Argonne NATIONAL LABORATORY

EDM
Extensible Display Manager for EPICS

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U.S. DEPARTMENT OF ENERGY

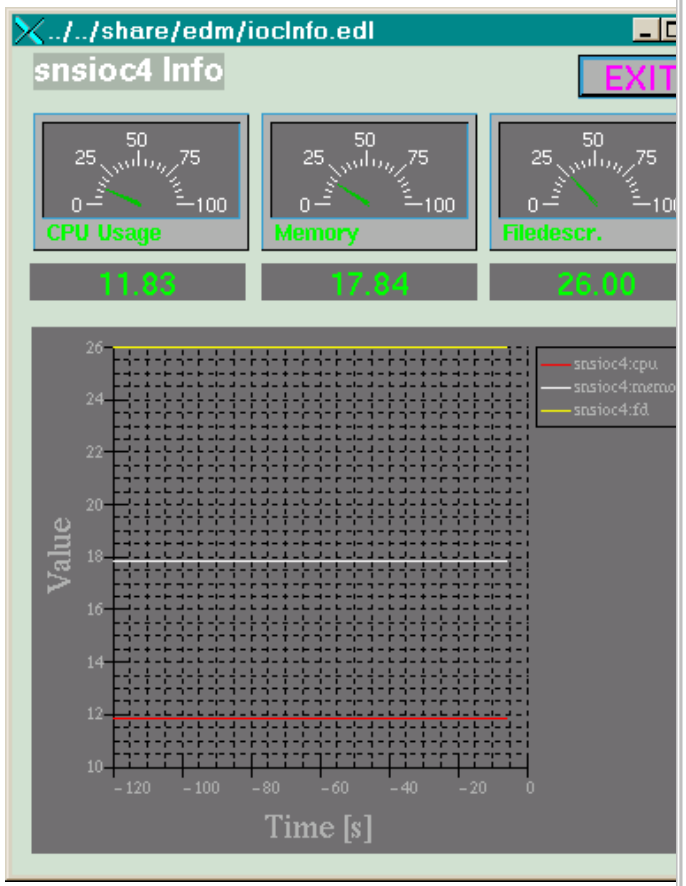
Introduction

- EDM is an interactive GUI builder and execution engine, EPICS documentation uses the term *Display Manager*
- Maintained by ORNL EPICS community
- Component based, thus extensible by other members of the EPICS collaboration

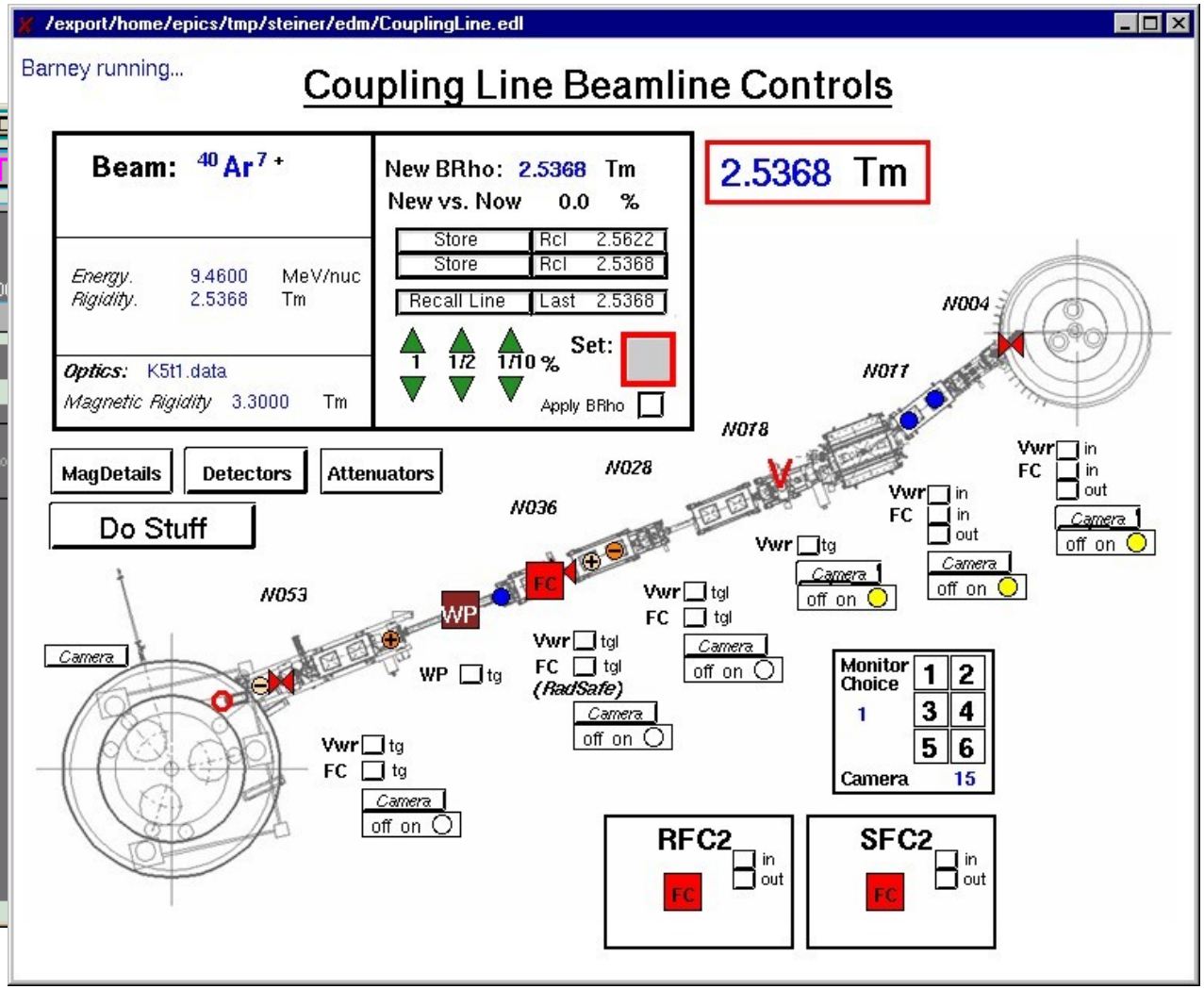
Extensible defined as:

- All “objects” are loaded from shared libraries
- EDM administrator can add & remove objects from the list of available objects without recompiling EDM itself
- Objects are versioned; carefully coded objects can be upgraded without impacting existing displays

Example EDM Operator Screens

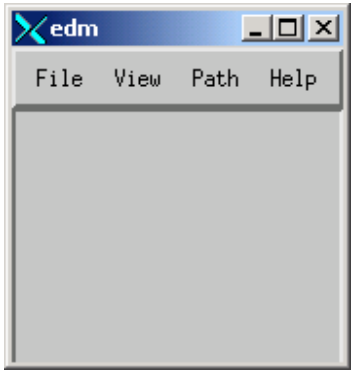


(SNS Linac test)



(Matthias Steiner, Nat'l Superconducting Cyclotron Lab., Michigan State University)

EDM Main Window

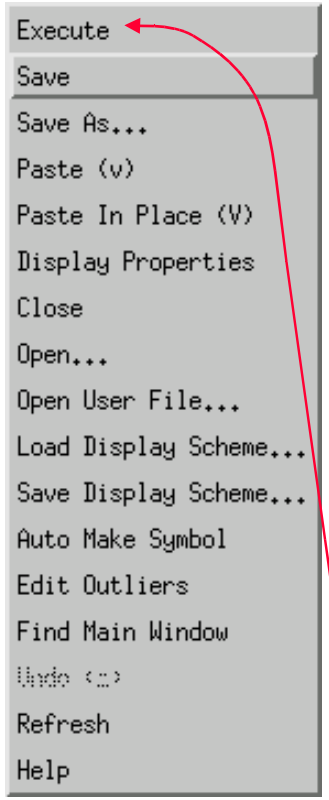


- Only a menu bar, rest of the window is not used:
  - File/New – Create new display
  - File/Open – Open existing display
  - Path – Select one of the directories listed in EDMDATAFILES variable
  - Help – explains many editing features and explains properties of most objects

For MEDM Users...

