

Pump and Probe experiments at the Low Density Matter beamline of FERMI@Elettra

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Outline

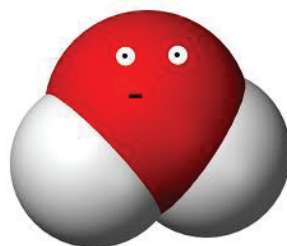
- Experimental Apparatus
- Pump & Probe Experiments: a way to characterize the FEL
- Special Class of pump & Probe Experiments:
Two Color Dichroism

Low Density Matter (LDM)

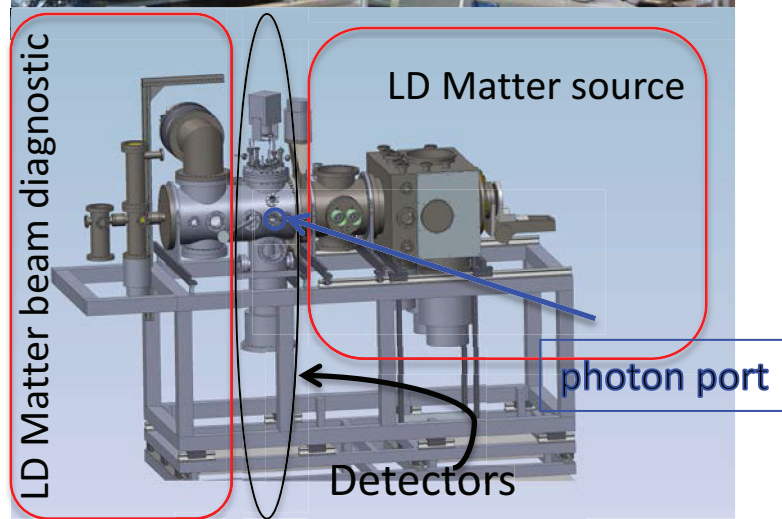
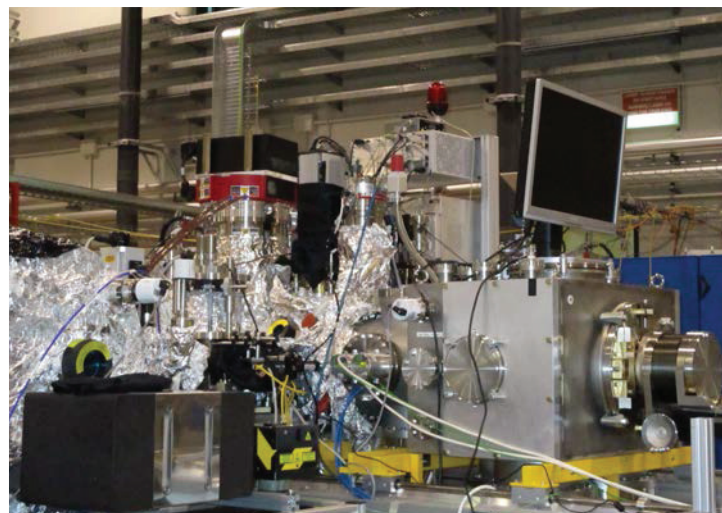
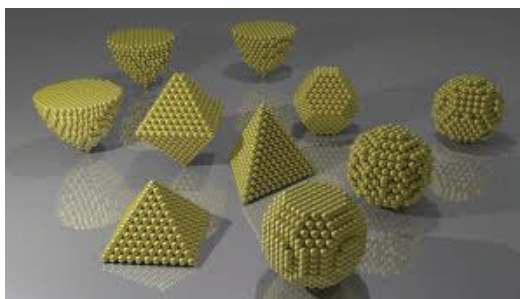
Atoms



