Forecasting of Radiation and Geomagnetic Storms by networks of particle detectors (FORGES-2008)

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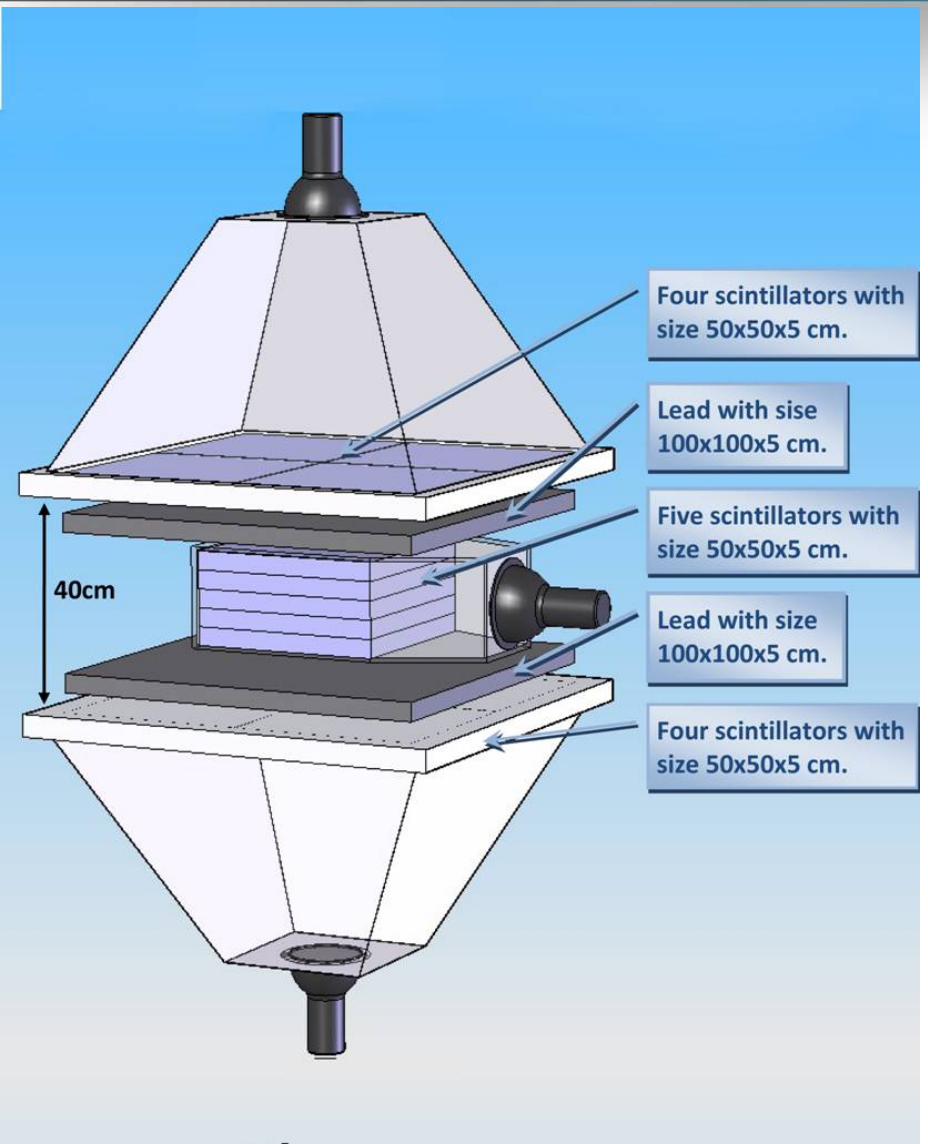
ELECTRONICS FOR SEVAN

(Space Environmental Viewing and Analysis Network)

K. Arakelyan, A. Avetisyan, S. Abovyan, D. Pokhsraryan, V. Danielyan

Construction of SEVAN particle detectors



The basic detecting unit of the SEVAN network is assembled from standard slabs of 50x50x5cm3 plastic scintillators.

