

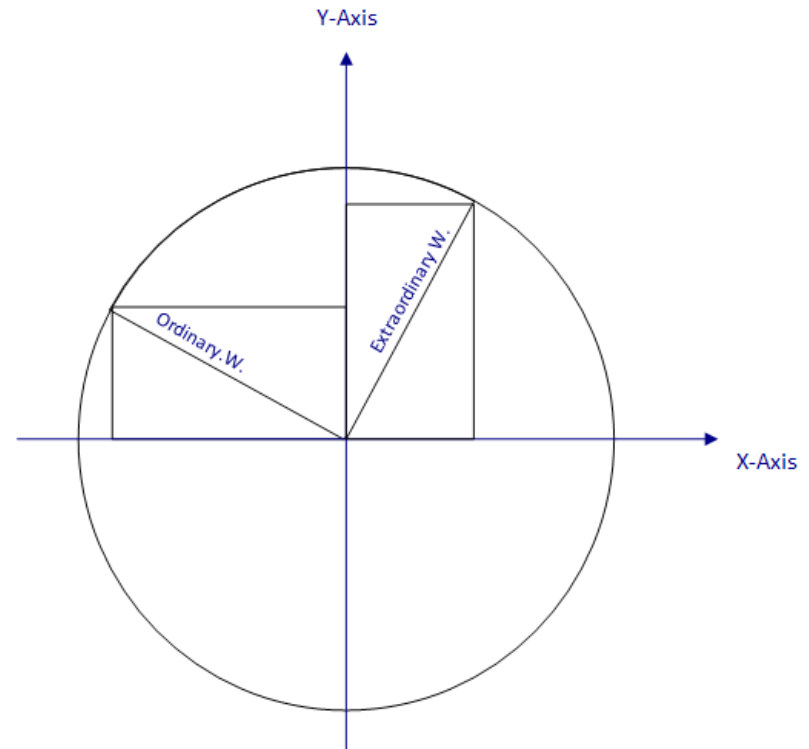
Simulation of the beamshaper of the MBI Laser to optimize crystal settings

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PITZ Physics Seminar
18.12.2014

Theory

- > 2 copies of the input pulse in each crystal
- > delay depends on the length of the crystal and the refraction indices
- > Phase shift because of length and Temperature of the crystal
 - Phase shift because of temperature not known (needs to be measured)
 - Phase shift because of length

$$\varphi = \pi / \lambda * d (n_e - n_o)$$



Theory

- > Jones formalism for description of optical elements

Polarizer (P)

$$\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$$

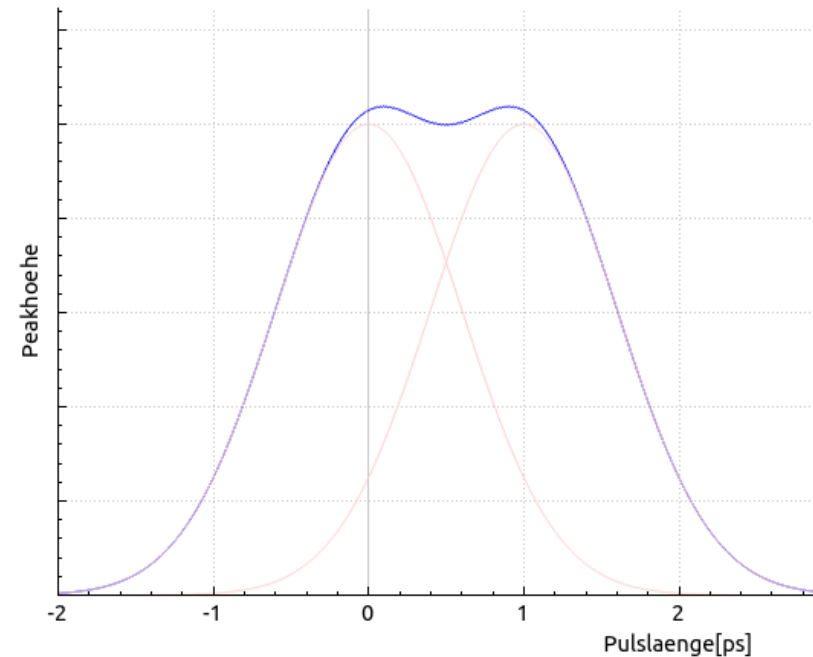
Rotation ($R(\alpha)$)

$$\begin{pmatrix} \cos(\alpha) & -\sin(\alpha) \\ \sin(\alpha) & \cos(\alpha) \end{pmatrix}$$

