

PAUL SCHERRER INSTITUT



**Alvra Commissioning beamtime**

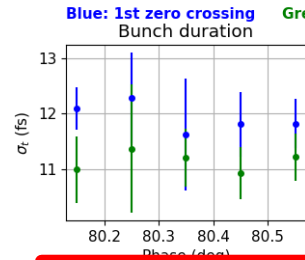
**October 10<sup>th</sup> & 11<sup>th</sup>, 2020**

41	Mon 5	SD	SD	SD	
	Tue 6	SD	SD	SD	
	Wed 7	MS	MS	MS	100 pC
	Thu 8	PC	PC	PC	MW - canc
	Fri 9	BC	BC	BC	MW - canc
	Sat 10	AC	AC	AC	MW - canc
	Sun 11	AC	AC	AC	MW - canc

- 12 keV photon energy
- 100 pC mode

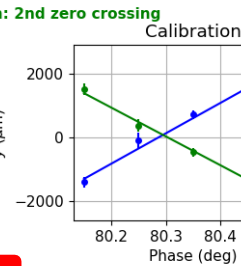


### Bunch length measurement

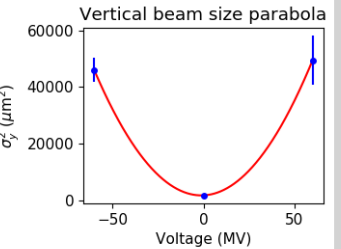


**Bunch duration: 11.2 fs**  
 1st zero crossing: 11.6 fs  
 2nd zero crossing: 11.2 fs  
 Time jitter: 9.8 fs  
 $\sigma_0 = 42.04 \mu\text{m}$

RF Deflector: S30CB14  
 Profile Monitor: SARCL01-DSCR170

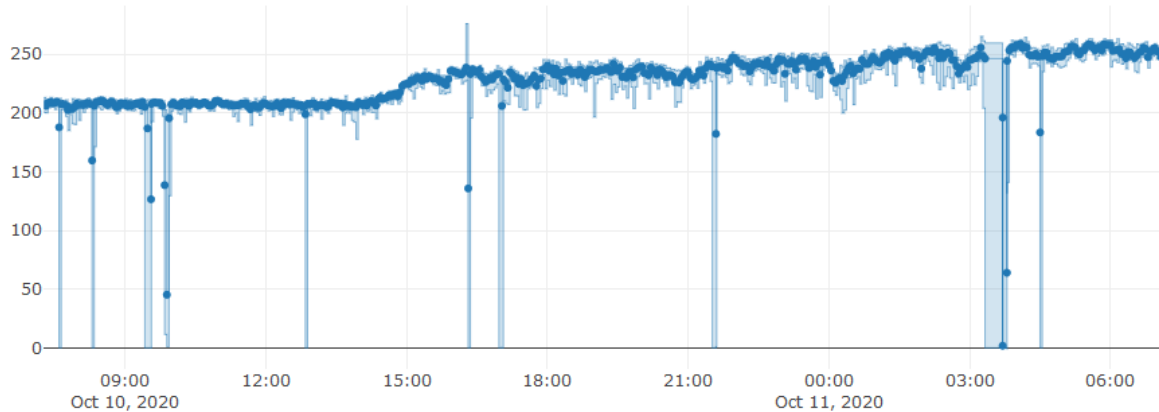


**Calibration: 19.14  $\mu\text{m}/\text{fs}$**   
 1st zero crossing: 19.64  $\mu\text{m}/\text{fs}$   
 2nd zero crossing: 18.63  $\mu\text{m}/\text{fs}$   
 Fits cross at 80.29 deg  
 Resolution: 2.20  $\mu\text{m}/\text{fs}$



$y = 12.76x^2 + 29.34x + 1766.99$   
 Min. voltage: -1.08 MV

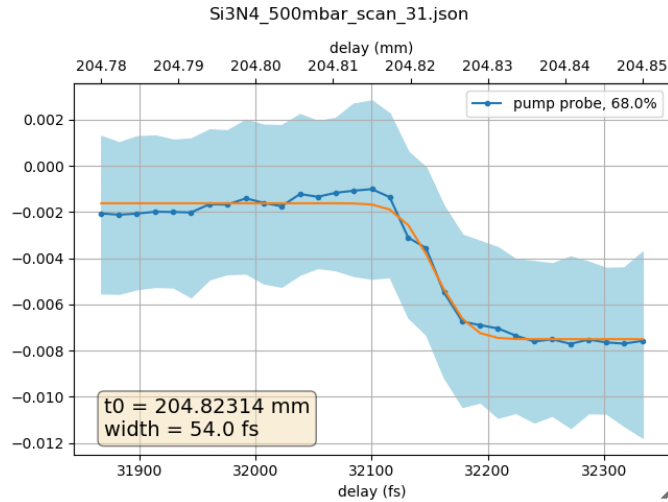
Wed 07-10-2020 22:41:05



SARFE10-PBPG050:PHOTON-ENERGY-PER-PULSE-AVG\$max  
 SARFE10-PBPG050:PHOTON-ENERGY-PER-PULSE-AVG\$mean  
 SARFE10-PBPG050:PHOTON-ENERGY-PER-PULSE-AVG\$min

