

Short report on the evolution of the CIC

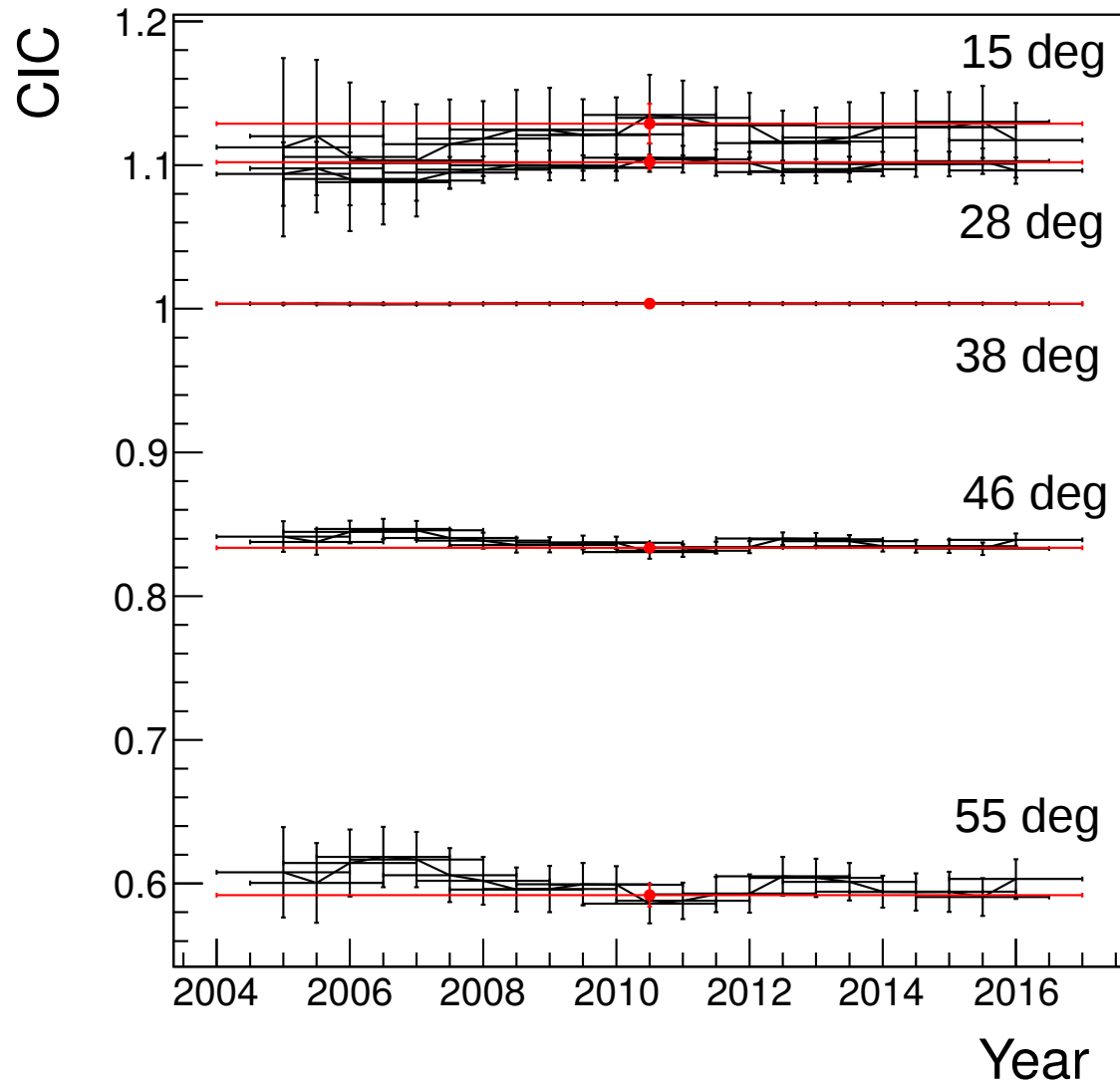
F. Fenu

28-06-2018

Introduction

- Check the evolution of the attenuation CIC function in time
- Check CIC function evolution
- Check the attenuation curve
- Check the single parameters (fixed C + free fit)

Evolution of CIC



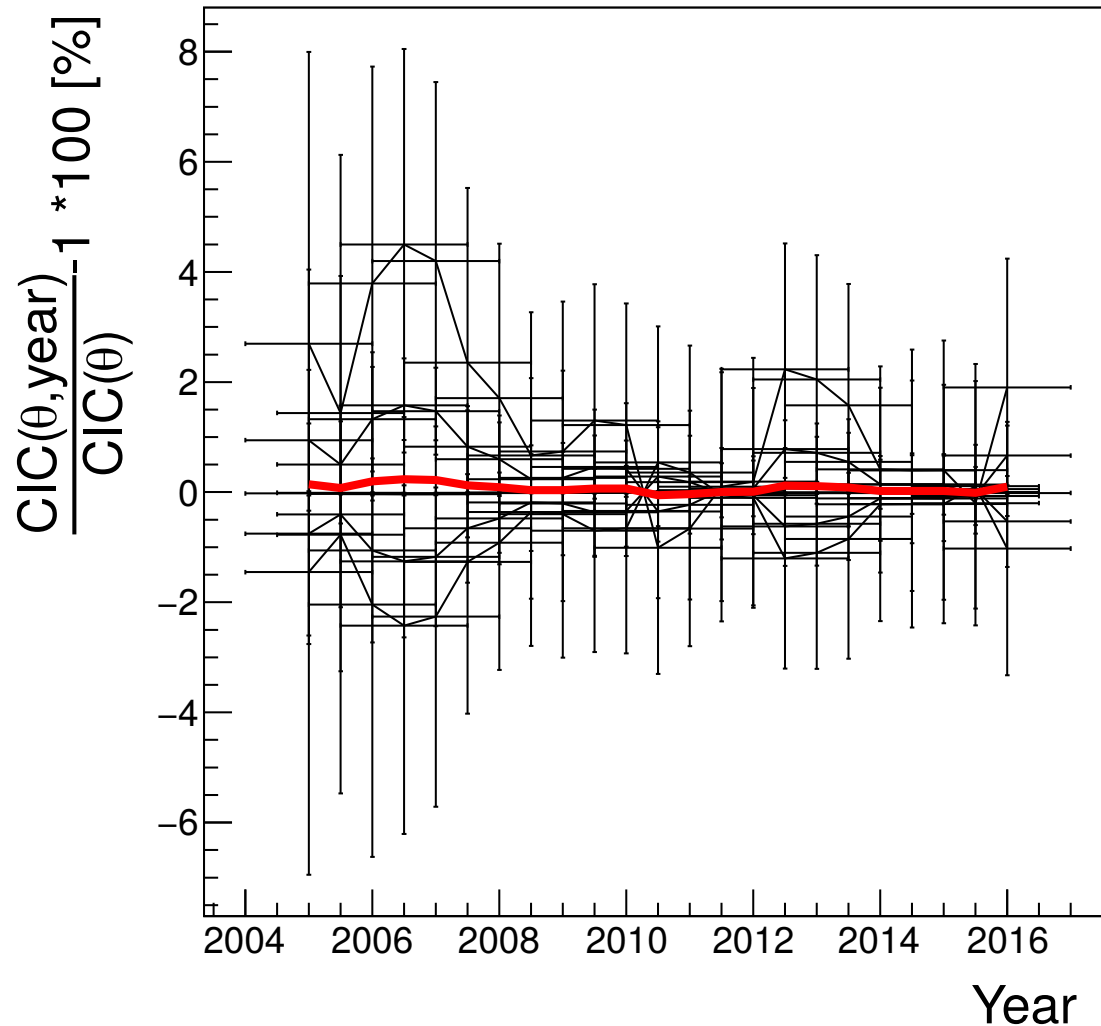
- **CIC evolution at 40 VEM**
- **Red: full interval CIC**
- 2 parameters CIC
- 5 angular bins of equal exposure
- Fix C parameter (quadratic term)

