

# Real-Time Mesh Utilities

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# Outline

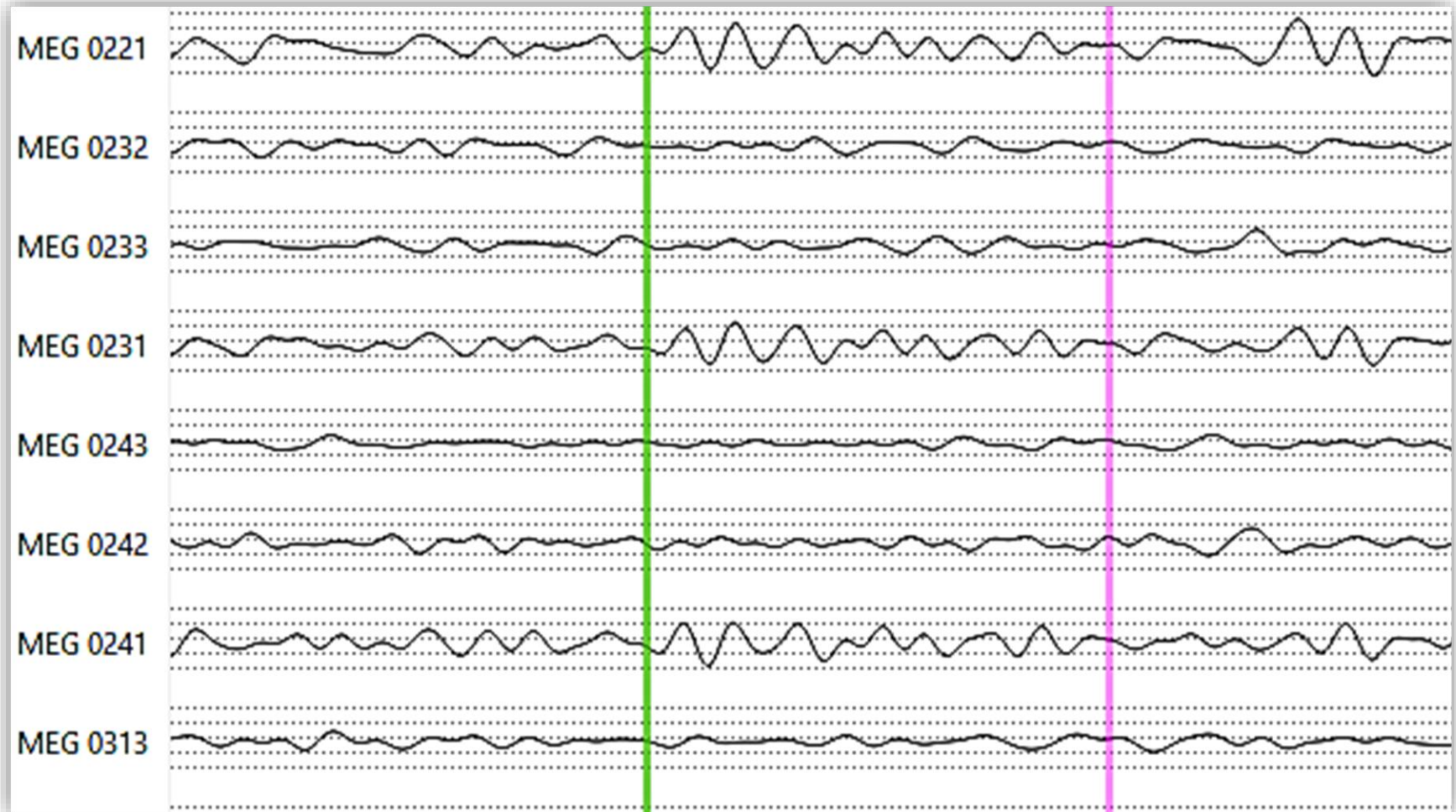
- Assignment / Task
- Features
- Status
- Outlook
- Software Demonstration

