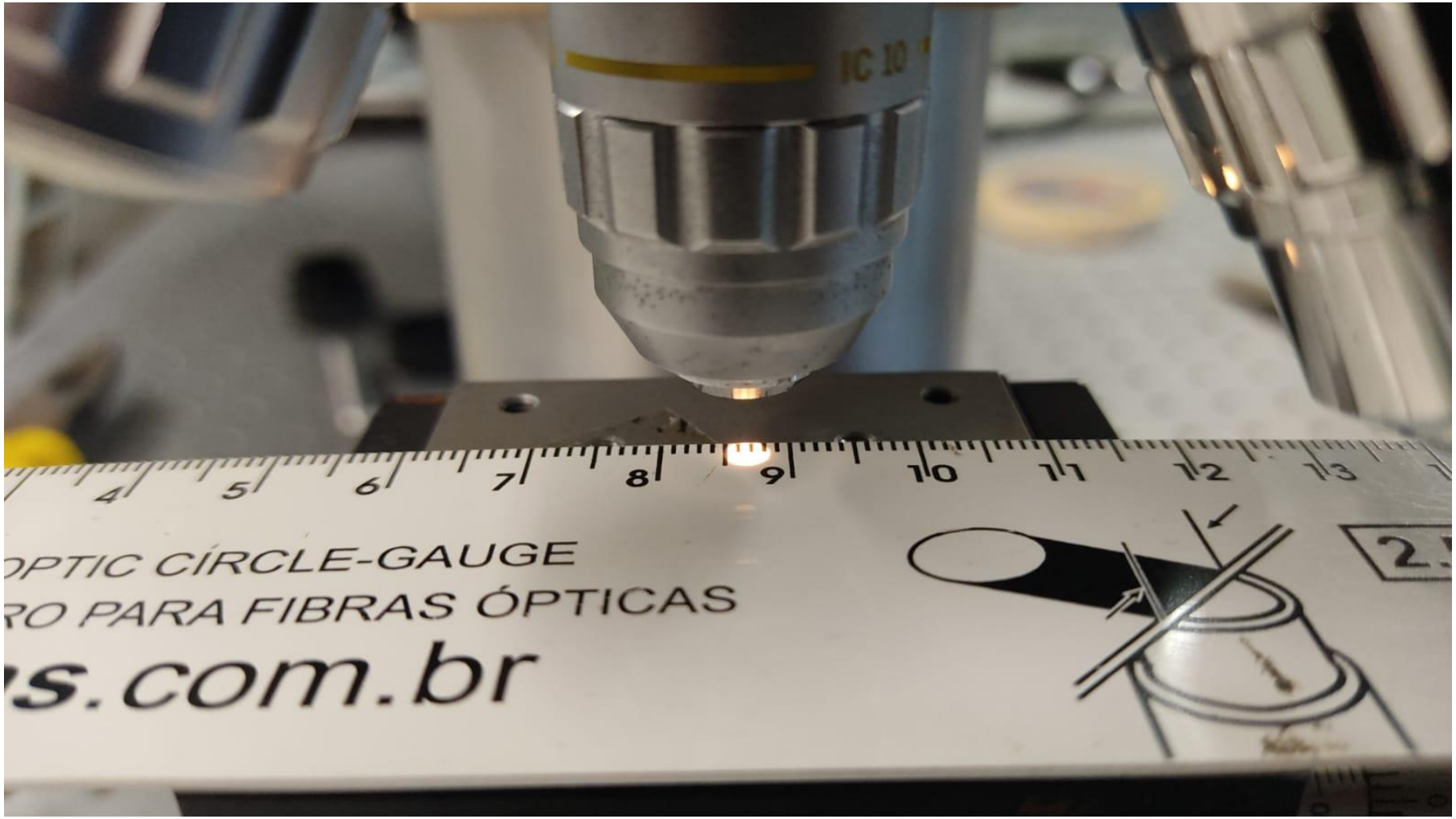


Laser pointer

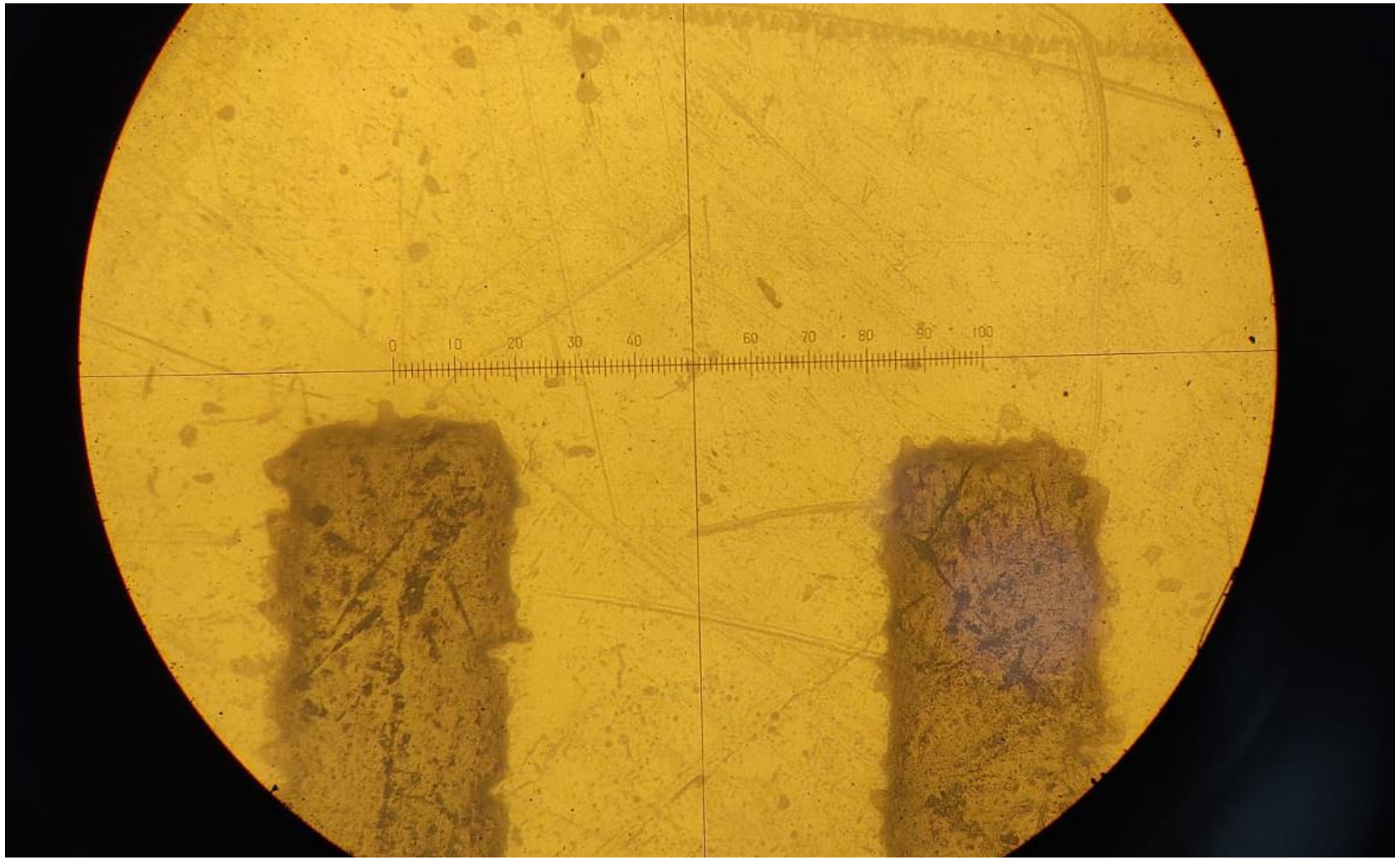
Medição distância fenda-anteparo