$$CIC = 1 + BX + CX^2$$

**No trend
observed**

± 1 year sliding window, 6 months step forward

Relative evolution of CIC

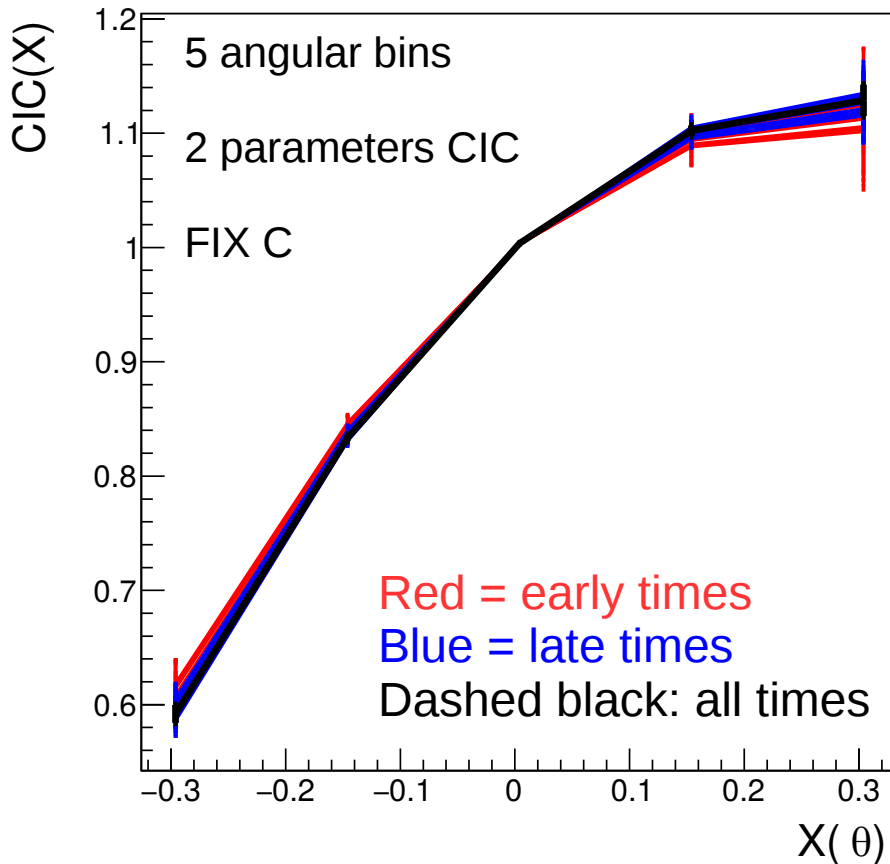


- CIC evolution at 40 VEM relative to full interval CIC
- Red: average of CIC curves
- 2 parameters CIC
- 5 angular bins of equal exposure
- Fix C parameter (quadratic term)

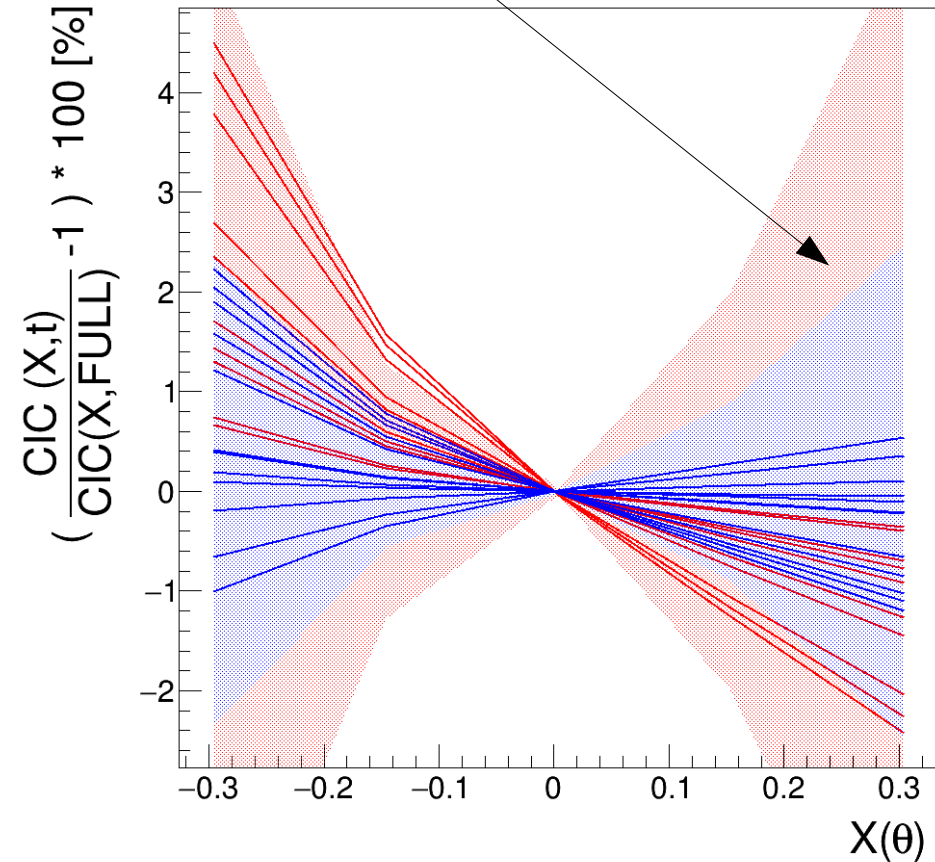
Largest deviation during construction phase ~4%

