Impressions from POSIPOL2018

- Schedule
- News from Japan
- News from the undulator source
- News from the e- driven source
- ‘News’ from physics
- News from the rest

LINEAR COLLIDER COLLABORATION

Schedule

Monday 03 September 2018

Welcome - 6-2-024 - BE Auditorium Meyrin (14:00-14:20)

- Presenters: EVANS, Lyn; STAPNES, Steinar

ILC Status in Japan - 6-2-024 - BE Auditorium Meyrin (14:20-14:40)

- Presenter: TAKAHASHI, Tohru

ILC positron source update - 6-2-024 - BE Auditorium Meyrin (14:40-15:00)

- Presenter: YOKOYA, Kaoru

CLIC Status - 6-2-024 - BE Auditorium Meyrin (15:00-15:20)

- Presenter: STAPNES, Steinar

ILC E-Driven Positron source design and simulation and Target Area - 6-2-024 - BE Auditorium Meyrin (16:00-16:40)

- Presenter: KURIKI, masao

Acceptable peak temperature and thermal stress in Ti6Al4V target of ILC positron source - 6-2-024 - BE Auditorium Meyrin (16:40-17:05)

- Presenter: USHAKOV, Andriy

Undulator target - 6-2-024 - BE Auditorium Meyrin (17:05-17:30)

- Presenter: RIEMANN, Sabine

ILC tunnel lengths & Commissioning with E-driven e+ source - 6-2-024 - BE Auditorium Meyrin (17:30-17:55)

- Presenter: OMORI, Tsunehiko

Schedule

Tuesday 04 September 2018

Photon Dump Design and RD plan - 6-2-024 - BE Auditorium Meyrin (09:00-09:25)

- Presenter: MORIKAWA, Y.

ILC E-driven e+ source: Rotation Target design and R&D - 6-2-024 - BE Auditorium Meyrin (09:30-09:55)

- Presenter: OMORI, Tsunehiko

Development of Start-to-End Simulation for ILC positron sources - 6-2-024 - BE Auditorium Meyrin (10:00-10:25)

- Presenter: FUKUDA, Masafumi

CLIC target optimisation - 6-2-024 - BE Auditorium Meyrin (11:00-11:25)

- Presenter: HAN, Yanliang

Hybrid targets - 6-2-024 - BE Auditorium Meyrin (11:25-11:50)

- Presenter: CHEHAB, Robert

Energy deposit and effect to the first accelerator of the positron capture linac - 6-2-024 - BE Auditorium Meyrin (11:50-12:15)

- Presenter: TAKAHASHI, Tohru

Engineering study for the ILC-Undulator Positron Target with Pulsed Solenoids as a Matching Device - 6-2-024 - BE Auditorium Meyrin (12:15-13:00)

- Presenter: SIEVERS, Peter

Wednesday 05 September 2018

Need for polarization - 6-2-024 - BE Auditorium Meyrin (08:50-09:15)

- Presenter: MOORTGAT-PICK, Gudrid

Optimization of undulator parameters for 125 GeV drive beam' - 6-2-024 - BE Auditorium Meyrin (09:15-09:40)

- Presenter: FORMELA, Manuel

Statistics in Polarized Positrons Sources - 6-2-024 - BE Auditorium Meyrin (09:40-10:05)

- Presenter: BULYAK, Eugene

GBAR experiment - 6-2-024 - BE Auditorium Meyrin (10:05-10:30)

- Presenter: LISZKAY, Laszlo

The Positron Source of CepC - 6-2-024 - BE Auditorium Meyrin (11:00-11:25)

- Presenter: ZHANG, Jingru

FCC-ee source - 6-2-024 - BE Auditorium Meyrin (11:30-11:55)

- Presenters: CHAIKOVSKA, Iryna; MARTYSHKIN, Pavel

GBAR visit - Tbc - 6-2-024 - BE Auditorium Meyrin (12:00-13:00)

Positron beams from laser wakefield accelerated electrons - 6-2-024 - BE Auditorium Meyrin (14:00-14:25)

- Presenter: ALEJO, Aaron

LEMMA, a novel scheme for producing low-emittance muon beams - 6-2-024 - BE Auditorium Meyrin (14:30-14:55)

- Presenter: GUIDUCCI, Susanna

Positron regeneration in LEMMA - 6-2-024 - BE Auditorium Meyrin (15:00-15:25)

- Presenter: COLLAMATI, Francesco

Generation of very small emittance positron beams for Plasma acceleration - 6-2-024 - BE Auditorium Meyrin (16:00-16:25)

- Presenter: GESSNER, Spencer

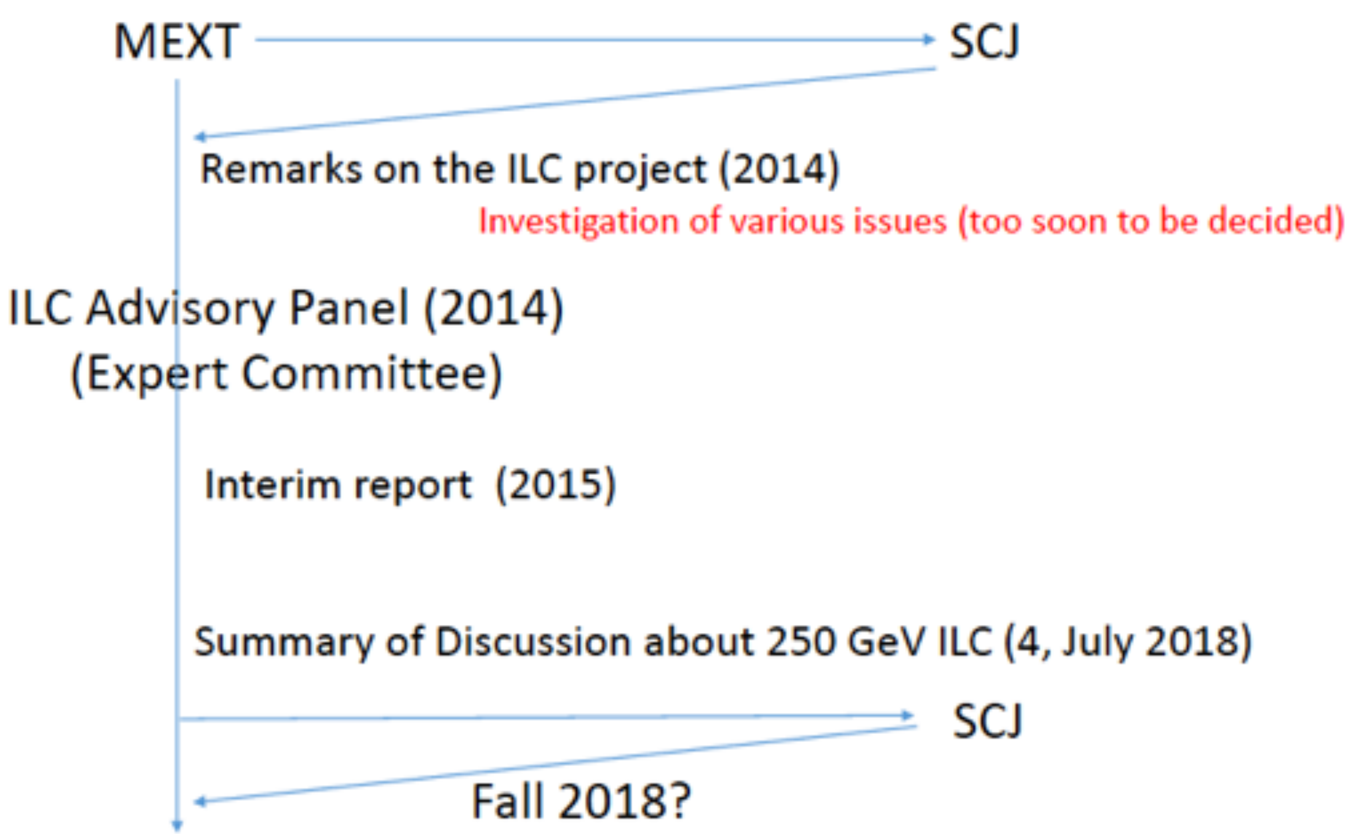
Discussion on future R&D - 6-2-024 - BE Auditorium Meyrin (16:30-17:00)

