

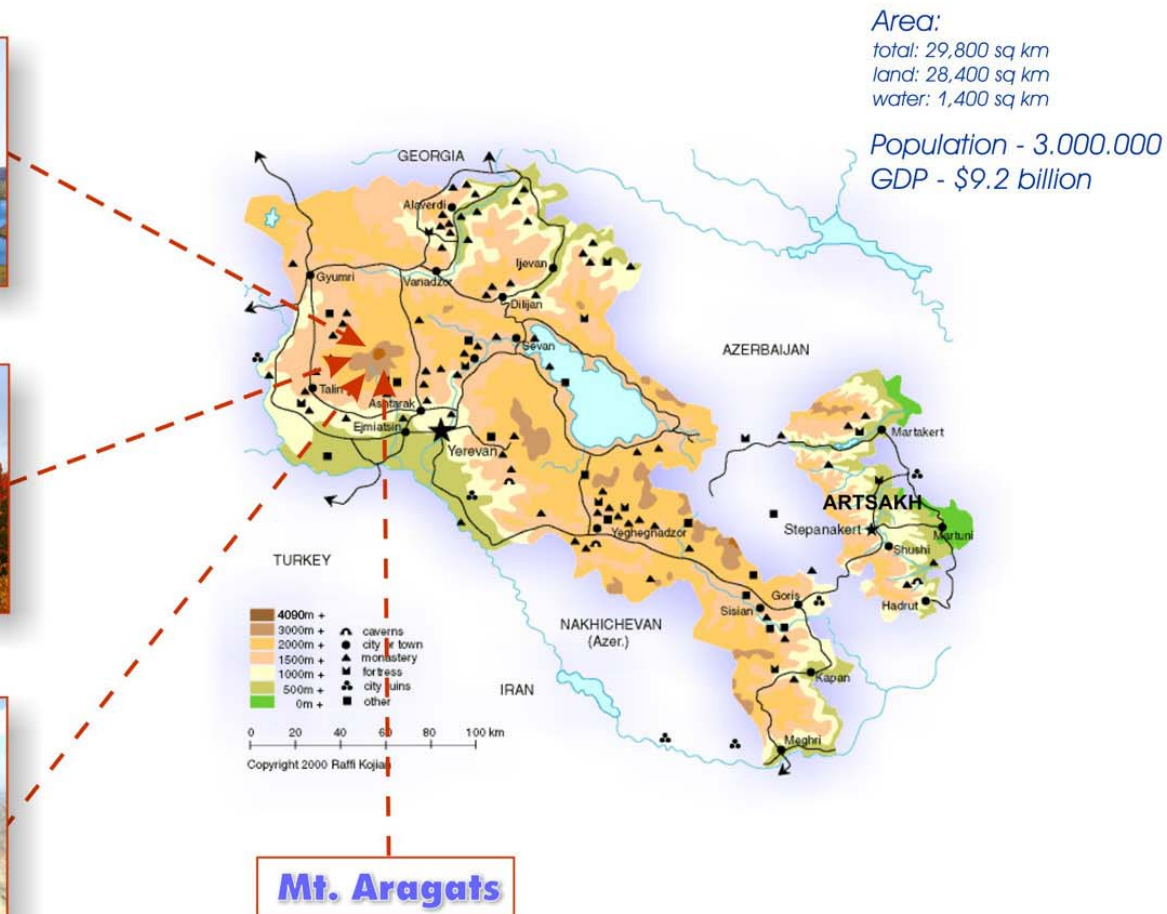
Cosmic Rays in Space Weather research

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Alikhanyan Physics Institute, Armenia***

Aragats Space-Environmental Center (ASEC), Cosmic Ray Division (CRD), Alikhanyan Physics Institute

Map of Armenia



Aragats Space-Environmental Center

- Measure as much as possible secondary CR fluxes with different energy thresholds;
- Measure the histogram of energy releases on minute-by-minute basis;
- Monitor correlations between changing CR fluxes;
- Measure particle arrival directions;
- Use same detectors for SW and high energy CR;
- Perform simulation of the time-series registered by the ASEC monitors;
- Correlate surface and space-born detectors data assessable from the Internet;
- Be part of world-wide networks and create new networks;
- Provide forecasting and alerts on severe conditions of the SW.

List of ASEC Particle Detectors

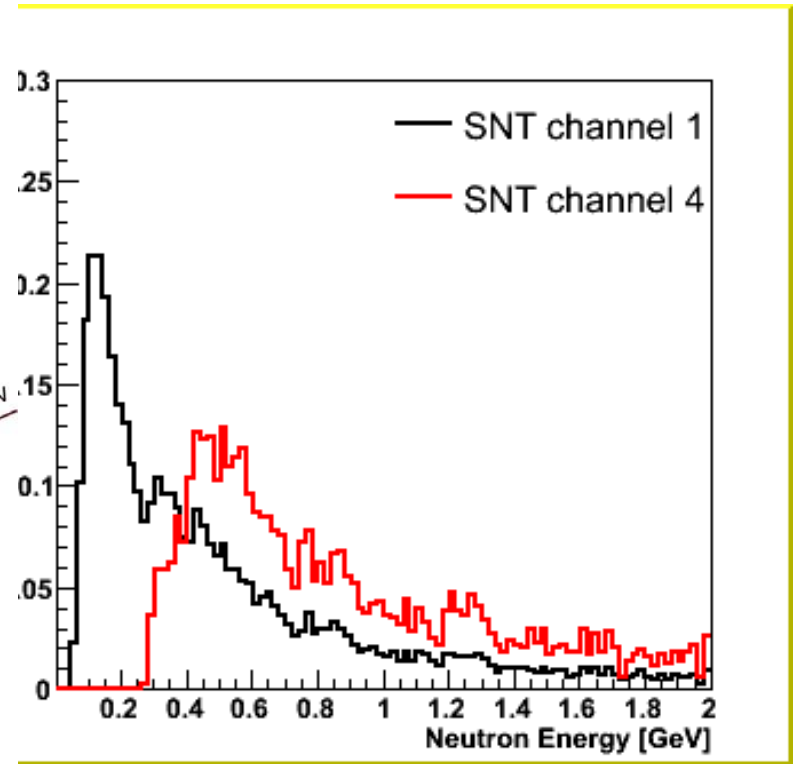
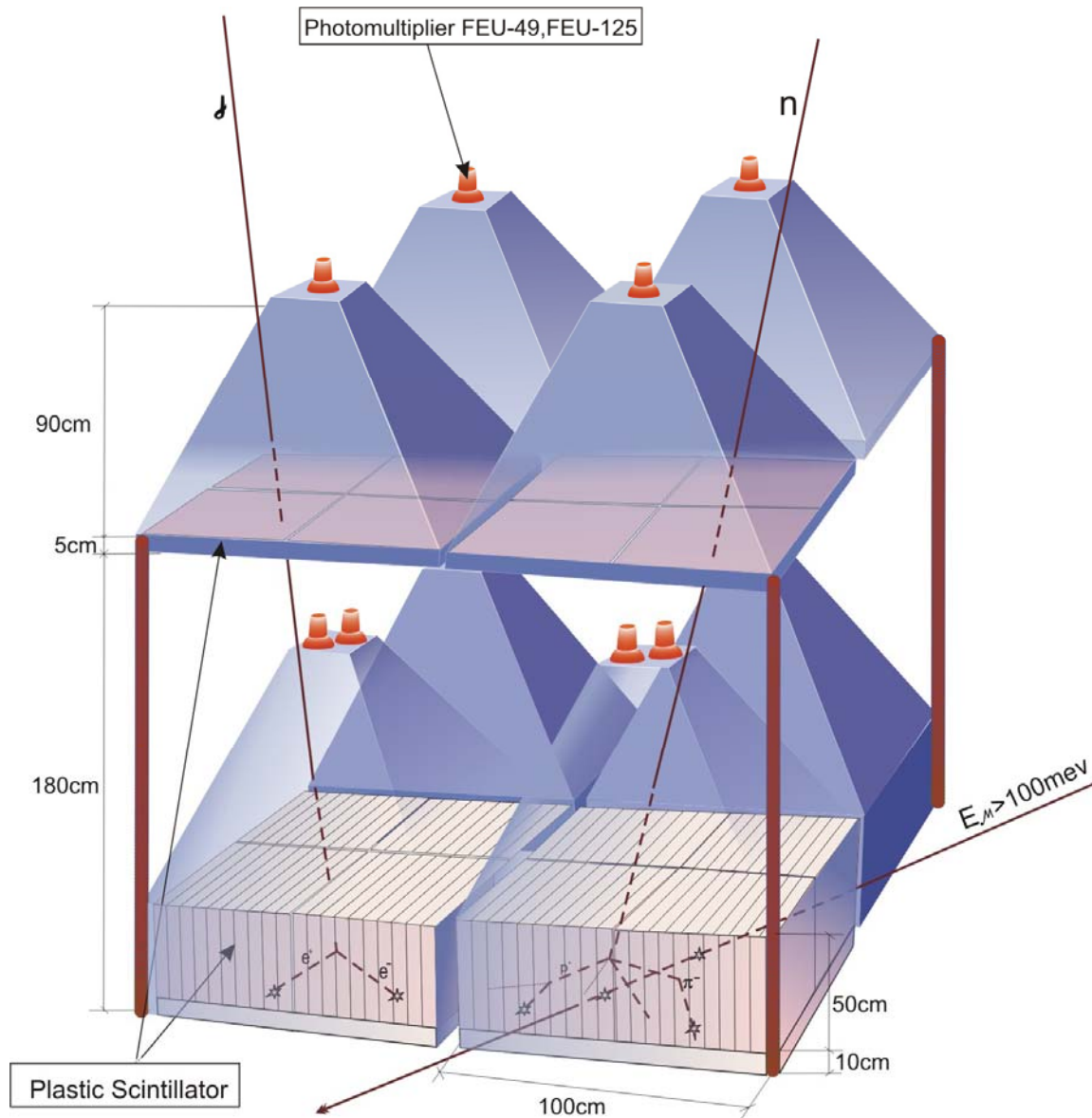
Detector	Altitude <i>m</i>	Surface m^2	Threshold(s) <i>MeV</i>	Operation	Count rate (min^{-1})
NANM (18NM64)	2000	18	50	1996	2.7×10^4
ANM (18NM64)	3200	18	50	2000	6.1×10^4
SNT-4channels + veto	3200	4 (60cm thick) 4 (5cm thick)	120, 200, 300, 500 7	1998	$5.2 \times 10^{4*}$ 1.2×10^5
NAMMM	2000	5 + 5	7 ; 350 ^{***}	2002	7.0×10^4
AMMM	3200	45	5000	2002	$1.3 \times 10^{5**}$
MAKET-ANI	3200	6	7	1996	1.5×10^5

