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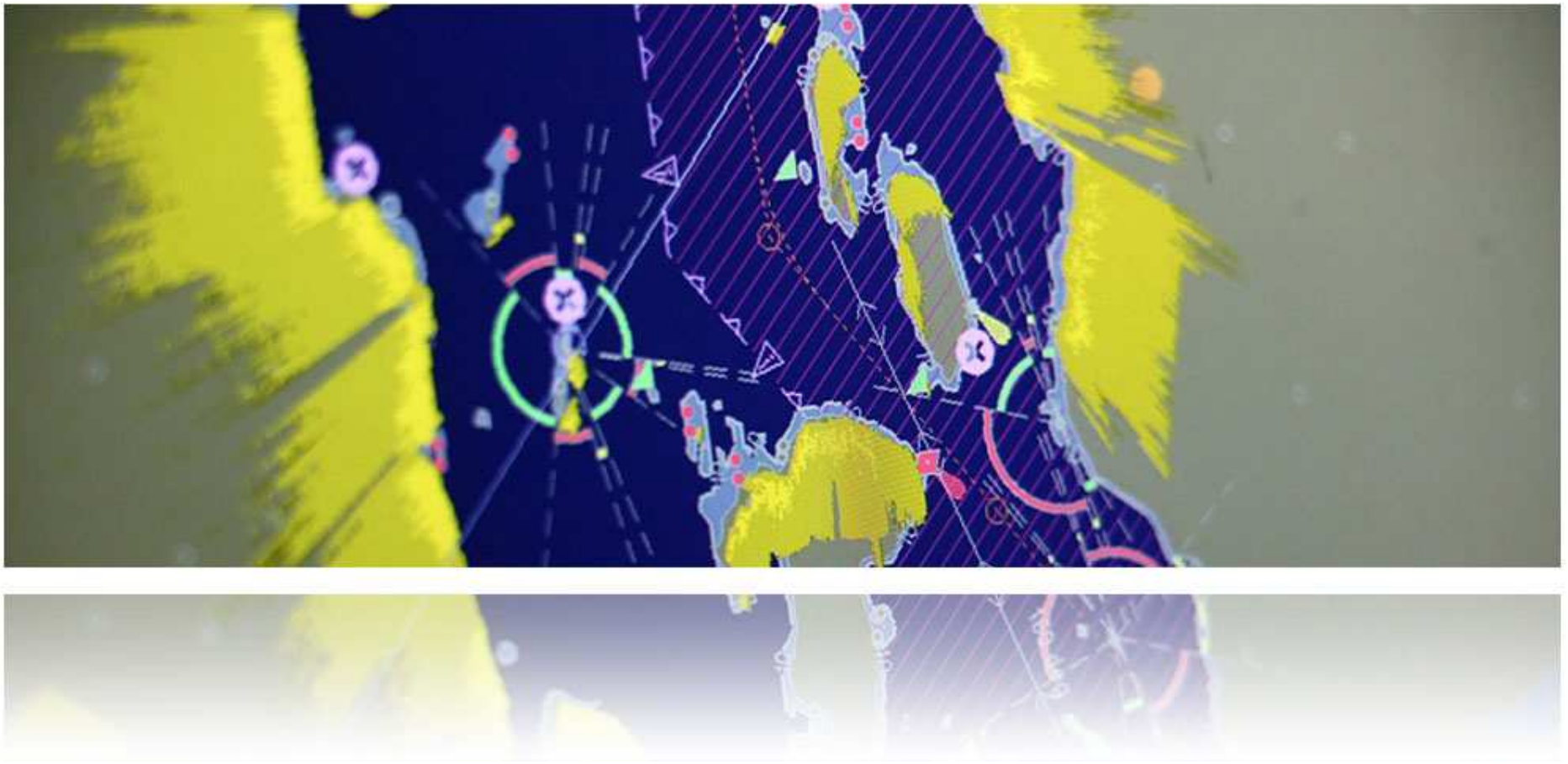
# Kongsberg Maritime