Molecules

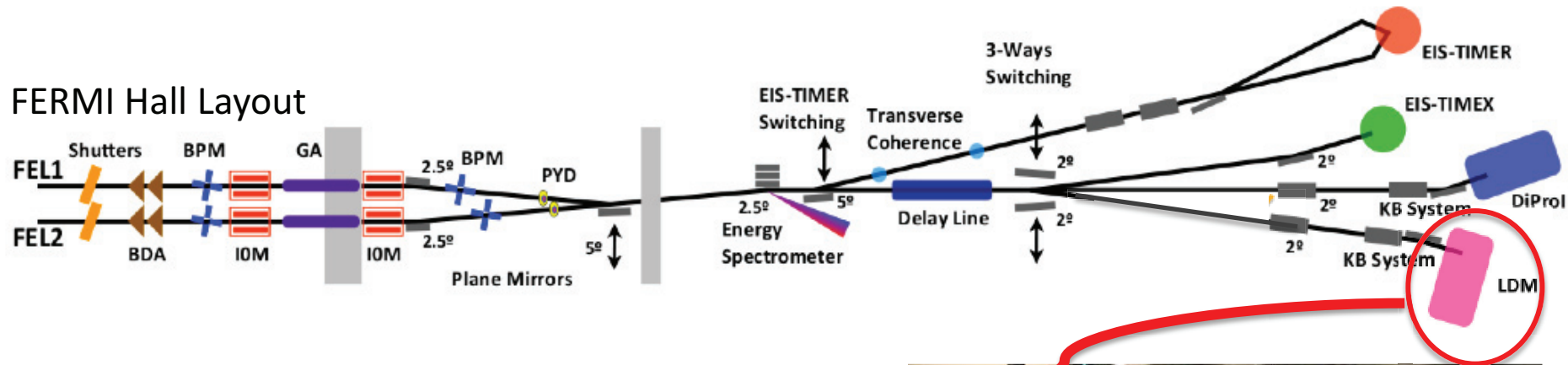


Clusters



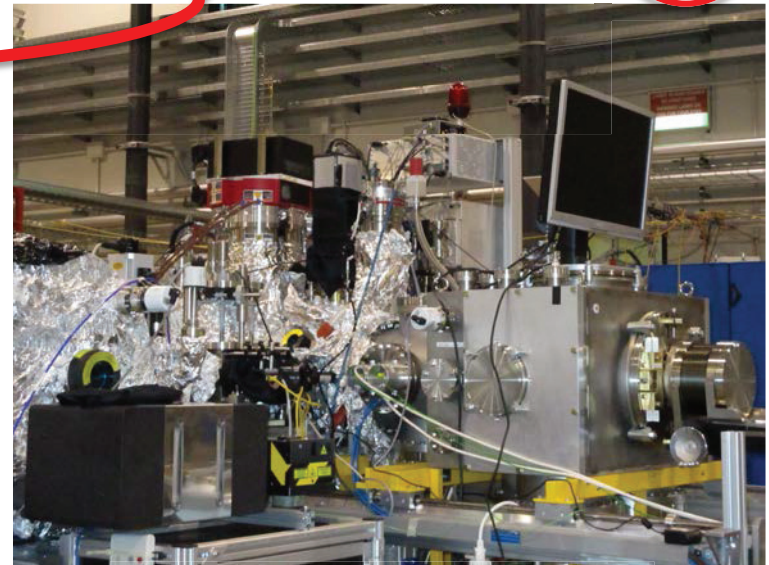
LDM end-station

<http://www.elettra.trieste.it/lightsources/fermi/fermi-beamlines/ldm/ldmhome-page.html>



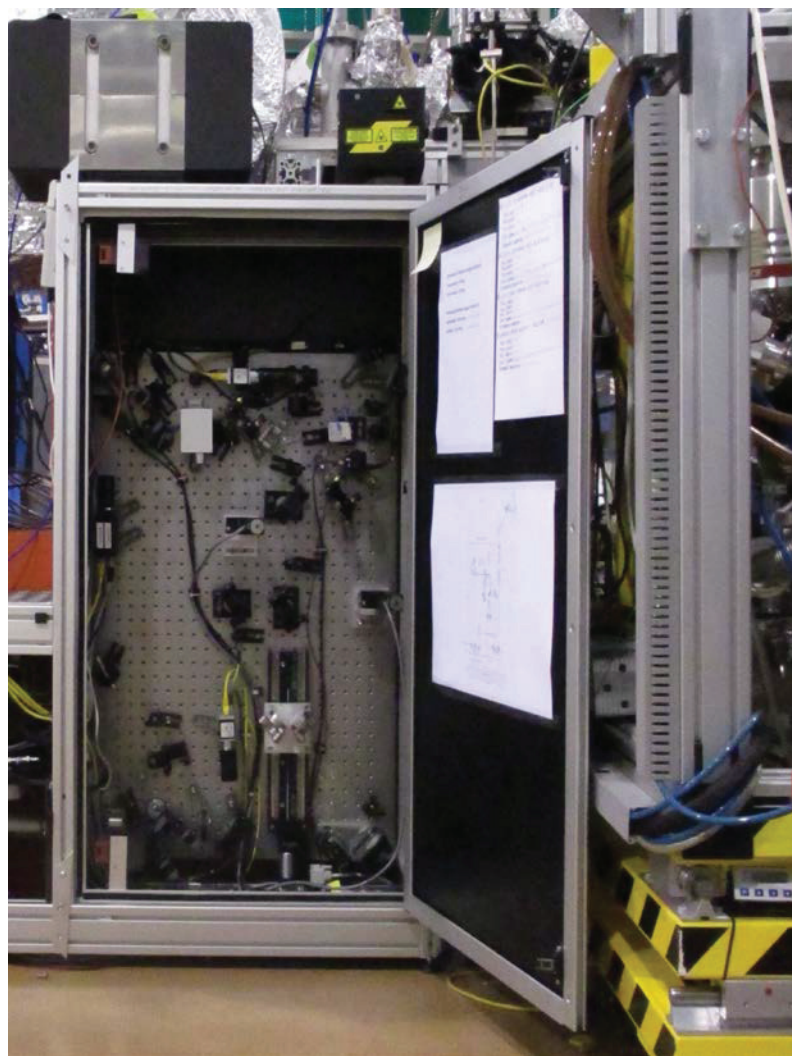
LDM: open to external users
since Dec. 2012