*Count rate for the first threshold; near vertical charged particles are excluded

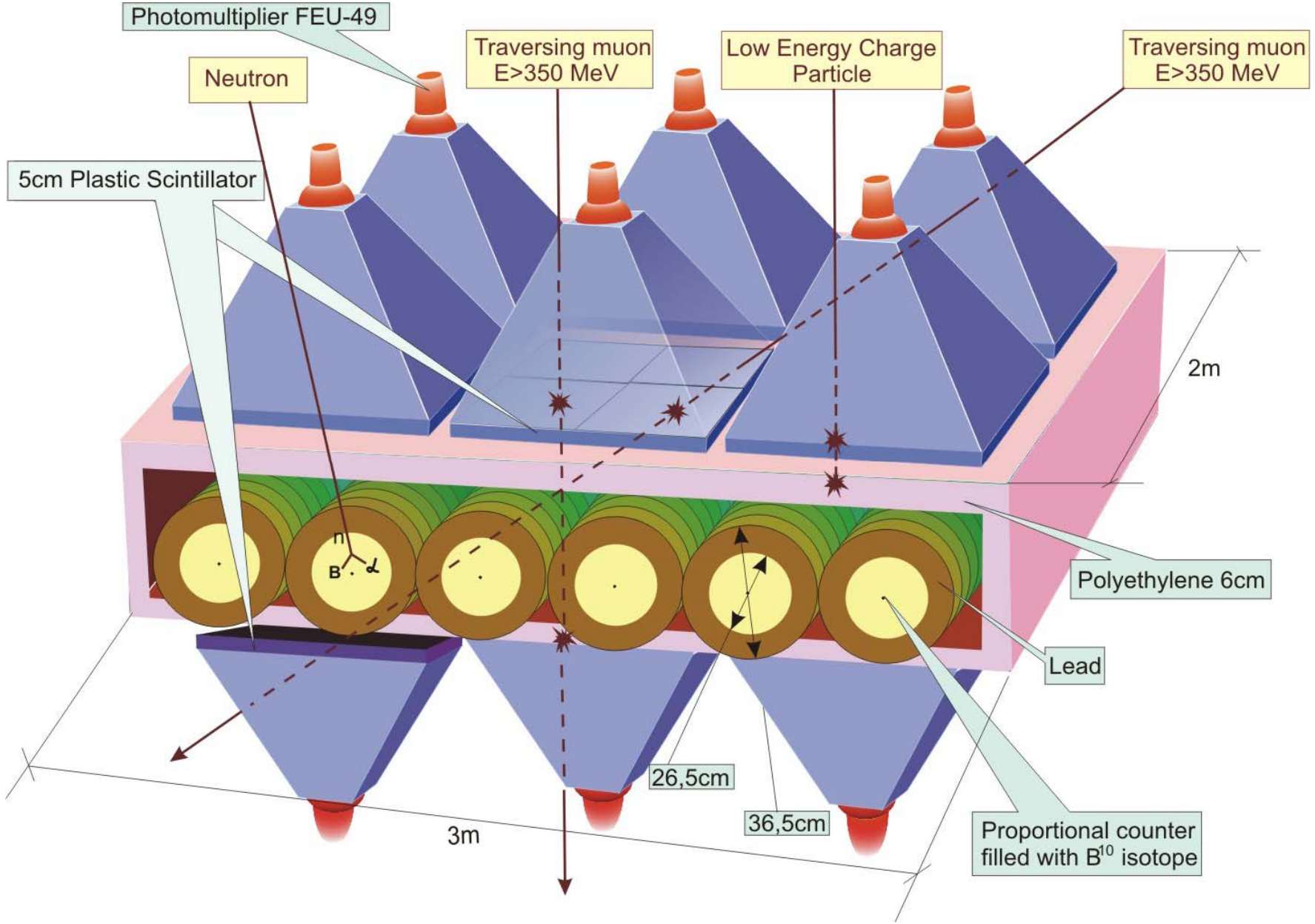
**Total count rate of 45 muon detectors from 150 (100 to be put in operation in 2006)

