Das AMANDA dAOM Projekt – Stand und zukünftige Arbeiten

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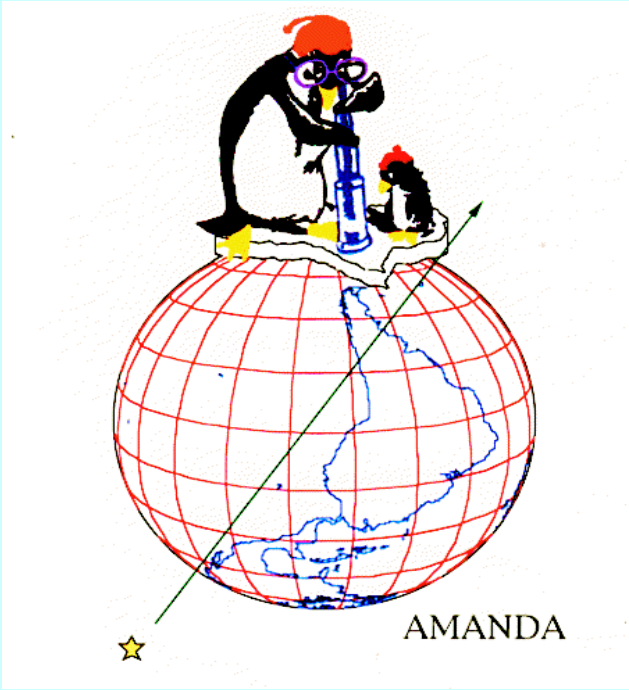
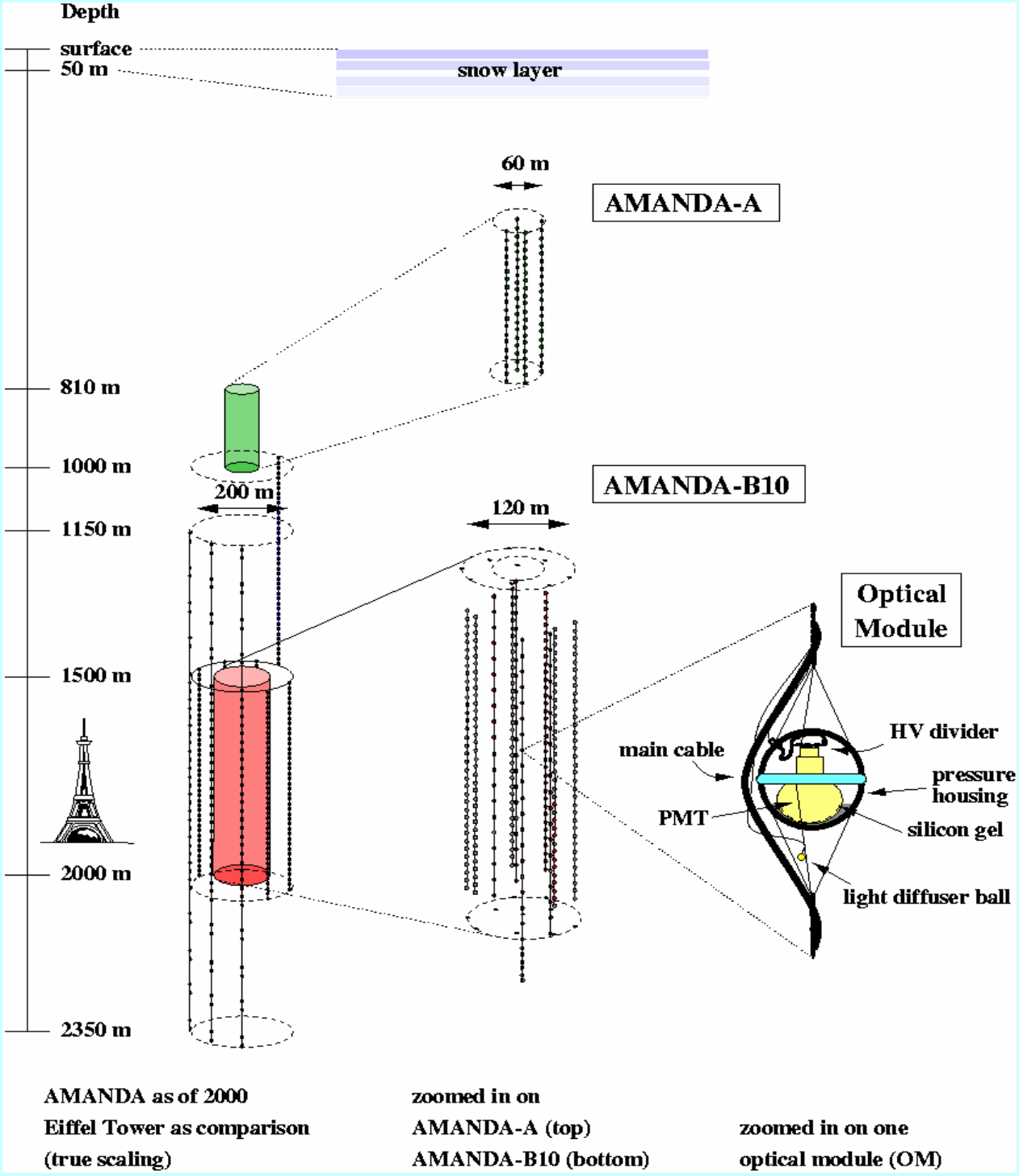
T. Schmidt



Outline

- The Amanda Experiment
- Optical Module Concepts
- Main dAOM Functions
- dAOM Architecture
- dAOM Control System at the Surface
- Control Software
- User Interface
- Future Developments

