**Presentation Outline**

* Forschungsfeld
  + WDM: keep slide as is, but without experimental setup
  + HIHEX scheme:
    - Introduce as novel way to probe WDM
    - Three main aspects: Way to generate WDM samples homogeneously, intense and fast x-ray source, robust diagnostic technique 🡪 heavy-ion beam, laser plasma source, XAFS
    - Show experimental setup
  + XAFS
    - Just say caused by quantum mechanical scattering
    - Show the graph where the graphic currently is
    - Go through graph like before
  + Experimental scheme
    - Show general HIHEX scheme as before, then insert names of laser, ion beam, backlighter materials and aluminum sample
    - Generalized goal: design and test a spectrometer for absorption spectroscopy of aluminum
* Spectrometer Design
  + Fundamentals of x-ray spectrometers
    - Outline difficulties in spectrometer design 🡪 basic design with crystal
    - Two main parameters: spectral resolution and signal-to-noise ratio
    - Main decisions for design: crystal choice and geometry
    - Leads to needing to design specialized spectrometer
      * Problem: lots of options
      * Solution: test two opposing design philosophies
    - Thesis goal: design, build, and test a flat-crystal and bent-crystal design, with end goal of informing a design for next experiment
  + Flat crystal spectrometer
    - DUCC
  + Bent crystal spectrometer
    - FSSR
  + Comparison slide
    - Simplify to get main idea of design philosophies
  + Mechanical Realization for each spectrometer
    - Inventor pics to real pic
* Experiment
  + Show experimental setup of spectrometers
    - Note that there is SUCC and OSUCC
    - Goal: find most effective spectrometers + backlighter combination to produce absorption spectra
      * Fundamentally 2 choices of backlighter (show example spectrum of each)
        + Rare-earth: intense but structure-heavy
        + Teflon: lower intensity but smooth spectrum
  + Results to consider (maybe switch order there)
    - Qualitative: Absorption spectra
      * Want smooth spectra with few features from setup
      * DUCC can produce alone bc of dual channel, rest need a combination of spectrometers
    - Quantitative: spectral resolution
      * Spectral resolution influenced by rocking curve width (essentially how far from a given bragg angle that still reflects rays), as well as geometry
      * Show pic of rocking curve width
* Results and discussion
  + Data processing
    - Show the diagram, name AXAWOTLS
  + Quantitative
    - show example of graph to show processing method. Only show gauss fits
    - Results in a table with energy range, requirements, simulated values
    - DUCC and FSSR worse resolutions than expected, traced back to crystal quality
    - SUCC and FSSR good enough resolutions for EXAFS, DUCC resolution not good enough
  + Qualitative
    - Processing method beginning with normal spectra
    - Show each relevant combination in text box, then iterate through, giving a check or x for each with main reasons as bullet points
  + Summary of results
    - DUCC: double channel design produces good absorption spectra, but resolution insufficient for purpose
    - SUCC: produces excellent absorption spectra over wide energy range with sufficient resolution
    - FSSR: resolution is very high, but with the mica crystal cannot produce good absorption spectra
* Outlook
  + DUCC with ADP crystals has potential, but need to ensure better quality crystals
  + FSSR is a powerful geometry as shown by resolution and SNR, but is complicated and unsuitable to Al XAFS with current mica crystal. Potential for farther future applications with other crystals
  + Use DUCC dual channel layout with KAP crystals for next combined experiment
    - Plus: Perform EXAFS with components known to work, leveraging the identical measuring device of the dual channel
  + With this spectrometer, investigating Al WDM samples using the novel combination of heavy-ion beam heating, laser plasma backlighters, and XAFS is possible, opening new doors to WDM research at GSI and FAIR.