VESUVIO assessment

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1 Calibration with no CCR

The MANTID routine EVSCalibrationAnalysis is used in order to get a calibration of the instrument when no Al CCR is used. As a first step, the aforementioned routine can determine the values of L_0 and t_0 using:

- an U foil in the sample position inside CCR (run 14025 measured by M. Adams on December 2008, 45.6 μAh). This is used to define L_0 and t_0 from the (n, γ) resonances measured by YAP detectors in forward scattering.
- a 2 mm Lead with U foil upstream (run 12571 measured by M. Adams on February 2008, 3129 μAh). This is used to define L_0 and t_0 from the dips in the spectra measured by ^{6}Li glass detectors in backscattering.
- a 2 mm Lead (run 12571 measured by M. Adams on February 2008, 2799 μAh). This is used as a background in both cases since there are no structures in the region of the resonances 120 μs $< t <$ 320 μs.

These are all old runs, but are mainly needed for quantities that should be independent on the position of the detectors. On the other hand, if the negative value for t_0 is due to electronics issues, there could have been major changes in the last 7 years with replacement of cables and devices.

The other parameters to be fitted are L_1, E_1 and θ. The calibration of these parameters is based[1] on

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[1]Calibration of an electron volt neutron spectrometer, Nuclear Instruments and Methods in Physics Research A (15 October 2010), doi:10.1016/j.nima.2010.09.079 by J. Mayers, M. A. Adams

- a 2 mm Lead in chimney with no CCR (runs 17687 – 17712 measured by MK and GR on April 2015, 2340 μAh). d-spacing is used for θ and L_1 and the position of the recoiling peak for E_1 and L_1.
- a V slab as a background (run 17086 measured by A. Seel on April 2014, 1509 μAh).

The procedure is iterate twice and convergence for the parameters is obtained. The iterative procedure is initialised by an input consisting of an old instrument parameter file.

2 Dependence of the results on the initialising parameters

Three Instrument Parameter (IP) files have been used in order to initialise the calibration routine: Ip0004, Ip0005 and a mechanically-measured list of parameters denoted as IpSurvey. All considered initialising IP files where calibrated in CCR. L_0 assumed the same value for all the initialising files: $L_0 = 11.005$ m, and after the calibration it is again the same in the three outputs: $L_0 = 11.0047$ m, that is the value is unchanged. Simultaneously, the value for t_0 is obtained for all the detectors. In Figure 4, the values for the three outputs are reported. While the value for t_0 is defined in the calibration algorithm as shared by all front-scattering detectors ($t_0 = -0.196$), it is individually defined for the backscattering detectors. The mean value on the distribution of backscattering detectors seems also different (and lower) than that on front-scattering detectors. The standard deviations for each detector are evaluated on the ensemble of the values form the three calibrations and reported in the same Figure 4 showing not-appreciable differences for all detectors but detector 55. The values of t_0 for front-scattering detectors reported in IP files IP2572 (2008), IP004 (2013) and IP005 (2014) are respectively -0.52 μs, -0.40 μs and -0.32 μs. The value just measured confirms a trend of decrease year-after-year.

The values for L_1 resulting from the calibration procedure are reported in Figure 2 and are presented as the deviation with respect to the mechanically-measured value from the IpSurvey. An almost constant offset of 2 cm is found for all detectors in both front- and backscattering: he mean position for the photon or neutron detection is different from the front face of the YAP detectors or from the centre of the ^{6}Li glasses. With the exception of few detectors, the values for the three calibrations are so similar that the standard deviations are not appreciable. The differences between the initialising and resulting values in the case of IP0005 are also reported. The difference is appreciable and of about 1 cm.

In Figure 3, the values for θ are presented as the deviation with respect to the mechanically-measured value from the IpSurvey. With the exception of few detectors, the values for the three

