

Status of the photon structure analysis including forward detectors

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Expected measurement capabilities

Estimated numbers of events per 10 months of work

	sqrt(s) [GeV]	Luminosity [$10^{34} \text{cm}^{-2}\text{s}^{-1}$]	$\sigma(e^+e^- \rightarrow e^+e^-\gamma\gamma \rightarrow e^+e^-\text{hadrons})$ [pb]	N(events)
ILC	500	1.8	39.36	1.84×10^6
	1000	3.6	33.08	3.68×10^6
CLIC	1500	3.7	7.63	7.32×10^6
	3000	5.7	8.93	1.46×10^7

But taking into account the acceptance of detectors expected numbers of events are smaller, e.g.:

BeamCal	$- 7.16 \times 10^4$	} for ILC (500)
LumiCal	$- 2.45 \times 10^4$	
ECAL end-cap	$- 1.54 \times 10^3$	

Expected kinematic ranges

	ILC (500)		CLIC (3000)	
	x_{\min}	Q^2 [GeV 2]	x_{\min}	Q^2 [GeV 2]
BeamCal	2×10^{-4}	0.1 – 100	1×10^{-3}	250 – 3950
LumiCal	1×10^{-3}	30 – 390	9×10^{-3}	1580 – 39800
ECAL end-cap	1×10^{-2}	390 – 25000	1×10^{-2}	25000 – 195000

ILC

LumiCal

31 – 78 mrad

BeamCal

5.8 – 43.5 mrad

ECAL end-cap

100 – 700 mrad

CLIC

LumiCal

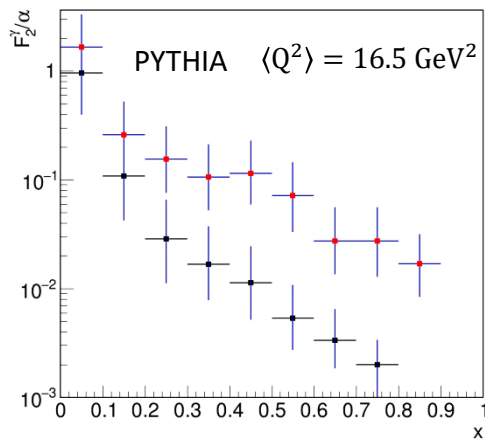
38 – 110 mrad

BeamCal

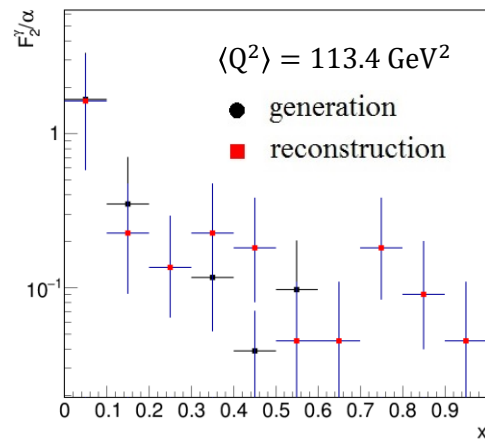
15 – 38 mrad

ECAL end-cap

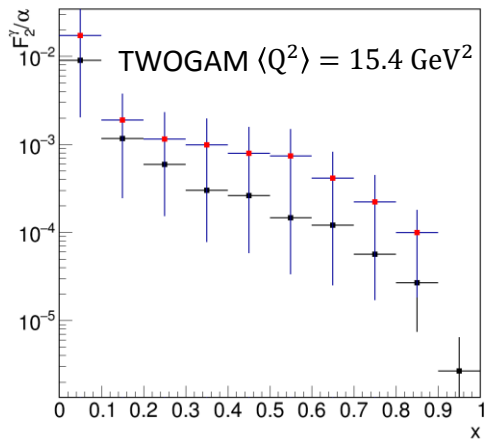
135 – 705 mrad



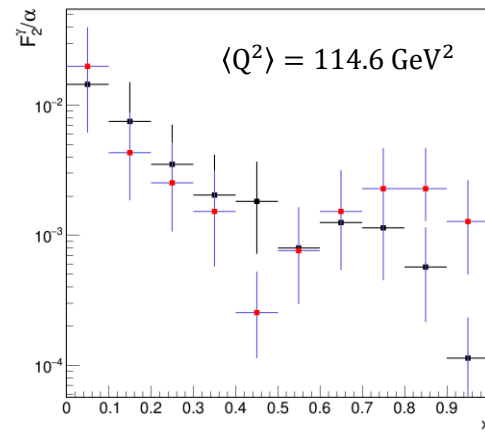
QCD photon structure function, BeamCal, ILC(500)



