

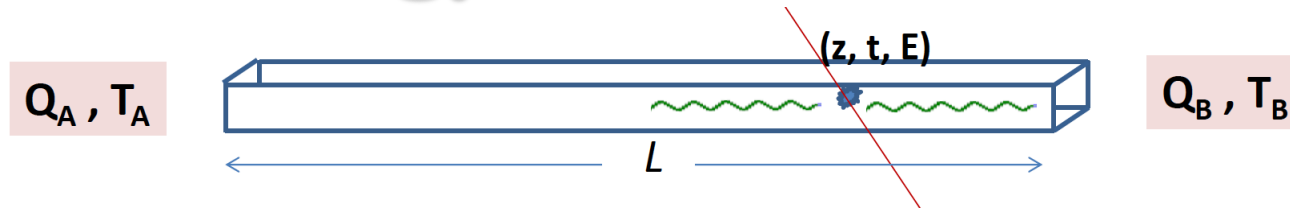
# Update on ECAL Calibration studies

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# Energy reconstruction



$$E_i^{(A,B)} [\text{MeV}] = \frac{(Q_i^{(A,B)} - P_i^{(A,B)}) [\text{ADC counts}]}{C_i [\text{ADC counts/MIP}]} K \times f_{MIP2MeV} [\text{MeV/MIP}]$$

- $C_i$  = peak of the MIP distribution
- Corrections to the  $C_i$  with the Bhabha scattering events ( $e^+e^- \rightarrow e^+e^-$ ): showers of 510 MeV
- Absolute energy scale  $K$  fixed at cluster level with the  $e^+e^- \rightarrow \gamma\gamma$  events

$$\Rightarrow \text{Calib. Const.} = \frac{K}{C_i}$$

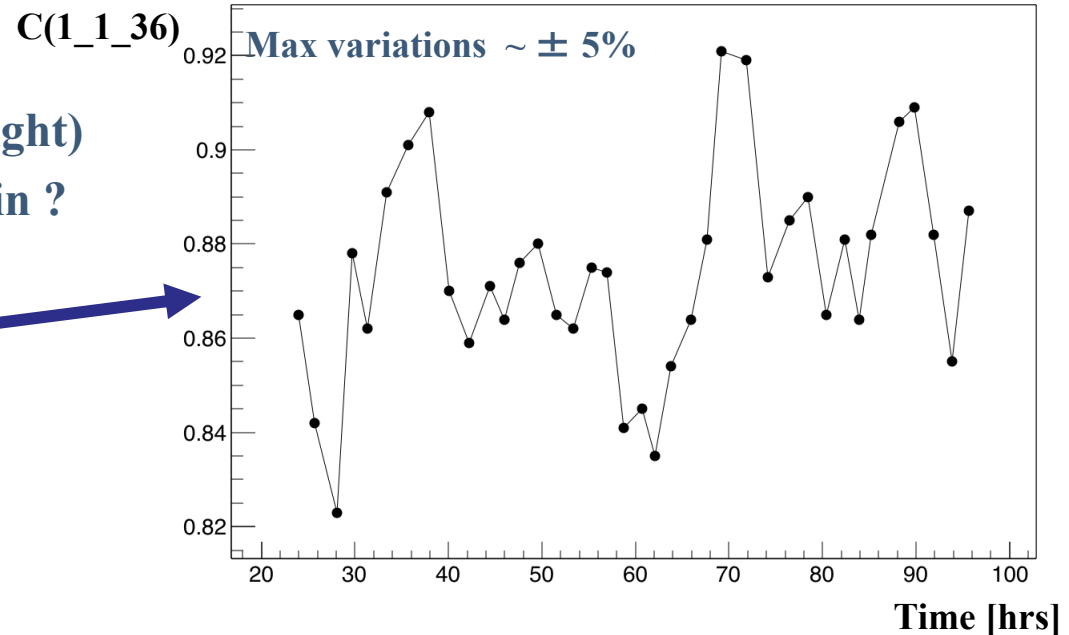
- Look for possible periodic variation of the constants

# Energy calibration

- Typical calibration constant variations in KLOE (1 barrel channel)