**Next deadline for proposal submission:
October 31st, 2013.**



LDM end-station

The User Seed LASER



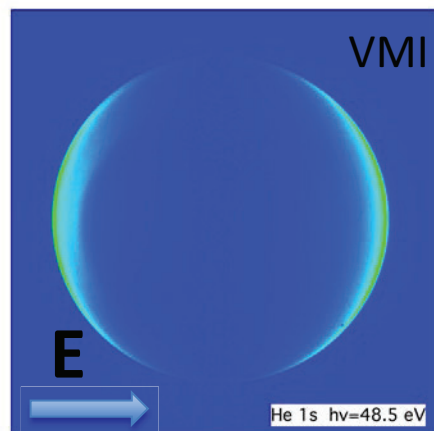
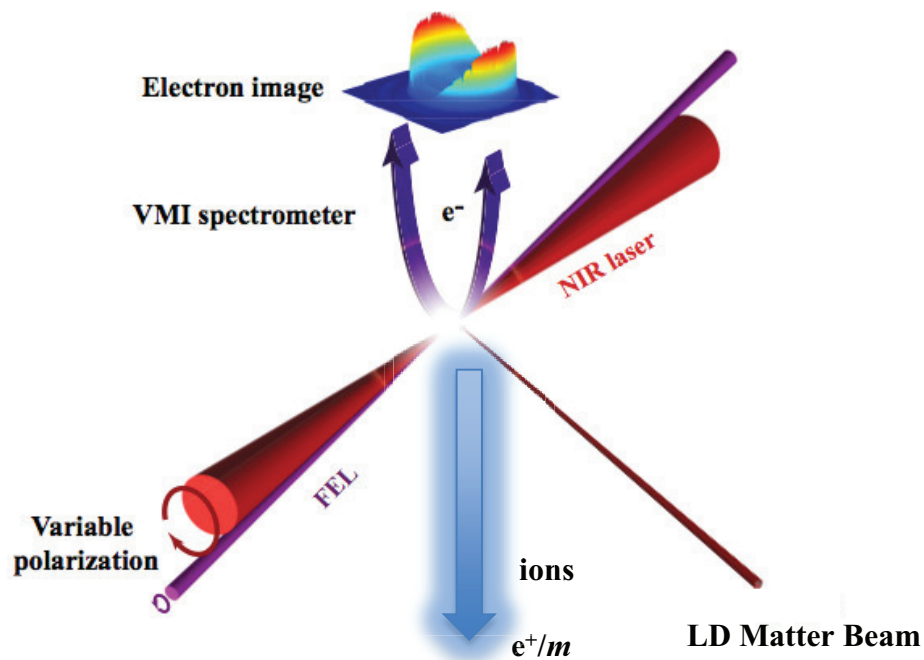
Ti:sapphire (same used to form the FEL pulse)

$\lambda=780 \text{ nm}$

Energy/pulse: 1 mJ
Pulse width 140 fs
(autocorrelation)

USL-LDM Controls	
Attenuation (energy meter available)	0 – 100 %
Polarization	Full control
Delay resolution	2.6 fs
Beam Position resolution	10 μrad (upgrade: piezo tip-tilt)

