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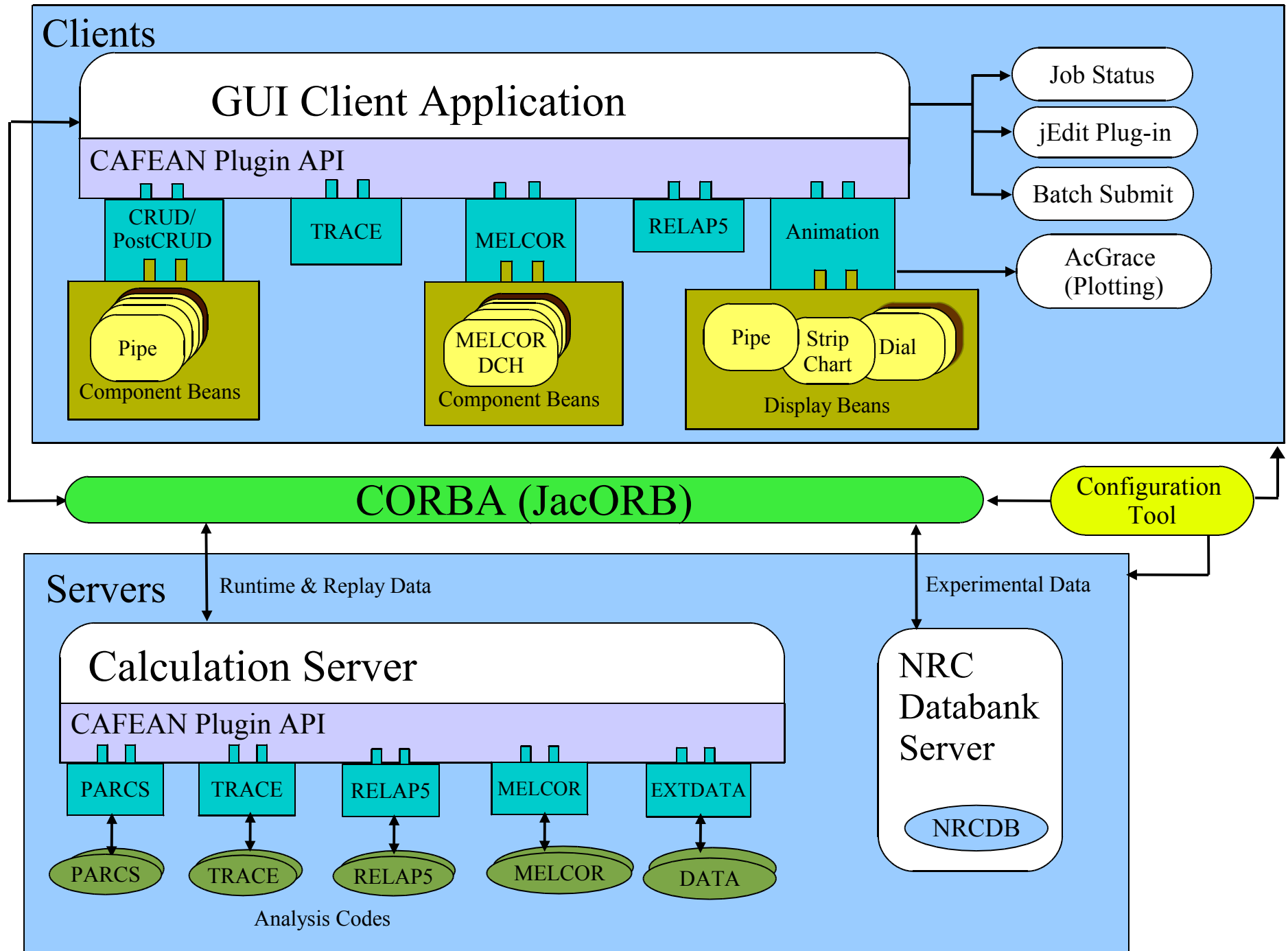
SNAP User Interface

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Outline

- Brief Overview of System Architecture
- Extensibility
- GUI Features
- Current Development Efforts
- SNAP Demo

SNAP System Architecture



Design Features

- Platform independent
 - Pure Java (JRE 1.4 - 1.5)
 - Supported on Windows, MAC, Linux, SUN, HP, etc...
- Common Environment for Performing Engineering Analysis
 - Can Be Adapted to Any Engineering Analysis Code
 - Supports Model Development, Maintenance, and Analysis
 - Highly Extensible and Flexible
- Consistent and Intuitive User Interface
 - Minimize Learning Curve for Analysis Codes
 - Logical Organization of Model Components and Interconnections
 - 2D and 3D Visualization
 - Model Validation Tests

Extensible Design

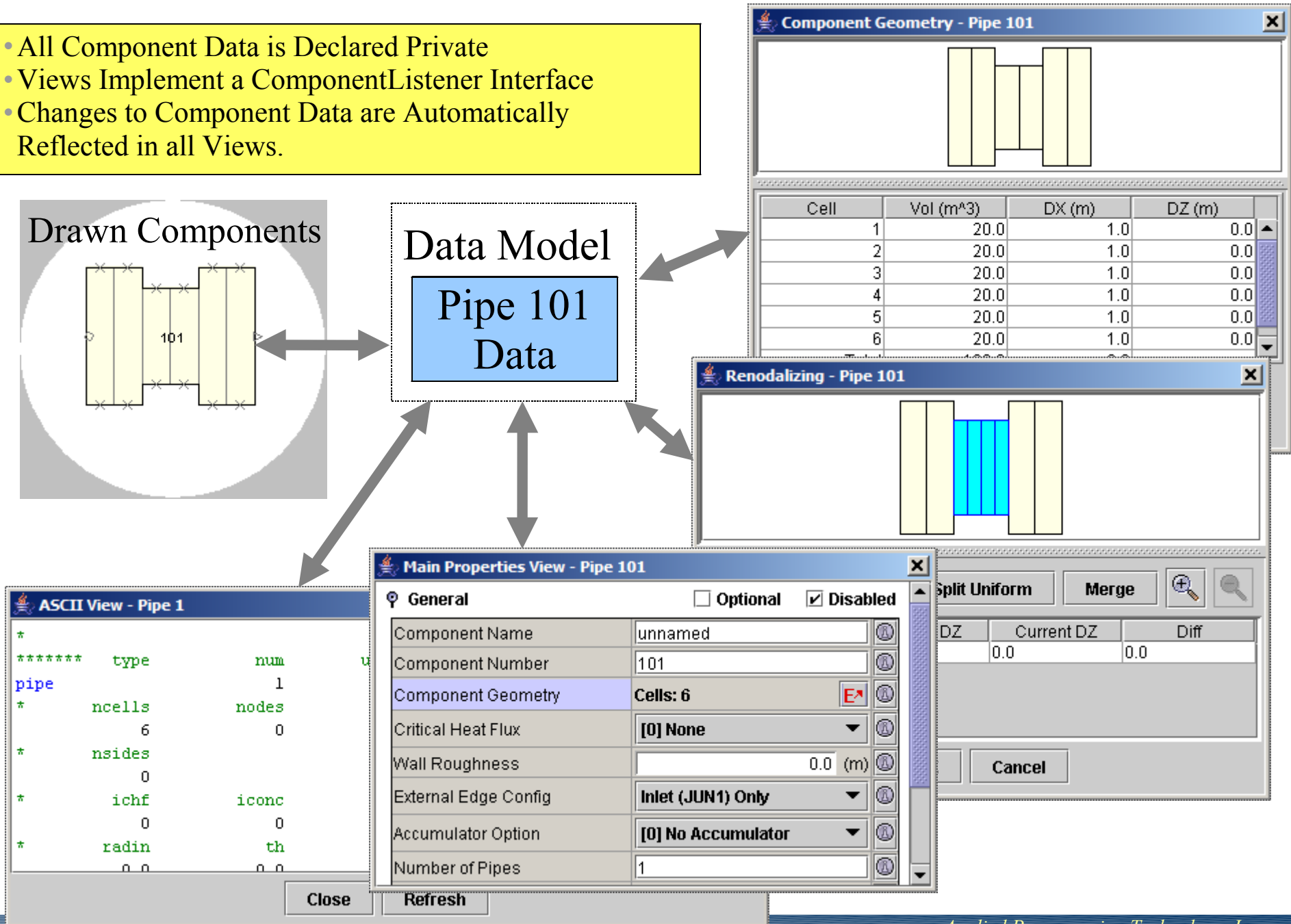
- CORBA Used for All System Component Communication
 - Strictly Defined, Well Documented Interfaces
 - Easy to Implement New Client Applications
- Plug-in Design Used in Client GUI and Calculation Server
 - Analysis Code Plug-ins
 - Feature Plug-ins
 - No Modification of the Base Code Required
- JavaBean Component Design
 - Custom Beans can be independently developed
 - Shared Repository for Contributed Beans
- Python Scripting
 - User Defined Functions – Calculate Model Input
 - Python Data Channels – Post-Processing Calculations, Animations

