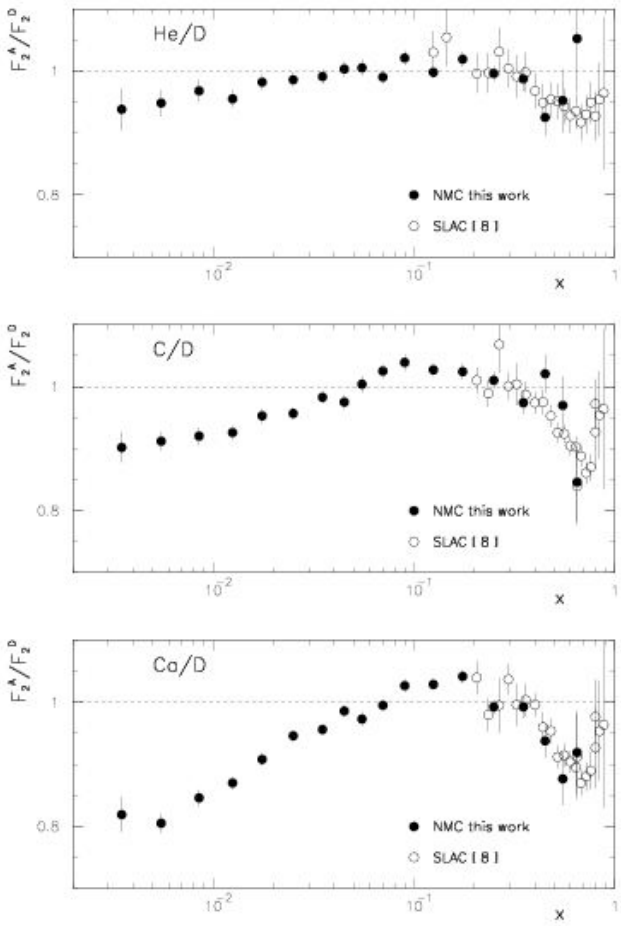
Shadowing and radiative corrections at low x and Q^2

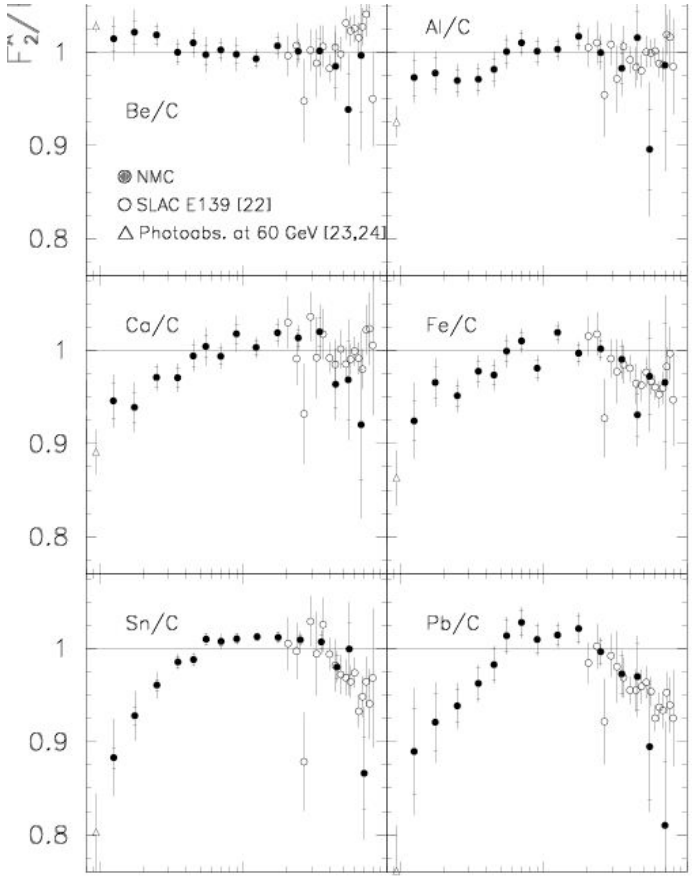
Antje Bruell

Hall C summer workshop, August 2008

Motivation

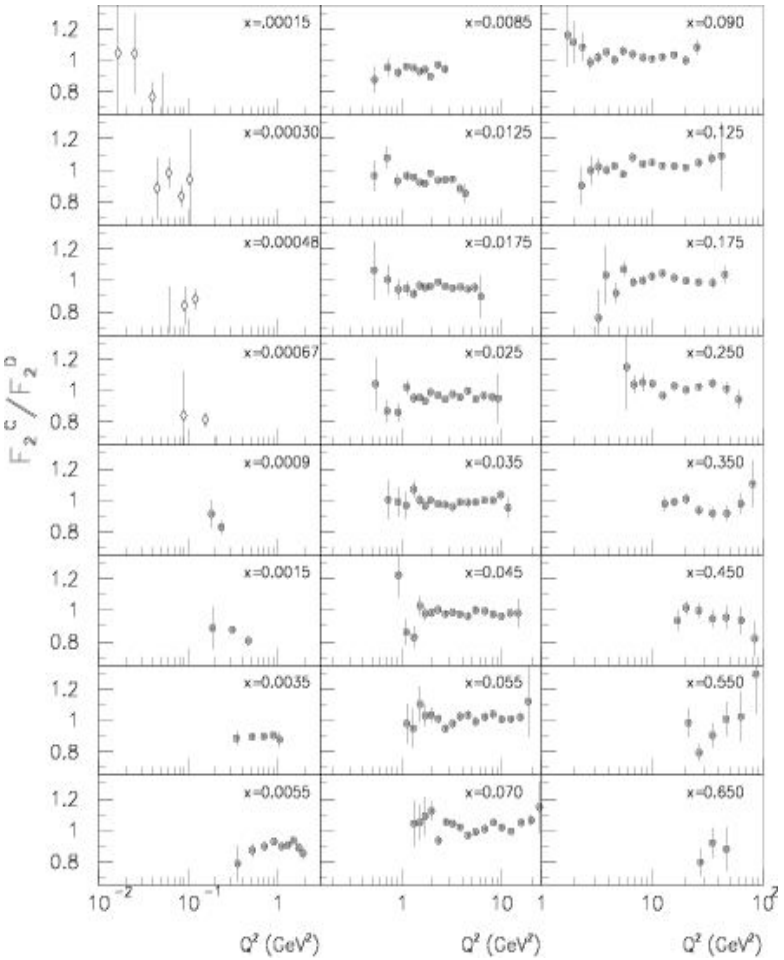
- **x- and A-dependence of the EMC effect**