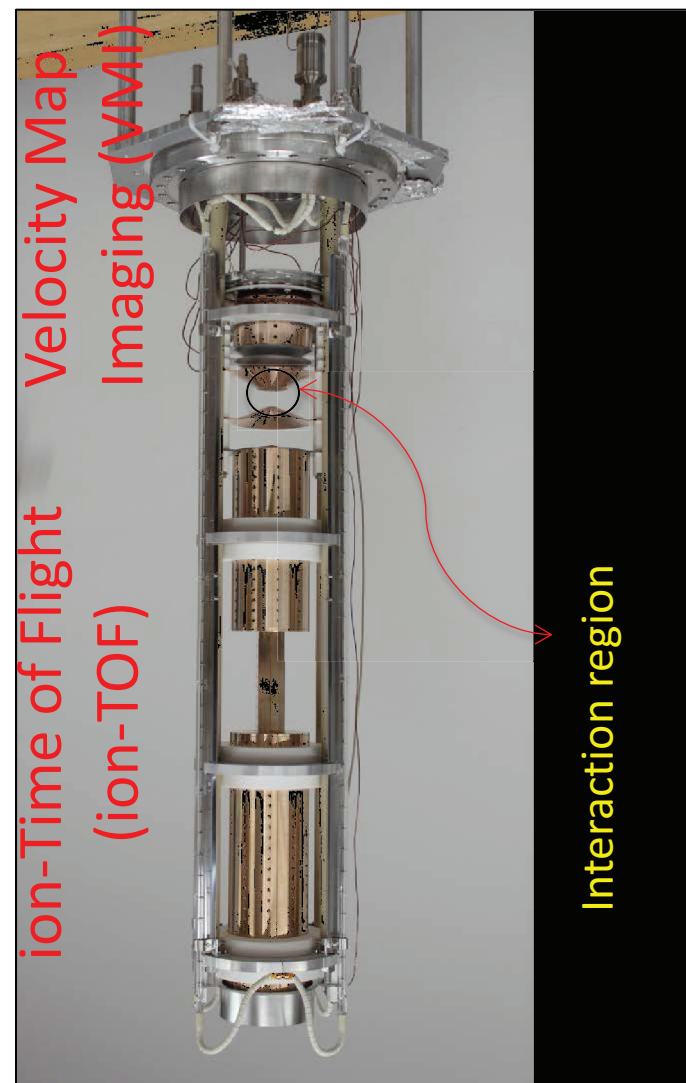
LDM Setup



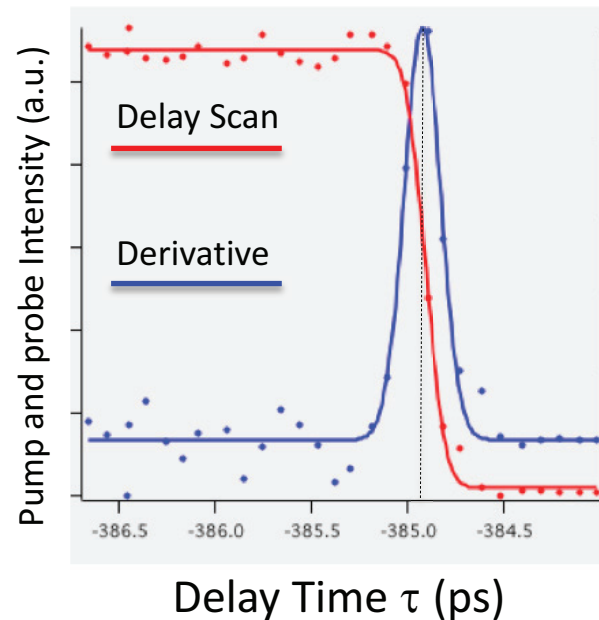
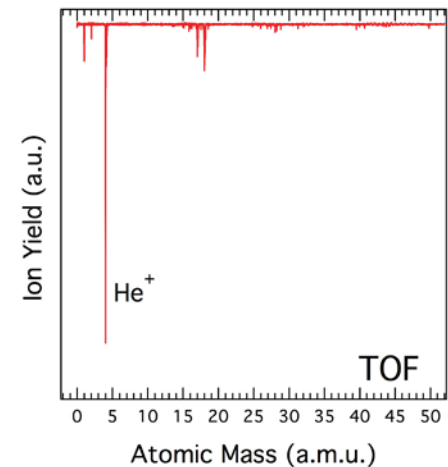
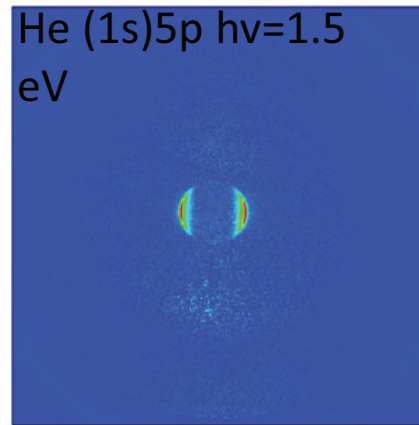
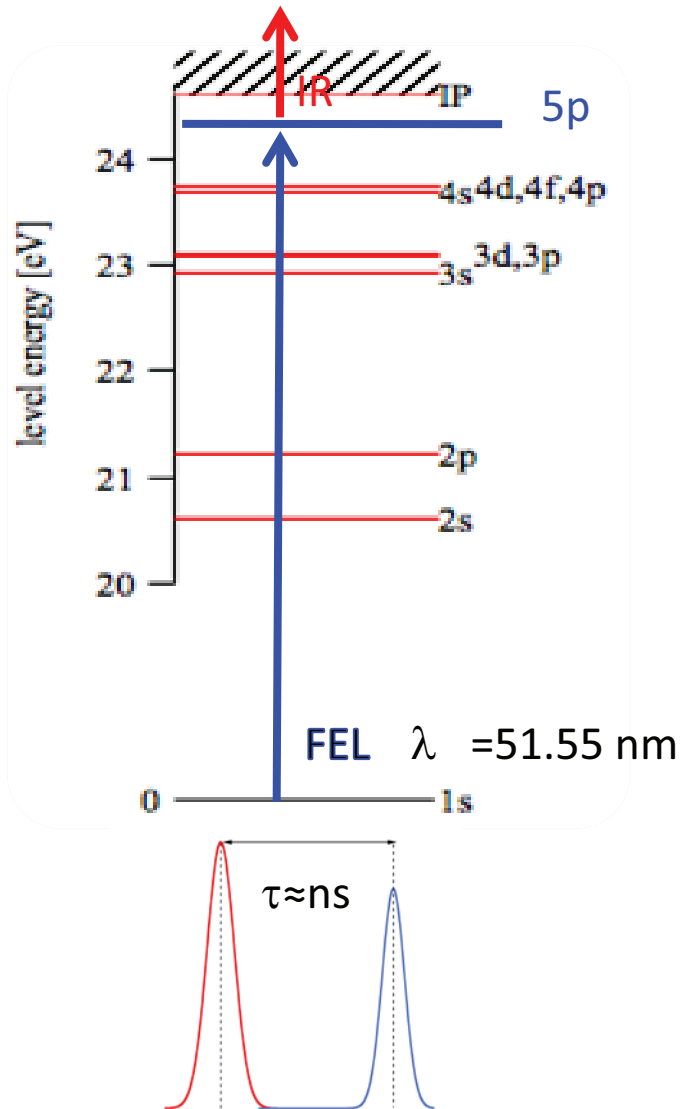
Beam Spot-Size

