Problem Description
Discretized transport equations for a fluid flow include two types of unknowns:
- Velocity components \( u, v, w \)
- Pressure field \( p \)

As seen in the previous chapter, scalar quantities such as \( p \) (denoted \( \phi \) in the previous chapters) are typically stored at computational nodes (i.e., CV centers).

**Question:** can the velocity components be stored at the same locations?

**Example: Pressure and velocities stored at the computational nodes in a uniform grid**
In this example, let’s assume that the pressure field (grey values) is a highly irregular “checkerboard”.

![Diagram of a staggered grid showing pressure and velocity field storage](image)

Calculation of the pressure gradients across the active CV:

\[
\frac{\partial p}{\partial x} = \]

\[
\frac{\partial p}{\partial y} = \]

\[
\Rightarrow \]
**Staggered Grid**

To overcome this issue, a **staggered grid** can be used to store the velocity components:

Calculation of the pressure gradients across the u-CV:

\[
\frac{\partial p}{\partial x} = \quad \frac{\partial p}{\partial y} =
\]

Advantages:
STAGGERED GRID NOTATION

Unbroken grid lines:

Dashed lines: