A setup to test multiple GCUs with physics events

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Introduction

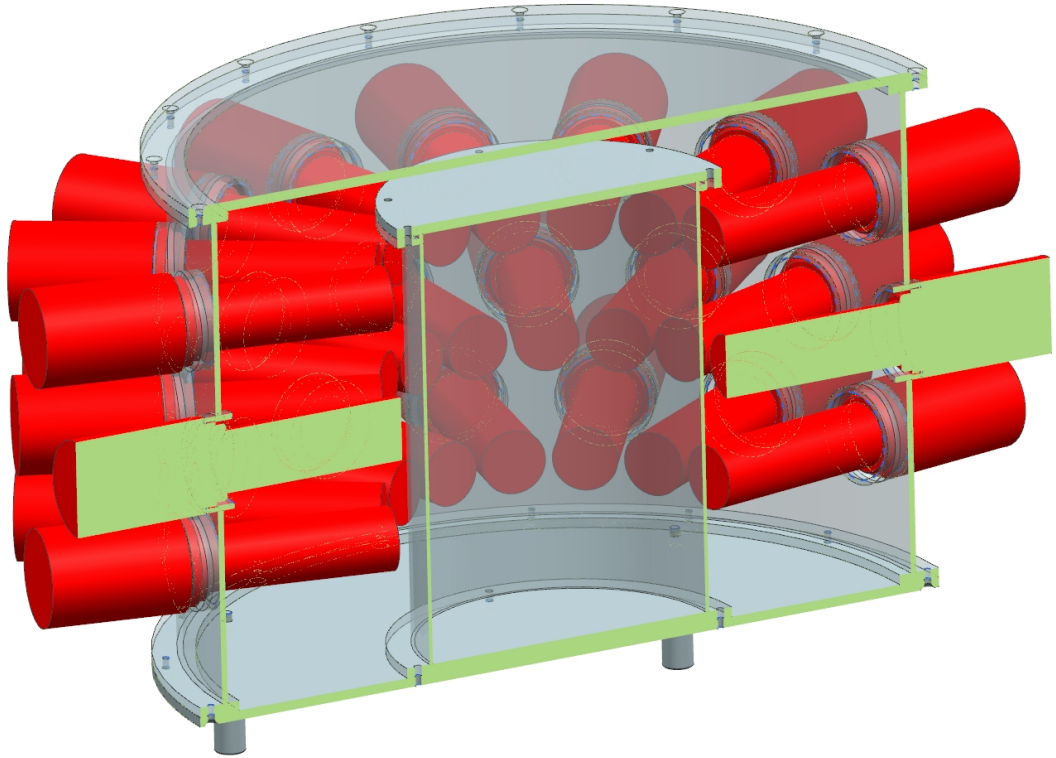
The ideas behind

- test a full JUNO electronics chain
- setup the minimum number of channels which allow to test the full system, from the PMT to the DAQ
- test the PMT response with physics events (cosmics and gamma sources)
- provide a test bench which allows to develop and test trigger, and GCU synchronization
- the system can be used to test simultaneously 48 GCUs plus other JUNO electronics with physics events

The experimental setup

Basic principles

- provide a detector : inner chamber with about 5 liters of LAB (with proper doping)
- scintillation light can be produced by cosmic muons or radioactive sources (γ, or β and possibly α)
- light travels to the PMTs and can produce p.e. $\rightarrow$ signal
- the PMTs can be readout with commercial or custom (JUNO) electronics
- additional external detectors (i.e. plastic scintillators) can be added on top and bottom to provide external trigger signals



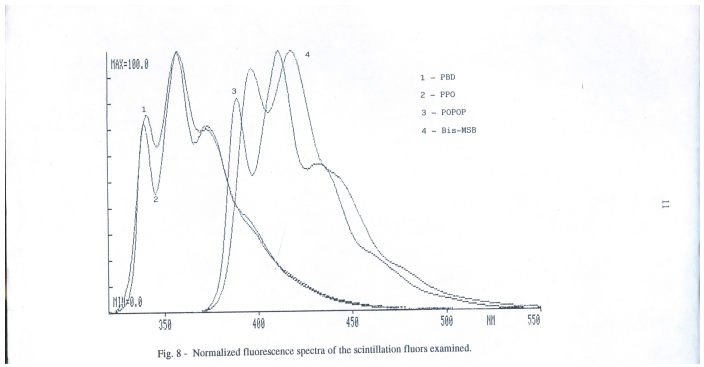


Fig. 8 - Normalized fluorescence spectra of the scintillation fluors examined.

