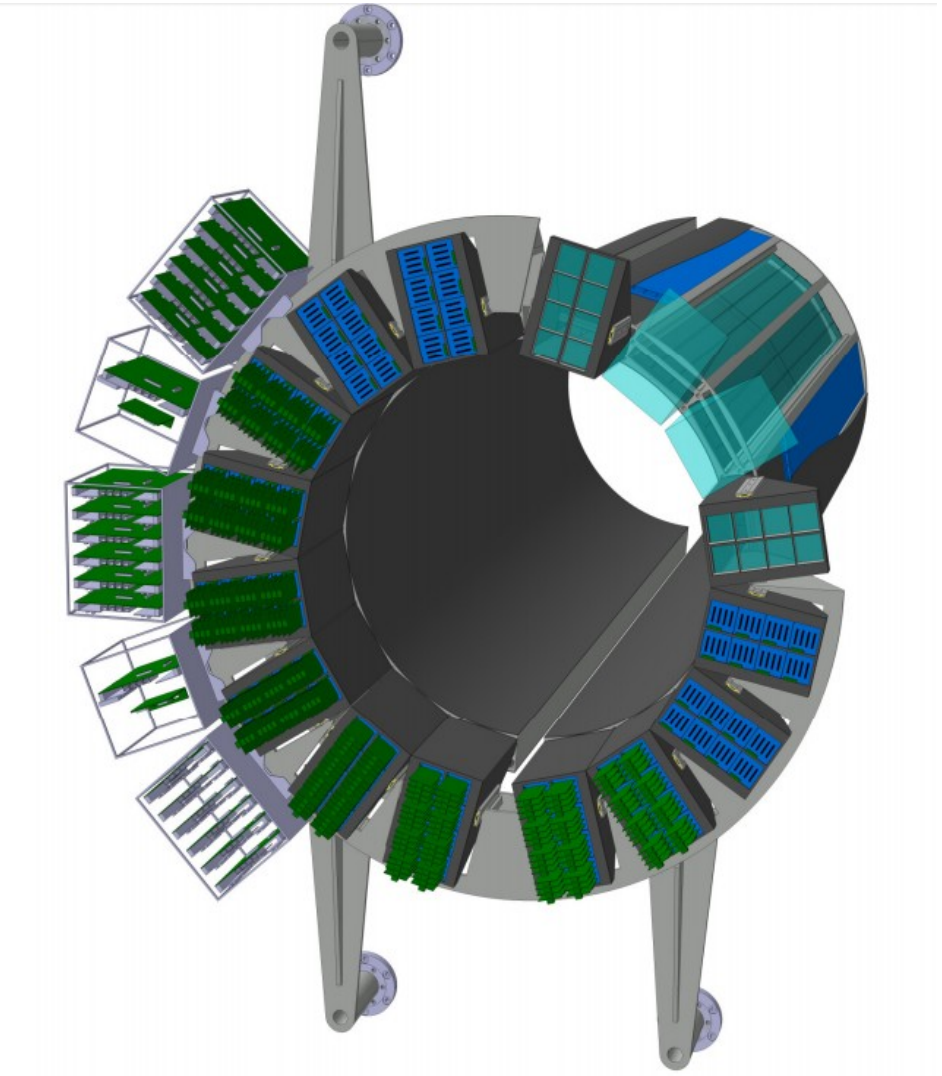
Barrel DIRC Overview

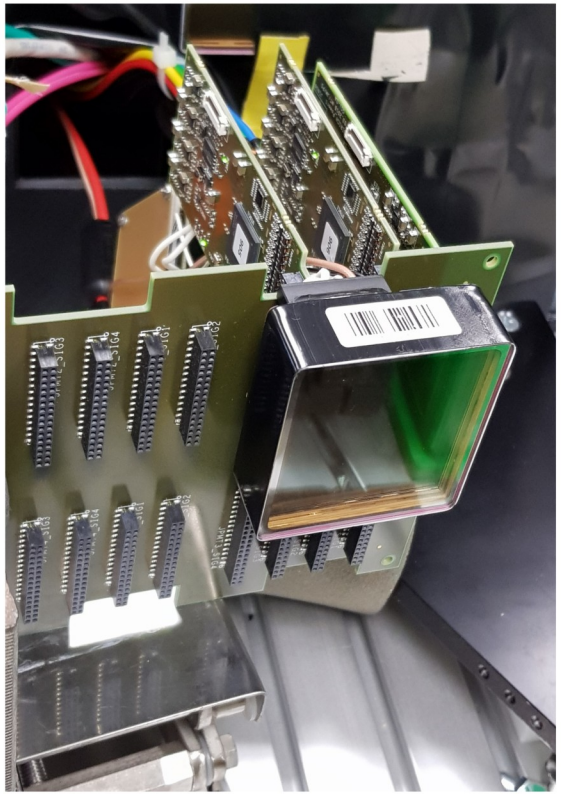
Carsten Schwarz, GSI



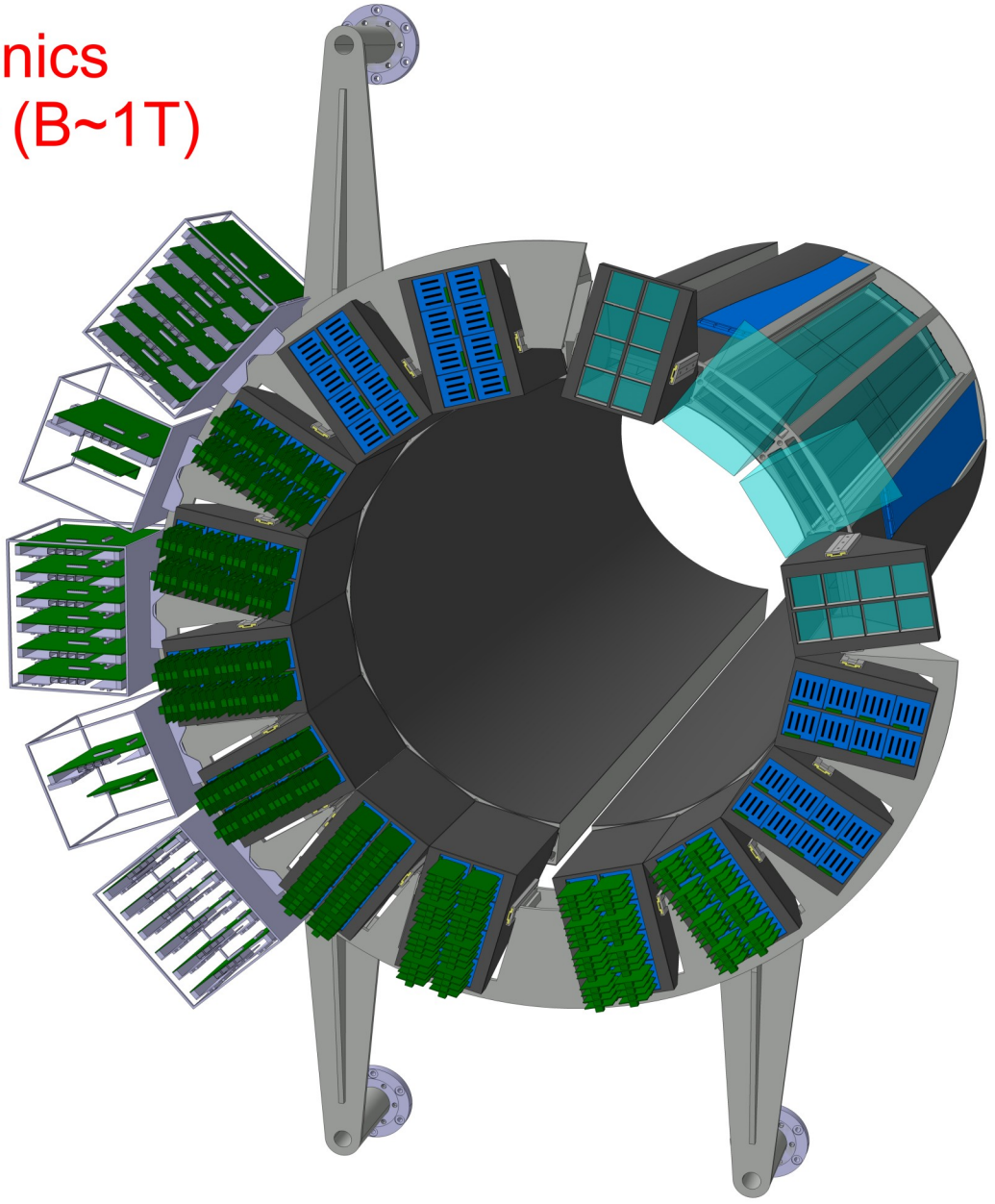