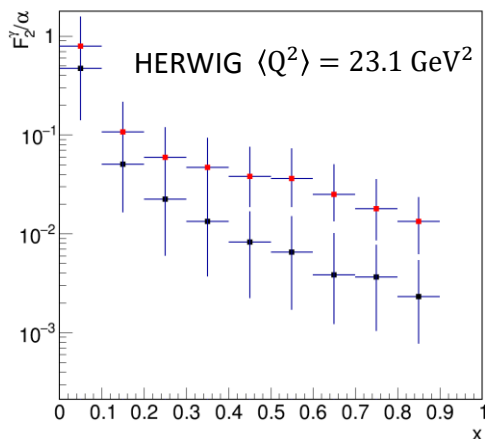
QCD photon structure function, LumiCal, ILC(500)



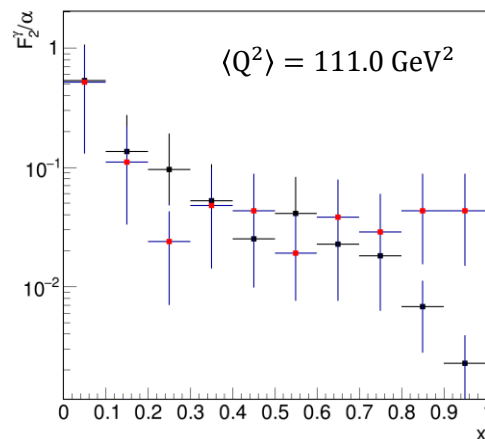
QCD photon structure function, BeamCal, ILC(500)



QCD photon structure function, LumiCal, ILC(500)



QCD photon structure function, BeamCal, ILC(500)



QCD photon structure function, LumiCal, ILC(500)

Photon structure function

Examples of results for generation and reconstruction level – ILC (500 GeV)

