n_TOF Analysis Group Meeting

Bologna, Wednesday, November 27, 2013

Material is available on INDICO at: http://indico.cern.ch/conferenceDisplay.py?confId=275569

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51	Christina Weiss	**CERN**	CW
52	Phil Woods	**Edinborgh University**	PW
53	Tobias Wright	**University of Manchester**	TW
54	Petar Zugec	**University of Zagreb**	PZ

Opening:

The head of INFN in Bologna opens the meeting at 9:00 at the University in Bologna with a welcome speech.

EC thanks ENEA, INFN and the University of Bologna for organizing the meeting and sponsoring the social event and the catering during the meeting. He forwards the apologies by Peter Schillebeeckx, Daniel Cano and Enrique Gonzales, for not having the possibility to join the meeting.

CM welcomes the n_TOF collaboration in Bologna and gives details about the venue and the city. He thanks the department of Physics and INFN Bologna for the funding.

Fission by Intermediate energy neutrons (Dr. Sergio Lo Meo):

Fission induced by intermediate energy nucleons (200 MeV – 2.5 GeV) is usually considered as a two-stage process. The fast intra-nuclear cascade is described as a succession of binary collisions and is followed by the de-excitation of the residual nucleus. The following codes are available for the description of the process: INCL++ for the fast cascade and Gemini++ or ABLA07 for the de-excitation.

The computational strategy in Gemini++ is to calibrate the parameters of fission models with experimental (p.f) cross-sections before applying them to the calculations of (n,f) cross-sections. Then the theoretical ratios to 235U(n,f) is compared to n_TOF ratios.

Discrepancies are still present between the calculations and JENDL at high energies for actinides (n_TOF data is normalized to JENDL). It seems to be a matter of normalization.

To conclude, both INCL + GEMINI and INCL + ABLA07 can reproduce experimental cross sections, but the absolute (n,f) cross-sections are larger. For the future a systematic analysis is planned to have the possibility to predict the cross-sections measured at n_TOF and angular distributions of fission fragments for isotopes of interest to n_TOF.

NC: The absolute cross-section seems to be the problem. Maybe there is an interest to measure the 235U(n,f) absolute cross-section above 200 MeV. It should be clarified how fission at high energies is defined, as binary fission is for sure not happening.

LTG: The transient time has to be taken into account at high energies. Maybe this would enhance the results above 200 MeV. - In ABLA07 it is included.

AF: The available experimental data for actinides all show that the cross-section is going down at high projectile energies, which is also visible in the JENDL evaluation. The pre-equilibrium stage is not taken into account in the calculations, which would result in too high excitation of the nucleus. This might be the reason for the discrepancies at high energies. For lighter elements this would not have such a strong effect, which would explain the better agreement for Bi and Pb.

241Am & 235U capture with the TAC (E. Mendoza):

1) 241Am(n,γ):

The measurement was performed in 2010. All the analysis with alpha-gamma discrimination and all calibrations is finished. The main issues are the background determination and the normalization. Monte Carlo simulations seem to be in good agreement with the experiment. In the extended resolved resonance region the resonance analysis is still to be done.

There is an open issue with runs that were recorded with different sampling rates (500 and 250 MS/s). It is not clear whether the geometry for these runs was different or if there is a problem with the analysis routine. It could also be that the digitizers work different, depending on the sampling rate. This is still under investigation.

The background situation is still under investigation. In the dummy measurement resonances of Sm are visible.

For the normalization, the effects from the detection efficiency as well as the BIF are considered. It seems that there is an open issue still for the BIF. There is a 7% difference between two calculations for the BIF.

The analysis is still on-going. The tasks are the normalization, the determination of the background and the resonance analysis at high neutron energies.

1) 235U(n,γ):

The measurement was performed last year. A new student at CIEMAT is analysing the data. The raw data was re-analysed with a new Raw2DST routine (v16). The energy and time (also for coincidences TAC-FTMG) calibrations are done. The energy calibration looks fine. Some preliminary results are already available. The first simulation of the fission gammas was performed. The experiment and the simulation do not agree yet.

NC: The comparison of the 241Am measurement with the C6D6 measurement should be done. One should also check if Au was measured with different sampling rates to clarify the issue with the sampling rate. - EM will check, but the statistics is not very good for Au.

FG: Did you compare the yields and not the cross-sections? – EM: Yes.

TW: Where does the 0.6 scaling factor come from? – EM: This would be the scaling factor in order to agree with the libraries. But the background is not flat as there were different materials in the beam and different BaF2 crystals could play a role.

Findings on the neutron sensitivity from Geant4 simulations (P. Zugec):

The previously presented Geant4 simulations for the C6D6 measurement campaign of 58Ni showed large discrepancies to the experimental data for natC. In contrary, there was a good agreement for the predictions of the experimental yield for 58Ni and Au. The best guess was that there could be PVC (C2H3Cl)n in the isolation tape on the detector. The analysis of this material showed that this is not the case. However, one should always take care about the materials at the detector.

New simulations were performed with the geometry of the whole experimental area included. The detector part is very detailed. The neutron flux was included up to 20 GeV from experimental data and the FLUKA simulations, as neutrons above 10 MeV could be a cause of the problem. Indeed the new simulations show that this was the cause for the discrepancies. Now the shape of the experimental yield is reproduced with the Geant4 simulations. The reason is the inelastic reactions in C as some residual nuclei are radioactive with high decay-beta energies, the most dominant being 12B. The high precision models in Geant4 stop at 20 MeV, which explains the discrepancies, which are still present.

Conclusion: Carbon measurements cannot be used for normalization below 1 keV as the beta reactions dominate in the low energy region.

An analysis of the contributions for the neutron sensitivity of the different components was made for Bicron and FZK detectors. The thermal tail now agrees well for both detector types. For the neutron sensitivity the experimental hall has to be taken into account.

Gamma-cascades are reproduced in Geant4, as the simulations give the same spectra as data published in libraries. But there is an inter-spectrum that shows up in the simulations, as the correlations between different gamma de-excitations is not taken into account in Geant4. As the weighting function makes the yield independent of the cascade path this is not a problem, but one should be aware of it. In addition, it is shown that the dips in the n_TOF neutron flux are not only due to Al, but also Mn and Cd.

A paper on the simulations of the neutron background is in preparation. For questions about the included models in the simulations, contact PZ.

NC: This is possibly the most beautiful work ever done at n_TOF. With these simulations we are finally able to get the prompt and delayed components of the neutron sensitivity.

CG: We have to distinguish between prompt and delayed neutron sensitivity. When we look at the resonances this is most important as there we do not care about the constant background. Unless the cross-sections are very well known, the prompt neutron sensitivity has to be taken into account.

EM congratulates PZ. It could be interesting for the people of Geant4, to make a comparison of the different models above 20 MeV.

Status of 25Mg(n,γ) and neutron flux in 2012 (C. Massimi):

Neutron flux 2012:

In 2012, 5 experiments with capture collimator and one measurement with fission collimator were performed. In 2012 only SiMon and PPAC were used to measure the neutron flux. The 4 SILI detectors are in good agreement; an amplitude cut for the triton peak was used. There is electronic noise present at a few ms after the g-flash. The electronic noise cannot be completely rejected, as it cannot be distinguished in the amplitude spectrum from the signals. When SiMon is normalized to PKUP it agrees well. There is less than 5% uncertainty due to statistics.

When comparing to other years, the beam intensity was about 10% lower than in the past. The efficiency of the SiMon is not well known. We cannot trust SiMon above 20-30 keV. Hence the PPAC data was used in addition to measure the flux. 3-25 keV neutron energy is the matching region between the two detectors to get the neutron fluence over the full spectrum. The neutron flux from thermal to 1 MeV is now available. The shape of 2012 and 2011 flux agree, but the absolute value is lower for 2012.

Hence the evaluated flux should not be used for 2012, but rather the data presented now. The uncertainty is <4% for statistics and systematic about 3%.

25Mg(n,γ):

25Mg(n,γ) was measured again as there was a problem with the sample in 2003. The statistic in 2012 was again not very good, but the sample was much better and the borated water, as moderator, was better for the measurement. In 2003 the data was normalized to the natural sample. Now the data is normalized with transmission data from Gelina, which is unfortunately only available up to 300 keV. There are big differences between the measurements 2003 and 2012. The resonance shape analysis is still on-going. The MACS of this work is 10-20% lower than what was measured 10 years ago. The uncertainty of the data is reduced.

MB: The search for coincidences should have worked to get rid of the noise in the SiMon data.

FK: What is the impact of the new Mg data to the inverse reaction? This is of highest importance to astrophysics.

CW: The resolution in the amplitude spectra of the SILI detectors is worrying. Maybe there is a problem with the detectors? - NC: This is due to the electronics, which is very noisy. The detectors were calibrated with α particles and the response was good.

AF: Do we have an explanation for the decrease of flux? - CG: it is due to 235U normalization in a region where the cross-section is not reliable. - EB: The Li foil in 2012 was degraded! The question which flux is to be used for 2012 is not clear. The SiMon is only for monitoring that the shape does not change and not for an absolute measurement. CG suggests using the evaluated flux for 2012 measurements, and normalizing to known resonances.

240,242Pu(n,f) measurement update (A. Tsinganis):

The challenges of the measurement were the baseline oscillations after the g-flash, the high α-activity of 240Pu and the spontaneous fission background of 242Pu. The final difficulty was a serious deterioration of the detectors over the measurement due to the high α-activity! This is unfortunately not negligible in the data analysis. The only advantages for the MGAS detectors that stay after this experience are the low background and the fast signal. We cannot state anymore that the MGAS detectors are robust and radiation hard, neither that they are stable for long runs.

Due to the deterioration of the detectors the fission fragments were not distinguishable anymore after a certain point from the α-particles. There are also some fluctuations on small time scales. This could be related with the gas flow or pressure. This should be kept in mind for very long measurements with the MGAS detectors. All the data had to be put into small bunches and analysed separately, for time windows where the gain was more or less constant.

Various resonances are visible at low energies for 242Pu on top of the spontaneous fission background from the samples. This background was fitted for both beam-off and beam-on runs to confirm that spontaneous fission is dominating the background at low energies.

Baseline oscillations have been removed by subtracting the oscillations of different detectors from each other. This is the basis of the analysis in the high-energy region.

Some new resonances, which are not included in ENDF, were observed, for example around 1.8 keV. This measurement should be a good complement to the measurement at Los Alamos, which was performed at a short flight path, as we had the good resolution, but suffer of the spontaneous fission background. We should be able to analyse the data up to a few 10 of MeV.

Concerning the simulations for these measurements, the GEF code, which should be well suited as it reproduces the experimental data very well, is used for reproducing signals from α and fission fragments.

A large part of the 240Pu data has to be discarded. The analysis fro 240 Pu has to be done in a different way as the α-background has to be subtracted very accurately in order to not loose more statistics due to a high threshold.

NC: How is the data normalized? – AT: There is no normalization at this stage.

LTG: The 'bump' after the fission threshold in the cross-section could be due to an angular distribution effect, which is exactly at this neutron energy. One can check this with the 235U data as this effect is also in this isotope at about this energy.

PW: Could you have done something about the degradation during the measurement? – AT: Maybe a voltage change could have solved a bit of the problem.

FG: It should not be too expensive to exchange the detectors! – To be kept in mind for the future.

Status of 33S(n,α) with MGAS (M. Sabate-Gilarte):

The main purpose to measure this reaction is to clarify the discrepancy of available experimental and evaluated data and to provide some experimental data below 10 keV.

For the measurement 2 MGAS chambers were used with 6 33S samples in total, together with auxiliary samples. The samples were measured back to back. The presented results are for chamber 1.

The data is normalized to ENDF 10B data. In the amplitude spectrum the alphas cannot be distinguished from the background, so a cut was made in the scatter plot. There is a step visible in the projected spectrum at a few keV neutron energy, which is not understood yet.

First resonances are presented and compared to the data of Wagemans for the front and back samples. The preliminary cross-section is higher than measured by Wagemans. The area of the resonances will be analysed in the future.

To conclude, data for this reaction are for the first time presented below 10 keV neutron energy. The samples were characterized by means of RBS and PIXE at CNA. The presented results are preliminary.

NC: Was the Li data already analysed? – MS: No, that comes in the future. The presented results are only for MGAS-chamber 1.

PW: Can one improve the noise to go below 1 MeV alpha energy? – MS: Probably possible in the future.

AT: It would be good to measure in Spain at a mono-energetic beam.