- DiRICH readout
- Power supplies
- Cooling

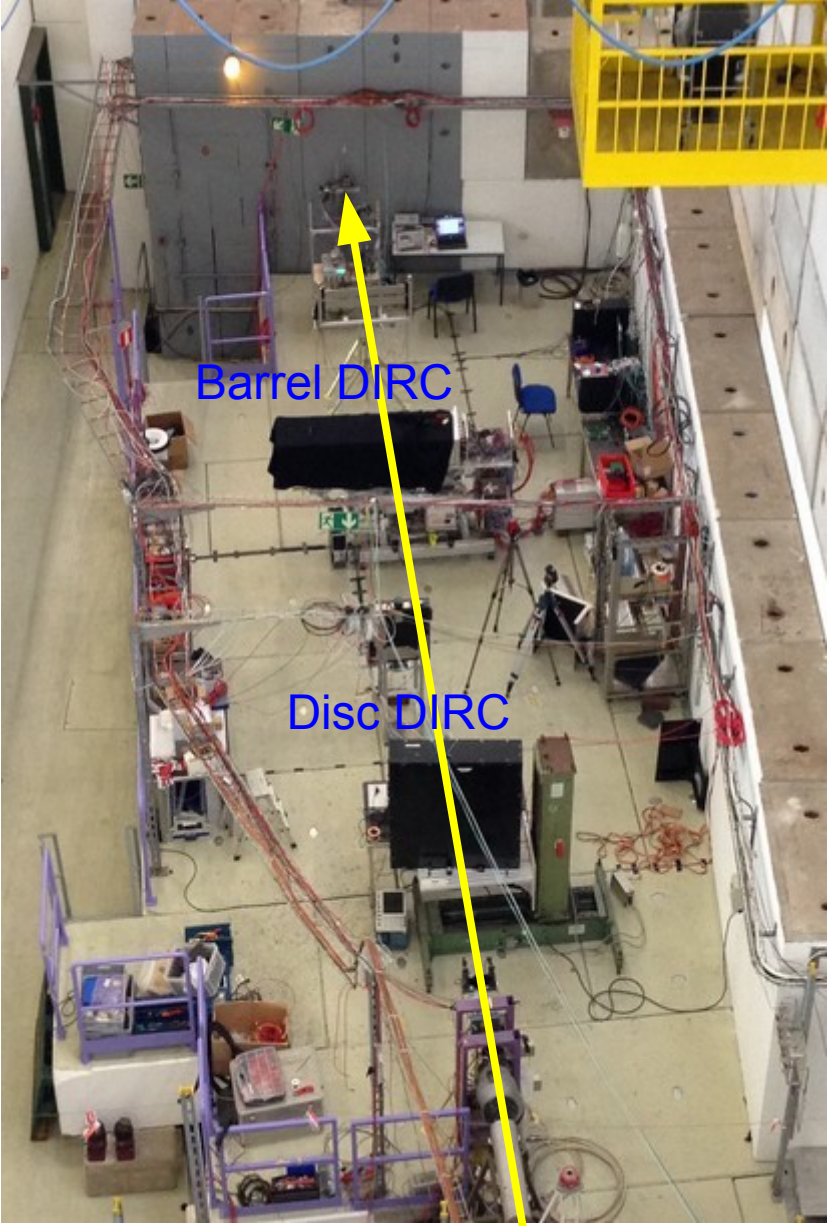
Photon detectors and electronics inside of target spectrometer (B~1T)

