

Forward Endcap Status

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- Glueing
 - Glueing procedure (BO \leftrightarrow GI)
 - Primer involved couplings
- Electronics
 - APD preamps (gain determination)
 - VPTTs: B-field screening and gain measurements
- Mechanics:
 - Subunit manufacturing
 - Electronics ring
 - Support frame
 - Aluminum closing covers

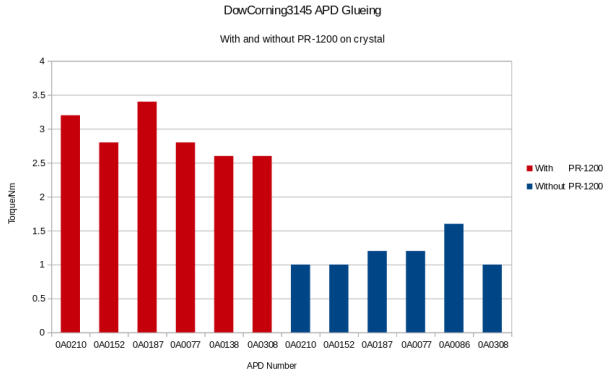
Glueing Procedure: BO \leftrightarrow GI

- Discussion with Barrel people (GI) in October
- Adopted some of their glueing techniques (pressure vs. evacuation of glue)
- Definition of coupling strength:
Tool to remove glued APDs well defined (milled off 18 mm nut, torque wrench)
- No improvement in coupling strength
- Hope: Primer Dow Corning PR-1200 RTV
- Primer improves adhesion of moisture reactive silicones to non-porous substrates
- Improvement of coupling by use of primer:
> 3 \times the strength (breaking torque), durability (T-cycling)
- Transparency, radiation hardness of primer?



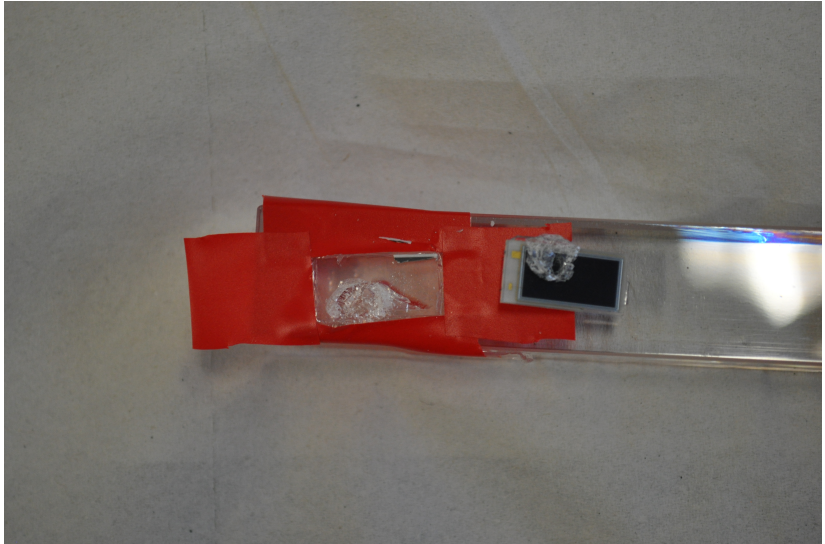
Glueing Procedure: BO \leftrightarrow GI

- Comparison: Glueings done w/ vs. w/o primer
- Within group (red, blue): w/ vs. w/o pressure application



- Additional: Vacuumizing does not harm coupling, however pressurized curing more applicable

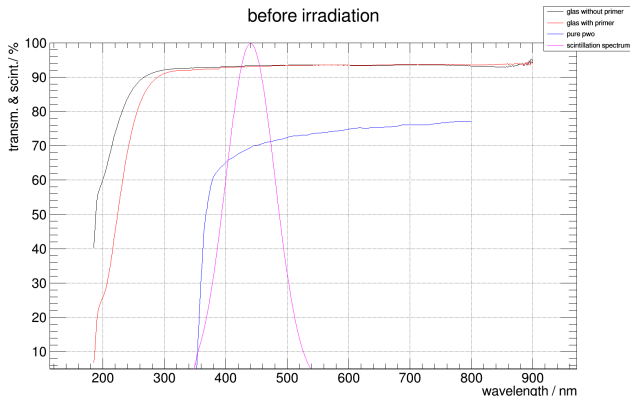
Glueing Procedure: BO \leftrightarrow GI



- Primered couplings may become stronger than crystal...

