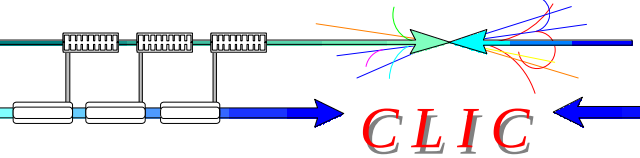

Summary of the POSIPOL 07 workshop

L. Rinolfi

POSIPOL 2007 Workshop

Orsay, France 23-25 May, 2007

http://events.lal.in2p3.fr/conferences/Posipol07

International Programme Committee

ARTRU Xavier - *IN2P3 - Lyon*
BULYAK Eugène - *KIPT*
CHEHAB Robert - *IPN - Lyon & LAL*
DELAHAYE Jean-Pierre - *CERN*
GLADKIKH Peter - *KIPT*
GRONBERG Jeffrey - *LLNL*
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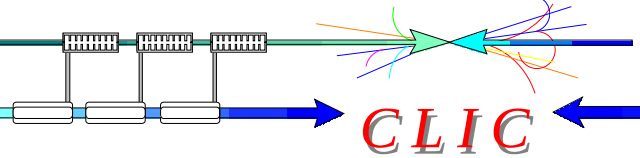
KURIKI Masao - *KEK*
MOORTGAT-PICK Gudrid - *Univ. of Durham*
OMORI Tsunehiko - *KEK*
POOLE Mike - *Daresbury Lab / ASTEC*
RIEMANN Sabine - *DESY- Zeuthen*
RINOLFI Louis - *CERN*
RUTH Ronald - *LYNCEAN Technologies/SLAC*
STRAKHOVENKO Vladimir - *BINP*
URAKAWA Junji - *KEK*
VARIOLA Alessandro - *LAL*
ZIMMERMANN Frank - *CERN*
ZOMER Fabian - *LAL*

Local Organising Committee

BOURGE Catherine
CHEHAB Robert
MOUTON Bernard
SOKOLSKY Isabelle
VARIOLA Alessandro
VIVOLI Alessandro
ZOMER Fabian



Some POSIPOL 2007 numbers

- 55 participants from Europe, Asian and USA
- 3 days workshop
- 35 talks
- Different sessions : Schemes, Lasers, Compton&Accelerators, Capture section, Physics&polarimetry, Targets, Optical cavities, Industrial-medical applications

Workshop Goals

as defined by the Chairman A. Variola

1) Take stock of the situation of the different machines, schemes, studies and R&D's.

2) Gather information on the new technologies (fiber laser, mirrors…). Define the possible associated R&D's.

3) Find the overlap with the undulator solution, both for funding (EU FP7…) and common work.

4) Benchmark of the GEANT4 polarized version.

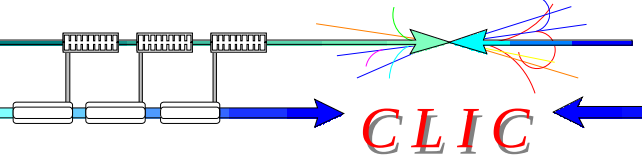
5) Review the industrial – medical applications of Compton machine (extremely important for R&D fund request).

CLIC

- Redefine the parameters. Analyze the differences from the earlier proposal and have a first "feasibility" scheme.

ILC

- Converge towards a scheme that can produce a valid "alternative" design and clearly assess what R&D's are necessary to validate the scheme.
- Point the way to EDR
- Study the possibility of a demonstrator experiment
- Define the aspects of the schemes that still need answering (stacking, costing…) and make a work plan



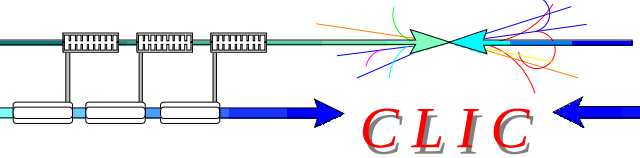
Main events from POSIPOL 2006

Also mentioned by A. Variola at LCWS 07

- CLIC parameters change and update of the existing scheme
- Meetings in Daresbury and Bejing
- ILC RDR published
- ILC EDR ongoing
- E166 results
- GEANT4 polarized version

- Compton sources: Fiber laser technology opens the way to high power, high repetition frequency lasers

- Rising interest for the use of low energy Compton sources for medical and industrial applications



Physics with polarized e+

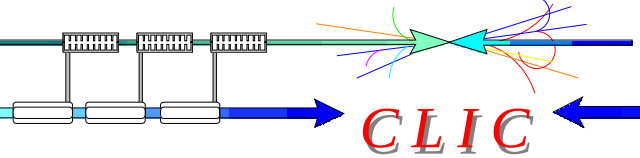
S. Riemann / Desy

- For ILC, we will have a polarized machine from the beginning!