16 x 8 x 64
= 8192 pixel



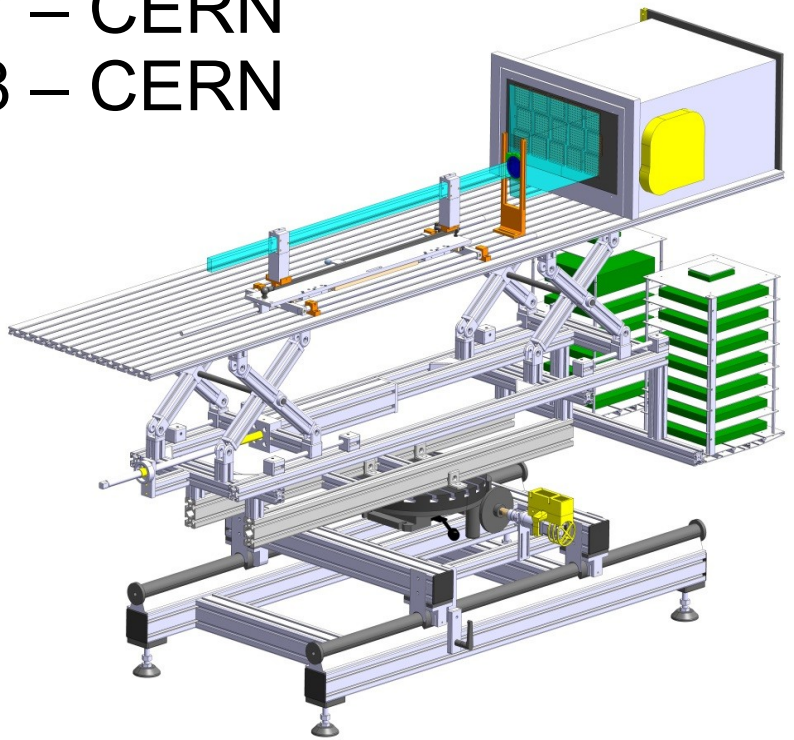
MCP-PMT, 8x8 =64 pixels
with 6x6 mm^2



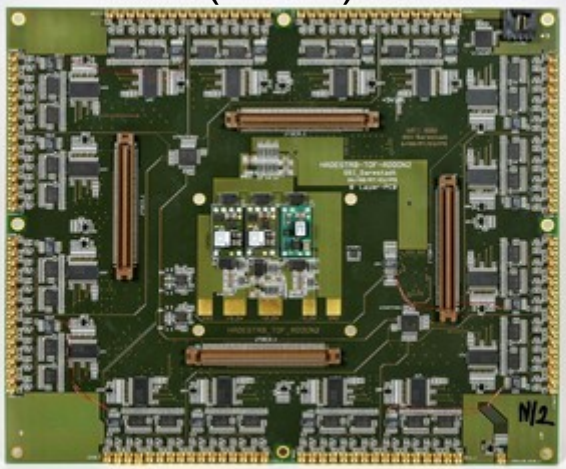


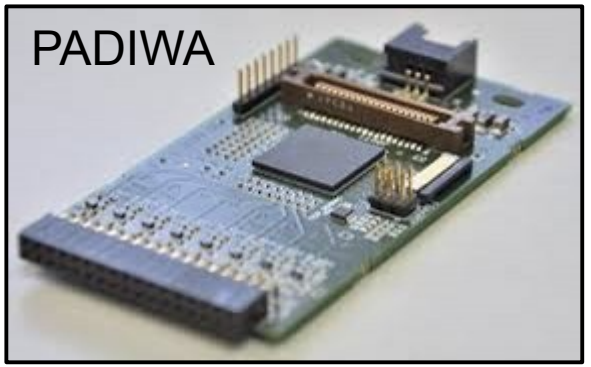
29 m TOF

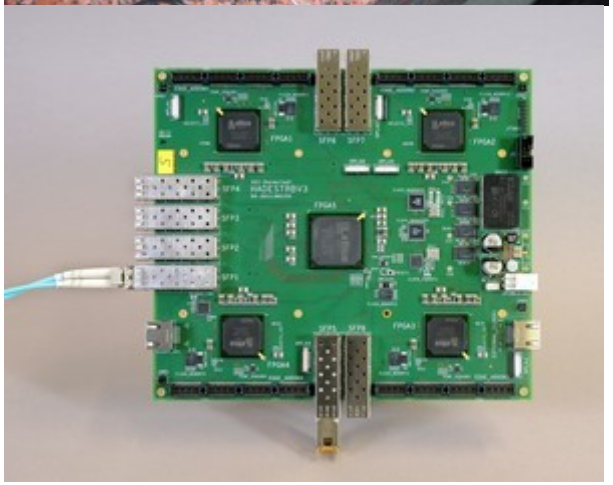
Experiments,
2008 – GSI
2009 – GSI
2011 – GSI, CERN
2012 – CERN
2013 – Mainz
2014 – GSI
2015 – CERN
2016 – CERN
2017 – CERN
2018 – CERN



TOF add-on (NINO)







TRB 2

TRB 3

Last: DIRICH
Coll. of
PANDA
CBM
HADES

Walk correction by TOT

Time over threshold spectra (TOT) show modulation which we ignore for **walk correction**

Possible explanation:
TOT + small high frequency noise

NIM A791 (2015) 16, Gonella et al.