# Assignment/Task

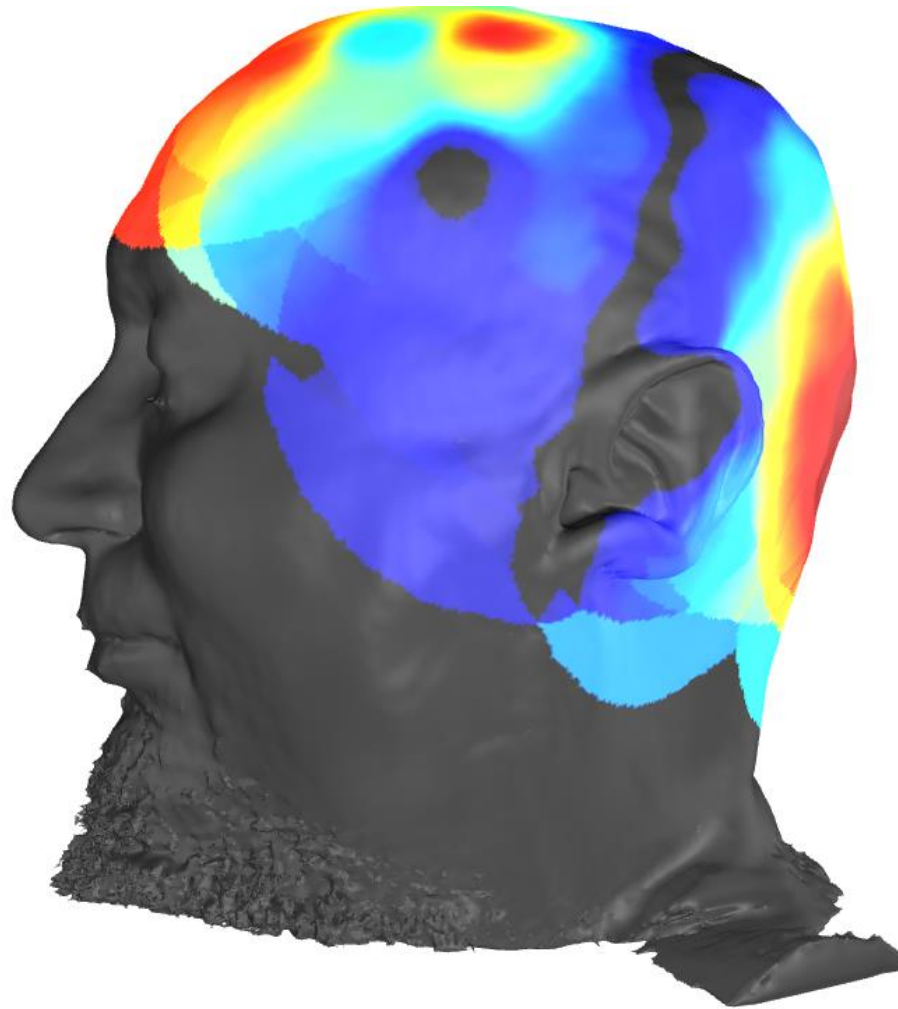


**Goal:** Utilities for real-time capable interpolation and visualization of MEG/EEG sensor data

# Standard Visualization



# 3D Realtime Visualization



# Input/Output

## MNE-CPP

### Input:

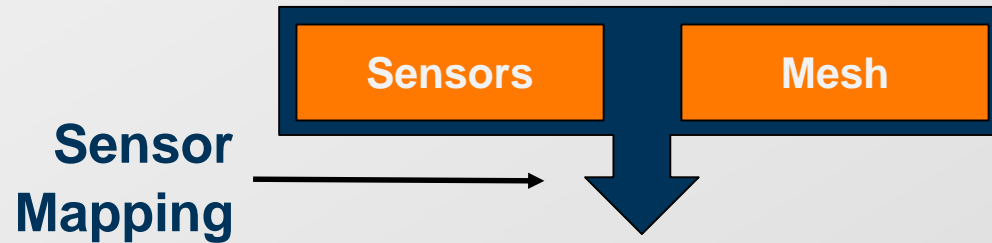
- Vertices (x, y, z)
- Neighbour-relationships
- Sensor points (x, y, z)
- Sensordata (1000hz)