Plug-ins

- Plug-in API for Adding New Analysis Codes & New Features
 - available at: <http://www.nrcsnap.com/snap>
- Plug-in Contains All Analysis Code Specific Functionality
 - File I/O
 - Custom Editors
 - Component Drawing
 - Documentation Links
 - Component Renodalization
 - Initial Condition Extraction
 - etc.
- SNAP Code Plug-ins (Partial List)
 - TRACE
 - RELAP5 (MOD 3.3 & RELAP5-3D[®])
 - CONTAIN
 - FRAPCON3
 - MELCOR 1.8.6
 - PARCS
 - COBRA-IE
- SNAP Feature Plug-ins
 - RELAP5 to TRACE Vessel Conversion Wizard
 - TRACE Data Channel Naming Conversion Utility
 - RELAP5 Legacy Model Conversion Utility

Component Data Model

- All Component Data is Declared Private
- Views Implement a ComponentListener Interface
- Changes to Component Data are Automatically Reflected in all Views.



Multiple-Window Mode

The screenshot displays the Model Editor interface with several windows open:

- Model Editor (0.22.9):** The main application window with a menu bar (File, Edit, Tools, Window, Help) and a toolbar. The left sidebar contains a **Component Navigator** tree showing a hierarchy of models and components, including 'Heat Structures' and 'Heat Structure 31'.
- Default View:** The main workspace showing a schematic of a pipe with a 'Heat Structure' and a 'Fill State Controller'. A '2D Views' callout points to a vertical pipe diagram with numbered segments (10-21). A pink box titled 'Interactive Calculation' contains text: 'Vertical, 20m, 6" Schedule 80 Heated from 2m-18m.' and 'Interactive Variables are used to control: Outer Surface Heat Flux, Fill State Conditions, Inlet Steam and Vapor Velocities'. An 'Output Signal Variables' box shows 'Inner Surface Temp.'.
- ASCII View - Pipe 21:** A window displaying a table of pipe parameters.

	type	num	userid	component name		
Liquid Velo	pipe	21	1	unnamed		
Vapor Velo	ncells	nodes	jun1	jun2	eps	
Liquid Tem	radin	th	houtl	houtv	toutl	
Vapor Tem	toutv	pwin	pwoff	rpwmax	pwsc1	
	dx		1.0	1.0	1.0	1.0s
	dx		1.0	1.0	1.0	1.0s
- Main Properties View - Pipe 21:** A window showing the 'General' tab with fields for Component Name (unnamed), Description (<none>), Comments (<none>), Component Geometry (Cells: 20), Initial Conditions ([Valid Conditions]), Friction (Fric (0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0...)), Accumulator Option ([0] No Accumulator), and Number of Pipes (1). It also has sections for Trace Species, Pipe Wall (Use Pipewall: True), and Wall Power.
- Message Window:** A window at the bottom showing system messages such as 'Open Complete.', 'Opening file C:\SNAP_PROJECTS\SNAP\lib\Demo\Interactive\interactive_anim.med', and 'Loading C:\SNAP_PROJECTS\SNAP\lib\Demo\Interactive\interactive_anim.med please wait...'. It also shows 'connected to: Master: calcserv://localhost/Local/LR5_308110537' and 'initializing Python Interpreter...'. A 'Message Window' callout points to this window.

Single-Window Mode

Model Editor 0.22.9

File Edit Tools Window Help

RELAP5 models
typwr.med - (typwr)
Animation models
typwr_anim.med - (Typical PWR)
Model Options
Python Data Source
Data Sources [1]
Ranges [4]
Numerics [0]
Views [3]
Primary Full Plant
Fluid Condition Range
Temperature Range (Fuel)
Primary Vessel
Python Example

General Optional Disabled

Data Source	Master: calcserv://local...
Range	Fluid Condition Range
Volume ID	108040000
X-Axis Alignment	0.5
Y-Axis Alignment	0.5
Background Color	204, 204, 204
Border	None
Command Menu	-not set-
Curved Fraction	0.75
Font	Dialog 8
Foreground Color	0, 0, 0
Opaque	<input type="radio"/> True <input checked="" type="radio"/> False
Orientation	South-West
Outline Width	3
Pipe Width Fraction	0.5
ToolTip Text	volume-108040000

Primary Typical PWR Model

Time: 706.03 s
% CTP: 2.31 %
Pressure: 9.04e+02 psia

HL Break
CL Break

Fuel (Temperature)
1500
1380
1260
1140
1020
900
780
660
540
420
300

Fluid Condition
2000 (K)
Sat. Steam
Sat. Liquid
300 (K)