With *no objects selected(!)*
in a display screen,
click the middle mouse button
on the display background

This menu pops-up



Save
Save As…
Close
Open…
Open User File...
and:
Switch between edit and execute mode

File Operation Notes

- You never need to include the file extension (*.edl*) in a file open or save operation
- “Save As…” to overwrite an existing file requires user confirmation

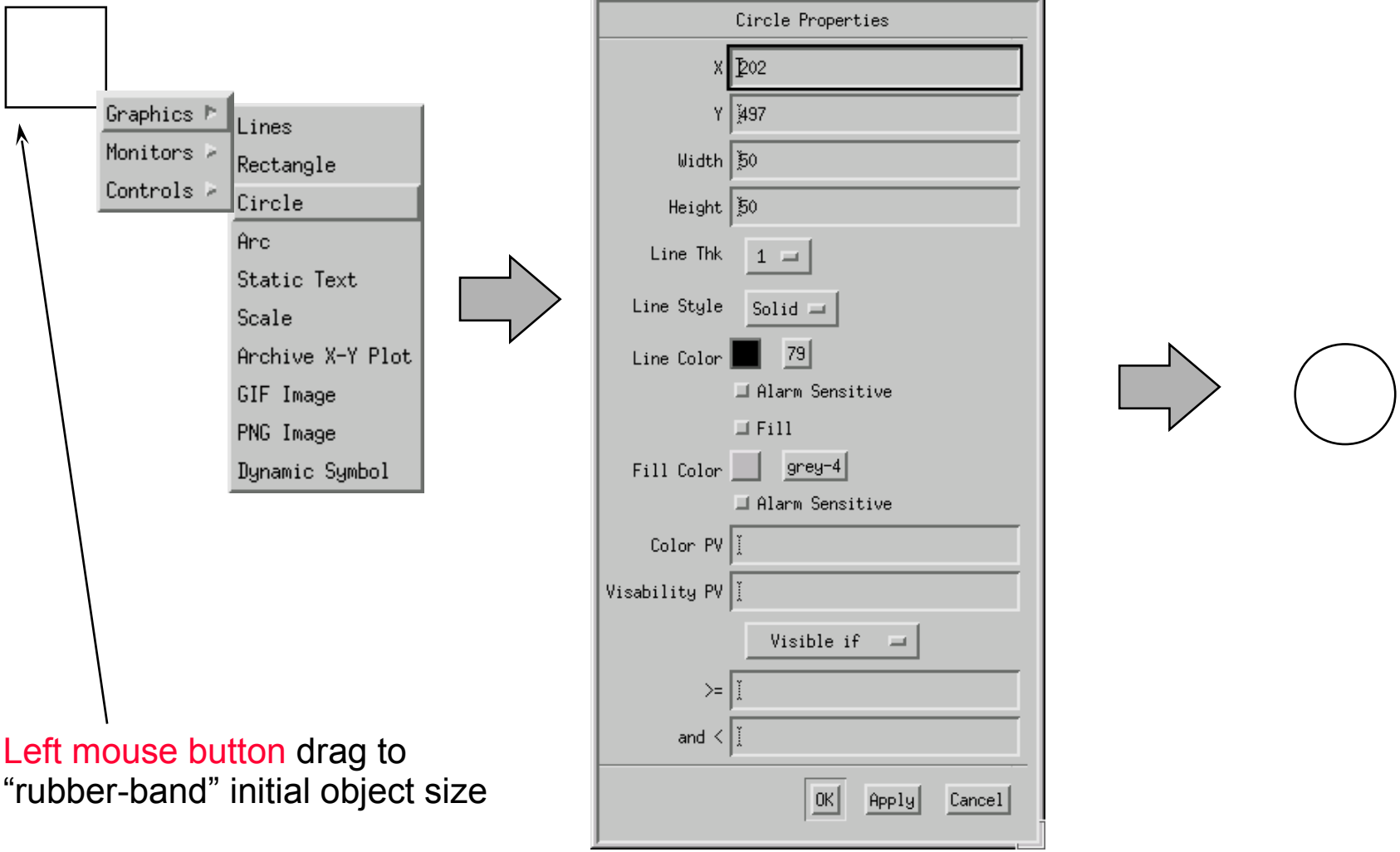
Creating/Editing Display Content

- Expert friendly
- All mouse buttons, many keys and most of the conceivable combinations of shift/ctrl/double-click are used!
- Takes some getting-used-to, but in the end allows for very efficient editing
- If lost: Press ESC and left-double-click somewhere on the display where there is no object (exits line-edit mode)

Some Advice

- Use the online help
- Create your own cheat-sheet
- Read the help information before working with lines – editing these can be somewhat complicated!

Creating Objects



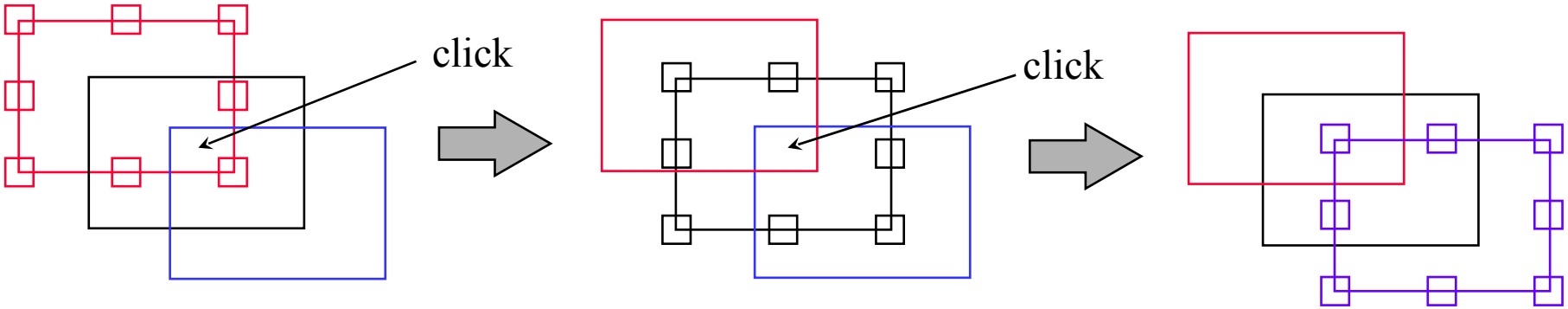
Left mouse button drag to
“rubber-band” initial object size

Selecting Objects

- Left button click
  - Single exclusive select: object is selected, currently selected objects are deselected
- Shift-left button click
  - Single inclusive select: object is added or removed from the current group of selected objects
- Control-left button click
  - De-select the current object pointed to and select the one below it in the stack

Selecting Objects (cont)

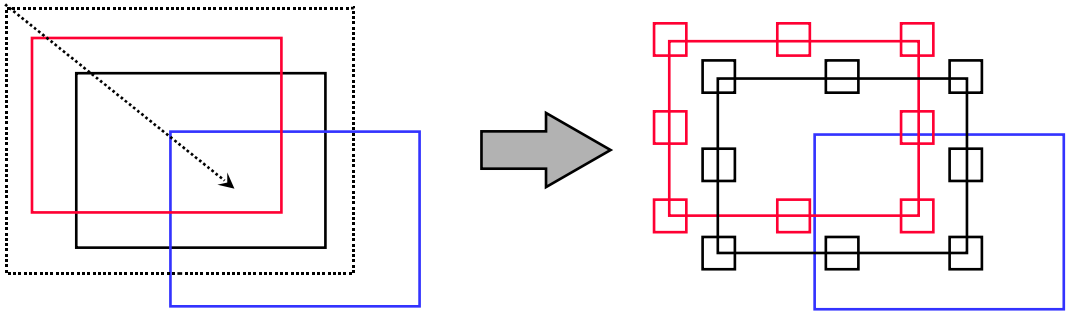
- Control-left button click
  - If only one object is currently selected then selection *cycles* among overlapping objects



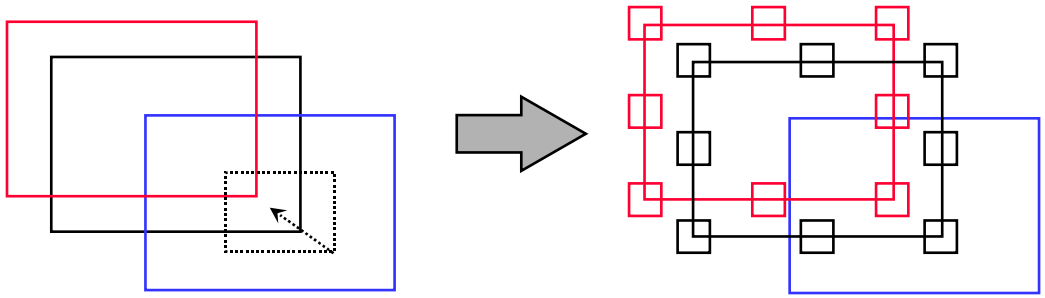
Selecting Objects (cont)