For generation were used various generators

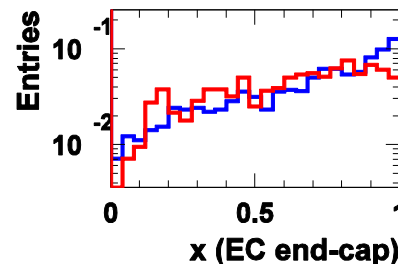
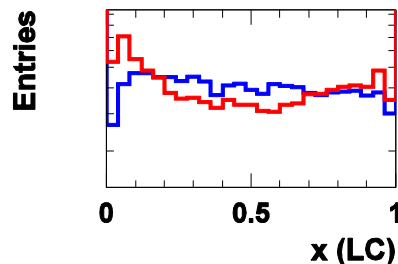
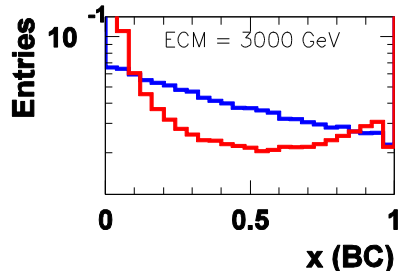
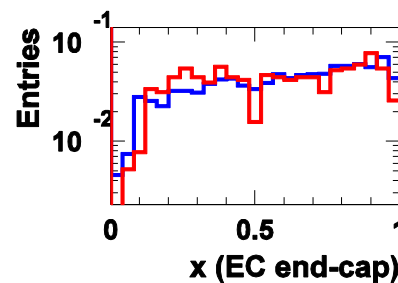
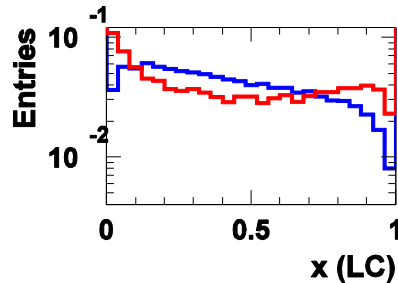
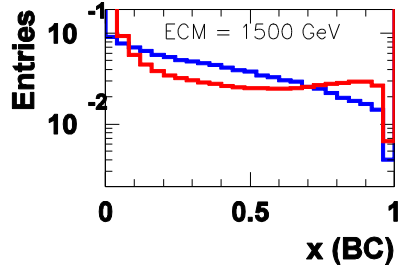
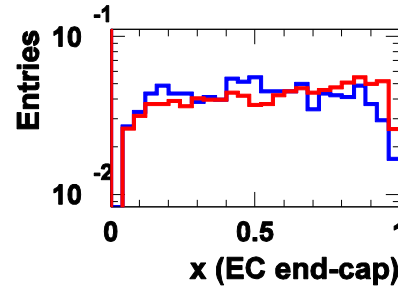
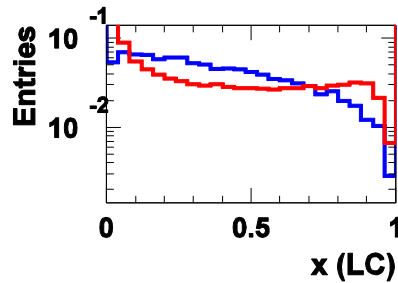
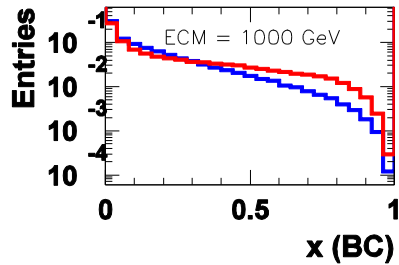
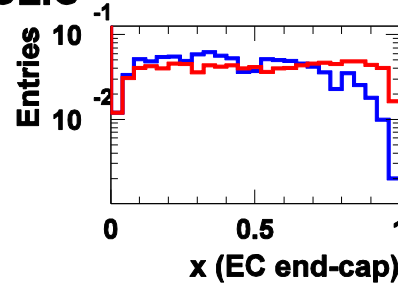
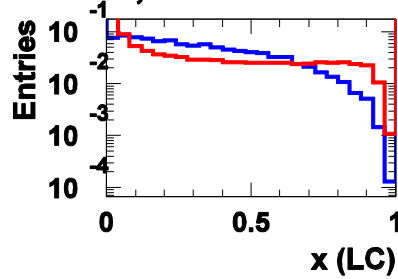
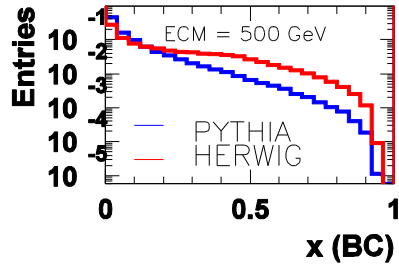
Scattered electrons tagged at the LumiCal and BeamCal

Only statistical uncertainties

The correction due to the detector effects is needed

Comparison of generation level results

PYTHIA, HERWIG: ILC/CLIC

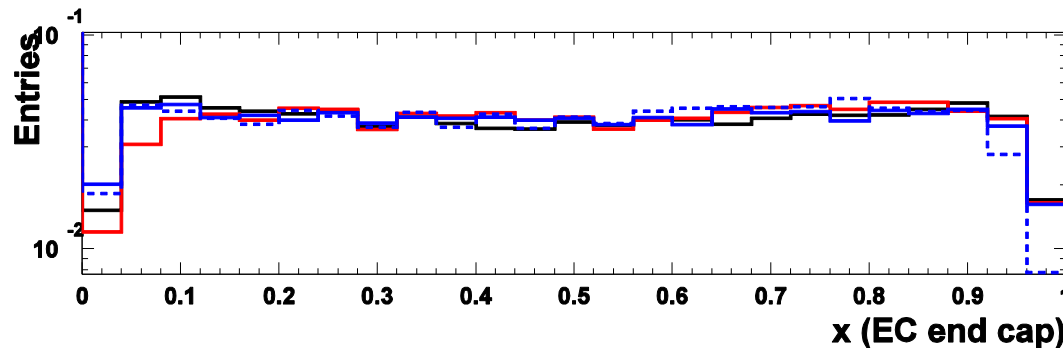
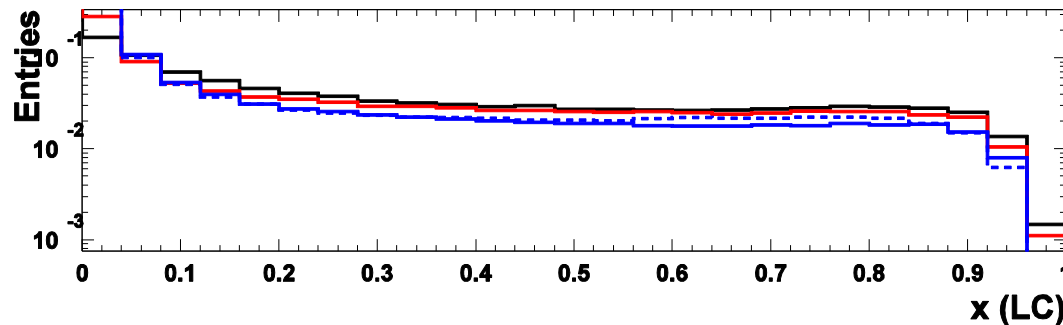
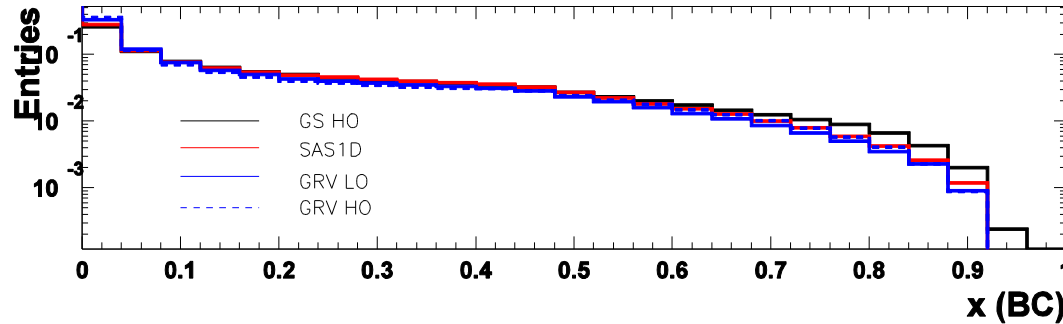


