



# Python Extension of the ATLAS Online Software for the ATLAS Thin Gap Chamber Trigger System

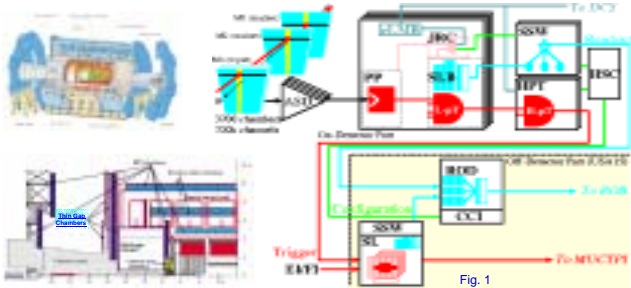
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## Abstract

A Python extension module of the ATLAS Online Software (SW) has been developed for the ATLAS Thin Gap Chamber (TGC) trigger system. Python is an interactive scripting language including the built-in high level libraries and provides the easy way to build useful WEB applications. These features, not included in the ATLAS Online SW, are important for the ATLAS TGC trigger system test. A WEB application with Zope is developed which is useful for secure system monitoring from all over the world. The functionalities of the Python extension and its applications are presented.

## ATLAS TGC Trigger/Readout System



## ATLAS Online SW Framework

The ATLAS Online SW is responsible for the overall experiment control, configuration of the Trigger-DAQ system and management of data taking partitions. BUT ATLAS Online SW has NO WEB Application Interface at this moment.



Fig. 2

## Python Extension Module

Interfacing any language to Python involves building a module which can be loaded by the Python interpreter, but which is not written in Python. This module is known as an

"extension module". We have developed an extension module which allows Python to access C++ functions of the ATLAS Online SW. Fig.3 shows the development framework of the extension module for the ATLAS online SW. The extension module is implemented by using a C++ template library, "Boost.Python" version 2. The boost C++ library collection contains the "Boost.Python" which enables seamless integration of C++ and Python with many capabilities. We wrote C++ wrapper codes using the "Boost.Python". The wrapper codes are built as a shared library. After that, the ATLAS Online SW APIs can be called in Python. Note that although Python native library for the ATLAS online SW could be developed, it takes a lot of development time. Therefore we determined to write C++ wrapper codes.

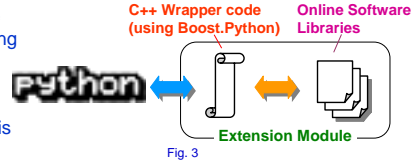


Fig. 3

## Event Display using Python Extension

The advantages of the Python extension for ATLAS Online SW are listed as follows:

- It reduce the application development time and improve the program code quality.
- It can be executed interactively to confirm the system behavior step by step. This is useful for the system diagnostic test.
- It provides easy way to build WEB applications.

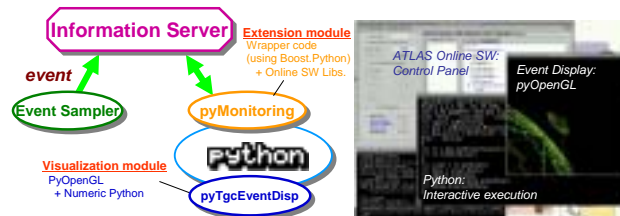


Fig. 4

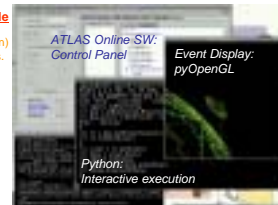


Fig. 5

## WEB Application for Monitoring

The most significant advantage of the Python extension is that it provides an easy way to build WEB applications with Zope. We have developed a WEB application to monitor the trigger system performance in real time (Fig.6). The main components of the application are Apache, Zope, the ATLAS Online SW and the Python extension module. Apache works for the front-end WWW server, which receives a HTTP/HTTPS request from the WEB browser and passes the request to Zope by using the mod\_pcg2 module. Zope interprets the request and calls the ATLAS Online SW APIs to examine the trigger system performance. Then it builds a response message which is sent to the WEB browser via Apache. The WEB browser visualizes the received message to show the event display, the trigger rate, and the system status (Fig. 7).

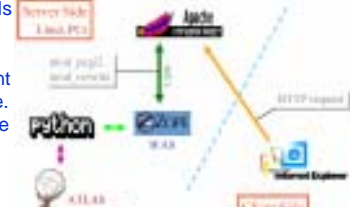


Fig. 6



Fig. 7-1



Fig. 7-2



Fig. 7-3

## Conclusion

We have developed the Python extension module of the ATLAS Online SW. The extension module provides easy ways to build interactive application and to link the ATLAS Online SW with Python high-level libraries, which shorten the development time and cost. And it also allows us to develop WEB applications with Zope. The practical applications including the WEB application are developed for ATLAS TGC trigger system test. It is available over secure network and we do not need to develop any special client SW for it. This means the clients can monitor the trigger system status from all over the world.