ATLAS W+*D* Analysis and PDF Fits

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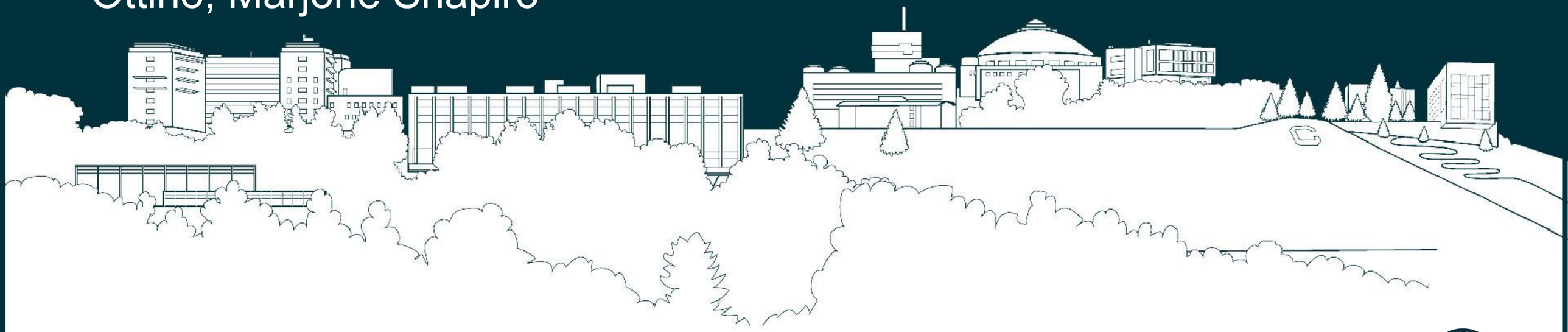
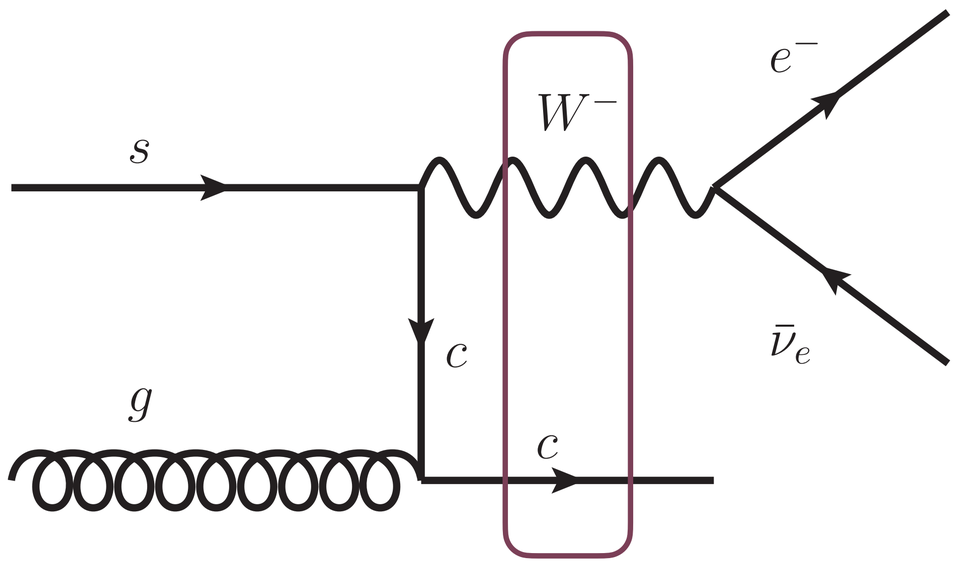