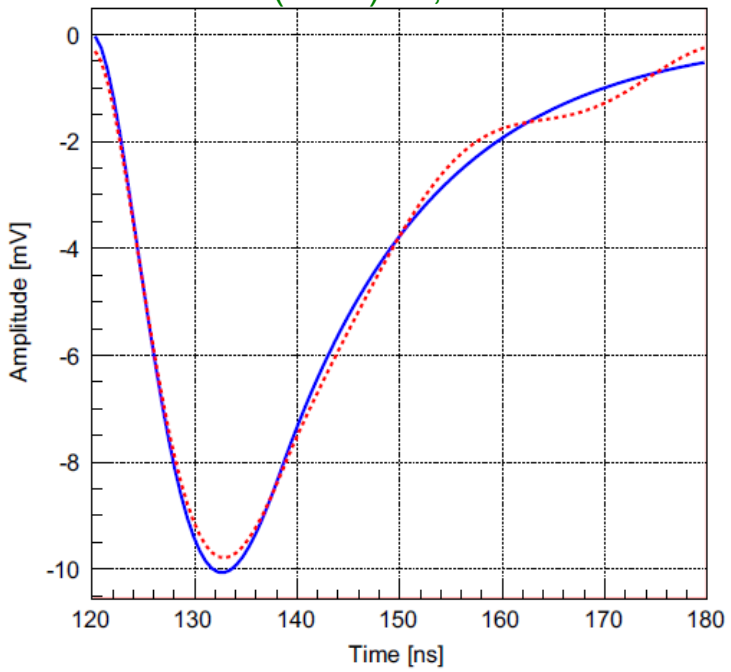
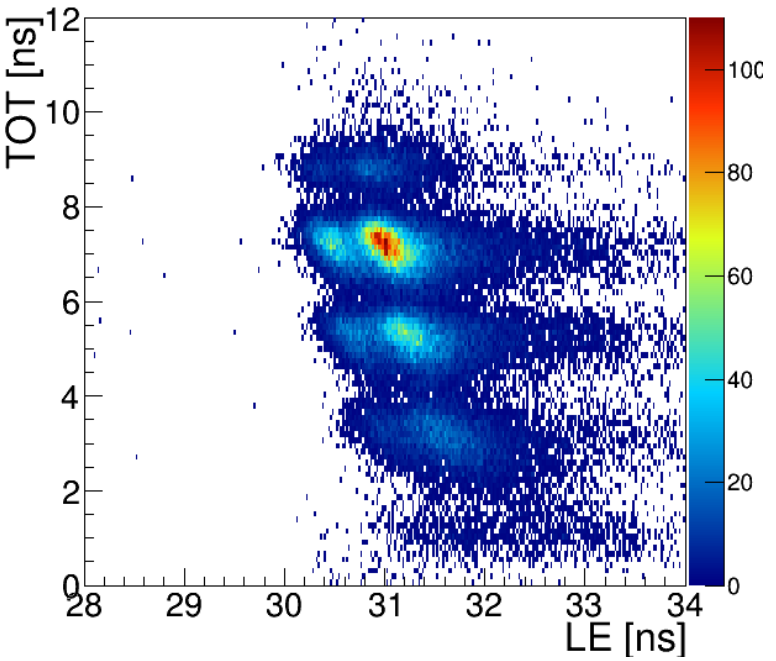
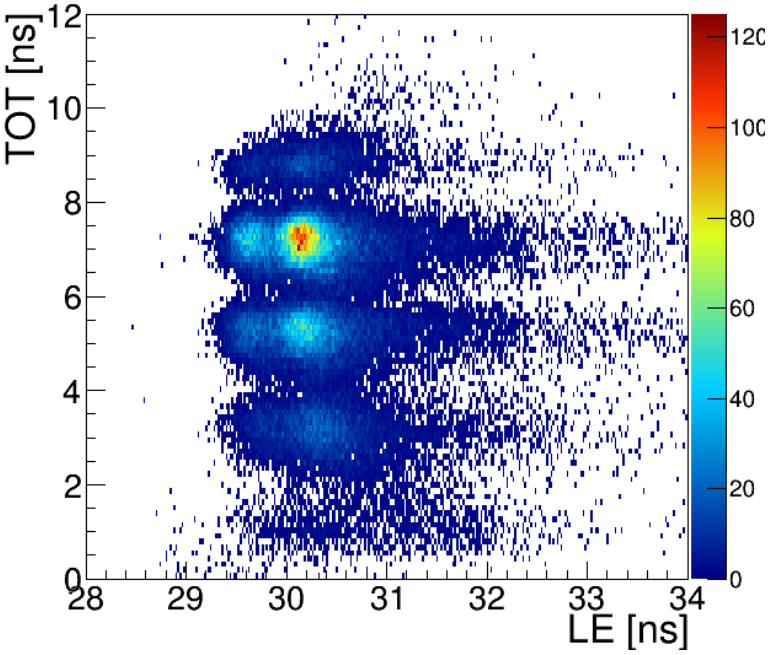


Fig. 5. Simulated shape of the output signal of the system lead-glass block – PMT without (solid curve) and with addition of 300 μV noise at 40 MHz frequency (dashed curve).

PADIWA discriminators





Amplitude

Time

DIRICH

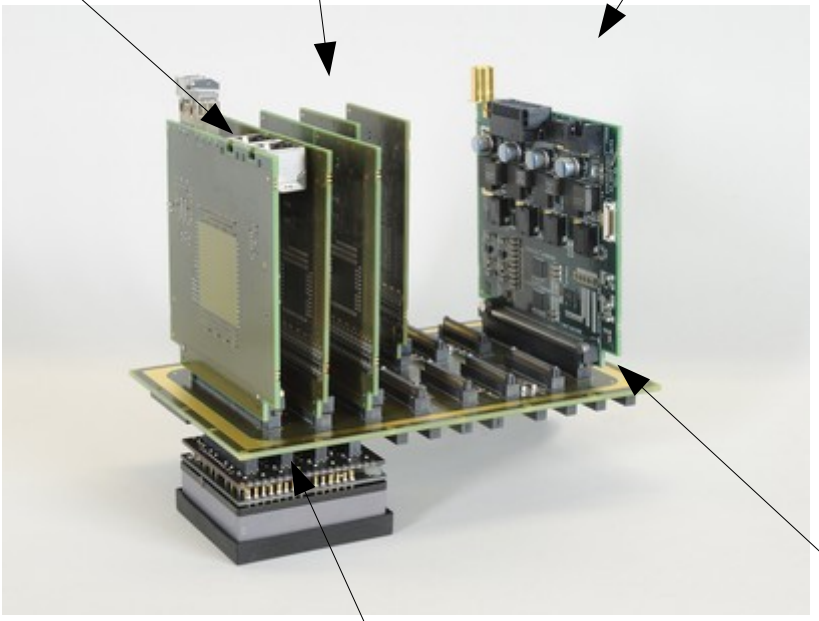
PANDA-DIRC/CBM-RICH and HADES-RICH

Successor of PADIWA3 + TRB3

12 DIRICH
FPGA TDC

Power
Module
(PM)