After 2008 deviation is below 2%

Attenuation curves evolution



Statistical fluctuations on single periods

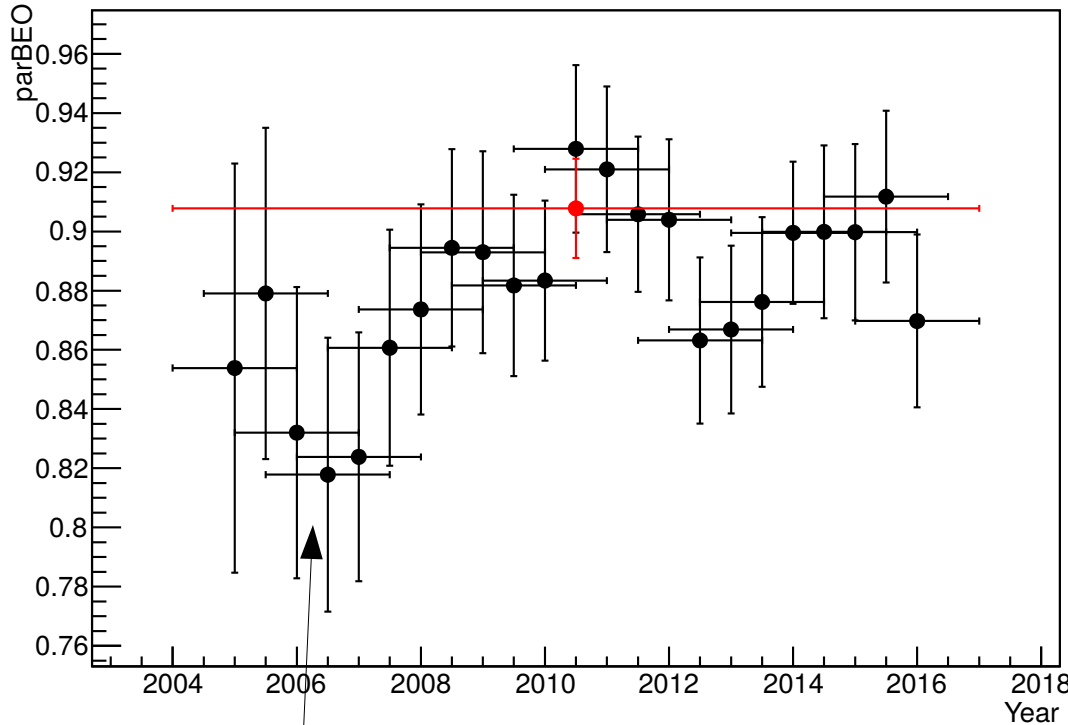


Evolution of attenuation curves is always fully within statistical fluctuations

Statistical fluctuations are larger in the construction phase

NO evolution of the attenuation can be measured above the statistical fluctuations

CIC parameters evolution



- B evolution at 40 VEM
- Red: full interval B
- 2 parameters CIC
- 5 angular bins of equal exposure
- Fix C parameter (quadratic term)

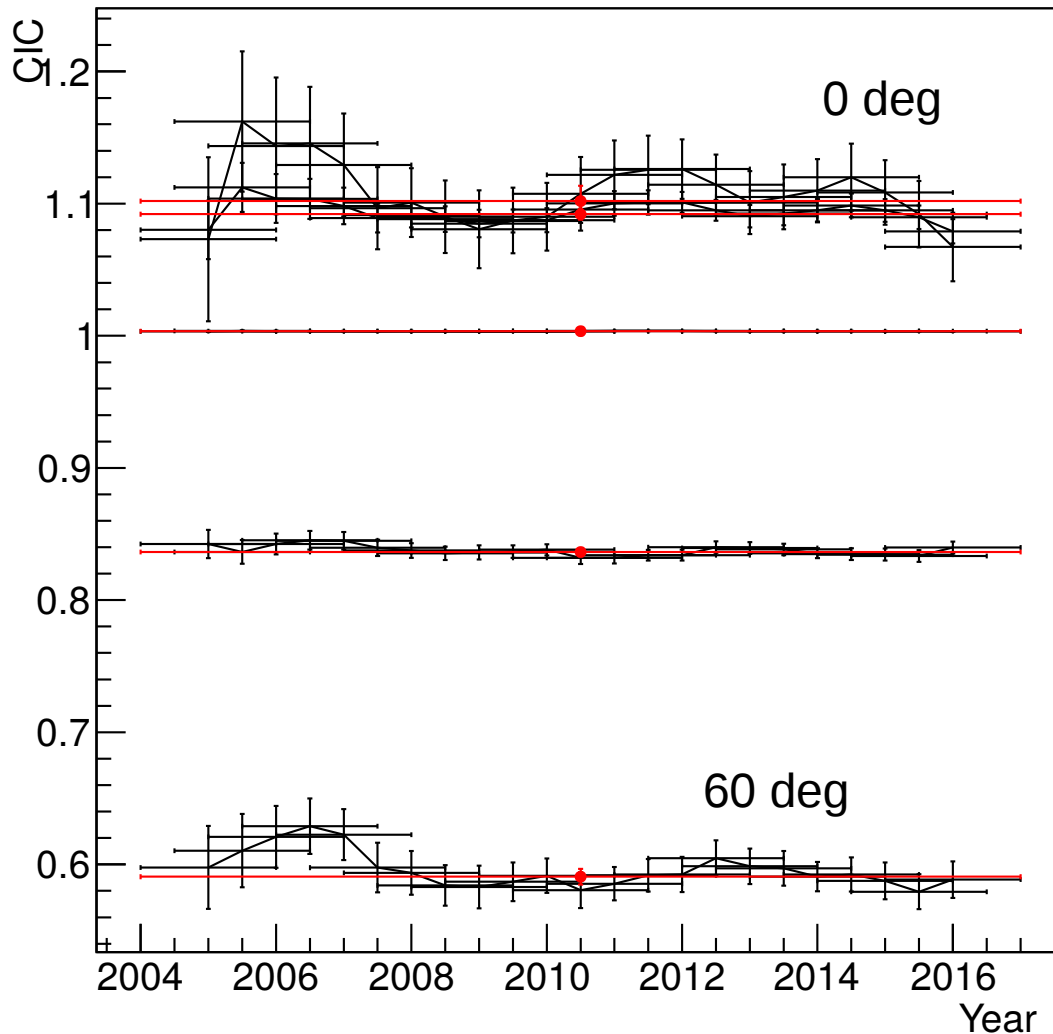
Smaller B by fixed C means flatter attenuation
(as seen before)

