α_s Determinations from H1

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- Inclusive ep scattering
- Inclusive jets
- Jet rates
- Event shapes
- Summary

... all in NLO precision...

Inclusive DIS

DESY-00-181
December 2000

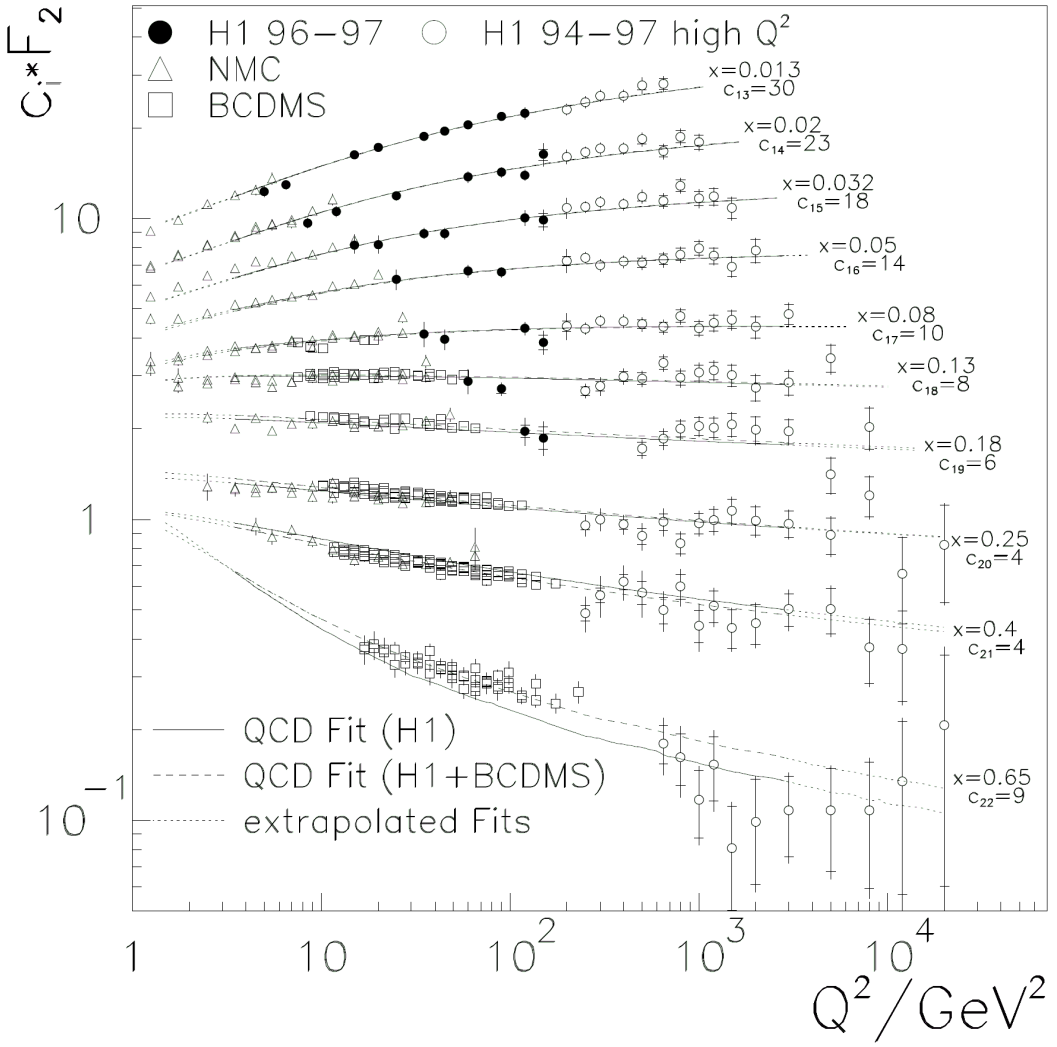
Deep-Inelastic Inclusive ep Scattering at Low x and a Determination of α_s