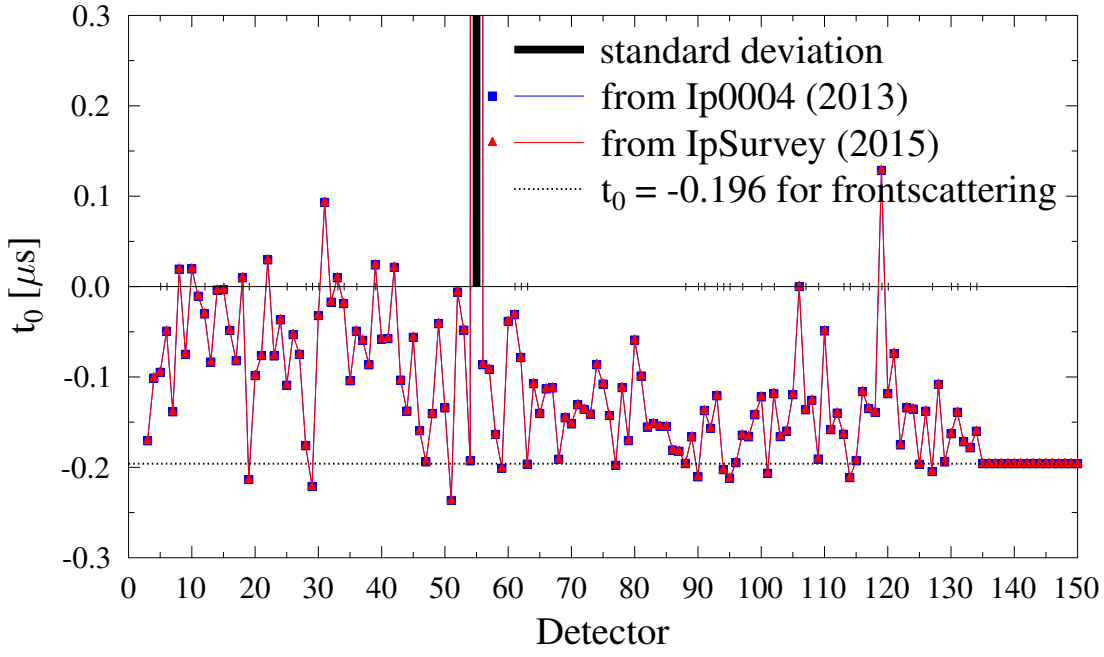

Figure 1: Values of t_0 after the calibration from different initialising IP files. The values from IP0005 are the same as those from IP0004 and have not been reported. The standard deviations for each detector are evaluated on the ensemble of the values form the three calibrations. Detector 55 has an anomalous values of $t_0(Ip0004) = 36.5051$ μs and $t_0(IpSurvey) = 33.6723$ μs. Detector 106 has all the values identically null. Differences between the values from different IP files are of the order of 10^{-5} μs.

calibrations are so similar that the standard deviations are not appreciable. While the values of θ are generally underestimated by 2 degrees with respect to the survey values in backscattering, in the case of front-scattering they are overestimated by about 1 degree. The differences between the initialising and resulting values in the case of IP0005 are also reported. The difference is appreciable and of about 1 degree for backscattering detectors.

3 Comments

- U-foil on sample position with no CCR, 2 mm Pb with U-foil upstream and with no CCR and V slab with no CCR are needed for upgrade
- Why are we using vanadium as a background instead of lead 2mm?
- we should add an option to take ENERGY_ESTIMATE = constant for the calibration.