### Features

### Output:

- Vector containing (interpolated) intensities for every vertex

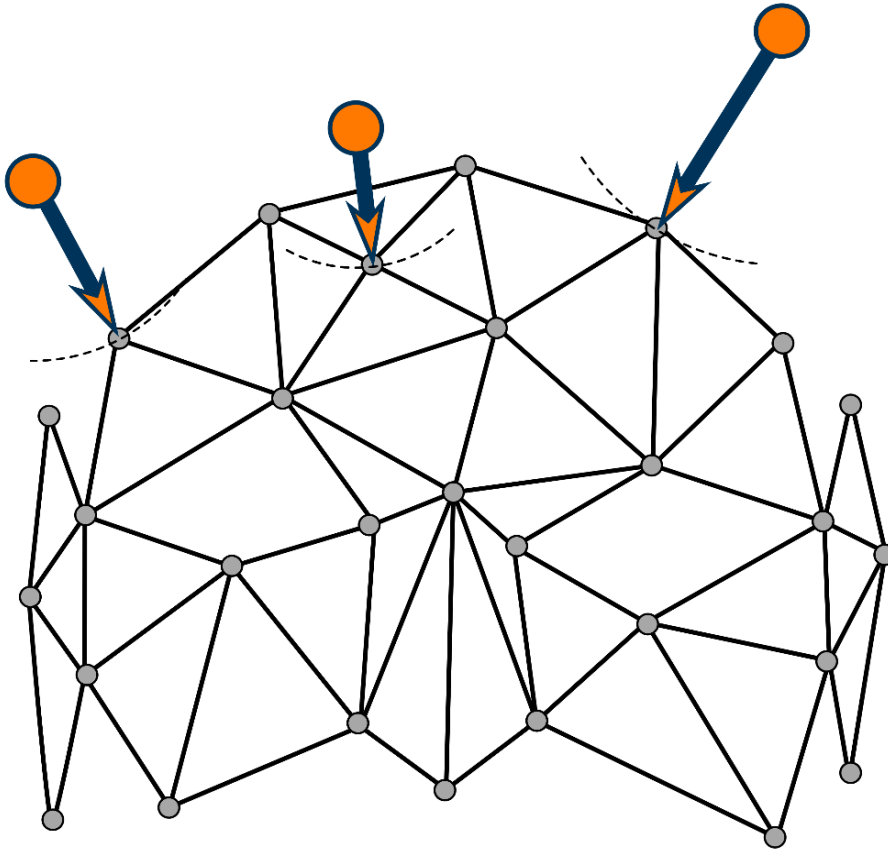
# Features



MNE-CPP

# Sensor Mapping

## Feature 1

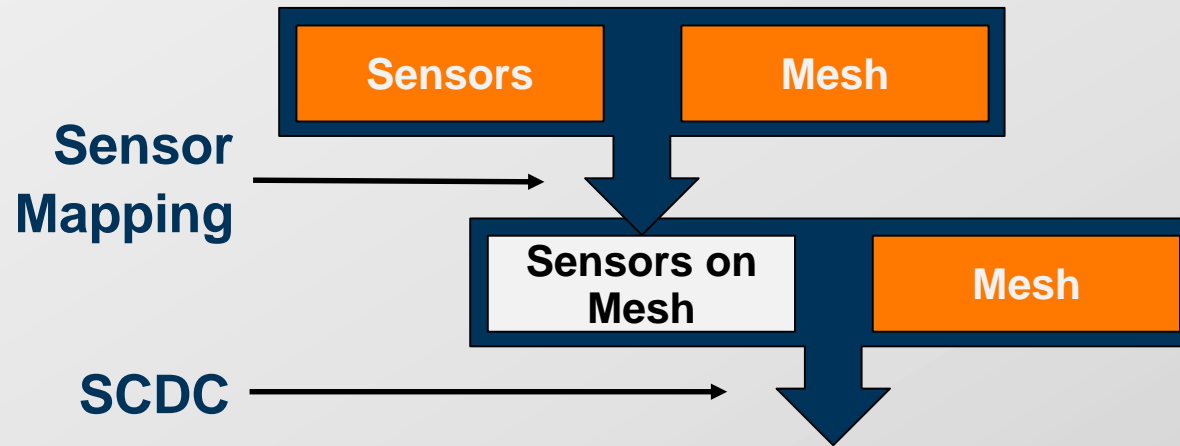


- Sensorpoints are not part of the mesh