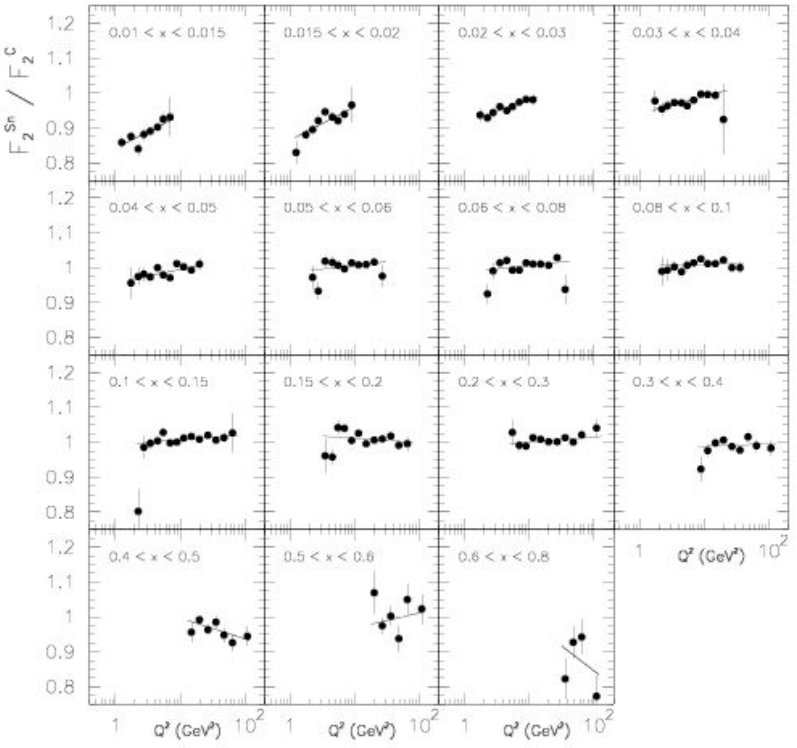




Motivation

- Q^2-dependence of the EMC effect





Motivation

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