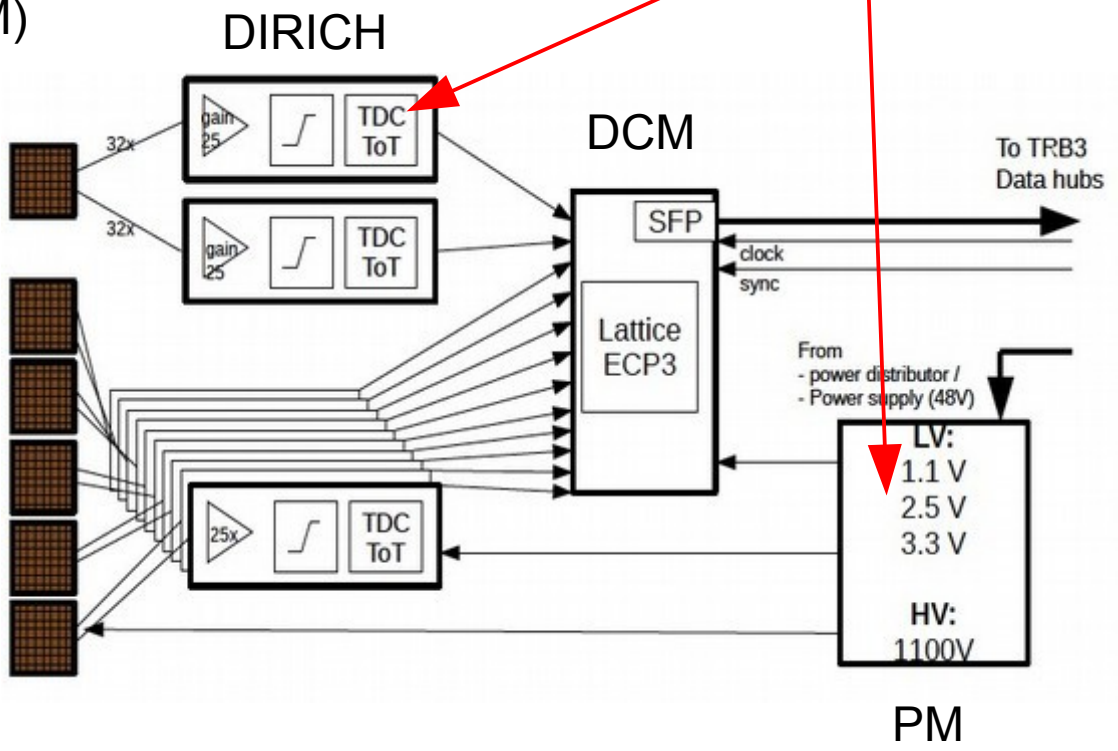
1(2) 4.8 Gb/s
links



Communication via back plane

Data Combiner Module (DCM)

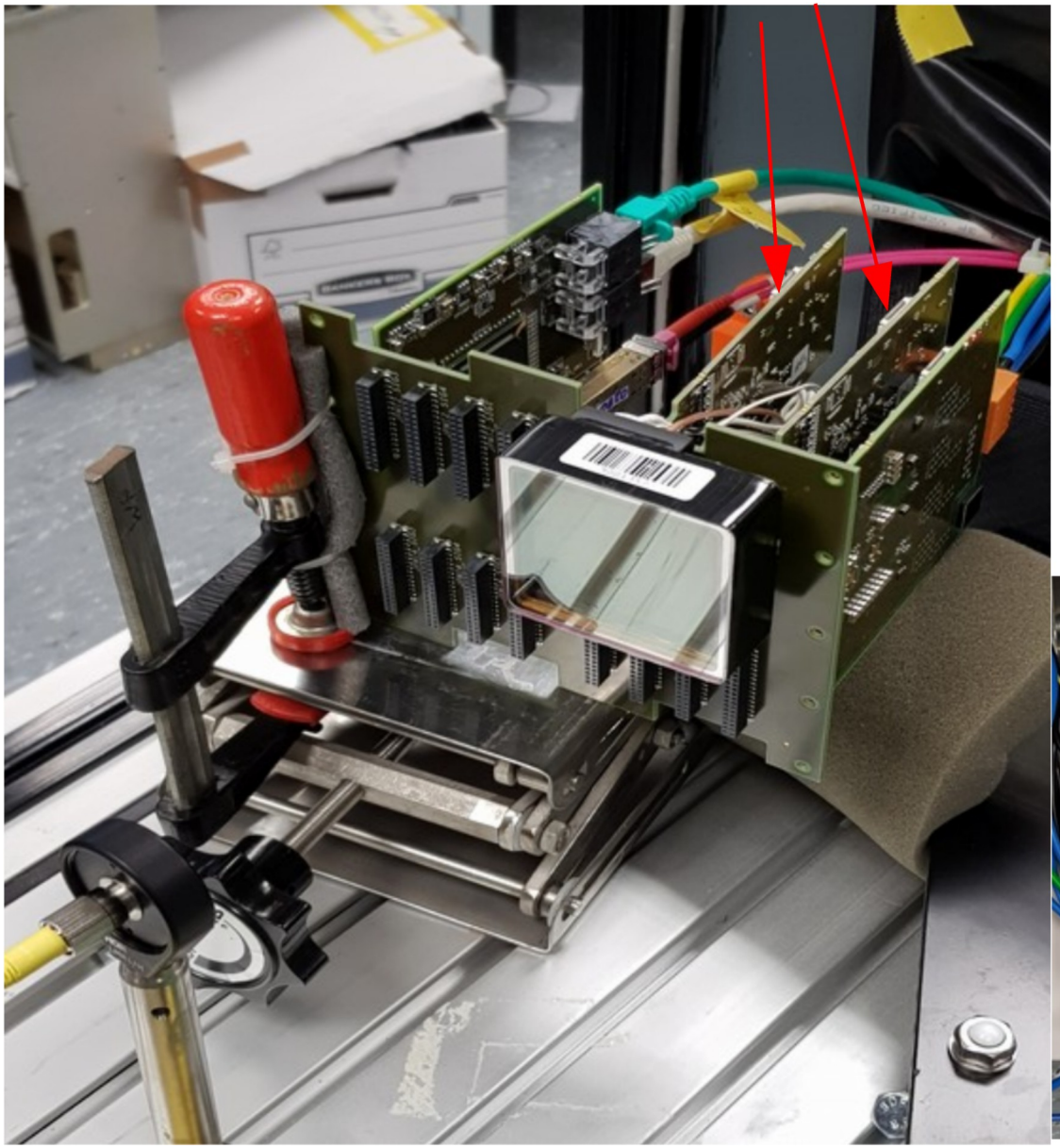
**Voltages, currents,
Temperature monitored
by perl scripts via TRB-net.**



