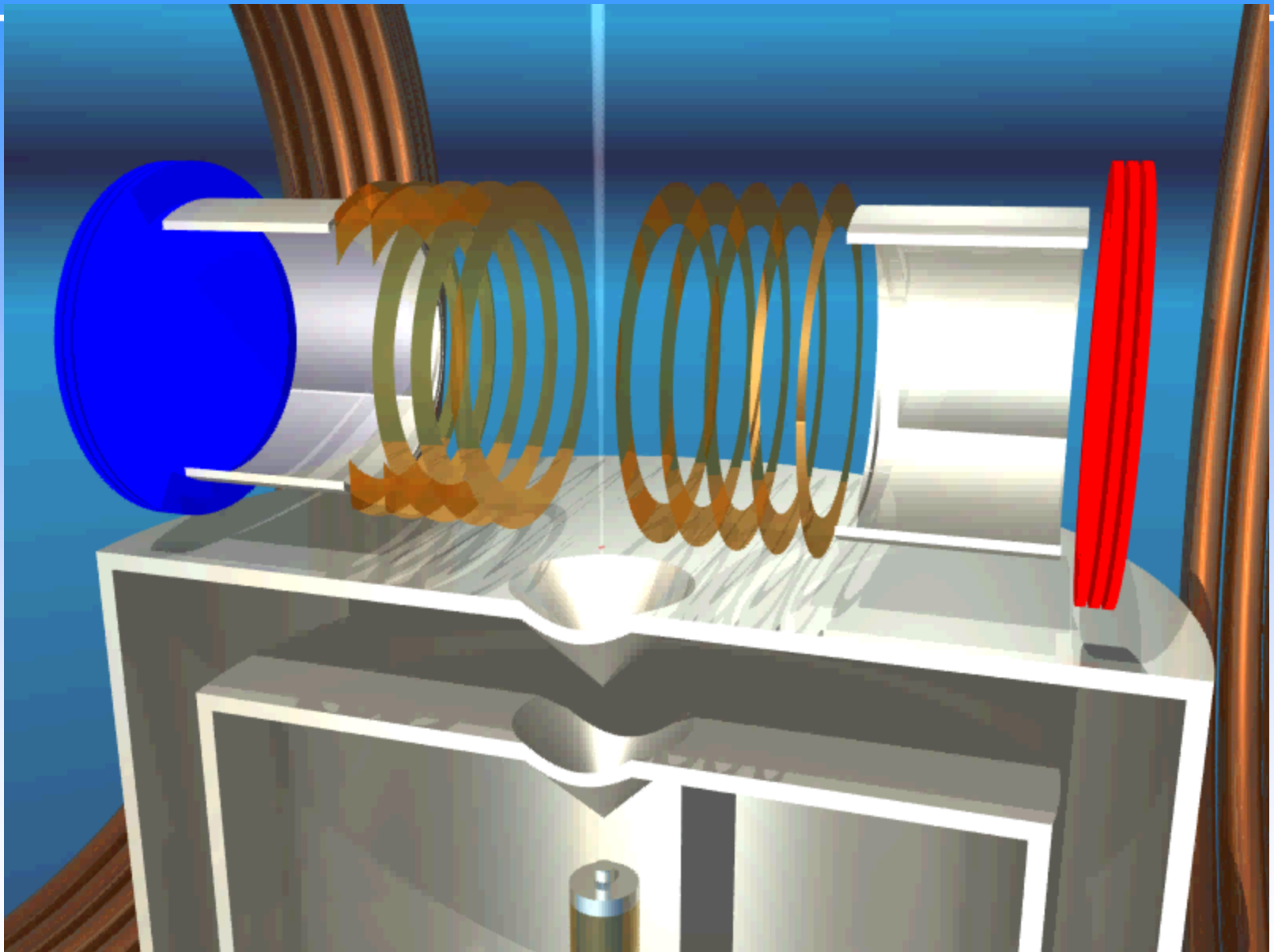


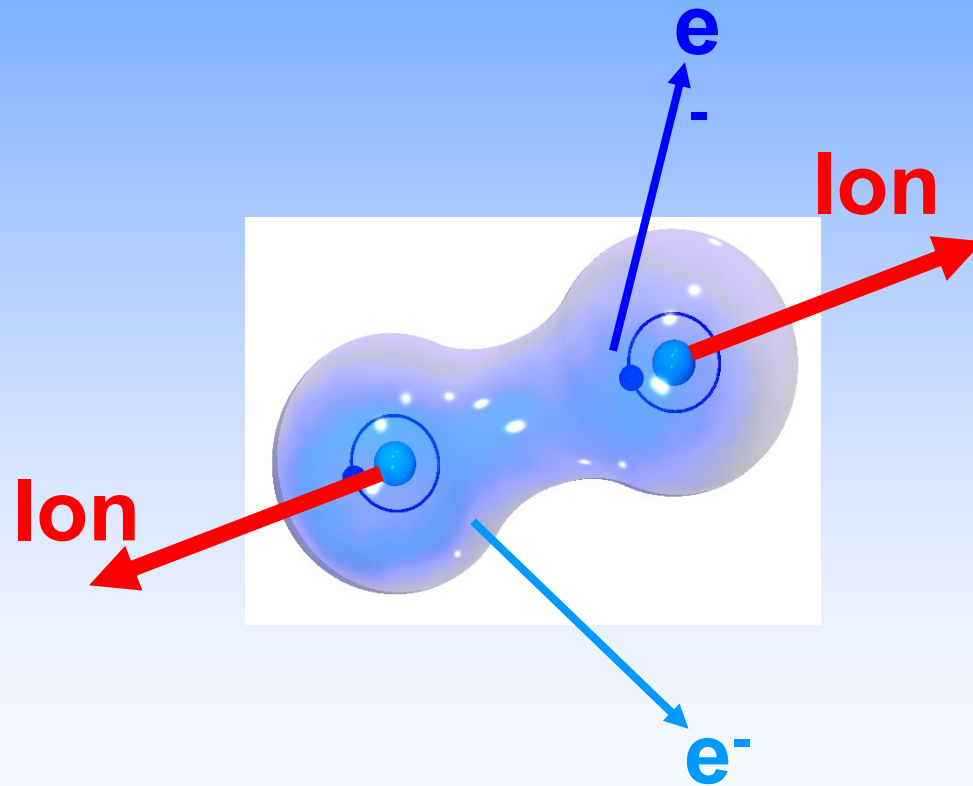
Time resolved coincident momentum imaging at XFEL

