

SOHO/ERNE proton event catalog: Progress results under the SEP origin project

Rositsa Miteva

rmiteva@space.bas.bg

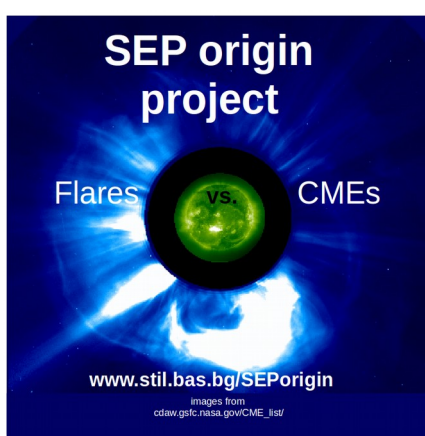
and

Dimitar Danov

Space Research and Technology Institute, Bulgarian Academy of Sciences, Bulgaria



10th Workshop on “Solar influences on the magnetosphere, ionosphere and atmosphere”
4–8 June 2018, Primorsko, Bulgaria



Project title:

The origin of solar energetic particles: solar flares vs. coronal mass ejections

Call for proposals

Competition for financial support for bilateral projects 2016 – Bulgaria – Russia

Duration: 2 years

PI (Bulgaria): *Rositsa Miteva*

Start date: 23 June 2017

PI (Russia): *Larisa Kashapova*

Objectives

The goal of the project is to identify the individual contribution of flares vs. CMEs to the resultant flux of solar energetic particles by means of observations.

Different working hypotheses will be tested: there is one primary particle accelerator for the entire SEP population; there is a mixed contribution from flares and CMEs that vary from event to event; the injection and transport processes are the dominant factors compared to acceleration.

Large statistical studies will be complemented with detailed event analysis (using also data from the Russian satellites Vernov and CORONAS-F SONG and from the ground-based Rozhen observatory in Bulgaria).

Acknowledgements

This study is funded by the project

The origin of solar energetic particles: solar flares vs. coronal mass ejections

with grants from

National Science Fund of Bulgaria
[DNTS/Russia 01/6 23-Jun-2017]



and

Russian Foundation for Basic Research
[Project № 17-52-19050]





SEP origin project

Research collaboration and network



HOME

WORK PACKAGES ▼

TEAM

RESULTS ▼

OUTREACH ▼

Project title:

The origin of solar energetic particles:

solar flares vs. coronal mass ejections

Team members

Bulgaria

R. Miteva, D. Danov

Space Research and Technology Institute, Bulgarian Academy of Sciences

N. Petrov, Ts. Tsvetkov

Institute of Astronomy and National Astronomical Observatory, Bulgarian Academy of Sciences

Russia

L. Kashapova, N. Meshalkina, I. Myshyakov, D. Zhdanov

Institute of Solar Terrestrial Physics - SB Russian Academy of Sciences

I. Myagkova, A. Bogomolov

Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University





SEP origin project

Research collaboration and network



- HOME
- WORK PACKAGES ▾
- TEAM
- RESULTS ▾
- OUTREACH ▾

Project title:

The origin of solar energetic particles: solar flares vs. coronal mass ejections

Call for proposals

Competition for financial support for bilateral projects 2016 – Bulgaria – Russia

Duration: 2 years

Start date: 23 June 2017

PI (Bulgaria): *Rositsa Miteva*

PI (Russia): *Larisa Kashapova*

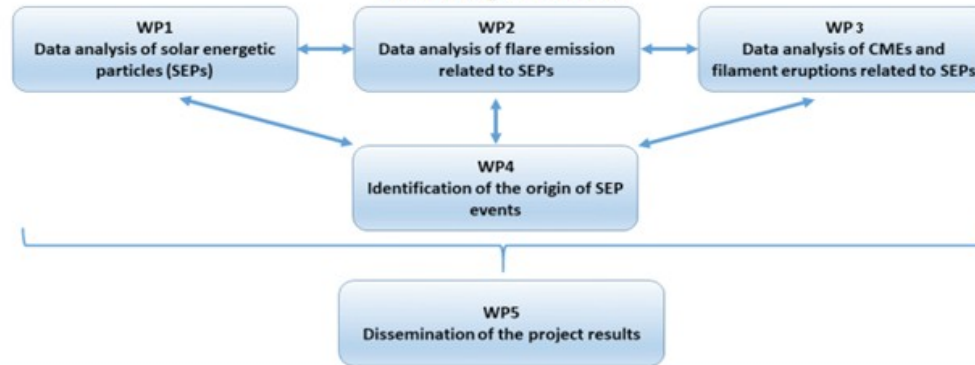
Objectives

The goal of the project is to identify the individual contribution of flares vs. CMEs to the resultant flux of solar energetic particles by means of observations.