*** First number – energy threshold for the upper detector, second number – bottom detector.

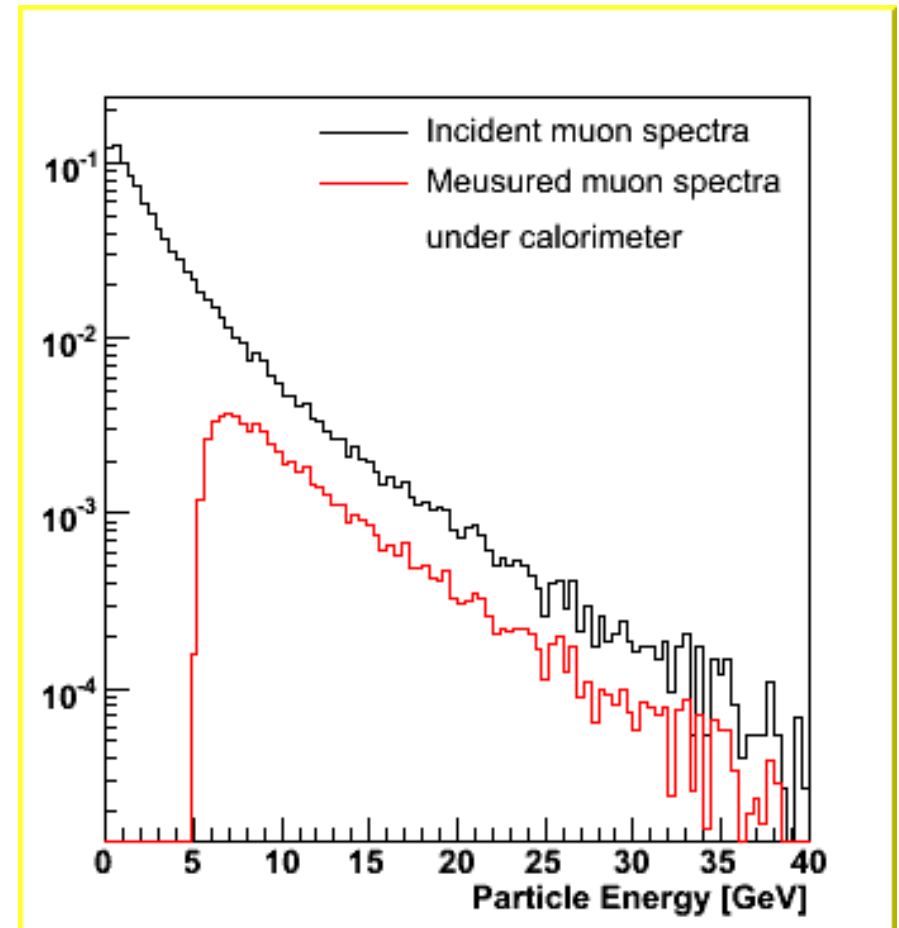
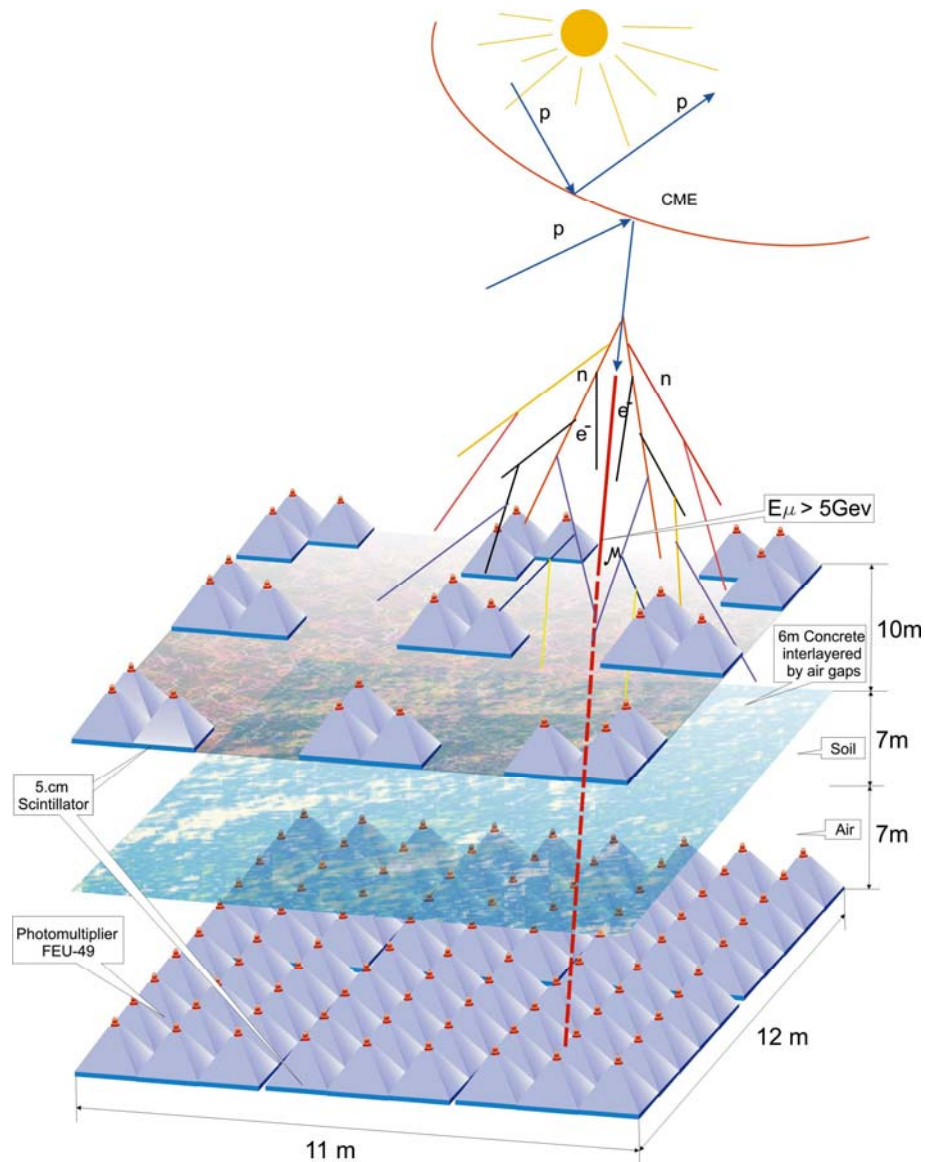
Solar Neutron Telescope



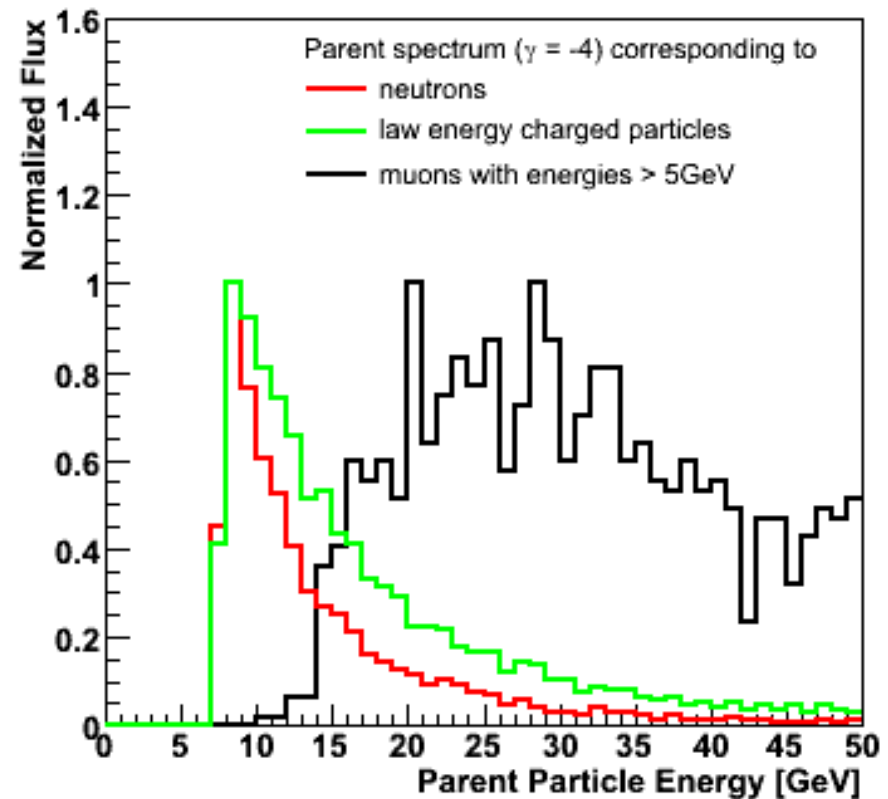
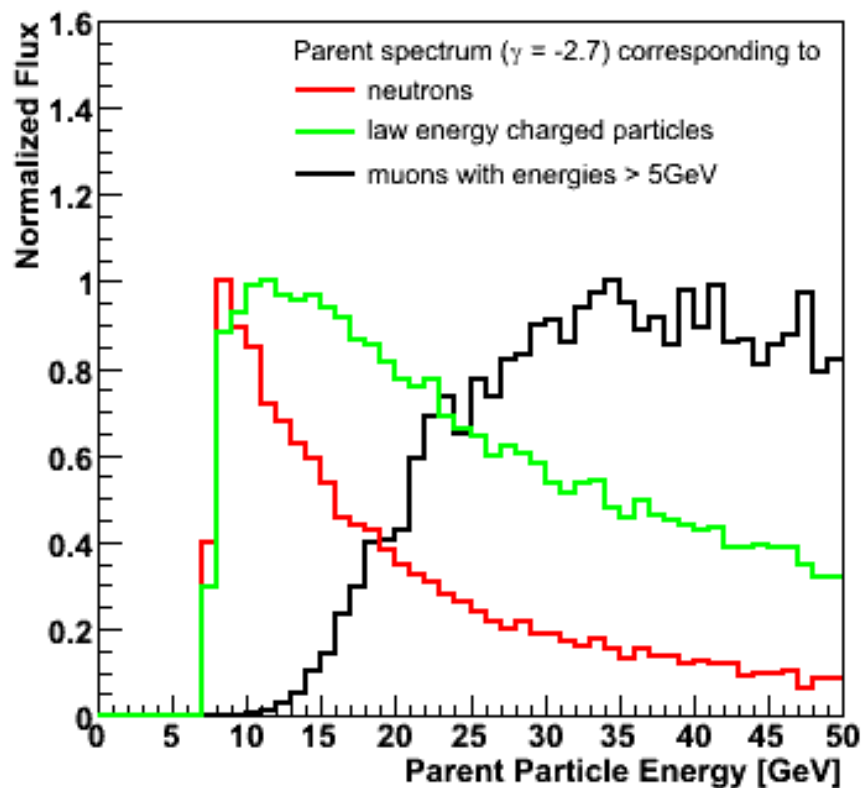
Nor Amberd Multidirectional Muon Monitor



