IceCube DOM Development

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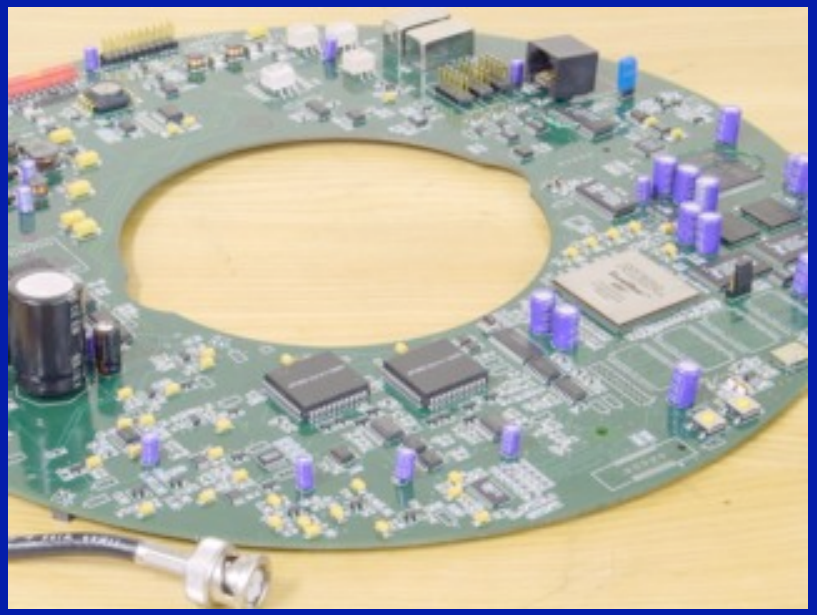
- DOM Mainboard Overview
- STF Test Development
- ATWD Ping-Pong Mode
- IceTop Second Penetrator

Mainboard Overview



- ARM microprocessor
- Programmable devices: FPGA, CPLD, serial PROM
- Flash memory file system

Xilinx CPLD

- CPLD = complex programmable logic device
- Firmware in VHDL
- Lower-level functions: HV, Flasherboard interfaces
- Stores firmware w/o power, but harder to change (JTAG)