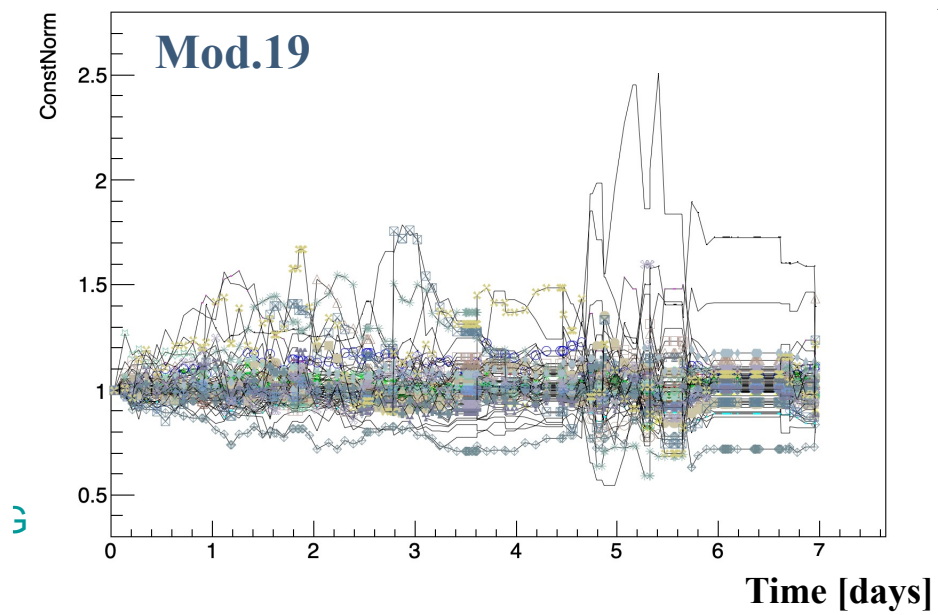
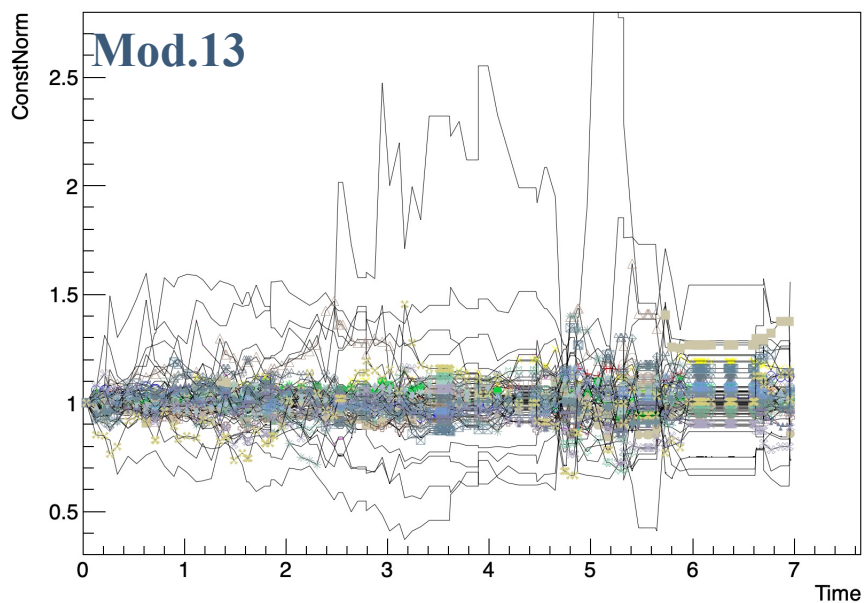
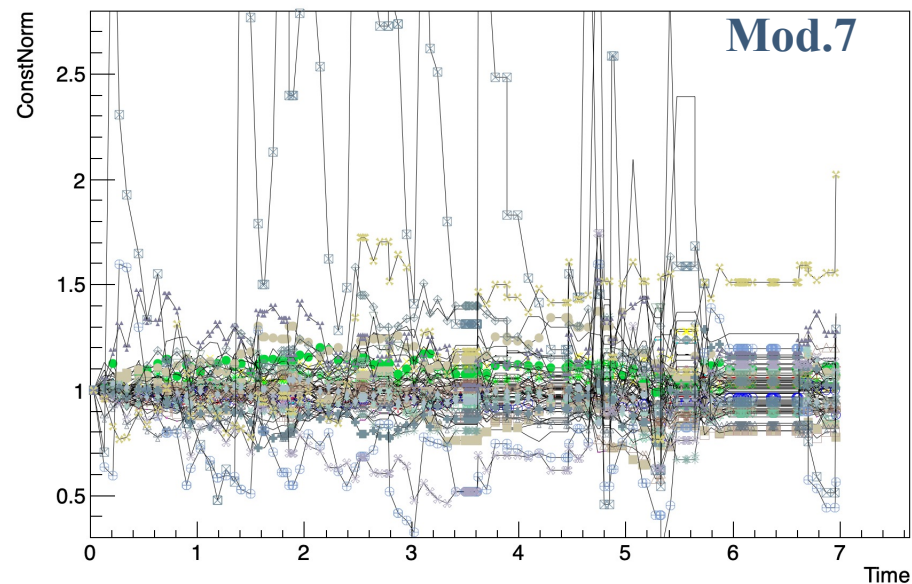
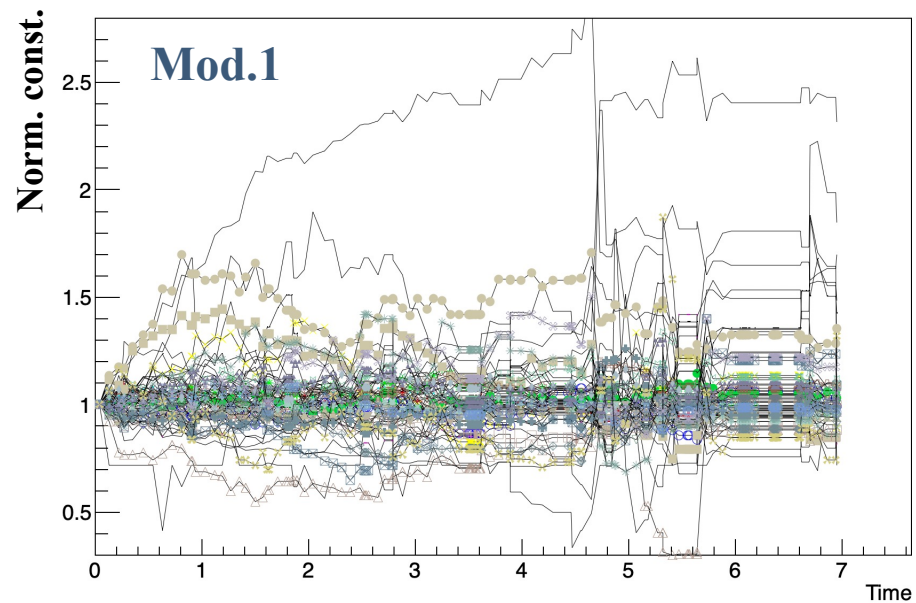
- Is there any periodic (e.g. day/night) variations in the whole gain chain ?

