HKS/HES Drift Chambers

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Abstract

This document describes basic information of HKS/HES Drift Chamber. Two HKS Drift Chambers (KDC1&KDC2), and one of the HES Drift Chamber (EDC2) have same geometrical and operational parameters, and another HES Drift Chamber (EDC1) is honeycomb cell drift chamber.

1. Purpose

The HKS Drift Chambers (KDC1&KDC2) and one of the HES Drift Chamber (EDC2) were built by Hampton University group; another HES Drift Chamber (EDC1) was built by Tohoku University group. KDC1&KDC2 are mounted directly on the HKS dipole magnet and are the first detectors after dipole exit; meanwhile EDC1&EDC2 are mounted HES magnet exit.

HKS Drift Chambers and HES Drift Chambers measure particle trajectory at HKS and HES spectrometers focal plane, respectively. This combined with spectrometer optics can be used to reconstruct particle momentum and angle at target.

2. Geometrical Parameters

EDC2 has 10 planes (xx',uu',vv',xx') and x'(u',v') planes is shifted by half of cell from x(u,v) plane(Figure 1). Moreover, the cell size of the honey comber chamber is 5cm. u and u' (v and v') planes tilted by degree (-30degree).

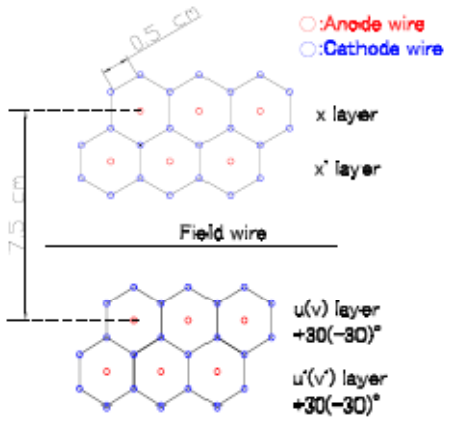

Fig.1 Wire Geometry of EDC2

KDC1, KDC2 and EDC2 have 6 planes (xx',uu',vv'), respectively, and the geometrical parameters are shown in table1.

Table1: Geometrical parameters of KDC1, KDC2 and EDC1

Dimension (L×W×T)	59.25''×22.75×3''
Active Region	48.2"×12''
Wire Plane Configuration	u,u',x,x',v,v'

The wire planes of HKS drift chambers measure positions in three directions x, u and v, shown as Fig.2. These coordinate are then transformed into focal plane coordinate x, y and z.

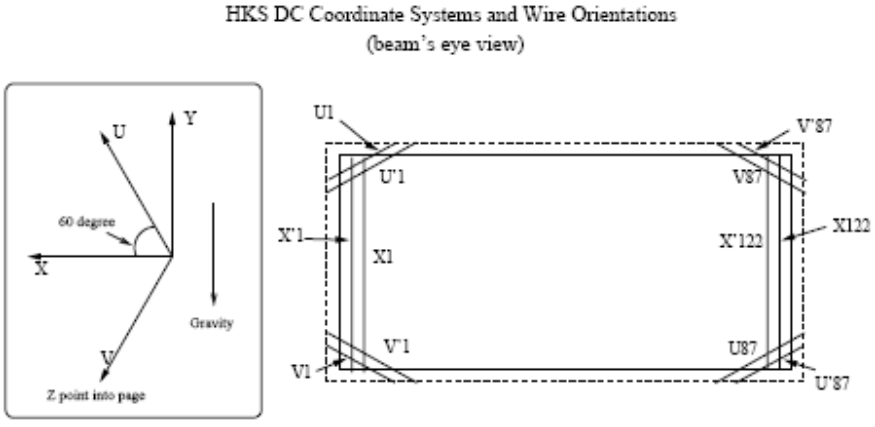

Fig.2 HKS DC wire layout and coordinate system

3. Operational parameters

EDC1 has 5 SHV input connectors for each pair planes. Without beam, the current should be almost zero. The operational HV and threshold are decided from the result of performance test at Laboratory of Nuclear Science (LNS), Japan. Simultaneously, the test results gave us the total position resolution of 210 μm. The efficiency is almost 100% if –HV is about 2100V and will decrease if threshold is above 4.0V. The operational parameters for EDC1 are shown in table 2.

