Post-PTV software of Beat Lüthi

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The principal of the following software is described in pages 6-9 of Luthi et al., JFM 2005 (Luthi_2005_JFM_deriv_PTV.pdf) and the core for the derivatives is described on page 3 of Luthi et al., JoT 2007 (Luthi_2007_JoT_multi_part.pdf).

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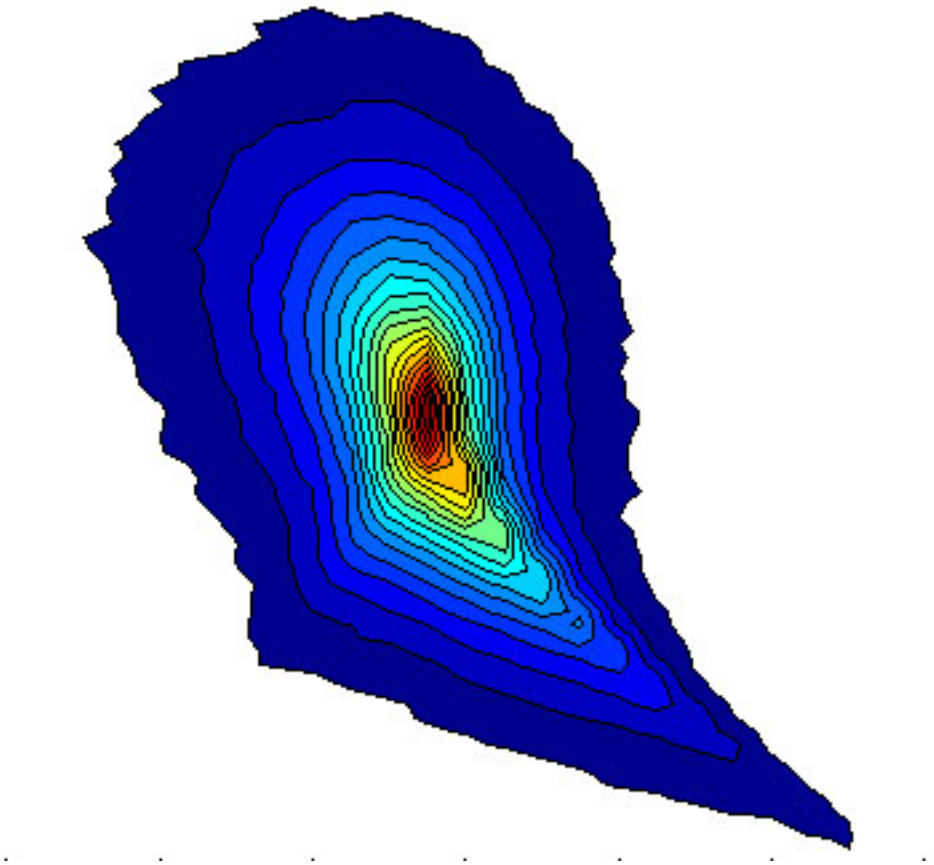
We now have a no-GUI, very up-to-date, and reduced-to-the-max version of post_process.exe post_process software. It is written in C, MVS, has one sinlge ASCII input file (input.inp) and as output has ASCII files with filtered:

x,y,z, u,v,w ax,ay,az, du/dt (3) du/dx (9) da/dx (9)

It can be used to make, e.g., RQ plots from ptv_is files:



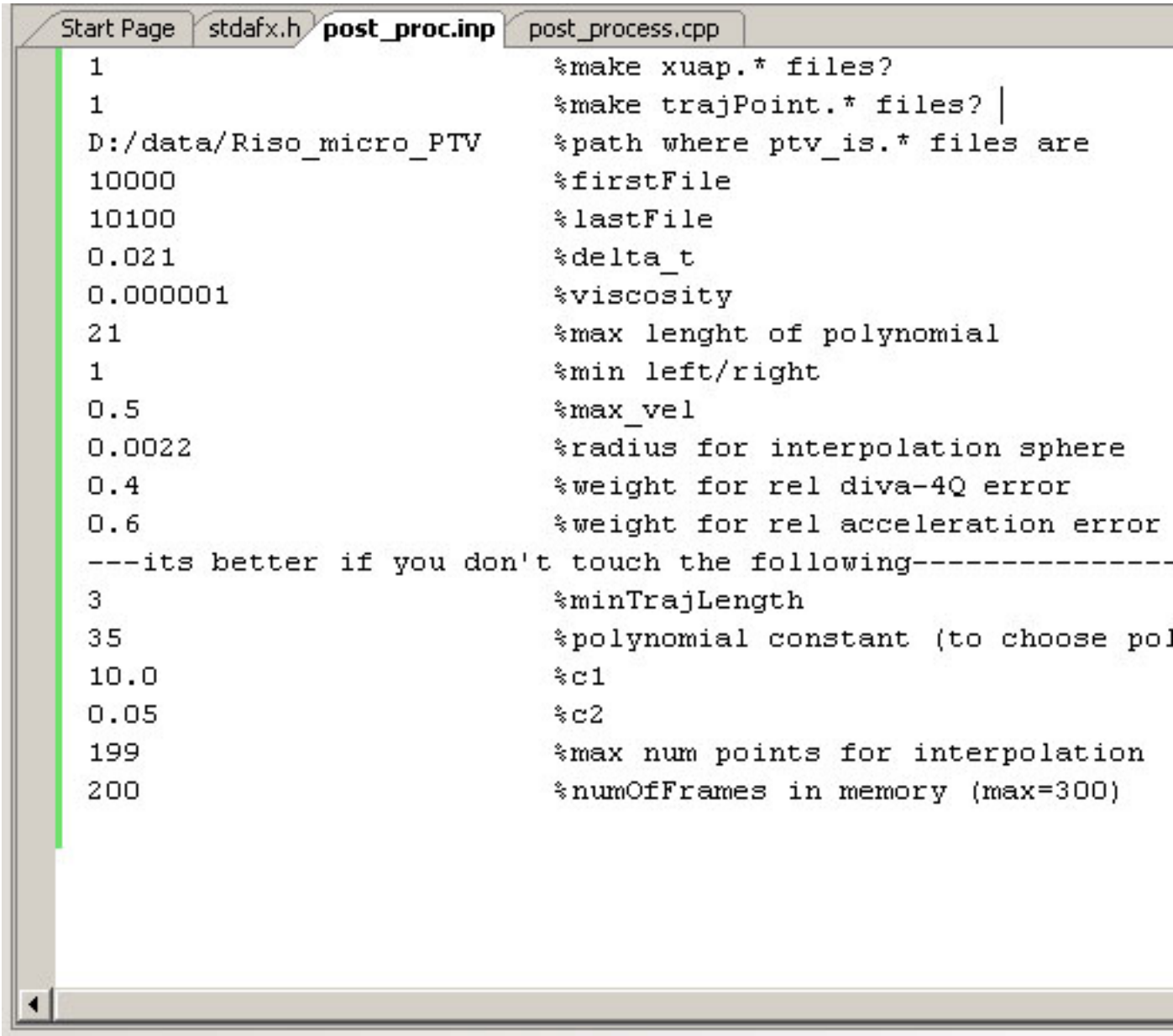
The source code is in post_process.cpp and stdafx.h.

How to run it?

save the two files *post_process.exe* and your edited *input.inp* in a folder and go there in a command console. Type post_process input.inp and press enter. Now it should run and it should look like:

How to control it?

In the input file you define essentially 13 parameters.



The first two flags determine which parts should be executed: ptv_is.* -> xuap.* -> trajPoint.* The format of those files is explained below.

Then you tell the programm where the ptv_is.* files are and where the xuap.* and trajPoint.* files should be written.

FirstFile, LastFile, delta_t, viscosity should be clear.

