# Image Browser for ePIC

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# **Goals of ePIC Early Science**

As John emphasized earlier, early science should be meaningful and impactful. What does this mean from a purely software perspective?

# Meaningful

Engage our community, facilitate deeper scientific insights, and provide enjoyable tools

interested in.

### Early Science should be *Meaningful* and *Impactful*

- What do I mean by this?
- Meaningful: The EIC early science program must engage the collaboration; it must get the collaboration excited about working hard for the future. It must have a balance of *breadth* and *depth*.
- *Impactful*: The EIC early science program must take the first steps down the path to realizing the EIC science goals.

### Impactful

Directly advance science, validate results efficiently, quickly produce and communicate new results

Good software directly supports these goals -- streamlining your workflow, removing frustrations, and allowing you to focus more on the science you are





# How do we design good software that is actually used?

It starts with empathy-- understanding what users experience in their day to day work. My first step when designing software is understanding the current users, their needs, and what they are trying to do.

### Who are our end users?

Primarily physicists -- professors, staff scientists, post docs, and graduate students with varying levels of software development expertise.

Various groups -- working groups, detector experts, software experts, shift crews (eventually). Each group has unique workflows and requirements.



"We will understand our users better than any other company"

Mike Markkula · 1977



# User Workflows: Generating and sharing results

My workflow as a Ph.D. student:

### Make some plots

Probably with a name likeh2, h2\_new, h2\_<cut

name here>

# Write a ROOT macro

### Save them locally

It likely isn't pretty but it works

Somewhere on my desktop, usually not in any smart, east-to-find place

### Add to Slide Deck(s)

Fill slide deck with multiple histograms with varying cuts to convince my advisor we know what is going on

# Something

Add to Indico, send to advisor/collaborators, redo analysis, etc, etc





# Scalable User Workflows: Production Campaigns and CI/CD

Good software fits naturally into your workflows, rather than forcing you to adapt to it. Aligning our design to your actual workflows increases productivity and doesn't further burden anyone.

# **Obtain ROOT macros** from working groups

This is hard -- working groups might not know what they want to look at, end users might not want to share their macros

# Make some plots

Run macros over latest simulation campaigns OR produce via CI/CD system



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# **User Interface/User Experience**

### **User Interface**

Space where a human interacts with a technology or digital product, often through a screen

# **User Experience**

Overall experience a user has when interacting with a product, service, or system. Encompasses how easy and intuitive the product is to use, how relevant the content is, and how the user feels about the interaction.



# **Design System for ePIC**

Set of reusable components and patterns for designing and building UIs as well as guidelines on when and how to use them

Benefits: Consistency, Scale, Reusability, Clarity

# Material Design

Material 3 is the latest version of Google's open-source design system. Design and build beautiful, usable pro-

### Get started

# Build fast, responsive sites with Bootstrap

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### Design

Overview Pathway

### **Human Interface Guidelines**

Learn essential information about platforms, foundations, patterns, components, inputs, and technologies. The HIG offers guidance and best practices for designing exceptional user experiences across all Apple platforms.

Explore the Human Interface Guidelines



Sans Serif font HEX/RGB codes for Red (#FF0000) and Blue (#0058FF)





# Components

Reusable components I've created already (not including the logo)

### image card modal

# image card





### filter sidebar

Discover

Campaign

Plot Type

Geometry

Energy

MinQ2





# **Components v2**

Because sometimes design is more fun than writing/debugging javascript



Photon energy resolution as a function of energy in different \eta ranges. The energy resolution was calculated by dividing \sigma by m,

	Campaign: MinQ2
More Info	🕁 Download 🛛 🛈 More Info



# **Core Features to Provide**

Software that aligns with user workflows amplifies productivity

### Discovery

Quickly searching and retrieving specific images

# Visualization

Efficiently exploring large volumes of images in a structured manner

Good design can streamline discovery and facilitate meaningful collaboration. Easy collaboration and sharing ensures results can be quickly validated and refined.

### Collaboration

Sharing relevant findings seamlessly within groups

# **Diagnostics**

Identifying and flagging anomalies or data quality issues



# **Image Browser for Simulation Campaigns**

Publicly available web-based application for exploring and validating image based data. Available here: eic.jlab.org/epic/image\_browser.html



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Campaign 24.02.0 24.03.1 24.04.0 24.05.0 24.06.0 24.07.0 24.08.1

### Plot Type

All Generated Jet Eta Generated Jet Phi vs Eta Generated Jet Pt

Geometry

Beam Energy

MinQ2

# **Search and Filtering**

It can be difficult to find relevant images and plots from various working groups.

Sidebar

Rapidly identify the data you need, by working group, campaign, plot type, etc





Campaign 24.02.0 24.03.1 24.04.0 24.05.0 24.06.0 24.07.0 24.08.1

epit

Plot Type

All Generated Jet Eta Generated Jet Pt

Geometry

Beam Energy

MinQ2

# **Organized**, Interactive Viewing

Once you've filtered your results, you can view images that meet the selection criteria in a grid for easy comparison

Image cards are sorted by campaign and Q2 value, with optional ascending/ descending order

### Home Physics Detector CI



### Image card grid





# **Easy Sharing**

One-click sharing of plots and entire filtered collections

epi

Campaign

24.02.0 24.03.1 24.04.0 24.05.0 24.06.0 24.07.0 24.08.1 Plot Type All Generated Jet Constituent Energ Generated Jet Constituent Energy Generated Jet Constituent Eta Generated Jet Pairwise Constitu Generated Jet Constituent Phi vs Generated Jet Constituent Phi vs Generated Jet Energy vs Eta Generated Jet Energy vs Eta, No Generated Jet Eta Generated Jet Phi vs Eta Generated Jet Phi vs Eta, No Ele Generated Jet Pt Matched Gen-Reco Jet Delta R Matched Jet Resolution vs Energ Matched Jet Resolution vs Energ Fit Summary: Matched Jet Resolu Matched Jet Resolution vs Energy Fit Summary: Matched Jet Resolu Matched Jet Resolution vs Energy

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2255 Images

Geometry

Beam Energy

MinQ2



Sort by 🗸





# Diagnostics

Eventually, we can utilize annotation and/or labeling for diagnostics

### annotate card prototype





# **User-Centered Design Process**

### **Iterative development**

Continuous cycles of feedback and refinement with end-users

# Rapid prototyping + user testing

Come up with new feature implementation

Have users test new implementation

Frequent engagement ensures alignment with your needs

### **Example improvements**

Readable image names

Most recent campaigns/pipelines shown by default

Sharing links to the page with filter selections pre-applied



# Path Forward: Building Together

# How to get images on the page

If you have made the same plot more than once for different campaigns, we should probably automate that.

Likely solution: web form + existing repository for code

### **Commitment to empathy**

The design is centered around understanding your experiences, workflows, and goals.

### Feedback

Encourage collaboration and feedback. I very much value your critiques -- if I know something isn't working well, we can fix it together.



# **Summary and Invitation**

### **Image Browser**

Enables exploration and validation of simulated data produced from campaigns and the CI/CD system

# **Community Feedback**

Your input guides the development of this tool. It should be built based on current user needs and goals.

# Scaling for the future

Eventually we will have real data to look at in both online and offline settings, we can work together to ensure relevance for future use cases.





# **Full Stack Infrastructure**

# MySQL database



Relational database that stores a lot of information about the images (Name, Description, Working) Groups, References, Comments, Labels, etc etc)

### PHP

Used to communicate (read from/ write to) with the database

### **Front End**

Written in plain old javascript, HTML, and CSS. Find code in github.com/ eic/image\_browser and via browser **Developer Tools** 

