Druhý miniworkshop difrakce a ultraperiferálních srážek
26-27 September, 2019
Děčín, Česká republika

Introduction to FDD

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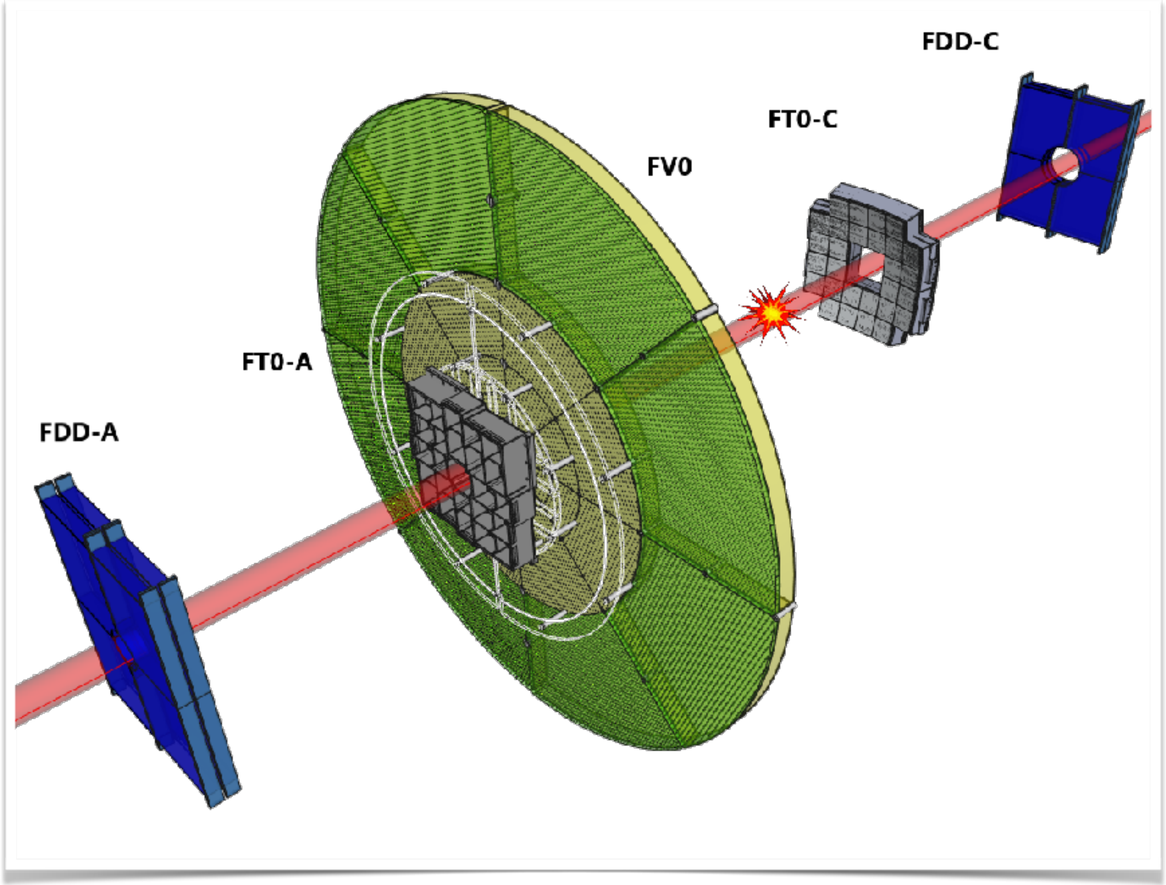
Czech Technical University

