
Online Muon Capture and Decay Experiment

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grant from the NSF.



Overview


- ▶ Purpose:

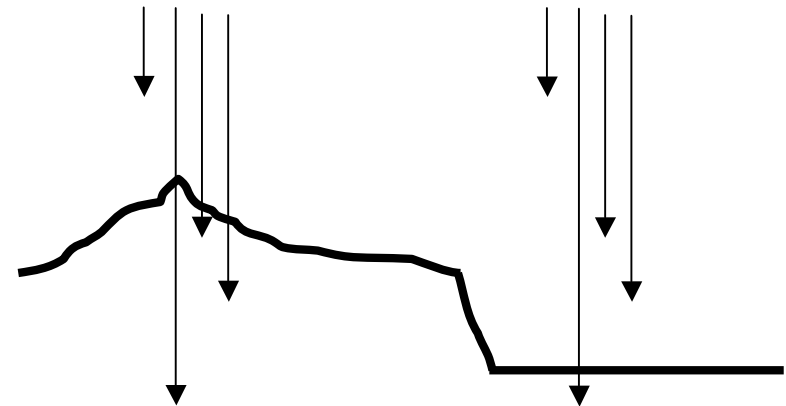
- ▶ To capture and share data from cosmic muons, making a “real” physics experiment accessible to the public.

- ▶ In this talk:

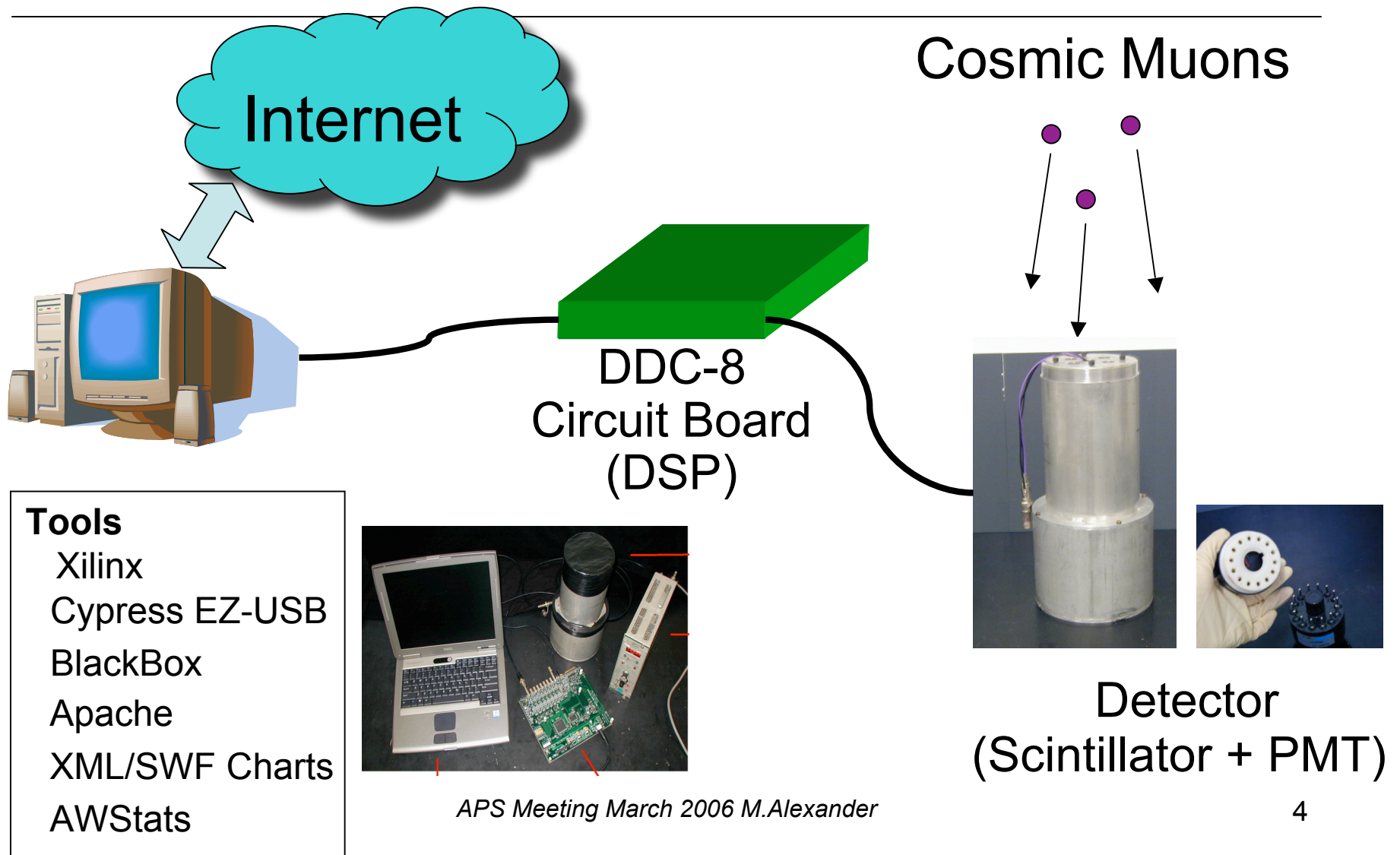
- ▶ Experimental details
 - ▶ Website tour

