MEDM Overview

- MEDM stands for Motif Editor and Display Manager
- It is a graphical user interface (GUI) for designing and implementing control screens, also called displays
- It is a mature program
  - Robust
  - Powerful
  - Efficient
- Tens of thousands of screens have been designed for MEDM
- It is used worldwide at many sites
- It is the primary means by which operators and engineers control the APS and its subsystems
  - And most of the experiments

It is what you see in the Control Room

... or on the TV monitors

Beam Current: 102.1 mA
Lifetime: 0.0 Hours

Selected USER OPERATIONS:
- Present Decluster Beam

Operations Messages:
- Operator: dean wynott 2-0181
- FESS Pattern:
- Problem Information:
- Exit Stop/Fire
- Not Full Information:
- Top-Up Ongoing
- 35 Shutters Open
- Global Feedback On
Example MEDM Screens

- And thousands of others

MEDM Design Philosophy

- Performance, robustness, and maintainability come first
  - KISS [Keep It Simple Stupid] tends to work well
- Features are important but feature bloat is incommensurate with robustness and maintainability
- MEDM tries to strike a balance
  - Robustness and maintainability come first
- MEDM tries to enable, not restrict, the user
  - You are responsible for not shooting yourself in the foot
- Extensibility is best added with additional applications
  - ADT is a good example
  - As are all the Tcl/Tk apps at the APS
  - If these crash or use resources, they do not affect MEDM
  - MEDM can do the few things it does rapidly and efficiently
  - This philosophy has worked out well at the APS

History

- It is an APS product
- Started by Mark Anderson in 1990
  - Responsible for the look and feel, much of the implementation
  - Based on DM and EDD written at Los Alamos
  - Choose Motif for a more impressive interface
- Taken over by Fred Vong from Fall 1994 to Winter 1996
  - Improved the performance under load
  - Rewrote the Strip Chart
  - Many of his improvements were unfinished when he left
- Taken over by Ken Evans in 1996
  - Concentrated on robustness, stability
  - Added most of the Editing features (Undo, Align, etc.)
  - Made Composite object be dynamic
  - Added animated GIFs, many other features

More Information

- There is far more to MEDM than can be covered in this presentation
- The main source of information is the MEDM Reference Manual
  - Can be accessed from the Help Menu
  - Uses your browser to display HTML help
  - Netscape on UNIX may take a long time to come up
  - Also available as a Word document, Postscript, and PDF
- There is an MEDM web page
  - Has the Reference Manual and tar files of recent versions
  - Can be found from the EPICS home page
- MEDM for Windows is in the EPICS WIN32 Extensions
  - See the MEDM web page
**MEDM Virtual Linac Screen**

- The Virtual Linac MEDM screen is a good example to explore

![Virtual Linac MEDM Screen](image)

**Flash Demos**

- The demos in this presentation use Flash
- The Flash Player is installed on most computers
- If you do not see the demos, try right clicking where they should be and check if Play is selected
- If there is no right-click menu, you do not have the Flash Player
- If the version on the right-click menu is not 7 or above, you may have trouble with the slides, particularly advancing them
  - The advance arrow at the bottom left of the slide may work
- You can get or update the Flash Player via the link at:
  - [http://macromedia.com](http://macromedia.com)
  - It is a Plug-in for Netscape/Mozilla and an ActiveX Control for IE
  - You need the IE version for PowerPoint
  - (Use IE to visit the link)

**MEDM Main Window and Overview**

![MEDM Main Window](image)

**MEDM Objects**

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This is the MEDM Main Window

![MEDM Objects](image)
**Resource Palette**

- Each object has a set of properties
- The properties are chosen via the Resource Palette
- All objects have
  - X and Y Position
  - Height and Width
- Others vary depending on the object
- Properties are specified by
  - Text Boxes
  - Color selectors
  - Pull down menus
  - Dialogs

**Examples of All MEDM Objects**

**Editing Features**

- Menus are all Tear-Off
- Undo and Redo
- Align
  - Left, Horizontal Center, Right
  - Top, Vertical Center, Bottom
  - Position to Grid
  - Edges to Grid
- Space Evenly
  - Horizontal and Vertical
  - 2-D
- Grid
  - Toggle Show Grid
  - Toggle Snap to Grid
  - Set Grid Spacing