Fixação da abertura da fenda

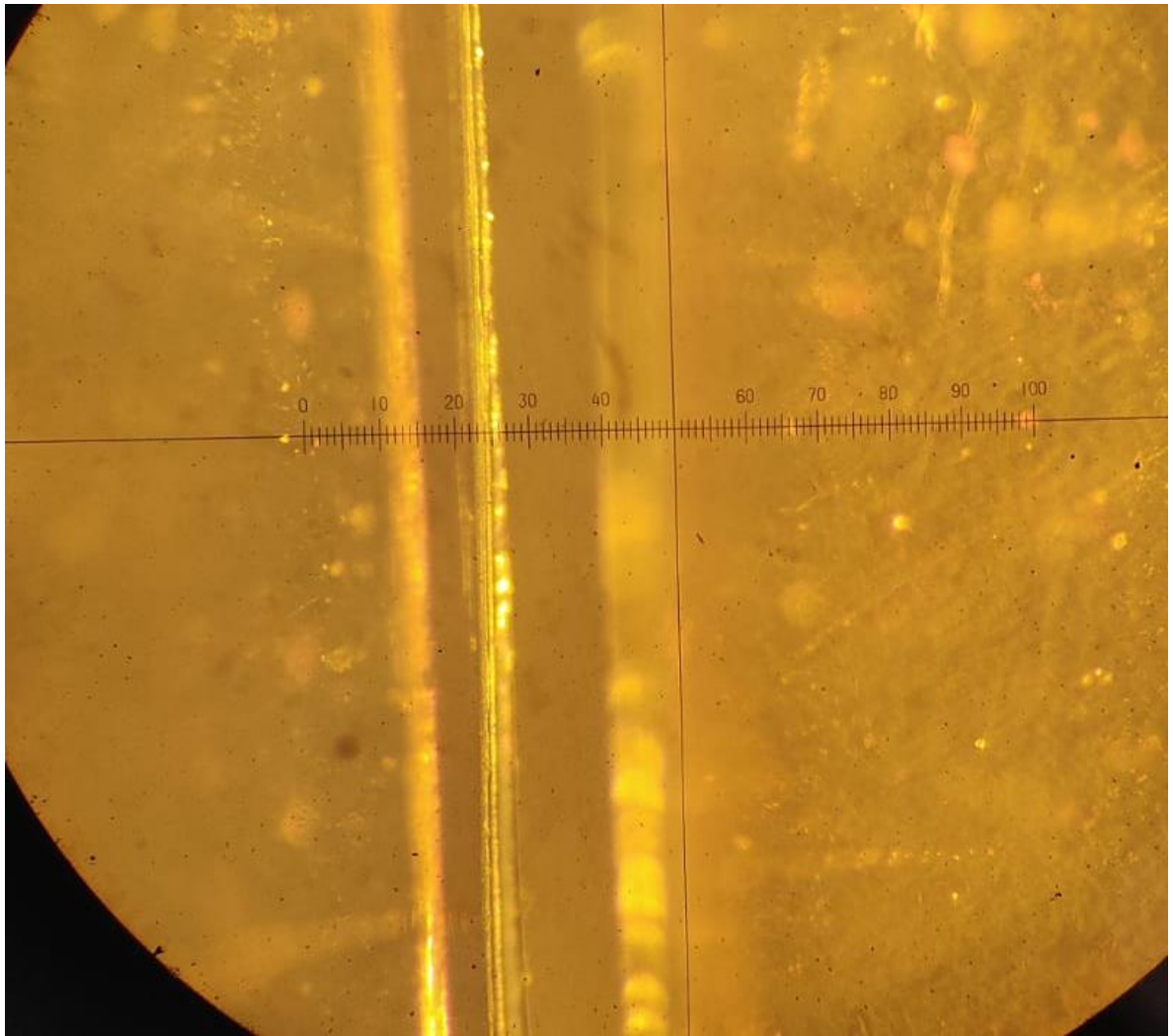
Medida da largura da fenda simples com microscópio

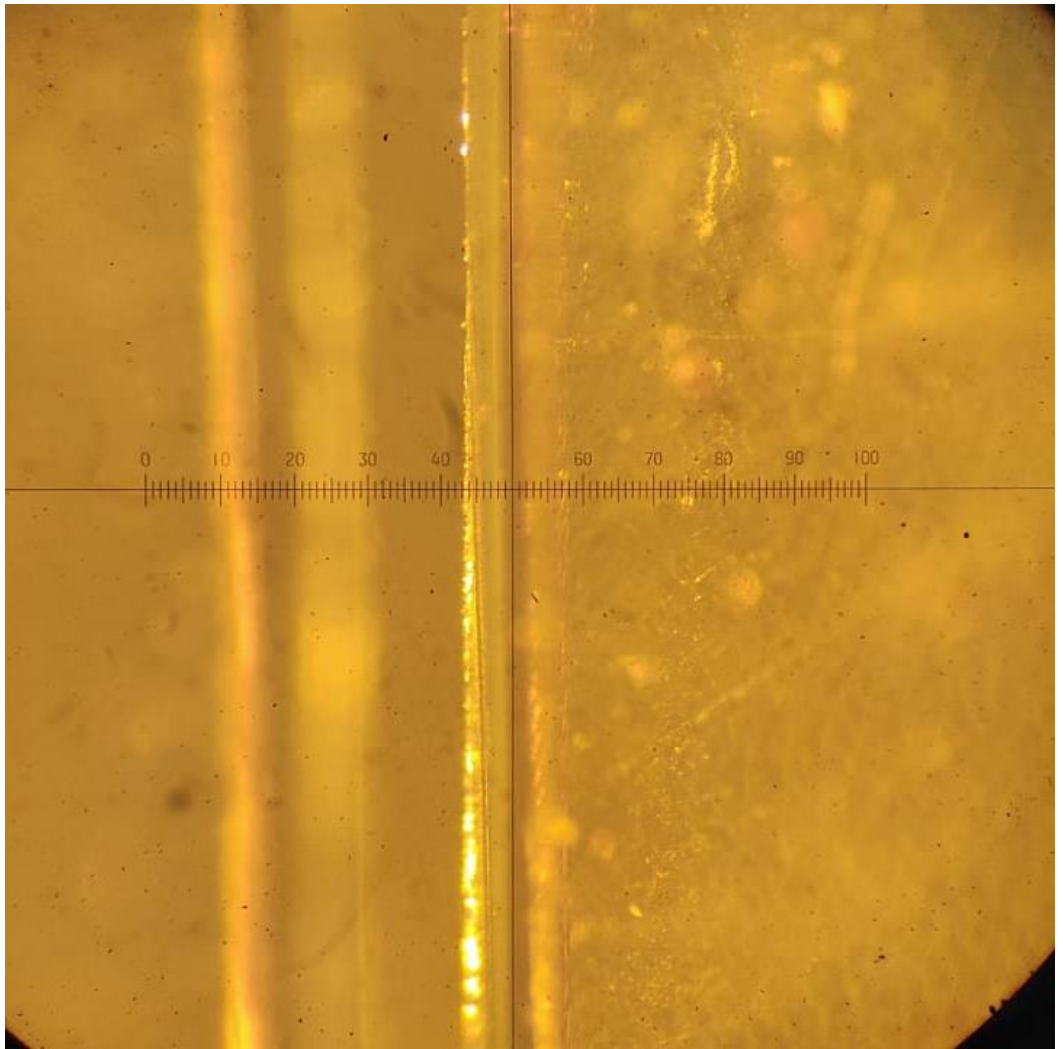