~10% change in B means 3-4%
change in CIC

$$CIC = 1 + BX + CX^2$$

Evolution of CIC – Free fit

CIC evolution at 40 VEM

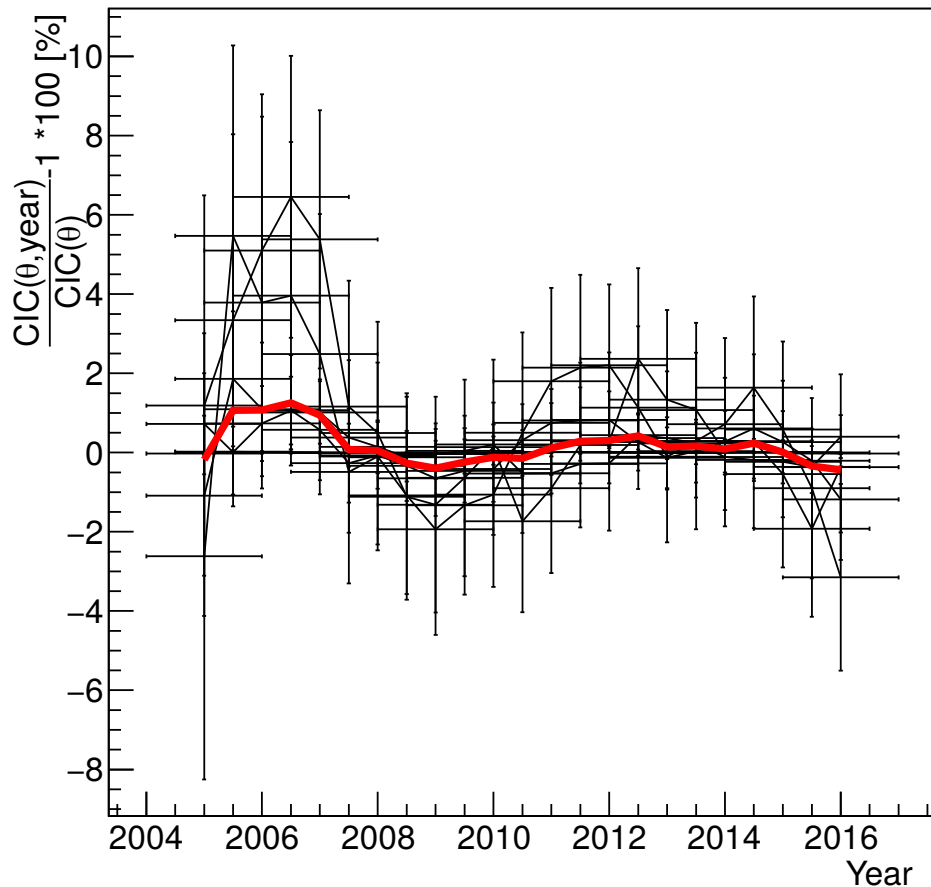


- **CIC evolution at 40 VEM**
- **Red: full interval CIC**
- 2 parameters CIC
- 5 angular bins of equal exposure
- All free parameters

**No trend
observed**

(but some additional fluctuation
is present)

Relative evolution of CIC – Free fit



- CIC evolution at 40 VEM relative to full interval CIC
- Red: average of CIC curves
- 2 parameters CIC
- 5 angular bins of equal exposure
- All parameters free

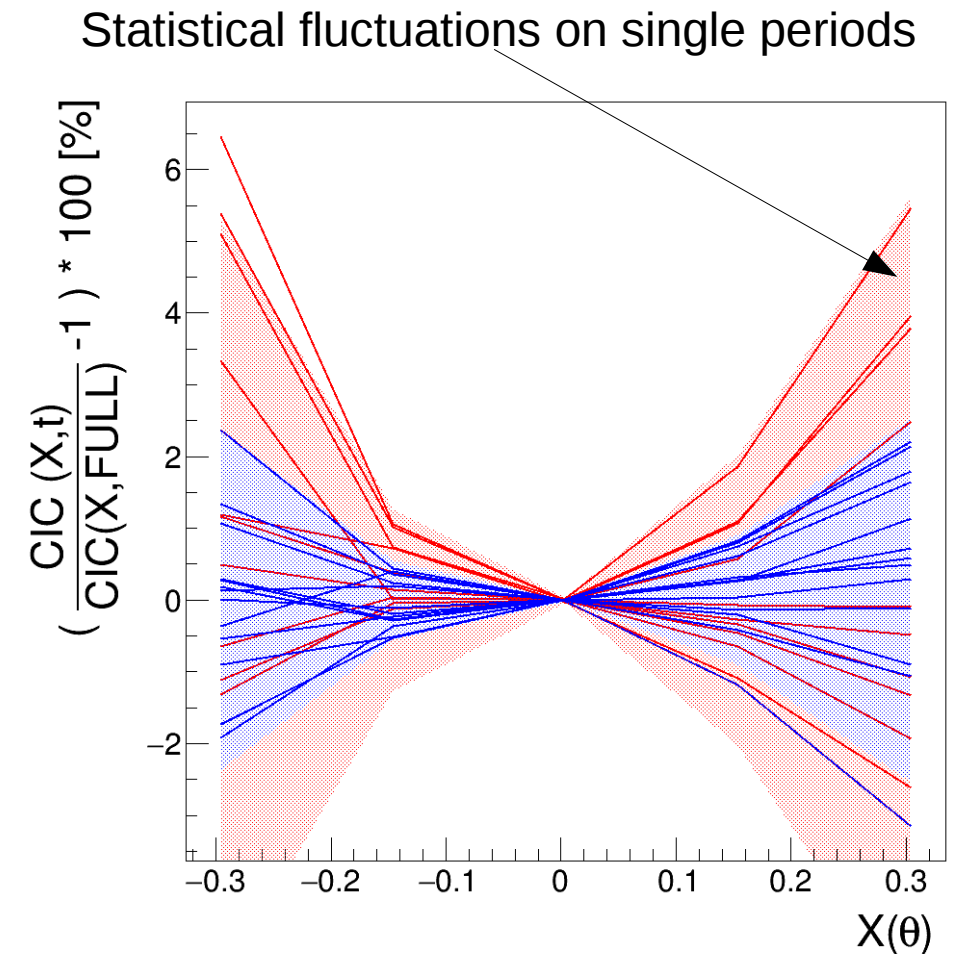
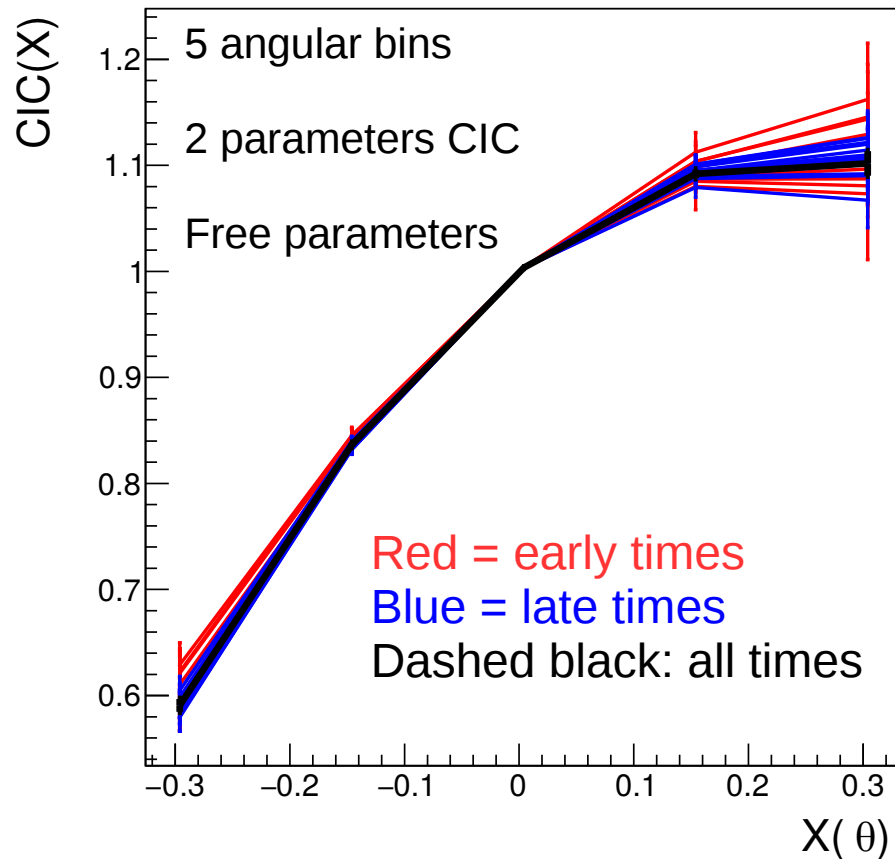
Largest deviation during construction phase ~6%