# Handling large amouts of Multibeam Data

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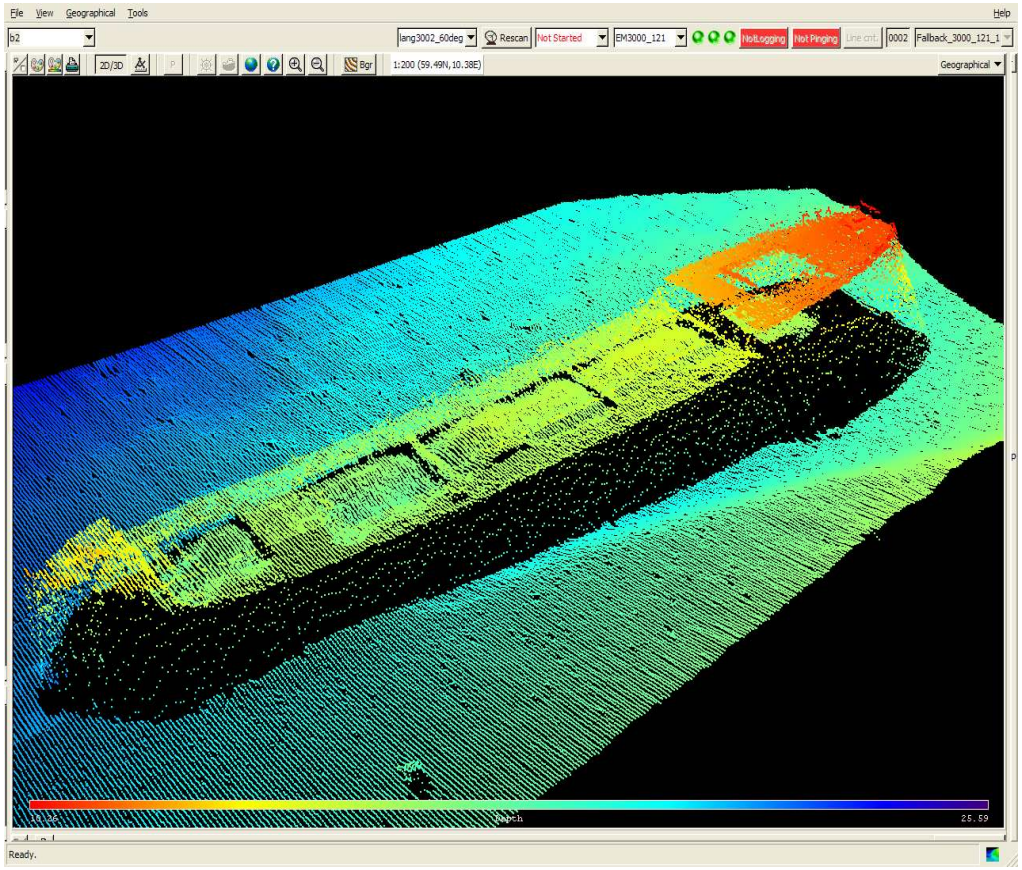
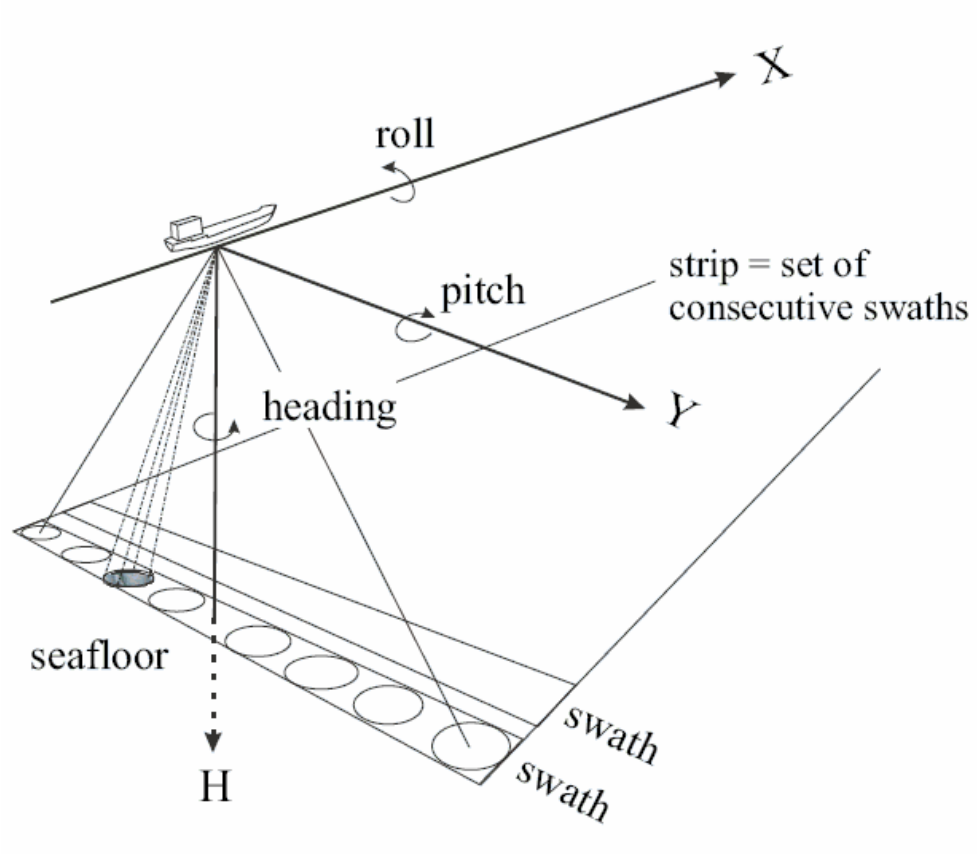
# Overview

- What exactly are our Point Clouds ?
- How are our Point Clouds handled ?



