



Geant4 Model Testing Framework: From PAW to ROOT

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Summer Student Presentation

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Introduction

- ▶ **Project**

- ▶ PAW to ROOT translation of several .kumac macro files in order to build a framework/tool for Geant4 models testing
- ▶ Building an underlying unified database for the models testing

- ▶ **PAW: Physics Analysis Workstation**

- ▶ Provides interactive graphical presentation and statistical or mathematical analysis (FORTRAN)

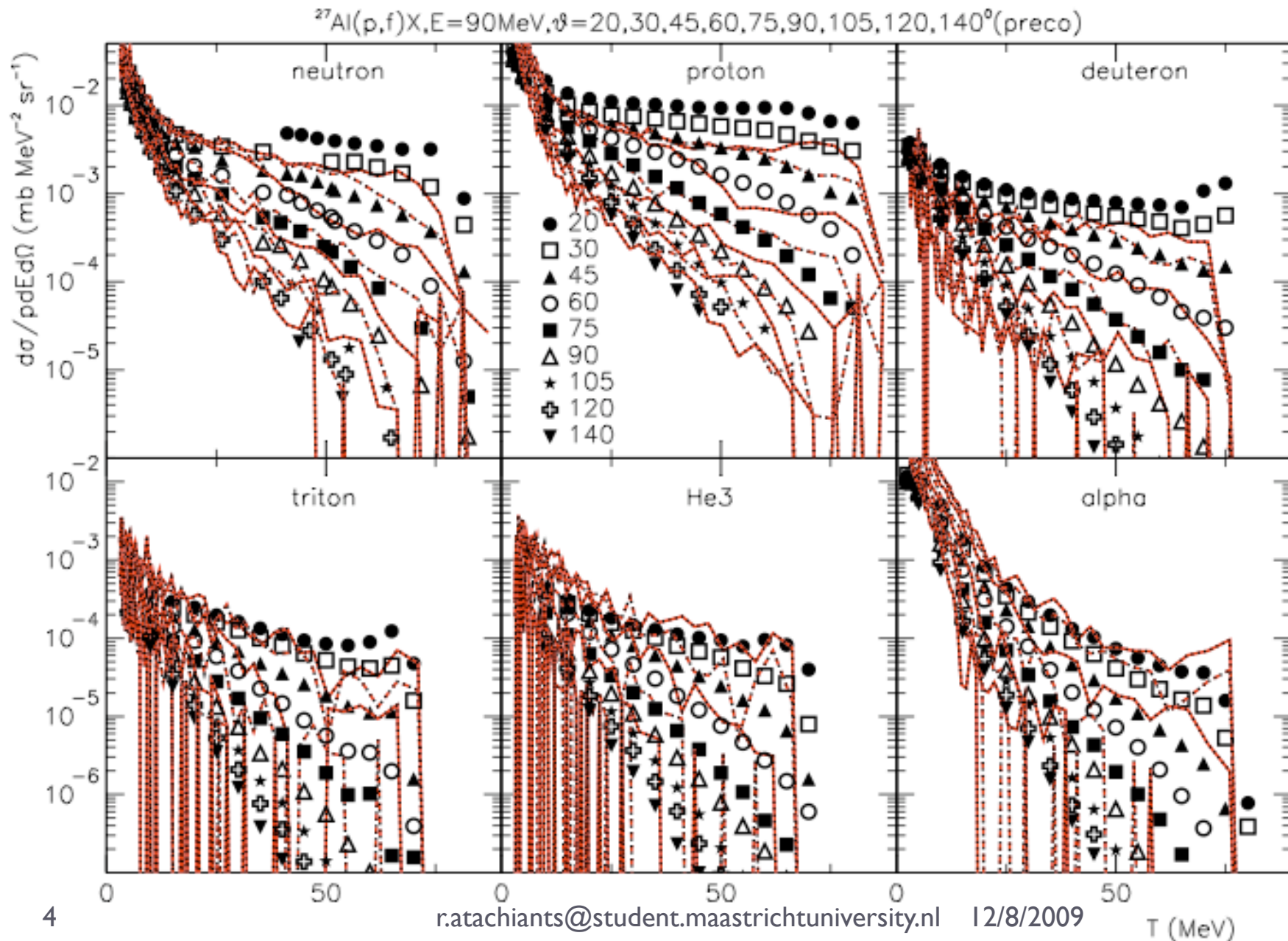
- ▶ **ROOT**

- ▶ cf. Fons Rademakers lecture: Introduction to ROOT [1]