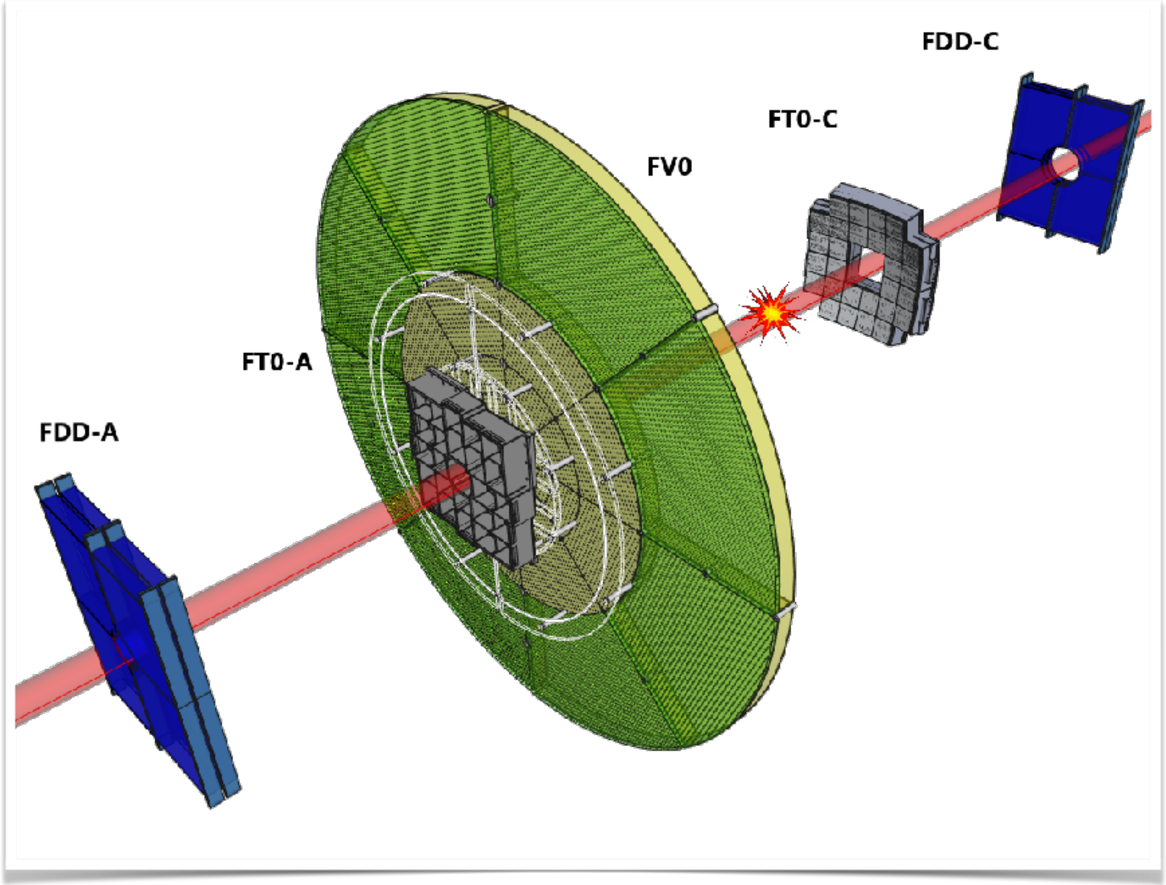
September 26, 2019, Děčín

Workshop supported by grant SVK30/19/F4

The FDD

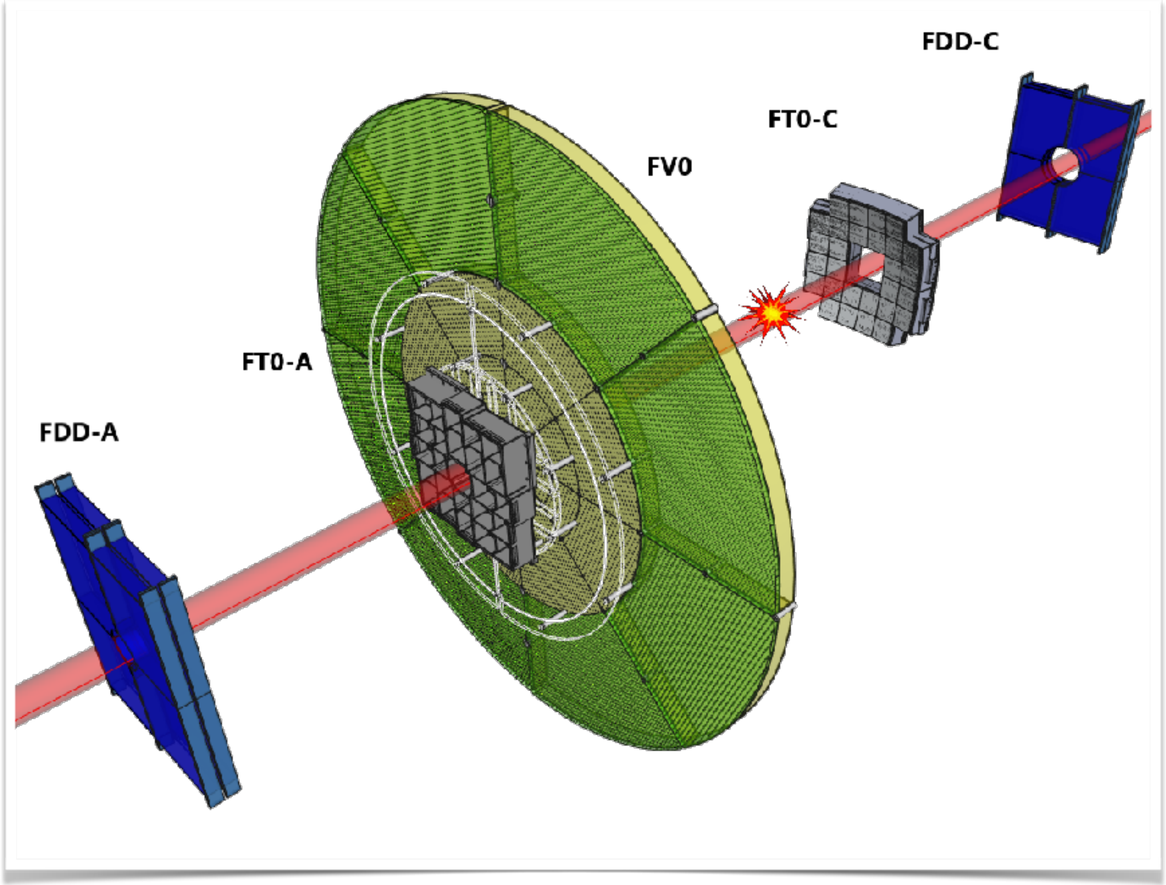


The FDD



Two arrays: FDDA, FDDC
Each made of four sectors
Each sector made of two independent modules

The FDD

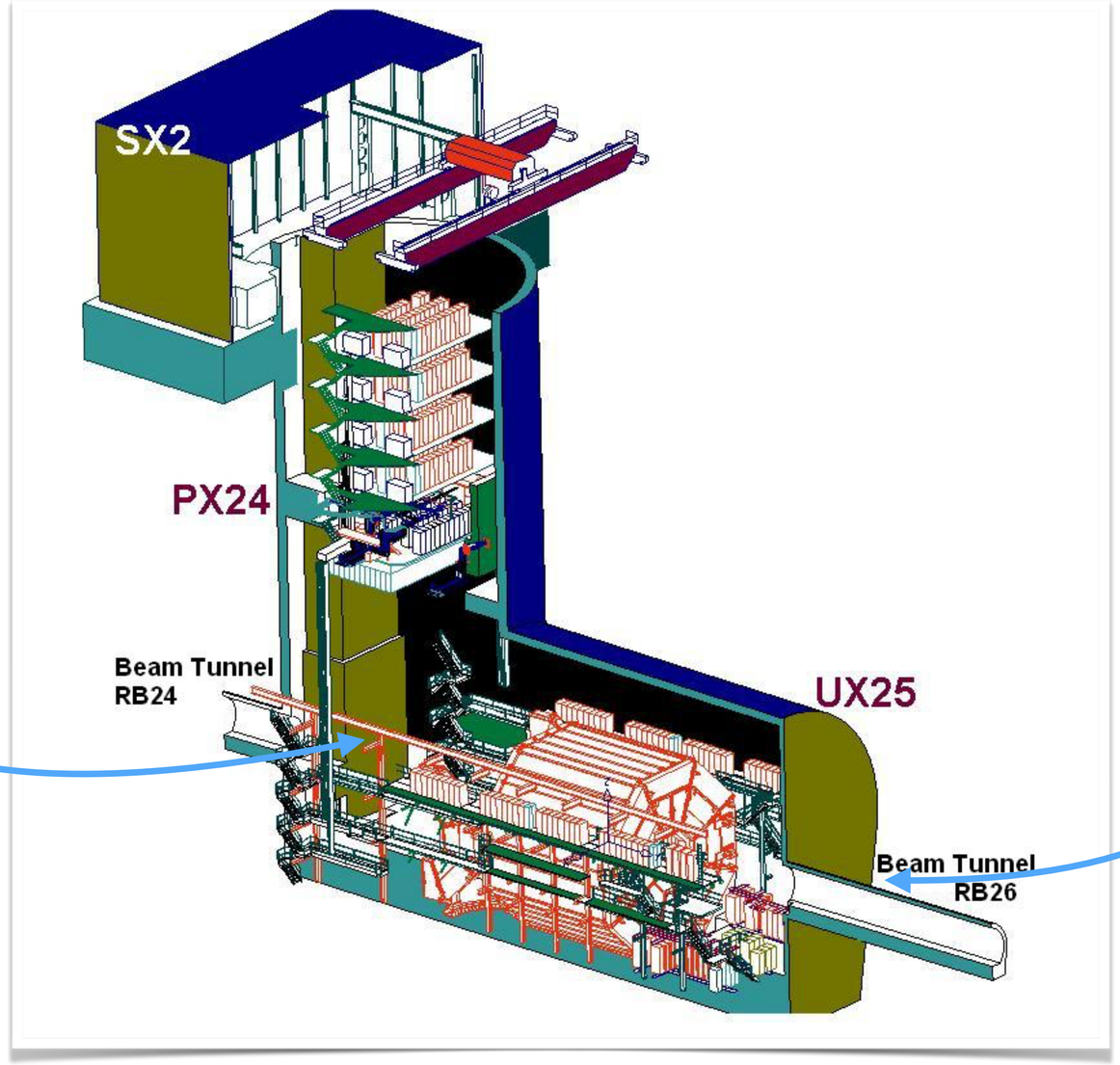


Two arrays: FDDA, FDDC
Each made of four sectors
Each sector made of two independent modules

For each module:
Plastic scintillator
WLS
Clear fibers
PMTs
and cables, readout, calibration, …
… simulation

General overview

ALICE diagrams from: http://alice-detector-facilities.web.cern.ch/alice-detector-facilities/