PYTHIA and HERWIG used for DIS events generation

Scattered electrons tagged at the BeamCal, LumiCal and ECAL end-cap

Distributions of x for various structure functions

HERWIG, ILC (500 GeV)



Results obtained using HERWIG

Distributions of x variable are little sensitive to a selected structure function

However all presented further results relate to SAS1D

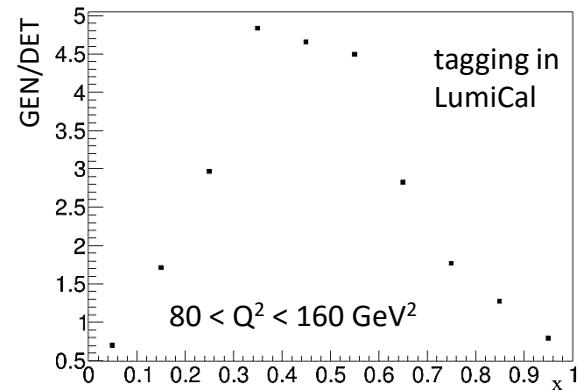
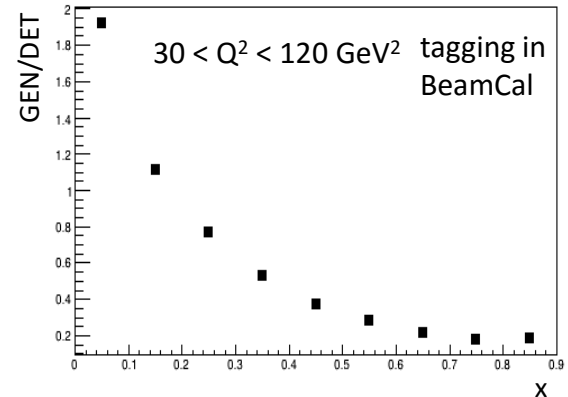
Correction due to detector effects

Bin-by-bin correction method is used.