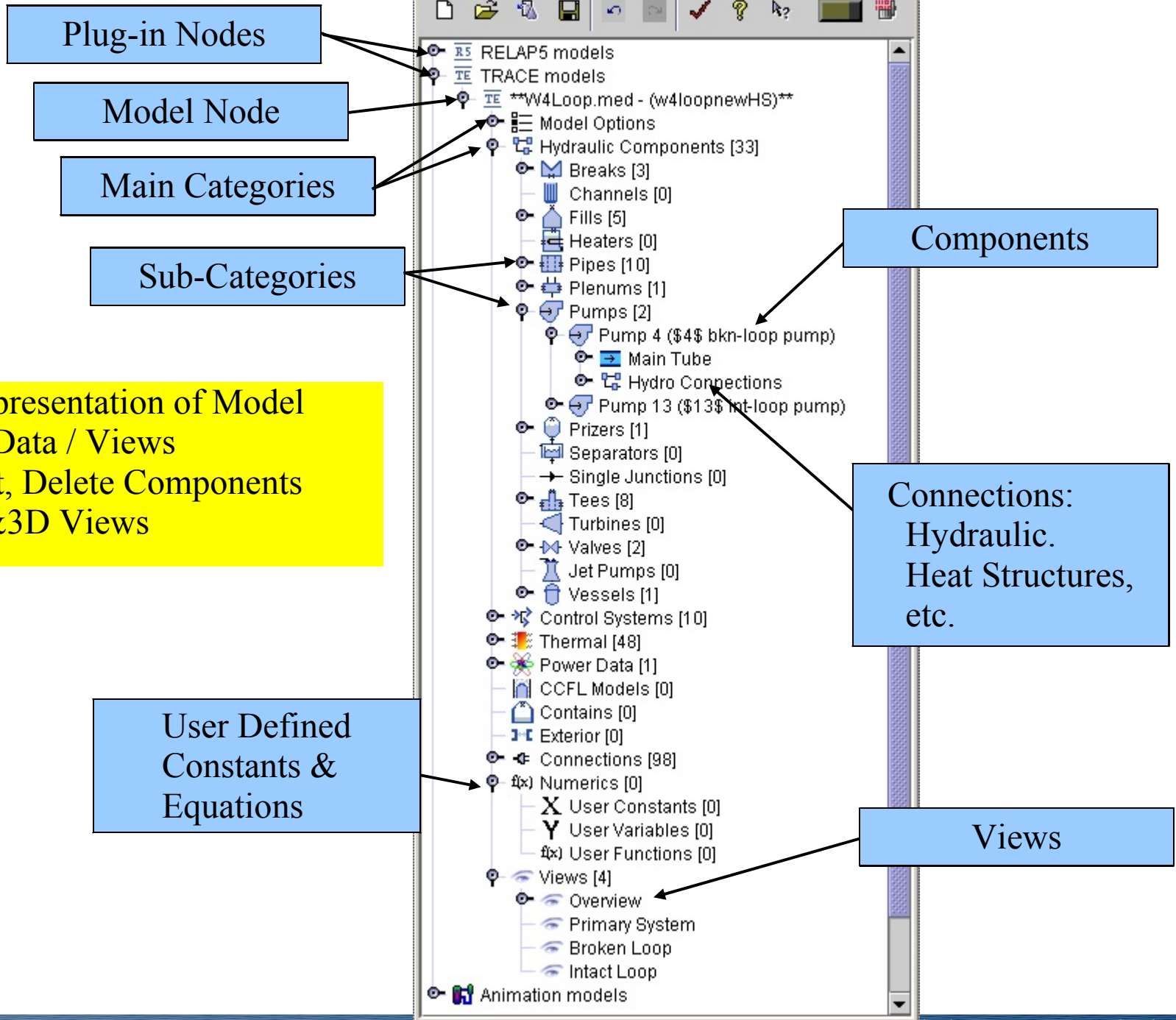
Primary Hydraulic View Broken Loop Steam Generator Intact Loop Steam Generator Primary Full Plant Primary Vessel

Messages

- Disconnected from: Python Data Source
- Disconnected from: Master: calcserv://localhost/Local/LR5_308110537
- Connected to: Master: calcserv://localhost/Local/LR5_308110537
- Connected to: Python Data Source

Component Navigator

- Logical Representation of Model
- All Model Data / Views
- Create, Edit, Delete Components
- Create 2D&3D Views



Properties View

Mini-Navigator points to the tree view on the left showing the hierarchy: Break 7 (\$7\$ bkn-loop containment) > Hydro Connections > Hydro Connection [8]: Valve 6 (\$6\$ bkn-loop break valve).

Display Options points to the Optional and Disabled checkboxes at the top of the General tab.

Help Buttons points to the question mark icons next to the Component Name and Component Number fields.

Attribute Descriptions points to the Description and Comments fields.

Attribute Values points to the numerical input fields for Length (0.1 m), Volume (10.0 m³), Initial Gas Volume Fraction (1.0), Initial Mixture Temperature (300.0 K), and Initial Pressure (1.0E5 pa).

Attribute Groups points to the collapsed sections: Scale Factors, Trace Species, State Controllers, and Contan Coupling.

Custom Editors points to the 'E' icons next to the Break Table and Rate Factor Table rows.

Attribute Popup Help points to the IBTY popup window, which contains the following text:

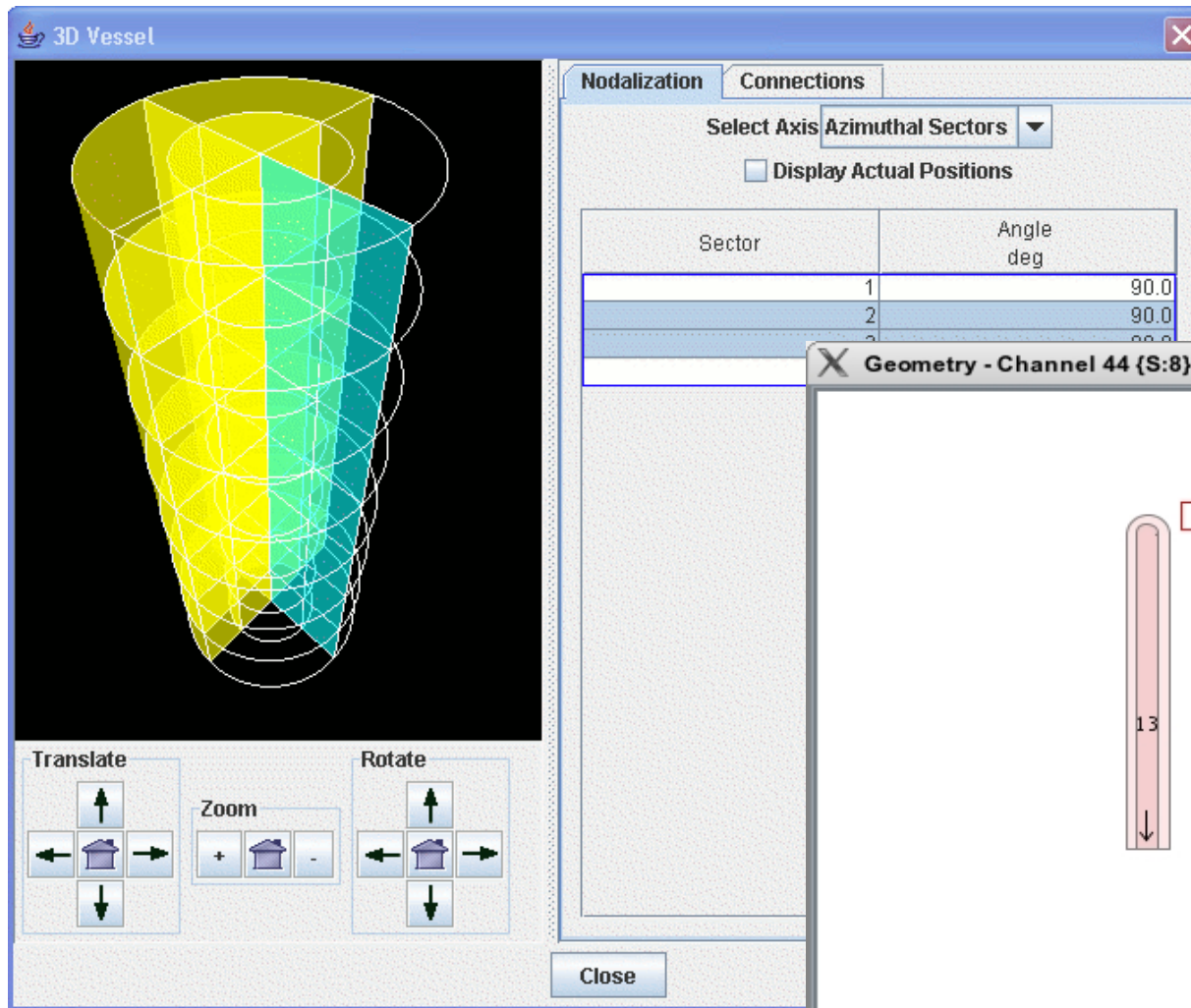
IBTY

BREAK-type option.
 0 = no tables input and not a Generalized BREAK (see IBTY = 6);
 1 = input pressure table (array PTB, Card Set 14);
 2 = input pressure and temperature tables (arrays PTB and TLTB, and TVTB if ISAT = 4, Card Set 14, Card Set 15, and Card Set 16);
 3 = input above tables plus gas volume-fraction table (array ALPTB, Card Set 17);
 4 = input above tables plus noncondensable-gas partial-pressure table (array PATB, Card Set 18);
 5 = input above tables plus solute-to-coolant mass-ratio table (array CONCTB, Card Set 19), [requires ISOLUT = 1 (Word 3 on Main-Data Card 9)];
 6 = Generalized-BREAK fluid parameters defined individually by a signal variable or control block (see Card Number 10). Note: this option is not under direct control by trip ID number IBTR (Word 1 on Card Number 4) and the rate of change of the fluid parameters is not constrained by RBMX (Word 3 on Card Number 6).
 7 = Connected with CONTAN component. All BREAK fluid parameters are defined by the connecting CONTAN compartment.

