Adaptive observation scheduling

D. Dominis Prester, A. Babić, M. Bervida, M. Doro,
L. Font, C. Fruck, M. Gaug, T. Terzić, M. Will

MAGIC Collaboration Physics Meeting, Zeuthen, 17 June 2015

Outline

- **Why** should we apply Adaptive Observation Scheduling?
- Effects of the **atmospheric transmission** on our data
- Data quality classes (LIDAR)
- Plan for the next 3 years

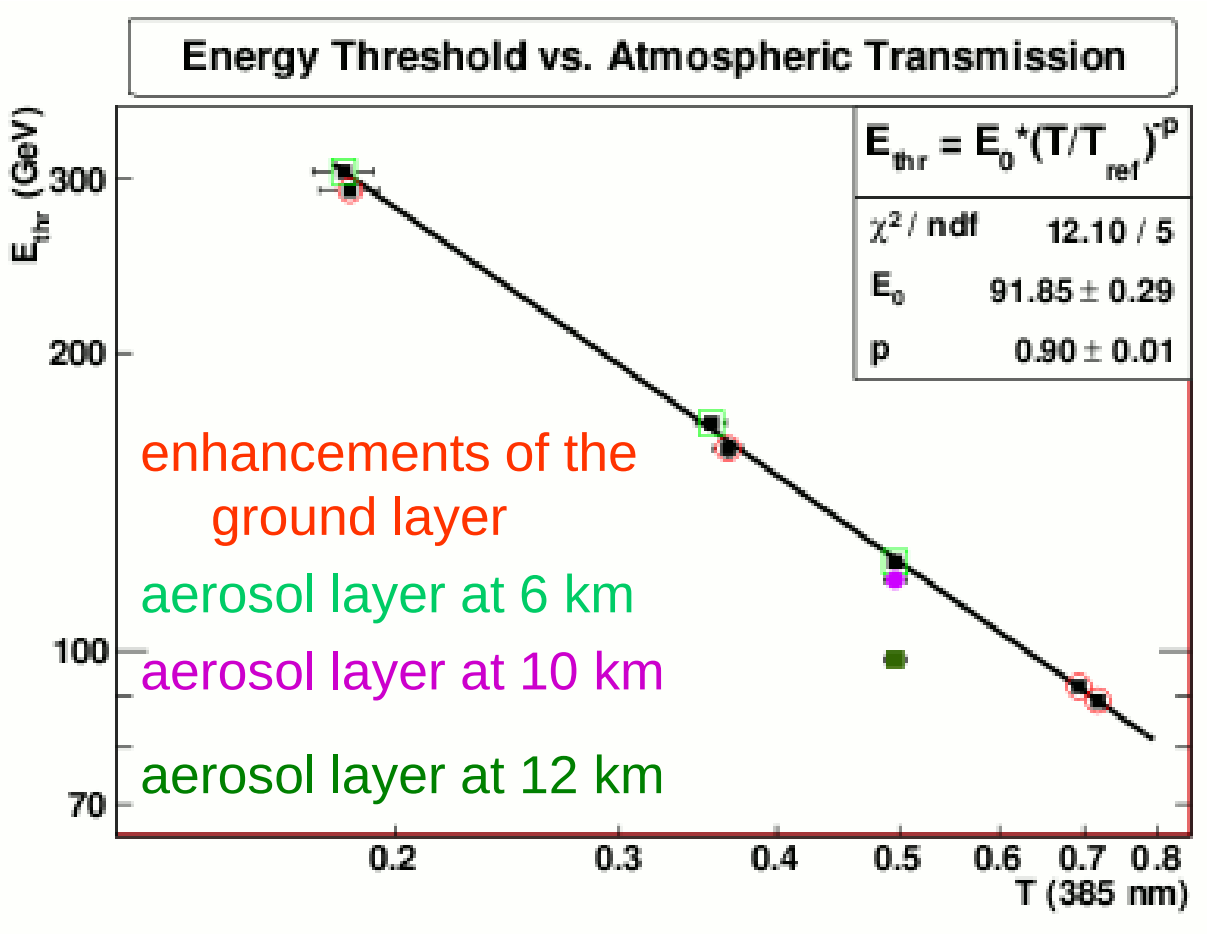
Motivation

- How much of the data observed by MAGIC is actually analyzed?
- What percentage of data is being rejected for different types of sources, due to the low atmospheric transmission?
- >20% of our observations can be corrected!
- We should optimize the usage of our observing time!