The AMANDA detector in the ice at the Southpole

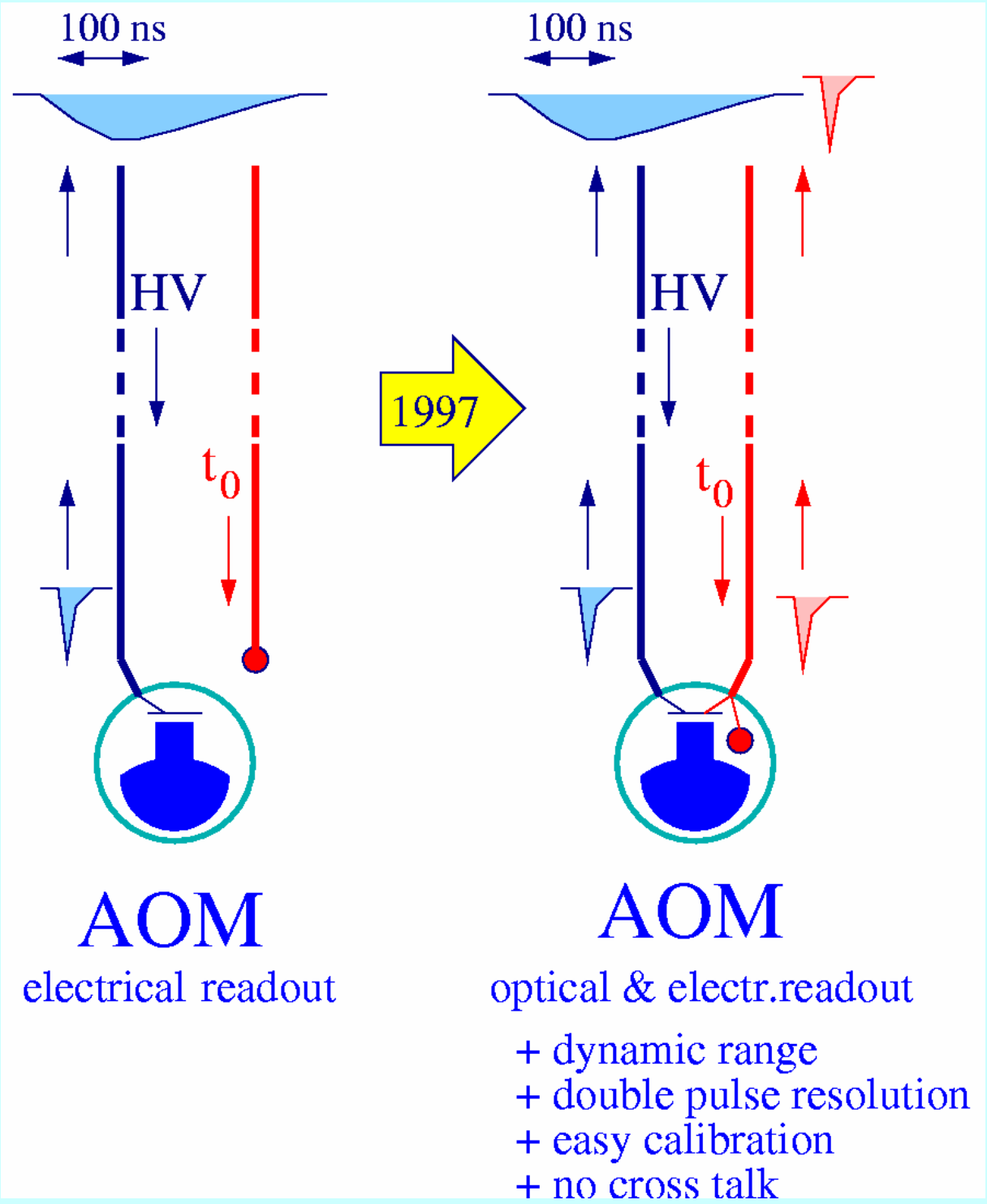


Optical Module Concepts

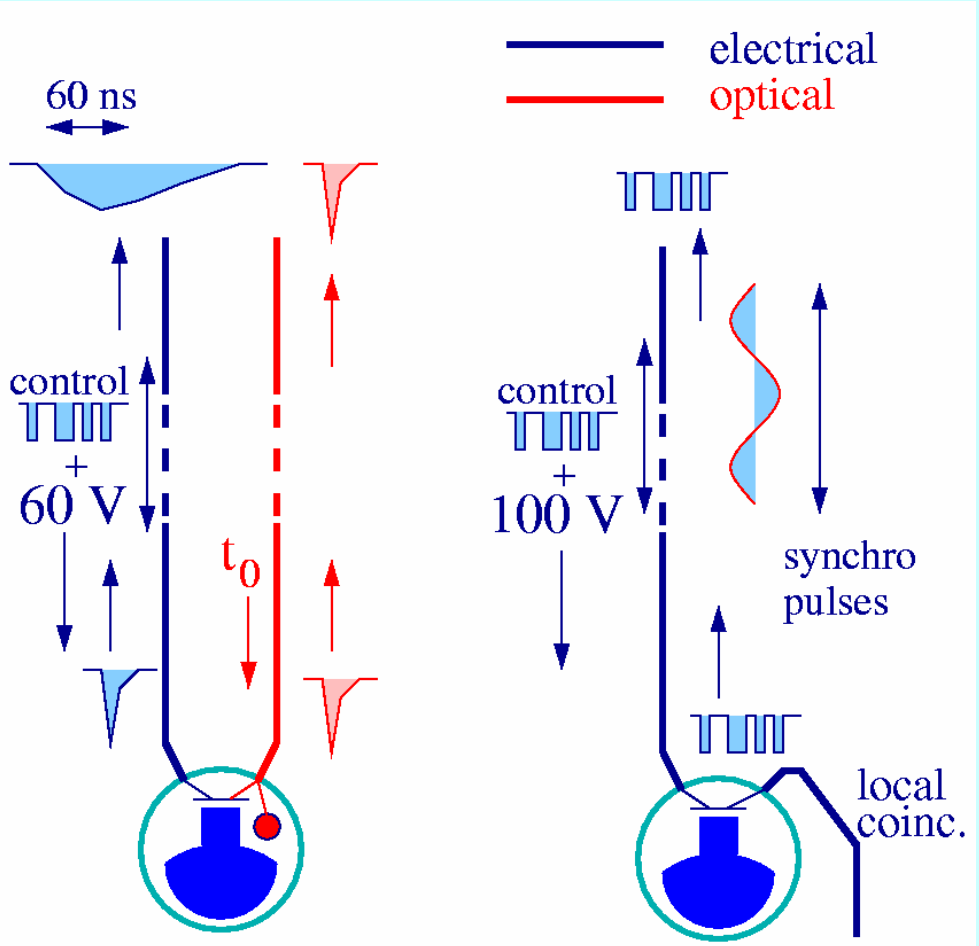
During the lifetime of AMANDA 3 different types of OMs have been developed:

- The Analog Optical Module: AOM
- The Digitally controlled Analog Optical Module: dAOM
- The Digital Optical Module: DOM

AMANDA: Analog Optical Modules



Optical Modules with new Technology



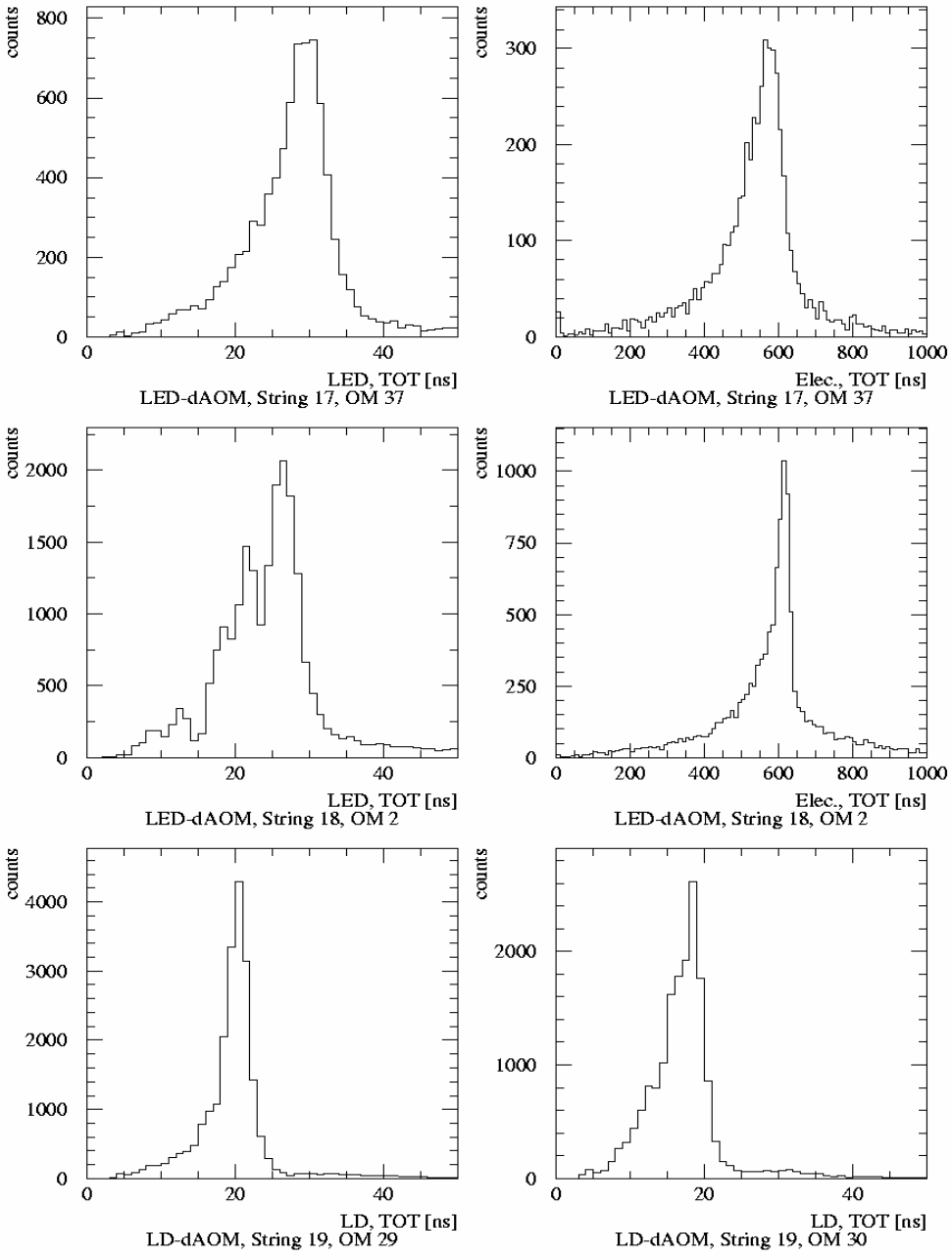
dAOM

HV in OM, sep. 1.dynode
biased LED
el.ampl. with cable comp.
+ linearity
+ lower HV
+ good P/V
+ shorter el. signal
temperature sensor

