Coherent Diffraction Radiation experiment

Maximilian Micheler, Grahame Blair, Stewart Boogert, Pavel Karataev
John Adams Institute at Royal Holloway

David Howell
John Adams Institute at Oxford University

Nicolas Chritin, Roberto Corsini, Thibaut Lefevre, Patrick Lelong
CERN

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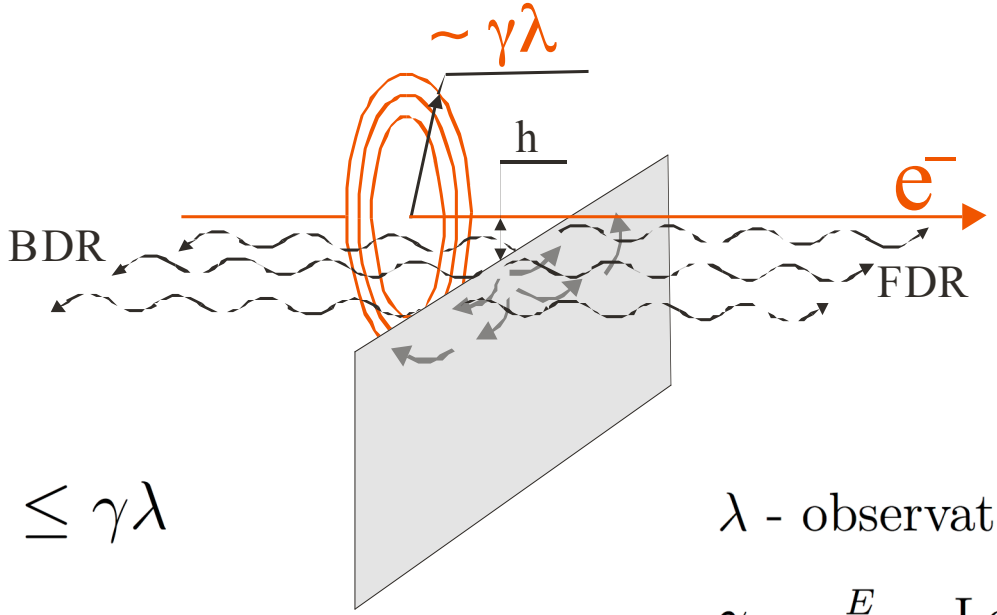
Diffraction Radiation

Basic Principle:

• Diffraction radiation (DR) appears when a charged particle moves in the vicinity of a medium

• Impact parameter, h, is the shortest distance between the target and the particle trajectory



$h \leq \gamma\lambda$

λ - observation wavelength

$\gamma = \frac{E}{mc^2}$ - Lorentz factor

Experimental Plan

Phase 1 (October 2008):

- Observation of CSR signal
- Check hardware performance
- Check the signal level
- Study CSR characteristics
- Observe CDR signal as a function of target position and orientation angle

Phase 2 (March 2009):

- Interferometric measurements of CDR and CSR spectra

Later:

- Inserting 2nd target
- Consider putting interferometer in vacuum
- Single shot spectral measurements using grating type spectrometer

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Hardware Components

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Components needed to perform experiment in Phase 1:

- Vacuum hardware ✓
  - two 6-way crosses
  - two Kodial viewports for alignment
  - fused silica quartz viewports (for start)
  - 4D vacuum manipulator
  - Diamond UHV window
- Target (aluminized silicon wafer) ✓
- Motion controller plus motors ✓
- Periscope (posts, Al mirrors, mirror mounts) ✓
- Schottky Barrier Diode (SBD) detector (3.33 - 5 mm) ✓
- cPCI board with digitizer module ✗
  → Not here yet
- Data Acquisition PC ✓
- Support for the vacuum system ✗
  → Designed and ready to manufacture
- Target holder ✗
  → Ready soon
- Detector holder ✓
- Control cables for the manipulator motors ✗
  → Discussed with Patrick Lelong
- Alignment laser → from CERN ✓
- Optical table → from CERN ✓
- RF cable for the signal ✗
  → Discussed with Thibaut Lefevre
- clock/trigger signal ✓

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Hardware Components

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Additional components needed to perform experiment in Phase 2:

- Interferometer components
  - Al mirrors ✓
  - mirror holders ✓
  - claming forks etc. ✓
- Motorized stage for the optical delay control in the interferometer ✓
- Control cable for the stage ✗
  → will be taken care of at a later stage
- Microwave splitter ✗
  → Mylar splitter is considered

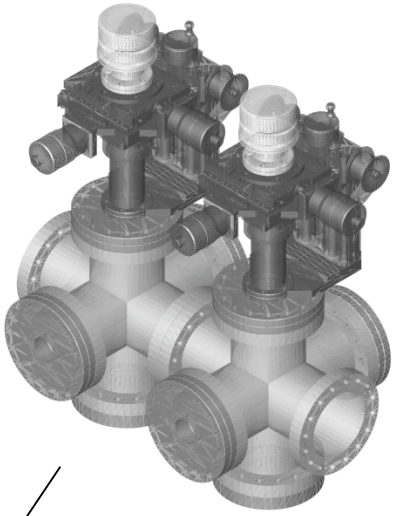
Further options and upgrades:

- a spare 6-way cross is available
- 6 more SBD detectors are ordered. All 7 detectors will cover the entire wavelength range from 0.6 - 11.3 mm

