Next Generation Seabed Characterization Research Toolbox

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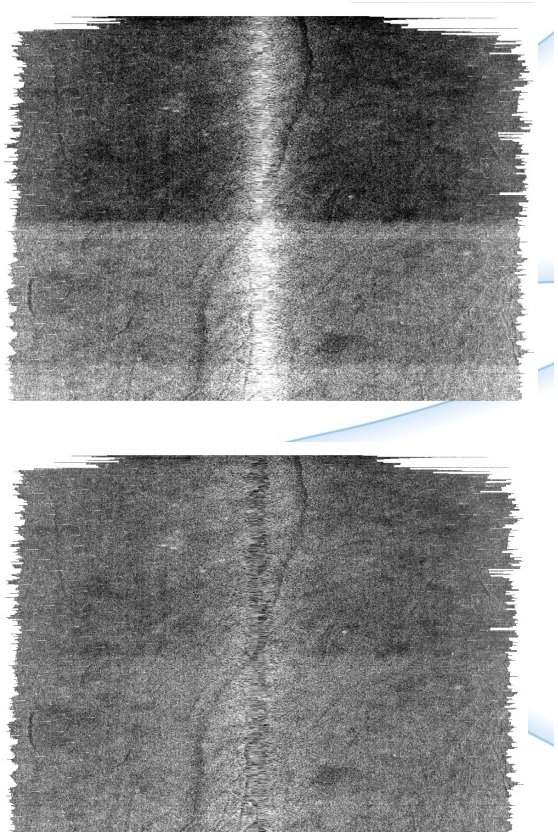
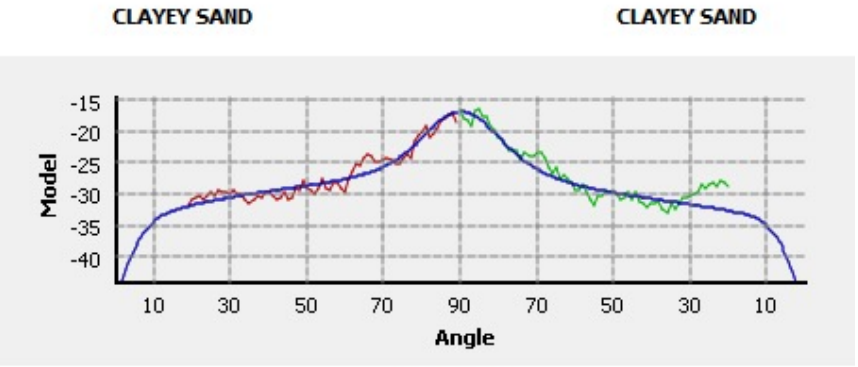
Geocoder

- Geocoder processes and analyses MBES reflectivity measurement
- Typical tasks:
  - Correct MBES signals for geometric and radiometric effects
  - Despeckling, feathering, mosaicing data to provide visually pleasing backscatter mosaics
  - Analysis of backscatter to estimate seafloor physical properties and "classify" the seabed
  - Geographic clustering of acoustic themes in support of benthic habitat mapping





Research Code & Production Code

- Geocoder is the result of many years of research software development attempting to solve the problems associated with these tasks
- pr

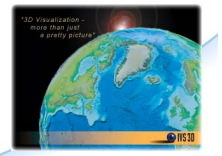
Research vs Production

- Research code
  - Goal: prove an idea works
  - Built in pieces over long periods often with little regard for the overall software architecture framework
  - Researchers are usually not Software Engineers
  - Serves the needs of a few users, programmers are often the users

- Production code
  - Goal: implement ideas behind research code
  - Implemented in a stable, dependable, extendable way and integrated into existing software by professional programmers
  - Extensively tested prior to release
  - Serves many users, programmers are not the users

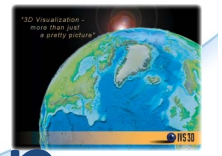
Geocoder at UNH

- Geocoder algorithms are good and sound but implementation can be improved (e.g. efficiency, memory management, etc)
- Loss of lead developer (Luciano Fonseca) makes it difficult to augment code base for new mapping systems, data formats, algorithms, etc
- CCOM Lesson Learned: succession management is important in research projects involving a lot of software development



