Drag and Drop Display and Builder.

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Motivation

- Operations of complicated colliders (Tevatron, the LHC, and the ILC) require **sophisticated** control systems.
    - **Security**
    - Data pool management
    - Alarms
    - Logging
- The people who must build, operate, and maintain these accelerators
    - Operators
    - Engineers
    - Accelerator physicists

  require **rapid development** of control displays and application programs.

Motivation

- For rapid development, the **system expert** (operator, engineer, or physicist) should be the one to **develop** the displays or applications

- These advanced control systems can seem **overwhelming** to non controls experts.
  - This is why Lab View is so popular
  - However Lab View offers little of the benefits of an advanced control system.

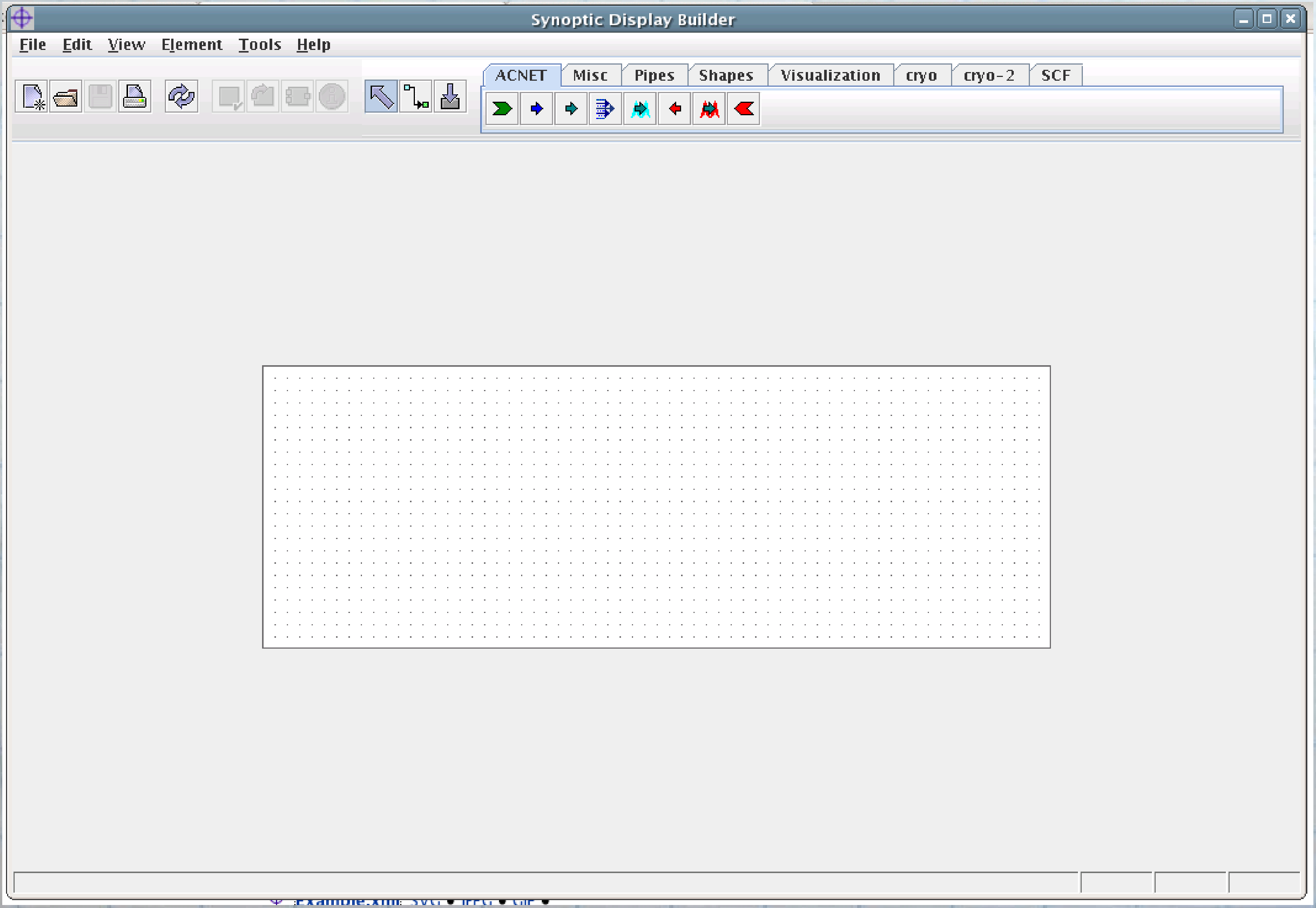
Solution

- Drag and Drop is an environment that gives non-control system experts the ability to quickly build controls displays which operate within a context of the control system.
- Drag and Drop:
  - is easy to use
  - sophisticated enough to handle complex displays
  - uses web browsers and/or Java Web Start
  - is easily extendible
  - is a mature application
    - First developed in 2001
    - Fermilab Cryogenics department are heavy users

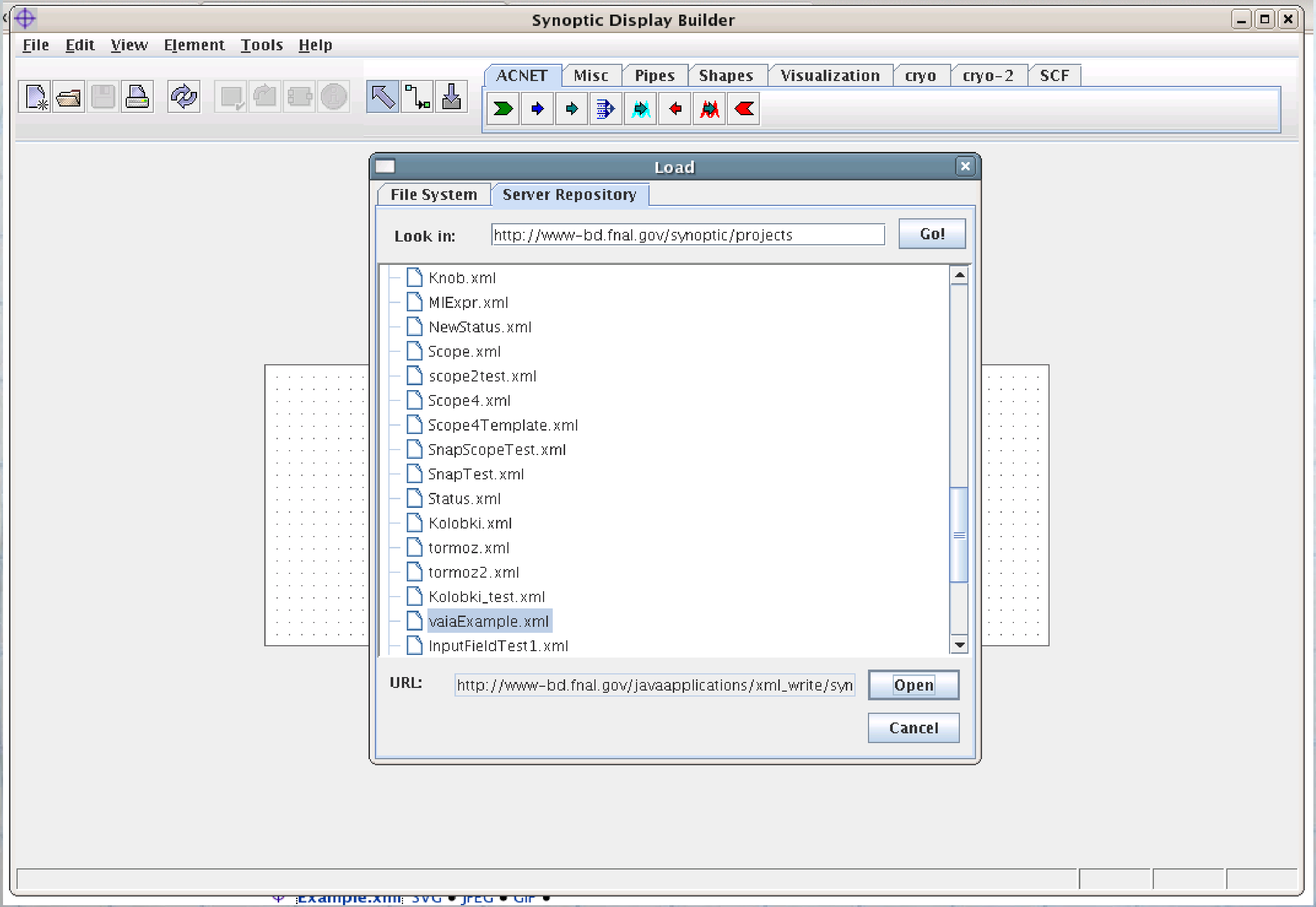
Drag and Drop Display and Builder

- Drag and Drop a consists of two parts:
  - Display
  - Builder
- The Drag and Drop Display can be run from a web browser (readings only) so it can viewed anywhere in the world.
  - Files are stored on a web server (well organized and secure)
  - Displays are extremely quick because it uses Scalable Vector Graphics (SVG) so that the screen does not constantly have to be re-drawn.
- The Builder has a simple graphical user interface that offers a rich set of graphical components
  - Display can be built and deployed in a matter of minutes
  - The builder is easily extendible
  - can be run on any machine because it is based on Java