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When producing xuap.* files along trajectories moving cubic polynomials of 3d order are fitted to the raw particle positions. From this filtered positions, velocities, and accelerations are produced and written into xuap.* files. 21 is the possible maximum of points that can be used for such a fit. The minimum is 4. It will crash with less than 4 and more than 21.

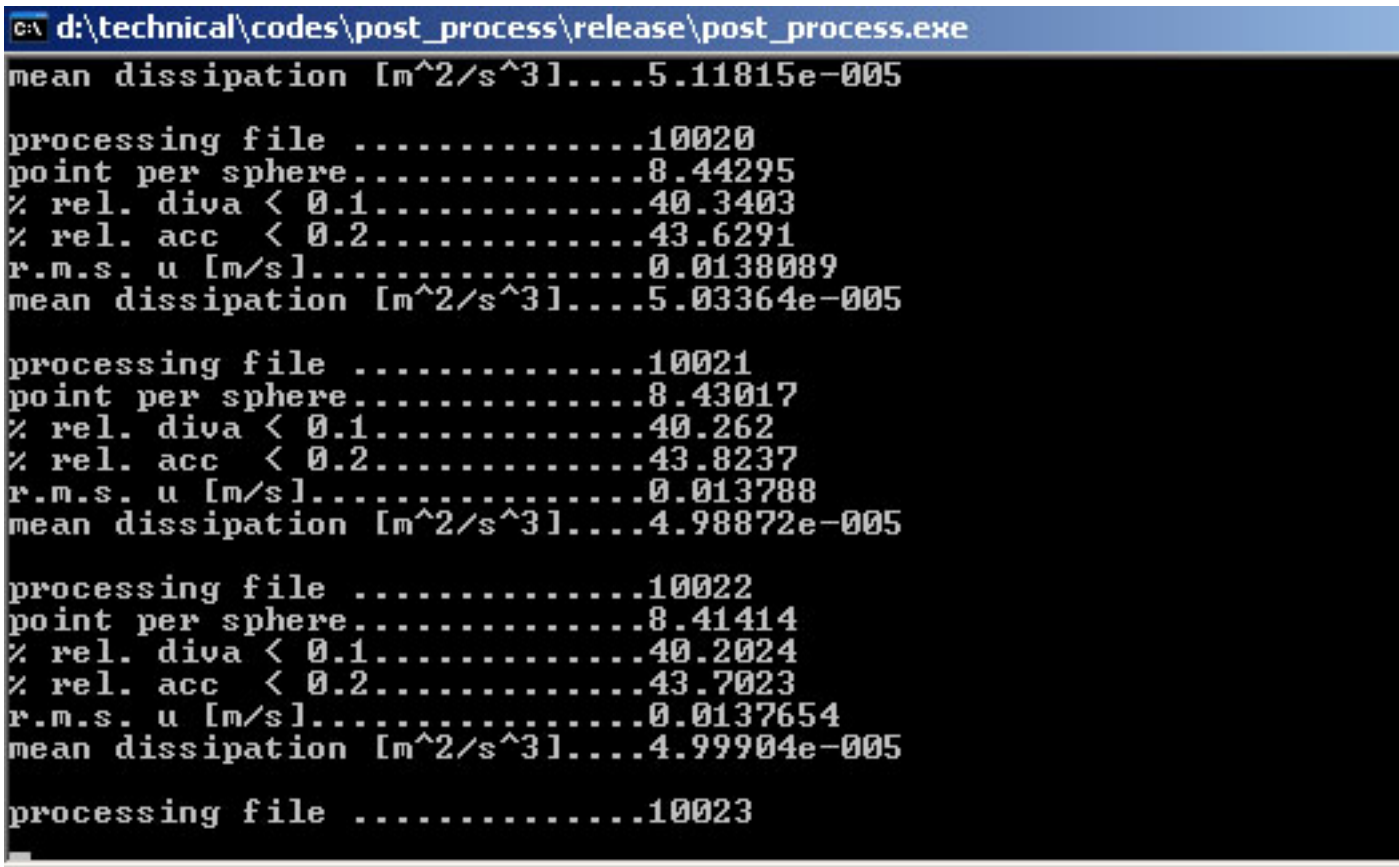
Min left/right determines how much centered such a fit should be.

