Minutes of the 8th Euro-Japan Compton capture&stacking meeting

Date: April 1st 17:00(JST) 10:00 (CET), 2008

A part of Attendees (whom Omori was able to hear the voices):
Vivoli(LAL), Variola(LAL), Chehab(LAL), Eugene(NSC-KIPT),
Louis(CERN), Frank(CERN), Kamitani(KEK), Urakawa(KEK),
and Omori(KEK)

Agenda:
1. Discussion, Towards Upcoming Meetings
2. Consistency Check (1.8 GeV ERL scheme) : Omori
3. Capture simulation update : Vivoli-san
4. Stacking simulation update : Frank-san
5. Discussion: flexibility in the choice of DR parameters
6. Rod-like target & optimal target thickness. : Eugene-san
7. General Discussions

Presentations and materials:

Upcoming Meetings:
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080401/
20080401-Discussion_UpcomingMeetings.pdf

T. Omori: Consistency Check (1.8 GeV ERL scheme)
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080401/
20080401_Omori_ConsistencyCheck.pdf

A. Vivoli: Capture Simulation Update
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080401/
20080401-Vivoli_Table.pdf

F. Zimmermann: Staking Simulation Update
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080401/
20080401-Frank_StackingSimulations.pdf

E. Bulyak, Rod-like target & optimal target thickness:
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080401/
20080401-Eugene_CT-pres.pdf

Summary of the discussions:

1. Towards Upcoming Meetings

   Please see "20080401-Discussion_UpcomingMeetings.pdf"

   (a) DESY Zeuthen ILC e+ meeting (7-9/Apr)

      Variola-san will attend the Zeuthen meeting on April 7th
      and present status of the R/D of ERL/Ring scheme.

Urakawa-san will attend the meeting too, but as the associate project manager.

(b) Nano-Beam WS at at BINP (24-29/May)

The Nano-Beam WS at at BINP will include advanced accelerator technonogies, such as beam handling by crystals, advanced positron generation methods, gamma-gamma colliders.

Urakawa-san, Takahashi-san, Kamitani-san and Omori will attend the WS.

Chehab-san considers possibility to attend the WS.

In this occasion we will have the meeting with BINP people to discuss positron generation R/Ds.
The date of the meeting will be afternoon of 24th and/or 25th.

(c) GDE meeting at Dubna (4-6/June)

Kuriki-san will attend the GDE meeting.
Positron source will be discussed in the meeting in the view point of the cost reduction.

2. Consistency Check (1.8 GeV ERL scheme)

Please see "20080401_Omori_ConsistencyCheck.pdf"

Omori presented the results of the consistency check of the 1.8 GeV ERL scheme.

The current simulation was performed in three steps, and each step was performed by different person.

Step 1: Gamma generation by Omori
Step 2: e+ production and capture by Vivoli-san,
Step 3: e+ stacking in the DR by Frank-san

Omori checked and confirmed the consistency between the three steps.

However the current parameter had three difficulties in ERL.

(i) large bunch charge : Nb/bunch = 1x10^{10} (1.6 nC)
(ii) large current : I = 1.6 nC x 80 MHz = 130 mA
(iii) intermittent operation : 10 msec wait for DR damping

We discussed possible cures.

(a) inject every 20th turn and no waiting
In the current parameter, a bunch is injected into DR every second turn and ERL bunch repetition was 80 MHz.
If we employ "every 20th turn", we can use 8 MHz repetition

of ERL bunch repetition. This reduces (ii) to 13 mA and avoids (iii), but no change in (i). The 8 MHz repetition make laser stacking cavity very long and difficult. Anyway we need stacking simulation with this condition.

(b) use storage ring instead of ERL
Storage rings have advantage in handling large bunch charge, but have disadvantage in achieving short bunch length. Crab crossing or ultra small momentum compaction may cure the issue of bunch length.

(c) pre-DR
A pre-DR may be effective. But usually the circumference of a pre-DR is much smaller than DR. This requires intermittent injection to DR. Therefore a pre-DR is suitable for storage ring scheme, but not suitable for ERL scheme.

(d) two laser beams in one collision point
Variola-san pointed out that we can put two laser beams in one collision point. This makes number of gamma-ray per bunch double, so number of stacking half.

(e) inject as continuous as possible with no waiting
Frank-san pointed out the possibility of continuous injection. In order to achieve continuous injection, we need very small energy spread of the positron bunch. To achieve this, we cut tail and head of a energy distribution of a positron bunch when it's energy is still small. This makes number of positrons in a bunch very small, but continuous injection may compensate it.

(f) try 1.6 nC and 130 mA
Both 1.6 nC and 130 mA are very hard challenge. But Variola-san pointed out that those were not impossible goal. Actually those values are goals of some ERL R/D projects which are already funded.

3. Capture simulation update

Please see "20080401-Vivoli_Table.pdf"

So far Vivoli-san's old simulation was up to 182 MeV.
Vivoli-san was trying to extend simulation up to 5 GeV.
In the April 1st meeting, he showed new result up to 495 MeV.

The result (number of transported positrons up to 495 MeV) was bud. This bud result was caused by improper focus parameters. This will be fixed soon.
He will continue the simulation.

4. Stacking simulation update

Please see "20080401-Frank_StackingSimulations.pdf"

Frank-san studied that how the energy spread at injection

affects the stacking efficiency. He compared the stacking losses with two values of energy spread at injection. He compared results with rms energy spread of 0.04% and of 0.06%.

The stacking loss was 11 % (15 %) when energy spread was 0.04% (0.06%).

The result showed that the small energy spread at injection was very important.

5. Discussion: flexibility in the choice of DR parameters

In the current stacking simulation, Frank-san assumed that longitudinal damping time was 6.4 m sec. The value in RDR was 12.8 m sec.

Urakawa-san said that 6.4 m sec was possible when we increase number of wigglers in the current DR design. On the other hand he said that a damping time much shorter than 6.4 m sec seemed impossible in the current DR design.

Valiola-san pointed the possibility to put another (additional) ring in the same tunnel.

6. Rod-like target & optimal target thickness.

Please see "20080401-Eugene_CT-pres.pdf"

Eugene-san compared various target thickness and shape in view point of positron production.

The rod target showed the good result. However the rod target was not suitable when gamma spot size was large.

In order to cure this problem, Eugene-san proposed the sliced rod target.

He also analyzed the thermal lord of the target.

The date of the next meeting is 21st April, 17:00 JST (10:00 CET).

Reported by T. OMORI