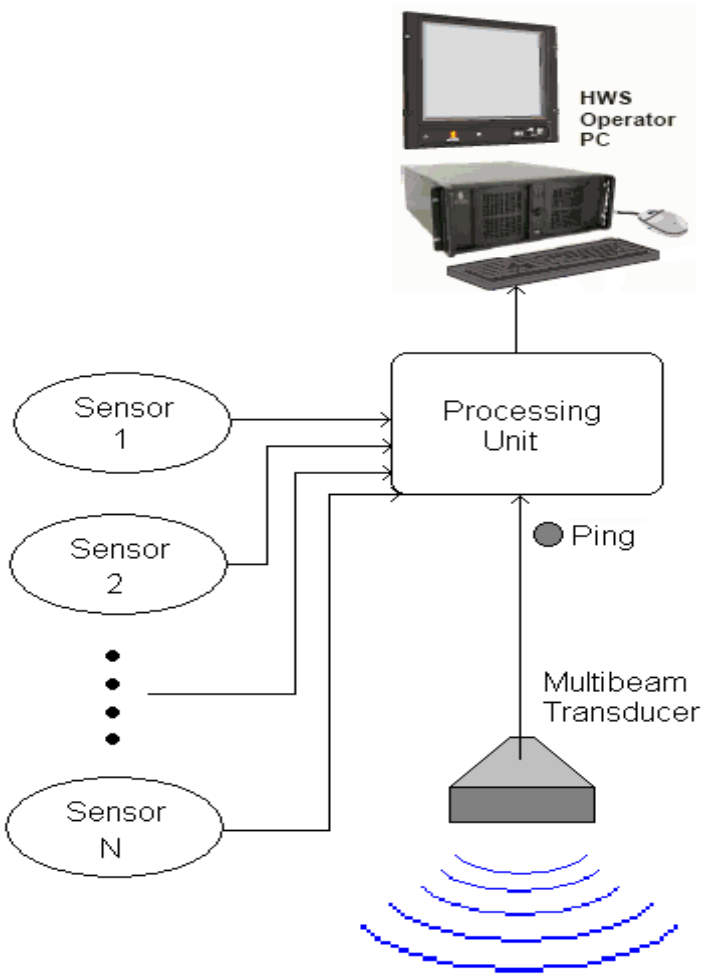
# Receiving depth points

- Point clouds are massive collections of depths records.
- One depth record contains 5 different depth values, + seabed data.
- Depth points are received at the vessel.
- One swath (ping) is an array of depths.



# Datapath

- Processing Unit (PU) gathers data.
- HWS with SIS recieves packets of data from the PU.
- SIS controls the echo sounder and displays and logs data recieved from it.



