

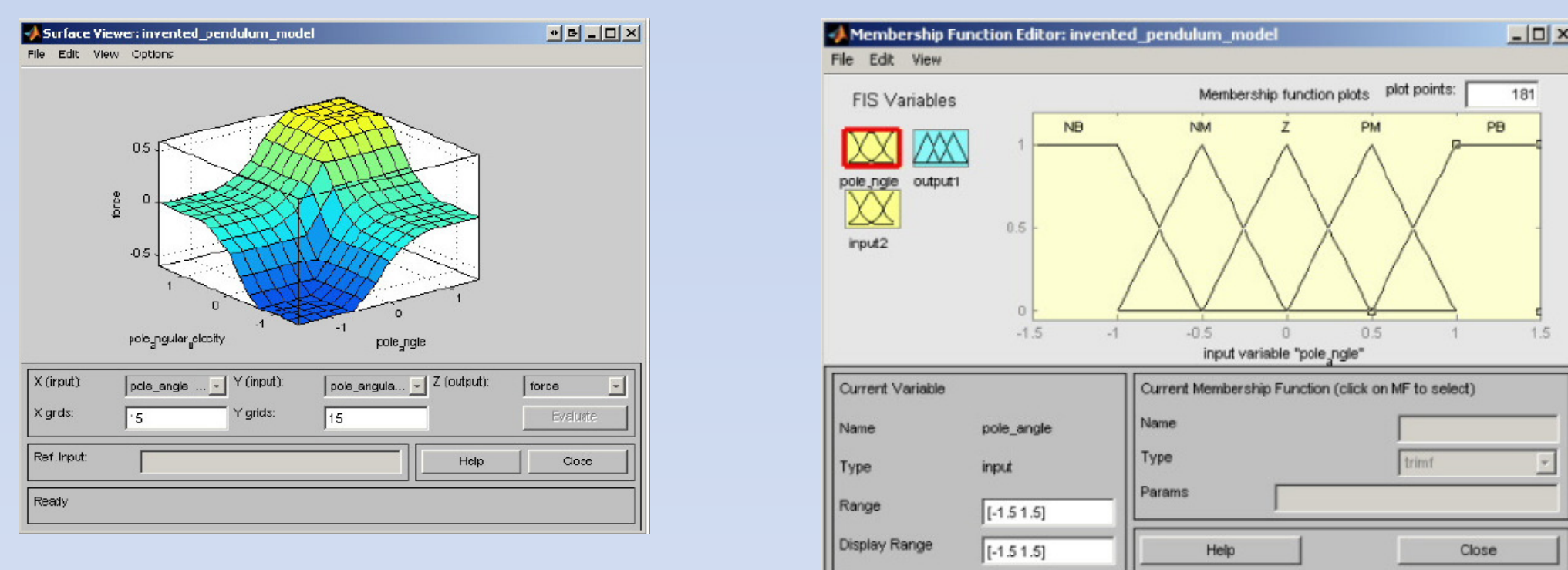


## Hardware Accelerators for Processor Extensions

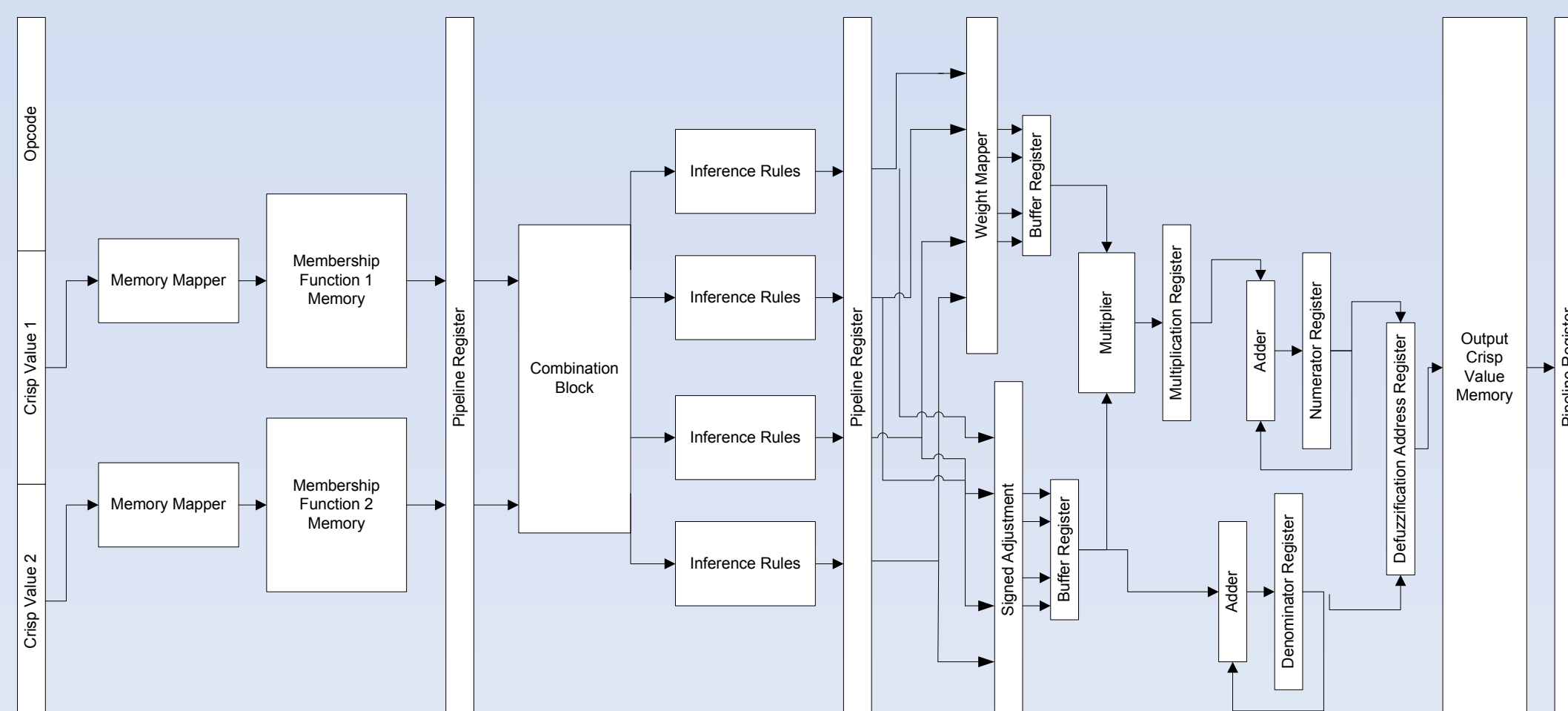
With identified Processor Extensions, what will the hardware look like to execute the extension? Hardware Accelerators are used to accelerate specific instructions by executing them through a customized datapath. What will the Hardware Accelerator look like? How big? How fast? These types of questions are answered by performing Design Space Exploration.

## Research Overview

System modeling and implementation using MathWorks MATLAB and Celoxica's DK Design Suite helped in the design of a Fuzzy Logic Coprocessor for control based Processor Extensions.



Fuzzy Logic (FL) Coprocessor Datapath:



## Current Research

Currently, the Fuzzy Logic (FL) Coprocessor is being extended by making it configurable for different types of Fuzzy Logic (FL) problems. Design Space Exploration (DSE) principles are also being determined and applied to the FL Coprocessor, making it more customizable for specific design requirements.