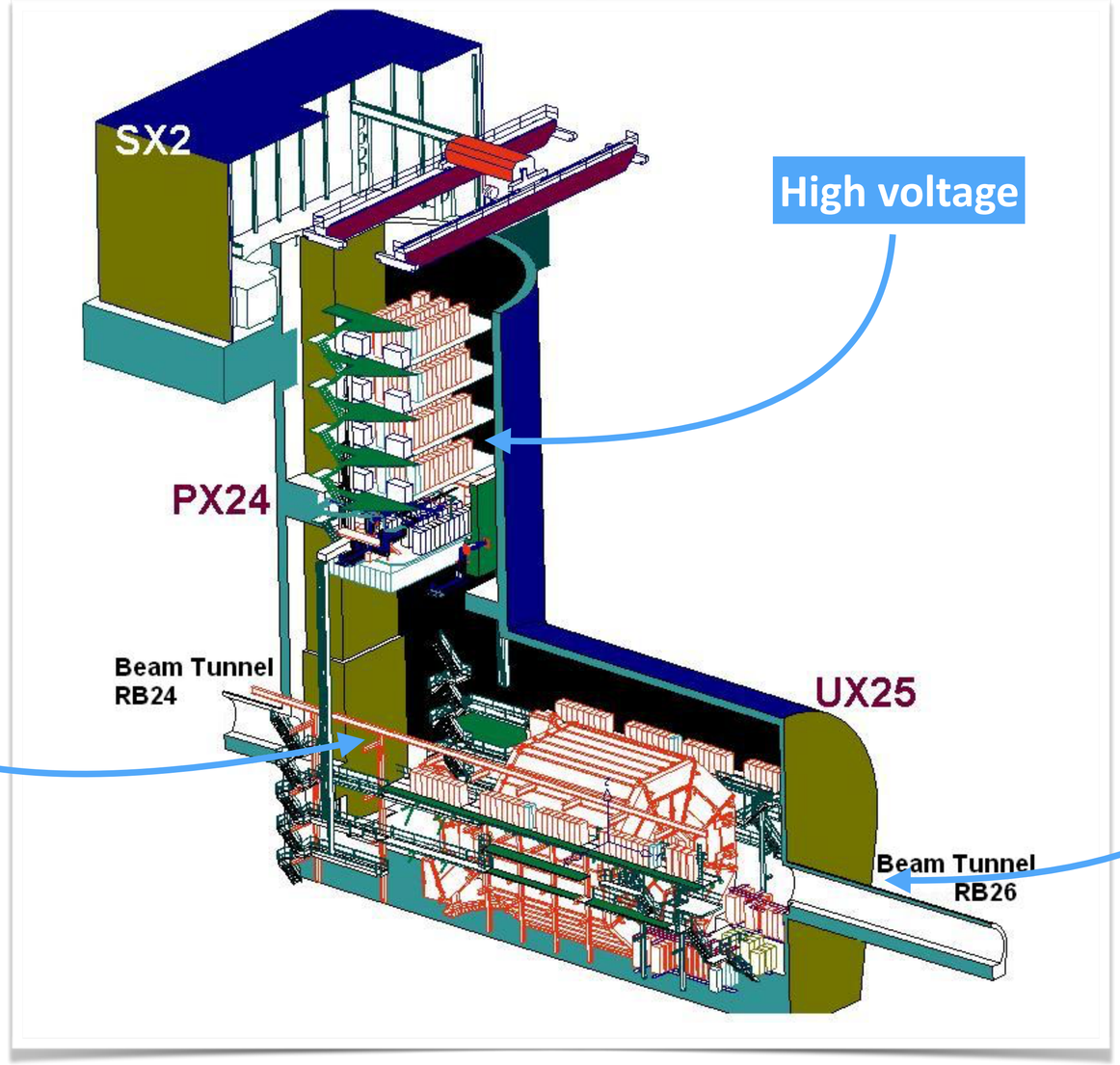


FDD-A

FDD-C

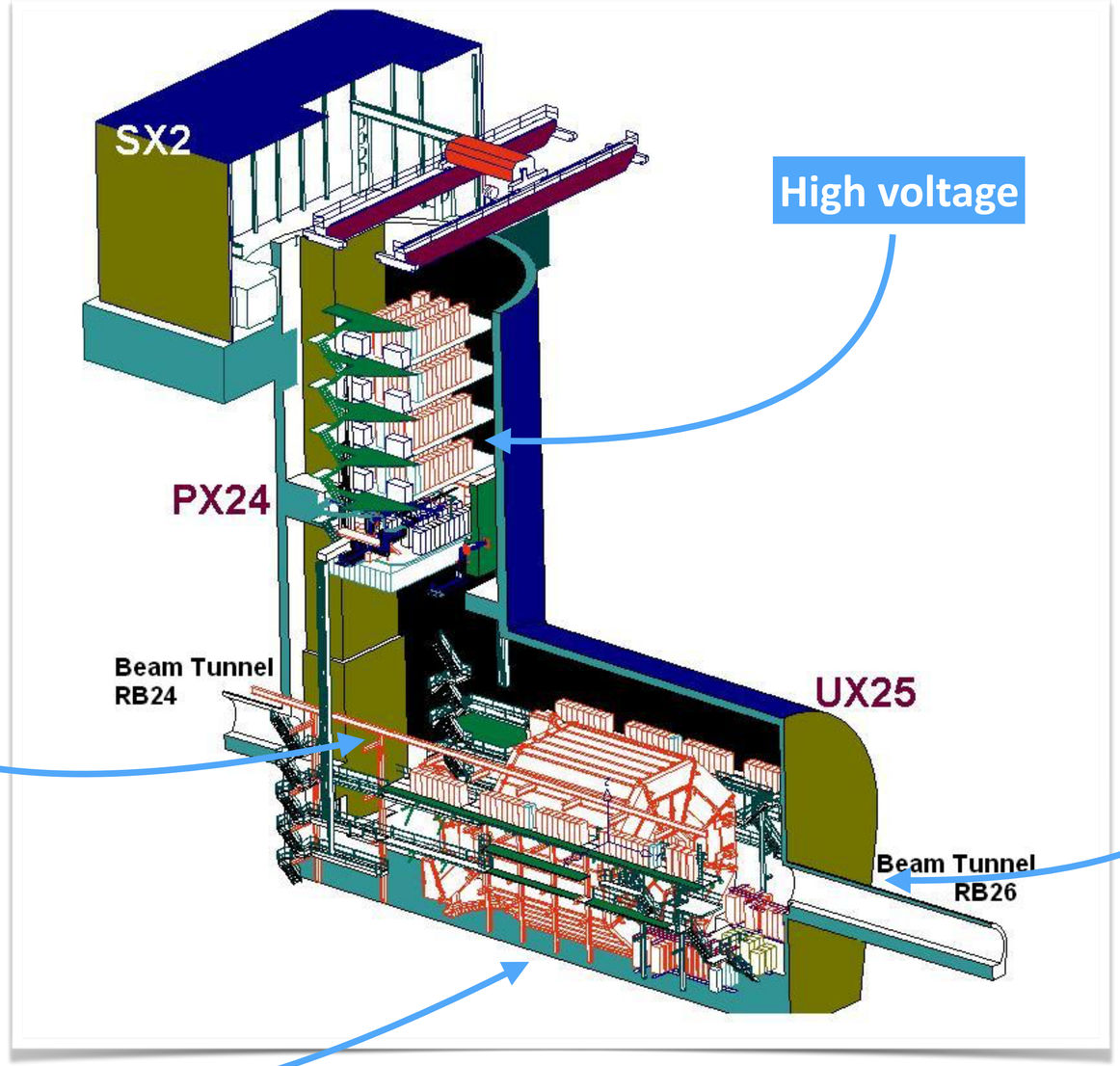
General overview

ALICE diagrams from: http://alice-detector-facilities.web.cern.ch/alice-detector-facilities/



General overview

ALICE diagrams from: http://alice-detector-facilities.web.cern.ch/alice-detector-facilities/