# SIS Geographical View

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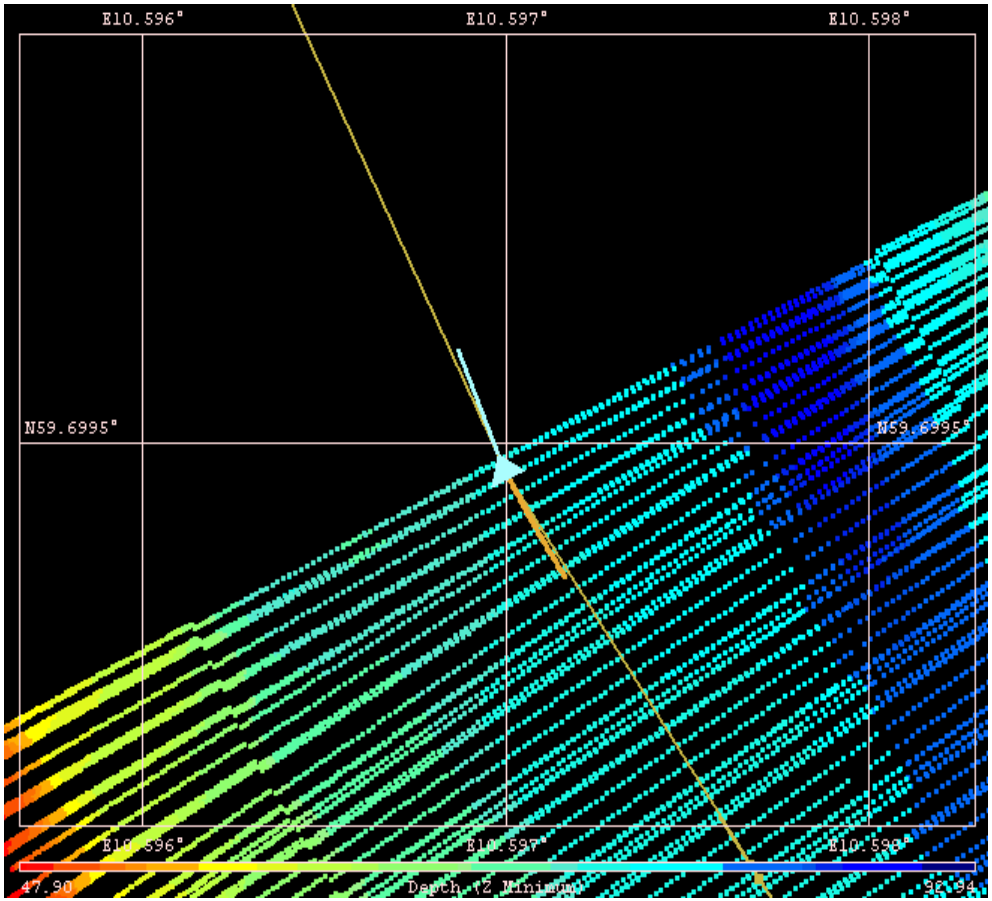
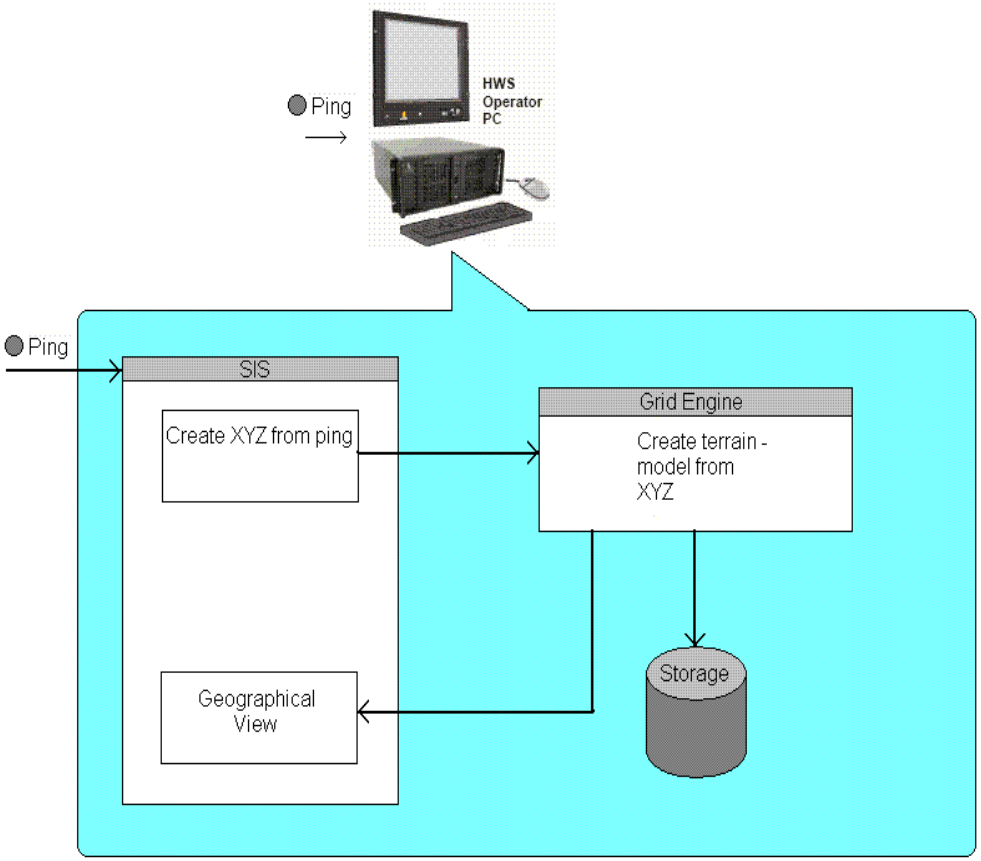
- Depths are projected to a world reference.
- Necessary parameters are set in SIS (soundspeed profile, installation parameters)
- Depths may then be displayed and logged.
- We now want to create a terrain model !



