PANDA Forward Spectrometer Calorimeter (Shashlyk) status and plans

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Outline

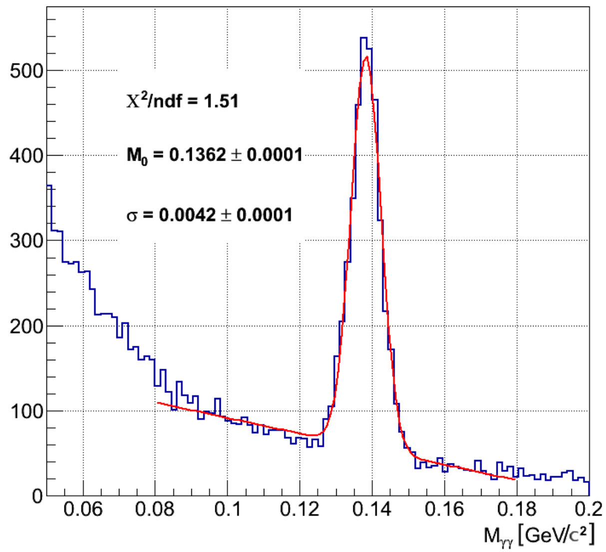
- FSC TDR status
- FSC new prototype tests
- DCS and monitoring system development
- Possible FSC production schedule

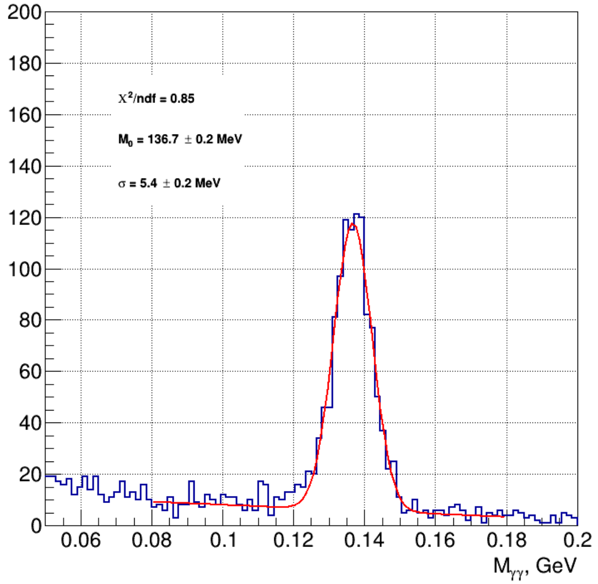
FSC TDR status

- Two rounds of questions-answers with ECE panel at the beginning of the 2016
  - Simulations results
  - Load on the bottom layer of the modules
  - Details of the modules manufacturing process and QA
- Final acceptance of FSC TDR: March of 2016
- Formal request was send to the FAIR management to assign Collaboration Contract for the PANDA FSC construction to IHEP Protvino

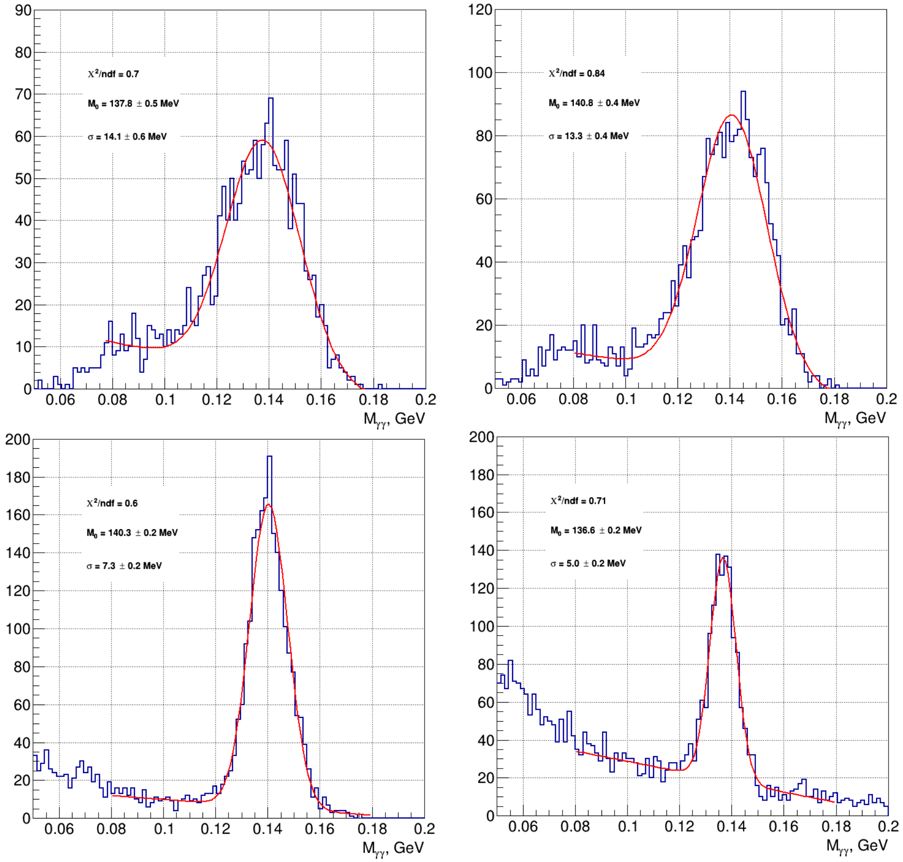
ECE panel questions on simulation results