## Hardware Accelerators for Signal Processing

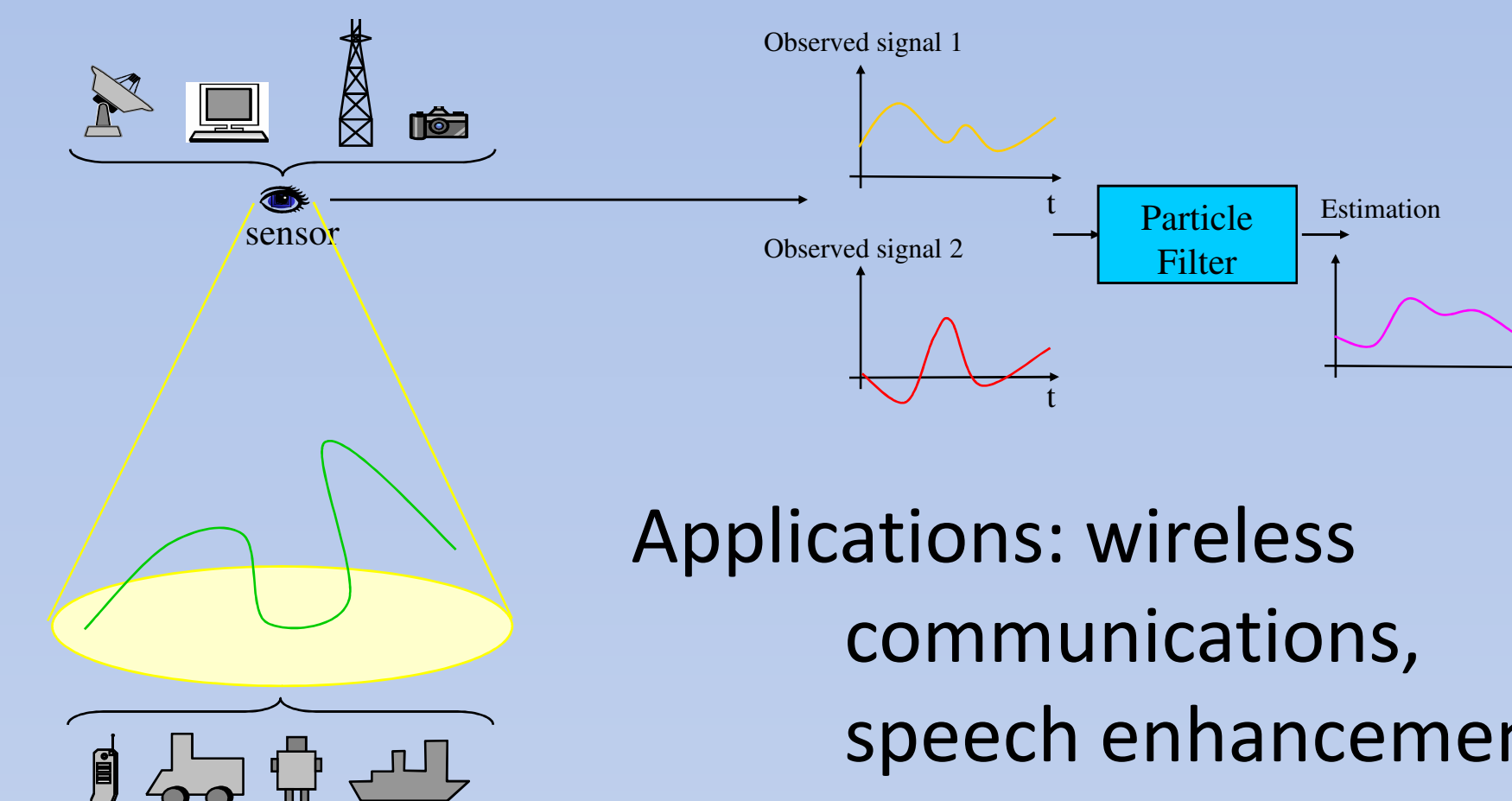
Objective:  
 Modify signal processing algorithms so that they are more suitable for hardware implementation.