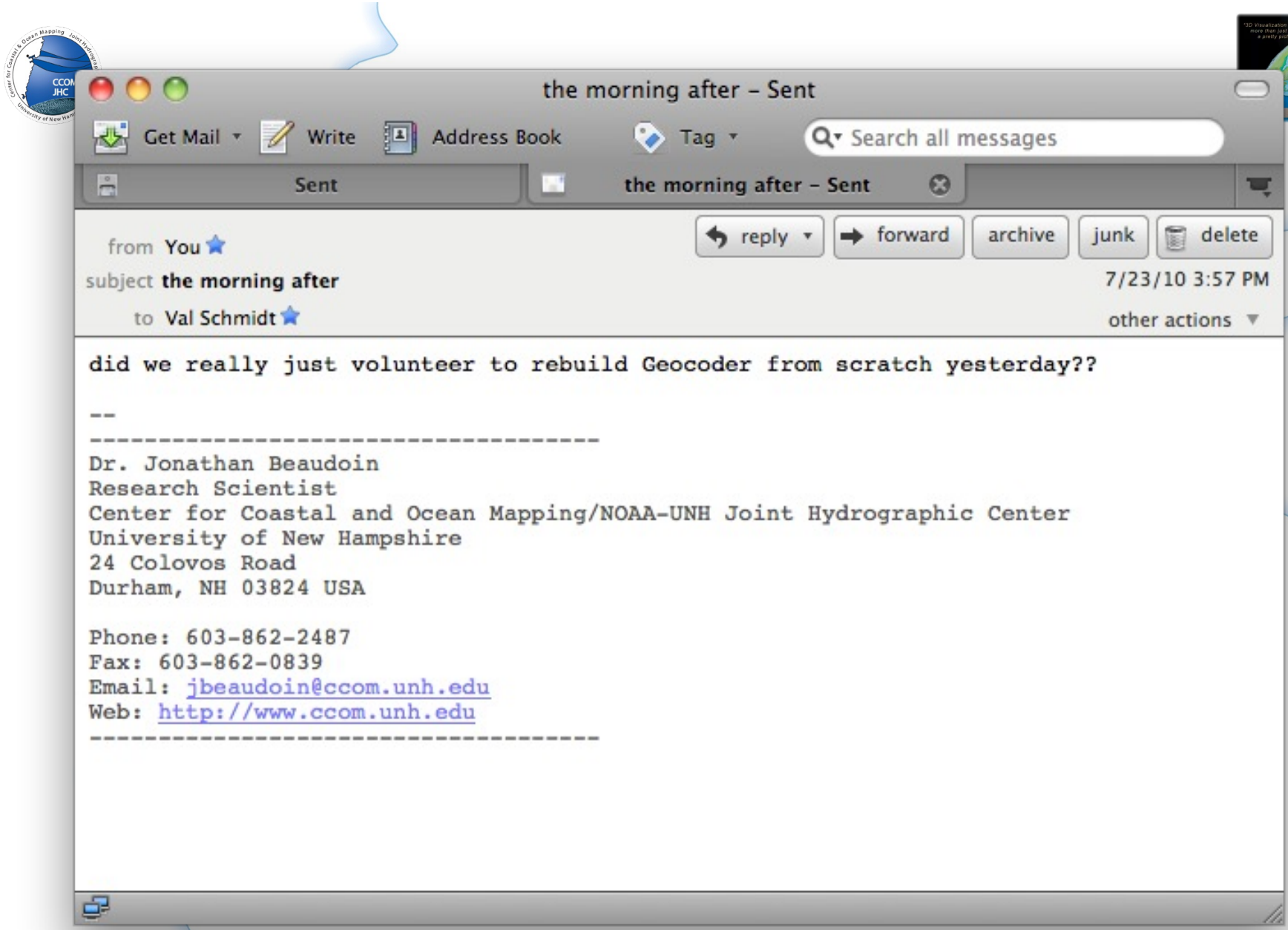
CCOM Geocoder Team

- Geocoder must be a TEAM effort within CCOM
- Experienced Geocoder warriors:
  - Yuri Rzhanov
  - Brian Calder
- Fresh troops:
  - Jonathan Beaudoin
  - Tom Weber
  - Val Schmidt
- First order of business: what is the way forward?