News from Japan

- **Lyn:**
- **Japan:**

Takahashi

Where we are



News from Japan

Takahashi

Summary of Discussion about 250 GeV ILC (4, July 2018) (summarized and translated by tt)

- Science
  - Has chance to direct physics of BSM by Higgs study
  - New particle unlikely, no top quark
  - Capability of dark matter search is comparable with 500 GeV
- Cost /Technology
  - Must be realized by an international cost sharing
  - Potential risk of cost increase are noted
  - R&D remaining for beam dump, sources, control system, damping ring
- Understanding of public and scientific community are important

➡ Inputs to the discussions in SCJ

News from Japan

Takahashi

ILC Committee in SCJ (July 26)

【Committee members】

Denji Kobayashi	(Vice president Osaka Univ.	Philosophy)
Tatsuyoshi Saijo	(Kochi Inst. of Tech,	Economy/Environment)
Takaaki Kajita	(U Tokyo, Particle Physics)	
Hirokazu Tamjura	(Tohoku Gakuin,	Nuclear Physics)
Masako Yoneda	(Keio Univ,	Civil Engineering/Architecture)
Yasuhiro Ie	(SCJ: Chair	Material Physics)
Mitsuru Uesaka	(U Tokyo,	Acc. Physics)
Naoshi Sugiyama	(Nagoya U,	Astro Physics)
Tomofumi Nagae	(Kyoto Univ.	Nuclear Physics)
Toshio Hirano (	QST,	Medical)

【Sub Committee】

Masafumi Kamon (Kyoto Univ.、Civil Engineering/Architecture/Environment)

Toru Chujo (Research Institute for Humanity and Nature, Biology/ Environment)
Tsuneyoshi Mochiduki (Economic Research Association, Engineering/ Architecture)
Hitoshi Tanaka (Spring 8, Acc.)

News from Japan

Takahashi

SCJ committee meetings

- Aug 10 committee/ tech. sub committee
- Aug 20 tech. sub committee
- Aug 21 committee
- Aug 23 tech. sub commttee
- Aug 29 committee

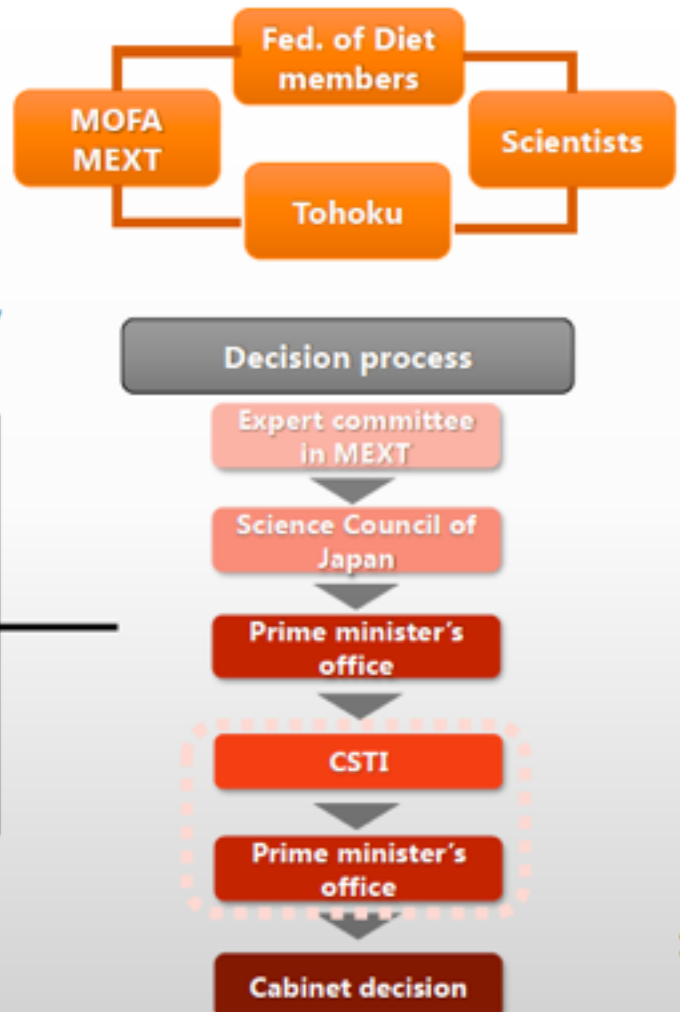
➡ Interviews with
MEXT committee members,
JAHEP chair (H. Aihara),
Particle Accelerator Society of Japan (R. Hajima)
KEKDG (M. Yamauchi), KEK (Fujii, Michizono, Miyahara)

News from Japan

Takahashi

ILC Timeline

2013 2017	US・EU・Labs. in the world Support ILC in Japan
2018	Japan-France・Japan-Germany Established Government – Politic- Academic Body July 2018 Expert Committee in MEXT by fall 2018 Discussion in Science Council of Japan by the end of Dec. 2018 Expression of Interest from Japanese government
2019	Japan-US intergovernmental discussion Discussion of 5 year European Strategy



S. Yamashita at FCCJ

News from Japan

Takahashi

Summary

We

- Local government
  - Tohoku ILC preparation office (chair: A Suzuki)
- Industry
  - AAA
- Academic sector
  - KEK, Universities

are working very hard to get a green signal by the end of this year.