DOM

no fiber
waveform digitizing
local coincidence

TOT Values for Electrical and Optical Signals at the Surface



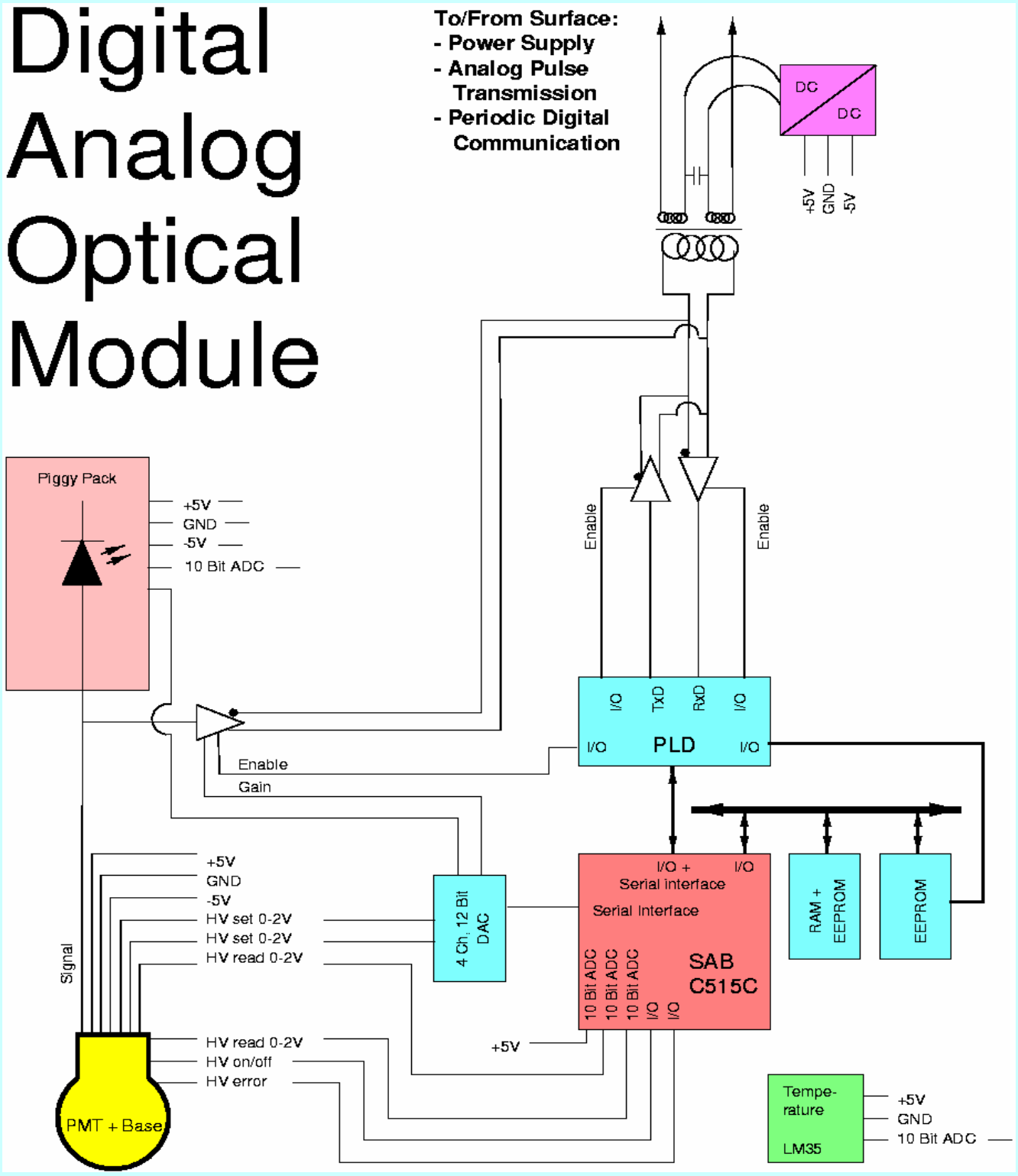
Requirements for the dAOM design

- Reliability, high MTBF
- Cost efficiency
- Flexibility
- Easy to deploy and to exploit
- Low power consumption

Main dAOM Functions

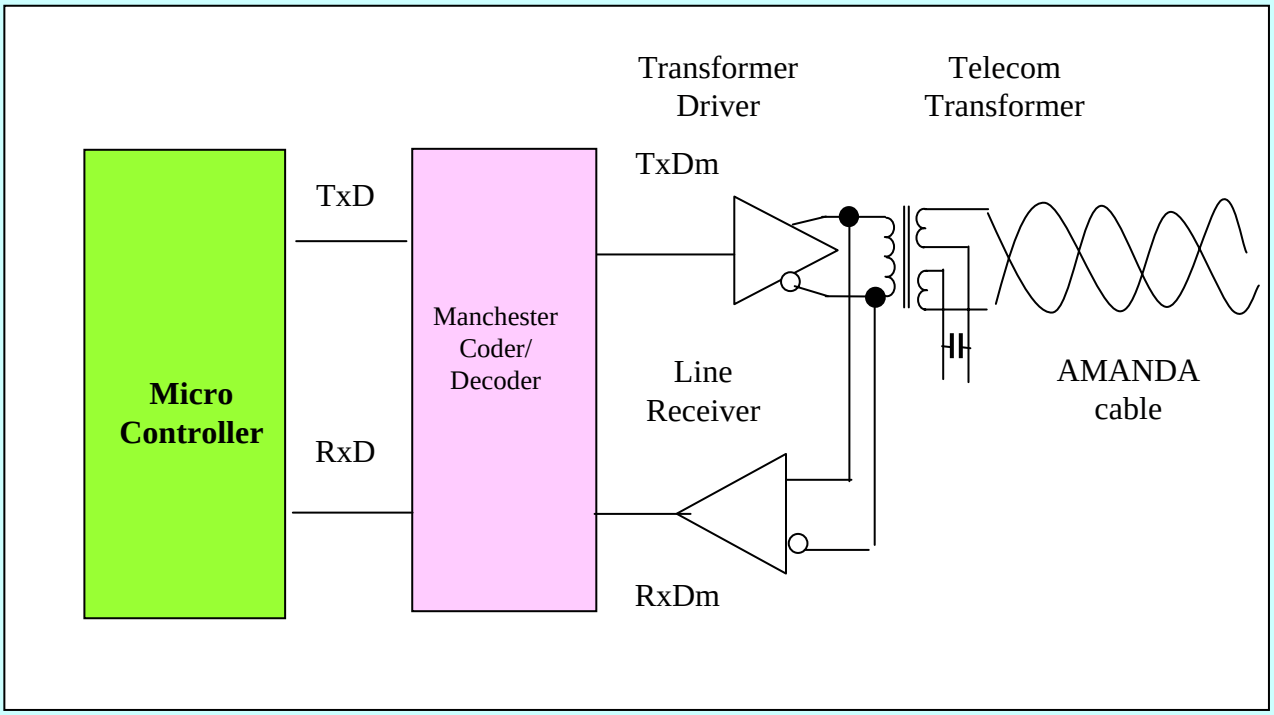
- PMT power supply
  - High voltage (HV) for the PMT is generated using a special designed DC-to-HV converter
- Communication with the DAQ system at the surface
- Analog pulse transmission via optical fiber and electrical copper cable
- Slow control functions:
  - Setting the HV for the PMT
  - Setting the gain for the analog signal transmission to the surface
  - Setting the bias current for the laser diode in the optical signal transmission path
- Monitoring:
  - the Temperature inside the dAOM
  - Actual HV level (anode and last dynode) and status (on/off)
  - Supply voltage levels (+5V)