Demo – Empty Builder



Demo – Builder, Open Project

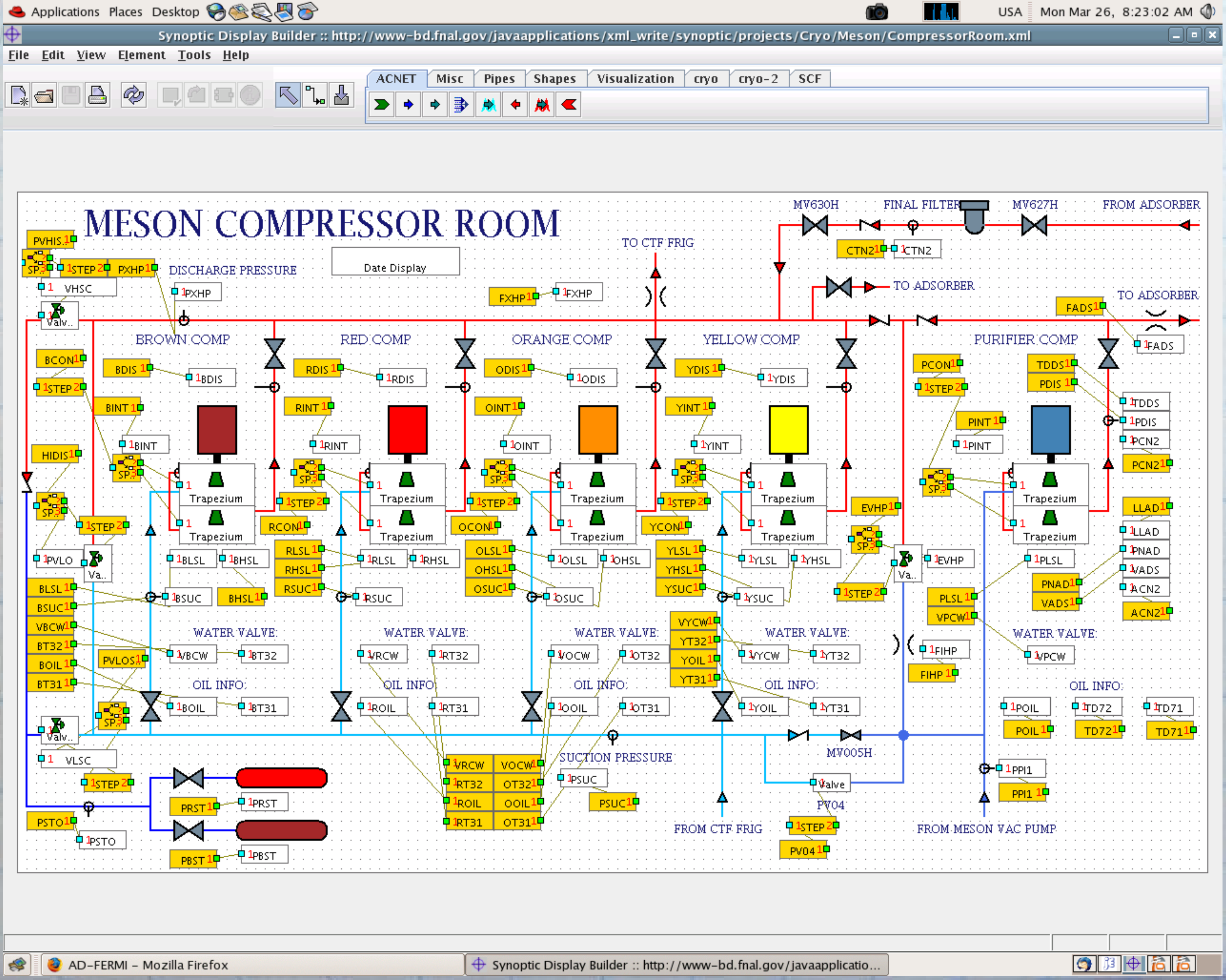


Look in: http://www-bd.fnal.gov/synoptic/projects

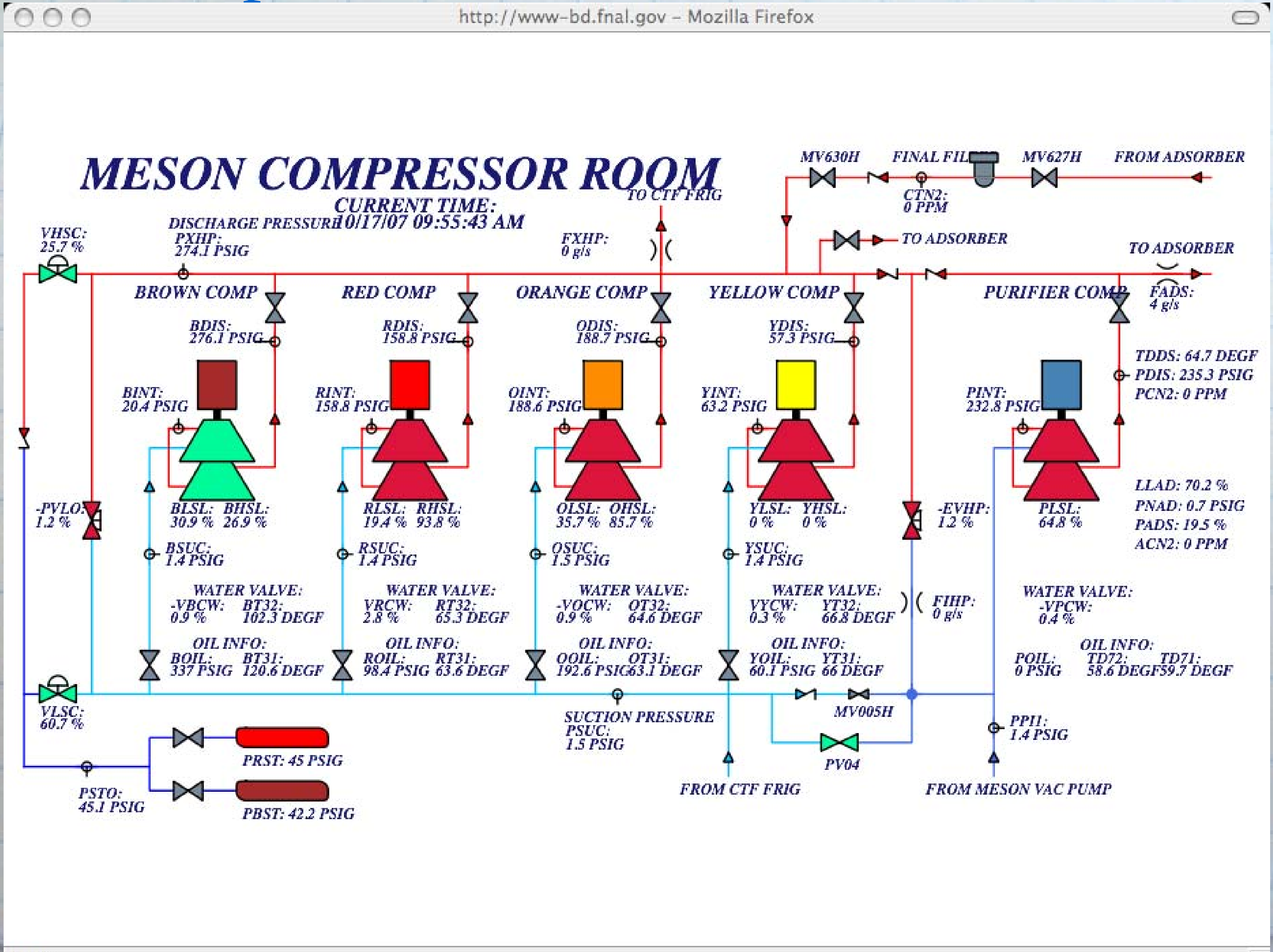
- Knob.xml
- MIExpr.xml
- NewStatus.xml
- Scope.xml
- scope2test.xml
- Scope4.xml
- Scope4Template.xml
- SnapScopeTest.xml
- SnapTest.xml
- Status.xml
- Kolobki.xml
- tormoz.xml
- tormoz2.xml
- Kolobki_test.xml
- vaiaExample.xml
- InputFieldTest1.xml

URL: http://www-bd.fnal.gov/javaapplications/xml_write/syn

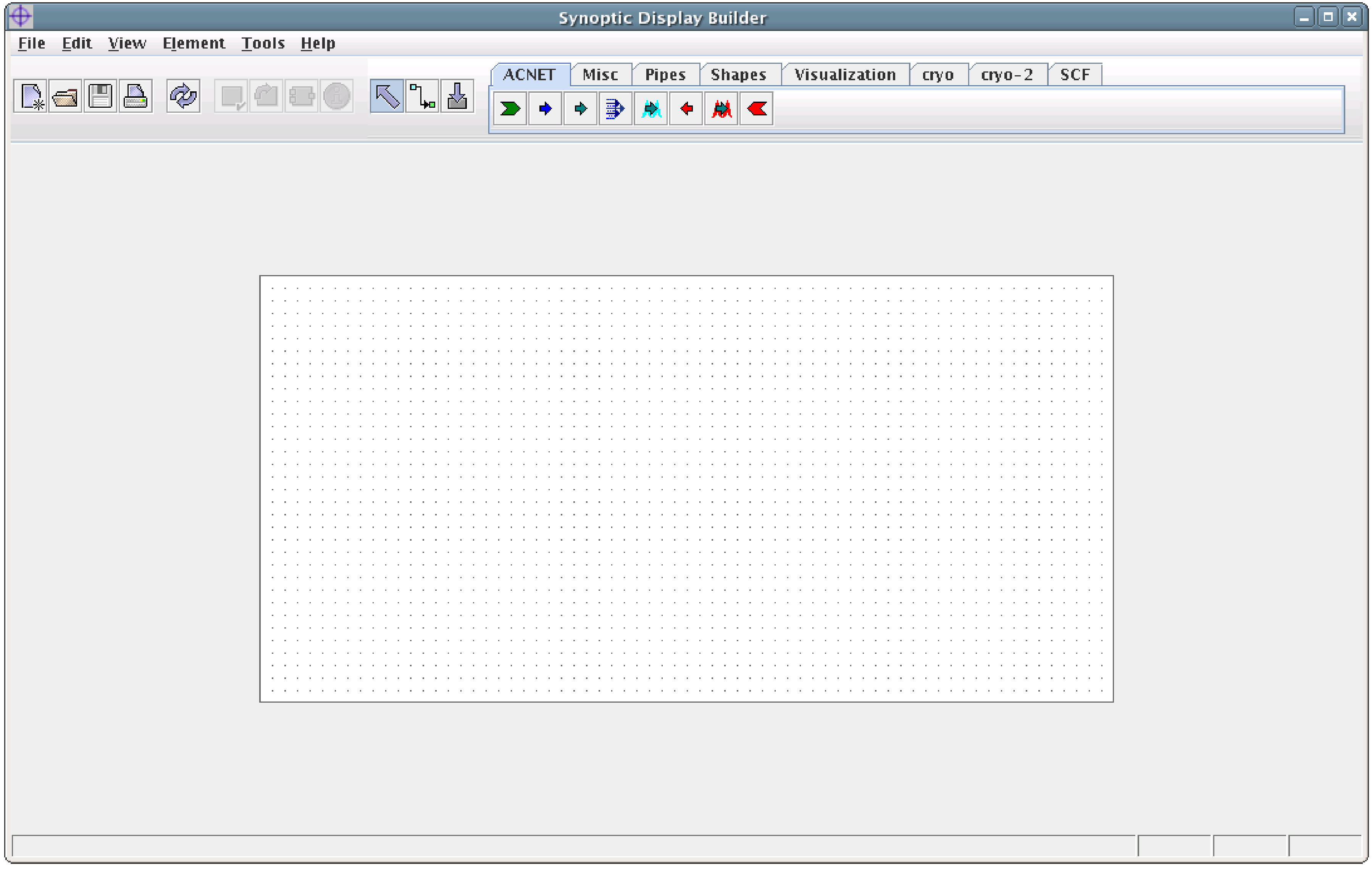
Demo – Builder, Meson Compressor Room



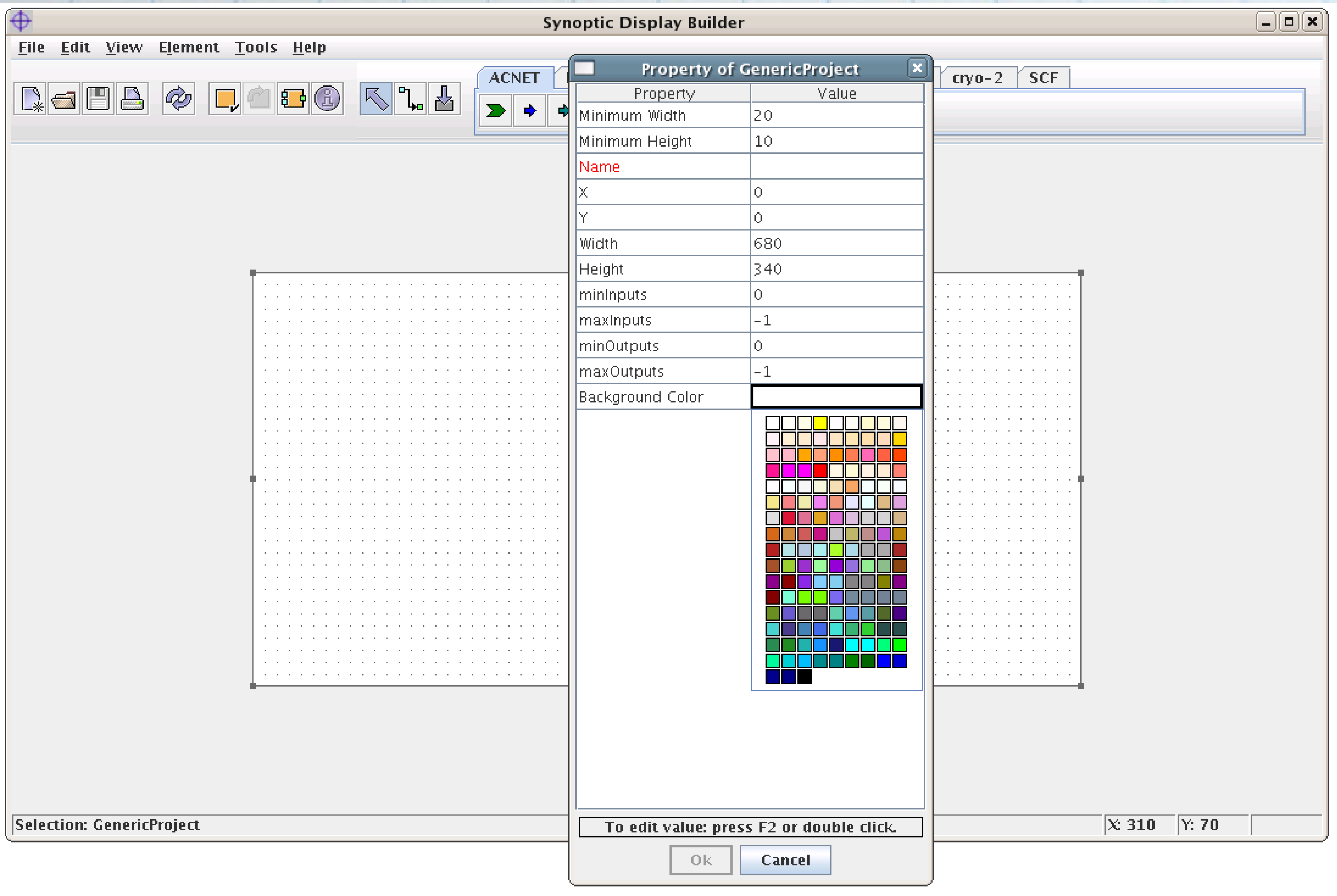
Demo – Display, Meson Compressor Room



Demo – Klystron Step 1, Empty Builder


Synoptic Display Builder
File Edit View Element Tools Help
ACNET Misc Pipes Shapes Visualization cryo cryo-2 SCF

