Implementation of SMOKE and SMOKE Tool in Models-3

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Overview

- Introduction
- Models-3 and SMOKE
- SMOKE Tool and datasets
- SMOKE Tool capabilities
- SMOKE Tool interfaces
- SMOKE interfaces
- Plans for the future

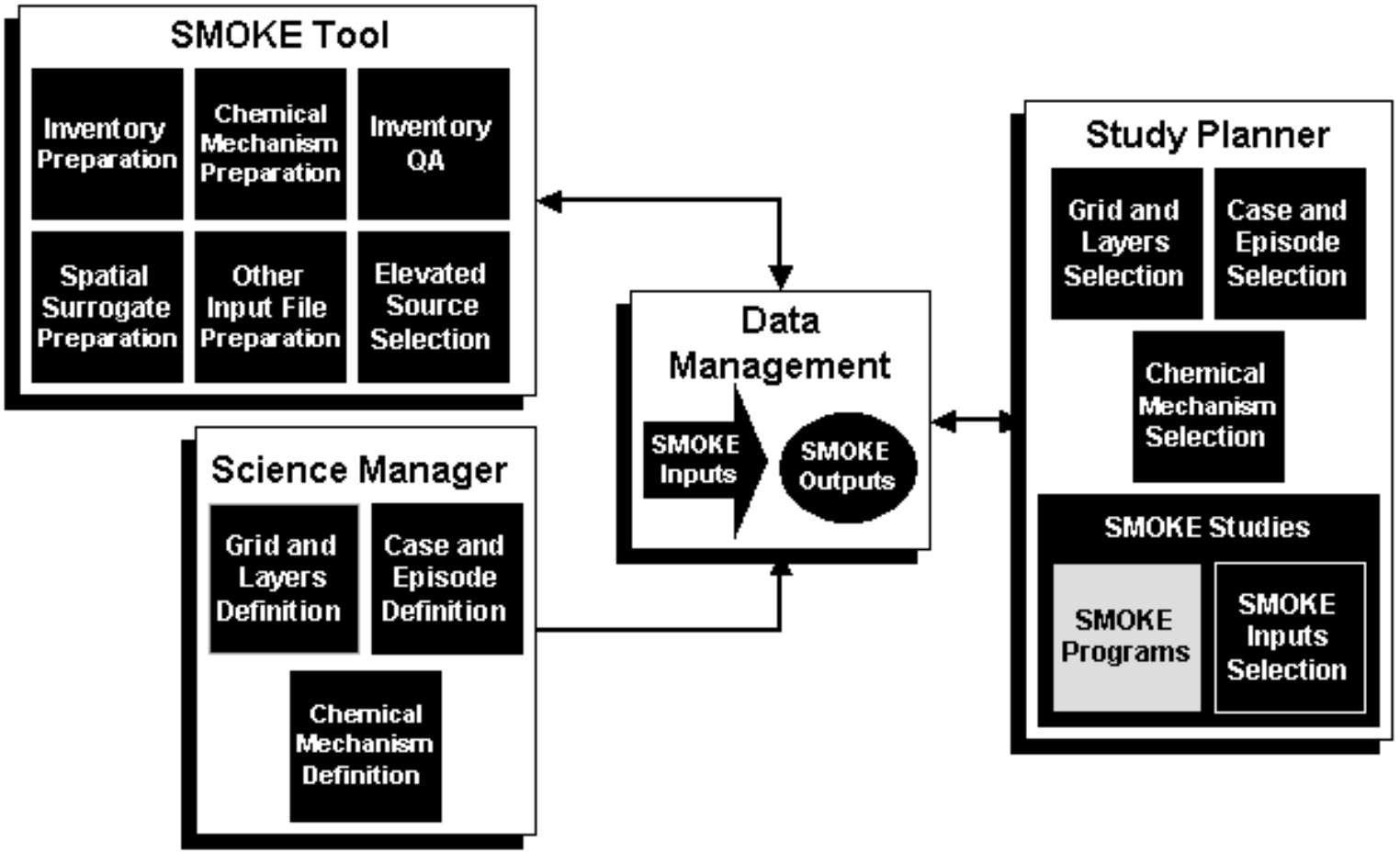
Introduction

Origins of Emission Modeling in Models-3

- Emission modeling intended to be an integral part of the Models-3 system
- Integral components of the framework use the I/O API NetCDF format for communication
- SMOKE uses I/O API, but was not available for first Models-3 release
- MEPPS used as an interim measure for reasons of cost and timing