Different working hypotheses will be tested: there is one primary particle accelerator for the entire SEP population; there is a mixed contribution from flares and CMEs that vary from event to event; the injection and transport processes are the dominant factors compared to acceleration.

Large statistical studies will be complemented with detailed event analysis (using also data from the Russian satellites Vernov and CORONAS-F SONG and from the ground-based Rozhen observatory in Bulgaria).

Work organization



© SRTI-BAS 2017 Last modified 17-08-2017

The project is supported by:



Like Share 5 people like this. Sign Up to see what your friends like.

Join SEPorigin group on Facebook

Follow @SEPorigin

Project E-mail: [project_sep-origin\[at\]abv.bg](mailto:project_sep-origin[at]abv.bg)

StatCounter "Number of Visits" from August 01, 2017 until now is 00000054



www.newserver.stil.bas.bg/SEPorigin

Project organization chart (work packages and tasks)

WP1 leader: I. Maygkova

WP2 leader: N. Meshalkina

WP3 leader: N. Petrov

WP1: Data analysis of solar energetic particles (SEPs)

- T1.1 SOHO/ERNE proton catalog **in progress**
- T1.2 Detailed analysis of well-observed SEPs **in progress**
- T1.3 Timing, spatial and spectral studies of selected SEPs **year II**

WP2: Data analysis of flare emission related to SEPs

- T2.1 Multi-frequency and spectral analysis of solar flares **in progress**
- T2.2 3D magnetic field reconstruction **in progress**
- T2.3 SEP escape deduced from radio observations **year II**

WP3: Data analysis of CMEs and filament eruptions related to SEPs

- T3.1 CME analysis **year II**
- T3.2 SEP-related eruptive prominences **in progress**
- T3.3 Effect of multiple-CME interactions on SEPs **year II**

WP4: Identification of the origin of SEP events **year II**

WP leader: L. Kashapova

WP5: Dissemination of the project results

- T5.1 Scientific dissemination **in progress**
- T5.2 Popular dissemination **in progress**
- T5.3 On-line repository and web-site **completed**

WP5 leader: R. Miteva

WP5: Dissemination of the project results

Task 5.1 Scientific dissemination

Project meetings

Kick-off meeting (Sofia, 2017)

First-year meeting (Primorsko, 2018)

Progress meeting (Irkutsk, 2018)

Scientific meetings

2017 (6)

2018 (6 planned)

Talks (8) & Posters (12)

Publications in science journals

refereed with IF (1)

(JSWSC)

refereed without IF (1)

(Sun and Geosphere)

non-refereed (6)

(proceedings)

submitted/under revision (4)

Task 5.2 Popular dissemination

Facebook page and public group

<https://www.facebook.com/SEPorigin>

Twitter

<https://twitter.com/SEPorigin>

Seminars to public

R. Miteva (scheduled public lecture)

R. Miteva (public astro-seminar)

N. Petrov (webinar, organized by L. Kashapova)

R. Miteva (public lecture)

with presentations (as pdf) available on-line

Task 5.3 Online repository and web-site completed

Topical session: First results from the SEP origin project

WP1/Task 1.1

Task 1.1 SOHO/ERNE proton event catalog
this presentation

WP1/Task 1.2

Task 1.2 Detailed analysis of well-observed SEP events
presentation by Irina Myagkova

WP1 & WP2

presentations by Larisa Kashapova & Dmitrii Zhdanov

WP3/Task 3.2

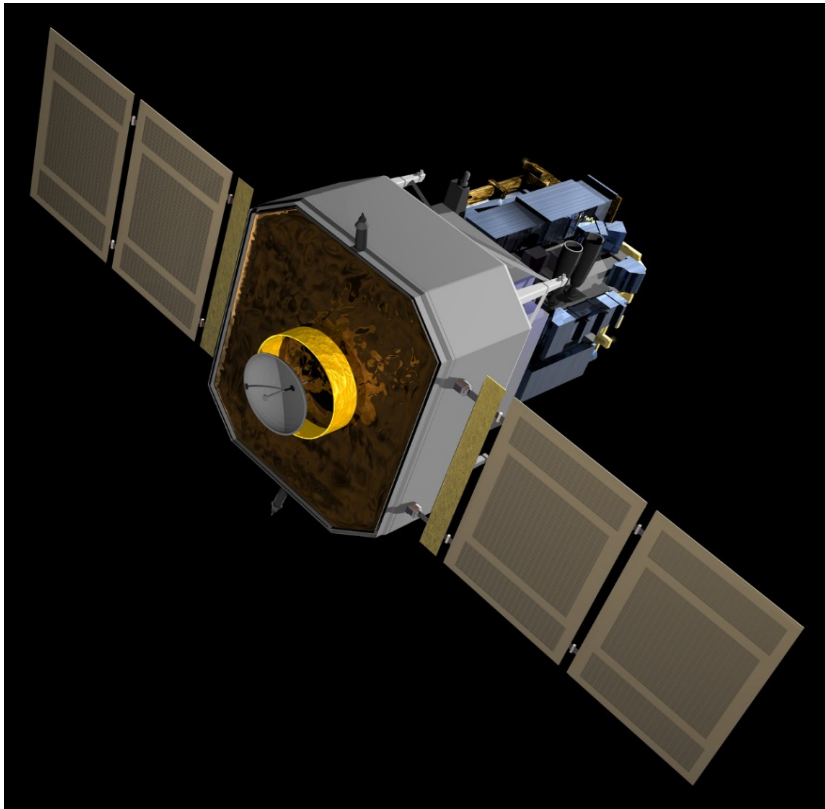
Task 3.2 SEP-related eruptive prominences
presentation by Tsvetan Tsvetkov