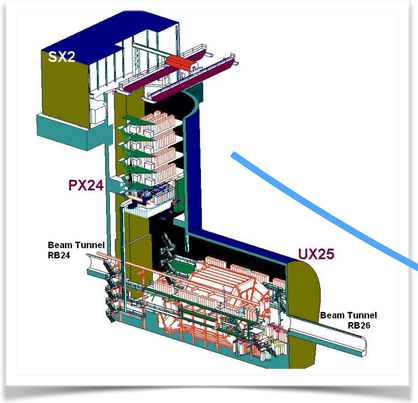
High voltage

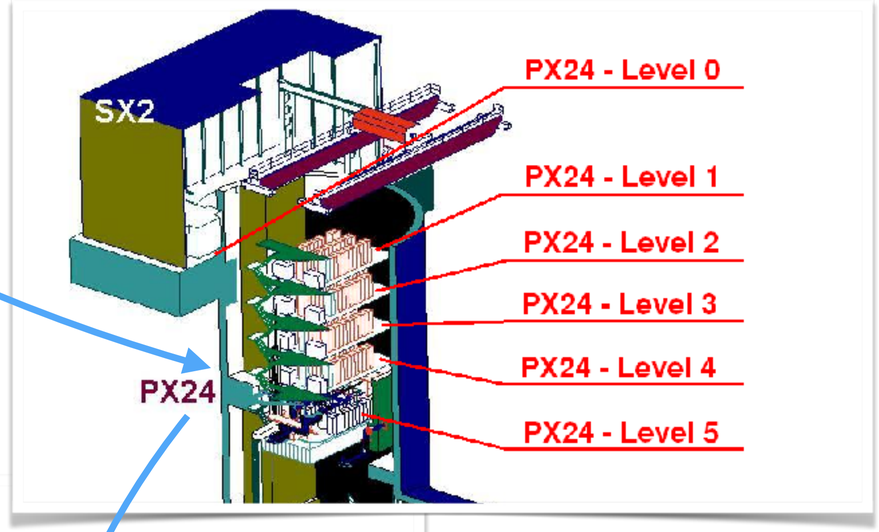
FDD-A

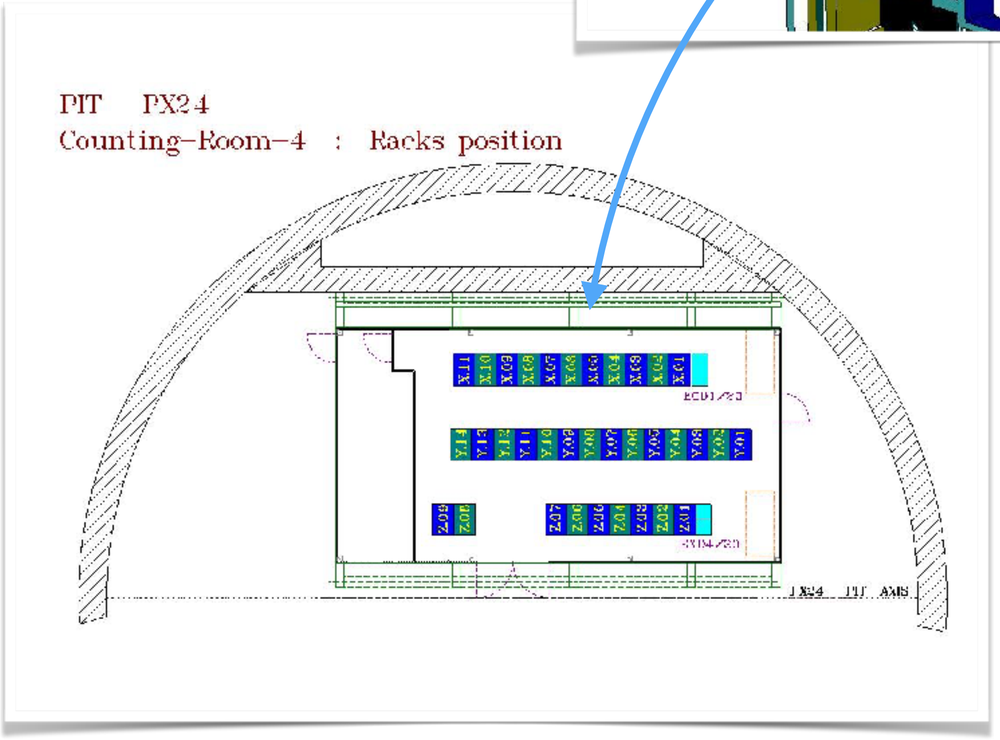
FDD-C

Electronics

High voltage (1/2)





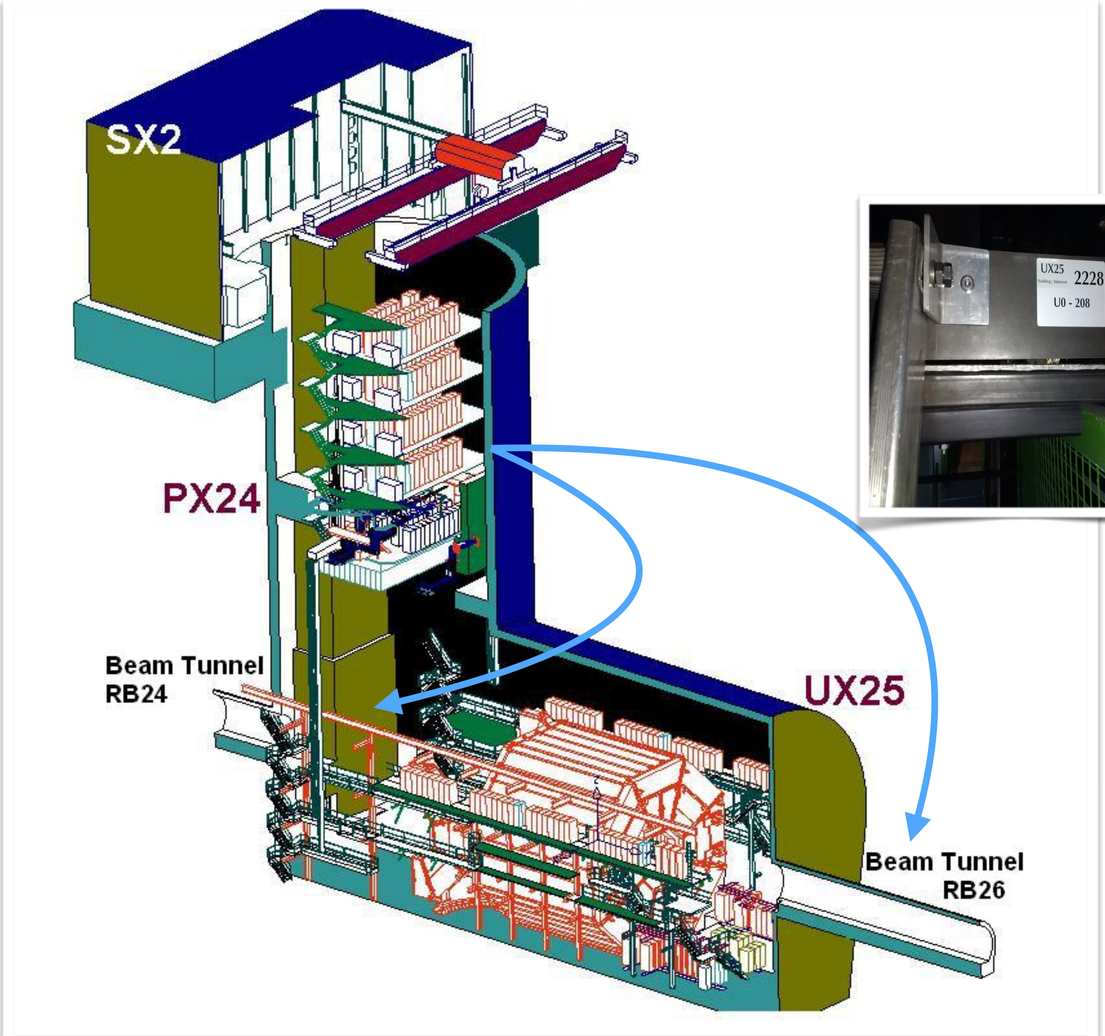


CR4 - X05

VME create: SY4527

HV cards: A7236 (12 channels)

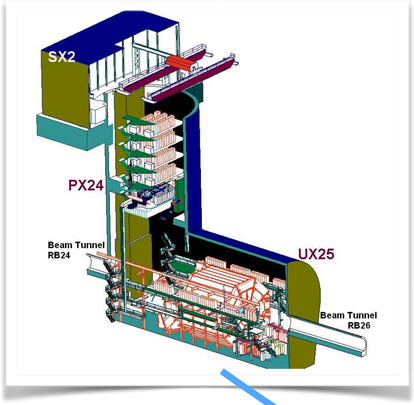
High voltage (2/2)