News from Japan

Yokoya

Second Round at SCJ

- MEXT side committees done
- The ball is now back at SCJ, according to the last line of the first recommendation report
  - What is to be evaluated is ILC@250
- SCJ formed a review committee and its subcommittee
- They are well aware of the time limit coming from the European Strategy
- Meetings
  - Aug.10 main & sub
  - Aug.20 sub
  - Aug.21 main
  - Aug.23 sub
  - Aug.29 main
  - Sep.6 KEK visit by some of the committee members
  - Sep.11 main (closed)
  - Sep.13 sub
  - Sep.18 main

These 2 meeting might be the last ones?

News from Japan

Subcommittee

Yokoya

- Tasks
  - Validity of the large facility construction verified from the technical and professional point of view.
    1. Technical feasibility of large facilities
    2. Cost evaluation
    3. Economic ripple effect
    4. Environmental assessment
- Members
  - Masashi KAMON (Civil Engineering)
  - Tohru NAKASHIZUKA (Biology, environmental)
  - Tsuneyoshi MOCHIZUKI (Civil engineering)
  - Hitoshi TANAKA (Spring-8)
  - Masako YONEDA (Civil Engineering, chair)
  - Tatsuyoshi SAIJO (Economics, environmental)
  - Yasuhiro IYE (Physics)

News from Japan

Yokoya

Major Issues in SCJ (main and sub)

- Safety is the first issue.
  Note: the subcommittee contains only 1 physicist and 1 accelerator experts.
  Others are civil engineering and environment experts.
- e.g.,
  - Accident on the main dump.
    - Window breaking.
    - Recovery from window failure
    - Tritium.
  - Tunnel repair
  - Loss of power supply (remember Fukushima).
    - Spare power system.
  - Environment assessment. Takes long!
  - Discommissioning
- Other questions
  - Why in Japan?
  - What happens if not be built in Japan?
  - Length of international negotiation
  - Japan lacks strong leaders
  - Understanding by the nation

News from Japan

Yokoya

Siting Issues

- We down-selected the candidate site in 2013, but this is only a judgment by scientists. MEXT is not involved in this decision.
- All the MEXT-related documents have been based on anonymous site, at least formally.
- There was some misunderstanding among the SCJ committee members In the beginning. They said "Will take >10 years for the studies of site issues!!"
- Now, I think they understand we made already lots of studies about the site.

News from Japan

Yokoya

We are preparing documents for the last meetings!

- List of possible risks
  - including those raised by Nomura report
- Plan for the preparation period (assumed to be 4 years)

Unfortunately, all these are in Japanese

The Final decision to be made by MEXT and Government, not by SCJ.

Only a few more months to approval/disapproval !!

2018/9/3 POSIPOL2018
Yokoya

22

Do not use: 'staged'.....

we agreed on 'upgradable' !

News from the Undulator

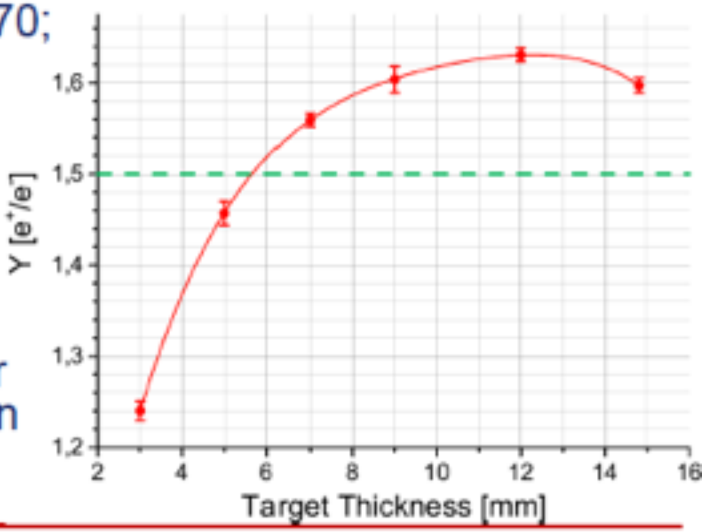
Riemann

The positron target

- Wheel of 1m diameter, spinning in vacuum with 2000rpm (100m/s tangential speed)
- Target material Ti6Al4V, thickness 0.4 X0 = 1.48cm for ILC500

- lesson from prototyping for target wheel at LLNL
  - water-cooling of the wheel will be extremely difficult (vacuum seals, bearing) → use radiative cooling
  - see Gronberg et al., arXive1203.0070; Gronberg et al., POSIPOL2013

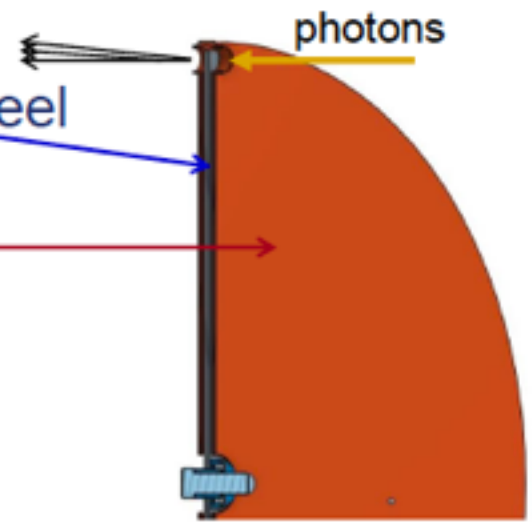
- ILC250:
  - Photon energy is lower, ~7.7 MeV
  - Reduction of target thickness from 14.8mm (TDR) to 7mm maintains Y=1.5e+/e- and reduces the power deposition in the target by more than a factor 2 to ~2kW



News from the Undulator

Riemann

Cooling by thermal radiation



- heat is radiated from spinning target wheel which radiates to a stationary water-cooled cooler

$$P \sim \sigma \varepsilon A\left(T_{radiator}^4 - T_{cool}^4\right)$$

ε = effective emissivity

  - Rough estimate: for 2kW power deposition about 0.6 m^2 are needed to keep material at 400C average temperature ($\varepsilon = 0.3$)

- low thermal conductivity of Ti alloys (λ = 0.06 – 0.15 K/cm/s)
  - heat dissipation ~ 0.5cm in 7sec

  → heat accumulates in the rim near to beam path

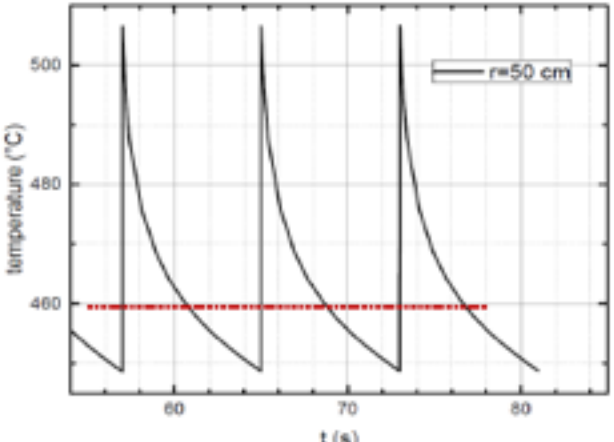
What is the load on target, and can the material stand it ?

