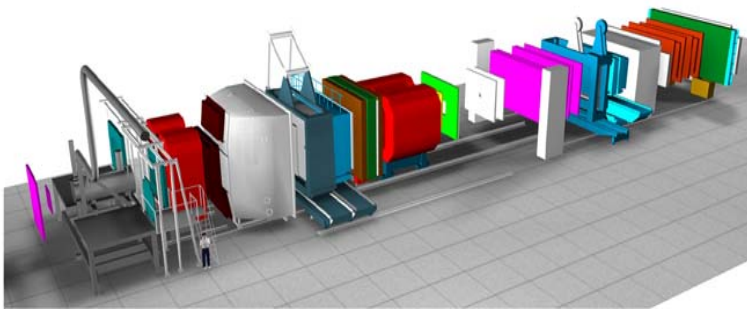




Activity on Compass 2 detector with Calibration at Prague

COMmon Muon Proton
Apparatus for Structure and
Spectroscopy

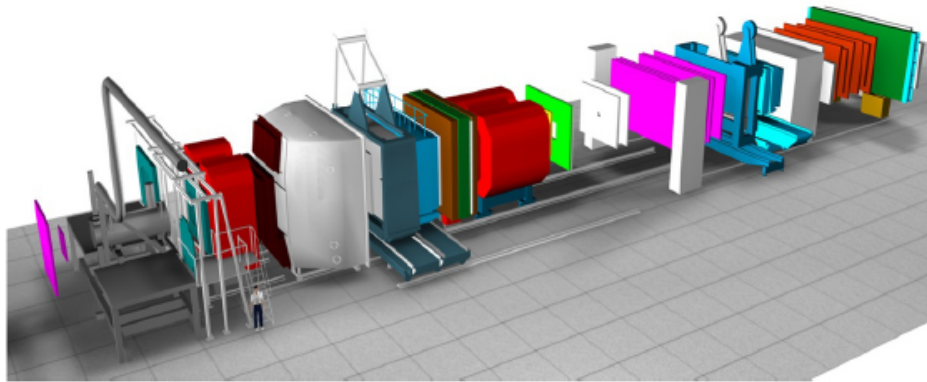
Ivo Polák, on behalf of Prague's group
polaki@fzu.cz



- Compass detector
- Prague contribution to ECAL0
- 60 Fibres in bundle
- Modification of QMB1 with PIN PD feedback
- Plans

COMPASS experiment

- ▶ fixed target experiment at SPS accelerator at CERN
- ▶ study of hadron structure and hadron spectroscopy with high intensity muon and hadron beams
- ▶ data-taking started in 2002
- ▶ trigger rate up to 50 kHz, event size 35 kB average



Josef Nový

CTU Prague, CERN

12 countries participate on Compass

3 institutions at ECAL0 subdetector

our institute (FZU) been invited to collaborate on calibration on ECAL0

Representatives:

I. Savin, Z. Krumstein,
A. Nagaytsev

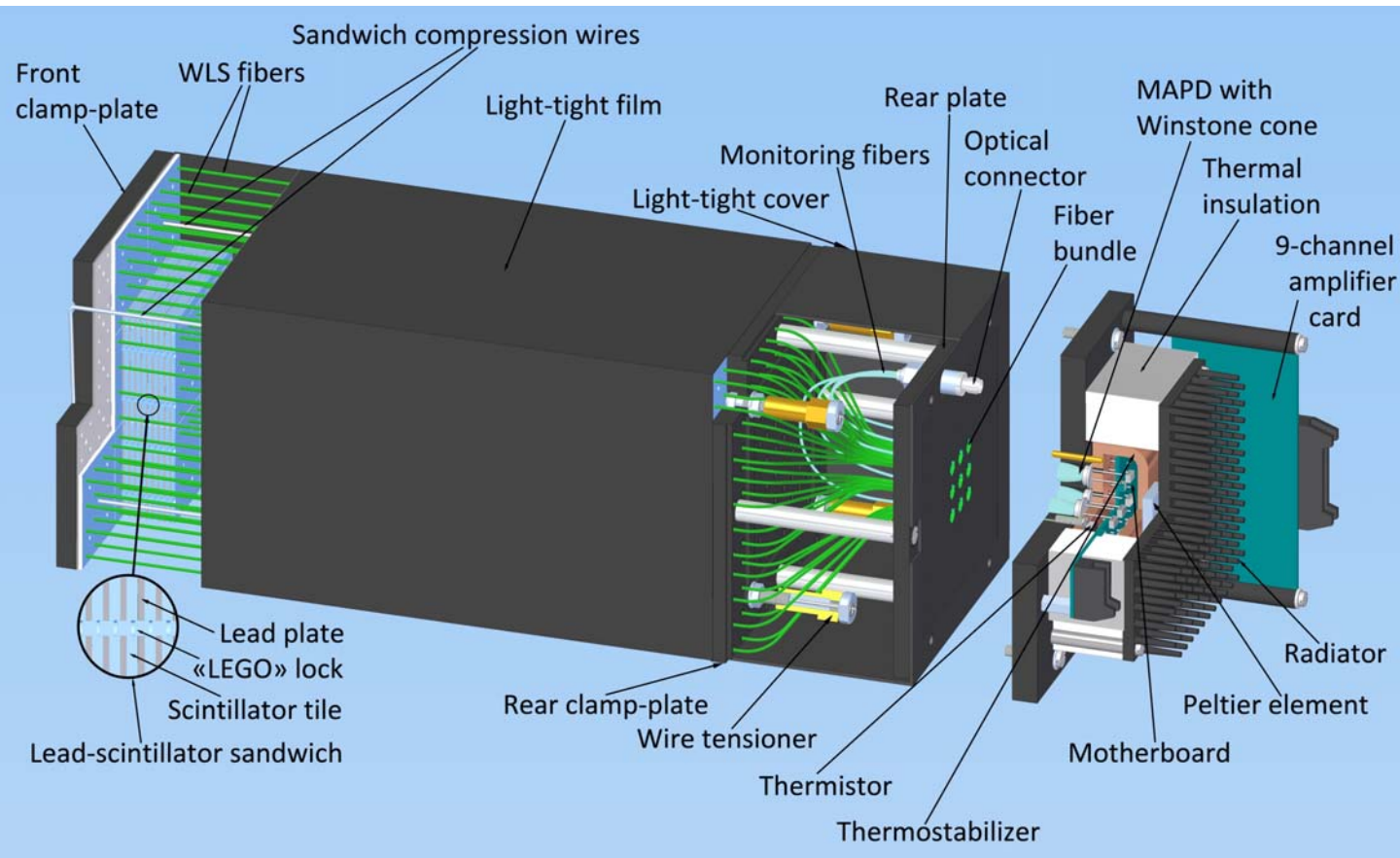
R. Leitner

P. Zhmurin

ECAL0

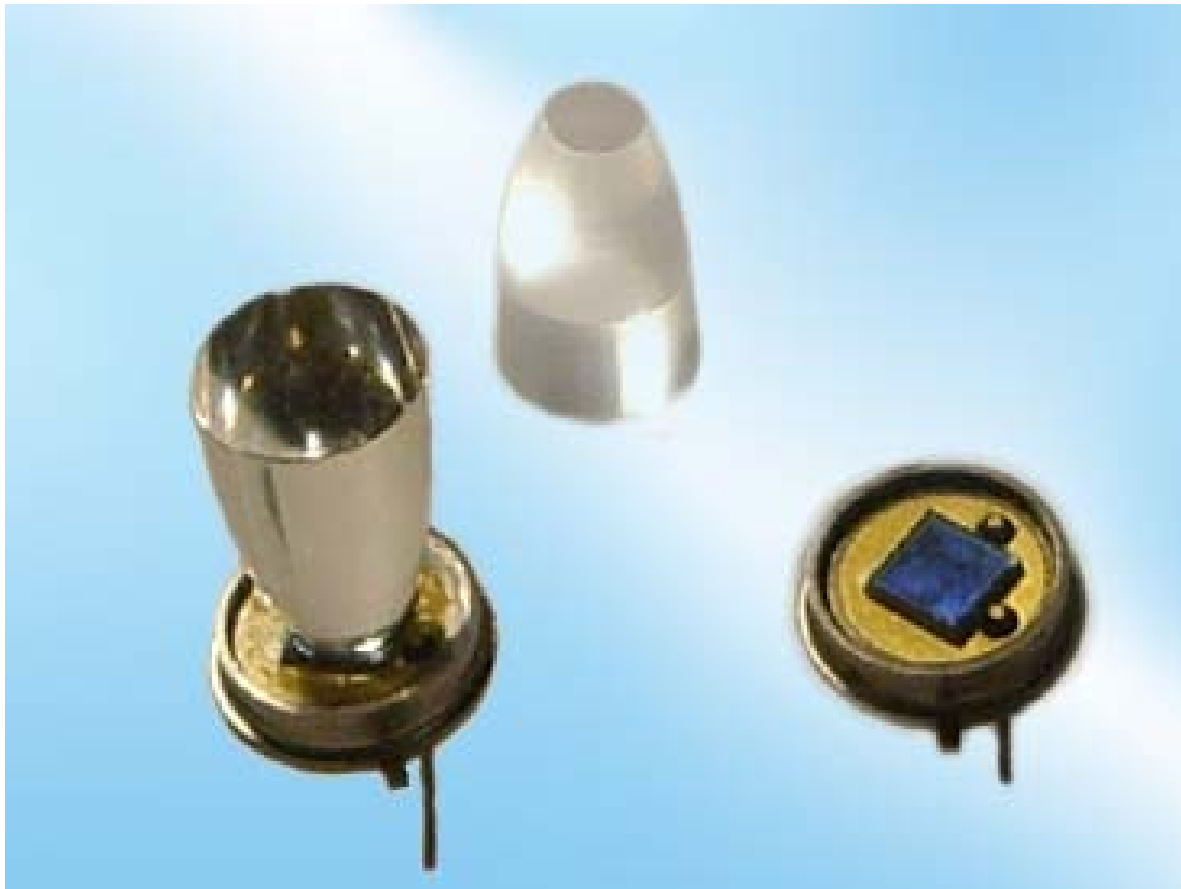
- Joint Institute for Nuclear Research, Dubna, **Russia**
- Faculty of Mathematics and Physics of Charles University, Prague, **Czech Republic**
- Institute for Scintillation Materials NAS of **Ukraine**

ECAL0 module for Compass 2



The new-generation high-granularity Shashlyk EM calorimeter readout by micropixel avalanche photodiodes (MAPD) with precision thermostabilization based on the Peltier element is designed, constructed and tested. MAPD-3N with superhigh pixel density $1.5 \times 10^4 \text{ mm}^{-2}$ and