$3.5<Q^2<3000$ GeV^2

Data from 94-97, ~30pb^{-1}

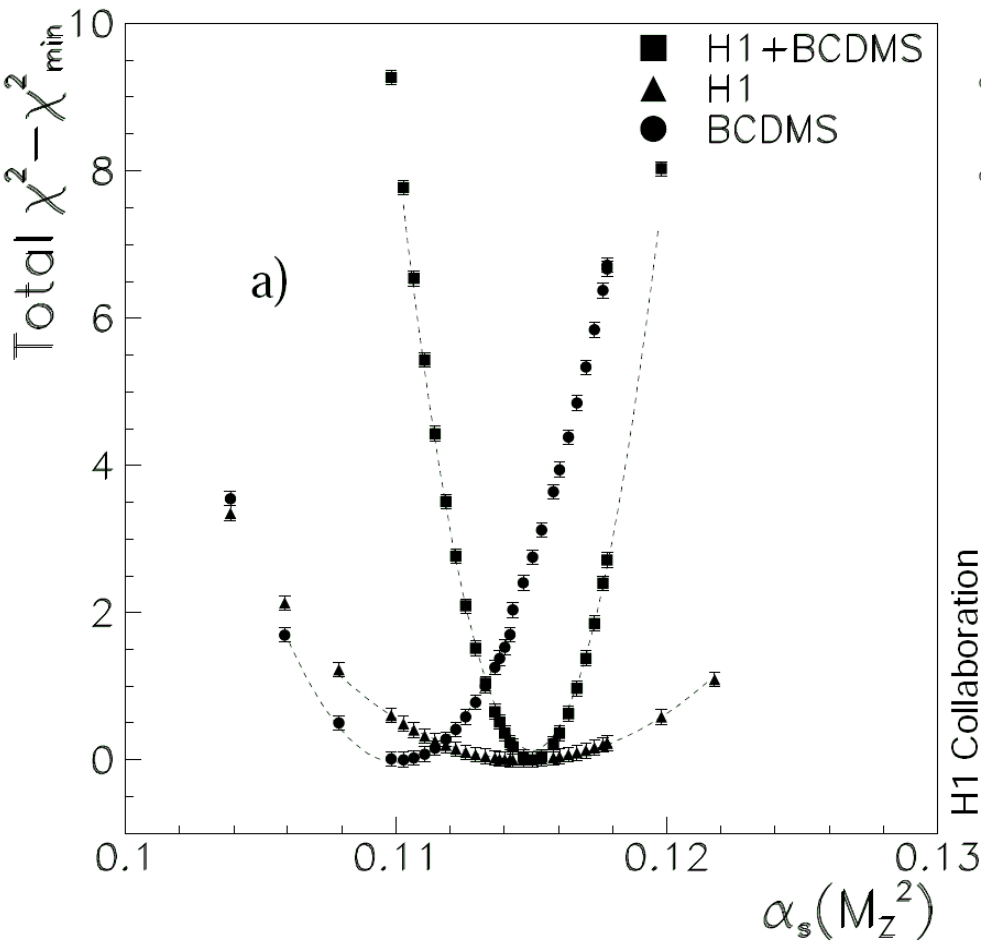
Simultaneous fit of gluon and $\alpha_s(M_Z)$ to H1 and BCDMS data

Gluon important at low x



Inclusive DIS

$$\alpha_s(M_Z^2) = 0.1150 \pm 0.0017(exp)^{+\ 0.0009}_{-\ 0.0005}(model) \pm 0.005(\text{scale})$$