News from the Undulator

Riemann

Cyclic load at the target - peak temperature

- Max temperature evolution along rim
  - if wheel has equilibrium temperature distribution reached, pulse increases temperature up to ~510C (2kW, ε_{eff}= 0.33 for ε_{Ti} =ε_{Cu}=0.5)



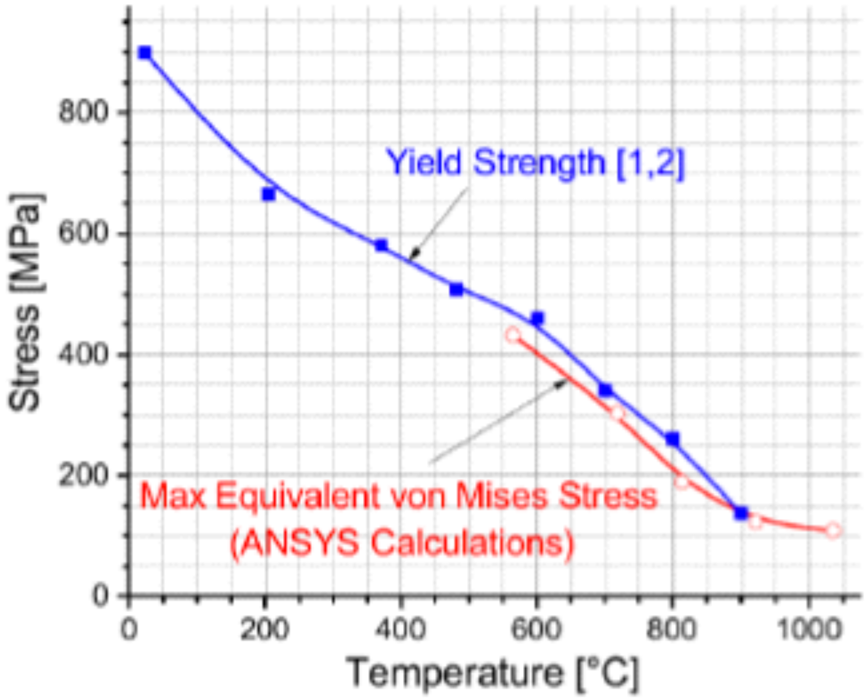
- for ILC250, nominal luminosity; the average temperature as well as cyclic peak temperature are below the limits that Ti6Al4V accepts (see talk of Andriy Ushakov)

News from the Undulator

Riemann

Following the tests at MAMI and Andriy's studies (see his talk), we are safe with the von Mises stress of 300 MPa for ILC250 (nom.Lumi)

Lumi upgrade → Peak stress values could exceed limits



Stress reduction is possible with expansion slots

News from the Undulator

Riemann

Summary and plans

- The roadmap towards the undulator target wheel is clear
- To be done
  - Finalize the parameter list for the undulator based source
  - Finalize the engineering specifications for a target wheel
  - Test in the lab the cooling efficiencies by thermal radiation for a target piece
    - Including mechanical load tests ?
  - Develop a full-size mock-up for the target to test the target rotation in vacuum
    - this includes the full set-up of the target including motor, bearings
    - full-size wheel
  - Photon dump design
- Our problem: resources (→ slow progress for target design)
  - Third-party funding and DESY support material studies. Prototyping is not in the budget.
  - The current manpower situation at DESY/Uni HH does not guarantee that the feasibility will firmly verified in the time of design finalization

Do not forget: no 'showstopper' identified for the undulator

agreed by many!

News from the Undulator

Riemann

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News from the Undulator

Fukuda

The purpose of development of simulation for ILC positron source

- I will develop start-to-end simulation codes for ILC positron source.
  - Positron generation of target: Geant4
  - Target to Capture section: Geant4 or GPT
  - Booster section to DR: SAD
- **The purpose is to compare the yield calculation of positron generation for both undulator scheme and e-driven scheme under the same condition.**
- I am developing the simulation program from the positron generation to the end of the capture section.
  - Code: Geant4.10
  - The program is based on the example program of B4.

News from the Undulator

Tracking Simulations

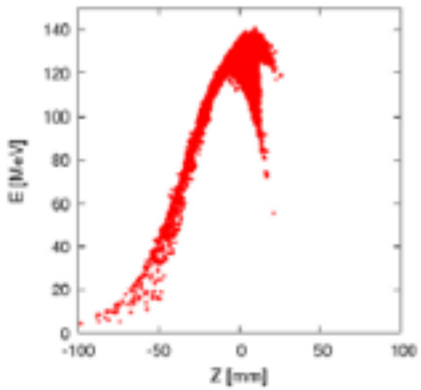
Fukuda

simulated by Andriy Ushakov

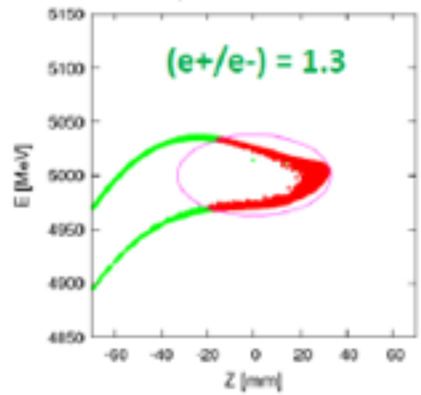
Used parameters are:

- *126.5 GeV e- beam
- 231 m undulator with K = 0.85
- 401 m distance between the middle of undulator and the target
- 7 mm target thickness (Ti6Al4V)
- QWT with 1.04 T field solenoid downstream the target
- Deceleation E-field downstream QWT*

Positron profile after 125MeV NC linac



Transported to EC end

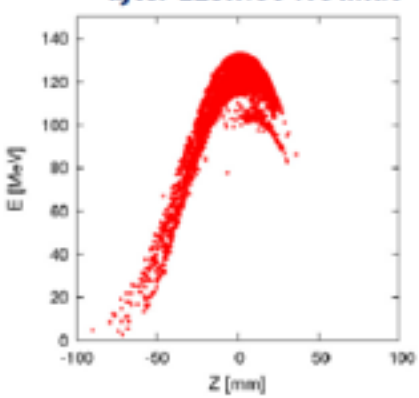


Please note: Andriy's results consistent with W. Mings result!

