Possible beam scenario for october

The following scedule is based on a 7 days block of beam

Day 1: 6:00 to 24/00 Machine and beam tuning at high intensity (5 10^{10} per spill)

Nigth 1: 0.00 to 8:00 Reduce pion beam intensity down to 10^5. HADES tuning and start data taking with solid target at p_π= 1.7 GeV/c on a set of 3 solid target s (C, Cu and Pb)

Day 2: 8:00 to 22:00 test of the beam line (1st part) (coordinated by TH and WK)

Nigth 2: 0.00 to 8:00 Tuning and data taking with solid target at p_π= 1.7 GeV/c

Day 3: 8:00 to 22:00 test of the beam line (2nd part)

Nigth 3: 0.00 to 8:00 data taking with solid target at p_π= 1.7 GeV/c

Day 4: 8:00 to 22:00 test of the beam line (3rd part if necessary) otherwise take data

From day 5^{th} at 0:00 up to day 8 at 6:00: production beam time

Test of the beam line to be realized

During the first day time period , we want to check the transport coefficients. That means check that their numerical values fit to the calculated ones and identify possible misalignements (Silicon position detectors and magnets). Let us call respectively p_SIS and p_HADES the momentum over z values for the incident beam transport line (up to the pion production target) and for the HADES spectrometer part (from production target to LH2 target). According to simulations and calculations with TRANSPORT and apart of offsets and misalignments, there are 5 transport coefficients we have to measure, namely, T16, T166, T12, T122 and T126.

PART I

Step 1: send a low intensity heavy ion beam (10^4 particles per spill) through the whole beam line with p_SIS=p_HADES (production target out, correction for the energy loss in the detector at the intermediate focus, beam centered at the pion production target, both in position and angle for H and V), p_HADES=p_SIS Note the position impacts (H and V) at all detectors on the HADES beam line, Si detectors, start detector and all beam diagnostic position sensitive devices.

Step 2: decrease the p_HADES value by 3% and note the position on all detectors

Step 3: increase the p_HADES value by 3% and note the position on all detectors

Step 4: repeat these 3 measurements at a lower momentum central value, typically 1 GeV/c to check saturation effects

By doing step 1 to 4, one can check all the offsets and the transport coefficients T16 and T166. These steps are relatively easy, since one has only to scale the currents in the magnets accordingly. A 4 hours slot should be enough.

PART II

Step 5: Tune the heavy ion beam such as its angle of incidence in the horizontal plane at the pion production target is 5 mrad (p_SIS=P_HADES) . The vertical angle should be centered at 0. Note the position on all detectors

Step 6: Tune the heavy ion beam such as its angle of incidence at the pion production target is -5 mrad (p_SIS=P_HADES) . Note the position on all detectors

By doing steps 5 and 6, one measures the coefficients T12 and T122. This might be somewhat more time consuming, since one has to find a correct 'detuning' of the incident beam line. The beam has to reach the pion target at the central position, and there is a need of determining with high precision the centroid of the angle shifted beam with a precision of about 0.5 mrad.

8 hours could be needed to achieve that.

PART III

The next step are required to measure transport coefficients which couple the horizontal angle theta and the momentum. This coupling, represented by the coefficient T126, which plays a dominant role in the determination of the momentum. It is especially important at the intermediate focus, as being the second more important term after the dispersion term T16.

Step 7: Tune the heavy ion beam such as its angle of incidence at the pion production target is 5 mrad (p_HADES=p_SIS + and - 3%) . note the position on all detectors

Step 8: Tune the heavy ion beam such as its angle of incidence at the pion production target is -5 mrad (p_HADES=p_SIS + and - 3%) . Note the position on all detectors

For that. another period of 4 hours is requested.

PART IV

Simulation have shown that offset of the beam at the production target might influence the pion transmission. Effects in the horizontal plane are not expected to be important, except of a slight overall shift of the momentum, relatively easy to correct off-line by using missing mass methods. In vertical, an position offset could lead to a reduced pion flux. It is then worth checking that and finding the optimal experimental conditions, that is including other possible unknown misalignments of magnetic elements. For this the pion production target has to be put in.

Step 9: slightly move the vertical impact of the incident beam on the production target (the corresponding angle theta is irrelevant in that case) and measure the pion flux that reach the the useful part of the HADES LH2 target. This requires the complete MDC tracking system, for being able to select the so-called useful particles. About 2 hours are necessary to complete this study.

In total, about 3 shifts (24 hours) are needed to fulfill the goals.