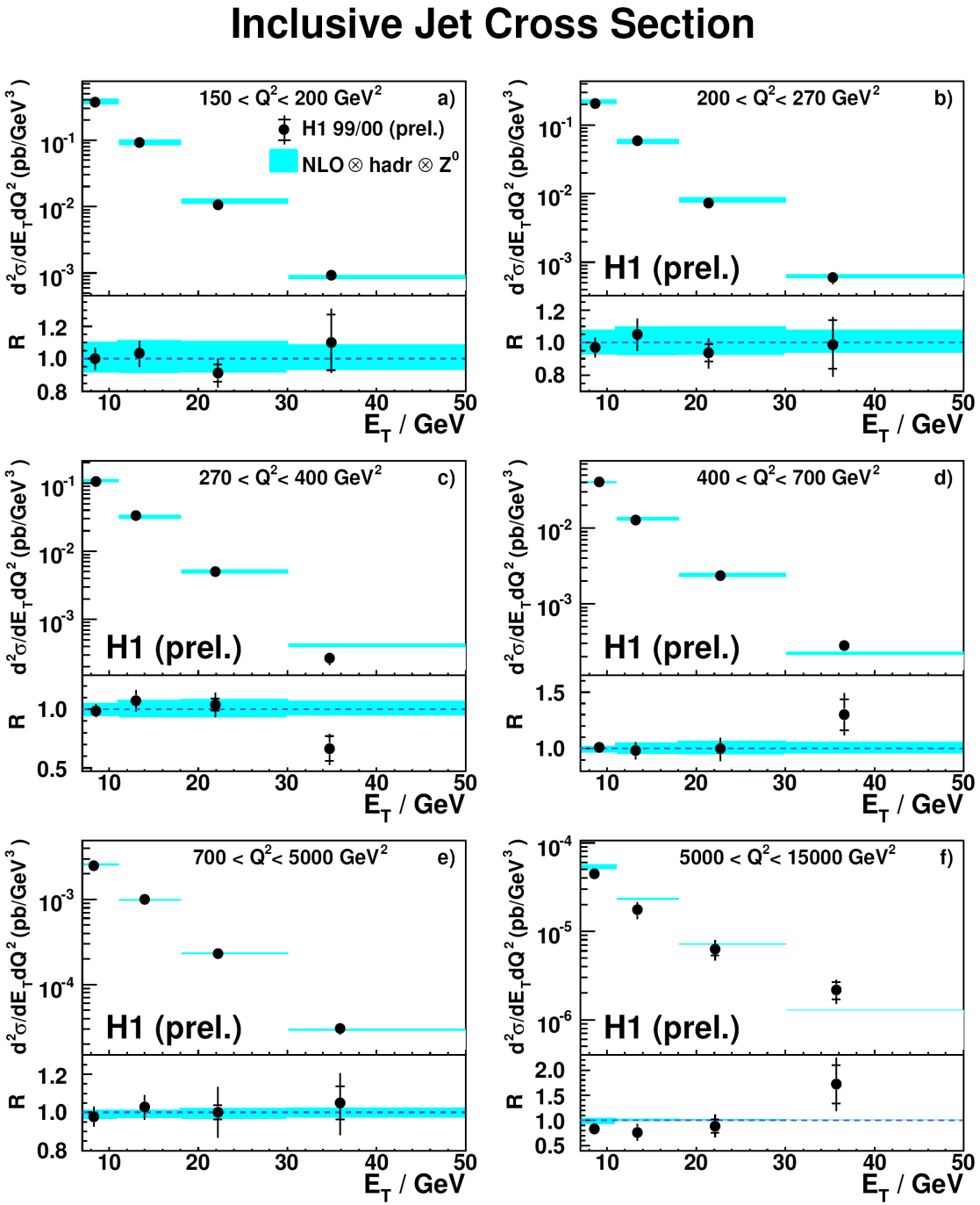
analysis uncertainty	$+\delta\ \alpha_s$	$-\delta\ \alpha_s$
$Q^2_{min} = 2$ GeV^2		0.00002
$Q^2_{min} = 5$ GeV^2	0.00016	
parameterisations	0.00011	
$Q^2_0 = 2.5$ GeV^2	0.00023	
$Q^2_0 = 6$ GeV^2		0.00018
$y_e < 0.35$	0.00013	
$x < 0.6$	0.00033	
$y_\mu > 0.4$	0.00025	
$x > 5 \cdot 10^{-4}$	0.00051	
uncertainty of $\overline{u} - \overline{d}$	0.00005	0.00005
strange quark contribution $\epsilon = 0$	0.00010	
$m_c + 0.1$ GeV	0.00047	
$m_c - 0.1$ GeV		0.00044
$m_b + 0.2$ GeV	0.00007	
$m_b - 0.2$ GeV		0.00007
total uncertainty	0.00088	0.00048

	$m_r = 0.25$	$m_r = 1$	$m_r = 4$
$m_f = 0.25$	-0.0038	-0.0001	$+0.0043$
$m_f = 1$	-0.0055	$--$	$+0.0047$
$m_f = 4$	$--$	$+0.0005$	$+0.0063$