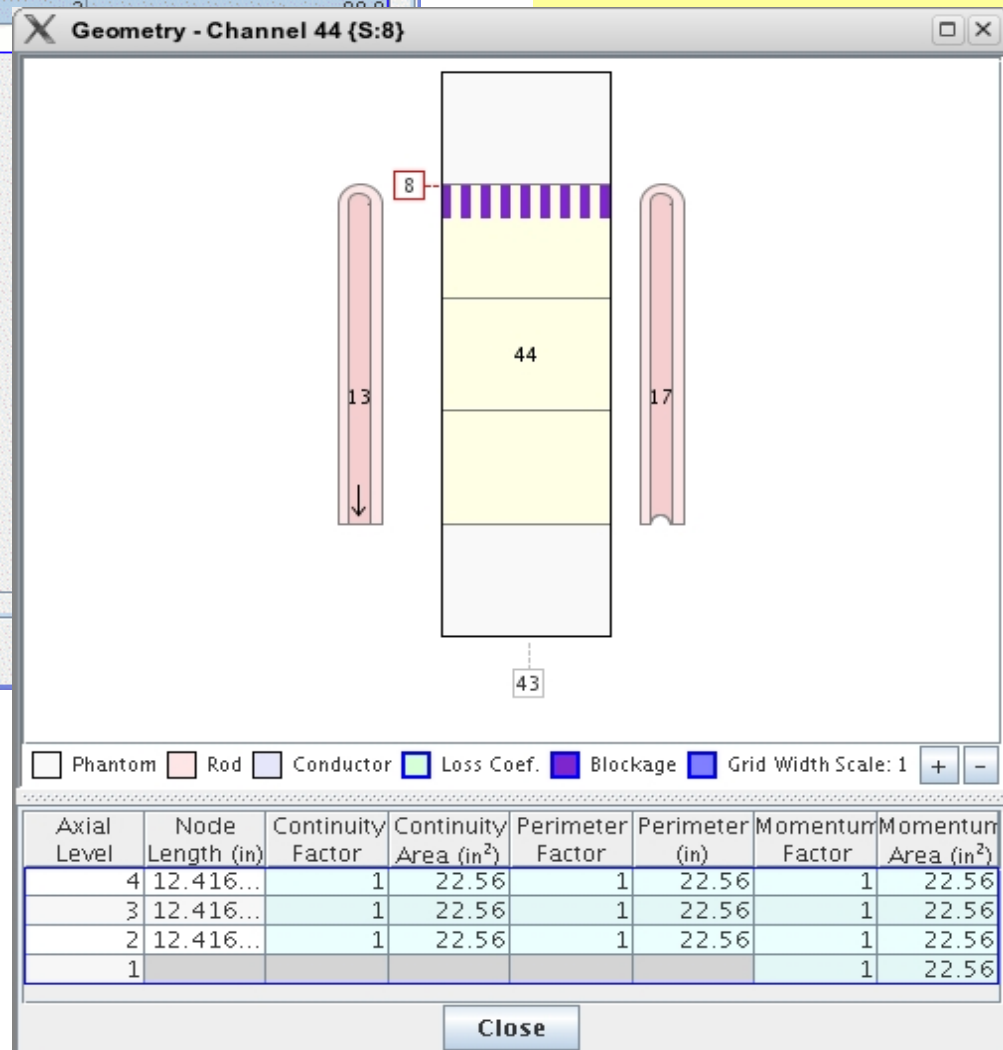
The Main Property View

- Reflects the Current Selection
- Supports Multi-Selection-Edit

Custom Editors

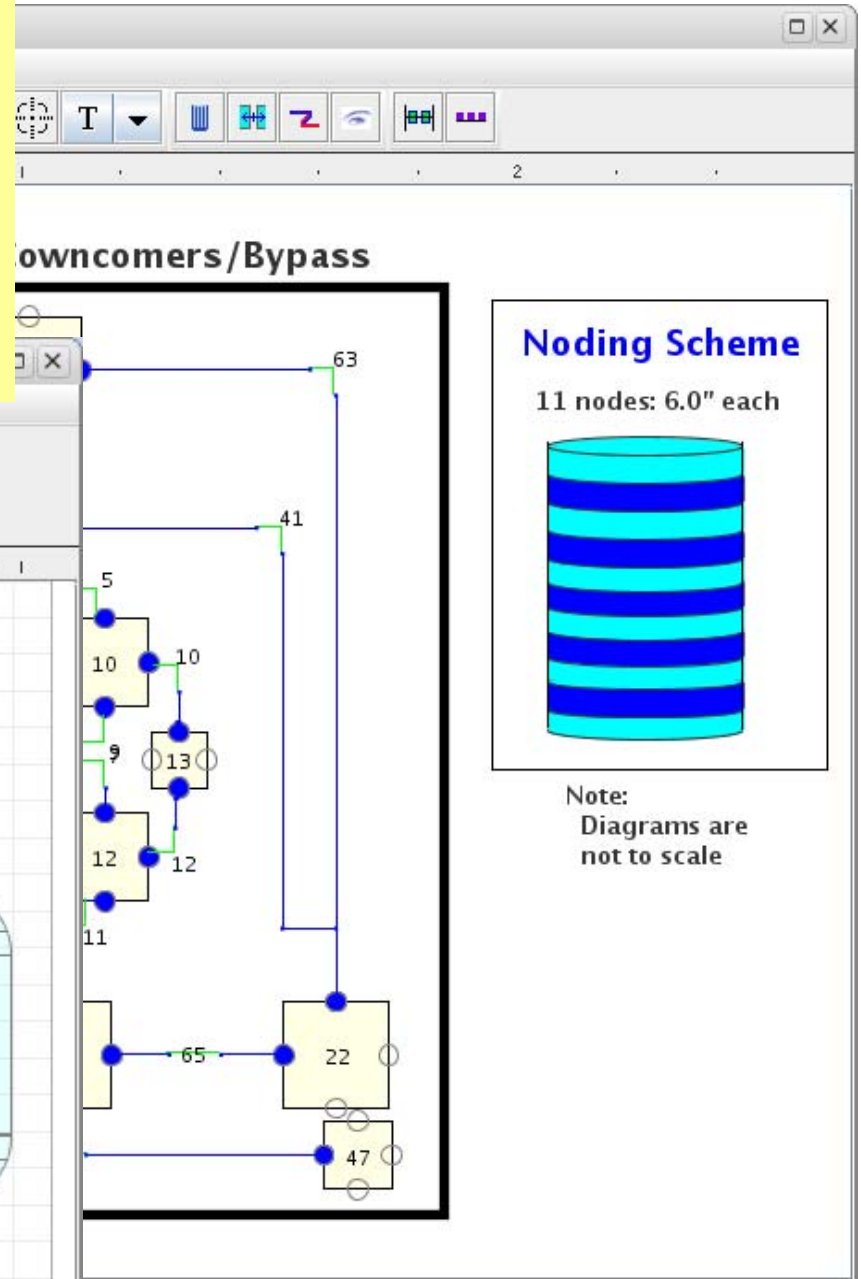
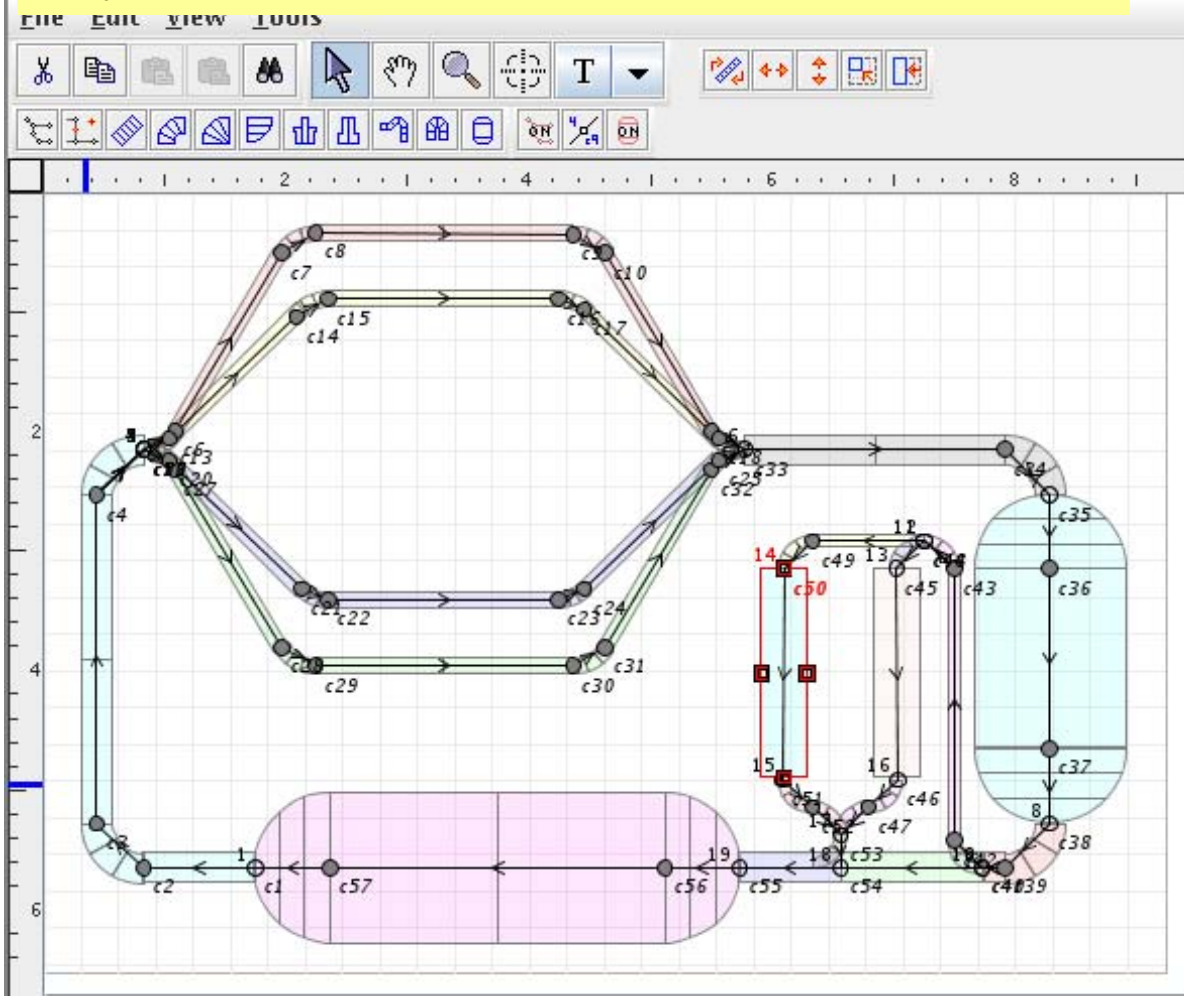