This convenient idea was adopted from AutoCad…

- Middle button drag
  - Objects are added or removed from the current selection group



Top-left to bottom-right:
Select enclosed **objects**

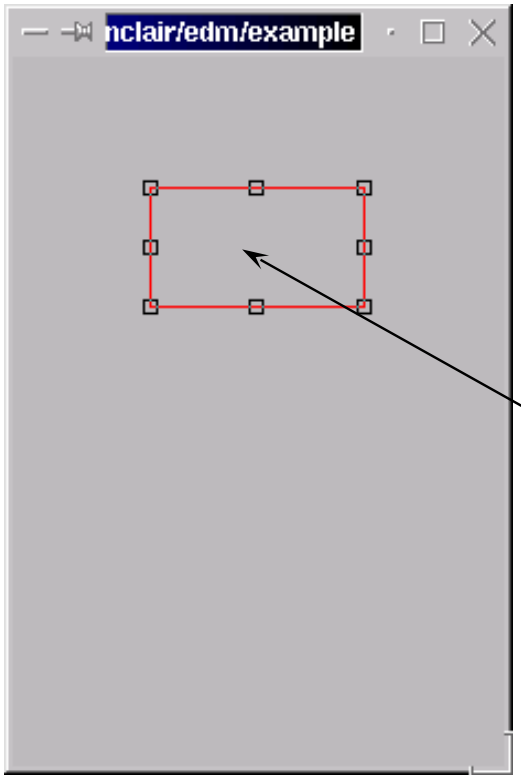


Bottom-right to top-left:
Select enclosed **corners**

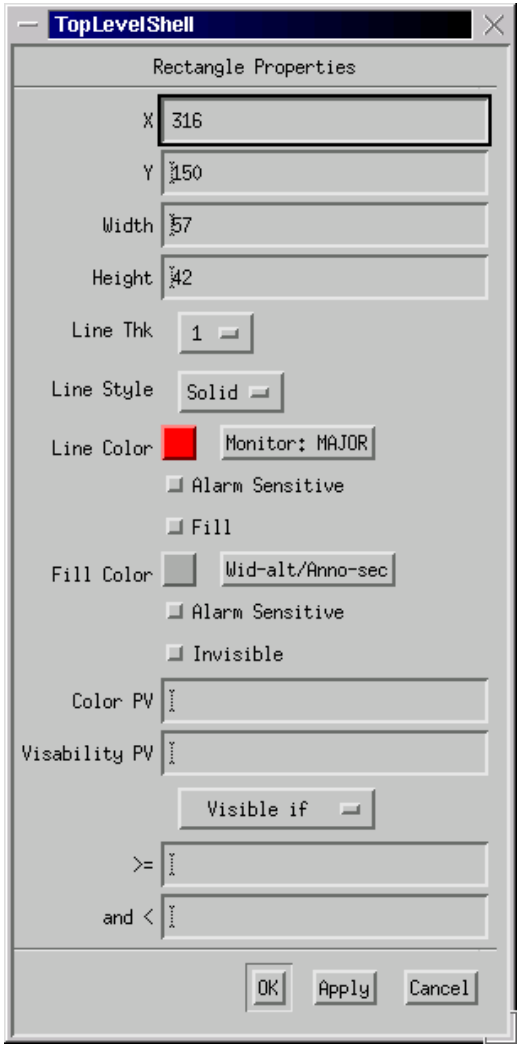
Again:

- Left button rubber-band
  - Create new object
- Middle button rubber-band
  - Select objects

Editing Objects: Property Dialog



left click on
selected object

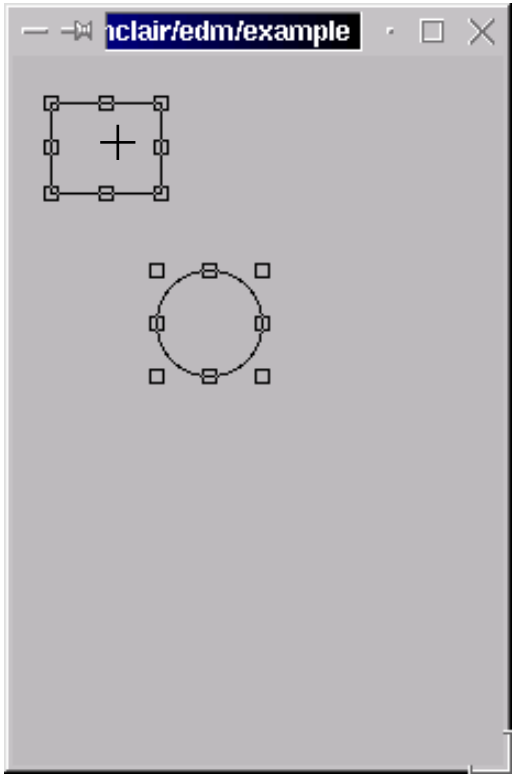


Note: The property dialog varies with Object type…

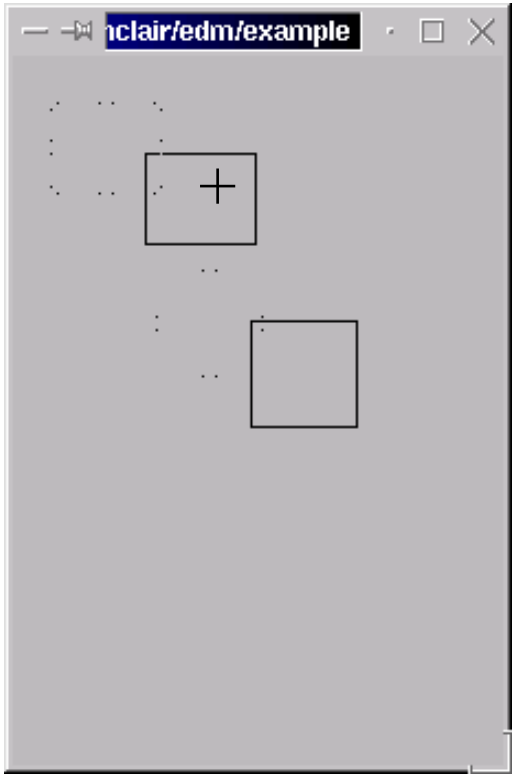
Editing Notes

- Clicking on a *group* of selected objects brings up property dialog boxes for all the selected objects, one by one
  - the OK button takes you to the next dialog box
- Inside the property dialog box:
  - Left double-click is the same as pressing OK
  - Middle double-click is Apply
  - Right double-click is Cancel