Much more data available, NNLO theory

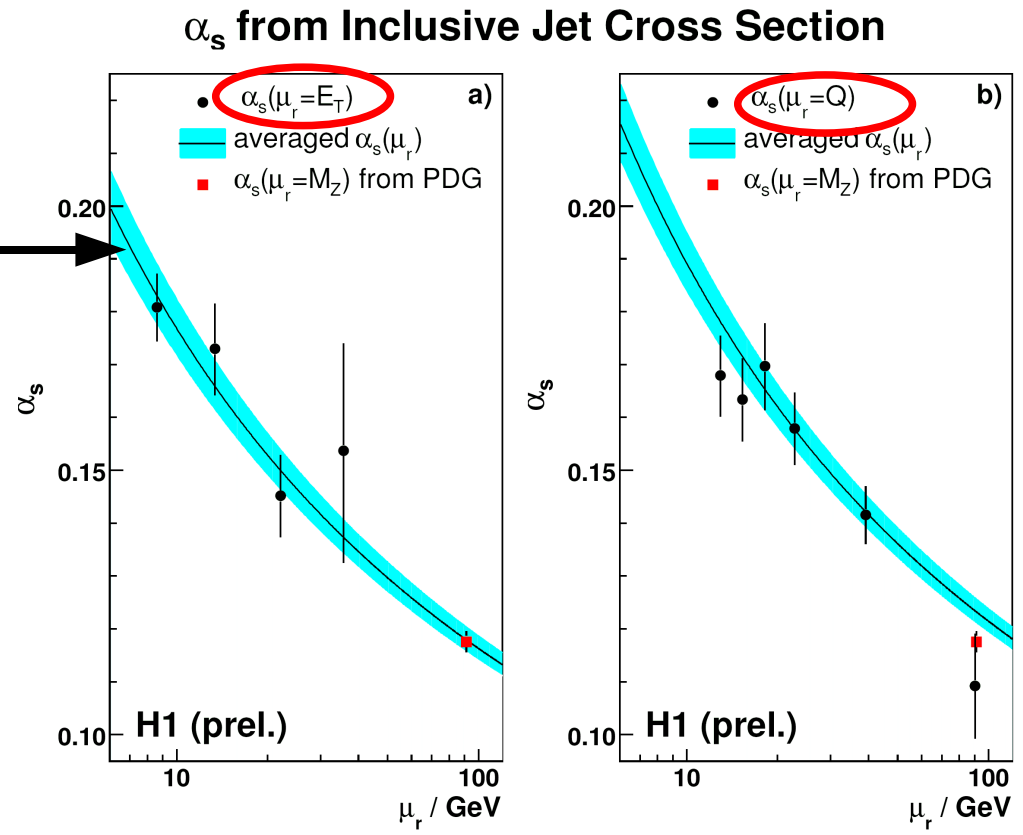
Inclusive Jets

- 1999-2000, e^+p , $\mathscr{L}_{int}$=65pb^{-1}
- NC DIS, 150<Q^2<15000 GeV^2
- k_T jets in the Breit frame
  $7 < E_{T,jet}^{BREIT} < 50$GeV
- Main exp. uncertainties:
  had. energy scale and model
- Take PDFs from CTEQ6.5,
  fit $\alpha_s(M_Z)$
- In addition:
  normalised jet cross section
  $\sigma^{jet} / \sigma^{NCDIS}$
  average number of jets per event



Inclusive Jets

exp. error only



Theory error from scale variation by factor 2

- Inclusive jet cross section

$$\alpha_s(M_Z) = 0.1179 \pm 0.0024\,(\text{exp.}) \,^{+0.0052}_{-0.0032}\,(\text{th.}) \pm 0.0030\,(\text{pdf.})$$

- Normalised inclusive jet cross section

$$\alpha_s(M_Z) = 0.1193 \pm 0.0014\,(\text{exp.}) \,^{+0.0046}_{-0.0032}\,(\text{th.}) \pm 0.0016\,(\text{pdf.})$$