Between two identical semblies of 100 x 100 x 5 cm3 scintillators (four standard slabs) are located two 100 x 100 x 5 cm3 lead absorbers and thick 50 x 50 x 25 cm3 scintillator assembly (5 standard slabs).

A scintillator light capture cone and Photo Multiplier Tube (PMT) are located on the top, bottom and the intermediate layers of detector.

111 – traversal of high energy muon;

011 & 010 – traversal of the neutral particle;

100 – traversal of low energy charged particle stopped in scintillator or in first lead absorber.

110 – traversal of higher energy charged particle stopped in the second lead absorber.

001 – registration of the inclined charged particles.

Block Map of SEVAN Electronics

PULSES

Photomultiplier tube

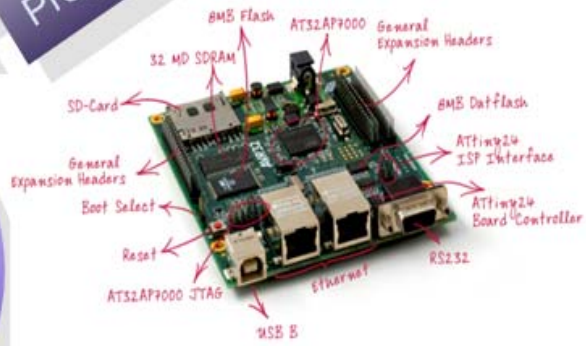
8-channel Programmable Threshold Comparator and Counter