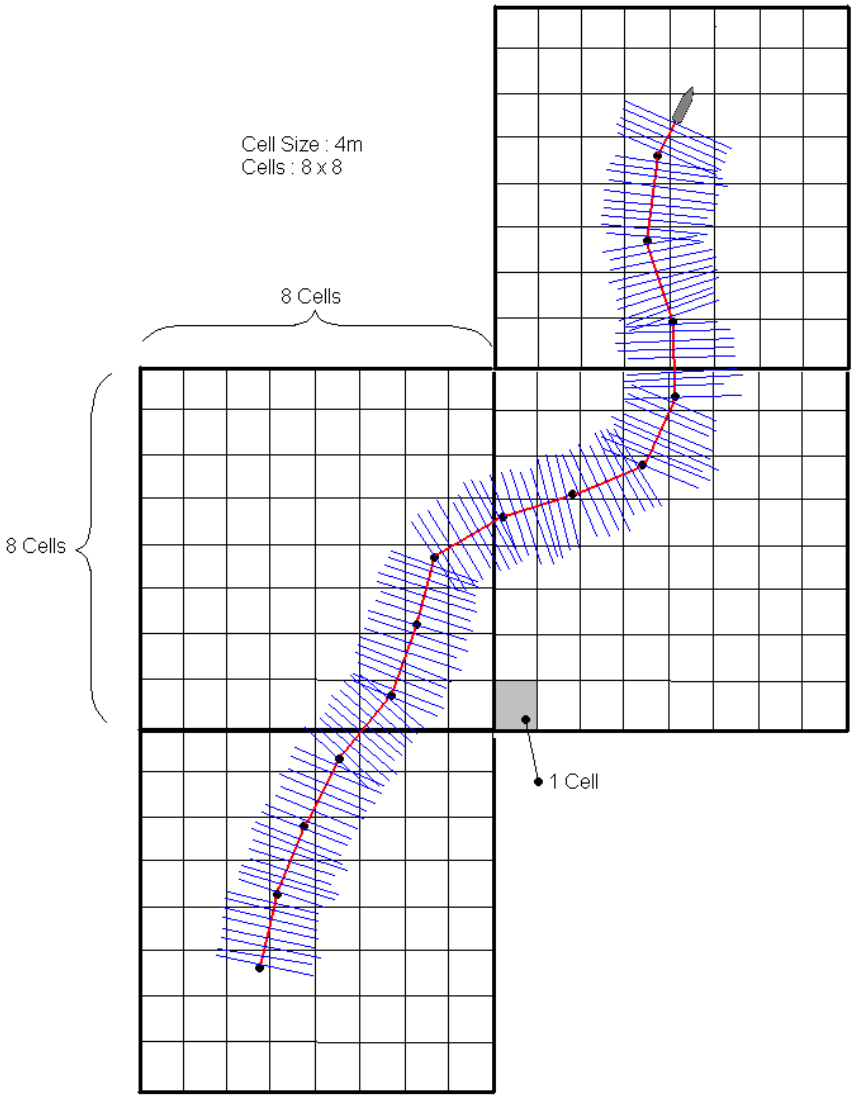
# The Grid Engine

- The Grid Engine (GE) creates terrain models from depths.
- It is a standalone server-based application.
- It is implemented using the Java language.
- SIS and GE communicates using HTML commands.

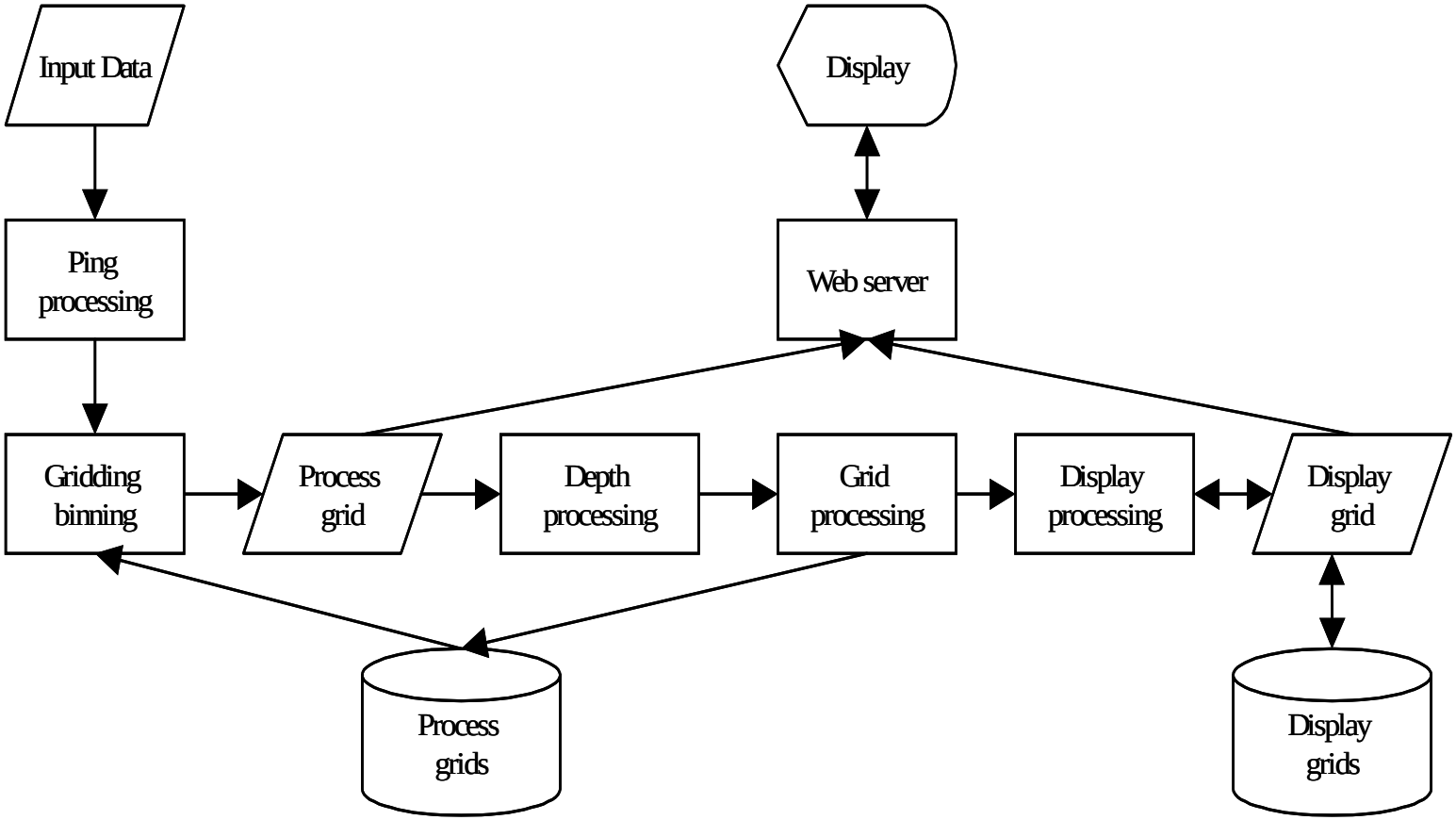


# GE – what is it doing ?

- GE accepts depth data, process it and creates a terrain model.
- Creates a ”grid” consisting of a square number of ”cells”.
- Cells are square containers with depth data and statistics.