Different sources produce different spectra

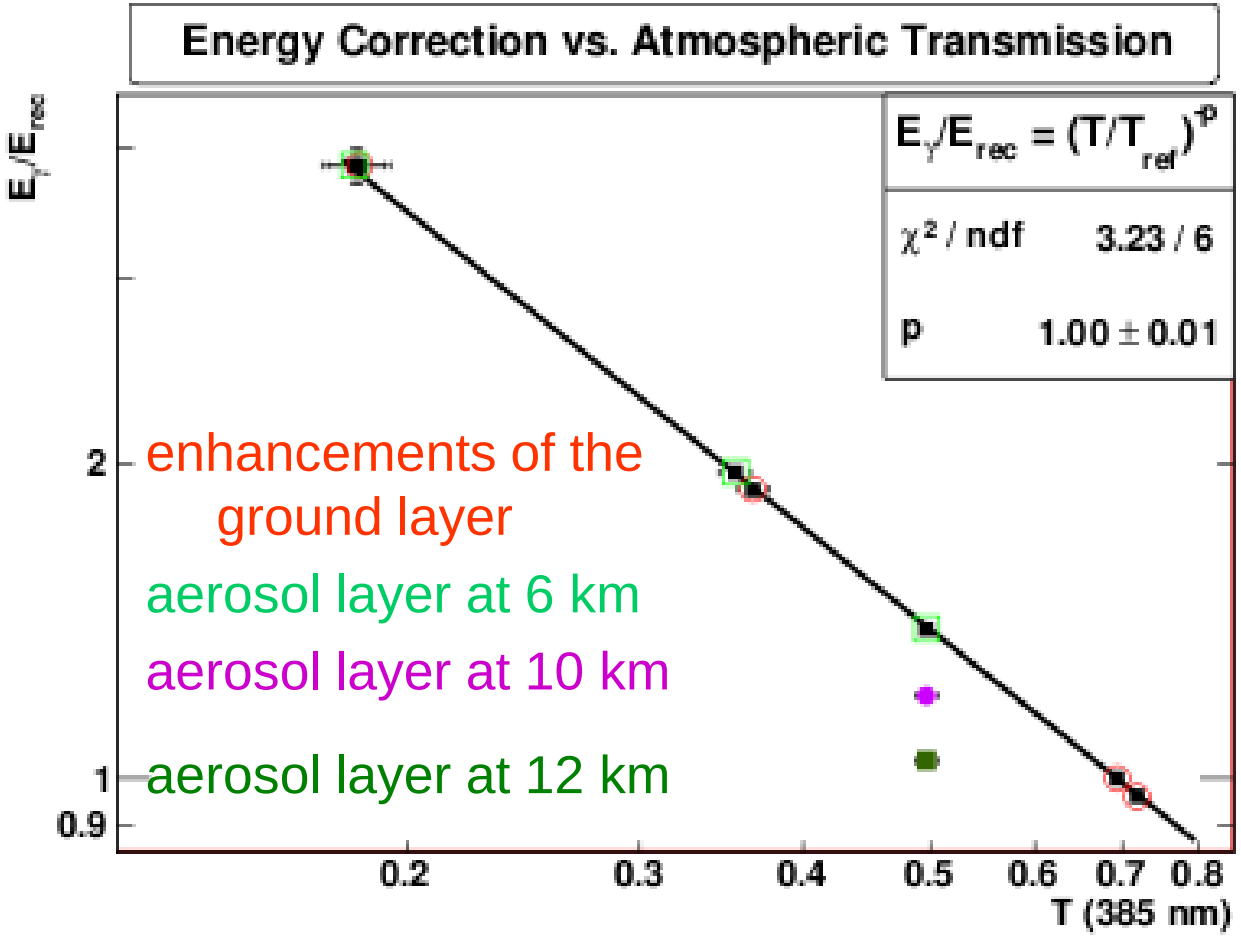
- “Hard” and “Soft” VHE gamma spectra
- EBL absorption (depending on the *z*)
- High-state (Flare) -> harder spectra
- Different energy thresholds needed for observations of different targets
- How does the atmospheric transmission change the observed spectra?