Demo – Klystron, Step 2, Project Properties



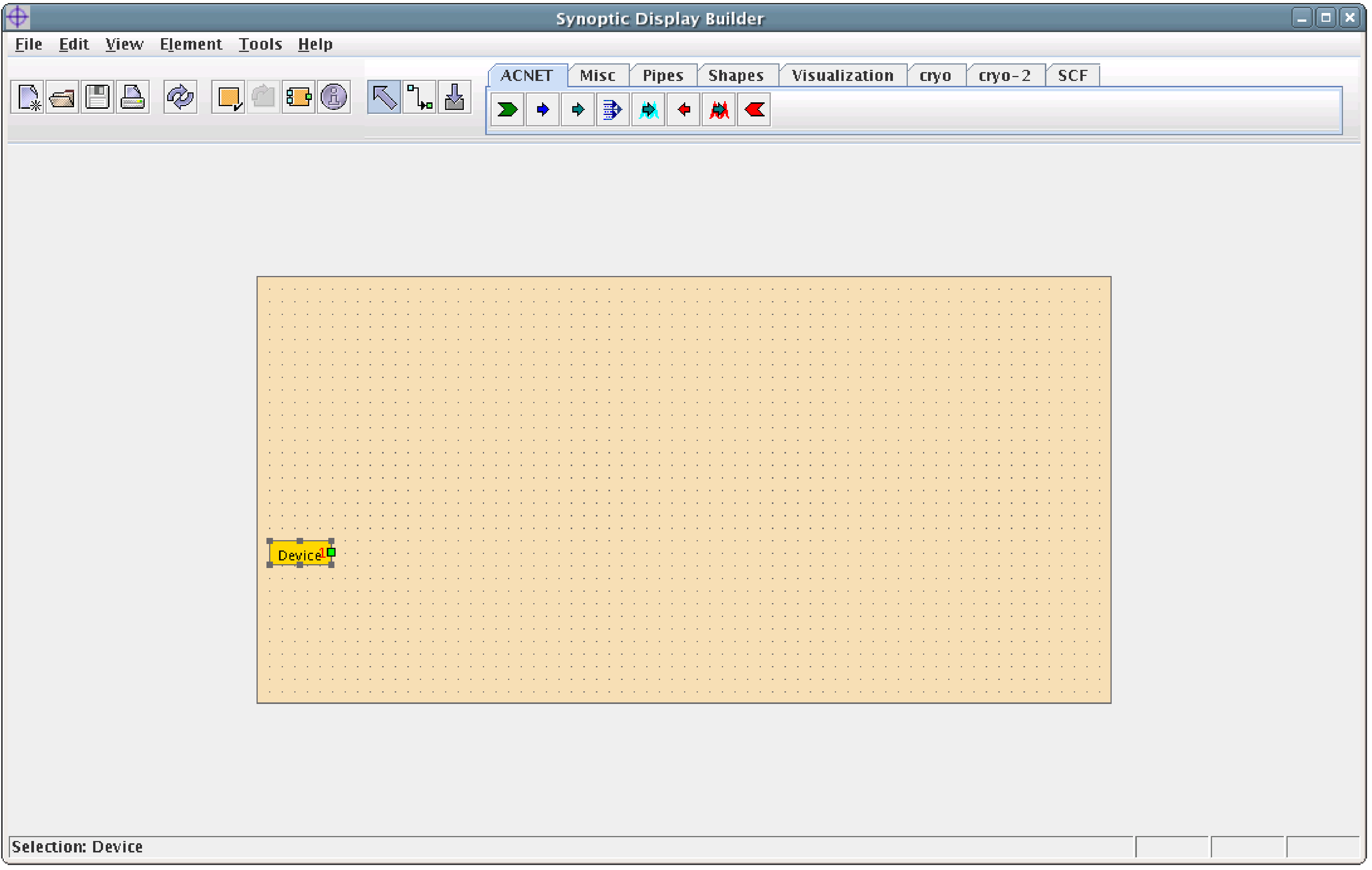
Property	Value
Minimum Width	20
Minimum Height	10
Name	
X	0
Y	0
Width	680
Height	340
minInputs	0
maxInputs	-1
minOutputs	0
maxOutputs	-1
Background Color	

To edit value: press F2 or double click.

Selection: GenericProject

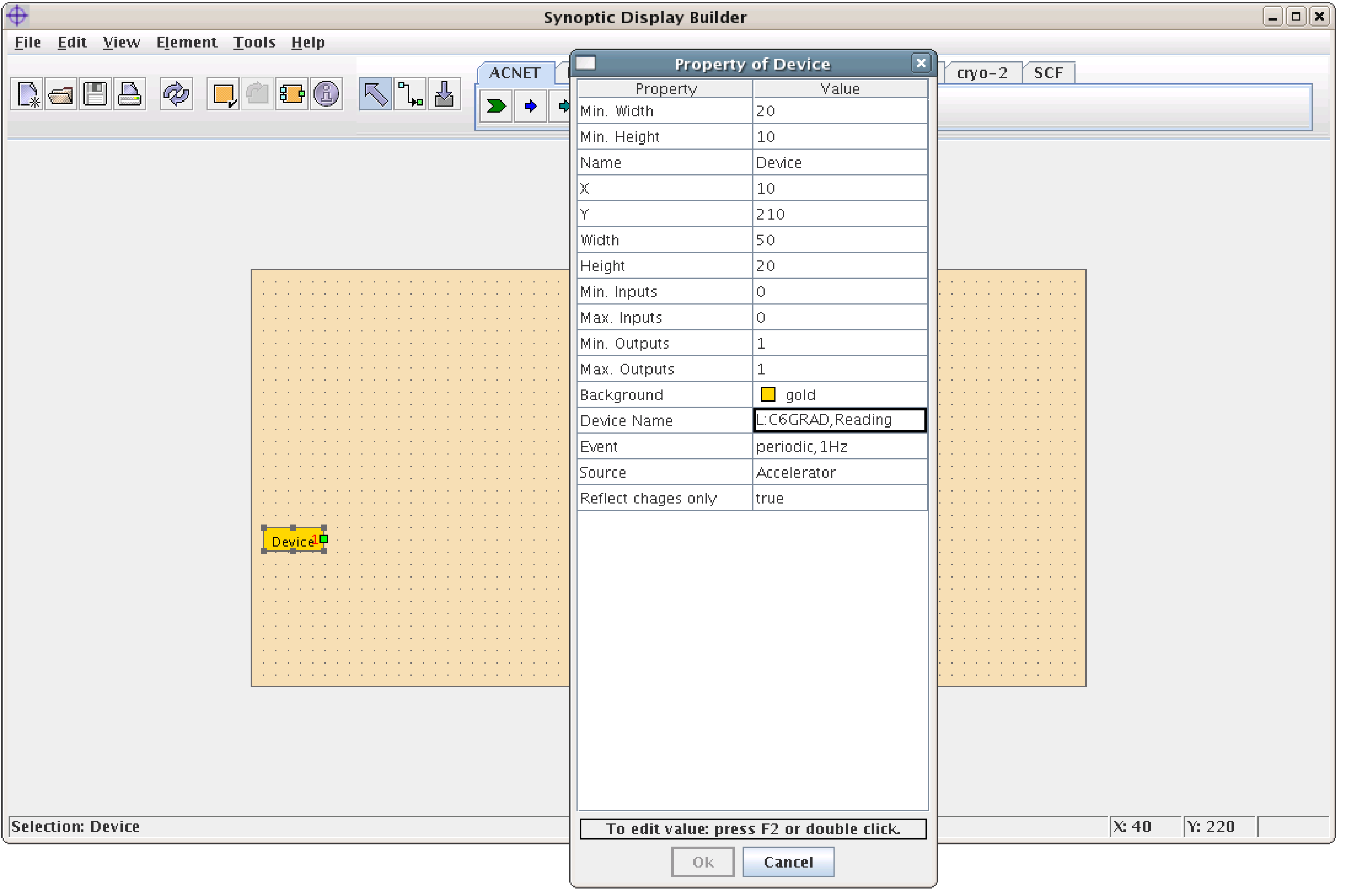
X: 310 Y: 70

Demo – Klystron, Step 3, Adding a Device



Selection: Device

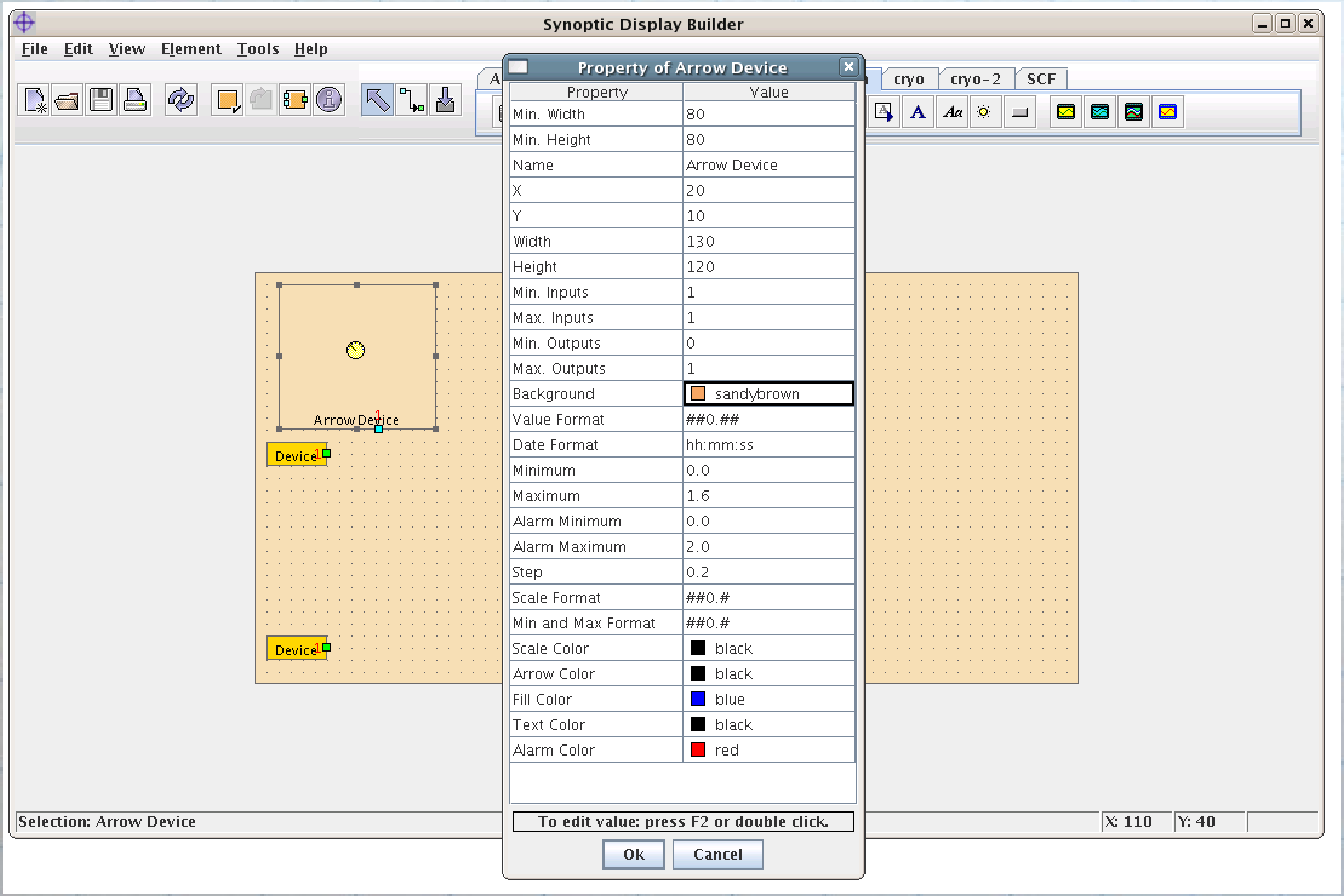
Demo – Klystron, Step 4, Setting Up Device



Property	Value
Min. Width	20
Min. Height	10
Name	Device
X	10
Y	210
Width	50
Height	20
Min. Inputs	0
Max. Inputs	0
Min. Outputs	1
Max. Outputs	1
Background	🟨 gold
Device Name	L:C6GRAD,Reading
Event	periodic, 1Hz
Source	Accelerator
Reflect chages only	true

To edit value: press F2 or double click.