dAOM Architecture

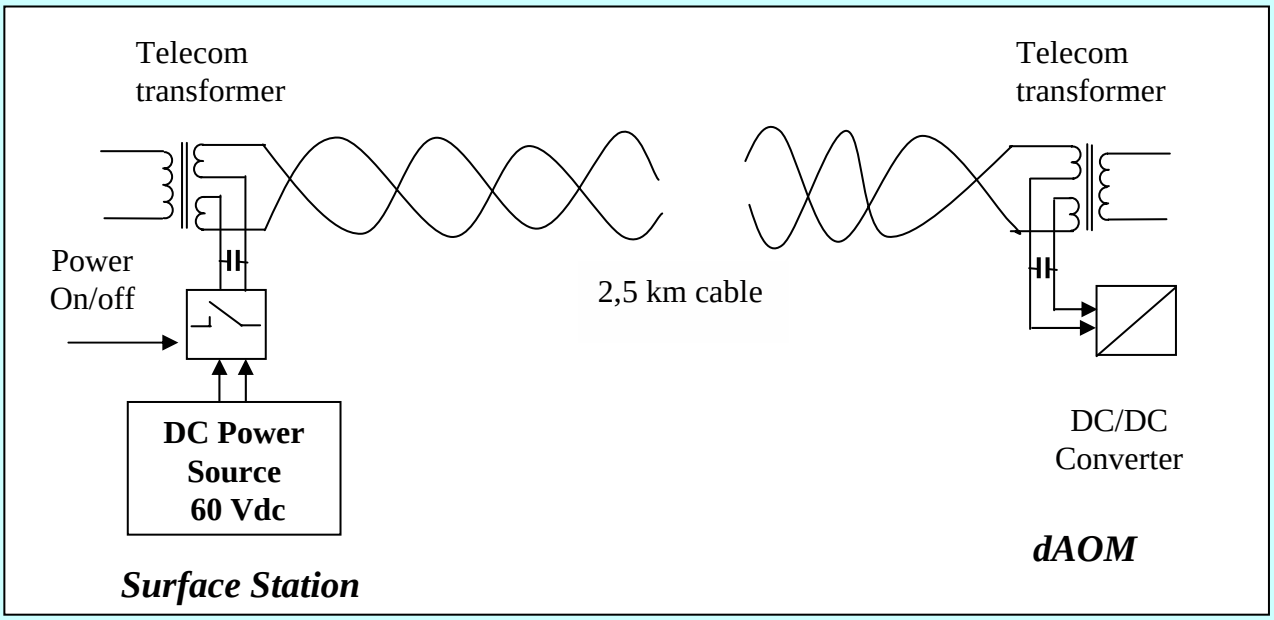


dAOM - Surface Communication

- The implemented solution for communication uses the following protocols:
  - Physical layer:
    - Manchester coded digital signal transfer based on a carrier of 320 kHz
  - Data link layer:
    - self defined ASCII based frame structure protocol
  - Network layer:
    - half duplex data transfer with a clear defined master-slave relationship