Medida da largura da fenda simples com microscópio

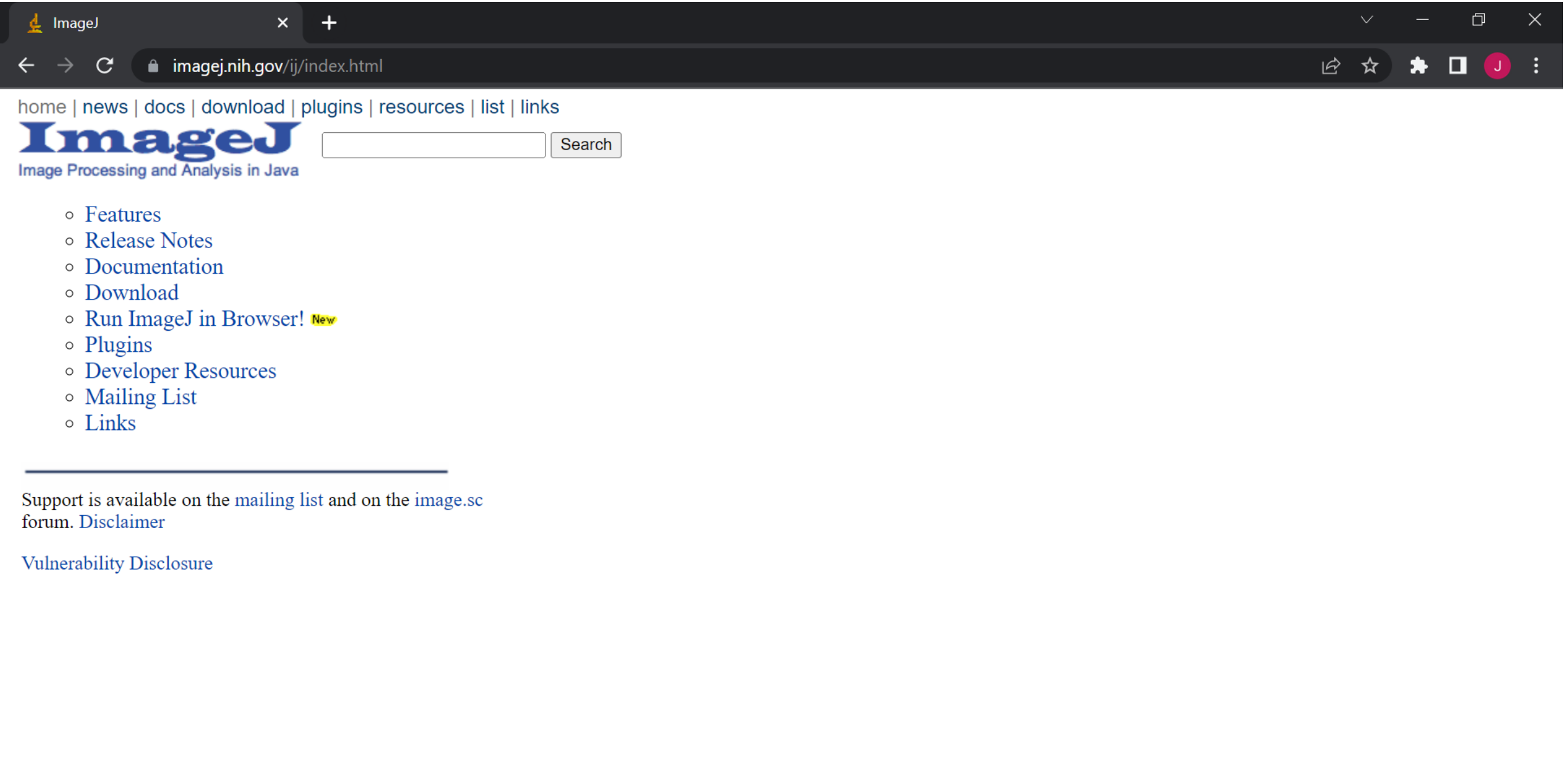


Medida da largura da fenda simples