FARICH prototype status

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Budker INP

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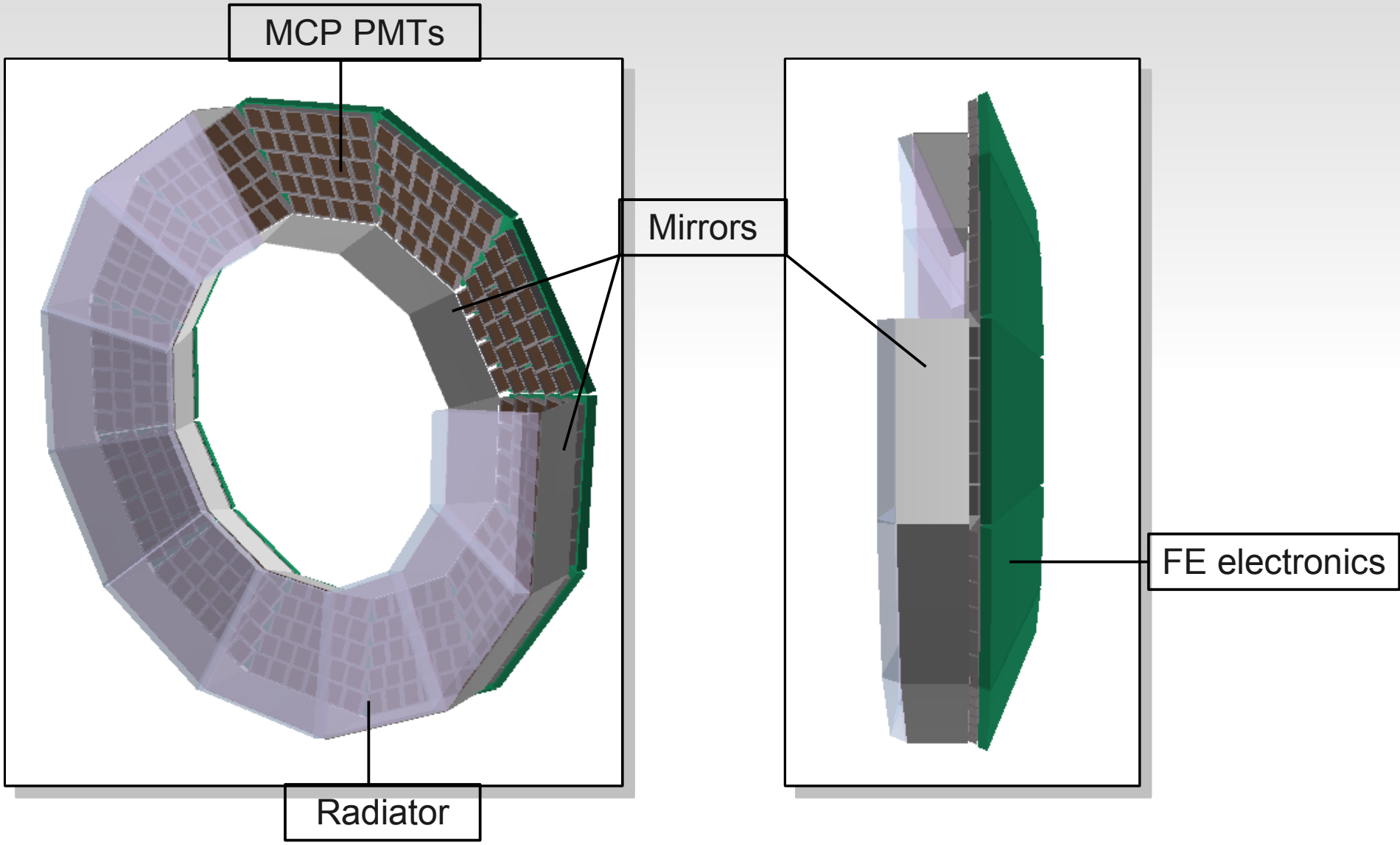
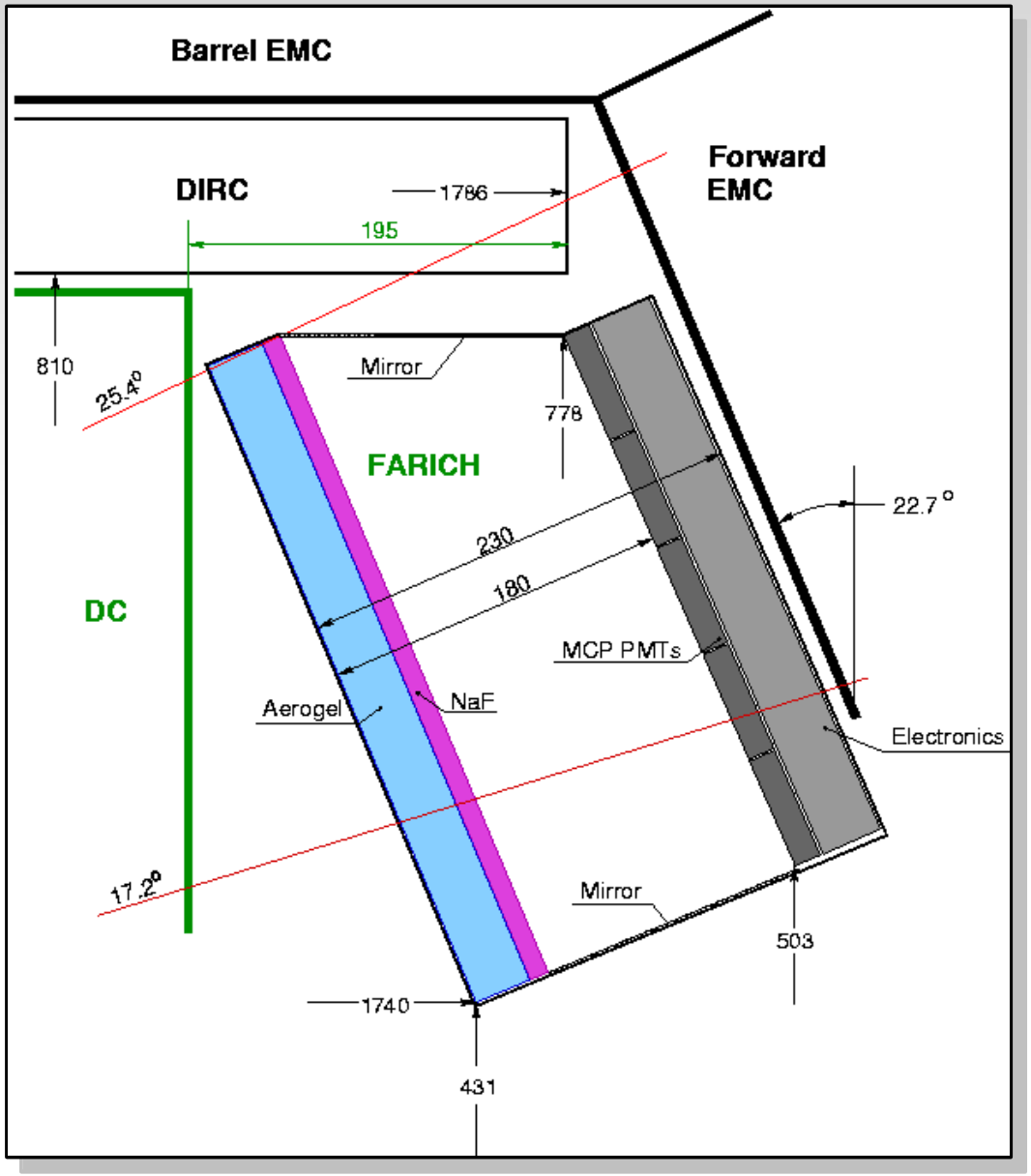
FARICH for SuperB



FARICH for SuperB



- Expansion gap ~180 mm
- 312 Photonis XP85012 MCP PMTs
- 3-layer focusing aerogel n_{max} =1.07, 40mm thickness
- NaF 5mm thickness

Material budget (X/X_0)

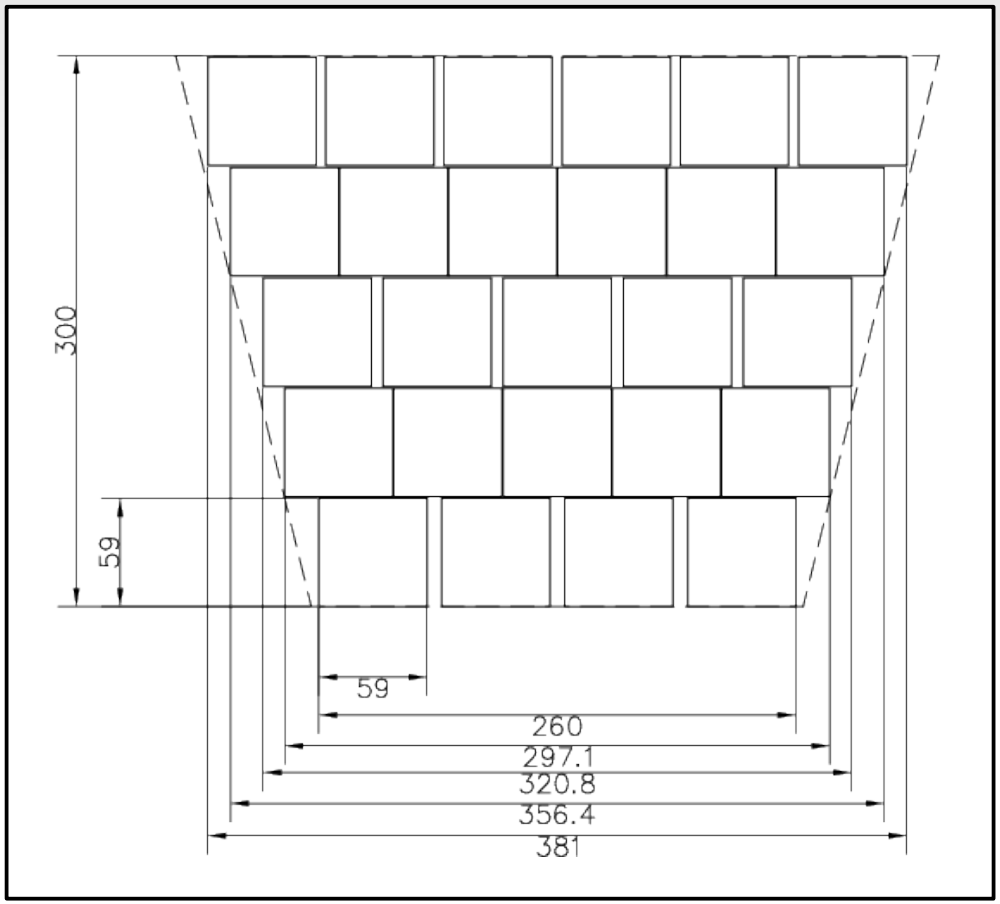
Aerogel	4%
NaF	4%
MCP PMT	10%
Support, electronics, etc	8%
Total	**26%**