After 2008 deviation is at most ~2%

Average CIC has a maximum fluctuation of ~1%

C term makes change in CIC asymmetric

Attenuation curves evolution

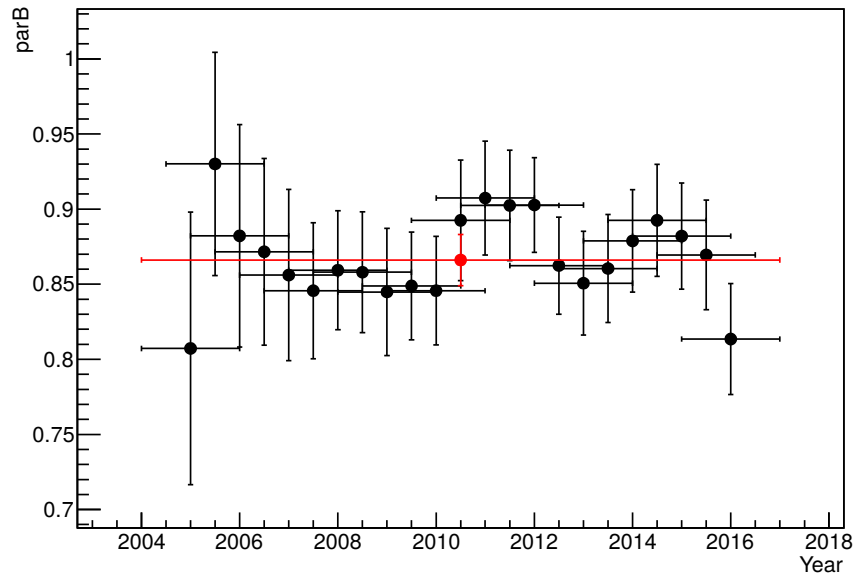


Evolution of attenuation curves is within statistical fluctuations

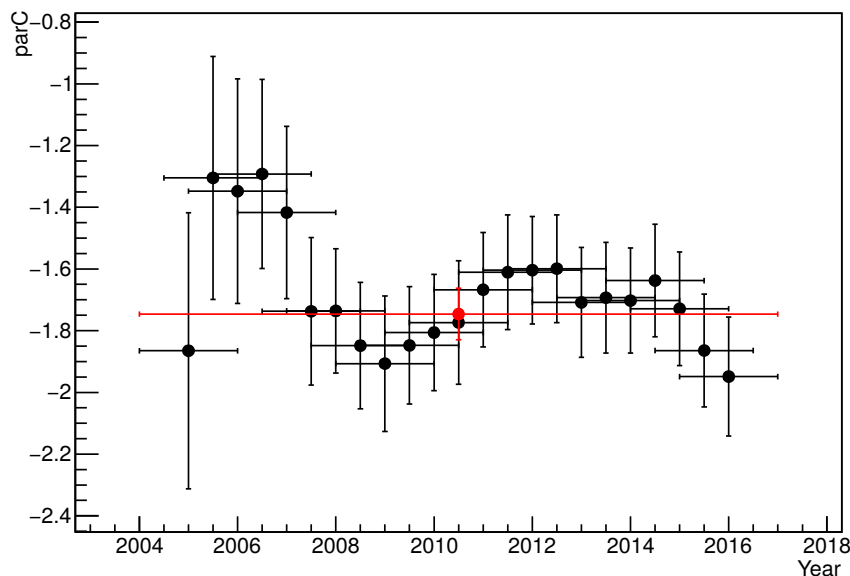
Statical fluctuation are larger in the construction phase

NO evolution of the attenuation can be measured above the statistical fluctuations⁹

CIC parameters evolution



- B evolution at 40 VEM
- Red: full interval B
- 2 parameters CIC
- 5 angular bins of equal exposure
- Free parameters