Energy Threshold



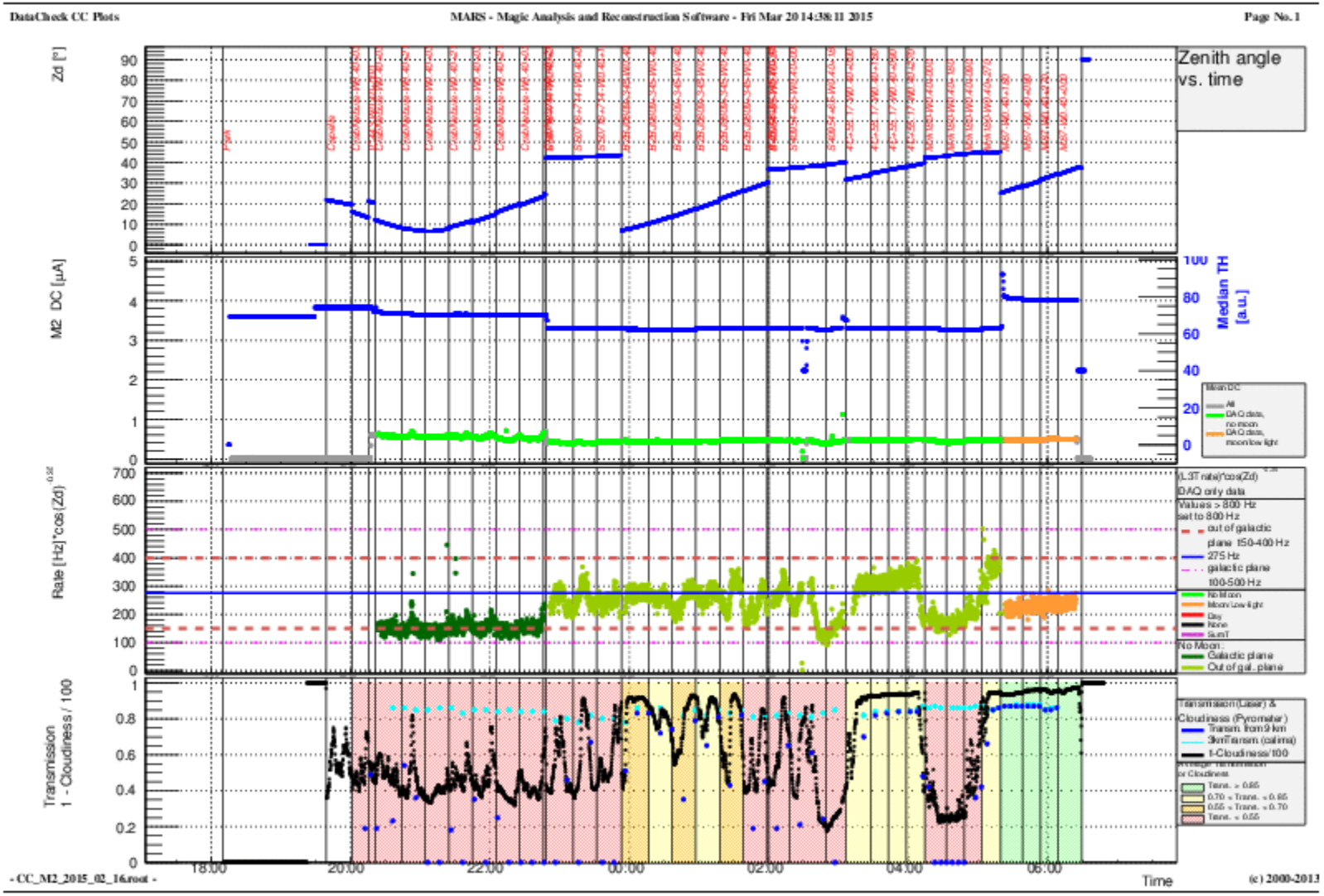
Garrido, Gaug, Font, Moralejo (MAGIC Coll.), 2014

