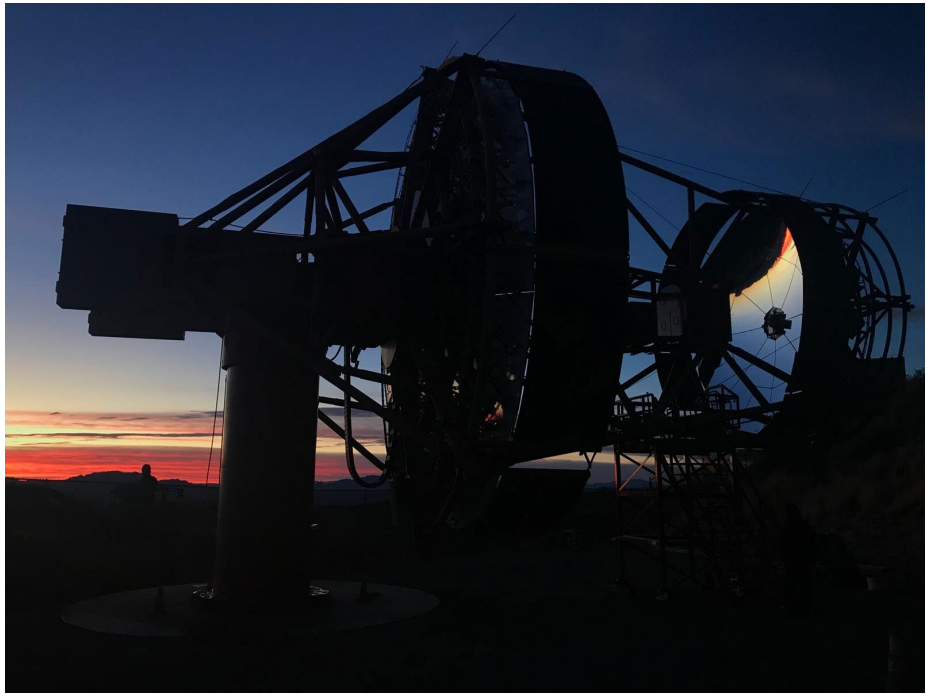
MAGIC/CTA

Resp. Locale F. Giordano



Modulo EC/EN 7

A cura di: Francesco Giordano

Ricercatori

	Nome	Età	Contratto	Qualifica	Aff.	%
1	Altomare Corrado		Associato	Dottorando	CSN II	50
2	Bissaldi Elisabetta		Associato	Ricercatore B Tempo Determinato Tipo B	CSN II	45
3	Di Venere Leonardo		Dipendente	Assegno di Ricerca	CSN II	30
4	Giglietto Nicola		Associato	Prof. Ordinario	CSN II	70
5	Giordano Francesco		Associato	Prof. Associato	CSN II	50
6	Loporchio Serena		Associato	Dottorando	CSN II	100
7	Pantaleo Francesca Romana		Associato	Assegnista	CSN II	50
8	Raino' Silvia		Associato	Prof. Associato	CSN II	50
				Numero Totale Ricercatori	8	FTE: 4.5

Tecnologi

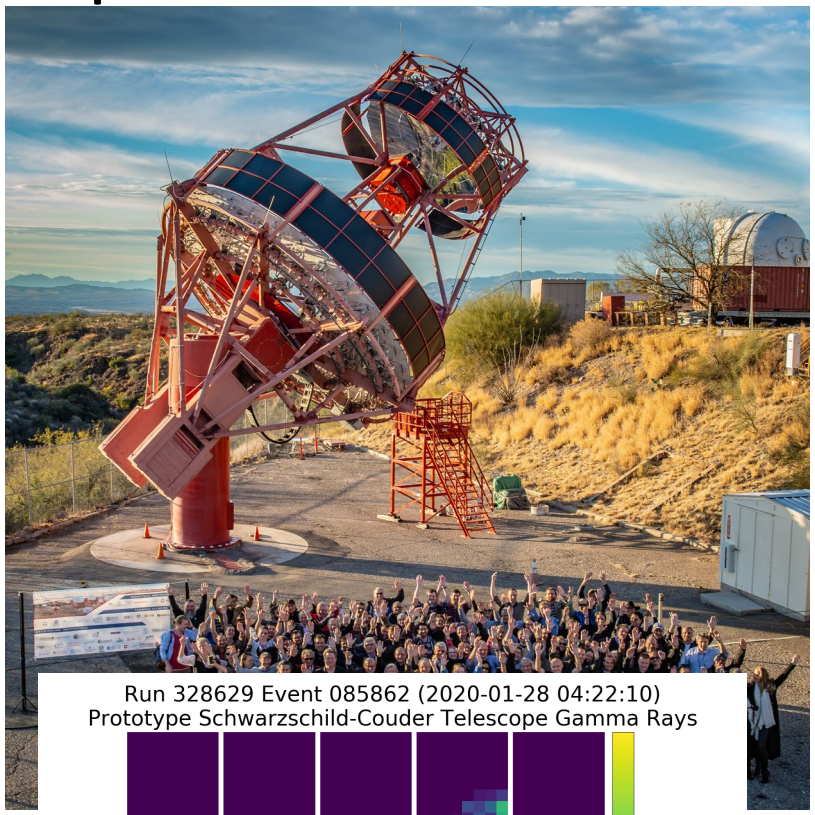
	Nome	Età	Contratto	Qualifica	Aff.	%
1	Licciulli Francesco		Dipendente	Tecnologo		20
				Numero Totale Tecnologi	1	FTE: 0.2

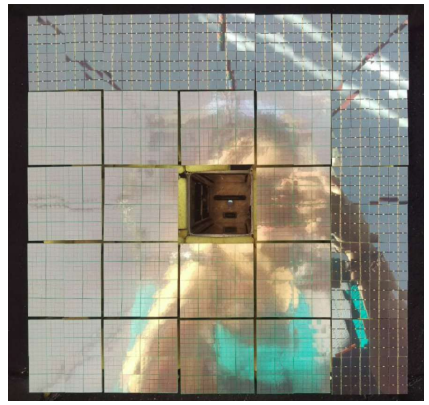
Giglietto – Resp. Nazionale MAGIC
Giordano – PI call NSF SCT
Bissaldi – SAPO member
Bissaldi – CTA INFN Science coordinator

3 main activities

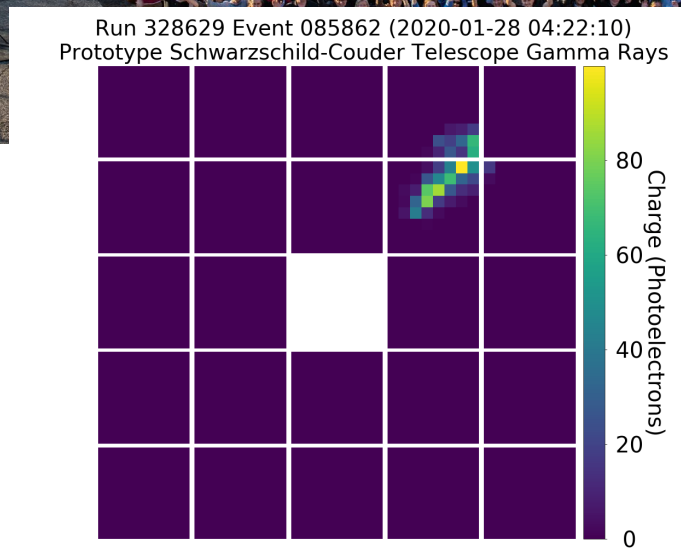
- SCT (CTA)
- LST (CTA)
- MAGIC

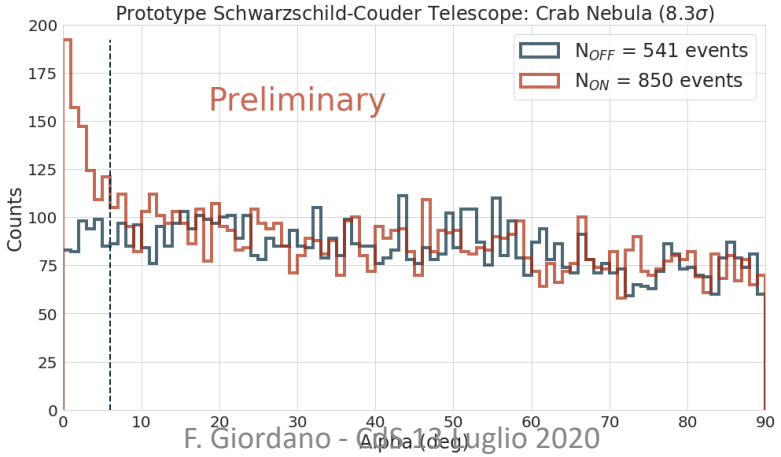
pSCT commissioning

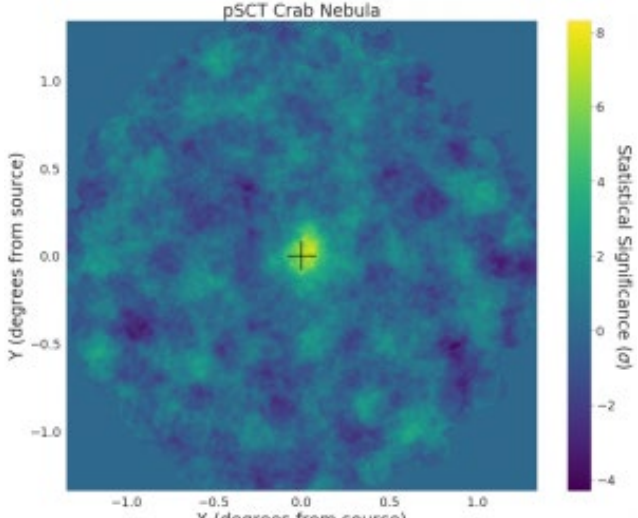




- **inauguration:** January 17-18, 2019
  - Mirrors and camera installed
  - Drive system demonstration
  - Camera ready to be turned on
- **first light:** January 23, 2019
- **Optics alignment:** full alignment in december 2019
- **Crab campaign:** Jan 18 – Feb 26 2020
- **Crab detection**: announced on Jun 2, 2020

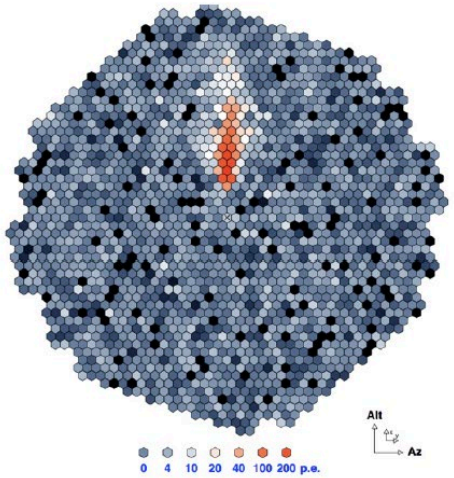


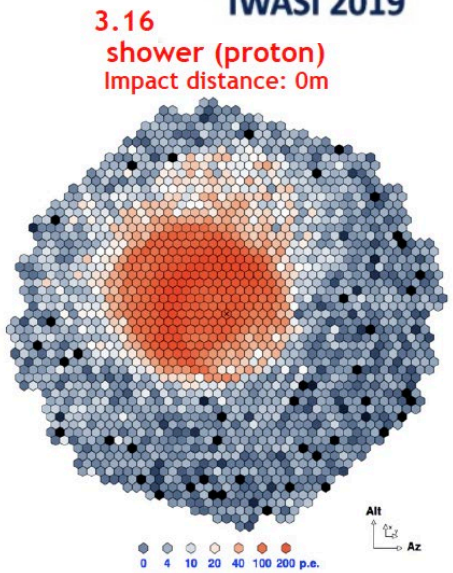




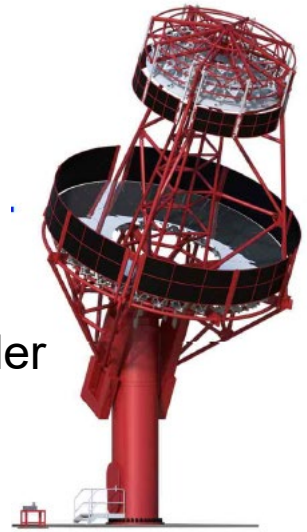
The Schwarschild Couder Telescope (SCT)