WP2/Task 2.2 & WP3

presentation by Ivan Myshiakov

WP1/Task 1.1

Data: ERNE (Energetic and Relativistic Nuclei and Electron) instrument aboard SOHO satellite



ESA-NASA satellite SOHO
launch Dec-1995
image: en.wikipedia.org

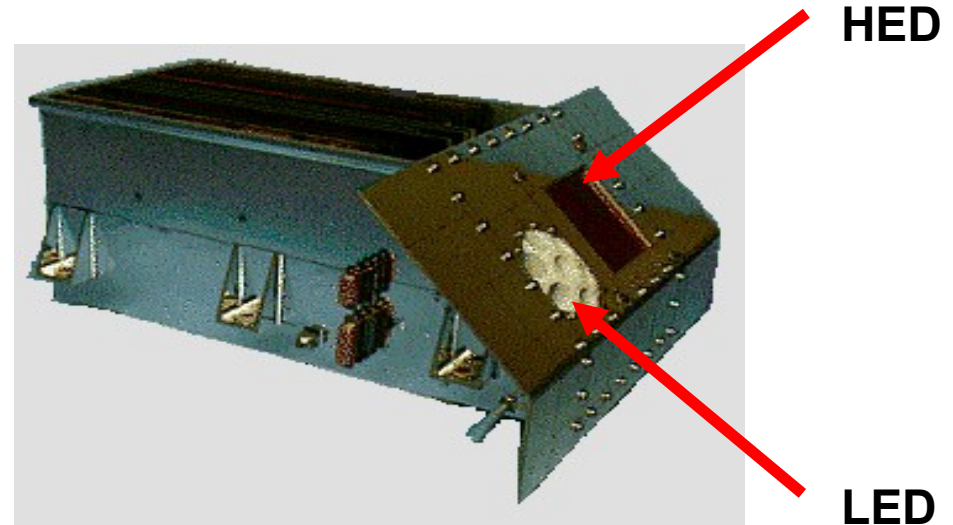


image: <https://srl.utu.fi/projects/erne>

LED: Low energy channel
10 channels covering **1.3–13 MeV**

HED: High energy channel
10 channels covering **14–131 MeV**

Catalogs of Solar Energetic Particles and Related Phenomena

© SRTI-BAS 2018 Last modified 12/12/2017 16:18:53

[Wind/EPACT proton event catalog](#)

[SOHO/ERNE proton event catalog](#)

[Radio emission signatures catalog](#)

Supported by
Space Climate Group
Space Research and Technology Institute
Bulgarian Academy of Sciences

Contact: [R. Miteva](#)
Web-support: [D. Danov](#)

StatCounter "Number of Visits" from Jan. 12, 2017 until now is **000527**

SOHO/ERNE proton event catalog

© SRTI-BAS 2018 Last modified 05/25/2018 10:00:59

[Solar cycle 23: 1996-2008](#)

[Back to list of Catalogs](#)

[Solar cycle 24: 2009-present](#)

This catalog lists the proton enhancements from the **High Energy Detector (HED)** aboard [SOHO/ERNE](#) instrument identified during solar cycle (SC) 23 (1996-2008) and the ongoing solar cycle 24 (since 2009). The catalog lists the peak intensity for the solar proton events in the different HED energy channels (in the range 17÷131 MeV) and additional information organized in table-form separately for SC23 and SC24.

Explanatory notes:

Proton peak: identified at the maximum of the particle profile (local enhancements are not considered).

Onset time: identified as the time of 3-sigma intensity value above pre-event level.

Peak time: the time at the peak proton intensity.

J_p : peak proton intensity after subtraction of the pre-event level in protons/(cm² s sr MeV).

class: GOES soft X-ray flare class

speed: linear speed of the CME in km s⁻¹

time: all time markers are in UT

The reported here onset/peak times and J_p are based on 5-min averaged data.

