SvPablo: A Graphical Source Code Browser for Performance Tuning and Visualization

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Project Participants

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- Staff and Post-doctoral Associates
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  - Ying Zhang

Outline

- Background
- SvPablo overview
- SvPablo model
- Interactive instrumentation of programs
- Example
- Conclusions and software availability

Background

- Motivations
  - emerging high-level languages (HPF and HPC++)
  - aggressive code transformations for parallelism
  - large semantic gap between user and code
- Goals
  - relate dynamic performance data to source
  - hide semantic gap
  - generate instrumented executable/simulated code
  - support performance scalability predictions

SvPablo Overview

SvPablo Provides:

- performance data capture,
- analysis, and
- presentation

for applications executing on a variety of sequential and parallel platforms.

SvPablo Overview

A graphical user interface tool for:

- source code instrumentation
- browsing runtime performance data

Two major components:

- performance instrumentation libraries
- performance analysis and presentation

SvPablo Overview

- Instrumentation
  - automatic
    - » HPF (from PGI)
  - interactive
    - » ANSI C
    - » Fortran 77
    - » Fortran 90
- Data capture
  - dynamic software statistics (no traces)
  - SGI R10000 counter values

SvPablo Overview

- source code instrumentation
  - HPF: PGI runtime system invokes instrumentation
    - » each procedure call
    - » each HPF source line
  - C and Fortran programs: interactively instrumented
    - » outer loops
    - » function calls
- instrumentation maintains statistical summary
- summaries correlated across processors
- correlated summary input to browser

SvPablo Overview

- Architectures:
  - any system with the PGI HPF compiler
  - any system with F77 or F90
  - C applications supported on
    - » single processor Unix workstations
    - » network of Unix workstations using MPI
    - » Intel Paragon
    - » Meiko CS2
- Graphical User Interface supports:
  - Sun (Solaris)
  - SGI (IRIX)

Procedure Statistics Metrics

- count
- exclusive duration
- inclusive duration
- send message duration (HPF only)
- receive message duration (HPF only)

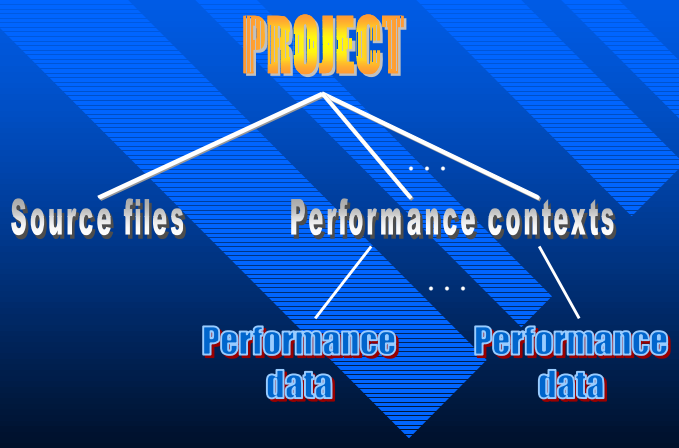
Line Statistics Metrics

- count
- duration
- exclusive duration
- message send and message receive (HPF)
  - duration
  - count
  - size
- R10K event counters

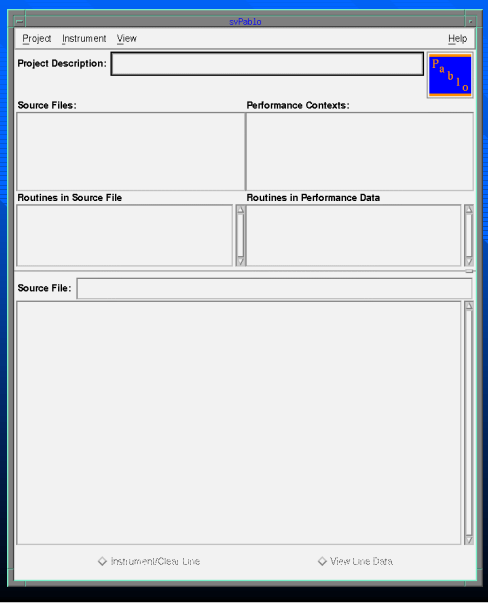
Metrics Statistics

- mean
- standard deviation
- minimum value
- task number corresponding to minimum value
- maximum value
- task number corresponding to maximum value