Demo – Klystron, Step 5, Adding Indicator



Property of Arrow Device

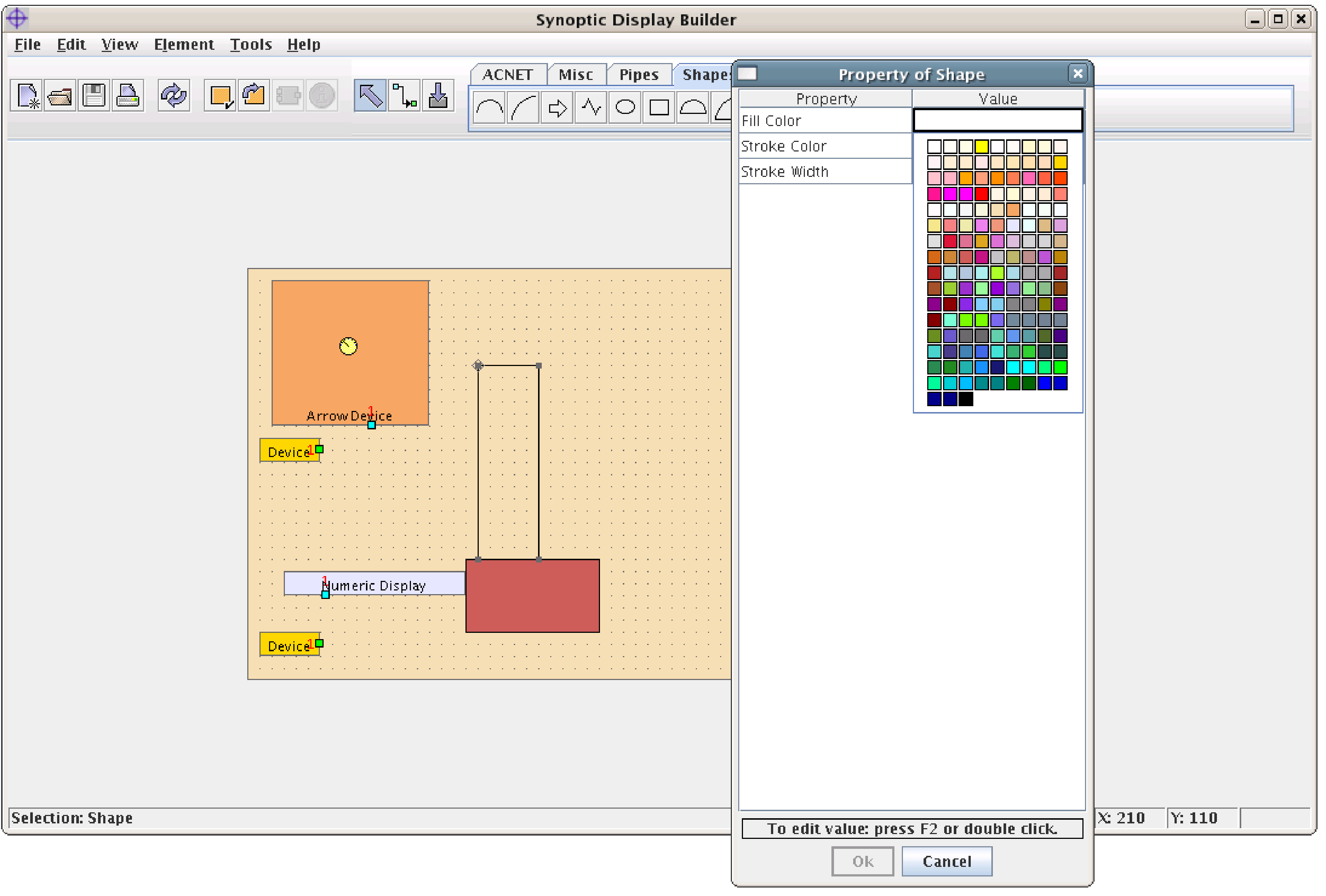
Property	Value
Min. Width	80
Min. Height	80
Name	Arrow Device
X	20
Y	10
Width	130
Height	120
Min. Inputs	1
Max. Inputs	1
Min. Outputs	0
Max. Outputs	1
Background	🟧 sandybrown
Value Format	##0.##
Date Format	hh:mm:ss
Minimum	0.0
Maximum	1.6
Alarm Minimum	0.0
Alarm Maximum	2.0
Step	0.2
Scale Format	##0.#
Min and Max Format	##0.#
Scale Color	■ black
Arrow Color	■ black
Fill Color	🟦 blue
Text Color	■ black
Alarm Color	🟥 red

To edit value: press F2 or double click.

Selection: Arrow Device

X: 110 Y: 40

Demo – Klystron, Step 6, Adding Graphics



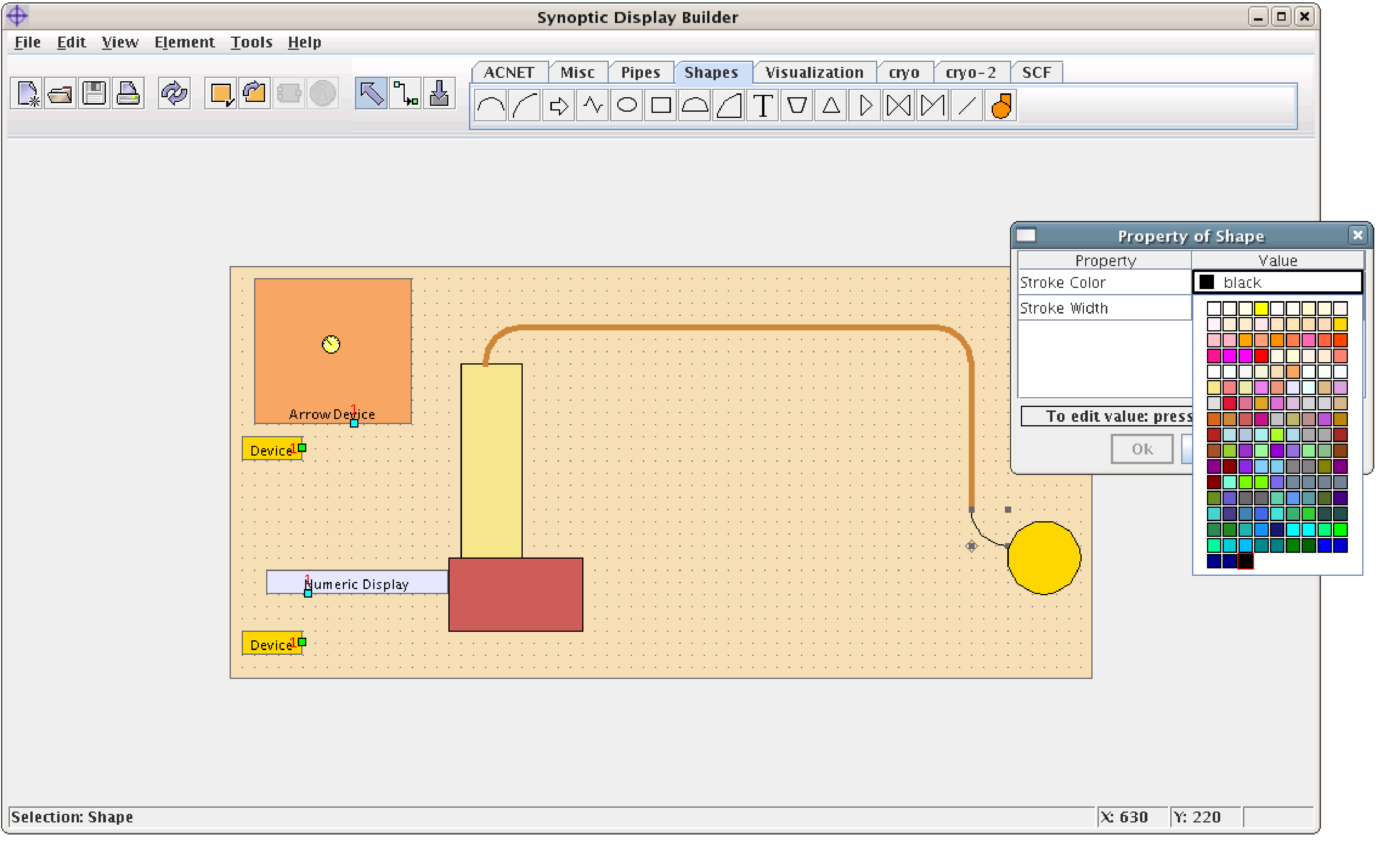
Property	Value
Fill Color	
Stroke Color	
Stroke Width	

To edit value: press F2 or double click.

