SVT - TPC Matching Program

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1) Location of the Code

The code and the newest executable file can be found on the RHIC-cluster at BNL. The program was linked and compiled on the 4-CPU Silicon Graphics computer. The Telnet address is RSGIOO. RHIC.BNL.GOV.
You can find the source code and the executable in the directory

/u2/bormann /match.lib .

There is also a copy of this files on the CSA/RNC-cluster at LBL in

DISK$RNCO:[BORMANN.MATCH_LIB]

2) How to Make the Executable

In the same directory you can find a Makefile that includes every necessary step to make the executable on the Silicon Graphics. To compile and link just

enter

make match

The result will be an executable file with the name 'match'.

3) The Parameter File

The parameter file 'match.par' contains informations the program needs at run-time. A sample parameter file looks like this:

```
TRK - file          : /scrl/jones/trk_auau_5_str.trk
GEANT - file    :/scrl/jones/lund_auau_5_str.fzd
Histogram - file : match_str_5_oldg.dat
Output - file            : output.mat
Process# events  :5
TRK-file forma  : 0
Output-option    :0
```

It contains a short description of the parameter in the first 20 columns and the actual parameter in columns 21 through 80. Please keep the order of the parameters. If you have to change it, don't forget to change the parameter read routine in the FUNCTION 'mat_init()' in the file 'match.f' as well. The parameters have the following meaning:

TRK - file: File containing the TPC track and hit information. This is the output file of Iwona Sakejda's pattern recognition program (Created with output-switch IDEBUG=l).

GEANT - file: File containing GEANT information about all hits and tracks in the whole STAR-detector. In this program it's only used to retrieve the SVT hit information and to check the results after the matching.

Histogram - file: This is the file name of the program that will contain HBOOK histograms generated at run-time.

Output - file: File name of the output file. At the moment only track parameters are written out

Process # events : Number of events that should be processed.

TRK-file format : Format of the TRK-file. Possible options and their meaning are:

0 : normal output of the pattern recognition program

1 : output from the so called ‘perfect tracking' or 'MC-tracking' version of the patt. recogn. program.

Output-option :Format of the Output-file:

0 : no output
1 : binary output
2: ASCII output

4) Where to find or how to create input data

In order to run the matching program you need two input files. A TRK-file for the TPC hit and track information and a corresponding GEANT-file for the SVT hit information.

a) Existing Files

There are some input files on the RHIC-cluster at BNL in the following directories:

/scrl/bormann
/scrl/jones
/scr4/bormann

The output files of the pattern recognition are named 'trk*.trk' and the GEANT-files'*.fzd'. I used to name the output files '*.mat', the histogram files '*.dat', and the Log-files '*.log'.

Numbers in the filename normally indicate the number of events in this file. 'mc' means that the file is a 'MC-tracking' file (see above). 'rad' and 'str' specify radial or straight pad-rows in the TPC. 'newg' is short for new SVT geometry and 'auau' or 'sisi' means gold or silicon events.

b) Creating New Files

I assume that you have a GEANT-file. If you don't have one ask Peter Jones or Richard Morse how you can create one.
The first step is to run Peter Jones' fast simulator (FST). In the directory /u2/bormann/trk you find a command file (e.g. fst_auau_str.com) to do this. Before you run this file you have to change the file names in the 6th, 9th, and in the last line. '*.fzd' is the input file and '*.hits' is the output file.

In the same directory are the command files to run the mc-version of the pattern recognition program. To run the normal version ask Iwona Sakrejda. For straight TPC pad rows you have to run 'trk_auau_5_str_mc.com', and for radial pad rows 'trk_auau_5_mc.com'. But don't forget to change the file names in line 6, 9, and 10. In these command files '*.hits' is the input file and 'trk*.trk' is the output file.

5) How to Run the Program

The program can be started by just entering 'match', but I suggest that the program should be started with

time match >& match.log &

This starts the program as a background process and redirects (>&) the terminal-output and error messages to the file 'match.log'. The prefix 'time' is optional, it gives you some information about the time the program was executed, the CPU-time, etc.. For more information see the manual pages ('man time').

6) Short Description of the Code

The main program can be found in the file 'match.f . It mainly consists of an event loop and some initiallizing routines.
'Err_Register()' initializes the error report mechanism.
The next function which is called is 'Mat_Init()'. In it ZEBRA/GEANT are initialized, HBOOK histograms are booked, the parameter file is read in and the input and output files are opened.
'Mat-Done()' which is called after the last event loop, closes the files and writes the HBOOK histograms to a file.

The event loop is either executed as many times as specified in the parameter file (variable N_EVENT) or until the end of one of the input files is reached. The first routine is 'Get_Next_Event()'. It reads in the GEANT chunks and puts them back together to a whole event . A chunk is a part of a GEANT event. It is necessary to split up one event in several (about 12) chunks because GEANT is not able to handle the large number of tracks which are generated in one RHIC gold on gold event. In 'Get-Next_Event()' the functions 'SVT_Read_Chunk()' and 'SVT_Assemble_Event()' handle the SVT hits. The subroutine 'TRK_GSKINE' stores the GEANT track information in a local data structure. You can retrieve this information with the subroutine 'TRK_GFKINE'. Both subroutines have the same formal parameters like the original GEANT routines.

'HIT_Create_Hits' used to call the functions that read the SVT and TPC hits. Now it only calls the TPC hit routine, because due to event chunking the SVT hit part had to be moved to 'Get_Next_Event()'.
"TPC_Create_Hits()' in file 'tpc_create_hits_2.f' reads the TPC hit information from the pattern recognition output file (TRK-file).

The function 'TRK_Create_Tracks()' calls "TPC_Track_Event()' which reads in the TPC track information from the TRK-file and 'SVT_Track_Event()' which is the function where the matching takes place.

'SVT_Track-Event()' which can be found in file 'svt_track_event_3_dist.f' contains a loop over all TPC tracks that were read in.
The basic idea is to extrapolate the helix to the next SVT layer, calculate the expected multiple coulomb scattering to define a search area, fit every hit in the search area to the helix, and use the new helix parameters to extrapolate to the next layer. This gives you a tree of possible tracks from which the track with the best χ^2 of the helix fit is chosen and stored.

The last function of the event loop is "TRK_ Check_tracing'. In it the results from the matching are compared with the corresponding GEANT-data to see if the correct hits were matched to a TPC-track.