Energy correction



Garrido, Gaug, Font, Moralejo (MAGIC Coll.), 2014

Variable atmosphere

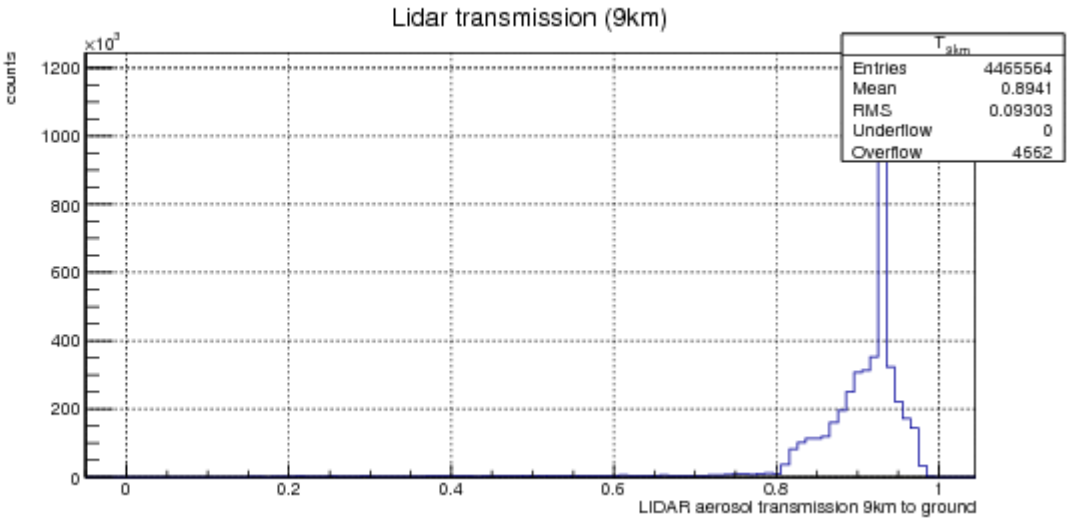


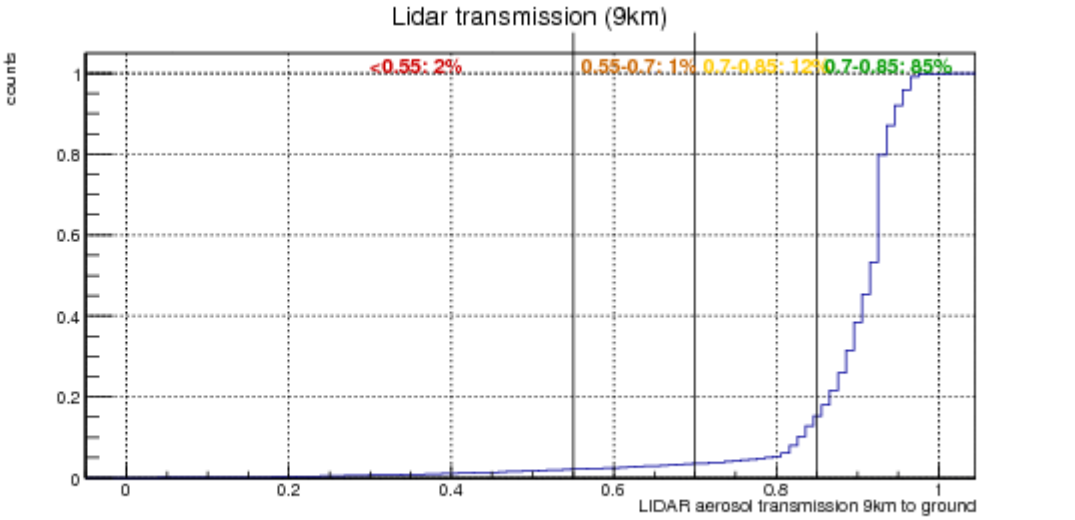
Data quality classes: Preliminary MAGIC 2 year statistics

Data quality class	LIDAR T (9 km)	Without calima cut (% of time)	With calima cut
1. (no corrections)	1.00-0.85	69	85
2. (corrections)	0.85-0.70	17	9
3. (corrections)	0.70-0.55	6	2
4. (“garbage”)	0.55-0.00	8	4

Lidar statistics plot (calima cut)

By M. Gaug





?


GRANITE
LIMONE
ARANCIA
€ 2.00
MISTER SANDWICHES
GELATO DA PASSEGGIO

Next 3 years

Cycle 10 (ongoing, 2015)

- Test data quality classes (evaluation of proposal times)
- LIDAR vs. Pyrometer relation
- Define Dark vs. Moon limit
- Implement shifter-user-friendly LIDAR flags for different data quality classes in the operations
- Take more “Crap Crab” data
- Simulations of source visibilities for different sources including probable transmission ranges
- **PI-s, Conveners, Schedulers: exchange the ideas on the E_th limits for different sources**

Next 3 years

Cycle 11 (2015-2016)

- Moderate application of adaptive scheduling - TESTING
- Crab in different data quality classes
- Observe Mrk421 and Mrk501 during moderate transmission? (hard sources, complementary in visibility to Crab)
- Shifters learn switching between the 2 schedules (for high vs. Low transmission)
- Schedulers learn producing adaptive schedules
- Software development, testing CTA scheduling sofware on MAGIC
- Final definition of data quality classes

Next 3 years

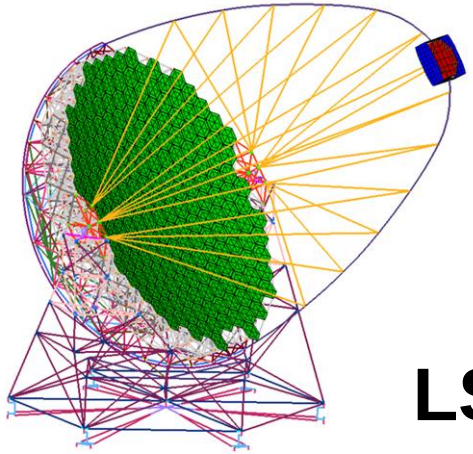
Cycle 12 (2016-2017)

- Proposals submitted and graded for different data quality classes (E_th limit)
- Conveners reccommend classes for different sources
- TAC decides
- Analyzers apply corrections
- Testing of the method in paralel on MAGIC and LST1 prototype (if ready)

Next 3 years

Cycle 13 (2017-2018)

- Proposals submitted and graded for different data quality classes (E_thr limit)
- Application on both MAGIC, and the LST1 prototype on La Palma
- Comparison of the two methods: transmission ranges (MAGIC) and continuous variables (CTA)
- Commission LST1, test and prepare for the CTA