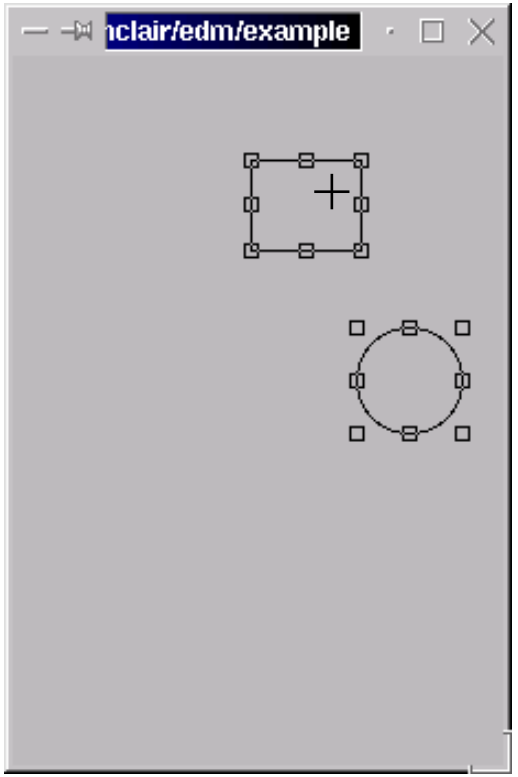
Moving Objects



Place mouse cursor on interior of one object

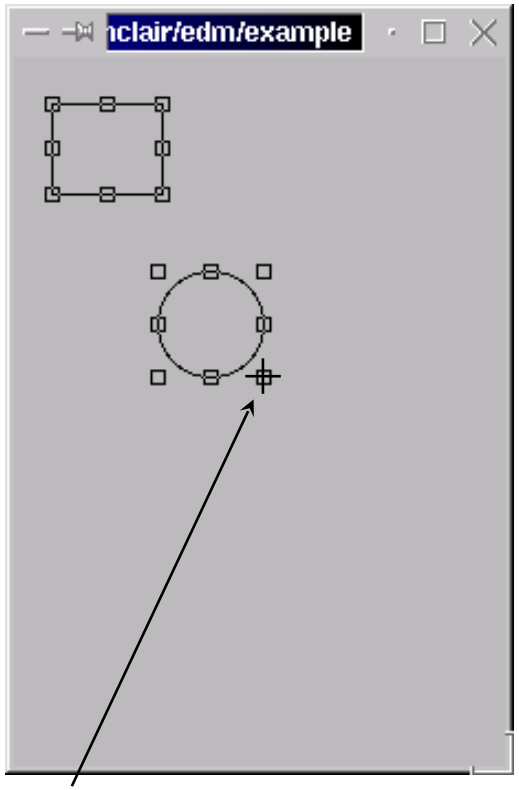


Press left button and drag objects to new location

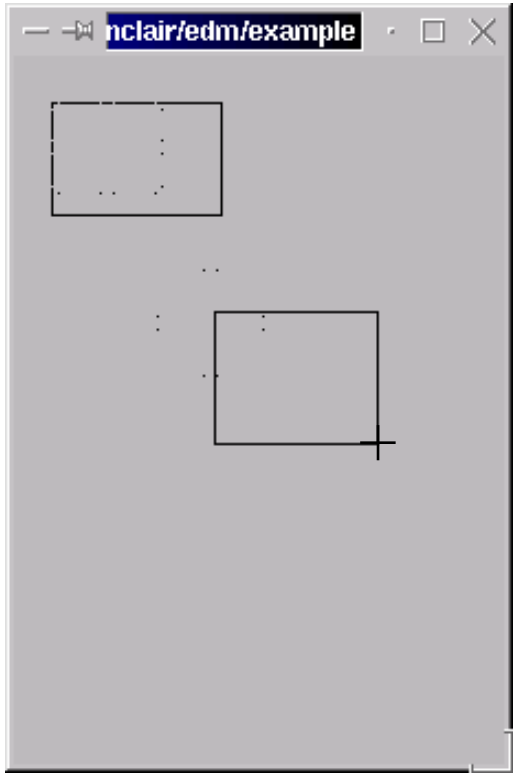


Release mouse button

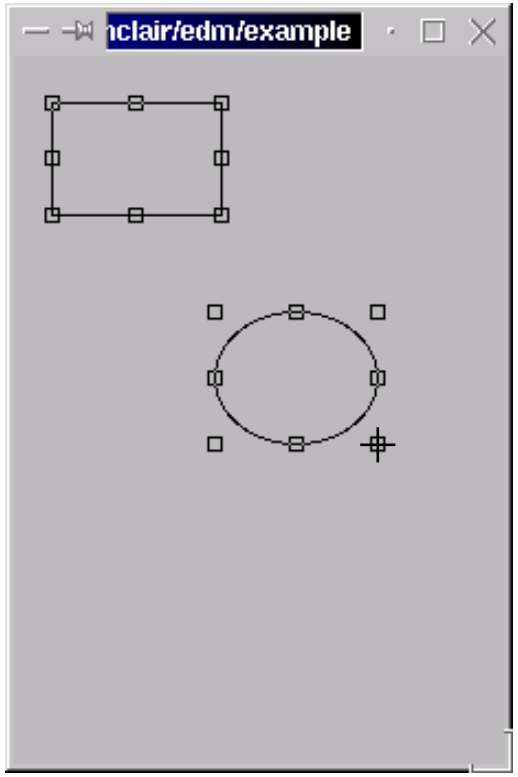
Resizing Objects



Place mouse cursor on control point of one object



Press left button and drag to new size



Release mouse button

Draw/Move/Resize Notes

- Fine control may be achieved on moves and resizes by using keyboard arrow keys (mouse button release or click ends op)
- Control key forces move (prevents resize)
  - Useful for tiny objects where you cannot click “inside” w/o hitting the resize handles
- Shortcuts to options in the Display Properties
  - M/m key turns ON/off orthogonal move
  - L/l key turns ON/off orthogonal line draw
  - G/g key turns ON/off grid
  - S/s key turns ON/off snap-to-grid

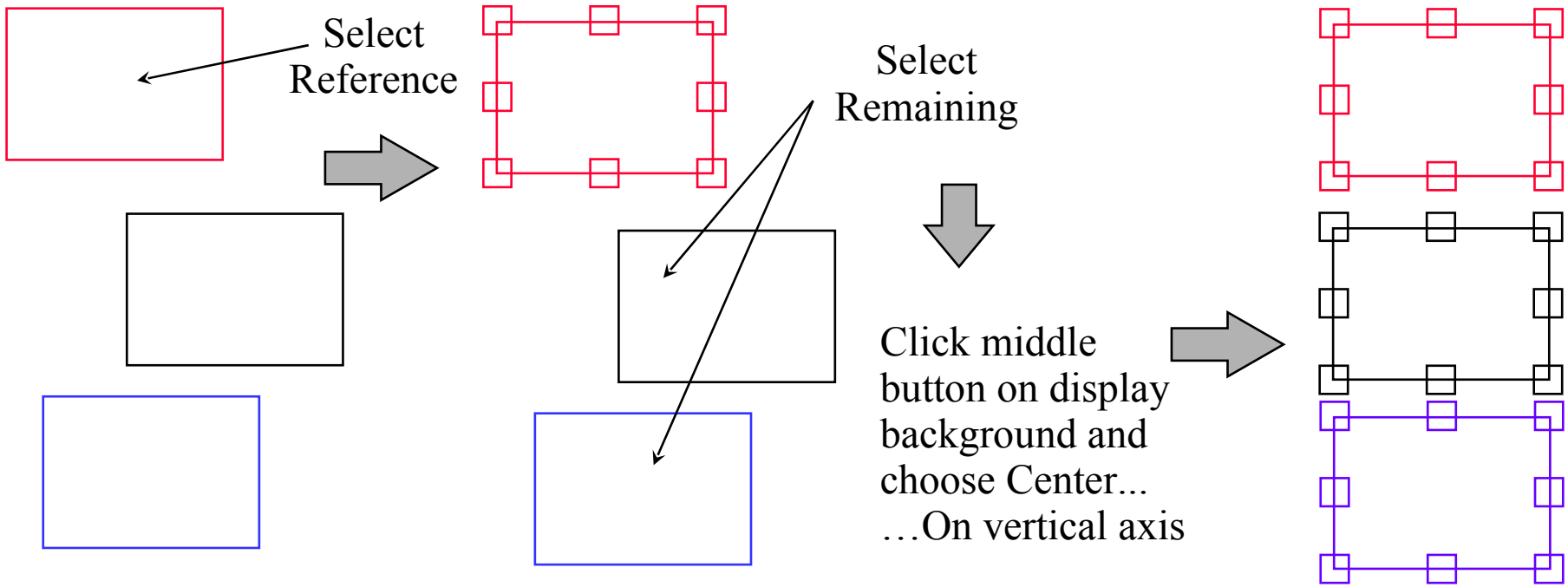
Alignment Operations

- Reference Independent
  - Align left, right, top, bottom
- Reference Dependent
  - Center: horizontal, vertical, both
  - Size: width, height, both
  - Distribute: vertical axis, horizontal axis
  - Distribute Midpoint: vertical axis, horizontal axis

Reference Dependent Operations

- The first object selected is used as the reference
- If no reference object is specified, an appropriate object is chosen (topmost, leftmost, etc.)