FEL  30 μm

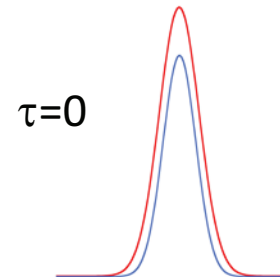
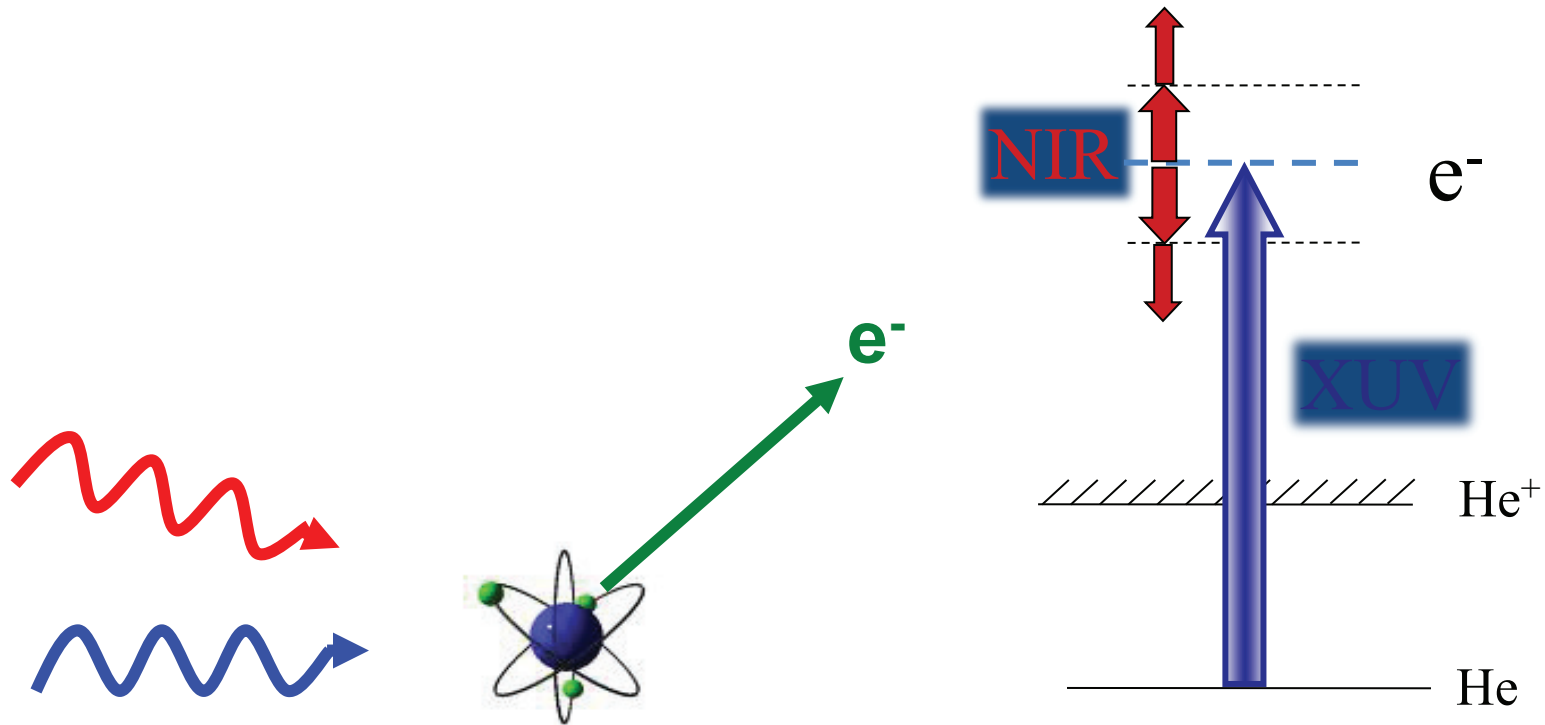
IR  100 μm