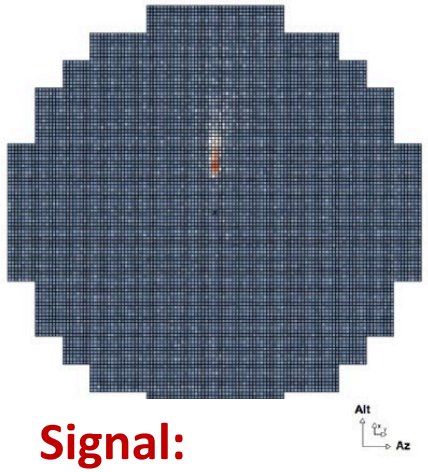
MST
Single mirror
Davies-Cotton
~ 2k PMTs

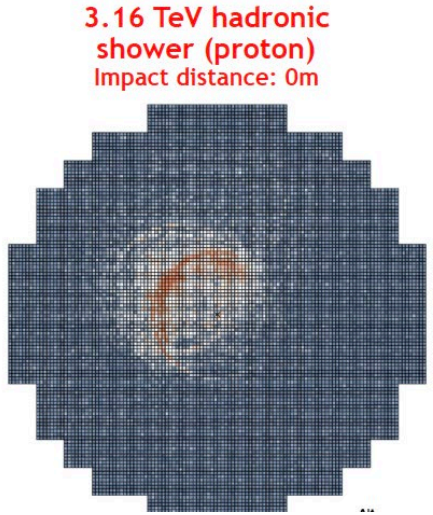




SCT
Double mirror
Schwarzschild-Couder
~ 12k SiPMs



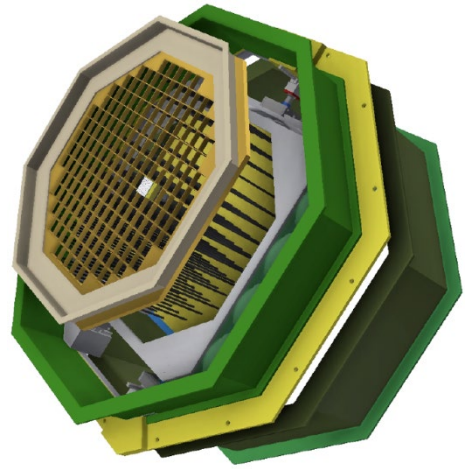




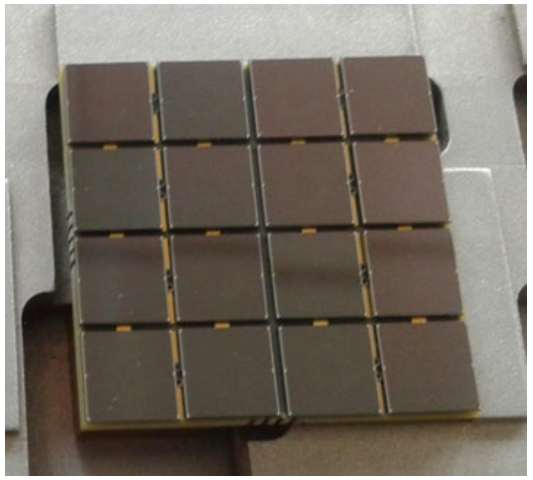
Signal:
γ-ray Shower

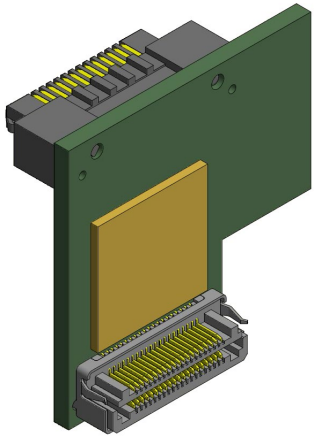
Background
proton shower

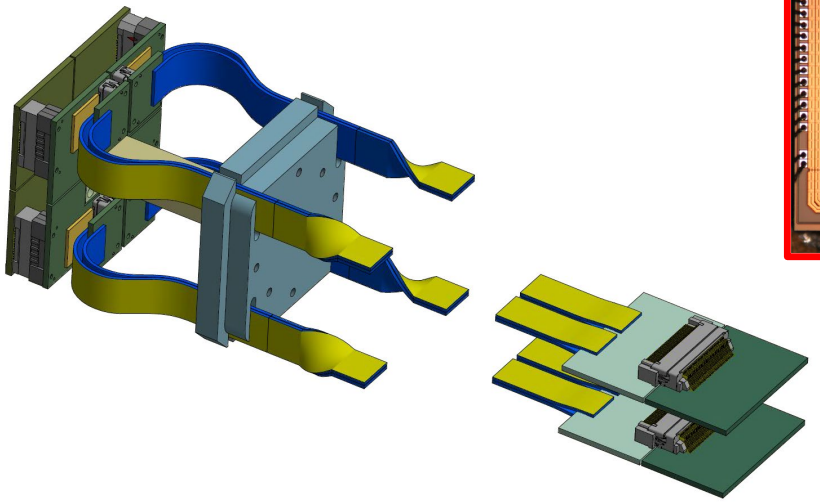
Camera Upgrade

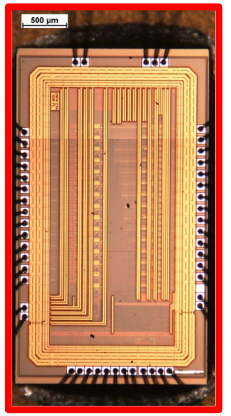


- SMART ASIC will be hosted on a small PCB to be plugged directly the SiPMs
- Production of 1000 ASICs for full camera - late 2020
- Designed and produced @INFN-Bari → tests to start soon
- A third version of the ASIC (Lfoundry) is foreseen to better match the required performance → **design ongoing by <u>F. Licciulli</u>**



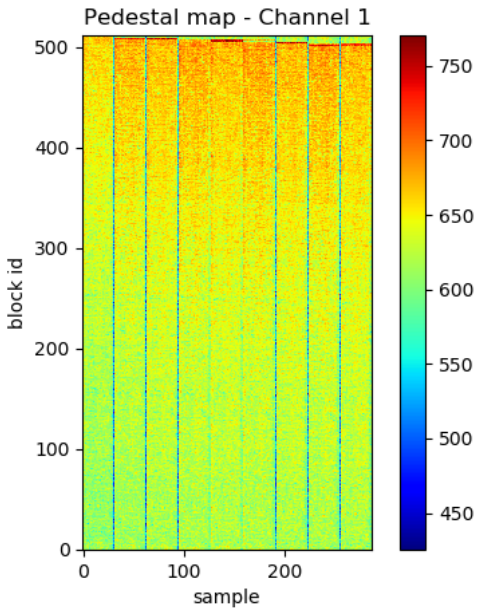


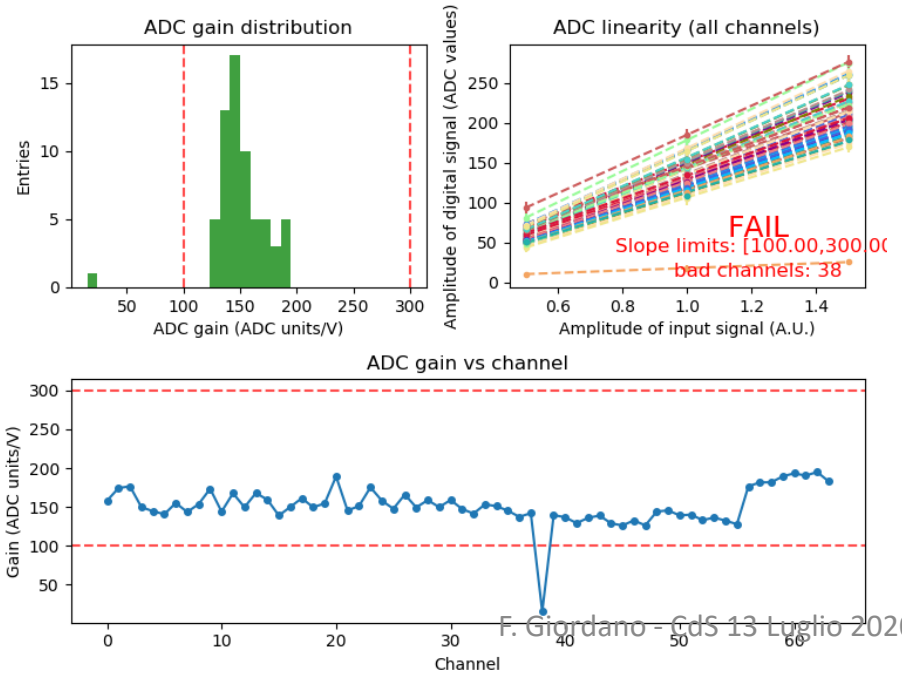


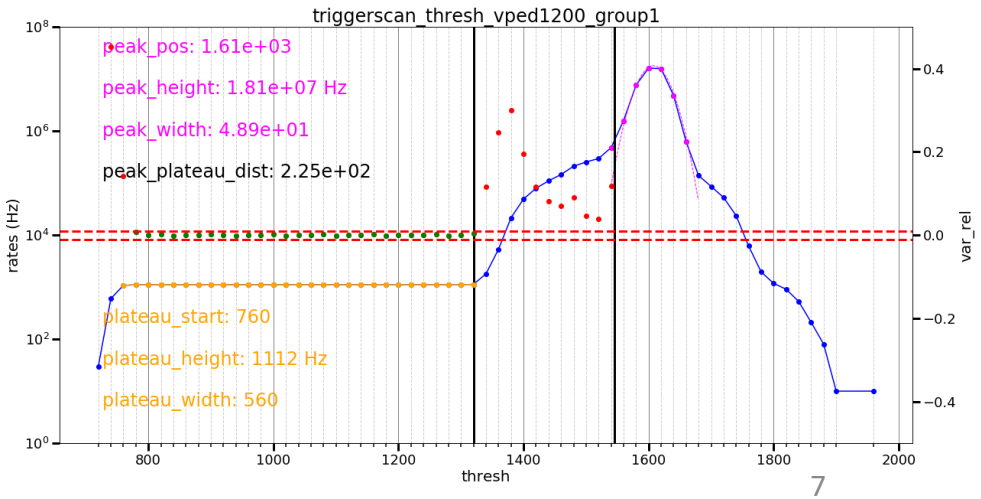


FEE modules

- Production of 200 modules funded by INFN
- Tender published, but delayed due to COVID19
  - first modules probably produced within few months
- Software for QC validation of 200 modules **– team lead by <u>Di Venere L.</u>**







