

Minutes of the 17th Euro-Japan Compton capture&stacking meeting

Date: November 7th 17:00(JST) 9:00 (CET), 2008

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

Agenda (tentative)

1. Reports from Daresbury meeting: Urakawa-san, Kuriki-san, and Omori
2. Discussion, Towards GDE/LCWS at Chicago
3. Report from the channeling workshop: Chehab-san

Presentations:

http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081107/20081107-Omori_ReportDaresburyE+Meeting.pdf

http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081107/20081107-Kuriki_ReportDaresburyE+Meeting.pdf

http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081107/20081107-Chehab_ReportErice.pdf

Materials:

http://www-jlc.kek.jp/~omori/EuroJapanMeeting/20081107/20081107-Discussion_ChicagoMeeting.pdf

Summary of the discussions:

1. Reports from Daresbury e+ meeting:

(a) Omori's report:

Please see "20081107-Omori_ReportDaresburyE+Meeting.pdf".

(a-1) Minimum machine and the undulator location:

In the Daresbury meeting, Nick-san (a project manager) mentioned the minimum machine. He pointed out that the performance determined by ILCSC-parameter-committee should be kept.

$E_{cm} = 200 - 500 \text{ GeV}$

Luminosity: Peak at max. energy $2 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$
Assume $1/\gamma$ scaling for $E_{cm} < 500 \text{ GeV}$

Omori thought that a undulator located at the end of the e- main linac, at the 250-GeV-point, was not a good idea.

If Higgs mass is low, we need low energy operation, for an example $E_{cm} = 240$ GeV. This means that the undulator should create an enough number of gamma-rays from a low energy e- beam ($E_b=120$ GeV for an example).

The energy of the gamma-rays created by a undulator is proportional to the a square of the beam energy. So the effect is quite big.

In order to meet low energy operation, we need a very long undulator even we put it at the end of the e- main linac.

Other possibility is an alternate operation. In the alternate operation, a half of pulses are used for positron generation and a half of pulses are used for the collision.

In the alternate operation scheme, the undulator length can be significantly short, because we only use a 250 GeV e- beam.

However, in this scheme, we have only a half luminosity below a some energy (probably about below $E_{cm} = 350$ GeV).

(a-2) Test of the prototype undulator:

In the Daresbury meeting, Rochford-san reported the status of the prototype undulator.

The vertical test of the prototype undulator was successful.

The measured non-uniformity of the B-field was slightly larger than the expected value. We probably need a small correction dipole magnet at every 4 meters.

Marc-san pointed out that we need the measurement of the B-field uniformity in horizontal setting.

The straightness of undulators is controlled to be less than 100 micron in the production.

Omori pointed out that we need the measurement of the straightness in cold and in horizontal setting.

We had a problem in the horizontal test in using the prototype cryostat. A He leak to inside the beam

pipe was happened. The 4-meter-undulator module consists of two 2-meter-undulators. Two 2-meter-undulators are in a cryostat. The leak was occurred at the center, the connection point of the two undulators.

Rochford-san's team will make a repair of the prototype undulator and continue the test.

We need careful consideration of the cause of the He leak.

(a-3) Frank-san's presentation on the stacking simulation:

In the Daresbury meeting, Frank-san reported the stacking simulation study.

His report was quite impressive. A stacking efficiency reached 90 -95 % in all schemes; both ILC and CLIC Compton schemes.

Frank-san assumed the energy compression by factor three to six. We need more study including a feasibility of the energy compression.

(b) Kuriki-san's report, Extendable-KAS:

Please see "20081107-Kuriki_ReportDaresburyE+Meeting.pdf".

Kuriki-san made a report of the Extendable-KAS.

In the initial phase, 3X0 W-Re for high e+ intensity.
700 MeV SC accelerator (36m) can generate 32 % intensity e+ beam.

This beam is more useful for commissioning.

The target can be replaced when undulator e+ is ready for the commissioning. KAS becomes a small backup with a few % intensity with 0.4X0 Ti-alloy target.

The 5 GeV e+ booster can be shared with the Extendable KAS and the undulator source.

In a meantime, 400m drift space for undulator gamma is enough to accommodate.

A 6 GeV linac for conventional e+ source with the full intensity.

A 4 GeV linac for linac laser Compton e+ source.

The tunnel for undulator section is therefore compatible to all schemes which we have considered.

Even after completion of tunnel, we can switch a e+ scheme

among them.

Because of this flexibility, the extendable KAS minimizes unexpected risks.

* Question from Louis-san:

Assume we use three extendable-KAS, can we make a full-intensity beam? Maybe that is cheaper than the undulator source.

Kuriki-san's answer:

The bunch charge is 32% of the nominal charge.
So we need the bunch merging.

* Question from Omori:

Is the stress on the target OK?

Kuriki-san's answer:

We don't have detailed analysis yet.
However I believe that the target stress of this source is much smaller than that of the 6-GeV driven source.