Selection: Shape

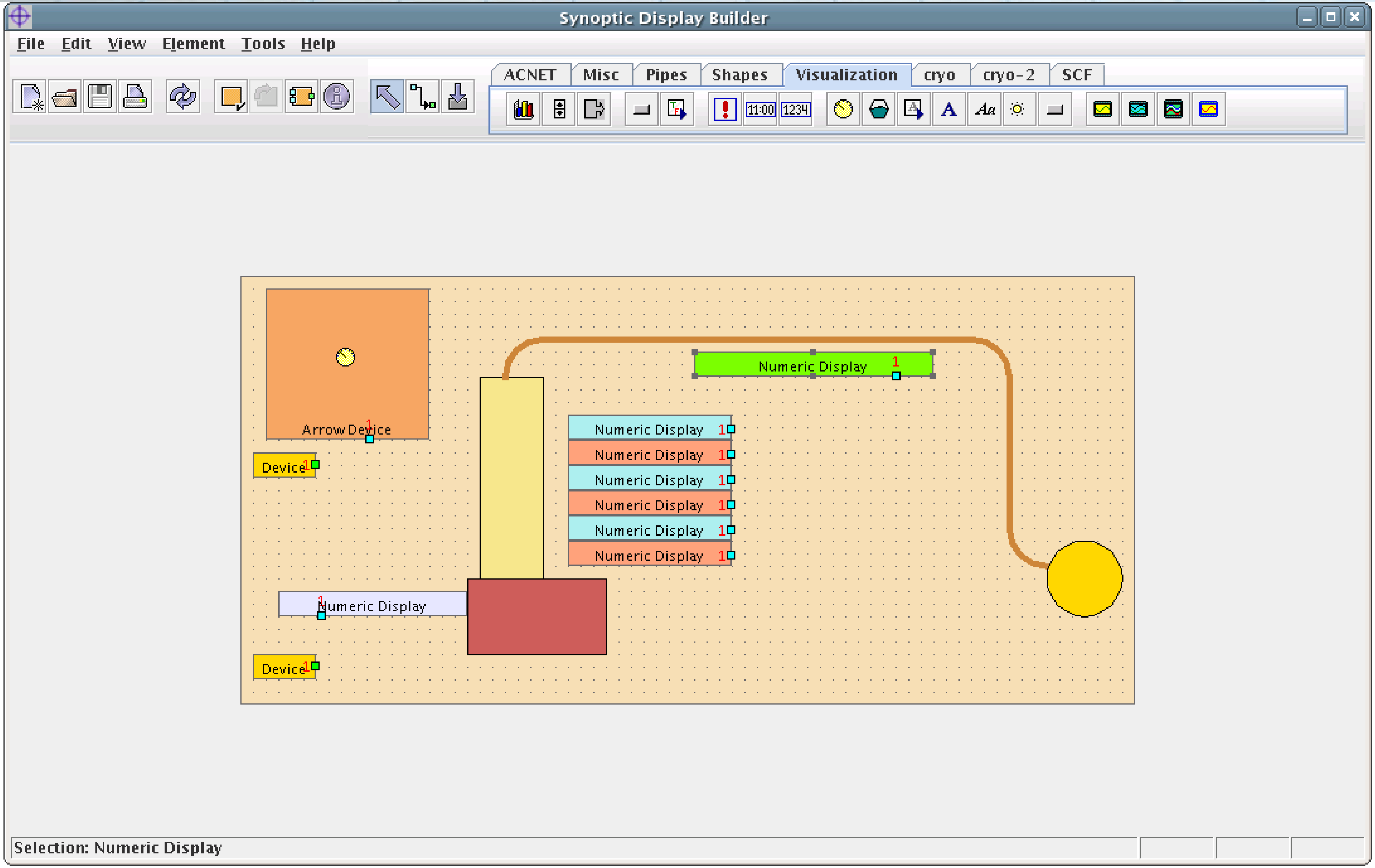
X: 210 Y: 110

Demo – Klystron, Step 7, Adding Graphics



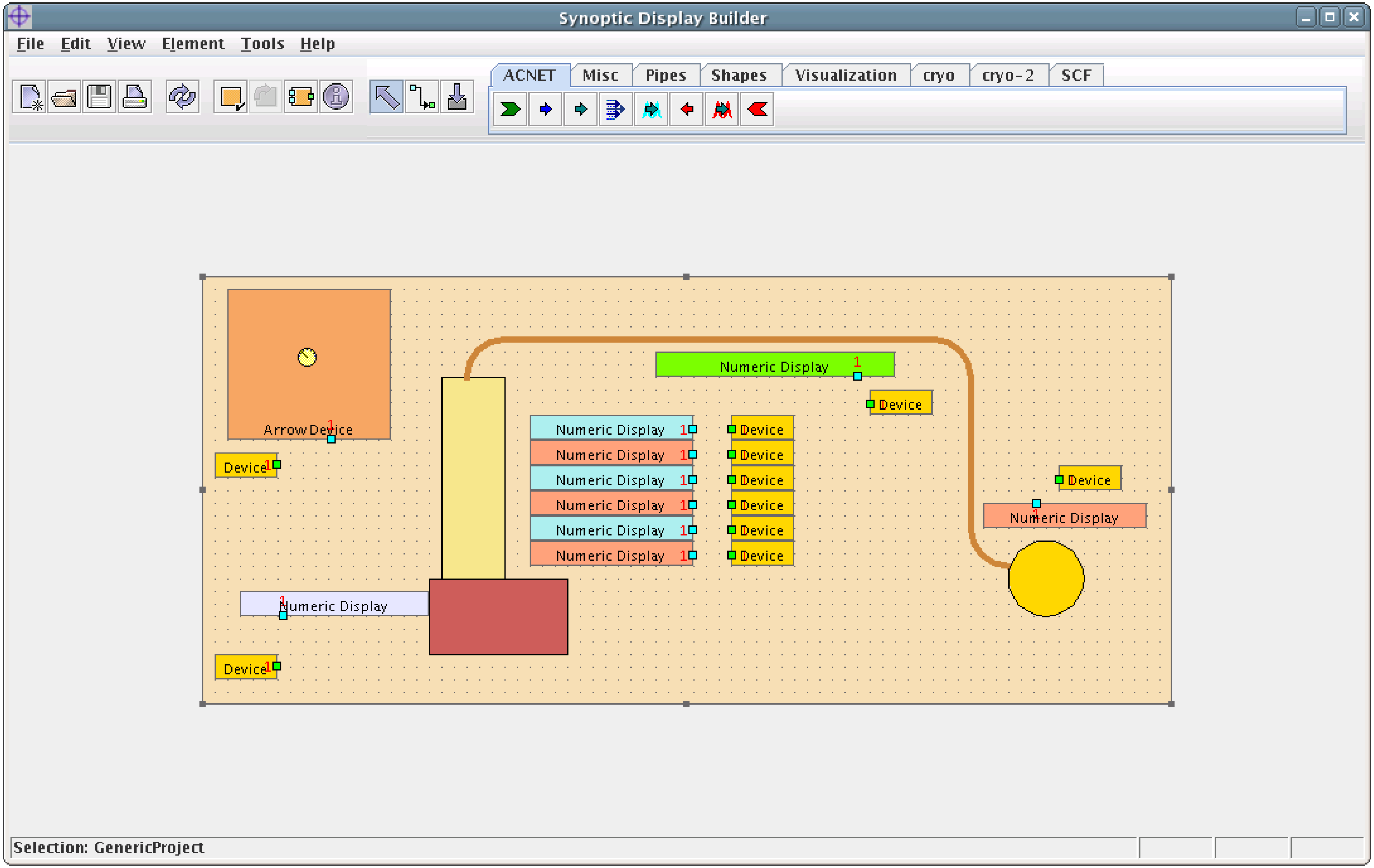
Property	Value
Stroke Color	black
Stroke Width	

Demo - Klystron, Step 8, More Components



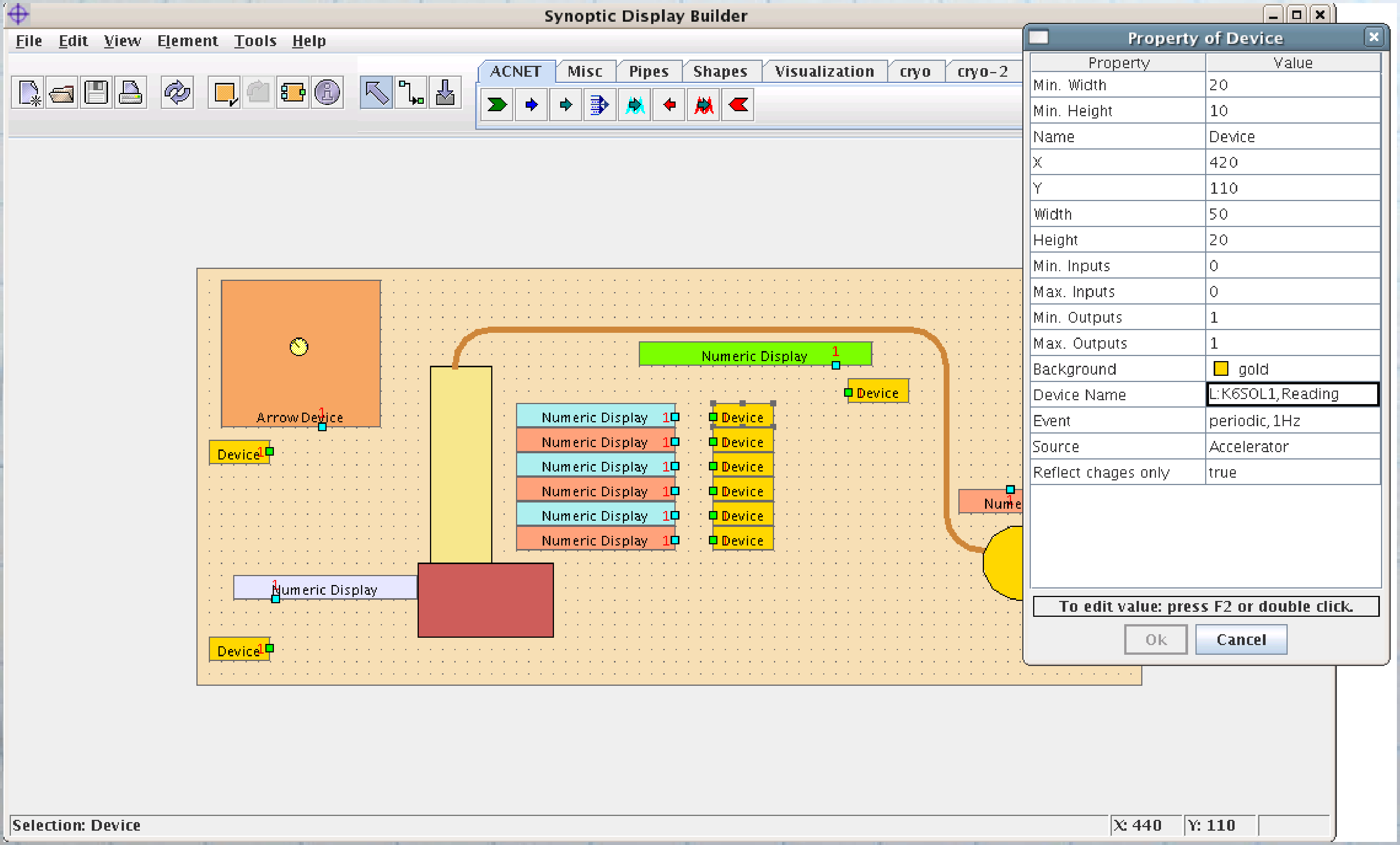
Selection: Numeric Display

Demo – Klystron, Step 9, More Devices



Selection: GenericProject

Demo – Klystron, Step 10, Setting Up Device



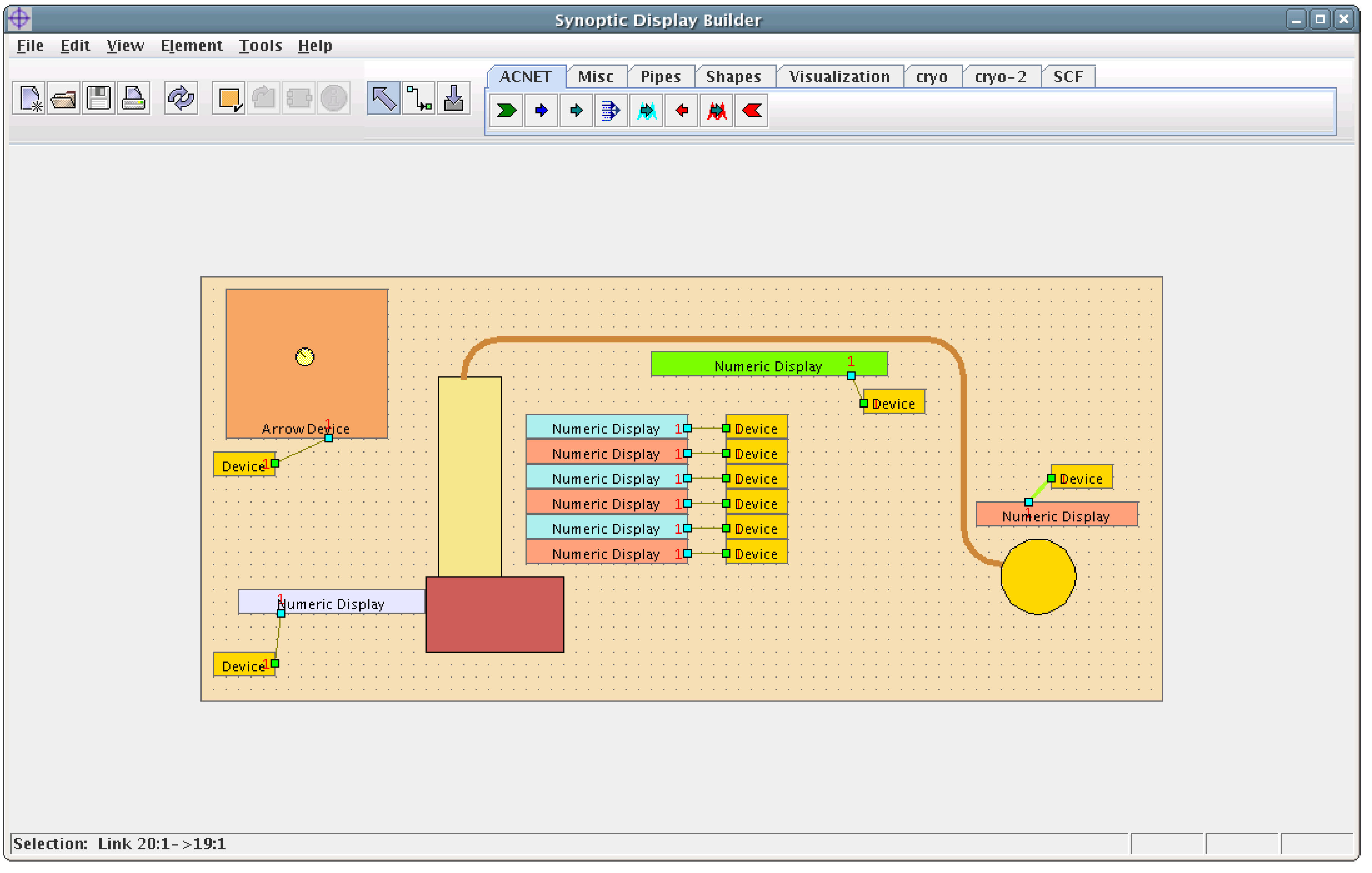
Property	Value
Min. Width	20
Min. Height	10
Name	Device
X	420
Y	110
Width	50
Height	20
Min. Inputs	0
Max. Inputs	0
Min. Outputs	1
Max. Outputs	1
Background	🟨 gold
Device Name	L:K6SOL1,Reading
Event	periodic,1Hz
Source	Accelerator
Reflect chages only	true

To edit value: press F2 or double click.