SiPM Workshop: from fundamental research to industrial applications

Participant List

90 participants

First Name	Last Name	Affiliation
Adriaan	Heering	University of Notre Dame
Alberto	Dalla Mora	Politecnico di Milano - Dipartimento di...
Alberto Giacomo	Gola	Fondazione Bruno Kessler
Alessandro	Cortopassi	CAEN SPA
Alessandro	Razeto	LNGS
Anatolii	Zenin	Nagoya University
Andrea	Falcone	University of Milano Bicocca and INFN...
Andrii	Nagai	University of Geneva, DPNC
Angaraj	Duara	University of Leicester
Anthony	Hutcheson	Naval Research Laboratory
Asish	Moharana	Gran Sasso Science Institute (GSSI) - ...
Bayarto	Lubsandorzhiev	Institute for Nuclear Research of the R...
Boxiang	Yu	Institute of high energy physics
Carina	Trippl	EPFL
Carla	Aramo	INFN Napoli
Carlo	Tintori	CAEN SPA
Christophe	de La Taille	OMEGA (FR) Ecole Polytechnique CNR...
Cong	Guo	Institute of High Enegy Physics

90 partecipanti

https://agenda.infn.it/event/17801/overview

Servizi		
	Servizio	M.U.
1	Camera Pulita	1.00
2	Elettronica	5.00
3	Officina Meccanica	2.00
4	Progettazione Meccanica	2.00
	Totale Mesi/Uomo Servizi Per CTA Bari	10.00

Annotazioni

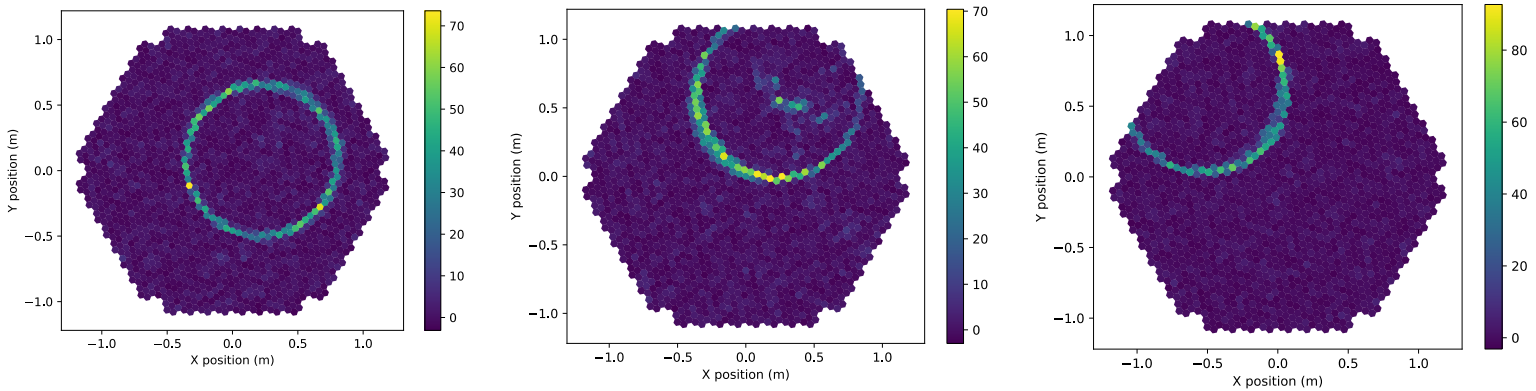
Calibration of the LST1 optical efficiency with muons

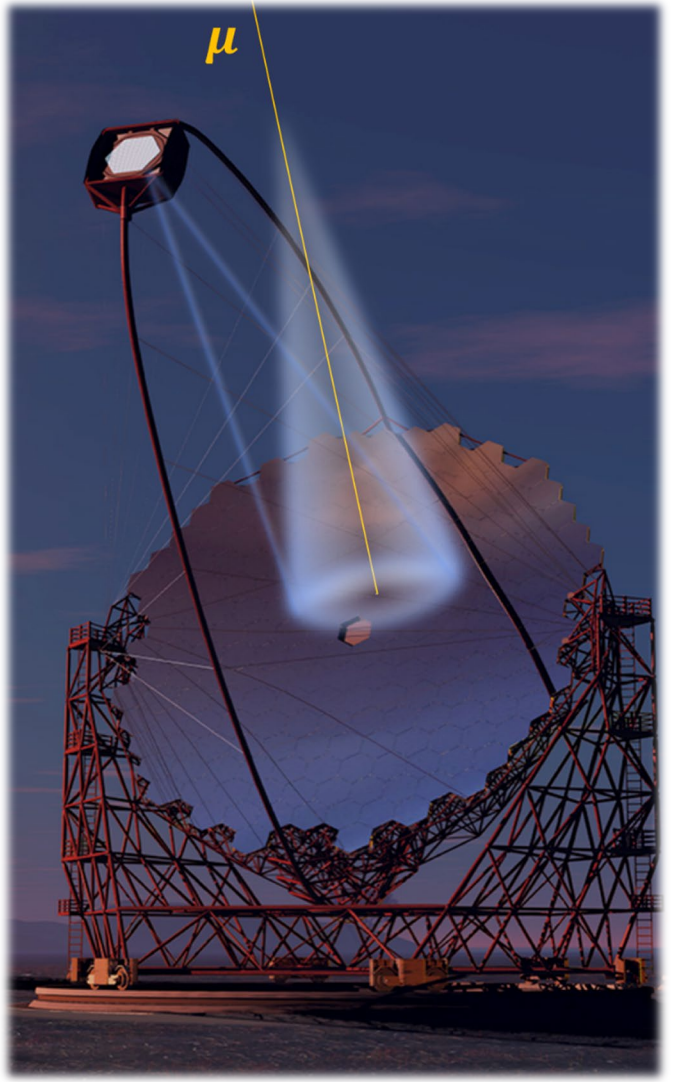
Muons are used to evaluate the **optical efficiency** of the telescope

Muon analysis steps:

1. Muon identification
2. Muon efficiency fit

bottleneck of the procedure
⇒ optimized with dedicated algorithms:
⇒ Taubin fit, majority