Models-3 and SMOKE

- MEPPS and SMOKE developed separately until 1998, when SMOKE was revised to be compatible with the current Models-3 framework version
- SMOKE architecture was streamlined to use the same core programs (e.g., temporal allocation, speciation) for all source types to the extent possible



Source: Houyoux and Vukovich, 1999

SMOKE Tool (1)

- SMOKE requires input files prepared externally
- SMOKE Tool assists in SMOKE input file preparation
  - Grid files and gridded spatial surrogate files
  - Inventory files in IDA format
  - Packet files for control, growth, and reactivity factors
  - Allow editing of chemical species groupings

SMOKE Tool (2)

- SMOKE Tool based on SAS and Arc/Info
- SMOKE Tool linked to Models-3 framework, but not based on I/O API NetCDF
- Basic SMOKE Tool basic functions:
  - Data import and quality control
  - Allows re-grouping of chemical species
  - Preparation of SMOKE input files

SMOKE Tool Datasets

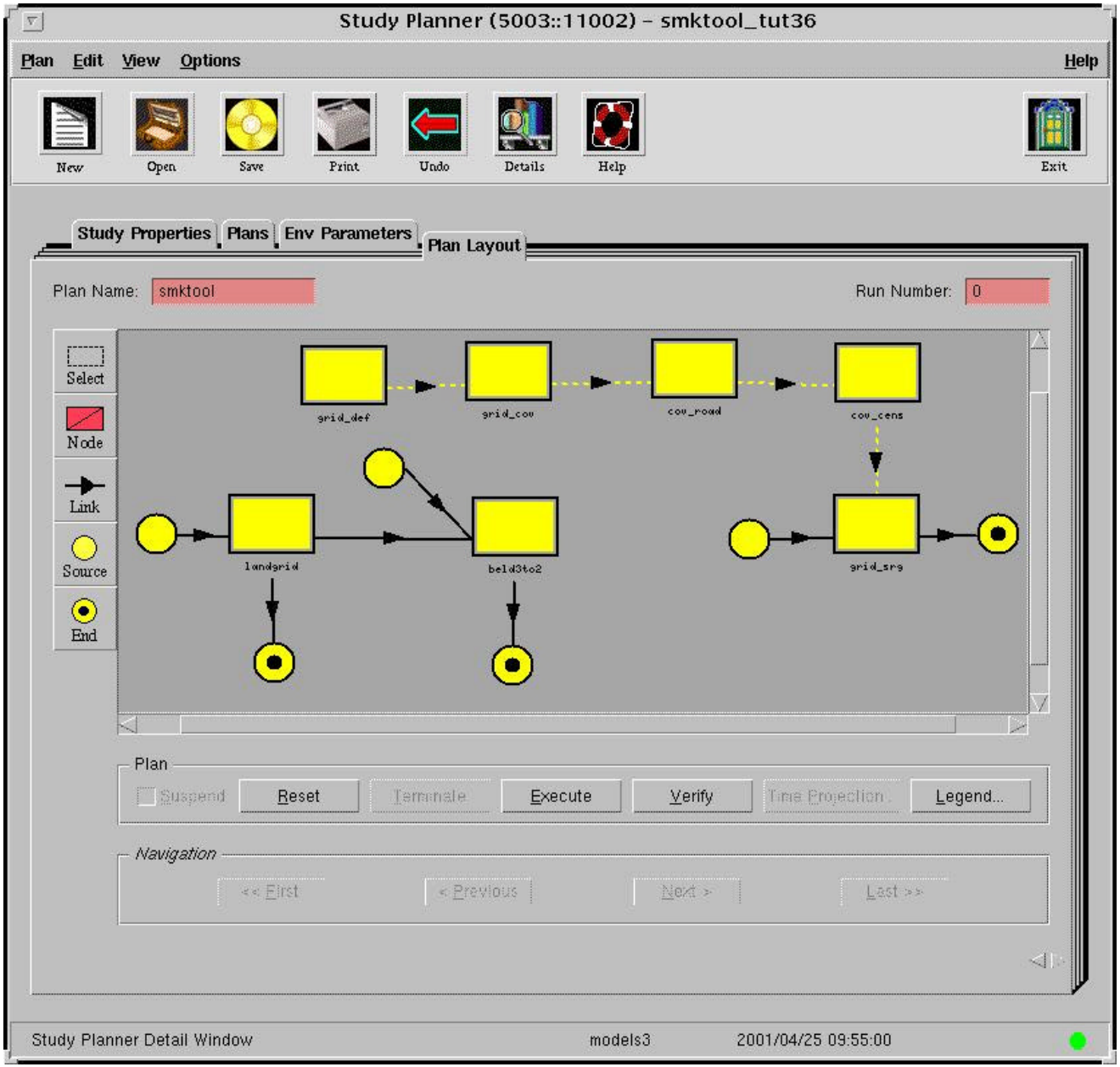
- Datasets included with SMOKE Tool
  - 1990, 1995, 1996 National Inventories
  - Spatial surrogate coverages for SMOKE
  - County and 1-km resolution BELD3 land cover data
  - Projection factor tables by SCC and region
  - Models-3 SMOKE Tool and SMOKE tutorial files for July 14, 1995