128 MCP-PMTs:

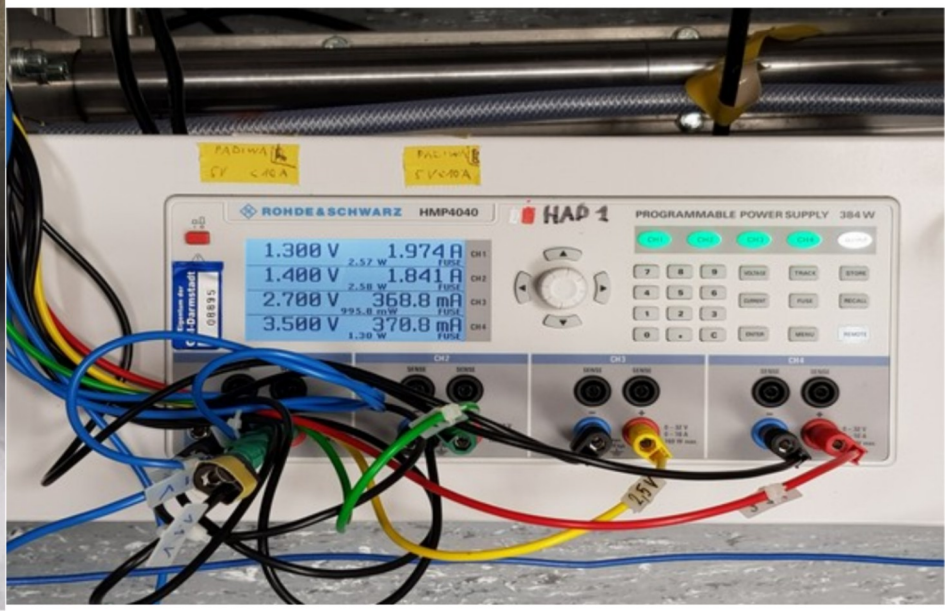
256 DiRICH
~400 A @ 1.1 V

2 DiRICH



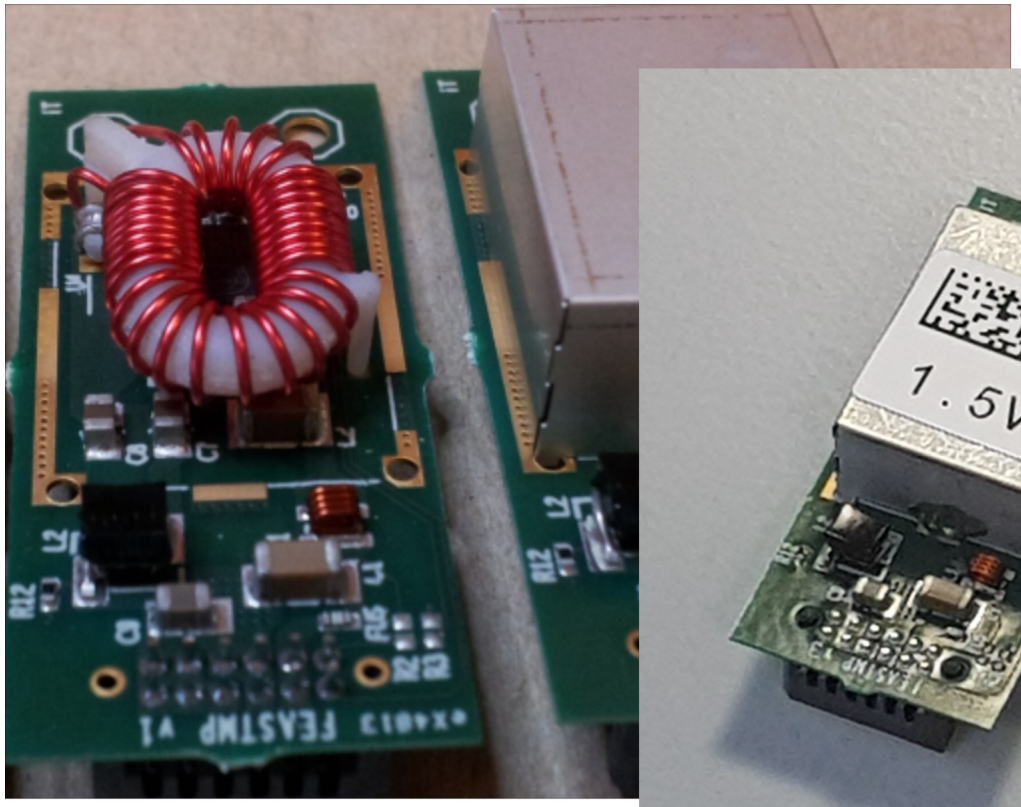
Backplane for 4 MCP-PMT

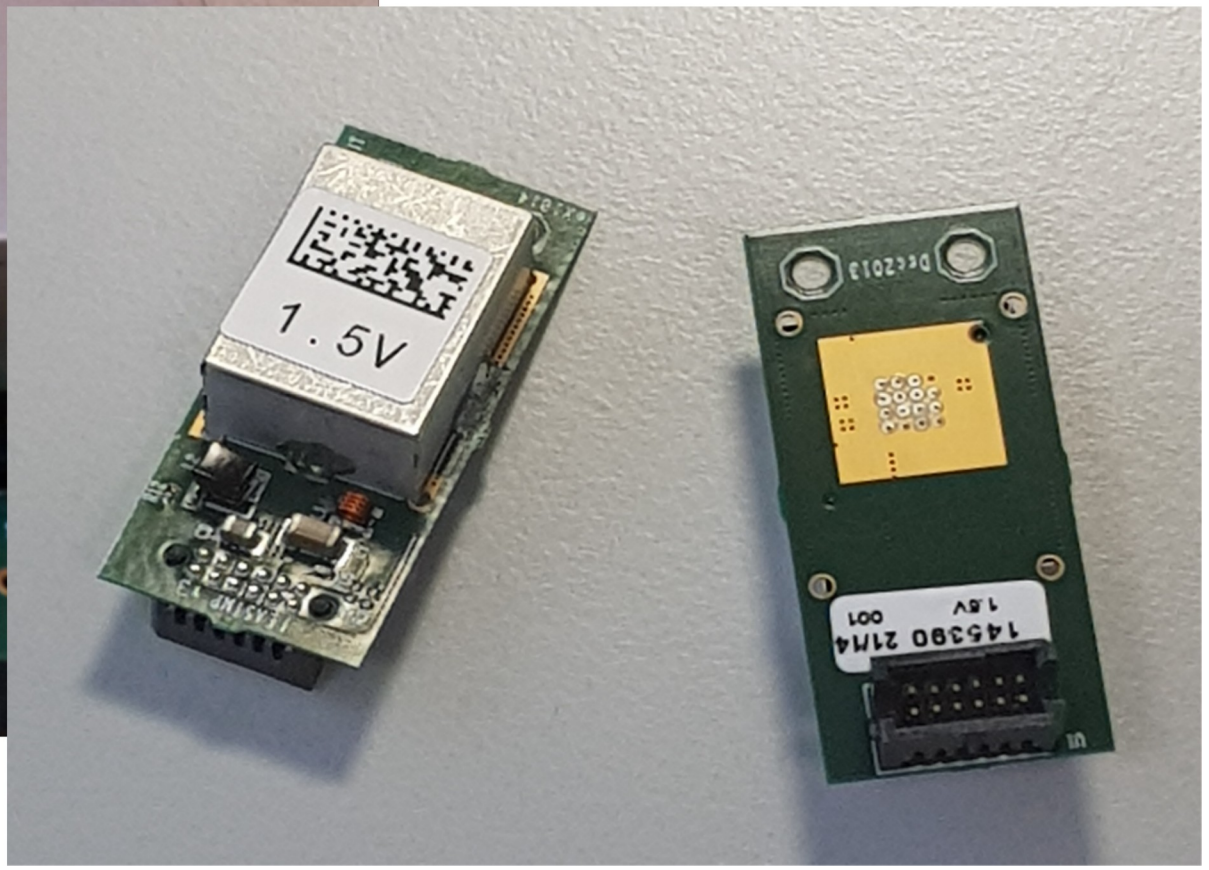
Each barbox-prism unit
has 8 MCP-PMT



First premature results
- only some channels show TOT oscillations
- about 100-150 ps timing precision