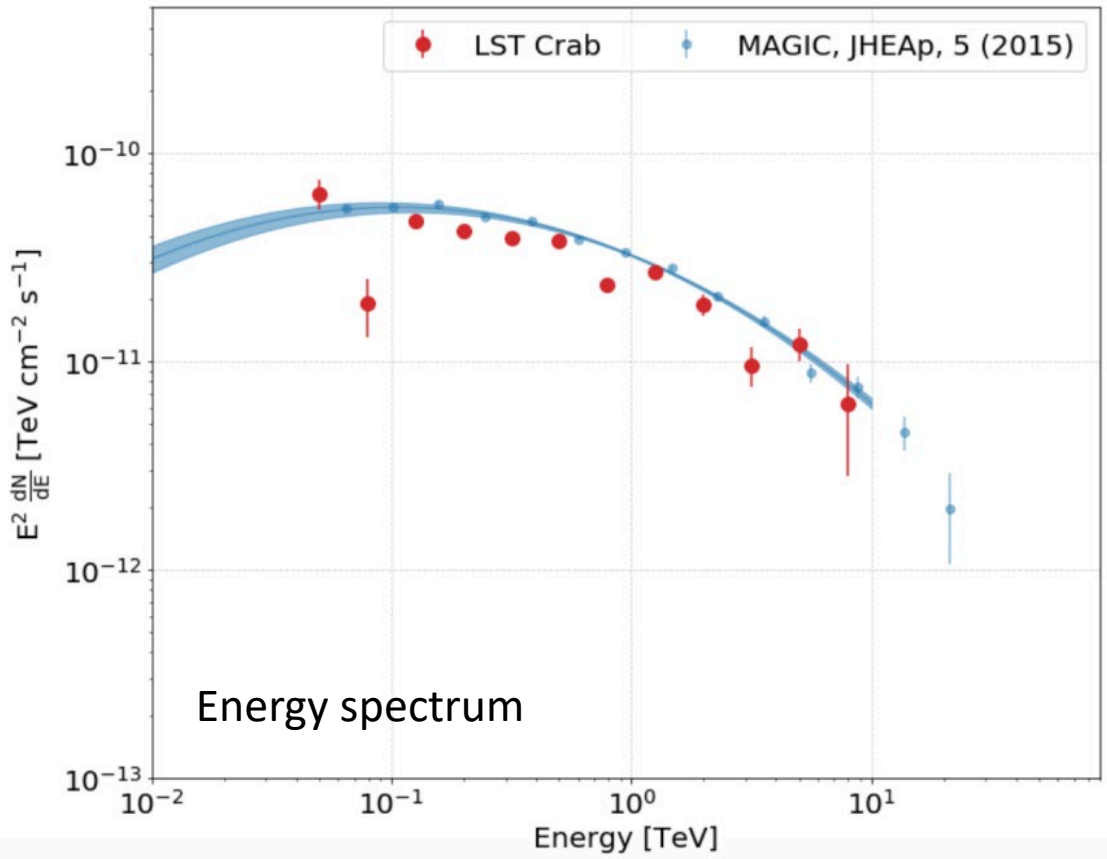


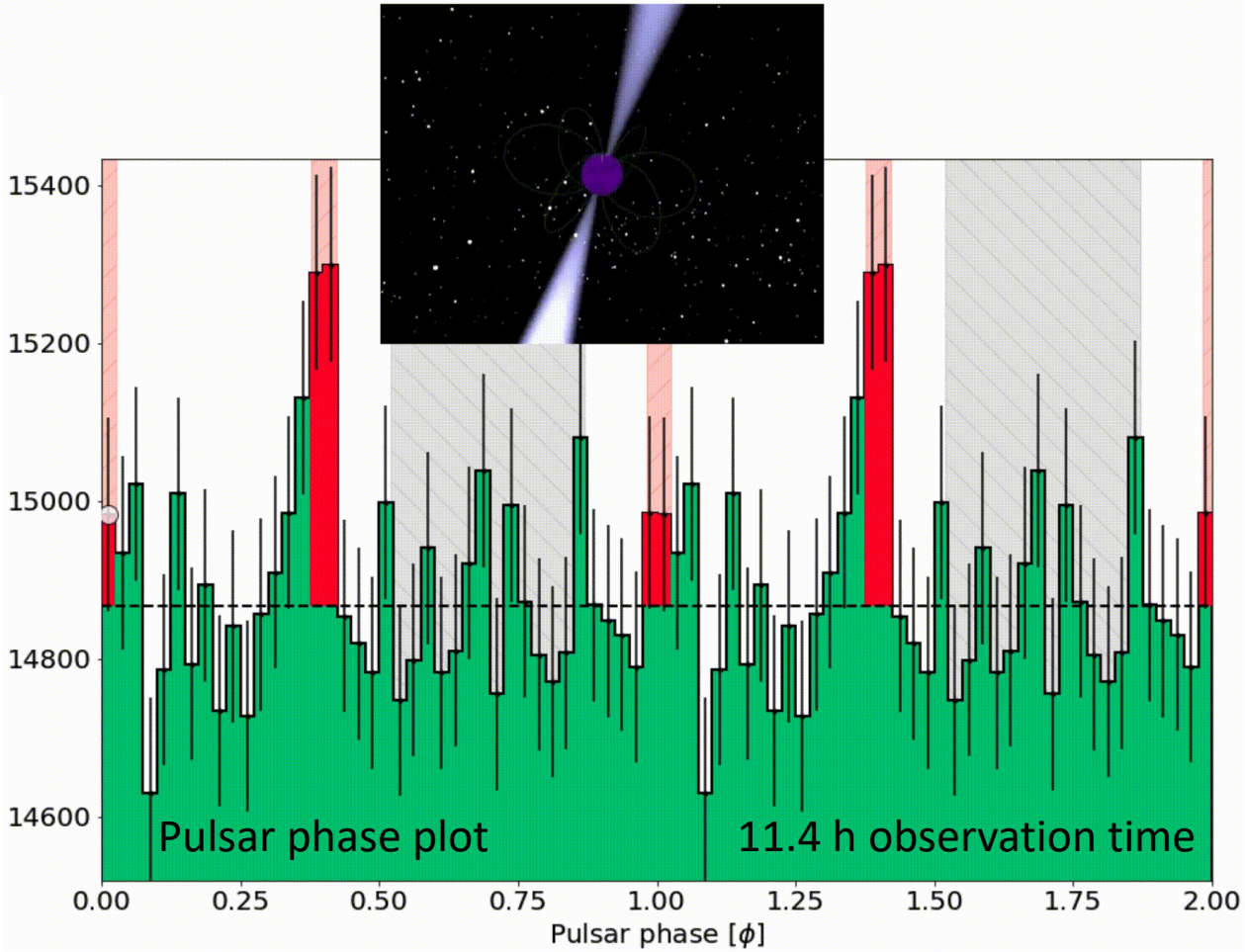


master thesis by R. Pillera

➢ **CTA requirement on muon flagging at camera level with 90 % efficiency**

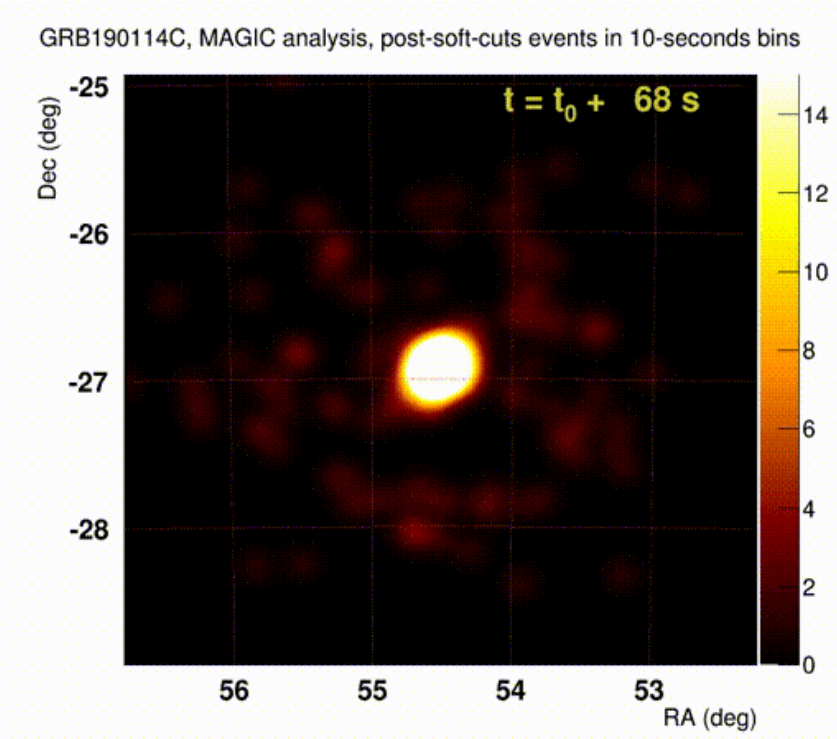
LST1 Crab campaign 2020 results: Crab nebula





Crab P2 peak detection using commissioning data already at 5.2 σ.
First pulsar detected with a prototype telescope of CTA.

Rubén López-Coto
30/06/20



Article | Published: 20 November 2019

Teraelectronvolt emission from the γ-ray burst GRB 190114C

MAGIC Collaboration

Nature **575**, 455–458(2019) | Cite this article

6681 Accesses | **14** Citations | **563** Altmetric | Metrics

GRB detection with MAGIC
Signed by:
L. Di Venere, N. Giglietto, F. Giordano and S. Loporchio

Article | Published: 20 November 2019

Observation of inverse Compton emission from a long γ-ray burst

MAGIC Collaboration, P. Veres, [...] D. R. Young

Nature **575**, 459–463(2019) | Cite this article

7498 Accesses | **13** Citations | **804** Altmetric | Metrics

Access by

Featured in Physics

Bounds on Lorentz Invariance Violation from MAGIC Observation of GRB 190114C

V. A. Acciari *et al.* (MAGIC Collaboration)
Phys. Rev. Lett. **125**, 021301 – Published 9 July 2020

Recentissima press release (09/07/2020)
https://home.infn.it/it/comunicazione/comunicati-stampa/4069-magic-conferma-einstein-la-velocita-della-luce-nel-vuoto-e-costante-anche-alle-energie-piu-elevate

Article | Published: 20 November 2019

A very-high-energy component deep in the γ-ray burst afterglow

H. Abdalla, R. Adam, [...] O. J. Roberts

Nature **575**, 464–467(2019) | Cite this article

4866 Accesses | **11** Citations | **382** Altmetric | Metrics

+ GRB detection with HESS
Signed by E. Bissaldi

MNRAS 000, 1–13 (2020) Preprint 13 July 2020 Compiled using MNRAS LATEX style file v3.0

First detection of VHE gamma-ray emission from TXS 1515–273, detailed study of its X-ray variability and spectral energy distribution

MAGIC collaboration

Accepted XXX. Received YYY; in original form ZZZ

ABSTRACT

TXS 1515–273 is a very little studied blazar with rather hard spectral index in GeV γ-ray band and was therefore considered as extreme high synchrotron peaking source candidate. The source TXS 1515–273 was observed in different energy ranges, from radio to very-high-energy (VHE, > 100 GeV) gamma rays during its flaring activity in 2019. In particular, the MAGIC telescopes also observed the source, resulting in a first-time detection at VHE energies. A very good coverage of the flare in the X-ray was provided by *Swift*-XRT, *XMM-Newton* and *NuSTAR*. The long continuous observations by *XMM-Newton* and *NuSTAR* were separated by half a day, but both showed clear hour scale flares. The X-ray variability timescales were used to constrain the size of the emission region and the strength of the magnetic field. The high quality X-ray data also allowed us to investigate the spectral evolution in $\leq$10 minutes timescales. The data allowed to determine the location of the synchrotron peak frequency and classify the source as a high, but not extreme, synchrotron peaked object during the flare. Finally, taking into count the constraints and variability patterns from the X-ray data, we modelled the broad-band spectral energy distribution (SED). We first applied simple one-zone model, which could not reproduce the radio part, and the two-zone model with two interacting components, which enabled us to reproduce the spectral energy distribution from from radio to VHE γ-ray band.

In prepatation

S. Loporchio in Turku for data analysis and SED modeling (corresponding author)

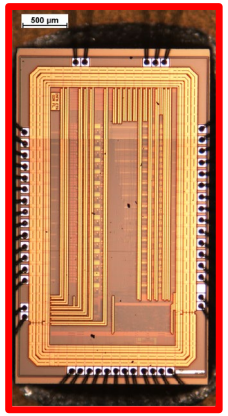
Conclusioni

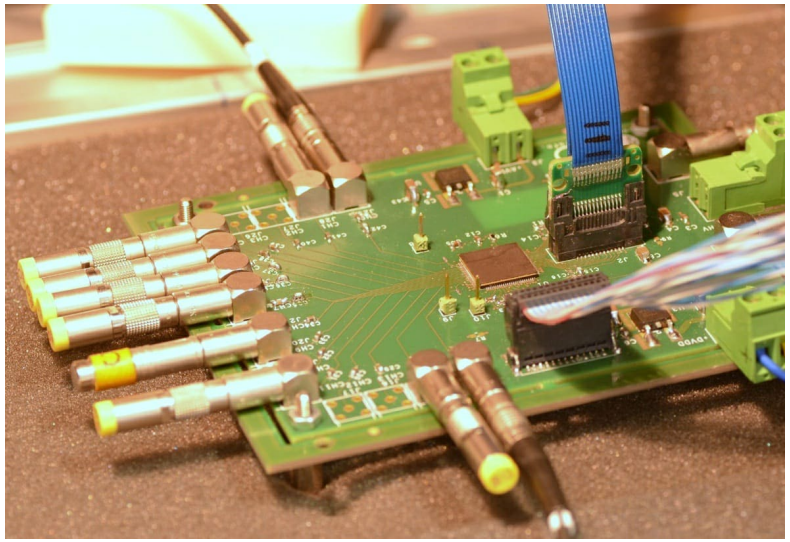
- Construzione SCT - tutto 2021
- Analisi in LST1
- Analisi in MAGIC
- MoU LST-MAGIC per fare scienza congiunta