Selection: Device

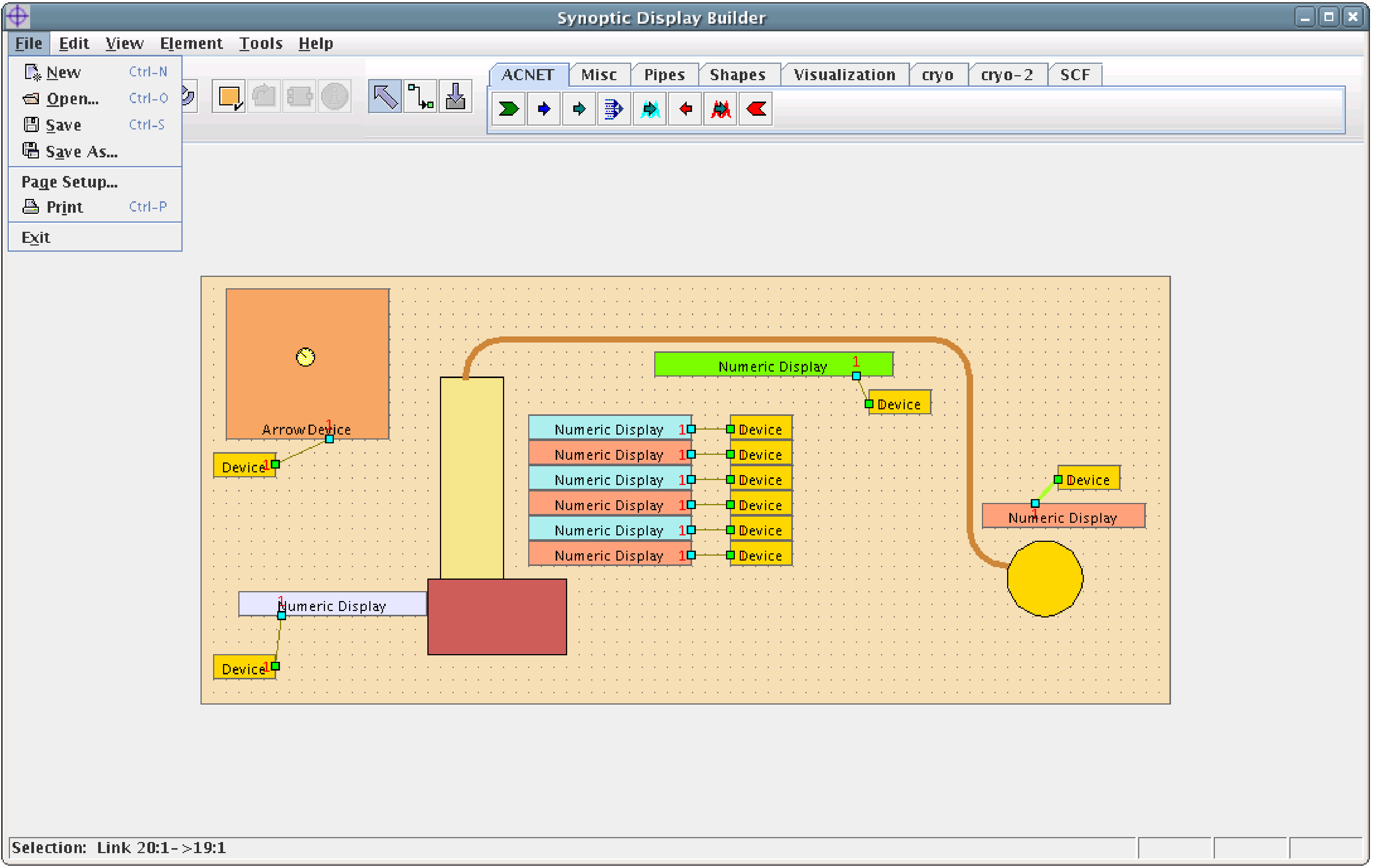
X: 440 Y: 110

Demo – Klystron, Step 11, Connecting



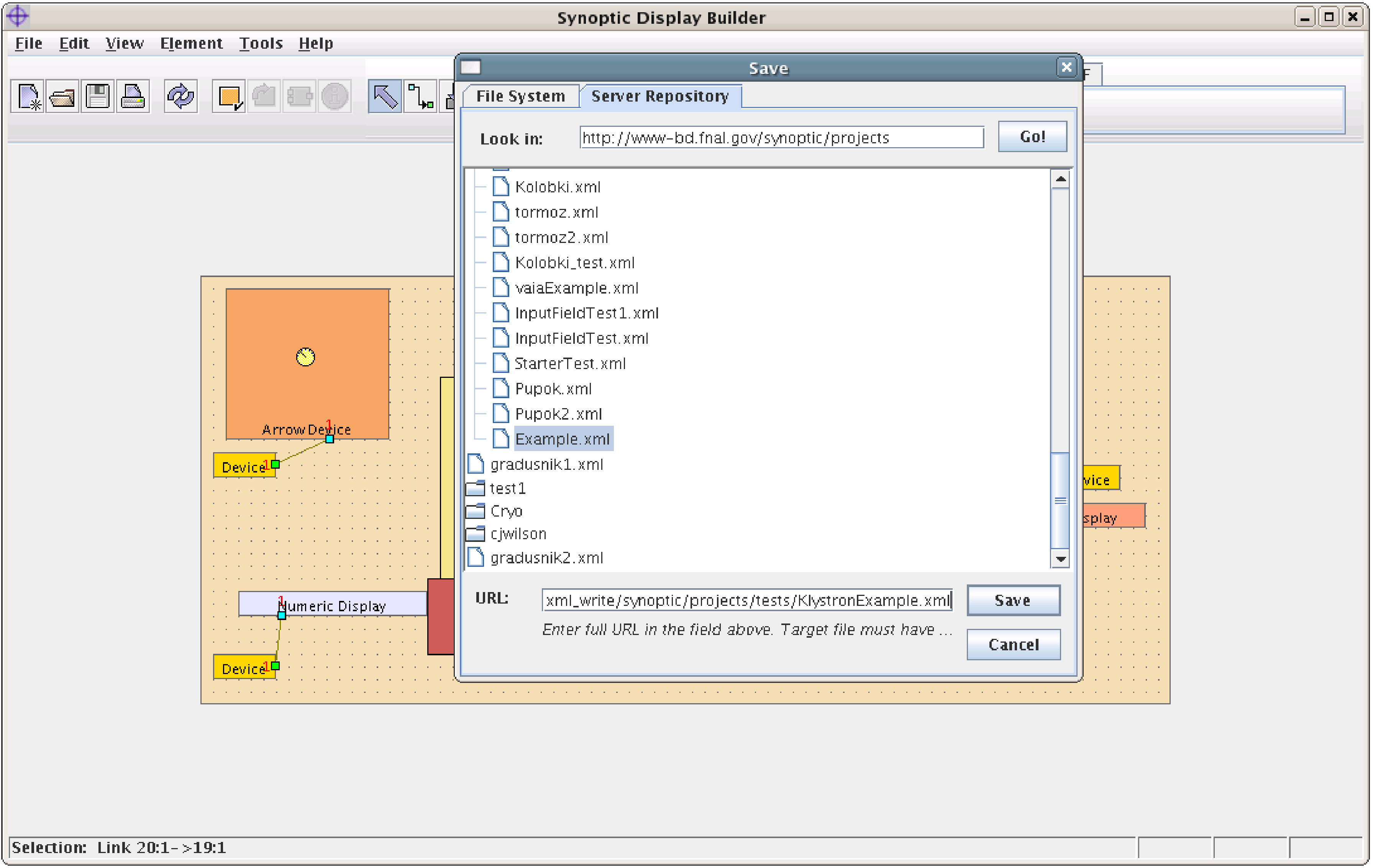
Selection: Link 20:1->19:1

Demo – Klystron, Step 12, Saving Project



Selection: Link 20:1->19:1

Demo – Klystron, Step 13, Saving Project 2



Look in: http://www-bd.fnal.gov/synoptic/projects

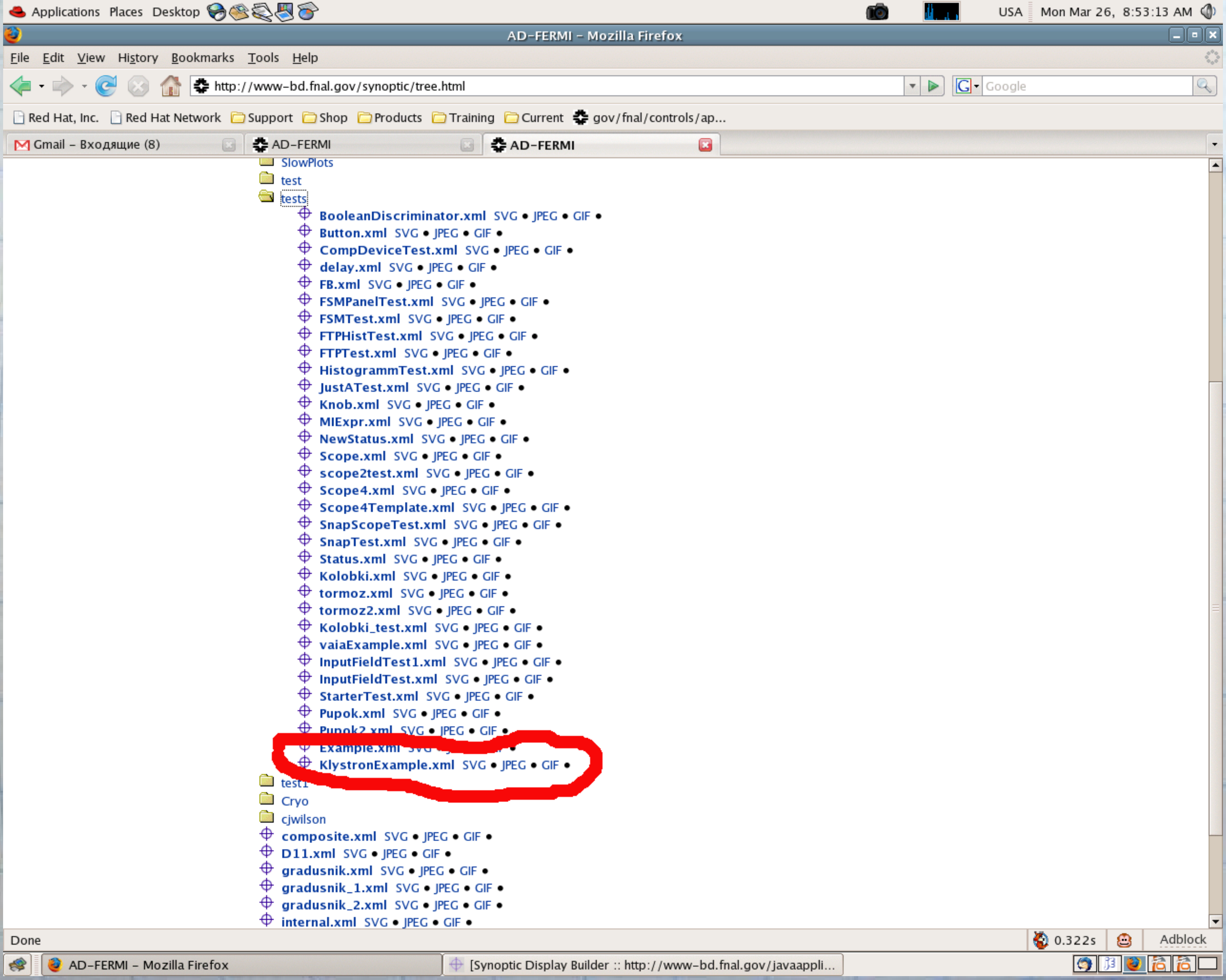
- Kolobki.xml
- tormoz.xml
- tormoz2.xml
- Kolobki_test.xml
- vaiaExample.xml
- InputFieldTest1.xml
- InputFieldTest.xml
- StarterTest.xml
- Pupok.xml
- Pupok2.xml
- Example.xml
- gradusnik1.xml
- test1
- Cryo
- cjwilson
- gradusnik2.xml

URL: xml_write/synoptic/projects/tests/KlystronExample.xml

Enter full URL in the field above. Target file must have ...