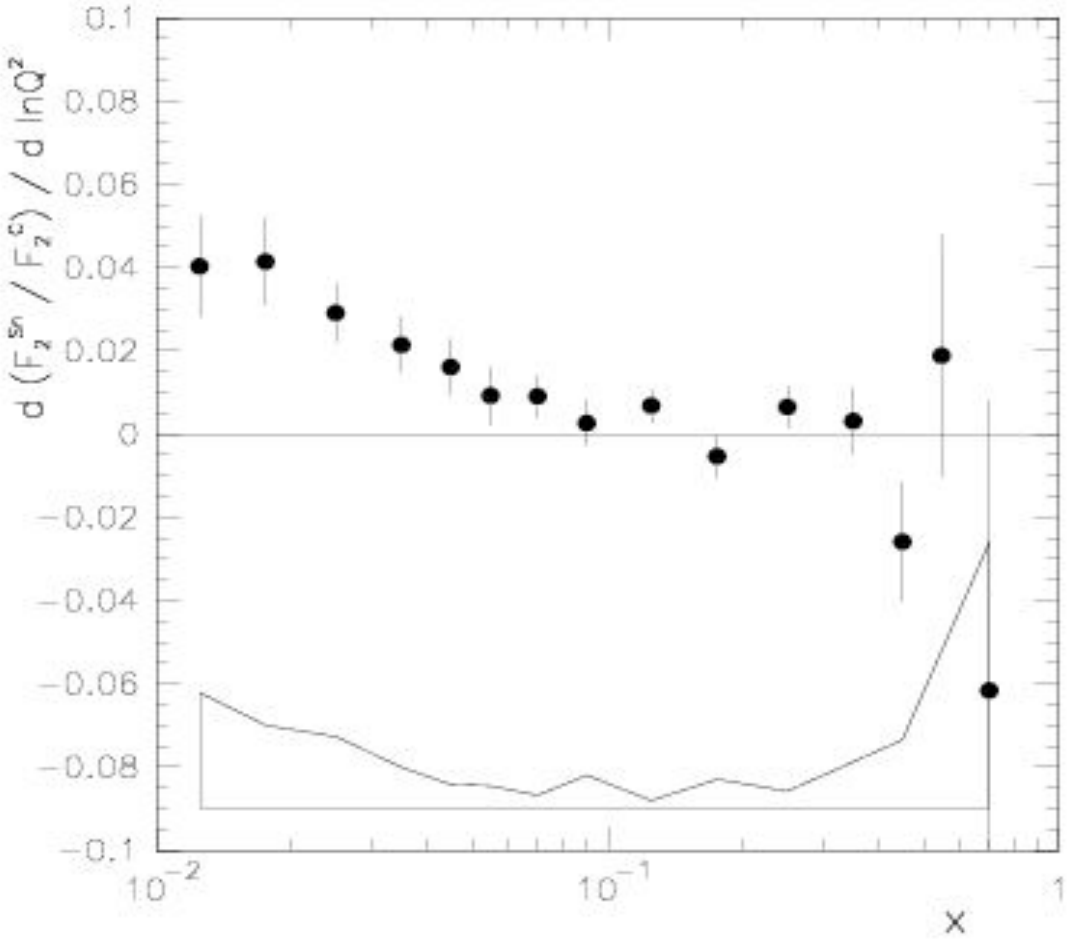
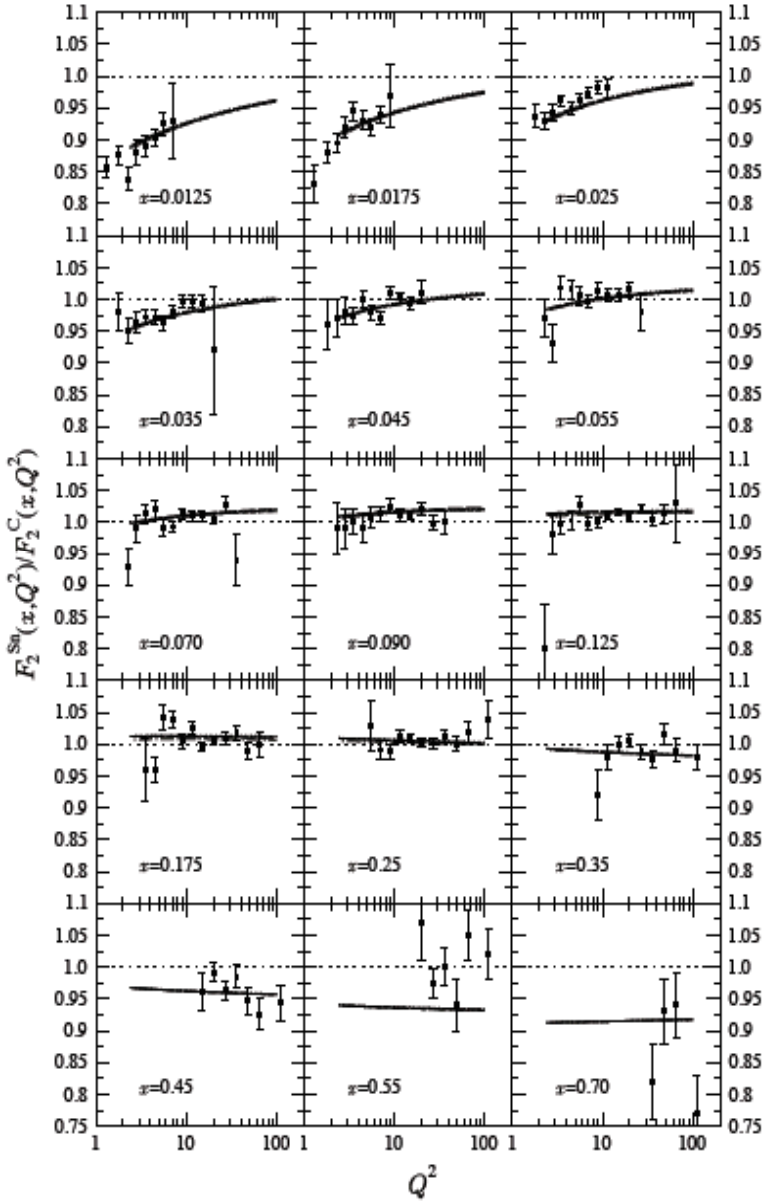
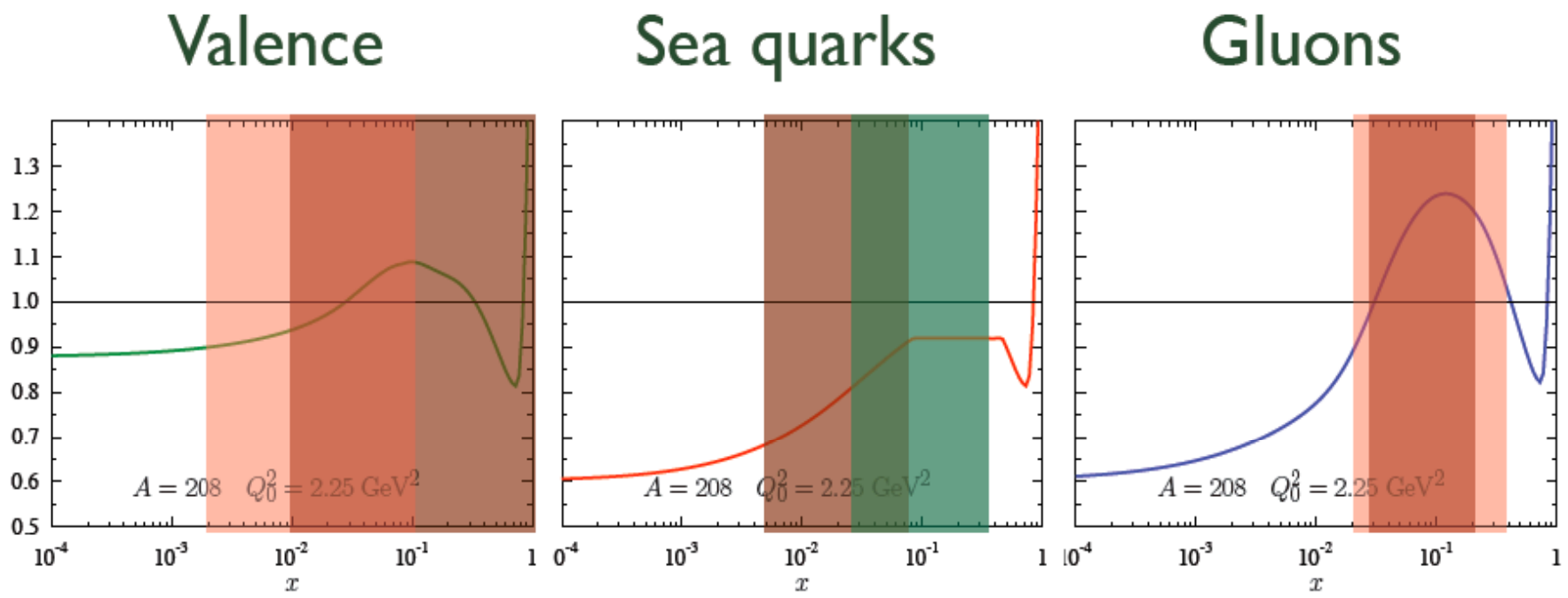