com microscópio: fenda feita com gilete observada no microscópio com magnificação de 10 x

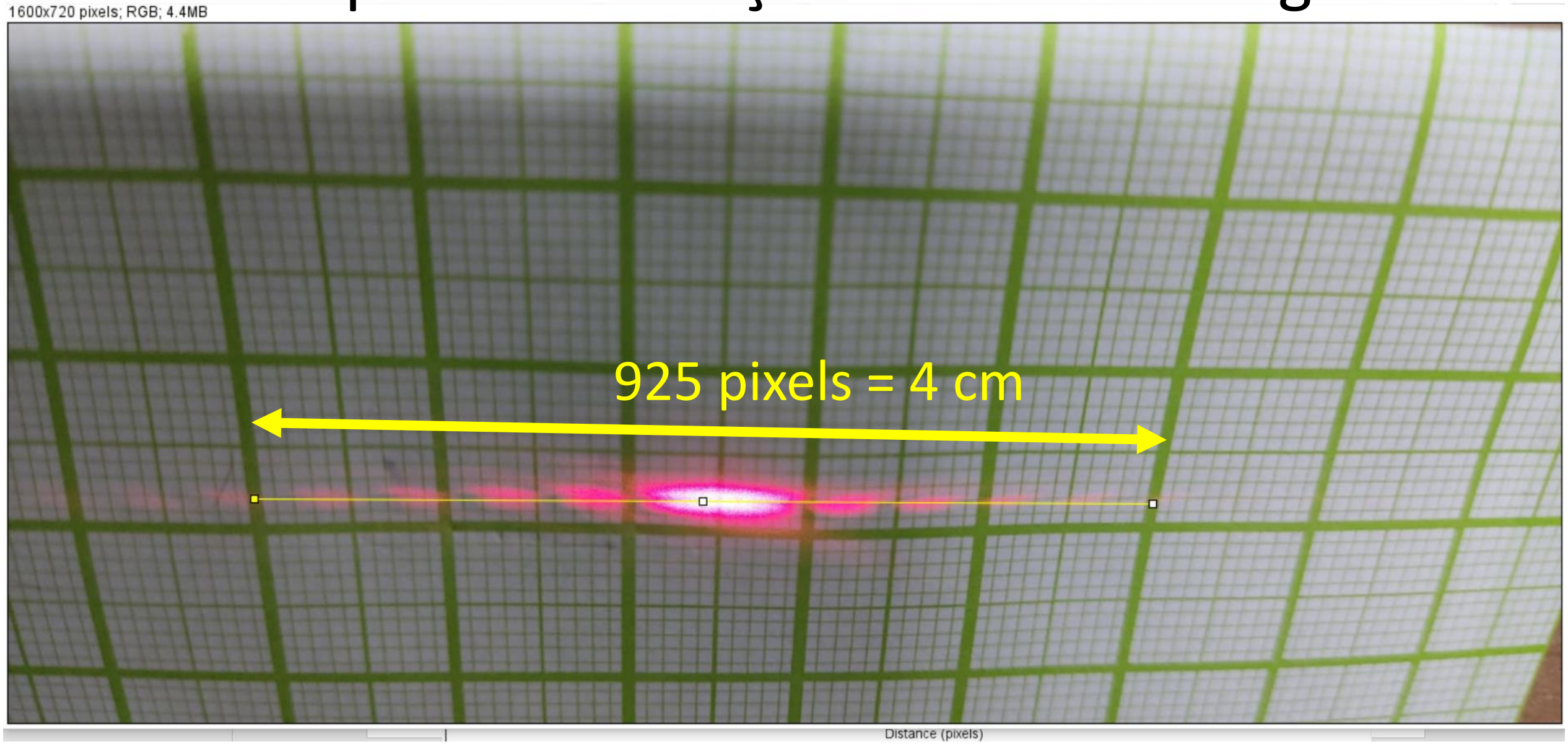