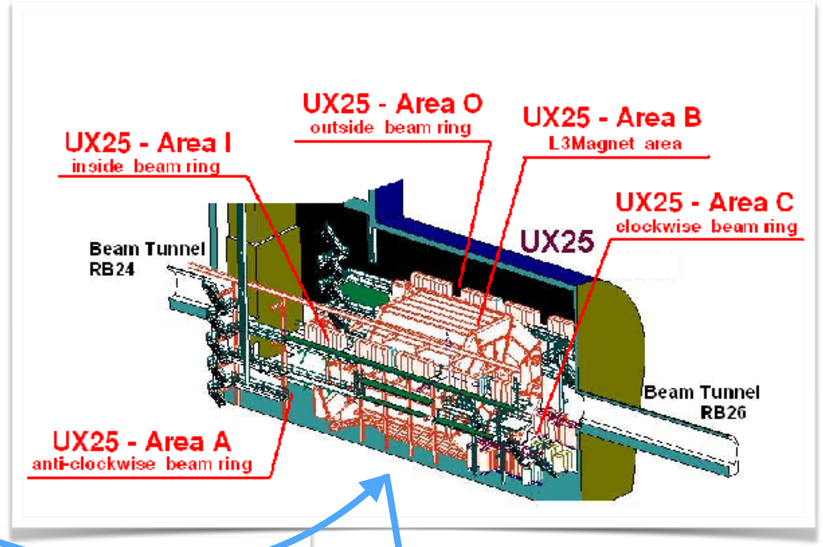


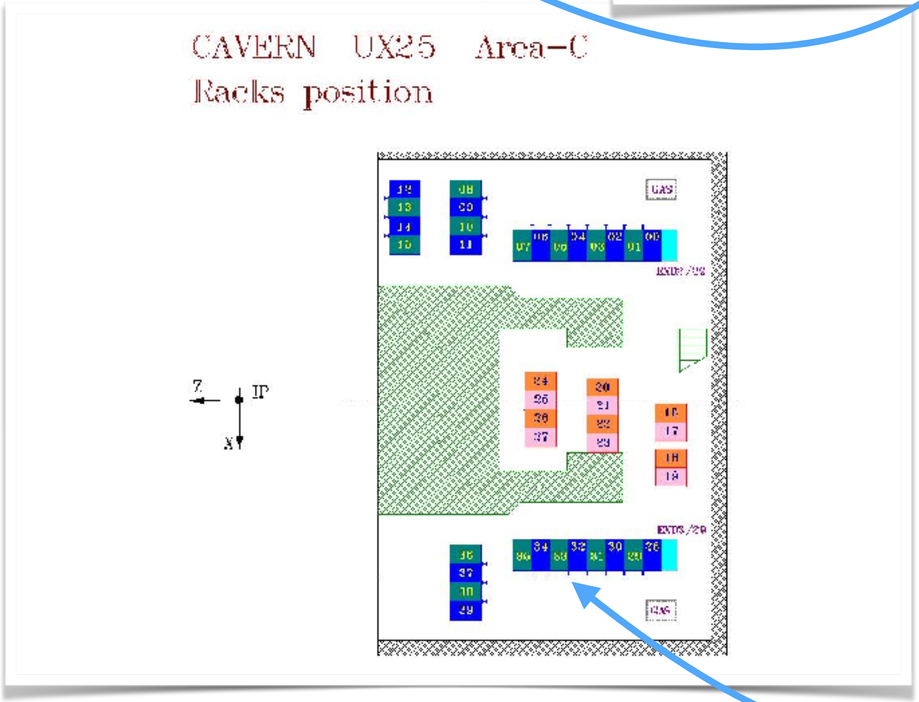
Cables: 04.31.51.555.2 (type HTC-50-3-2)
Connectors: 09.41.25.108.3 (11 SHV-50-3-1C)

FDD-A: 8 (+1)
PP0 FDD patch panel to CR4-X05 (90 m each)
FDD-C: 8 (+1)
FDD in UX25 2228 to CR4-X05 (120 m each)

Electronics (1/2)







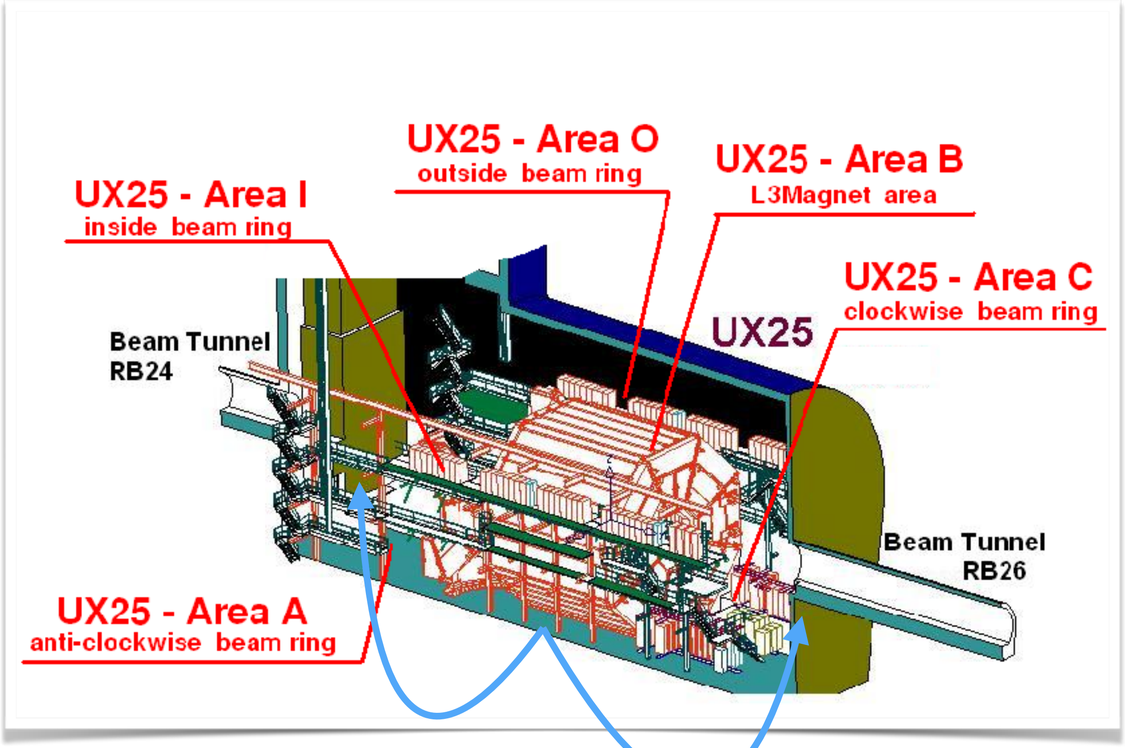
Is this create adequate?

Located in C32

VME create: Wiener 6U VME 6021
FIT modules: PM (?+?), TMC (?+?)

Not clear yet (to us) how many PM and TMC moduels we need

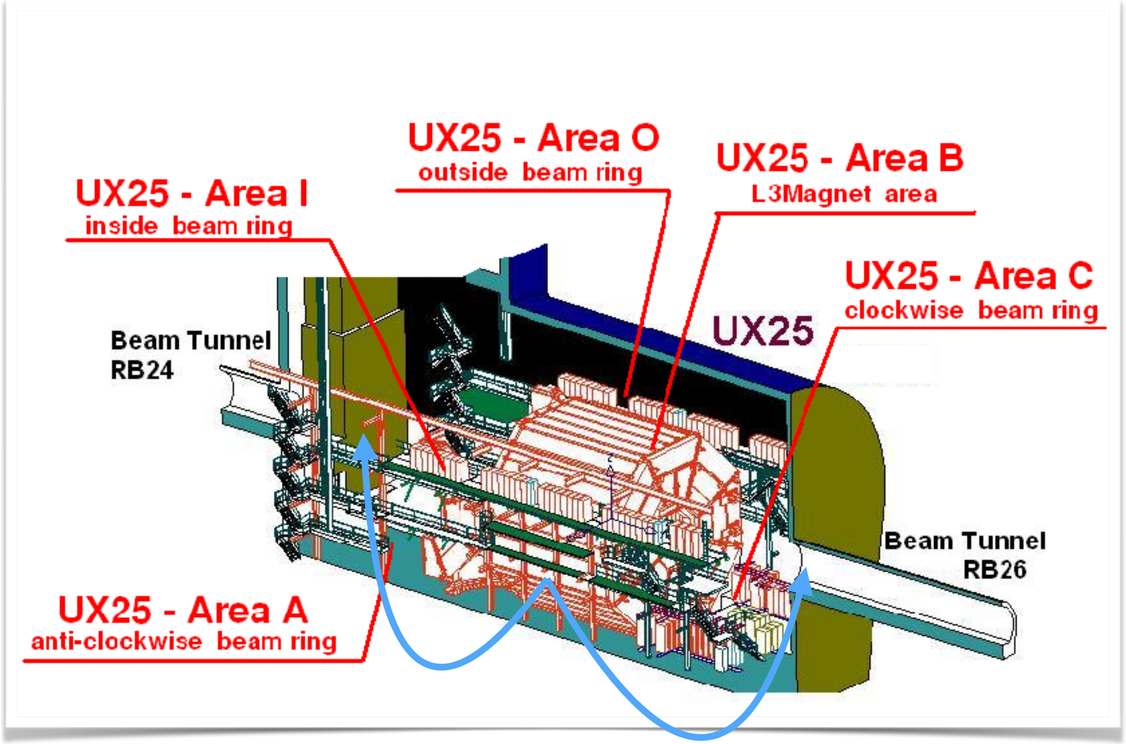
Connections to electronics



Cables: 004.61.11.E
Connectors: Amphenol SMA Jack Amphenol 132118

FDD-A: 8 (+1)
PP0 FDD patch panel to C32 (50 m each)
FDD-C: 8 (+1)
FDD in UX25 2228 to C32 (50 m each)

Calibration



Cables: 50/125 OM3
Connectors: Orig: LC, Dest FC

FDD-A: 2 (+1)
PP0 FDD patch panel to C32 (50 m each)
FDD-C: 2 (+1)
FDD in UX25 2228 to C32 (50 m each)

