

Extrapolation of ITC tracks to TPC

Lorenzo Vitale Lluís Garrido
TRIESTE University CERN

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Abstract

It is well known that at present in JULIA(2.30) the TPC coordinates with low θ are not used for tracking due to the requirement of having at least 4 points to make a track. Here we describe the subroutine ITCTPC that extrapolates the low θ tracks of the ITC to the unassociated points of the TPC and solve the problem mentioned above. This subroutine has to be called in JULIA between the ITC and VDET reconstruction.

1 Description and implementation of the method

1.1 Method

From all the ITC tracks we choose those that belong to a low θ region. This is well done for our problem if we take the tracks that cross the TPC external surface corresponding at the first five pads. The TPC coordinates, candidates to be associated, are those that belong to the same θ region and has not been associated to a TPC track.

Now we can try to extrapolate the ITC chosen tracks to all the TPC selected points, using their r coordinate.

The track equation, in cilindric coordinates, is of the form:

$$\phi(r, w, \tan(\lambda), \phi_0, d_0, z_0) = \phi_0 + (sst - s sr) \frac{\pi}{2} - s sr \arcsin\left(sst \left(\frac{w(r^2 - d_0^2)}{2r(d_0 w - 1)} + \frac{d_0}{r} \right)\right) \quad (1)$$

$$z(r, w, \tan(\lambda), \phi_0, d_0, z_0) = z_0 - 2 \frac{\tan(\lambda)}{w} \arcsin\left(-\frac{w}{2} \sqrt{\frac{r^2 - d_0^2}{1 - d_0 w}}\right) \quad (2)$$

- $sst = 1$ for tracks bending counterclockwise, -1 for clockwise bending
- $s sr = sst$ if the point belongs to the first half of the helix, $-sst$ otherwise.
- $w =$ inverse radius of curvature (signed), $w = \frac{sst}{R}$
- $\tan(\lambda) = \frac{dz}{ds_{xy}} =$ tangent of the dip angle in $s_{xy} - z$ plane (s_{xy} is the length of the projected track in the x-y plane from the point where $x^2 + y^2 = d_0^2$).

- ϕ_0 = emission angle in the x-y plane at the point of closest approach to the origin in the x-y plane
- d_0 = smallest distance in the x-y plane between the projected track and the origin, signed positive if the particle has a positive angular momentum around the origin at this point, negative otherwise.
- z_0 = z coordinate at $x^2 + y^2 = d_0^2$.

Good candidate points to associate at a certain track will be the ones whose d^2 , defined as:

$$d^2 = \frac{(\phi_{track} - \phi_{coordinate})^2}{(\Delta\phi_{track})^2 + (\Delta\phi_{coordinate})^2} + \frac{(z_{track} - z_{coordinate})^2}{(\Delta z_{track})^2 + (\Delta z_{coordinate})^2} \quad (3)$$

will be less than a certain amount (in our case four). Then, to avoid that a certain point is associated to more than one track or that points with the same r belong to the same track, we select the least d^2 solution.

At this point we can try to fit all together the ITC points belonging to a track and these new TPC points using the subroutine UFITMS. This subroutine provides us with a χ^2 and the contribute of all the points to it; so we can reject the points that have more than a certain amount in the χ^2 and repeat the fit.

At the end, if the χ^2 is not bigger than a certain amount (in our case 250), the TPC points are accepted.

1.2 Input and output banks

The input banks of the subroutine ITCTPC are:

- ITFT(2) . This bank contains all the features of the ITC tracks, i.e. the five parameters of the helix, the covariant matrix of the fit, the χ^2 , etc.
- TPCO . This bank contains the TPC coordinates and the TPC track number associated to the point, or zero if the point has not been associated to a track.