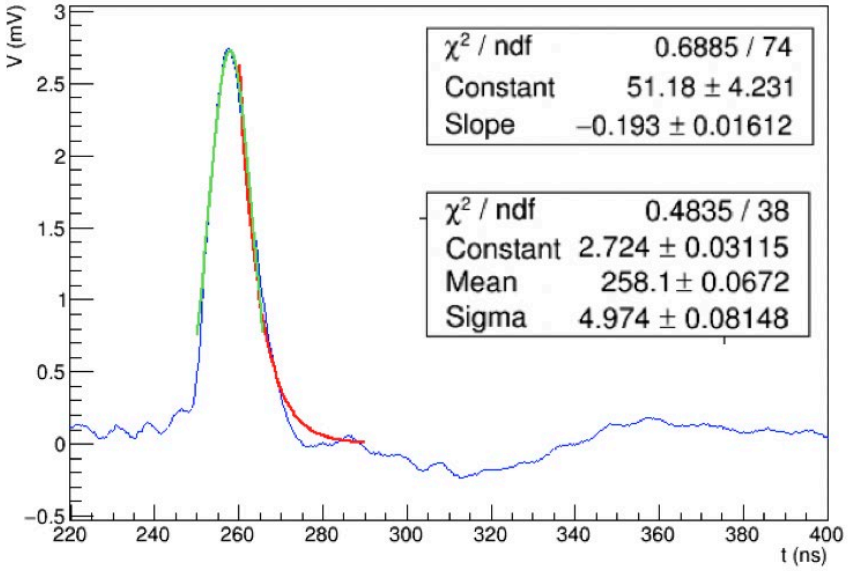
backup

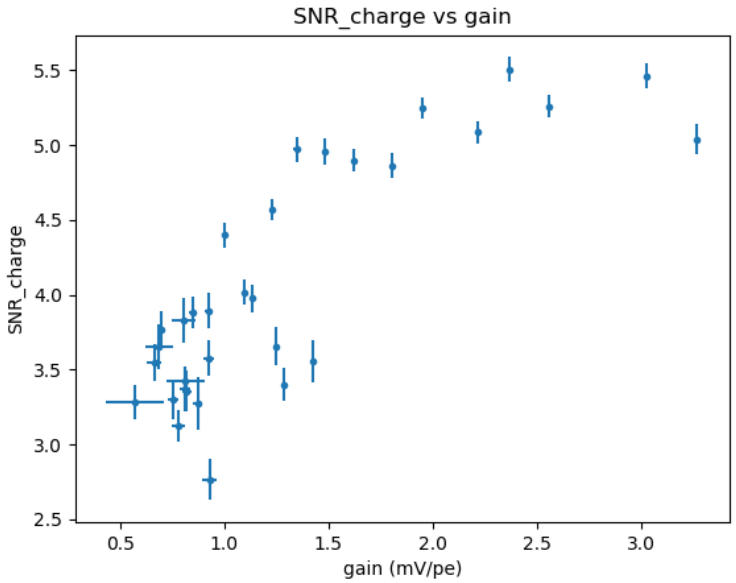
SMART ASIC

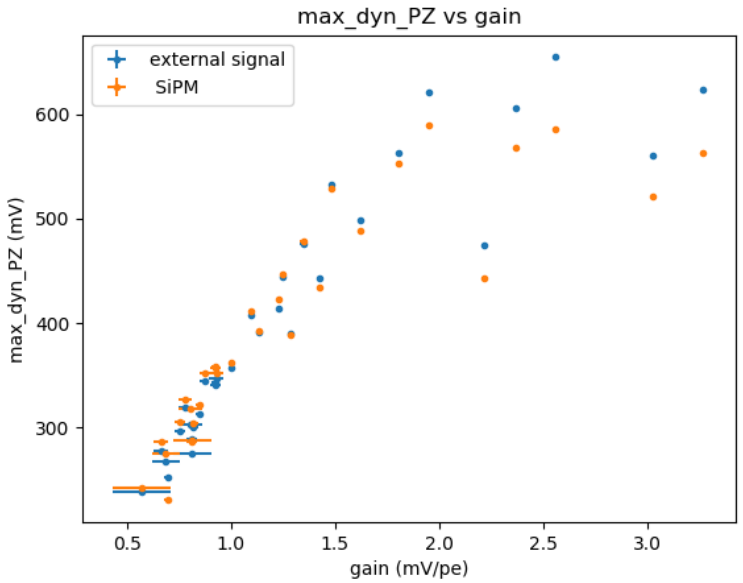
- 16-channel trans-impedance amplifier
- Bias + gain/shape adjustment
- DC current monitoring
- Prototype of second version tested - end 2019







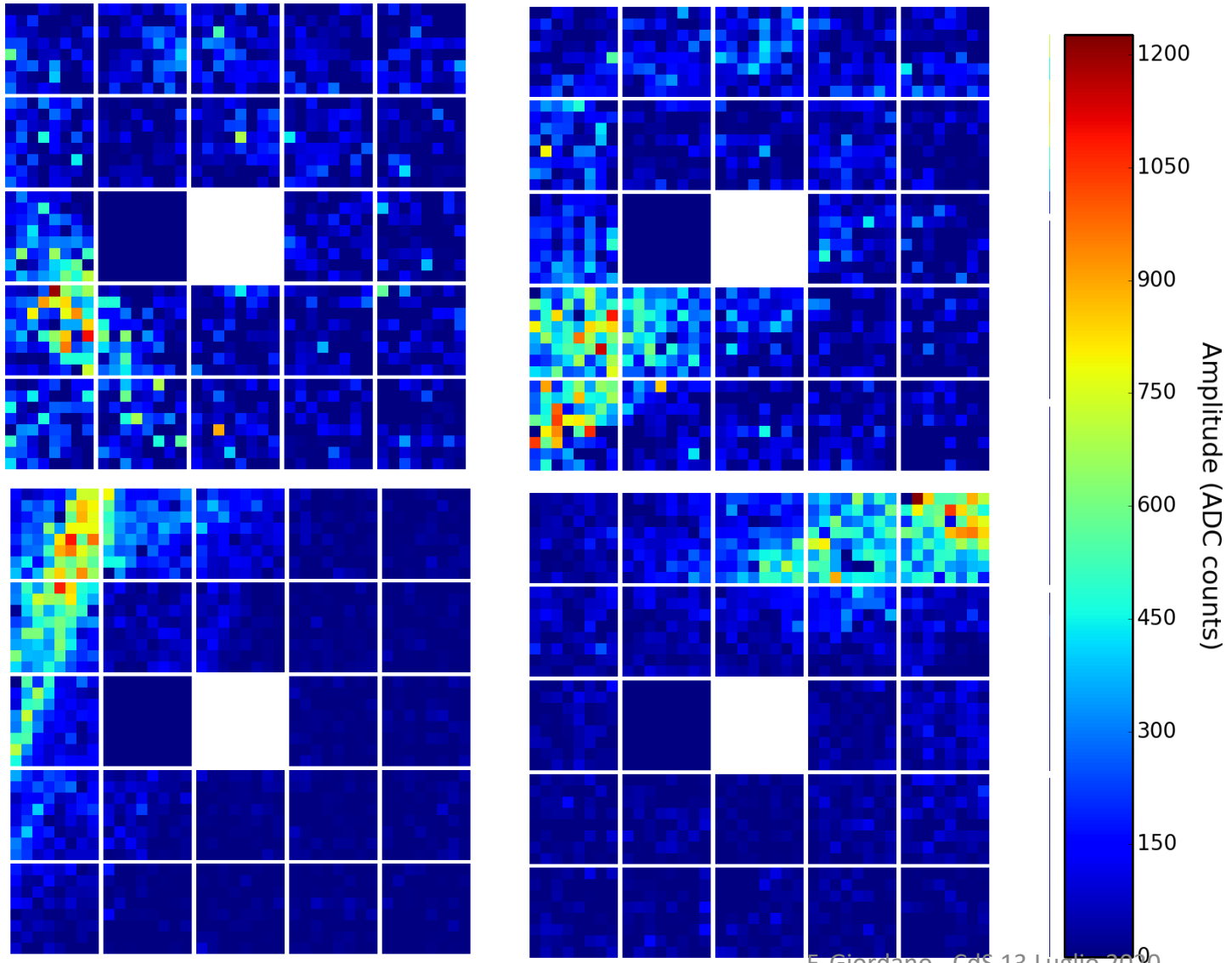




pSCT commissioning

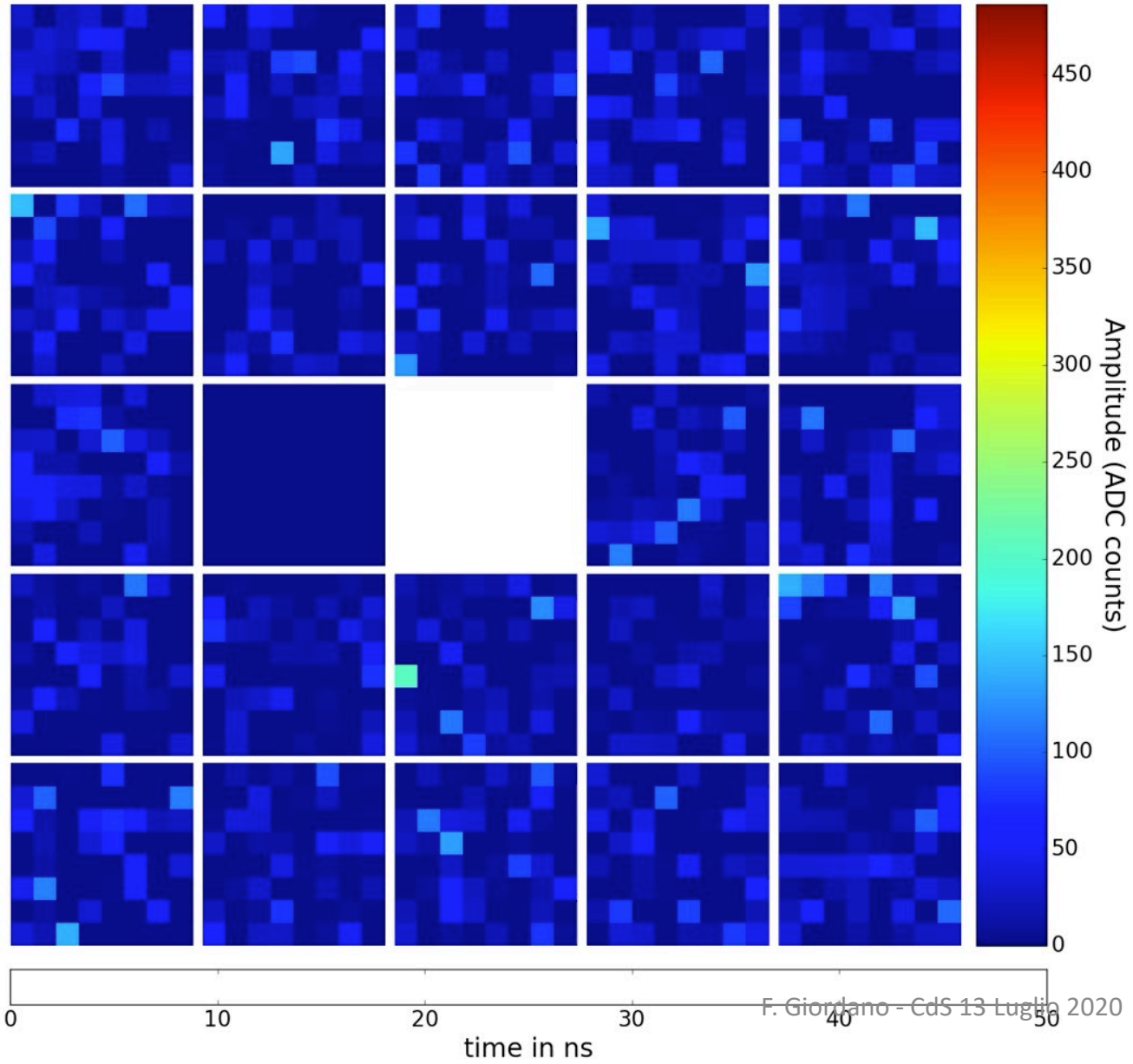
- Onsite commissioning and integration
  - Installation of new flasher
  - Restructuring and simplification of data-taking software
  - Characterization and understanding of temperature and rates
  - First Crab observation in November
  - Installation and initial testing of the time tagging system
  - Optics fully aligned in December 2019
  - First confirmed gamma ray event in January 2019
- First “handoff” to new observers for continued Crab observations
- Measurement of point spread function using current readings
- Measurement of position correction using current readings

pSCT first light: January 23, 2019



- Central module removed
- Neighboring module disabled
- Optical system not yet aligned
- Uncalibrated camera data

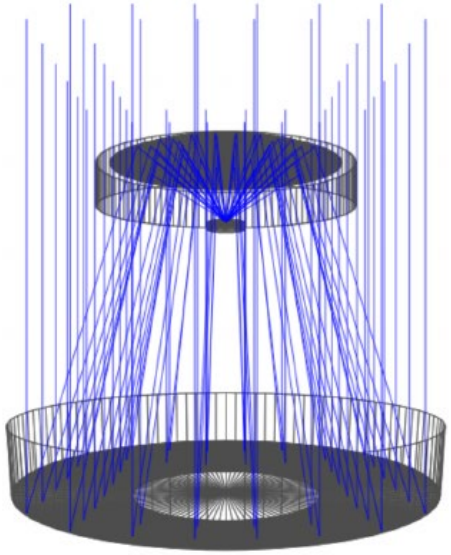
pSCT first light: January 23, 2019

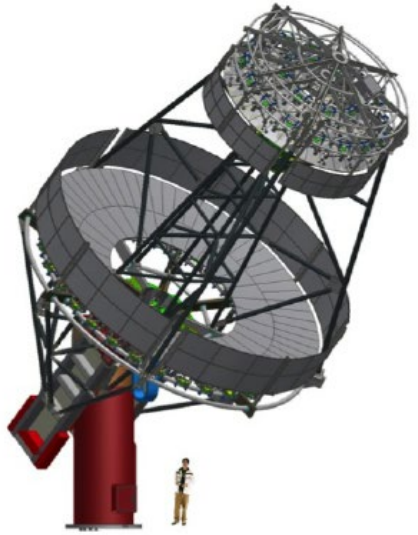


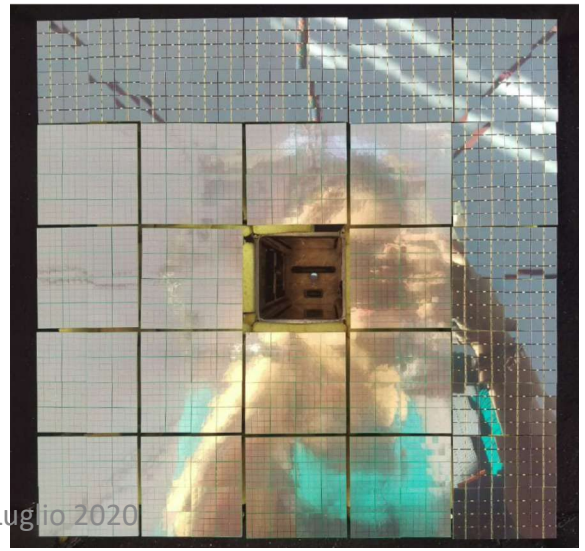
- Central module removed
- Neighboring module disabled
- Optical system not yet aligned
- Uncalibrated camera data