EKS98

- Parametrize $R^A_{F_2}(x)$ at $Q_0^2 = 2.25\,\mathrm{GeV}^2$
- Valence quarks $R^A_{u_V} = R^A_{d_V} = R^A_V(x)$
  - Large-x fixed to $R^A_V \simeq R^A_{F_2}$
  - Intermediate-x by DY
  - Rest: Baryon number sum rule
- Sea quarks $R^A_{\bar{u}} = R^A_{\bar{d}} = R^A_{\bar{s}} = R^A_S(x)$
  - Small-x fixed to $R^A_S \simeq R^A_{F_2}$
  - Intermediate-x by DY
  - Large-x: assumption
- Gluons
  - Large/small-x fixed to $R^A_g \simeq R^A_{F_2}$
  - Intermediate-x: DGLAP



Approximate ranges and constraints in EKS98

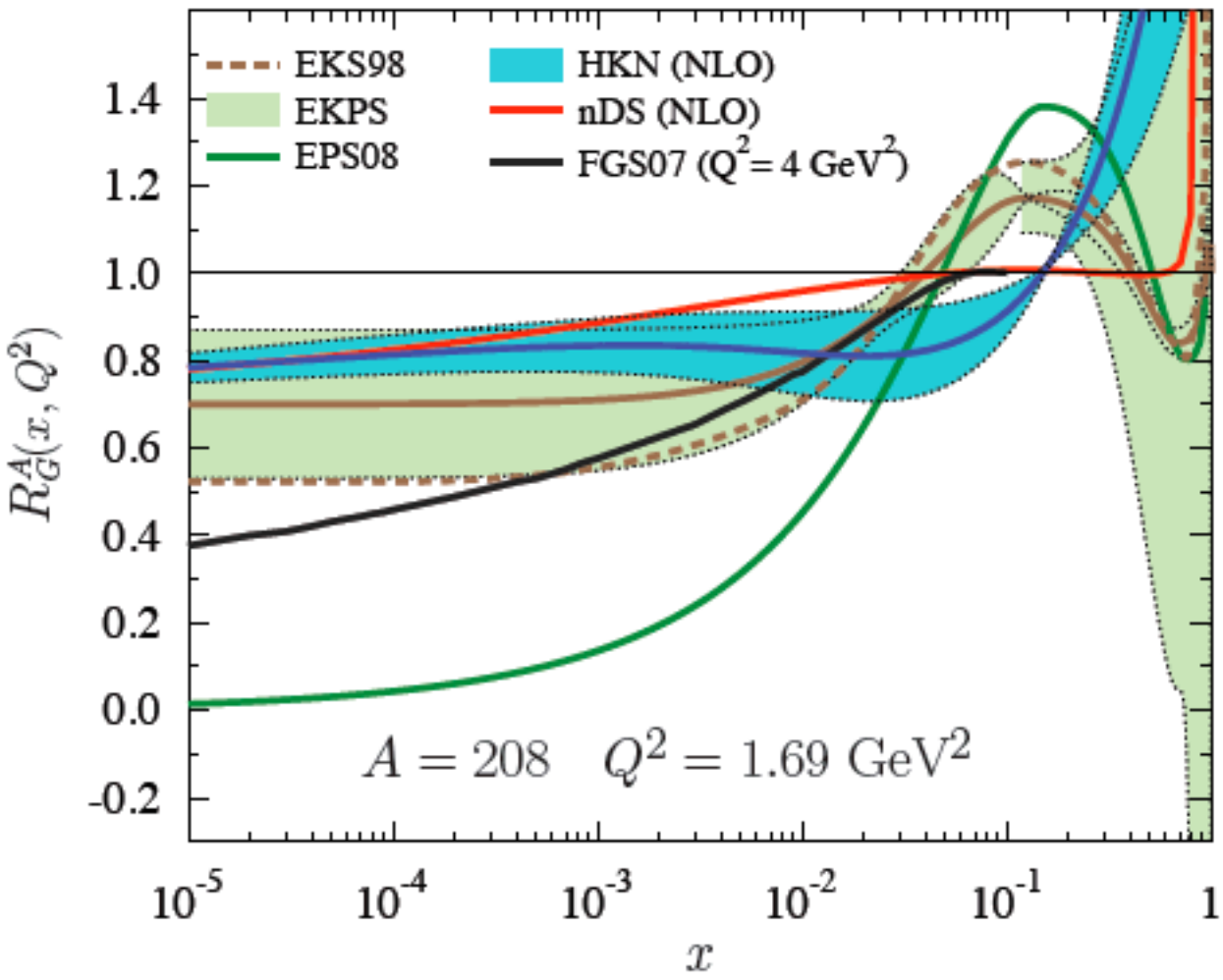


Constrained by DIS

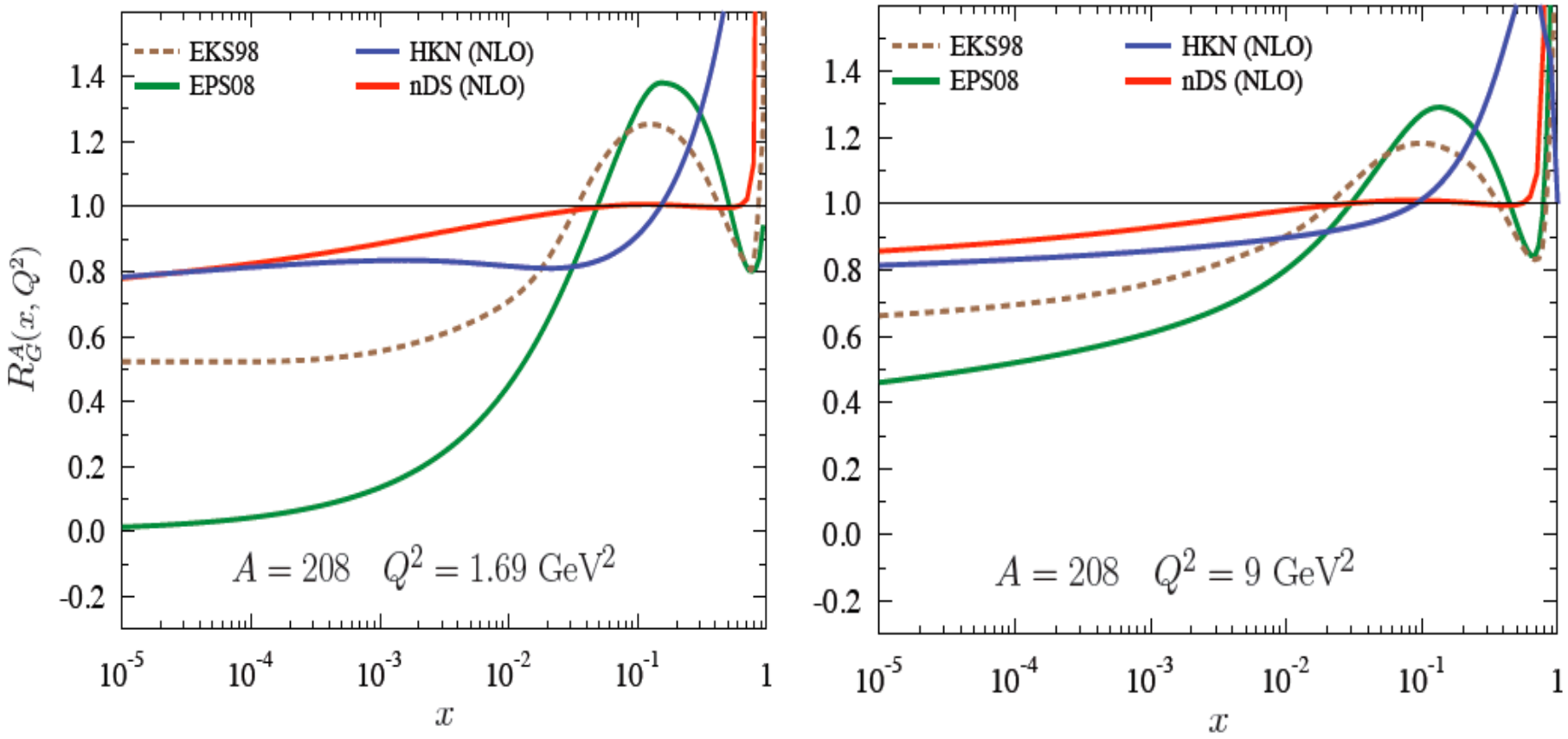
Constrained by DY

Constrained by Sum rules

Comparison of different parametrisations

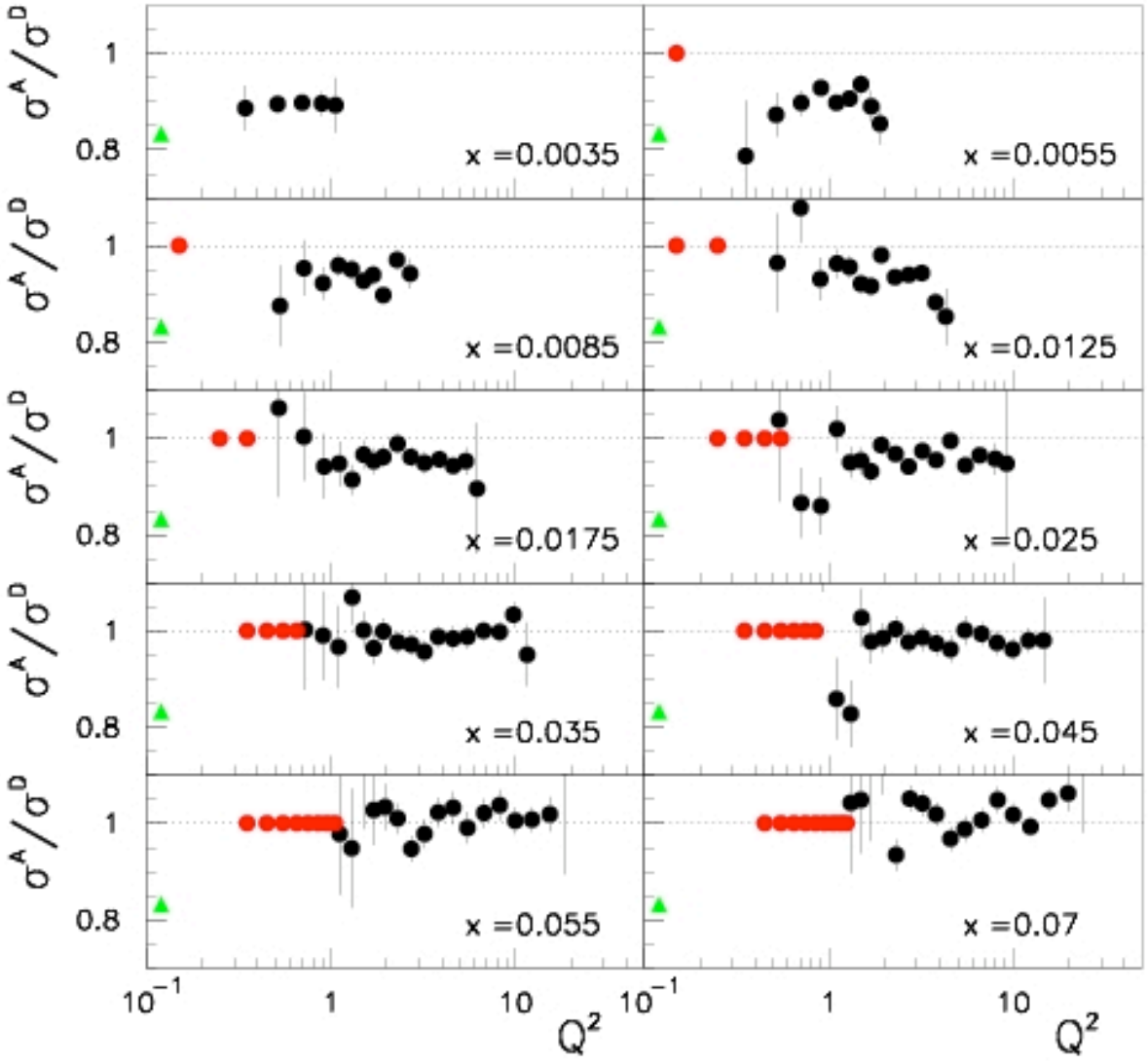


Q^2 evolution of R_G^A



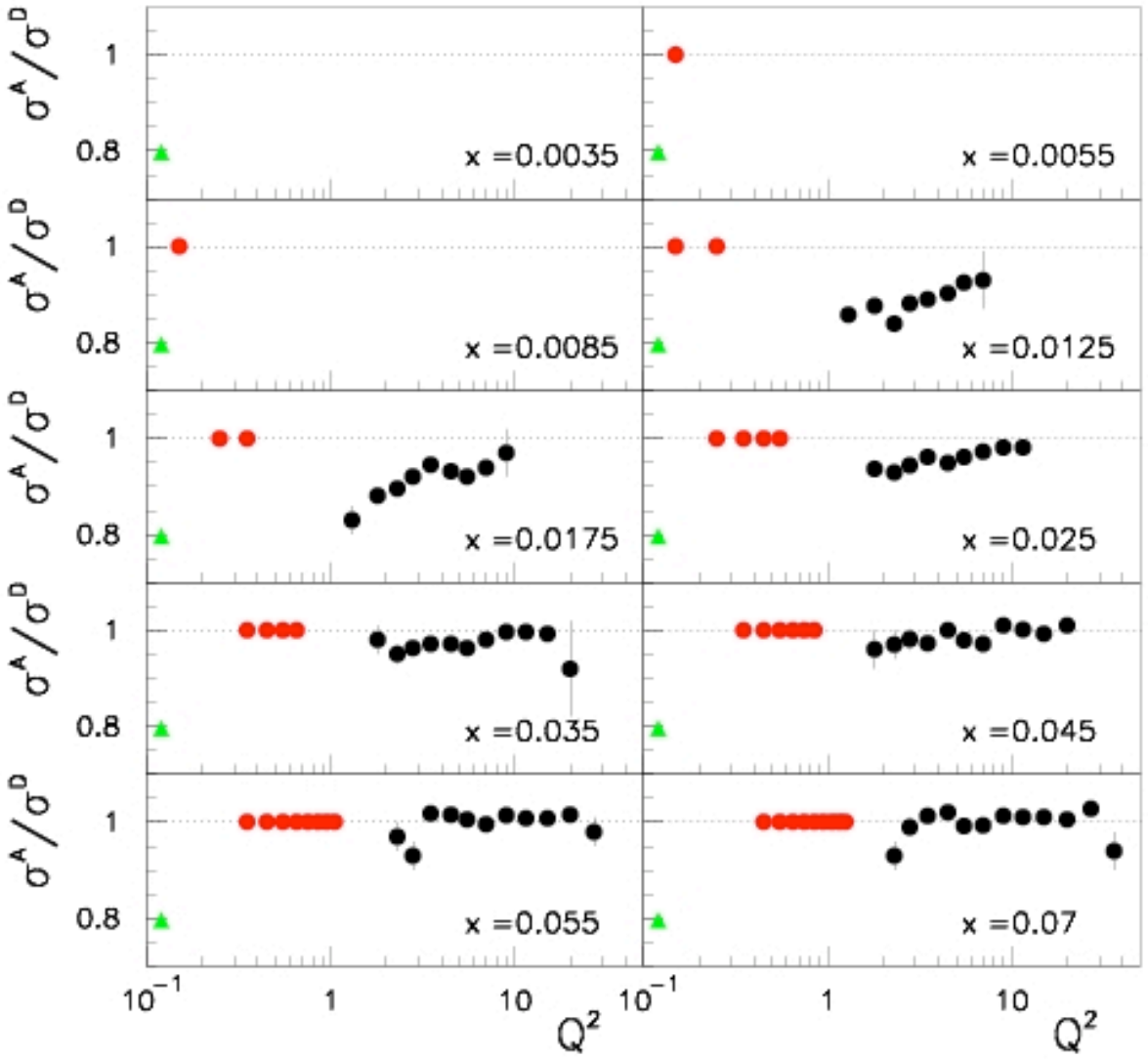
DGLAP evolution removes the nuclear effects very efficiently