Markus S. Schöffler



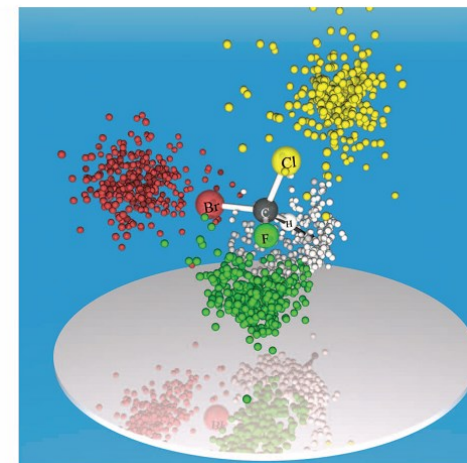
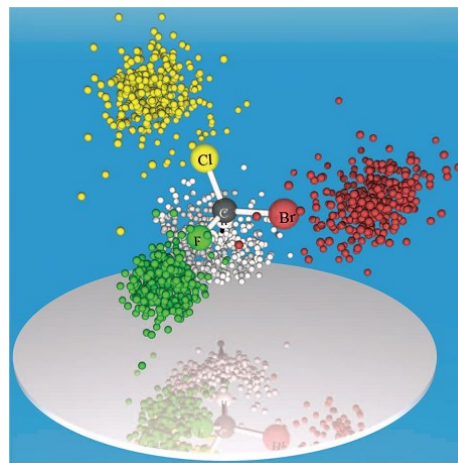
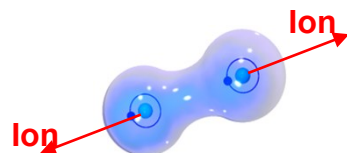
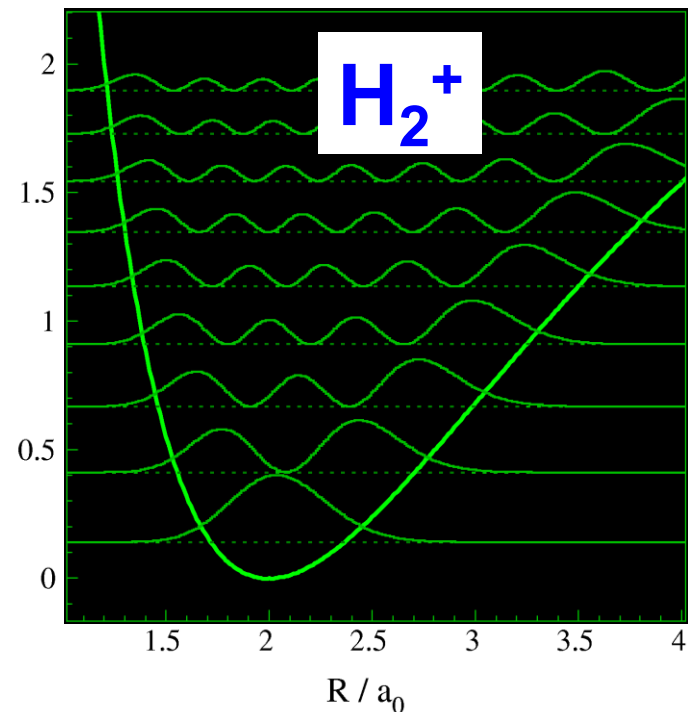


Introduction



Ion detection

$E_{\text{vib}} / \text{eV}$



„Determination of the absolute Configuration“
Pitzer et al., Science **341**, 1096 (2013)

„Spatial Imaging at the quantum limit“
L. Schmidt et al PRL **108**, 73202 (2012)

