

LHeC Collaboration

Main Study areas for the LHeC that need to be addressed

Ring-Ring option:

1.1) Lattice design for a ring-ring option: CERN contact: **Oliver Brüning**
(well advanced and taken care off by BE-ABP group except for 1 degree IR)

Work packages:

- i. Lattice design of the main arcs including specifications for the required vacuum chamber dimensions -> **John Jowett** (CERN)
- ii. Synchrotron radiation calculations and Layout design of the bypasses -> **Helmut Burkhardt** (CERN)
- iii. LHeC IR optics design -> **Bernhard Holzer** (DESY)

1.2) RF design for the ring-ring option: CERN contact: **Trevor Linnecar**
(will be taken care off by RF group at CERN)

Work packages:

- i. RF design (total length, required cavities and RF power)
- ii. Space estimate for the alcoves / bypasses for cavities and klystrons

1.3) Injector complex design: CERN contact: **Helmut Burkhardt**
(Recirculating SPL is an interesting option that needs to be studied) SLAC?

Work packages:

- i. Electron and positron source design
- ii. Injector ring design

1.4) Injection areas and beam dump aspects: CERN contact: **Brennan Goddard**
(will be taken care off by BT group at CERN)

Work packages:

- i. Interaction region design for a ring-ring option
- ii. Transfer line design
- iii. Beam dump line and beam dump design

1.5) Beam-Beam effects CERN contact: **Werner Herr**
(Taken care off by collaboration with EPFL)

Work packages:

- i. Head-on beam-beam limit
- ii. Long range beam-beam effects and required crossing angle
- iii. Multi bunch beam-beam effects
- iv. Coupling between p-p and p-e collisions

1.6) Impedance: CERN contact: **Frank Zimmermann**
(we need help here: potential package for SLAC?)

Work packages:

- i. Resistive wall instability threshold and specification of acceptable surface resistivity
- ii. TMCI instability threshold estimation
- iii. Mutli-bunch instability estimates
- iv. Electron cloud estimates (positron-proton collisions)
- v. Fast ion instability estimates
- vi. Specification of required feedback systems

1.7) Vacuum aspects

CERN contact: **Migule Jimenez**
(will be taken care off by VAC group at CERN)

Work packages:

- i. Specification of vacuum requirements
- ii. Layout vacuum design
- iii. Vacuum Engineering: can be a work package (bellows, plug in modules, magnet chambers...)
- iv. Vacuum studies
- v. Vacuum Intrumentation & Interlocks

1.8) Integration and machine protection issues

CERN contact: **K-H. Mess**
(taken care off by K-H. Mess at CERN)

Work packages:

- i. Space requirements in the arcs outside the cleaning areas
- ii. Space requirements in the cleaning areas
- iii. Space requirements in the injection and ejection areas
- iv. Space requirements for the power converters and other electronics
- v. How to bypass the pp experiments
- vi. Impact of the synchrotron radiation on the electronics in the tunnel
- vii. Compatibility with the proton beam loss system
- viii. Space requirements for the electron dump
- ix. Protection of the p-machine against heavy electron losses
- x. How to combine the Machine Protection of both rings?

1.9) Magnet issues

CERN contact: **D. Tommasini**
(taken care off by Novosibirsk collaboration)

Work packages:

- i. Magnet coil design (main dipole and quadrupole and corrector magnets)
- ii. Magnet infrastructure specification (cooling, ventilation etc...)
- iii. Specification of space and support requirements

1.10) Powering issues

CERN contact: **F. Bordry**
(will be taken care off by PO group at CERN)

Work packages:

- i. Specification of space and infrastructure requirements

Ring-Linac option:

2.0) Baseline Parameters

CERN contact: **Hans Braun**

(Hans left CERN and help will be provided by Georg Hoffstaedter)

Work packages:

- i. rf gradient, cooling power, rf power, dc vs pulsed operation
- ii. scenarios: ILC based, CLIC based, ep only mode with superbunch
- iii. overall cost optimization, rough total length
- iv. desired range: luminosity, polarization, e⁺, energy?
- v. optimization of IP and beam parameters (beta* for e^{+/-} & p, Nb)
- vi. space estimate for the linac tunnel
- vii. proton beam parameters → **Frank Zimmermann**
- viii. energy recovery options and implications for the installation
→ **Frank Zimmermann**

2.1) RF design:

CERN contact: **Hans Braun**

(Hans left CERN and we need help here: potential package for SLAC?)

Work packages:

- i. RF design for the linac (total length, required cavities, power etc.)

2.2) Spent-beam line and beam dump:

CERN contact: **Brennan Goddard**

(will be taken care off by BT group at CERN)

Work packages:

- i. e- beam dump design for a ring-linac option

2.3) Linac source:

CERN contact: **Louis Rinolfi**

(we need help here: potential package for SLAC?)

Work packages:

- i. Polarized electron source design
 1. DC gun with preparation chamber for photo-cathode
 2. Laser system
 3. Pre-injector Linac for e⁻ (~ 5 MeV)
- ii. Unpolarized positron source design
 1. Thermionic gun
 2. Primary Linac (2 - 5 GeV range)
 3. Target with AMD
 4. Pre-injector Linac for e⁺ (~ 200 MeV)
- iii. Polarized positron source design
 1. RF gun
 2. Laser system
 3. Linac (1.3 - 1.8 GeV range)
 4. Compton ring
 5. Stacking cavity
 6. Target with AMD
 7. Pre-injector Linac for e⁺ (~ 200 MeV)

2.4) Linac Lattice and Impedance:

CERN contact: **Daniel Schulte**

(we need help here: potential package for SLAC?)

Work packages:

- i. Layout and lattice design for the linac
- ii. Wake field and alignment tolerances
- iii. Beam breakup and emittance preservation

Ion effects, fast ion and e- cloud instabilities, vacuum tolerance

2.5) Beam-Beam effects

CERN contact: **Werner Herr**
(Taken care off by collaboration with EPFL)

Work packages:

- i. Head-on beam-beam limit
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- iii. Coupling between p-p and p-e collisions

2.6) Vacuum aspects

CERN contact: **Migule Jimenez**
(will be taken care off by VAC group at CERN)

Work packages:

- i. Specification of vacuum requirements
- ii. Layout vacuum design
- iii. Vacuum Engineering: can be a work package (bellows, plug in modules, magnet chambers...)
- iv. Vacuum studies
- v. Vacuum Instrumentation & Interlocks

2.7) Integration and machine protection issues

CERN contact: **K-H. Mess**
(taken care off by K-H. Mess at CERN)

Work packages:

- i. Space requirements in the electron injection and ejection areas
- ii. Space requirements for the power converters and other electronics
- iii. Space requirements for the electron dump
- iv. Space requirements for the electronics in the LINAC
- v. Impact of the synchrotron radiation on the electronics in both tunnels
- vi. Machine Protection System for the LINAC
- vii. Compatibility with the proton beam loss system
- viii. Protection of the p-machine against heavy electron losses

2.8) IR Layout for linac-ring scenarios

CERN contact: **D. Schulte**
(could use the IR layout of Ring-Ring option for 10 degree solution. 1 degree?)

Work packages:

- i. Magnet and detector layout, β^* , three-beam orbits & separation
- ii. IR optics, β^* , crab waist

2.9) Magnet issues

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(taken care of by Novosibirsk collaboration)

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- iii. Specification of space and support requirements

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- i. Specification of space and infrastructure requirements