Max vel is hardly used, but acts as a safety measure. Typically it should be 3-5 times larger than r.m.s u.

Radius of interpolation is a very important parameter. It determines how large the interpolation domain around a point x should be. As a rule of thumb the radius should not exceed 5 Kolmogorov units. Anything from from 7-12 points per interpolation sphere is enough.

Depending on the weights the result aims to improve quality of relative error of *diva=-4Q* and relative acceleration error of *Du/Dt=du/dt+u du/dx*.

When running the trajPoint part you should see something like the following (make sure that points per sphere are around 7-10, that the number of good points are around 40% or better, and that the values for r.m.s. u and dissipation are *plausible*).



Output format?

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The output is in two kinds of files. For each ptv_is.* there will be a xuap.* containing column by column the following (r=raw, f=filtered):

link_past, link_future, x_r,y_r,z_r,x_f,y_f,z_f,u_f,v_f,w_f,ax_f,ay_f,az_f,sucessfull

The main result is stored in the trajPoint.* files. Each trajectory that starts at frame x will be stored in trajPoint.x. This explains why the second trajPoint.* is so much larger than all the others. The format is best explained with a screen shot of where the output is written to file:

```
fprintf(fpp, "%lf\t", xp[ii]);//1
fprintf(fpp, "%lf\t", yp[ii]);//2
fprintf(fpp, "%lf\t", zp[ii]);//3
fprintf(fpp, "%lf\t", up[ii]);//4
fprintf(fpp, "%lf\t", vp[ii]);//5
fprintf(fpp, "%lf\t", wp[ii]);//6
fprintf(fpp, "%lf\t", axp[ii]);//7
fprintf(fpp, "%lf\t", ayp[ii]);//8
fprintf(fpp, "%lf\t", azp[ii]);//9
fprintf(fpp, "%lf\t", w1p[ii]);//10
fprintf(fpp, "%lf\t", w2p[ii]);//11
fprintf(fpp, "%lf\t", w3p[ii]);//12
fprintf(fpp, "%lf\t", s11p[ii]);//13
fprintf(fpp, "%lf\t", s12p[ii]);//14
fprintf(fpp, "%lf\t", s13p[ii]);//15
fprintf(fpp, "%lf\t", s22p[ii]);//16
fprintf(fpp, "%lf\t", s23p[ii]);//17
fprintf(fpp, "%lf\t", s33p[ii]);//18
fprintf(fpp, "%lf\t", utp[ii]);//19
fprintf(fpp, "%lf\t", vtp[ii]);//20
fprintf(fpp, "%lf\t", wtp[ii]);//21
fprintf(fpp, "%lf\t", daxdxp[ii]);//22
fprintf(fpp, "%lf\t", daxdyp[ii]);//23
fprintf(fpp, "%lf\t", daxdzp[ii]);//24
fprintf(fpp, "%lf\t", daydxp[ii]);//25
fprintf(fpp, "%lf\t", daydyp[ii]);//26
fprintf(fpp, "%lf\t", daydzp[ii]);//27
fprintf(fpp, "%lf\t", dazdxp[ii]);//28
fprintf(fpp, "%lf\t", dazdyp[ii]);//29
fprintf(fpp, "%lf\t", dazdzp[ii]);//30
fprintf(fpp, "%lf\t", quality);//31 0=good, 1=bad
fprintf(fpp, "%lf\n", (double)(ii));//32 age along trajecto
```

More?

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The rest is up to you. We use such files to take it to Matlab or make HDF5 files from it. If you have question ask Beat , Alex or Markus .