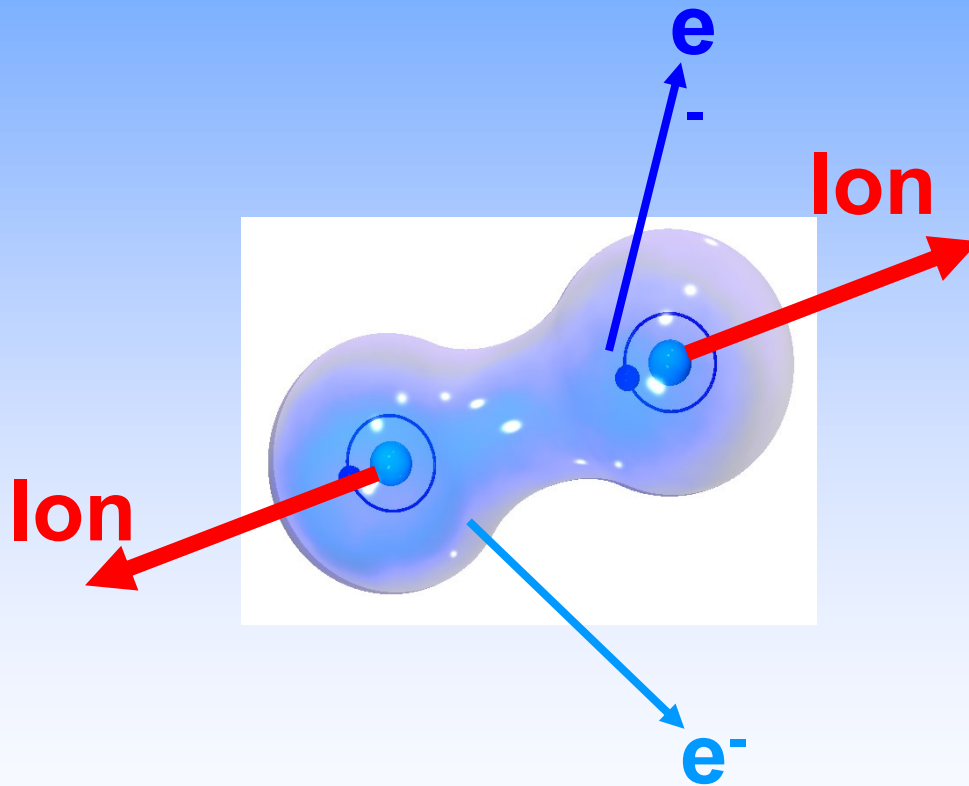


Ion detection

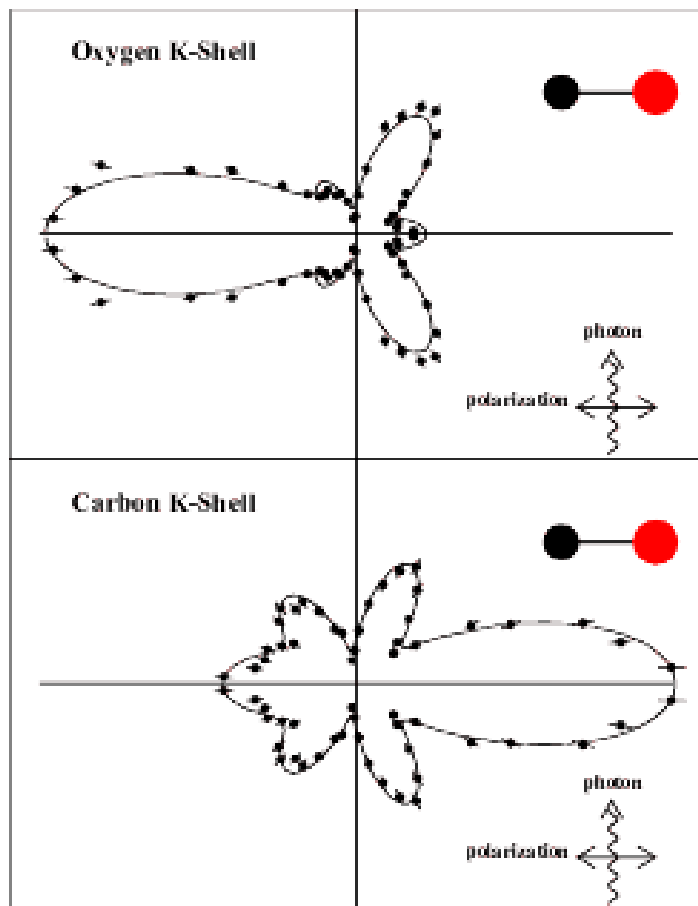
Ion detection → internuklear wave function
→ molecular geometry



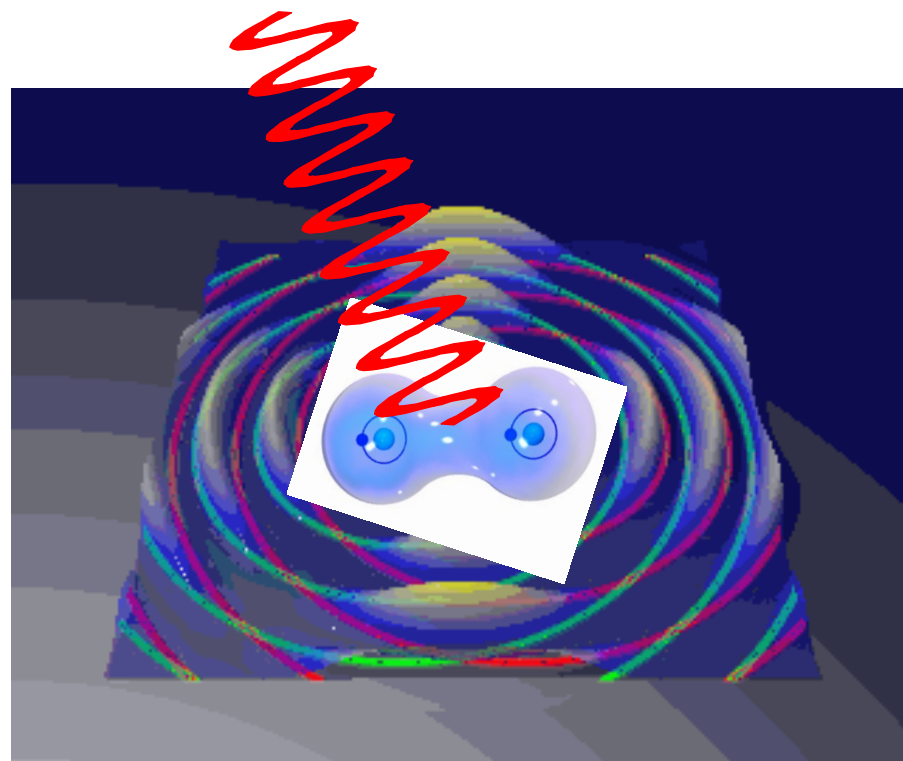
Photoelectron



Photoelectron



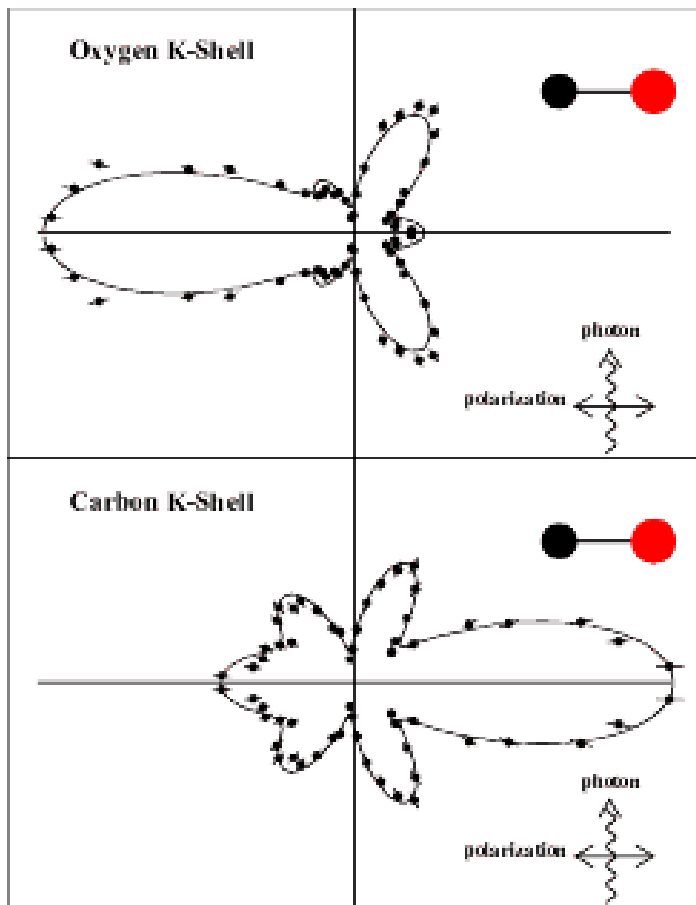
„Molecules illuminated from within“
Landers et al., PRL **87**, 013002 (2001)