- Used to Provide Intuitive Interface for Editing Complex Data
- Table Data can be Copied to/from Spreadsheet Apps

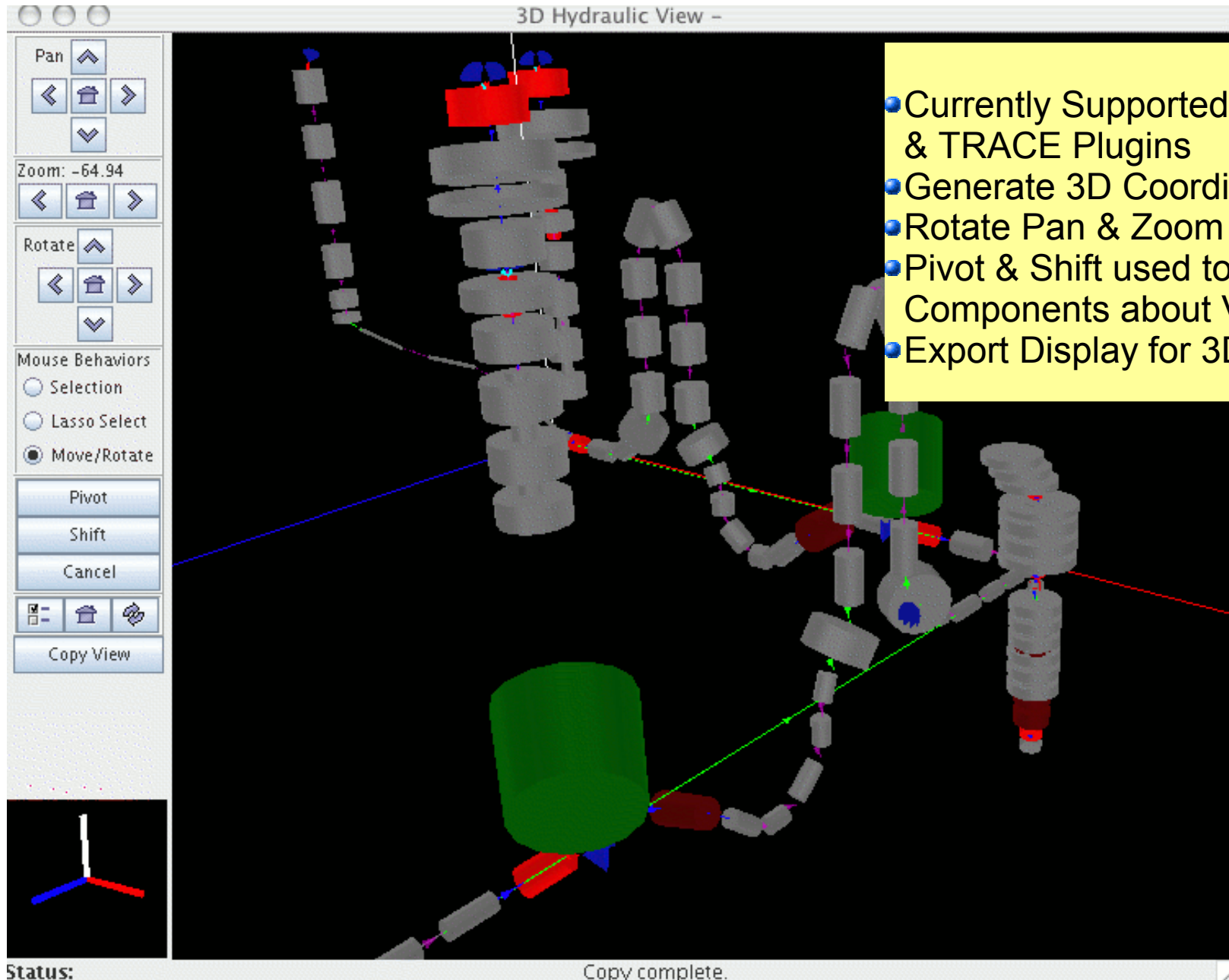


2D Model Views

- May Contain any Component Type.
- Create/Edit/Delete Components and Connections.
- Any component can be displayed in multiple views.
- Embed a View into another View to Link Views.
- Export to Raster or Vector Image Formats.
- Add Text, Line, Shape and Image Annotations.
- Model Views Can be Copied to create Animation Views
- Layouts can be saved as Templates