(c) Urakawa-san's report:

The liquid Li lens was a subject in the Daresbury e+ meeting. The liquid Li lens has two concerns. One is the high risk of Li leak. The other is the window survivability. We will discuss those issues in the Chicago meeting.

2. Discussion, Towards GDE/LCWS at Chicago:

People who will go to Chicago from our collaboration:

Louis-san, Urakawa-san, Kuriki-san, Takahashi-san, Vitary-san, and Omori

Expected talks from Compton/related activities

Louis-san: GDE source session

CLIC-ILC e+ source common activity

Takahashi-san: LCWS gamma-gamma session

Optical cavity, the quantum beam project, and LUCX project

Frank-san (WebEx) : GDE source session

Stacking simulation update

Chehab-san (WebEx) : GDE source session

Hybrid target

Urakawa-san : GDE source session

Window and Li lens

Yakimenko-san: GDE source session
Linac Compton

Omori: GDE source session
Cavity Compton Exp. at ATF and Ring/ERL Compton Design

Kamitani-san (WebEx) or Omori : GDE source session
300 Hz e+ generation scheme

Kuriki-san : GDE source session
Extendable KAS

Comments by Omori:

Omori asked Kuriki-san the cost estimations of the
Extendable KAS and the 300 Hz scheme.

3. Report from the channeling workshop at Erice:

Chehab-san made reports from the channeling workshop
at Erice (Erice 2008).

(a) General report:

Please see the first half of
"20081107-Chehab_ReportErice.pdf".

This workshop, held every 2 years, was at that time
housed in the center "Ettore Majorana" of Erice in Sicily.
The talks and posters presented in this workshop are
concerning generally radiation problems in periodic
structures or fields; channeling in crystals is
a typical case.

Subjects discussed in the workshop.

- * Particle collimation using bent crystals.
- * Crystal effects: channeling radiation,
coherent bremsstrahlung,
ordinary bremsstrahlung.
- * Synchrotron radiation:
- * Crystal undulators
- * Compton interaction:
- * Transition radiation:
- * Diffraction radiation:
- * Smith-Purcell radiation:
- * Parametric X Ray:

OTHER ITEMS

Different subjects not really related to the topics
of the workshop were presented:

- * Nuclear waste treatment
- * X rays transmission using capillary tubes

(b) Hybrid target:

In the workshop, Chehab-san made a presentation the hybrid target.

Please see the last half of "20081107-Chehab_ReportErice.pdf".

Summary of hybrid target e+ sources:

	for CLIC (*)	for ILC (**)
drive e- beam Energy	5 GeV	10 GeV
crystal W radiator	1.4 mm	1.0 mm
amorphous W converter	10 mm	8 mm
e+/e- (use photon only)	1.3	2.3
PEDD(***)	18 J/g	31.3 J/g

(*) CLIC 3 TeV parameter was assumed.

(**) ILC RDR parameter (e.g. 3000 bunch) was assumed. The 300 Hz generation scheme was assumed.

(***) PEDD : Peak Energy Deposition Density
The upper limit of PEDD is 35 J/g from the SLAC experiment.

Questions and comments in the phone meeting:

(i) Why energy of drive e- beam was different in CLIC and in ILC? (Question from Omori)

Answer by Chehab-san:

Historical reason. Once Chehab-san did the study for GLC, and GLC assumed 10 GeV drive linac. And, channeling is more effective when the electron energy is high.

(ii) If we can choose 5 GeV for ILC, it is preferable because it is low cost. (Comment from Omori)

Comment from Louis-san:

CLIC chose 5 GeV because of cost.

Answer by Chehab-san.

In general, higher energy is better for e+ generation. Channeling is more effective when the electron energy is high. The e+/e- ratio is high in high energy. An optimal value is between 5 to 10 GeV. We need to study.

(iii) Do you have a plan of a beam test at CERN? (Question from Omori)

Answer by Chehab-san:

Once we did perform an experiment of a hybrid target, but without a sweeping magnet.

We do not have a immediate plan now.

However we are discussing a possibility with an experimental group which is performing a channeling experiment. The discussion is encouraging.

- (iv) Can you make the distance between the radiator and the converter shorter? (Question from Kamitani-san)

Answer by Chehab-san:

If we make the distance smaller, it make the gamma spot size on the converter smaller.

This make PEDD larger. It is no good especially for ILC, because the PEDD in ILC hybrid source is very close to the upper limit.

Question from Kakitani-san:

Can we make e- spot size larger to compensate it?

Answer by Chehab-san:

In principle we can.

But we need careful consideration including the capture system.

- (v) Can you use a bend-crystal instead of a magnet? (Question from Kamitani-san)

Answer by Chehab-san:

Electrons and positrons will make photon in a bend-crystal. This could be a problem.

The date of the next meeting will be either November 27th or 28th. We will decide later.

Reported by T. OMORI