Status of 238U(n,γ) with the C6D6 (F. Mingrone):

The measurement campaign included background measurements and sample with and without filters.

Data reductions have been performed very accurately together with calibrations and background subtraction. The analysis of the background with filters in on-going. The 2012 flux by C. Massimi was used for the analysis.

The resonance shape analysis is on-going. The yield of Au was compared with evaluated data to be sure that the data is fine. The phase 2 resolution function was tested for the resonance of 238U at 6.65 eV. With the new numerical resolution function the shapes are reproduced best. It is more suited for the analysis of the data than the old analytical resolution function. This holds as well for the data recorded with the natFe sample, although the effect can only be seen in the tail of the resonances.

To conclude: Data reduction, calibrations and background subtraction are finalized. Only the analysis of the background level with filters is still on-going. A preliminary resonance shape analysis up to 1 keV was presented. It is suggested to use the numerical resolution function for the analysis of phase 2 measurements.

FG: For saturated resonance one has to apply a different weighting function than elsewhere. – FM: The self-absorption was taken into account in the analysis. FG suggests applying this also to other resonances.

NC suggests using REFIT as well for the analysis.

TW: How was the uncertainty for the kernels obtained? – FG: By error propagation, but the analysis is not finalized yet.

CG: The 3rd Fe-resonance is not affected by the resolution function, so this is not a good validation for testing the resolution function to be used! One has to go to 20 and 80 eV to validate the resolution function. In addition, is there an estimation already available for the unresolved resonance region? – FG: We should be able to go up to 500 keV, but first we had to agree on the flux.

MB: There seems to be a trend in the ration of the Kernels, could it be that there is still a problem? – FG: This could be related to the background estimation. It will be better understood once the measurements with filters are analysed.

238U Neutron Capture with the Total Absorption Calorimeter (T. Wright):

Only updates to the analysis, with respect to the last meeting, will be presented. The neutron scattering background is the main source of uncertainty. There was an issue with the pile up for this measurement. CIEMAT has provided simulations to estimate this, which is the basis for the pile up corrections. There is good agreement within 1% for runs with high and low count rates. One count per μs is the highest count rate that can be digested for an accuracy of 1% in the pile up correction. The yields do agree again within 1%, so the correction is validated.

The resonance analysis was also performed with the new resolution function, as the old one did not work (same as for FM). With SAMMY fits the background was assumed to have a constant component and an energy dependent component.

Probably the multiple scattering is still an issue. But in evaluations the uncertainty is about 2%, so it will be difficult to beat that.

To conclude, the dead time and pile-up corrections are finished. The normalisation to the first resonance must be accurate within 1%, which is now achieved. The final accuracy is expected to be no larger than 3% up to 10 keV. Details on the analysis can be found in the ANDES project.

Study of 234U(n,f) fission fragment angular distribution (E. Leal-Cidoncha)

The angular distribution is important to be known for the state of the nuclide at the saddle point and the fission dynamics as well as for the detection efficiency to improve the values of the cross section, especially in the threshold region.

The measurement was performed with IPN-Orsay PPACs. The samples were put between two PPAC detectors, with the samples on thin Al backings. Results of the analysis of data from the first 234U target are presented. The detectors were tilted by 45deg to improve the efficiency (finally about 57% on average over all angles).

Different fission fragments are well distinguishable in the scatter plot. PPAC is almost insensitive to gamma rays. Via the coincidence method the alpha activity and spallation reaction products can be discriminated.

The FF trajectory is reconstructed with a delay line with a maximum of 320 ns length. A calibration of the detection efficiency was performed with 234U(n,f) isotropic behaviour at thermal energies. Anisotropy parameter is obtained by now up to 100 MeV.

The method was proven already with 232Th and now with the data of 234U. The data are in good agreement with existing data. All the remaining detectors will be analysed next as well as a resonance analysis will be made.

A measurement with 231Pa is planned, but the authorities did not allow the import yet. LTG says that the measurement will not be feasible before 2015.

Fission angular distribution of 232Th and physique mechanism (L.S. Leong)

This talk is about the same measurement analysis as presented for 234U. The reconstruction of the target shape shows the power of the tracking method. The efficiency can directly be extracted from the experimental data. The angular distribution was fitted with Legendre Polynomials for all energies. The anisotropy parameter is given up to 600 MeV for 232Th.