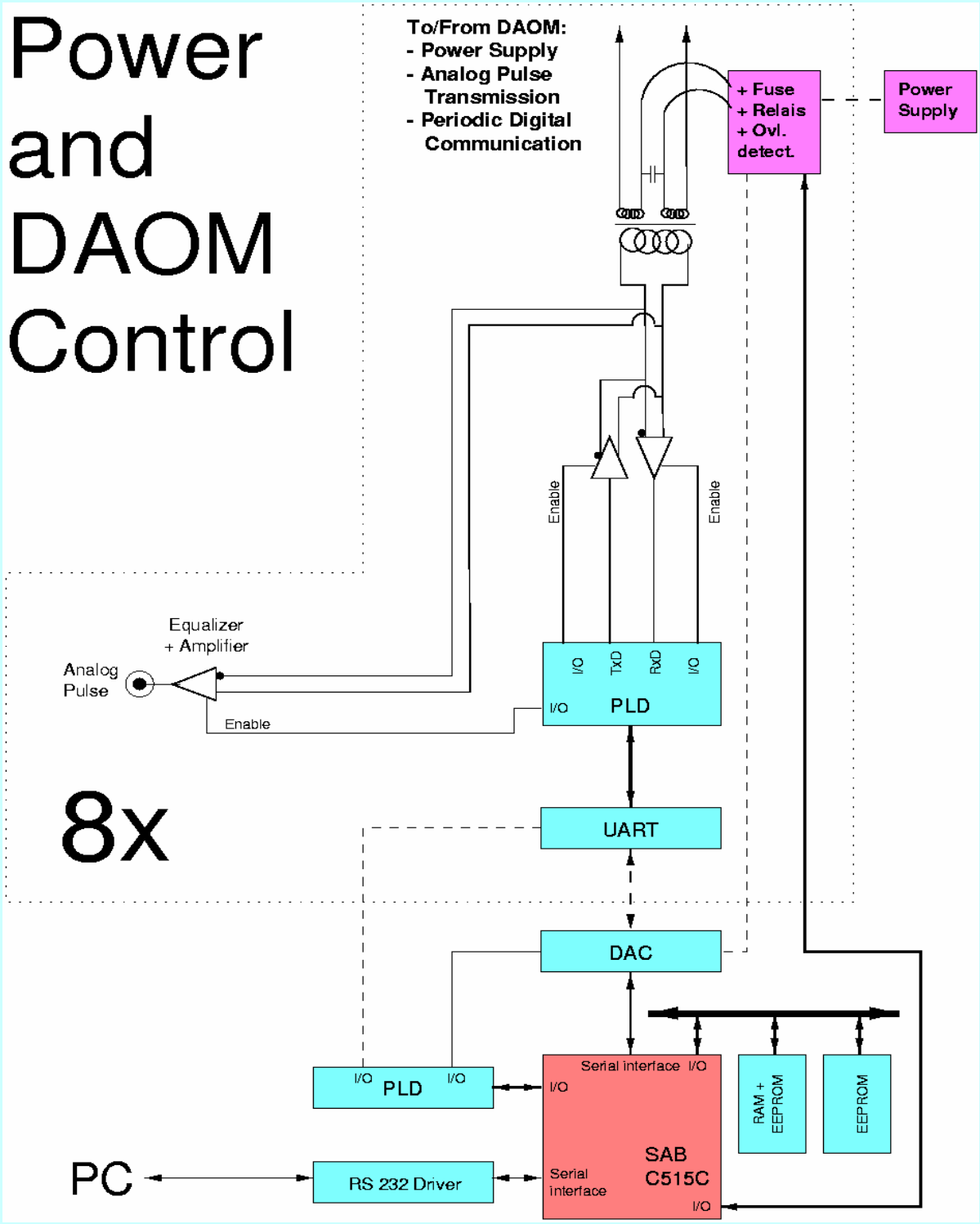
Remote Power Supply & HV



Specifications for the HV-base (ISEG GmbH) :

- Total HV: 0 ... 2100 VDC
- HV 1. dynode: 250 ... 800 VDC
- HV anode: 600 ... 1300 VDC
- Stability: $< 1*10^{-4}$
- Temperature coefficient: $T_k < 5 * 10^{-5}$
- Ripple: < 10 mV
- Power consumption: < 140 mW
- Control voltage, HV 1. dynode: 0.25 ... 0.8 VDC
- Control voltage, HV anode: 0.6 ... 1.3 VDC
- Monitor voltage, HV 1. dynode: 0.25 ... 0.8 VDC
- Monitor voltage, HV anode: 0.6 ... 1.3 VDC
- Digital control: HV on/off
- Digital monitor: HV error
- Operating/storage temperature: -40 ... + 85 Celsius
- ***Cathode is at GND, Anode at +HV***

The dAOM Surface DAQ System



dAOM Command Format

Data is transmitted in form of frames.
The command frames for the dAOM have the format:

Preamble	C	Command ID	Parameters	CR LF

DAOM commands

	Command ID (character & space)	Parameters	Description
C	S	D1:A	Setup PMT High Voltage Dynode1:Anode
C	H	On/off	High Voltage ON = 1/0
C	E	G:LD	Analog transmitter gain G = 0..4095 LED dc bias DAC LD = 0..4095
C	V	-	Request dAOM settings & Switch on digital mode
C	C	-	Switch on analog transmission mode
C	T	hh:mm:ss	Time Setup
C	D	MM/DD/YYYY	Date Setup

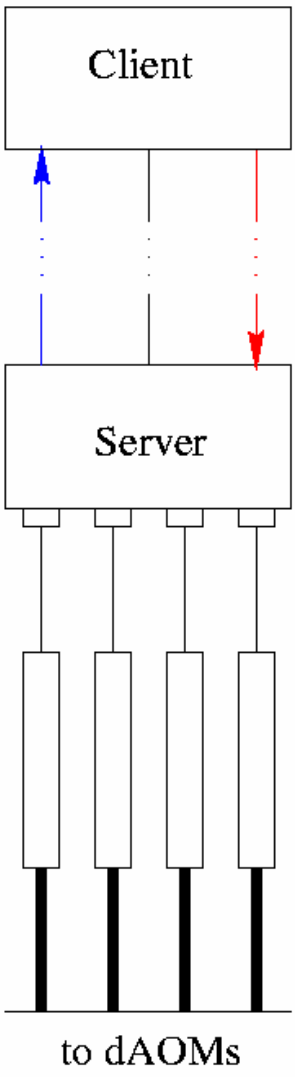
DAQ board commands

C8	K	Threshold	Power supply current monitoring Threshold = 0..4095
C8	Q	-	Request dAOM_DAQ board status
C8	H	N:on	Channel N = 0..7 Power switch ON = 1..0

Commands to download programs to DAQ boards and dAOMs

Channel #			
CN	W	one record from .hex file	Write to RAM record in Intel Hex File Format
CN	I	-	Reset Program in RAM

The Slow Control Program



@ Zeuthen or elsewhere

Command Requests

Via Internet connection

Setting Requested

pamanda3 @ South Pole

4 serial interfaces

dAOM DAQ Boards

8 dAOMs connected to each DAQ Board

Presently 23 dAOMs connected

Client Software

USE OF QT GRAPHICAL USER INTERFACE

- Easy and flexible C++ multi-platform libraries tools portable to all major operating systems
- Compatible with CORBA implementations

- Graphic interface easy to use
- Client can be in any other programming language different from Server

Client connects to Server through the network, tells it to do the requested action and visualizes dAOM Settings