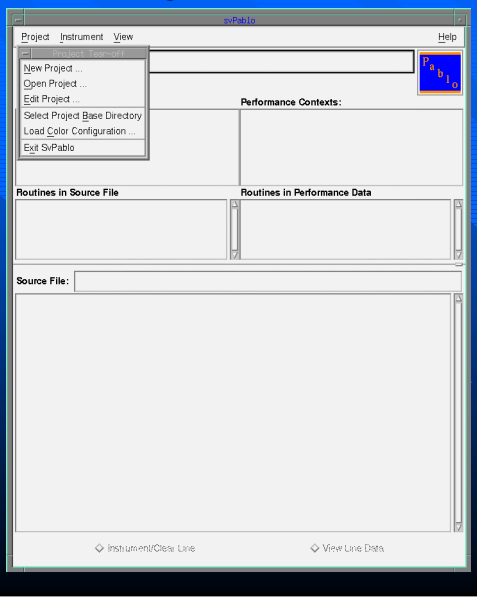
SvPablo Model



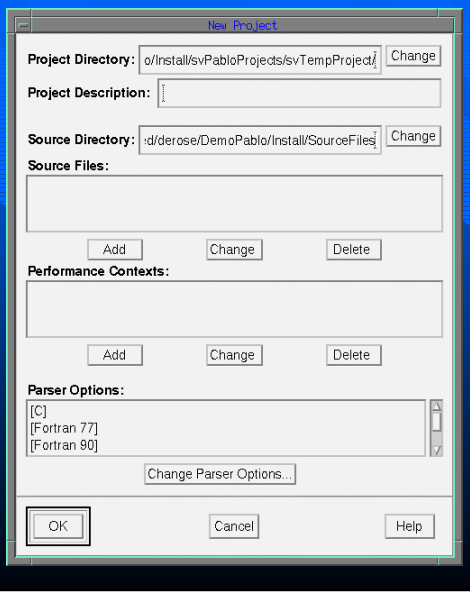
SvPablo Main Window



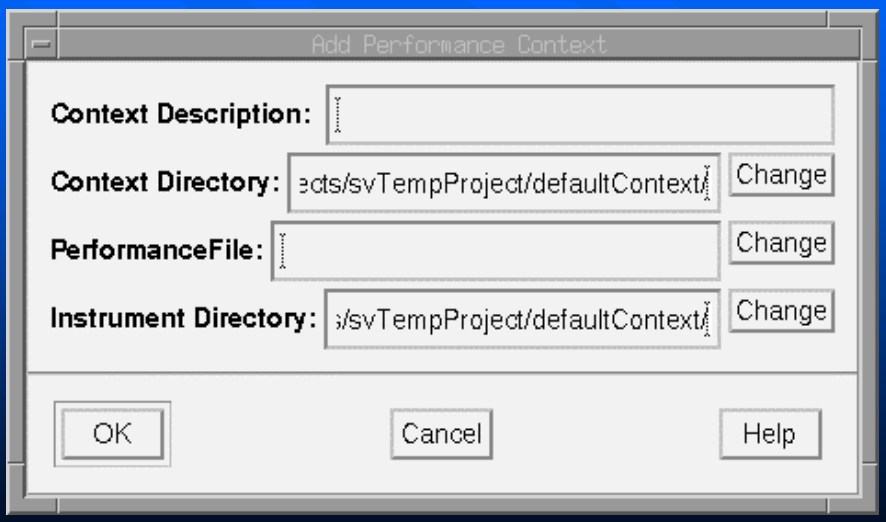
Project Menu



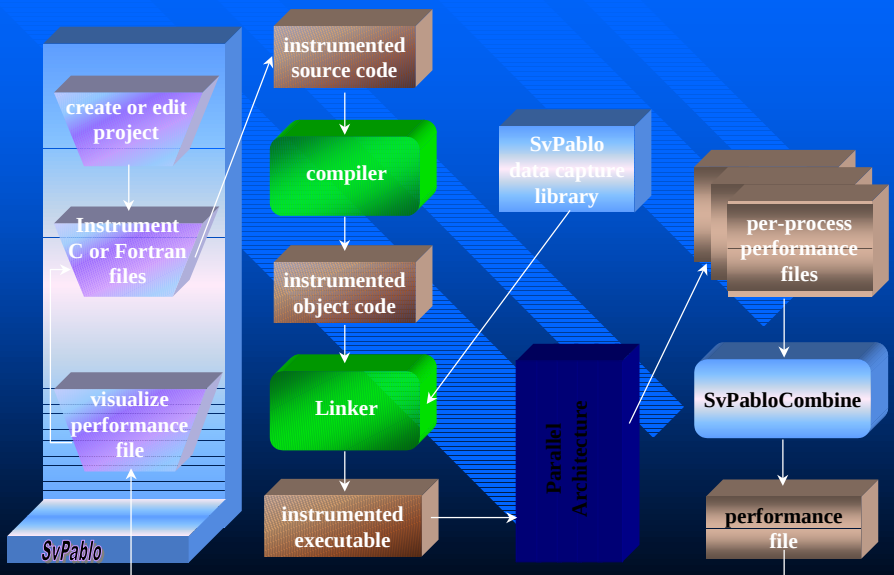
New Project Dialog Box



