

Minutes of the 14th Euro-Japan Compton capture&stacking meeting

Date: August 25th 17:00(JST) 10:00 (CET), 2008

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

Agenda:

1. Upcoming Meetings : Omori
2. Energy spread in Compton Rings (long vs short) : Eugene-san
3. Pre-DR proposal : Variola-san
4. Discussion on Pre-DR : Louis-san
5. General Discussions

Presentations:

Upcoming Meetings:

http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080825/20080825-Discussion_UpcomingMeetings.pdf

E. Bulyak,: Energy spread in Compton Rings (long vs short)
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080825/20080825-Eugene_Spr-pres.pdf

A. Variola: Pre-DR proposal
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080825/20080825-Variola_scheme_corrected.pdf

L. Rinolfi: Discussion on Variola-san's Pre-DR proposal
http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080825/20080825-Louis_scheme_reviewed_LR.pdf

Summary of the discussions:

1. Towards Upcoming Meetings:

- (a) Compton WS at Sardegna (Italia) (September 8th-12nd)
The topics of this meeting is all sort of Compton-based X-ray/pamma-ray/positron source.
Fabian-san, Variola-san, Urakawa-san, Yakinemko-san, and Omori will attend.
- (b) ILC Asia R/D Seminar at KyungPook (September 29-30th)
Urakawa-san, Kuriki-san, and Omori will attend
- (c) SPIN2008 (October 6th-11th)
Clarke-san will make a talk in the first day plenary session

- (d) CLIC workshop at CERN (October 14th-17th)
Louis-san, Frank-san, Variola-san, Chehab-san, and Urakawa-san will attend.
- (e) Channeling Meeting at Sicily (Italia) (End of October)
The topics of this meeting is all sort of positron source using the channeling effect.
Chehab-san will attend.

Please see "20080825-Discussion_UpcomingMeetings.pdf" for other meetings.

2. Energy spread in Compton Rings (long vs short):

Eugene-san reported the comparison of a short Compton ring and a long Compton ring in the view of the energy spread.

Please see "20080825-Eugene_Spr-pres.pdf".

He compared three Compton rings.

- (a) Long ring: 10-turn generation of gammas
(proposed by P.Gladkikh-san)
- (b) Short ring: 100-turn generation of gammas
- (c) CLIC ring: 2500-turn generation of gammas & low laser power

Eugene-san reported that the analytical method was effective to evaluate the CLIC ring in which a (semi) steady collision mode was adopted. However, the analytical method was not effective to evaluate the long and the short rings, in which a dynamic collision mode was adopted. So, he made the simulation of both the long and the short rings.

The simplified simulation showed that the long ring (after 10 turns) and the short ring (after 100 turns) had roughly same span of energy distribution.

Eugene-san also made a more realistic simulation of both the long and the short rings. The simulation treated several generation cycles. A single generation cycle of the long (short) ring correspond 10 (100) turns. The number of generated gamma-rays (yield) per cycle was 3 for the long ring and 23 for the short ring. The yield per one turn was 0.3 for the long ring and 0.23 for the short ring. Thus, the yield per one turn of the long ring was about 1.3 times larger than that of the short ring. In the long ring, the single cycle is much shorter than the synchrotron period. This gives the long ring larger number of yield per turn.

Eugene-san also discussed possibilities of better solutions.

- (i) Double chicane scheme reduces spread in a ring.
- (ii) 2 micron laser and 2 GeV ring.
- (iii) CLIC like semi-steady mode with lower power laser and pre-DR.

3. Pre-DR proposal:

Variola-san explained his proposal of the scheme with a pre-DR.

Please see "20080825-Variola_scheme_corrected.pdf".

Omori made a brief description of Variola-san's scheme. Please see the post meeting information attached at the bottom of this report.

Variola-san stressed that the proposed scheme was only for starting discussions. We have to consider every parameter carefully.

Eugene-san asked of an effect if we can increase a positron capture efficiency by factor 2 or even better. Variola-san answered that the basic of the scheme was unchanged. But, the better capture efficiency ease many parameters of the scheme. So, it helps to establish the scheme.

4. Discussion on Variola-san's Pre-DR proposal:

Louis-san made a very good review of the Variola-san's scheme.

Please see "20080825-Louis_scheme_reviewed_LR.pdf".

Then, Louis-san asked Variola-san three questions.

One of the questions was why Variola-san choose the three times larger $T_{b_to_b}$ in the CR than that in the pre-DR. Variola-san's answer was that;

- (i) pre-DR has a little cooling time because stacking in the same bucket happens every third turn, and
- (ii) we can keep CR not too long.