LST

Conclusion

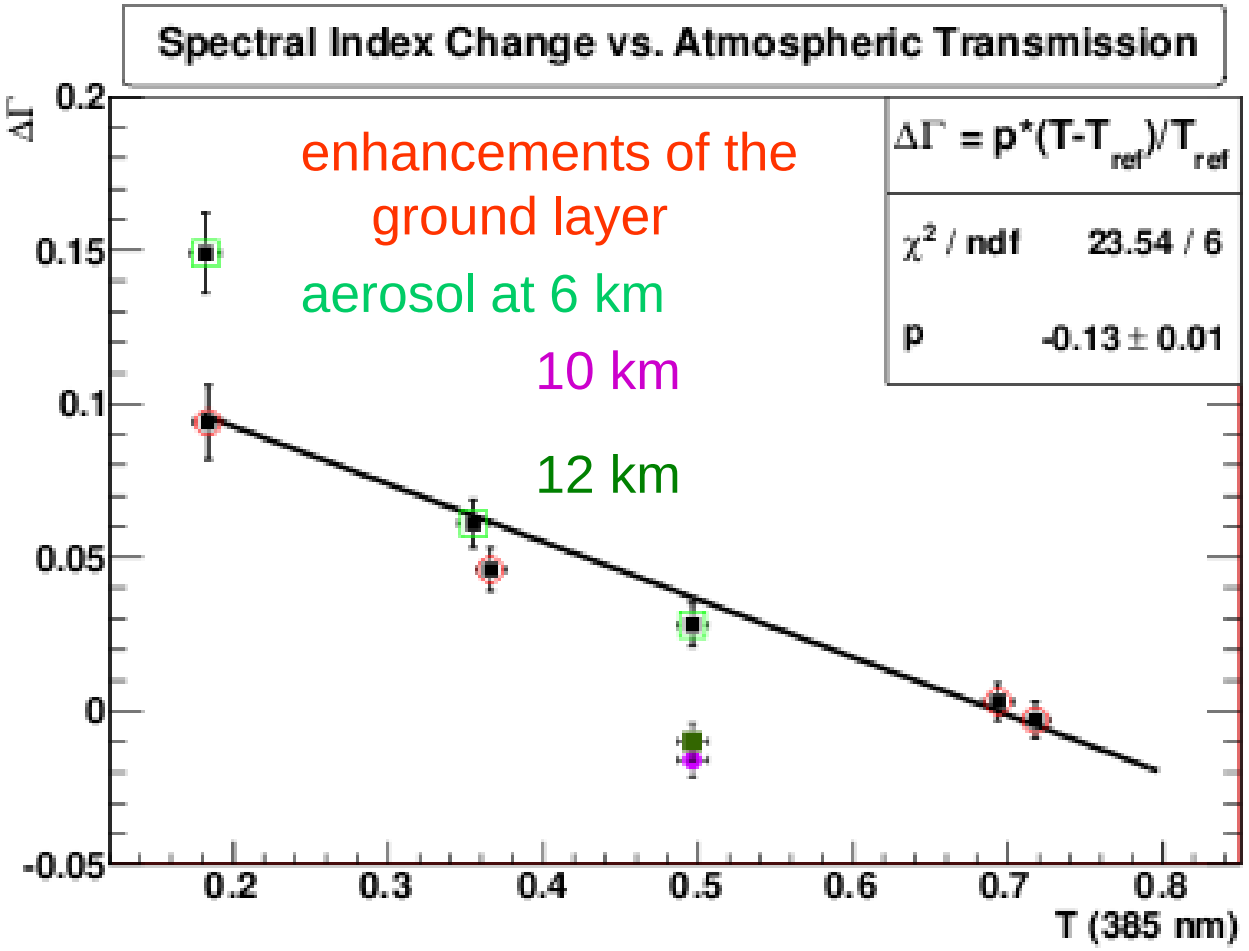
- We can recover most of the **30% accounted time** (otherwise removed during analysis)
- **Tight collaboration** among conveners, schedulers, analyzers and the ATCA experts needed for this task

  => analyzers will finally have **more** time of **useful data** for the analysis
- Test and commission LST1 – prepare for the CTA
- **If we learn to understand how to deal with the atmospheric conditions, they become a less important factor!**


"I love the clouds, the clouds that pass up there.
Up there, the wonderful clouds!"
Charles Baudelaire: "The Stranger"