simulated by M. Fukuda

Target: Ti alloy (Ti-6AL-4V), 7mm
QWT: 1.04T
ACC SOL: 0.5T
ACC SWx2: Eacc 15.2MV/m
ACC TWx3: Eacc 7.2MV/m

Positron profile after 125MeV NC linac



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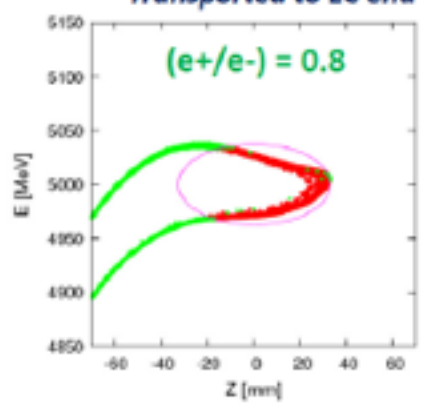


Fukuda has Andriys files…. still comparison needed…… but:

Analyzed by T. Okugi

Further news from the Undulator

- **Still ongoing PhD in Zeuthen: Khaled Alharbi**
  - working on calculating non-ideal undulator field
  - continuation of work from Ian Baileys group: David Newton (died 2015)
- **Master student: Manuel Formela**
  - optimizing undulator for 125 GeV drive-beam (Bachelor work)
  - simulation
  - with Andriy and K. Floettmann

News from the Undulator

Sievers

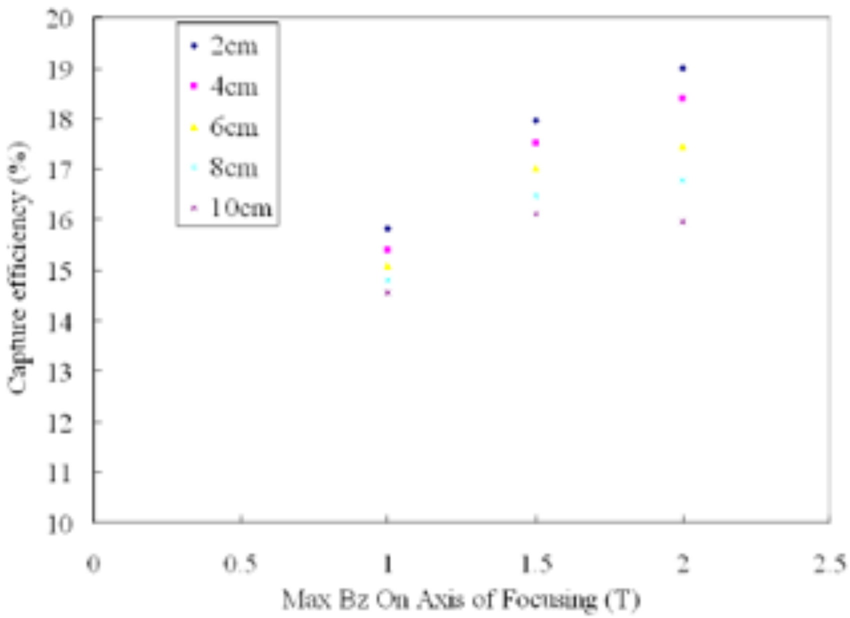
3. Pulsed Coils as a Matching Device for the Positron Target.

- Using Flux Concentrators, powered by long and stable 1 ms pulses of about 3.5 T seems to be difficult.
- D.C. powered Quarter Wave Transformers with maximum fields of about 1 T are envisaged, with however limited yield.
- Motivated by discussions with Wanming Liu, Fukuda-san, Louis Rinolfi and Rober Chehab:
  Pulsed Solenoids as a matching device could be a valid option.
- Such solenoids have been widely used or studied in the past: LEP, LAL, DESY, KEKB,.....

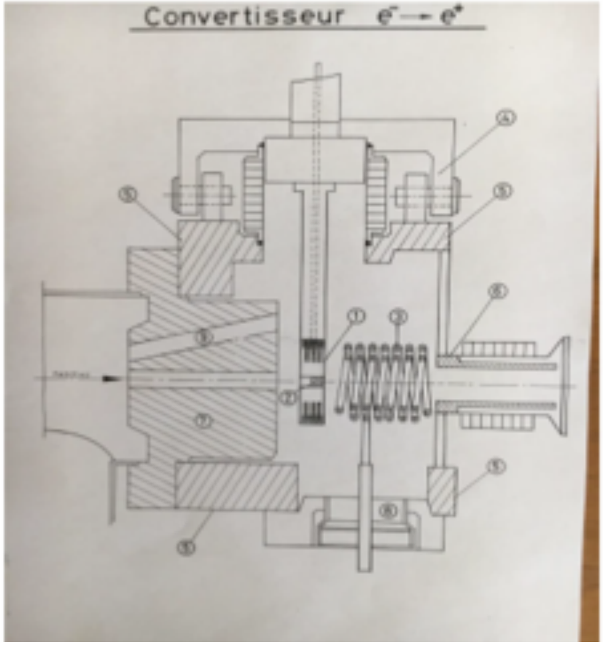
News from the Undulator

Yield versus Bz: Cortesy Wanming Liu.

Sievers



The LEP Positron Source-
Cortesy L. Rinolfi.



News from the Undulator

Sievers

Parameters for the Cu-Conductor per unit length of 1 m.

Powering	Duration of Half-sine Pulses	Frequency	Peak Current	Av. Resistance	Av. Power
	4 ms	5 Hz	50 kA	2.4 10^-4 Ω	5.95 kW

Pulsing	El. PEDD/Pulse	ΔT/Pulse	Water Cooling	Peak Temp. in Cu	Peak Temp. in Cu
	1.86 J/g (83W/cm^3)	8.35 K/pulse	6 m/s 0.17 kg/s	At inlet 38.3 oC	At outlet 46.7 oC

Parameters for the Coils.

- With the 1 m long conductor, a coil with 7 turns, with an inside uniform diameter of 4 cm and an insulating gap of 2 mm between turns, an effective length of 7 x 1.2 = 8.4 cm can be built.
- The diameter of 4 cm is important to place the Cu-conductor beyond the radiation emerging from the target. There the PEED(beam) is next to zero (Takahashi-san).
- With a peak current of 50 kA a peak field of 4.83 T is achieved inside the coil.
- Option: a coil with an inside diameter of 2 cm, with 16 turns over 19.2 cm would give a field of 6.25 T.
- With 2 cm aperture, the PEDD from the beam is about 13 J/g. Adding the ohmic PEDD, would result in 15 J/g (700W/cm^3), above the limit of about 10-12 J/g.