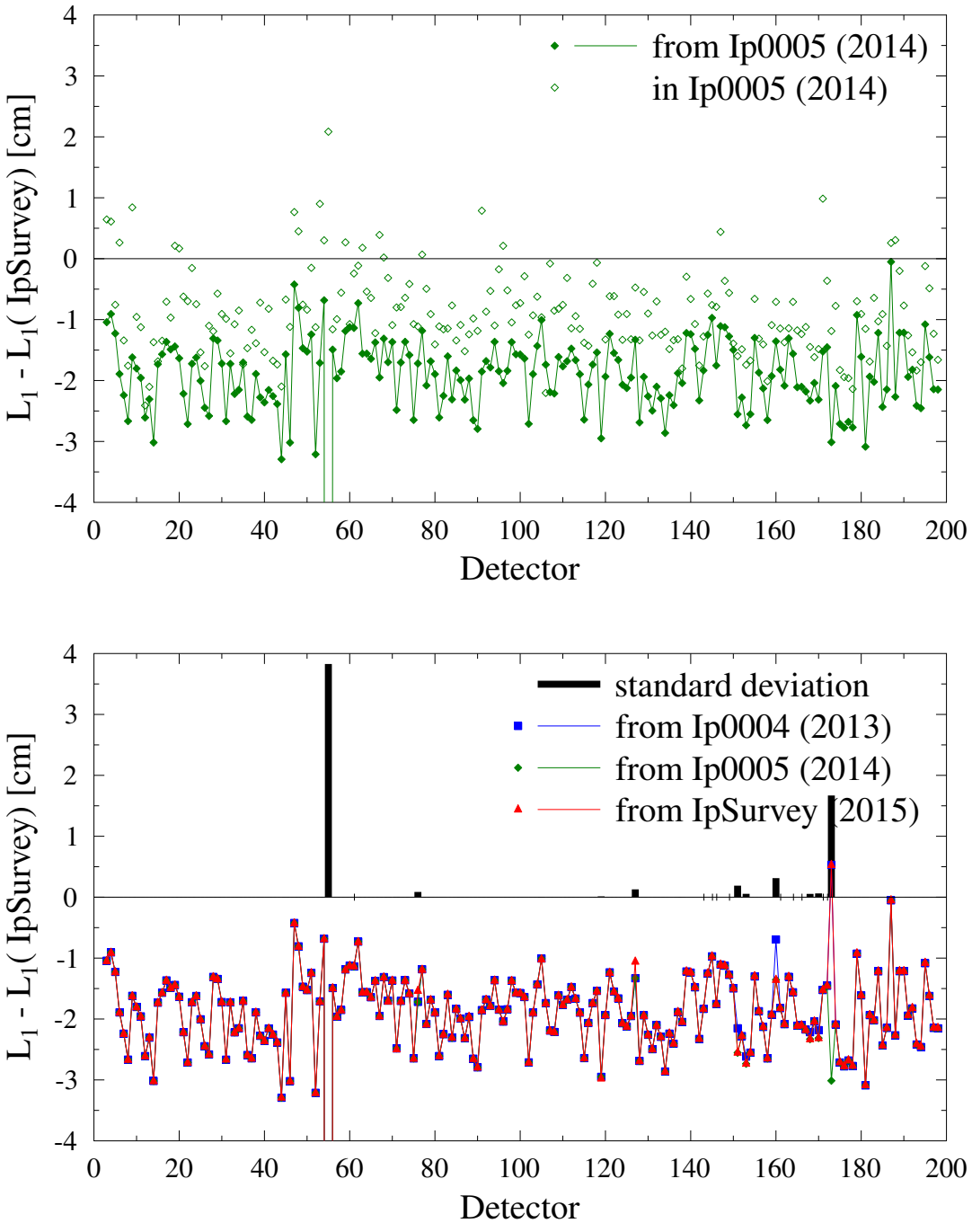

Figure 2: Values of L_1 after the calibration from different initialising IP files. The mechanically-measured values in IpSurvey are used as the offset. The standard deviations for each detector are evaluated on the ensemble of the values form the three calibrations. The two largest discrepancies are for detectors 55 and 173.