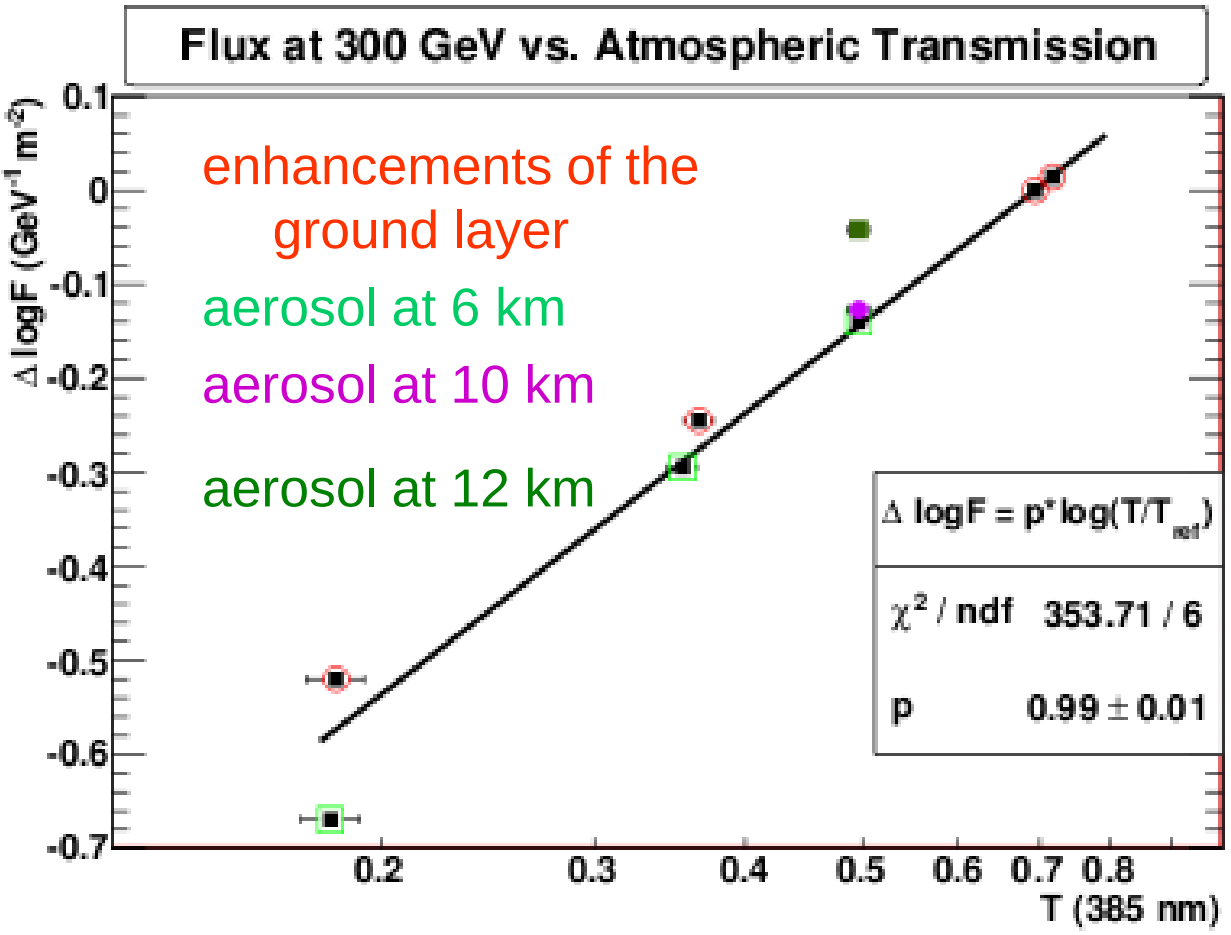
Backup slides

Spectral index change

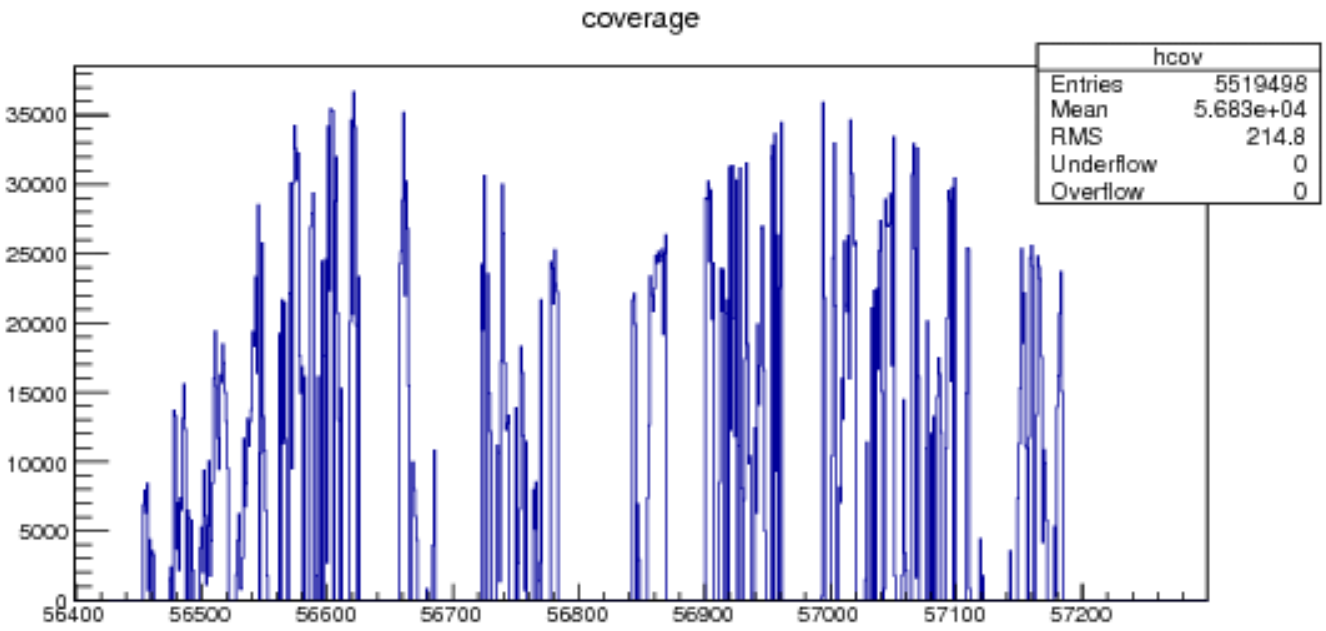