1+1 Two Color He photoemission



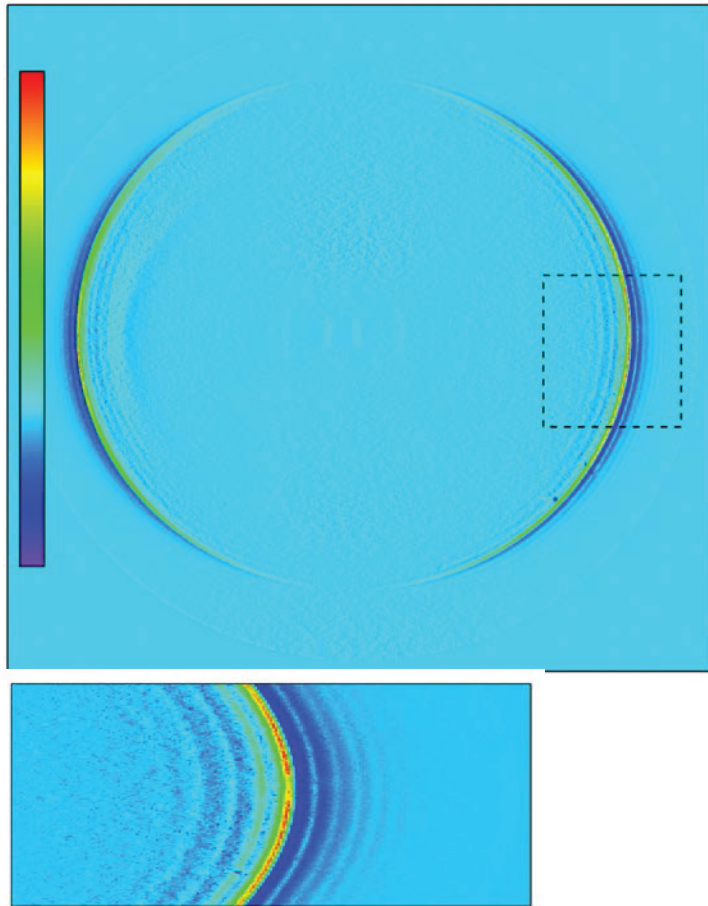
Side Bands: He 1s photoemission



Side Bands-Cross Correlator

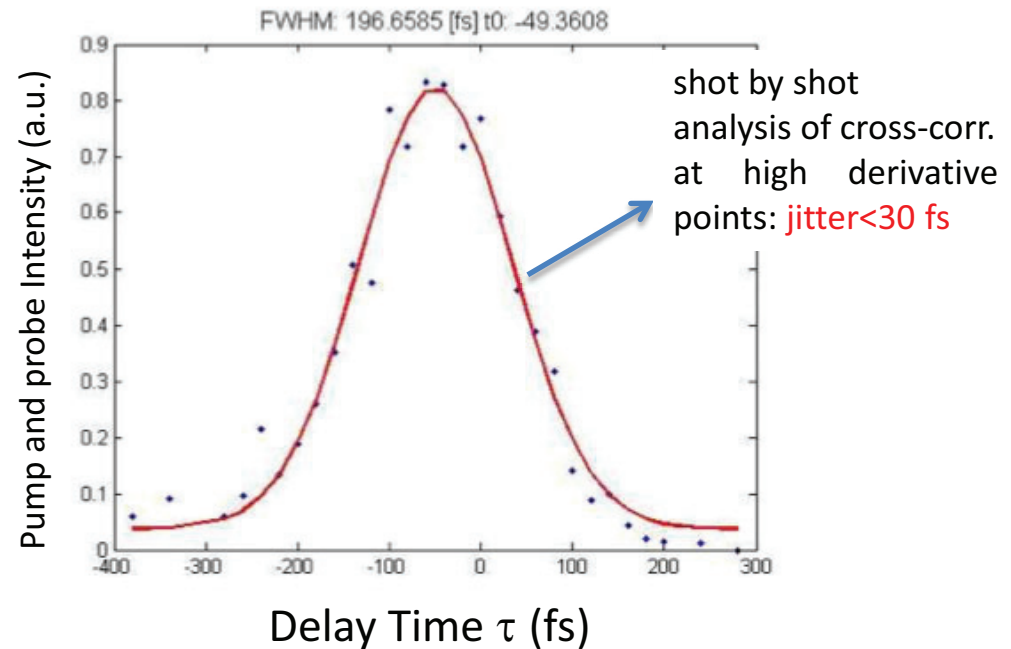


Elettra Sincrotrone Trieste



FERMI: 48.4 eV, 80 μ J, linear pol.

IR: 750 μ J, linear polarization

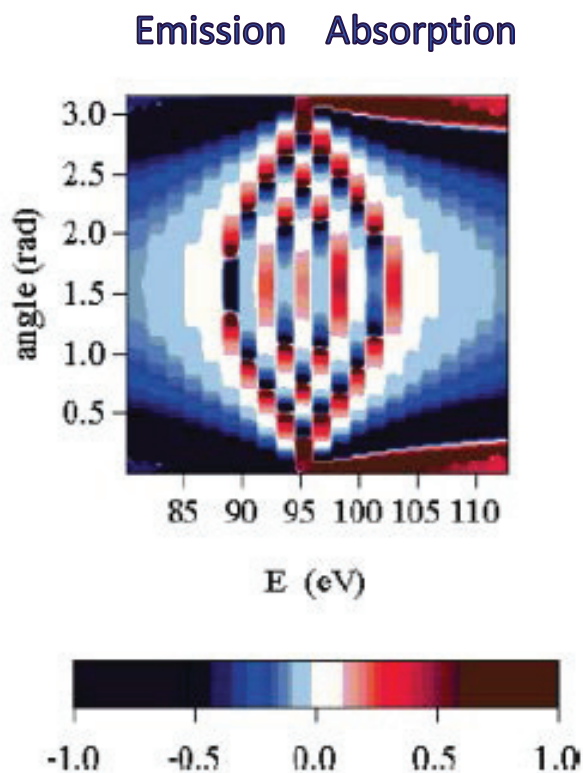