Table 2: Operational parameters for EDC1

HV	-2200V
Threshold	2.0V
Gas content	Ar/C_2H_6 50:50

As to KDC1, KDC2 and EDC2, the cathode foil planes and field wires are applied the same HVs. Each chamber has 4 HV input connectors, two for foil planes and tow for field wires. The operational parameters for KDC1, KDC2 and EDC2 are shown in table 3.

Table 3: Operational parameters of KDC1, KDC2 and EDC2

Operation HV	2075V
Threshold	1.0V
Gas Content	Argon/Ethane 50:50 mixture
Gas pressure	~30psi

The working gas inside the HKS Drift Chamber and one the HES Drift Chamber (EDC2) is Argon and Ethane 50:50 mixtures and the gas pressure we set now is ~30psi (it might be changed after long time's condition). It also contains a small amount of (about 1%) alcohol vapor to prevent aging of the wire chamber. The gas is mixed in the outside gas shed. For detail information about Hall C gas system, please refer to Hall C How-To: Drift Chamber Gas System.

The signals from anode wires of all the chambers go into Nanometric N277L cards for preamplifying and discriminating. There are 70 cards for EDC1, 35 on top side and 35 on bottom side. For KDC1, KDC2 and EDC2, there are 20 cards for each chamber, 10 on one

side and 10 on the other side of the chamber. N277L card need both +5V and -5V power input. The voltages are supplied by two Acopiann power supplies, respectively. The output signals from cards go into fastbus TDCs via 33 ft. Flat cables. Each chamber has 4 HV input connectors, two for foil planes and two for field wires. In addition to that, the threshold of KDC1&KDC2 and EDC2 is set to 1.0V now; it might be changed after long time's condition.

4. Commission Procedure

Following is the list of major steps to bring the chamber into working condition:

1. Check gas system for correct setting of pressure and flow rate. Flush working gas into the chamber for at least several days to drive out air and moisture.
2. Apply HV up to setting point (currently 2075V, it may be changed after long time's condition). Monitor leakage current at the same time.
3. Turn on the threshold voltage and Low voltage power for the preamplifying and discriminating cards. The threshold voltage supply will be located inside the electronic room of the counting house.
4. Taking some data to check the tracking efficiency, wire map, drift time and tracking residue histograms. Adjusting the drift velocity and plane position offset parameters if necessary.

5. EDC1 Tracking parameters

These are the main parameters for EDC1:

edc_tdc_min_win,edc_tdc_max_win: In edc.param. Select a good hit in this window.

Edc_layer_time_zero: In edc.param. Set time zero of ALL cards (total 70 variables).

Edift_coeff: In edriftcoeff.param. Constants for 3-order polynomial to calculate drift distance from drift time. 0-order,2-order and 3-order of ALL cards (total 70 variables) are required.

6. EDC2 and HKS Drift Chamber tracking parameters

The parameter set for KDC1&KDC2, and EDC2 tracking comprises geometrical constants, tracking criterion and other wire chamber constants. They are needed in the tracking routine to convert raw wire hit into coordinates and fitting the tracks.

Each wire plane of the chamber is described by the following constants:

1. Plane number: (for KDC1&KDC2, from 1 to 12, for EDC2, from 1 to 6)
2. hdc_zpos: The coordinate in the particle traveling direction.
3. hdc_beta, hdc_gama and hdc_alpha: these are the three rotation angles of wire plane about the Y axis, Y axis and Z axis.
4. hdc_nrwire: number of wires in plane.
5. hdc_central_wire: the fictitious wire number of the middle wire. It is used in calculation of the wire center position.
   "hdc_wire_center(goodhit)=hdc_pitch(planne)*((hdc_nrwire(plane)+(1-wire))-hdc_central_wire(plane))-hdc_center(plane)"
6. hdc_wire_counting: a flag that indicates whether wire is counted along positive (+1) or negative (-1) x direction. For KDC1&KDC2 and EDC2, all wires are counting for the positive x side. So it is +1 for all the planes.
7. Hdc_center: offset of the planes along the local coordinate.
8. hdc_length_x and hdc_length_y : the dimensions of the DC active area in x and y directions.
9. Sigma: the Gaussian width of the tracking fitting residues.