USART 1 HV Control

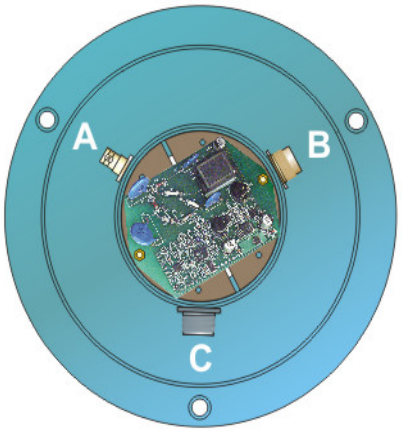
USART 2 Thresholds Programming

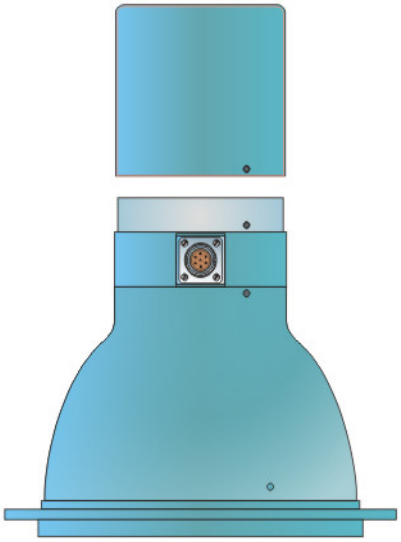
CPU AT32AP7000 ATMEL

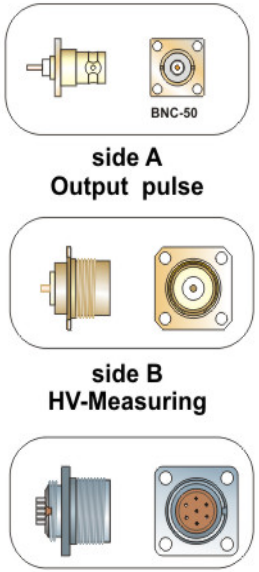
NGW100



Photomultiplier Tube Design



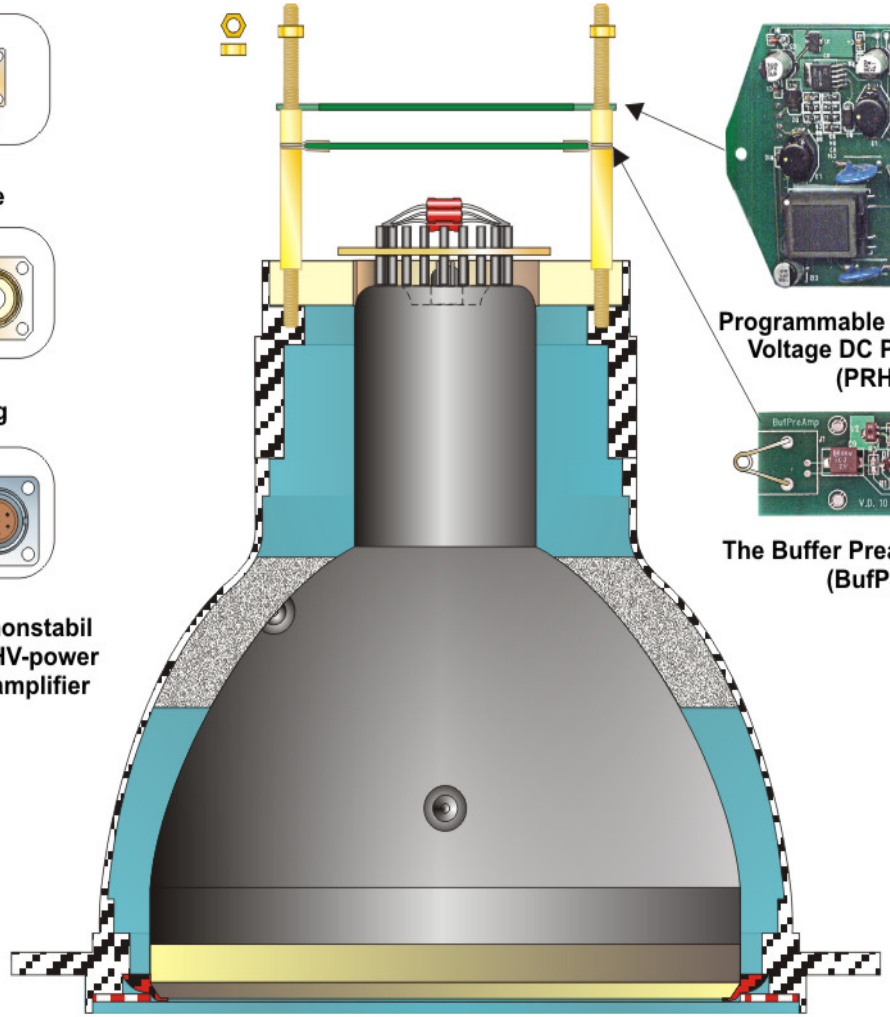


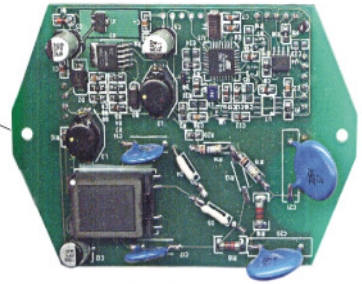


side A
Output pulse

side B
HV-Measuring

side C
interface RS-485 and nonstabil
+15 V for supply PHM HV-power
supply and buffer preamplifier