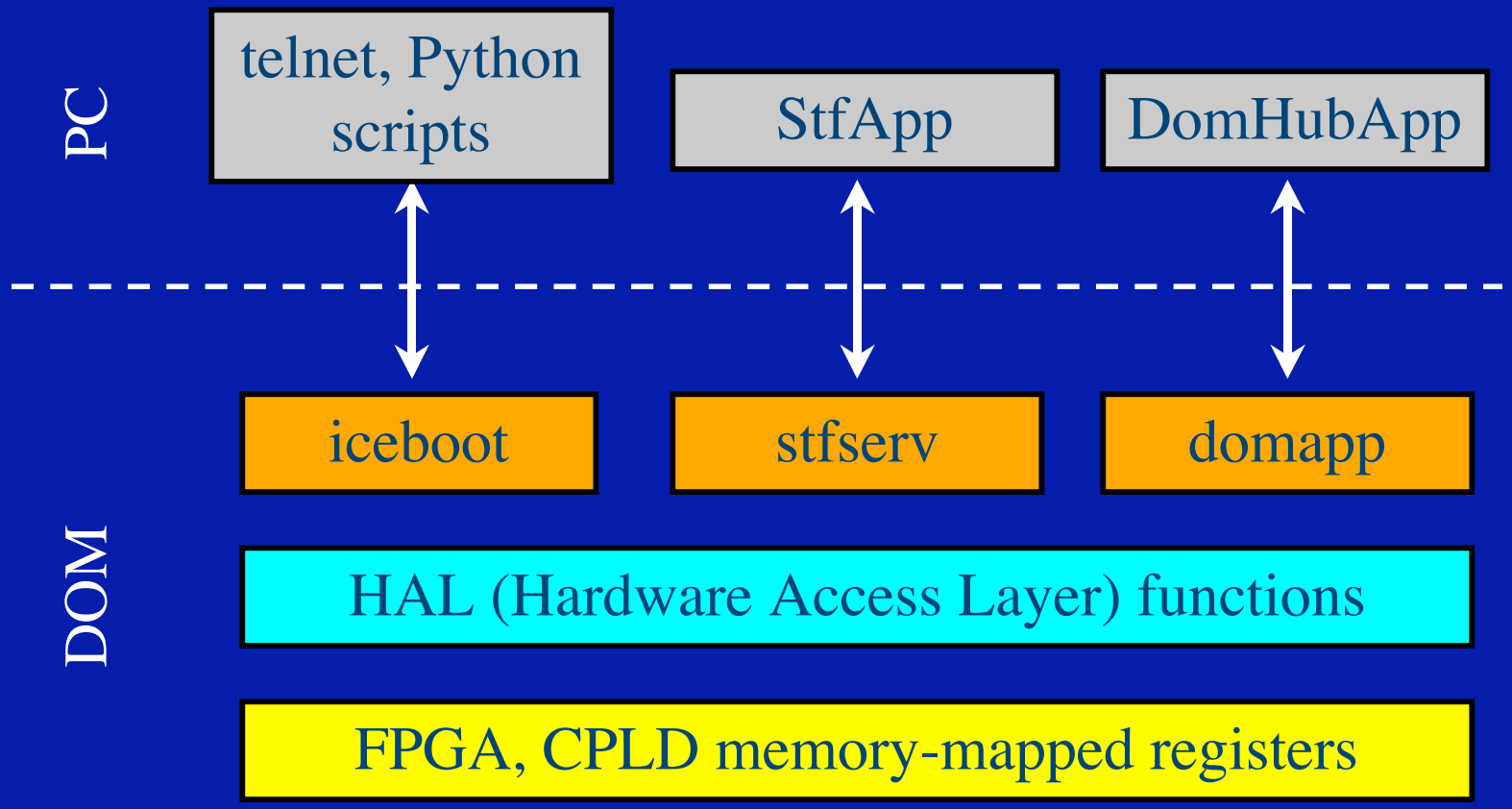
Excalibur: **FPGA**+ARM

- FPGA = field programmable gate array
- Firmware in VHDL (mostly)
- Controls triggers, communications, etc.
- Must reload after power-cycle, but easy to do
- EPXA1 vs. EPXA4