The Schwarzschild-Couder Telescope for CTA

- **Schwarzschild-Couder dual mirror optics**
  Medium Size Telescope
  - Dual mirror optics designed to cancel aberration and de-magnify images, to be compatible with compact high-resolution SiPM camera
  - Improved angular resolution
  - Mechanical stability and mirror alignment are the main challenges.
- **Integration and camera installation**
  - 9 FBK modules in top-right edges
  - 15 Hamamatsu modules







Testing emission models on the extreme blazar 2WHSP J073326.7+515354 detected at very high energies with the MAGIC telescopes

MAGIC Collaboration: , External Collaborators:

Monthly Notices of the Royal Astronomical Society, Volume 490, Issue 2, December 2019, Pages 2284–2299, https://doi.org/10.1093/mnras/stz2725

Published: 30 September 2019 **Article history ▾**

THE ASTROPHYSICAL JOURNAL

Constraints on Gamma-Ray and Neutrino Emission from NGC 1068 with the MAGIC Telescopes

V. A. Acciari[1], S. Ansoldi[2,3], L. A. Antonelli[4], A. Arbet Engels[5], D. Baack[6], A. Babić[7], B. Banerjee[8], U. Barres de Almeida[9,32], J. A. Barrio[10], J. Becerra González[1]

+ Show full author list

ELSEVIER

Physics of the Dark Universe

Volume 28, May 2020, 100529

A search for dark matter in Triangulum II with the MAGIC telescopes

MAGIC Collaboration, V.A. Acciari [1], S. Ansoldi [3, 31], L.A. Antonelli [4], A. Arbet Engels [5], D. Baack [6], A. Babić [9], B. Banerjee [11], U. Barres de Almeida [12], J.A. Barrio [13], J. Becerra González [1, 2], W. Bednarek [14], L. Bellizzi [15], E. Bernardini [16, 20], A. Berti [17], J. Besenrieder [18], W. Bhattacharyya [16], C. Bigongiari [4] ... D. Zarić [8]

A&A 635, A158 (2020)

MAGIC very large zenith angle observations of the Crab Nebula up to 100 TeV

MAGIC Collaboration

An intermittent extreme BL Lac: MWL study of 1ES 2344+514 in an enhanced state

MAGIC Collaboration: V A Acciari, S Ansoldi, L A Antonelli, A Arbet Engels ✉, A Babić, B Banerjee, U Barres de Almeida, J A Barrio, J Becerra González, W Bednarek ... Show more

Monthly Notices of the Royal Astronomical Society, Volume 496, Issue 3, August 2020, Pages 3912–3928, https://doi.org/10.1093/mnras/staa1702

Published: 17 June 2020 **Article history ▾**

THE ASTROPHYSICAL JOURNAL

SUPPLEMENT SERIES

New Hard-TeV Extreme Blazars Detected with the MAGIC Telescopes*

V. A. Acciari[1], S. Ansoldi[2,3,4], L. A. Antonelli[4], A. Arbet Engels[5], K. Asano[3,4], D. Baack[6], A. Babić[7], B. Banerjee[8], U. Barres de Almeida[9], J. A. Barrio[10] + Show full author list

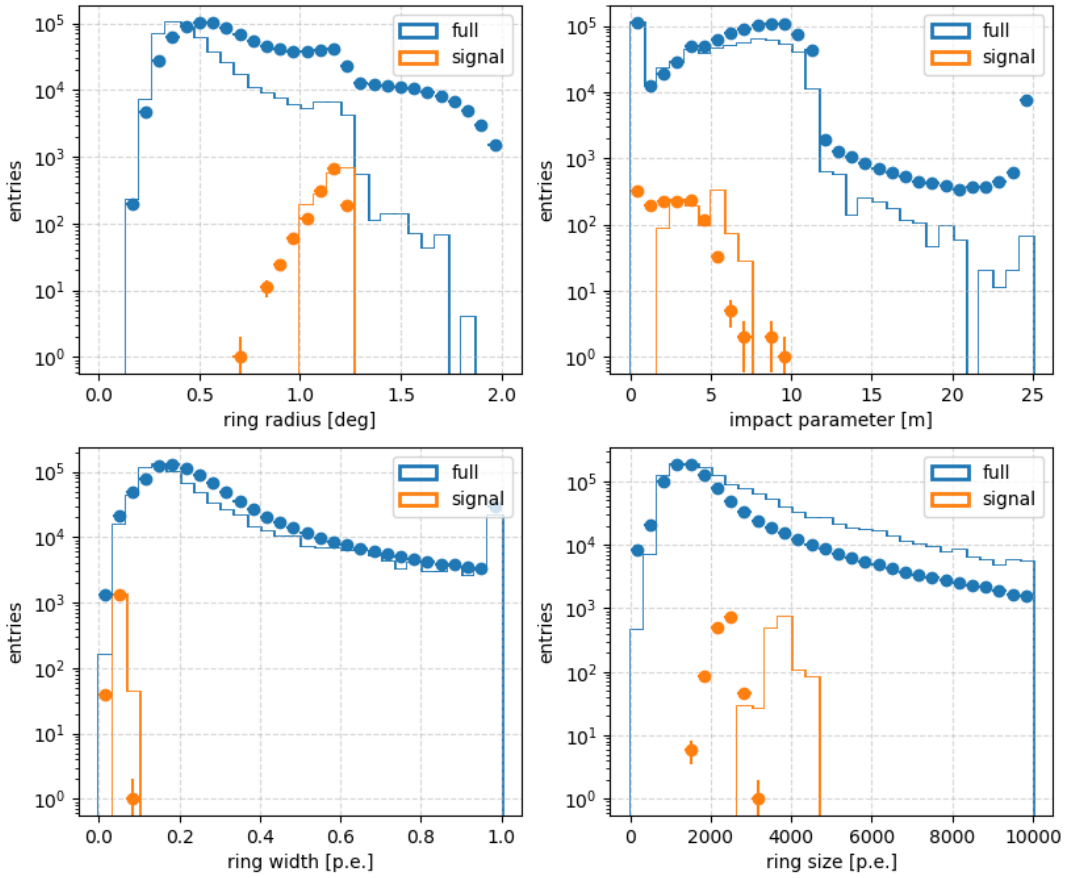
The Astrophysical Journal Supplement Series, Volume 247, Number 1

+ many others to be published

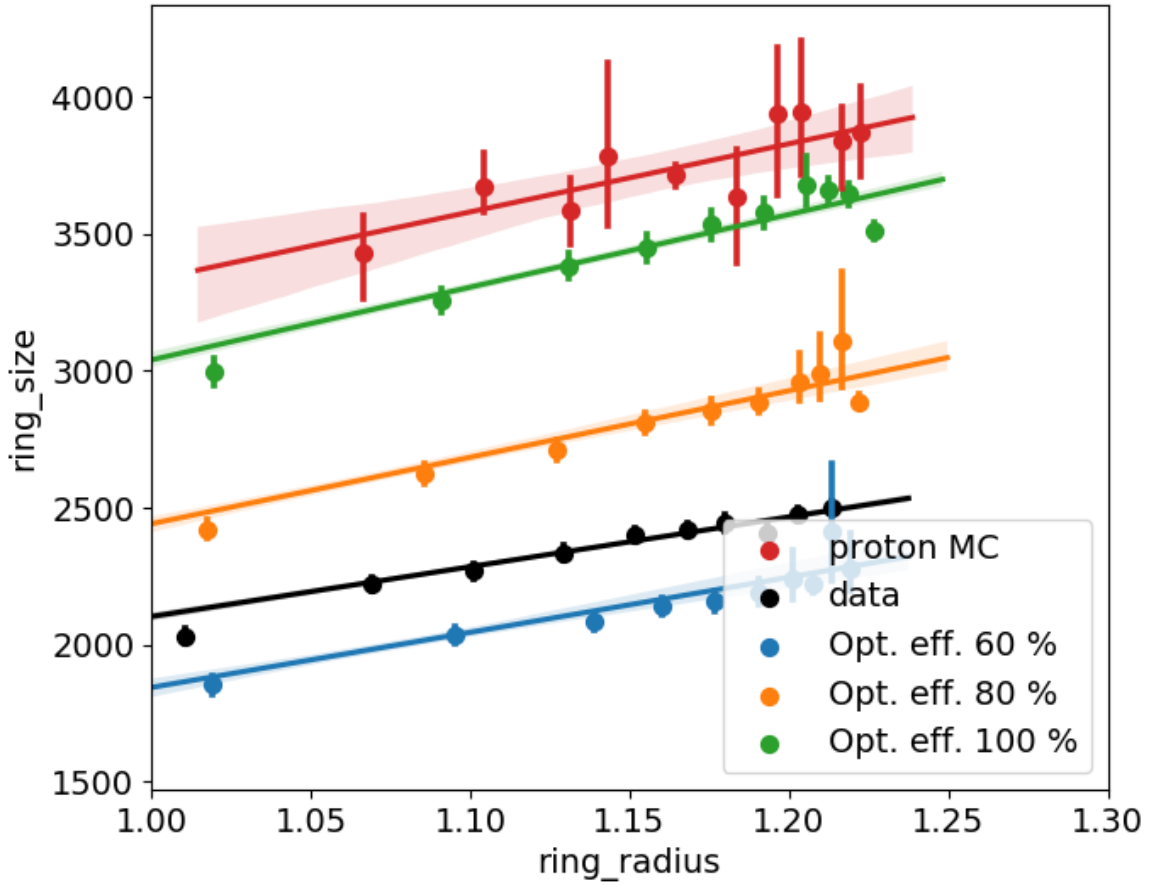
Signed by:
L. Di Venere, N. Giglietto, F. Giordano and S. Loporchio

Parameter comparison MC/LST1 data

Some of the muon identification parameters with January 2020 data of the LST1 Crab campaign