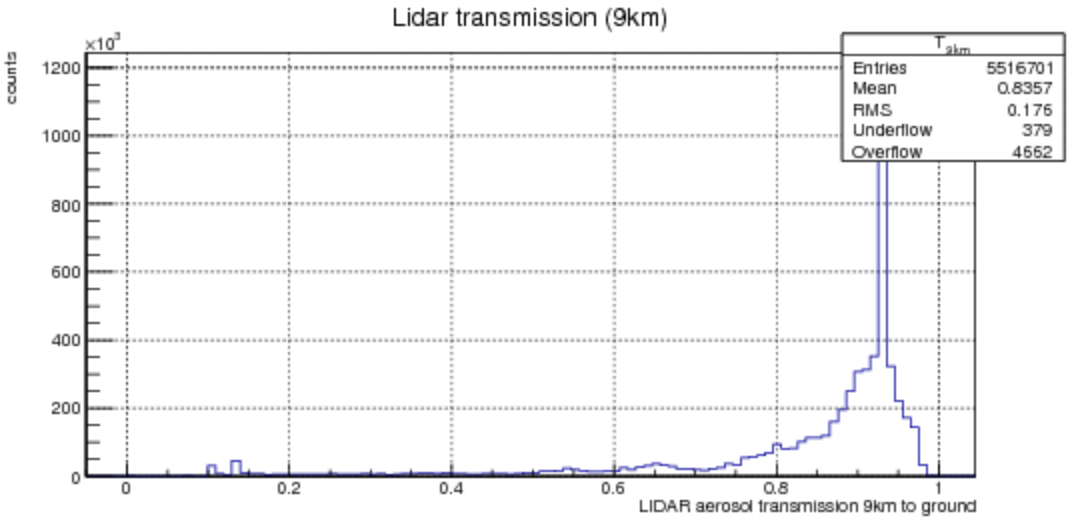
Garrido, Gaug, Font, Moralejo (MAGIC Coll.), 2014