For prototype: Universal power supply





DC-DC converter, example FEAST v3

Electrical pulser **test with 1.1 V FEAST** → v3 (analog part of DIRICH) showed no deterioration

	Attenuated pocket pulser:	
Signals	36 mV	6 mV
DC-DC	53.5(1)	130-150 ps
Linear	51.5(1)	130-150ps

outside solenoid
rack

48 V → 12 V
230V → 12 V

80 A

76 W * 0.7 = 53 W

12.5 V → 3.3 V
bPOL12V

53 W

882 W * 0.7 = 618 W

12 V → 2.5 V
bPOL12V

72 W

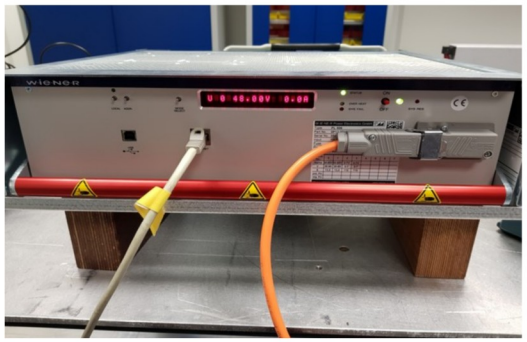
143 W * 0.7 = 100 W

2.5 V → 1.2 V
bPOL2V5

403 W * 0.7 = 282 W

2.5 V → 1.1 V
bPOL2V5

LinPOL12V ?
256 A = 282 W/ 1.1 V
640 W



Wiener PL506 (3U=133mm)
has 6 units a 800 W

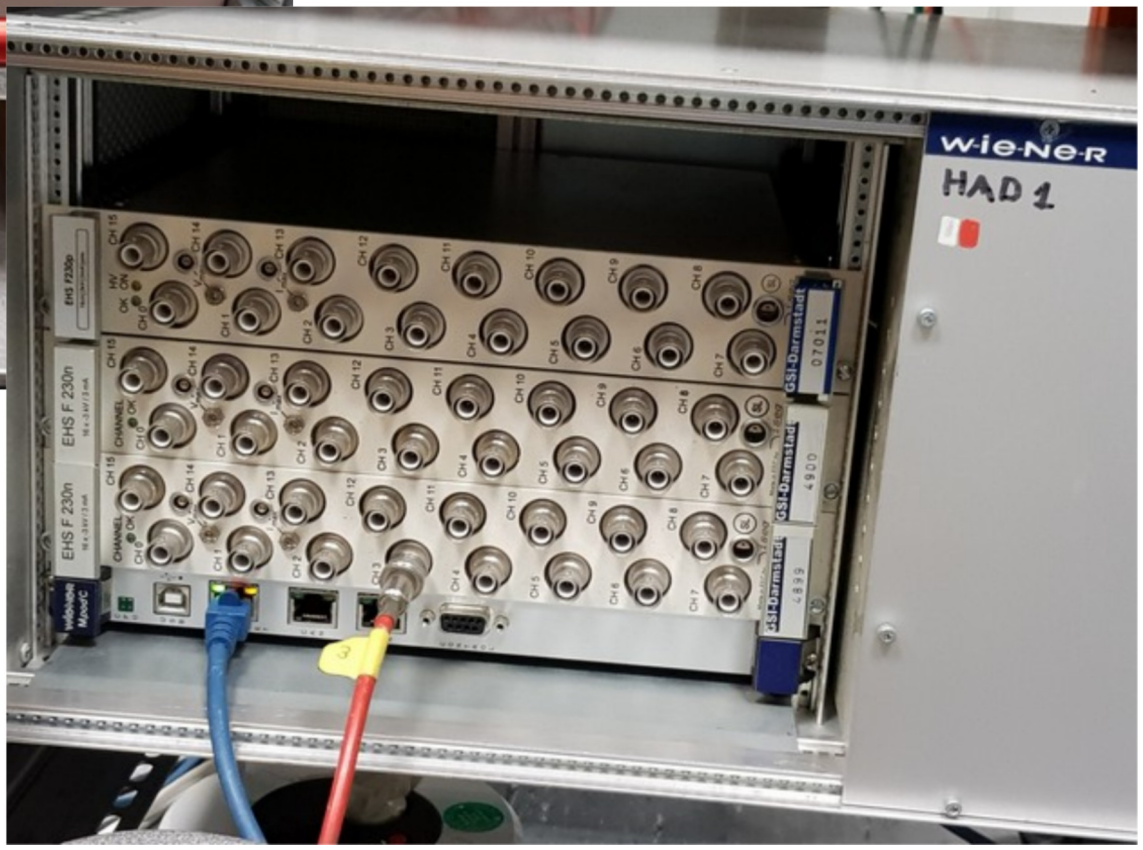
inside solenoid

Either 2 units for 12 V
or fall back solution:
1 unit 2.5 V 29 A
1 unit 3.3 V 16 A
1 unit 1.2 V 83 A
1 unit 1.1 V 256 A