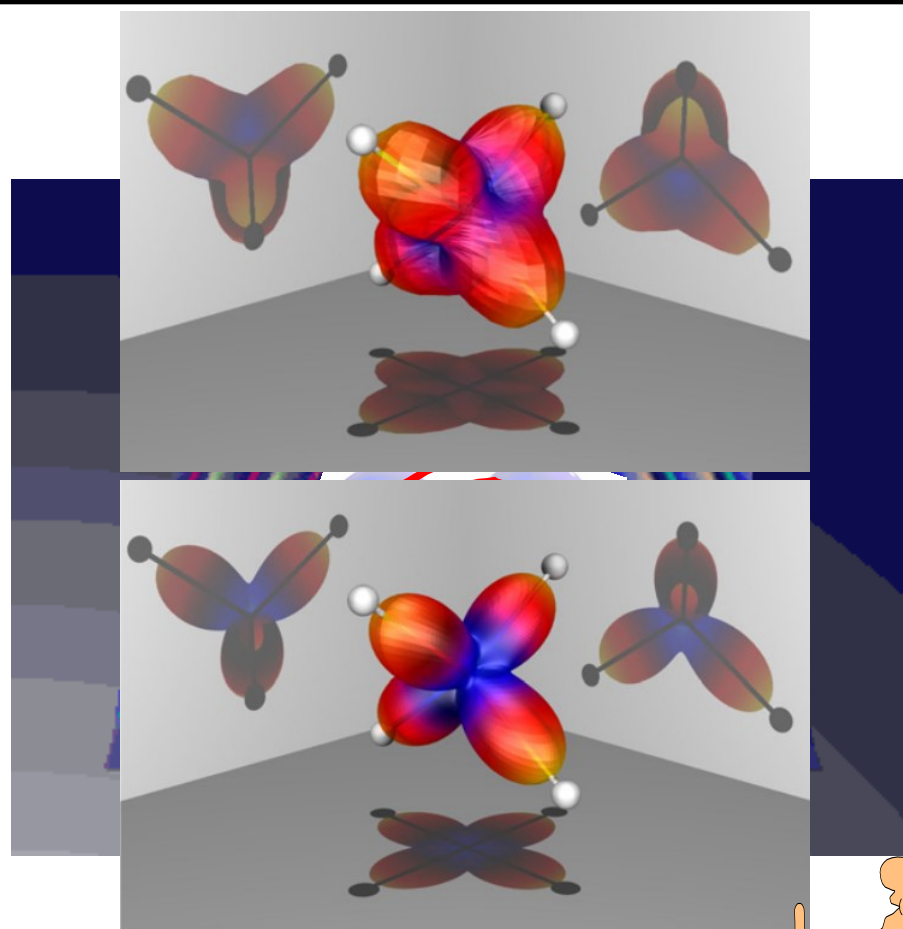
„Molecules illuminated from within“
Williams et al., PRL **108**, 233002 (2012)



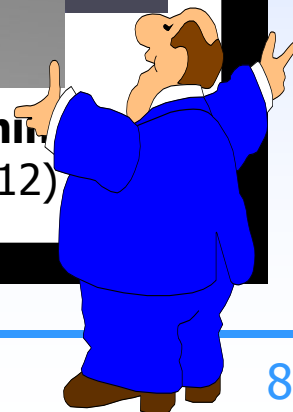
Photoelectron



„Molecules illuminated from within“
Landers et al., PRL **87**, 013002 (2001)



„Molecules illuminated from within“
Williams et al., PRL **108**, 233002 (2012)