- Already 30% e+ polarization is benefit for physics

- Low P(e+) allows test of operation with both beams polarized
- Utilization of low e+ polarization needs
  - Positron polarization measurement
  - Spin rotation
    - proposed scheme exists: spin rotators before (LTR) and after the DR (RTL) are needed (see SLAC-TN-05-045, EUROTeV-Report-2005-024-1)

- Further design & simulation work has to be done and should include the ~30% option (depolarisation, polarimeter, spin-flip-frequency etc.)



Polarization results

Experimental results obtained at ATF (KEK): Compton

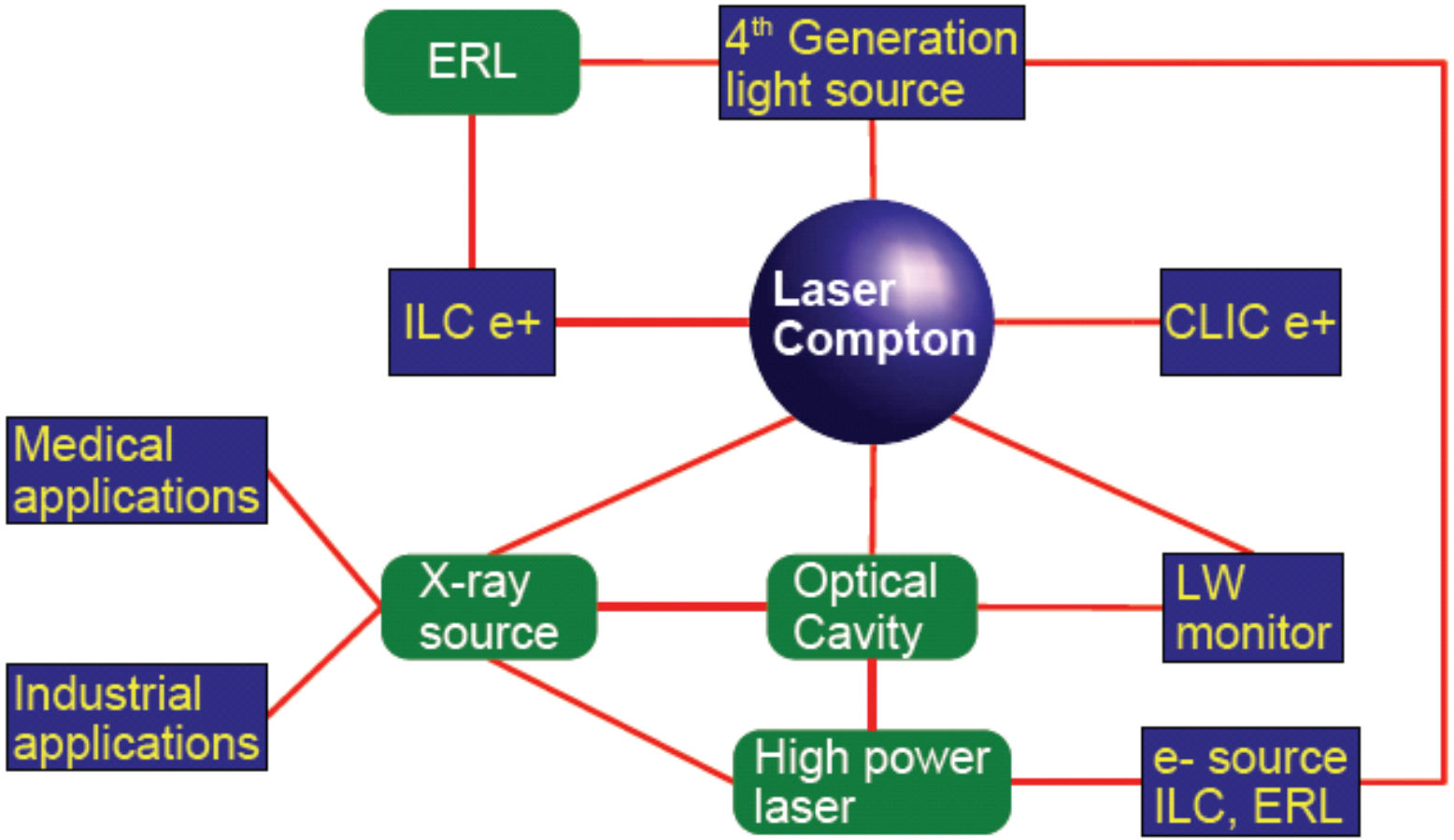
10^4 polarized e^+ per bunch with 73% ± 15% ± 19% polarization

