

Minutes of the 19th Euro-Japan Compton capture&stacking meeting

Date: December 12th 17:00(JST) 9:00 (CET), 2008

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

Agenda:

1. Report from the LAL meeting : Chehab-san
2. The e+ source tests at CERN and at KEK : Chehab-san
3. Submission to PAC (1) : Louis-san
4. Submission to PAC (2) : Frank-san
5. Submission to PAC (3) : Variola-san
6. Report of DESY visit : Urakawa-san
7. Gamma/electron and small-vs-large CRs : Omori
8. Discussion, extension of the meeting : Louis-san
9. General discussions

Presentations:

[http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/
20081212-Chehab_FJPPLSUM.pdf](http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/20081212-Chehab_FJPPLSUM.pdf)

[http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/
20081212-Chehab_POSCERNKEK.pdf](http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/20081212-Chehab_POSCERNKEK.pdf)

[http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/
20081212-Louis_Abstract_PAC09_LR.pdf](http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/20081212-Louis_Abstract_PAC09_LR.pdf)

[http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/
20081212-Frank_StackingAbstractPAC09.pdf](http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/20081212-Frank_StackingAbstractPAC09.pdf)

[http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/
20081212-Variola_PACabstr2.pdf](http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/20081212-Variola_PACabstr2.pdf)

[http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/
20081212-Omori_SmallCR_LargeCR.pdf](http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/20081212-Omori_SmallCR_LargeCR.pdf)

[http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/
20081212-Louis_Proposal_Webex_meeting_ILC_CLIC.pdf](http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081212/20081212-Louis_Proposal_Webex_meeting_ILC_CLIC.pdf)

1. Report from the LAL meeting:

Chehab-san reported the FJPPL meeting held at LAL on December 1st and 2nd.

The list of attendees of the LAL meeting:

LAL: J.Bonis, R.Chiche, R.Cizeron, O.Dadoun, D.Jehanno,
M.Lacroix, A.Variola, F.Zomer
IPNL: R.Chehab
CERN: L.Rinolfi, F. Zimmermann(WebEx)
Hiroshima: T.Takahashi, M.Kuriki
KEK: J.Urakawa, Y.Funahashi, T.Suwada, T.Kamitani, T.Omori

Program of the LAL meeting:

Monday December 1st in the morning: the Compton source

- * Stacking Simulation Update (F.Zimmermann)
- * Status of the KEK 4 mirror cavity design and tests (R.Cizeron)
- * Results of the Orsay 4 mirrors (1 inch) and Ti:Saphir cw laser: first results of the 2 inch mirrors and cw Nd:Yag laser (F.Zomer for V.Soskov)
- * Laser (F.Zomer)
- * Simulations on Compton positron source: status (T.Omori)
- * Simulations on Compton positron source: pre-DR (A.Variola)
- * The "Quantum Beam Project" (J.Urakawa)

Monday December 1st in the afternoon : the hybrid source

- * Operational performance on positron production from tungsten monocrystalline target at the KEKB injector linac (T.Suwada)
- * Studies on an hybrid target for ILC and CLIC (R.Chehab)
- * The hybrid source for CLIC : some studies at CERN ? (L.Rinolfi)
- * A test of the hybrid source at CERN ? (R.Chehab)

Tuesday December 2nd in the morning: Compton cavity

- * KEK & Hiroshima presentations (T. Omori)
- * Results of the 2 mirrors 30000 cavity finesse (R.Chiche)
- * Round table discussion
- * Visit to the new optical lab

We can get presentations in the LAL meeting:

<http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=625>

Chehab-san made a short summary of talks in the LAL meeting.

Please see "20081212-Chehab_FJPPLSUM.pdf".

After Chehab-san gave the summary, we made discussion on the hybrid target.

Question by Suwada-san:

Dose difference of Eth make big difference on PEDD?

Eth: threshold energy to cut the secondary electrons/positrons

Answer by Chehab-san:

There is no big difference.

Eth = 50 MeV and Eth = 900 MeV give us very similar results.

Question by Eugene-san:

How do we cool the hybrid target.

Answer by Chehab-san:

There is no concrete answer for the cooling.

We need study.

The cooling of the hybrid target for CLIC is probably OK.

The cooling of the target for ILC is difficult even employing the 300 Hz scheme. Probably, we need rotating wheel in ILC.

Comment by Variola-san:

Heating of the hybrid target in ILC will be acceptable level. I think that the ILC type rotating wheel with 1/5 rotation speed works for the hybrid target.

Question by Eugene-san:

I think that we can rotate the amorphous part of the target. However, I don't think that we can rotate the crystal part of the target.

Answer by Variola-san:

The crystal part is very thin. So energy deposit on the crystal part is very small. Therefore, rotation is probably not necessary.