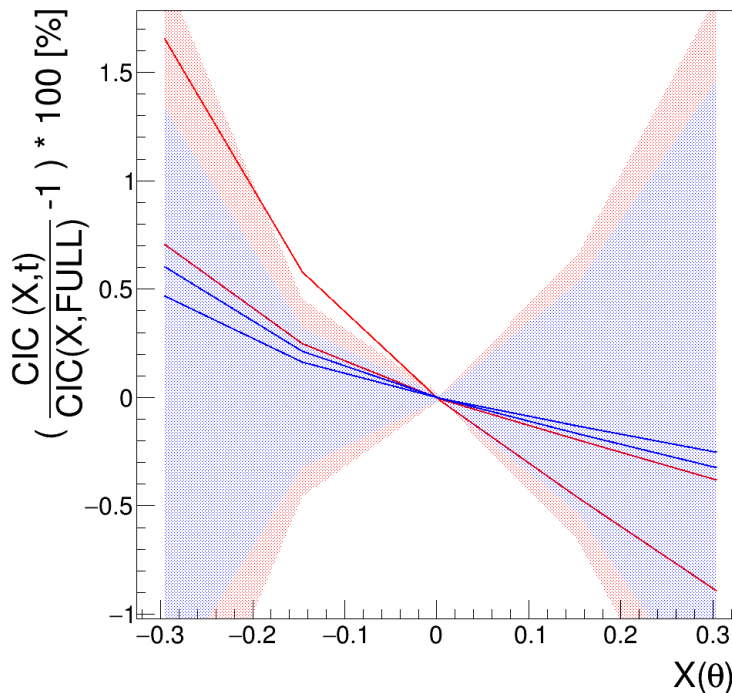
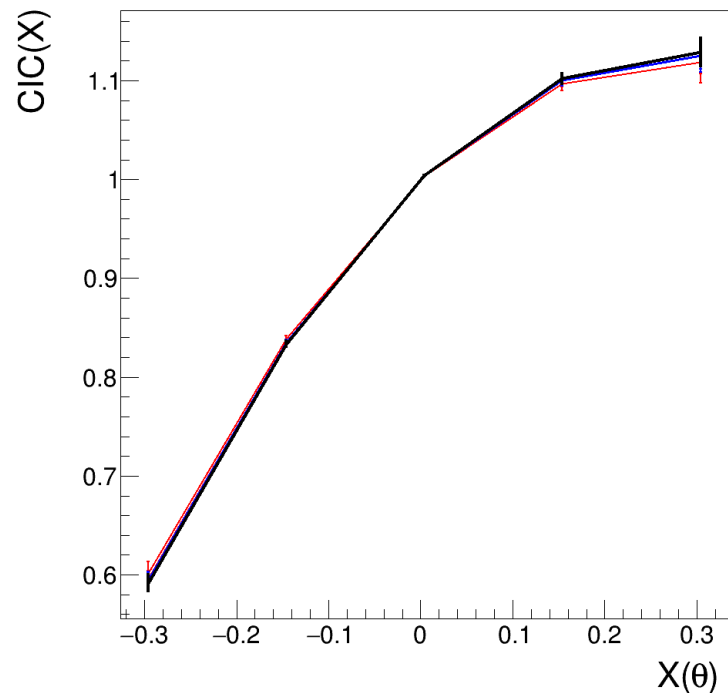


Increase in C around 2006 makes the CIC function increase for all the zenith angles

Asymmetry is now introduced in 2006

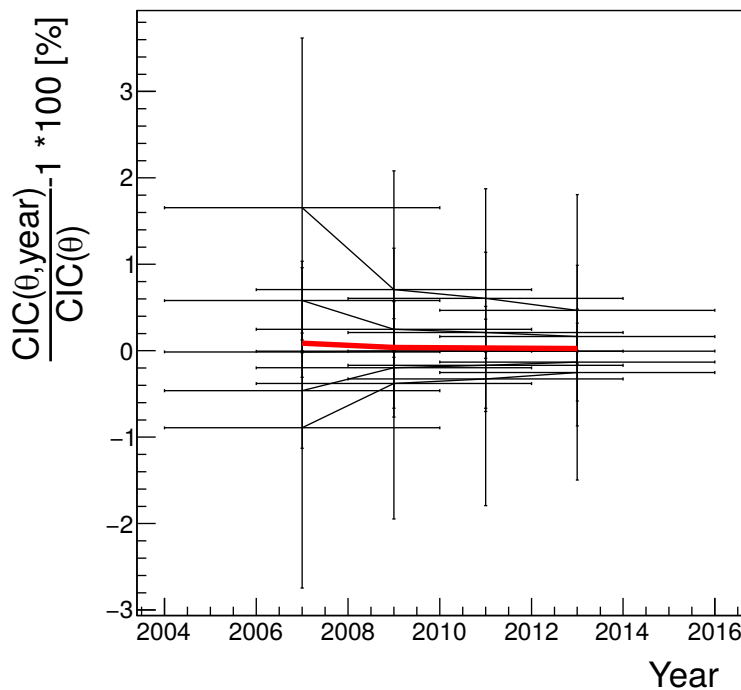
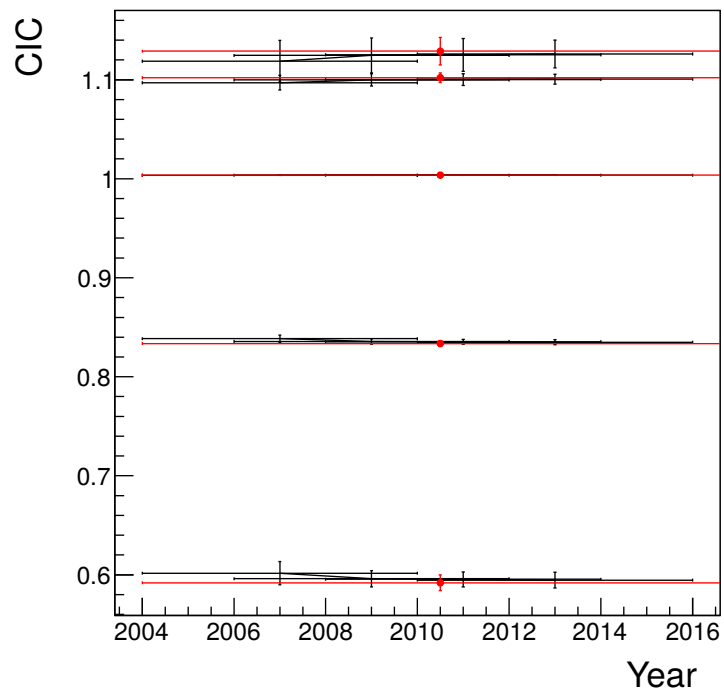
No evolution can be seen otherwise

CIC calculated over 6 years



To increase statistics

- Sliding window ± 3 yr
- Forward step 2 yr
- 5 angular bins
- 2 param. CIC
- Fix C