Abbreviations:

AW: angular width of the CME (in degrees)

CME: coronal mass ejection

N/A: onset not found and/or it was fully masked by previous ongoing event

nd: next day

pd: previous day

p: peak is poorly defined

u: uncertain

Acknowledgements:

We use proton data provided by SOHO/ERNE PI Prof. Eino Valtonen

(ERNE data is also available via: [SEPServer data server](#));

flare information from: [GOES flare listings](#) and www.Solarmonitor.org;

and CME information from: [CDAW LASCO CME catalog](#).

Contact: [R. Miteva](#)

Links: [Space Climate Group Homepage](#)

[Space Research and Technology Institute Homepage](#)

SOHO/ERNE proton event catalog is part of **SEP origin project**

The **SEP origin project** is supported by:

the National Science Fund of Bulgaria



with contract No. ДНТС/Russia 01/6 (23-Jun-2017)

the Russian Foundation for Basic Research



Project No.17-52-18050

SOHO/ERNE proton event catalog

Solar cycle 23: 1996-2008

© SRTI-BAS 2018 Last modified 03/26/2018 16:52:12

reference channel

[Back to list of Catalogs](#)

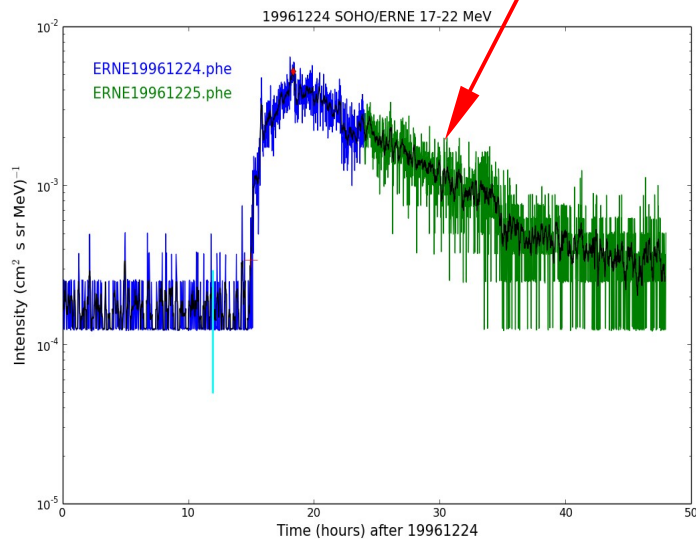
[Back to SOHO/ERNE](#)

[Solar cycle 24: 2009-present](#)

Event date	14-17 MeV	17-22 MeV			21-28 MeV	26-32 MeV	32-40 MeV	40-51 MeV	51-67 MeV	64-80 MeV	80-101 MeV	101-131 MeV	Flare	
	J_p	onset time	peak time	J_p	J_p	J_p	J_p	J_p	J_p	J_p	J_p	J_p	class/onset/location	time
1996-07-09		10:03	10:50	0.0016		0.0004		-		-		-	X2.6/09:05/S10W30	
1996-08-13		17:53	22:05	0.0038		0.0012		0.0005		-		-	uncertain	16:
1996-11-27		00:18	02:37	0.0004		-		-		-		-	B9.0/20:48 ^{Pd} /u	21:
1996-11-27		14:22	15:20	0.0005		-		-		-		-	uncertain	
1996-11-28		19:53	22:09	0.0034		0.0007		-		-		-	C1.3/15:35/u	16:
1996-11-29		04:43	13:49	0.0015		0.0003		-		-		-	uncertain	
1996-11-30		06:23	07:14	0.0101		0.0022		0.0002		-		-	uncertain	
1996-12-01		22:05	01:33 nd	0.0005		-		-		-		-	M1.0/20:16/S06W47	
1996-12-24		14:59	18:21	0.0050		0.0014		0.0003		-		-	C2.1/13:03/N05W95	13:
1997														
1998														

[Back to SOHO/ERNE](#)

[Solar cycle 24: 2009-present](#)



Flare and CME information

SOHO/ERNE proton event catalog

Solar cycle 24: 2009-present

© SRTI-BAS 2018 Last modified 03/20/2018 19:49:11

[Back to list of Catalogs](#)

[Back to SOHO/ERNE](#)

[Solar cycle 23: 1996-2008](#)

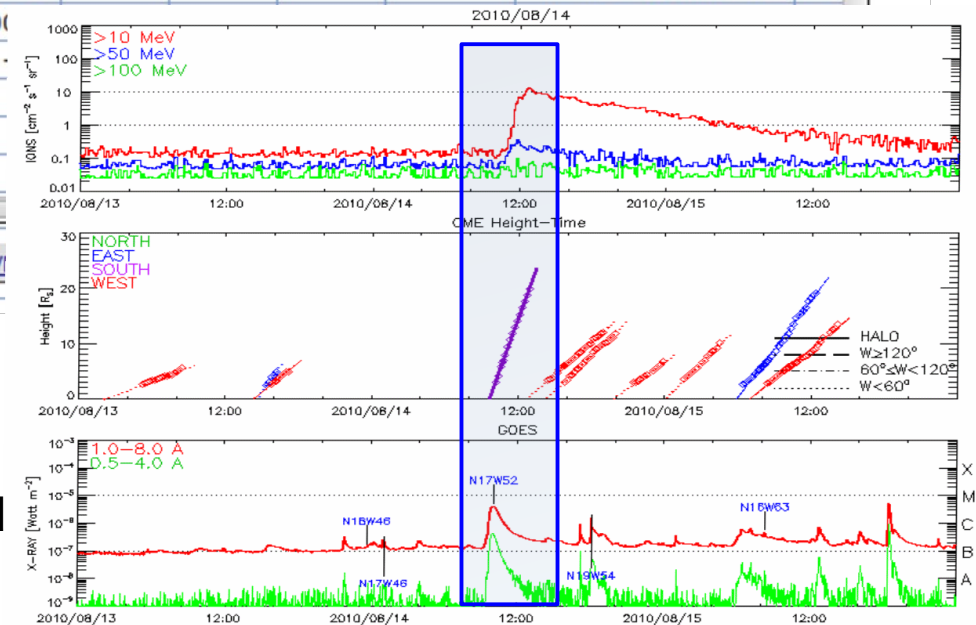
Event date	14-17 MeV	17-22 MeV		21-28 MeV	26-32 MeV	32-40 MeV	40-51 MeV	51-67 MeV	64-80 MeV	80-101 MeV	101-131 MeV	Flare	
yyyy-mm-dd	J_p	onset time	peak time	J_p	J_p	J_p	J_p	J_p	J_p	J_p	J_p	class/onset/location	time
2009-12-22		07:33	13:18	0.0011	0.0004		0.00022		-			C7.2/04:50/S26W46	
2010-02-12		17:20	22:19	0.0007	0.0003		-		-			M8.3/11:19/N23E11	
2010-04-04		10:23	11:06	0.0002	-		-		-			uncertain	
2010-06-12		02:32	07:02	0.0207	0.0061		0.0023		-			M2.0/00:30/N43W23	01:
2010-08-03		N/A	23:06 ^u	0.0326	0.0025		-		-			uncertain	
2010-08-07		20:09	01:33 nd	0.0042	0.0042		0.0011		-			M1.0/17:55/N11E34	18:
2010-08-14		10:53	12:48	0.6267	0.1852		0.0512		-			C4.4/09:38/N17W52	10:
2010-08-18		07:18	11:52	0.1170	0.0190		0.0037		-			C4.5/04:45/N18W88	05:
2010-08-31		23:28	04:20 nd	0.0191	0.0046		0.0010		-			uncertain	21:
2010-09-09		01:02	04:38	0.0135	0.0024		0.0010		-			uncertain	
2010-12-31		05:58	06:57	0.0004					-				
2011													
2012													
2013													

[Back to list of Catalogs](#)

[Back to SOHO/](#)

