

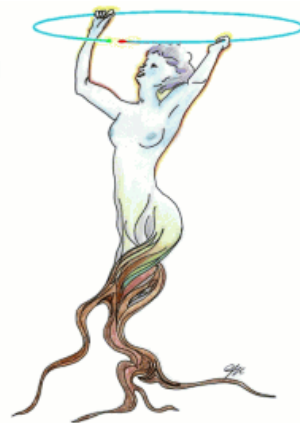
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## The next episode in the UAL and ROOT integration

V. Fine, N. Malitsky, R. Talman

# ROOT

An Object-Oriented  
Data Analysis Framework



## Unified Accelerator Libraries

Make your own way

# Abstract

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The episode introduces a new package integrating UAL simulation algorithms with the Qt-based GUI and an open collection of ROOT analysis and visualization components. The primary user application is implemented as an interactive and configurable Accelerator Physics Player whose extensibility is provided by plug-in architecture. Its interface to data analysis and visualization modules is based on the Qt layer supported by the Star experiment.

# Outline

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- Prologue: Unified Accelerator Libraries**
- Episode I: API interface**
- Episode II: Interactive Analysis Extension**
- Sequel**

# Prologue: UAL Objectives

ICAP 1996

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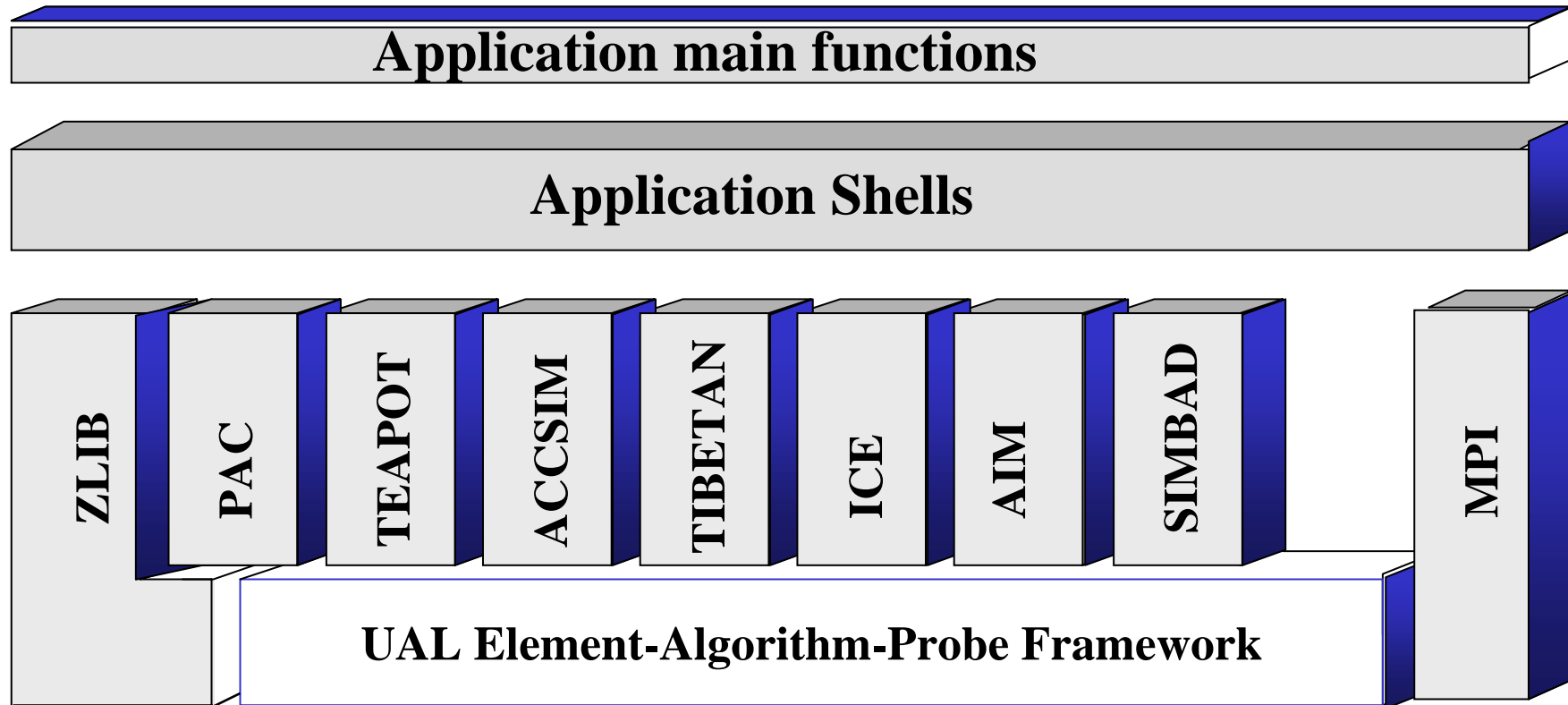
- ❑ Form a customizable and extendable environment adaptable to new accelerator applications and conceptual models
- ❑ Facilitate development, deployment and reuse of diverse independently developed accelerator programs
- ❑ Integrate accelerator conceptual models and analysis patterns with modern technologies and software