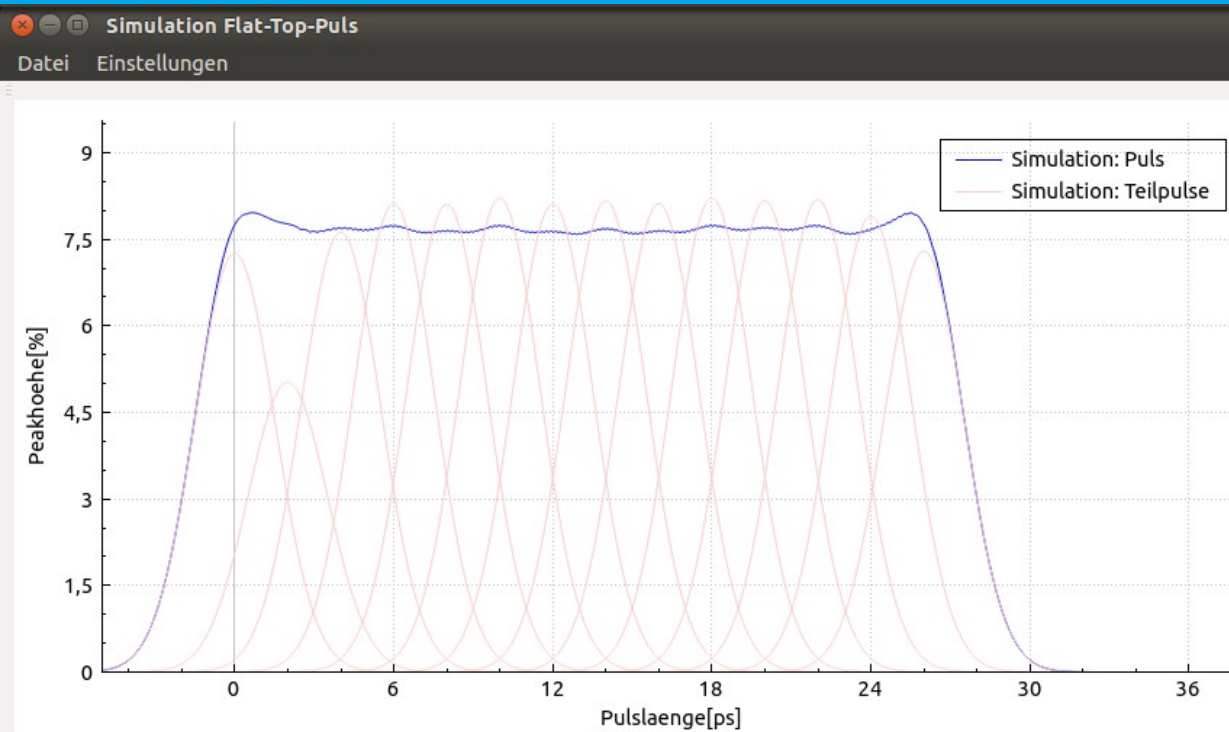
- > incoming Wave $E(t) = \cos(\omega t + \varphi) * \begin{pmatrix} 1 \\ 0 \end{pmatrix}$

- > For 1 copy of the input pulse and 1 crystal

$$E(t) = R(\alpha) * P * R(-\alpha) * E_0(t) * \text{Gauss}(t, t_0)$$



Programm



	Winkel [°]	Winkel [rad]	Phasenverschiebung[Pi]
Kristall Nr.1	4.476577	0.07813100	0.49999990
Kristall Nr.2	9.867193	0.17221500	0.49999990
Kristall Nr.3	15.945301	0.27829800	0.49999990
Kristall Nr.4	22.445335	0.39174500	0.49999990
Kristall Nr.5	29.273388	0.51091700	0.49999990
Kristall Nr.6	36.191395	0.63165900	0.49999990
Kristall Nr.7	43.109402	0.75240100	0.49999990
Kristall Nr.8	49.808596	0.86932400	0.49999990
Kristall Nr.9	56.226583	0.98133900	0.49999990
Kristall Nr.10	62.121115	1.08421800	0.49999990
Kristall Nr.11	67.472656	1.17762000	0.49999990
Kristall Nr.12	71.953129	1.25581900	0.49999990
Kristall Nr.13	74.453115	1.29945200	0.49999990