- Fig 7.6 of the TDR showed invariant mass spectrum of the photon pairs from pi0 decays with the energy of pi0 up to 15 GeV into the FSC acceptance. The question on origin of the low energy tail.
- Additional simulation showed the origin of the tail is from the large numbers of the registered at FSC clusters, which increases with energy. It seems, the reason is an EM-shower formation somewhere before the FSC. If we select the events with number of clusters below seven, the low energies tail background disappears





ECE panel questions on simulation results



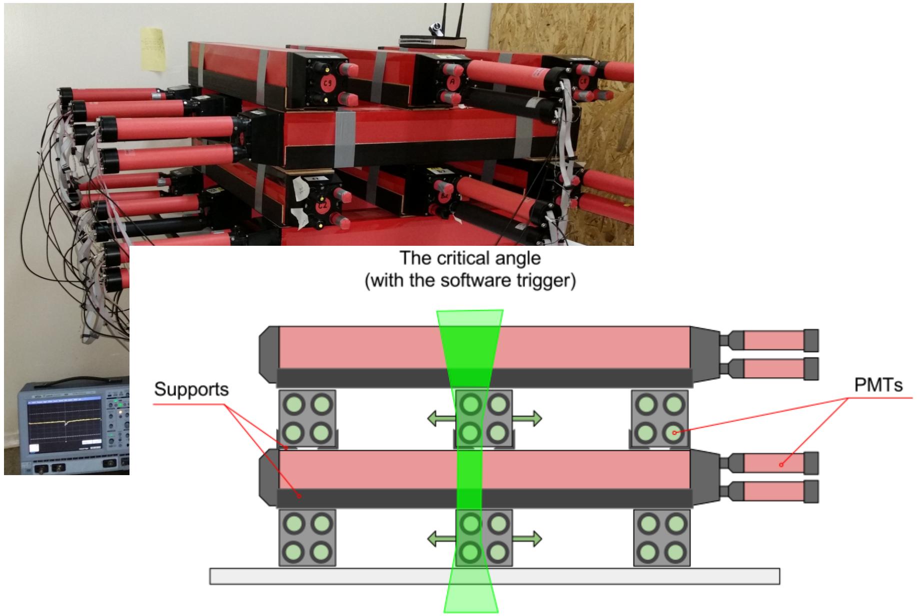
- To prove the reconstruction performance at low energies a set of simulations was done for the pi0 energies 20-50 MeV (?=14 MeV) , 50-100 MeV (?=13 MeV) , 100-1000 MeV (?=7 MeV) an 1-15 GeV (?=5 MeV)
- At least one photon goes to the FSC