Motivation

- ▶ Time dilation (special relativity) \vec{v} 
- ▶ Classic experiment, popular in advanced physics labs
- ▶ Outreach



Experiment Setup



DDC-8

► Developed by Wojtek Skulski.

JTAG connector

ADC 40 MHz * 10 bits (8 channels)

RAM 500 kB

micro processor

RS-232

USB

FPGA

Analog signal IN 8 channels (only 1 used) with digital offset and gain control

ECL clock IN (optional)

Diagnostic OUT 40 MHz * 10 bits

Logic connectors NIM 16 lines IN, 8 lines OUT

16 bidirectional TTL lines + 1 in (pool of extra logic I/O)

Analog shapers

Discriminators and logic

A/D and readout

Digital Pulse Processor DDC-8

*DDC-B/NIM Rev. 0
IC: Wojtek Skulski 2002*

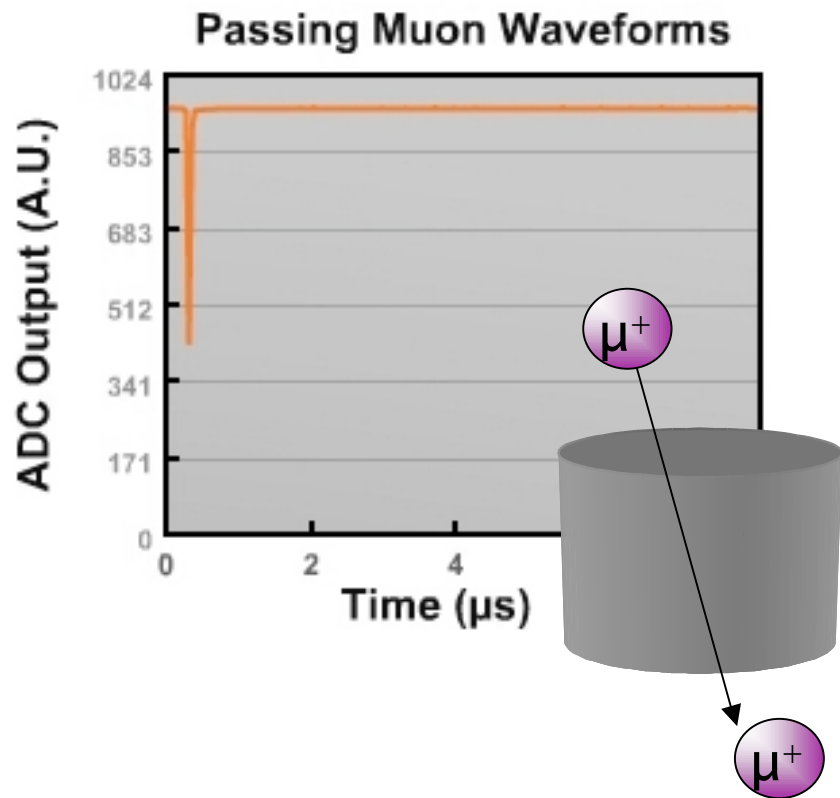
*Digital Signal Processor
DDC-B/NIM Rev. 0
IC: Wojtek Skulski 2002*