News from the Undulator

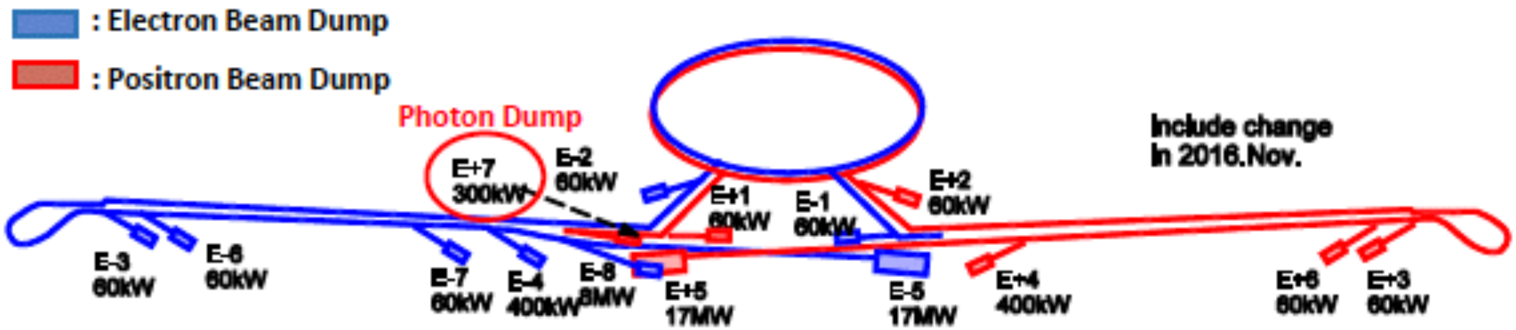
5. Conclusions.

Sievers

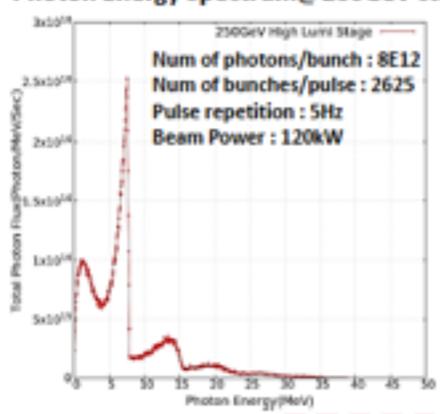
- Mature engineering designs have been evaluated for the target wheel, its cooling by radiation and its rotation in vacuum using magnetic bearings.
- As a next step, these issues must be validated by small scale loboratory tests and should be funded in the next future.
- Pulsed coils as a matching device can provide high fields of several Tesla, near to or even inside the target and are stable in time over 1 ms.
- Their strength is, however, limited by the power in the coils as well as by parasitic heating of the rotating wheel by eddy currnets.
- The pulser for the coils must still be designed.
- The e+ yield must now be evaluated and optimised by using appropriate combinations of coil geometries and peak currents while minimising the magnetically induced power and friction in the rotating target.
- This should bring the Undulator driven e+ source very close to reality and hopefully to increased yields!

News from the Photon Dump

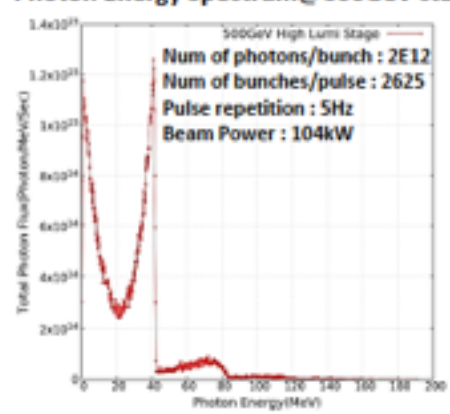
Morikawa



Photon Energy Spectrum@250GeV stage



Photon Energy Spectrum@500GeV stage



Photon Beam	250GeV stage	500GeV stage
Num of photons/bunch	8E12	2E12
Num of bunches/pulse	1312, 2625	
Pulse repetition	5Hz	
Peak Photon Energy	7MeV, 14MeV...	41MeV, 73MeV...
Beam power	60kW, 120kW	52kW, 104kW

Calculation by Yokoya-san

News from the Photon Dump

Morikawa

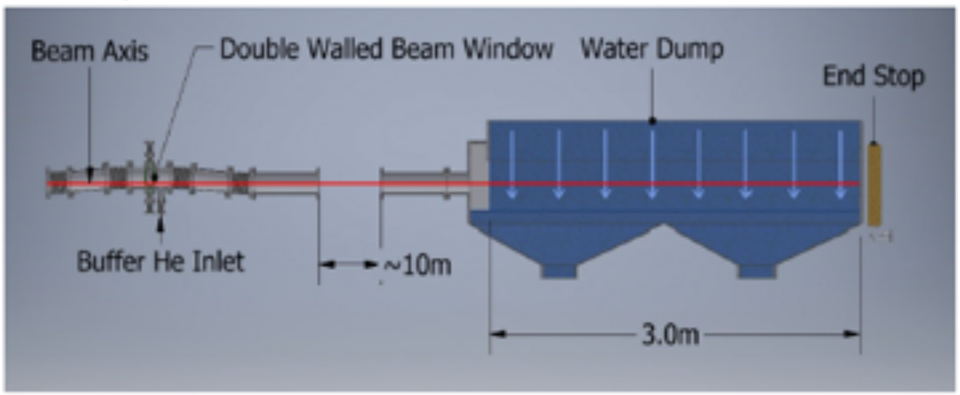
Design of Water Curtain

【Base Idea】

①Beam incidents to falling water(Water Curtain)
This system can accept water boiling.

②Double Walled Beam Window Cooled by Helium gas.
This window is tumbled to reduce the radiation damage.

【Base Design】



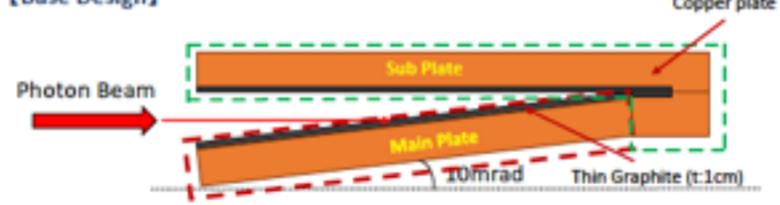
Design of Graphite Photon Dump

【Base Idea】

①To enlarge the photon beam spot on beam dump
・ putting long distance between positron target and beam dump(2km).