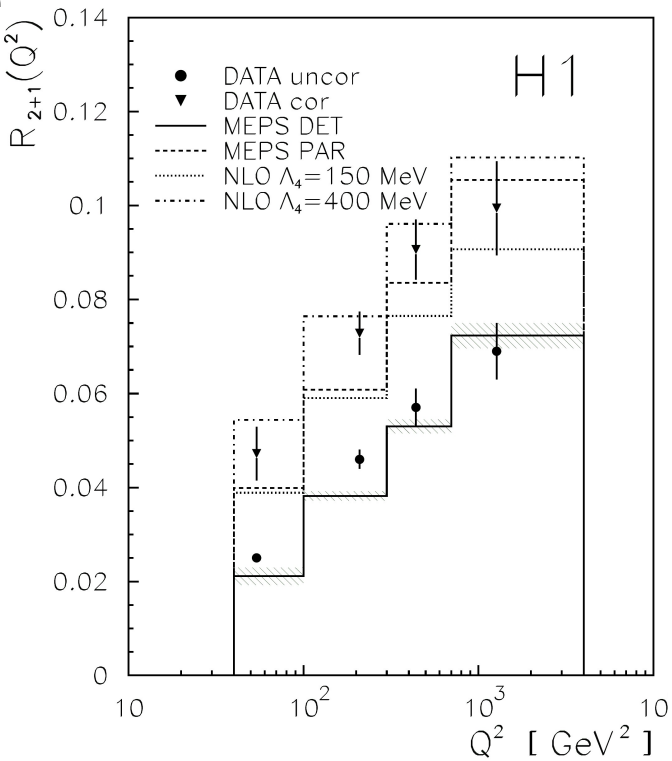
Jet Rates

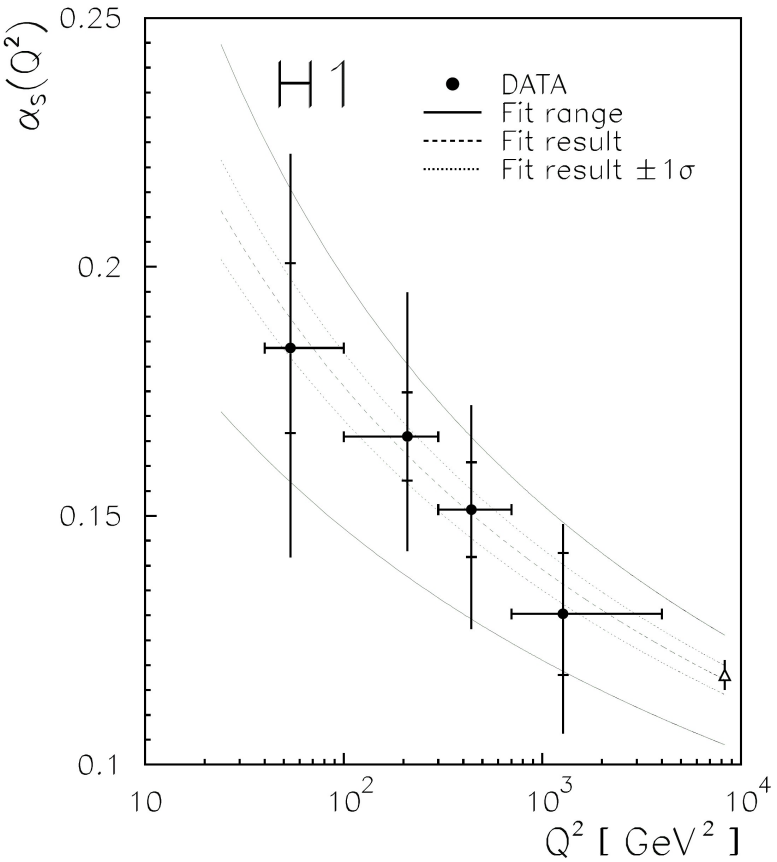
modified JADE in lab frame

$R_{2+1}=N_{2+1}/(N_{1+1}+N_{2+1})$
at $y_{cut}=0.02$

$40<Q^2<4000$ GeV^2
data from 94-95, ~10pb^{-1}

MEPJET, had. cor.





$$\alpha_s(M_Z^2) = 0.117 \pm 0.003\,(stat)\,{}^{+0.009}_{-0.013}\,(sys)\ +0.005\text{-}0.008\ (\text{theo.})$$