- Relative position on surface unknown

► **Multithreaded linear search**



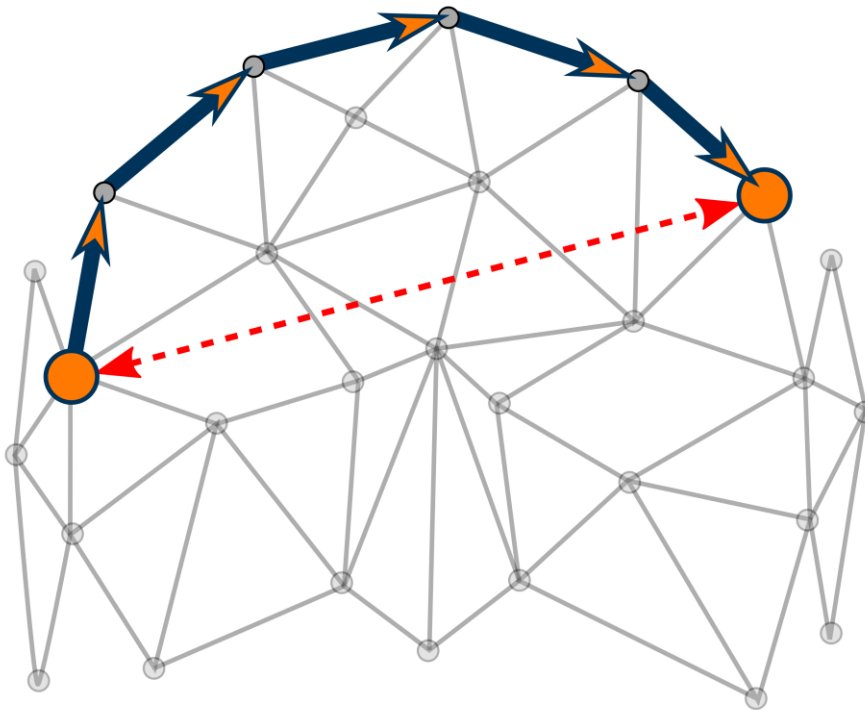
# Features



# SCDC

## Feature 2

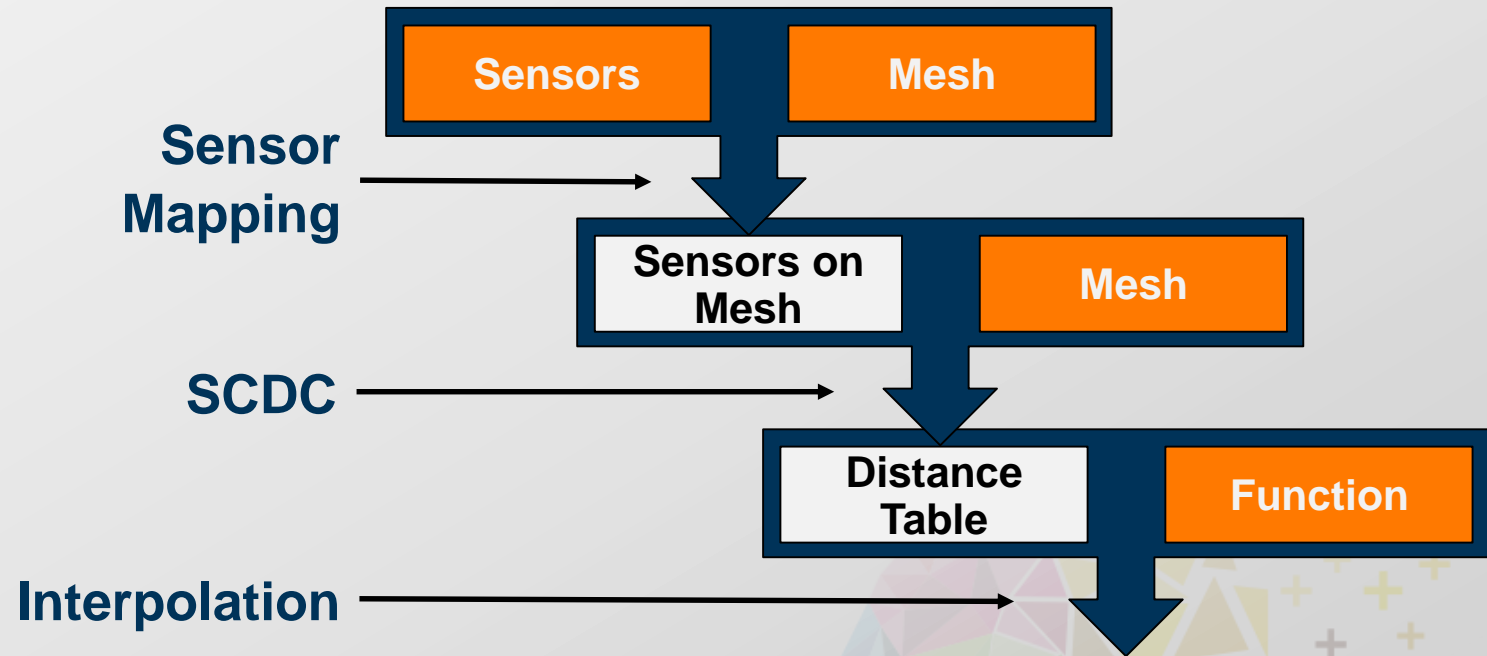
(Surface-Constrained Distance Calculation)