# The Grid Engine



# Realtime Ping Processing

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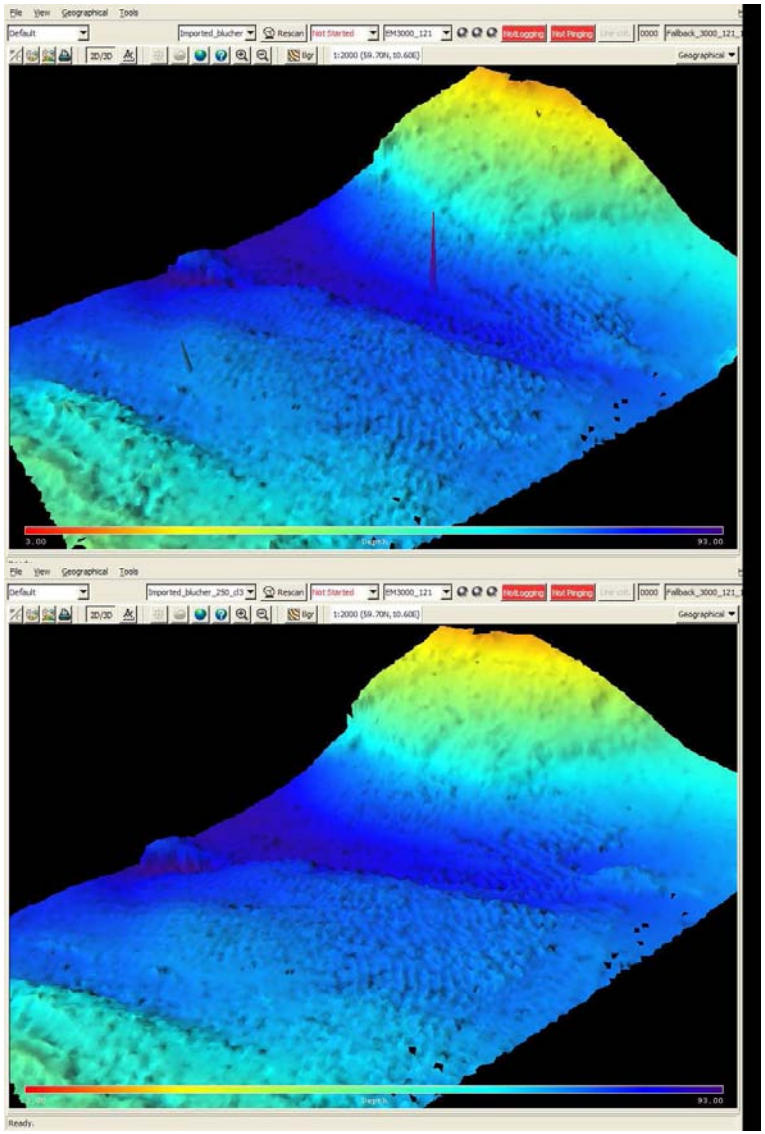
- Flag out points that probably are erroneous.
- Single ping rules, always performed first
- Neighborhood rules performed second.



