Ideas for a Muon Trigger in the First COMPASS Spectrometer

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Motivations

- A large fraction of DY muons are detected in the first spectrometer only
- Small production cross section $\rightarrow$ high beam intensity and high trigger purity required
- Trigger must be able to separate DY muons from halo $\rightarrow$ high granumarity for good target pointing
- Large surface: $\sim 5 \times 4$ m^2
- Can we make use of existing hardware?
- The Muon Wall 1 system satisfies all above requirements, but. . . it is slow ($\sim$ 100 ns signal time jitter)

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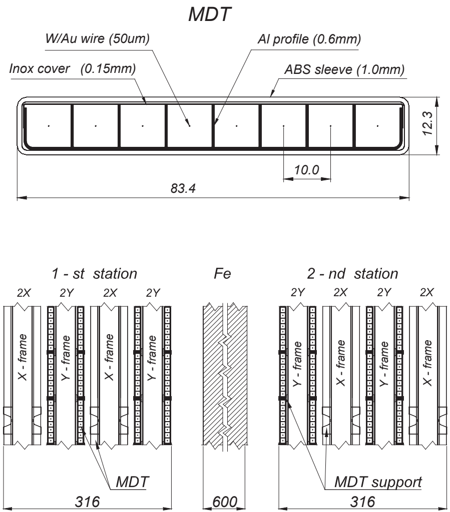
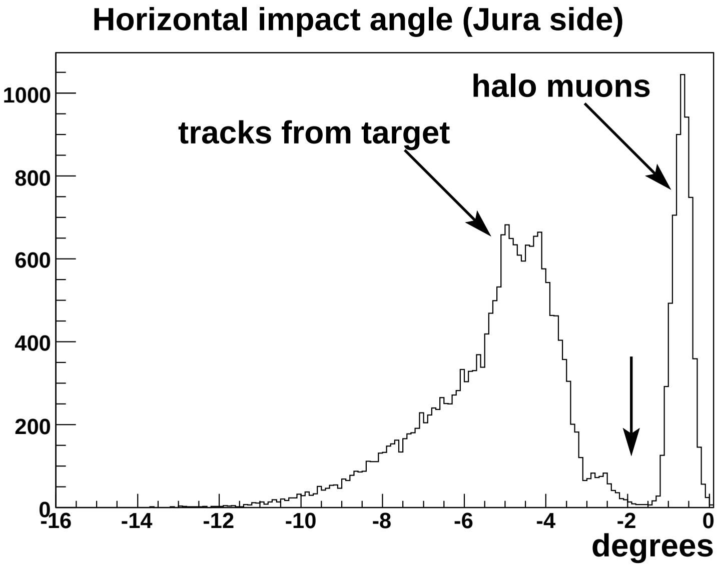
The Muon Wall 1 system



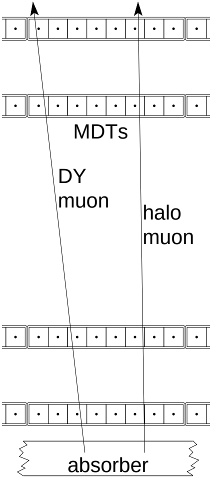
- The basic detector element is the Mini Drift Tube (MDT)
- Vertical (X) and horizontal (Y) planes are formed by $\sim$ 60 MDTs each
- Two stations of 4X and 4Y planes sorround a 60 cm thick hadron absorber

Muon impact angle (real data)



MW1-based Trigger

MW1 geometry (in scale)



- Muons can be identified from specific patterns of fired channels in the detector planes downstream of the absorber
- The angular resolution is of about 3 degrees
- Halo muons hit the detector almost perpendicular and can be recognized/ rejected
- Angular resolution can be improved by an approximate measurement of the dritf time

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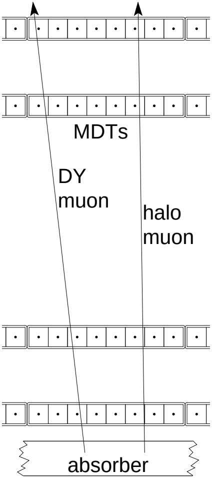

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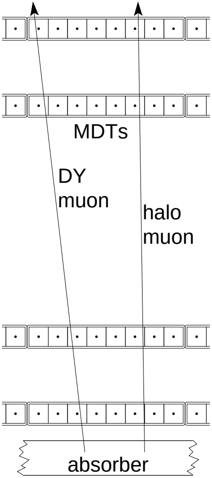

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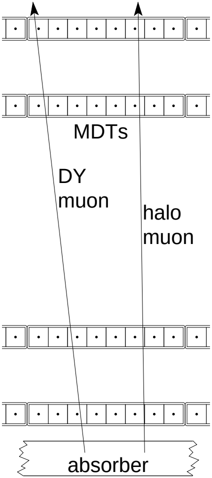

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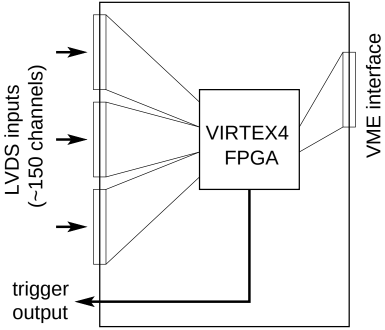
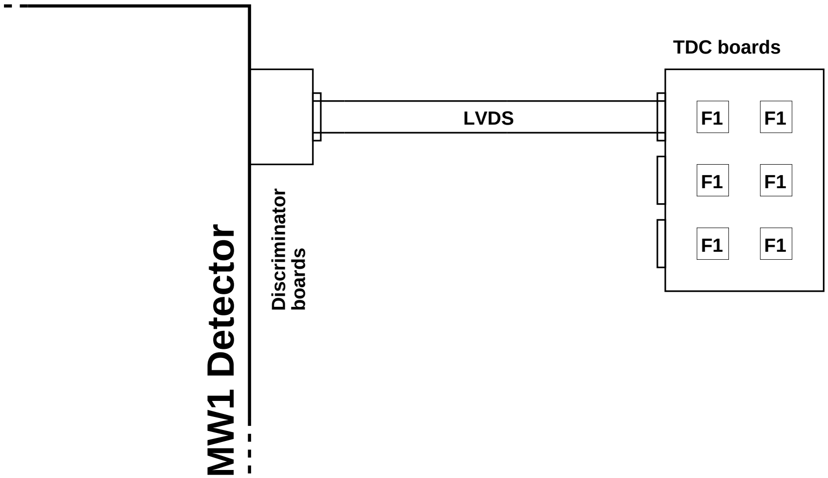
MW1 Trigger Board (sketch)

Trigger logic can(?) be implemented into FPGA-based hardware



- The front-end discriminator outputs can be directly fed to the FPGA
- Few components needed $\rightarrow$ high concentration of channels
- Virtex4 FPGAs:
  - high computing power
  - large number of input pins
  - high clock frequencies
  - independent programmable delays for each input

Integration in the Readout



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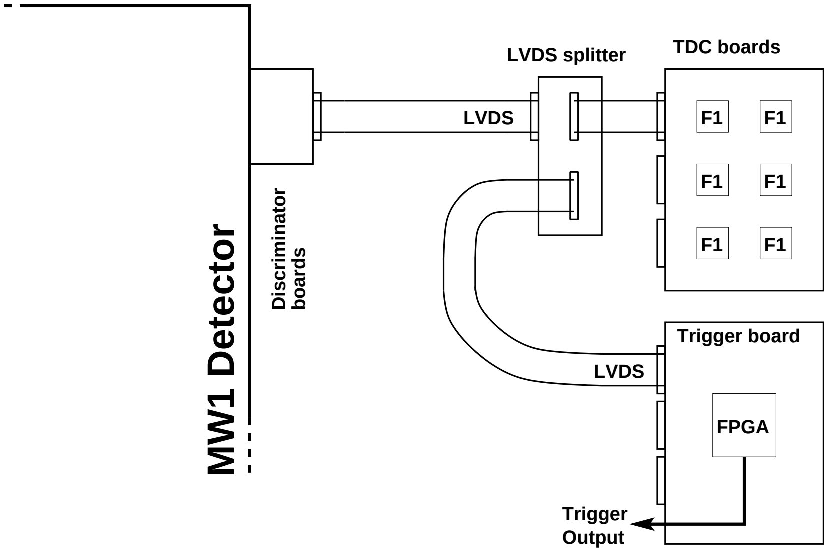

Outlook

The next steps in the project are:

- Validate the algorithm using MC simulations and real data
- Estimate expected background rates
- Implement the algorithm into an FPGA firmware
- Build a prototype trigger board and test it with the small MW1 prototype and cosmics

The achievable time resolution and its effect on the overall performances must be carefully studied…

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