- One cell over ~ 100 hrs



- Look for variations of the constants in one week time interval (1/12/2017 – 7/12/1017)

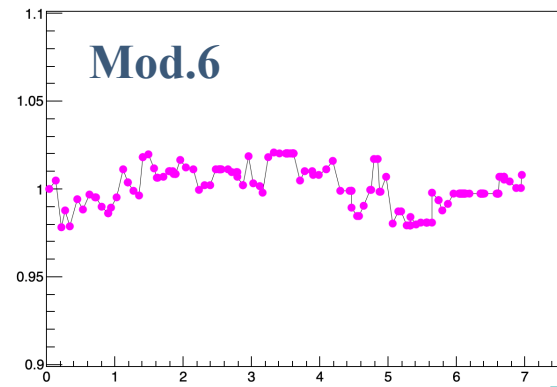
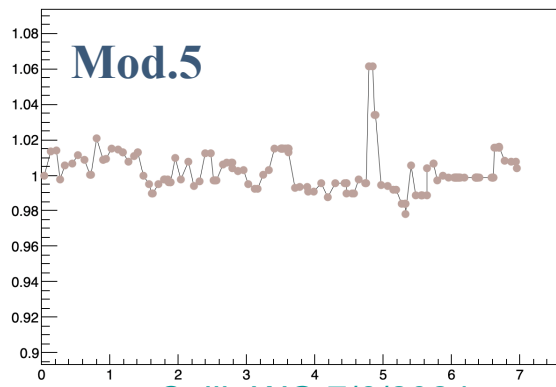
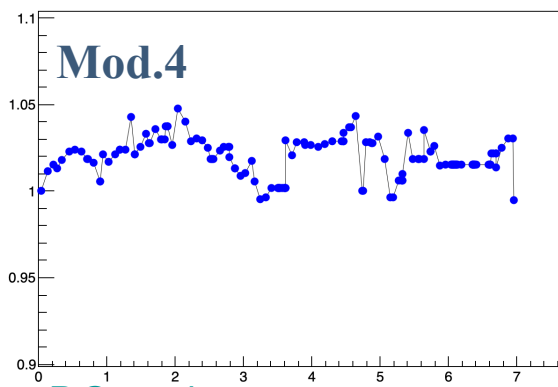
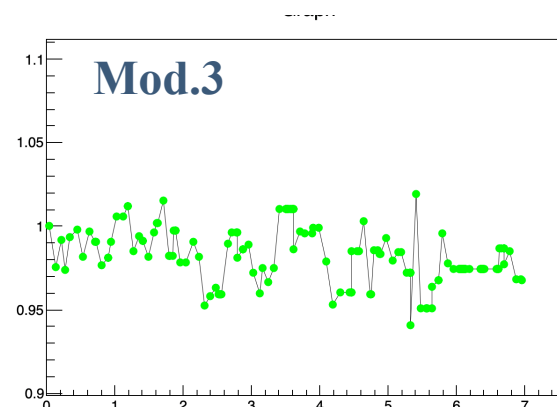
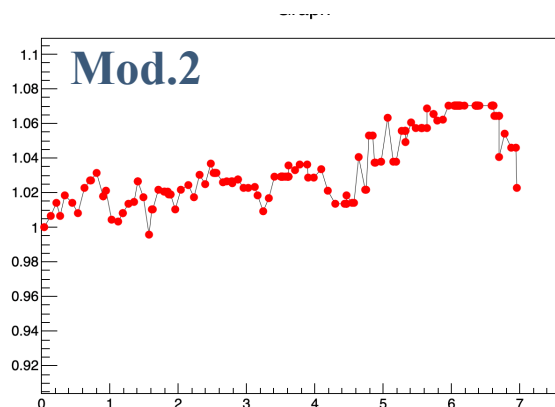
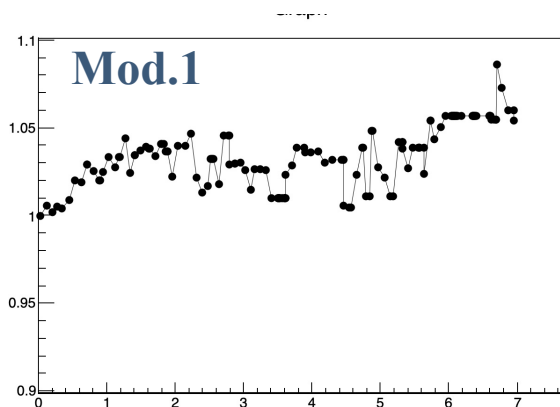
# Constant variations