Read-out geometry

- 12 phi-sectors
- 26 PMTs per sector
- Total of 312 PMTs
- 19'968 channels

- FE ASIC and SCATS TDC as in DIRC
- Got in contact with Cristophe and Vanessa on DIRC electronics
- FEE seems to fit in 5 cm behind PMTs
- Design and integration is wanted

Layout of PMTs in a sector

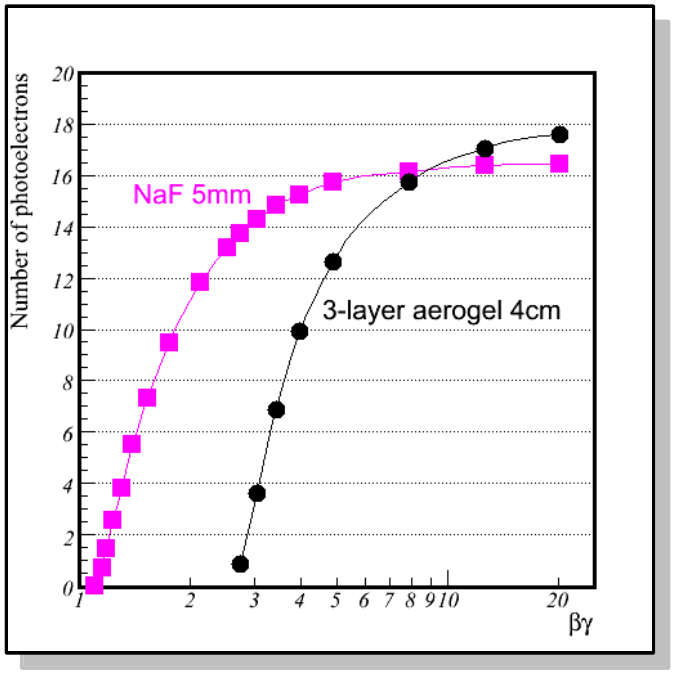


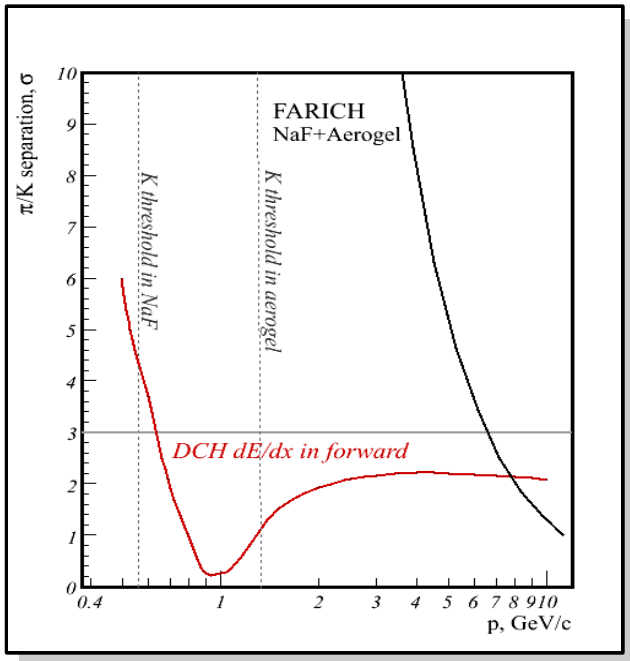
FARICH performance

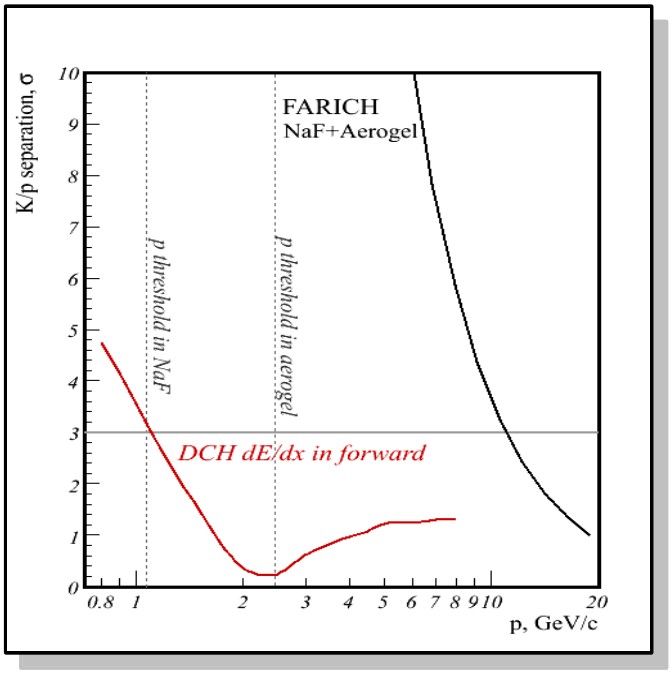
Aerogel + NaF

- excellent PID level:
  π/K better than 8σ (MC) for momenta 0.6−4 GeV/c
- background is well under control
- less than 10% QE drop is expected in 5 SuperB years
- cost 3.4 M€