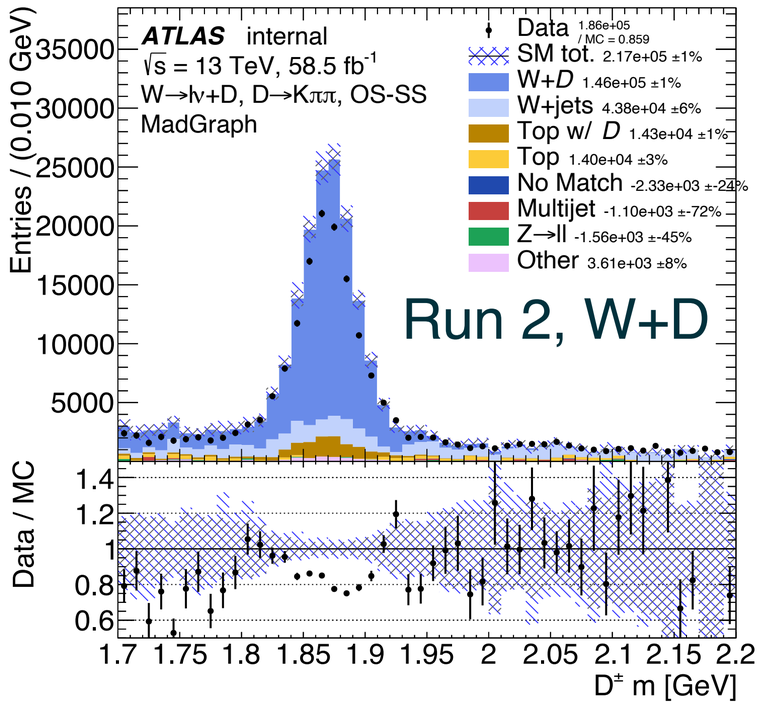
BERKELEY LAB

ATLAS EXPERIMENT

Introduction

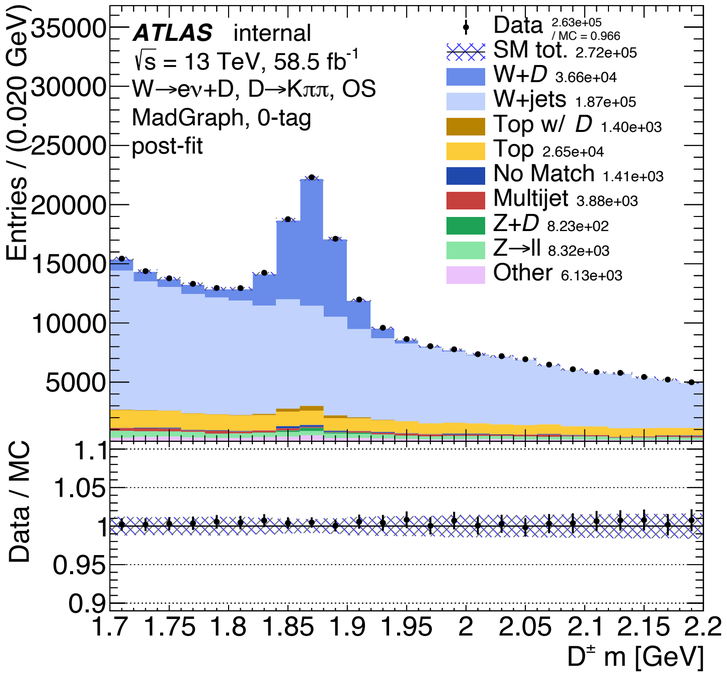
- Measure $\sigma(W^{\pm}D^{\mp})$ for various D-species (D, D*, Ds),
- Directly sensitive to s-quark PDF at *pp* colliders (d-quark production Cabbibo suppressed and at the level of 10% compared to s-quark production),
- Charge correlation between W and D— signal always has opposite-sign (OS), while backgrounds are mostly charge symmetric between OS and SS,
  - Backgrounds: W+cc/bb (gluon splitting), W+light mesons, ttbar, multijet, …
- D mesons are reconstructed with a secondary vertex fit and a likelihood fit of m(D) shape is used to extract the signal.