Platforms:  
 Dedicated hardware in FPGA or multiprocessing systems on chip

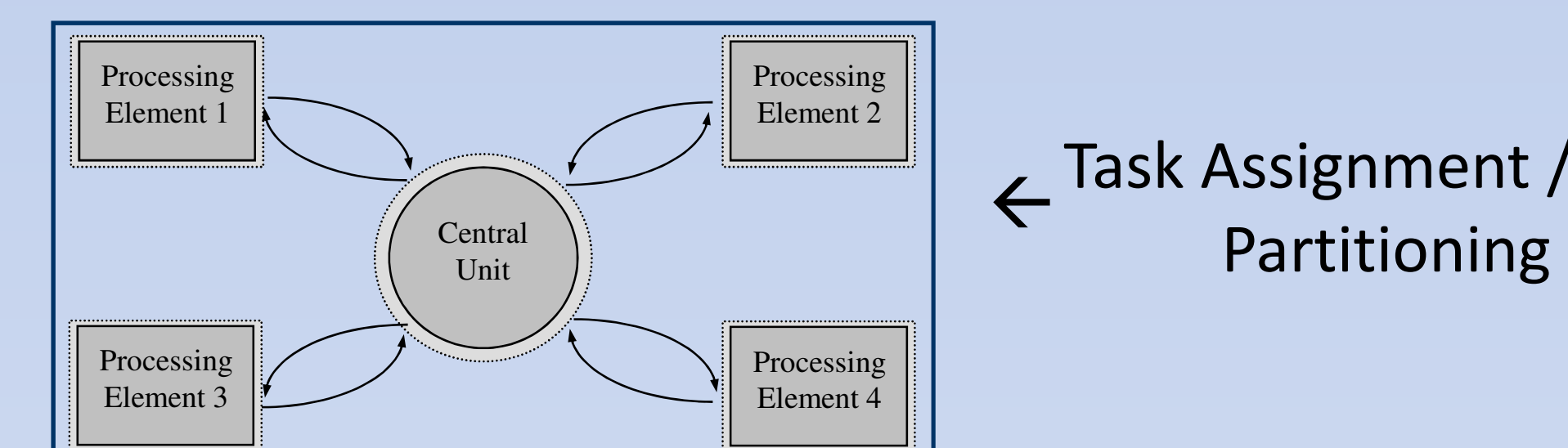
- Steps:
1. Analysis of straight-forward implementation of the algorithms
  2. Modifications of the algorithms and proof of correctness of new algorithms
  3. Efficient implementation of new algorithms

Projects:  
 Implementation of particle filters Wavelet transform

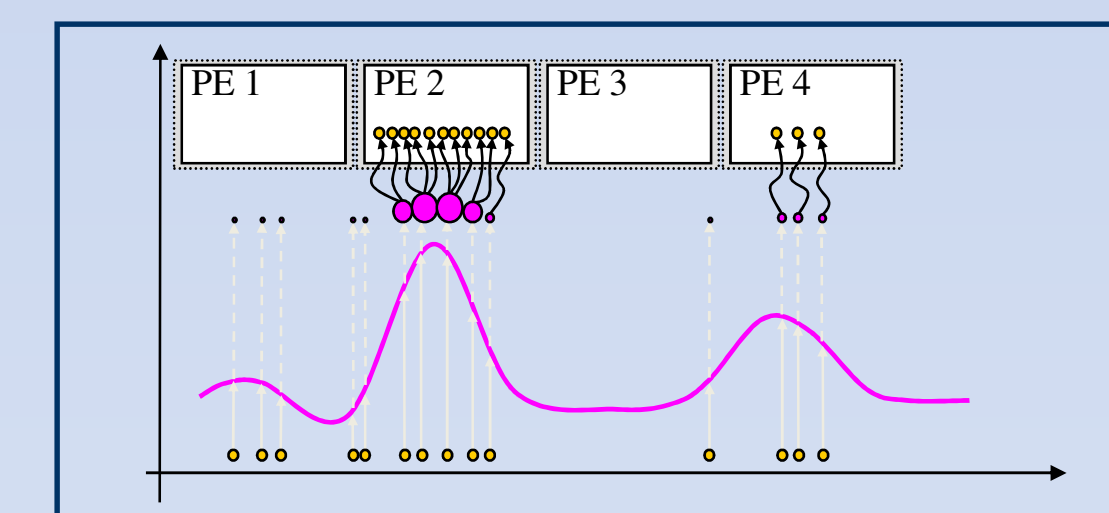
## Implementation of Particle Filters



Applications: wireless communications, speech enhancement, tracking and navigation



Load Balancing →



Results:

- First FPGA implementation and first parallel particle filter implementation
- Improvements in speed of about 50 times

Future projects:

- Reduction of complexity of particle filters
- Analysis of the optimality criteria for parallel particle filters