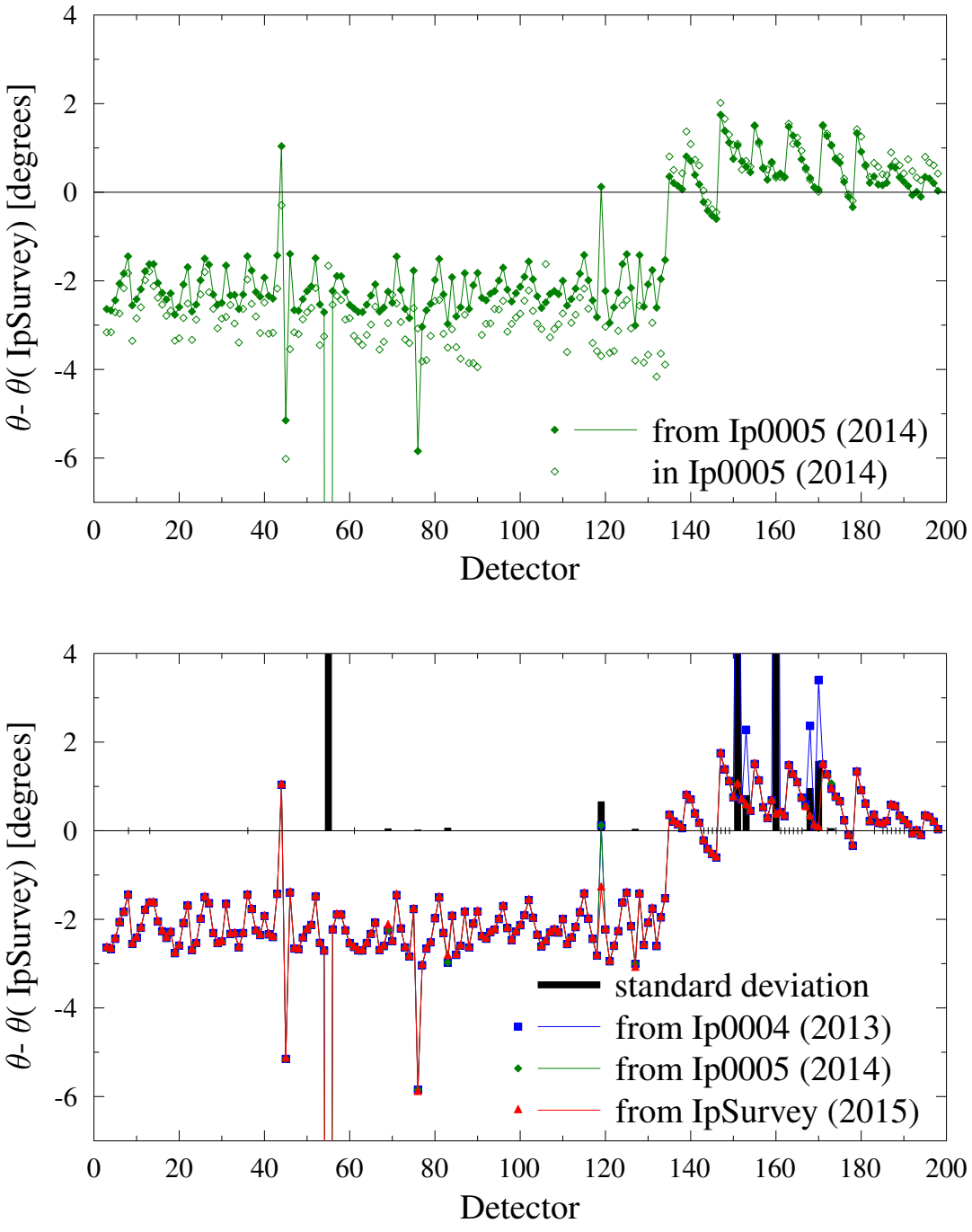

Figure 3: Values of θ after the calibration from different initialising IP files. The mechanically-measured values in IpSurvey are used as the offset. The standard deviations for each detector are evaluated on the ensemble of the values form the three calibrations. The largest discrepancies are found for detectors 55, 119, 151, 153, 160, 168 and 170.

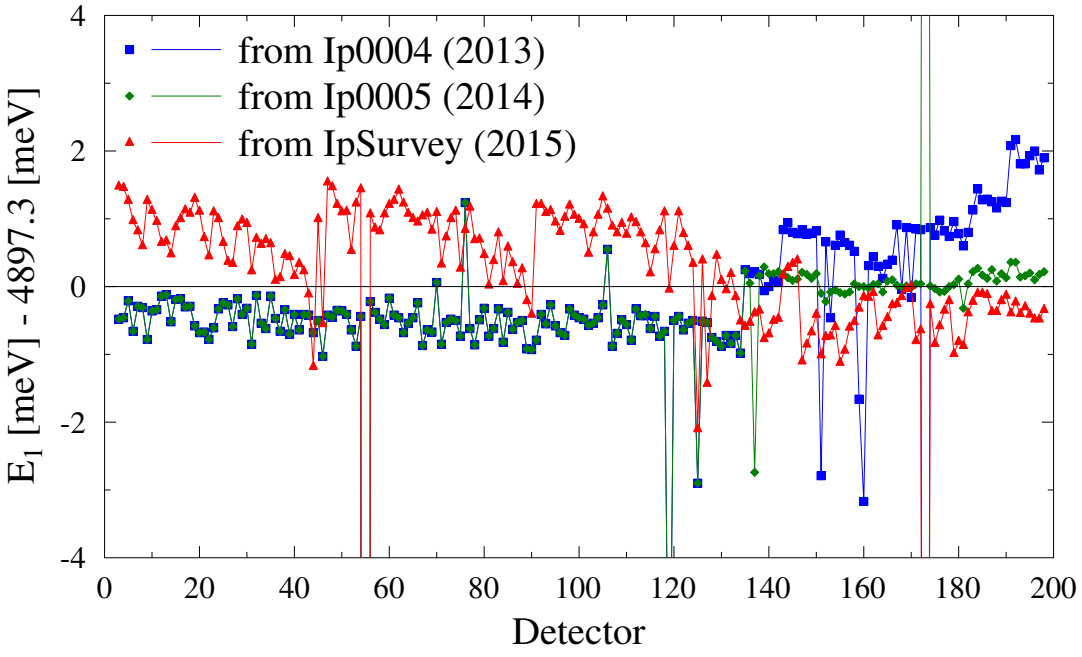

Figure 4: Values of E_1 after the calibration from different initialising IP files. Values are presented as offset with respect to the published value of $E_1 = 4897.3$ meV. The largest discrepancies are found for detectors 55, 119, 137 151, 160 and 173.

- Do we expect different values of t_0 between front- and backscattering and between old and new calibrations?