Performance Context

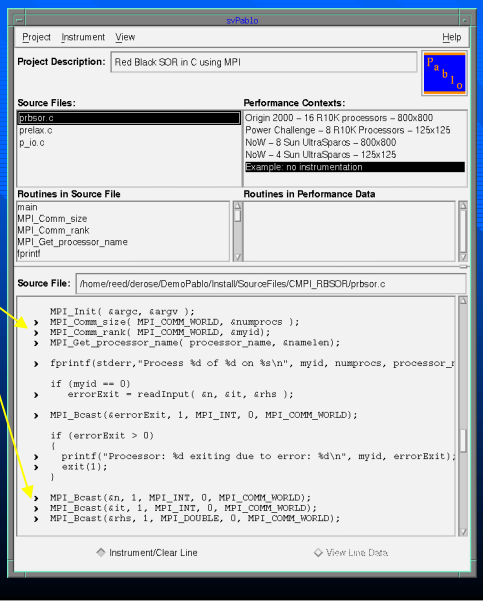


C/F77/F90 Data Flow

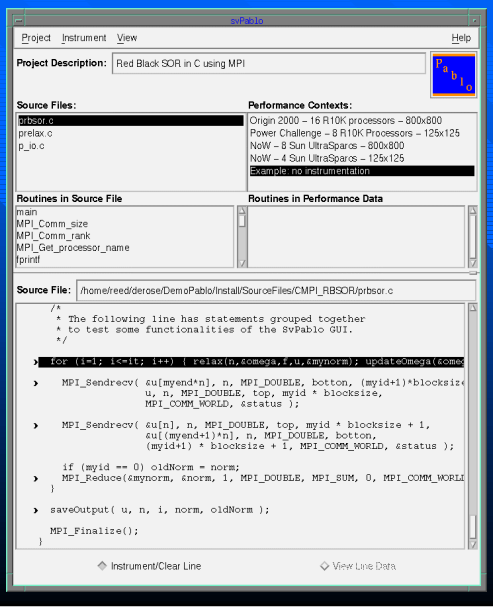


Interactive Instrumentation

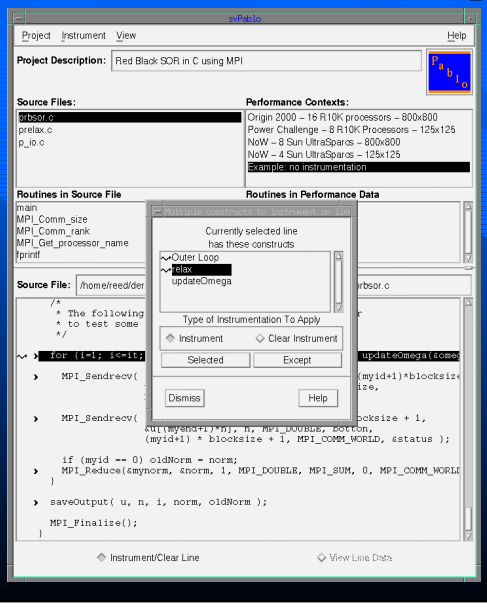
Instrumentable Constructs (function calls and outer loops)