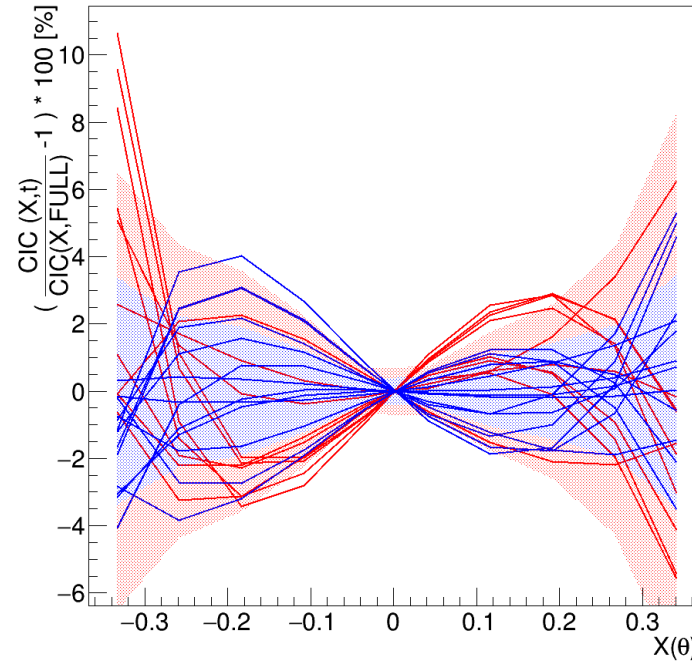
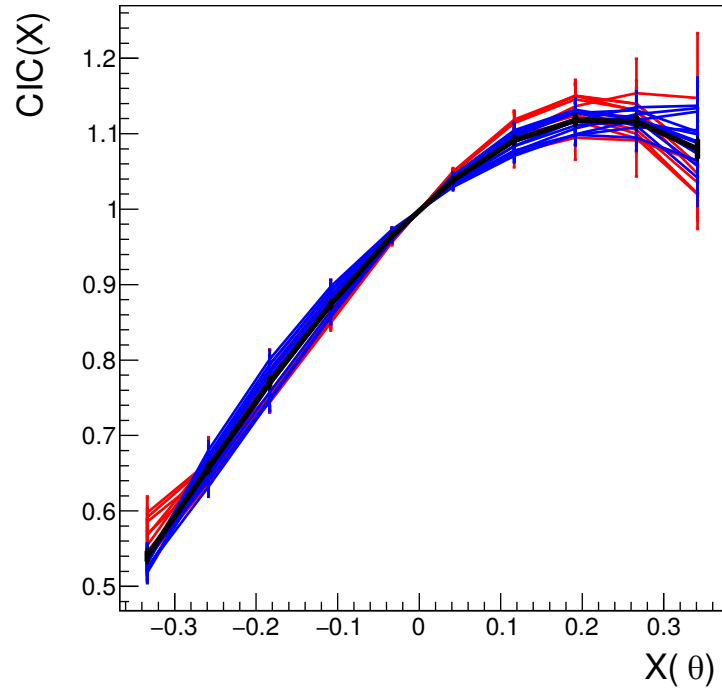
**NO evolution above
statistical
fluctuations**

Evolution < 1%

Conclusions

- Largest deviation in the construction phase
- After 2008 very stable CIC
- **No significant evolution is observed in the CIC function**
- If any evolution is present it must be smaller than 1%

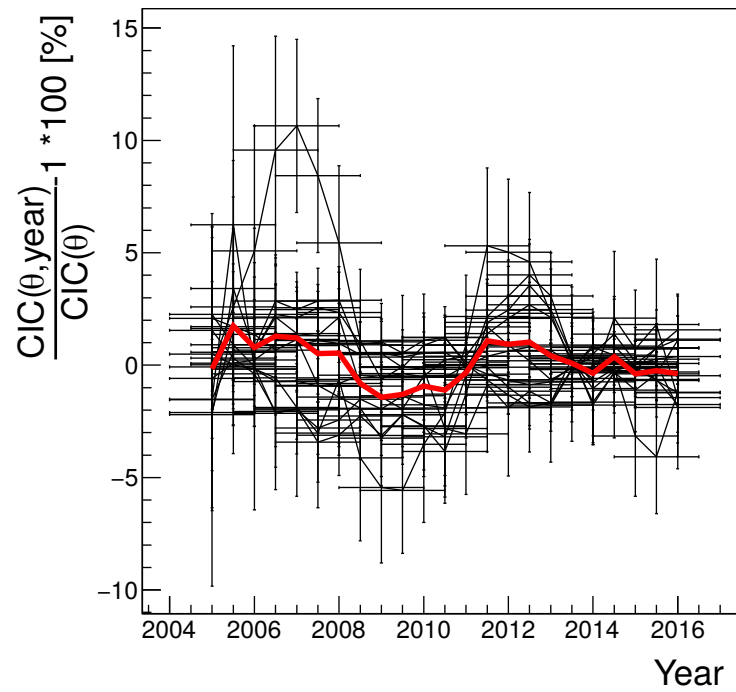
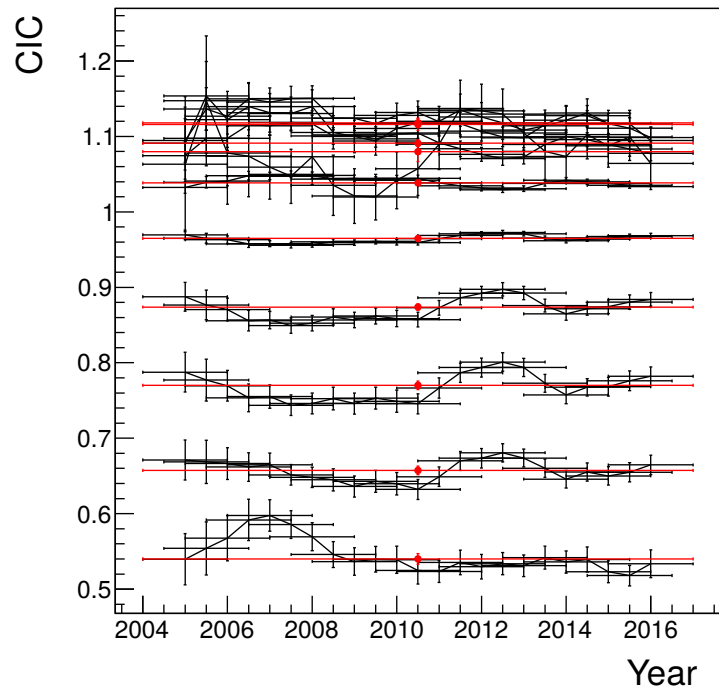
Evolution CIC Relative