SMOKE Tool
Grids and gridding surrogates (1)

- Creation of model gridded and gridded spatial surrogates in SMOKE Tool via Models-3 Study Planner graphical interface
- Grid definition referenced from Models-3 grid definition to ensure grid consistency with air quality, emission, and meteorology spatial domains

SMOKE Tool
Grids and gridding surrogates (2)

- SMOKE Tool graphical interface includes nodes (program representations) for:
  - Creation of a grid file
  - Gridding of census and road network surrogate data
  - Gridding of all other spatial surrogate data
  - Converting BELD3 1-km land use data for use with BEIS-2



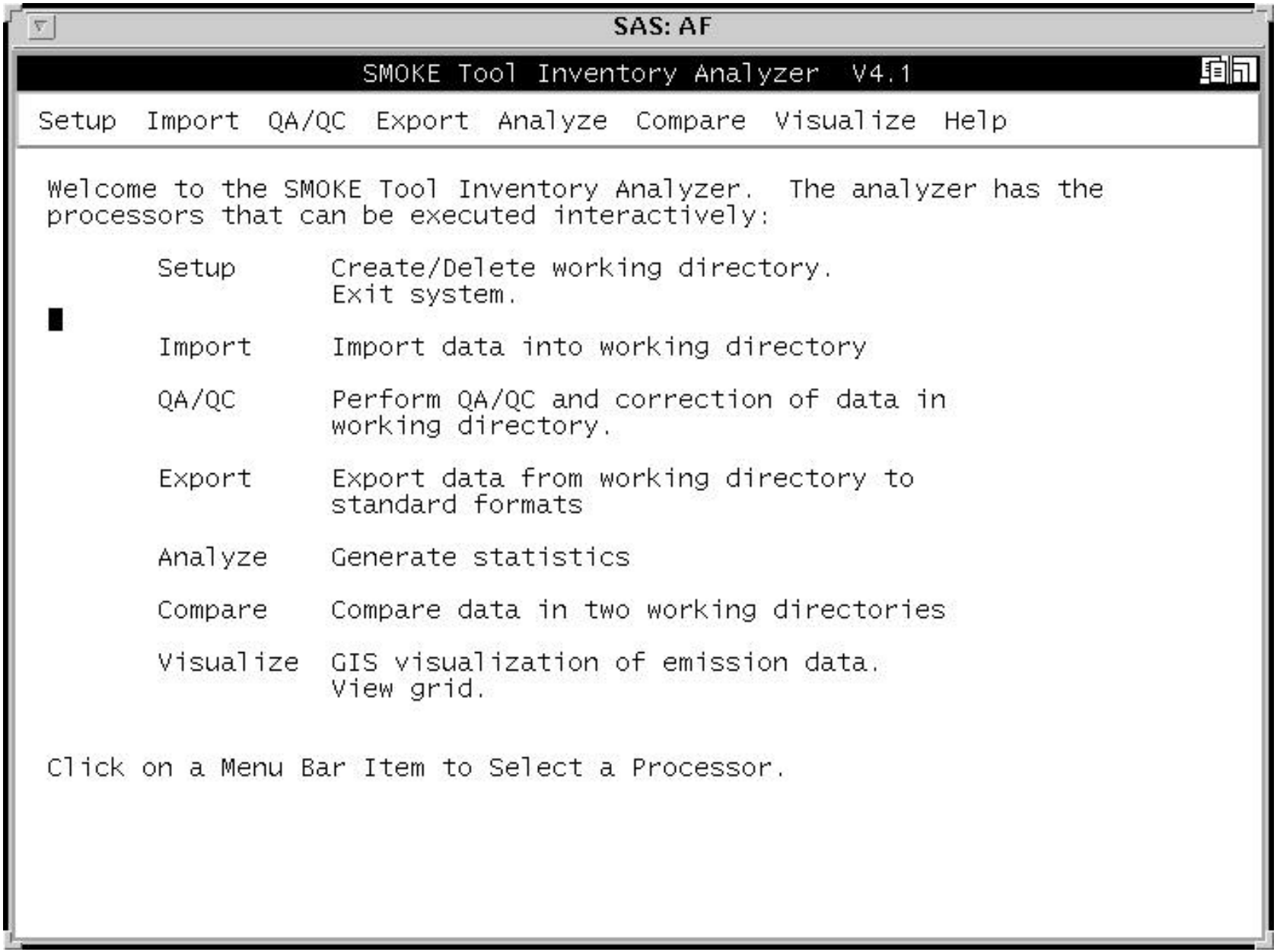
SMOKE Tool Grid and Gridded Surrogate Graphic Window