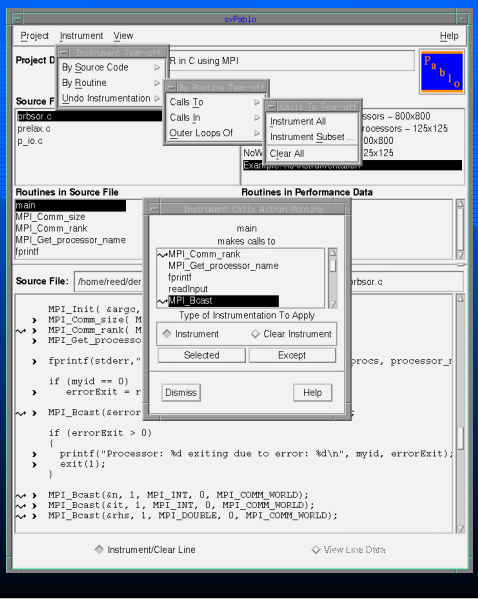
Line Instrumentation



Line Instrumentation - Multiple events



Instrumentation Menu

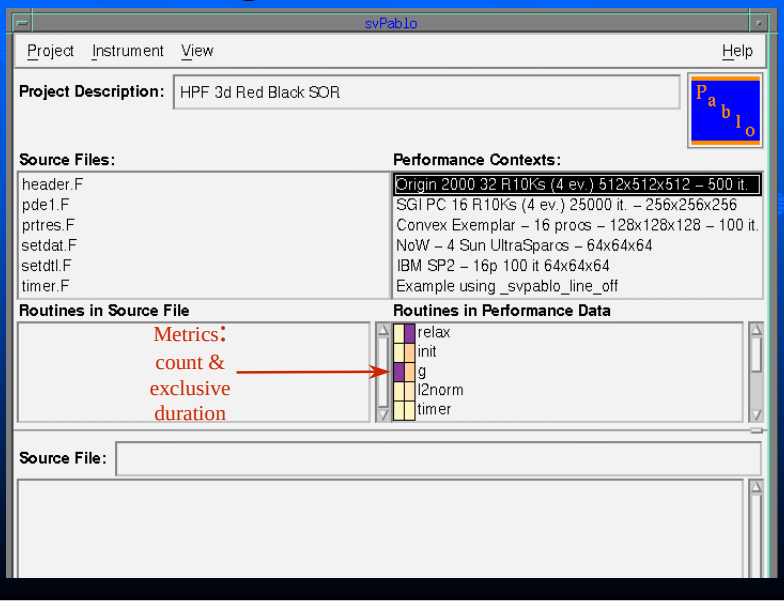


Generating Instrumented Executable Program

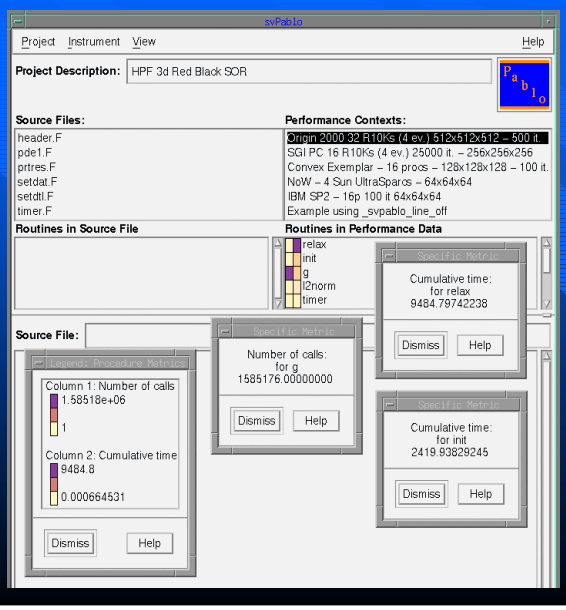
- mpicc -c file1.Context1.inst.c
- mpicc -c file2.Context1.inst.c
- mpicc -c Context1/InstrumentationInit.c
- mpicc -o instFile InstrumentationInit.o
  file1.Context1.inst.o
  file2.Context1.inst.o
  svPabloDcl.a

(similar for Fortran 77 and Fortran 90)

