# GenFit implement into the J-PARC E42 K1.8 Analyzer

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## Environment setting

Nothing to do. Same as the K1.8-analyzer

## Features

- GenFit package
- GenKEK codes
- GenKEK dsts
- HypTPC geometry GDML

## Install

Install the GenFit package and the GenKEK follows.

How-to Compile:

```
$> cp Makefile.genfit Makefile
$> make
$> make pcms
```

You can complie seperately 1. K1.8-Analyer(k18ana) or 2. GenKEK(genfit)

```
all: k18ana genfit
k18ana: lib usr dst
genfit: genkek genfit_dst
```

## Library

lib/libK18Analyzer.a : for K1.8-analyzer compiling
lib/ligGenKEK.a : for K1.8-analyzer & GenFit package & GenKEK compiling

## Paramters

Add "TPCGDML" in the conf param file

```
TPCGDML:  param/geometry/hypypcGeo.gdml
```

And add "Fitter" and "Iteration" in the USER param file

```
#GenFit
Fitter 0 #KalmanFitterRefTrack
#Fitter 1 #KalmanFitter
#Fitter 2 #DAF w/ RefTrack
#Fitter 3 #DAF w/o RefTrack
nIteration 5 20
```

### dst rule

GenKEK dsts have name starting with "Genfit" and should be placed at "dst/"
e.g.) dst/GenfitHelixGeant4.cc, dst/GenfitSkeleton.cc

# GenKEK development guide

## GenKEK directory

All files are placed in "genfit/genkek/".
e.g.) genfit/genkek/include/HypTPCTask.hh, genfit/genkek/src/HypTPCTask.cc

## Units

GenFit : GeV/c, ns, cm, kGauss
K1.8Ana : GeV/c, ns, mm, T

## Features

Environment setting and Translation

- HypTPC geometry file (param/geometry/hyptpcGeo.gdml)
- HypTPCFieldMan : HS field management
- HypTPCSpacePointMeasurement & HypTPCHit : Translating Hit-Pos&Resolution information into the GenFit format
- HypTPCFitter : Handling GenFit Fitting algorithms

Main Parts for the track fitting
Inheritance ( HypTPCTrack -> HypTPCFitProcess -> HypTPCTask )

- HypTPCTrack : Track container
  GenFit tracks can be provided several TrackReps to describe the same track in order to fit different particle hypotheses(Pion, Proton . . . ) -> Find best reslt (defult setting is finding minChi2)

TPCLocalTrack/TPCLocalTrackHelix should provide "PDGcode" and initial "Position seed" & "Momentum seed" from pre-fitting.

- HypTPCFitProcess : Handling the fitting process
- HypTPCTask : Useful functions (Handling the fit results)
  e.g.) get fitting results (chi2, ndf, tof, mom, length, residuals. . . ) or useful functions (extrapolation. . . )

## Development guide

Please add more functions in the HypTPCTask class.
Get a fitted-track from the container and use GenFit functions to work the way you want.
1. Directly use the genfit::Track
or 2. Get genfit::FitStatus from the track and use it
or 3. Get genfit::AbsTrackRep to use hypothese and track parameterization

You can find most useful GenFit funtions in the follows.

```
genfit/core/include/track.h .. : useful track functions
genfit/core/include/MeasuredStateOnPlane.h, StateOnPlane.h ... : functions for State vector
genfit/core/include/AbsTrackRep : extrapolation and others
```

Expecially core directory has most useful functions.
All header files have discription.

e.g. 1) HypTPC::GetTrackLength()

```
genfit::Track* fittedTrack = GetTrack(trackid);
length = 10*fittedTrack -> getTrackLen(nullptr,start,end); //cm -> mm
return length;
```

e.g. 2) HypTPC::GetChi2()

```
genfit::FitStatus *fitStatus = GetFitStatus(trackid);
if(fitStatus) chi2 = fitStatus -> getChi2();
```