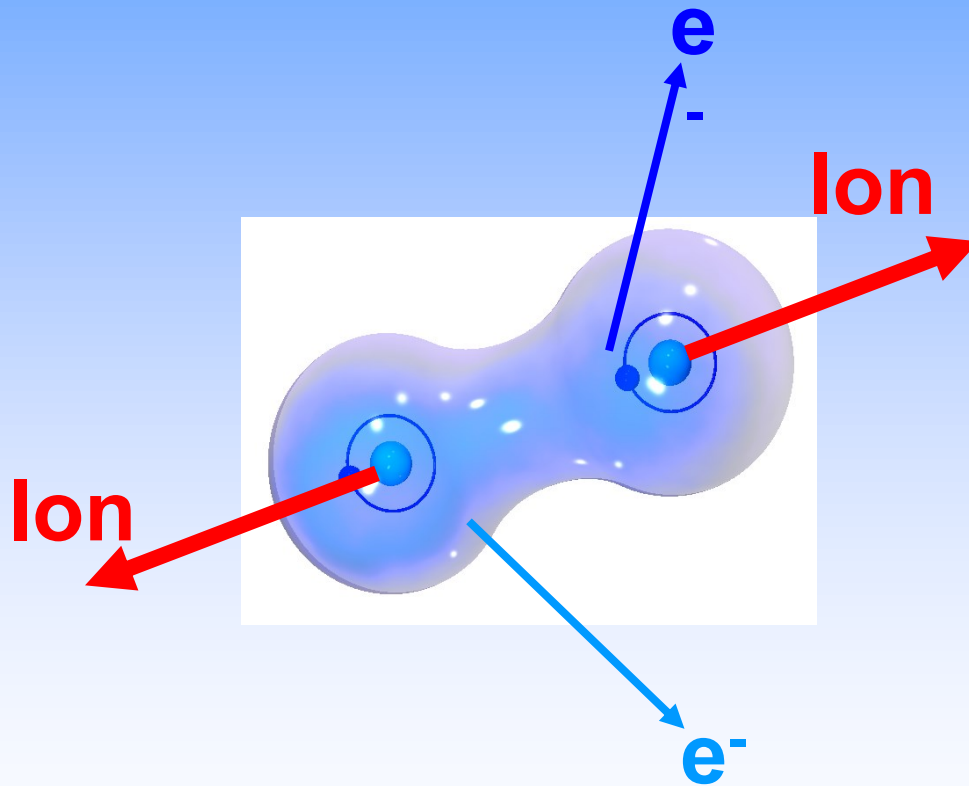
Electron diffraction

Ion detection → internuklear wave function
→ molecular geometry

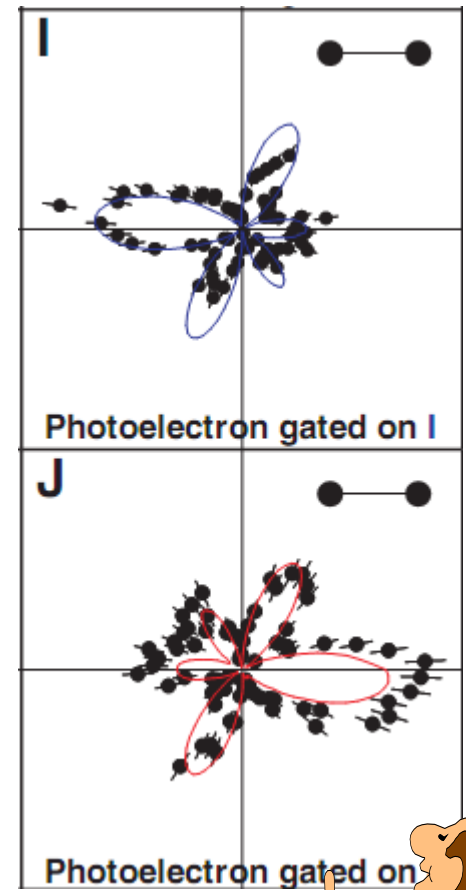
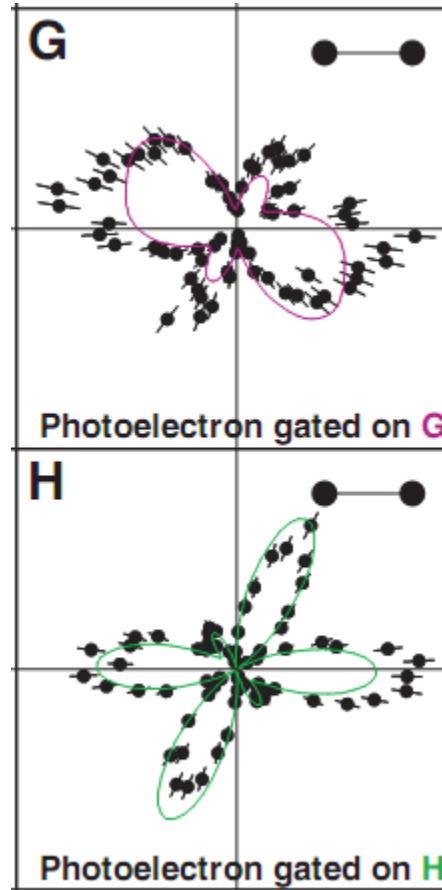
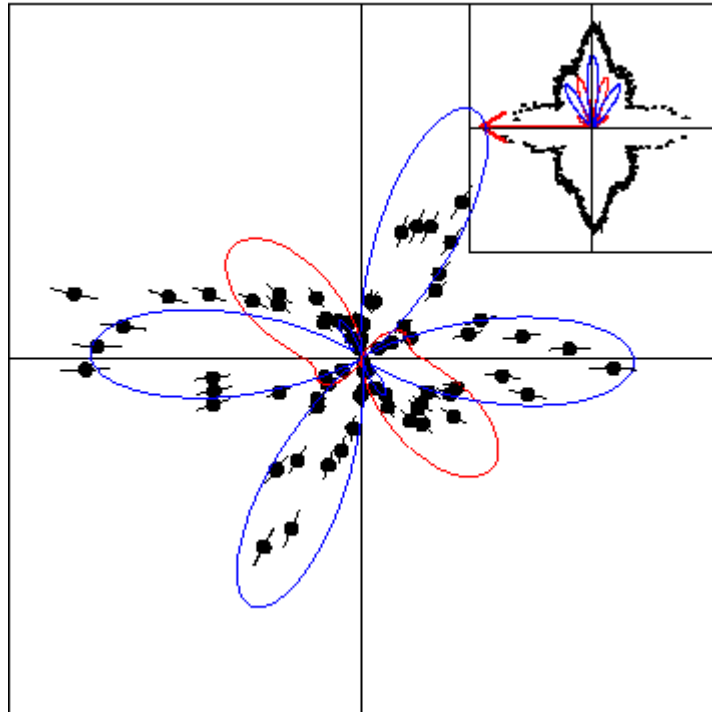
Photoelectron → molecules illuminated from within



Secondary electrons



Electron-Electron-coincidences



„Corehole localization & electron entanglement in N₂“
Schöffler et al., Science **320**, 920 (2008)