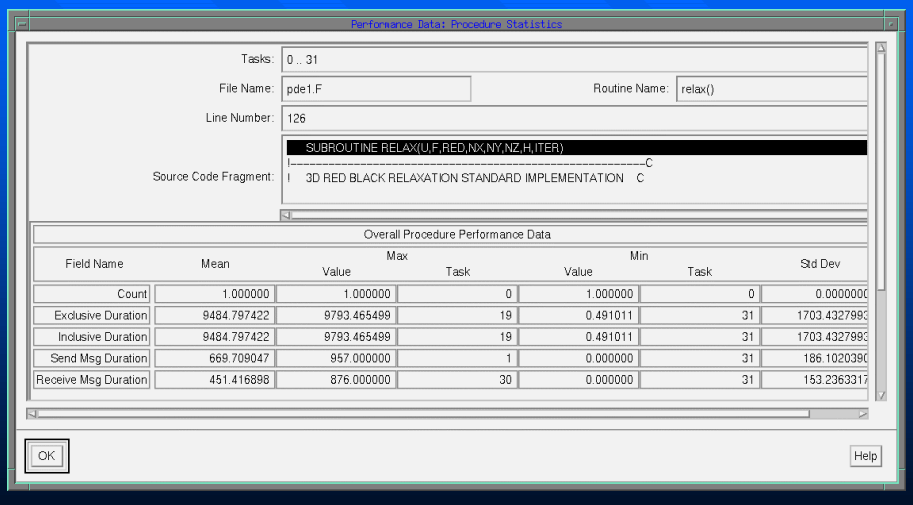
Visualizing Routines Performance



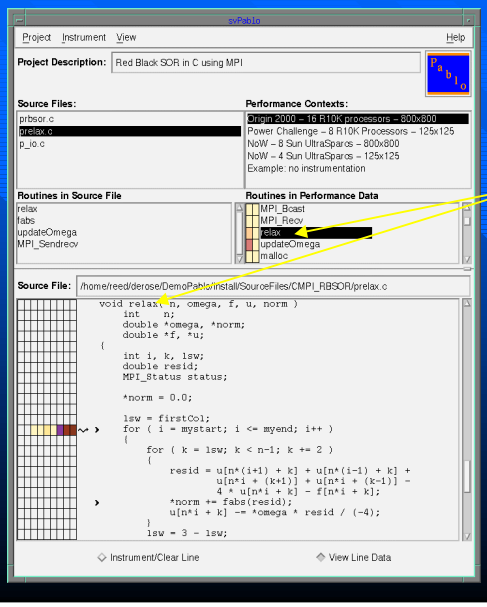
Metric Values



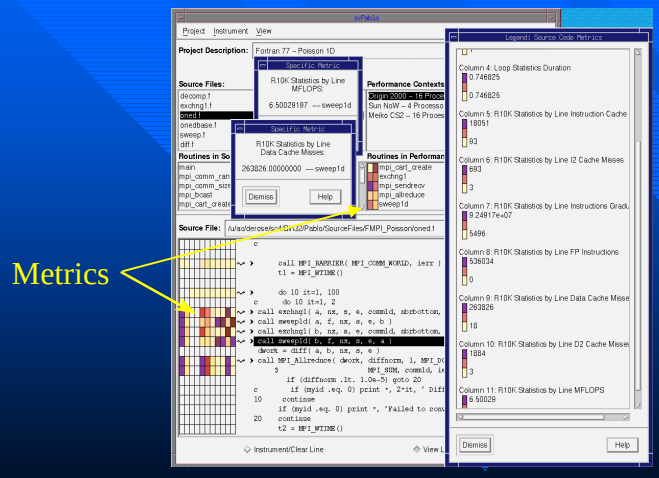
Procedure Statistics



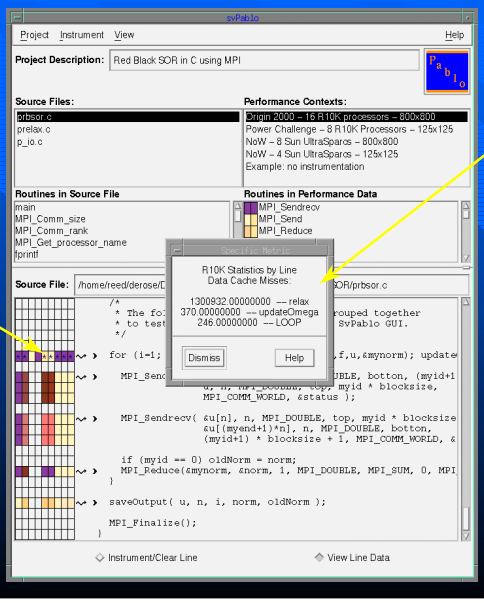
Function Visualization



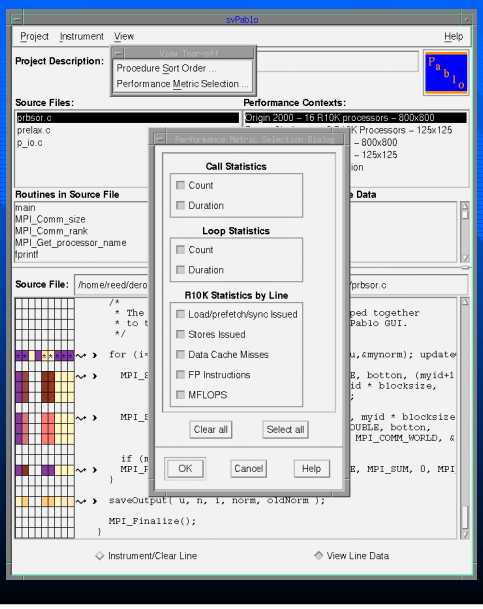
Source Code Visualization



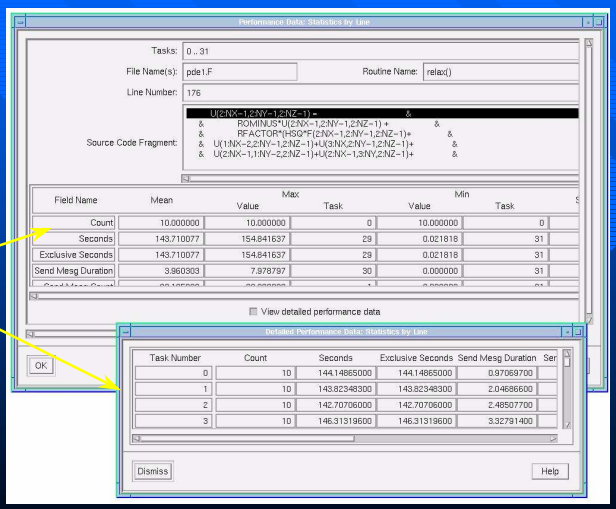
Multiple Events Metric Box



Performance Metric Selection Dialog



Performance Statistics

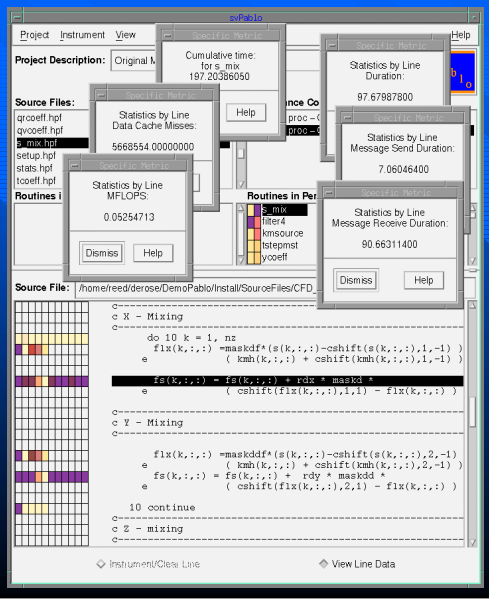


Metric details