Selection: Link 20:1->19:1

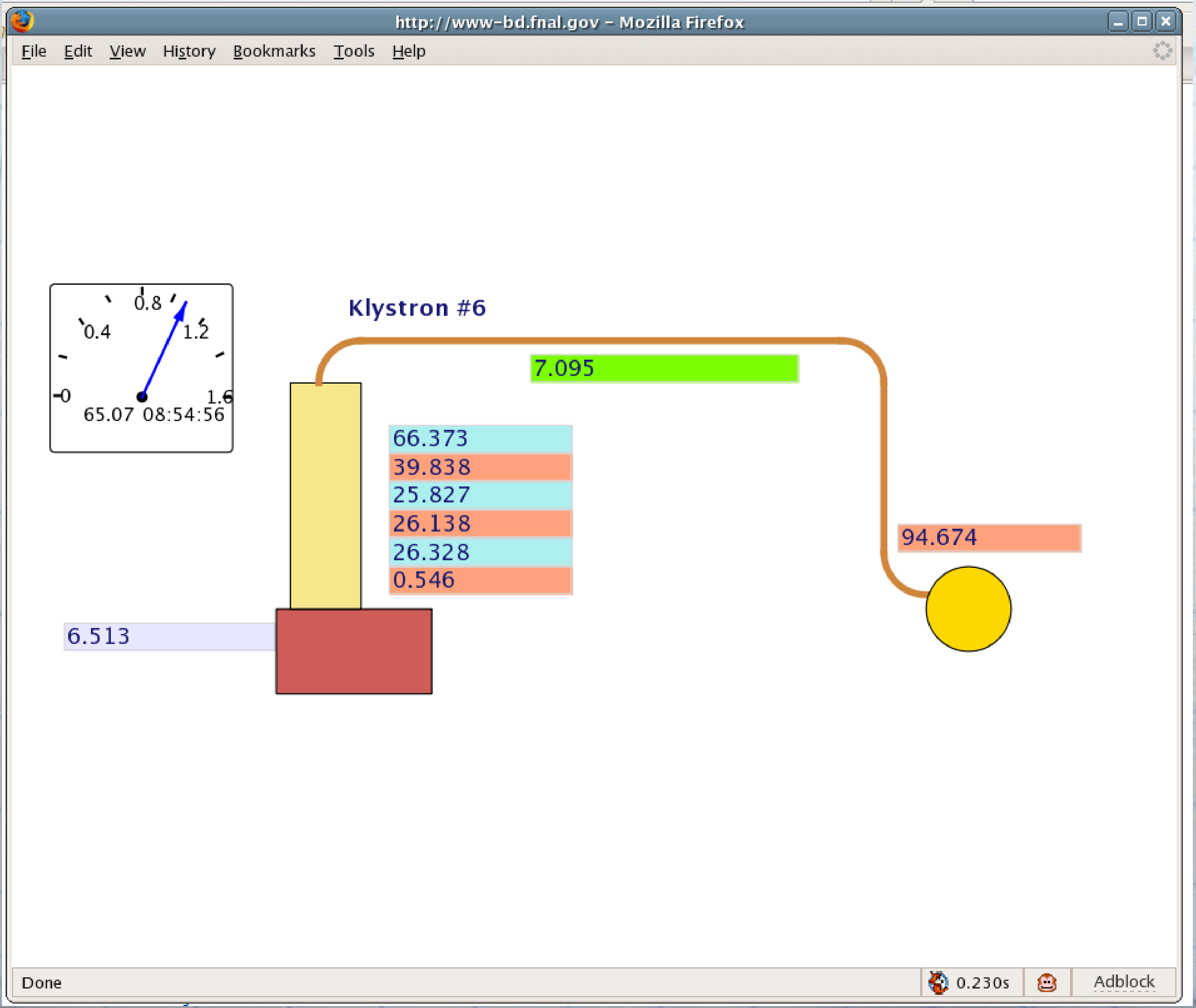
Demo – Klystron, Step 14, Projects Repository


Applications Places Desktop
USA Mon Mar 26, 8:53:13 AM
AD-FERMI - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://www-bd.fnal.gov/synoptic/tree.html
Google
Red Hat, Inc. Red Hat Network Support Shop Products Training Current gov/fnal/controls/ap...
Gmail - Входящие (8)
AD-FERMI
AD-FERMI
Done
0.322s
Adblock
AD-FERMI - Mozilla Firefox
[Synoptic Display Builder :: http://www-bd.fnal.gov/javaappli...

SlowPlots
test
tests
- BooleanDiscriminator.xml SVG • JPEG • GIF •
- Button.xml SVG • JPEG • GIF •
- CompDeviceTest.xml SVG • JPEG • GIF •
- delay.xml SVG • JPEG • GIF •
- FB.xml SVG • JPEG • GIF •
- FSMPanelTest.xml SVG • JPEG • GIF •
- FSMTest.xml SVG • JPEG • GIF •
- FTPHistTest.xml SVG • JPEG • GIF •
- FTPTest.xml SVG • JPEG • GIF •
- HistogrammTest.xml SVG • JPEG • GIF •
- JustATest.xml SVG • JPEG • GIF •
- Knob.xml SVG • JPEG • GIF •
- MIExpr.xml SVG • JPEG • GIF •
- NewStatus.xml SVG • JPEG • GIF •
- Scope.xml SVG • JPEG • GIF •
- scope2test.xml SVG • JPEG • GIF •
- Scope4.xml SVG • JPEG • GIF •
- Scope4Template.xml SVG • JPEG • GIF •
- SnapScopeTest.xml SVG • JPEG • GIF •
- SnapTest.xml SVG • JPEG • GIF •
- Status.xml SVG • JPEG • GIF •
- Kolobki.xml SVG • JPEG • GIF •
- tormoz.xml SVG • JPEG • GIF •
- tormoz2.xml SVG • JPEG • GIF •
- Kolobki_test.xml SVG • JPEG • GIF •
- vaiaExample.xml SVG • JPEG • GIF •
- InputFieldTest1.xml SVG • JPEG • GIF •
- InputFieldTest.xml SVG • JPEG • GIF •
- StarterTest.xml SVG • JPEG • GIF •
- Pupok.xml SVG • JPEG • GIF •
- Pupok2.xml SVG • JPEG • GIF •
- Example.xml SVG • JPEG • GIF •
- KlystronExample.xml SVG • JPEG • GIF •

test1
Cryo
cjwilson
- composite.xml SVG • JPEG • GIF •
- D11.xml SVG • JPEG • GIF •
- gradusnik.xml SVG • JPEG • GIF •
- gradusnik_1.xml SVG • JPEG • GIF •
- gradusnik_2.xml SVG • JPEG • GIF •
- internal.xml SVG • JPEG • GIF •

Demo – Klystron, Step 15, Display

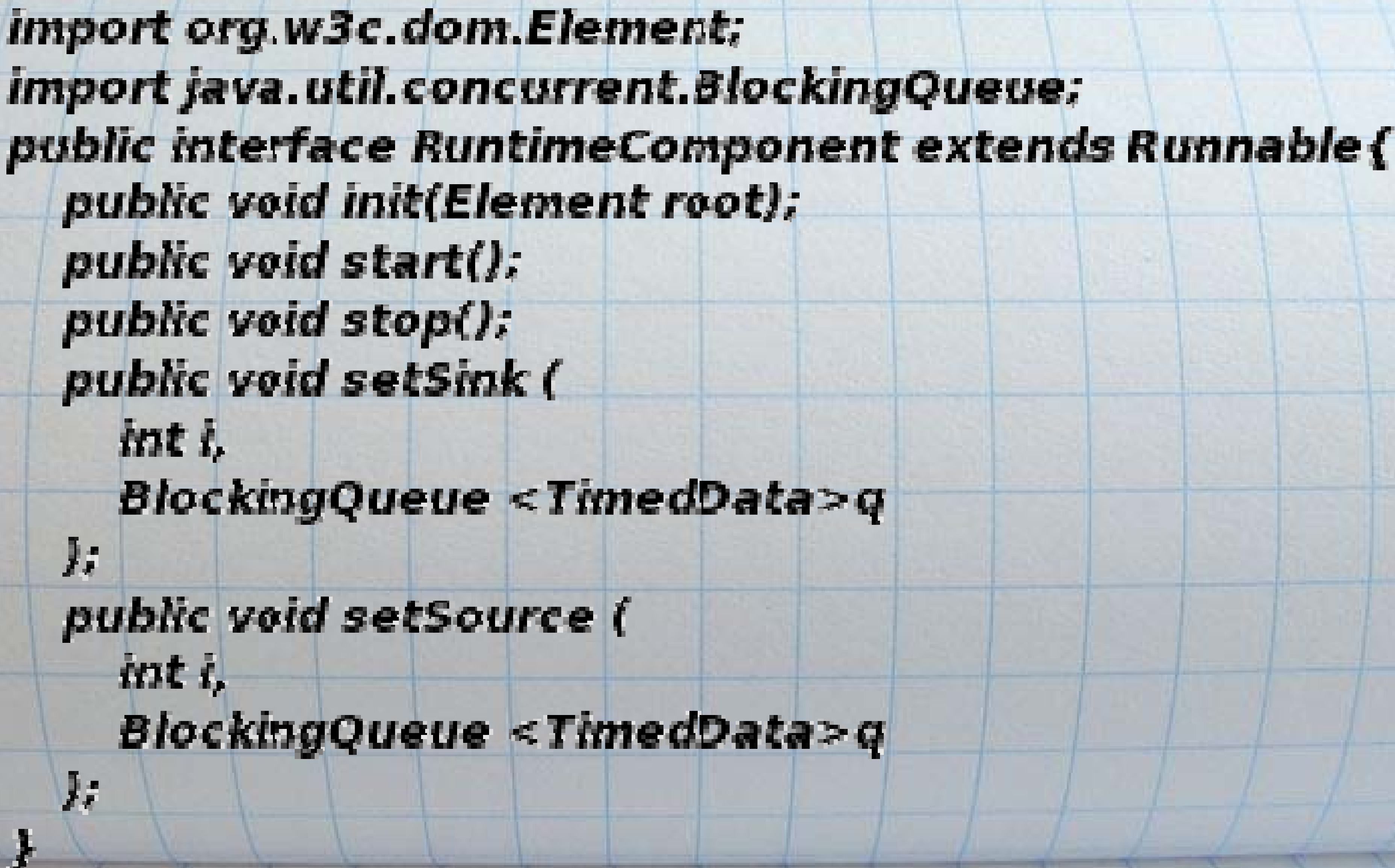


Architecture: Components-based.

- Software component is a system element offering a predefined service and able to communicate with other components.
- They do not share state and communicate by exchanging messages carrying data.
- Criteria:
  - Multiple-use
  - Non-context-specific
  - Composable with other components
  - Encapsulated i.e., non-investigable through its interfaces
  - A unit of independent deployment and versioning

Architecture: Components-based.

A **simpler** definition can be: ***A component is an object written to a specification.***

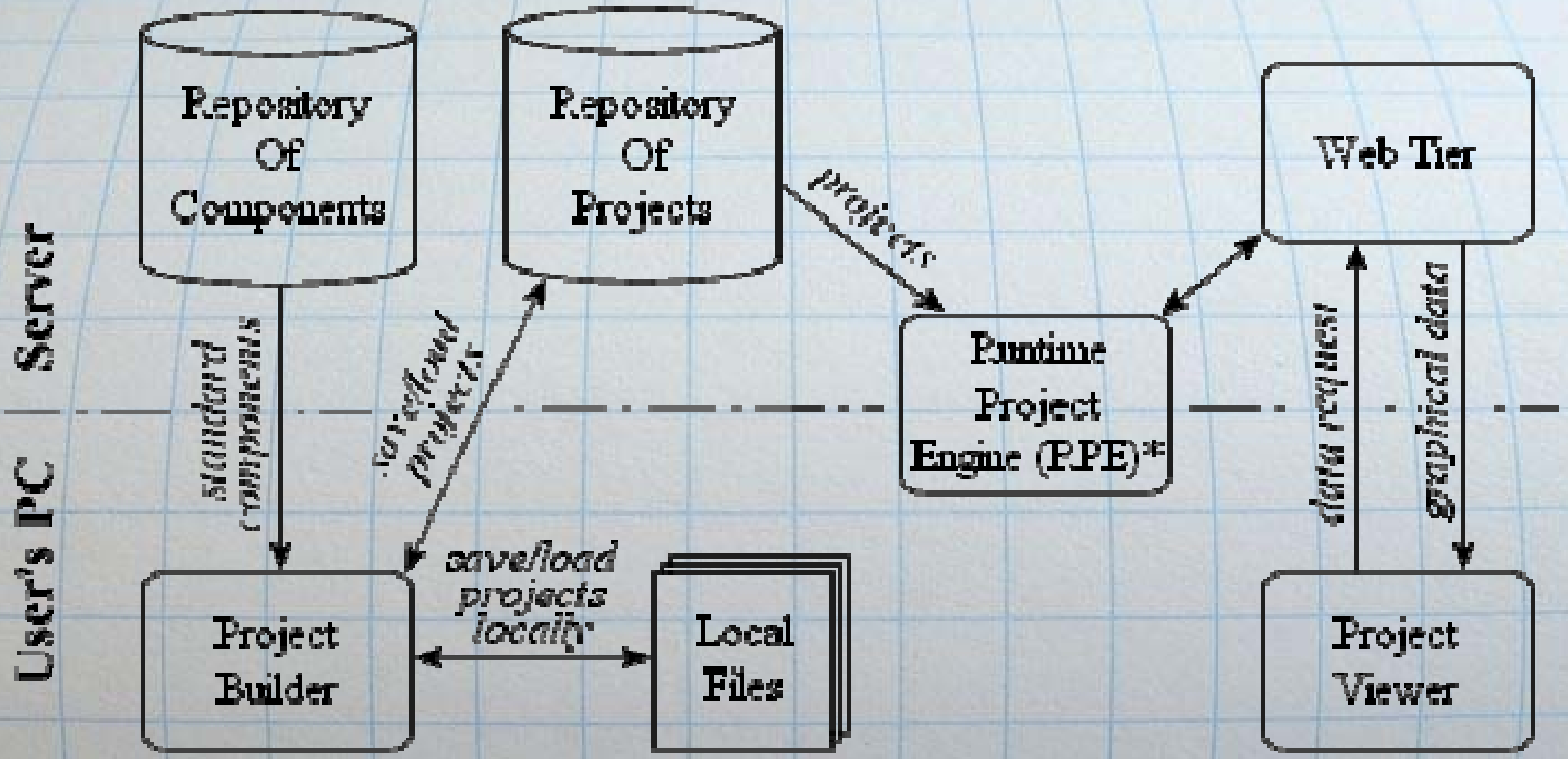


```
import org.w3c.dom.Element;
import java.util.concurrent.BlockingQueue;
public interface RuntimeComponent extends Runnable{
    public void init(Element root);
    public void start();
    public void stop();
    public void setSink (
        int i,
        BlockingQueue <TimedData>q
    );
    public void setSource (
        int i,
        BlockingQueue <TimedData>q
    );
}
```

Philosophy: Components libraries.

