Lepton Collider Break-out Session

J. Wenninger

Work units

Lepton collider

Functional machine design

- Beam dynamics and collective effects
- Collimation concepts
- Injection and extraction concepts and designs
- Interaction region and final focus design
- Booster ring conceptual design and integration
- Lattice design and single particle dynamics
- Polarization and energy calibration
- Machine detector interface
- Machine protection concepts
- Radiation effects

J. Wenninger

Technical systems

- Beam diagnostics requirements and conceptual design
- Beam transfer elements requirements and conceptual design
- Collimation systems and absorber requirements and conceptual design
- Dump and stopper requirements and conceptual design
- Element support and alignment requirements and conceptual design
- Machine detector integration
- Machine protection system requirements and conceptual design
- Normal magnet requirements and element conceptual design
- Power converter requirements and conceptual design
- Quench protection and stored energy management requirements and concepts
- RF system requirements and conceptual design
- Superconducting magnet and cryostat requirements and conceptual design
- Proximity cryogenics for RF and magnets
- Vacuum system requirements and conceptual design
- Shielding

M. Jimenez

⇔ hadron machine

Machine design

Functional machine design

Beam dynamics and collective effects	
Collimation concepts	
Injection and extraction concepts and designs	CERN BT group?
Interaction region and final focus design	R. Tomas
Booster ring conceptual design and integration	
Lattice design and single particle dynamics	B. Holzer
Polarization and energy calibration	
Machine detector interface	H. Burkhardt, M. Boscolo
Machine protection concepts	
Radiation effects	FLUKA team

- Not all of the proposed Work Units currently have a 'responsible'.
  - *'Inherited' from TLEP study.*
- Various colleagues (in-/outside CERN) are (have been) contributing to the various subjects.

Injector

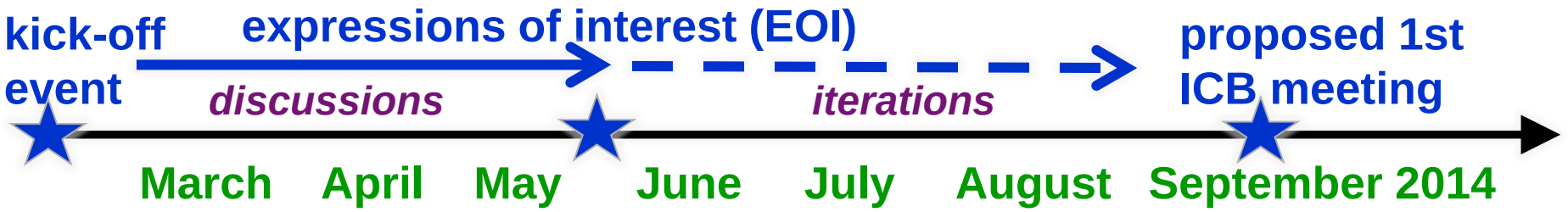
- **Lepton injectors**
  - **Overall design parameters**
    - Baseline layout
    - Baseline parameters
  - **Functional machine design**
    - LEP chain performance and gaps
    - LEP chain compatibility with hadron injectors
    - New injector chain baseline
  - **Technical systems**
    - Low energy beam transfer lines
    - LIL/EPA re-installation feasibility
    - Existing injectors to be decommissioned for lepton operation
    - Technologies that require R&D
    - SuperKEKB-type injector option
    - CTF3 option usability
    - Planned LHeC test facility usability
    - Electron and positron sources

It is all in the hands of Yannis Papaphilippou !

International collaboration process in 2014

Proposal for next steps:

- Suggestions and comments from international community and **discussion on study contents, organisation and resources**
- Invitation of non-committing **expressions of interest for contributions** from worldwide institutes **by end May 2014**
- Prepare for formation of **International Collaboration Board (ICB)**; proposed date first meeting **9-11 September 2014, to start FCC study**



Process can be moderated by preparation group (possibly extended – following EOI) until global collaboration is formed and an international team is put in place to conduct the further study

Process remains open, further joining possible …

- For expression of interest (EI) for collaboration, I suggest that you contact the WU responsible:
  - *Optics and IR : B. Holzer & R. Tomas*
  - *Machine-experiment interface: H. Burkardt, M. Boscolo*
  - *Polarization, beam dynamics, booster : J. Wenninger*
  - *Injector chain: Y. Papaphilippou*
- We will collect those EIs and forward them to M. Benedict et al.
- Based on the proposals, we will also propose names for WU holders to fill the empty slots.

Optics / Lattice

- A lot of activity is currently taking place on the optics (arc and IR) around B. Holzer and R. Tomas.
  - *Provide the required emittances,*
  - *Design a very low β^* IR with large energy acceptance,*
  - *IR layout (crossing…).*
- We have to converge towards a first baseline machine model to serve as input to all the other work:
  - *Realistic V emittances (errors !),*
  - *Polarization,.*
  - *Machine detector interface,*
  - *Synchrotron radiation issues,*
  - *Beam-beam studies.*

Parameter table (1)

	LEP1	LEP2	Z	W	H	tt
Circumference [km]	26.7		100			
Bending radius [km]	3.1		11			
Beam energy [GeV]	45.4	104	45.5	80	120	175
Beam current [mA]	2.6	3.04	1450	152	30	6.6
Bunches / beam	12	4	16700	4490	1360	98
Bunch population [10^{11}]	1.8	4.2	1.8	0.7	0.46	1.4
Transverse emittance e						
- **Horizontal [nm]**	20	22	29.2	3.3	0.94	2
- **Vertical [pm]**	400	250	60	7	1.9	2
Momentum comp. [10^{-5}]	18.6	14	18	2	0.5	0.5
Betatron function at IP b*						
- **Horizontal [m]**	2	1.2	0.5	0.5	0.5	1
- **Vertical [mm]**	50	50	1	1	1	1
Beam size at IP s* [mm]						
- **Horizontal**	224	182	121	26	22	45
- **Vertical**	4.5	3.2	0.25	0.13	0.044	0.045
Energy spread [%]						
- **Synchrotron radiation**	0.07	0.16	0.04	0.07	0.10	0.14
- **Total (including BS)**	0.07	0.16	0.06	0.09	0.14	0.19
Bunch length [mm]						
- **Synchrotron radiation**	8.6	11.5	1.64	1.01	0.81	1.16
- **Total**	8.6	11.5	2.56	1.49	1.17	1.49

Parameter table (2)

	LEP1	LEP2	Z	W	H	tt
Energy loss / turn [GeV]	0.12	3.34	0.03	0.33	1.67	7.55
SR power / beam [MW]	0.3	11		50		
Total RF voltage [GV]	0.24	3.5	2.5	4	5.5	11
RF frequency [MHz]	352			800		
Longitudinal damping time t_E [turns]	371	31	1320	243	72	23
Energy acceptance RF [%]	1.7	0.8	2.7	7.2	11.2	7.1
Synchrotron tune Q_s	0.065	0.083	0.65	0.21	0.096	0.10
Polarization time t_p [min]	252	4	11200	672	89	13
Hourglass factor H	1	1	0.64	0.77	0.83	0.78
Luminosity/IP [10^{34} $cm^{-2}s^{-1}$]	0.002	0.012	28.0	12.0	6.0	1.8
Beam-beam parameter - **Horizontal** - **Vertical**	 0.044 0.044	 0.040 0.060	 0.031 0.030	 0.060 0.059	 0.093 0.093	 0.092 0.092
Luminosity lifetime [min][(2)]	1250	310	213	52	21	15
Beamstrahlung critical	No		No	No	Yes	Yes