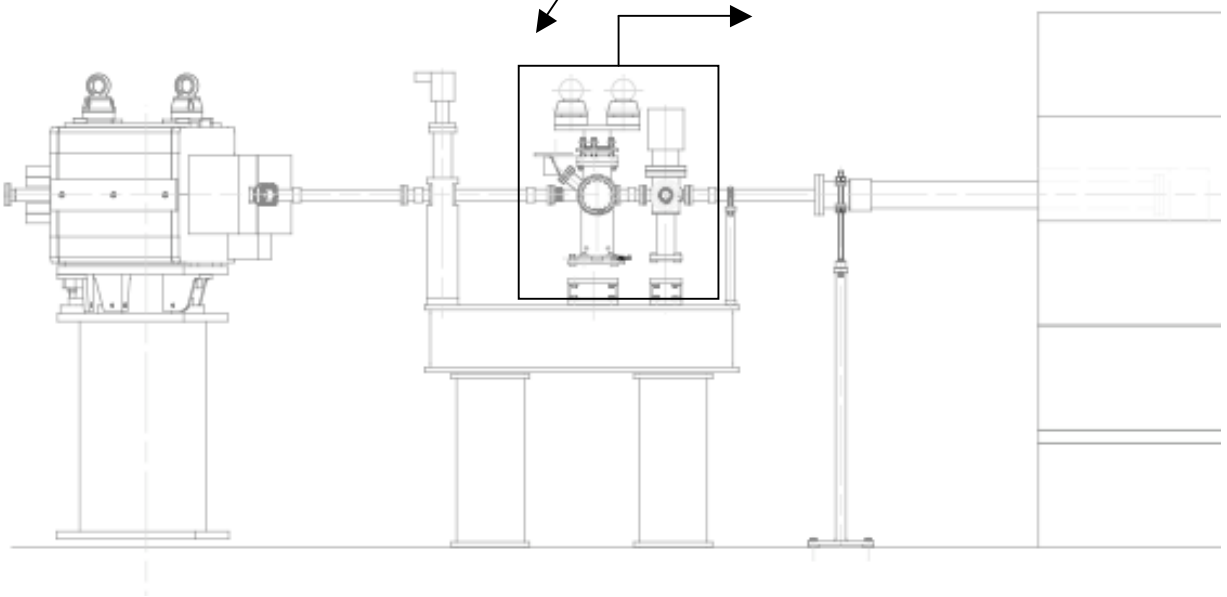
Location of CDR monitor

CDR monitor to be installed at the CRM line:

- MTV screen and ion pump pushed towards the end of the girder
- Elongation of girder present in the CRM line but not shown on the drawing→ enough space for CDR
- CDR monitor inserted just behind the valve to combiner ring
- Do not have to dismantle the dump
- Beam monitoring after CDR



We will only have one manipulator in the beginning!!!



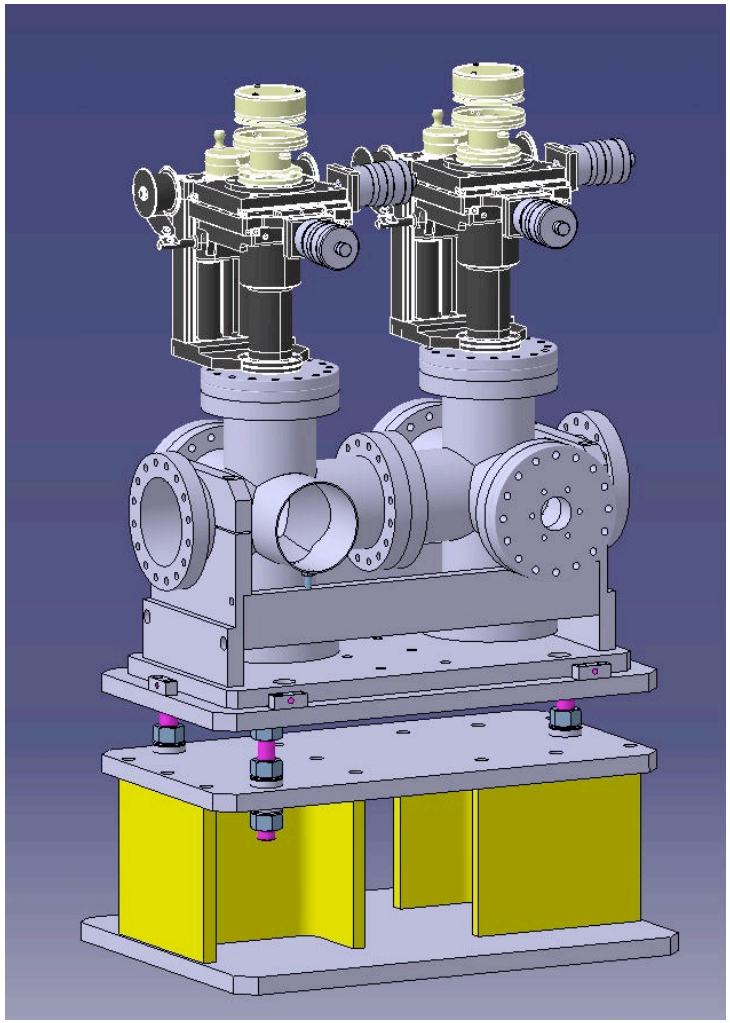
Support & Cabling

Support for CDR setup:

- Nicolas Chritin designed a support
- As soon as components are shipped from UK and support is ready, we can:
  - assemble system
  - perform vacuum test
  - perform mechanical calibration

Cabling for CDR:

- Discussion with Patrick Lelong
- Agreed on the cables
- Pulled in during the June shut-down



We will only have one manipulator in the beginning!!!

Summary

- All crucial components needed to install the setup at CTF3 are either ready or have been designed and are ready for manufacturing:
  - Vacuum hardware
  - Manipulator
  - Support
- Shipping components to CERN next week (commencing 23 June 2008)
- Able to perform initial test and calibration
- Ready to perform experiments of Phase 1 (CSR studies, hardware check etc.)

→ On schedule for installation in October 2008!!!