Electron-Electron-coincidences

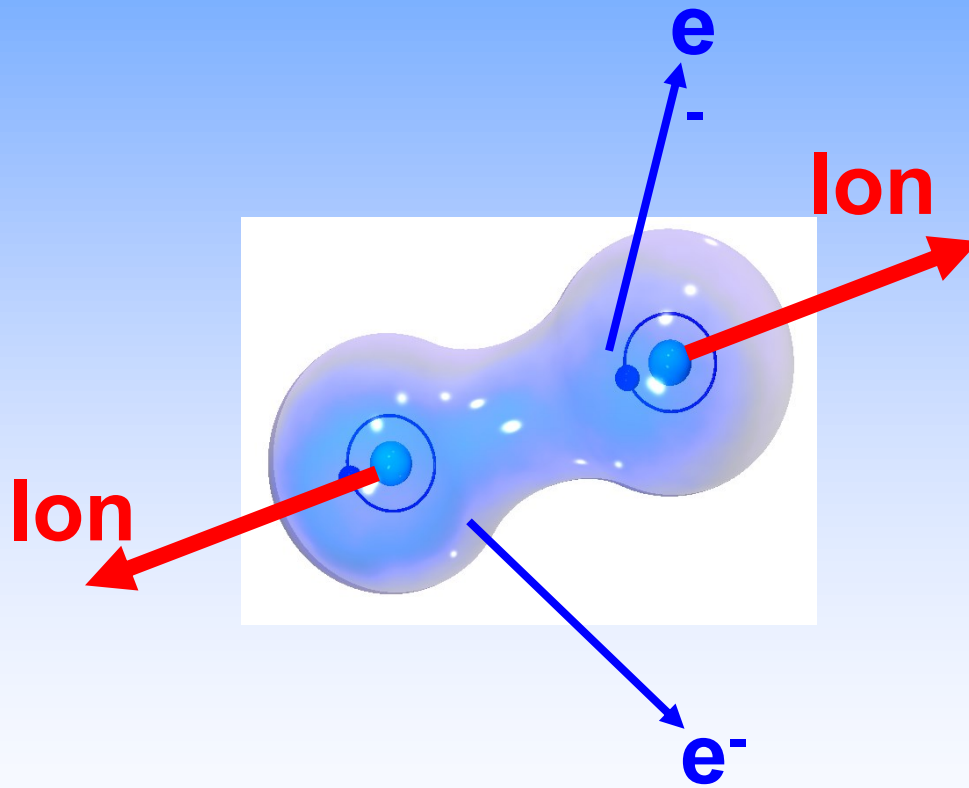
Ion detection → internuklear wave function
→ molecular geometry