②To absorb beam heat only by thin Graphite
・ tilting beam dump (10mrad (almost horizontal))

【Base Design】



Main Plate : 78kW deposited (65% of total) ⇒ Primary Beam
Sub Plate : 42kW deposited (35% of total) ⇒ Secondary (scattered) Bea

Cooling mechanism : Only cooling water in copper
No cooling, protection gas : No need to introducing the beam window

News from the Photon Dump

Morikawa

Technical Issues

- **Water Curtain dump**
  - Beam window durability

  ⇒Combination of thin window and high flow velocity helium and tumbling
  Each element has already been put into practical use in various accelerator.
  We should conduct mock-up test to prove this systems.
- **Graphite dump**
  - Radiation damage : degradation of thermal conductivity, material deformation
  - Bonding method of copper and graphite
  - High temperature and thermal stress

  If thermal conductivity degraded to 10W/mK ,
  Temperature exceeds 1000℃ in 250GeV high-lumi stage.

R&D plan

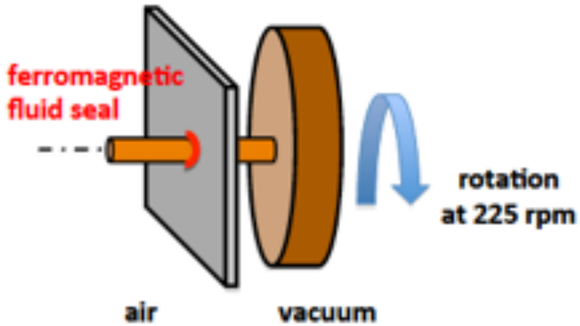
- **Total Designing**
  - ILC R&D team is requested to make more detailed design for construction.
  We should start to make design including utilities, maintenance scheme.
- **Collaborative R&D with qualified industry**
  - To clear the technical issues, I'm going to start discussion with industry.
  Manufacturing way of the beam window system, bonding method Cu/C etc.

News from the electron driven source

Omori

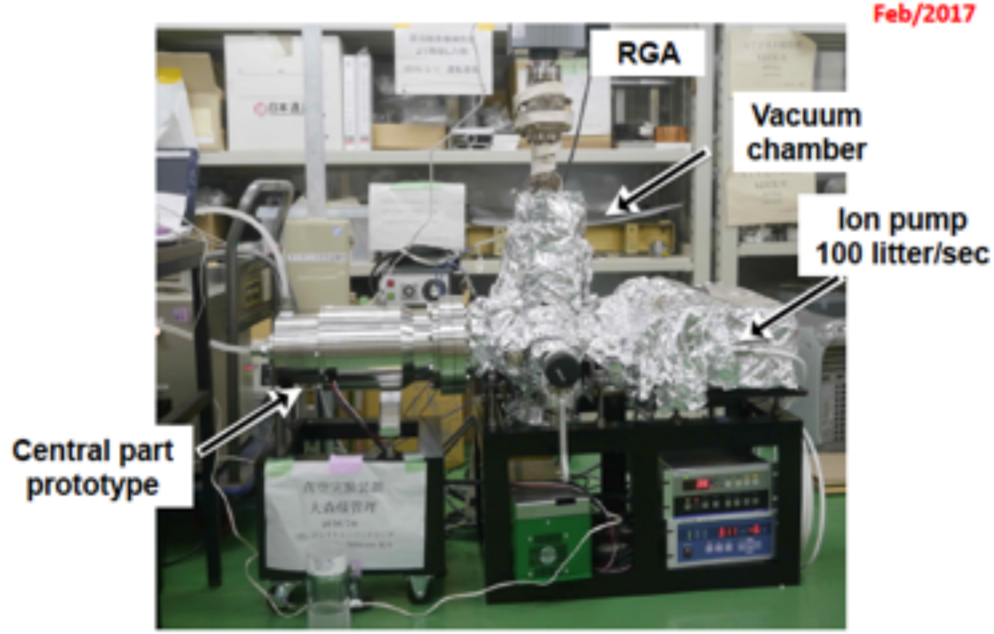
ILC E-driven e+ source

Rotation Target design and R&D



Central Part Prototype Vacuum Test

Feb/2017



Central Part Prototype: Funded by KEK
Vacuum Test: Funded mostly by Hiroshima Univ.

News from the electron driven source

Omori

October-November (2017) : New Tests

- **Fast speed rotation**

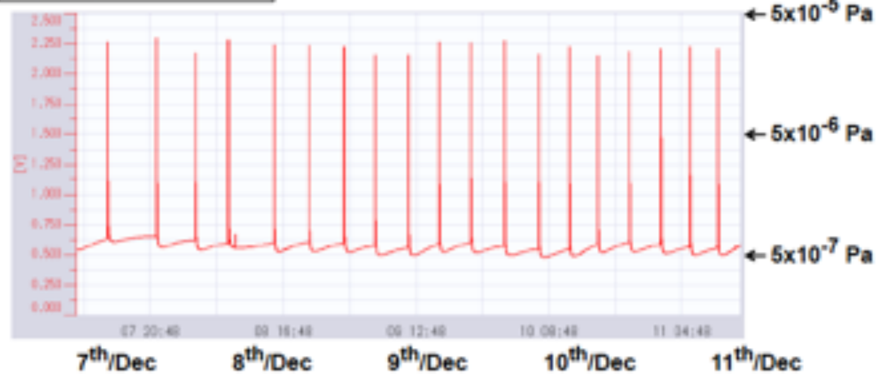
  We intentionally change the rotation speed to much faster than the rated speed to change the state (condition) of the fluid.
  - rotation at 900 rpm
  - rotation at 1150 rpm
  - change speed every 3 minutes, (225 <-> 900)x20 times

- **End of October**

  Situation at the end of October.
  Vaccum: 3.3×10^{-6} Pa at 225rpm
  Spikes: every 2-3 hours (height ~x20)

Vacuum at 225 rpm

dry N2 gas 100 mL/min



base	~ 5×10^{-7} Pa
peak of spikes	~ 2×10^{-5} Pa

Vacuum TDR Requirement 10^{-6} Pa

Summary of Target Vacuum Test

(1) Results of the experiments (so far)

- 5×10^{-7} Pa at 225 rpm (dry N2 gas flowing in the "air" side)
- 3×10^{-6} Pa at 225 rpm (NO gas flow)
  gradual degradation of vacuum 1×10^{-6} Pa/month
- Spikes
  5×10^{-7} Pa → 2×10^{-5} Pa (every 6 hours, duration 2 min)
  (225 rpm, dry N2 gas)

(2) Calculations of Vac. at First Acc. tube(inputs: (1))

- from 7×10^{-8} to 4×10^{-9} Pa
  (when 5×10^{-7} Pa at near seal (base))
- from 3×10^{-6} to 2×10^{-7} Pa
  (when 2×10^{-5} Pa at near seal (peak of spikes))

TDR Requirement 10^{-6} Pa

(3) Plans of Improvements

Try Super Seal (in 2018)

Try two-stage seal (when we get increased budget)

News from physics

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Advisory Panel's Summary

- Recommendation 1: The ILC project requires huge investment that is so huge that a single country cannot cover, thus it is indispensable to share the cost internationally. From the viewpoint that the huge investments in new science projects must be weighed based upon the scientific merit of the project, a **clear vision on the discovery potential of new particles as well as that of precision measurements of the Higgs boson and the top quark** has to be shown so as to bring about novel development that goes beyond the Standard Model of the particle physics.
- Recommendation 2: **Since the specifications of the performance and the scientific achievements of the ILC are considered to be designed based on the results of LHC experiments, which are planned to be executed through the end of 2017, it is necessary to closely monitor, analyze and examine the development of LHC experiments.** Furthermore, it is necessary to clarify how to solve technical issues and how to mitigate cost risk associated with the project.