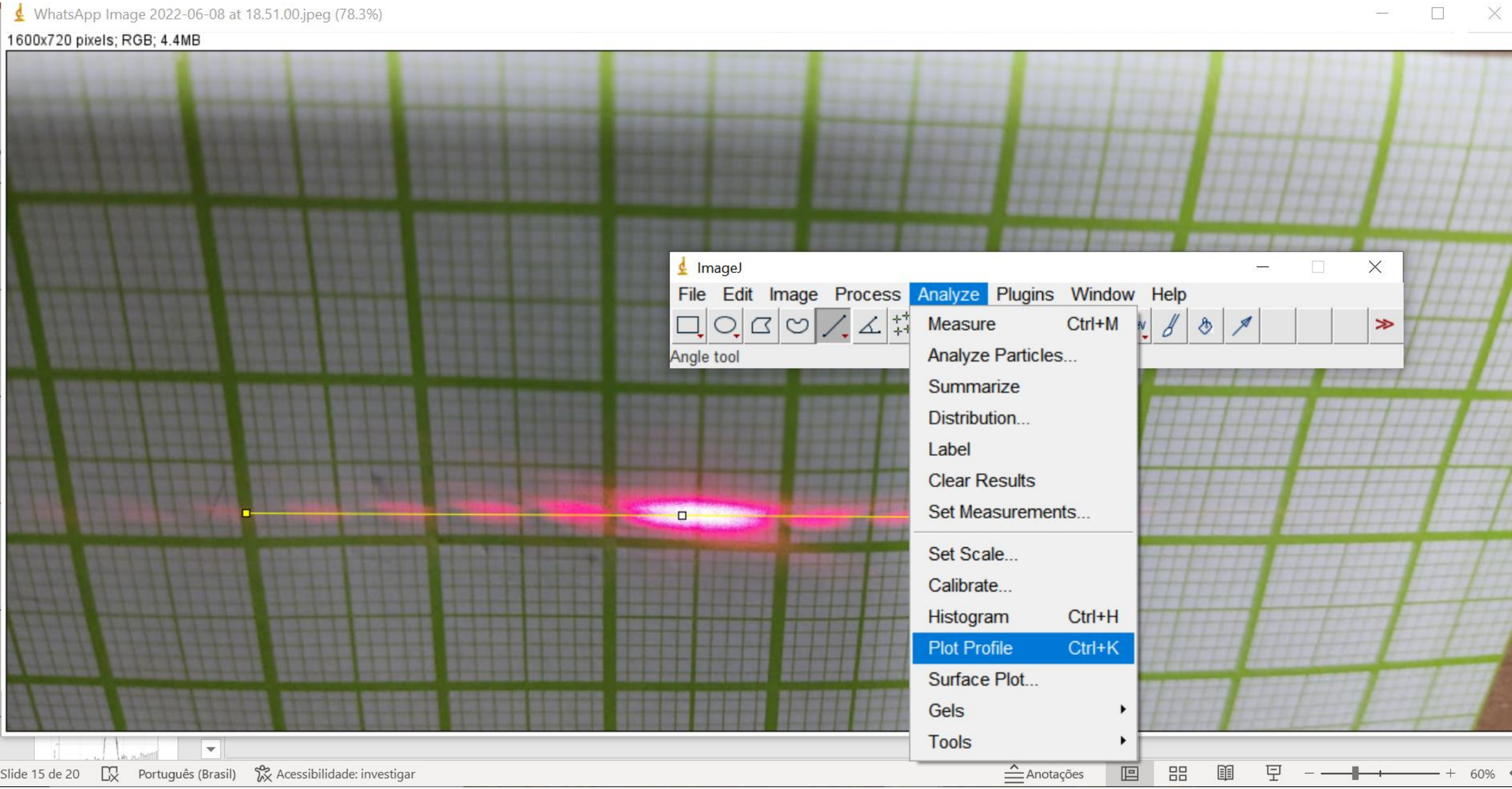


Página para download do progrma ImageJ



Exemplo de calibração utilizando ImageJ

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