Experimental results expected at E-166 (SLAC):Undulator

2 x10^7 polarized e^+ per bunch with 40 - 80 % polarization

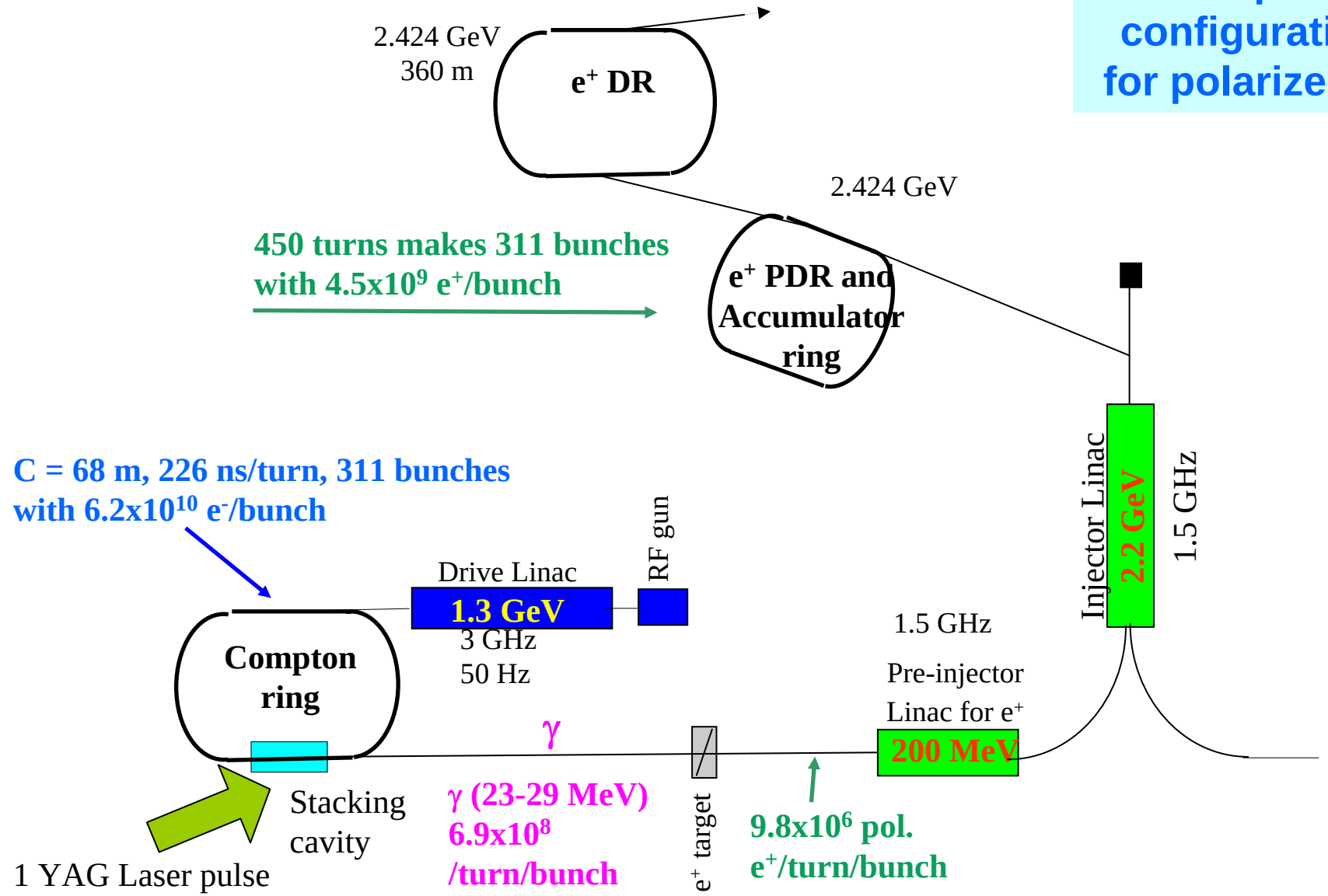
M. Kuriki / KEK

Chart of PosiPol R&Ds



CLIC scheme in 2007

Compton configuration for polarized e^+



High power ultrafast fiber amplifiers

M. Hanna / CNRS

INSTITUT d'OPTIQUE GRADUATE SCHOOL

State of the art

- High average power femtosecond fiber amplifier

  Röser et al., Opt. Lett., vol. 30, no. 20 (2005) Jena group (J. Limpert)

  131 W 220 fs 73 MHz

- High energy femtosecond fiber amplifier

  Liao et al. CLEO 2006 postdeadline CPDB4 Michigan group (A. Galvanauskas)

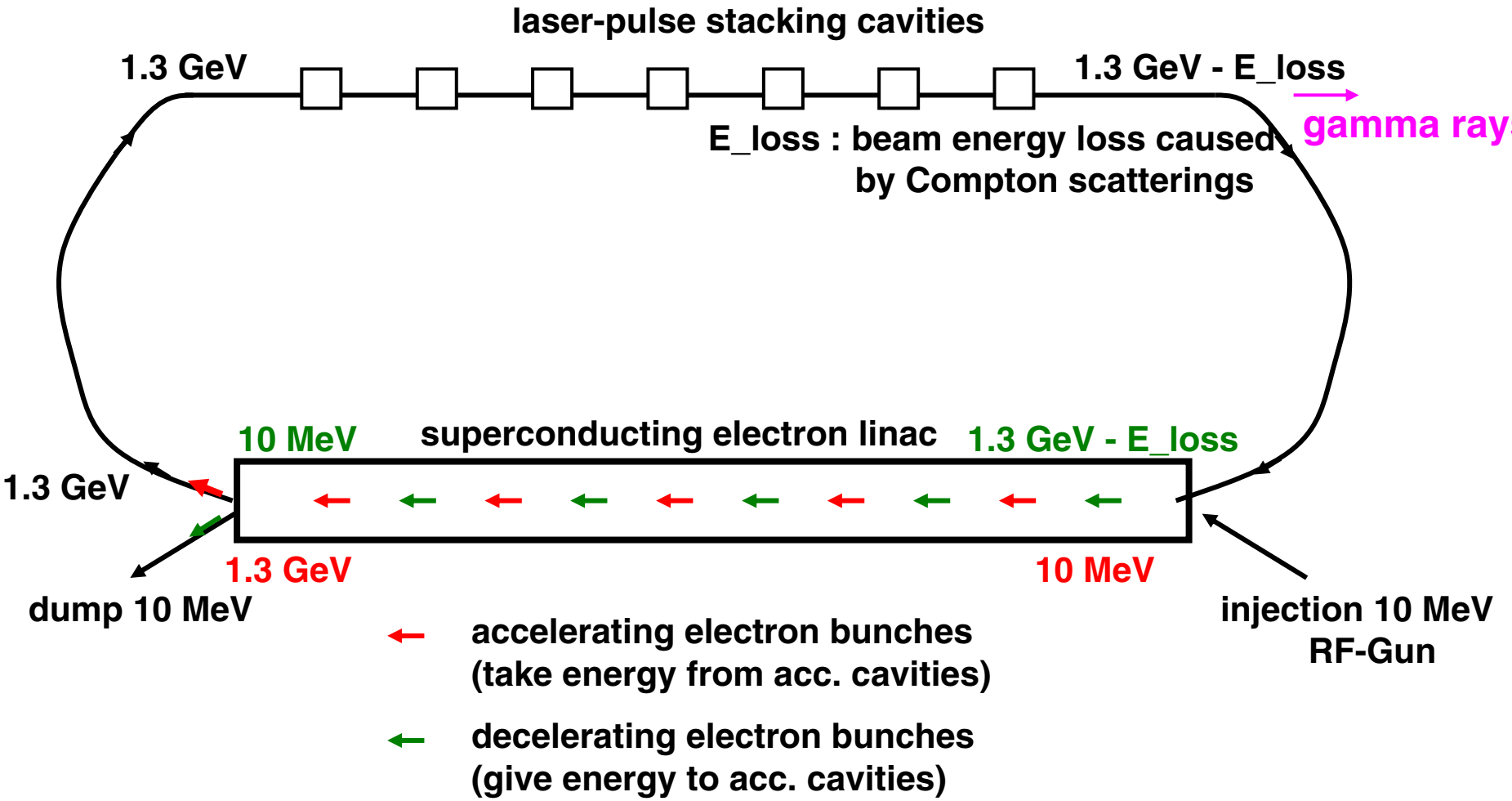
  500 µJ 520 fs 5 kHz

- Review paper

Tunnermann et al., Topics in applied physics vol. 96, pp.35-53 (2004)

ERL based Compton source

T. Omori / KEK



Laser requirements

M. Kuriki / KEK

Requirements

- ERL based Laser Compton ILC e+ source requires
  - 160MHz repetition
  - 30μJ pulse energy
  - 1ps or less pulse length
- which has 4.8 kW average power and 30 MW peak power, which is quite challenging.
- This laser is not available at this moment and need our own efforts for
  - Basic R&D,
  - System integration,
  - Demonstration.

Linac CO_2 laser cavity design

Phys. Rev. ST Accel. Beams 9, 091001 (2006)

Polarized gamma-source based on Compton backscattering in a laser cavity

V. Yakimenko, I.V. Pogorelsky

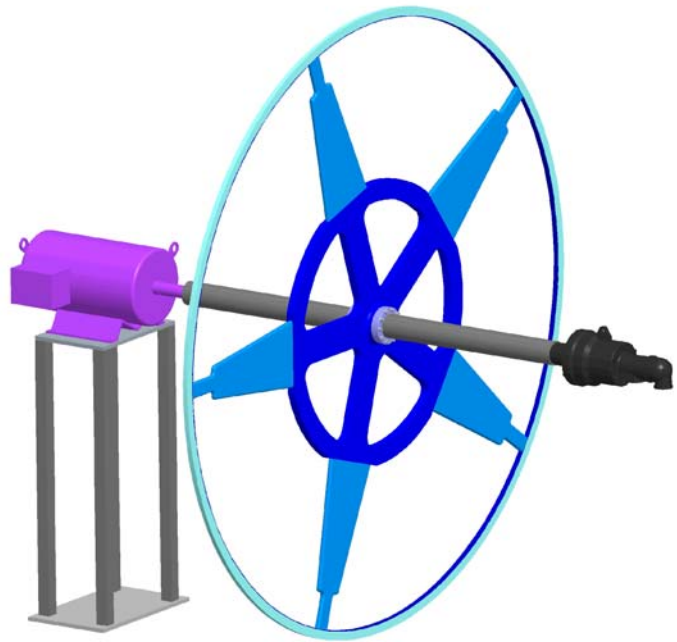
Accelerator Test Facility, Brookhaven National Laboratory, 820, Upton, NY 11973, USA

Abstract. We propose a novel gamma-source suitable for generating a polarized positron beam for the next generation of electron-positron colliders, such as the International Linear Collider (ILC) and the Compact Linear Collider (CLIC). This 30-MeV polarized gamma-source is based on Compton scattering inside a picosecond CO_2 laser cavity from electron bunches produced by a 4-GeV linac. We identified and experimentally verified the optimum conditions for generating at least one gamma photon per every electron. After multiplication at several consecutive interaction points, the gamma-rays will be stopped on a target, thereby creating a copious numbers of circularly polarized positrons. We address the practical feasibility of having an intra-cavity Compton polarized positron source as the injector for these new colliders.