Kristall Nr.
 Winkelschritt
 Eingabe im Bogenmaß

Simulation

Bereich Anfang Ende
 RMS: nan FWHM: 29.28
 Hoehe: nan
 groeste Abw.: 0.0000

Anzahl Kristalle
 FWHM Gausspuls [ps]
 Zeitverzögerung der ordinären und extraordinären Welle[ps]
 max. Abweichung der Teilpulse vom Durchschnitt [%]
 Phasenverschiebung [Pi]

Einstellungen
 OSS-Kurve einblenden
 OSS Plot verschieben
 Pulshöhe in %
 An Teilpulsen ausrichten
 Winkel manuell suchen



Programm: Features

- > Save and load crystal settings
- > Save plots
- > Automatic search for a given form(only angle will change)
- > Set limits of the angle of the crystals
- > Manipulate angle and phase shift by hand
- > Loading OSS plots
- > Output of the average deviation/length of the flattop
planned:
- > English language



Programm: Limits

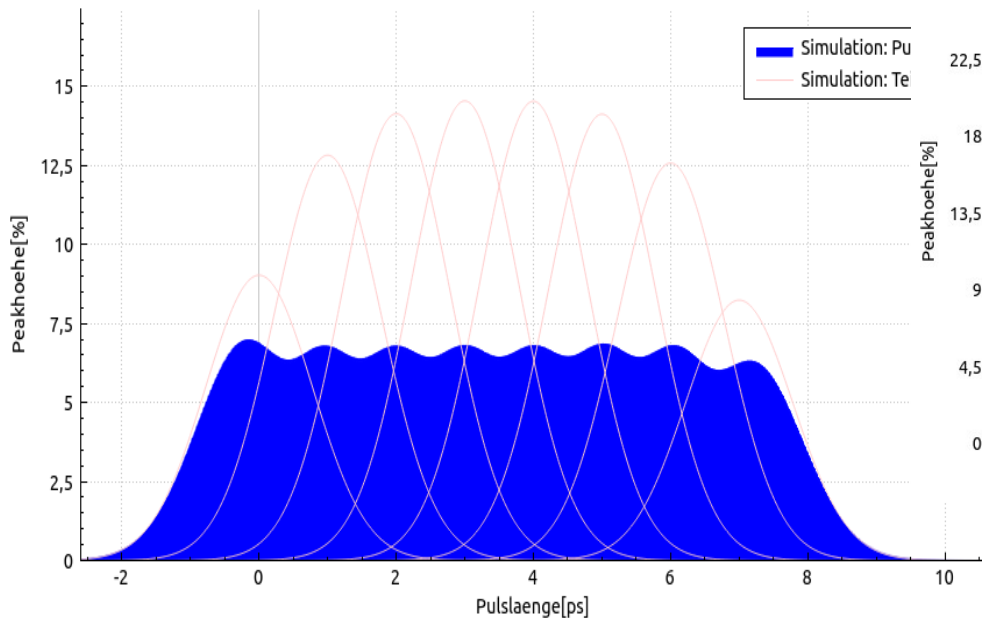
- > 20 crystals maximum
 - Tested with 13
 - Maximal number of crystals may depend on Pc
(computation power/ internal memory)
- > Ratio of width of gaussian pulse to delay time influences effectiveness of automatic search
- > Problems for some angles of the output polarizer
- > No optimization of the phase shift
(computation power)