For details see the talk in Elba'10

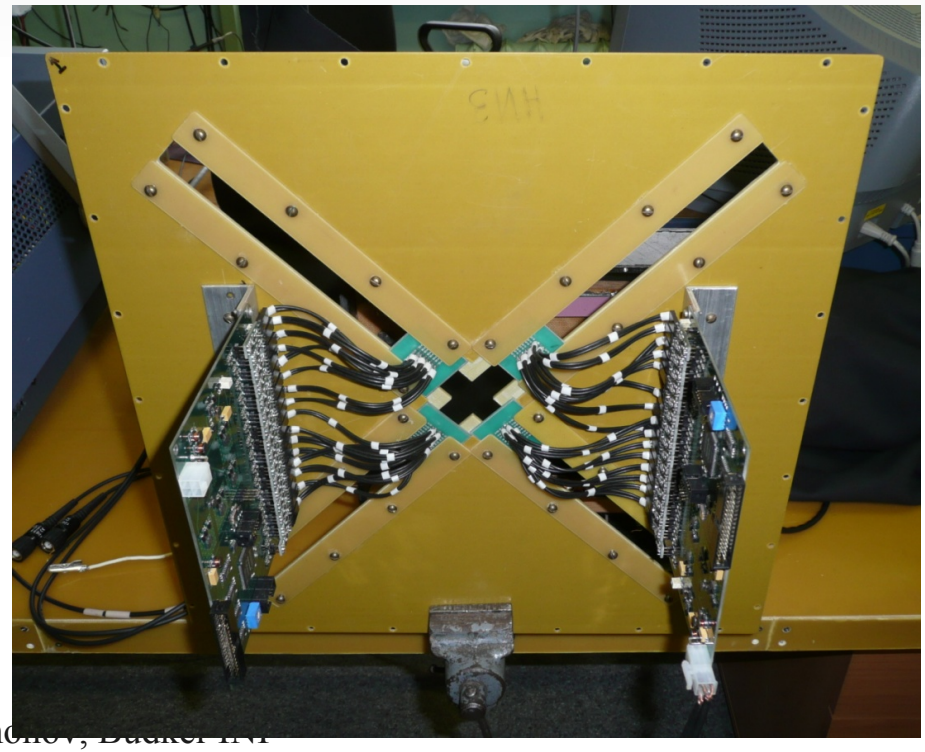






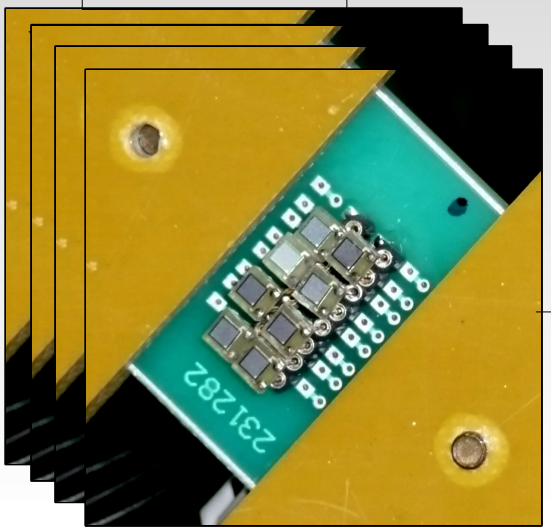
FARICH prototype

- Box is designed for radiator-PD distance 50−700 mm
- 32 MRS-APDs (SiPMs) as photon detectors
- Custom made discriminator boards
- CAEN V1190B 64-ch multi-hit TDC
- Two focusing aerogel tiles for SuperB are ready to be tested, 2-4 more are expected in October.