Cross- correlation curve from He side bands FWHM: 197 fs

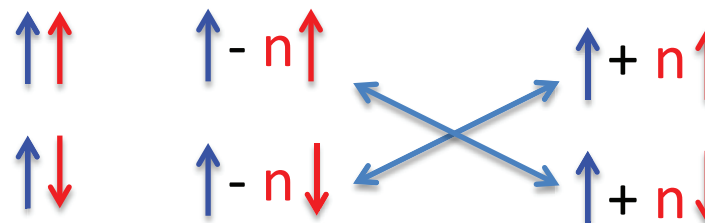
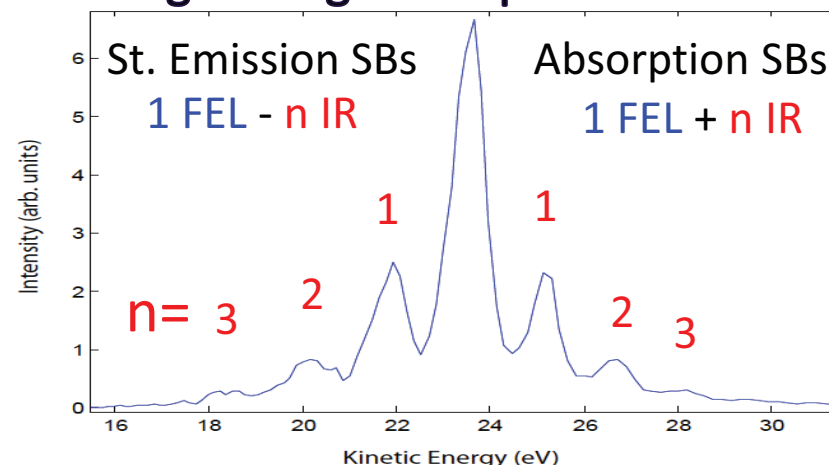
From autocorrelation measurements the infra-red laser was 140 fs FWHM. From the above cross-correlation curve it was found that the FEL pulse was of comparable length