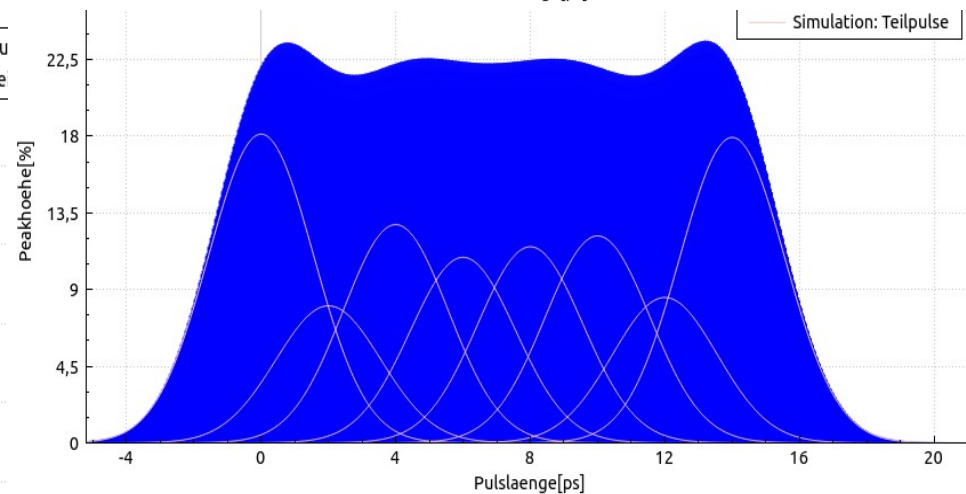
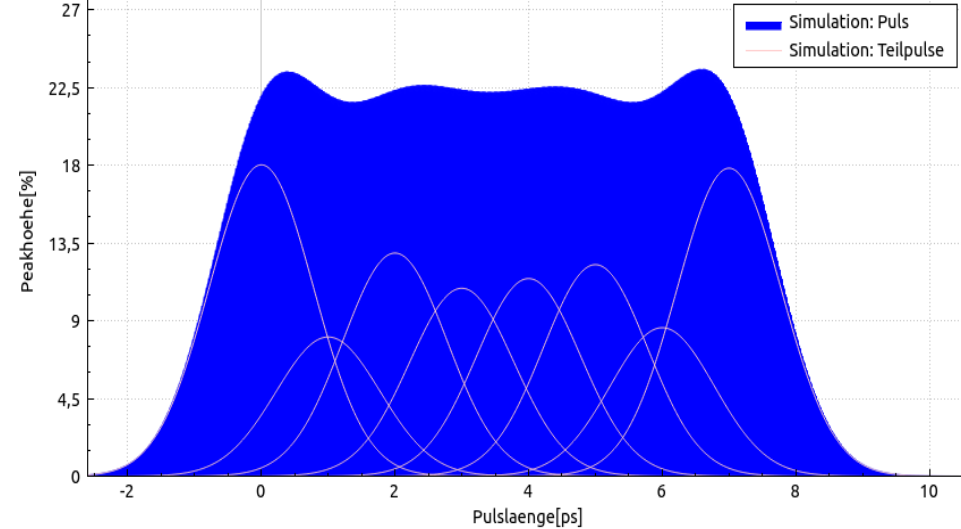
First Results

- > Phase shift influences the gap between the pulses
- > For same ratio of width of gaussian pulse to delay time same structure between pulses

