Minutes of HPD meeting on 5th July 2002

C. Joram
Christian reported on the z resolution using two methods..
Method 1: To calculate the z coordinate and its error a factor k has to be added to the standard formula of charge asymmetry. It has been observe d in the microscopic simulation that this factor is necessary to get a linear relation between the z of emission and the reconstructed z. k≈3 and it propagates through the error➔ the z resolution is 3 times worse.

Method 2: Another way to calculate the z coordinate and its error is using the formula

$$\mathbf{z} = \frac{1}{2}(\mathbf{L} - \mathbf{k}.l \ln(\mathbf{Q_R}/\mathbf{Q_L})) \quad , \quad \mathbf{sz} = \frac{\mathbf{k}l}{\sqrt{2\mathbf{Q}}}\sqrt{\mathbf{e}^{\frac{L-z}{l}} + \mathbf{e}^{\frac{z}{l}}}$$

where again a factor k is needed because the real path length of the photons is longer than the geometrical distance z. In this case k=0.8
Plots on the reconstructed z vs the generated z have been shown by Christian using the two methods. Also the resolution as a function of the z of the interaction for different values of absorption length have been shown. Using the second method and for λ=75mm the resolution is ~ 2.5mm at the center of the crystal and ~ 3.2 mm at the edges.
The number of collected photoelectrons changes (for λ=75mm) from ~750 at the center of the crystal to 1000 at the edges. For smaller absorption lengths the number of photoelec trons emitted at the center of the crystal is smaller. This would degrade the energy resolution.

He also presented a comparison between the axial geometry and the standard geometry with the following assumptions
crystal section 3.2x3.2 mm
Absorption length λ=75mm
Source size 2x2 mm box
Angular distorsion: 0.5 degrees (θ, ϕ)
Photons are generated back to back in x between –100mm and 100mm; in y between –100mm and 100 mm and in z at 0. After measuring the signal collected in the modules the interaction point is reconstructed.
In the axial geometry the resolution in x and y on the reconstructed interaction point is independent of the position where the photons where originated. In z the resolution is slightly worse than in x,y.

In the standard geometry the resolution in x and y degrades as the x and y are generated far away from the (0,0). On the other hand the z resolution is better.

Have a look to the transparencies to see what the axial and standard geometry is and to understand the definition of the system of coordinates.

M. Chamizo
Reported on the comparison between LSO and YAP performances using GEANT4 simulation.

	YAP	LSO
Photofraction	4.5%	33.8%
1c+1pe	10%	35%
1c+1pe unambiguous	2.3%	12%
Prob. Detection in coinc.	0.45%	21%

Also a report on the energy resolutions was done comparing the geometries where a lens is added at the end of the crystal and when no lens is added.
The energy resolution is better when no lens is considered and it is ~3% RMS for 511 keV photons.

F. Schoenal
Reported on different possibilities of generators to simulate the interaction of lowenergy phtons with a PET scanner. The best option is obtained with GEANT and EPDL97 libraries (EIDOLON simulator). He reported on the input parameters necessary for the program and the output obtained (sinograms). Also he reported on the corrections needed to get the final image.

C. Joram for A. Braem
Mail from A. Braem

-   Serge has prepared the last ceramic to kovar active-brazing test (needed to weld the 5" knife flange). Brazing will be done as soon as he will be back from his holiday.

-   A "standard" brazing technology (with MoMn + Ni metallisation of ceramic) already tested at CERN can also be used for the ceramic-Kovar joint, but has a slighty higher cost.

-   The drawing of the Pet Ceramic Round 5" (PCR5) envelope has been updated with the "standard" technology at the ceramic-Kovar joint (to be on the safe side)

-   a set of detailed drawings have been produced

-   The following items have been ordered:

           3 Saphire windows diameter 114mm, 1.8mm thick   Tot.   960.- Euros
           9 test Saphire windows (we had to order a min. of 9pc)
                               diam. 54mm, 1mm thick   Tot. 1170.- Euros
           1 Ceramic tube diam. 116 / 105mm length 160mm   210.80
Euros
           4 metallised ceramic rings (For the "standard" brazing tech.)   Tot. 2000.-
   CHF

- Quotation received from CERN's main workshop:

    Machining of 8 electrodes (Nb provided by Serge):   Tot. 780.- CHF
        (Tooling 200.-CHF + machining 580.- CHF)

    Machining of 3 Nb rings (Nb provided by Serge):   Tot.   390.- CHF
        (Tooling 150.- CHF + machining 240.- CHF)

    Machining of 4 Kovar tubes   Tot.   1100.- CHF
        (Tooling 550.- CHF + machining 550.- CHF)

- A 5" knife flange has been recuperated from a broken HPD, ready to be sealed to PCR5

Activity proposed for the next month:

- Continuation of test brazing on small size ceramics (Serge)
- Machining of PCR5 ceramics (EP/TA1)
- Machining of PCR5 Nb and Kovar elements. (main workshop)
- Study of the evaporation tooling needed for the PCR5 photocathode deposition. (TA1)

+ Actions resulting from your meeting...

I apologise for the inconvenience of the late notice of my absence.

Enrico Chesi reports on progress with test electronics for VATAGP3 tests including full test of sparse readout. The design of the VME readout system including XLINX logic is finished and is checked using a simulator. Gerber files will be sent to Ruy for production of the PCBs in about 10 days.
Federico Cindolo is joining the project and will do programming together with Enrico to set up the VME test facility.

Heinz Pernegger reported on the analysis of some test data obtained with the VATAGP3 mounted on the test hybrid of Enrico. The chip is connected to a 128 channel COMPTON pad sensor. Abnormal gain variations and noise variations across the 128 channels of the chip are observed. Effect needs further studies. Is probably due to non-uniform pick-up over all channels.

Peter W reported on some problems with SINTEF. Their offer for the HPD pad sensors for HPD-PET does not include new masks. This means that they charge 58% more than last time. P.W. will deal with SINTEF.
P.W. gave some short comments on a workshop on PEM last week in Lisbon. PEM could be a very interesting application for the HPD-PET module.

Terry Pritchard reported on VATAGP3 testing. 4 more hybrids will be equipped with 1 VATAGP3 each. Terry needs help in analysis software to be able to look at data taken in list mode. Maybe Federico could come into this activity as well.
Bettina Mikulec wants to get involved in the VATA tests after her holidays.