Two Color CD – He Side Bands



Angle integrated spectrum of SB

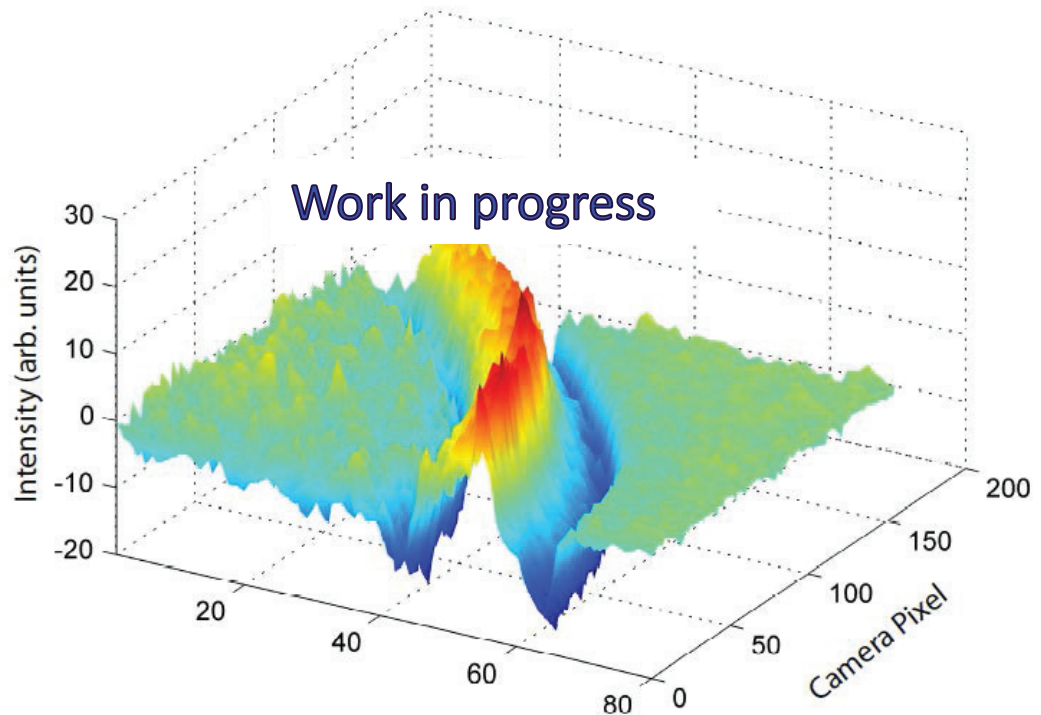
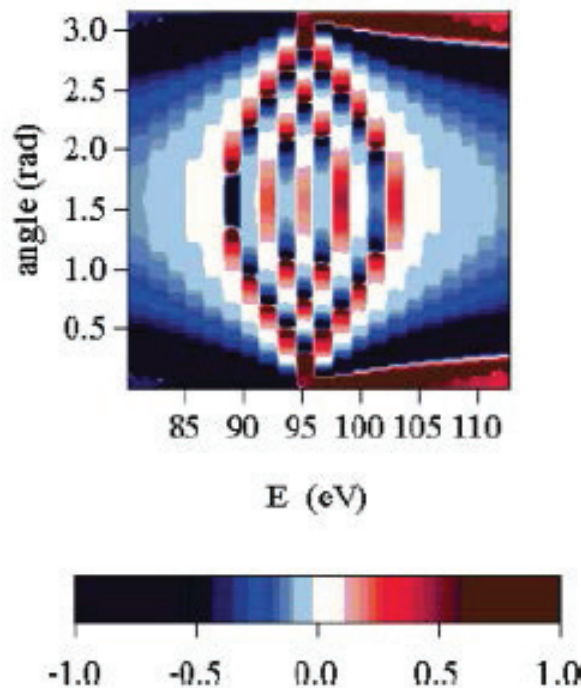


$$CD = \frac{\begin{array}{c} \uparrow\uparrow \\ \uparrow\downarrow \end{array} - \begin{array}{c} \uparrow\downarrow \\ \uparrow\uparrow \end{array}}{\begin{array}{c} \uparrow\uparrow \\ \uparrow\downarrow \end{array} + \begin{array}{c} \uparrow\downarrow \\ \uparrow\uparrow \end{array}}$$

A. Kazansky et al. PRA 85, 053409 (2012)

CD in two-color multi-photon ionization of He

Experiment carried out on LDM (M. Meyer, XFEL)



FERMI: 48.4 eV, 80 μ J, circular pol. (one helicity)

IR: 25 μ J, circular polarization (right or left)

A. Kazansky et al. PRA 85, 053409 (2012)

Thank you for your attention