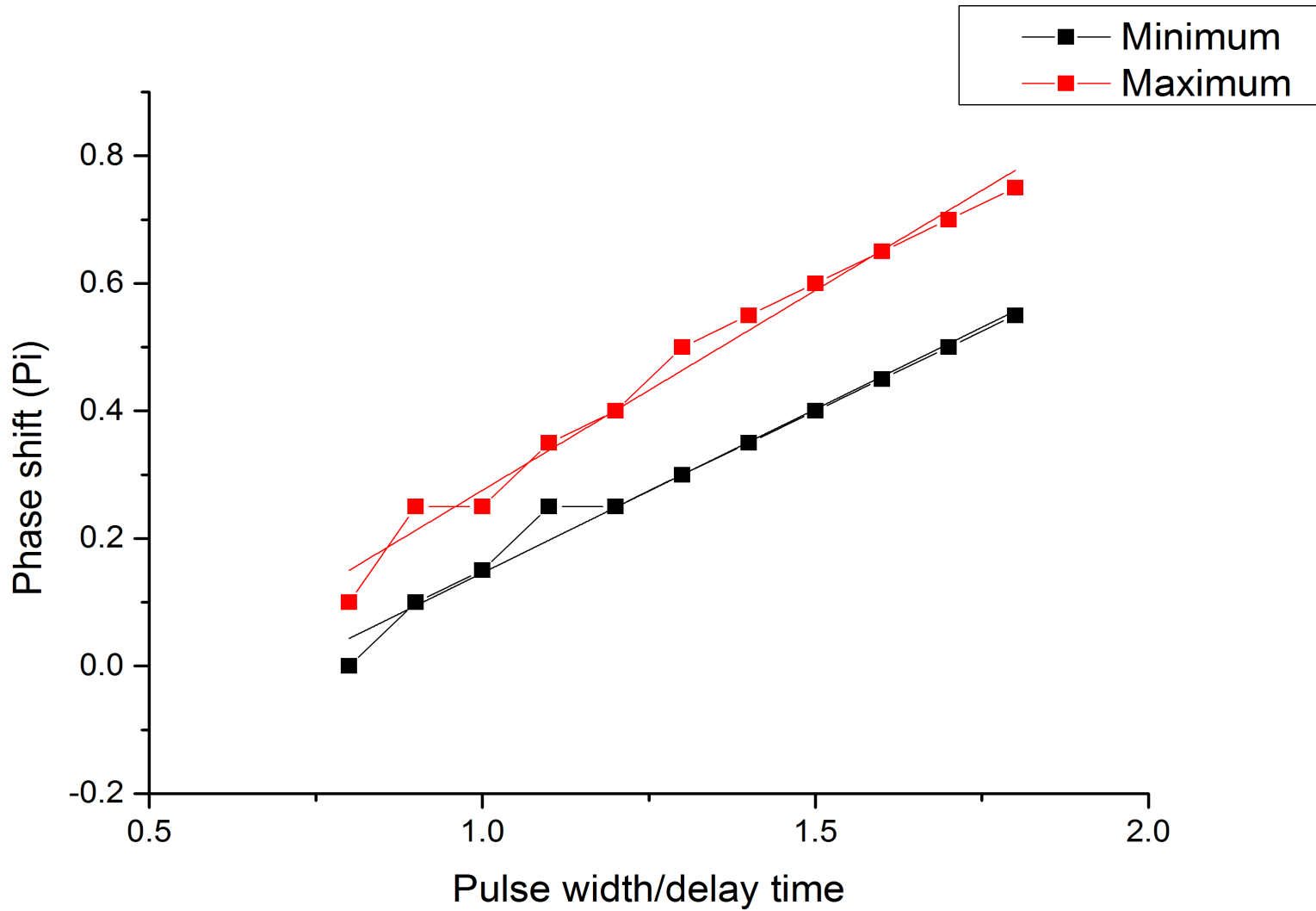
Phase shift: 0.7π