Example Center-Align Operation



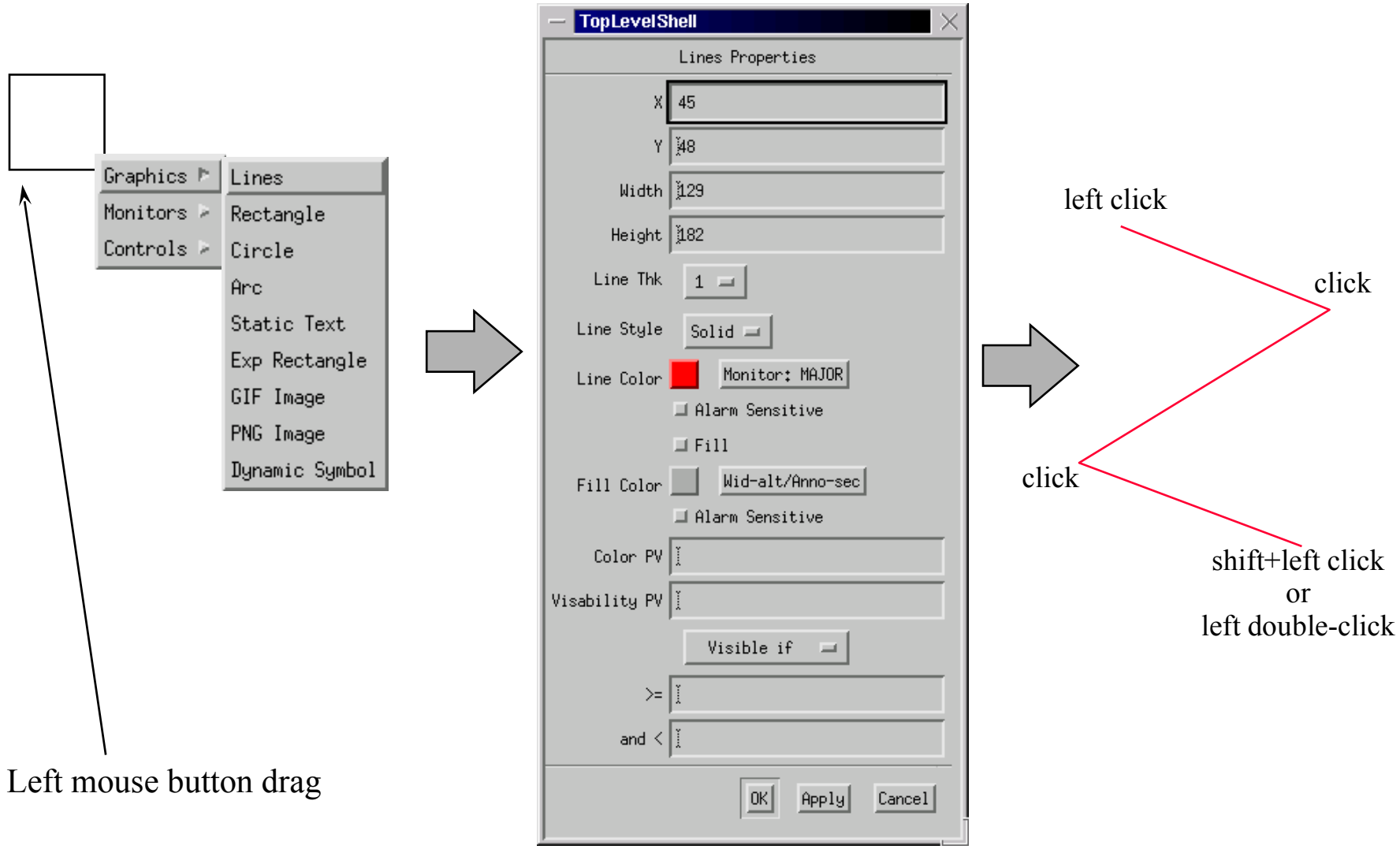
Miscellaneous. Operations

- Raise (u), Lower (d)
- Copy (c), Cut (x), Paste (v)
- Group ([), Ungroup (])
- Flip H & V
- Rotate CW & CCW
- Group Edit
- Undo

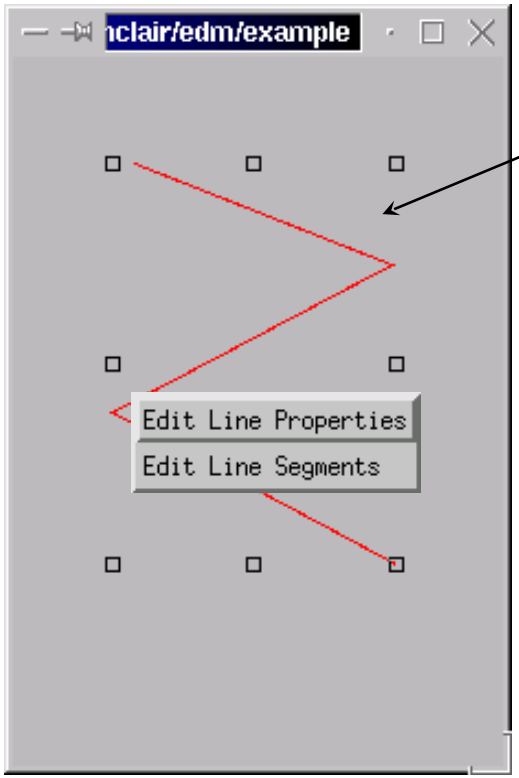
Undo

- Most useful for move, resize, & alignment operations
- Current limitations:
  - Cannot undo edit operations
  - Cut, Group, and Ungroup : Flush undo stack