Photoelectron → molecules illuminated from within

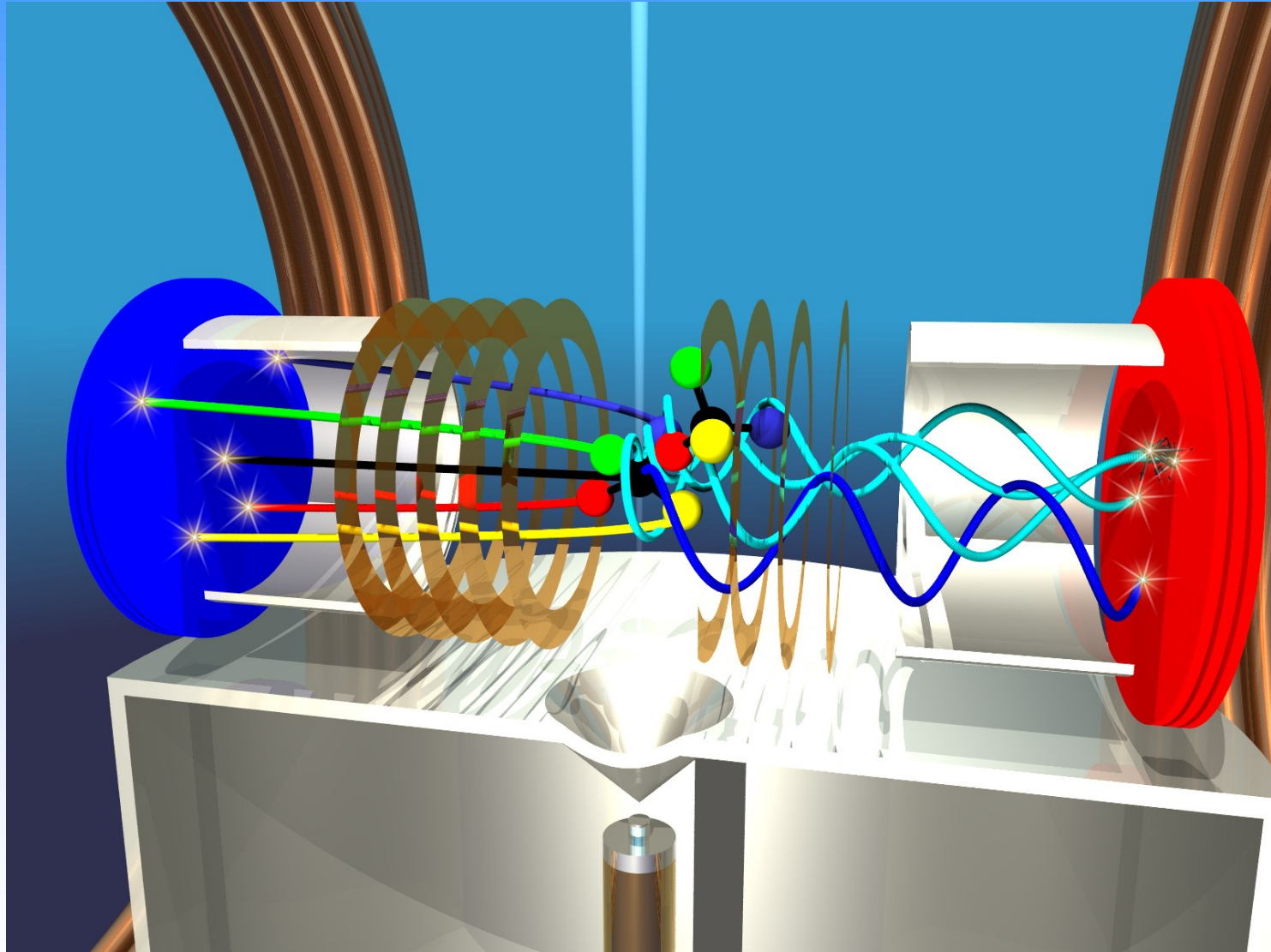
2nd electron → entanglement



Pump-Probe



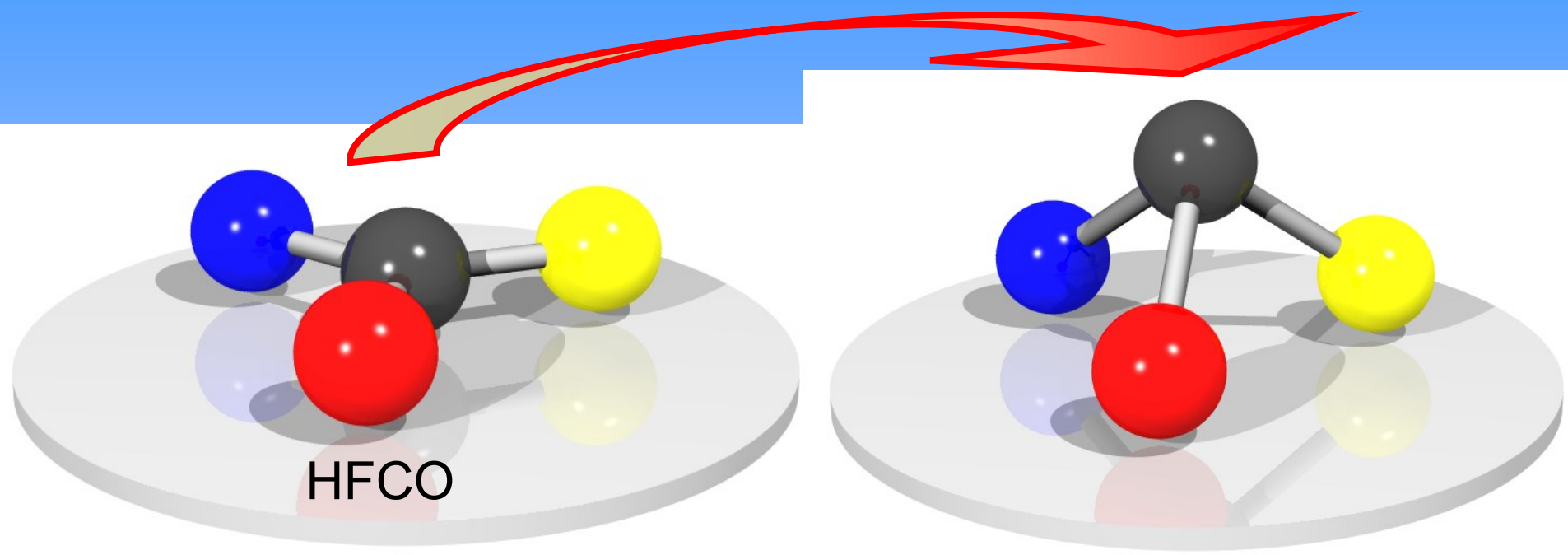
Challenge I



Parameters Wish List

	Day 0	Nice to have
Experimental techniques	COLTRIMS	
Source properties		
Energy range		
Pulse duration		
bandwidth		
Device properties		
Maximum Temporal delay		
Pulse intensity ratio		
2 Colors		
Symmetric delay around t=0		
Spatial separation behind sample		
Add your suggestions	SMALL FOCUS (< 1 μ m ²)	

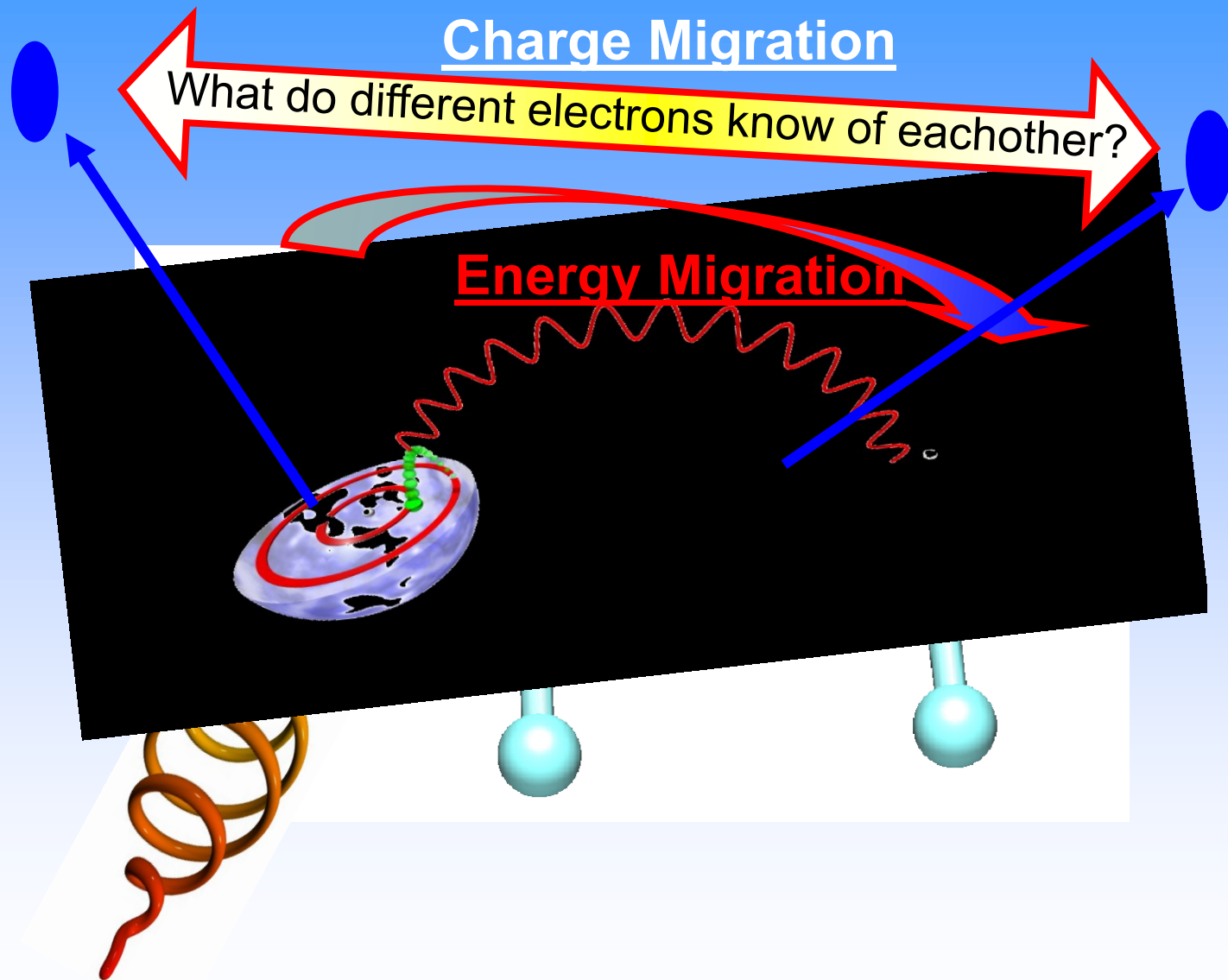
Molecular movie



achiral \rightarrow excitation (pump) \rightarrow chiral
XFEL (probe)

