Minutes of the 19th "ILC-CLIC e+ studies" meeting

Date: February 17th, 17:00(JST) 9:00(CET), 2011

A part of Attendees (whom Omori was able to hear the voices):
Louis(CERN), Vivoli(CERN), Chehab(LAL), Chenghai(IHEP/LAL),
Eugene(NSC-KIPT), Peter(NSC-KIPT), Sabine(DESY),
Andriy(DESY), Norbert(CI), Fabian(LAL), Pei(IHEP),
Takahashi(Hiroshima), Kamitani(KEK), Suwada(KEK),
Yokoya(KEK), Urakawa(KEK), and Omori(KEK)

Agenda:

1. Superconducting e+ Stacking Ring for CLIC : Peter-san
2. POSIPOL2011 preparation : Pei-san
3. Report of Baseline Assessment Workshop 2 : Omori

Presentations:

http://www-jlc.kek.jp/~omori/ILC-CLIC-e+Studies/20110217/
20110217_Peter_SupCondSR.pdf

http://www-jlc.kek.jp/~omori/ILC-CLIC-e+Studies/20110217/
20110217_Omori_BAW2report.pdf

Post meeting material:
http://www-jlc.kek.jp/~omori/ILC-CLIC-e+Studies/20110217/
20110217_Tables1-3_v2.pdf

1. Superconducting e+ Stacking Ring for CLIC:

   Peter-san presented the study of the superconducting e+ stacking ring for CLIC.

   Please look at "20110217_Peter_SupCondSR.pdf".

   The overall system consists of the Compton ring (CR), the superconducting stacking ring (SR), the time diagram transformer ring (TDT), the pre-damping ring (preDR) and the damping ring (DR).

   The 5 GeV superconducting stacking ring (SR) is a key of the proposed positron source. The damping time of SR is very short, 100 micro seconds.

   Since the energy of SR is 5 GeV, the energies of preDR and DR are assumed to be 5 GeV.

About 20 bunches are stacked in the same bucket in SR. The simulation showed that stacking efficiency was good, it was larger than 90%. After the stacking, damping was done in SR.

Large pawer of the synchrotron radiation in SR is the problem. However, Peter-san present the operating mode which was able to maintain the pawer of the synchrotron radiation at 300 kW. It is still large, but not so crazy.

After the damping in SR, the beam is sent to the TDT ring. In the TDT ring, 3 bunches are stacked in the the same bucket in the transverse phase space. It makes the emittance larger, probably by factor 10. After the stacking, the beam is immediately extracted from the TDT to the preDR. There is no damping in TDT.

Discussions:

Louis-san's:
5 GeV is rather high, it my prevent from making small emittance in (pre)RD.

Peter-san's answer:
Maybe we can lower the energy 3.5 GeV.

Frank-san's comment:
We can decelerate after stacking.

Post meeting Information:
After the meeting, there were some discussions via e-mails. Omori made the tables to summarize the parameters of the Peter-san's scheme.
Please look at "20110217_Tables1-3_v2.pdf".

2. POSIPOL2011 preparation:

Pei-san reported the preparation status of POSIPOL 2011.

The Web-page is ready and opened.
http://posipol2011.ihep.ac.cn/

There is a link from the calender-page of the ILC Web-site.
http://www.linearcollider.org/Calendar

The next step will be to make an agenda (program).
The two points are under discussion.

(i) Pol. e- source session:

The session of pol. e- source is mentioned in the scope statement in the Web-page.
Is it OK? Isn't the scope too wide?

* Louis-san's comment on the above question:
  Since the beginning of the POSIPOL workshop series beginning at 2006 at CERN, there was an e- session. It is OK to include pol. e- source.

- consensus in the meeting:
  It is OK to include pol. e- source.

(ii) Summary talk of each session (each group):

In the program which is now under preparation, summary talk of each session is scheduled in the last day. Do we need summary talk of each session?

* Omori's comment:
  We don't need summary talk of each session. This is a small workshop, all sessions are plenary. There will be no parallel sessions. So, summary talk of each session is not necessary. It is good that we have only the summary of the whole workshop at the last day.

* Louis-san's comment:
  It is a small workshop, we don't need summary talk of each session. Instead, we need to have enough long discussion time for each subject. It is good that we have only the summary of the whole workshop at the last day.

- consensus in the meeting:
  Summary talk of each session (each group) is NOT necessary.

3. Report of Baseline Assessment Workshop 2:

Omori made a report of the Baseline Assessment Workshop 2 (BAW2).

Please look at "20110217_Omori_BAW2report.pdf".

BAW2 was held at SLAC on January 18-21, 2011.

The sbuject of the workshop were;

* 'Reduced Beam Parameter set' (Day 1 - Day 2)
* 'Positron Source Location' (Day 3 - Day 4)

Omori reported mainly about 'Positron Source Location' (Day 3 - Day 4), but his report included a part of physics talks (afternoon of Day) and the proposal of new lowP parameter by Gao-san (the end of Day 4).

The GDE activities after RDR, Minimum Machine, Accelerator Design&Integration, SB2009, and BAWs, were mainly motivated by a cost reduction (containment).

(a) What is "Positron Source Location" ?:
(Positron Source Relocation)

(i) Move Undulator location from "middle of e- linac (E=150 GeV)" to "end of e- linac".

Eliminate double tunnel for undulator.
--> Cost down

(ii) In low energy operation (Ecm < 300 GeV), the e- beam energy running through undulator is too low.
--> too low Luminosity

Recovery by 10 Hz (5+5 alternative*) operation.
(10 Hz is for only low energy operation --> expect small cost increase)

(*)collision@5Hz

e- 150 GeV@5Hz + (e- 125 GeV x e+ 125 GeV)@5Hz
e- 150 GeV@5Hz + (e- 100 GeV x e+ 100 GeV)@5Hz

(b) Reports from each subsystem in BAW2:

(i) Main linac RF (ML):
Both KCS and DRFS have no essential difficulty.

(ii) Damping ring (DR):
In order to realize "10 Hz alternative operation in low energies", DRs (both e- DR and e+ DR) are required to reduce the damping time by factor two. There is no significant difficulty to reduce the damping time. But reducing the damping time make cost increase.
The "10 Hz" also requires 50%-duty-operation to DR. In order to overcome instability caused large change of the current in DR,

DR needs additional RF system. This makes cost increase.
It seemed that there were no fatal difficulty.

(iii) e+ source:
The undulator relocation gives big effects to other systems (especially main linac and DR), however it gives only small effect to undulator and e+ generation.
Therefore, Omori summarized only topics of hardware R/Ds from Wei-san's and Clarke-san's presentations. Omori skiped e+ source topics which were related to relocation.

* Rotating vacuum seal:
  LLNL was preparing the vacuum seal test. Since the high speed rotating vacuum seal is a big challenge in the ILC baseline (undulator) positron source, this test is very important.
* Undulator horizontal test:
  The test was successfully done in UK. It was good news.

(iv) e- source:
No significunt difficulty.

(v) Beam Dynamics of ML and undulator:
Kubo-san reported the results of the beam dynamics study of the "10 Hz" operation of ML and undulator.

* The main Linac will be tuned for the low energy (colliding) beam.
* Most magnets are DC. Only RF will be changed.
* Can high energy beam (for e+ production) go through the linac tuned for the low energy beam? An orbit and an emittance are the issues.
* Need orbit corrections for both the high the and low energy beams -> alternately changing magnets.
* In undulators, the orbit of the high energy beam should be good. The emittance of low energy beam should be preserved. Can be satisfied both?
* If not, low energy beam bypass undulator?
* High energy beam may cause problems at around IP? Bypass IP (go to e+ dump)?.
* Kubo-san presented the four options.
  - Pulse-by-pulse switching magnets (How Many?). No additional lines.
  - Bypass undulator.

- Dump High E beam.
- Both.

(vi) Cost impact of positron source relocation:
* Approx. Cost of 10Hz Alt. +0.6 %
* Approx. Cost of moving source -0.6 %
* Net cost impact ±0.0%

(c) Physics:
There were 6 physics talks in Day 2.
Omori introduce only one, Sabine-san's talk, which was related to e+ source.
* Sabine-san submitted a question.
  - Is P(e+) indispensable for a future linear collider?
* Sabine-san's summary.
  - Positron polarization:
    • Increases significantly the physics goal.
    • will be available from the beginning with the helical undulator as the baseline.
    • Undulator at the end of the ML some measures needed to take full advantage of e+ polarization
  - Under work:
    • Scenarios with polarization and consequences for physics precision
    • Spin tracking from start to end for updated design.
    • Depolarization effects at IP.
    • Demonstrate target (and photon collimator) reliability.
* What was important in Omori's point of view:
  - Sabine-san didn't conclude that pol e+ was indispensable.

(d) Other (Proposal of the new low_Q parameter)
This proposal was NOT related to "undulator relocation". Gao-san made the proposal of the new low_Q parameters.
* Main changes from the original SB2009 to the new low_Q parameters:
  - bunch charge: 2e10 -> 1e10.
  - bunch number: 1320 -> 2625.
  - bunch length: 300 um -> 166 um.
* Advantages of this parameter set
  - keep the same low beam power and low AC power as SB2009
  - lower risk for source (especially for e+)
  - easier emittance preservation in RTML and ML
  - much smaller beam beam effects (low machine background)
  - two-stage BC gives more flexibility to the whole machine

Omori's comment:
Gao-san only mentioned about reduction of machine background as a positive effect to physics studies. However, there is another good effect to physics studies. It is increase of "Peak 1 % Luminosity" (60% -> 75%). It makes smaller physics background.

(e) Summary:

(i) Cost decrease of "undulator relocation" and cost increase of "10 Hz" cancels each other. There is NO net cost reduction.

(ii) Nevertheless PMs proposed undulator relocation. Omori thought that PMs believed followings were good reasons;
* large energy overhead to drive the source.
* all high radiation sources now contained in 'central region' campus area.

(iii) The proposal of the new parameters by Gao-san was interesting.

The date of the next phone meeting will be on March/17th(Thu) 2011; 9:00(CET)/17:00(JST).

Reported by T. OMORI