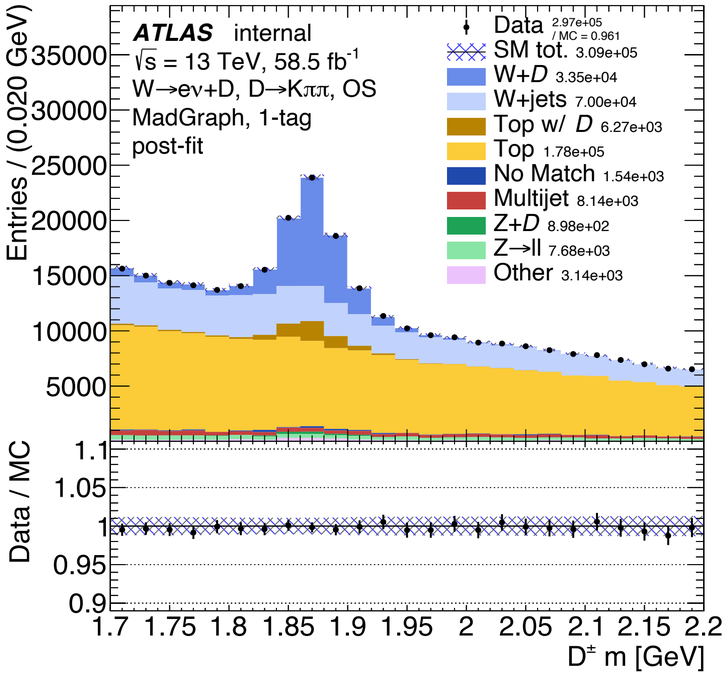


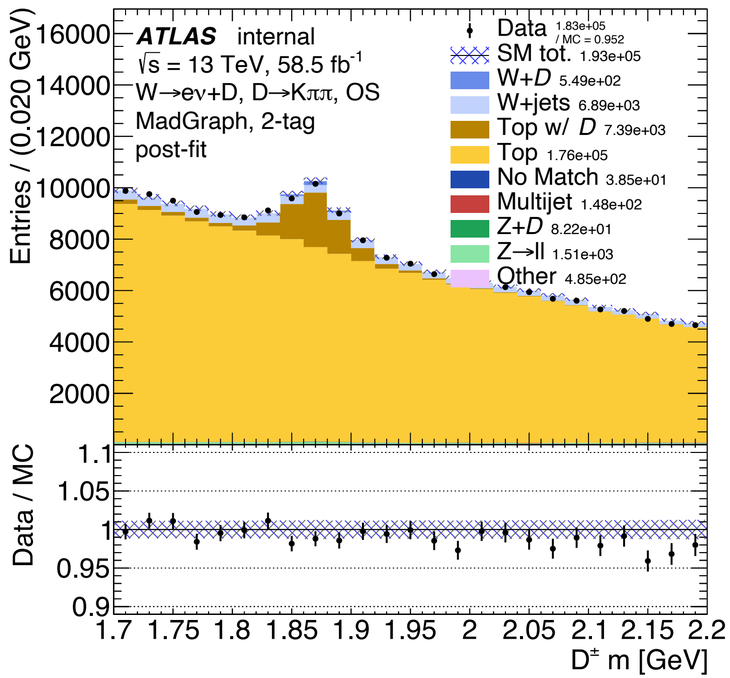


Experimental Methodology

- The measured quantity is the number of D candidates (not the number of events),
- The final result will be given as the ‘difference between the number of OS and SS candidates’ in a given fiducial selection,
- Yields extract with a likelihood fit split into 0/1/2 b-tag region to separate the W+jets and ttbar processes,
- Unfolded to the number of ‘OS-SS’ candidates, performing the same OS-SS subtraction in truth events.







Discussion

- The Run 1 paper includes both the W+D (SV fit) result and the W+c (soft muon tag) result,
- Only the W+c part has been used in PDF fits so far,
- One of the latest PDF fit papers: "*for ATLAS, we consider the charm-jet dataset, which is amenable to fixed-order calculations (instead of the D-meson dataset)*"