*8-channel
Digital Signal Processor
DDC-B/NIM Rev. 0*

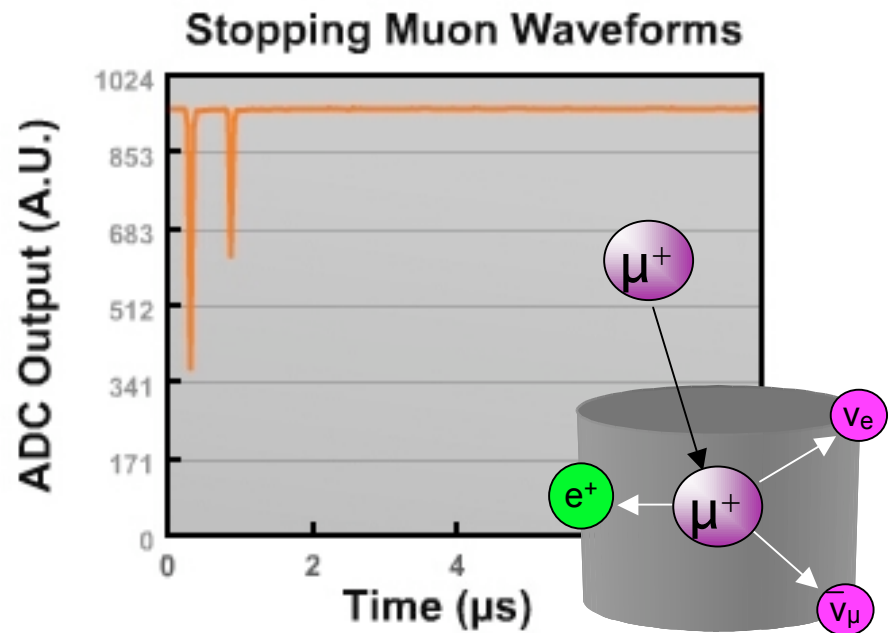
APS Meeting March 2006 M.Alexander

Typical Muon Signals

▶ Passing Muons:



▶ Stopping Muons:

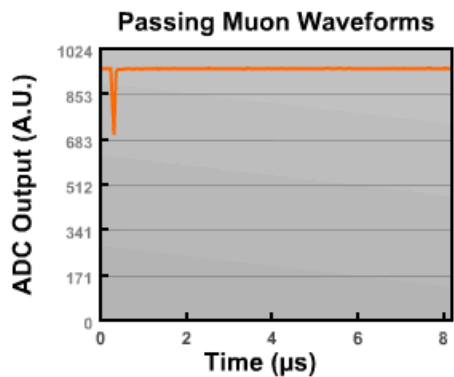
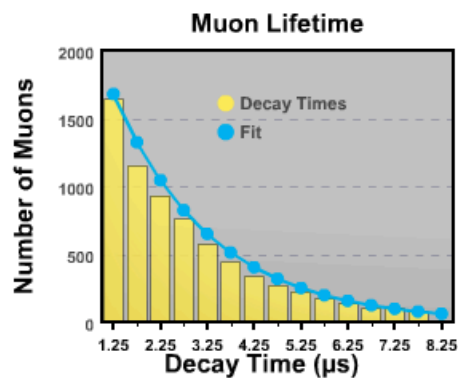
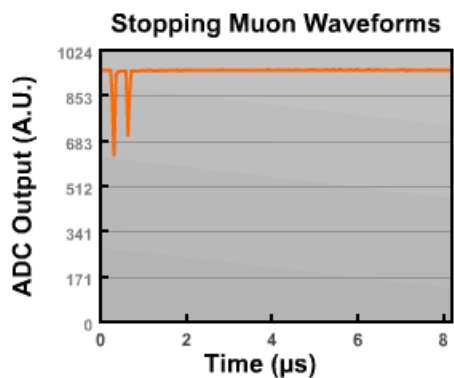


Web View: Waveforms

...DATA ACQUISITION IN PROGRESS...