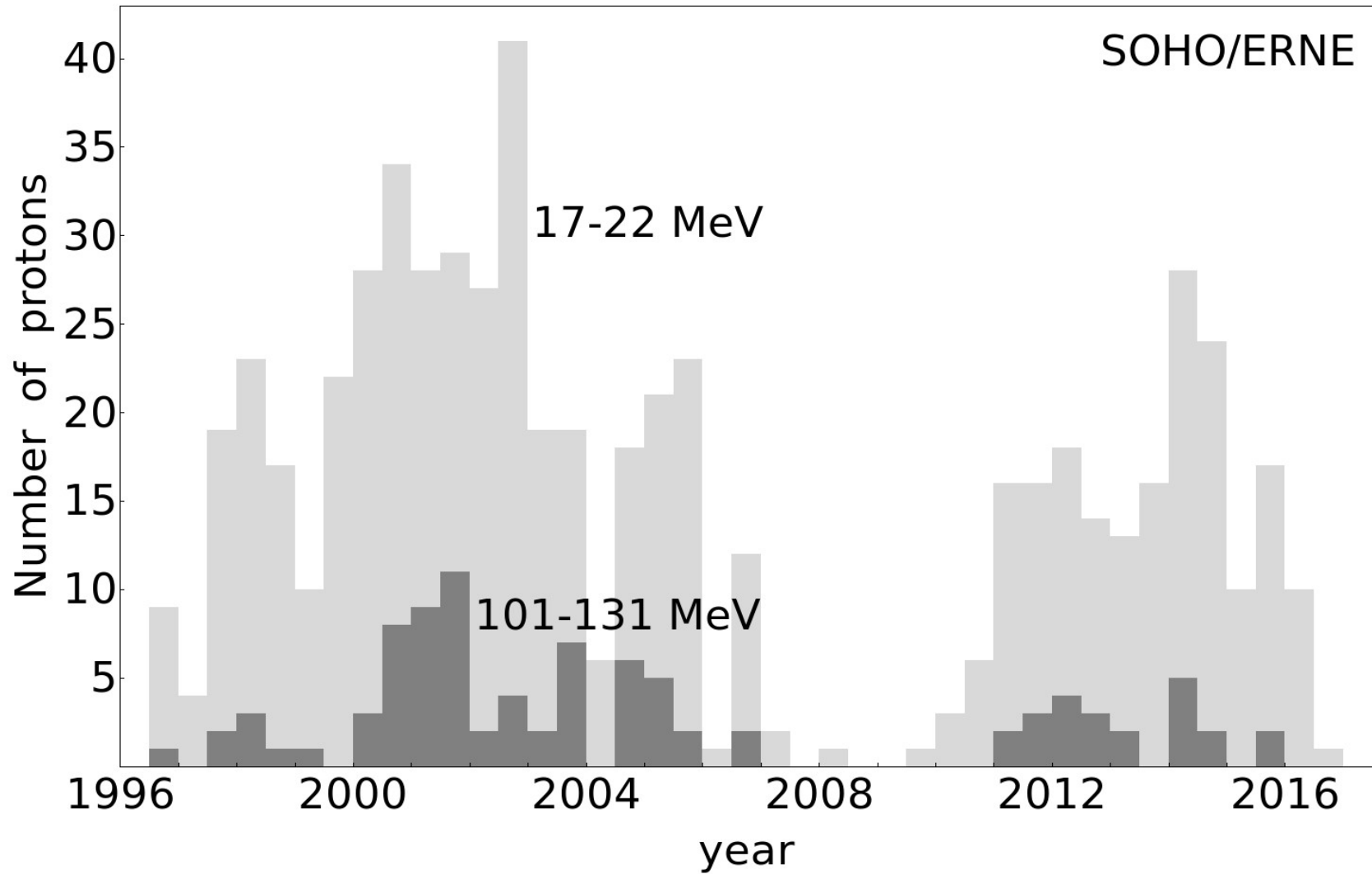
Future work:

- Completion of the remaining 5 energy channels.
- Catalog release: after acceptance of a dedicated publication.