These tracking parameters are set in files according to standard Hall C CTP file structure:

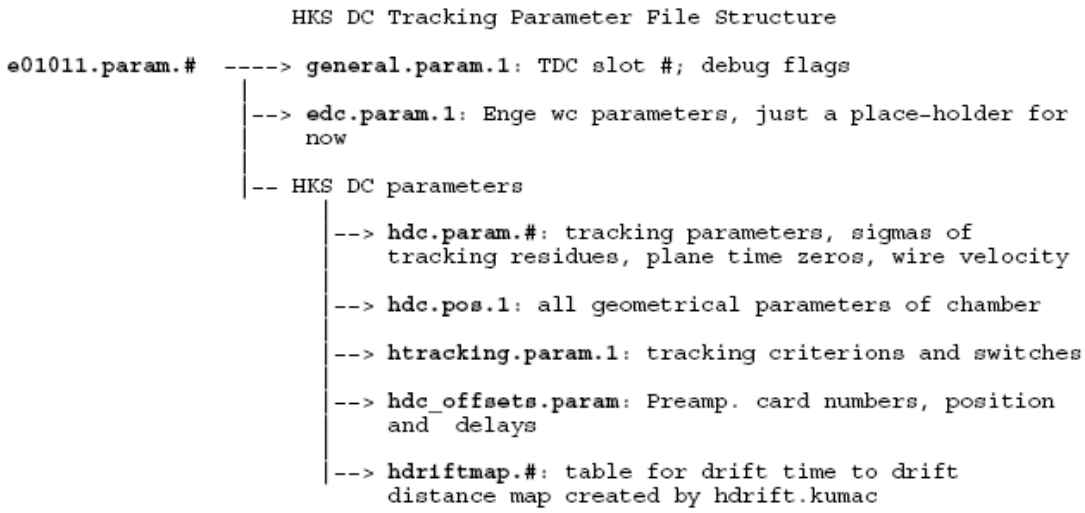

Fig. 3 File structure of HKS Drift Chamber and EDC2 tracking parameter

- The parameter values in tracking will be given in next version.

7. Flowchart of HKS DC and EDC2 tracking code

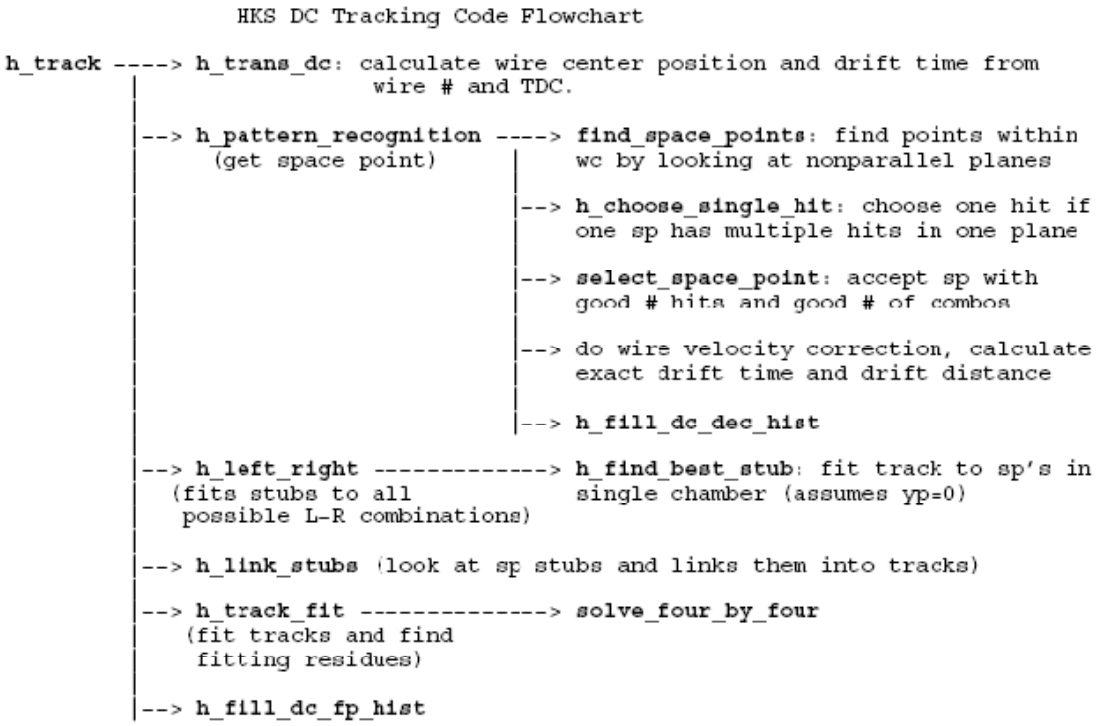

Fig. 4 flowchart of HKS DC and EDC2 tracking code

- The link between EDC1 and EDC2 will be given in next version.