[About the Waveforms](#)

[About the Time Constant](#)

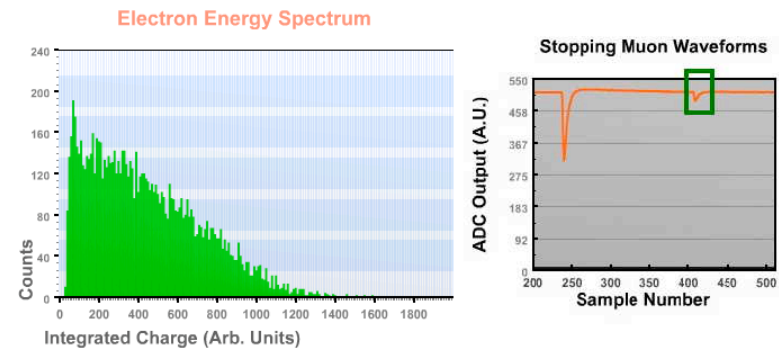
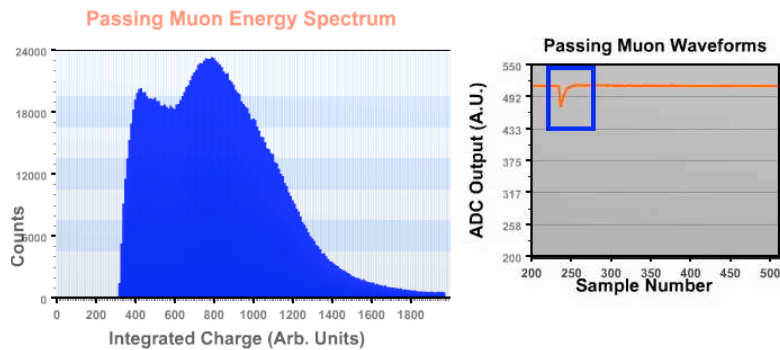


Data set began: Feb 21, 2006 7:05:17 AM
of Muons Processed (total): 1902129
of Stopping Muons: 9648
Time Constant in μs : 2.1
Last recorded muon: 09-Mar-2006 16:22:12 EDT

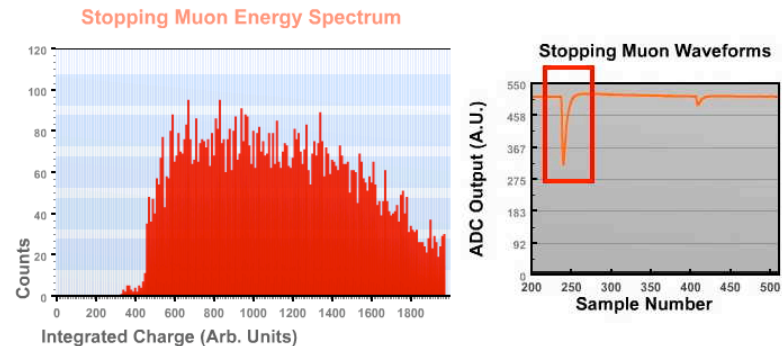
Time constant: 2.1 μs

<http://wolfspc.pas.rochester.edu/muon/daq.html>

Web View:Energy Spectra



- Conventional muon lifetime experiments do not exploit DSP for particle ID: this one does!