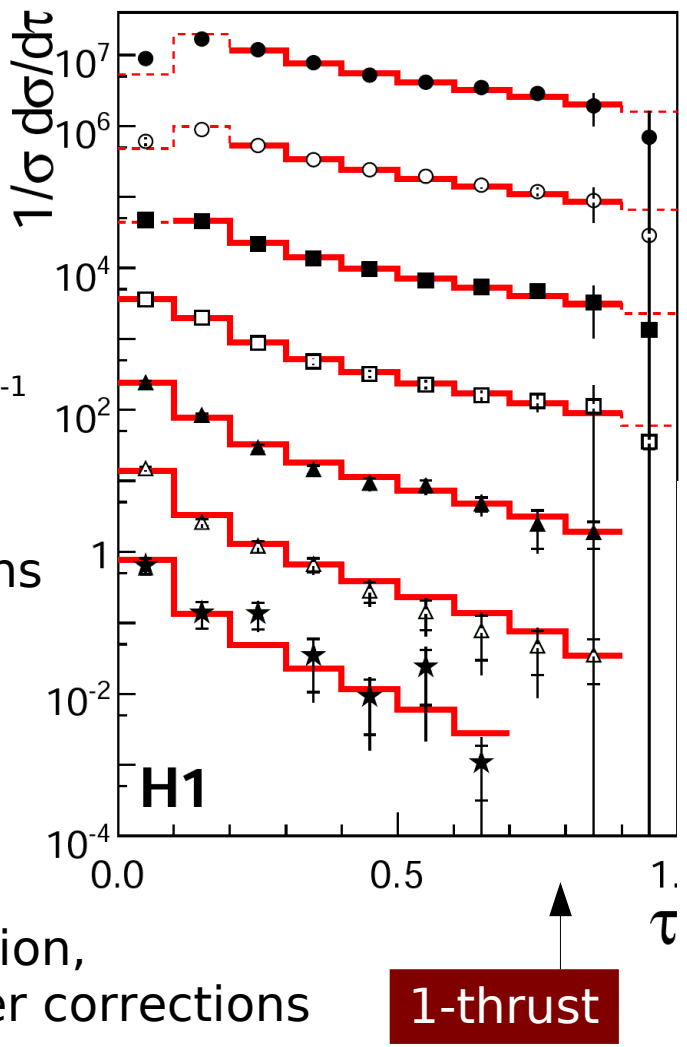
- Main exp. uncertainties: had. energy scale and model