Anotações
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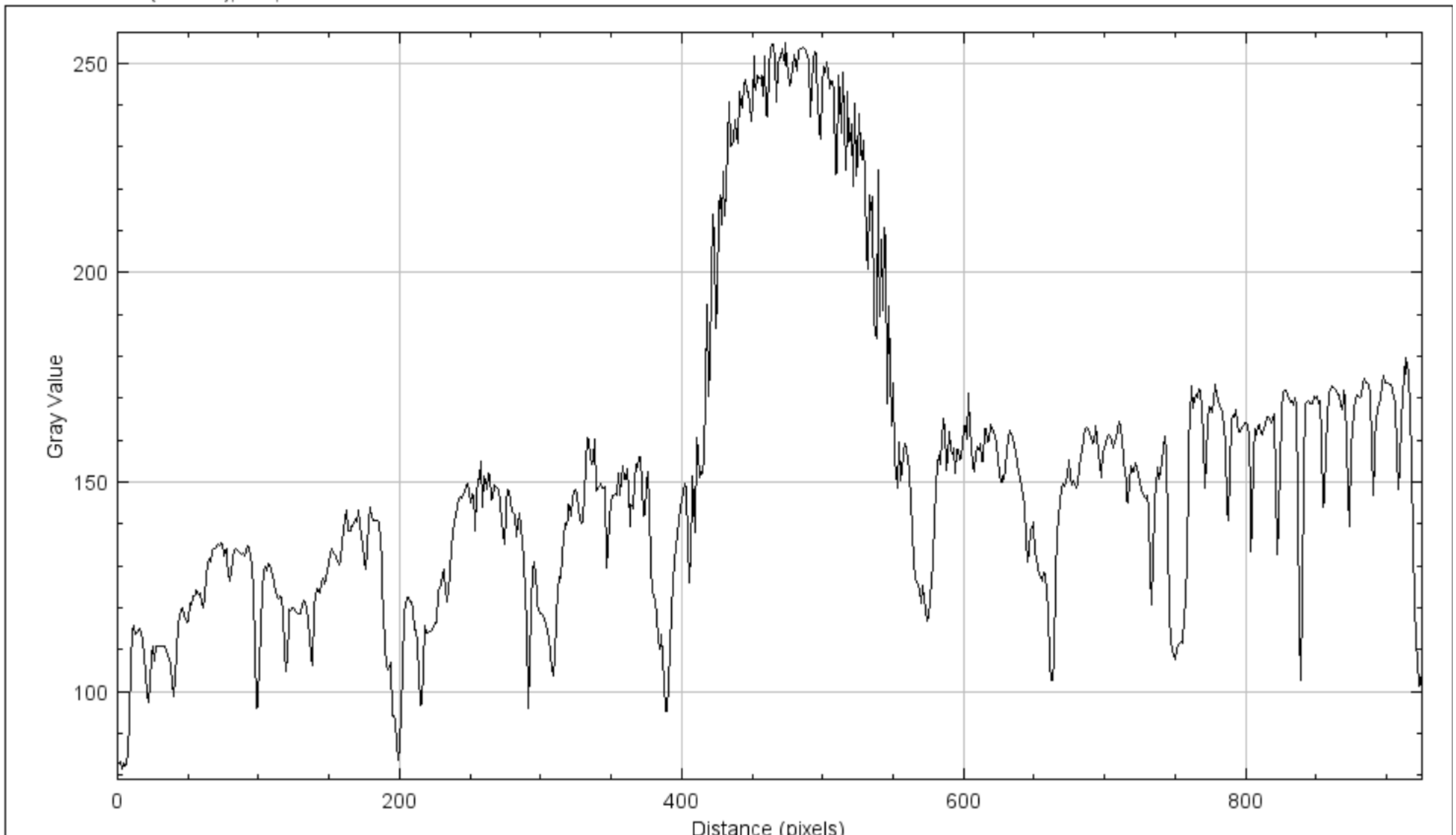