News from physics

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Polarization basics

- Longitudinal polarization: $\mathcal{P} = \frac{N_R - N_L}{N_R + N_L}$
- Cross section:

$$\sigma(\mathcal{P}_{e^-}, \mathcal{P}_{e^+}) = \frac{1}{4}\{(1+\mathcal{P}_{e^-})(1+\mathcal{P}_{e^+})\sigma_{\mathrm{RR}} + (1-\mathcal{P}_{e^-})(1-\mathcal{P}_{e^+})\sigma_{\mathrm{LL}} + (1+\mathcal{P}_{e^-})(1-\mathcal{P}_{e^+})\sigma_{\mathrm{RL}} + (1-\mathcal{P}_{e^-})(1+\mathcal{P}_{e^+})\sigma_{\mathrm{LR}}\}$$

- Unpolarized cross section:

$$\sigma_0 = \frac{1}{4}\{\sigma_{\mathrm{RR}} + \sigma_{\mathrm{LL}} + \sigma_{\mathrm{RL}} + \sigma_{\mathrm{LR}}\}$$

- Left-right asymmetry: $A_{\mathrm{LR}} = \frac{(\sigma_{\mathrm{LR}} - \sigma_{\mathrm{RL}})}{(\sigma_{\mathrm{LR}} + \sigma_{\mathrm{RL}})}$
- Effective polarization and luminosity:

$$\mathcal{P}_{\mathrm{eff}} = \frac{\mathcal{P}_{e^-} - \mathcal{P}_{e^+}}{1 - \mathcal{P}_{e^-}\mathcal{P}_{e^+}} \qquad \mathcal{L}_{\mathrm{eff}} = \frac{1}{2}(1 - \mathcal{P}_{e^-}\mathcal{P}_{e^+})\mathcal{L}$$

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L_{eff} and P_{eff}

- More concrete: If only LR and RL contributions: only 50 % of collisions useful

effective luminosity: $L_{eff}/L = \frac{1}{2}(1 - P_{e^-} P_{e^+})$

This quantity = the effective number of collisions, can only be changed with P_{e-} and P_{e+}

here:

With $\mp 80\%$, $\pm 30\%$, the increase is 24%
With $\mp 80\%$, $\pm 60\%$, the increase is 48%
With $\mp 90\%$, $\pm 60\%$, the increase is 54%

In other words: *no P_{e+} means 24% more running time (!)*
and
10% loss in P_{eff} = 10% loss in analyzing power!

Quite substantial in Higgs strahlung and electroweak 2f production !

- Charged currents, i.e. t-channel W- or ν-exchange (A_{LR}=1):

$$\sigma(\mathcal{P}_{e^-}, \mathcal{P}_{e^+}) = 2\sigma_0(\mathcal{L}_{\rm eff}/\mathcal{L})[1 - \mathcal{P}_{\rm eff}]$$

In other words: *no P_{e+} means 30% more running time needed !*

Quite substantial in Higgs production via WW-fusion!

News from physics

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Polarization measurement

- **Compton polarimeters: up- and downstream**
  - envisaged uncertainties of $\Delta P/P$=0.25% (at polarimeters!)
  - But that's is not enough for IP!
- **Use collision data to derive luminosity-weighted polarization**
  - single W, WW, ZZ, Z, etc.: combined fit

$$P^{-}_{e^\pm} = -|P_{e^\pm}| + \tfrac{1}{2}\delta_{e^\pm} \qquad P^{+}_{e^\pm} = |P_{e^\pm}| + \tfrac{1}{2}\delta_{e^\pm}$$

Karl, List,1703.00214

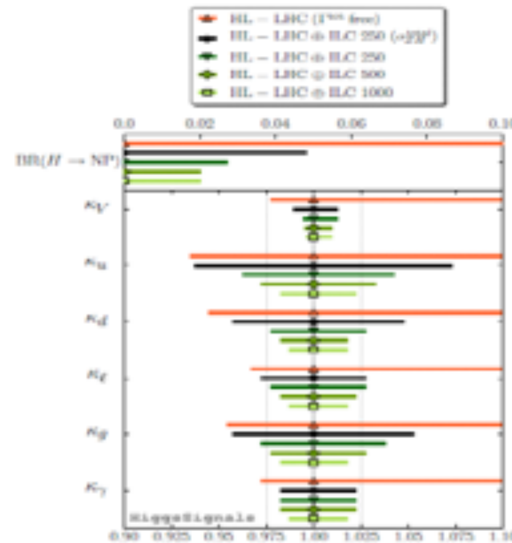
  - assume H-20 set-up concerning lumi
  - helicity reversal is important
  - non-perfect helicity-reversal can be compensated
  - 0.1% accuracy in $\Delta P/P$ is achievable at IP!
  - *NOT achievable without Pe+!*

Remember: even if no Pe+ (SLC! dedicated experiment at SLACs Endstation A), the P_{e+}~0.0007 had to be derived a posteriori for physics reason!

What did we promise?

Bechtle ea, '14

- Precision of 1-2% achievable in Higgs couplings !!!
- Crucial input from ILC
  - total cross section σ(HZ)
  - Has to be measured at √s=250GeV
  - Input parameter for all further Higgs studies (Higgs width etrc.) !
- Lots of improvement if only σ(HZ) from ILC is added



News from physics

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Conclusions

- Beam polarization e^- and e^+ gives 'added-value' to ILC
  - Crucial 'new' analysis tools compared to LHC numbers
- Strong precision promises......
  - Require both beams polarized from the beginning
  - Well thought scenarios for different configurations/flipping
- P_{e+} important at $\sqrt{s}$=250 GeV (Higgs!) and higher $\sqrt{s}$
  - Saves running time
  - Essential to control systematics
  - Crucial to compete with LHC options
  - Essential to match precision promises/expectations!
  - ➢ Precision allows sensitivity to beyond SM physics!

LCC physics group,1801.02840

Conclusions

- ......