A bit different: Creating Lines



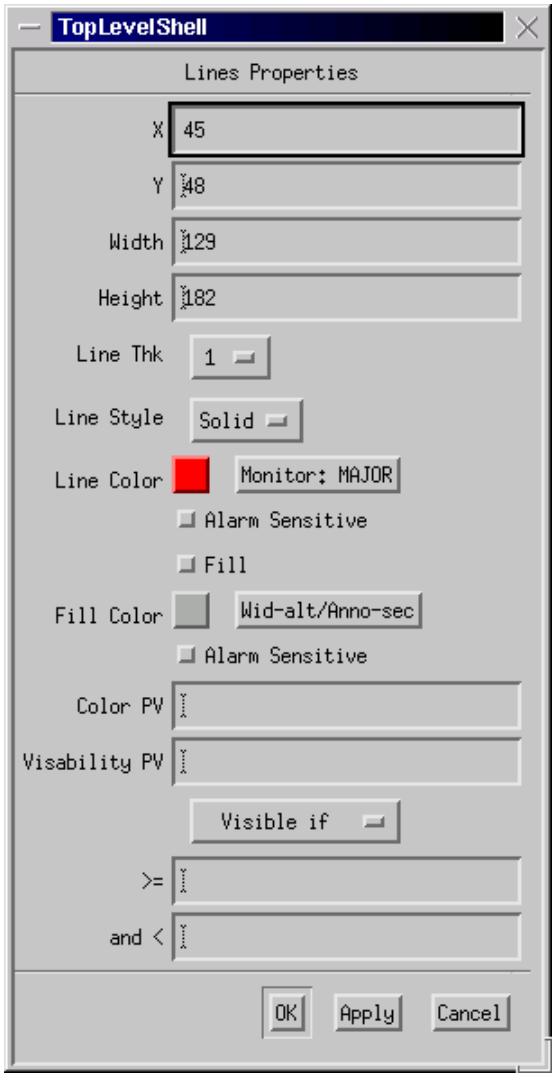
Editing Line Properties



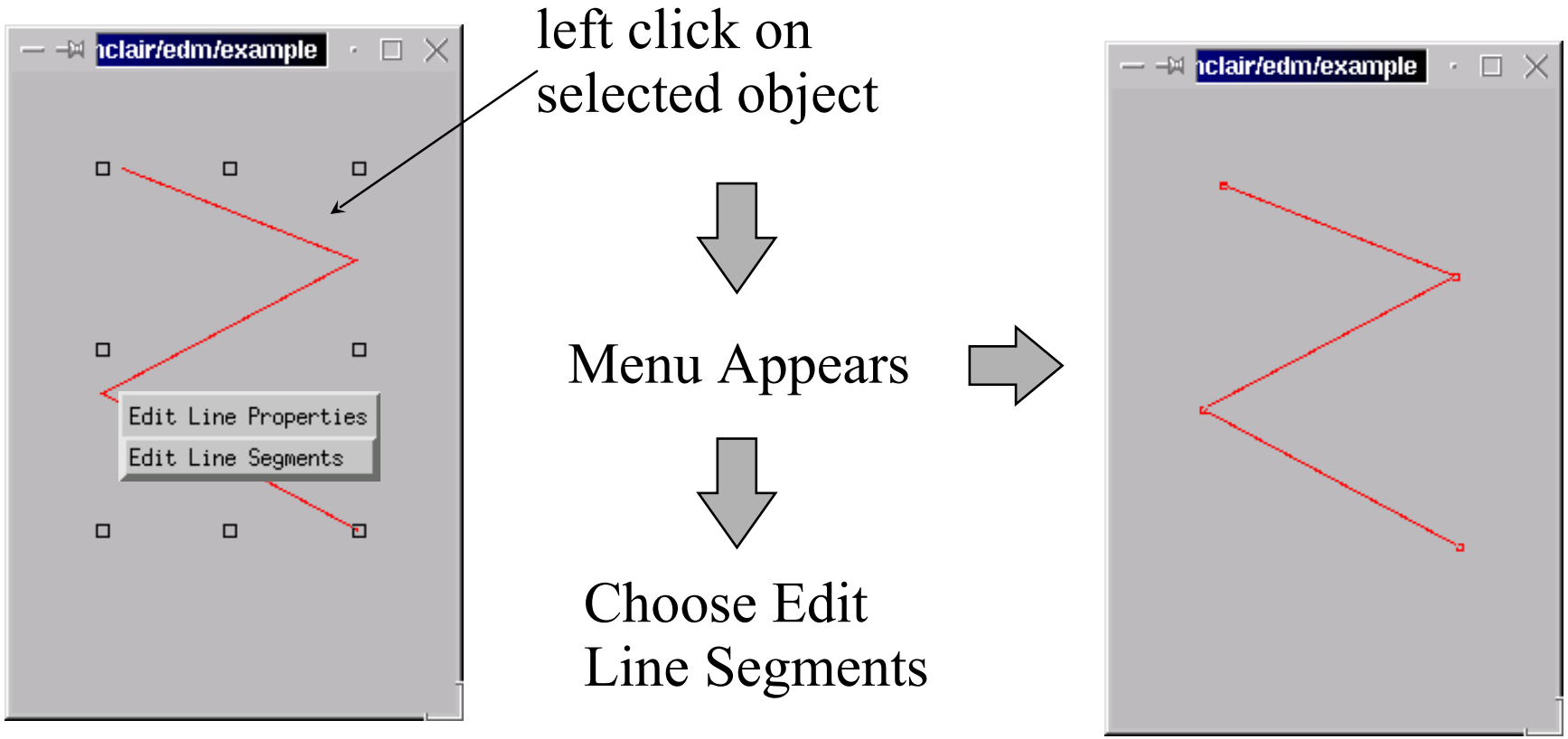
left click on selected object

Menu Appears

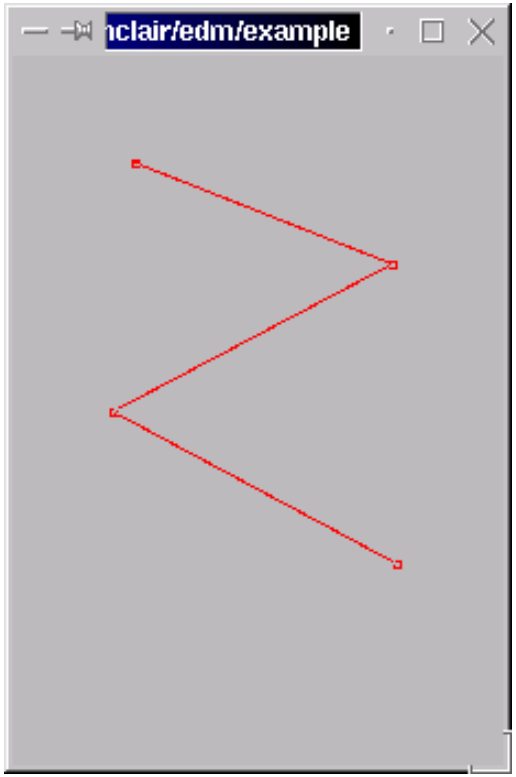
Choose Edit Line Properties



Editing Line Segments



Editing Line Segments (cont)



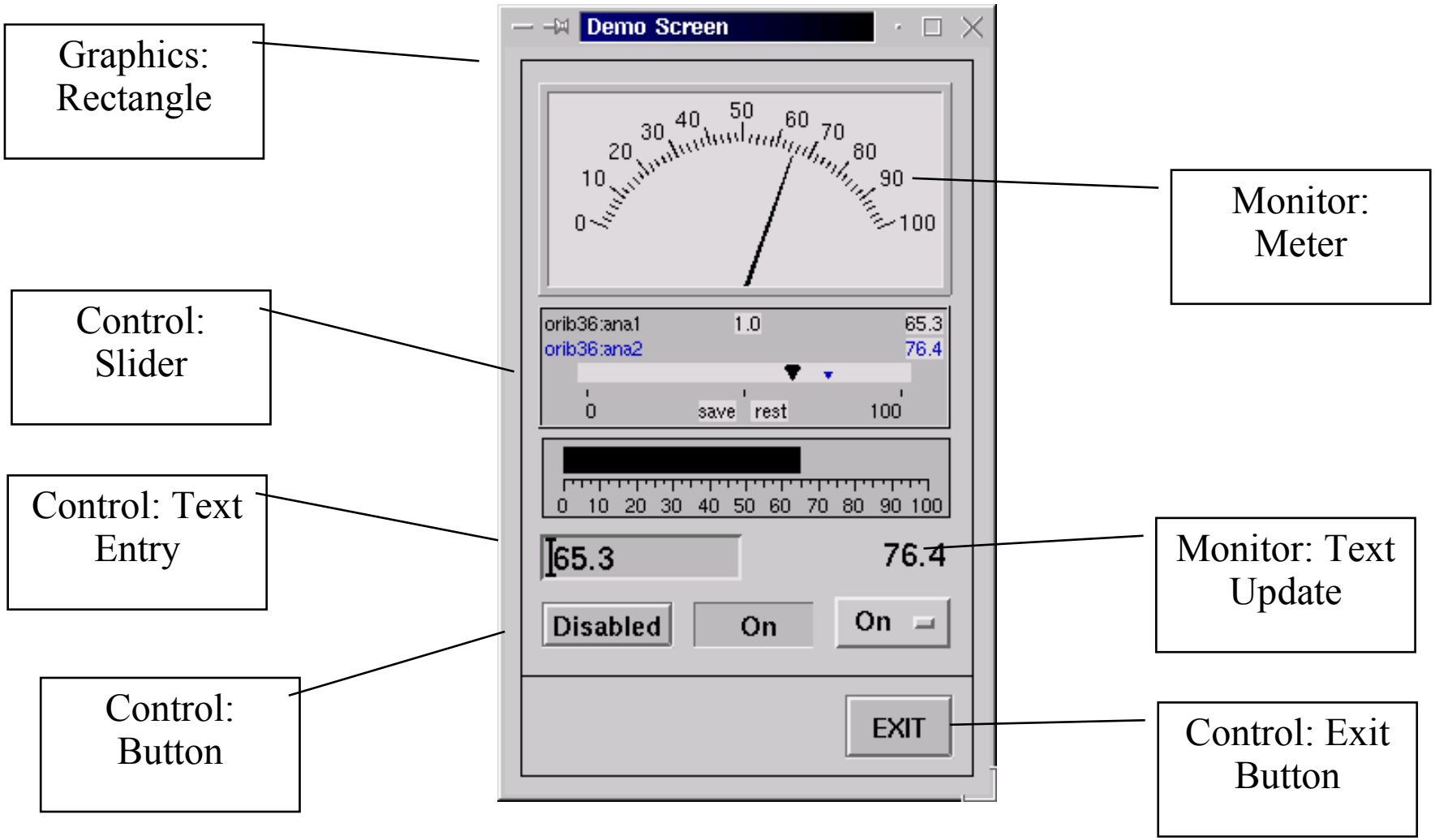
- Append point: Left click
- Insert point: Right click
- Move point: Middle drag
- Delete point: Ctrl+right click
- Delete last point: Ctrl+middle click
- Stop editing: Left double-click
  or Shift+left click

- Lots of details, but manipulating lines is easy once mastered

Group Edit

- Change visual attributes of all selected objects
- Change PV names for all selected objects