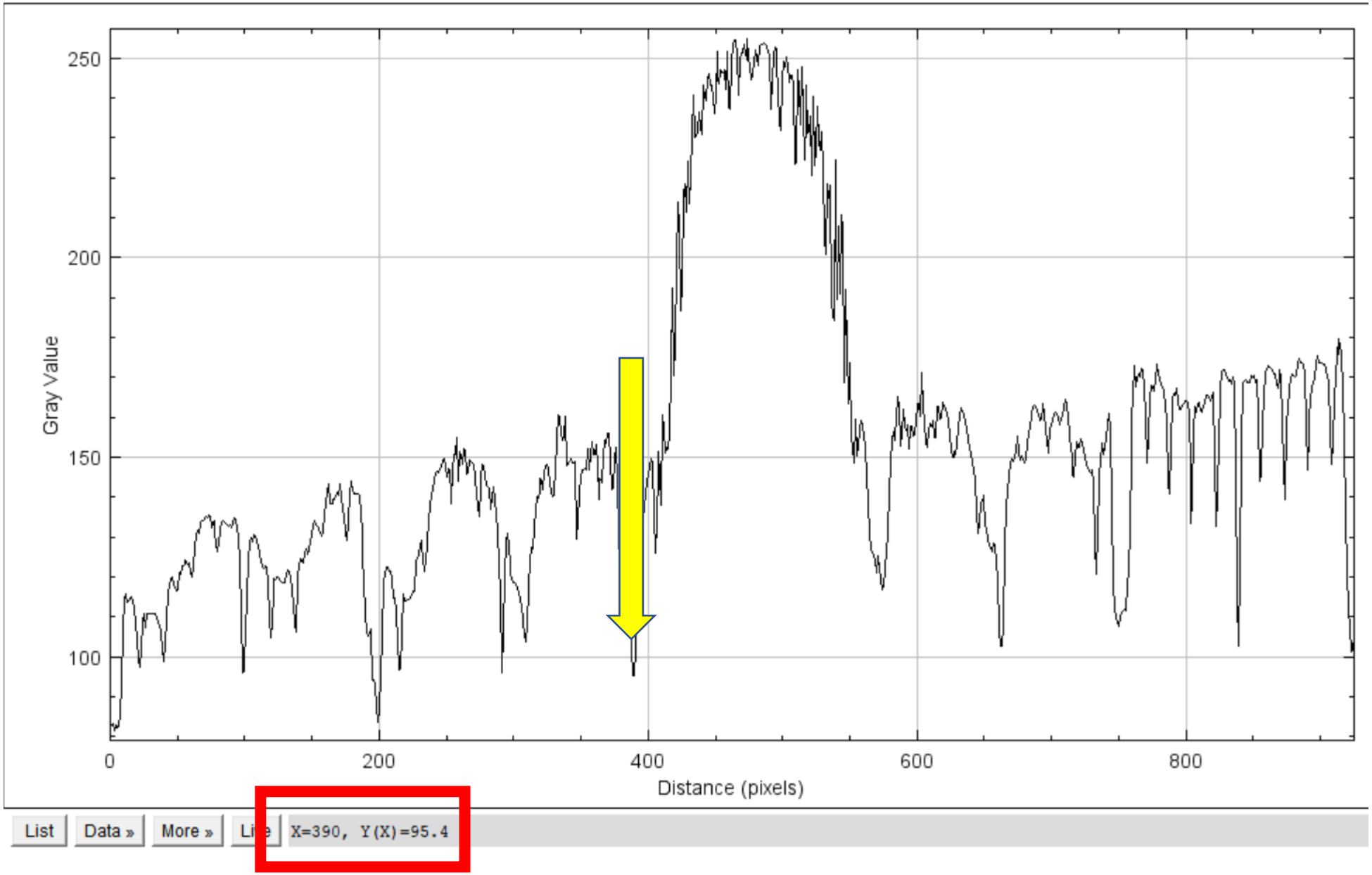
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More »
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