**Editing Features**

- Center
  - Horizontally and Vertically in Display
  - Both
- Orient
  - Flip Horizontally and Vertically
  - Rotate Clockwise and Counterclockwise
- Size
  - Same Size
  - Text to Contents
- Others
  - Find Outliers
  - Refresh
- Edit Summary (Keyboard and Button Shortcuts)
Creating a Display Demo

Fonts

- Fonts in MEDM are somewhat brain dead
  - Changing them would trash thousands of existing screens
- MEDM can use either Fixed or Scalable fonts
- Fixed fonts use font aliases for flexibility
  - widgetDM_4, widgetDM_6, …, widgetDM_60
  - These can be assigned to any X Windows Font
  - We are stuck with the original APS assignments
- Scalar fonts use one font (your choice) and vary the size
  - Was not available when the APS was started
  - For new sites, the defaults can be changed in siteSpecific.h
    - When MEDM is built
  - The font size is determined by the height of the text box
    - The text can extend beyond the box horizontally
    - In practice you vary it until it looks right

Default Fixed and Scalable Fonts

- `fontTable.adl` opened without and with `displayFont scalable`

  - The height (h) values do not scale uniformly
    - h < 35: widgetDM_36
    - h < 36: widgetDM_40

  - widgetDM_4 and widgetDM_60 are not possible

  - However, adjusting the height until it looks right works OK

Note:

- The scalable fonts do not use widgetDM.xxx
- The words are only accurate for the default fixed fonts and were determined empirically

siteSpecific.h

- Many of the MEDM default choices are in siteSpecific.h
  - C language header file
  - Used when MEDM is compiled
- Sites can change these defaults by changing this one file
- Some of the things that can be changed
  - Fixed or Scalable fonts
  - Colors
  - Location of the HTML Reference Manual
  - Printer defaults
  - Others
- Decisions must be made early before many screens are designed
**Graphic Objects**

- Many effects are created with Graphics objects

**Dynamic Attribute**

- Applies primarily to Graphics objects
  - Objects with a Dynamic Attribute can have their color or visibility change based on process variables or conditions
- Color Mode
  - Object has alarm colors (Green, Yellow, Red, White)
- Visibility Mode
  - Visible only if the process variable is zero or only if not zero
- Visibility Calc Mode
  - Visibility is based on a CALC expression involving up to 4 process variables plus HOPR, LOPR, STAT, SEVR, etc.
- Also applies to the Composite
  - Allows whole sections of the display to appear or disappear
  - Means any object can have a Dynamic Attribute
  - Make it be a Composite with just one member

**CALC in MEDM**

- Used in two places
- Visibility
  - Used when Visibility mode is set to “calc” and Visibility Calc is defined
  - CALC expression returns True or False
  - The APS Status Display uses this feature
    - With Composites (like the Demo)
- Image Frame Number (Animated GIFs)
  - Used when Image Calc is defined
  - Will just animate otherwise
  - CALC expression returns a frame number
  - Frame numbers start with 0
  - Uses 0 or last frame if out of range

**Visibility Demo**

This is an animated GIF with the frame determined by a CALC expression
**MEDM CALC Expression**

- **Expression involving 16 variables**
  - A The value of Channel A
  - B The value of Channel B
  - C The value of Channel C
  - D The value of Channel D
  - E Reserved
  - F Reserved
  - G The COUNT of Channel A
  - H The HOPR of Channel A
  - I The STATUS of Channel A
  - J The SEVERITY of Channel A
  - K The PRECISION of Channel A
  - L The LOPR of Channel A

**Examples of MEDM CALC Expressions**

- **Syntax is the same as for the EPICS CALC record**
  - See the Record Reference Manual

- **Some True/False Examples (for Visibility)**
  - !A Value is zero (Same as "if zero")
  - A Value not zero (Same as "if not zero")
  - A=12 Value is 12
  - A#12 Value is not 12
  - A<0&&B<0&&C<0 All are negative
  - A>.9*H Beyond 90% of upper limit
  - !J SEVERITY is not zero

- **Some Number Examples (for Image Calc)**
  - A Frame is value of A
  - A=12 Frame 0 or 1
  - (A+B)*SIN(C) Frame determined by expression

**Color Rules Using Animated GIFs**

- **Make a multi-frame GIF**
  - One frame per desired color, One pixel per frame