area $3 \times 3 \text{ mm}^2$ manufactured by the Zecotek Company were used in the photodetector unit.

Shaschlik EM calorimeter prototype with MAPD



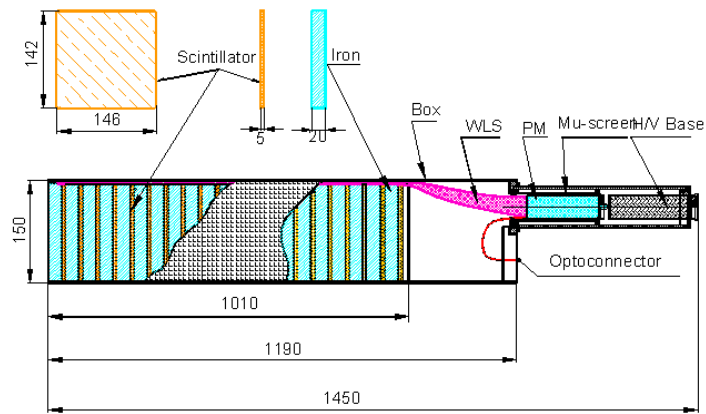
micropixel avalanche
photodiodes 3rd generation

MAPD-3N with the gain
 4×10^4

photon detection
efficiency (PDE) 25 % in
the green region

superhigh pixel density
 $1.5 \times 10^4 \text{ mm}^{-2}$ and area
 $3 \times 3 \text{ mm}^2$ manufactured by
Zecotek Company

Peltier element kept the
MAPD temperature at 15C
within 0.05C



Module of shashlyk ECAL prototype
 Readout with very high density MAPD
 Each module contains 9 MAPD
 In total 196 MAPDs

Requirements to calibrator:

Stable mid range pulses for monitoring
 Variable amplitude for amplitude scan
 No interest in Single p.e. spectra (low MAPDs gain)
 One LED illuminates 50 MAPDs modules
 Amplitude stability, pulse width 20 to 40ns

ECAL0 for COMPASS II

Modified QMB1

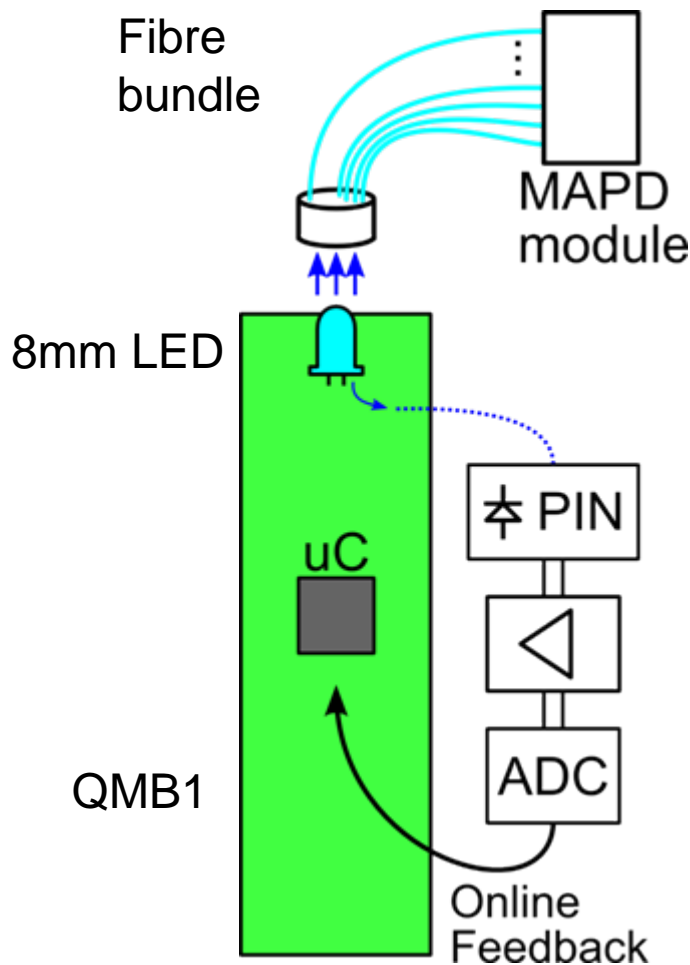
- 8mm blue LED
- Long pulses about 30 ns
- PIN photodiode feedback for higher amplitude stability
- USB controller, RS232
- One LED driver illuminates 60 modules
- Tunable amplitude

Fibre distribution system

One 8mm blue LED illuminates 60 fibres in bundle.

Length of the fibre is 2.5m to reach each MAPD

Modification of QMB1 to ECAL0



- One mid of range amplitude monitoring
- Amplitude scan of MAPDs
- Extending to 30ns pulse-width, external toroidal inductor
- On line feedback with PIN PD, to get better long term amplitude stability (LED!)
 - Amplitude (peak) detector, or fast ADC (?)
 - Averaging over 100 (10?) pulses
- Nov 2013 successful test with one module and 8mm LED

60 Fibres in bundle toward to 8mm Blue LED



First picture of 60 of 1mm dia fibres illuminated by a daylight.

Visible imperfections of some fibres.

Picture taken by small cheap USB 1.3Mpx camera microscope.

Distribution plot shows abt. 100% spread at 460nm, illuminated by blue 8mm LED.



Status & Plans

In Nov 2013 we tested one modified **QMB1m (30ns)** + 8mm blue LED + fibre bundle with one module of ECAL0 detector.

Optical distribution system consists 50 fibres in bundle with SMA connector, in total there will be $4 * 50 = 200$ fibres guides light to individual MAPDs. Now under the production.

Upgrade of QMB1m pulser to active PIN photodiode feedback **QMB1pin** boards ready to end of year 2014

Complete HW (QMB1pin + fibrebundles) in 1st Q of 2015

Compass 2, ECAL0 is going in Octobre 2014 to beamtest at CERN, starts to datataking

~ summer of 2015 installation of all calibrators to the detector ECAL0 at CERN