The output banks of the subroutine ITCTPC are:

- TGTL(2) . This bank is the analogue of TGTL(1) but referred to ITFT(2).
- TGCL(2) . Also this bank is the same of TGCL(1) but referred to ITFT(2).
- ITFT(2) . The informations about the extrapolated tracks are overwritten.
- TPCO . If the TPC point has been associated to an ITC track, the track number is overwritten.

2 Results

In the following pages there are some figures of an event with and without the extrapolation; figure 1 corresponds to the present situation of JULIA and figure 2 corresponds to the case where the extrapolation is done.

In this event we are able to extrapolate four ITC tracks into TPC:

- the track number 1 has now two TPC coordinates
- the track number 2 has now three TPC coordinates
- the track number 3 has now one TPC coordinate
- the track number 4 has now one TPC coordinate

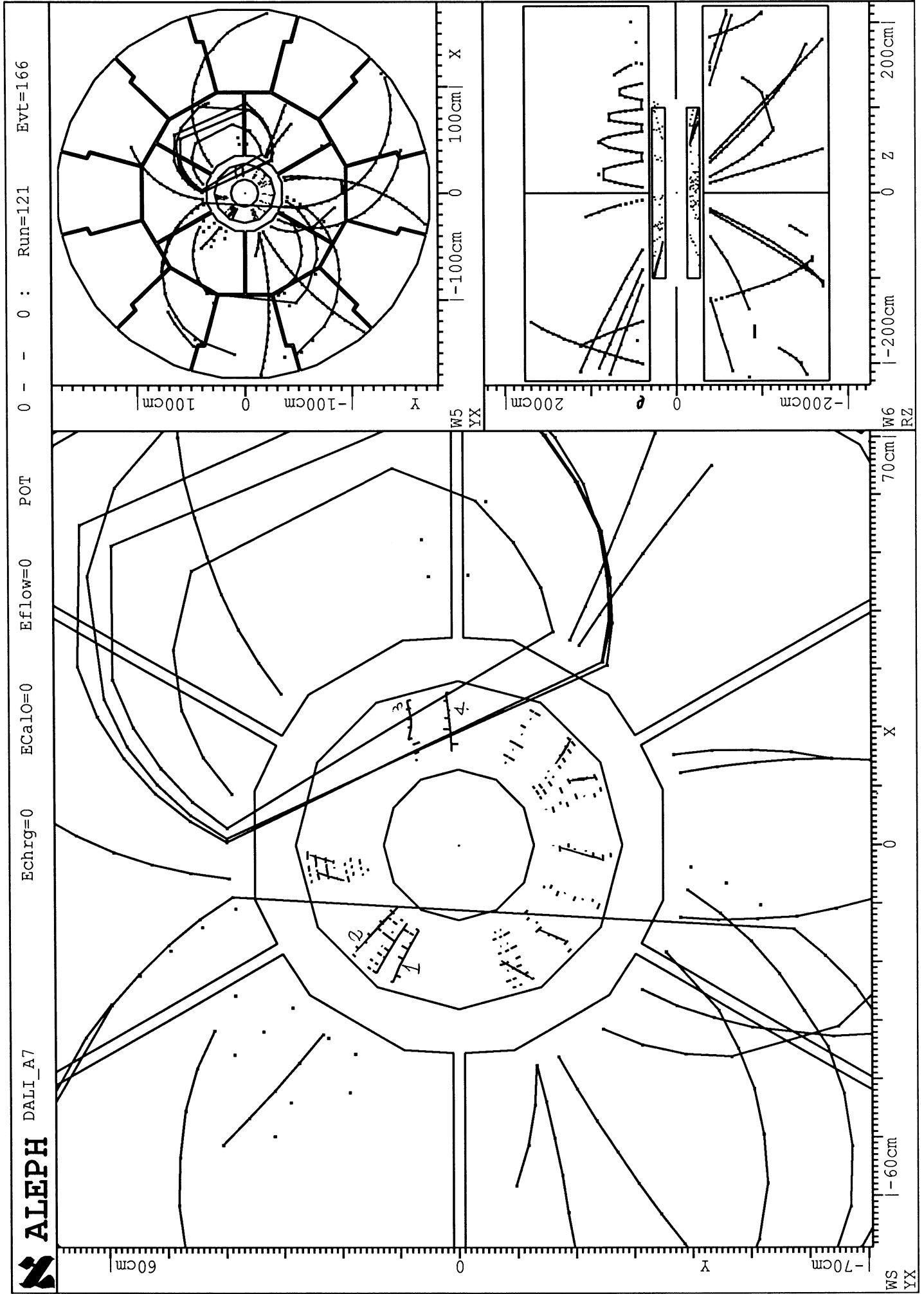


Figure 1

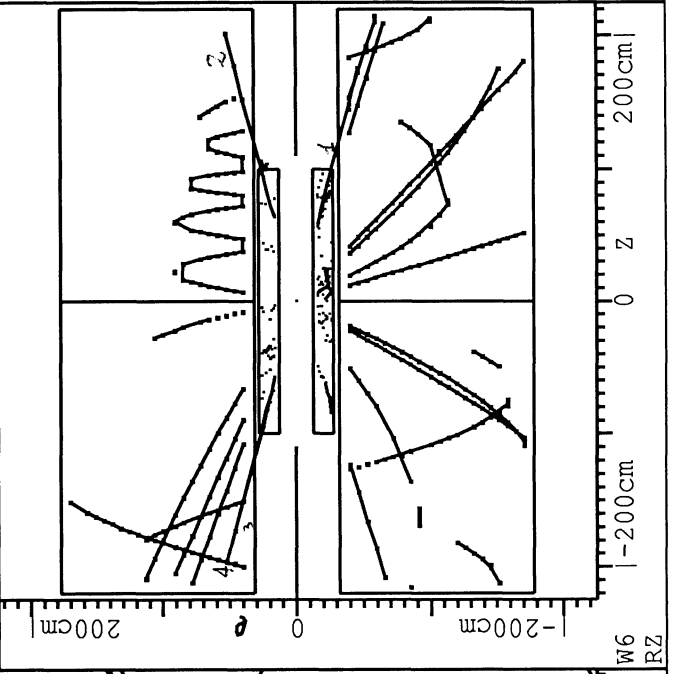
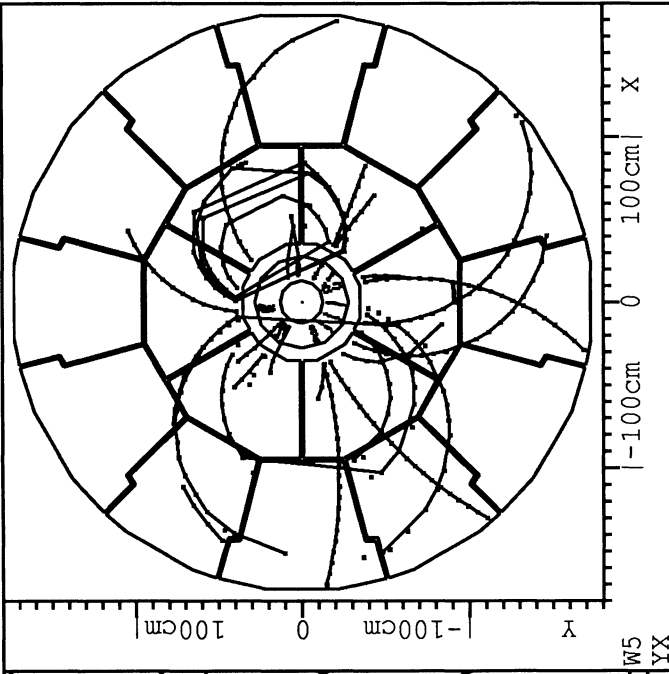
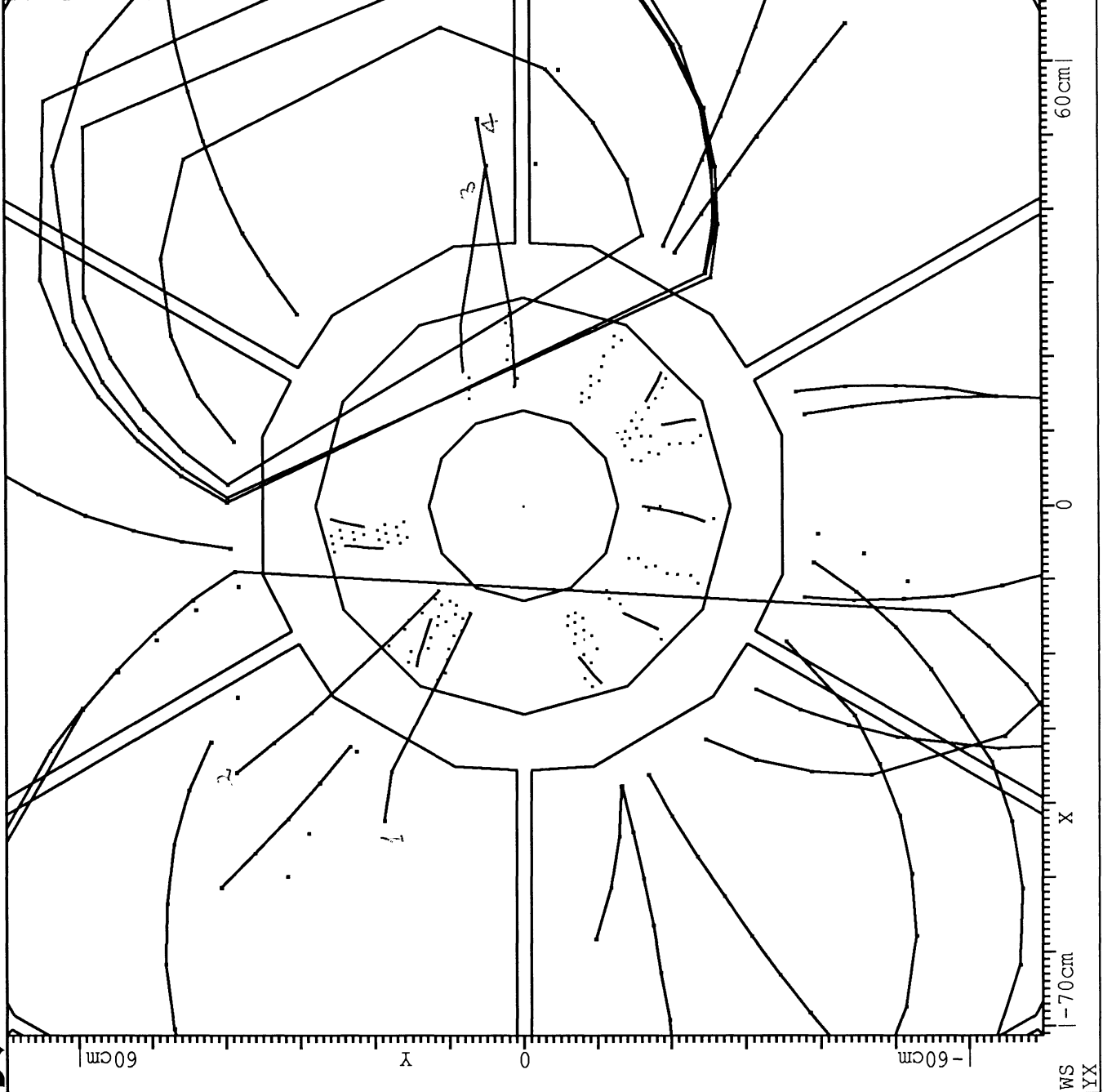


Figure 2