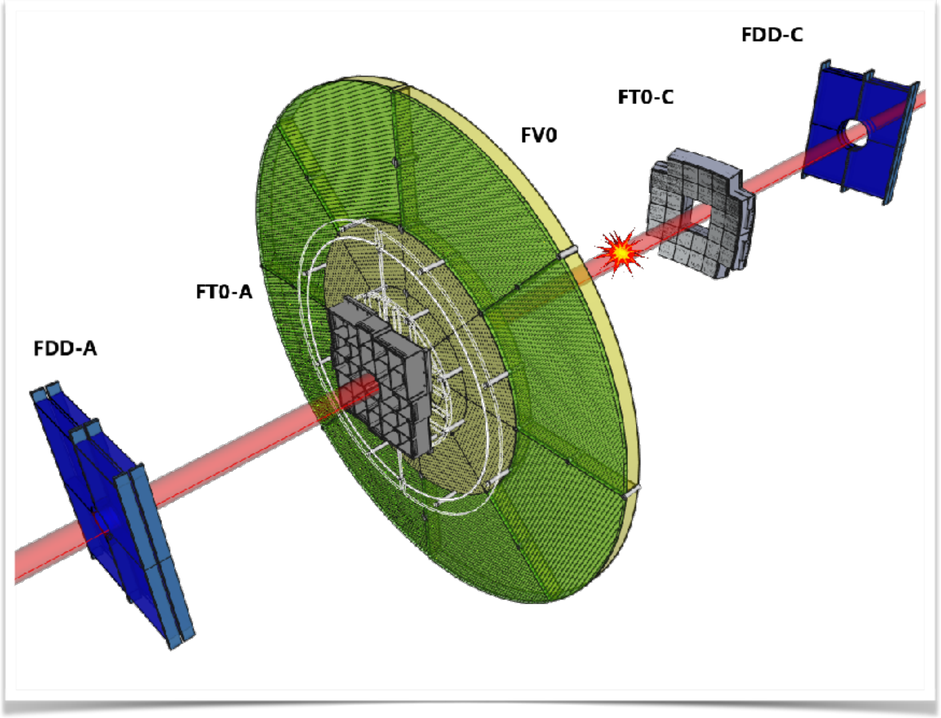
Laser system

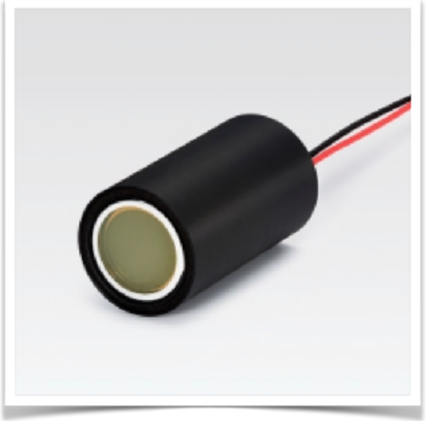
We do not have yet the details on the laser system

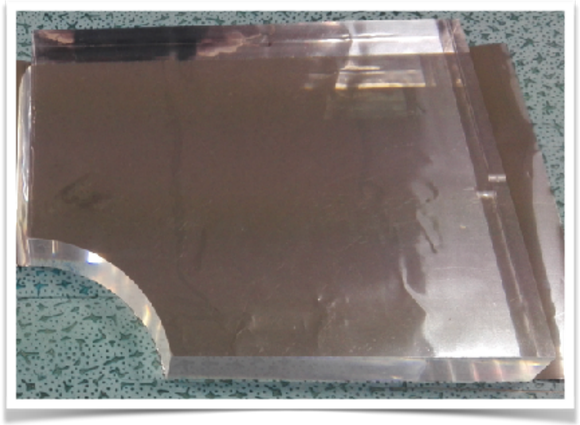
Detector

Two arrays: FDD-A and FDD-C

Located at 17.0 m and 19.5 m from IP, respectively
Covering 4.7<η<6.3 and -6.9<η<-4.9





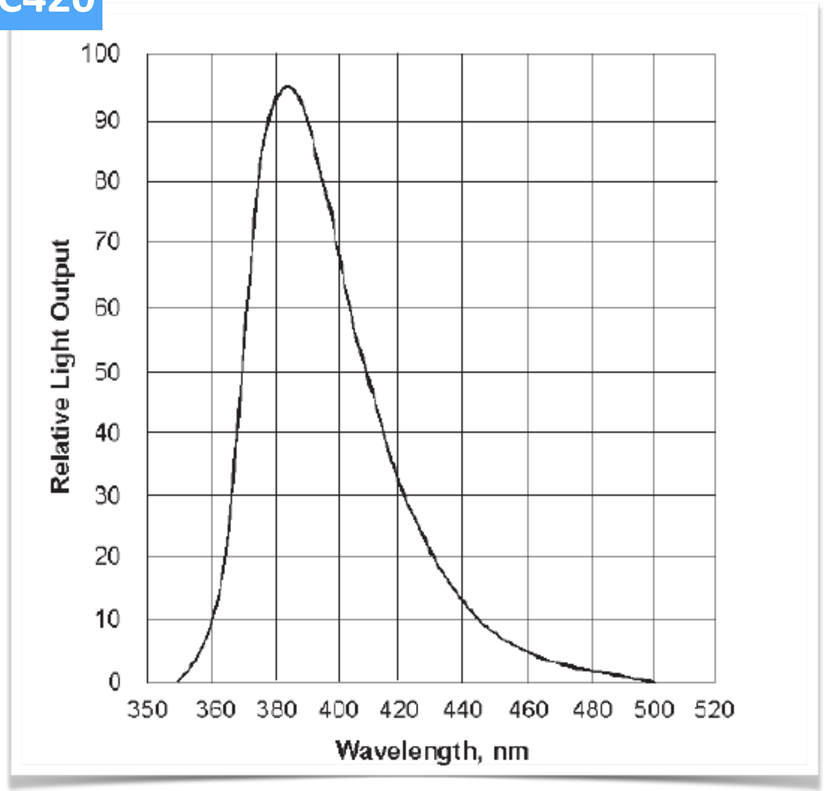


Each array: 2 layers of 4-modules each
Each module: Plastic → WLS → clear fibres → PMT

Plastic: BC420 (time decay 1.5 ns)
WLS: NOL38 (time decay 0.9 ns)
Clear fibres: Clear PSM double cladding, Kuraray
PMT: Fine mesh H8409-70