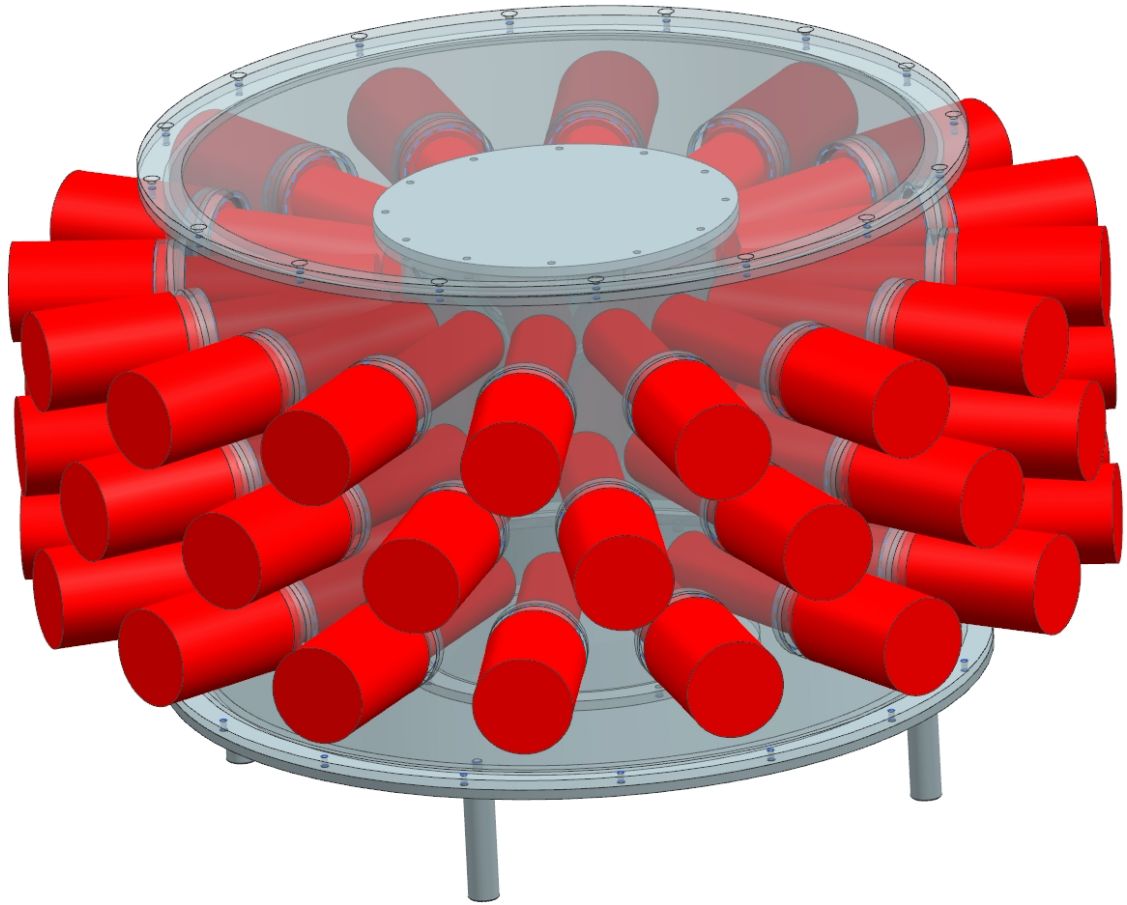
The setup

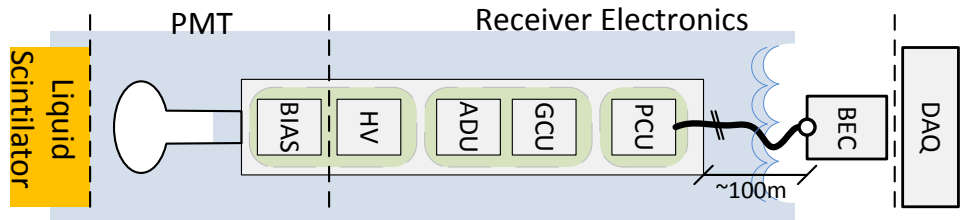
Detectors

- 48, 2" PMTs (Philips, XP2020)
- optically connected to the inner chamber (filled with LAB)

Electronics

- start commissioning the system with commercial electronics :
  - HV : CAEN SY5527, with A7030SP boards (3kV, 1mA)
  - DAQ : CAEN digitizer V1730 (14bit, 500 MS/s)
- add, at a later time, JUNO custom electronics :
- 48 GCUs + Power Boards + BackEnd + Trigger Board + ...
- components can be possibly integrated at different time stages