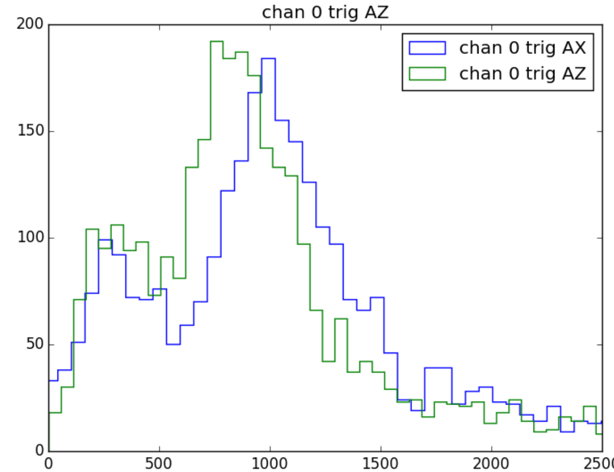
Bottom module load

- Since the FSC modules are placed over each other as a stack it was a worry about the stability of the bottom module optical properties.
- The stress is distributed uniformly over the module surface, which resulted in pressure to the bottom module of 0.046 MPa (average). Taking into account the holes in the tile one can calculate the effective average pressure increase up to 0.053 MPa. Stress concentration at holes is three times more – 0.16 MPa. Comparing this stress with tensile strength and ball indentation hardness from the table of BASF-143 properties, provided by manufacturer, we can see the safety factor of several orders of magnitude.

Density	1.043 g/cm^3
Tensile Modulus (Young Modulus)	3.30 GPa
Poisson ratio	0.22
Tensile Strength, Ultimate	46 MPa
Flexural Strength, Ultimate (Yield?)	72 MPa
Elongation at Break	2 %
Ball indentation Hardness : H at 358N/30c (Ball diameter D=5 mm, F_m=358 N, Time=30c)	150 MPa (indentation depth 📻0.167 mm)

FSC new prototype (no Tyvek) tests

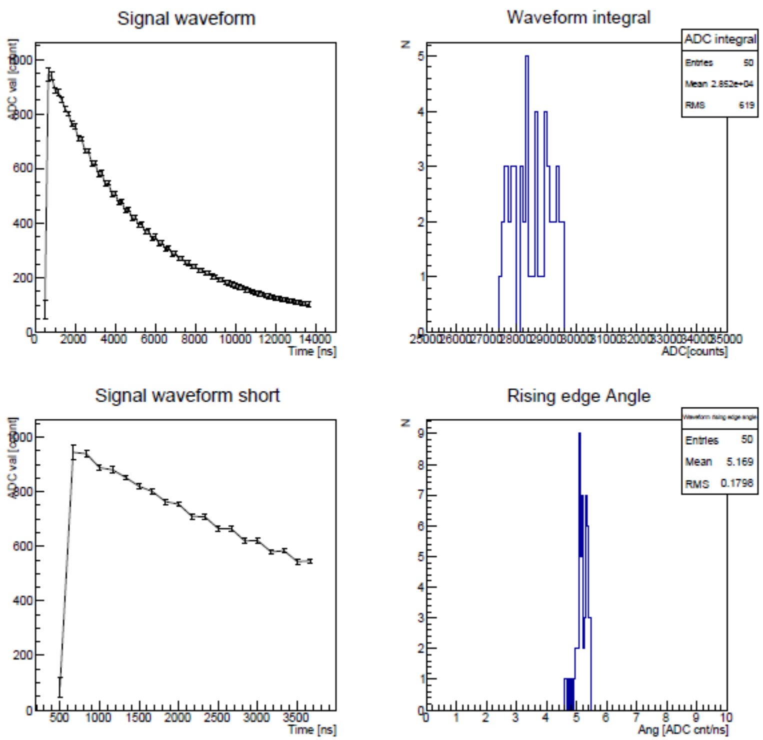




- The complete readout chain in triggerless mode, trigger at software level as a coincidence of 4 cells signals
- Signal sampling by one SIS3316-250-14 ADC utilizing feature extraction algorithm
- Study long-term stability and longitudinal homogeneity
- Quality control for production (24 modules at once – requires 3 ADCs and 48 PMTs