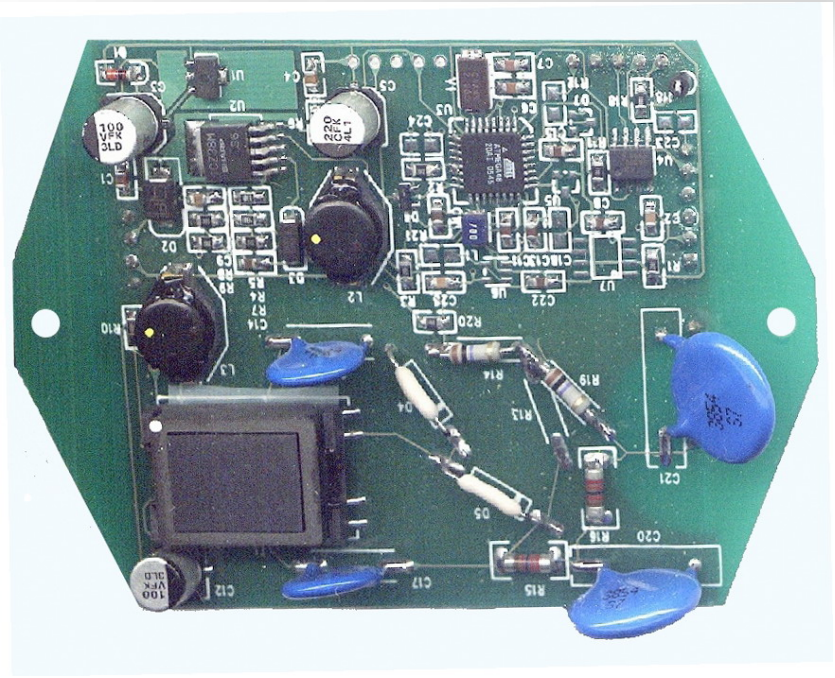




Programmable Regulated High
Voltage DC Power Supply
(PRHVPS)

The Buffer Preamplifier module
(BufPreAmp)

Programmable Regulated High Voltage DC Power Supply



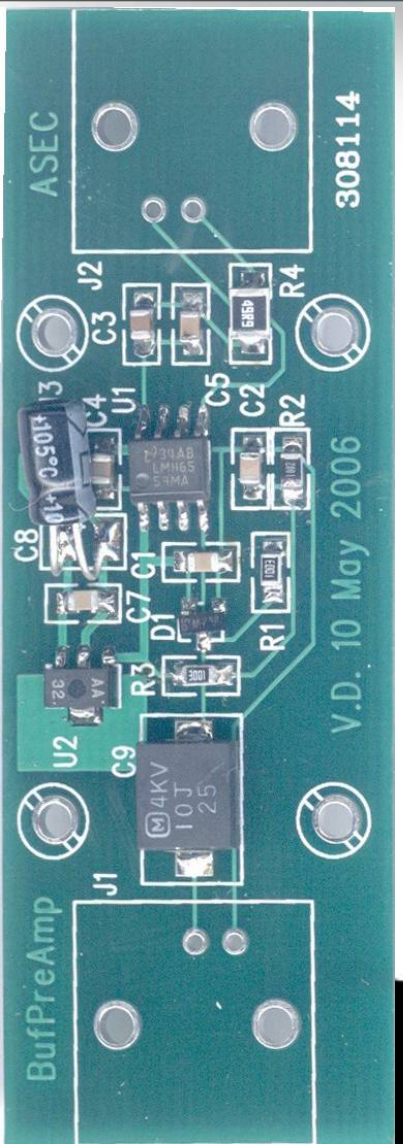
The PRHVPS consists of:

•Current-driven, low-noise sine wave DC/DC converter, with up to 2 stage RC output ripple
•Pulse Width Modulated programmable DC regulator
• Local +5V linear voltage regulator
• ATtiny26 microcontroller
• RS485 interface chip
•Optional temperature sensor

Specific Features:

•Voltage programming in two hardware selectable ranges
•± 900V to 2100V and ±1500 to 3000V in 2V steps
• Output voltage ripple less than 1mV
• Max. output current 1.2 mA for ± 900V to 2100V range; 0.8 mA for ±1500 to 3000V range
• Input voltage from +12V to +15V
• Absolute output voltage regulated to accuracy ±1V
•RS-485 half-duplex 2-wire 9600 baud interface program and monitor the output voltage

The Buffer Preamplifier module



The main parameters:

- **Gain – 1**
- **Small signal bandwidth – 1750 MHz**
- **Slew rate – 4580 V/us**
- **Input impedance – 100k**
- **Output impedance – 50 Ohm**
- **Maximal output pulse amplitude (Rload > 1k) – 8V**
- **Maximal output pulse amplitude (Rload = 50 Ohm) – 8V**
- **Power supply voltage – +12V – +15V unregulated**
- **Supply current <= 80mA**

Data Acquisition System for SEVAN

8-Channel Discriminator/Counter Unit

8-Channel Discriminator/Counter Unit consists of:

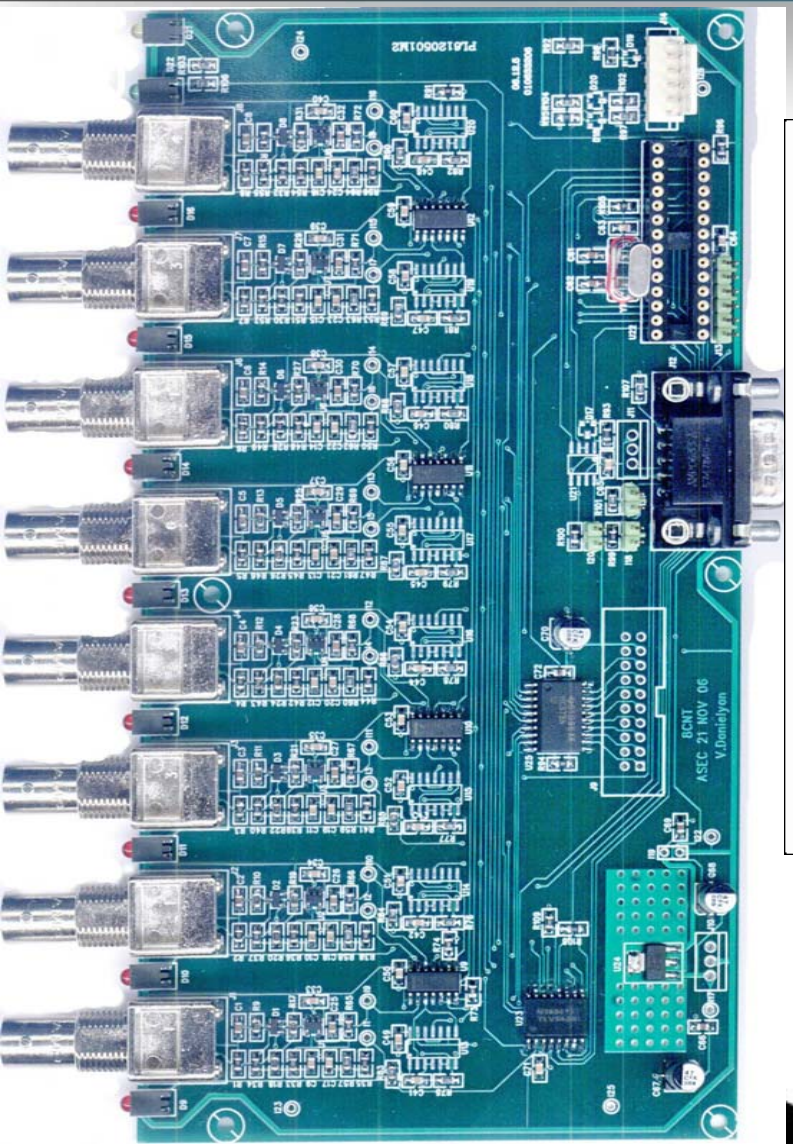
1. 8-Channel Discriminator/Counter module - 8CNT