# Average per module

- Average over the 60 cells of a barrel module

Norm. const.

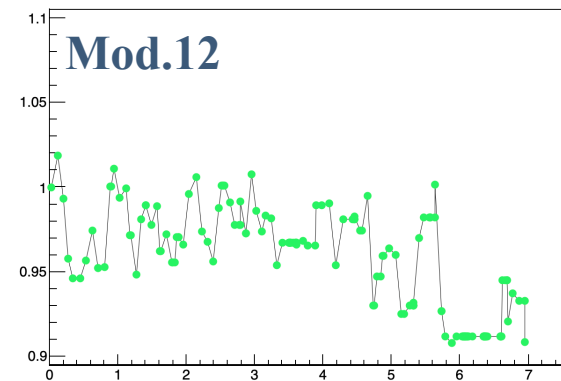
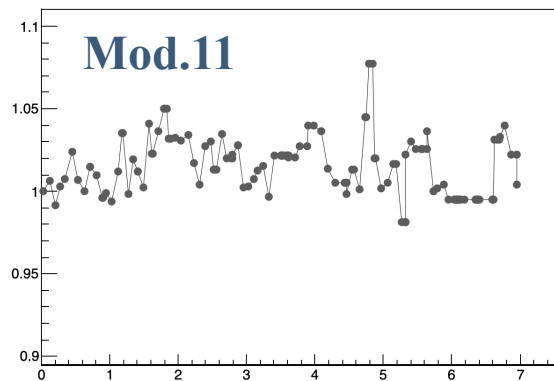
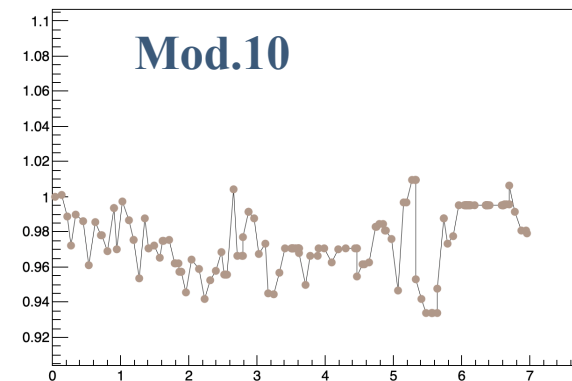
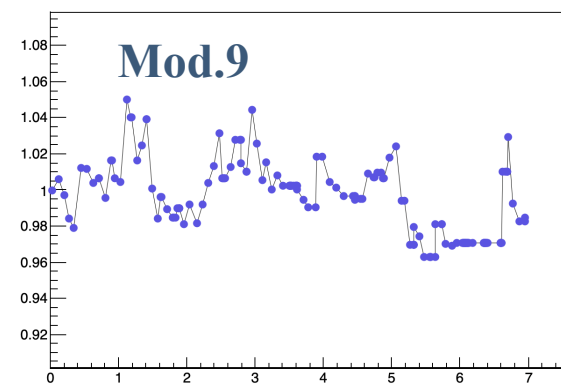
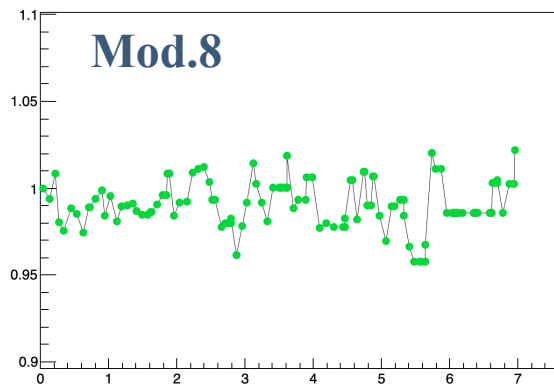
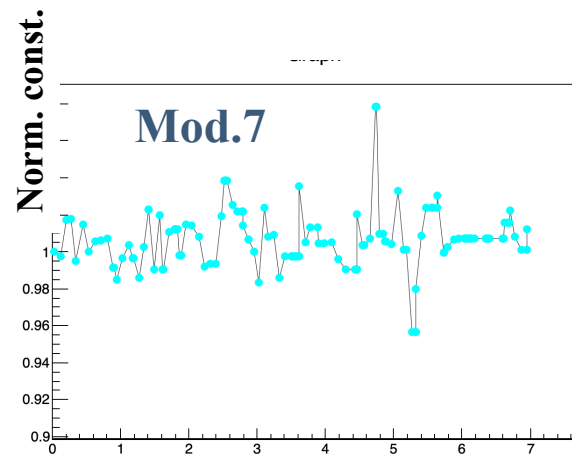