Plastic and WLS characteristics

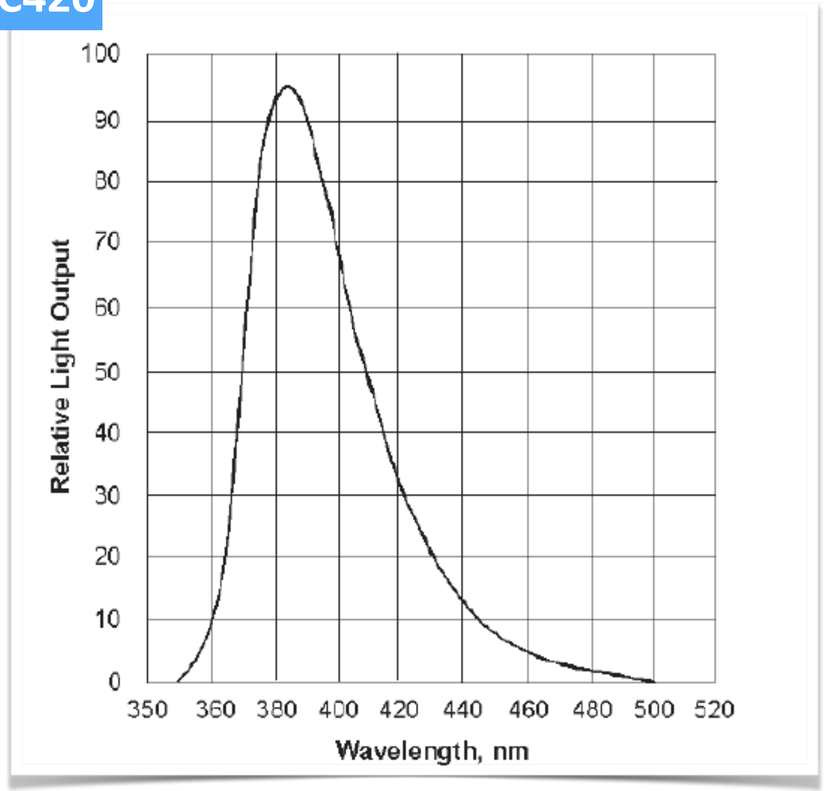
BC420

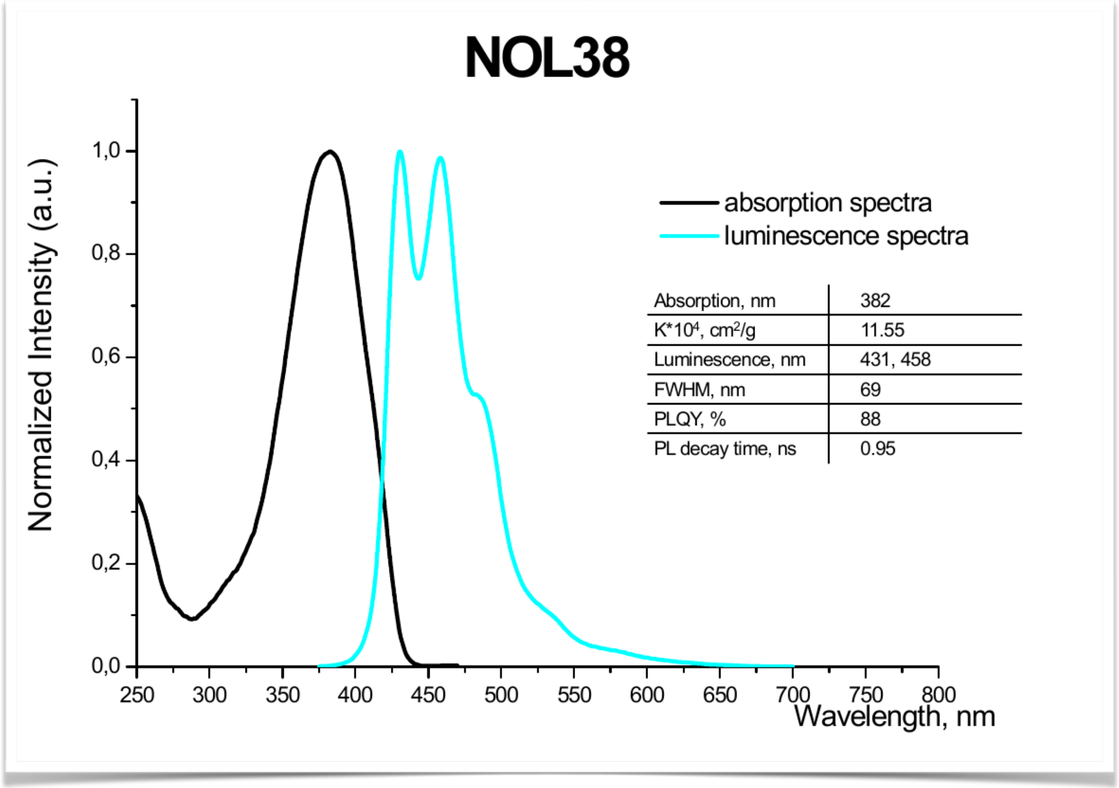


Rise time: 0.5 ns
Decay time: 1.5 ns
Wavelength of Max. Emission: 391 nm

Plastic and WLS characteristics

BC420





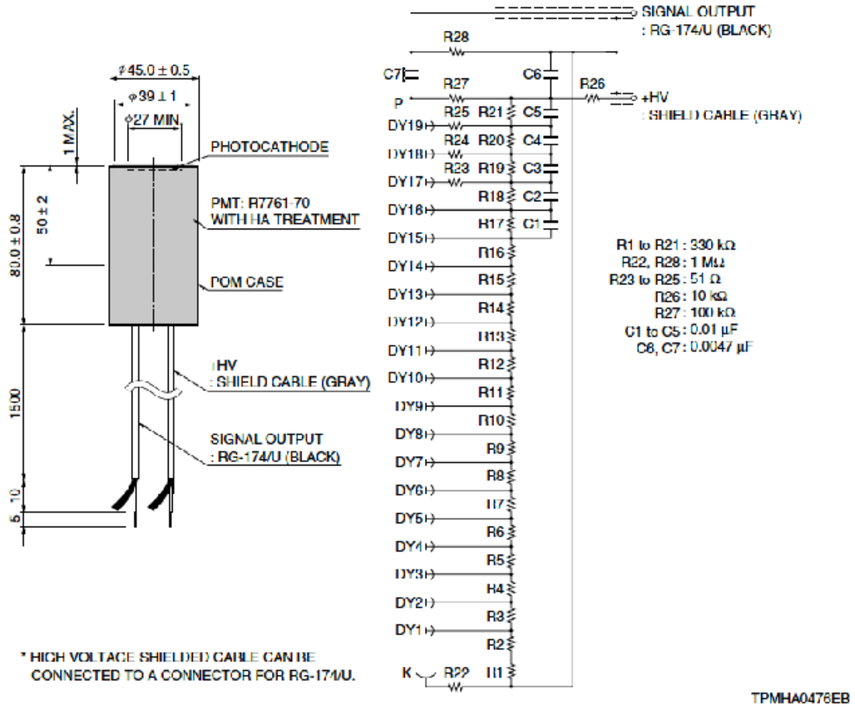
Rise time: 0.5 ns
Decay time: 1.5 ns
Wavelength of Max. Emission: 391 nm

Decay time: 0.95 ns
Absorption: 382 nm
Luminicence: 431 nm, 458 nm

PMT characteristics

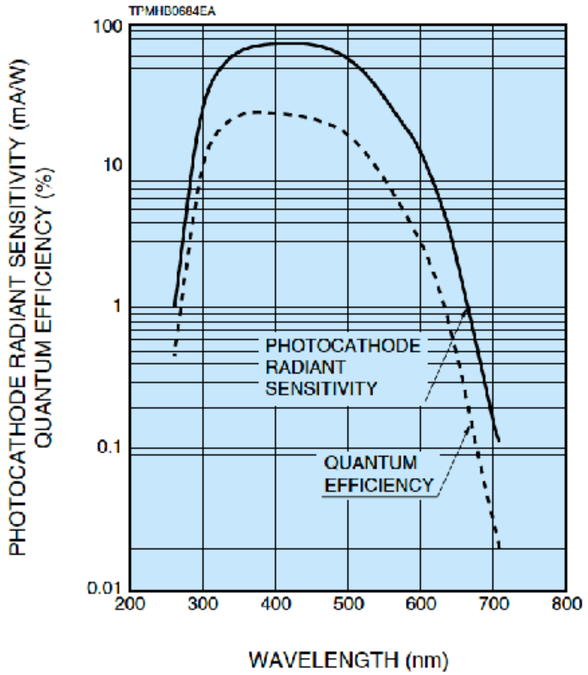
Information from Hammamatsu catalogue

⑬ H8409-70

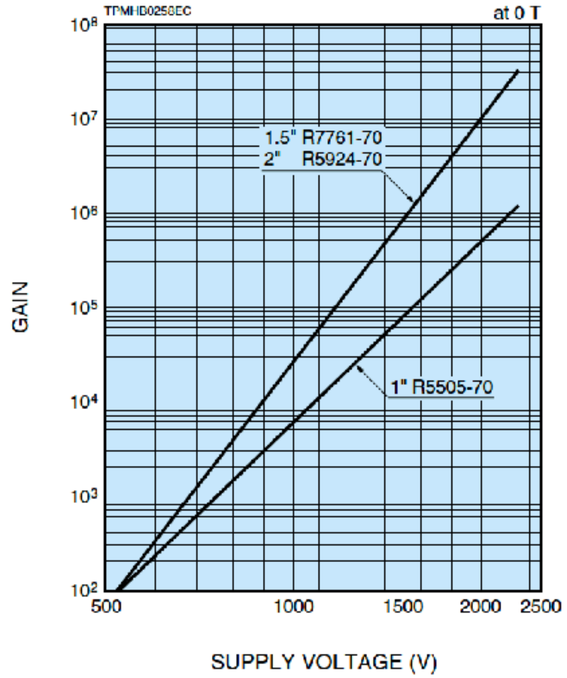


Cathode Characteristics				Anode Characteristics Ⓜ								(at 25 °C)
Luminous Typ. (μA/lm)	Blue Sensitivity Index (CS 5-58) Typ.	Radiant Ⓚ Typ. (mA/W)	Luminous Typ. (A/lm)	Gain at 0 T Typ.	Gain at 0.5 T Typ.	Gain at 1.0 T Typ.	Dark Current (After 30 min.) Typ. (nA)	Dark Current (After 30 min.) Max. (nA)	Time Response Rise Time Typ. (ns)	Time Response Transit Time Typ. (ns)	Notes	Type No. Ⓐ
80	9.5	76	40	5.0×10^5	2.3×10^5	1.8×10^4	5	30	1.5	5.6	(For +HV operation) Assembly type: H6152-70 Recommended	R5505-70
80	9.5	76	800	1.0×10^7	3.0×10^6	1.5×10^5	15	100	2.1	7.5	(For +HV operation) Assembly type: H8409-70 Recommended	R7761-70
70	9.0	72	700	1.0×10^7	4.1×10^6	2.0×10^5	30	200	2.5	9.5	(For +HV operation) Assembly type: H6614-70 Recommended	R5924-70