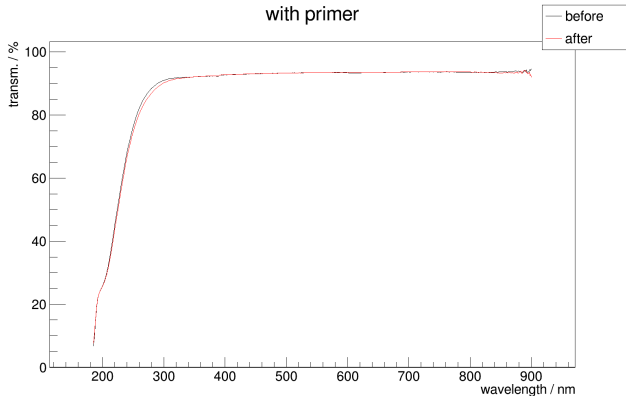
Primer Involved Couplings

- Transparency comparison w/ vs. w/o primer measured by Giessen colleagues
- \Rightarrow Transparency hardly impaired, no loss at relevant PbWO_4 wavelengths!



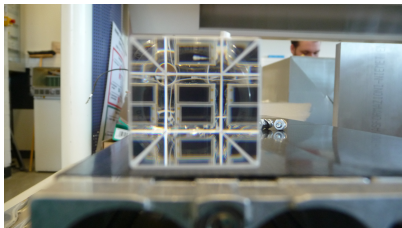
Primer Involved Couplings

- Radiation hardness of primer involved coupling measured by Giessen colleagues:
- No transparency loss after irradiation (PANDA lifetime dose)!



Primer Involved Couplings

- For the forward endcap EMC we will go for primered glueing!
- Several test crystal units having performed tempeature cycling operation ($-25/20^{\circ}\text{C}$) and still do - no coupling problems
- 18, 30, 72 test cycles so far, corresponding to months of operation yet
- Bonn cosmics APD preamp gain determination measurements done with primer coupling incl. transport BO \rightarrow BN \rightarrow BO



APD Preamplifiers

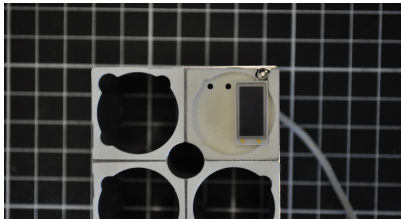
- Latest Bonn cosmics measurements on two (primer glued) final-like APD equipped crystals finished
- Goal was confirmation of necessary APD preamp gain of former measurements (2015 Bonn beam time data)
- Finally both measurements give consistent results of a needed preamp gain of 0.1 V/pC
- (There is one of the four APD-channels malfunctioning: Factor three lower response, some mV offset at output → need to dismantle and look for reason)
- This is the gain the latest ringing free preamp version already has (earlier estimation)
- Order of all 6500 pieces needed (incl. spares) passed to Basel, delivery expected in spring 2017

VPTT Subunit Assembly

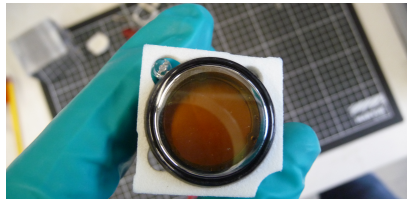
- All forward endcap crystals have been moved to Bochum
- 50/100 VPTTs still need to be screened for B-field gain loss (Bonn) and 1 kV-gain (Bochum)
- When full data set is available assignment of photo tubes to (radiation hardest) crystals will be finished (VPTT gain, crystal light yield)
→ Talk by Merlin in this session
- About 150 VPTTs equipped with voltage divider PCBs
- What is missing/currently worked on for subunit assembly is
 - Suitability of VPTT capsules
 - Final concept of annealing LED mounting

VPTT Subunit Assembly

- VPTT/APD capsules
 - May or may not transfer stress to crystal-photo detector coupling due to sagging/tilting of crystals in alveole
 - Needed for proper closing the 'stack' in z-direction (VPTT)
 - Has at least to be modified to carry annealing LED (APD)
- Need to finalize concept of annealing LED mounting
- Space available but...
 - ...does the LED with its attached cabling introduce noise to the front end electronics (high-C APDs!)
 - ...do we machine the existing capsules (by hand) or do we go for a new modified production (APD)? (VPTT: cut)