# UAL Environment

<http://www.ual.bnl.gov>

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CINT vs Perl



# Episode I: User-oriented API

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```
// Declare UI Interface
UAL::QT::PlayerShell shell;

// *****
cout << "Read the ADXF file (lattice description)." << endl;
// *****
shell.readADXF(Args() << Arg("file", latticeFile));
...

// *****
cout << "Read the APDF file (propagator description)." << endl;
// *****

shell.readAPDF(Args() << Arg("file", apdfFile));

// *****
cout << "Generate a bunch distribution." << endl;
// *****

shell.setBunch(Args()
    << Arg("np", 10000)
    << Arg("enx", 15.0e-6)
    << Arg("eny", 15.0e-6)
    << Arg("ctMax", 2.0)
    << Arg("deMax", 1.0e-3)
    << Arg("seed", -100));
```

### Evolution:

**1994:** C++ API

**1996:** Perl API

**1998:** Perl API + SXF lattice file

**2003:** Perl API + SXF lattice file  
+ XML-based propagator file

**2004:** C++ API + SXF lattice file  
+ XML-based propagator file

**2005:** C++ API + XML-based  
lattice and propagator files

### C++ with CINT vs Perl/Python:

**Pros:** debugging, maintenance

**Cons:** none

# Programming Languages (PL)

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Feature \ PL	C++	CINT	Perl	Python
Standard PL	★★★★★	★★★★	★★★★	★★★★
Debugging	★★★★★	not tested	★★	★★
C++ from PL	★★★★★	★★★★	★★★	★★★
PL from C++	★★★★★	not tested	not tested	not tested