Prototype's read-out

4x8 SiPMs

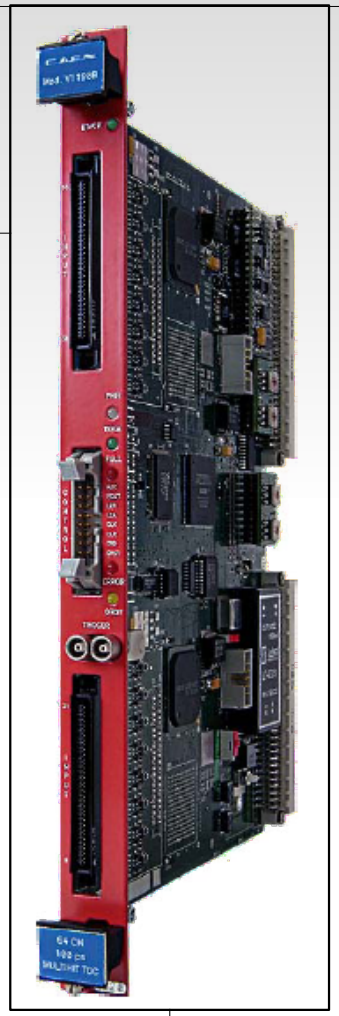


32

2x16ch Discriminator boards

32

CAEN TDC V1190B

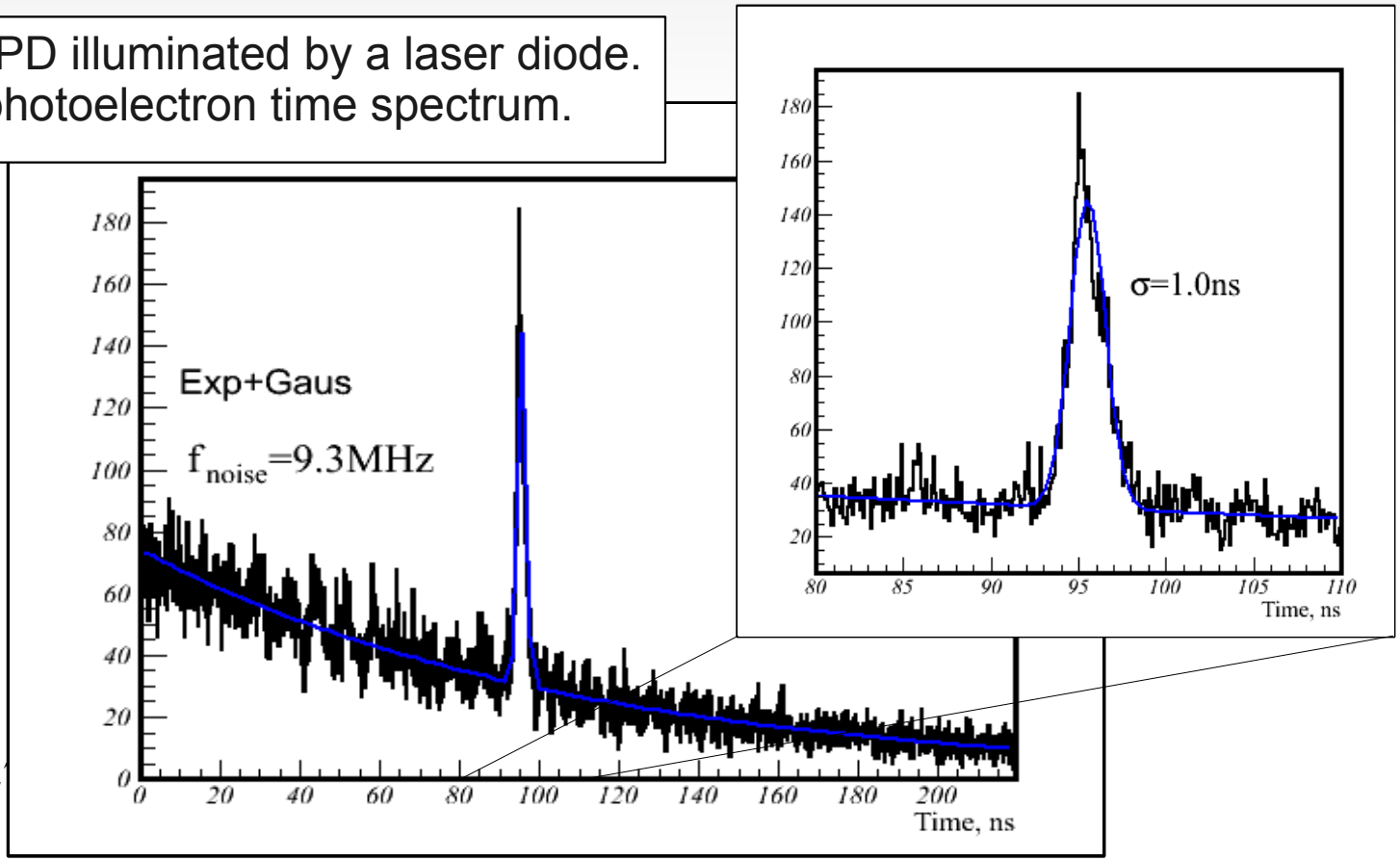


VME controller

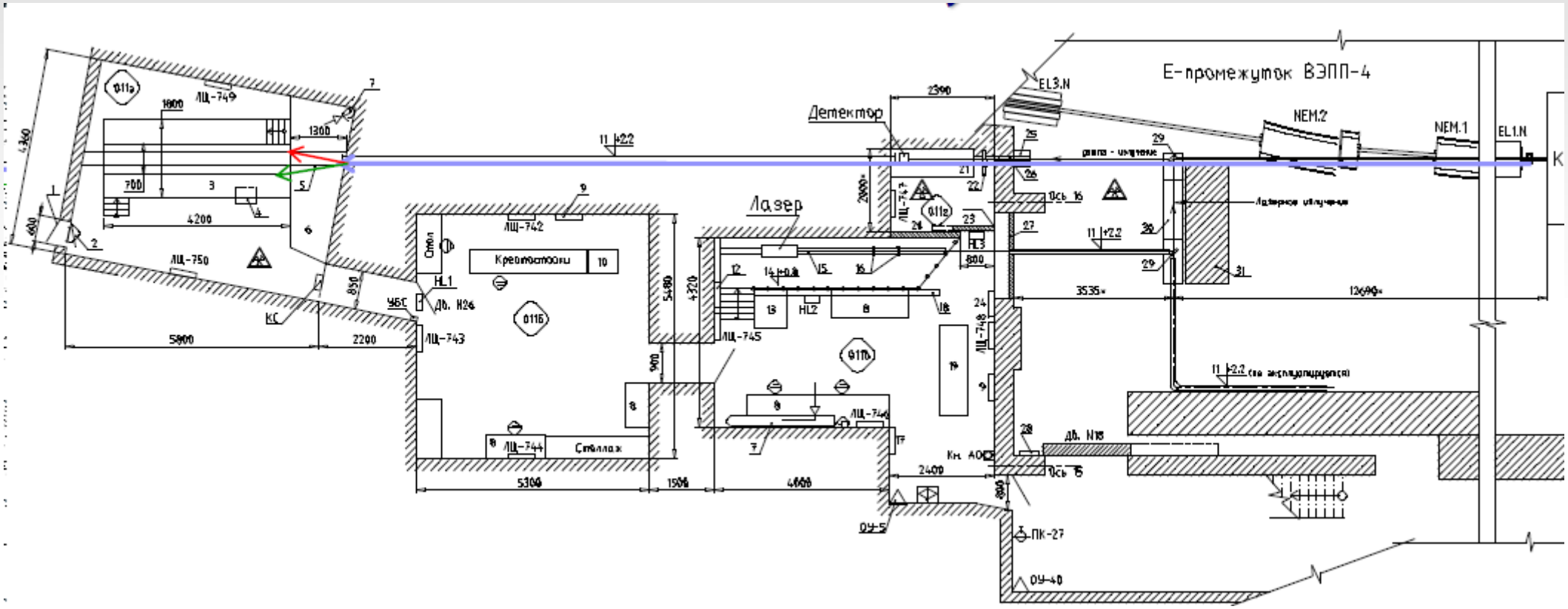
Prototype's status

- SiPMs are tested for amplification, noise rate
- TDC readout with SiPMs and discriminators is tested
- Measurements with a laser diode are ongoing