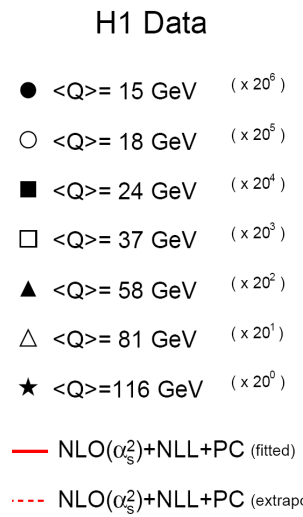
Event Shapes

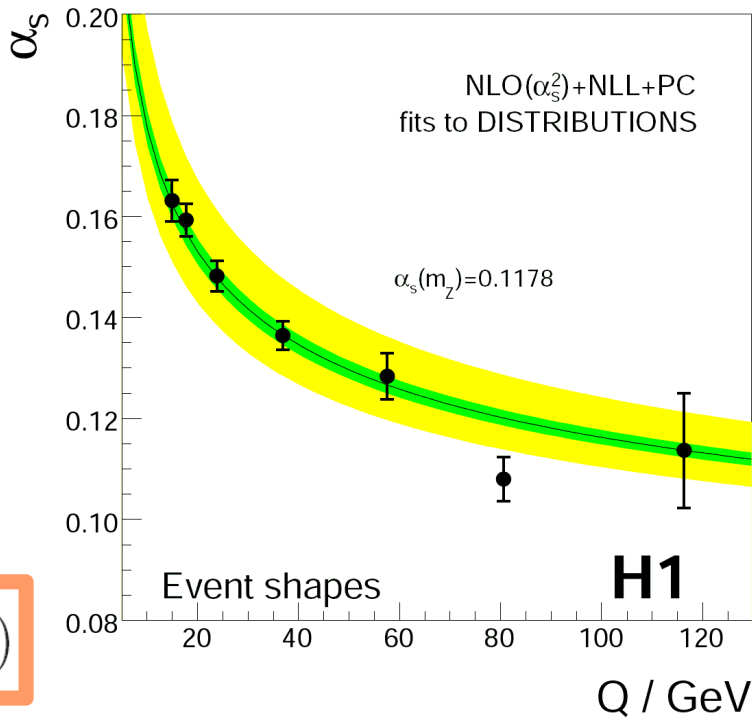
196<Q²<40000 GeV²

data from 98-00, ~106pb⁻¹

5 event shape distributions in the Breit frame





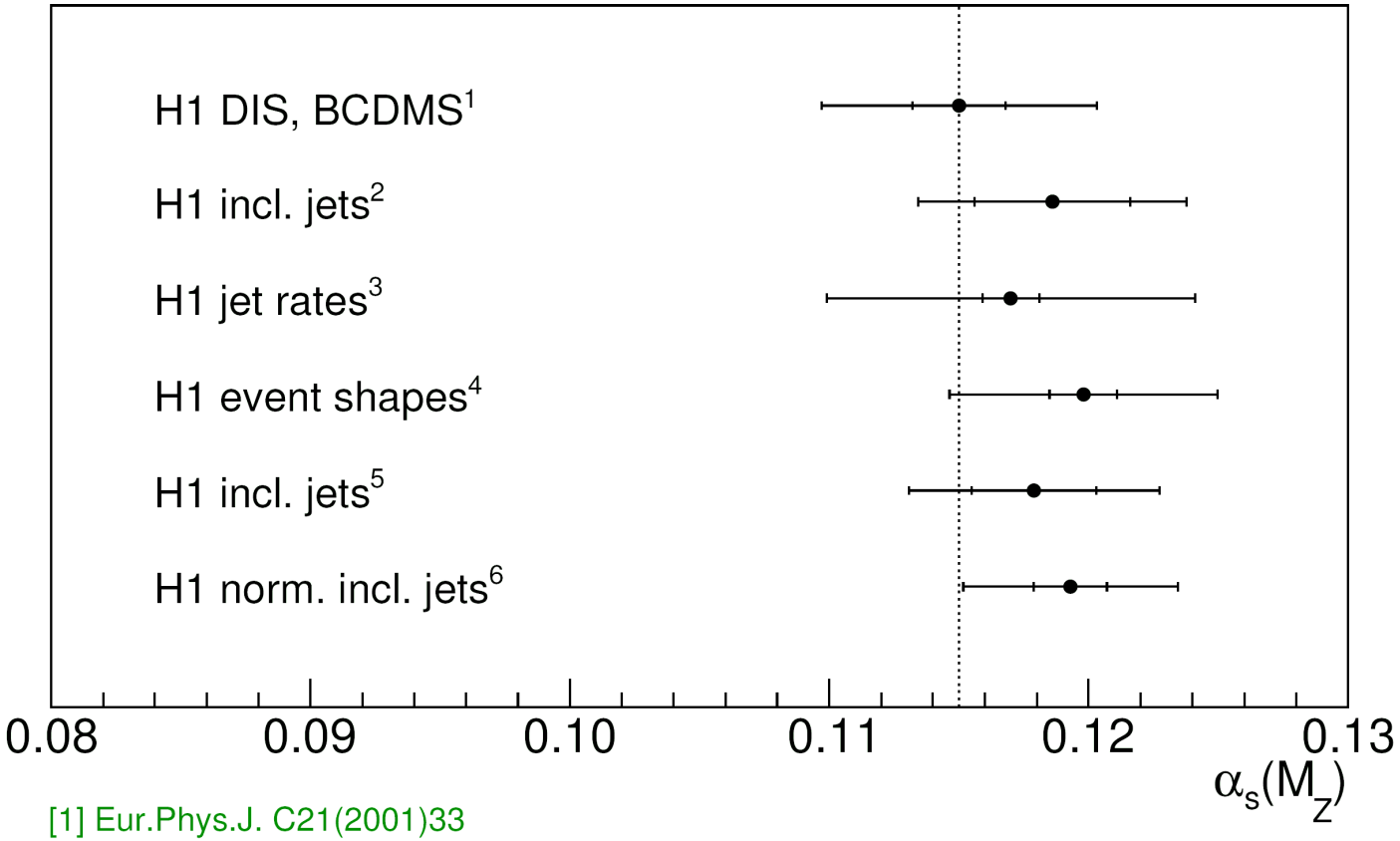


DISASTER++, resummation, Dokshitzer-Webber power corrections

$$\alpha_s(m_Z) = 0.1198 \pm 0.0013\,(\text{exp})\,{}^{+0.0056}_{-0.0043}\,(\text{theo})$$

- Main exp. uncertainties: elm. energy scale and model

Summary



[1] Eur.Phys.J. C21(2001)33
[2] Eur.Phys.J. C19(2001)289-311
[3] Eur.Phys.J. C6(1999)575
[4] Eur.Phys.J. C46(2006)343-356
[5] submitted to DIS07
[6] submitted to DIS07

- No obvious problem observed (within the current precision)
- Experimental uncertainties will continue to shrink
- NNLO for final states needed to get on...