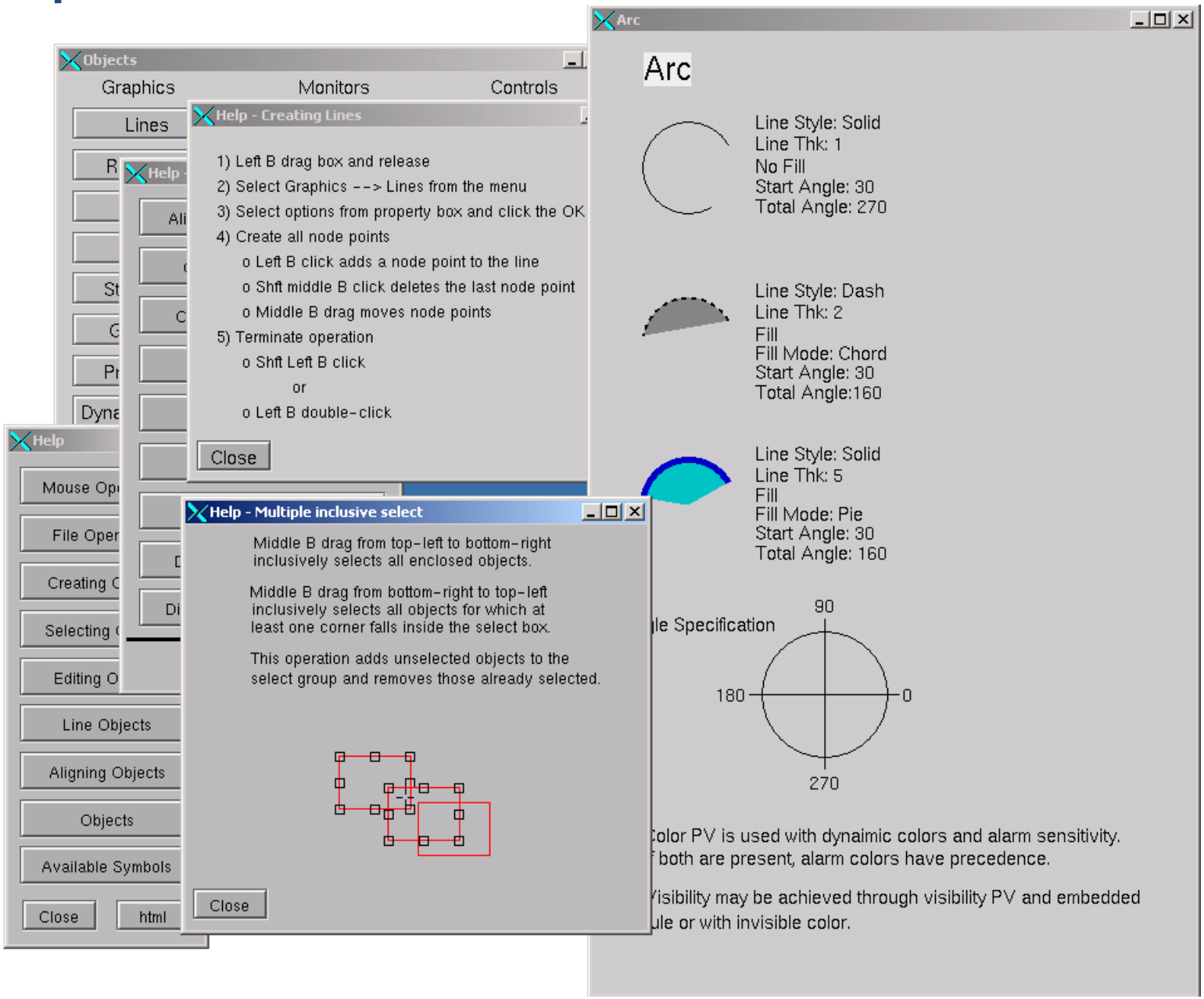
EDM Objects


Graphics: Rectangle
Control: Slider
Control: Text Entry
Control: Button
Demo Screen
0 10 20 30 40 50 60 70 80 90 100
orib36:ana1 1.0 65.3
orib36:ana2 76.4
0 save rest 100
0 10 20 30 40 50 60 70 80 90 100
65.3
76.4
Disabled
On
On
EXIT
Monitor: Meter
Monitor: Text Update
Control: Exit Button

Object Categories

- Graphics
  Do not require a process variable
  - Lines, rectangle, circle, arc, text, gif, png, dynamic symbol, embedded window
- Monitors
  Display current value of process variables
  - Meter, bar, message box, symbol, text update, graphs...
- Controls
  Modify value of process variables, change displays
  - Text, slider, button, menu button, message button, up-down button, related display, shell command, exit, …

Online Help


Objects
Graphics
Monitors
Controls
Lines
Help - Creating Lines
1) Left B drag box and release
2) Select Graphics --> Lines from the menu
3) Select options from property box and click the OK
4) Create all node points
o Left B click adds a node point to the line
o Shft middle B click deletes the last node point
o Middle B drag moves node points
5) Terminate operation
o Shft Left B click
or
o Left B double-click
Close
Help
Mouse Op
File Oper
Creating
Selecting
Editing O
Line Objects
Aligning Objects
Objects
Available Symbols
Close
html
Help - Multiple inclusive select
Middle B drag from top-left to bottom-right inclusively selects all enclosed objects.
Middle B drag from bottom-right to top-left inclusively selects all objects for which at least one corner falls inside the select box.
This operation adds unselected objects to the select group and removes those already selected.
Close
Arc
Arc
Line Style: Solid
Line Thk: 1
No Fill
Start Angle: 30
Total Angle: 270
Line Style: Dash
Line Thk: 2
Fill
Fill Mode: Chord
Start Angle: 30
Total Angle:160
Line Style: Solid
Line Thk: 5
Fill
Fill Mode: Pie
Start Angle: 30
Total Angle: 160
90
180
0
270
olor PV is used with dynaimic colors and alarm sensitivity.
both are present, alarm colors have precedence.
isibility may be achieved through visibility PV and embedded
ule or with invisible color.

Process Variables

- Many EDM objects accept PVs to
  - show the PV value (Monitors)
  - control the PV value (Controls)
  - change color or visibility based on the PV (all types)
- Formats:
  - **`EPICS\fred`**
    Use EPICS ChannelAccess to connect to “fred”
  - **`fred`**
    Use default method which is “EPICS”, i.e. same as above
  - **`CALC\sum(fred, 2)`**
    Use CALC PV “sum”, provide arguments “fred” and “2”.
  - **`XY\fred`**
    Use method XY (not implemented)…

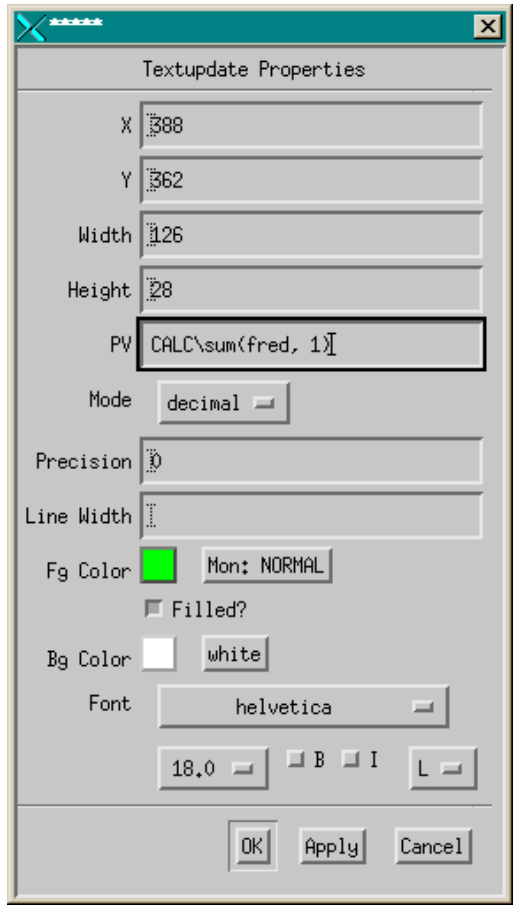
“CALC” PVs

- CALC: Formula like CALC record
- Selected via prefix “CALC\”
  (default is EPICS = Channel Access)
- Expressions are defined in an external file
- Examples:
  - The volume of a Martini from its ingredients:
    CALC\sum(gin,CALC\sum(water,tonic))
  - Convert from Fahrenheit to Celsius inside EDM:
    CALC\F2C(EPICS\temp_F)
- In recent releases, expressions can be used directly
  CALC\{(A-32)*5/9}(temp_F)