- The prototype will be moved to the beam in October
- Beam tests October-February

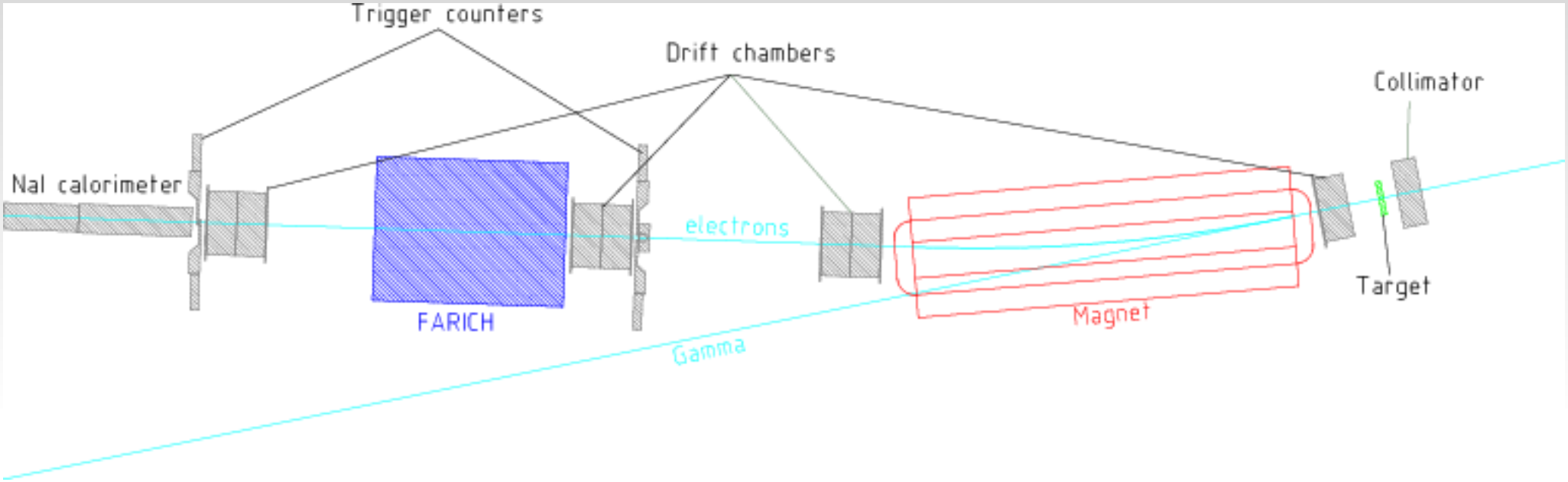
MRS APD illuminated by a laser diode.
Singe photoelectron time spectrum.



Test beam facility at VEPP-4M, Novosibirsk



Electron and tagged photon beams



Design parameters

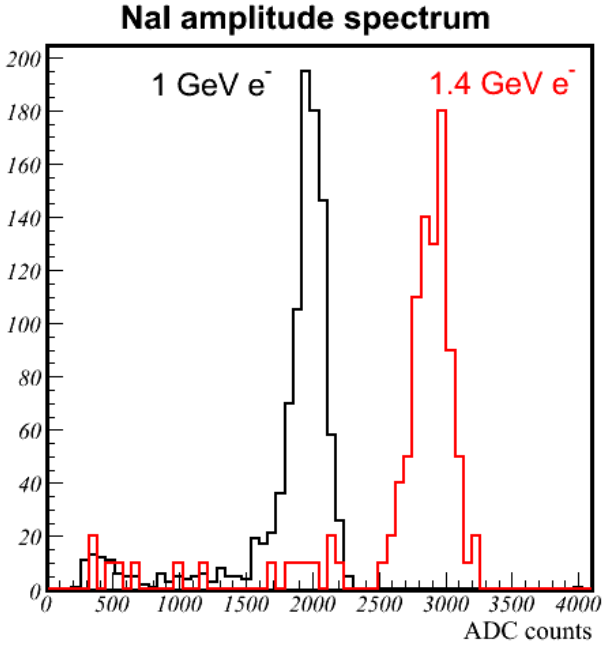
	Electrons	Gammas
Energy, GeV	0.5−3.0	0.05−3.0
ΔE/E, %	0.3−0.5	≈1
Intensity, Hz*	10−100	≈1000

