$\bar{P}$ANDA Barrel TOF
TDR (Internal) Review
What's next?

Ken Suzuki, Stefan-Meyer-Institut, ÖAW

08.03.2017, GSI

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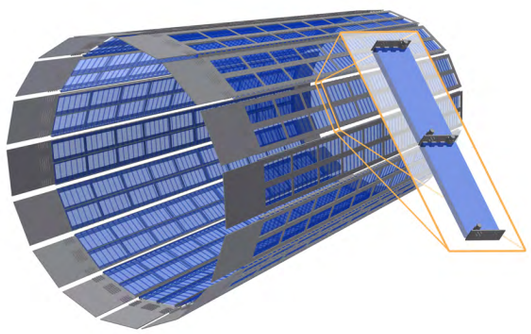
Technical Design Report for the:

$\overline{\text{P}}$ANDA Barrel Time-of-Flight

(AntiProton Annihilations at Darmstadt)

Strong Interaction Studies with Antiprotons

$\overline{\text{P}}$ANDA Collaboration December 2, 2016



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TDR Status

- 2016.12 Submission to the collaboration
  - tdr-barrel-tof_v1.1_20161202.pdf
- 2016.1 First Review Meeting
  - Review Committee
    - C. Schwarz (chair), J. Pochodzalla
    - S. Ritt (PSI), K. Kilian (Jülich), K. Hildenbrand (GSI)
  - tdr-barrel-tof_v1.2_20170113.pdf
- 2016.2 Second Review Meeting
  - tdr-barrel-tof_v1.3_20170221.pdf
- 2016.3 Report from the Committee

Committee Report

Findings

The PANDA Barrel TOF TDR has been presented at a meeting/telephone conference on Jan. 23rd, 2017 and questions have been answered at a meeting/telephone conference at GSI on Feb. 21st, 2017.

The status of the project was presented in a clear and convincing way. Both the status of the technical development of the detector and the simulation of its performance and embedding into the whole PANDA analysis frame (e.g. for the T_zero determination) seem rather advanced and sound.

The proposed detector layout of small scintillator tiles read out by SiPMs on both sides is state of the art; based on the test results described in the TDR and the experience of other projects it can be expected that this Barrel TOF will fully meet the requirements of the PANDA project.

The TOF Review committee thanks the TOF group for the careful consideration of the comments made by the committee. The majority of comments and suggestions were addressed and answered by the group satisfactory. The overall shape of the TDR is quite advanced and – after taking into account the suggestions of the referees – is ready for submission.

Committee Report

Comments

The style needs definitely to be improved. It would pay if somebody of the (co-) authors or an “outsider” from the collaboration spent the time to carefully read the text in order to remove the numerous misprints and the worst formulations and grammatical errors.

Recommendations

Elastic scattered antiproton-proton pairs are strongly correlated and allow monitoring and calibration of the barrel ToF and serve as a check of the luminosity. What are the consequences of the missing acceptance of barrel and forward ToF between 5 and 22 degree?

The geometry and size of the boards etc should be discussed .
Choice, size, and treatment of the scintillator should be optimized concerning cost. At least it should be

mentioned that the final choice is still under consideration.

The scintillators are fixed mechanically only through the glue joints, without any additional mechanical brackets or holders. After some months of operation in the MEG2 experiment, a significant fraction of …..

“R-TOF”

Consider a szintillator RING hodoscope **„RTOF“**
which closes the 22 degree open forward cone of the BTOF down to 5 degree.(The region below is covered further downstream by FTOF).
BTOF and RTOF would leave open about 12% of the laboratory solid angle in backward direction (much less in the cm system) and only <0.04% in forward direction. Most of the charged tracks go into the RTOF solid angle.
As a consequence the **charged tracks** belonging to a reaction event would practically **all and always** show up as hits in the BTOF and RTOF combination. Ambiguities in event building would be strongly reduced.
Practically 100% of **elastic antiproton-proton** scattering events would show up in BTOF-RTOF as two track coincidences. Their strict geometrical and kinematical correlations allow for a continuos monitoring of the PANDA beam and detector performace. Beam position, size, emittance, duty factor, luminosity are controllable. Elastic pairs illuminate the detector with tracks whose directions and momenta are strictly correlated and well known thus providing a continuos performance control for a large part of the detector components. This alone could justify an RTOF.
RTOF would also act as veto for early shower conversion.

One might consider a rotationaly symmetric szintillator „quirl“ hodoscope (like used in JETSET/LEAR, WASA/CELSIUS , TOF/COSY.) Three circular layers of 5mm thick plastic szintillator make a compact stack. One layer is arranged in staight wedges the other two with left and right tilted, distorted wedges (180 degree Archimedian spirals). For the readout SiPM are connected optically on the outer cicumference of the radiators. The diverging wedges have excellent light collection properties and they do not suffer from angular dependence of dead time effects.

