# Work Group III: Measurement of temporal properties

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## Challenges for timing measurements at XFEL

Pulse duration: a few fs to 100 fs

Coherence time: 0.2 to 1.4 fs

## Arrival time

## Pulse duration and shape

## Spectral distribution

# 1. Arrival time monitor:

reflectivity measurements

x-ray induced phase shift in an optical pulse due to charged carriers,
e.g. in diamond (Sokolowski-Tinten)
also as beam monitor (resolution: 50 fs, relative 20 - 30 fs
(needs only weak optical pulse, takes only 1% of the x-rays)

both have 1 D capabilities

side band generation or cross-correlation:
technical limits from imaging: 80 fs pulse duration, 20 fs arrival time

2 RF phase cavities

TEO

structural phase transition in materials which contain light atoms
(half a cycle of a 6 to 10 THz optical phonon)
(needs a beam splitter for the x-rays)

# 2. Pulse duration by

streaking:
THz source (FLASH: different undulator) required

saturated absorption (Sven Toleikis)
K shell absorption,
pulse duration has an influence on the transmission: 50 fs, 100 fs, 200 fs

one may also look in reflection and use multilayer material
in combination with autocorrelator really yields the pulse duration

Autocorrelator with a suitable nonlinear process

Ne ionization at LCLS: longer pulses induce sequential,
shorter mor direct processes

two-colour cross correlation with optical laser for longer pulses :
side band generation, shorter open)

2.a generate in addition an optical pulse in a second undulator,
better for the really short pulses

## 3. Pulse duration and maybe shape

Interference of sub-pulses (Sobierajski)

together with single shot temporal coherence

requires a beam splitter

## 4. Spectral distribution for measuring the sub-pulses on line:

to give a lower bound of the pulse duration