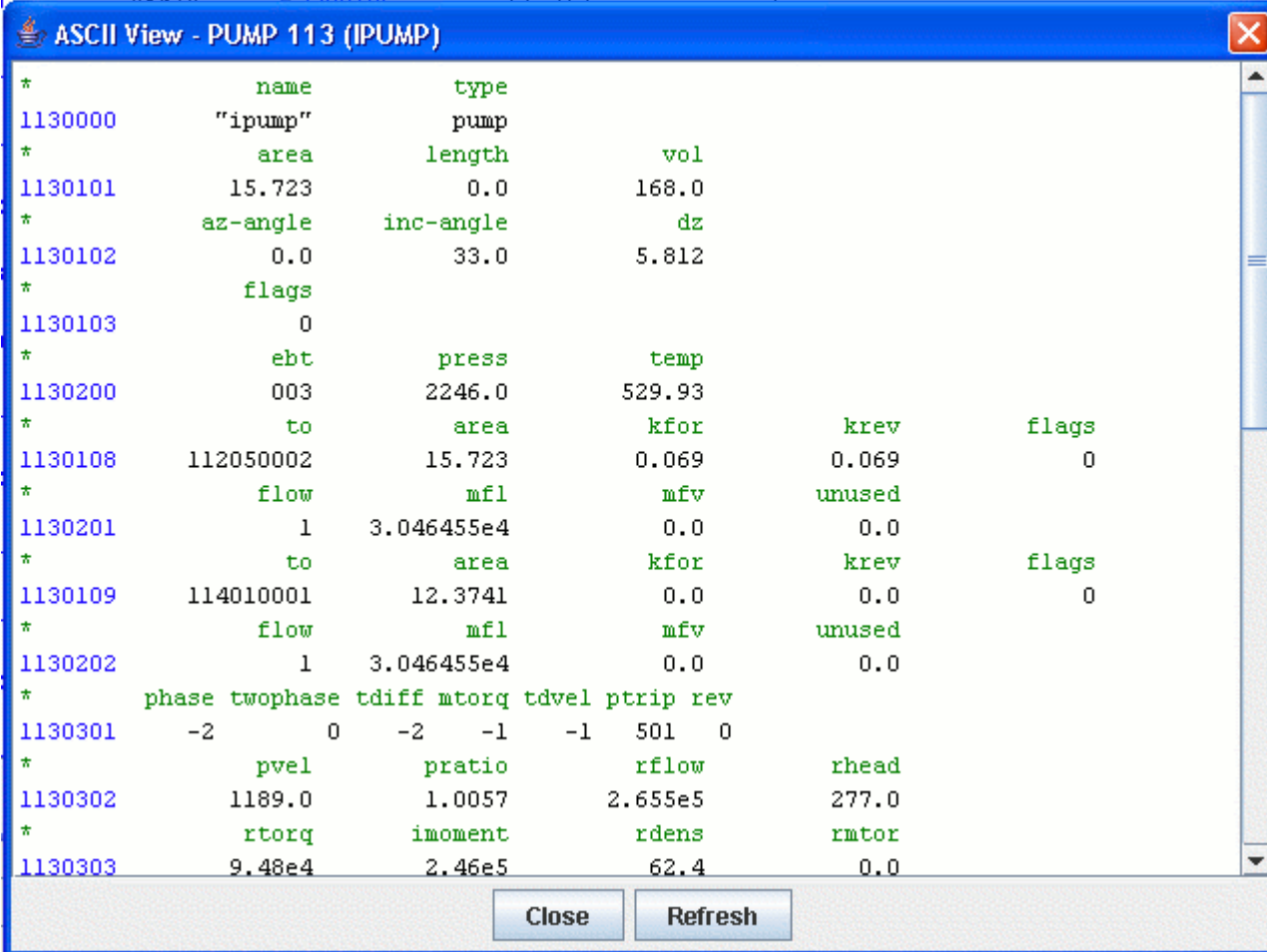
3D Visualization



- Currently Supported by RELAP5 & TRACE Plugins
- Generate 3D Coordinates
- Rotate Pan & Zoom View
- Pivot & Shift used to Move Components about Vertical Axis
- Export Display for 3D Animation

ASCII Views

- Component “Show ASCII” Menu Item
- Automatically Updates When Component Data Changes
- Syntax Highlighting



ASCII View - PUMP 113 (IPUMP)

*	name	type				
1130000	"ipump"	pump				
*	area	length	vol			
1130101	15.723	0.0	168.0			
*	az-angle	inc-angle	dz			
1130102	0.0	33.0	5.812			
*	flags					
1130103	0					
*	ebt	press	temp			
1130200	003	2246.0	529.93			
*	to	area	kfor	krev	flags	
1130108	112050002	15.723	0.069	0.069	0	
*	flow	mfl	mfv	unused		
1130201	1	3.046455e4	0.0	0.0		
*	to	area	kfor	krev	flags	
1130109	114010001	12.3741	0.0	0.0	0	
*	flow	mfl	mfv	unused		
1130202	1	3.046455e4	0.0	0.0		
*	phase	twophase	tdiff	mtorq	tdvel	ptrip rev
1130301	-2	0	-2	-1	-1	501 0
*	pvel	pratio	rflow	rhead		
1130302	1189.0	1.0057	2.655e5	277.0		
*	rtorq	imoment	rdens	rmtor		
1130303	9.48e4	2.46e5	62.4	0.0		

Close Refresh

User Defined Functions

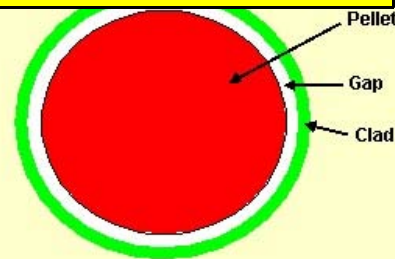
- **Constants/ Variables:**
 - Can be used to define values in editing dialogs
 - Include Engineering Units
 - Can be displayed and edited in 2D Views
 - Parametric Constants generate a set of Calculations
- **Functions:**
 - Python Interpreter
 - Calculate Variables based on Constants and Variables

```

Source Editor - Function: Fuel Element Calcul
# Define some constants
PI = 3.1415926
r = GetConstant("CHAN_CORNER_RADIUS")
w = GetConstant("CHAN_INSIDE_WIDTH")

# Calculate the Channel Inside Perimet
p = 4 * ( w - 2*r ) + ( 2*PI*r )
# Set the Result
SetVariable("CHAN_INSIDE_PERIM", p)

# Now Calculate the flow area
chanarea = w*w - (r*r - ( 2 * PI * (r*
rodsPerRow = GetConstant("RODS_PER_ROW
numFuelRods = rodsPerRow*rodsPerRow-Ge
fuelRodArea = PI*GetConstant("CLAD_OUT
waterRodArea = PI*GetConstant("WR_OUTS
#
chanFlowArea = chanarea - ( numFuelRods
# Set the Result
SetVariable("CHAN_FLOW_AREA", chanFlow
    
```

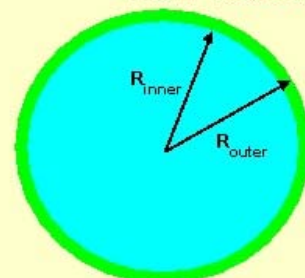


RODS PER ROW:

PELLET_RADIUS:

CLAD_INSIDE_RADIUS:

CLAD_OUTSIDE_RADIUS:

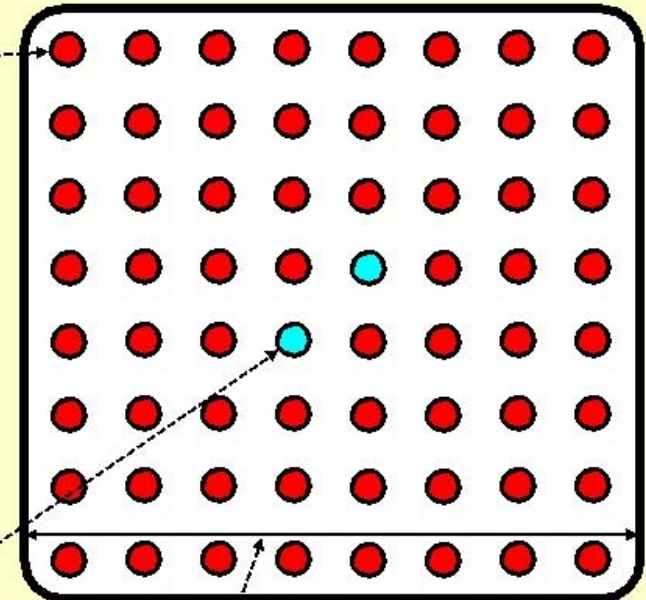


R_{inner} =

R_{outer} =

NUM_WATER_RODS:

R 8x8 Fuel Element Calculations



CHAN_INSIDE_WIDTH:

CHAN_CORNER_RADIUS:

Calculated Variables

CHAN_INSIDE_PERIM : 0.490505m

CHAN_FLOW_AREA : 4.985552E-3m²

Runtime & Post-processing

- Support for Interactive and Batch Modes as well as Importing Completed Runs
- Provides Access to Plot Data for Client Applications (Animation & Plotting)
- AcGrace (Legacy Plotting Package)

SNAP Job Status 0.24.2

File View Tools Help

localhost:5006
 Local
 tigger:5006
 cartman.appliedprog.com:5006
 cartman:5006
 bugs.appliedprog.com:5006
 bugs:5006

Calc Type	Job	Status	Calc Time	Started
RELAP	Typpwr-2	Complete	1998.028687	15:51:54

Output for Typpwr-2 file #0

File Edit Help

Points Of Interest Goto Find Close

```

MAJOR EDIT !!!time= 400.261 sec
O advancement total between edits|
O attempted: 1728 48 | min.dt= 0.265808 sec last dt= 0.453078 sec emas
O repeated: 5 0 | max.dt= 0.500000 sec crnt.dt= 0.453078 sec tmas
O successful: 1723 48 | avg.dt= 0.418873 sec merr.est= 1.022289E-05 em/1
O requested: 1724 48 | req.dt= 0.500000 sec cpu= 8.28000 sec tir

OTrip number, trip time (sec)
501 11.28245 502 14.72960 503 12.11710 504 17.15959 505 25.
506 1.0352478E-02 507 0.000000 508 -1.000000 509 -1.000000 510 -1.0
511 -1.000000 512 0.000000
1601 -1.000000 1602 -1.000000 1603 -1.000000 1604 -1.000000 1605 25.
1606 -1.000000 1607 25.34366 1608 25.34366

O Total power fission power gamma power reactivity rec. period
(Watts) (Watts) (Watts) (dollars) (sec-1)
9.17100E+07 63862. 9.16462E+07 -14.851 -1.63465E-02

OSystem 1 PRIMARY mass= 2.25795E+05 kg mass error = 56.003 kg merr.est.= 1.02229E-05
O Vol.no. pressure voidf voidg voidgo tempf tempg satt-part uf
(Pa) (K) (K) (K) (J/kg)
ih1 pipe
  
```

Current Line: 42630

Job Status Tool:

- View Status of All Runs
- Interactive Commands
- View ASCII Output
- Delete Runs

Animation Models

Animation Models

Data Sources

Animation Controls

Output Signal Variables

Interactive Calculation Demo.
Vertical, 20m, 6" Schedule 80 Pipe.
Heated from 2m-18m.

Interactive Variables are used to control:

- Outer Surface Heat Flux
- Fill State Conditions
- Inlet Steam and Vapor Velocities

Inner Surface Temp.
SURFT sv6 314.5 k

Outer Surface Temp.
SURFT sv7 315.1 k

Last Cell Temp
TEMPF sv3 309.2 k

First Cell Temp
TEMPF sv2 308.0 k

Fluid Velocity
FLUVELX sv5 0.0 m/s

Fluid Conditions (Fluid Condition)

2000 (K)
Sat. Steam
Sat. Liquid
300 (K)

Temperature

360.0
350.0
340.0
330.0
320.0
310.0

Reset 0.0 100.0

sv2
sv3
sv6
sv7

General Optional Disabled

Include in Animation True False

Master Source True False

Name Master

Source Run URL calcserv:localho...

Heat Structure

Outer Surface Boundary Flux

Fill State Controller

Pressure
Variable cb15 6.0E6 pa

Void Fraction
Variable cb14 0.0

Liquid Velocity
Variable cb10 0.0 m/s

Vapor Velocity
Variable cb11 0.0 m/s

Can be Created Directly from Model Views

Multiple Simultaneous Data Sources

- Analysis Code Calculations
- Experimental Data
- Python Calculations

2D & 3D Animation

Dynamic T/H Property Range Selection

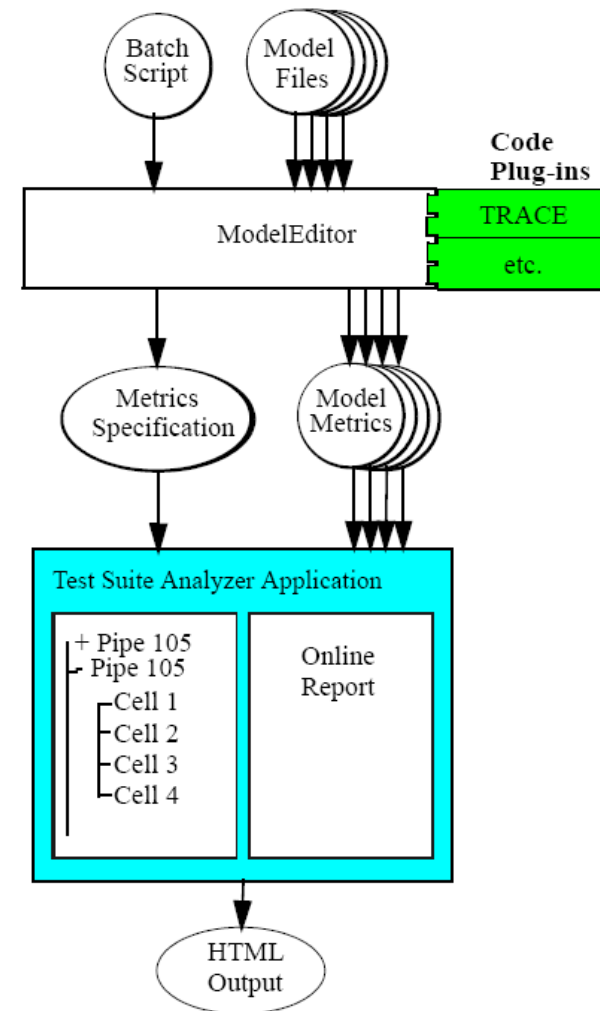
Interactive Capability

JavaBean Display Elements

- Easy to Add New User Defined Beans

Test Suite Analyzer (TSA)

- Collect and Analyze Model Metrics
- Identify Holes in the Test Suite
- Generate summary and detailed reports.
- Embedded SQL Database (DERBY)
- Custom and free-form queries may be used to explore the data.



Currently Under Development

- Runtime Improvements
 - On-Demand Startup & Auto-Shutdown (idle timeout)
 - Remote Connections
 - Multiple Jobs in One Folder & Multiple Root Folders
 - On-Demand Folder Scanning (Improved Performance)
 - Automatic Job Loading/Unloading
 - Runtime Server Configuration (Without Server Restart)
- Animation Plug-in
 - Data Source Job Sequences
 - Auto-Import Using Local Plot File Selector
- New Java-Based Plotting Package & Demultiplexers
- Animation Recording & AVI Movie Generation
- Updated User's Manual

Contacts

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