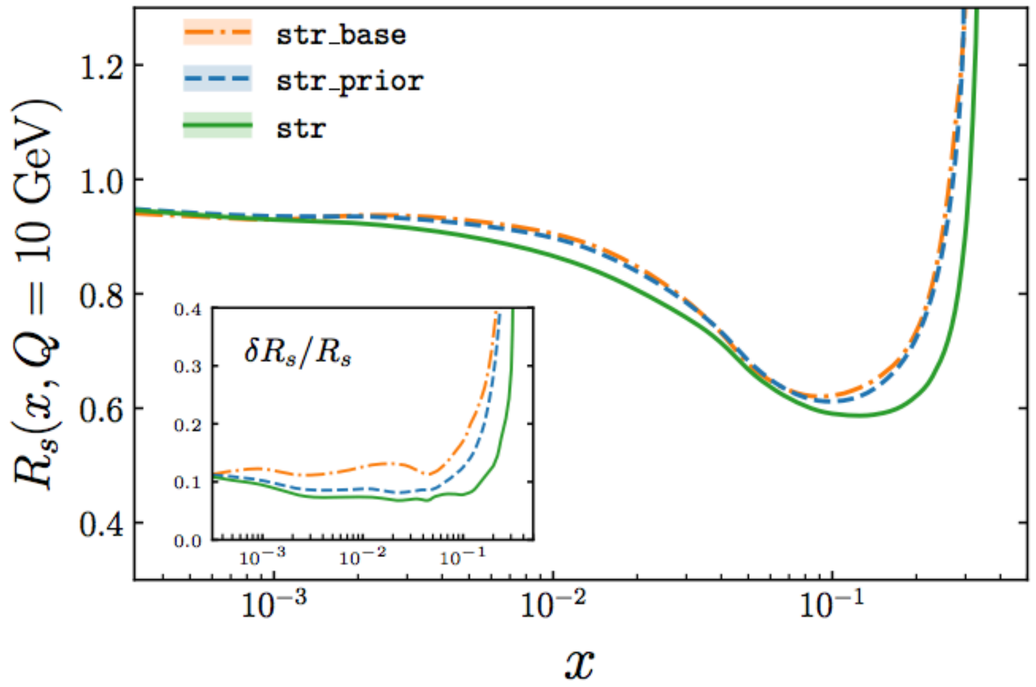
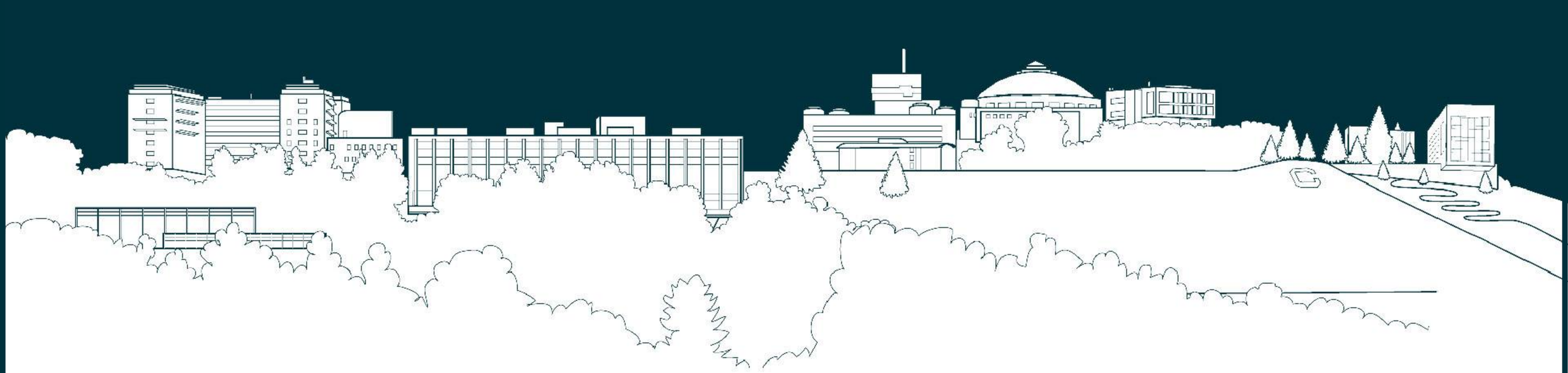


TABLE II. Values of the χ^2 per data point for the strangeness-sensitive datasets discussed in this work obtained from the three fits summarized in Table I. Values in square brackets correspond to datasets not included in the corresponding fit.

Process	Dataset	n_{dat}	χ^2_{bs}	χ^2_{pr}	χ^2_{str}
νDIS ($\mu\mu$)		76/76/95	0.76	0.71	0.53
	NuTeV [9]	76/76/76	0.76	0.71	0.53
	NOMAD [10]	—/—/19	[9.3]	[8.8]	0.55
W, Z (incl.)		391/418/418	1.45	1.40	1.40
	ATLAS [12]	34/61/61	1.96	1.65	1.67
W+c		—/37/37	[0.73]	0.68	0.60
	CMS [17, 18]	—/15/15	[1.04]	0.98	0.96
	ATLAS [16]	—/22/22	[0.52]	0.48	0.42
W+jets	ATLAS [15]	—/32/32	[1.58]	1.18	1.18
Total		3981/4077/4096	1.18	1.17	1.17

Backup



LHC W+D Publications

- ATLAS:
  - W+c cross sections at 7 TeV: STDM-2012-14

- CMS:
  - W+c cross sections at 13 TeV: CMS-PAS-SMP-17-014
  - W+c cross section at 7 TeV: CMS-SMP-12-002

- ATLAS 7 TeV includes both soft-muon tagging and
- CMS did only $D^+ \rightarrow K^- \pi^+ \pi^+$ and $D^{*+} \rightarrow D^0\pi^+ \rightarrow (K^- \pi^+)\pi^+$ decay modes so far.