P.Gauzzi

Calib.WG 7/6/2024

Time [days] <sup>5</sup>

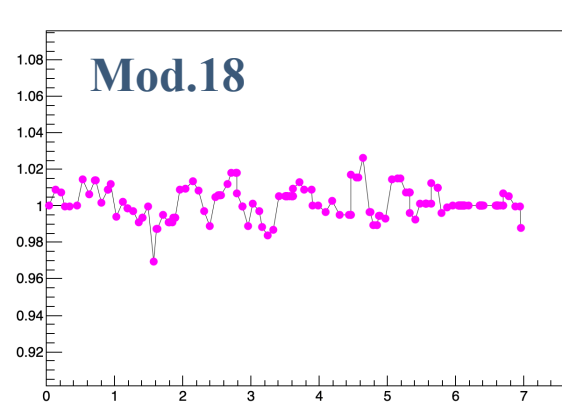
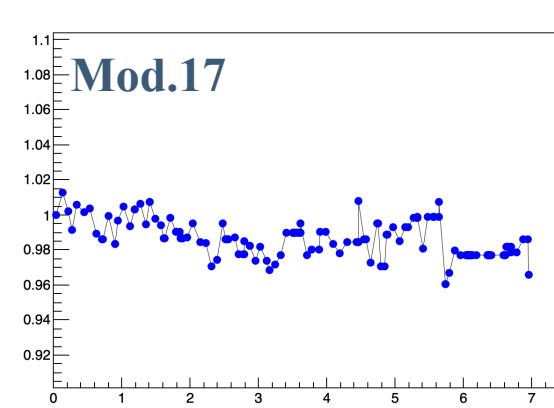
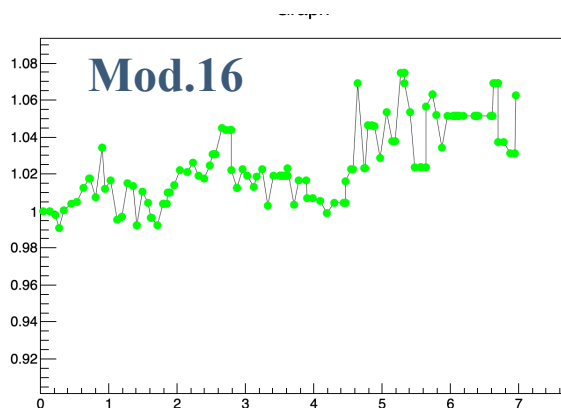
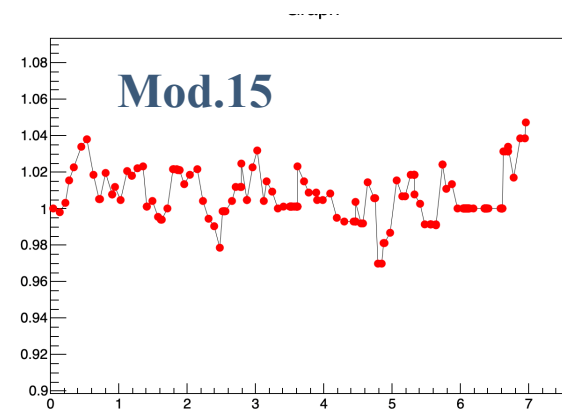
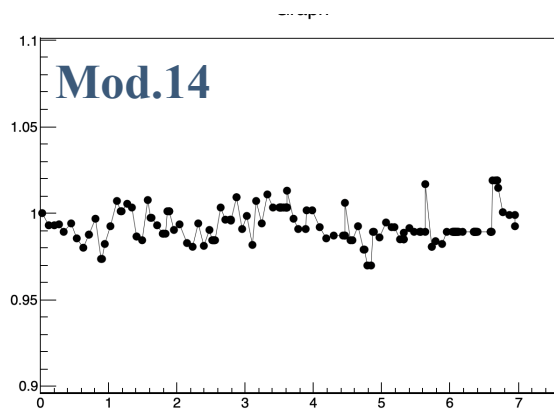
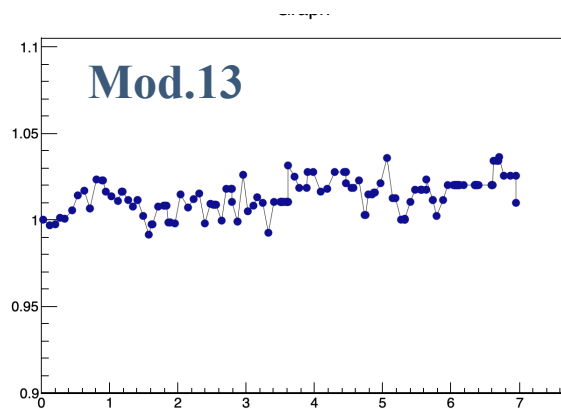
# Average per module