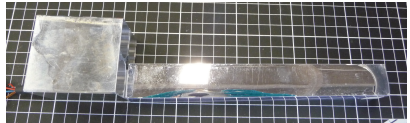
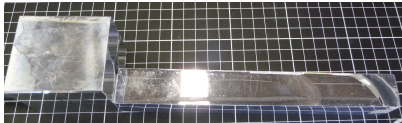
Thomas Held (RUB EPI)



Forward Endcap Status

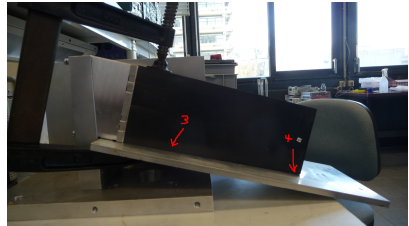
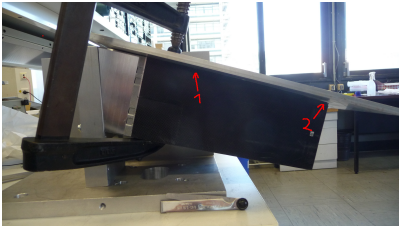
VPTT Subunit Assembly

- Estimation of sagging and tilting of crystals in alveole with respect to stress on coupling via capsule
- On the table:
 - Crystal w/ photo detector and capsule can be tilted by at least 1.5 degrees up and down (safe!)
 - A parallel displacement of the crystal relative to the insert is possible by only 0.5 mm!
 - Crystal movement in alveole between manufacturing and mounting position possibly a combination of both



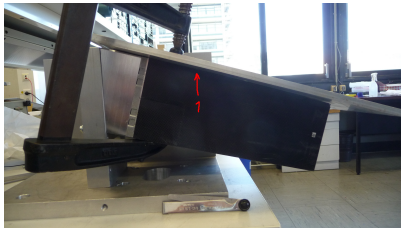
VPTT Subunit Assembly

- Subunit filled with high accuracy brass crystal dummies, wrapped in reflective foil, equipped with capsules
- Assembled while sitting on table, then mounted to backplate-like suspension
- Measure clearance with feeler gauge on four positions relative to aluminum plate oriented parallel to insert
- All four orientations (crystal - interface piece/backplate) checked



VPTT Subunit Assembly

- Alveole almost always in line with lower plate
- Most important value: play at insert side relative to upper aluminum plate (position '1')
- Clearance at position '1' in any case less than 0.5 mm
- Things might even get better when inserts are glued to the alveole during final assembly (A \rightarrow A')

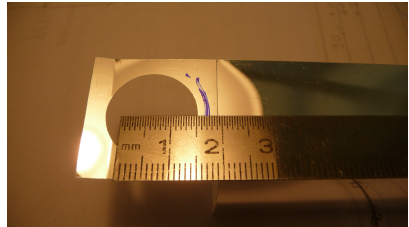
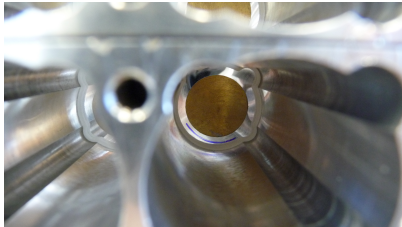


position \rightarrow orientation	1	2	3	4
A	0.1	1.1	0	0
B	0.04	1.0	0.03	0
C	0.08	0.8	0	0
D	0.03	0.4	0	0.15
A' (+24 h)	0.15	1.3	0	0

all numbers mm distance

VPTT Subunit Assembly

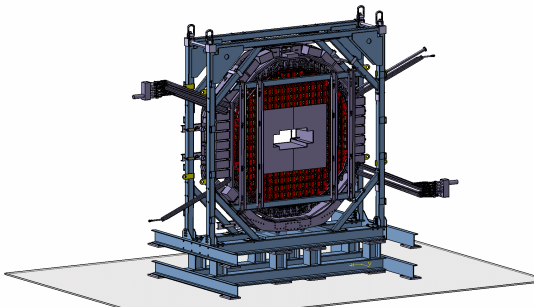
- Brute force test: pushing brass dummies in subunit by means of a lever (screw driver)
- Mark set in quiescent position, second mark set when pushed
- Marker line thickness 0.5 mm: estimated movement of crystal 0.5 mm (just okay)