- Folded/Curved surface
- Distance between 2 vertices?
- Euclidian distance is inaccurate

► **Multithreaded iterative Dijkstra**

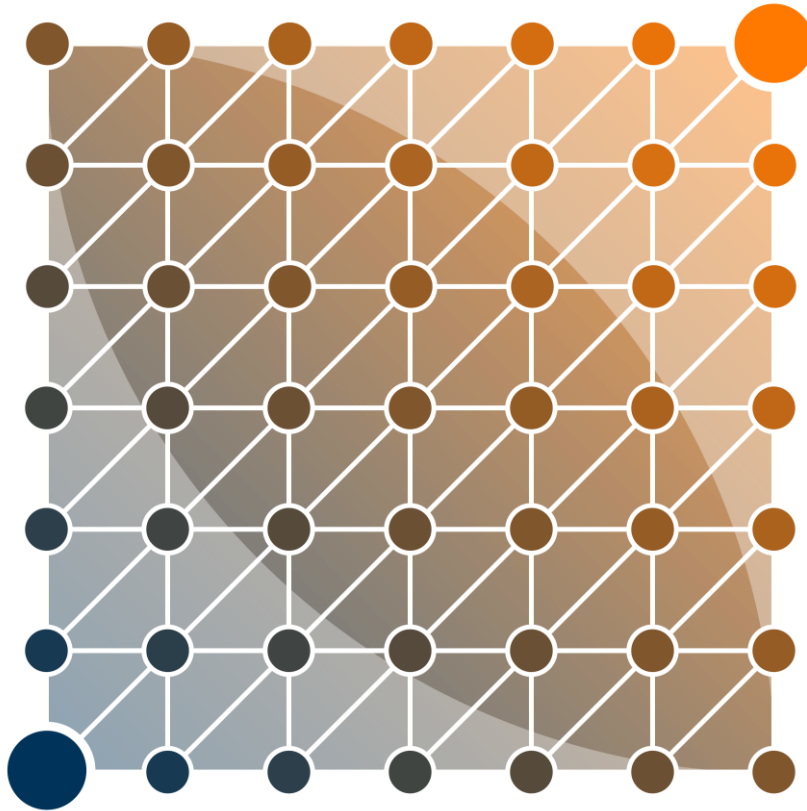
# Features



MNE-CPP

# Interpolation

## Feature 3

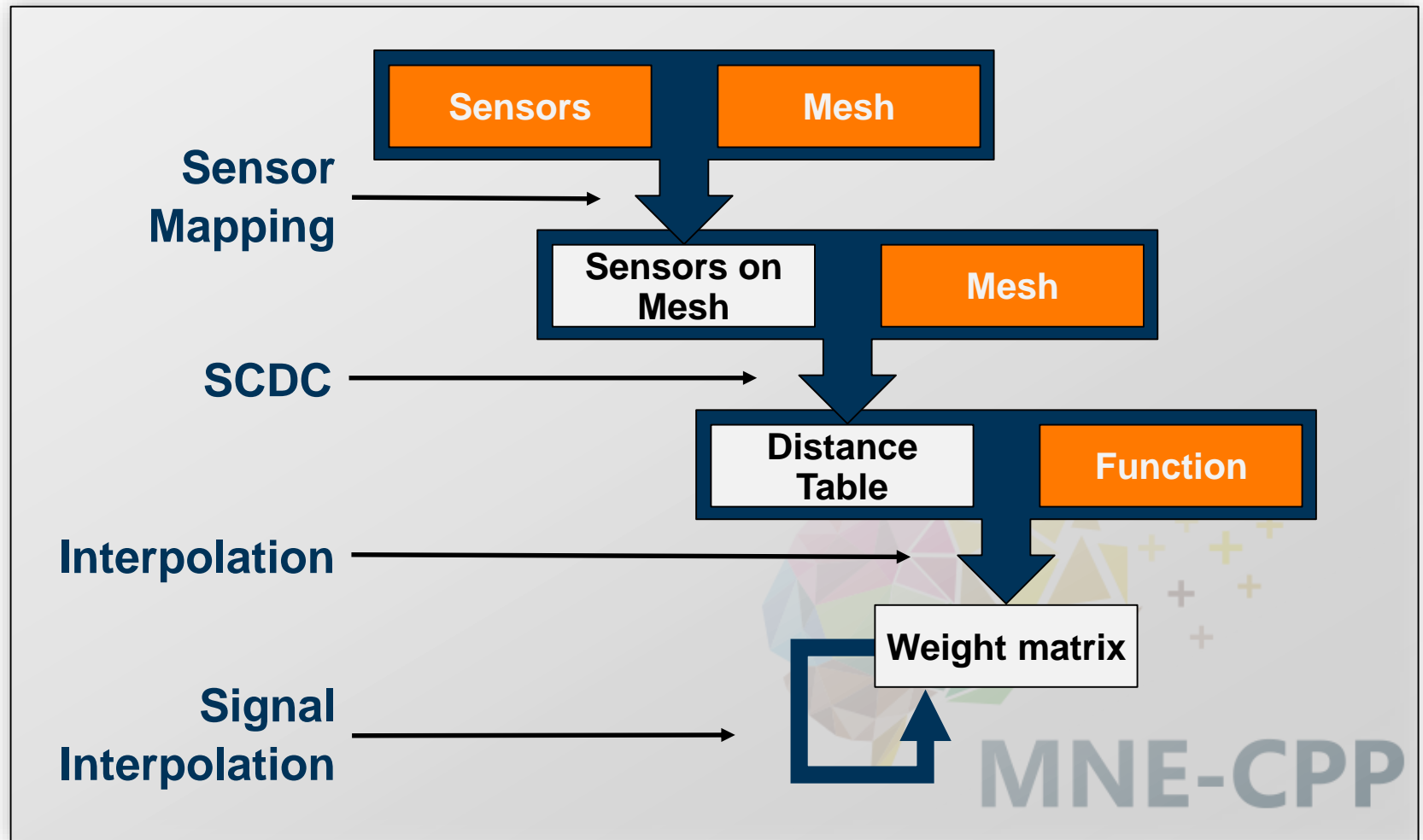


- Activity at certain points given ( $y_{sub}$ )
- Activity at all points wanted ( $y_{full}$ )