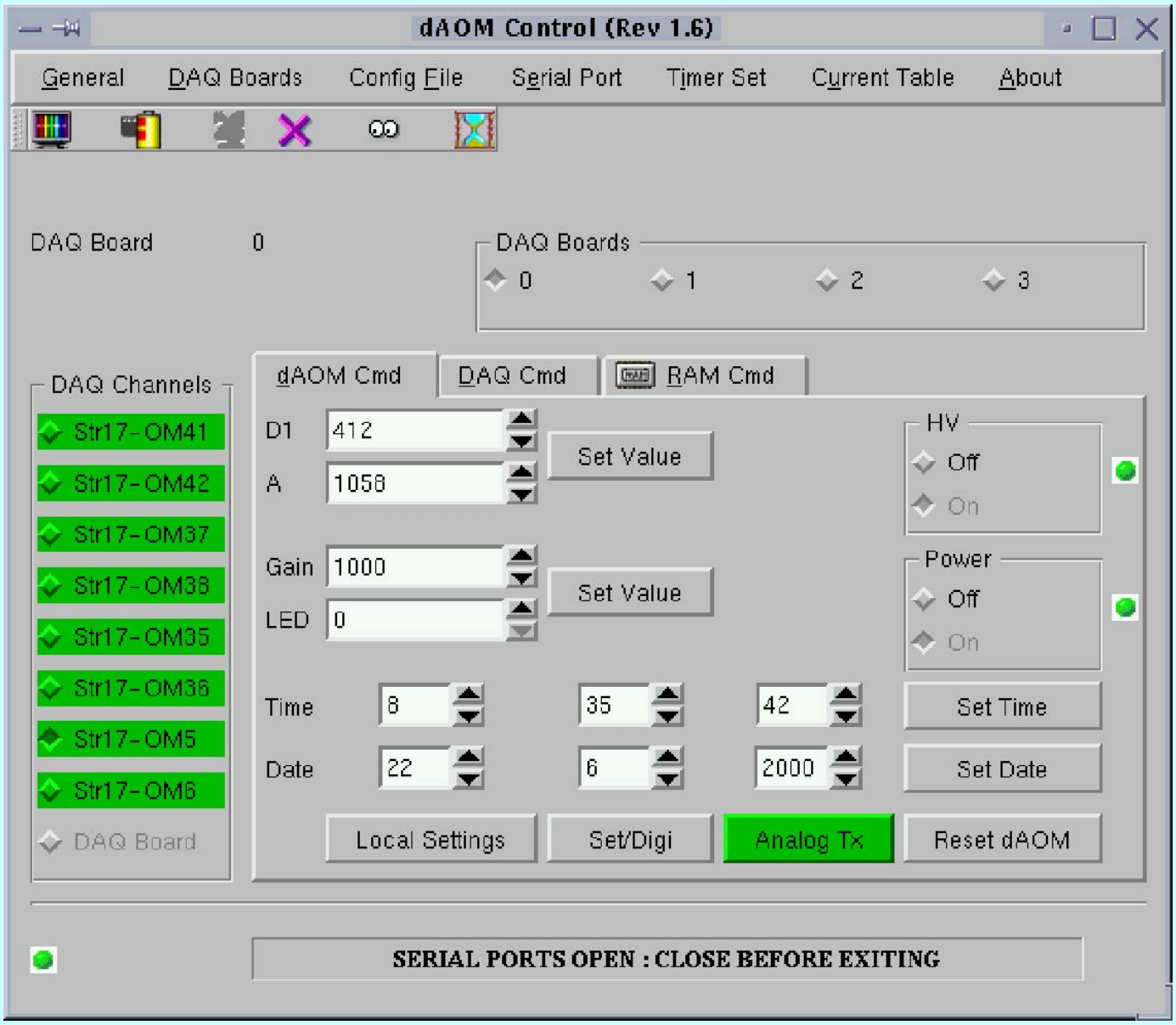
dAOM Monitoring

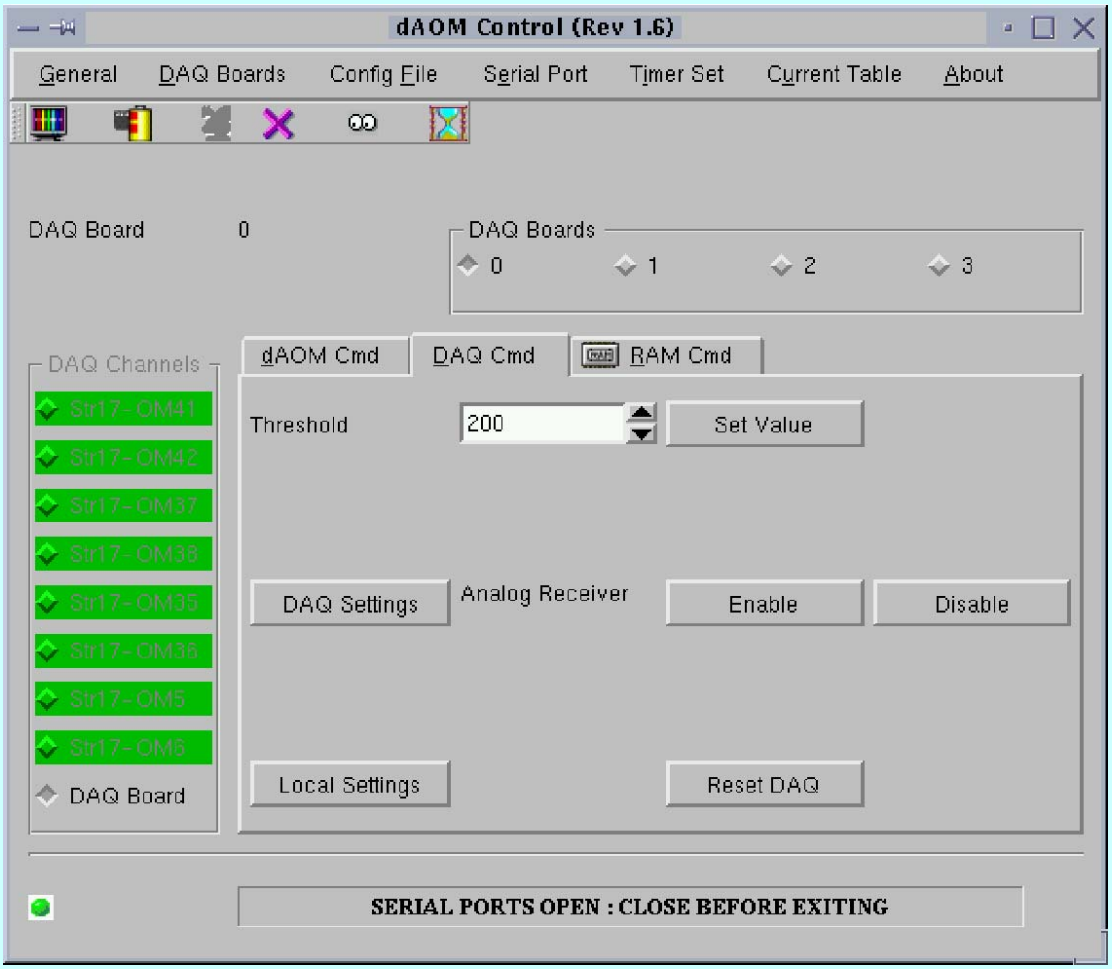
- NON-continous Monitoring to avoid digital signal interference with data flow
- Weekly Monitoring since 27^{th} March
  - Status Report on