Time [days]

# Average per module

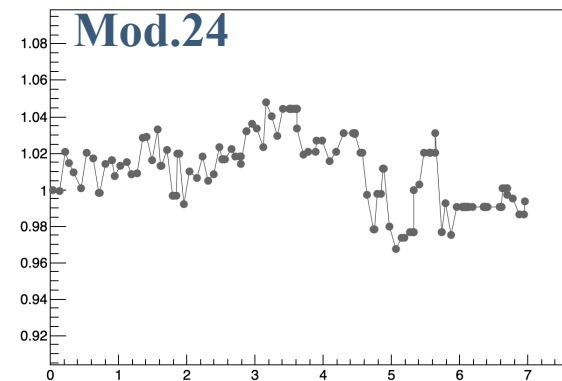
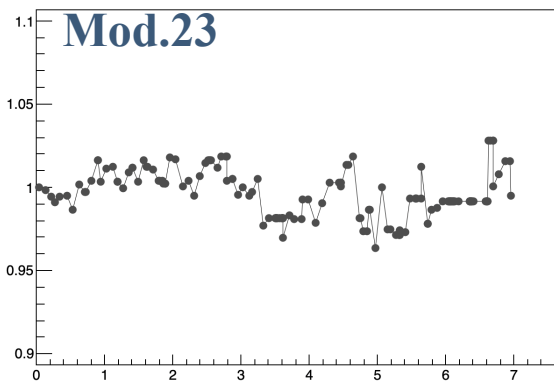
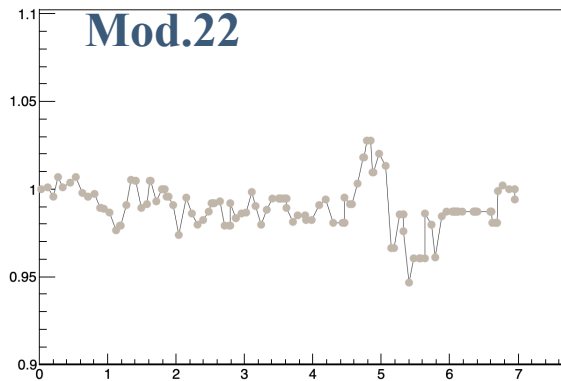
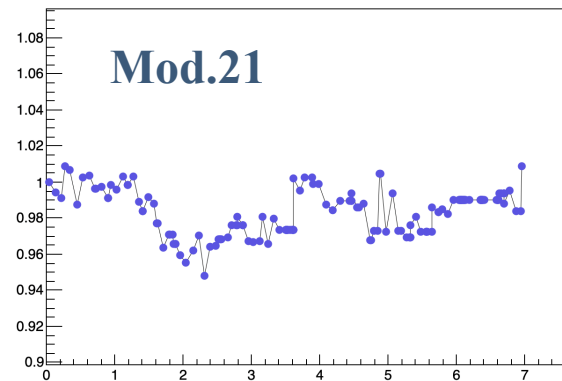
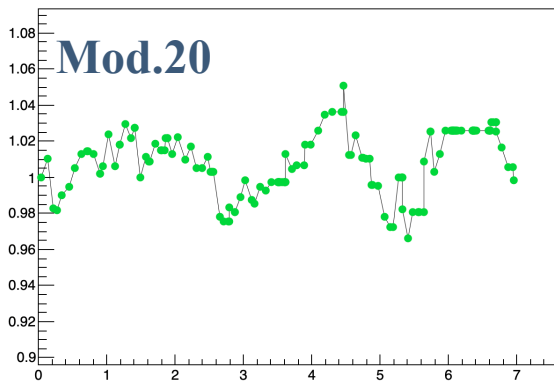
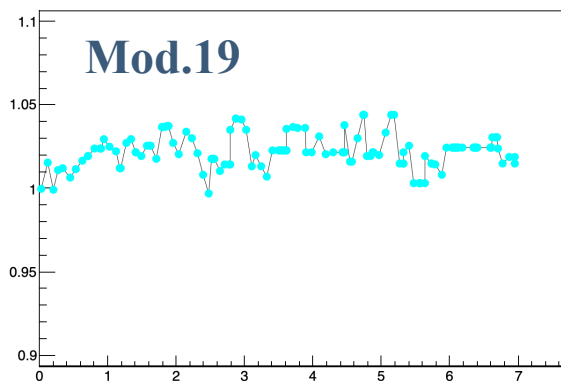
Norm. const.