Maintainable	★★★★★	not tested	★★	★★
Human-friendly (in general)	★★★	★★★	★★★	★★★
Human-friendly containers	★★★	★★★	★★★★★	★★★★★
Light scripting		★★★★★	★★★★★	★★★★★

# Rapid prototyping with light scripting

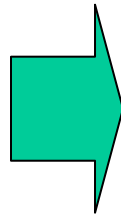
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## Rapid prototyping scenario:

### Perl/C++

1. Design of Perl application-specific packages
2. Implementation of these packages
3. Partial debugging
4. Test
5. Use with **light scripting** of the main script
6. Rewriting into C++



### CINT/C++

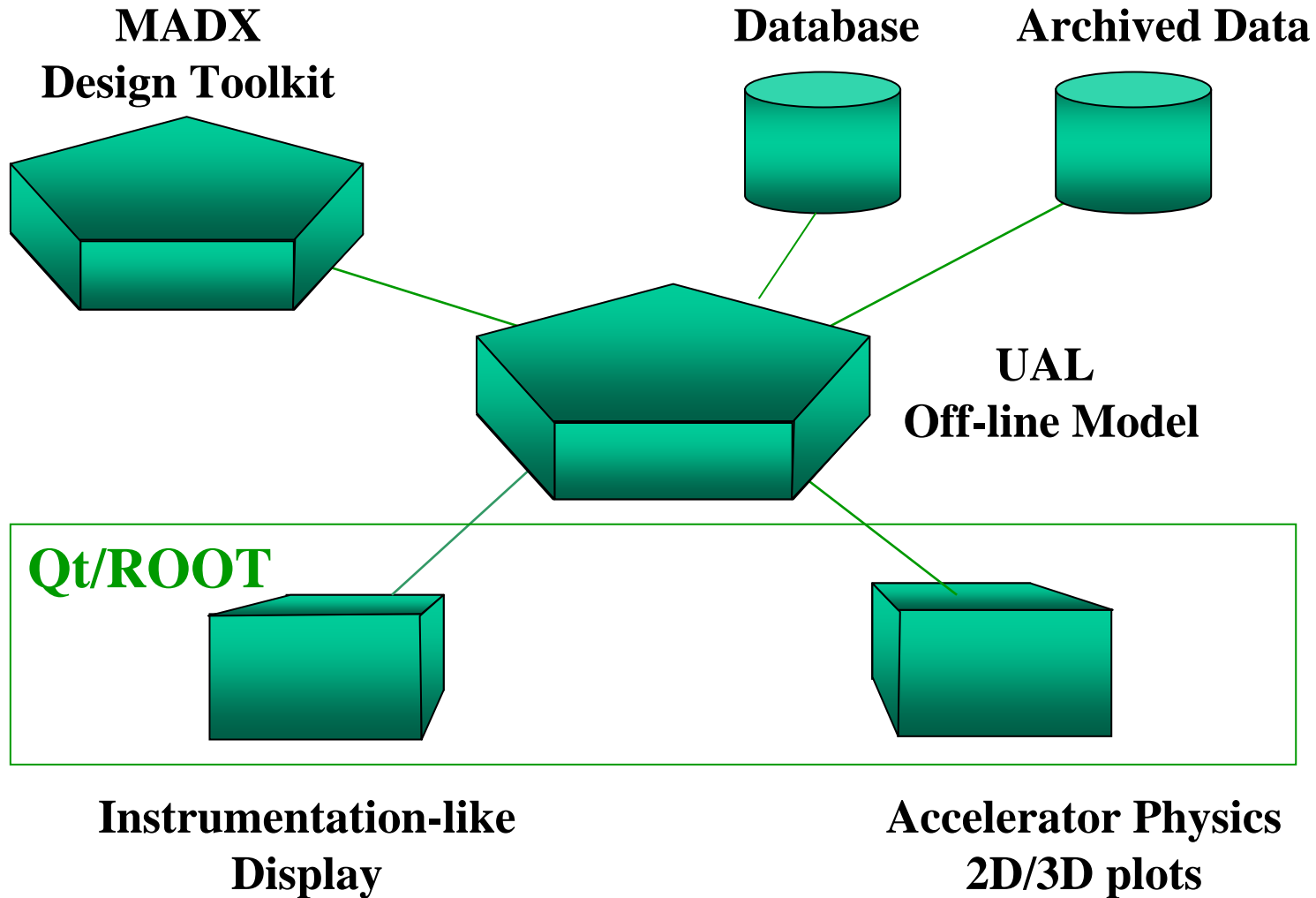
1. Design of C++ application-specific classes
2. Implementation of shared library
3. Debugging
4. Test
5. Use with **light scripting** of the main function.