- ▶ **Geant4**

- ▶ Toolkit for the simulation of the passage of particles through matter

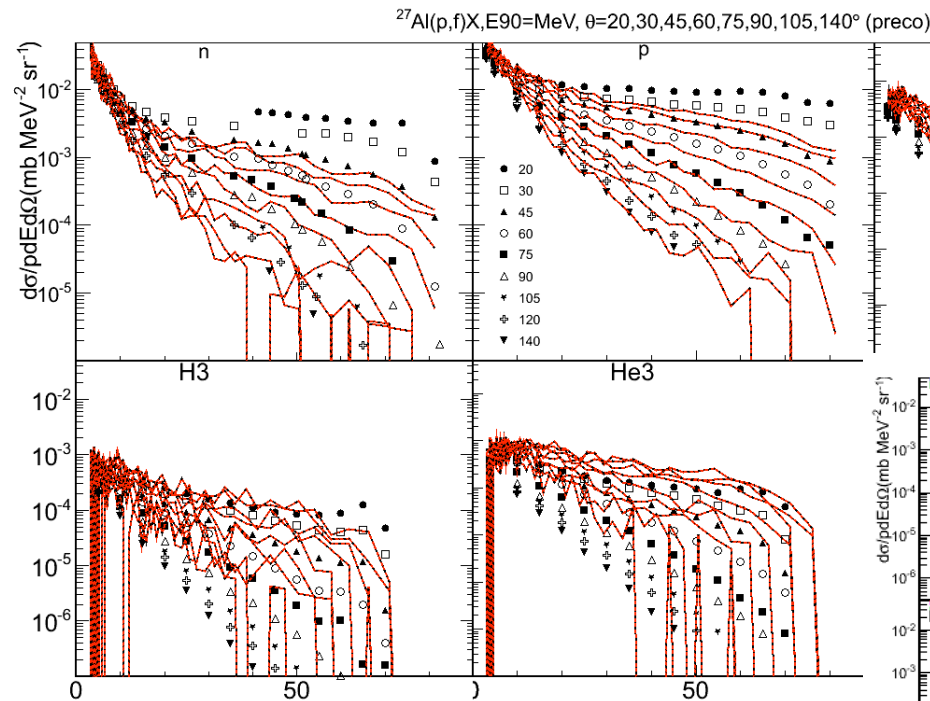
The goal is to compare the data points with the simulation curves



PAW to ROOT Conversion (1)