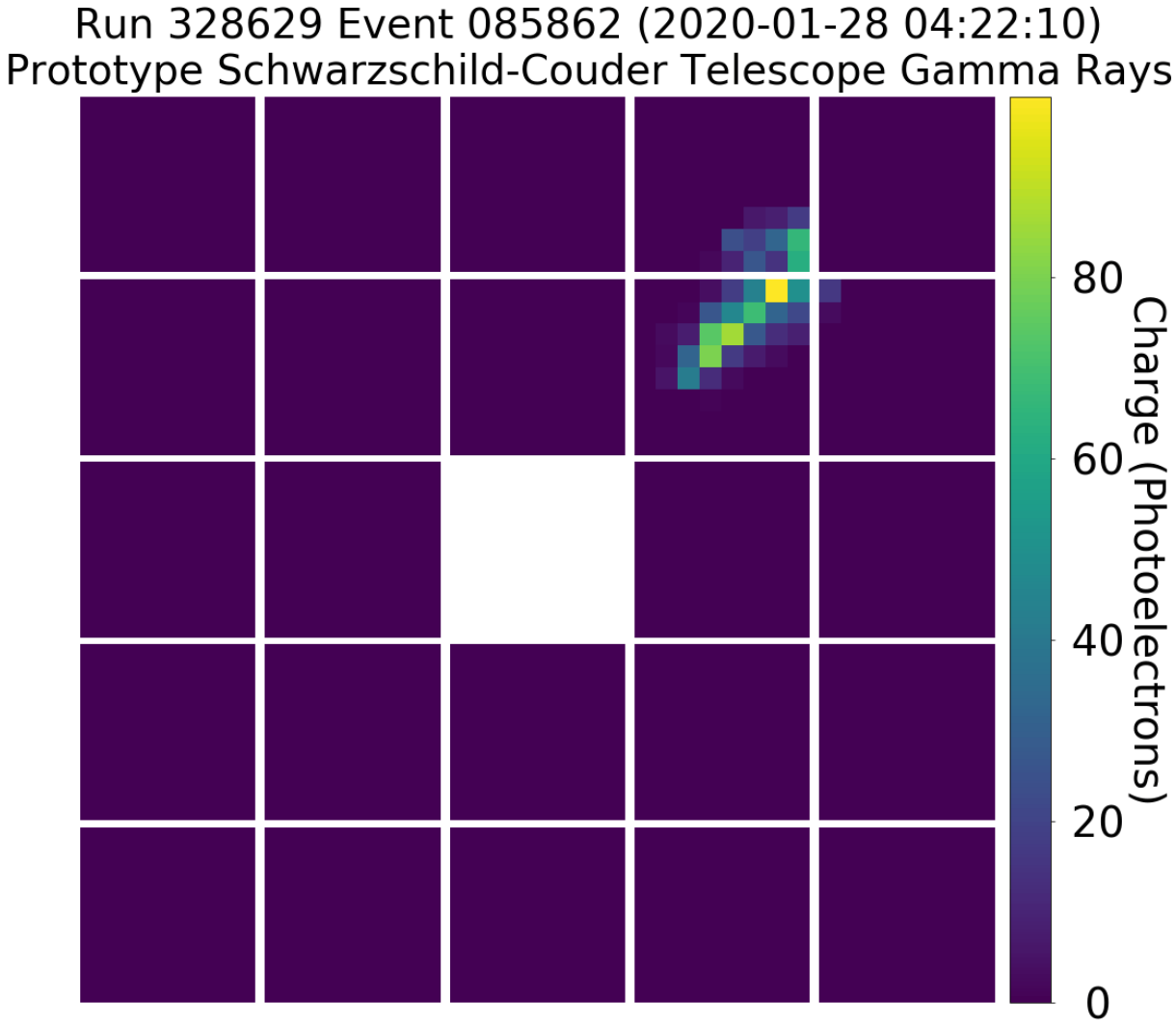


optical efficiency evaluation



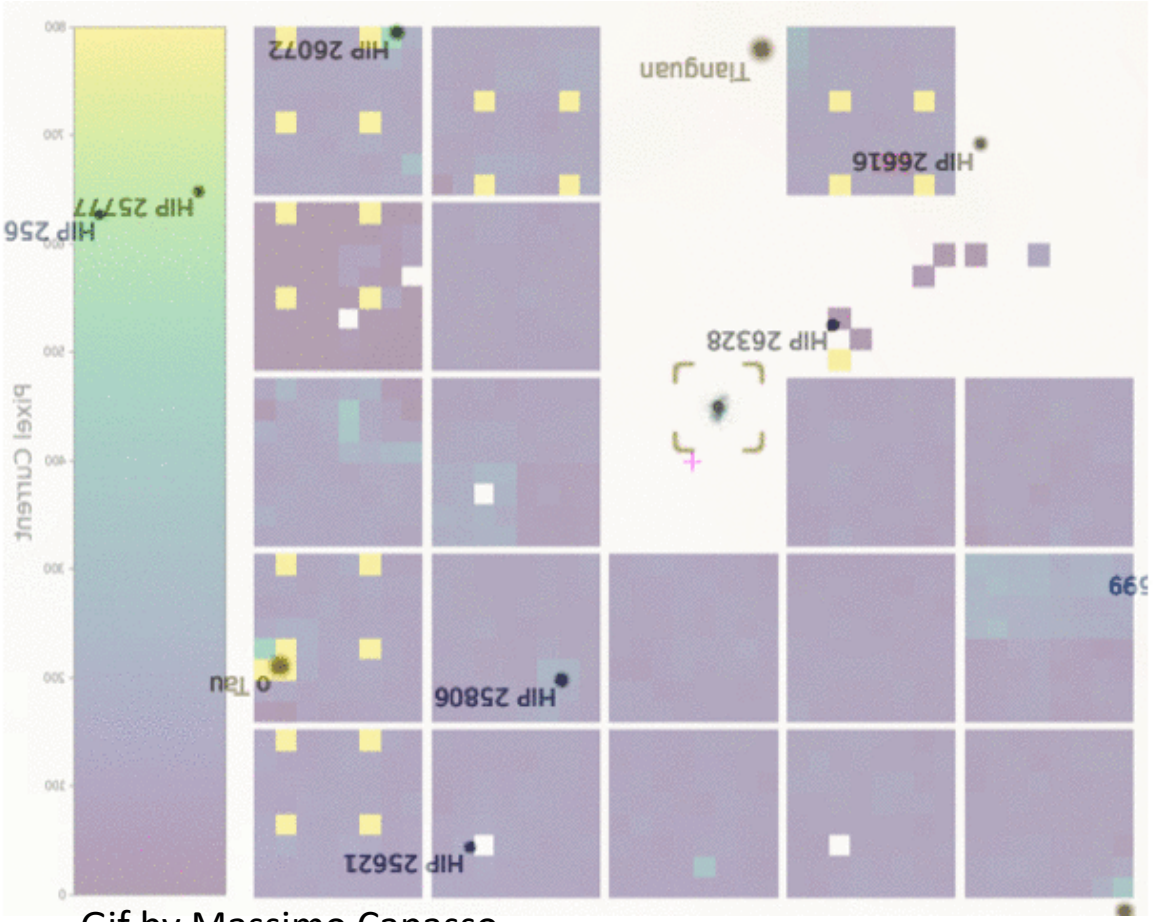
master thesis by R. Pillera

Crab events (sub-sample) after cleaning

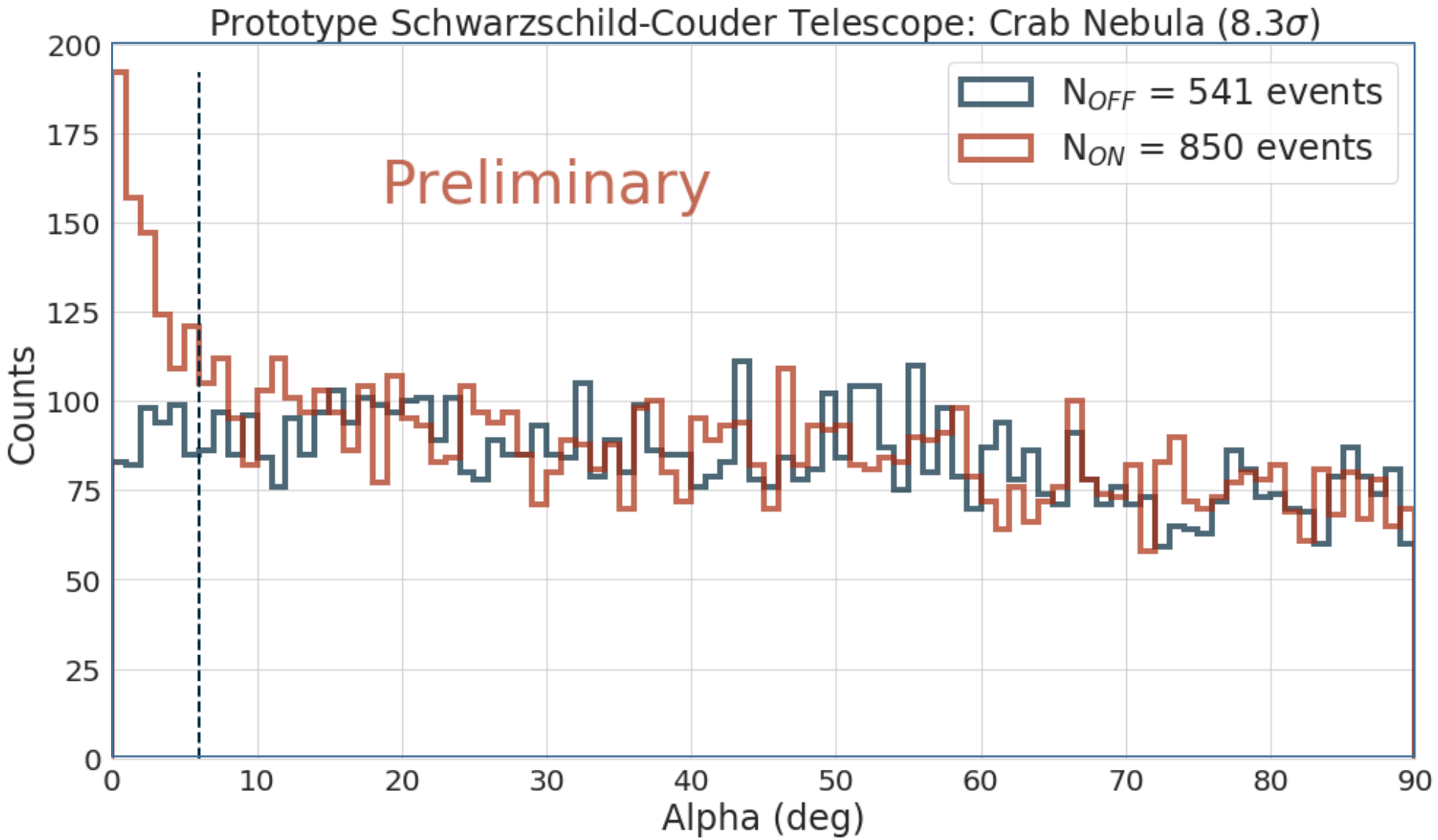


Pointing corrections

- Match current reading with the star field for that pointing/time
- The distance between the crab location and the center of the focal plane is the pointing correction
- Pointing correction is dependent on Azimuth and Elevation
- X and Y correction range from 0-0.17 degrees



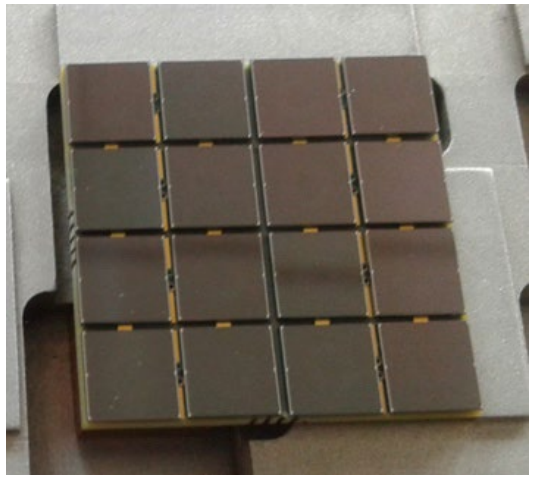
Gif by Massimo Capasso

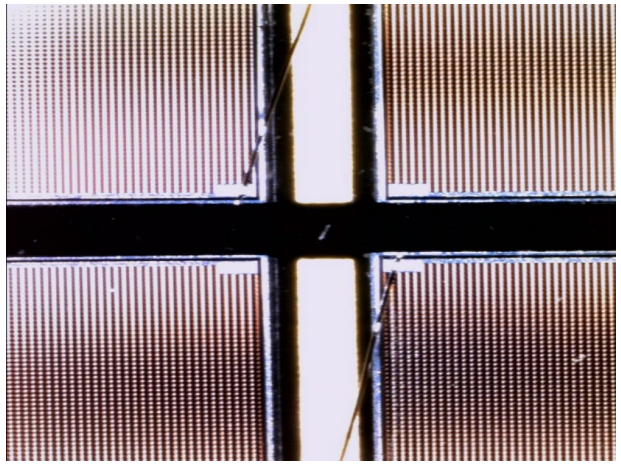


Presentation and press release at AAS meeting June 2. Please **keep confidential** before then.