- ▶ Weight matrix ( $W$ )
- ▶ Multiplication calculates the wanted values

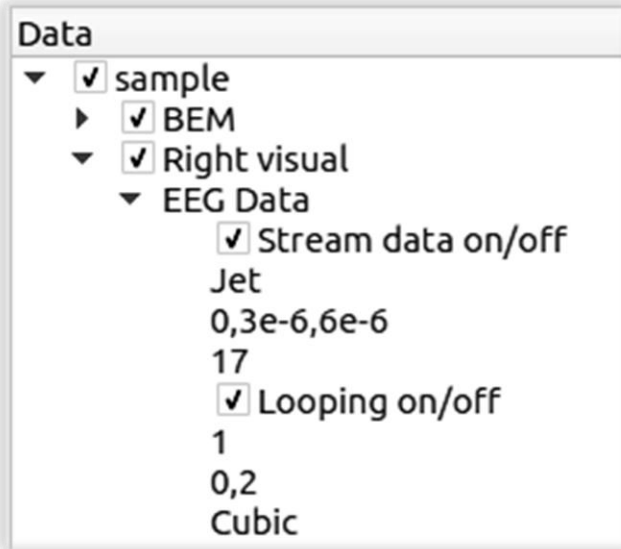
$$(y_{full} = W * y_{sub})$$

# Features



# SensorDataTreeltem

## Feature 4



- The disp3D library has a tree structure
- MetaTreeltems define the parameters of the algorithms
- The SensorDataTreeltem manages the features

Disp3D (Library)