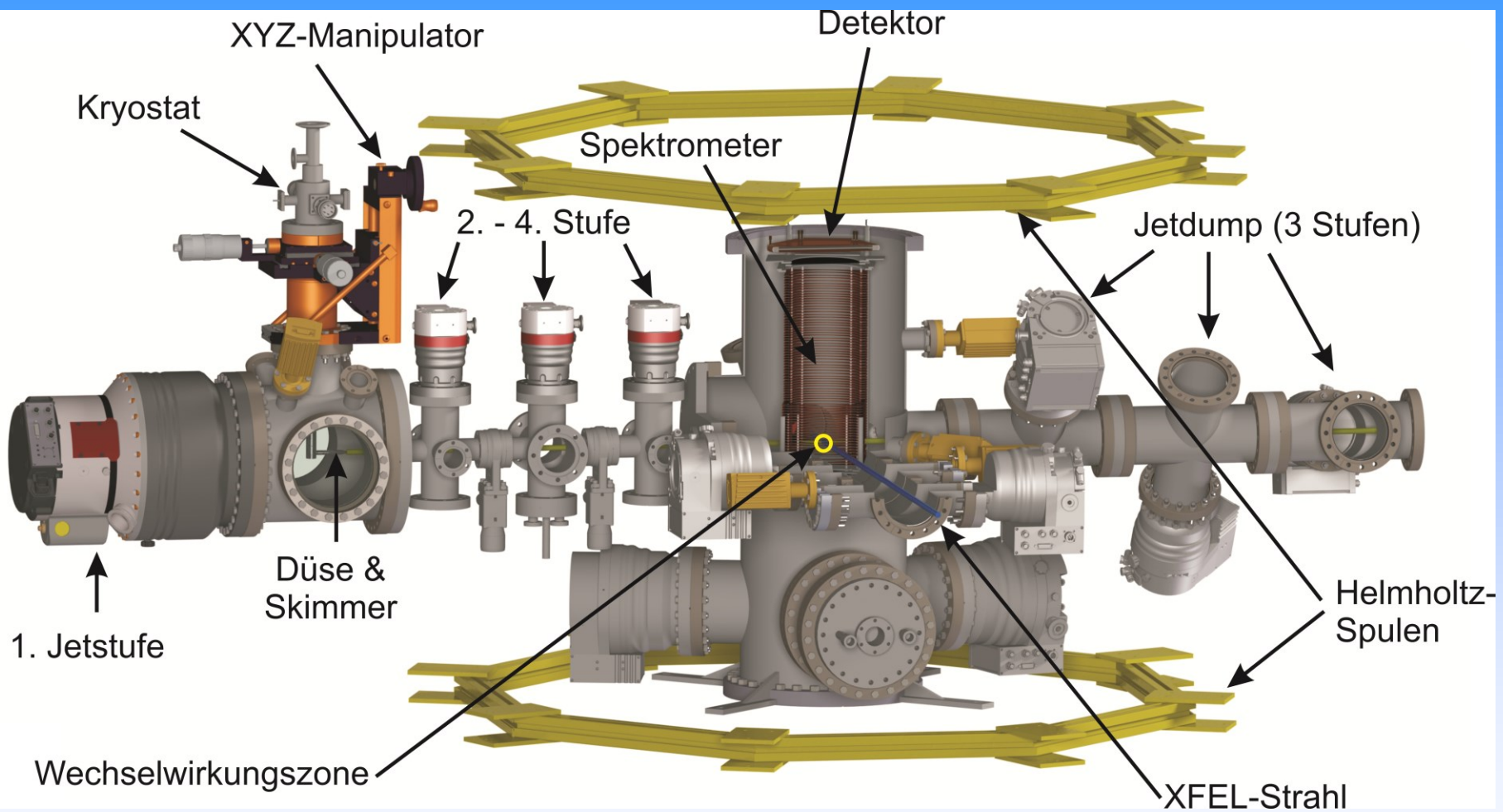
Parameters Wish List

	Day 0	Nice to have
Experimental techniques	COLTRIMS	
Source properties		
Energy range	250-350	
Pulse duration	100 fs	
bandwidth		
Device properties		
Maximum Temporal delay	>50 ps	
Pulse intensity ratio		
2 Colors		
Symmetric delay around t=0		
Spatial separation behind sample		
Add your suggestions	SMALL FOCUS (< 1 μ m ²)	



Parameters Wish List

	Day 0	Nice to have
Experimental techniques	COLTRIMS	
Source properties		
Energy range	250-500	200-3000
Pulse duration	<2 fs	
bandwidth	narrow <0.5 eV	band width limited
Device properties		
Maximum Temporal delay	250 fs	>50 ps
Pulse intensity ratio	Variable (1:1 – 10:1)	
2 Colors	yes > 1 %	few 100 eV
Symmetric delay around t=0	50 fs (auto correlation)	
Spatial separation behind sample	-	
Add your suggestions	SMALL FOCUS (< 1 μ m ²) good overlap	



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Sergey Semenov

Sendai:

Kiyoshi Ueda

Parameters Wish List (summary)

	Day 0	Nice to have
Experimental techniques	COLTRIMS	
Source properties		
Energy range	250-500 (C, N, O k-edge)	200-3000
Pulse duration	<2 fs	as short as possible
bandwidth	narrow <0.5 eV	band width limited
Device properties		
Maximum Temporal delay	>50 ps	
Pulse intensity ratio	Variable (1:1 – 10:1)	
2 Colors	yes > 1 %	few 100 eV
Symmetric delay around t=0	50 fs (auto correlation)	
Spatial separation behind sample	-	
Add your suggestions	SMALL FOCUS (< 1 μ m ²) good overlap	