* With converter in the beam halo

Installation of the components is finishing in October

First results on the electron beam

- Several runs with NaI calorimeter and 3 scintillation counters in place were taken in July this year
- We worked with Bremsstrahlung gammas from beam-gas interaction in VEPP-4M: E_e = 2.5 GeV, I_e = 3−10 mA
- Gammas hit 1 X_0 thick lead target to produce e^+e^-
- Magnet current was tuned to 1 GeV and 1.4 GeV electron energy
- 1x1 cm^2 trigger area in front of NaI (10x10cm^2, 20X_0)



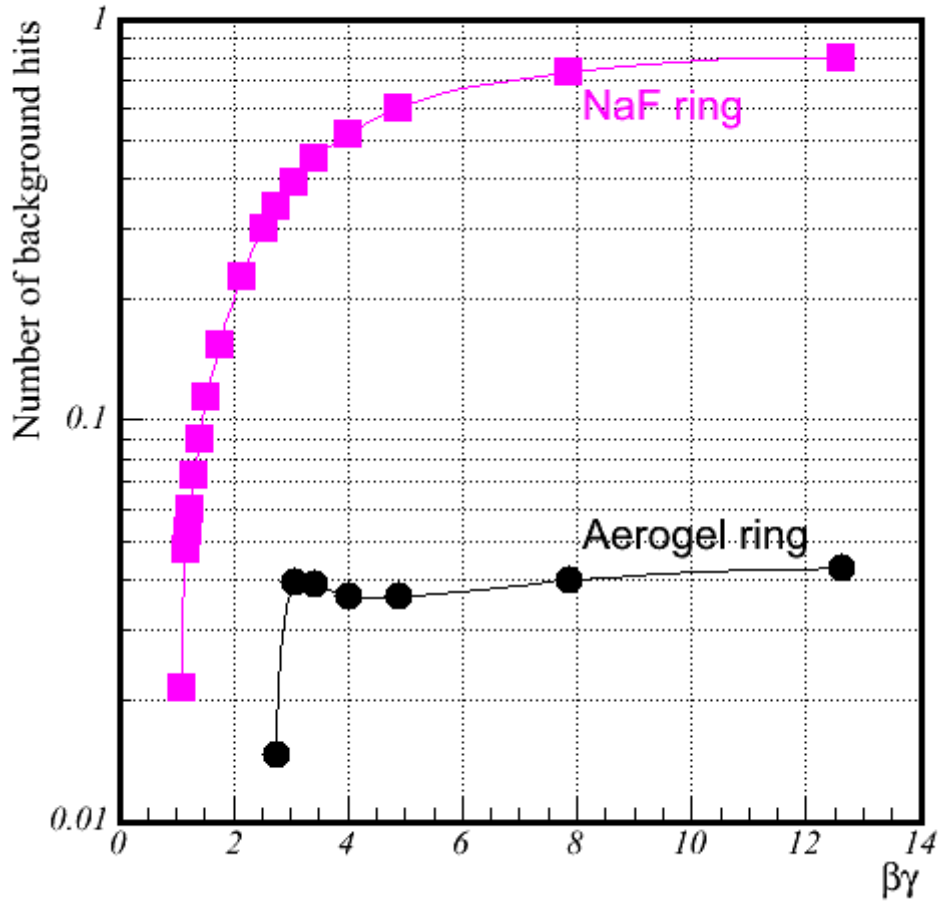
Event rate: 0.02 − 0.04 Hz/mA as expected

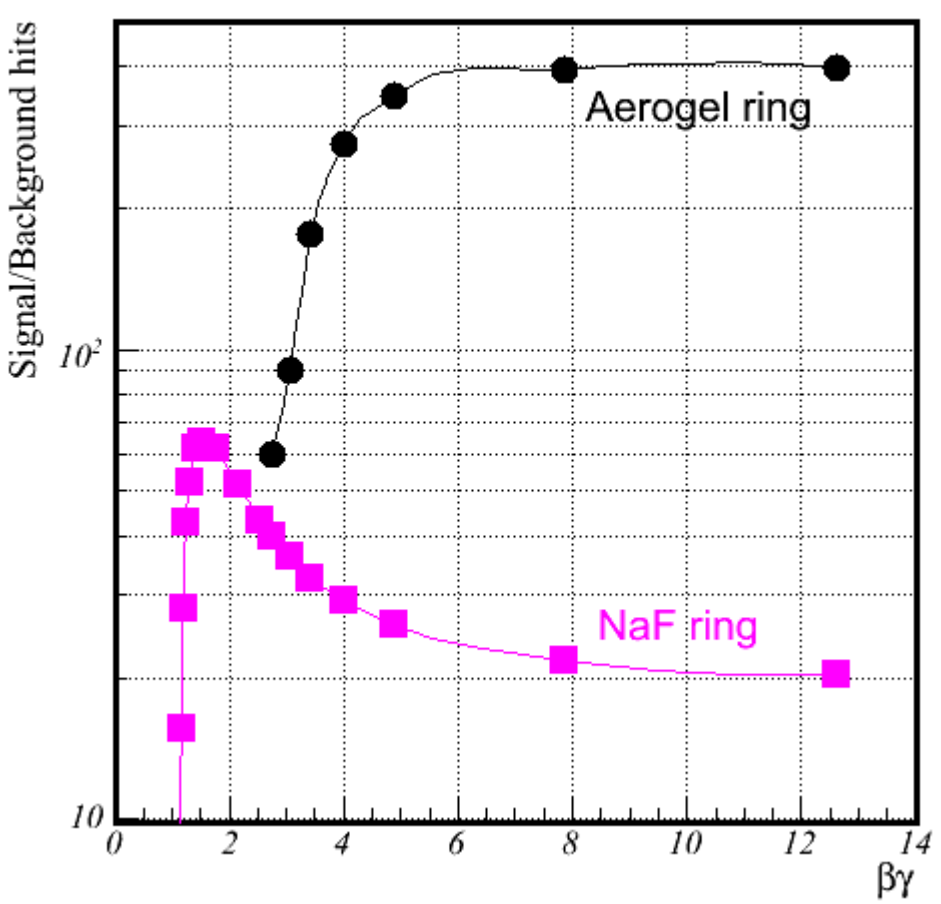
Moving converter in the beam halo is foreseen to increase intensity. Beam-beam interactions will also work.