It depends on the relation of K to J how anisotropic the fission process is. In the data one can distinguish between forward-backward peaked and sideways peaked fissions as well as nearly isotropic fission. The angular distributions differ to proton-induced fission, which shows that the angular distribution is related to fissility (Z^2/A). Spin, fissility and excitation govern the fission fragment angular distributions (FFAD).

To conclude, FFAD were measured up to 600 MeV. The results are in agreement with previous data at low energies. Proton induced fission was not measured, so we cannot make a statement for these FFAD.

VK: How was the target shape reconstructed? – LSL: See the explanation by ELC. The feasibility was also shown by Diego Tarrio by simulations.

Analysis of the 243Am(n,f) cross setion (M.Mastromarco):

This reaction is very important for transmutation studies, but only 2 sets of measurements are available so far. The libraries extracted resonance parameters from the total cross section by Simpson et al., but this is not reliable.

The measurement was performed in 2004 at n_TOF with oxide samples in the FIC chamber. Very high a-activity was present, but with a high amplitude threshold it could be suppressed. FLUKA simulations were performed to get the correction factor for this threshold.

A lot of contaminants were present in the sample and estimated with SAMMY. The resonance analysis is only possible until 250 eV, due to limited statistics. There was a resonance found at about 1 eV, which is not present in the evaluations. In contrary, according to the libraries resonances should be present at 8 and 11 eV, which is not present in our data. This could be due to a 239Pu contamination. Apparently, JENDL is based on a measurement with a Pu contamination in the sample.

Kernel comparisons show that the cross section is overestimated by about 8% in the libraries. In the unresolved resonance region the agreement is good. Above 500 keV the data agrees better than 5% with the libraries.

Analysis of the 237Np(n,f) with the FIC detector (M. Diakaki):

Preliminary results are presented for a measurement of n_TOF Phase1 (2003) with the FIC detector. There was one Np sample mounted with 235U and 238U reference samples in the FIC chamber. The reference samples had diameters of either 8 or 5.2 cm. The Np sample had a diameter of 8 cm. 100 us were recorded for each event. The samples were characterized in Athens by means of Rutherford Backscattering and α-activity. D. Karadimos provided the analysis routine for the measurement.

Above 1 MeV the data is very difficult to analyse. There was a baseline issue, which was solved with an averaging of the signals to filter out the baseline oscillations. There is no sensitivity to the grouping for the average signal. The analysis finds pileup signals very well. The sensitivity was also investigated for the noise level choice. A threshold of 30 FADC units was chosen.

The analysis was benchmarked with the 238U targets normalized to 235U. The analysis routine seems to have a problem with high counting rates. Some pulses are not found by the routine. Hence for the neutron fluence measurement the small 235U target is used (5cm). This is important below 2 MeV, as 238U is used above this energy and there is no problem with these samples.

Preliminary results below 10 MeV are presented. Above this region, the analysis is not possible.

LTG: What is the difference in the data to Paradela's measurement? – MD: about 6%.

NC: You will need a simulation for the correction factor due to different diameters of the sample surfaces.

AT: You could still use the rejected data with a refined analysis.

Detectors

A new detector for measuring proton recoils (P. Kavrigin):

The original idea was to build a proton recoil spectrometer based on diamond detectors. First measurements were performed with a 239Pu α-source, a PuBe neutron source and a measurement with thermal neutrons and a neutron converter.

The spectrum of the α-source is as expected at the correct α-energies. The measurement with the neutron source was to see the 12C(n,α) reaction with this source, which has a wide neutron energy spectrum. It had to be investigated how α counts can be distinguished from the background. For this the signals were read out with a current amplifier to be able to make a pulse shape analysis. This can be done in a sCVD diamond detector as one gets a triangular pulse for traversing particles and rectangular pulses for particles that get stuck in the detector. For the analysis different approaches are investigated.

For the measurement with the Li foil at the reactor the triton peak can be nicely distinguished already from the amplitude spectrum. The α peak or 6Li(n,α)t is covered by the gamma background. With the pulse shape analysis the α's can be distinguished.

NC: Are the number of counts in the two peaks of the Li measurement the same? – PK: This is under investigation; it is likely that the trigger plays a role. And the probability for α to exit the sample is smaller.