# Realtime Depth Processing

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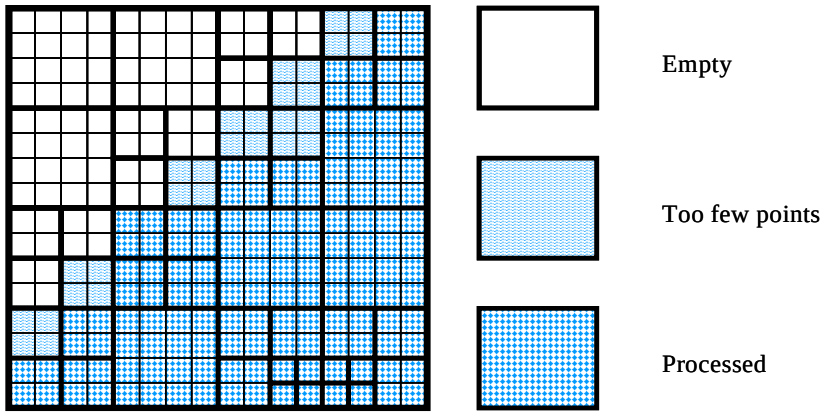
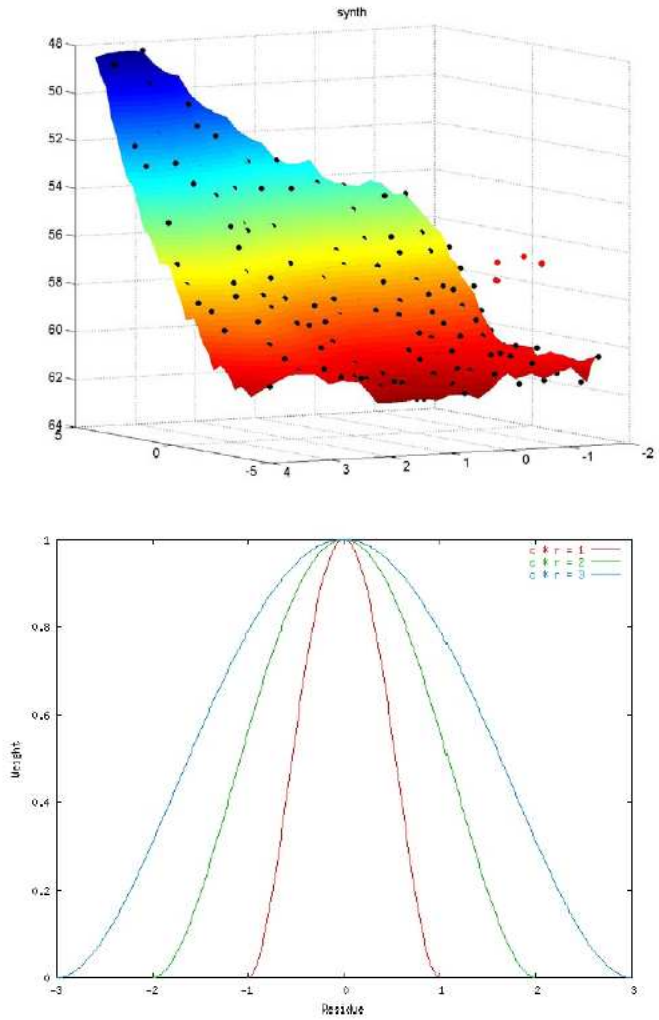
- After ping processing, process depths in a Process Grid.
- Cells are arranged into processing units depending on depth variations.
- Cells may be flagged out if they have too few points or are empty. They are never deleted !
- Cells can be merged into processing units.
- Processing units are added to a list, which in turn is sent to be processed.



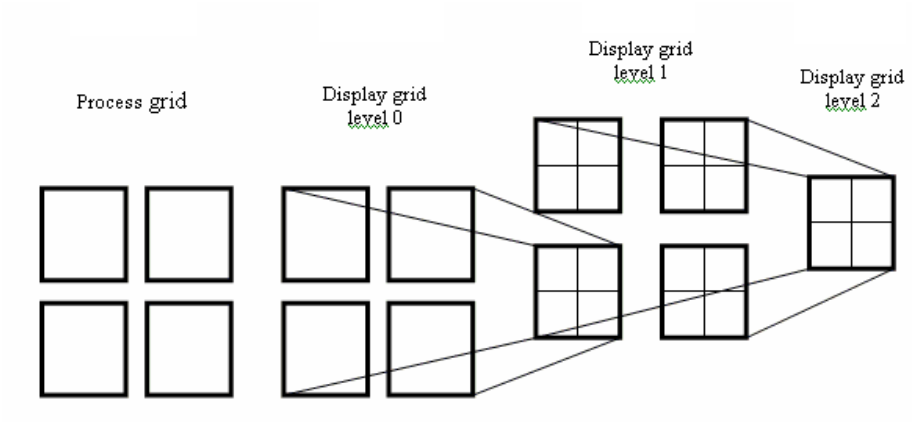
# Creating a Surface Estimate

- Each processing unit creates a surface estimate.
- Uses the IRLS (Tukey) algorithm (Iterated Reweighted Least Squares) to compute a high degree polynome which resembles the seafloor.
- After iteration completed, depths are flagged out based on various rules (residue, angle etc.)