SMOKE Tool
Grids and gridding surrogates (3)

- Other SMOKE Tool inputs via env. variables:
  - Grid name
  - Surrogate GIS coverages to be used
  - How spatial surrogates are to computed
  - Examples:
    - CENSUS_DATA (location)
    - EMS_HOME (work space)
    - FEATURE_SRG (file containing table)
    - HGRIDNAME (grid name)
    - COVER_DEF (file w/ available coverages)
    - *Coverage Name(s)* (use coverage Yes or No)

SMOKE Tool
Data Analysis

- Analyses of input data in SMOKE Tool
  - Access SAS-based windows via Models-3 Strategy Manager Window
  - Import, quality control and format emission inventory and emission modeling-related files
    - Missing or erroneous data (i.e. stack parameters)
    - Location coordinates
    - Visualization of input emissions
    - Definition of major point sources for use in SMOKE
    - Comparison of emission inventories



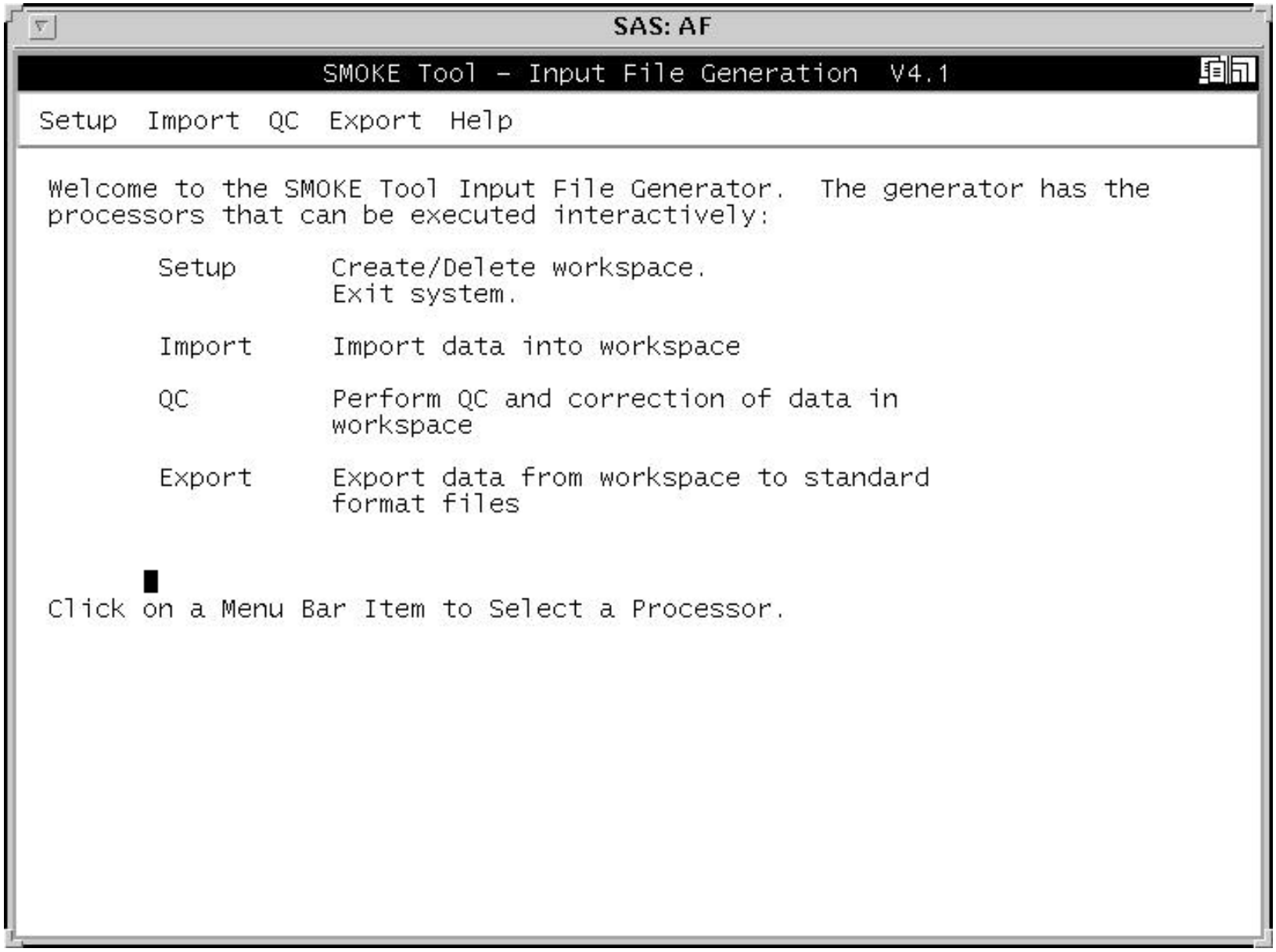
SMOKE Tool Main Window

SMOKE Tool
Creating SMOKE input files (1)

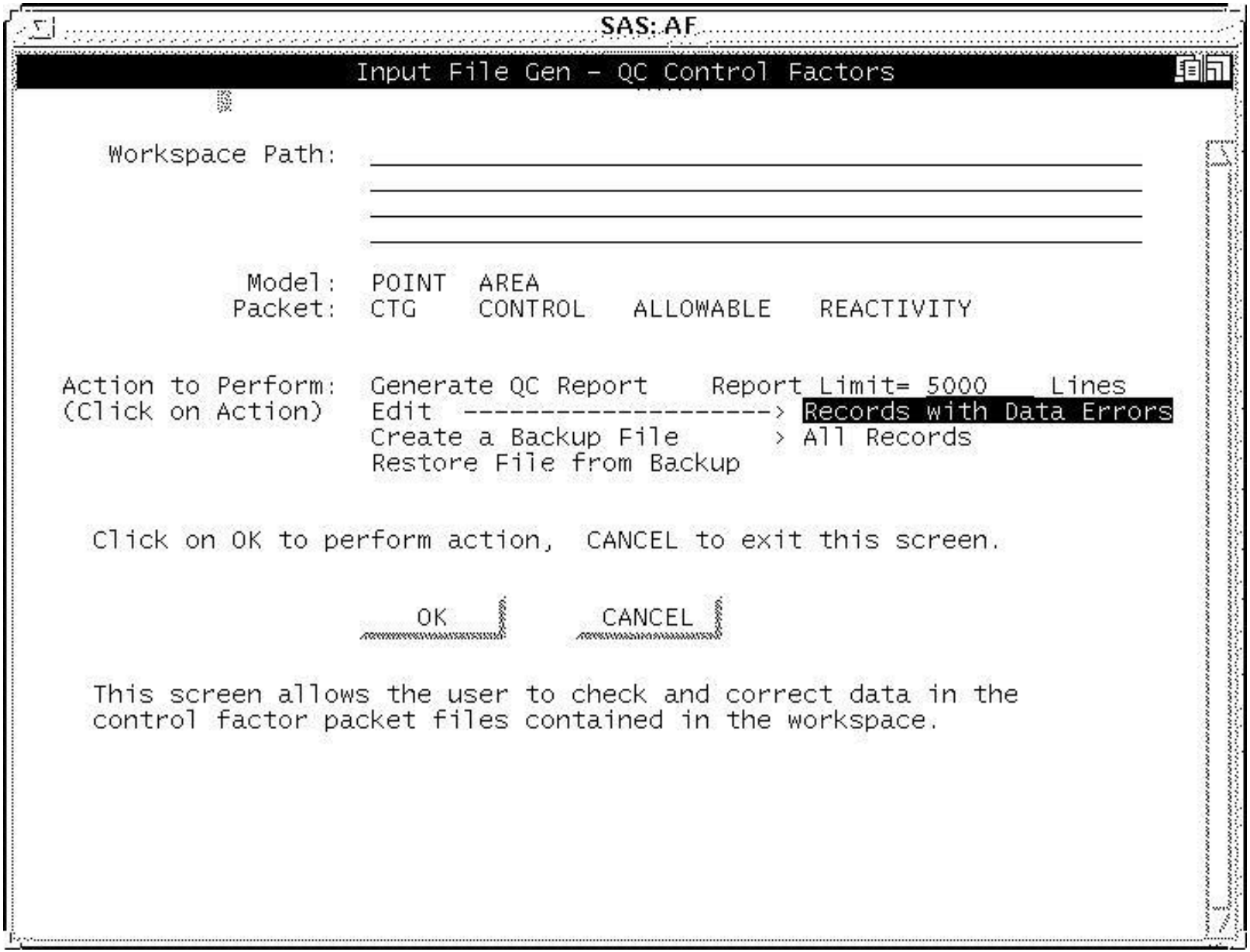
- IDA formatted emission files (point, area, mobile)
- Ability to check and supply SCC cross-reference files
- Creates Control Technology Guideline (CTG), Control, Allowable, and Reactivity packet files for application by SMOKE
- Reactivity packet allow addition, deletion and/or substitution of chemical species
- Adjustment packet (across the board multipliers) not yet supported by SMOKE