Time [days]

# Average per module

Norm. const.



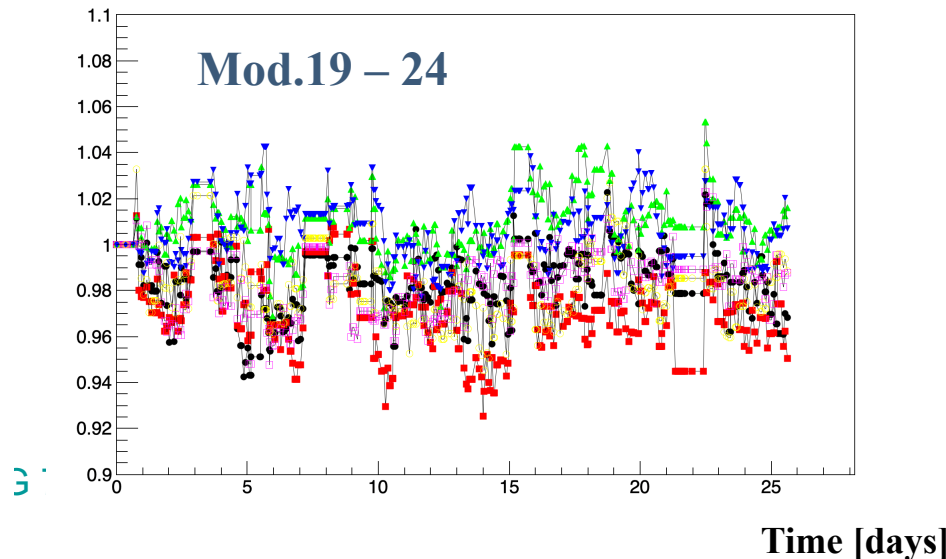
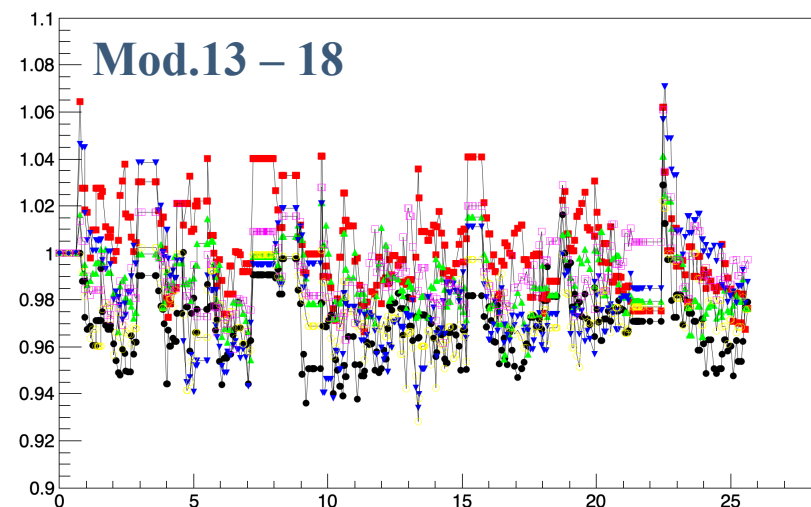
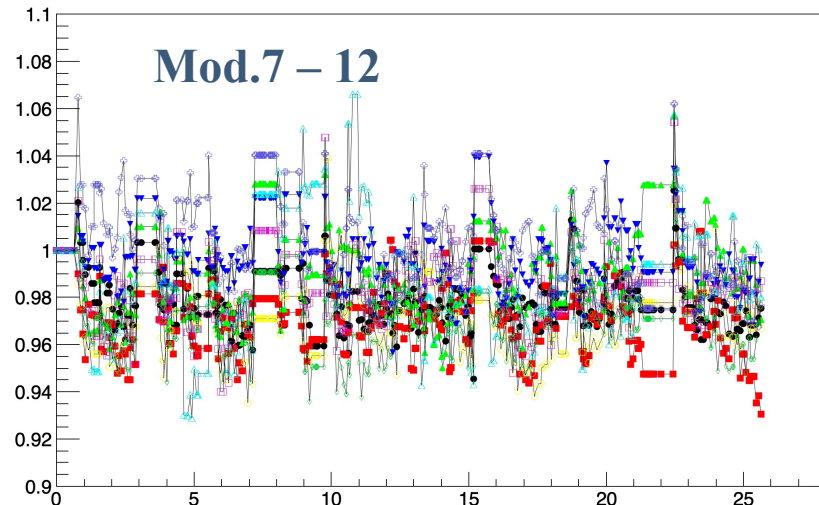
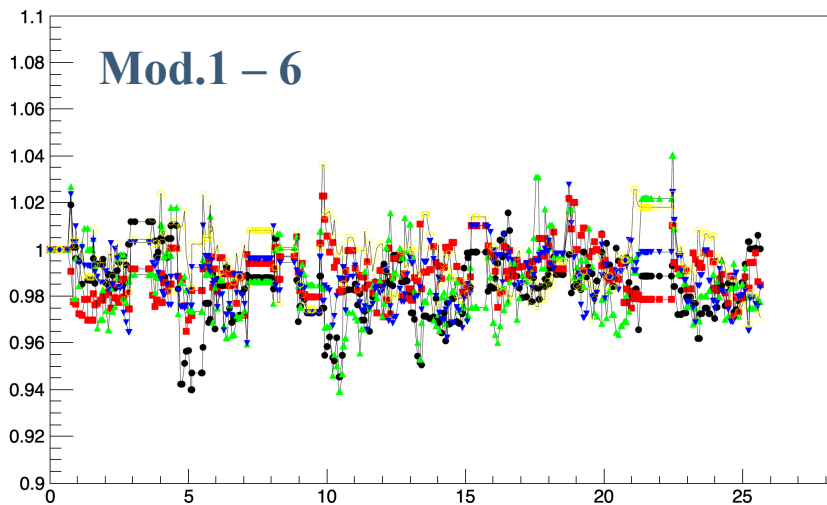
Time [days]