# Timing results (Alvra) Si<sub>3</sub>N<sub>4</sub>

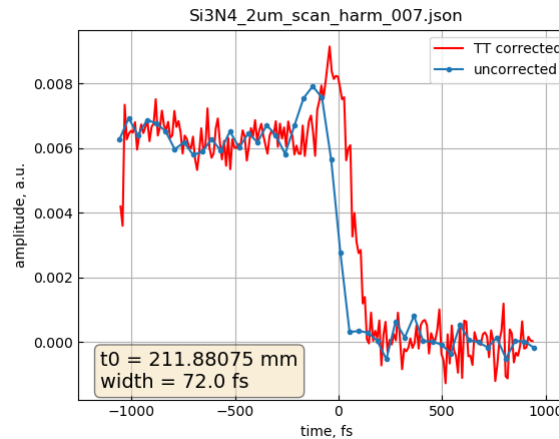
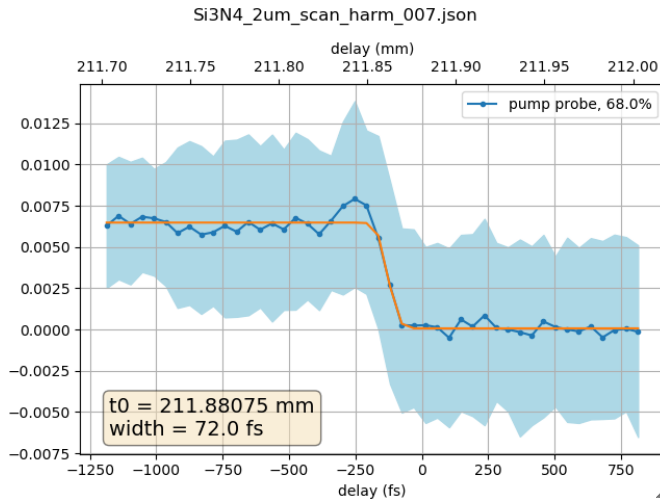
Pump-probe signal on 2 μm thick Si<sub>3</sub>N<sub>4</sub> using 800 nm (35 fs FWHM)



July 2020, 200 pC mode (30 fs e-bunch)

→ ~ 65 fs rise time

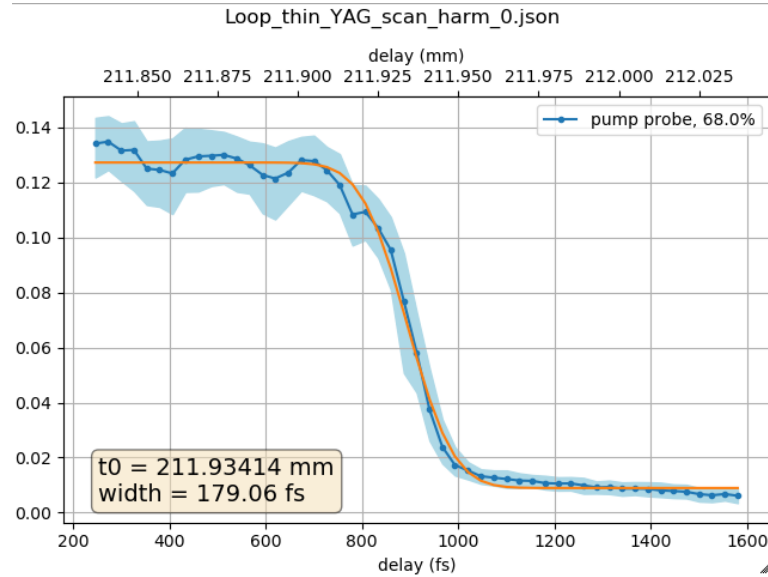
October 2020, 100 pC mode (11 fs e-bunch)



