Why:

$$D^3_x f[:,:,1] = \frac{\partial H}{\partial x} = \begin{bmatrix} \frac{\partial^3 f}{\partial x^3} & \frac{\partial^3 f}{\partial x \partial y \partial x} \\ \frac{\partial^3 f}{\partial y \partial x^2} & \frac{\partial^3 f}{\partial y^2 \partial x} \end{bmatrix}$$

And not:

$$D^3_{x,y} f[:,:,1] = \frac{\partial H}{\partial x} = \begin{bmatrix} \frac{\partial^3 f}{\partial x^3} & \frac{\partial^3 f}{\partial x^2 \partial y} \\ \frac{\partial^3 f}{\partial x \partial y \partial x} & \frac{\partial^3 f}{\partial x \partial y^2} \end{bmatrix}$$

And why:

$$D^3_x f[:,:,2] = \frac{\partial H}{\partial y} = \begin{bmatrix} \frac{\partial^3 f}{\partial x^2 \partial y} & \frac{\partial^3 f}{\partial x \partial y^2} \\ \frac{\partial^3 f}{\partial y \partial x \partial y} & \frac{\partial^3 f}{\partial y^3} \end{bmatrix}$$

And not:

$$D^3_{x,y} f[:,:,2] = \frac{\partial H}{\partial y} = \begin{bmatrix} \frac{\partial^3 f}{\partial y \partial x^2} & \frac{\partial^3 f}{\partial y \partial x \partial y} \\ \frac{\partial^3 f}{\partial y^2 \partial x} & \frac{\partial^3 f}{\partial y^3} \end{bmatrix}$$