Excalibur: FPGA+**ARM**

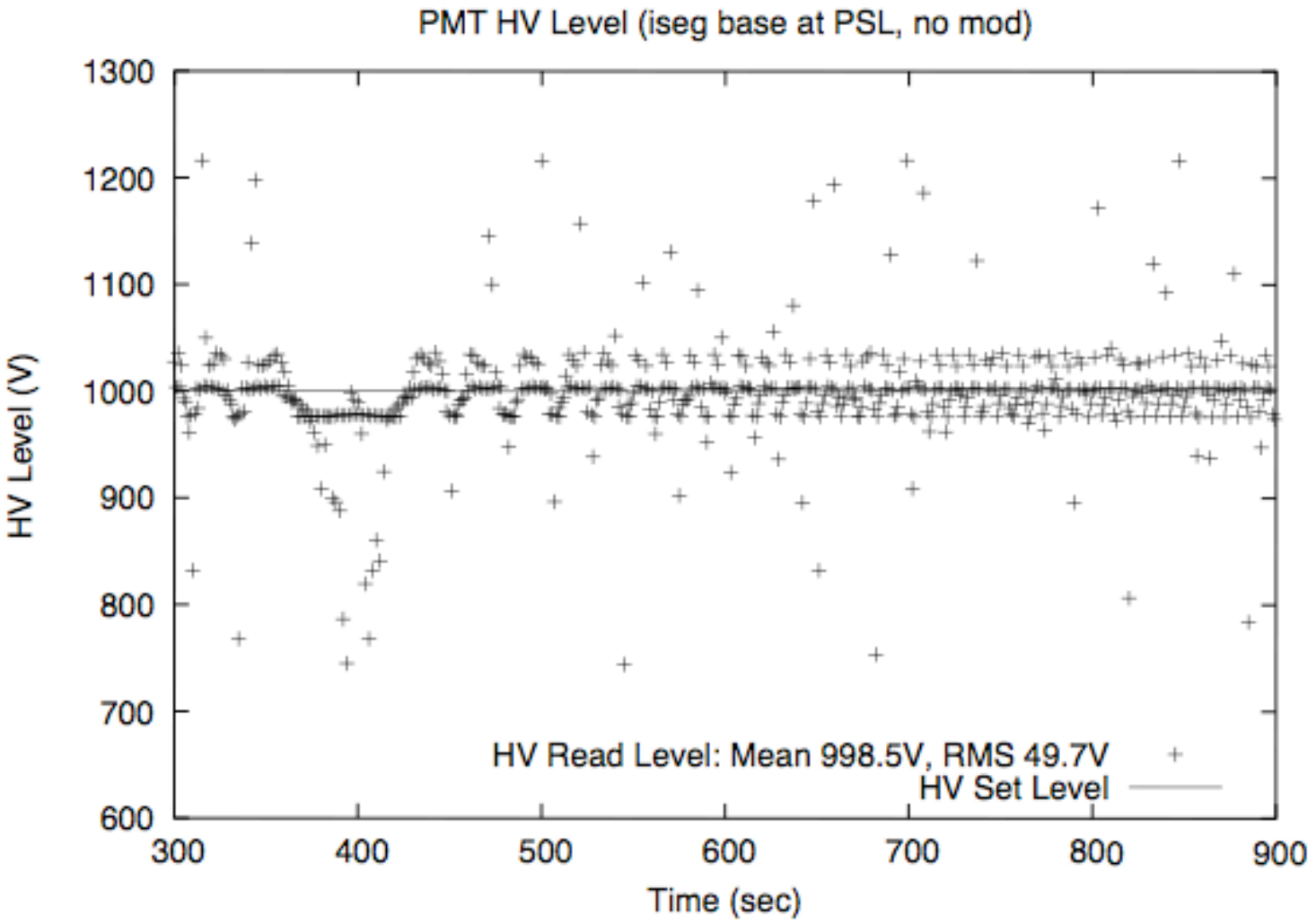
- ARM9 processor core
- High-level MB software (iceboot, domapp, stfserv)
- Most software in C; cross-compiled on Linux and then downloaded to flash file system

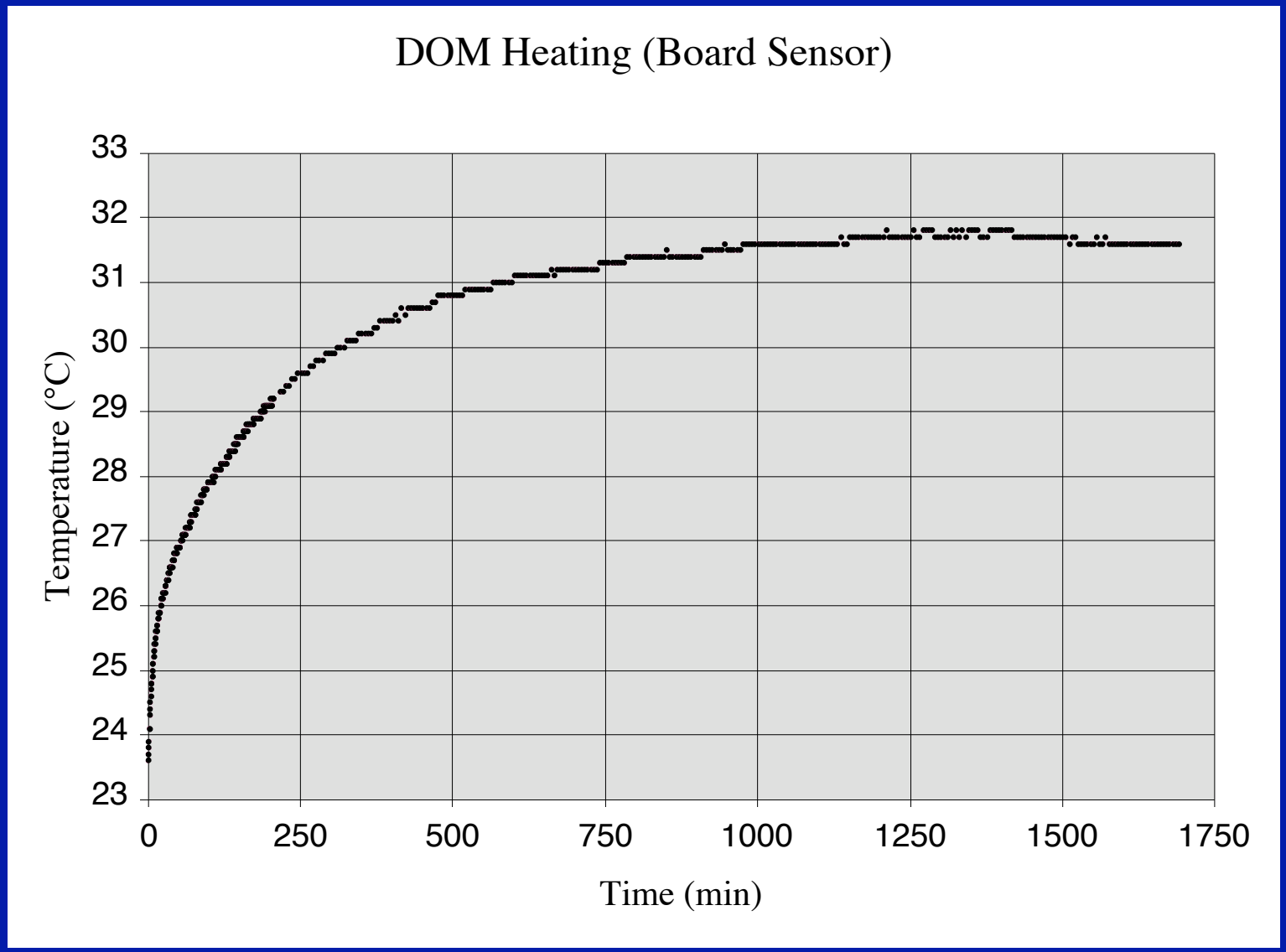
DOM Software Structure



STF: Standard Test Framework

- High Voltage Stability
- High Voltage Ramp
- Self-Heating (ad hoc)
- PMT P/V Ratio (in progress)


PMT HV Level (iseg base at PSL, no mod)
HV Level (V)
1300
1200
1100
1000
900
800
700
600
300
400
500
600
700
800
900
Time (sec)
HV Read Level: Mean 998.5V, RMS 49.7V
HV Set Level


DOM Heating (Board Sensor)
Temperature (°C)
33
32
31
30
29
28
27
26
25
24
23
0
250
500
750
1000
1250
1500
1750
Time (min)

ATWD Ping-Pong Mode

- ATWD: Analog Transient Waveform Digitizer
- Digitizes PMT pulses
- Largely controlled by FPGA

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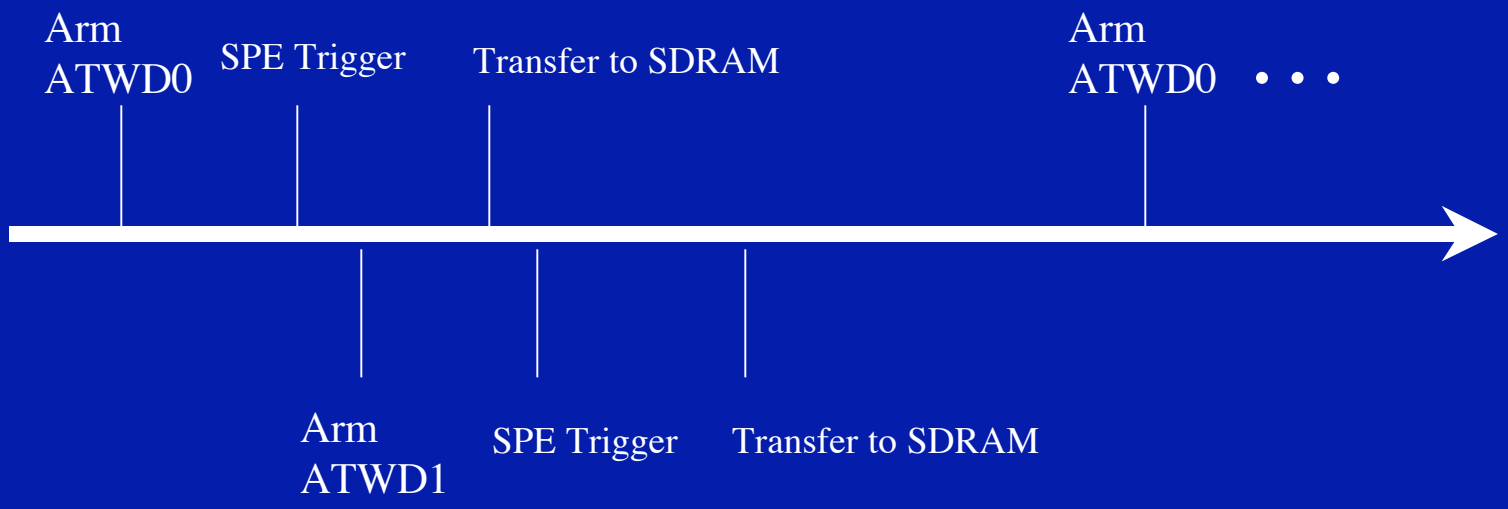
Without Ping-Pong:

With Ping-Pong:

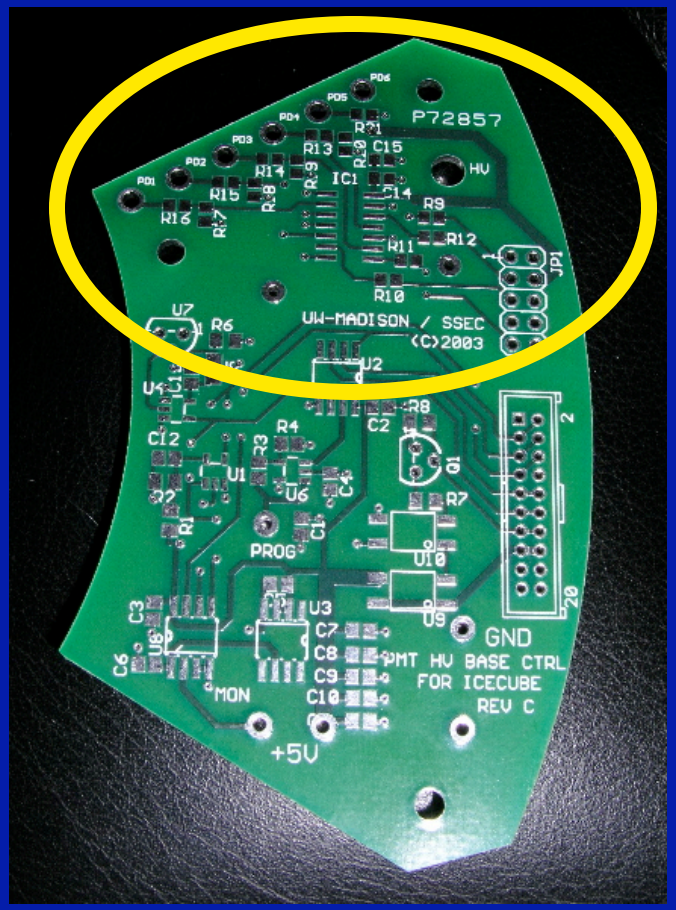


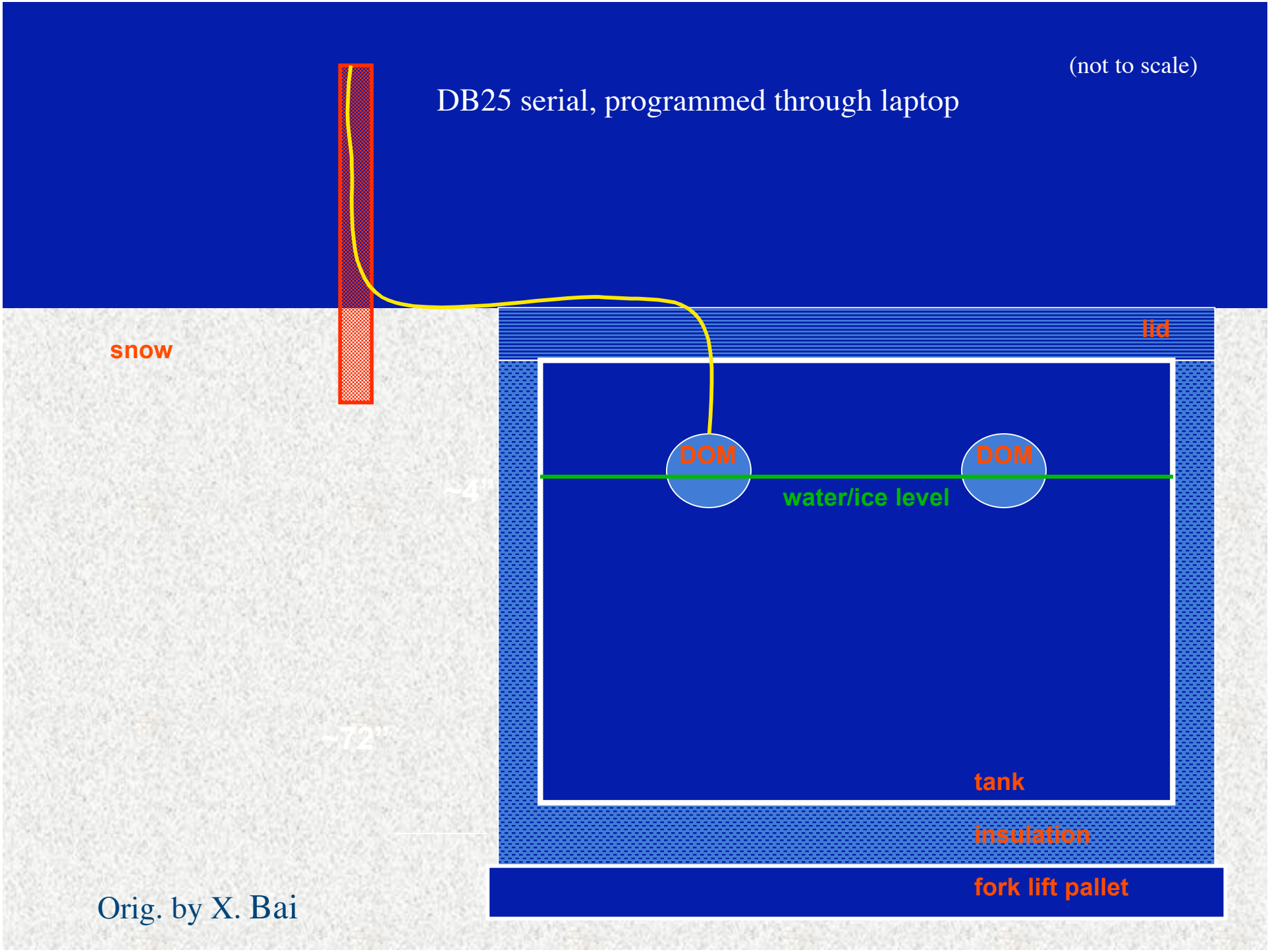
Gory Implementation Details

- FPGA firmware modified for new ATWD trigger control (two interlocked state machines); also added timestamping
- ATWD readout handshaking (SDRAM transfer still controlled by software)
- Ping-pong HAL calls
- Packaged in an iceboot function, “acq-pp”
- Improves maximum acquisition rate (burst) to ~10 kHz

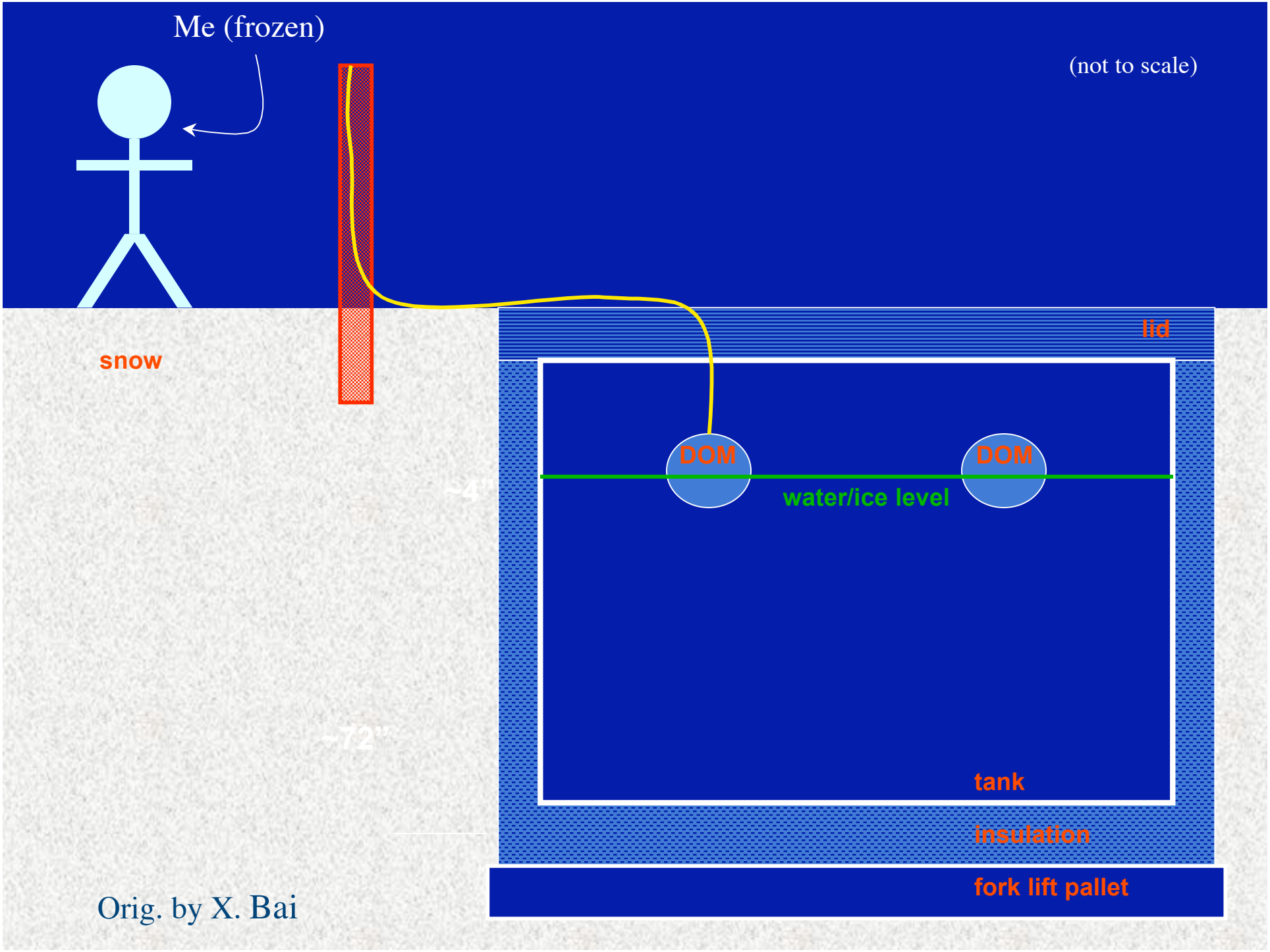
IceTop Penetrator

- Serial PROM will contain (changing) comm. protocol code (configboot)
- Expose JTAG port via buffer circuitry, 2nd penetrator, serial cable




(not to scale)
DB25 serial, programmed through laptop
snow
lid
DOM
DOM
~4"
water/ice level
~72"
tank
insulation
fork lift pallet

Orig. by X. Bai


Me (frozen)
(not to scale)
snow
lid
DOM
DOM
~4"
water/ice level
~72"
tank
insulation
fork lift pallet
Orig. by X. Bai