CDP: Can you distinguish between different penetration angles? – PK: No, this is not measureable in this form.

CG: Can you distinguish for the range of the particles? – PK: No, at least it is not straightforward.

EC: How is PK's PhD related to n_TOF? – EG: The PhD is in experimental neutron physics and the results will be relevant for future (n,α) measurements at n_TOF.

Report on the new Al-MGAS detector (J. Andrzejewski):

The motivation for the development of Al-MGAS was the proposed measurement of 25Mg(n,α), as the Q value is so low for this reaction. Different detectors were thought of for this measurement.

The Cu-MGAS detectors have a too high background to distinguish the alphas of the concerned reaction from the background. New Al-MGAS were built at CERN to investigate if this would be better, as Al has negative Q values for the (n,cp) reactions, in contrary to Cu. These new detectors were calibrated with a multiple alpha source. Both the signals from cathode and anode were investigated.

The spectrum in comparison with a Si detector is not very good. There is a huge background. Also with thermal neutrons and 6Li the detector was calibrated. When introducing the alphas from the side, a peak is becoming visible, but still there is a background at low energies where α of 25Mg are expected.

There was also a microphone effect observed with this detector.

Conclusion: The MGAS detector is not the optimal solution for our goal. Particle discrimination and good energy resolution are necessary. Telescope would be a possibility, but then the statistics will be a problem. In addition, a ΔE detector would not work, as the α-energy is too small. We do not have a solution yet for this measurement. Only a ΔE -E detector would allow the discrimination of background and signal.

PPAC monitoring for EAR2 (L. Tassan-Got):

A new vessel has to be constructed to house 2 or 3 PPACs and 1 or 2 targets. The front-end electronics has to be changed and a dedicated gas regulation is needed. The high counting rate will be difficult in EAR2, so the detector has to be adapted for this. The expected counting rate is presented for 231Pa, but this applies also for all other fissile isotopes. The delay line could be reduced to 80 ns. A conceptual drawing for the monitoring PPACs is presented, with Mylar, Kapton and the sample in the beam.

The front-end electronics will be funded by Needs, which will start in January 2014. For the PPACs there is no finance, but there are 2 in spare, which can be used for the commissioning. The targets have to be produced, but 2 are available for the commissioning. The gas regulation is hopefully financed by USC. The vessel could be financed by Vigo, this is the most crucial point.

NC: We can measure both neutron flux and beam profile? – LTG: Yes, but we should just characterize the beam spot once, and then for the monitoring just measure the beam intensity.

MB: What is the thickness of the materials in the beam? – LTG: 0.1 um of Al is on the Mylar foil for the electrodes of the detector.

CG: How difficult will it be to produce the vessel? – EC postpones this discussion to the next day, as it might be possible to provide the vessel at CERN.

NC: How accurate can you determine the thickness of the materials? – LTG: 1% is the final limit.

New monitors for n-flux measurements and n-beam profile in EAR-2 (L. Consentino):

Enrico welcomes LNS-INFN (Catania/Italy) in the collaboration.

The SiMon in EAR2 shall be reproduced by the group from Catania for EAR2. The detection principle is explained. For EAR2 the size of the SILI detectors will be reduced (3 x 3 cm^2) to compensate for the higher flux. The Li foil thickness will be less than in EAR1. Both 6Li and 6LiF can be produced.

For the beam profiling Si-strip detectors are investigated, the measurement would be done in 2 steps. The other possibility would be to use a position sensitive detector with read-out on the corners.

Concerning the electronics, a lin/log preamplifier is under investigation to reduce the effect of the γ-flash.

The carbon fibre chamber is already designed and presented.

FG: Does the chamber have windows? – CW: No, this is not planned, as the chamber housing the detector will be part of the beam line. This will be presented the next day in the report on the status of the EAR2 beam line.

PFM: There is a preamplifier developed that did not have a problem with the intensity of the γ-flash, but rather a baseline oscillation. The thickness of the Li foil might be a problem? – LC: No, it is thin enough to work fine.

A new detection concept for measuring (n,γ) cross section with improved sensitivity and resolution (C. Domingo-Pardo):

The motivation is the 204Tl(n,γ) cross-section measurement and the background for the experiment when measuring with C6D6. There is a background problem expected for this reaction from the contaminants, which would be worse in EAR2.