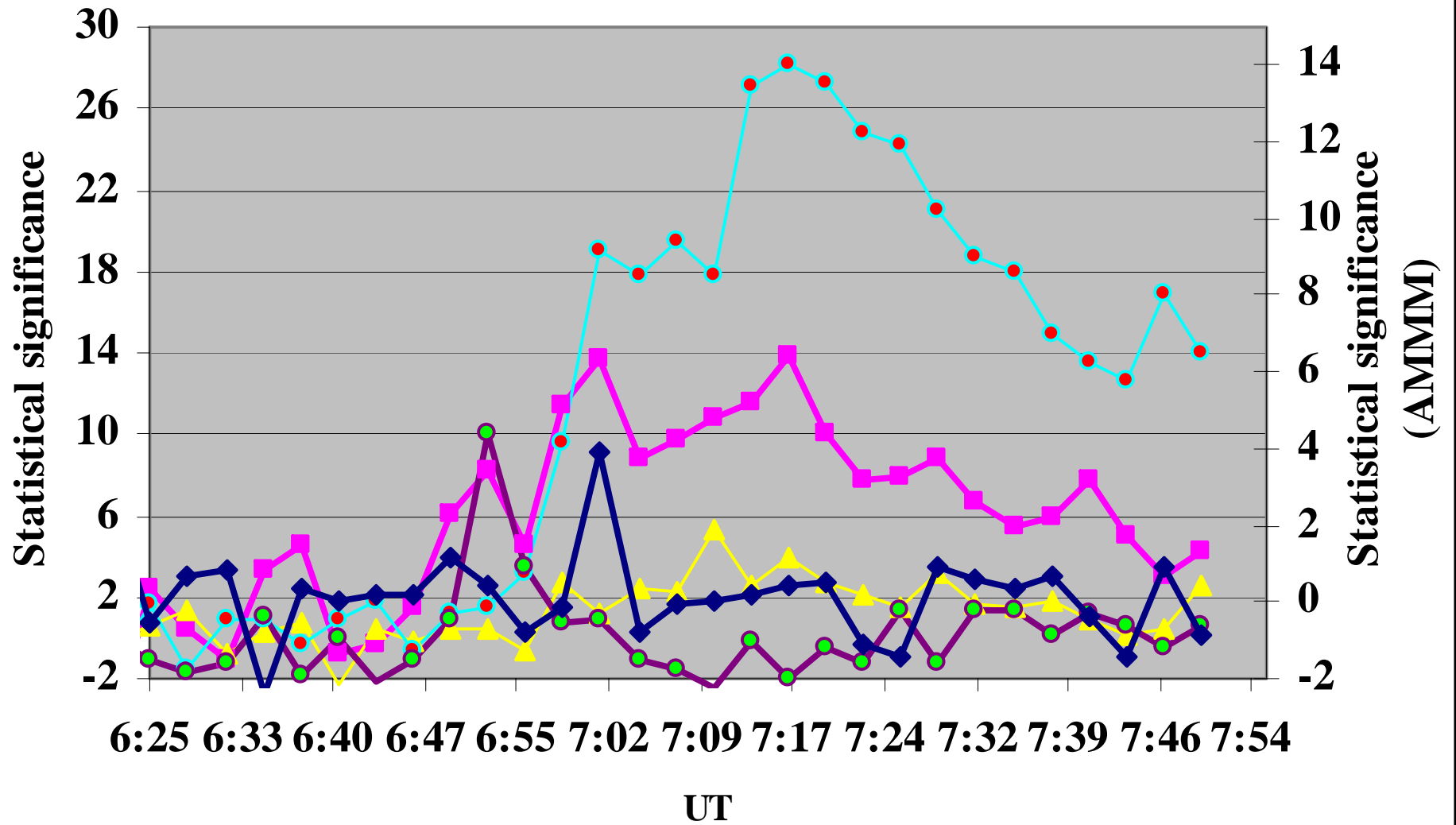
Aragats Multidirectional Muon Monitor (AMMM)



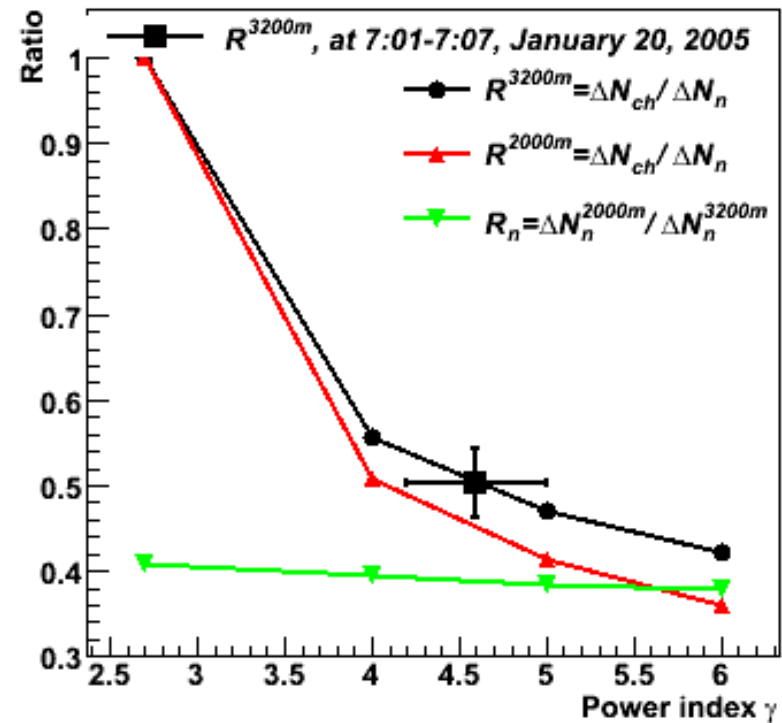
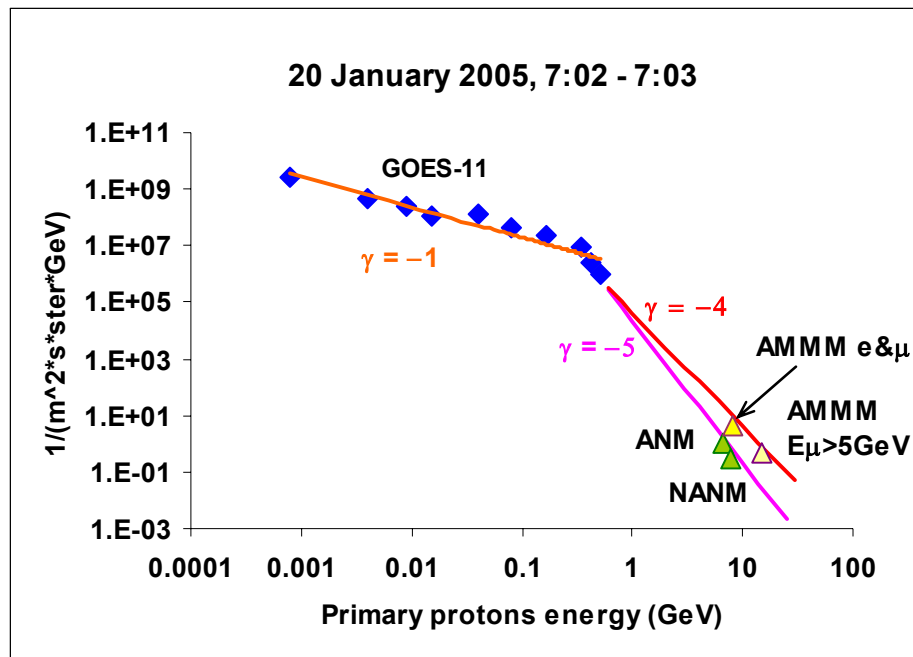
ASEC monitor are “selecting” different energy populations of GCR and SCR