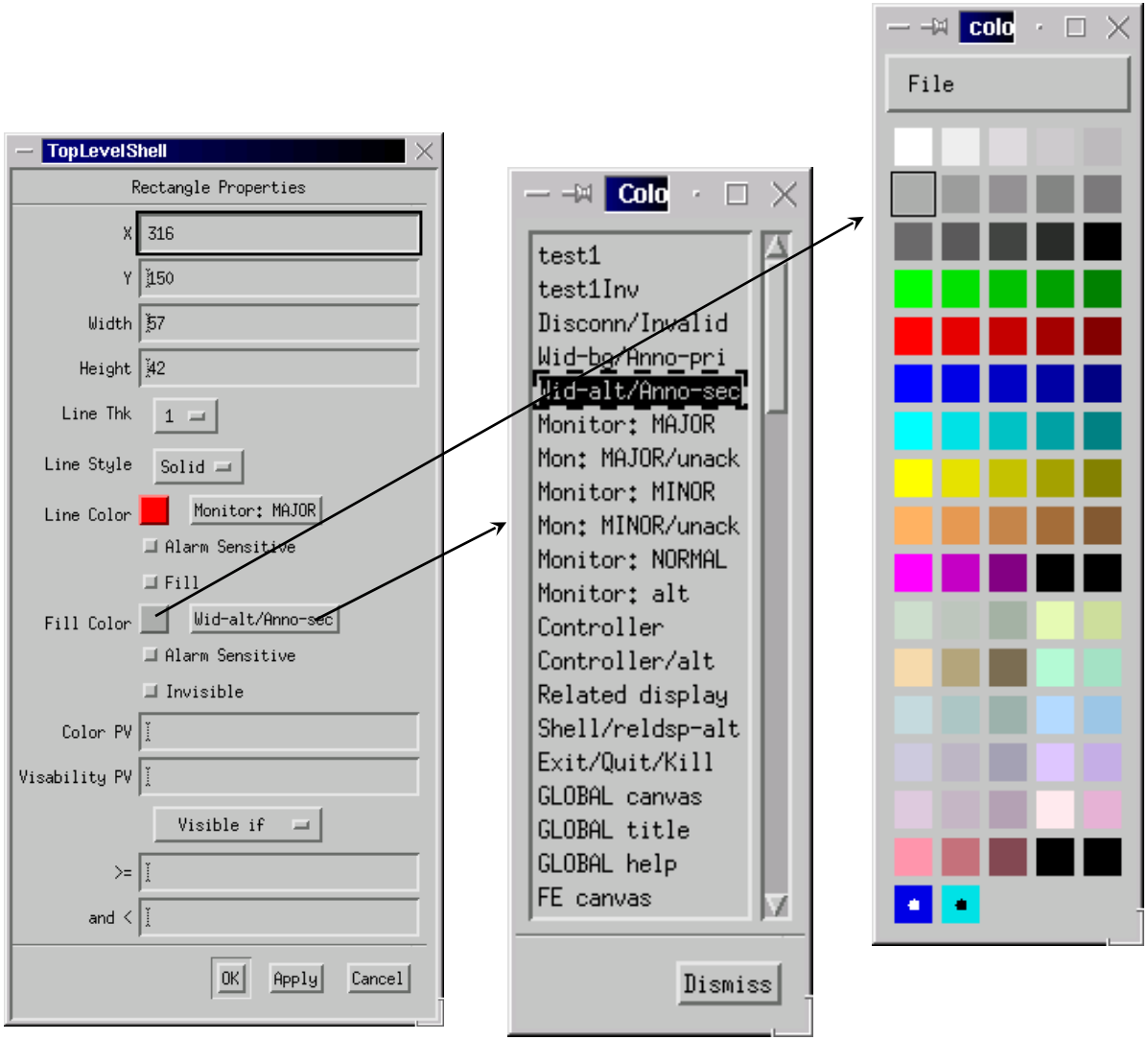
```
# File calc.list

# sum(A,B)
sum
# Implementation:
A+B

# F2C(A)
F2C
(A-32)*5/9
```



Specifying Color



- Color may be specified visually or by name
- EDM Website explains the color file format
- The color palette dialog shows color names as tool-tips
- *Pick by decoration or by meaning?*
  For example the same red might be named both “red” and “Monitor: MAJOR”;
  pick the one that fits the desired purpose.

Color - Static and Dynamic

- Some color entries are dynamic and are associated with a color rule
- In execute mode, dynamic colors change as a function of the color rule operating on the current value of an associated PV
- When selecting “alarm sensitive”, the color will change based on the PV's alarm severity.

Color - Static and Dynamic

- Colors may be specified for various object attributes and appear as one or more buttons in object property dialog boxes. Dynamic colors are differentiated from static colors like this:

- For a definition of the color, refer to the colors.list file and the online help

Color Rules

- Color Rules are defined in the edm color.list file. The following is an example of a rule:

```
rule Red-or-Blue
{
  <5          : red
  >=5         : blue
}
```

  - The color will display as either “red” or “blue” depending on the current value of the PV
- Some objects provide a separate “Color PV” that can be used instead of the “main” PV for color rule evaluation

EDM Macro Expansion

- Macro symbol sources
  - Command line
  - Related display or Embedded window parameter
  - Multiplexer object
- At run-time, the symbol expands to its given value
- For example:
  - EDM started with command line option **`-m 'one=1'`**
  - At run-time, $(one) ⇒ 1

Symbols

- EDM implements a primitive symbol facility
- Symbols are multi-state objects
  - Each state maps to a value range of an associated PV
  - Maximum 64 states
  - Symbol's color and size may be different for each instance of a symbol if desired

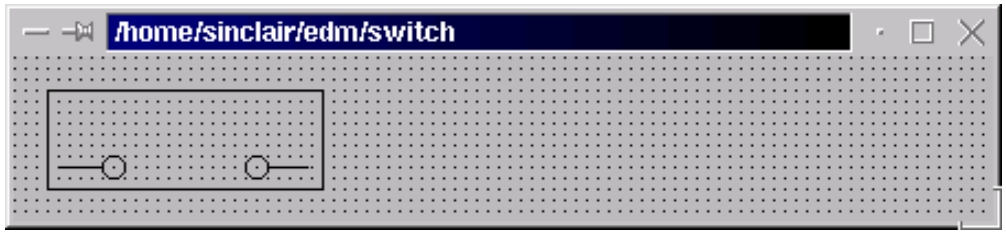
Symbols (cont)

- An EDM symbol is a standard EDM display file, where each symbol state is represented as a group of objects
- Only one grouping level is allowed
- The visual ordering corresponds to the ordering of states
- EDM contains an auto-make symbol command to perform the necessary grouping and ordering

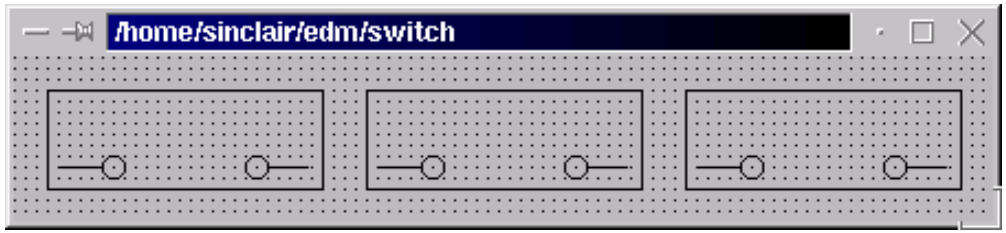
Creating Symbols

1. Create a rectangle corresponding to the geometric boundaries of the symbol, check the invisible attribute of this rectangle

2. Draw the invariant visual components of the symbol

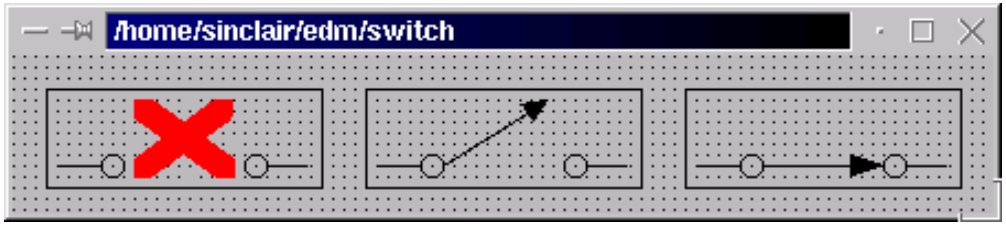


3. Copy this graphic and paste it N times; you now have N+1 visual states



Creating Symbols (cont)

4. Draw the state dependent visual components, the first state should be the out-of-band (error) state. EDM shows the second state when in edit mode



5. Make sure no grouped objects exist, click the middle mouse button on the display background, and choose *Auto make symbol* from the menu

6. Save the EDM display file, this file may now be used as a symbol file

Deploying Symbols

- A symbol instance is created like any other EDM object
- One property of a symbol instance is the symbol file name; this is the file discussed previously
- An exercise will illustrate this entire process in detail

Program Execution - Command Line Options

- Define macro values
  `-m "var1=value1,var2=value2,…"`
  - Macros are referenced as $(var1), $(var2) etc.
- Start in execute mode
  `-x`
- Usually used in conjunction with
  `-noedit`
- Typical command used in operations:
  `edm -x -noedit -m "var1=1,var2=2" displayFile`

Summary

- EDM is not only one of the available EPICS display managers
  - EDM has many editing features that support efficient display manipulation
  - The set of EDM objects can be extended
  - New PV types can be added