Possible Measurements @ 12 GeV



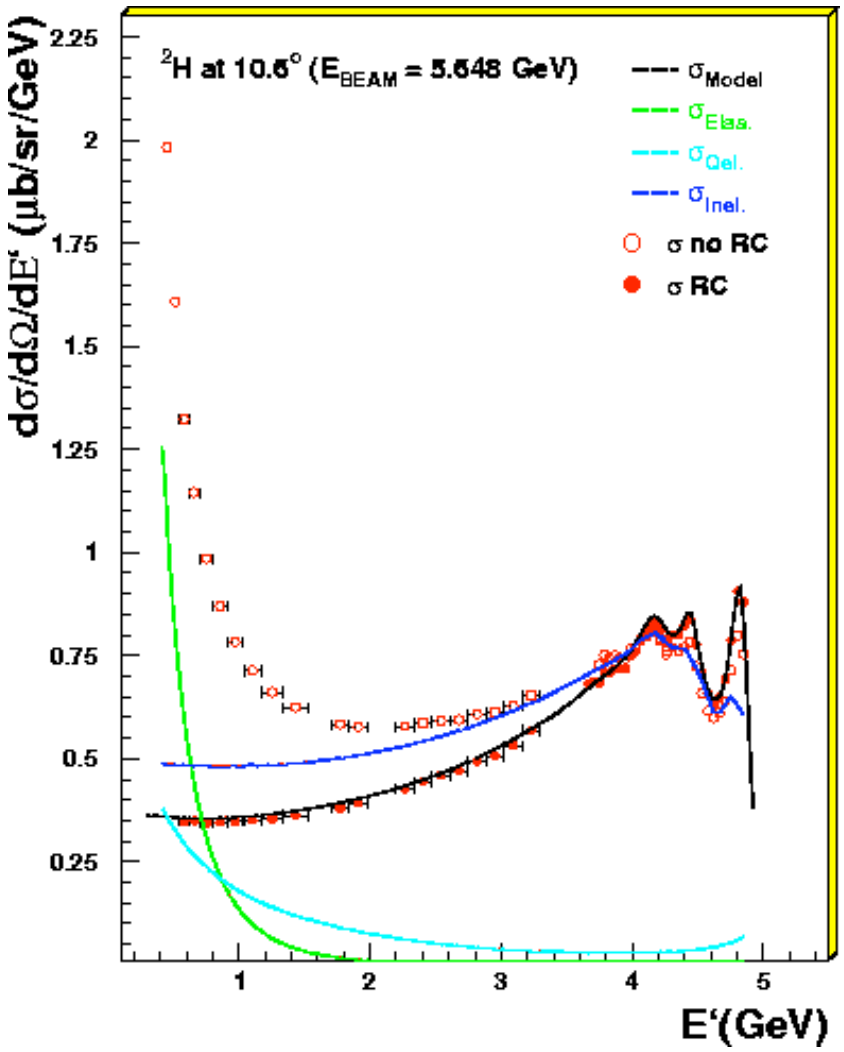
C/D

Possible Measurements @ 12 GeV



Sn/C

What's the problem ?

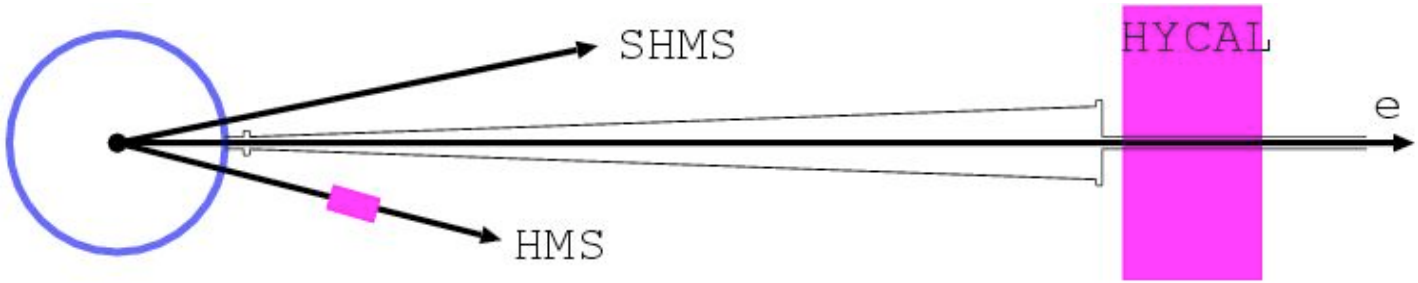


- **huge radiative effects at extreme kinematics**
- radiation from elastic and quasielastic scattering dominant at low E'
- both external and internal effects important
- higher order effects important
- additional complications for heavy nuclei

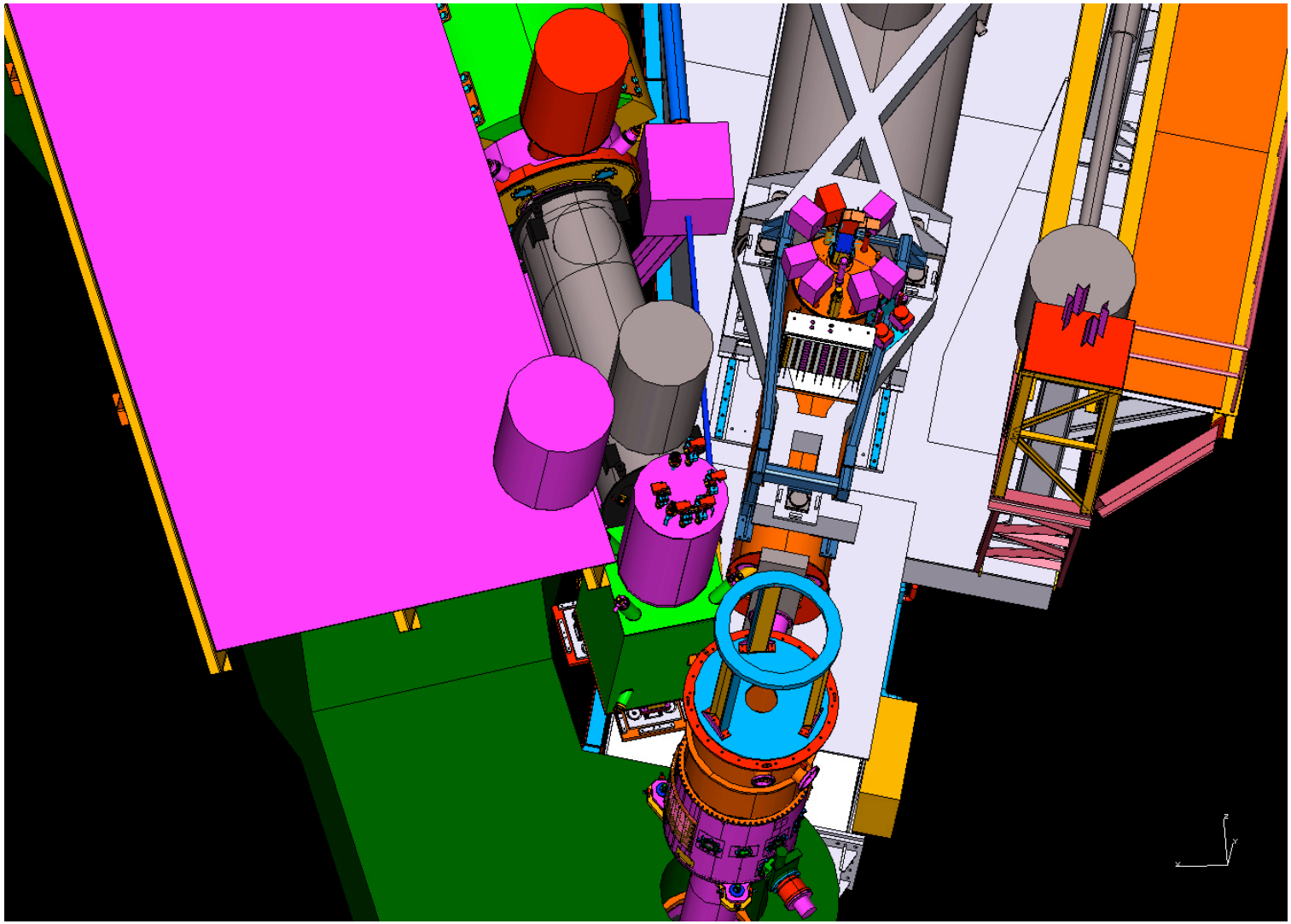
➢ **dedicated measurement of radiative effects**