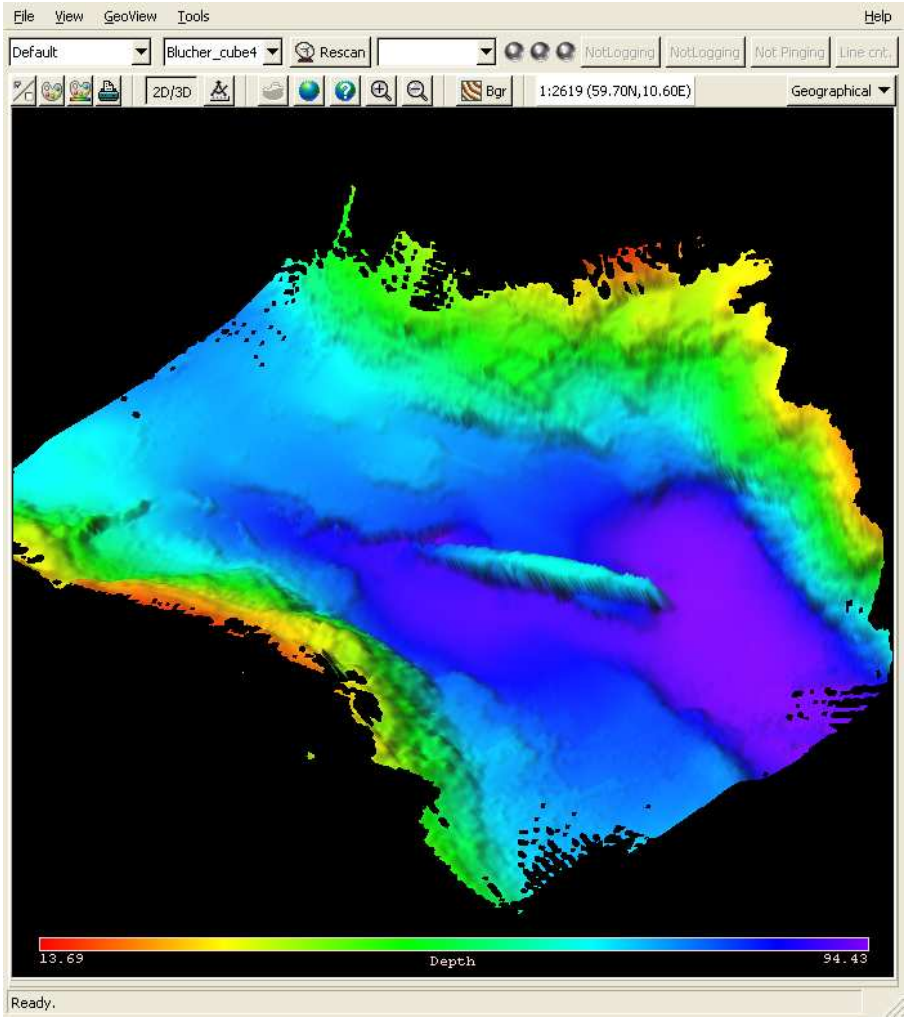
# Display grids

- Display Grid can be viewed in SIS.
- There are multiple resolution levels.
- Each Display Grid Cell is based on four neighboring cells at a higher detail level.



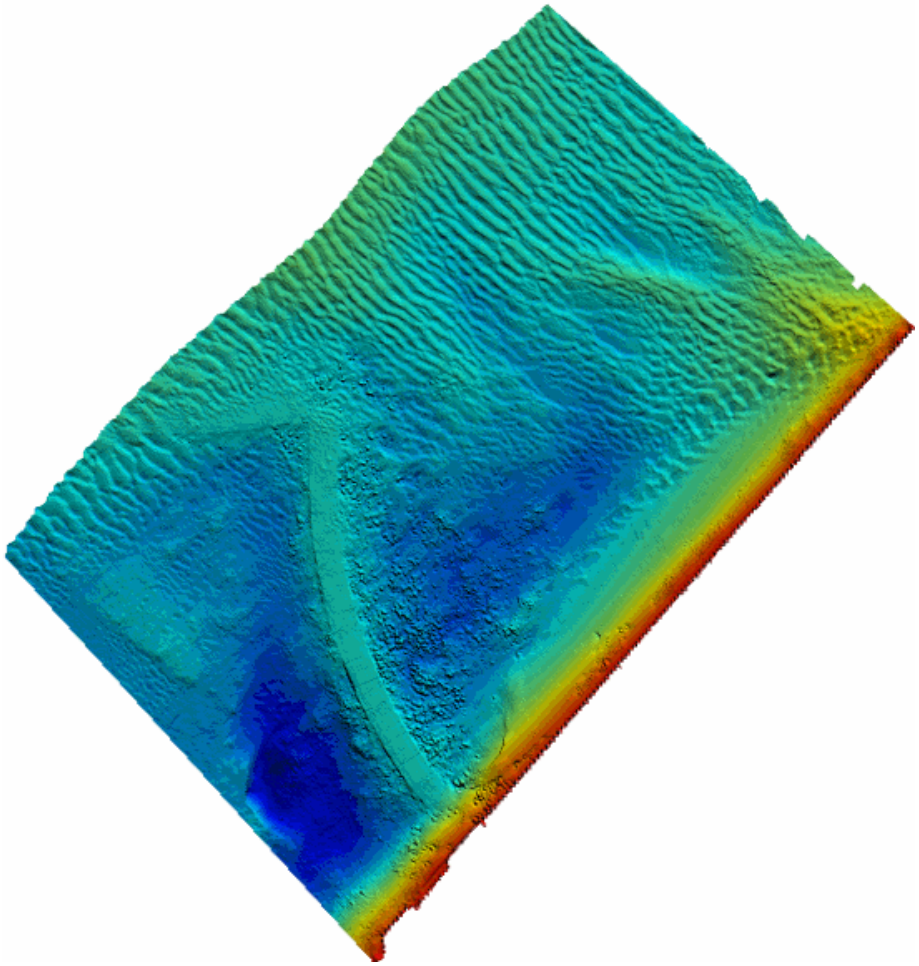
# Grid Engine Result

- A surface model that is continous and integradable in all points where it is defined.
- It can be viewed in both 2D and 3D from SIS.
- It is being updated in realtime.
- Requests are seamlessly handled, such as zooming specified by bounding area and LOD



# Some properties

- KM Echosounder systems can output up to 8000 (2 heads * 800 soundings * 5 depth values) depth records per second, with additional seabed data that is 3-5 times more.
- Everything is accepted by the GE which creates and maintains a terrain model in real time.
- GE will run until there is no more harddrive space, or it runs out of memory.
- It has been proven effective over several years, and is currently being utilized in several systems all around the world



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# THE FULL PICTURE