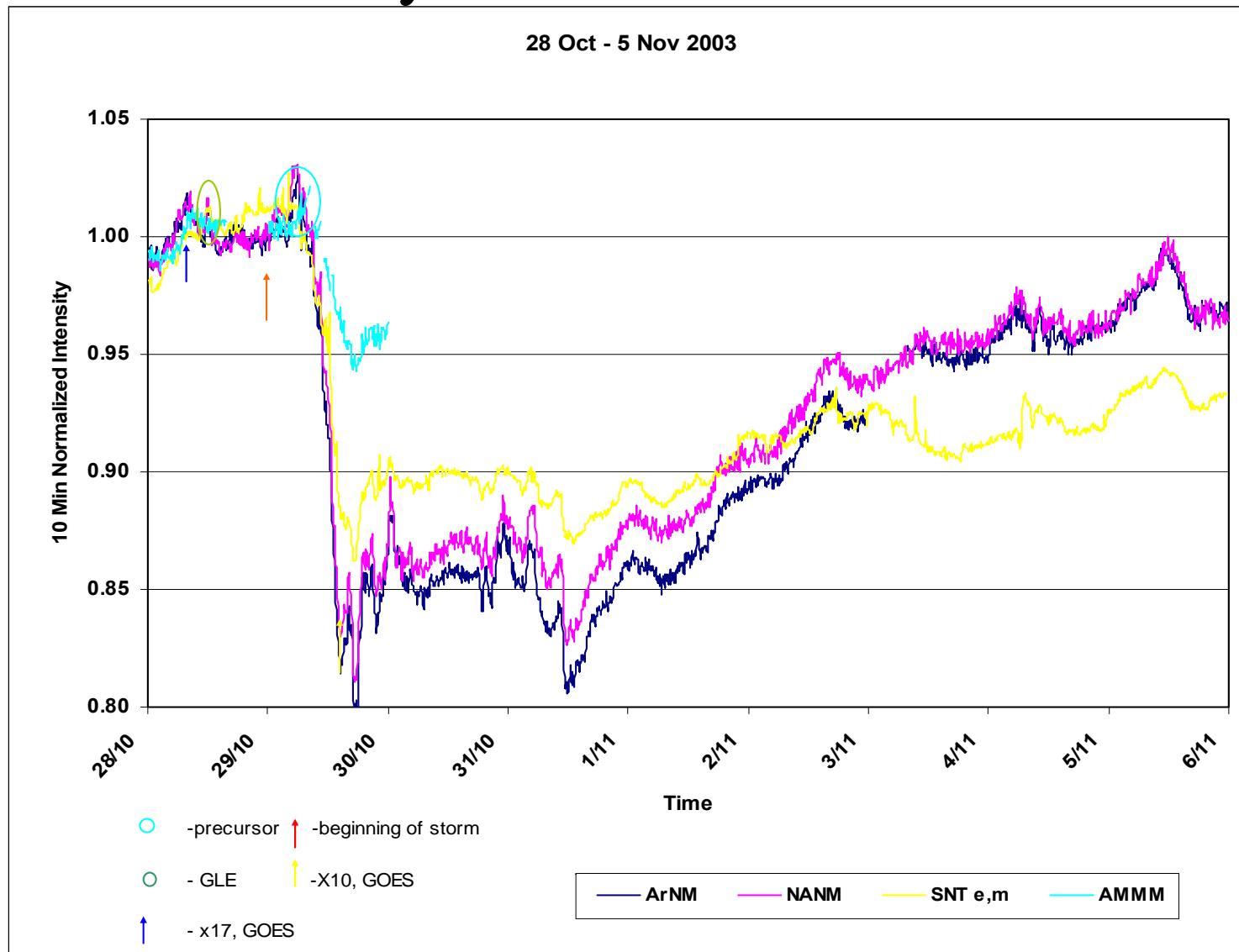
20.01.2005 (3min)



Energy Spectrum of the GLE from 20 January 2005



Famous “Halloween” events of 2003, detected in electron & muon and neutron fluxes by ASEC monitors



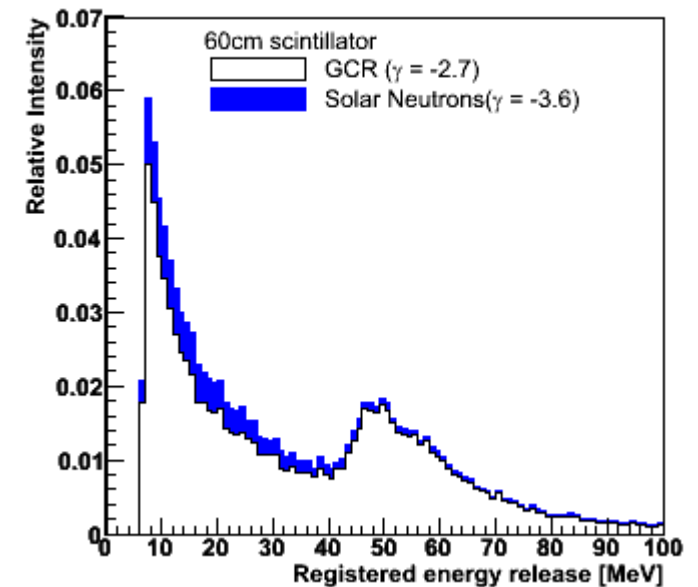
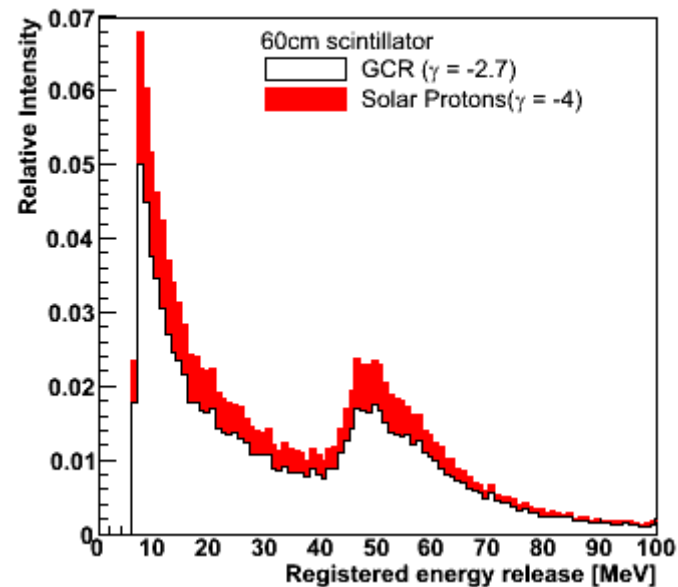
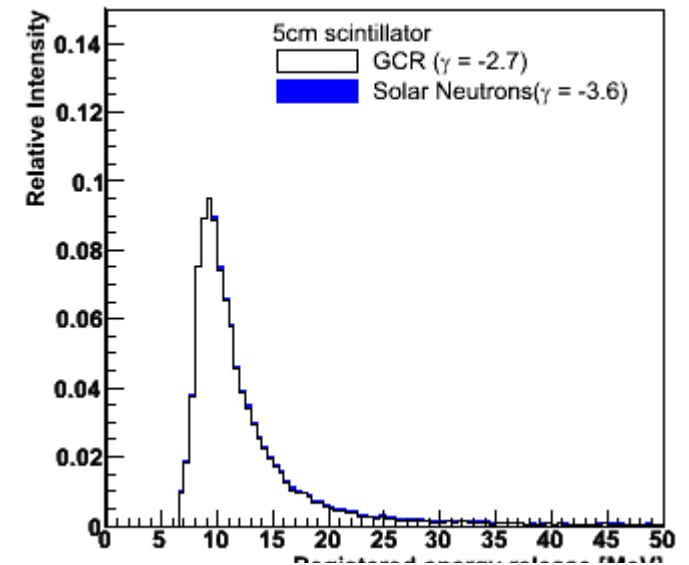
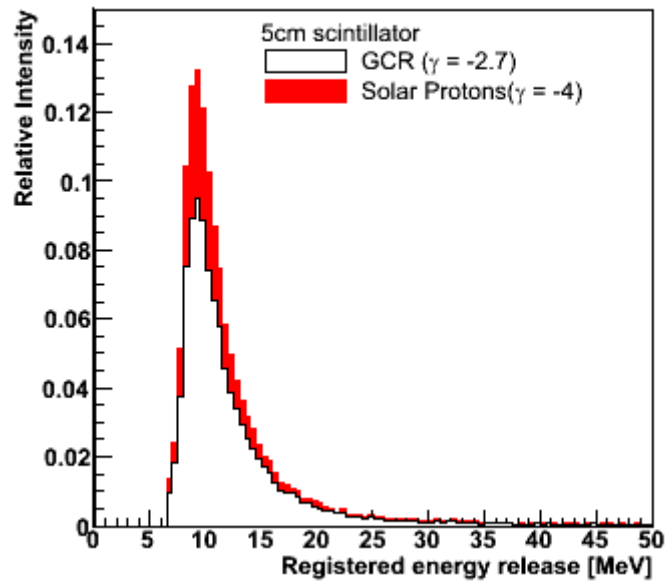
Correlation Matrix of ASEC monitors for 29 October 2003 (6:09 – 14:39), Fd