2. Universal RS232/RS485 interface module - IFCC,

3. Power transformer - 220V50Hz to 2x8V 0.5A + 2x15V 1.25A

4. ATMEL NGW 100 Network Gateway Kit

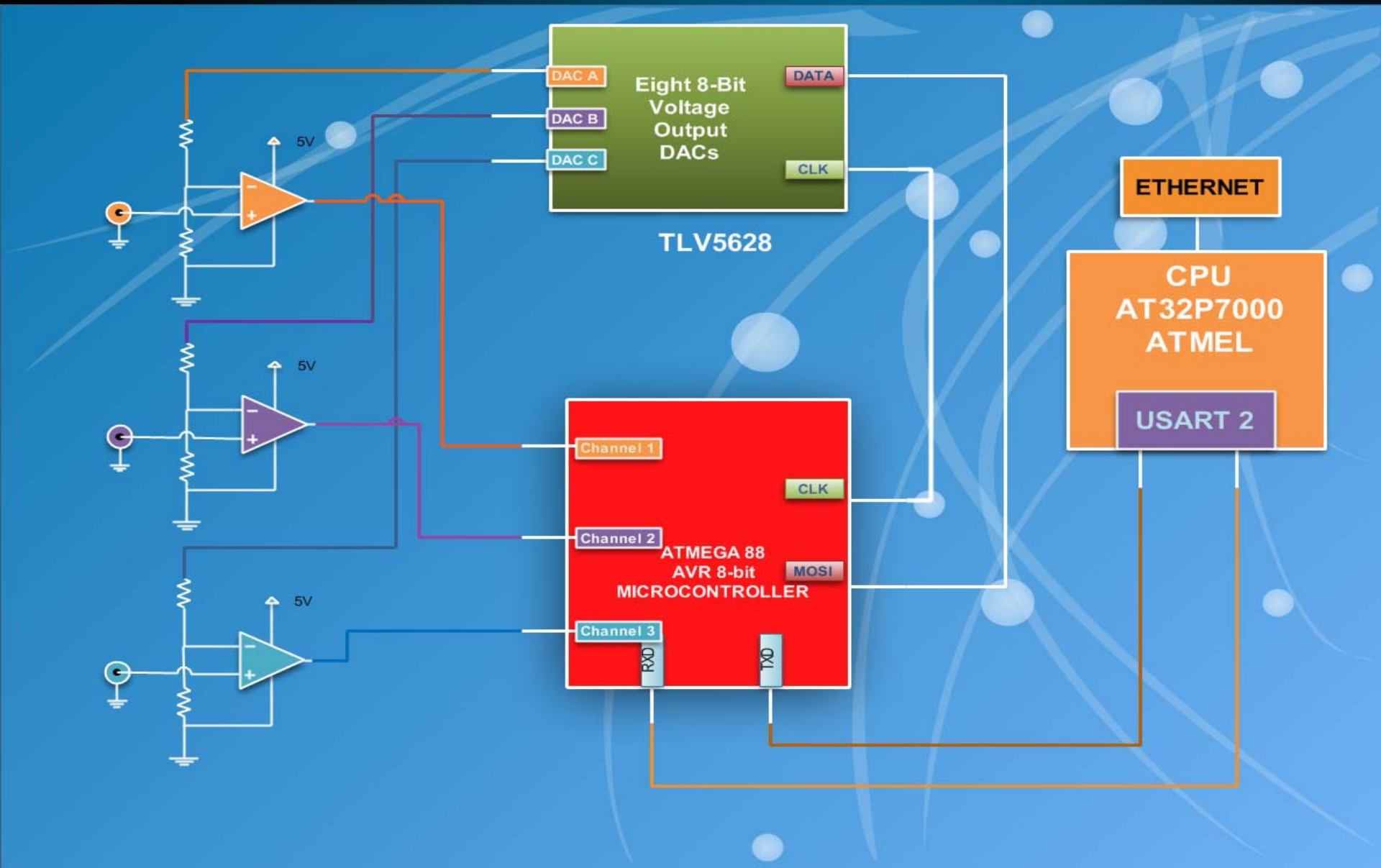
8CNT Board



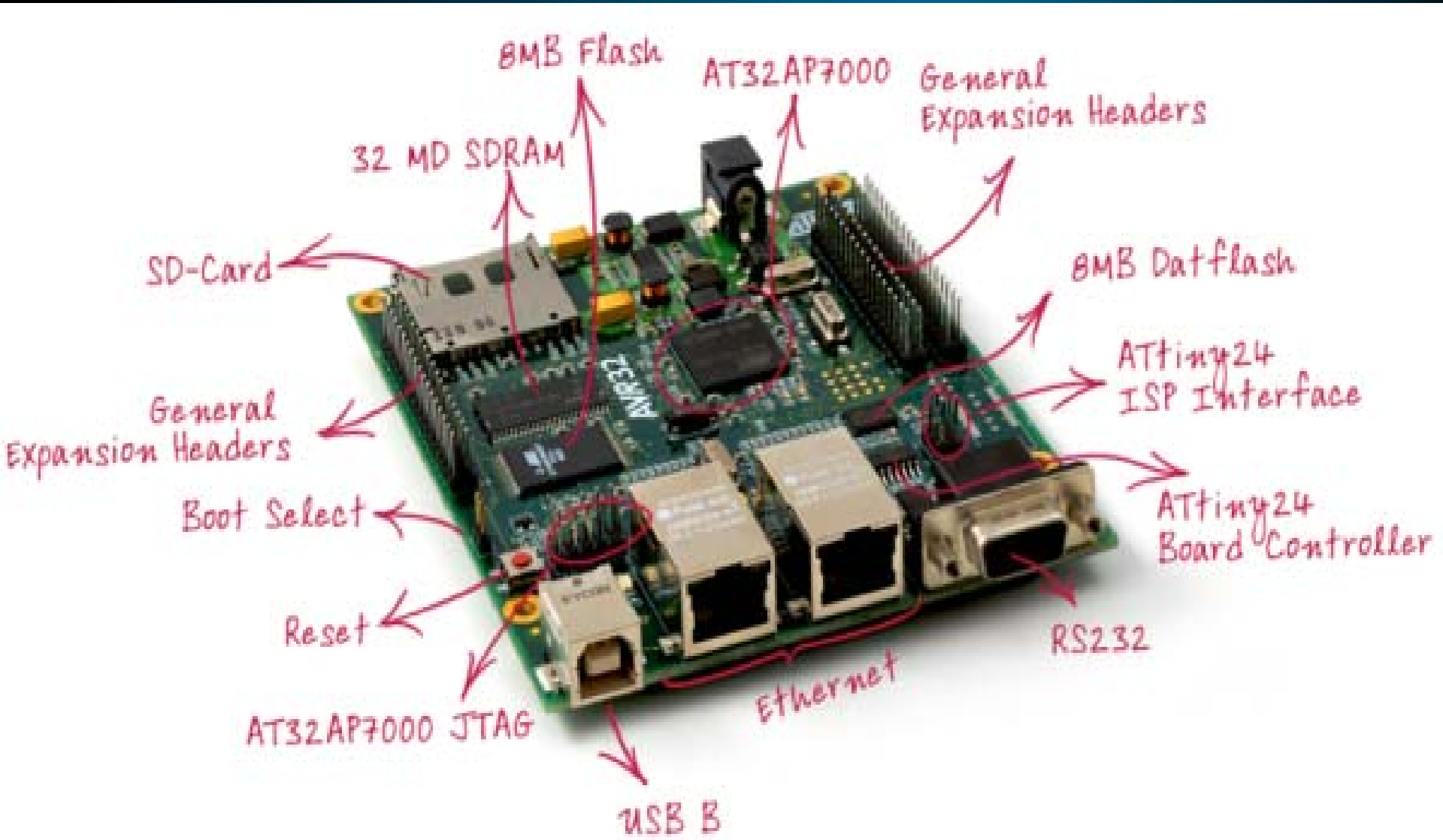
The main features are:
8 programmable threshold analog comparator
8 selectable level digital outputs for external counters,
Time delay, depending on the input pulse amplitude in range 30-50ns,
Threshold programming range 4mV-1000mV with 4mV step,
RS-485 interface with DSUB connector,
Internal +3.3V regulator,
Power supply voltage – unregulated 5V – 10V,
Supply Current <= 200mA,
Maximal counting frequency – 10kHz,
LEDs to indicate the input pulses presence for each channel, module power and programmable trigger condition,
8 input BNC connectors,
20-pin connector for digital outputs,
6-pin connector to the MultiIFC board