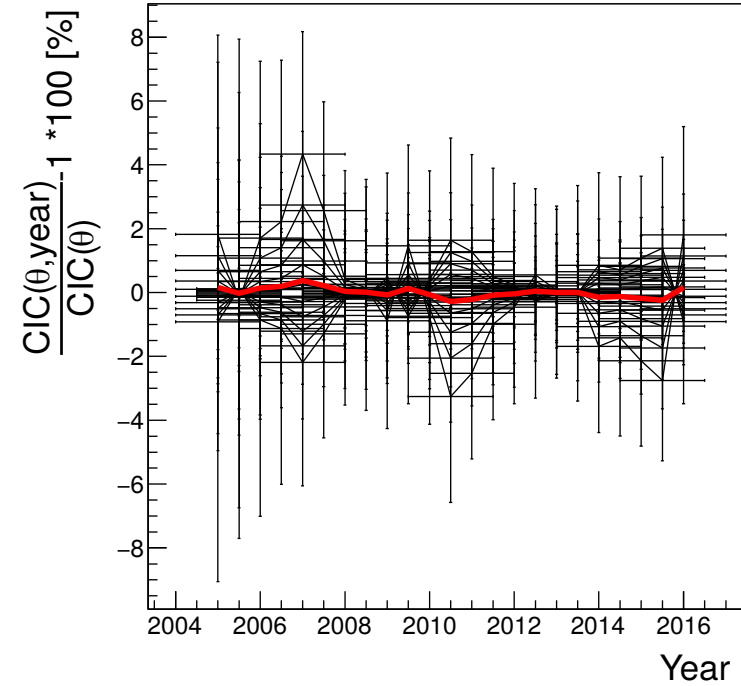
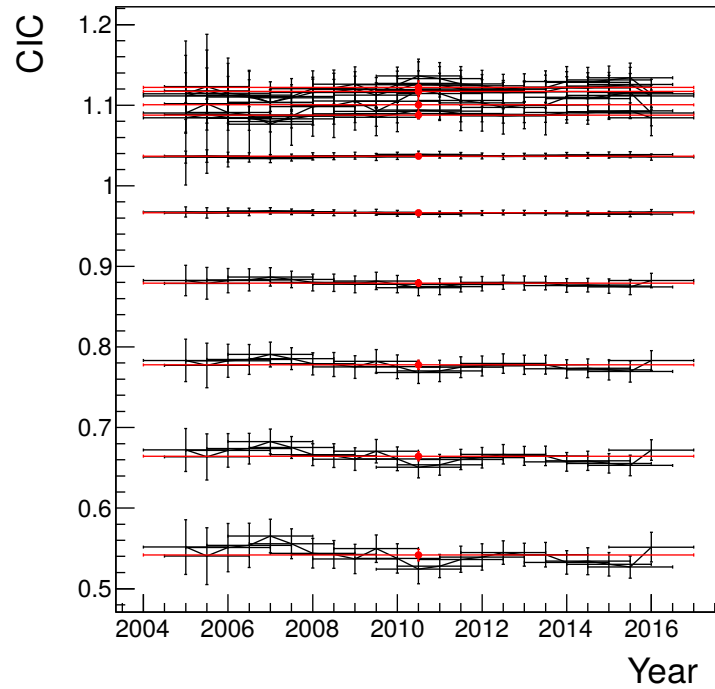
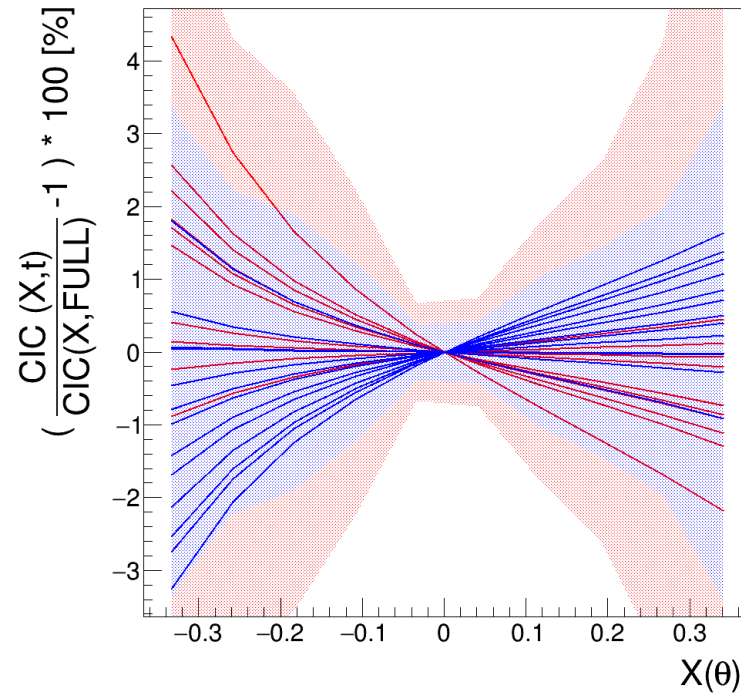
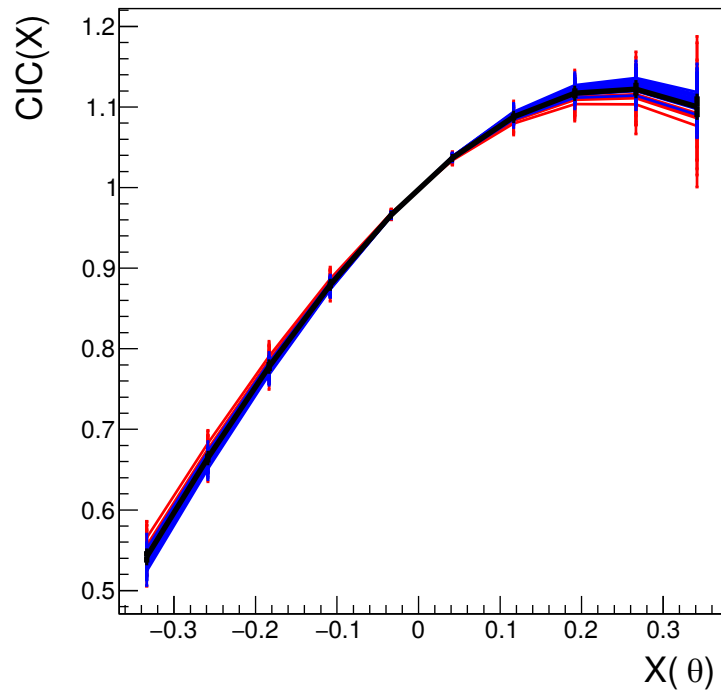


10 angular bins

3 param. CIC

All free parameters





10 angular bins

3 param. CIC

Fix C and D