For other two questions, please see "20080825-Louis_scheme_reviewed_LR.pdf".

Eugene-san pointed that the same length (circumference) and the same $T_{b_to_b}$ for a CR and for a pre-DR is preferable. It ease the requirements to the CR. It is also good for cost reduction because the CR and the pre-DR can share a tunnel.

5. Discussions:

(a) Information from Variola-san:

France-CERN collaboration has been launched. A CLIC positron source is one of the subjects of the collaboration. LAL will employ a postdoc for this collaboration. The person will work at LAL, but will frequently go to CERN. The term is two years, but if the person will show a good

performance she/he will have a chance to be employed in a permanent position.

- (b) Information from Louis-san:
Cockcroft-CERN collaboration has been launched.
A undulator-based positron source for CLIC is a subject of the collaboration.

The date of the next meeting is 6th(Monday) October, 17:00 JST (10:00 CET).

Reported by T. OMORI

Post meeting information:

According to the questions and answers in the meeting, Omori made re-corrected version of the drawing for Variola-san.

Pre-DR proposal

http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20080825/scheme_corrected2.pdf
[scheme_corrected2.ppt](#)

Here is a brief description of the scheme written by Omori.

- (a) $T_{b,b}$ in the Compton ring (CR) is three times longer than $T_{b,b}$ in the pre-damping ring (pre-DR).
 $T_{b,b}$ in CR = 18.45 ns
 $T_{b,b}$ in pre DR = 6.15 ns
Therefore stacking in a same bucket in the pre-DR happens every third turn of the pre-DR.
- (b) A single generation cycle corresponds 226 turns of the CR. (This is a definition of the single generation cycle.)
The CR has 100 benches. So 22600 bunches are generated in a single generation cycle.
- (c) Circumference of the CR is 553m, therefore a single turn of the CR takes 1.84 micro sec. So, 226 turns of CR takes 416 micro sec.
- (d) On the other hand, the pre_DR has 564 bunches. Therefore, 40 bunches ($4000/564 = 40.07$) are stacked in a same bucket in the pre-DR.
- (e) Since stacking in a same bucket happens every third turn turns of the pre-DR, stacking 40 times needs 120 turns ($3 \times 40 = 120$).
- (f) Circumference of the pre-DR is 1040m, therefore a single turn of the CR takes 3.47 micro sec. So, 120 turns of pre-DR takes 416 micro sec. This time equals to the

time necessary for 226 turns of the CR (see (c)).

- (g) "time for a single generation cycle of the CR" =
"time for a single stacking cycle of the pre-DR"
(definition: single stacking cycle = 40 stacks in a
same bucket of the pre-DR)
- (h) Since the stacking in a same bucket happens every third
turn of the pre-DR, the time between stackings in the pre-DR
is about 10.4 micro sec ($3.47 \times 3 = 10.4$). This is about
 $1/200$ of the cooling time ($T_{cool} = 2$ ms) of the
pre-DR.
- (i) After a single generation cycle (about 416 micro sec),
we wait about 2.5 ms. This is necessary for a cooling
in the CR. This is also necessary for a damping in the
pre-DR.
- (j) After 2.5 m sec waiting, 564 bunches are sent from the
pre-DR to the main-DR. This is named a "shot" in your
drawing.
- (k) The process (b)-(j) repeats. So, every 2.5 m sec, a
shot (=564 bunches) is sent from the pre-DR to the
main-DR ($1/2.5\text{ms} = 400$ Hz).
- (l) We assume the main-DR has 2820 bunches. Five shots
($564 \times 5 = 2820$) from the pre-DR make 2820 bunches in
the main-DR. This takes 12.5 m sec (2.5 ms \times 5 = 12.5 ms)
- (m) Stacking in a same bucket in the main-DR happens every
5th shot. The time between stackings in the main-DR
is about 12.5 m sec
- (n) In 100 m sec, the main-DR receives 40 shots ($2.5\text{ms} \times 40 =$
100 ms) from the pre-DR. Therefore, 8 bunches ($40/5 = 8$)
from the pre-DR are stacked in a same bucket in the
main-DR in 100 m sec.
- (o) Finally, a single bunch in the main-DR produced by
320 stacks ("in the pre-DR" \times "in the main-DR" =
 $40 \times 8 = 320$).
- (p) The main-DR still has another 100 m sec for damping.
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