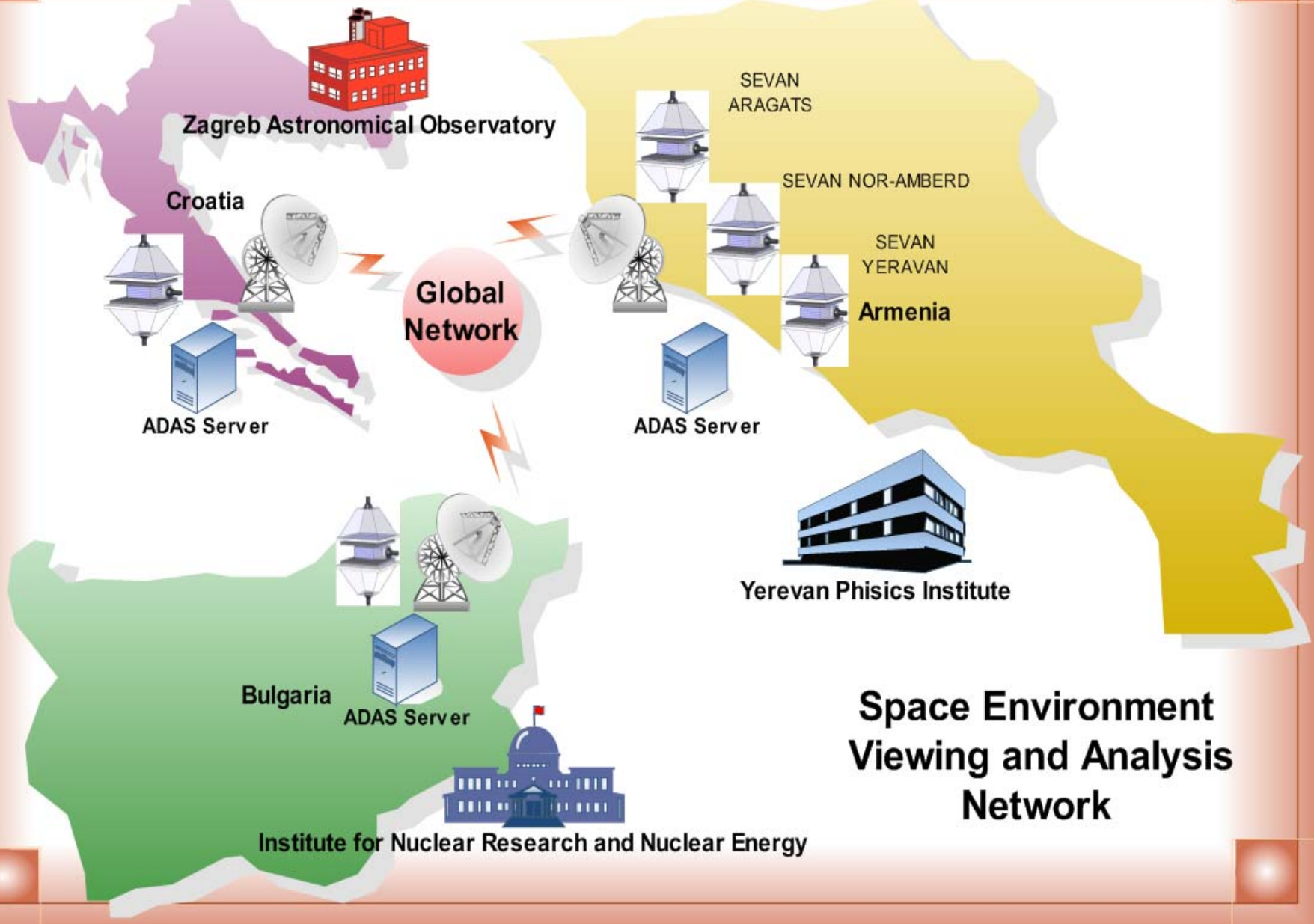
The module counter and interface logic is based on the Atmel AVR Atmega48 8-bit microcontroller.

8-channel Programmable Threshold Comparator and Counter



Atmel NGW100 Network Gateway

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Croatia
ADAS Server
Global Network
SEVAN ARAGATS
SEVAN NOR-AMBERD
SEVAN YERAVAN
Armenia
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Yerevan Phisics Institute
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ADAS Server
Institute for Nuclear Research and Nuclear Energy
Space Environment Viewing and Analysis Network