What’s next?

Funding

- Funding body ÖAW
- Funding period (2018-2020).
- No sharp deadline but as soon as possible.
- Profile of each year, but just a sum
- Additional personal?

- Main focus
  - is FEE development.
  - LED calibration system
  - TOF-PET2 ASIC
  - “collaboration” with Gießen (AG Düren, End-cap DIRC)
- In parallel
  - a production of the next prototype with full-length railboard.
    - new scheme of fixing scintillator
    - development of special tool
  - single tile performance optimisation
  - software development / physics simulation (D. Steinschaden / K. Dutta)

In near future

- Meeting with Hamamatsu at the upcoming DPG meeting in Münster and also in Vienna
- Meeting with G-Tech (Saitama, Japan)
  - mass production plan
  - scintillator thickness issue (polish 6 mm to 5 mm?)
  - scintillator supply from ELJEN Technology
- Irradiation test of SiPM and scintillator by Gießen group (H.-G. Zaunick)

LED Calibration System

- Blue LED
- SMD
- 1 per tile (single sided) / 2 per tile (each sensorboard)?
  - 2 if cost allows.
- How to drive them?
  - A la K. Kilian / a la S. Ritt ?
- Cost?

LED Calibration System

- Only one type found in Distrelec with condition blue/SMD

SMD-LED blau 3.2 V 1206, 156120BS75300, Würth Elektronik

Fehler melden

Art.Nr. 300-74-768 | Typ 156120BS75300

Neu

Verfügbarkeit

24 h 2018

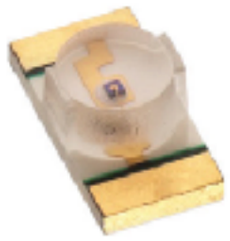
Weitere Lieferung erwartet in 3 Woche(n)

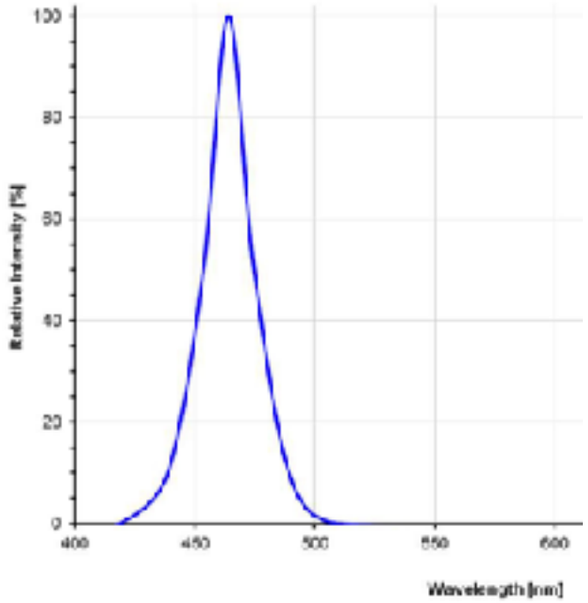
Pro 1 Stück exkl. MwSt. und Versandkosten EUR 0.33

Menge 1 In den Warenkorb

Ihr Preis	
1 +	EUR 0.33
50 +	EUR 0.28
100 +	EUR 0.20

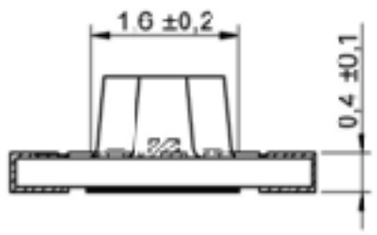
InGaN

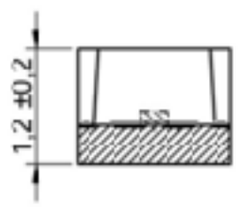


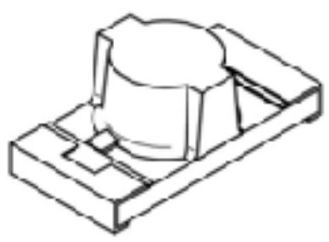


- Price is okay. Why not 2 per tile? (4000 ch → 800€)

- 1.2 mm thick







Comments? discussion?

Backup

Next Steps

- FEE development
  - TOF-PET(2) ASIC
  - will be done in Vienna
    - Help from Gießen (Kai), End-Cap DIRC, GSI (AG Düren +EE department)?
- Radiation hardness test
- Beam test of new prototypes