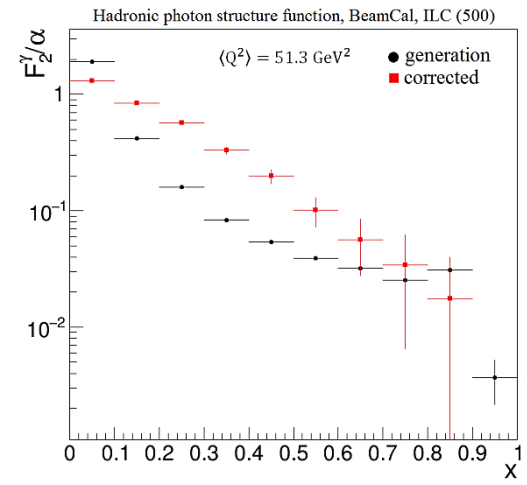
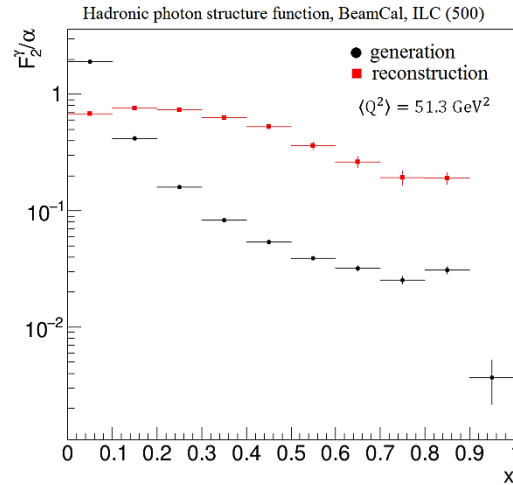
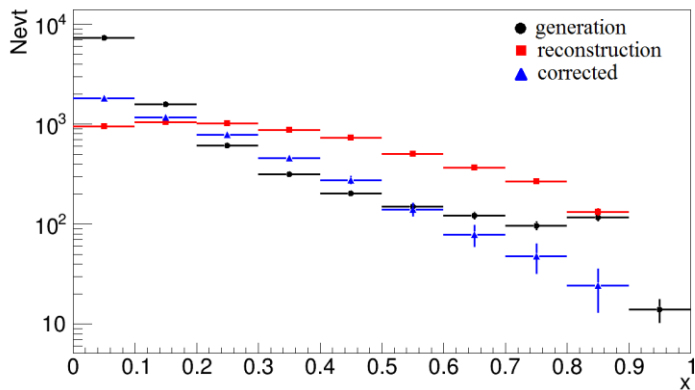
The number of reconstructed events N_i^{DET} in bin i is corrected obtaining the corrected number of events N_i^{COR} by multiplying with a correction factor:

$$N_i^{\text{COR}} = N_i^{\text{DET}} \cdot C_i, \text{ where } C_i = \frac{N_i^{\text{GEN}}}{N_i^{\text{DET}}}.$$

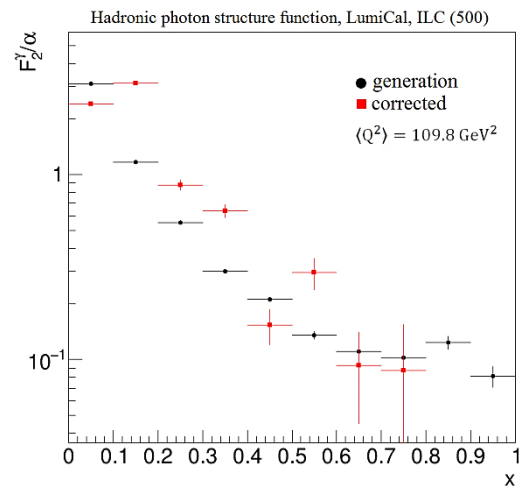
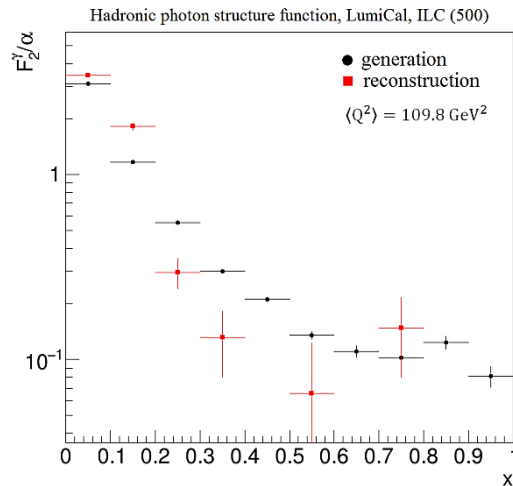
It seems that the most reliable correction we could get for ECAL end-cap. But this requires a large statistics in reconstruction.



Correction due to detector effects



Examples how such corrections have an impact on the x distribution and thereby on the evolution of structure function.



Summary and Outlook

- The forward detectors will allow to measure the photon structure function in $e\gamma$ DIS processes. Available angular ranges enable to obtain them in a wide range of Q^2 . To extend this range one can use information from ECAL end-cap.
- The determined kinematical variables should be corrected due to the detector effects. The attempt to do it was made using bin-by-bin method.
- Work to estimate the systematic effects is ongoing.