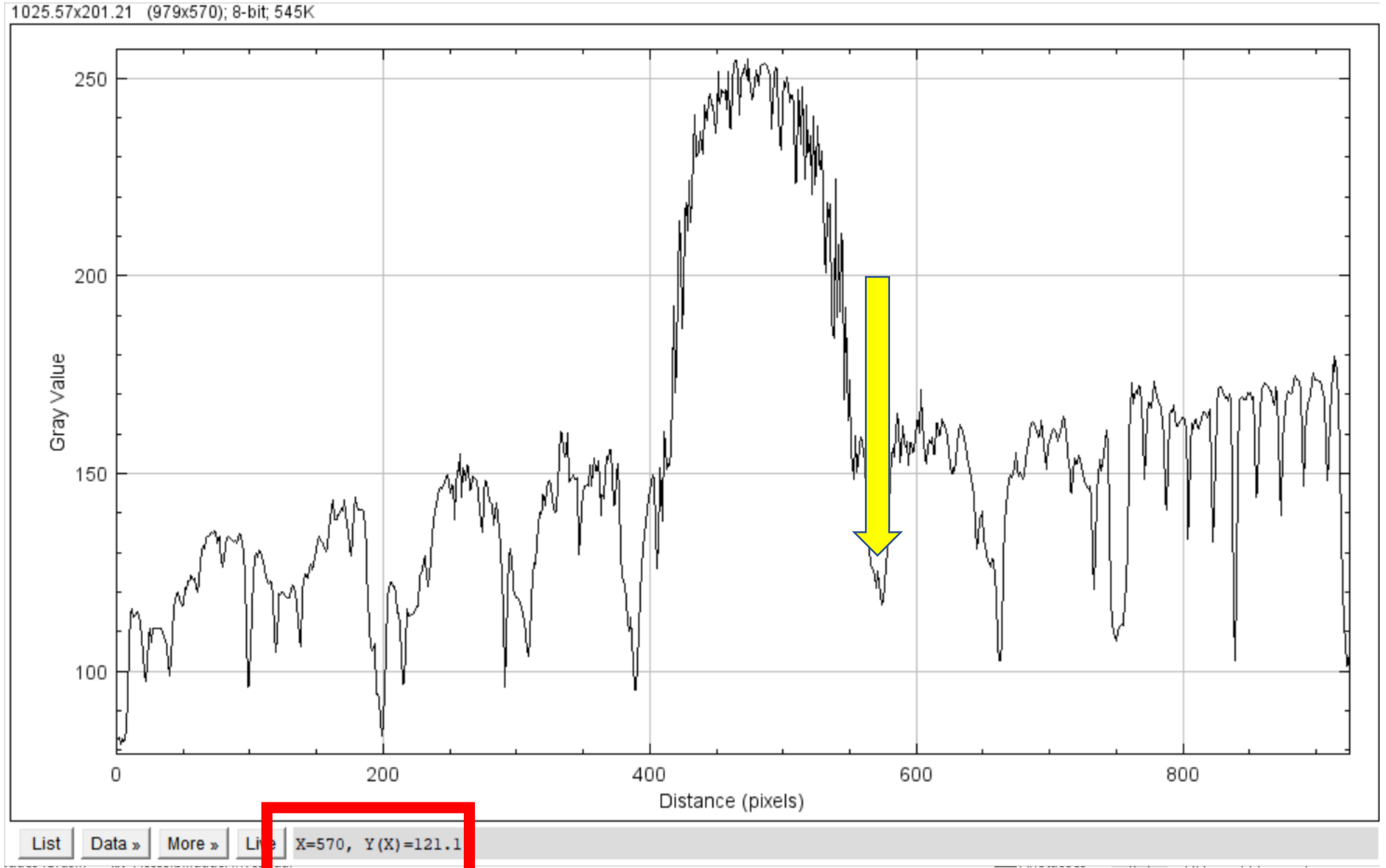
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Distance (pixels)
List
Data »
More »
X=570, Y(X)=121.1