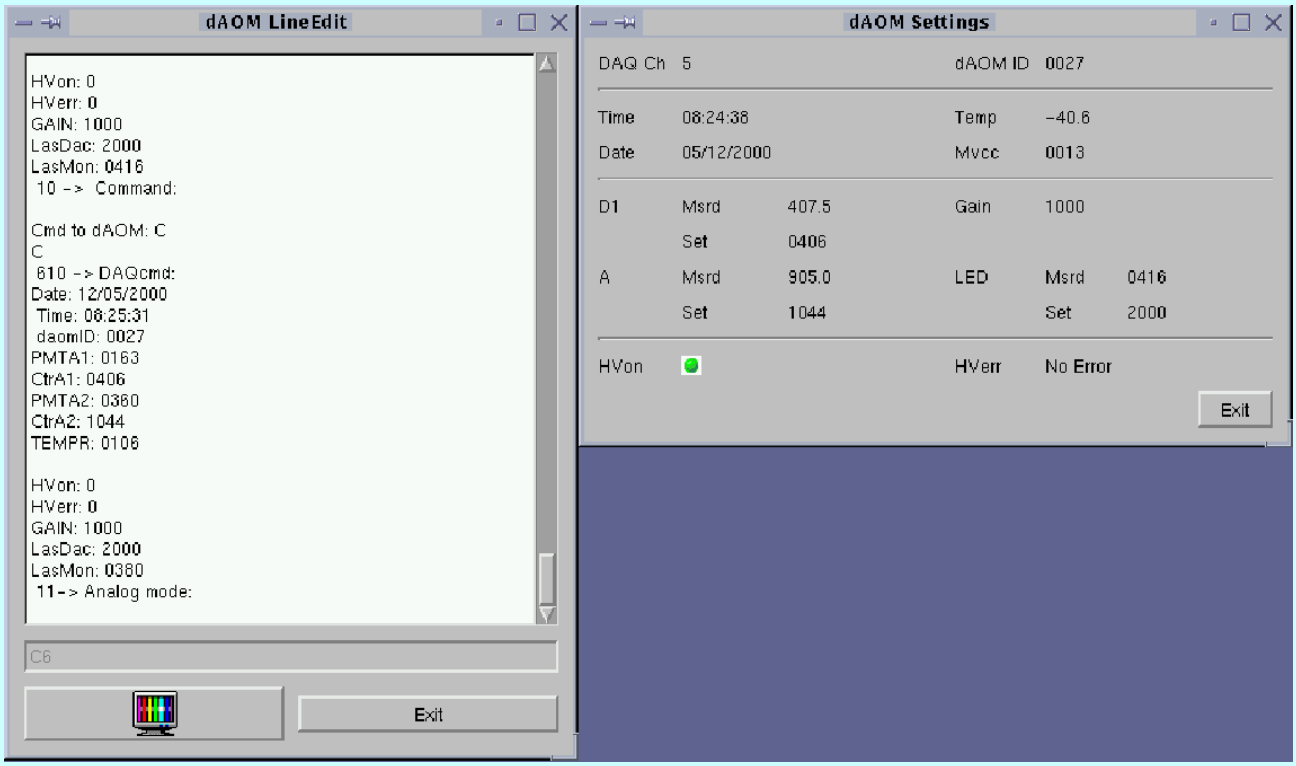
    `http://www.ifh.de/~desiati/dAOM/dAOM_Status.html`

- Monitor dAOM behaviour over long term
- Discover of instabilities and/or malfunctioning
- Correlations with muon data content
- Learn what can be improved for the next season

Slow Control User Interface




dAOM Control (Rev 1.6)
General
DAQ Boards
Config File
Serial Port
Timer Set
Current Table
About
DAQ Board
0
DAQ Boards
0
1
2
3
DAQ Channels
Str17-OM41
Str17-OM42
Str17-OM37
Str17-OM38
Str17-OM35
Str17-OM36
Str17-OM5
Str17-OM6
DAQ Board
dAOM Cmd
DAQ Cmd
RAM Cmd
Threshold
200
Set Value
DAQ Settings
Analog Receiver
Enable
Disable
Local Settings
Reset DAQ
SERIAL PORTS OPEN : CLOSE BEFORE EXITING


dAOM LineEdit
HVon: 0
HVerr: 0
GAIN: 1000
LasDac: 2000
LasMon: 0416
10 -> Command:
Cmd to dAOM: C
C
610 -> DAQcmd:
Date: 12/05/2000
Time: 08:25:31
daomID: 0027
PMTA1: 0163
CtrA1: 0406
PMTA2: 0360
CtrA2: 1044
TEMPR: 0106
HVon: 0
HVerr: 0
GAIN: 1000
LasDac: 2000
LasMon: 0360
11-> Analog mode:
C6
Exit
dAOM Settings
DAQ Ch 5
dAOM ID 0027
Time 08:24:38
Temp -40.6
Date 05/12/2000
Mvcc 0013
D1 Msrd 407.5
Gain 1000
Set 0406
A Msrd 905.0
LED Msrd 0416
Set 1044
Set 2000
HVon
HVerr No Error
Exit

dAOM Design Improvements

- Decreased power consumption
  - New DC/DC Converter
  - New 16 Bit μC (Siemens C164)
- CAN Bus based digital communication
- Changes in the Mechanics of the ISEG Base
- piggy pack Optical Transmitter Modul (OTM)
- ‘1 pe’ test pulser ?
- ...

dAOM DAQ System in CPCI Standard