Light Monitoring System development

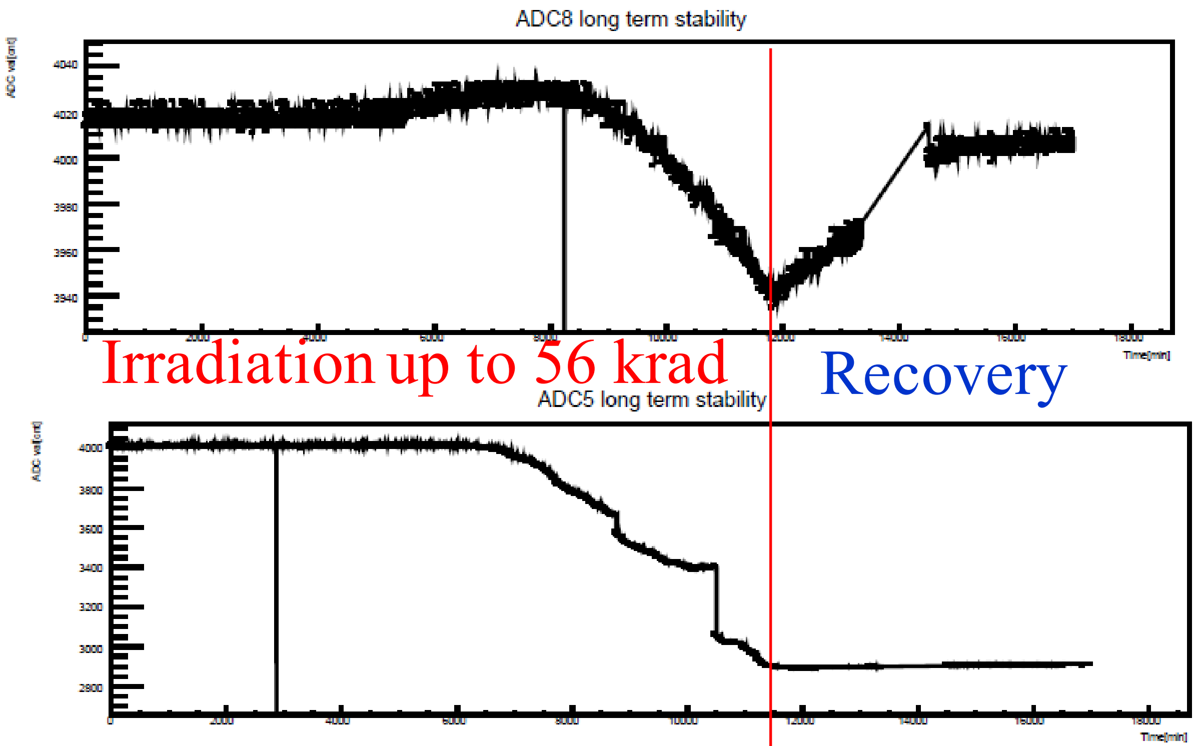
- In the frame of developments for the DCS (Sofia Bukreeva's report at DCS session) one more task for the FSC DCS was added - to watch the LMS LED stability.
- Electronics prototype (stable photodiode detector with microcontroller system and interface to EPICS IOC) was developed and tested



The precision is about 2-3% which is not enough for the high precision monitoring system, but we still have room for improvement

CW bases modification

- To measure actual HV set we are going to include ADC chips in the CW HV bases (Sofia Bukreeva's talk on DCS session)
- To avoid radiation damage problems with ADC we've selected rad.hard ADC chips (gamma and neutrons irradiation)
- ADC chips from TI was selected



Schedule

- End of 2016 - get a signed Collaboration contract of IHEP-Protvino with FAIR to produce the FSC at IHEP Protvino;
- January 2017 - December 2020 - the four years Collaboration contract of IHEP with FAIR on the FSC by using the Russian contributed money into FAIR;
- January 2017-June 2017 materials procurement, tooling production
- July 2017 – Decemeber 2017 Pre-series prototype build and test
- January 2018- December 2019 - manufacture parts,assemble and test all modules, ship it to Germany
- July 2017 – December 2018 - manufacture all the mechanical support parts in Russia and ship it to Germany;
- 2018 - purchase the photomultipliers and ship them directly from the manufacturer to Germany;
- 2018 - purchase the readout electronics (Uppsala University) and ship it to Germany;
- 2020 installation at PANDA hall and comissioning