# MADX-UAL-ROOT Off-line Facility

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# Episode II: UAL Interactive Analysis Extension

## Objectives

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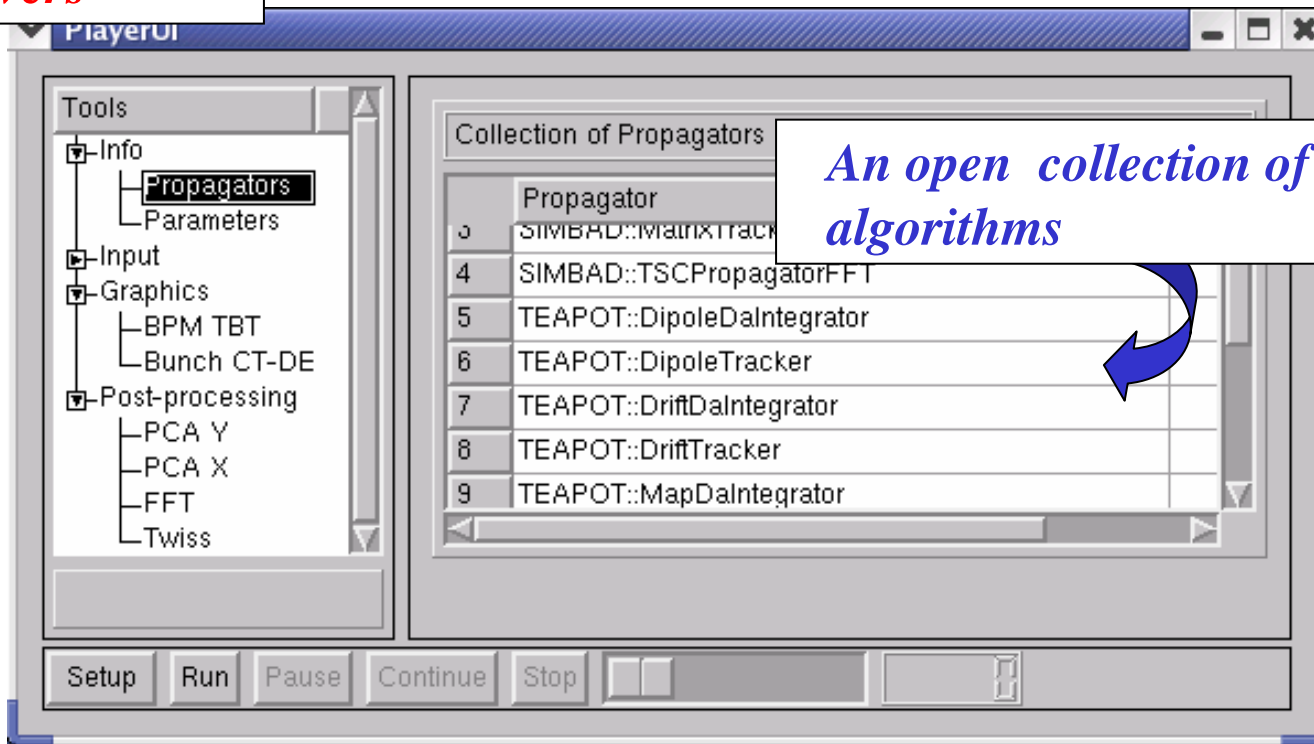
- ❑ Bring the UAL off-line applications to the RHIC online environment for analyzing accelerator physics experiments and operational data.
- ❑ Facilitate modeling and analysis of multi-particle applications, such as beam-beam and space charge effects, instabilities, cooling, *etc.*)

# Accelerator Physics Player

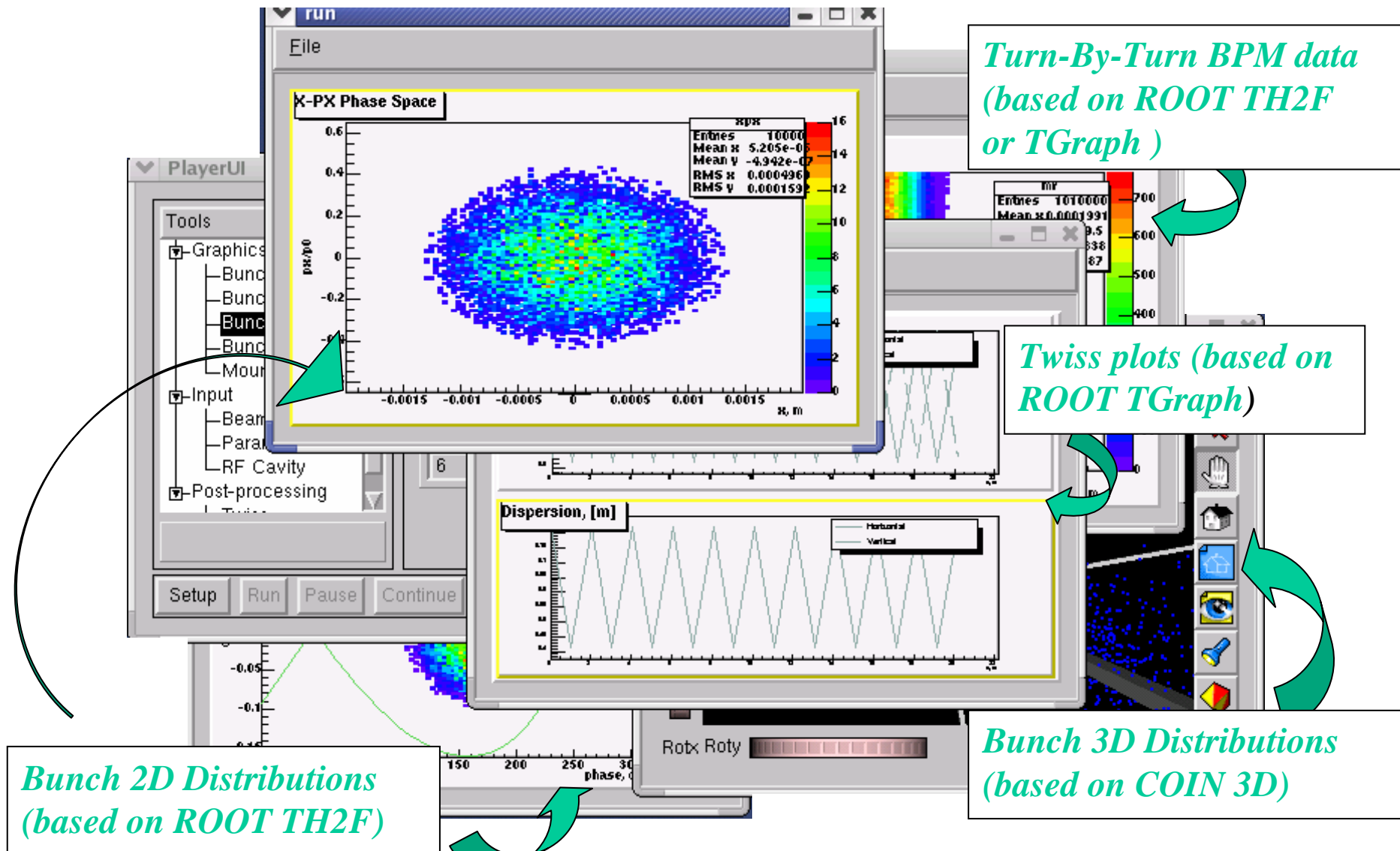
```
UAL::USPAS::BasicPlayer* player = new UAL::USPAS::BasicPlayer();  
player->setShell(&shell);  
  