<http://wolfspc.pas.rochester.edu/muon/EnergySpectra.html>

Downloadable Data



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http://wolfspc.pas.rochester.edu/muon/DownloadFiles/Waveforms_1172006.bt - Microsoft Internet Explorer provided by Compaq
File created: Jan 17, 2006
Settings:
Threshold: 780
Electron Threshold: 925
Stopping Threshold: 720
Main Pulse Window: 40

Begin Waveform Information
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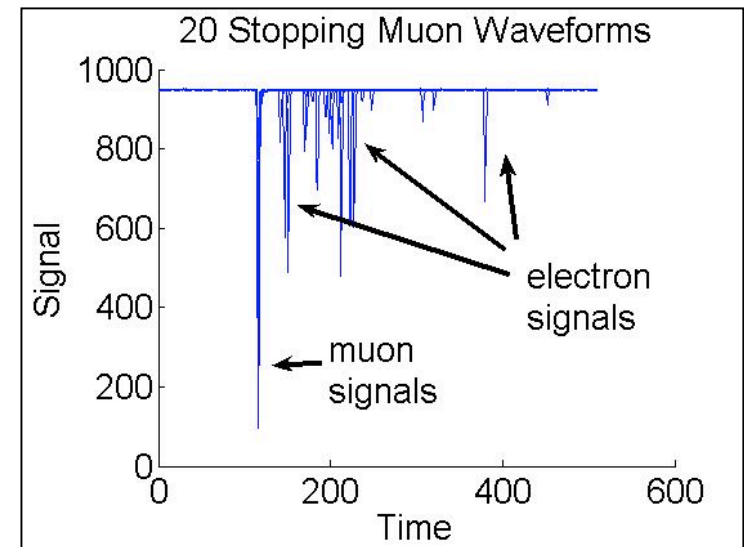
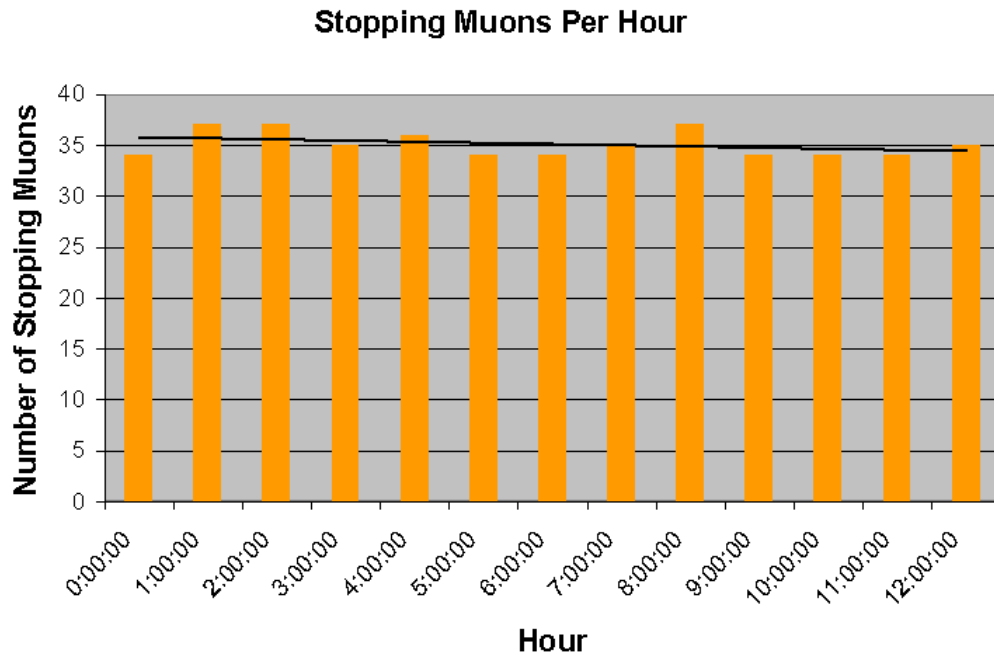
Begin Waveform Information
2.76
0.46
3.17
0.621
1.73
1.45
0.529
0.506
1.54
0.483
3.82
0.92
0.897
1.36
0.782
1.89
0.989
4.58
2.71
3.4
0.506
3.43
2.02
0.989
2.92
```



<http://wolfspc.pas.rochester.edu/muon/DLData.html>

Downloadable Data

▶ View from Excel, MATLAB



Summary and Conclusion

- ▶ Physics outreach enabled by hardware, software, web tools.
- ▶ Total unique visitors:

