

# Martijn Mulders

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## Research Experience

2001-present:

**Research Associate position at FERMILAB**, Batavia, IL, USA - *DØ and CMS experiments*

1996-2001:

**PhD. research position at NIKHEF**, Amsterdam, The Netherlands - *DELPHI experiment*

1993-1995:

**Undergraduate research projects** in Eindhoven (The Netherlands), Uppsala (Sweden), Gamba (Gabon, Africa) and Geneva (Switzerland)

## Education

**PhD in physics** (2001), University of Amsterdam, Amsterdam, The Netherlands

Thesis adviser: Professor Jos Engelen

Thesis subject: "Direct measurement of the W boson mass in DELPHI"

**Applied physics engineer** (1996), Eindhoven University of Technology, Eindhoven, The Netherlands

Thesis adviser: Professor Boudewijn Verhaar

Thesis subject: "Collisions of Dark States in a 3D VSCPT-trap"

Honors:

1995: Selected for CERN Summer Student program

1993: Selected for 'intercontinental' training project at Shell Oil Company

1990: Honored for outstanding 1<sup>st</sup> year results in physics at the Eindhoven University of Technology

1989: Bronze medal in International Physics Olympiad

1989: Silver medal in International Chemistry Olympiad

## Achievements and Responsibilities

- **Co-leader of the Muon Working Group of the LHC Physics Center** at Fermilab since September 2004. Our goal for the first year is to build a critical mass of local experts in LHC physics and CMS reconstruction code, create a meeting place for US-based physicists and contribute to a smooth transfer of hadron collider experience from Tevatron to the LHC experiments.
- **Co-convenor of the Muon Identification and Algorithms group in DØ** from July 2002 to July 2004. During this period the DØ experiment transitioned from commissioning to stable physics quality data taking. I was asked to become Muon Algorithms convenor after quickly acquiring sufficient knowledge of C++ and the DØ software to find and resolve a fundamental flaw in the muon reconstruction algorithm that prohibited the code from running on the L3 trigger farm, and discovering a few unresolved issues with the handling and description of the muon detector geometry. As convenor I was able to bring together a group of muon geometry experts and lead a coordinated effort to fix these muon geometry issues, important for simulation, data reconstruction, and performance of the muon triggers. During the second year our responsibility was extended to include more general strategies and algorithms for the identification of muons in physics analyses. Overall we improved the stability, speed and efficiency of the muon reconstruction and identification code, implemented a new data

format, and resolved discontinuities in the drift time and velocity calibration of the muon drift chambers promptly after they were discovered. I recruited and trained new muon experts as part of a project to prepare the software for a new set of muon scintillation counters before the detectors were installed in the fall of 2003. The muon detector and software are in good shape and the first two analyses published by DØ in Run II predominantly relied on muons in the final state.

- **Physics in DØ and DELPHI:**

- Lead analyzer and developer of a new technique for the measurement of the **top quark mass** in the lepton+jets channel **in DØ**. The analysis is based on the Ideogram technique (see below) and was presented at ICHEP 2004 as one of the two first preliminary top mass results by DØ in Run II. In the weeks leading up to ICHEP 2004 I pioneered the use of track confirmation of jets in DØ and played an essential role in starting, performing and resolving a series of investigations scrutinizing our understanding of the Run II data. This proved to be crucial for the approval of several of the preliminary DØ top physics results shown at ICHEP 2004.
- Lead analyzer and developer of the Ideogram technique for the measurement of the **W boson mass** in the fully hadronic channel **in DELPHI**. This was the first W mass analysis at LEP to take into account all jet combinations, the possibility of a fifth jet from final state gluon radiation, and the probability for each event to be background. This resulted in three DELPHI W mass publications. The fourth and final W mass publication by DELPHI is still in preparation.
- As co-convener of the muon group in DØ I worked with Tamsin Edwards, a Manchester PhD student, on her analysis of the **diffractive production of Z bosons in DØ** in the di-muon channel, which benefits greatly from the excellent efficiency and angular acceptance of the DØ muon detectors. This analysis is still in progress, pending on the understanding of low energy response of the calorimeter needed for the identification of rapidity gaps.