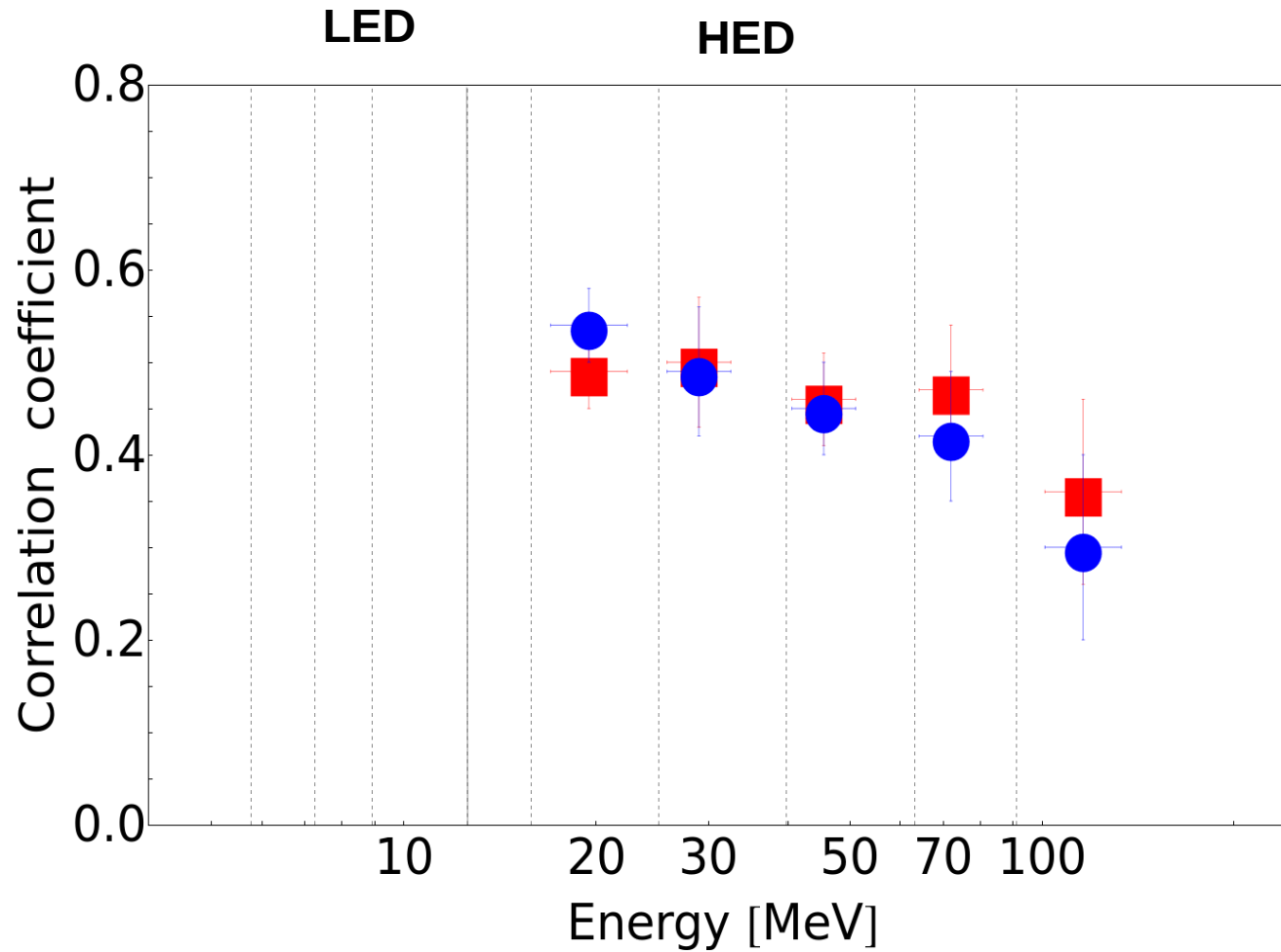
CDAW LASCO CME catalog

Preliminary results (1996–2017): distributions

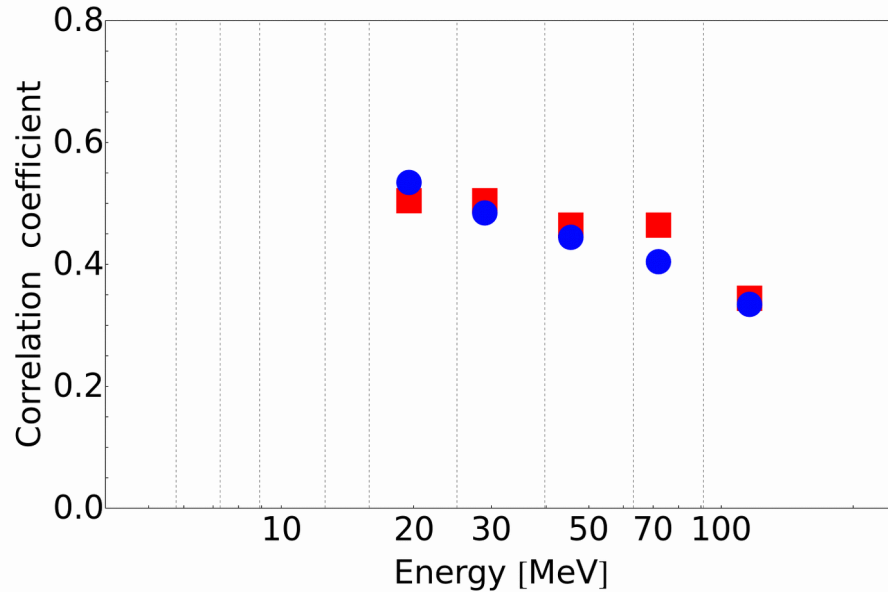


Preliminary results (1996–2017): statistics

Using all events: SC23 & SC24



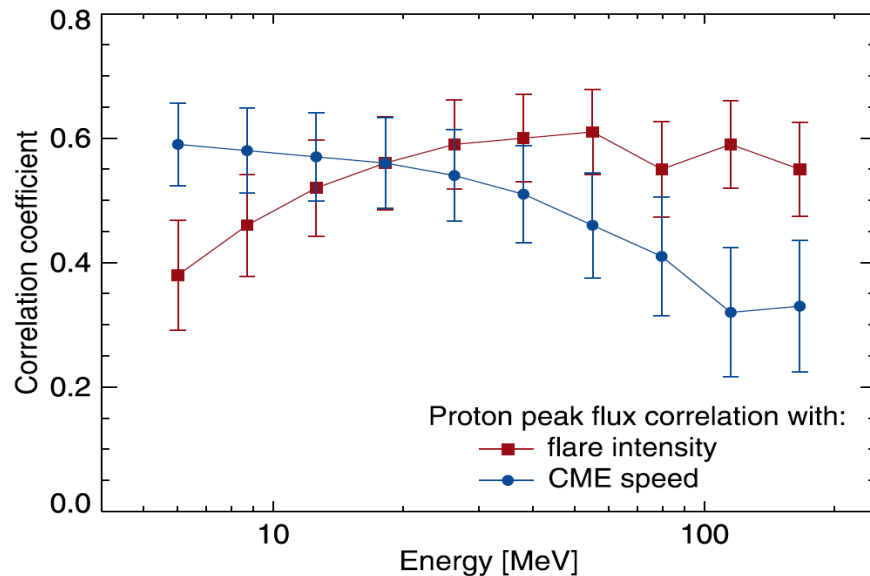
Preliminary results: statistics in SC23 (1996–2008)



this study

Alternative proton data at high energy:

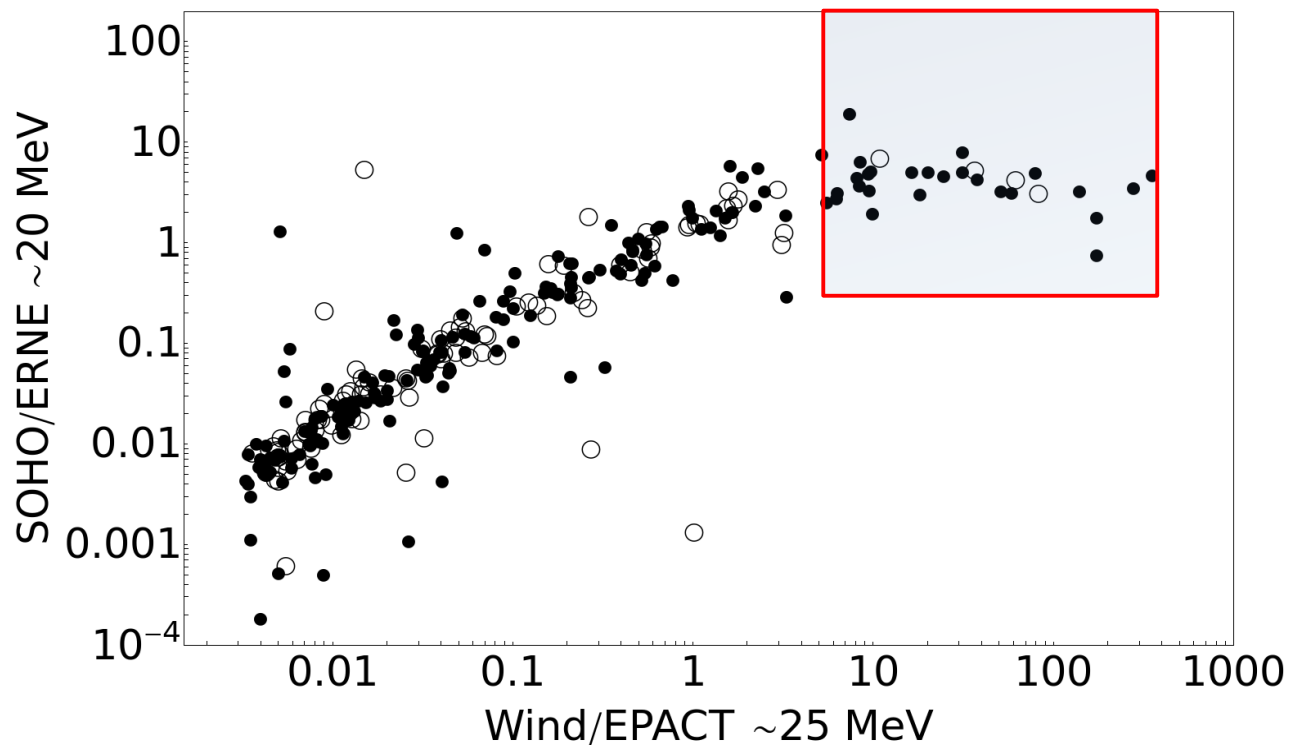
- SOHO/EPHIN > 500 MeV protons (Kühl et al. 2017)
- Other?



Dierckxsens et al. (2015)

Preliminary results: statistics

Saturation for large intensity ERNE events



Filled circles:
data in SC23

Open circles:
data in SC24

Aim: to compare different satellite data

- give consistent results for peak proton intensity (SC23)
- use to recognize bias (data; assumption; subjectivity)

Topical session: First results from the SEP origin project

WP1/Task 1.1

Task 1.1 SOHO/ERNE proton event catalog
this presentation

WP1/Task 1.2

Task 1.2 Detailed analysis of well-observed SEP events
presentation by Irina Myagkova

WP1 & WP2

presentations by Larisa Kashapova & Dmitrii Zhdanov

WP3/Task 3.2

Task 3.2 SEP-related eruptive prominences
presentation by Tsvetan Tsvetkov

WP2/Task 2.2 & WP3

presentation by Ivan Myshiakov