384 A /

WIENER PL506

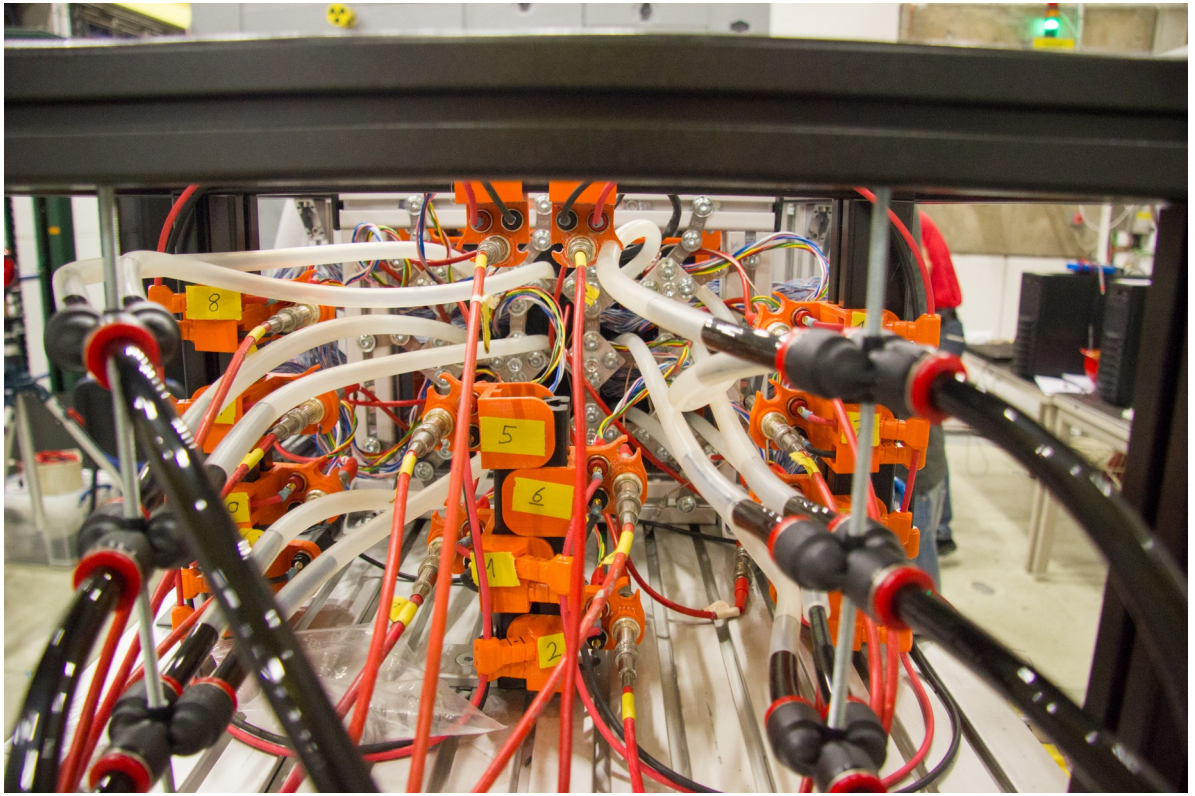
WIENER/ISEG MPOD

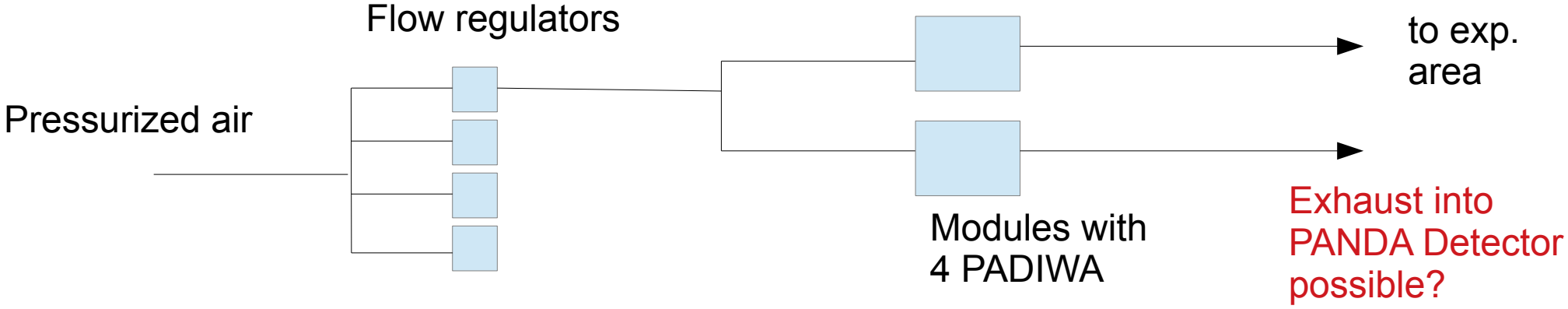


Both use the same scripting language:

Simple Network Management Protocol (SNMP)

Cooling of PADIWA discriminators at CERN experiments 2017/18





For DiRICH: Amount of air depends on heat transfer → Test setup needed.

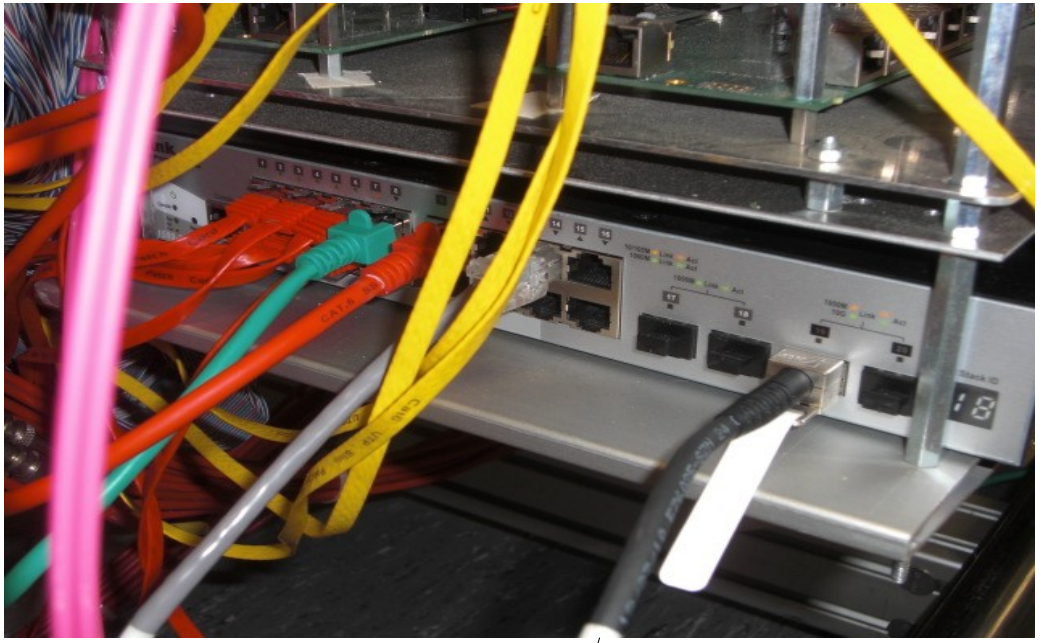
Summary

- Barrel DIRC uses DiRICH
- Power distribution options:
  - 48 V line going into detector
  - 12V line going into detector
  - four voltages
- Cooling scheme options:
  - pressurized air
  - water

20 Mhz interaction rate
x 2 charged particles (barrel)
x 50 detected Cherenkov photons

→ 2 10^9 hits/s

Leading edge (32 bit)
+ trailing edge (32 bit)
+ overhead (32 bit)
for TOT → 96 bits (12 bytes)



→ 200 Gbit/s
- 1,2,4,... copper Ethernet links
  (routing geometry to outside)