- **Development of new analysis tools and techniques:** In addition to the Ideogram technique for measurement of the W and the Top mass I promoted the use of advanced statistical techniques like ensemble testing with resampling and the Jackknife method. At LEP I introduced the Mixed Lorentz Boosted Z0 technique to study the jet energy scale in the W mass measurement to the MeV level using Z0 data. I also took the initiative to develop an improved method for the determination of the effective center-of-mass energy after initial state photon radiation, published in NIM and used as a standard method in many DELPHI analyses.
- **DØ detector:** Contributed to the successful installation and commissioning of a new Ethernet-based data-acquisition system for the DØ detector. This included detailed monitoring of electronic signals to debug communication issues on the VME backplanes in existing crates (Jan 2002 - July 2002).
- **DELPHI and DØ detector operation:** Shared responsibility for the maintenance of the DELPHI Inner Detector (a proportional drift chamber) at CERN and contributed to the operation of the DELPHI and DØ detector doing numerous shifts, including some as shift leader (in DELPHI).
- **Supervising students:** helped graduate students in the DØ top physics group with statistical tools and techniques for their analyses, and as Muon ID/algorithms convener in DØ I worked closely with students from different physics groups on topics related to muon identification.
- **Outreach:** Saturday-Morning physics tour guide for high-school students at Fermilab. Wrote an article about neutrino physics for 'Zenit', a Dutch popular science magazine aimed at amateur astronomers. Co-editor of a study report of a 100-student study tour to the EXPO'92 in Seville, Spain, where I led a group of 10 students to participate in the circus of physics at the CERN day of Science and became one of the founding members of the "Eindhoven Circus of Physics" promoting physics to publics of all ages in (and around) the Netherlands.

## Selected Talks

- "Measurements of top quark properties in  $t\bar{t}$  events at DØ", talk at PHENO 2004 symposium, Madison, Wisconsin, April 27 2004.
- "Muon Trigger and Reconstruction -- the DØ experience", talk at Joint CDF/DØ/LHC Muon workshop, Fermilab, Chicago, April 14 2004.
- "Diffraction using rapidity gaps at DØ", talk at Diffraction at the LHC workshop, Rio de Janeiro, April 1 2004.
- "Ethernet-based Data Acquisition System for the DØ Experiment at Fermilab", talk at IEEE Nuclear Science Symposium, Portland, Oregon, October 23 2003.
- "Hard Diffraction: Latest results from DØ and prospects for RunII", talk at Xth Blois Workshop on Elastic and Diffractive Scattering, Helsinki, Finland, June 24 2003.
- "Measurement of the W Mass and Width in DELPHI at LEP", talk at DPF2000 conference, Columbus, Ohio, USA, August 10 2000.
- "Summary of W mass systematics", summary talk at WW99 Workshop on WW physics at LEP200, Crete, Greece, October 23 1999.
- "Treatment of non-Gaussian resolution effects with Ideograms", talk at WW99 Workshop on WW physics at LEP200, Crete, Greece, October 23 1999.
- "Emulation of WW events using Mixed Lorentz Boosted Z0s in DELPHI", talk at WW99 Workshop on WW physics at LEP200, Crete, Greece, October 22 1999.
- "W mass and cross sections at LEP2", talk at 11th Rencontres de Blois, Blois, France, July 1 1999.
- "W pair production in DELPHI", talk at NIKHEF annual scientific meeting, Amsterdam, December 17 1998.
- "Direct measurement of the W boson mass in DELPHI", talk at annual meeting of Subatomic Physics section of the NNV (Dutch physical society), Petten, The Netherlands, October 31 1997.

## Selected Publications

Leading analyzer or developer of a main result presented in the following selected papers and conference notes:

- Measurement of the Top Quark Mass in the lepton+jets channel using DØ Run II data, DØ collaboration, DØ conference note 4574, contribution to ICHEP 2004.
- Mixed Lorentz Boosted Z0's, N.Kjaer and M.Mulders, CERN-OPEN-2001-026, contribution to Moriond 2001.
- Measurement of the mass and width of the W boson in  $e^+e^-$  collisions at  $s^{1/2} = 189$ -GeV, DELPHI Collaboration, Physics Letters B 511, 159 (2001)
- Measurement of the mass of the W boson using direct reconstruction at  $s^{1/2} = 183$  GeV, DELPHI Collaboration, Physics Letters B 462, 410 (1999)
- Measurement of the W pair cross-section and of the W mass in  $e^+e^-$  interactions at 172-GeV, DELPHI Collaboration Eur.Phys.J.C2, 581 (1998).
- The estimation of the effective center-of-mass energy in  $q\bar{q}\gamma$  events from DELPHI, P.Abreu et al. (10 authors), Nucl.Instrum.Meth.A 427, 487 (1999).

One of two DØ collaborators (not on the DØ Run I author list) acknowledged for a contribution to preparation of the following paper:

- A precision Measurement of the Mass of the Top Quark, DØ collaboration, Nature 429, 638 (2004).

Co-authored 158 publications in total (as of October, 2004). See separate list.