The Way Forward: Refactorization

- Need to refactor the code base to give us a stable base to further our research goals
- Refactoring code (according to Wikipedia):
  - Process of changing a computer program's source code without modifying its external functional behavior in order to improve some of the nonfunctional attributes of the software
  - Advantages include improved **code readability** and **reduced complexity** to **improve the maintainability** of the source code, as well as a more expressive internal architecture or object model to **improve extensibility**.


the morning after – Sent
Get Mail
Write
Address Book
Tag
Search all messages
Sent
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reply
forward
archive
junk
delete
from You
subject the morning after
7/23/10 3:57 PM
to Val Schmidt
other actions
did we really just volunteer to rebuild Geocoder from scratch yesterday??
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Meanwhile…

- IVS3D independently decided to refactorize their implementation
  (**FM Geocoder** becomes **FMGT**)
- IVS3D proposed partnership with CCOM/JHC:
  - IVS3D refactorizes & designs modularized plug-in architecture, IVS3D benefits from CCOM acoustics/multibeam expertise
  - CCOM uses FMGT for research purposes, plug-in architecture facilitates research into new algorithms within a stable code base

Refactorization Challenges

Geocoder Basic Architecture

Survey Line

Research code is inefficient, much room for improvement

GUI

Sonar Specific I/O

Process Data Structures

Sonar Specific Processing

System Memory Mosaic

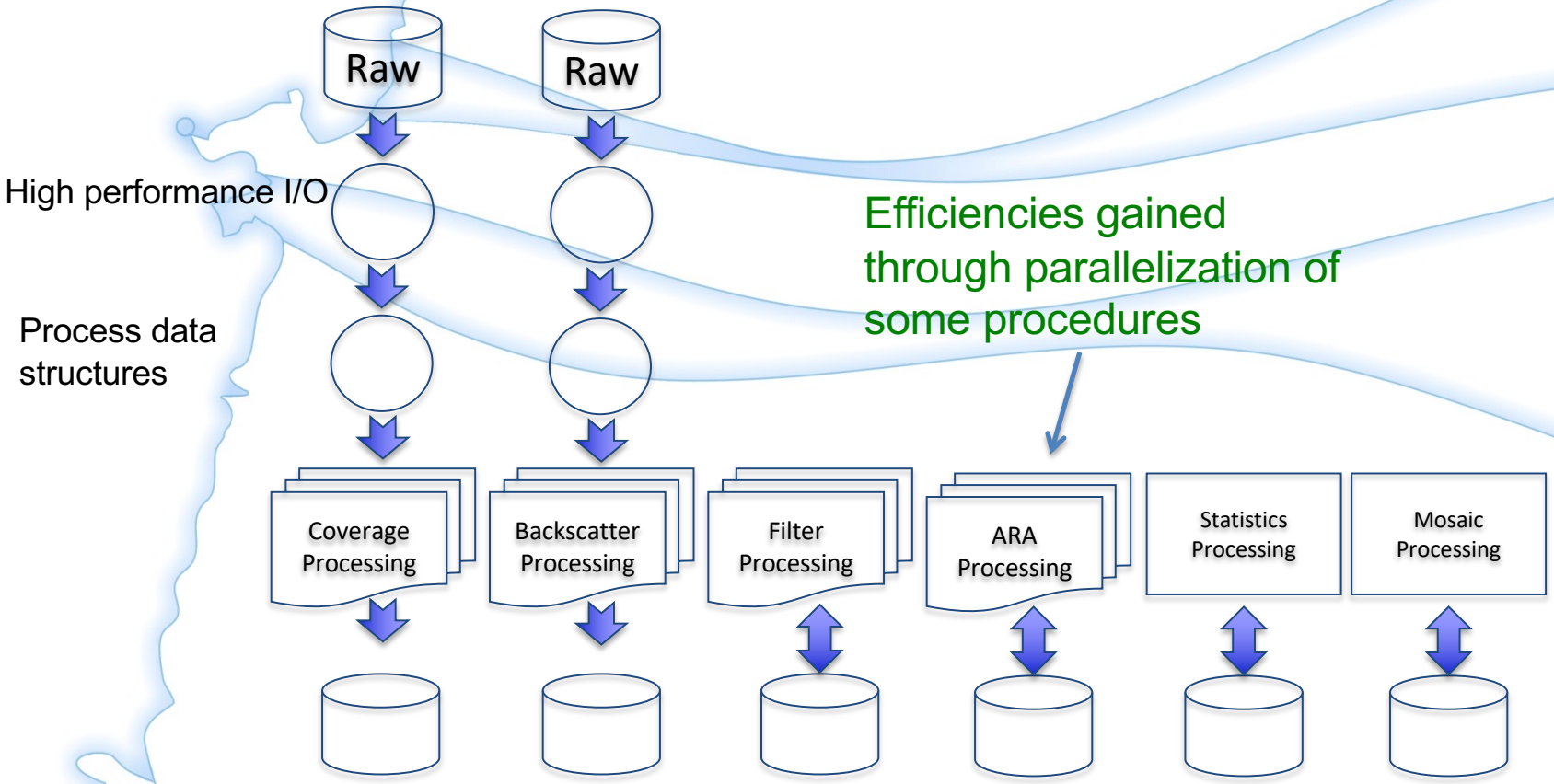
Display

Export Data

MUCH overlap in code, difficult to maintain, upgrade, etc

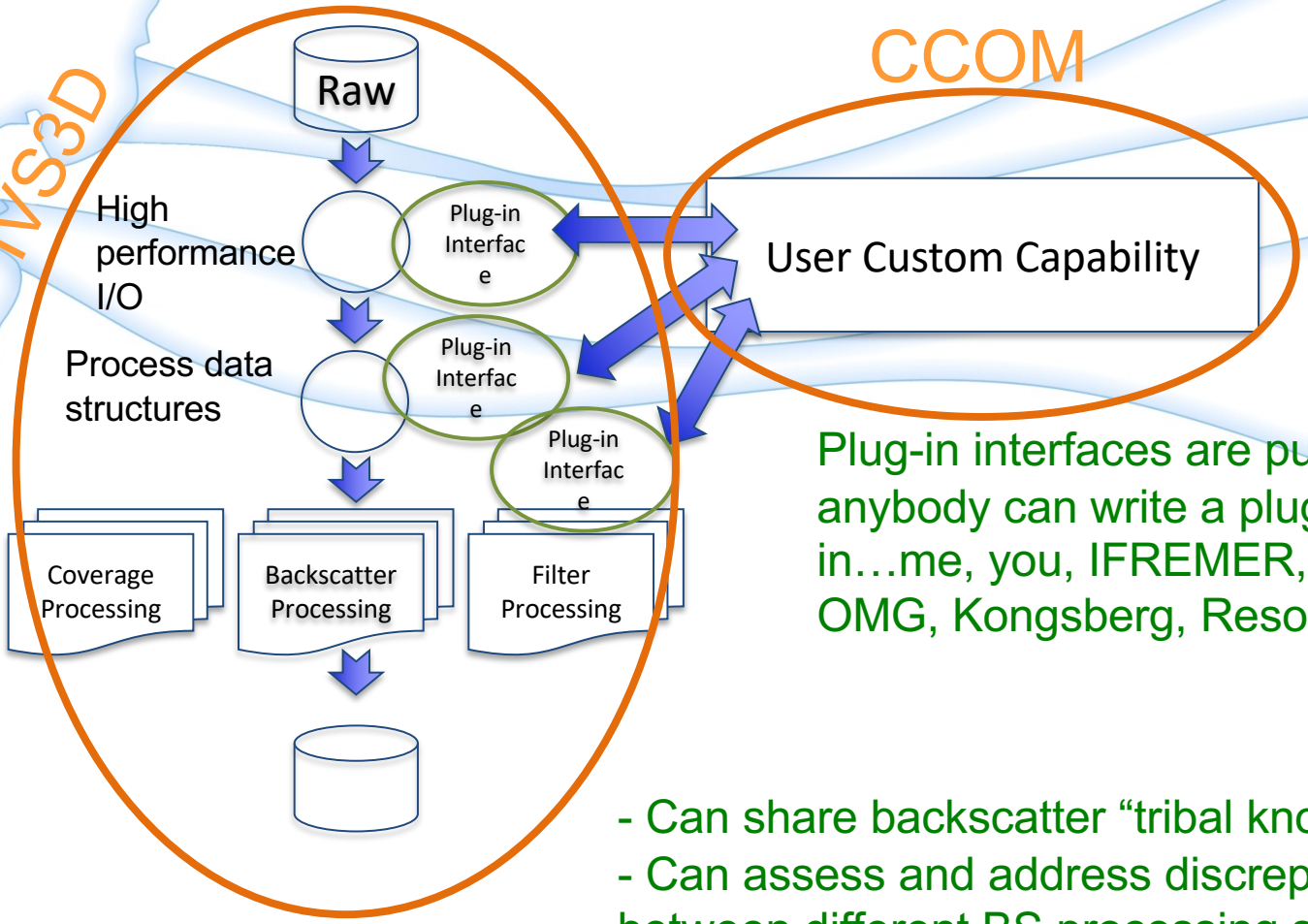
Data only saved at end of process…a "crash" means you have to start over. If you want to do something differently, you must start over.