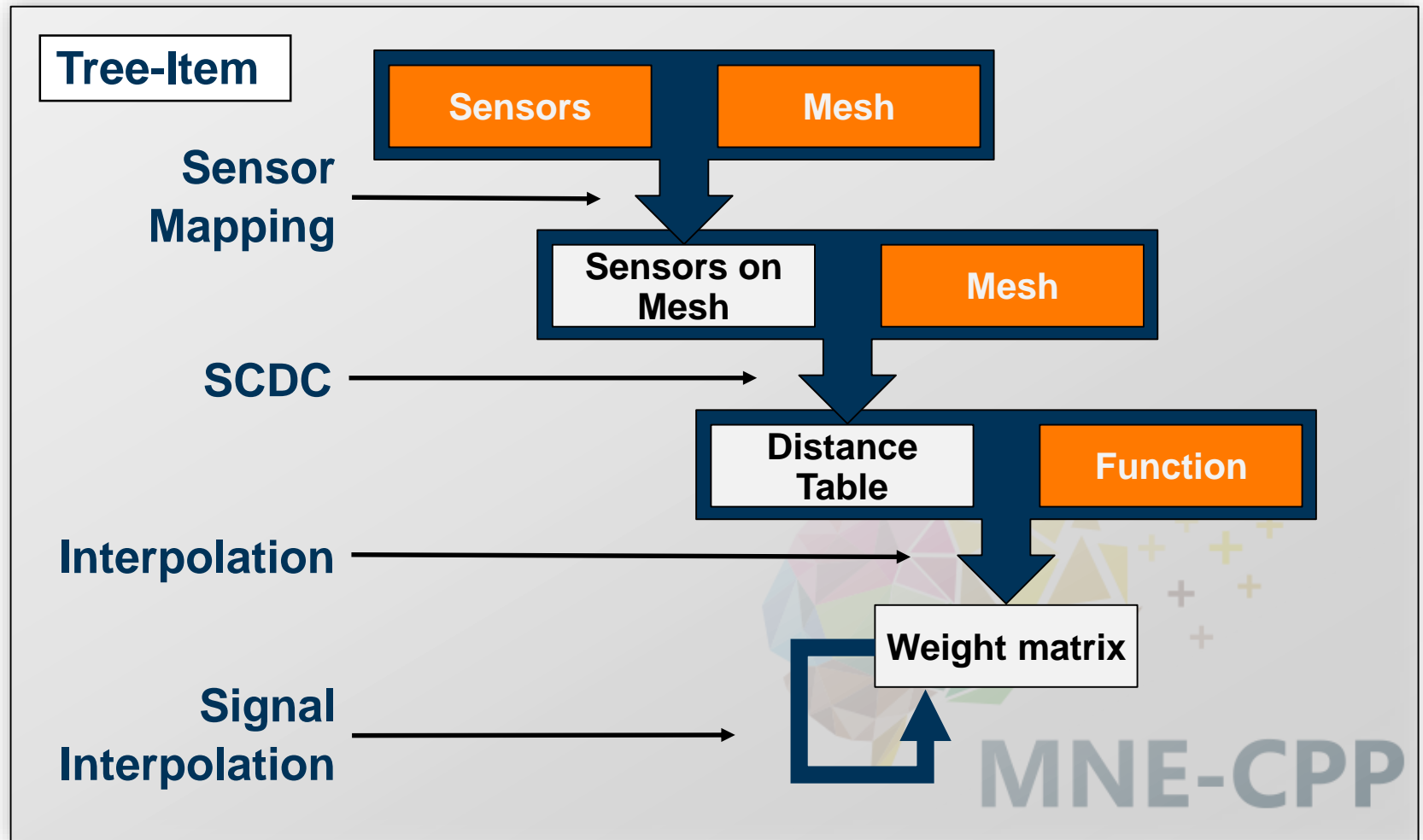
SensorDataTreeltem

Sensor Mapping

SCDC

Interpolation

# Features



# Status

- ✓ Features 1, 2, 3 and 4 implemented and operational 😊
- ✓ Computation highly performant
- ✓ Integrated into existing project
- ✓ Documented for further usage and development



# Review

- All functional requirements fulfilled
- Full SCDC needs more resources than estimated
- Internal communication good
- Detailed communication regarding the architecture with product owners sometimes complicated
- Issue-tracking ineffective (not updated correctly, not logged correctly)
- Feature 4 was far more complicated than estimated

# Outlook

- MNE-CPP is an Open-Source project
- Therefore everyone can contribute
- Further development ongoing
- The generic features (SCDC, projecting, interpolation) will be used in other functionalities
- The code is documented as required by the project, it fits in seamlessly