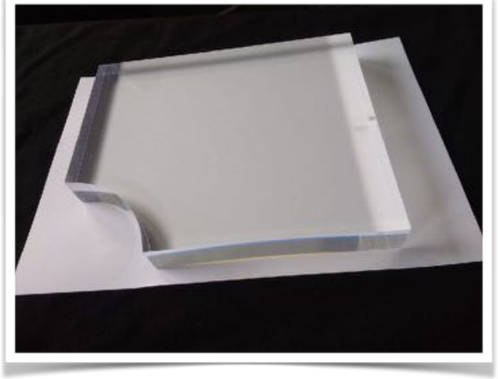
■Spectral Response

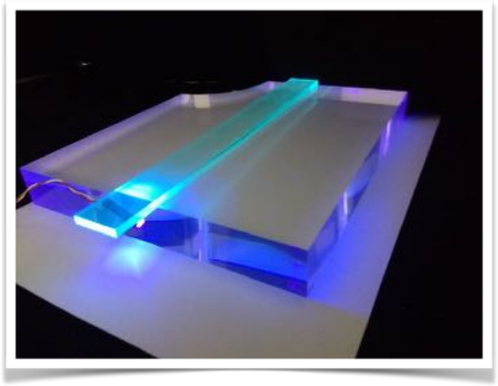


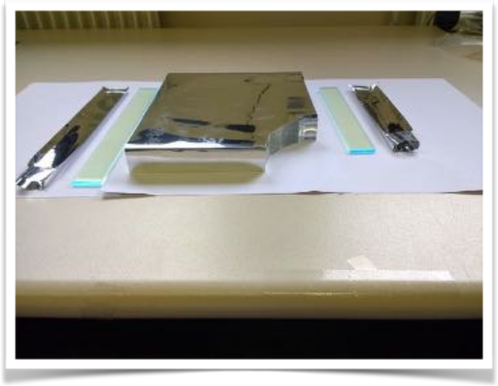
■Gain

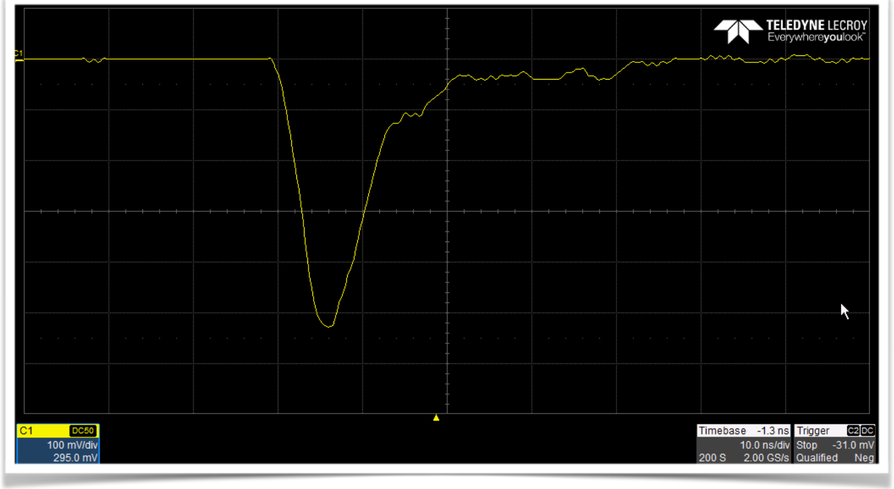


A full FDD prototype

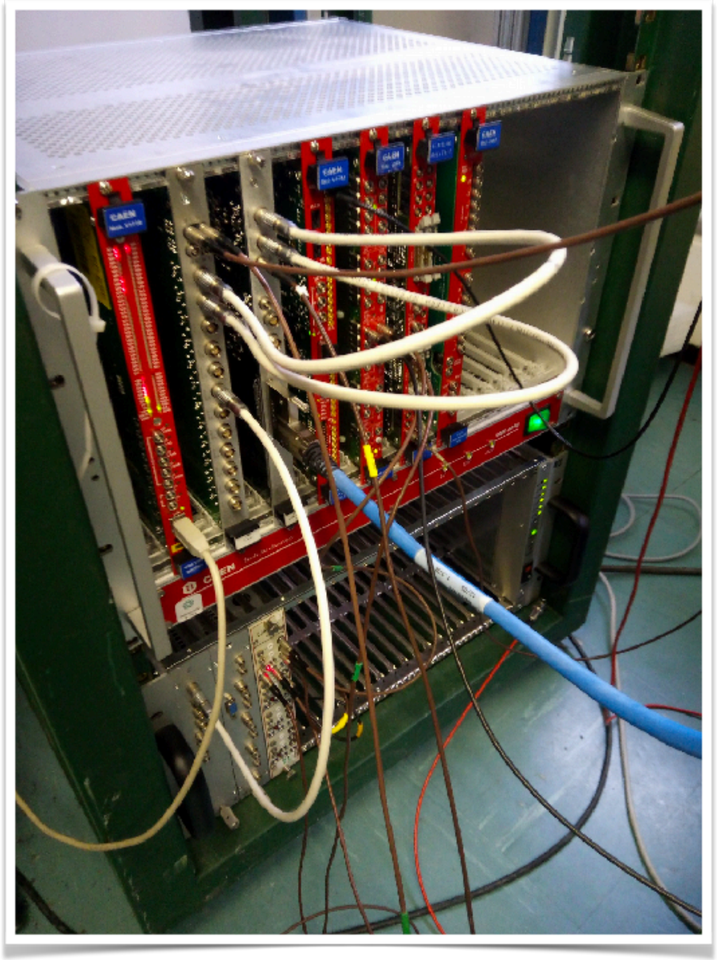




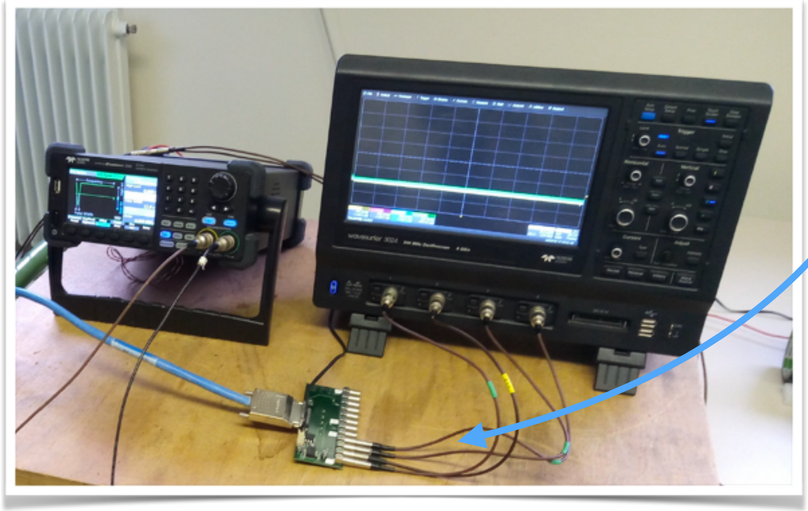




Test bench at CERN



Working prototype
Testing early version of FIT PM electronics



Similar test bench to be set up in our Department soon

Preliminary rough timeline for construction of FDD

September 26, 2019

Activity	04.-06. 2019	07.-09. 2019	10.-12. 2019	01.-03. 2020	04.-06. 2020	07.-09. 2020	10.-12. 2020
Design finalised	✅						
Test with prototypes	✅	✅	✅				
Procurement/tendering of material/components			✅	✅			
Construction of Modules				✅	✅		
Construction of fibre bundles					✅		
Commissioning and Installation						✅	✅

Summary

As part of our obligations to ALICE we have to contribute to the construction and operation of the FDD detectors.

We will participate in the construction of the modules, the development of the electronics and take responsibility for the full software