SMOKE Tool
Creating SMOKE input files (2)

- Control Packet File Types
  - Emission Controls (by SCC, SIC, and geographic area)
    - Control Efficiency
    - Rule Effectiveness
    - Rule Penetration
  - Projection packets by SCC code and geographic area (from Economic Growth and Analysis System files provided with Models-3)



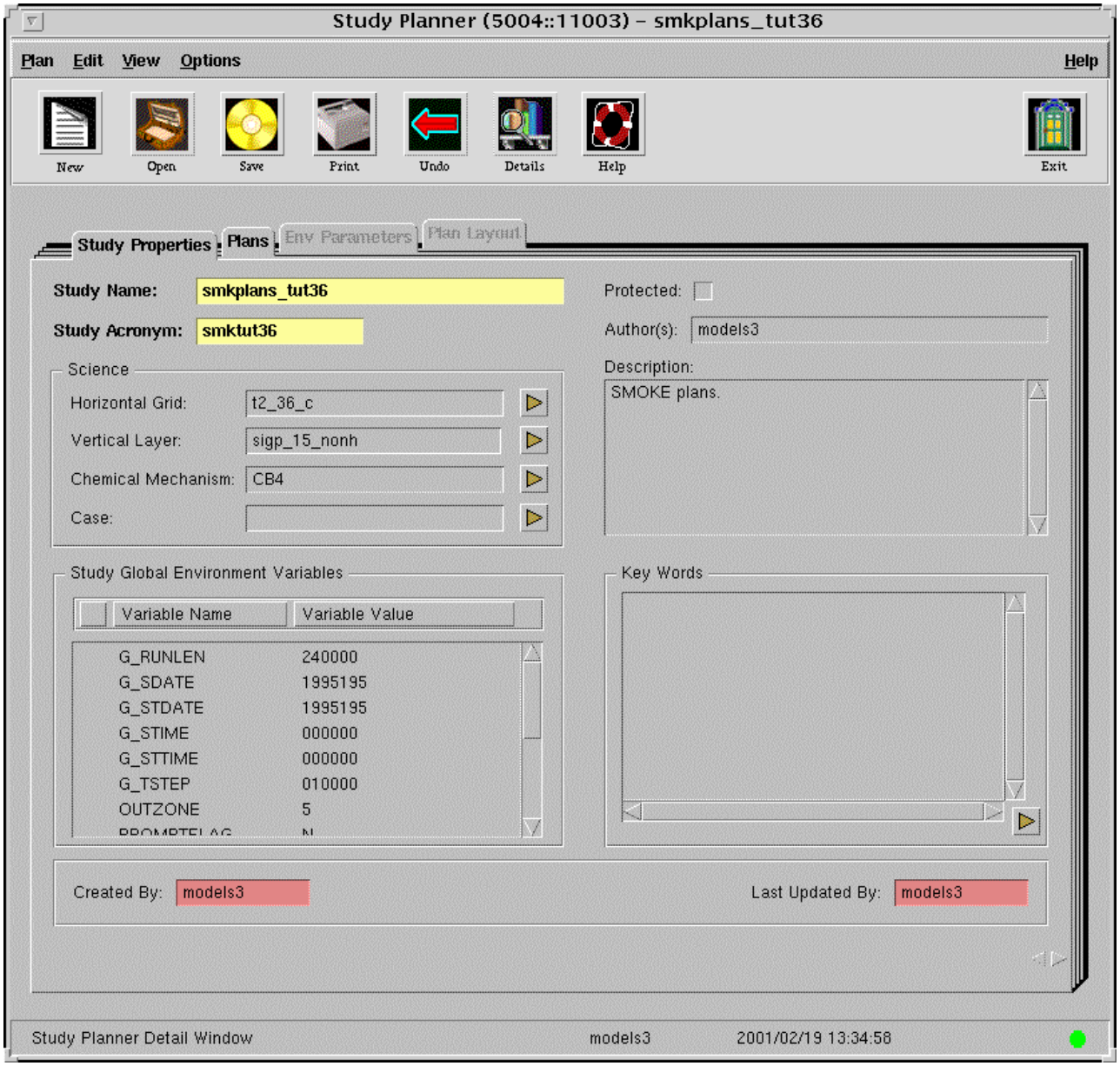
SMOKE Tool File Input and Quality Control Window