	ANM	NANM	AMMM	SNT_{e,μ}	SNT thr1	SNT thr2	SNT thr 3	SNT thr4
ANM	1	1,00	0,97	0,99	0,99	0,97	0,95	0,98
NANM	1,00	1	0,97	0,99	0,99	0,97	0,95	0,98
AMMM	0,97	0,97	1	0,97	0,97	0,95	0,93	0,95
SNT_{e,μ}	0,99	0,99	0,97	1	1,00	0,99	0,97	0,99
SNT thr1	0,99	0,99	0,97	1,00	1	0,99	0,96	0,99
SNT thr2	0,97	0,97	0,95	0,99	0,99	1	0,99	0,99
SNT thr3	0,95	0,95	0,93	0,97	0,96	0,99	1	0,97
SNT thr4	0,98	0,98	0,95	0,99	0,99	0,99	0,97	1

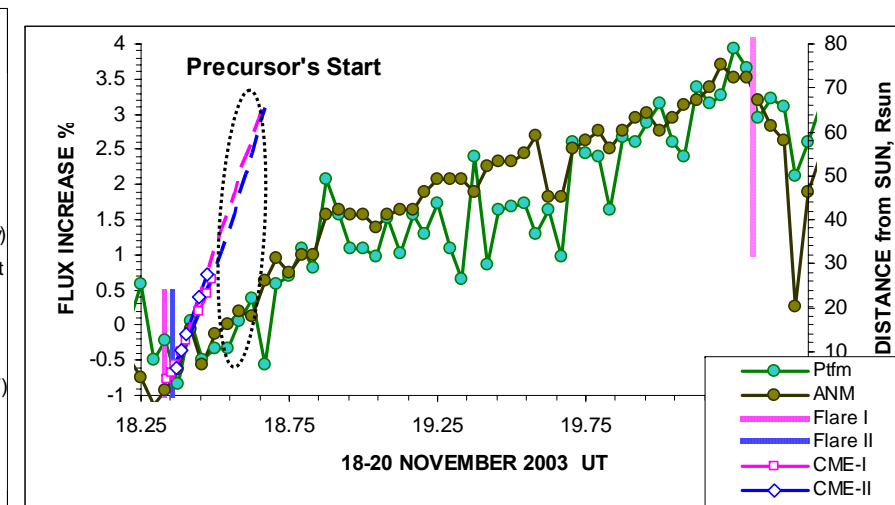
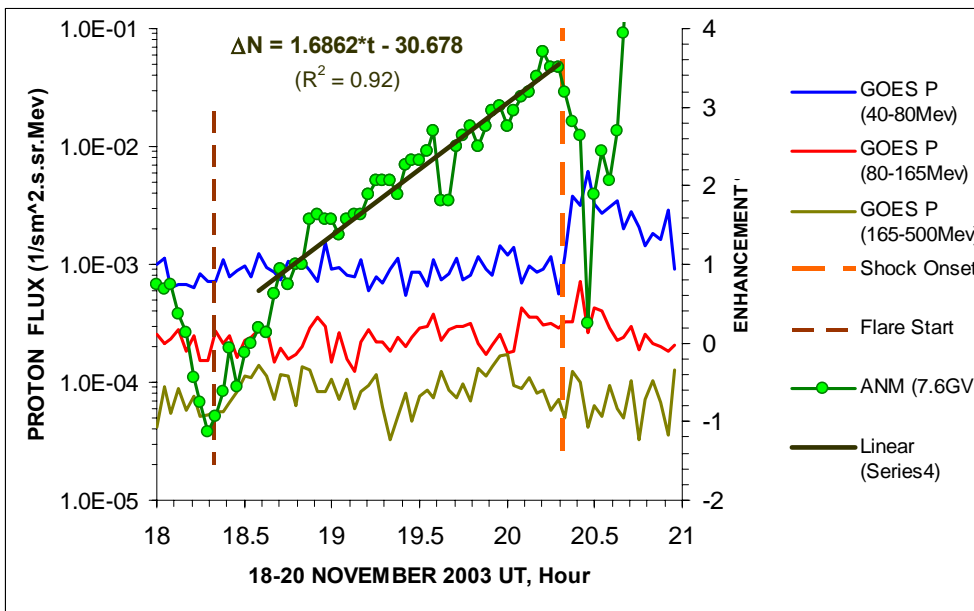
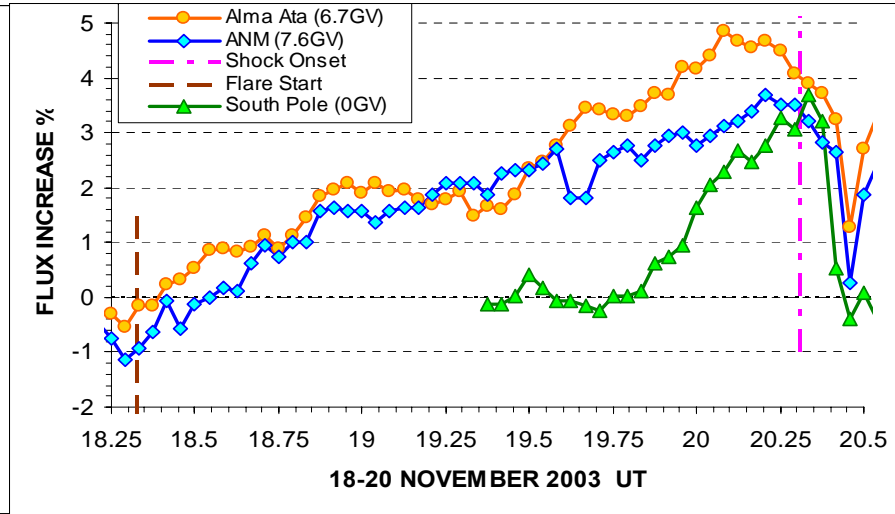
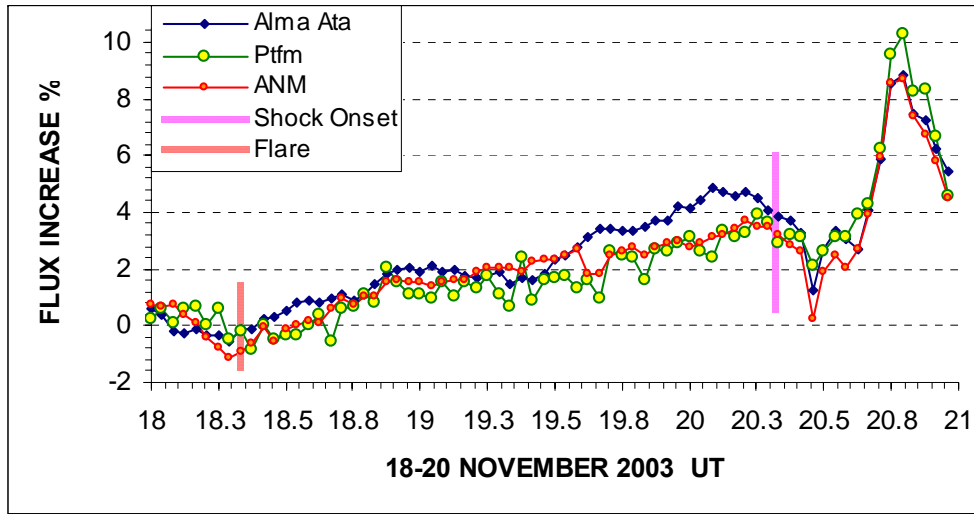
ASEC Monitors Correlation Matrix 25 Jan 2003, (quiet time)