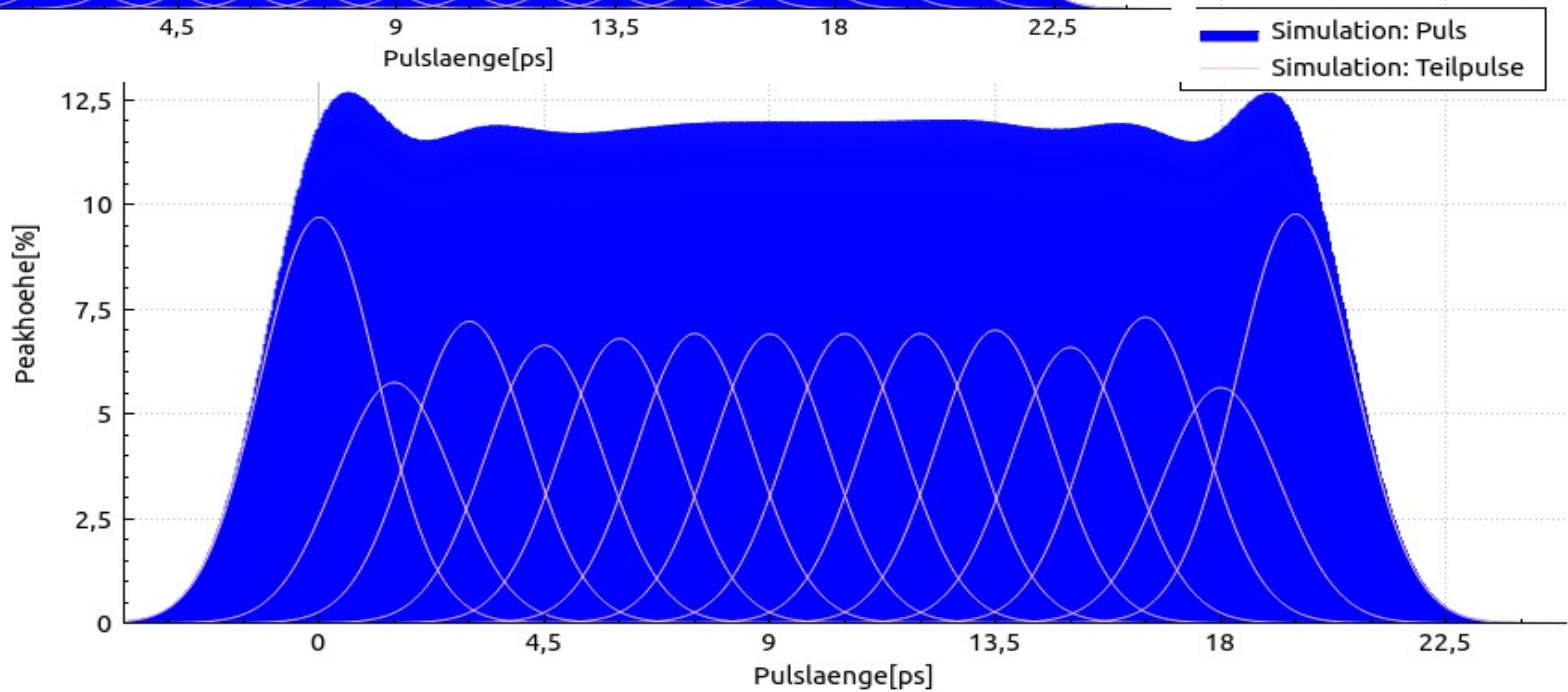
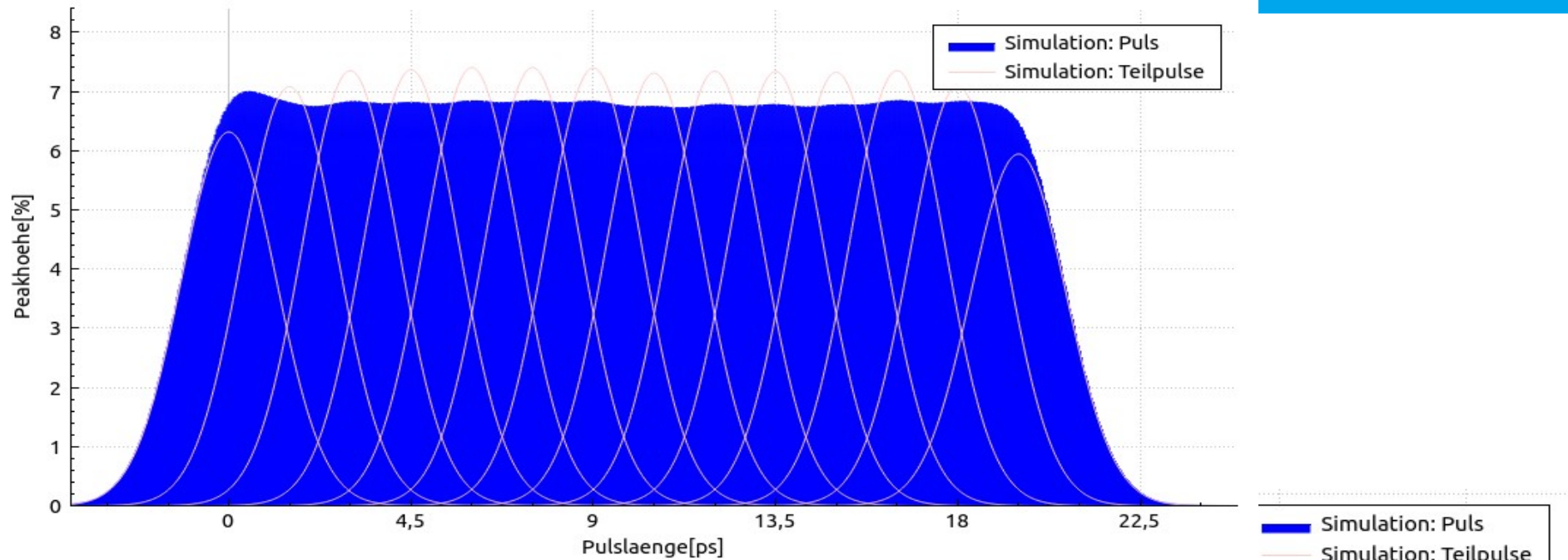
Phase shift: 0π