Comment by Chehab-san:

In my design the thickness of the crystal part is 1.4 mm for CLIC and 1.0 mm for ILC. It is very thin. Pair creation in the crystal part is very small.

2. The e+ source tests at CERN and at KEK:

Chehab-san made presentation of his proposal to make hybrid target test at CERN and at KEK.

Please see "20081212-Chehab_POSCERNKEK.pdf".

Proposed beam test at CERN:

- * The site of NA63 experiment at CERN.
Use transfer lines of SPS.
- * Collaboration with the team (NA63) of Prof. Ulrik Uggerhoj (Aarhus University).
- * Measurement of positron and photon angular distributions.
- * Measurement of energy spectrum.
- * Due to the time structure of the beam this is a particle experiment; it provides precise informations.

Proposed beam test at KEK:

- * Experiment in the KEKB test area.
- * Measurement of the permanent amorphous target heating: a system of thermocouples could be a solution
- * Measurement of the instantaneous heating on the exit face of the amorphous target. An infrared camera with a good spatial resolution might be the good means to get this information. (Are there intensified infrared cameras?)
- * Measurement of the positron yield.

- * Measurement of the positron energy spectrum.
- * The beam energy of 4 to 8 GeV is well suited for these experiments.
- * An intensity of 1 to 3 nC per bunch.

SUMMARY:

- * The experiments at CERN and KEK are of different nature.
- * At CERN it is a particle experiment with a few incident particles on the target. Precise measurements of the energy & angle distribution may be obtained. That could allow, in the future to select the charged particles impinging on the amorphous part of the hybrid target, by simple collimation.
- * The experiment at KEK is essentially a beam experiment. It provides precious informations on the heating of the target which is of big concern. Other measurements are also expected.
- * The two experiments may be complementary.

After Chehab-san's presentation, we made discussions.

Question by Kamitani-san:

Can we use the drift chambers in the CERN experiment?

Answer by Chehab-san:

No, the drift chambers used in our old experiment will go back to BINP. We can not use them.

There is another possibility. If we can borrow drift chambers from NA63 and if we can get support from them, we can use drift chambers. But it is not so easy.

Question by Omori:

In the KEK experiment, is 1 kG magnetic field is enough to derivate the primary electron beam off the amorphous target?

Answer by Variola-san:

It depends on the size of the amorphous target.

If we assume, beam energy = 10 GeV, B = 2 kG, crystal-amorphous distance = 1.5 m, the primary beam derivate about 3 cm. So if the size of the amorphous target is small, the primary beam dose not hit the amorphous target. So small magnetic field is OK.

Answer by Chehab-san:

The energy deposit on the amorphous target by the primary beam is small. So the derivation is not necessary.

Comment by Urakawa-san:

KEK directorate is considering to include e+ source and e- source studies as a part of the KEK to universities technology-transfer program.

Based on this program, Hayano-san and Urakawa-san made discussion with researchers of Osaka University and Hiroshima University. Urakawa-san is going to make a budget request to KEK with Osaka and Hiroshima

people. Presumably, we will hear the result in about one month.

3. Submission to PAC (1):

Louis-san presented his proposal to submit a abstract to PAC09.

The title is:

"The CLIC positron sources based on Compton schemes".

Please see "20081212-Louis_Abstract_PAC09_LR.pdf" for details.

4. Submission to PAC (2):

Frank-san presented his proposal to submit a abstract to PAC09.

The title is:

"Stacking Simulations for Compton Positron Sources of Future Linear Colliders"

Please see "20081212-Frank_StackingAbstractPAC09.pdf" for details.

5. Submission to PAC (3):

Variola-san presented his proposal to submit a abstract to PAC09.

The title is:

"ERL scheme for Compton polarised positron sources"

Please see "20081212-Variola_PACabstr2.pdf" for details.

6. Report of DESY visit:

After the meeting at LAL, a part of Japanese colleagues visited DESY on December 3rd and 4th.

Urakawa-san made the report of the DESY visit.

The member of the visit were, Urakawa-san, Funahashi-san, Takahashi-san, Kuriki-san, and Omori.

The original aim of the visit was study of the status of FLASH and XFEL.

However, on December 3rd and 4th, the XFEL-ILC joint CFS meeting was held at DESY. And Marc-san was stayed at DESY to attend the joint CFS meeting. Visit of the Urakawa-san's party accidentally coincided the joint CFS meeting.

Taking this occasion, the PMs (Marc-san, Nick-san, and Yamamoto-san) proposed to have the meeting about the R/D of conventional e+ source for ILC.

The people who attended the meeting were, Marc-san, Nick-san, Yamamoto-san(WebEx), Clarke-san(WebEx), Urakawa-san, Funahashi-san, Takahashi-san, Kuriki-san, and Omori.