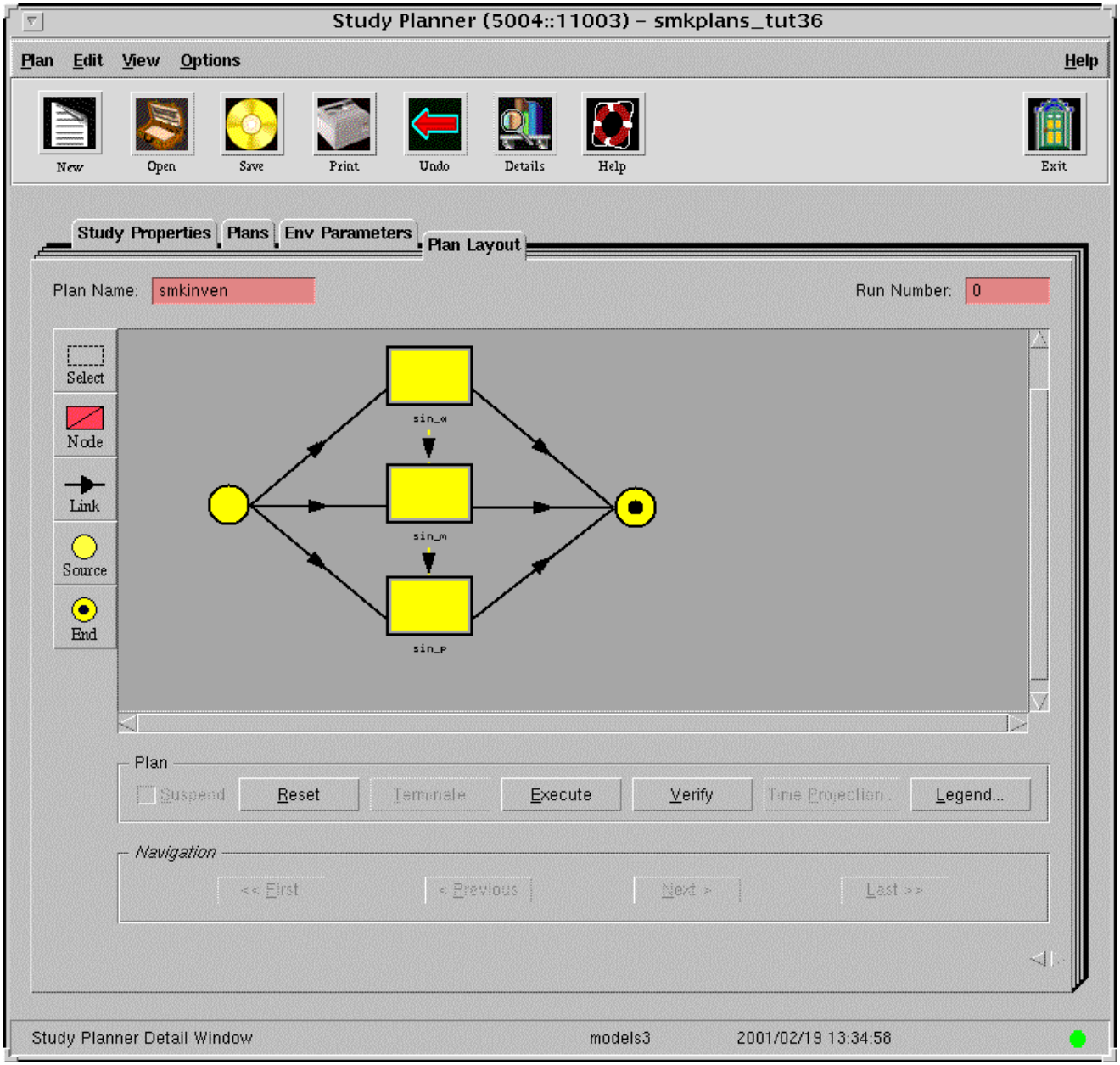
SMOKE Tool Emission and Packet File Creation Window

