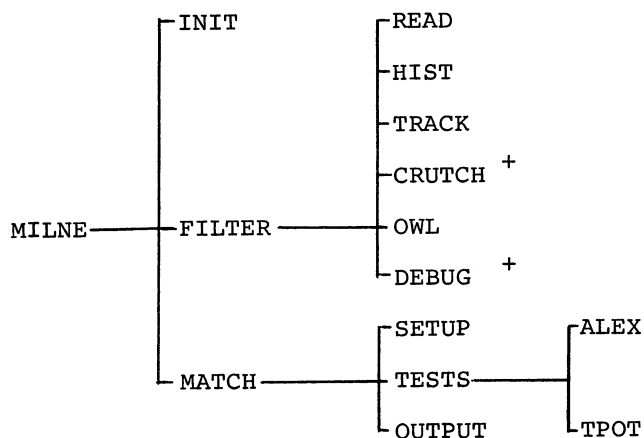


THE SCANDINAVIAN POOH

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The Scandinavian version of POOH originates from the famous Berkeley-version. It was found as a card deck on a shelf in Copenhagen, brought to our IBM 7094, compiled and slowly turned into a working program, initially by testing it on CERN SR-data and later on output from the Scandinavian SAAB-SR. The program has during the past years undergone a high number of changes, many of them being of technical art, but most of the modifications have been applied to increase detection efficiency, cleanliness of found solutions and also, which is important for this type of program, execution speed.

The present version of our POOH is installed on the Copenhagen UNIVAC 1106, the Stockholm CDC 3600 and on the Vienna IBM 7040. On all these computers it is overlayed - on the UNIVAC it occupies  $\sim 26$  K words (42 K words, when not overlayed) with the following overlay structure (schematic):



+) Only called in when needed.

POOH is (at least in principle) fully built out to handle up to four vertices and it also possesses a REDO facility (see later).

It will be impossible to describe all the smaller or greater improvements we have implemented (a description and full list is of course available for those interested) so here a few features of the program that might or might not differ from other versions will be presented.

#### Histogramming.

Histogramming is performed with rather few ( $\sim 200$ ) non-overlapping bins. In the case that a binslope contains more than a preset number of digitizing (e.g. 22) a routine RESOLVE is called. It splits the binslope up in 5 smaller bins, each with 3 subslopes. In this way, it can resolve tracks that are near each other in angle and momentum.

Normally, 10 points out of 18 possible are requested to form a track. The point distribution of HIST-found tracks is shown in fig. 1 for all tracks and (shaded) for matching tracks.

In order to obtain better starting parameters for tracking and also to improve the reject rate for spurious tracks a two-stage RMS limit method was introduced. So in verifying a track through the FIT-procedure it is first tried to establish a track which passes a low RMS-limit (e.g. 0.25 track widths) within the allowed number of points. If this fails the track is accepted anyway if its RMS is below a second limit (e.g. 0.50 track widths). The higher limit is necessary to catch low momentum tracks with high multiple scattering. The distribution of RMS at the HIST-stage is shown in fig. 2.

It has been found that a track often fails the  $\beta$ -test because a spurious digitizing near to the vertex has gone on the track. Therefore, in case the track fails the  $\beta$ -test, the innermost point of the track is removed (if enough points still remains to allow this) and the track is given another try.

### Tracking

During tracking a narrow angular interval is used in order to reduce tracking time and also to avoid mistracking. The angular interval is determined from the slope of the track and from the requirement that the next point on the track must be found within a preset number of revolutions (normally 7) following the last point added.

### Crutch points

If a track is sought in HUNNY from a crutch-point a radius interval for 8 possible digitizings is computed. Then 5 digitizings are required to form a track in the subsequent histogramming and also here a binslope is split up in 15 smaller binslopes if more than a certain number of digitizings (e.g. 14) are found within a normal binslope.

If the innermost edge of the radius interval falls outside the upper limit for HIST, no  $\beta$ -term is used in the fit as experience has shown that a  $\beta$ -term often leads to a faulty track.

Sometimes a HUNNY-found track cannot be tracked sufficiently near to the vertex because of a narrow crossing of two tracks. In such cases COMBIN is called to try to match the HUNNY-track to an already found HIST-track. If such a match can be found the two tracks are combined.

Tracks can be marked with an anticrutch-point (ACPT) to signal POOH that this track should not be used. This facility is in particular useful to discriminate against electron-pairs and V-zeroes that point directly to the vertex. It is also useful to erase tracks, not belonging to the event, that physically pass near to the vertex. An ACPT is normally only needed in one of the views, if applied in two views one is safeguarded against formation of unwanted doublets.

It is often wanted to extend high momentum tracks beyond the SR-range. This can be done by adding long crutch points (LCPT) to one of the tracks. They are normal CPT's with radii greater than SR-maximum. The LCPT's are added as x-y points to the track at OWL time.

#### End of filter stage

If a view-vertex contains more than 15 tracks and the end of the filter-stage, JACOB is called to choose the 15 "best" tracks based on an empirical function in which track-length, magnitude of RMS and  $\beta$ -term and on whether or not a crutch-point has been associated to the track.

Master points (usually 12) are built up by REDUCE. REDUCE first removes a number of points (depending on track length -  $\sim 4$  for full length) that have too large deviates to the overall fit. The master points are then formed from digitizings in equidistant intervals averaged with respect to the fitted parameters and weighted by radius of each digitizing. Labelled points are naturally not touched by this procedure.

#### Track match

The track match proper has not undergone much change from its original structure except on adoption to the CERN 2m HBC. Multi-vertex features have been completely revised and seem to work reliably for up to four vertices. Match time for manyprong events has been greatly reduced by improved logic in the match-steering routine ALEXB. Output formats have been changed to fit the standard CERN TC chain.

#### Doublets

A doublet facility has been introduced in track-match. All possible doublet matches are stored in a special control array. Found and accepted triplets are erased from this array. In case a full triplet solution cannot be found at a

vertex, fx. if a triplet is missing, a beam track not found or if charge is not conserved, then the doublet array is examined in order to find a high quality doublet to become part of the solution. Only one doublet track is allowed at each vertex.

#### Redoing

If a vertex contains a doublet REDO is called to try to find the missing track. The half digested data from all view-vertices are stored on the drum-file. If REDO is called, the relevant view-vertex is called in from this file. A prediction of angle and slope of the missing track is made by projecting the track from the two views where the track exists into the third view. Then a narrow path is laid around the predicted track position and the track is sought by fitting all digitizings within the path. If a new track is found it is checked and added to the track bank and the track match is entered once again.

#### Timing

The average time spent per event (3-4 groups) is 12 secs. on our UNIVAC 1106. Differential timing can be read below:

EEYORE, READIN, FIT	12%
HIST, PIGLET, FIT	27%
TRACK, HFALMP	31%
ELIM	5%
TIGGER, GORSE, HUNNY	6%
OWL, REDUCE	10%
MATCH	5%
REDO	4%

#### Transmission and reject rates

(Based on last 1400 3-4 groups processed)

Events accepted	91.6%
Events rejected (POOH)	8.4%

No track match:	3.0%
Not enough tracks:	2.9%
Charge not conserved:	0.7%
Beam track not accepted:	1.6%
Other rejects:	<u>0.2%</u>
	8.4%
REDO called:	16.9%
REDO found missing track:	9.6%
REDO failed (remaining doublets):	7.3%