In the meeting, Urakawa-san expressed our concern about the undulator-based positron source very straightforwardly. Kuriki-san presented his proposal: 700 MeV e- beam driven e+ source.

About Kuriki-san's proposal, please see the minutes of the Euro-Japan meeting on Nov/27th (see the web-page of the Euro-Japan meeting). Also, his presentation file was uploaded the same web-page.

<http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081127/20081127-MinutesEuroJapan.pdf>

http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081127/081119_MM_v03.pdf

In the meeting, the PMs agreed to include the conventional source R/Ds to the ILC Technical Design Phase 1 R/D plan. They also requested Urakawa-san to make the R/D plan. The PMs did not agree to include the conventional source R/Ds to the Minimum Machine studies.

Nick-san asked Kuriki-san to make presentation at the Area System and Technical Area Group Meeting (phone meeting) of ILC on January 7th.
(later the date was changed to February 4th).

7. Gamma/electron and small-vs-large CRs:

Omori discussed the energy spread of the beam in the Compton rings (CR), and the comparison between the small CR option and the large CR option.

Please see "20081212-Omori_SmallCR_LargeCR.pdf".

He made rough estimation of the energy spread just after the single generation cycle. Since a single generation cycle is much shorter than the damping time of a CR, he did not take damping (cooling) effect into account.

He made estimation by the following formula.

$$\text{Espread_CR} = (\text{Ng_cycle}/\text{Ne})^{(1/2)} \times \langle \text{Eg} \rangle$$

Espread_CR : energy spread just after single generation cycle

Ng_cycle : number of gamma per bunch in single gen. cycle
Ne : number of electron in a bunch
<Eg> : mean gamma-ray energy

Omori made comparison of the energy spreads in a small CR option (C=670m) and a large CR option (C=6.7 km).

Small CR: C = 670 m, Ee= 1.8 GeV <Eg> = 20 MeV
300 bunches in CR
CR 10 turn ---> create 3000 bunches
DR 10 stacking/cycle ---> CR 100 turn/cycle
Ne = 4×10^{10} /bunch
Ng_turn = 2.7×10^{10} (Laser : 600 mJ x 4)
 $\{Ng_cycle/Ne\}^{(1/2)} = \{(2.7 \times 10^{10}) / (4 \times 10^{10}) \times 100\}^{(1/2)} = 8$
Espred_CR = 160 MeV : too large!

Large CR: C = 6.7 km, Ee= 1.8 GeV <Eg> = 20 MeV
3000 bunches in CR
CR 1 turn ---> create 3000 bunches
DR 10 stacking/cycle ---> CR 10 turn/cycle
Ne = 4×10^{10} /bunch
Ng_turn = 2.7×10^{10} (Laser : 600 mJ x 4)
 $\{Ng_cycle/Ne\}^{(1/2)} = \{(2.7 \times 10^{10}) / (4 \times 10^{10}) \times 10\}^{(1/2)} = 2.6$
Espred_CR = 52 MeV : acceptable?

Large CR may be expensive. Put it in DR tunnel?

Possible cures of the large energy spread:

- * smaller electron energy,
- * larger Ne and smaller laser pulse E,
- * 2 micron laser (very difficult),

Another possible cures:

- * Choose $T_{b_to_b} < 6.15$ n sec,
For example 2.05 n sec, then we can put factor 3 more bunches.
We need a RF kicker at injection to DR.
- * In addition, make laser collision every N-th bunch (N=3 in the example above)

After Omori's presentation, we made discussions.

Comment by Eugene-san:

We need detailed simulation study in order to discuss the energy spread.

Omori will send the file to Eugene-san.

Then Eugene-san will make the simulation.

Comment by Eugene-san:

Choice of electron beam energy, 1.8 GeV, is too high.

1.3 GeV is maximum if we use 1 micron laser.

About the laser choice, 2 micron laser is much better.

Omori's answer:

2 micron laser is technically too hard.

8. Discussion, extension of the meeting:

Louis-san proposed to extend this phone meeting to a new meeting based on ILC-CLIC collaboration frame work.

Please see
"20081212-Louis_Proposal_Webex_meeting_ILC_CLIC.pdf".

He proposed that the name of our present Webex meeting, "Euro-Japan Compton capture and stacking", could be changed to "CLIC/ILC e+ studies".

He also proposed that Omori continues to work as the coordinator.

We agreed on his proposal.

Then we discussed the date of the meeting.
Louis-san proposed semi-fixed date.

After the discussion, we agreed the date will be "First or second Thursday of each month".

9. General discussions

Posipol 2009:

The date is from June 22nd to 26th.

The place is Lyon.

We already reserved the rooms for conference.

Soon, Chehab-san will visit Lyon and make detailed plan.

The date of the next meeting will be on February 5th.
(No meeting in January)

Reported by T. OMORI