Conclusion and outlook

- The Forward PID system based on FARICH with an excellent performance is proposed. Background rate is under control. Aging of MCP PMTs is minor.
- Electron beam is obtained
- Beam tests with the FARICH prototype scheduled for October−February. Runs after February 2011 can be provided if needed.
- Still need FARICH electronics design

Occupancy (NaF+Aerogel)



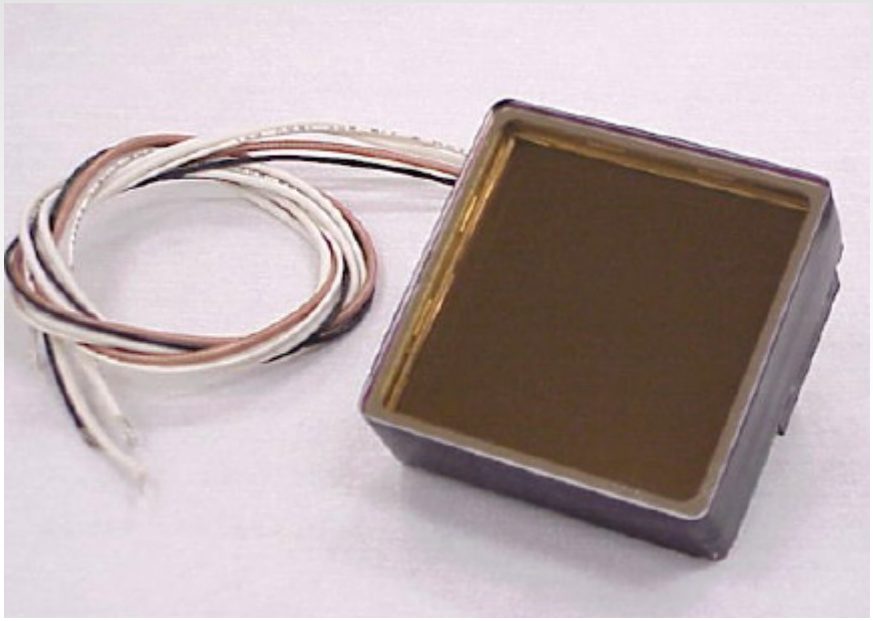


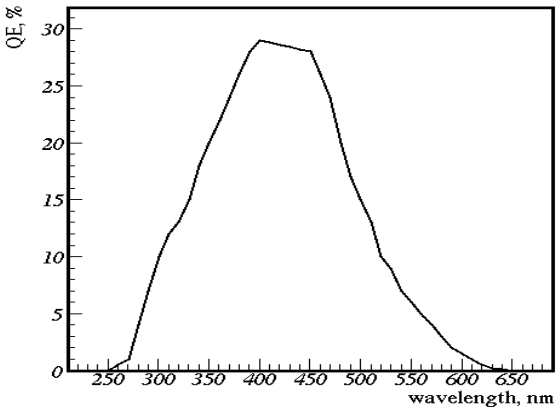
Background consideration

- **Pile-up noise**
  Time resolution **<**1ns
  Occupancy: 6p.e./20000ch = $3 \cdot 10^{-4}$ → less than one background hit within area of the rings – negligible for the ring reconstruction.
- **MCP PMT aging**
  Gain: 10^5
  Integrated anode charge:
  $6*200 \cdot 10^6 * 10^5 * 3 \cdot 10^7 * 1.6 \cdot 10^{-19} / (312 * 5.3^2)$ = 0.07 C/cm^2/year
  P. Krizan et al. poster at RICH2010:
  10% QE drop at 400mC/cm^2 (25μm version) ~6 years of SuperB
  Aging tests of 10μm version are ongoing (P.Krizan)
- **MCP PMT gain stability**
  Time between collisions: 5ns
  Rate: $6*200 \cdot 10^6/(312*5.3^2)$ = 140 kHz/cm^2 – no gain drop.

Photonis MCP PMT

XP85012





QE(λ)
J. Va'vra

- Chevron MCP configuration
- 8x8 anode pads with 6.5mm pitch
- Bialkali photocathode, QE(400nm)=29%
- Gain ~ $5 \cdot 10^5$
- 25μm pores, need 10μm to work in 1.5T field with gain ≥ 10^5
- MCP open area ratio ~70 %
- Size □59 mm
- Effective area fraction 81%
- excellent timing ~40ps single photon