- Conclusion: The capsules offer enough play in the insert holes to not put stress on the photo detector-crystal couplings
- However, if we decide to build new capsules (APDs) we should redesign for even more play

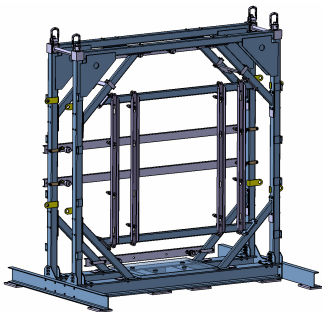
Forward Endcap Support Frame

- Jülich engineers (J. Colienne et al) finished construction of forward endcap support frame
- Massive steel construction intended to suspend forward endcap during preassembly in Jülich
- Frame also supports forward endcap during transport from Jülich to Darmstadt



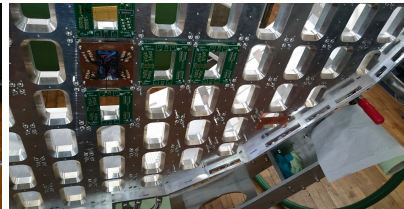
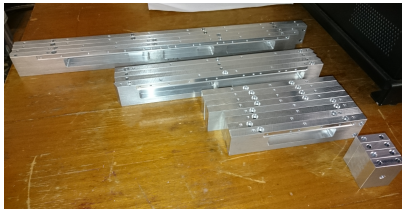
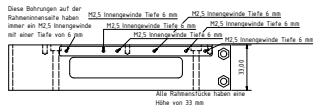
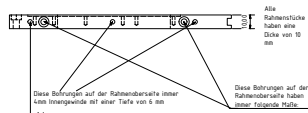
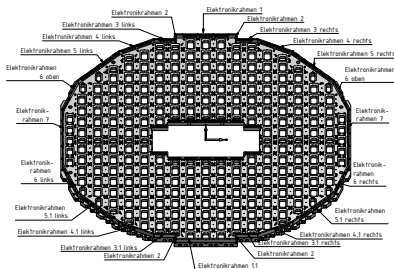
Forward Endcap Support Frame

- Frame can be departed in front and back subframe, allowing to assist in insertion procedure of forward endcap into PANDA magnet
- There is an additional platform the frame will sit on in Jülich in order to match endcap position with COSY beam height
- The frame is currently under construction at a steel works company in Herne (Riedl)



Electronics Frame

- Electronics frame on forward endcap backplate manufactured and (test) installed



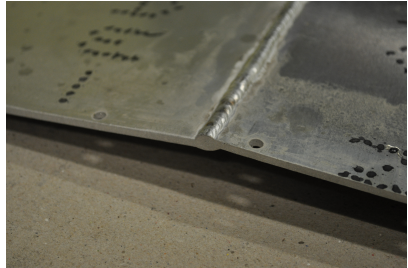
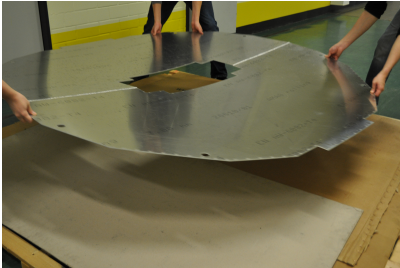
Aluminum Front And Back Lids

- Front and back cover aluminum closing lids of forward endcap finished
- 0.8 mm front lid challenging to weld (and grind)
- Both lids water jet cutted after welding:
Screw holes for mounting, securing, and beam hole



Aluminum Front And Back Lids

- 3 mm back lid turned out to be too much deformed during the welding process to be properly mounted
- Will go back to welding company for repair/grinding in January



Summary/Outlook

- The pressing problem with photo detector glueing is solved by usage of primer fluid
- All preamps now finalized and ordered (Basel)
- Subunit manufacturing can start as soon as recovery LED related issues are clear
- Forward endcap mechanics is progressing
- Support frame to be erected in COSY-TOF hall end of this month
- More forward endcap status related topics in this session:
 - SADC/shaper tests (Malte)
 - HV regulation board (Christoph)
 - Crystal/photo detector assignment (Merlin)
- Lever manipulator arm (CERN) for subunit mounting to backplane
 - Moving to Jülich, construction of PANDA subunit adapter