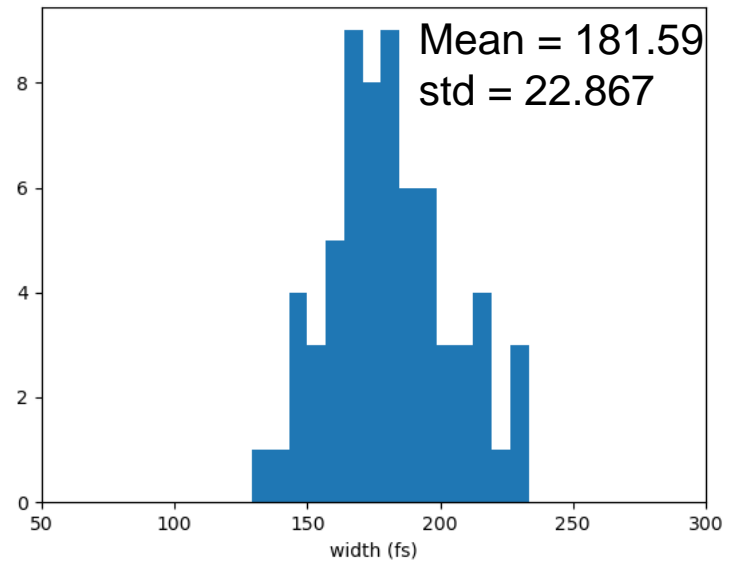
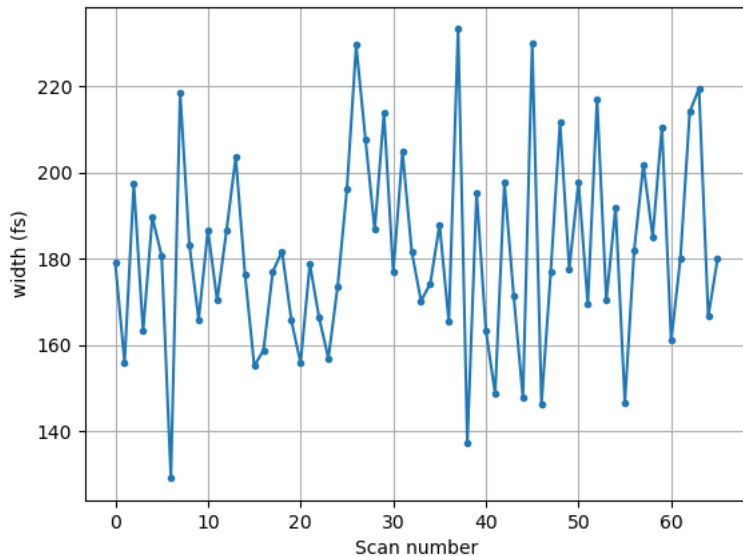
→ ~ 70 fs rise time

# Timing results (Alvra) YAG

Loop of 65 consecutive Xray/laser cross correlation curves.

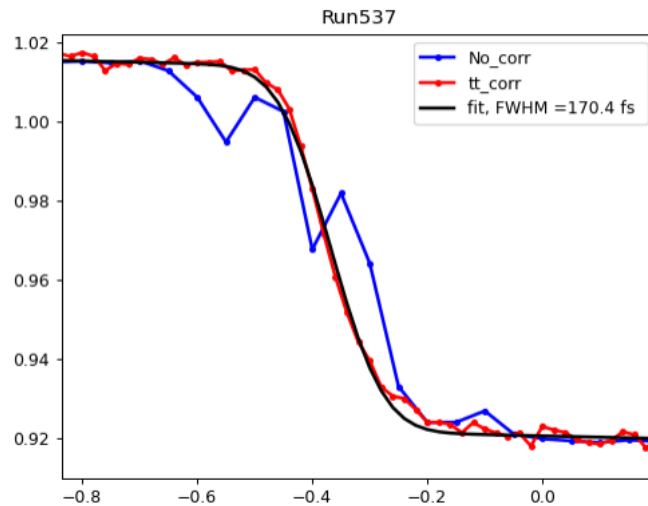


- YAG (20 um thick)
- 800 nm probe



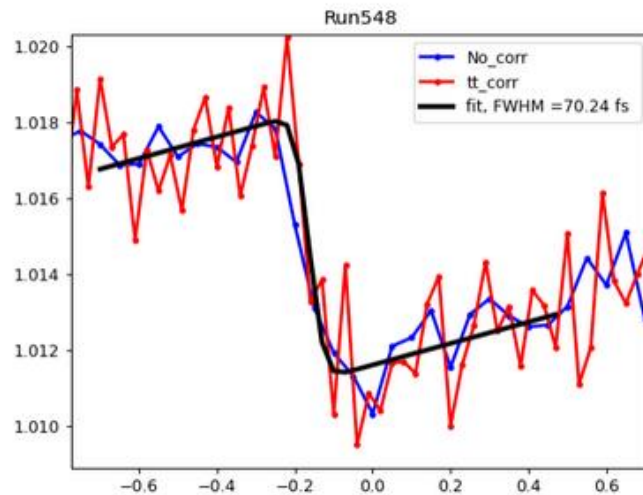
# Timing results (Bernina)

Pump-probe signal on using 800 nm (35 fs FWHM)



20  $\mu\text{m}$  thick YAG

➔ ~ 170 fs rise time



2  $\mu\text{m}$  thick  $\text{Si}_3\text{N}_4$

➔ ~ 70 fs rise time

# Conclusions & outlook

- Fastest transient measured is in the range of 70 fs, same as in July.
- The same result obtained with three different lasers (800 nm Globi & 800 nm Papamoll & NOPA)
- Most likely this is limited by the sample response?



- We need a diagnostic tool with faster response, to be able to see potential improvement achieved on the Xray pulse duration
- It would be nice to be able to tune the e-bunch length and see the effect on the cross correlation curves.