- Each component has only one function (e.g., simple and specialized).
  - Either **visualization** or data **acquisition**.
- TimedData travels via **connecting pipes**.
- Similar components are grouped into libraries:
  - Controls system interface (ACNET) : reading and writing data from hardware.
  - Visualization – formatted number, barrels with liquid level, plots, histograms, oscilloscopes, etc.
  - Data entry – input field and slider.
  - Static components – arcs, bars, specialized cryogenic symbols etc.
  - Processing pipes – components that process data and send it to visualization components.

Architecture



* RPE may be started either on server side or locally

Architecture

Project Builder

is a special-purpose graphical editor that allows users to define logical flows of information from data sources to data consumers through data handlers and pipes.

Repositories of Components and Projects

Runtime Project Engine

downloads project XML files from the repository and starts project as Java application.

Web Tier and Project Viewer

Upon the first user request, Web Tier sends the full SVG image to the client. On all subsequent requests, Web Tier sends just a difference between current image and the previous one.

Why redesign ?

Any Java application written in 2001 should be refactored to accommodate new language features and new standard libraries.

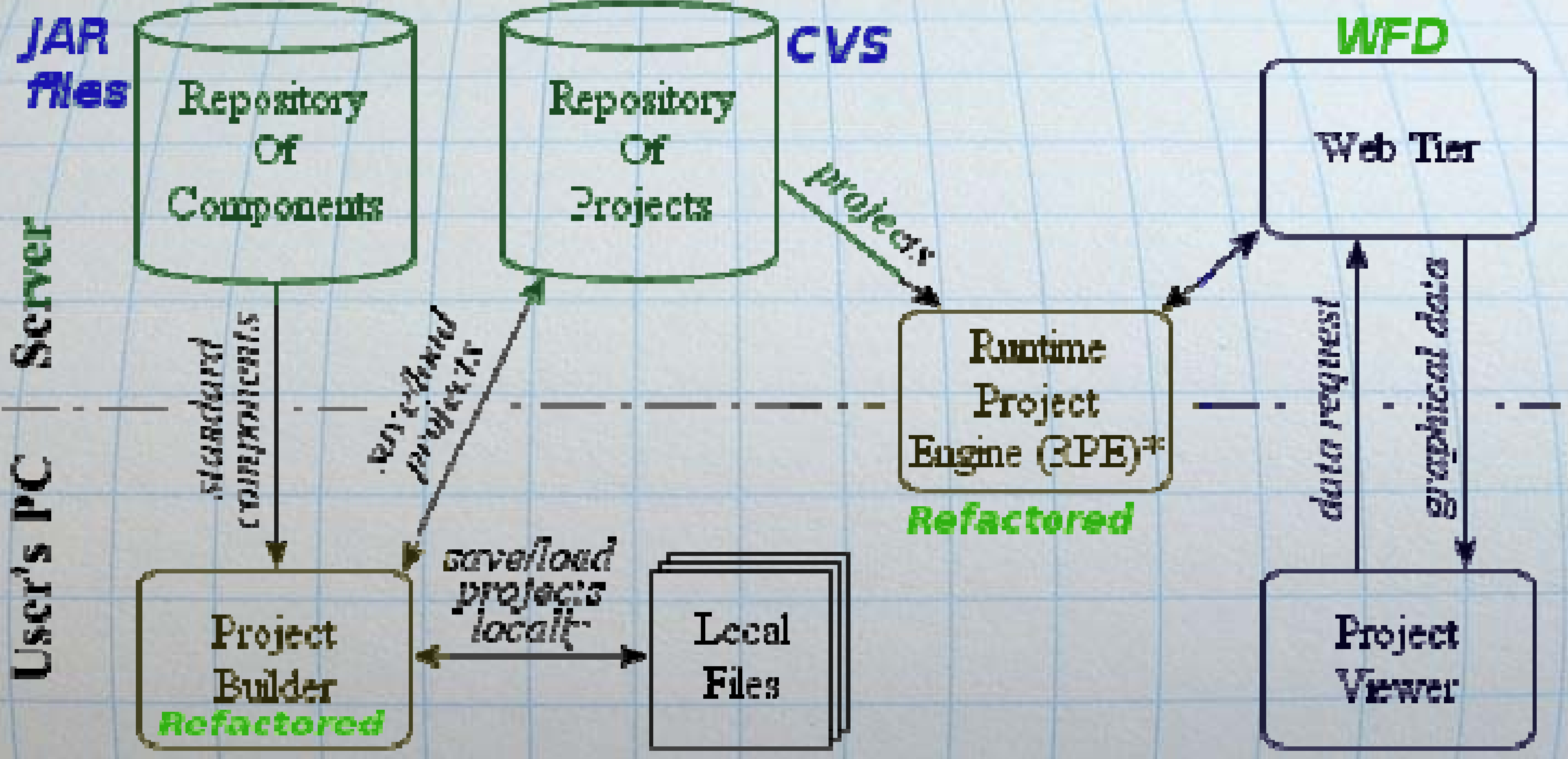
LAFS (LHC At Fermilab Software) group was formed in Fermilab in Autumn 2006.

LAFS Goal - share experience & software with CERN and learn from new CERN control system.

Drag and Drop web tier was separated into independent project and implemented.

Requirements for new version of Drag and Drop Display and Builder are discussed right now.

Changes in Architecture



* RPE may be started either on server side or locally

WFD - Web Fixed Displays.

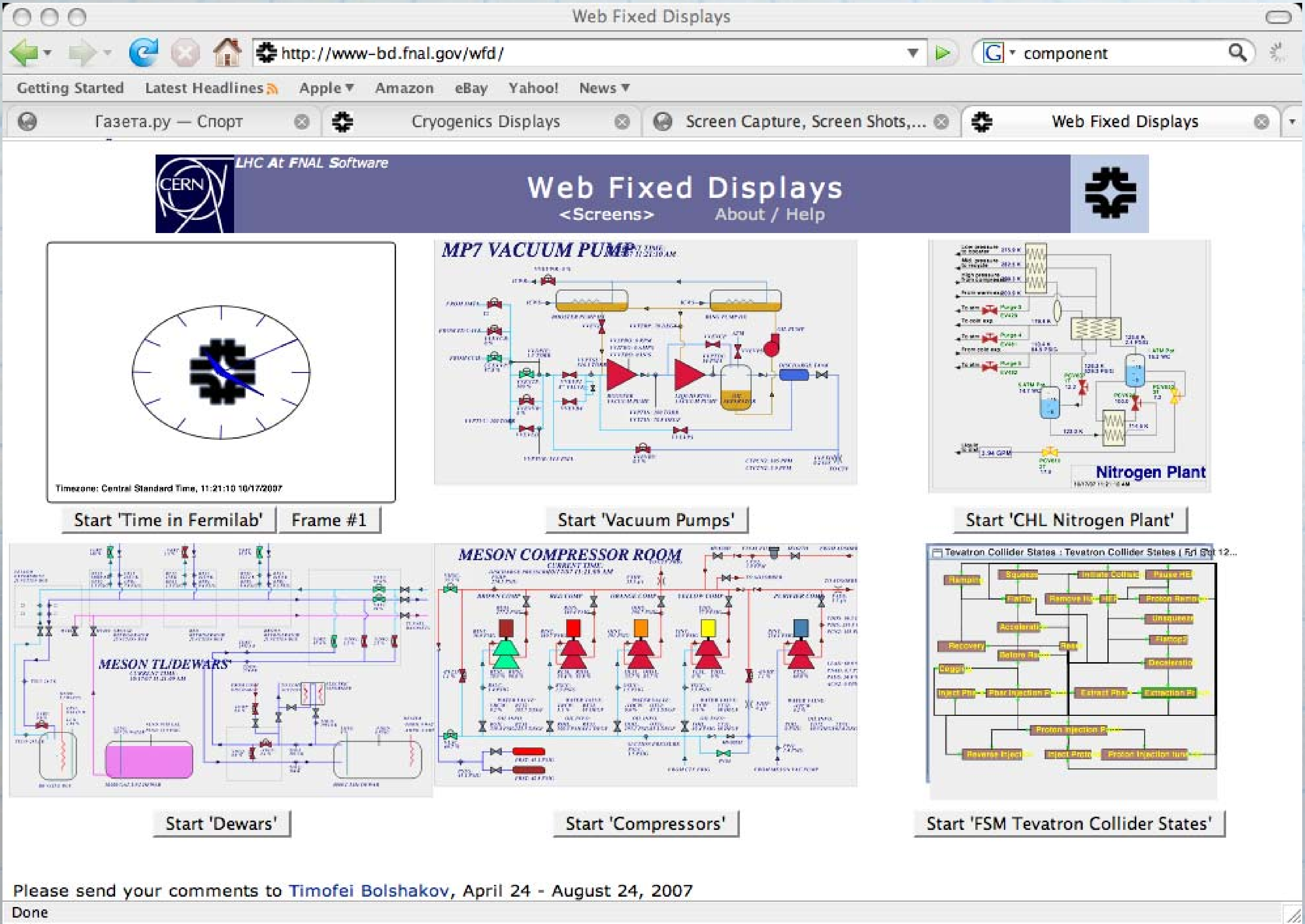
The web-tier was refactored and called Web Fixed Display (WFD).

CERN developers reviewed and modified Requirements and controlled quality of the implementation.

New features:

- WFD shows ANY Java Swing- or AWT- based application on the web and works with multiple frames.
- WFD allows every application to have a separate classpath.
- WFD has a live index page.
- Application is described in a property file.

http://www-bd.fnal.gov/wfd



LHC At FNAL Software

Web Fixed Displays

<Screens> About / Help

Please send your comments to Timofei Bolshakov, April 24 - August 24, 2007

WFD – How does it work.

WFD has 2 major parts – server side Java web application and client side AJAX Javacript.

Server side ApplicationManager (AM) starts preconfigured applications and produces Scalable Vector Graphics (SVG) images of these applications by periodical rendering them on special SVGGraphics2D.

SVG is a convenient graphical format – it is an XML W3C standard. Text in SVG:

```
<text class="cls33" id="849" x="2" y="14">
    ACN2:  0.7 PPM
</text>
<path class="cls11" id="863"
        d="M879 114 L854 94 L854 114 L879 94 zM879 114 "/>
```

WFD – How does it work.

Client side AJAX script downloads SVG image of application once.

After that it starts to request the differences from the server. Difference comes in following format:

<changes id=”849” content=”ACN2: 0.6 PPM”/>

<changes id=”863” attr=”d”

content=”M879 114 L854 94 L854 114 L879 94 L880 102 z“/>

And AJAX script changes SVG elements on client side using DOM API.

As you may see it is very economical way of updating live graphical web page! With just hundreds bytes per second you got rich updating picture!

Acknowledgments

To David McGinnes

for managing LAFS workgroup and

encouraging DnD redesign.

To Jakub Wozniak

for working from CERN side on WFD.

Thank you for your attention.