First Results

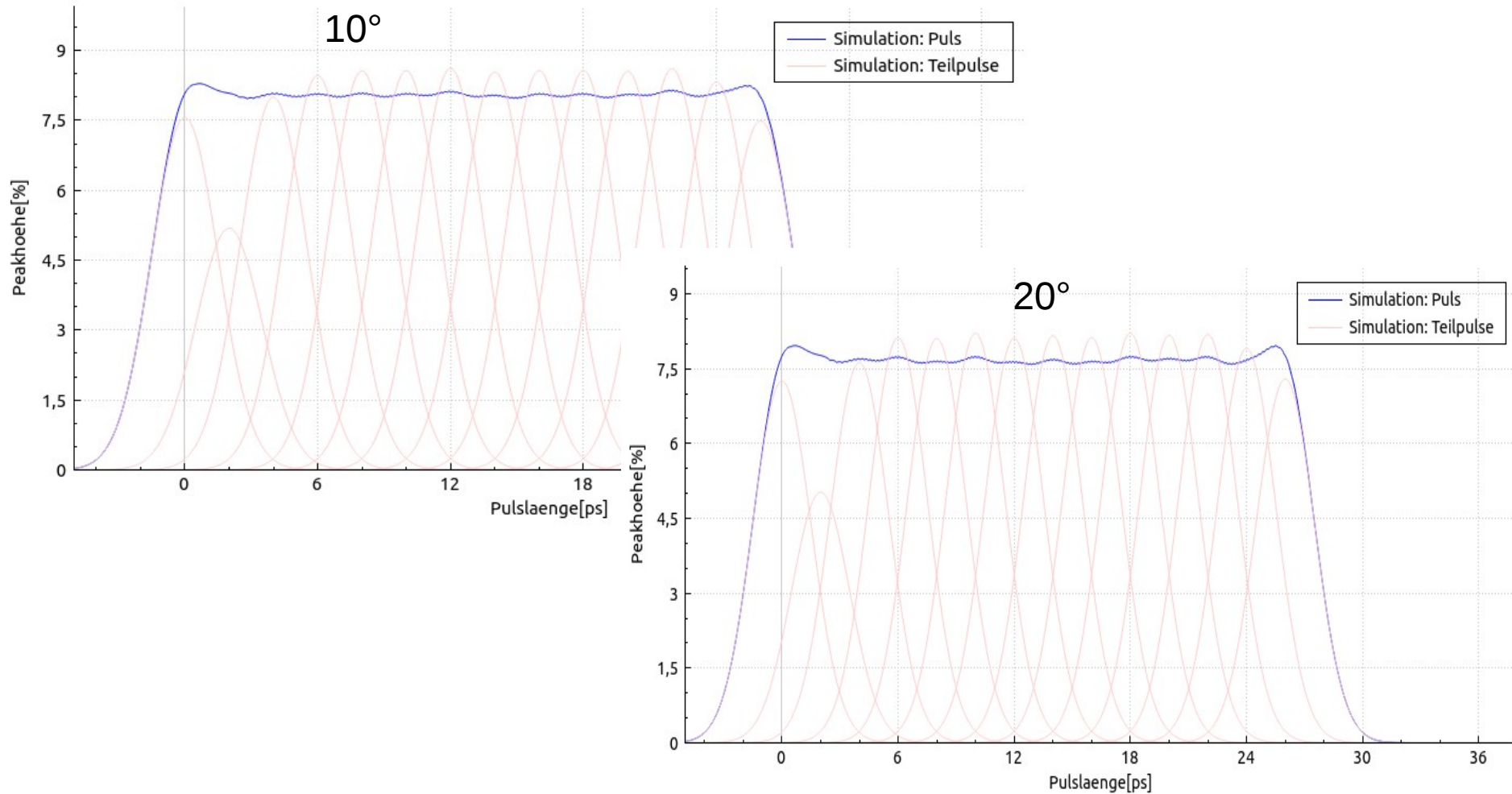


First Results



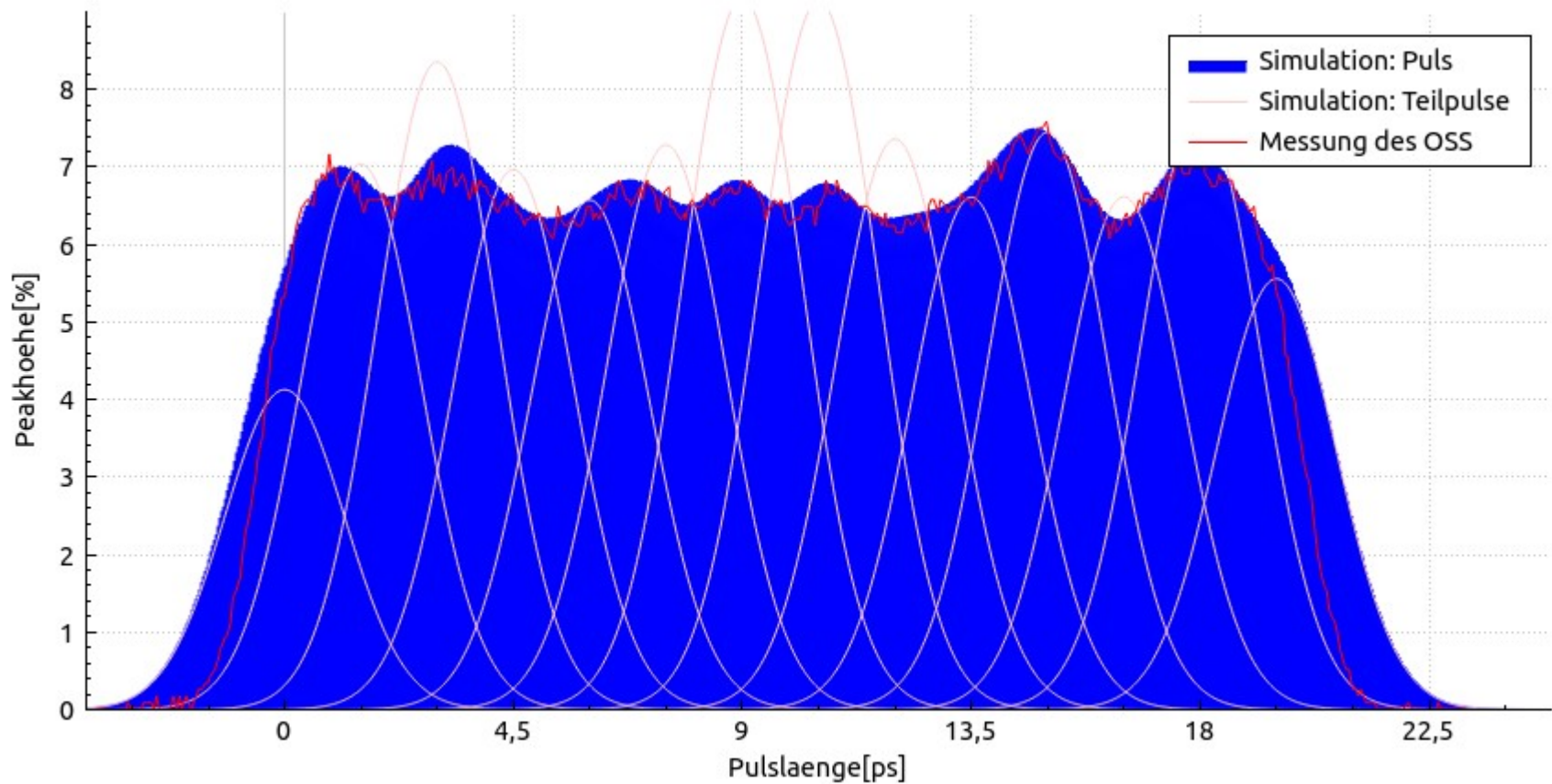
First Results

> Different angles of the output polarizer



First Results

- > First try to reproduce an OSS plot
 - Looks fine but not the only solution



Thank you