- No significant time dependences (day/night)



# Average constants

- Variation on a larger period, ~ 1 month



# ECAL Calibration in SAND

MIPs from cosmic rays:

- muon flux at surface  $\sim 0.02 \mu/(s \text{ cm}^2)$
- with an effective cross-section of the ECAL for vertical muons of  $\sim 5 \times 10^5 \text{ cm}^2$   
 $\Rightarrow \sim 10^4 \mu/s$  on ECAL ( $\Rightarrow 100 \text{ Hz}$  of “golden mips” in KLOE)
- Underground reduction of a factor of about 100  
 $\Rightarrow \sim 100 \mu/s$  on ECAL (without any selection)
- Rough estimate by rescaling the KLOE numbers  
 $\Rightarrow 1 \text{ day (24 hrs): } \sim 10 \text{ evts/cell}$
- Relaxing the “golden mip” selection: in few days  $\sim 10^3 \text{ evts/cell}$

# ECAL Calibration in SAND

MIPs from beam (rock, magnet and Fe yoke, upstream ECAL modules)

Cut	ECAL		Rock muons		Magnet events	
	Events	$\varepsilon$ (%)	Events	$\varepsilon$ (%)	Events	$\varepsilon$ (%)
No cut	2.23	100.0	1447.26	100.000	50.82	100.000
$\mu$ in ECAL FV	2.23	100.0	12.73	0.880	18.92	37.229
STT & ECAL hits	1.63	72.9	6.05	0.420	3.443	6.775
NN cut	1.56	95.5	0.10	0.007	0.07	0.136

Table 40: Number of events per spill ( $9.6 \mu\text{s}$ ,  $7.5 \times 10^{13}$  pot) and selection efficiency for the signal from  $\nu_\mu$  CC in the front barrel ECAL and the backgrounds from rock muons and magnet events.

(from DUNE-doc-13262, A Near Detector for DUNE)

$\sim 1.5 \times 10^3 \mu/\text{spill}$  (1 spill =  $9.6 \mu\text{s}$  every 1.2 s) without any selection

- The MC sample (produced by R.Petti) is not available anymore
- We must generate again these events
- R.D'Amico expressed interest to work on this item

# Conclusions

- **Study of the energy calibration constants in KLOE:**
  - ⇒ **No significant time dependences (day/night)**
- **Next: study the MIP production from beam events (Rock muons, Magnet + iron Yoke muons)**
- **We need to produce the MC samples**