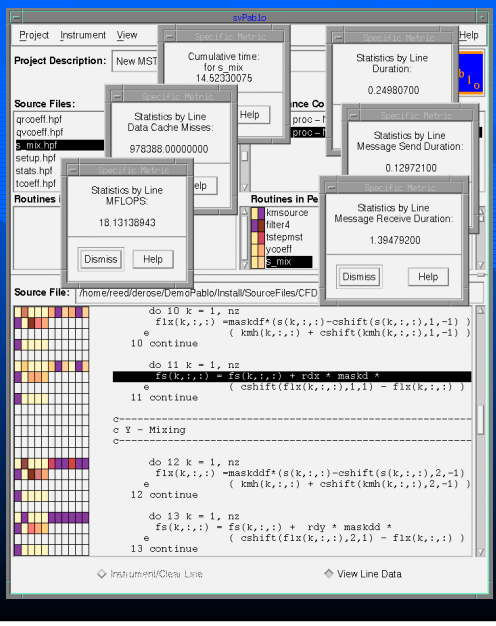
Application Tuning Example

- 3D numerical model to simulate cloud and density current dynamics
- translated from CM-Fortran to HPF
- approximately 9000 lines
- running on the SGI Origin 2000

Original MSTFLOW



Modified MSTFLOW



SvPablo Software Availability

- Features:
  - C, Fortran, and HPF performance analysis
  - SUN Solaris and SGI support
  - SGI hardware counters (R10000)
- WWW URL:
  - http://www-pablo.cs.uiuc.edu/
- Contact email address:
  - pablo-feedback@guitar.cs.uiuc.edu