The origin of background when using conventional C6D6 TEDs comes from capture in the photomultiplier material, scattered neutrons producing background radiation and in-beam γ-rays. The peak to background ratio is 1/5, meaning that 5 wrong events are registered.

The new idea would be to replace the C6D6 detectors with position sensitive scintillators. This would be made following the Compton principle, which would give information about the origin of the gamma ray. In addition, the mass of the detector would be less, which would reduce the neutron sensitivity.

The proposed detector consists of LaBr3 crystals with an AXIC based readout system and photomultipliers with 8 x 8 cells. In front of this would be a thinner LaBr3 crystal with a MPPC.

Simulations about the efficiency show that the efficiency is low enough to apply the pulse height weighing technique but a bit too low with 2 detectors. If a 4π geometry is used, the efficiency becomes acceptable.

Simulations were performed with the current setup of C6D6 detectors in comparison with the new setup. The signal to background ratio is 0.02 for the C6D6 and 4 for i-TED, with imaging it would be even 14.

The drawback of the system is the limited detection efficiency of 3-4% for a full array and the needed 80 channels for a full array. But the high energy resolution would allow extracting much more information on the levels.

More simulations will be made for this setup and a prototype will be build.

DJ: CeBr might be better as detector material, as it has no self-activity. – CDP: This should not be a problem, as we would measure in coincidence. There might be a problem with a strongly fluctuating efficiency.

FK congratulates to the work, it is a great step forward for neutron capture.

NC: The pulse height weighting technique will not be easy to apply, as the Compton scattering is not uniform.

FG: Could you start only with a crystal, but without a position sensitive system? – CDP: Yes, as was shown with the simulation. Even without imaging it works fine, the ratio is better than for C6D6.

EC: Do you plan a parasitic measurement for next year? – CDP: Yes, that would be nice!

What about the electron-positron pairs? – CDP: That is not included yet in the simulations, but should be investigated. Multiple scattering was taken into account in the simulations.

Status of existing detectors (S. Montesano):

Enrico introduces Simone Montesano as the new support engineer. His time is dedicated 50% to n_TOF and 50% for crystal collimation at CERN. The first task for him was to clarify the status at CERN concerning detectors.

Simone thanks the people helping him with the work. The detector needs for the measurements in 2014 are presented. The ready availability of detectors, samples and instrumentation will be fundamental from summer 2014 onwards, as n_TOF will have 2 experimental areas running in parallel. There is a general reorganization of the storage areas for n_TOF and the material. The inventory of chemicals and other material will be done from Dec. onwards. The detector status is given in this presentation.

The detailed list of available detectors can be seen in the presentation in Indico.

The needs are 4 C6D6 detectors, the TAC, 2 MGAS and eventually something for the commissioning and monitoring for both areas.

The TAC is in EAR1, the additional material in the old control room and the neutron absorber in the cupboards at the entrance of the controlled zone. Tests for the gated PMTs are on-going at CERN. It is not clear whether the optical connections of the detectors should be revised.

Concerning C6D6 detectors, there is one working detector from Karlsruhe, 2 working Bicrons and one working from Legnaro available. The not working, resp. leaking detectors will be thrown away. There are also 2 mechanical supports, so we will need new supports for these detectors. One sample exchanger is broken. In total, 4 working detectors are at CERN and 7 are in preparation or somewhere else.

A long list of MGAS detectors is presented. We have profiling detectors and monitoring detectors as well as big and small detectors. It is not clear yet which detectors work for sure. Some detectors are in production at the moment.

A calibration of the SILI detectors showed that the detectors do not need to be replaced. INFN will improve the shielding of the electronics. The 6Li foil should be replaced before the start in summer 2014.

Two FIC chambers are available at CERN.

There are several detectors at CERN, which could not be identified.

The next steps will be to conclude the inventory and the reorganization of the materials at CERN. A review for the measurements of 2014 will be done. The verification of the working conditions of the detectors should be organized. SM kindly asks for the people in charge of the different detectors for working meetings, so that the status of each type can be evaluated.

PFM: There will be only 2 additional C6D6 detectors provided. The leakage of the C6D6 should be investigated.

The meeting is closed at 18:10.