Measurement of radiative effects

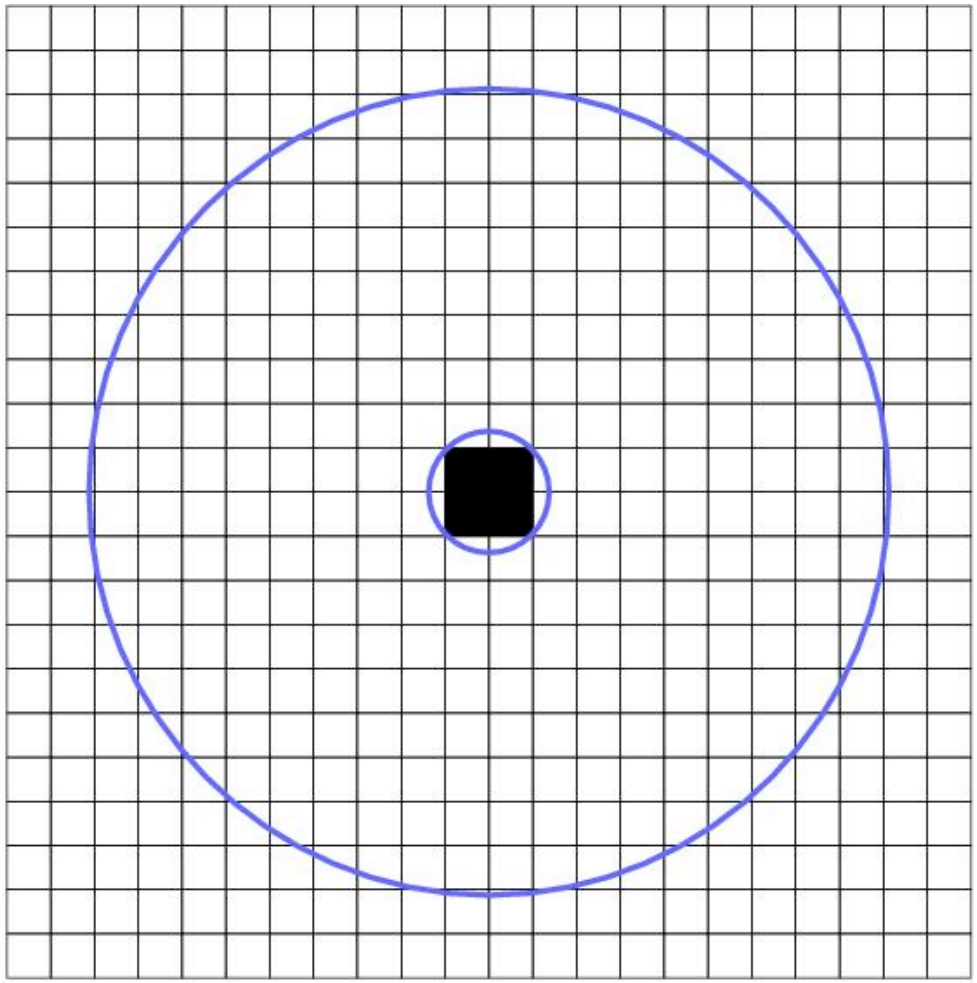
- select kinematics with large radiative effects
- Measure the spectrum of emitted photons up to angles of ~ 2^0
- Calorimeters around beam and scattered electron directions
- beam currents of ~ 10 nA to avoid radiation damage