qApp.setMainWidget(player);  
player->show();  
qApp.exec();
```

*An open collection  
of viewers*

*An open collection of  
algorithms*

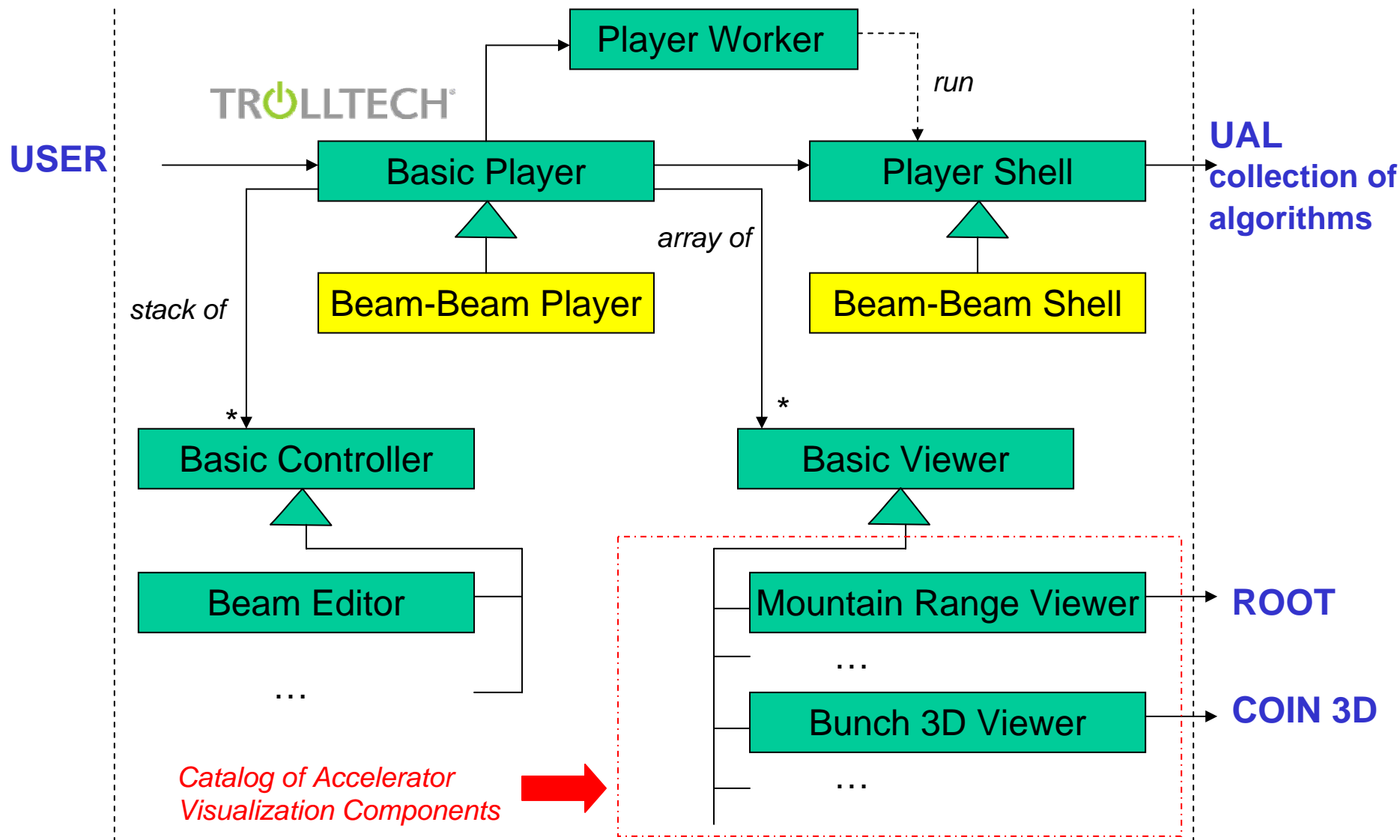


# Examples of the Accelerator-Specific Viewers



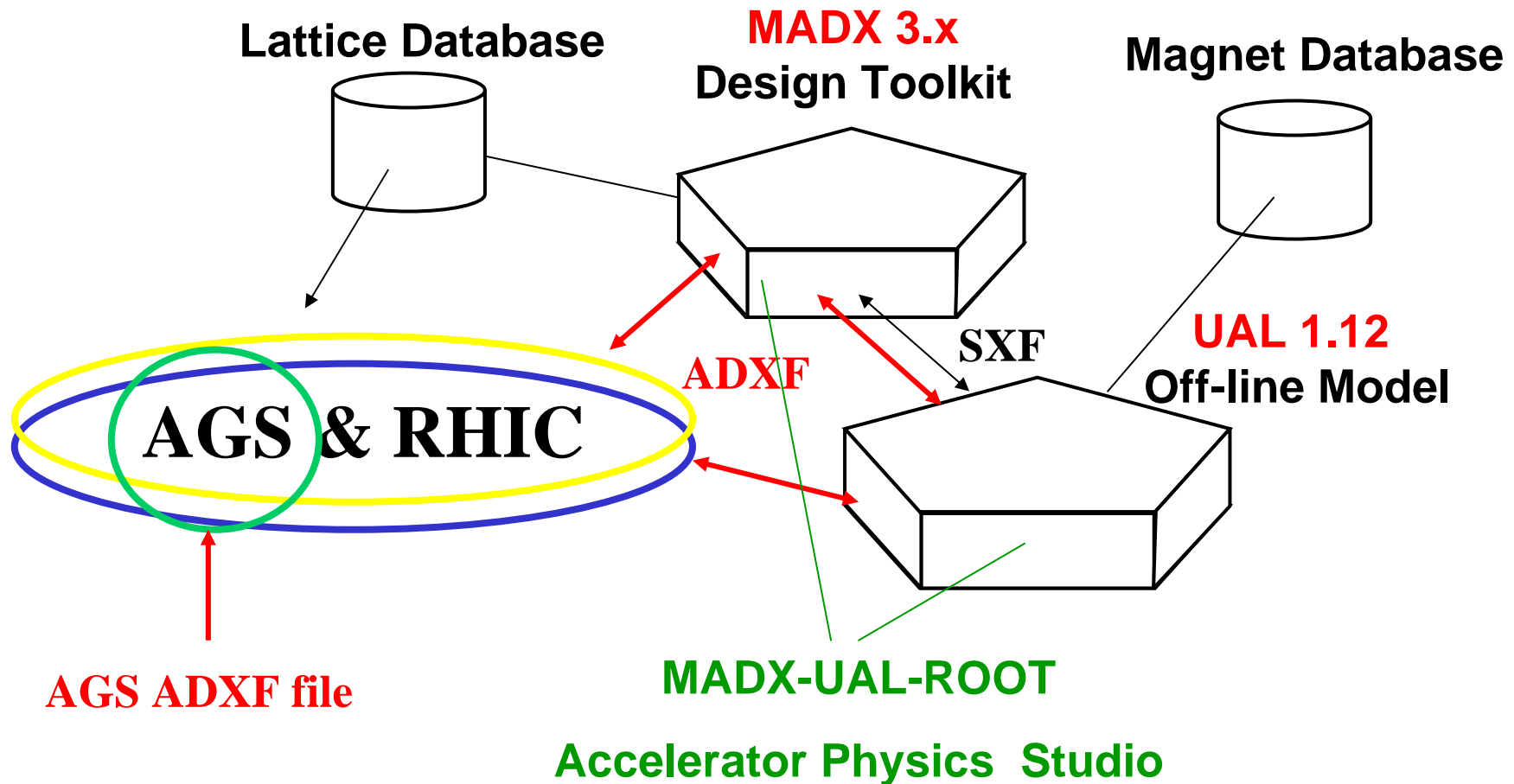
# Interactive Analysis Extension

## Architecture



# AGS and RHIC Online and Offline Models based on MADX-ADXF-UAL suite

(MAD-X Day, Sept. 23, 2005)



## Sequel: What would be Next ?

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