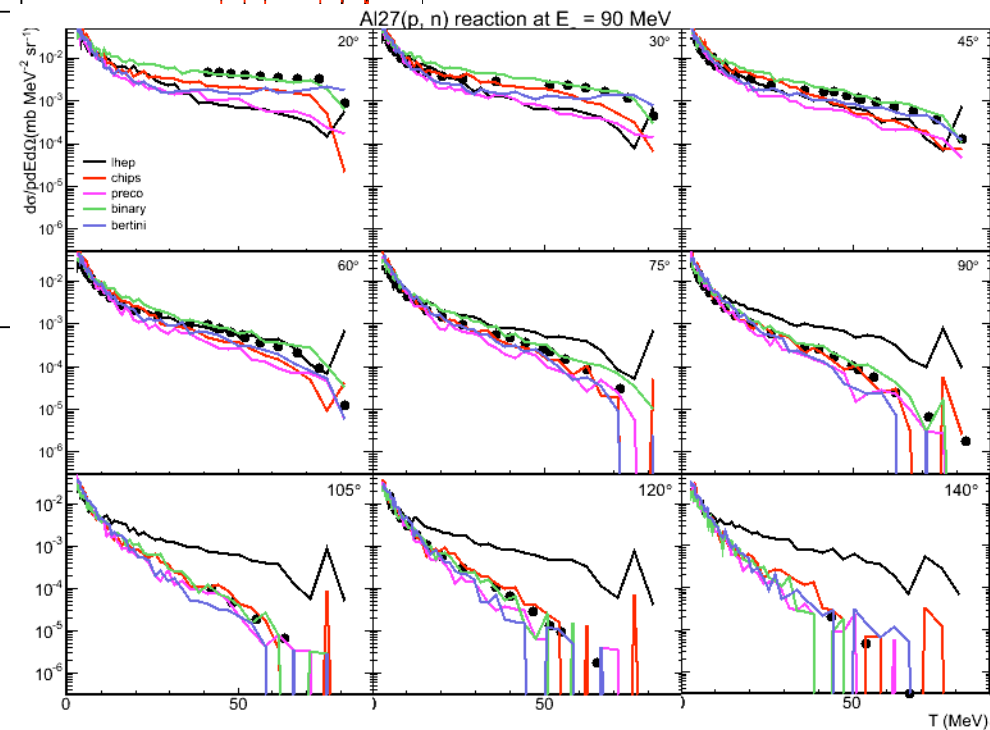
- ▶ Some useful information can be found in:
<http://root.cern.ch/root/HowtoConvertFromPAW.html>
- ▶ PAW vectors treated as ROOT TTrees
- ▶ The C++ methods of ROOT are more comprehensive than the PAW shortcuts, for example:
 - ▶ PAW handles histograms using ID's an in ROOT one can extract the pointer by ID: `gDirectory->Get(ID)`, and than use this pointer for different functions.
 - ▶ PAW `[put/get]/[abscissa/error/content]` are loops in ROOT:
 - ▶ `get/abs [id]([hf]:[hn]) wx`
 - ▶ `TAxis* axis = hDT->GetXaxis();`
`for(Int_t i = 0; i< hnbin; ++i) vZeroLevels[i] = axis->GetBinCenter(i);`

PAW to ROOT Conversion (2)



► Exactly the same result is achieved

- 2 modes of analysis:
 - Secondaries per Model
 - Models per Secondary



Architectural Overview

ROOT

- CINT
- Introspection
- MonteCarlo extensions (ParticlePDG)
- 10+ libraries

Test programs, on top of Geant4

- Test 19 and Test 29
 - By Mikhail Kosov

Tools: Simulation and Analysis

Data Model for Publications and Simulations

- DataObject and DataItemObject..
- Extended ParticlePDG DataBase (With Secondary Fragments)

Helpers and Utilities

- Plotting
- Simulating

Usage

- ▶ // Example of a ROOT Macro that launches the Geant4 model testing

```
{
```

```
    // load the Library
```

```
    gSystem->Load("libG4ModelTester.so");
```

```
    // run the simulation (proj.: p , targ.:Al27, 90 MeV)
```

```
    gSimulationTool->Run(1000010010,  
                          1000130270, 90, 450, "preco");
```

```
}
```


Conclusions and Future Work

- ▶ The universal experimental DB for model testing in Geant4 is completed, but still can be improved (designed to be)
- ▶ Show that ROOT can give bigger statistics and therefore better comparison results than PAW. The main reason for the PAW to ROOT porting
- ▶ ROOT Graphical User Interface for easier use of the tool (using the power of the framework)

Thank you for your attention!



References

- ▶ [1] Rademakers F., CERN Summer Student Lecture, Introduction to ROOT
- ▶ [2] ROOT User's Guide, <http://root.cern.ch/root/doc/RootDoc.html>
- ▶ [3] PAW – Physics Analysis Workstation, <http://wwwasd.web.cern.ch/wwwasd/paw/>
- ▶ [4] Geant4 - <http://www.geant4.org/geant4/>