SMOKE in Models-3
Study Planner User Steps

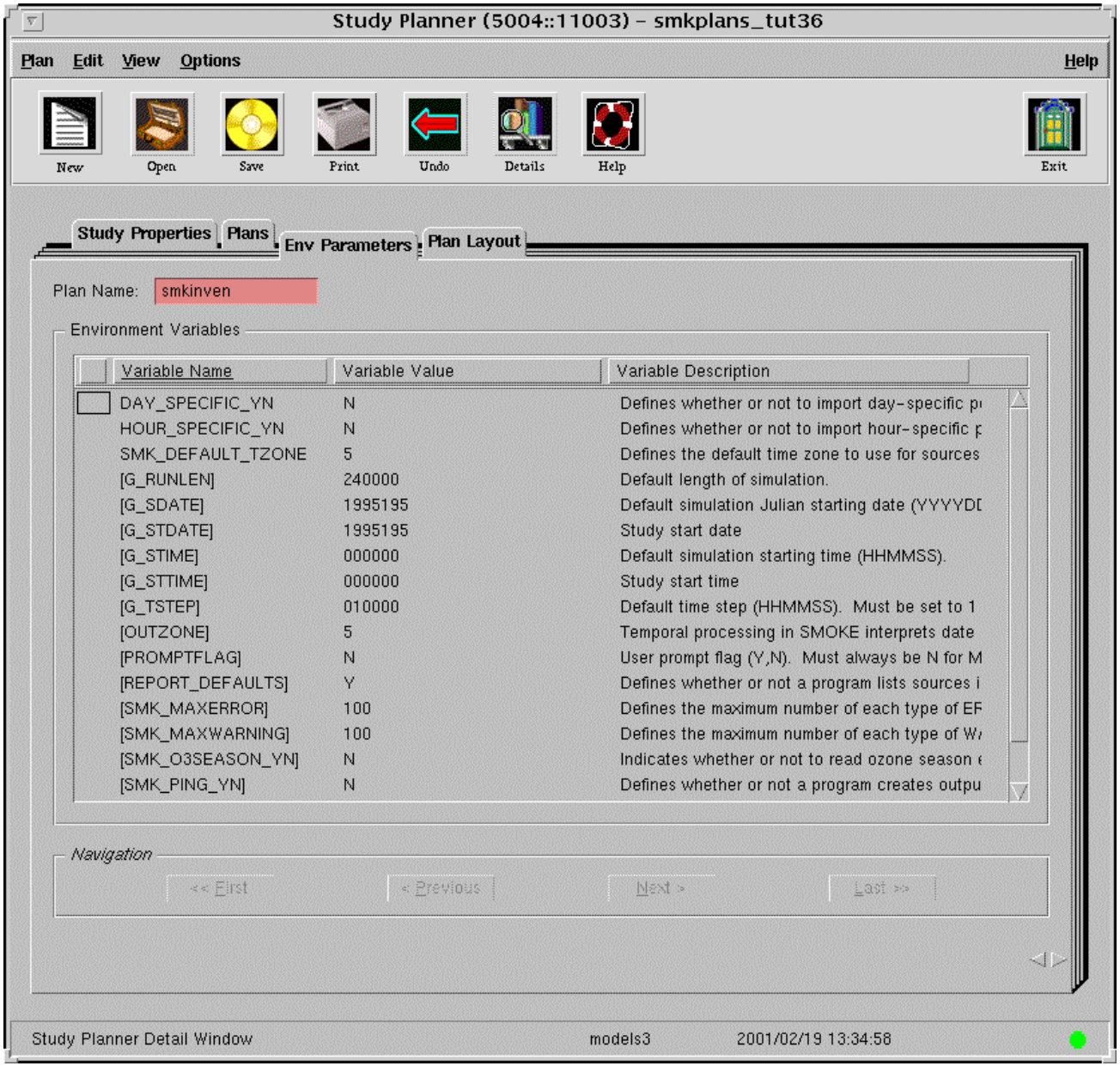
- Link SMOKE Tool output files to Smkinven Study Plan inputs
- Set Smkinven settings (environment variables) in Models-3 window in accordance with SMOKE documentation
- Execute Smkinven Plan and other SMOKE core program Plans
- Default SMOKE Study Plans may be changes for use with user-defined inputs



Study Properties Window



SMOKE Input (Smkinven) Graphic Interface



SMOKE Input (Smkinven) Environment Variable Window

Plans for the Future

- Updates to SMOKE to be included in updates to Models-3 (such as BEIS-3 and Mobile 6)
- Completely new Models-3 Java-based framework planned for November 2001 – will contain SMOKE and CMAQ at a minimum
- Plan to place SMOKE Tool functionality with the revised Models-3 framework
  - Probably not in the current form
  - May not all be present for November 2001

Information Sources

- SMOKE on-line:
  - **http://envpro.ncsc.org/products/smoke/**
- Models-3 on-line:
  - **http://www.epa.gov/asmdnerl/models3/**