	ArNM	NANM	AMMM	SNT _{e,μ}	SNT thr1	SNT thr2	SNT thr3	SNT thr4
ArNM	1							
NaNM	0,01	1						
AMMM	0,03	0,02	1					
SNT _{e,μ}	0,02	-0,01	0,12	1				
SNT thr1	0,05	0,03	0,08	0,06	1			
SNT thr2	0,04	-0,04	-0,04	-0,05	0,43	1		
SNT thr3	0,03	0,03	0,00	-0,01	0,31	0,42	1	
SNT thr4	0,01	-0,02	-0,04	0,03	0,15	0,33	0,46	1

Neutron and Proton GLEs as seen by the SNT



Precursor of largest GMS from 20 November 2003



Correlation Matrix of ASEC monitors for 20-21 November 2003 r. (14:40 – 6:00), Geomagnetic Storm

	ArNM	NANM	AMMM	SNT_{e,μ}	SNT thr1	SNT thr2	SNT thr3	SNT thr4
ArNM	1	0.89	-0.01	0.47	0.81	0.85	0.67	0.38
NANM	0.89	1	-0.04	0.44	0.79	0.83	0.65	0.35
AMMM	-0.01	-0.04	1	0.53	0.14	-0.04	0.13	0.13
SNT_{e,μ}	0.47	0.44	0.53	1	0.62	0.36	0.50	0.36
SNT thr1	0.81	0.79	0.14	0.62	1	0.87	0.72	0.43
SNT thr2	0.85	0.83	-0.04	0.36	0.87	1	0.81	0.48
SNT thr3	0.67	0.65	0.13	0.50	0.72	0.81	1	0.68
SNT thr4	0.38	0.35	0.13	0.36	0.43	0.48	0.68	1

ADAS

Aragats Data Acquisition Server

Version: 3.0.8
Status: Ok

- Server Info
- Documentation
- Configuration
- Error Log
- Real Time Data
- Current Data
- Today Data
- Stored Data

DarkSoft News
DarkSoft Projects

- Restart Server
- Stop Server
- Download Config
- Upload Config
- Configure USB
- NTP Status

Shutdown PC

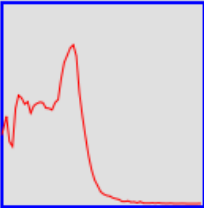
Submit

Channel 1 (Layer: 1, Sensor: 1)

High Voltage (V):

Threshold (V):

SoftThreshold :



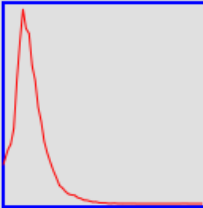
High Voltage: 1400
Cur. Counter: 691

Channel 5 (Layer: 2, Sensor: 1)

High Voltage (V):

Threshold (V):

SoftThreshold :



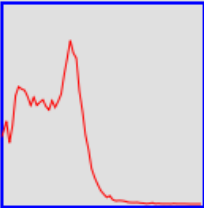
High Voltage: 1347
Cur. Counter: 400

Channel 2 (Layer: 1, Sensor: 2)

High Voltage (V):

Threshold (V):

SoftThreshold :



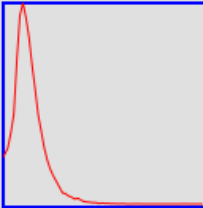
High Voltage: 1580
Cur. Counter: 715

Channel 6 (Layer: 2, Sensor: 2)

High Voltage (V):

Threshold (V):

SoftThreshold :



High Voltage: 1310
Cur. Counter: 402

ADAS

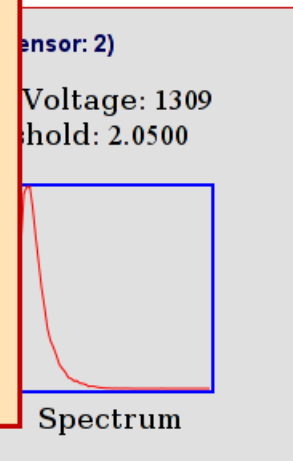
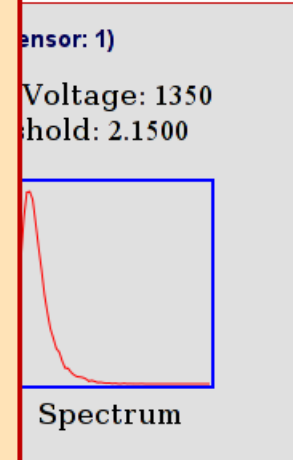
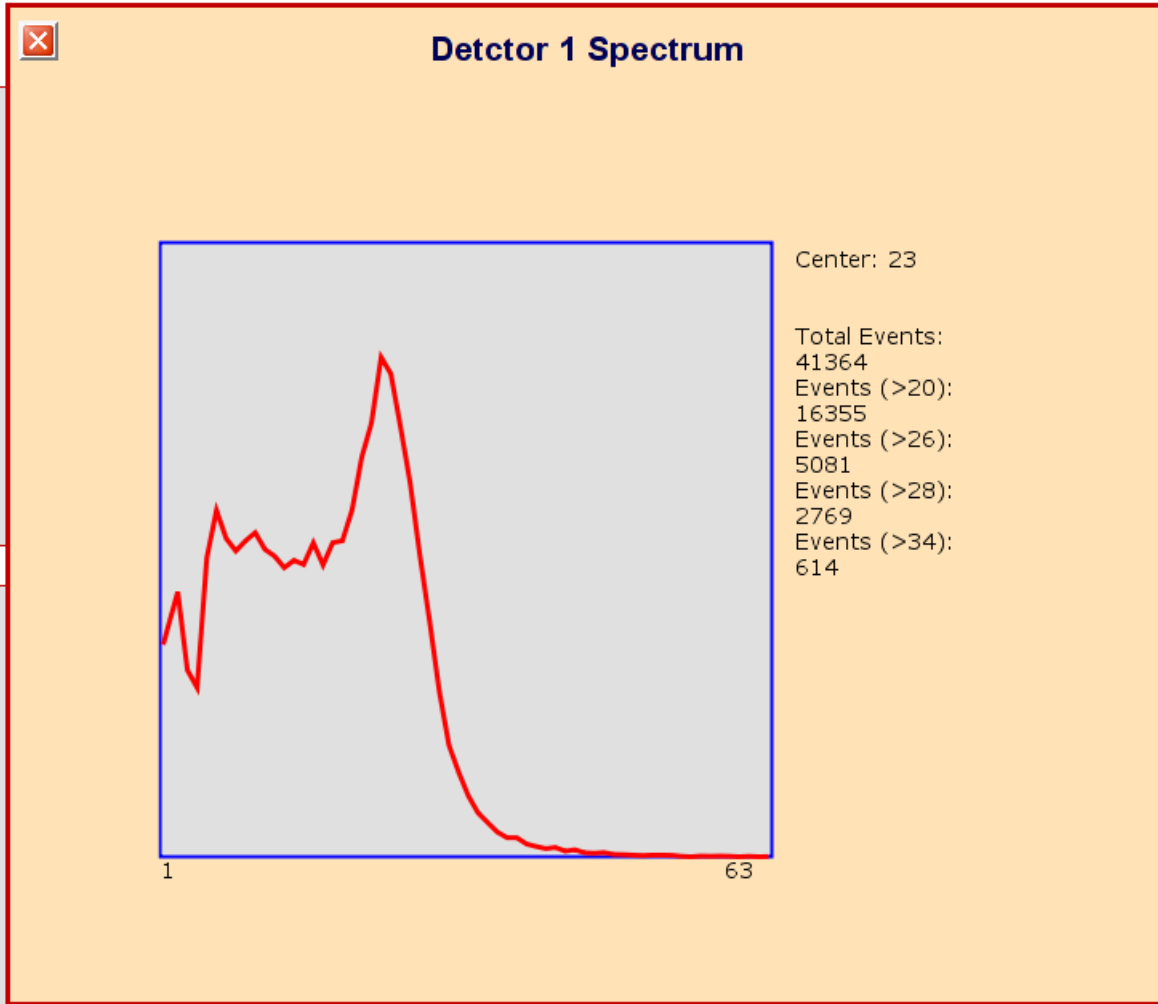
Aragats Data Acquisition Server

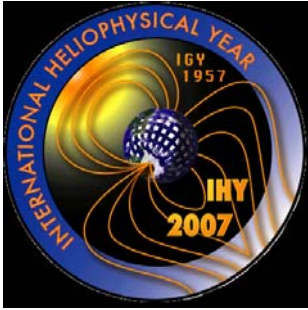
Version: 3.0.8
Status: Ok

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DarkSoft News
DarkSoft Projects