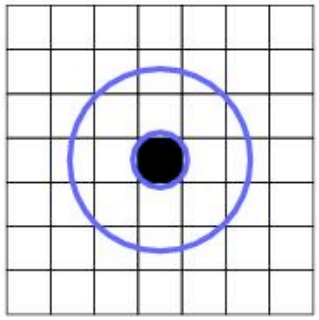


Measurement of radiative effects



Measurement of radiative effects

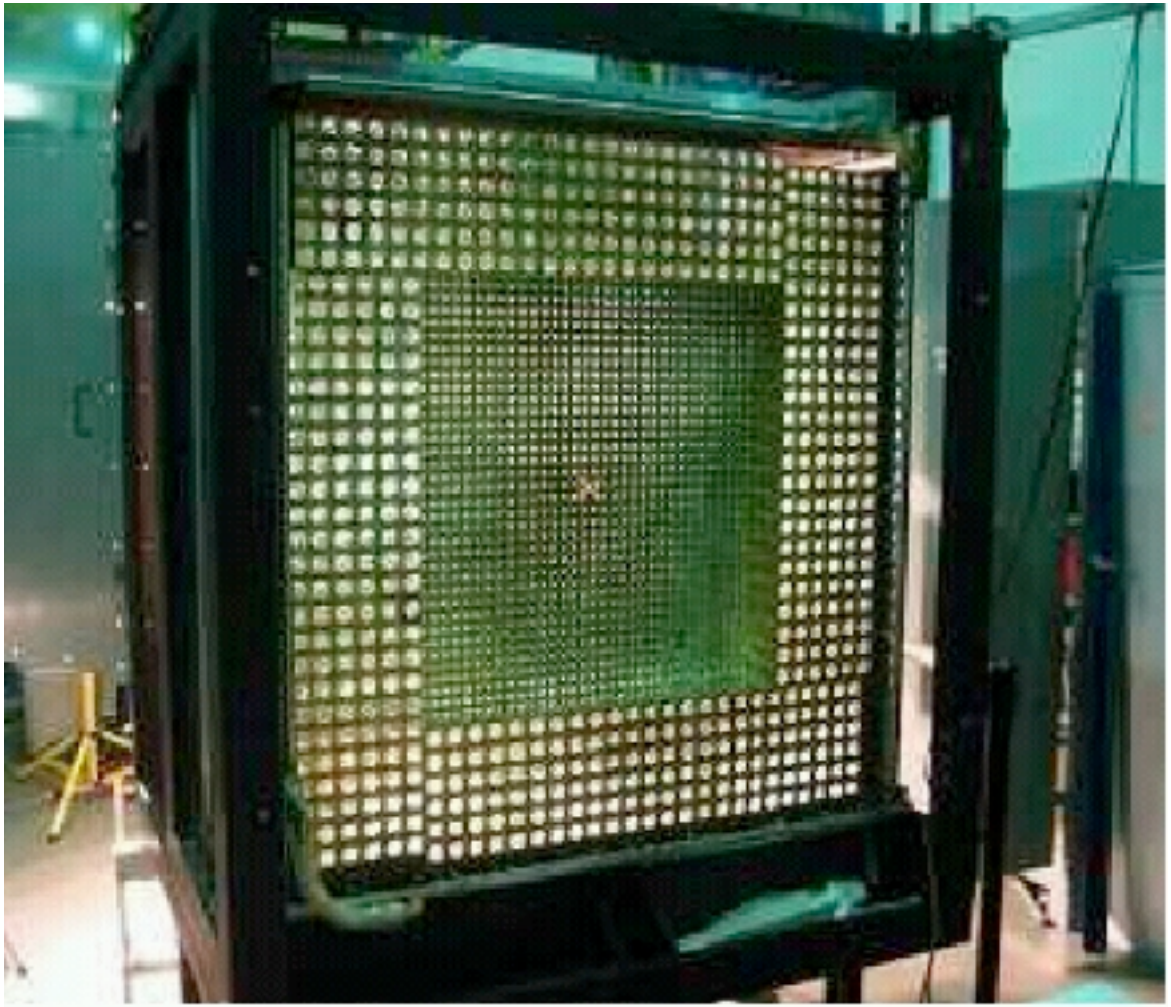




scattered electron
7x7 crystals

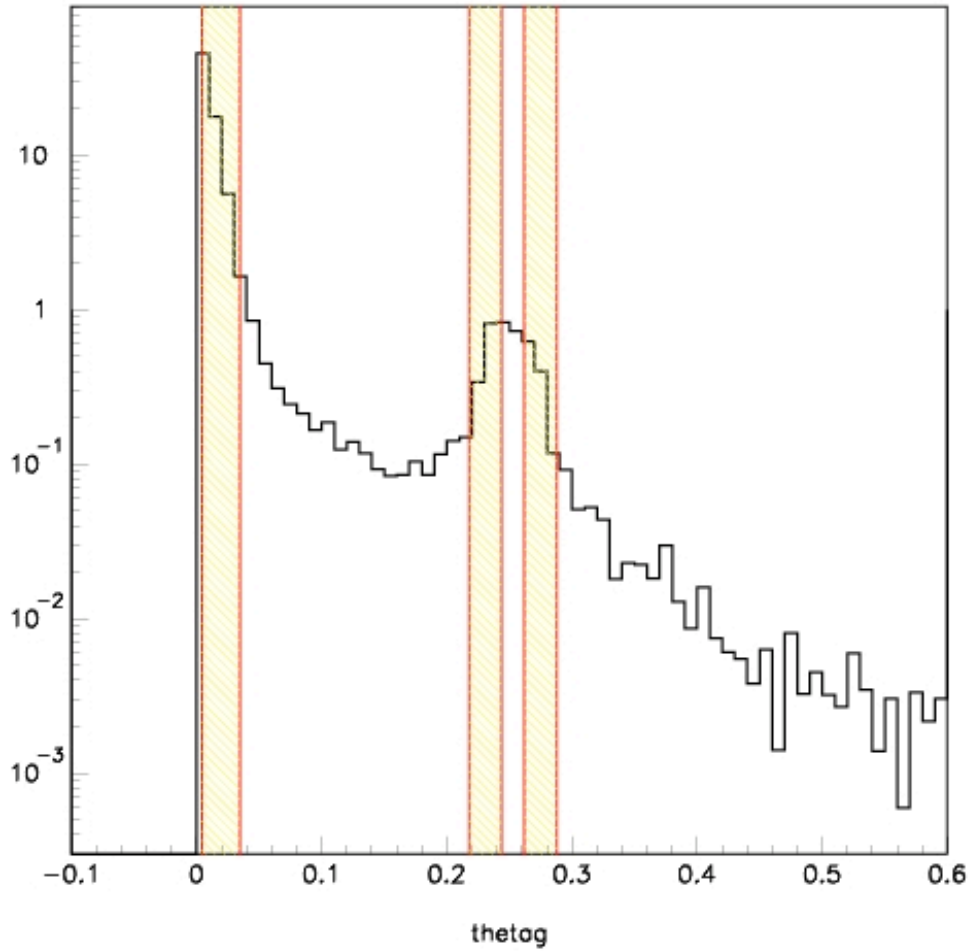
beam electron
22x22 crystals (2x2x18cm^3)

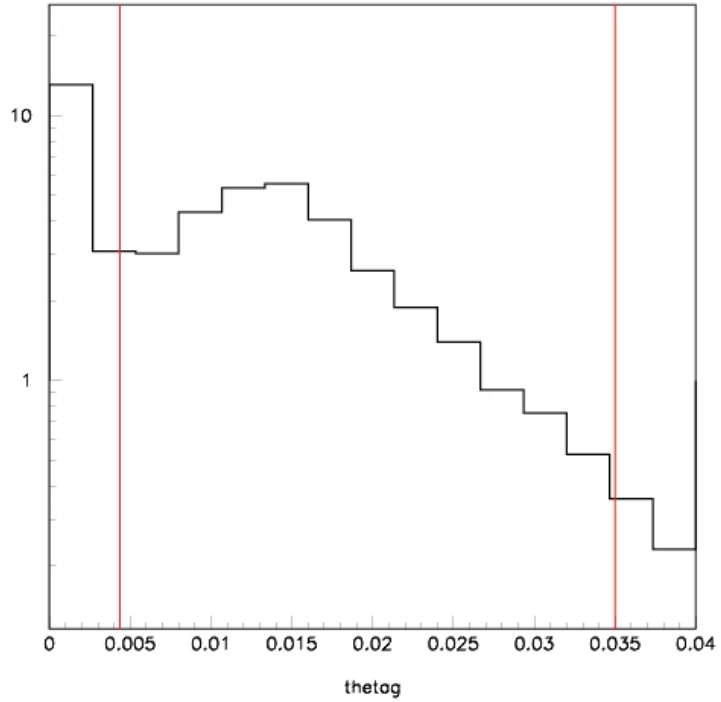
Measurement of radiative effects



beam electron: reconfiguration of HYCAL

Measurement of radiative effects





Summary

- Q^2 dependence of shadowing not understood
- important for determination of gluon distribution in nuclei
- previous measurements with electron beams limited by systematic uncertainties in radiative corrections

- 11 GeV beam allows measurements connecting to previous NMC experiments at low x
- Control of systematics requires to measure the spectrum of emitted photons
- Calorimeters around beam and scattered electron directions for dedicated measuremens at low currents

- possibility to measure F_L and its truncated moment presently under study
- parallel measurements of R_H and R_D at low x and Q^2