FBK NUV-HD3 SiPMs

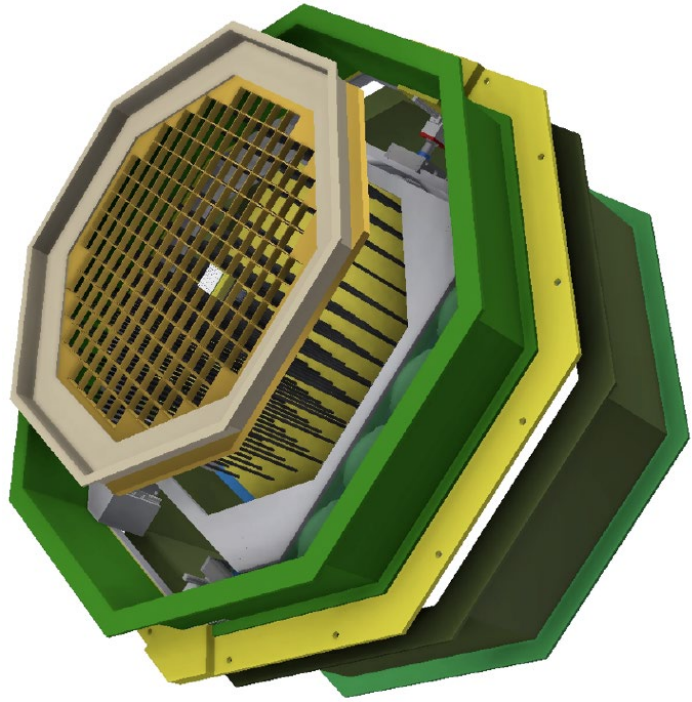
- SiPM modules have been assembled in 4x4 matrixes with wire bond
  - No coating applied
- First 9 modules installed
- Matrices ready to assemble further 25 modules



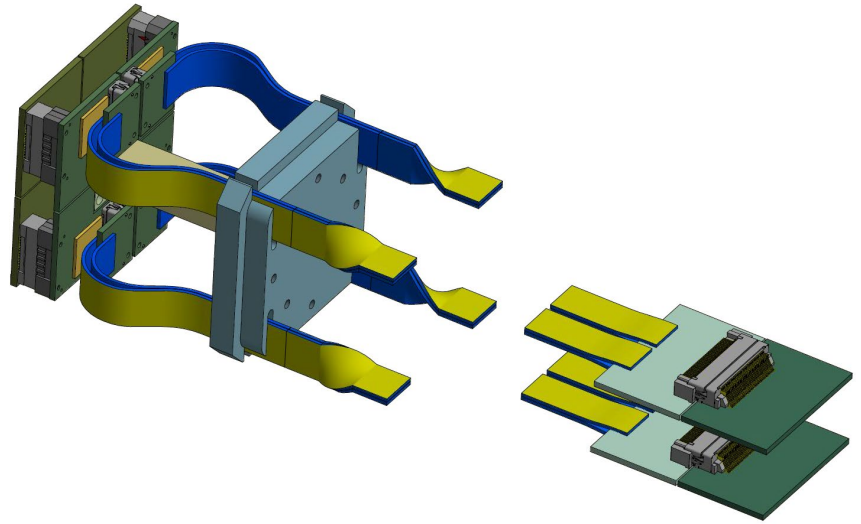


- Technology transfer FBK-Lfoundry for mass production
  - TSV technology will be employed
- Processed still ongoing
  - It was estimated to be completed for second half of 2020
  - Probably delayed due to COVID-19

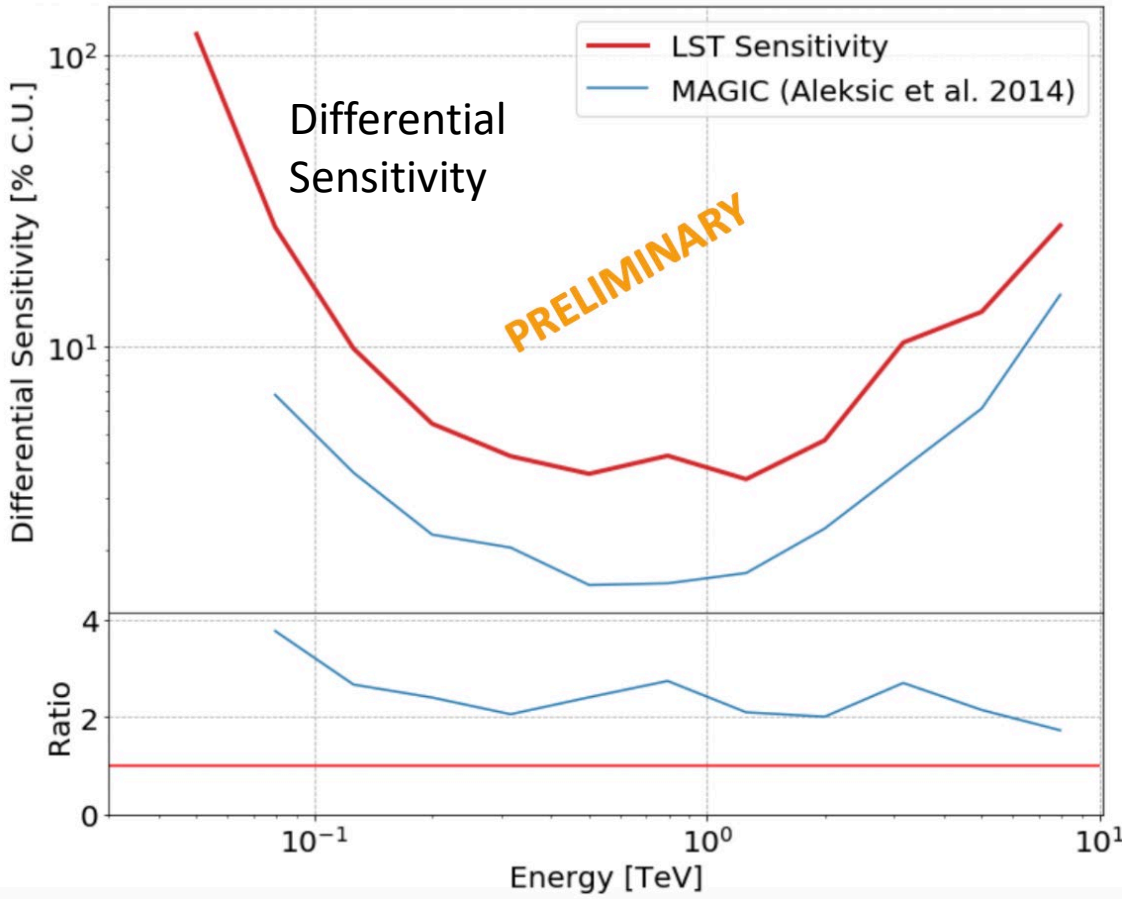
Camera upgrade

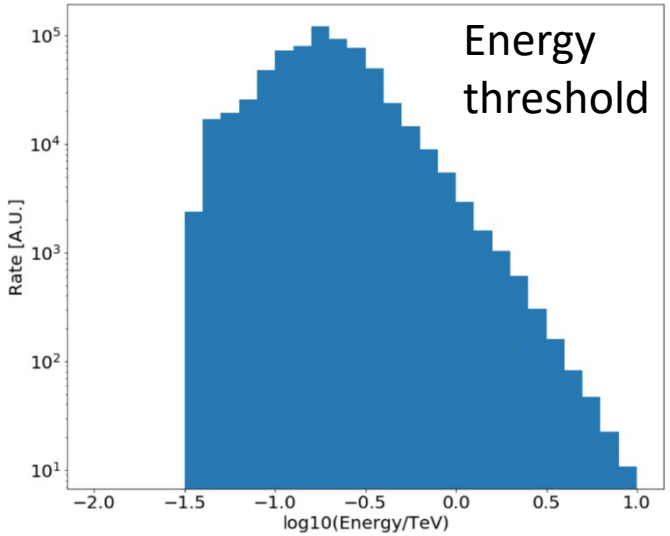


- 9 backplanes, for a total of 177 modules, 11328 pixels
- Upgrade of sensors and readout
  - FBK SiPMs to be produced by Lfoundry, TSV technology
    - First 150 SiPM matrix produced and assembled
    - Tests ongoing @INFN Bari
  - SMART ASIC for signal preamp – **designed by F. Licciulli**
    - Version 2 produced and tested
    - Preamp boards to host the ASICs designed – tests soon
  - New FEE modules based on TC+T5TEA ASICs
    - Prototypes tested
    - Production delayed due to covid-19

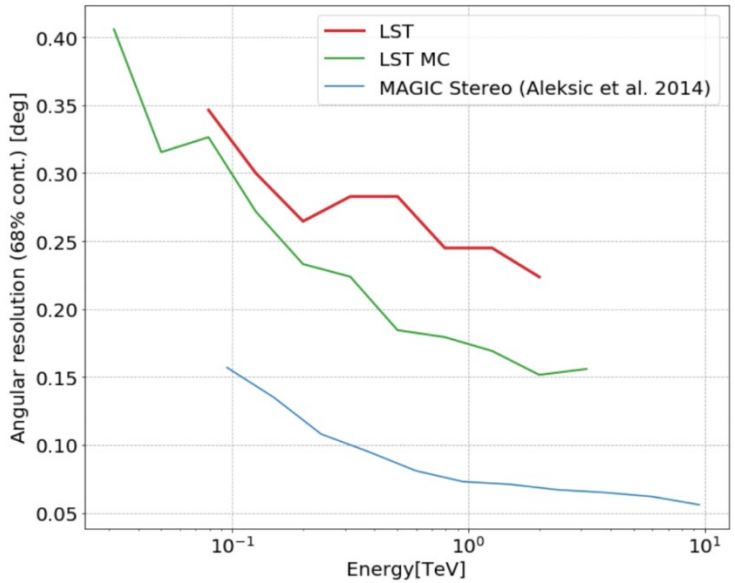


LST1 Crab campaign 2020 results: performance





Angular resolution



Rubén López-Coto
30/06/20

Differential sensitivity, and angular resolution -> approaching expectation

Energy threshold: ~150 GeV