- **Put this GIF under the object you want to have color rules**

- **Use a CALC expression that rounds off to the frame number**

- **Example: 3 colors: Green, Yellow, Red**
  - **CALC:** \((\text{ABS}(A)>.8*H)+(\text{ABS}(A)>.9*H)\)
  - **Gives:**
    - Green for \(|A|\) up to 0.8*HOPR (0 + 0)
    - Yellow for \(|A|\) from 0.8*HOPR to 0.9*HOPR (1 + 0)
    - Red for \(|A|\) greater than 0.9*HOPR (1 + 1)

**Use SGA to Make and Edit Animated GIFs**

- **Make a multi-frame GIF**
  - One frame per desired color, One pixel per frame

- **Put this GIF under the object you want to have color rules**

- **Use a CALC expression that rounds off to the frame number**

- **Example: 3 colors: Green, Yellow, Red**
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Execute Mode

- What's wrong with this screen?
- MEDM objects turn white when the connection is lost

Drag and Drop

- You can drag the process variable names from an object
  - Use Mouse Button 2
  - The Process variable name appears in its alarm color on black
  - Can be dragged to any Motif Drop Site
    - This includes Probe, StripTool, HistTool, and others
  - Names now go into the X Clipboard as well
    - Can paste them in the usual places without even dragging
  - In practice Button 2 is used as a fast way to see the process variable name

PV Info

- PV Info
  - Gives extensive information about the process variable
- Accessed through the Execute-Mode Menu
  - Right click the display
  - Use the cursor to pick which object

PV Limits

- PV Limits
  - Allows you to set the limits for Meters, Sliders, etc
  - The user can:
    - Use the values from Channel Access (HOPR, LOPR, PREC)
    - Use the defaults set by the screen designer
    - Set her own values
  - The screen designer can:
    - Set it to use Channel Access values for the defaults
    - Set the defaults
- Accessed through the Execute-Mode Menu
Execute Menu

- The Execute Menu is a user-configurable menu that can be added to the right-click menu on displays in Execute Mode
- Specified by the MEDM_EXEC_LIST environment variable
  - If not specified, it doesn’t appear at all
- Example
  - `setenv MEDM_EXEC_LIST Probe;probe &P &:
    - Gives the menu shown
    - Selecting the Probe item, for example, will allow you to select an object, then run
      Probe on its process variable
- See the manual for details

Macros

- Strings of the form $(name) in an ADL file can be replaced by some other string
  - For example, enter $(sector):$(corrector) as part of a PV name
- Replacement is specified:
  - 1. On command line:
    ```
    medm -x -macro "sector=S1A,corrector=H2"
    ```
  - 2. In Related Display configuration:
    - Resource Palette dialog
- Allows you to design one screen and use it for many similar items
- The Virtual Linac uses $(user) in front of PV names
  - So different users have their own PV names
  - Look at the startup scripts for MEDM for the Virtual Linac

Related Display

- Brings up a menu of other displays
- As with most MEDM objects there are many options
  - Related Display Options
    - If there is only one item in the menu, the label is centered, and clicking it brings up that one display
    - If there is more than one item in the menu, the label is left justified

Hidden Button Markers

- Related Displays can be hidden under other objects
- Toggle Hidden Button Markers shows where they are
  - Clicking on a hidden button brings up a (single) display just like the more conventional Related Display
Bar Monitor

- Here are some options for the Bar Monitor

![Bar Monitor Image]

Bar Monitor

- The no decorations mode, useful for bar graphs and effects

![Bar Monitor Image]

Strip Chart

- While not as powerful as StripTool, the MEDM Strip Chart has many features, which can be changed on the fly

![Strip Chart Image]

Cartesian Plot

- The Cartesian Plot is the most complicated MEDM object
- MEDM provides generic support for different plot packages
- XRT/Graph
  - Most complete implementation is XRT/Graph
  - Commercial product, not available for Windows
  - Requires a license on each machine on which it is built
  - Many features and works well
- SciPlot
  - Public Domain, modified extensively for MEDM
  - Included with MEDM, should work on any platform
  - Currently missing Second Y axis and Fill Under
- JPT
  - Developed at TJNAF
  - Does not support all MEDM Cartesian Plot features
Summary

- MEDM is a full featured, mature, robust program
- It is the principal means by which humans control the system
- This has been an overview of some of the MEDM features
  - There are many more
  - The Reference Manual is the best source of information

Thank You

This has been an APS Controls Presentation