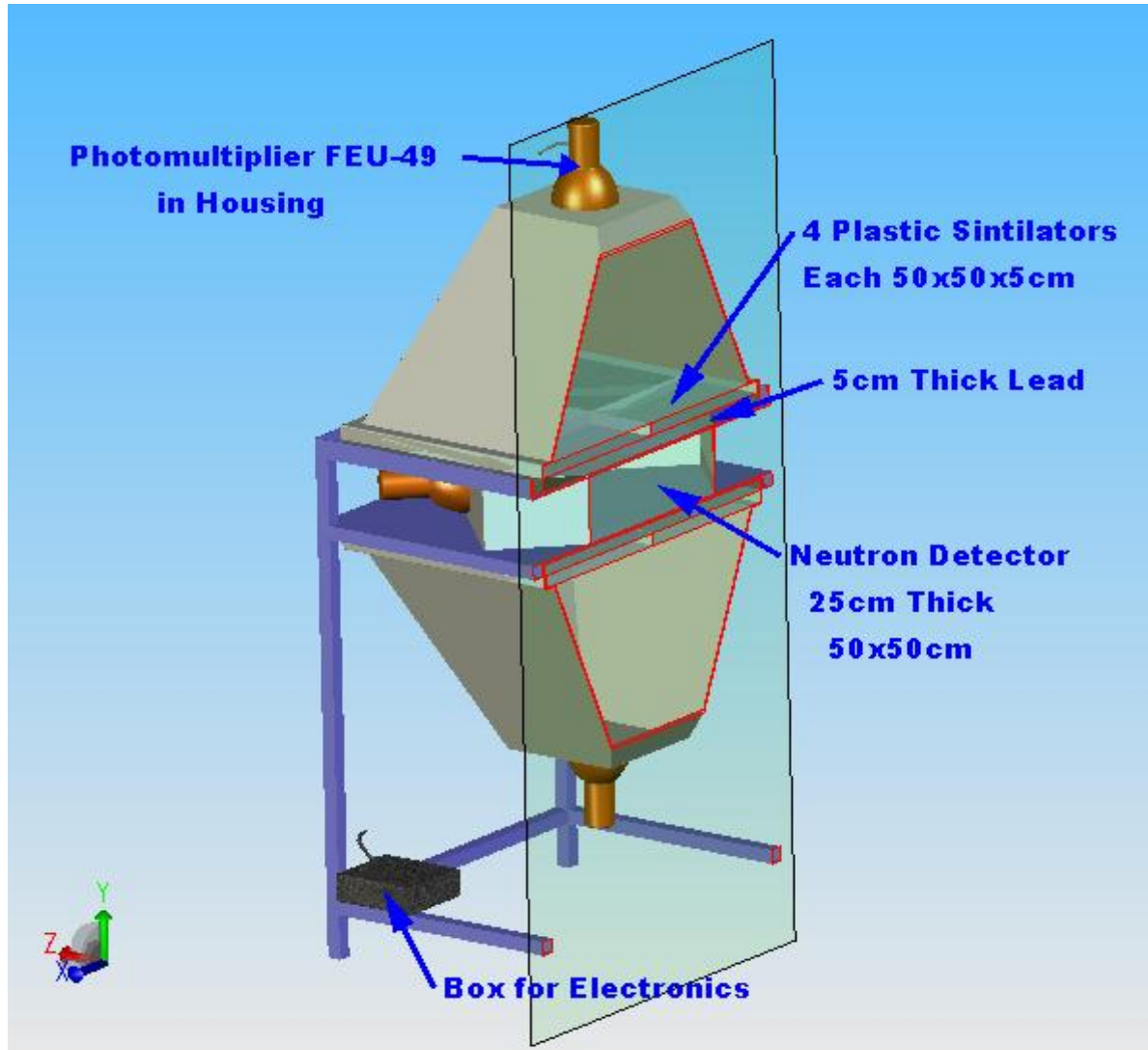
- Restart Server
- Stop Server
- Download Config
- Upload Config
- Configure USB
- NTP Status





Sevan Detector

Space Environmental Viewing and Analysis Network



Software Trigger
(Microcontroller based)

111 – Charged particle-high; 300 MeV muon

010 – Neutral particle

100 – Low energy charged particle

011 – High energy neutral particle

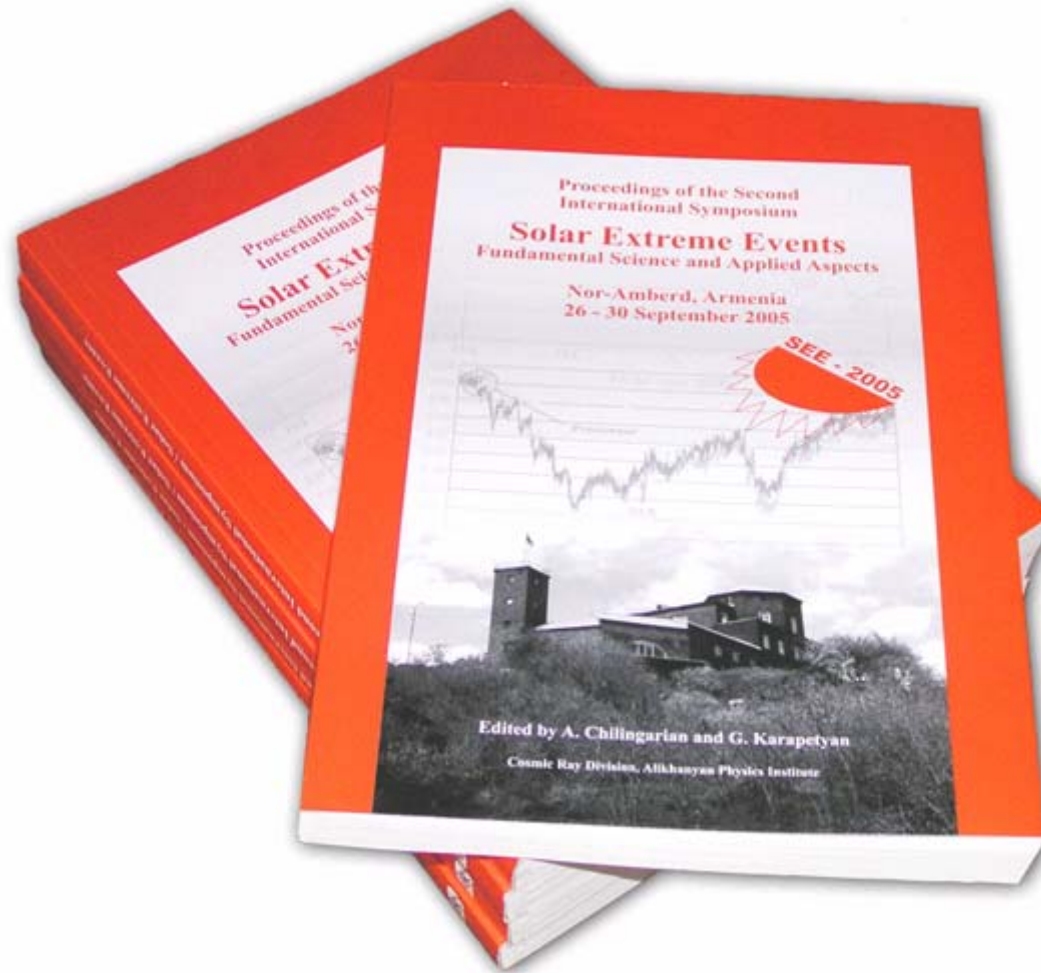
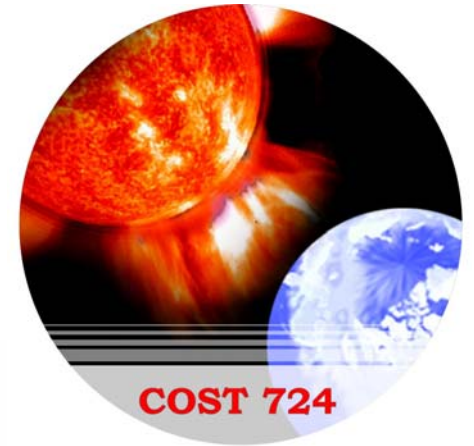
001 – horizontal muon

101 – 2 horizontal muons

MMM – Extensive Air Shower



Proceedings of the International Conference Solar Extreme Events - 2005



http://crdlx5.yerphi.am/index.php?Page=/Online_News/CRDSEE/Proceedings/&Title=0