**Pulse propagation**

If short pulse light sources are used, the propagation of the field through optical systems must be considered not only in the spatial, but also in the time domain. Especially the combination of both and the effect of time-dispersing elements are not easy to unterstand. Therefore a simulation tool is needed to calculate all these effects in a model. The fundament shoud be a classical system data base (Zemax and/or Matlab), which can be easily extended for the additional needed data. There are more simple matrix algorithm in paraxial approximation available, based on a pilot ray. Furthermore more complicated diffraction integral calculations allow for taking aberrations into account.

As deliverables of the master thesis, a working Matlab-tool with a short manual, the theory description and some worked out examples are desired.

In detail, the work should contain the following points:

1. Establishing a data sheet for the system definition with the opportunity to import Zemax data – DONE

2. Extending the types of components by defining gratings, prisms, roof surfaces and thin phase masks – Almost DONE

3. Paraxial or real ray trace of the pilot ray, taking the opd for a finite spectrum and material dispersion into account (GVD) –

4. Implementing a paraxial 4x4 matrix algorithm in space-time-domain –

5. Example calculations for simple setups like pulse stretcher, prism train, grating compressor, SSTF setup –

6. Calculation of more complicated setups by gaussian beam suporposition, implementing graphical representation of the results –

7. Implementation of a space-time diffraction integral in Fresnel approximation, combining this with the ABCD-calculation –

8. Investigation of classical setups with this tool, consideration of pre-chrip and effect of residual aberrations, single lens vs achromate –

9. Optimization of the Offner-Pulse shaping setup at the IAP –