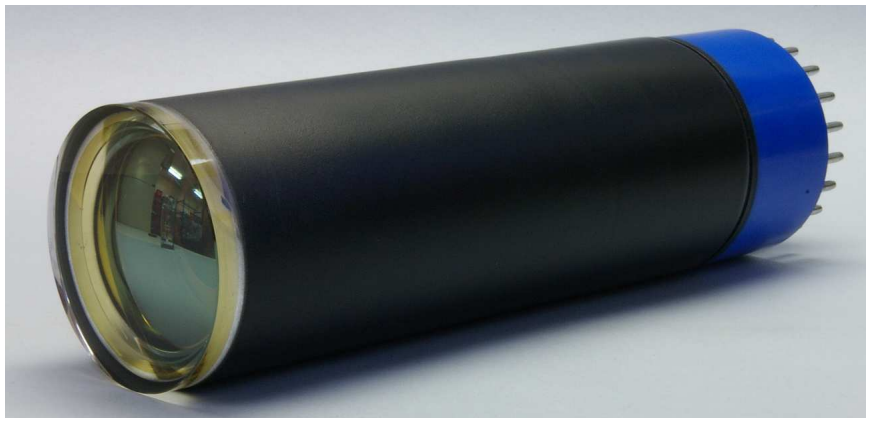




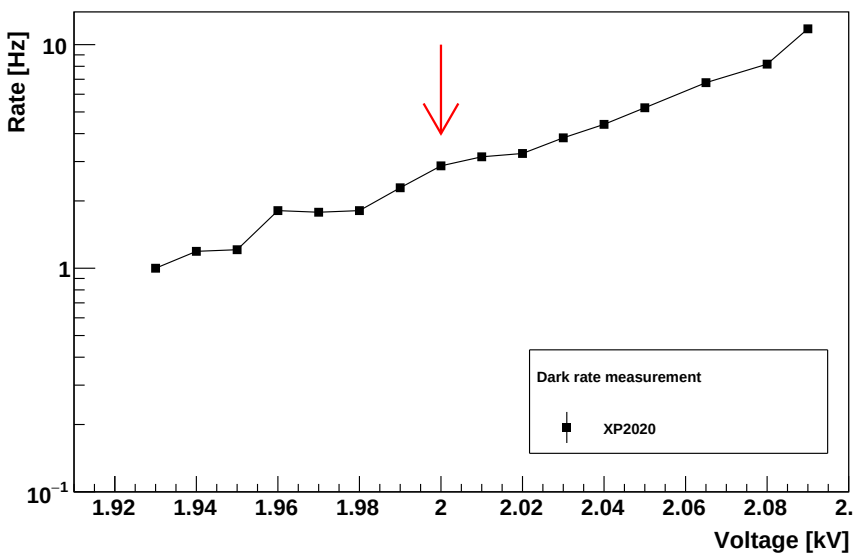
The PMTs: Philips XP2020

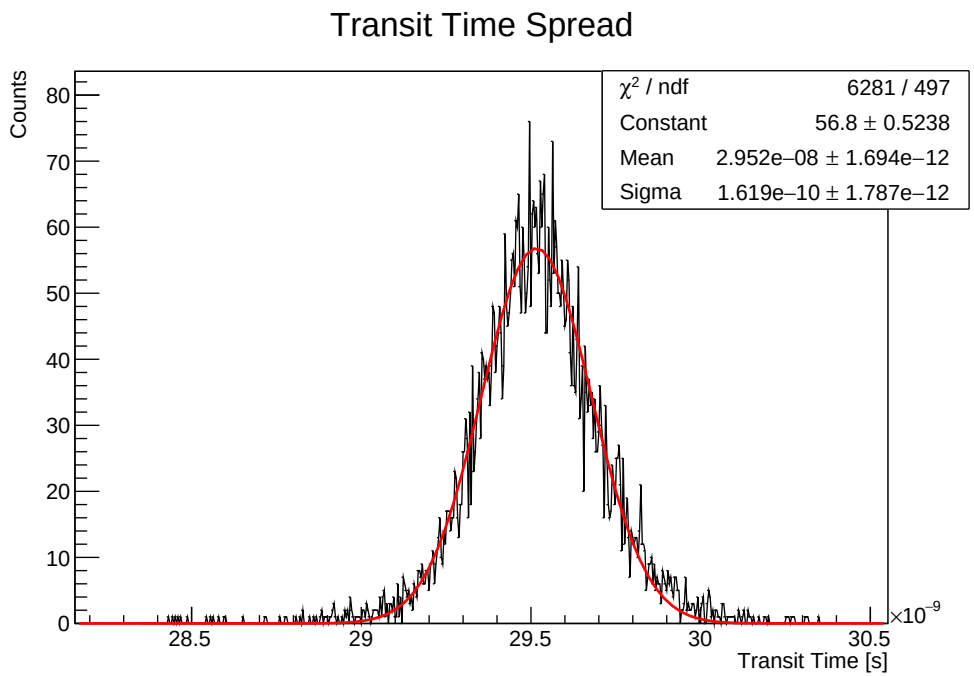
PMT specs

- dimensions: 2" (52 mm diam.)
- fast response: < 1 ns rise time
- transit time spread: $\sim$ 160ps
- Operational Voltage: ~ 2 kV
- High gain: 3×10^7
- Low dark rate: 2-3 Hz



48 PMTs available from a former experiment





Conclusion and Outlook

- We are designing a setup to test a full JUNO FrontEnd Module (48 channels)
- The system will allow to test/debug/improve the GCU firmware
- and to help the integration with the other components (up to BEC and DAQ)
- The system will be commissioned with standard commercial electronics and afterwards will be used to test JUNO electronics
- the system will help integrating and commissioning all the components of the JUNO readout electronics