Refactoring Geocoder



Intermediate data is “persisted” at each stage with metadata to ensure completed stages are not repeated in later sessions

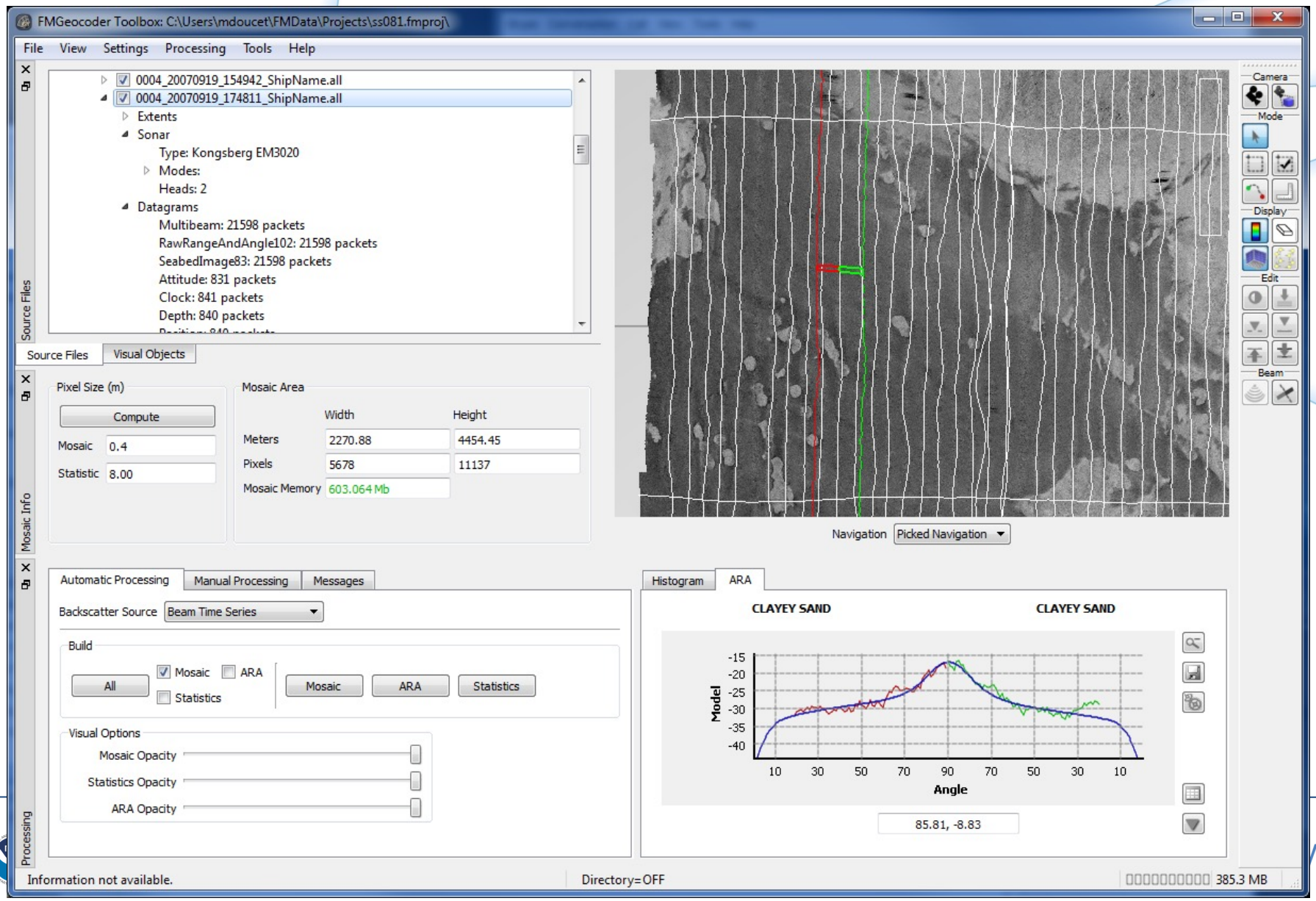
Plug-In Interface



Plug-in interfaces are public: anybody can write a plug-in…me, you, IFREMER, OMG, Kongsberg, Reson

- Can share backscatter “tribal knowledge”
- Can assess and address discrepancies between different BS processing software