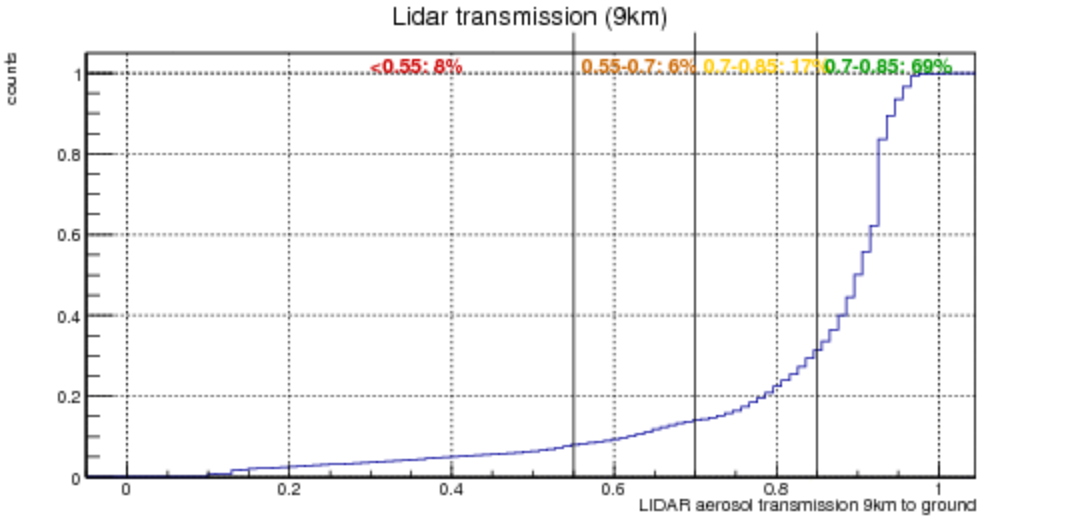
Flux at 300 GeV

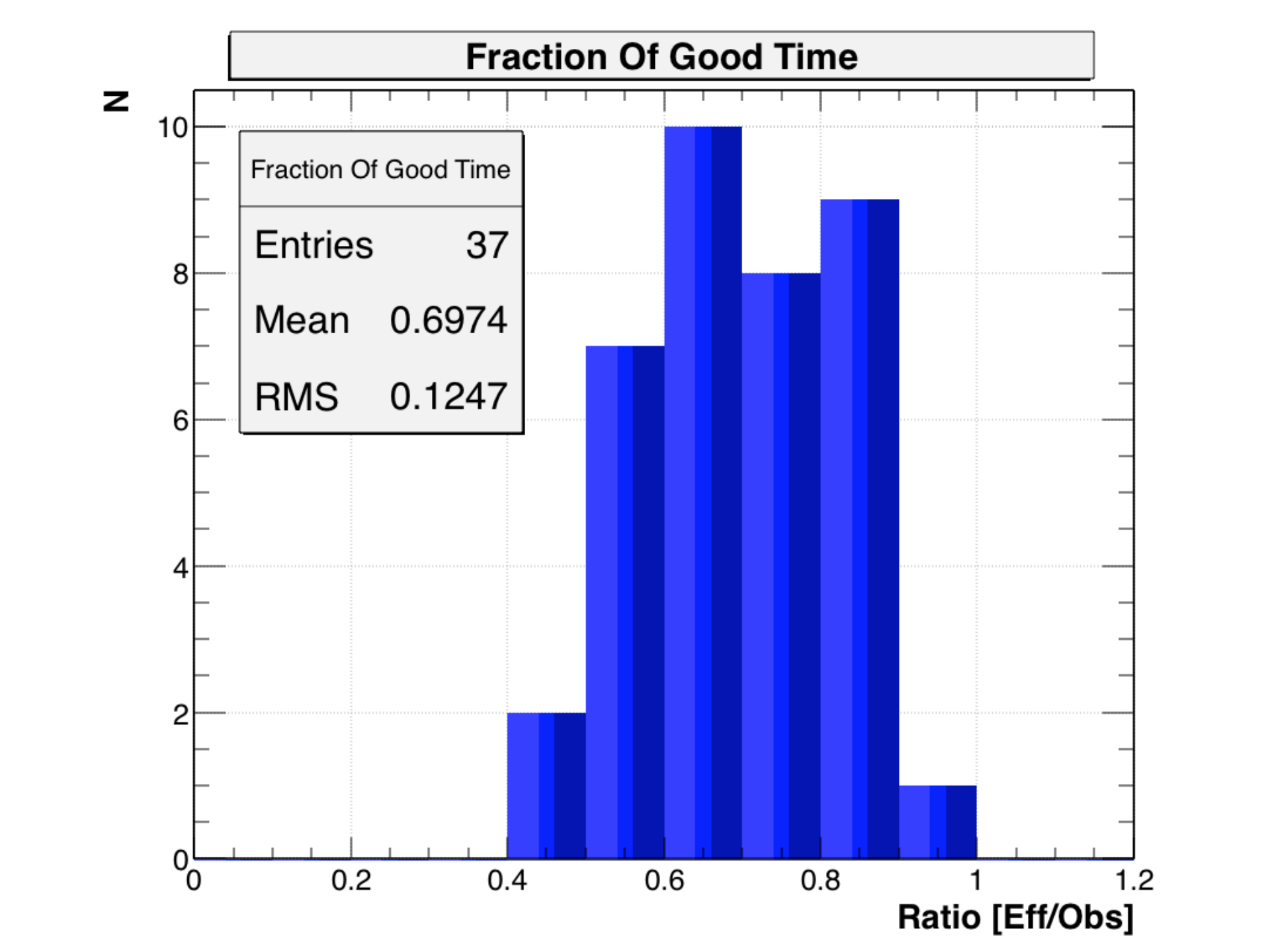


Garrido, Gaug, Font, Moralejo (MAGIC Coll.), 2014


coverage
hcov
Entries 5519498
Mean 5.683e+04
RMS 214.8
Underflow 0
Overflow 0
35000
30000
25000
20000
15000
10000
5000
0
56400
56500
56600
56700
56800
56900
57000
57100
57200


Lidar transmission (9km)
counts
×10³
1200
1000
800
600
400
200
0
0
0.2
0.4
0.6
0.8
1
LIDAR aerosol transmission 9km to ground
T9km
Entries 5516701
Mean 0.8357
RMS 0.176
Underflow 379
Overflow 4562


Lidar transmission (9km)
counts
<0.55: 8%
0.55-0.7: 6%
0.7-0.85: 17%
0.7-0.85: 69%
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
LIDAR aerosol transmission 9km to ground


Fraction Of Good Time
N
10
8
6
4
2
0
Fraction Of Good Time
Entries 37
Mean 0.6974
RMS 0.1247
0
0.2
0.4
0.6
0.8
1
1.2
Ratio [Eff/Obs]