FMGT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0004_20070919_174811_ShipName.all
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Sonar
Type: Kongsberg EM3020
Modes:
Heads: 2
Datagrams
Multibeam: 21598 packets
RawRangeAndAngle102: 21598 packets
SeabedImage83: 21598 packets
Attitude: 831 packets
Clock: 841 packets
Depth: 840 packets
Source Files
Visual Objects
Camera
Mode
Display
Edit
Beam
Navigation
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Pixel Size (m)
Compute
Mosaic 0.4
Statistic 8.00
Mosaic Area
Width
Height
Meters 2270.88 4454.45
Pixels 5678 11137
Mosaic Memory 603.064 Mb
Mosaic Info
Automatic Processing
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Messages
Backscatter Source
Beam Time Series
Build
All
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Statistics
Visual Options
Mosaic Opacity
Statistics Opacity
ARA Opacity
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CLAYEY SAND
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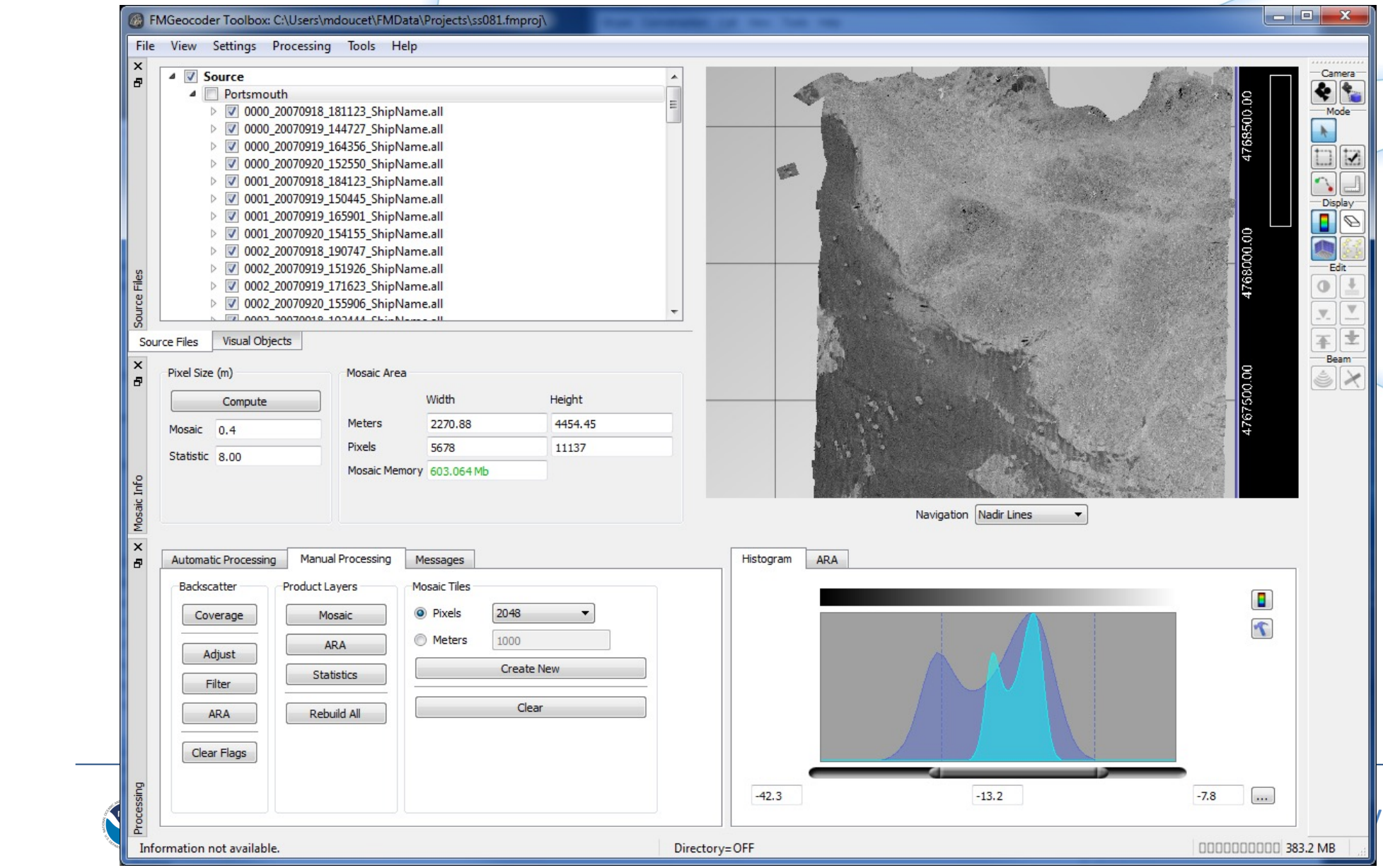
FMGT


FMGeocoder Toolbox: C:\Users\mdoucet\FMData\Projects\ss081.fmproj\
File View Settings Processing Tools Help
Source
Portsmouth
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Source Files
Visual Objects
Pixel Size (m)
Compute
Mosaic 0.4
Statistic 8.00
Mosaic Area
Width Height
Meters 2270.88 4454.45
Pixels 5678 11137
Mosaic Memory 603.064 Mb
Mosaic Info
4768500.00
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Camera
Mode
Display
Edit
Beam
Navigation Nadir Lines
Automatic Processing
Manual Processing
Messages
Backscatter
Coverage
Adjust
Filter
ARA
Clear Flags
Product Layers
Mosaic
ARA
Statistics
Rebuild All
Mosaic Tiles
Pixels 2048
Meters 1000
Create New
Clear
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ARA
-42.3
-13.2
-7.8
Processing
Information not available.
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383.2 MB

A Kinder and Gentler Geocoder

- Modular design allows us to construct flow path using a stable code base
- Can verify
  - module inputs and outputs
  - correctness of vendor implementations
- Innovation can get to market more robustly and more traceably
- Provides stable software for users
- Empowers researchers and users
  - add functionality
  - compare and evaluate algorithms
- Facilitate interchange of ideas
- Accelerates research

Acknowledgements

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Questions?