ILC Baseline Target Design

I. Bailey / Cockcroft Instit.

- Wheel rim speed (100m/s) fixed by thermal load (~8% of photon beam power)
- Rotation reduces pulse energy density from ~900J/g to ~24J/g
- Cooled by internal water-cooling channel
- Wheel diameter (~1m) fixed by radiation damage and capture optics
- Materials fixed by thermal and mechanical properties and pair-production cross-section (Ti6%Al4%V)
- Wheel geometry (~30mm radial width) constrained by eddy currents.
- 20cm between target and rf cavity.



T. Piggott, LLNL

Drive motor and water union are mounted on opposite ends of through-shaft.

Tracking results

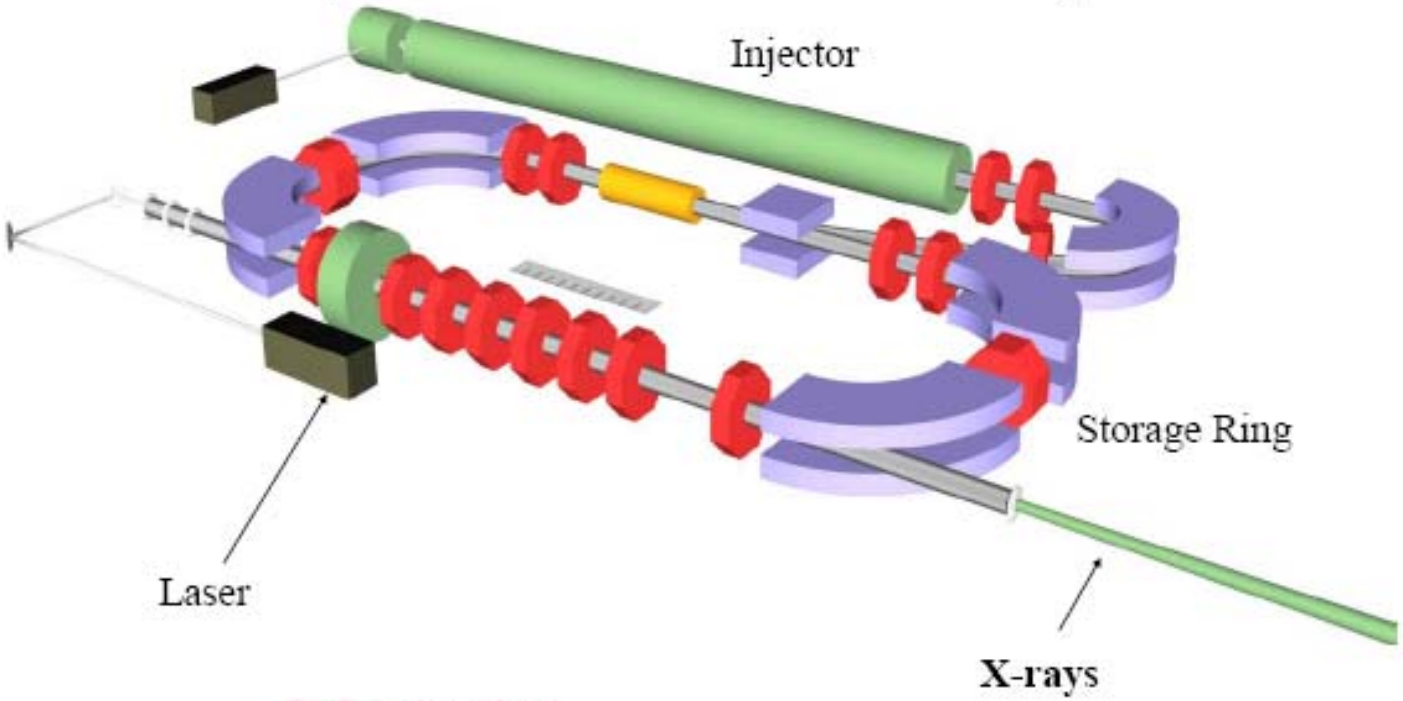
W. Gei / ANL

(using ILC undulator criteria and parameters, could be different for the CLIC)

- Photons: provided by T. OMORI
- Target 0.4 rl titanium
- AMD: 5T-0.25T,50cm
- RF linac:
  - L band NC, 0.25T focusing solenoid,12MV/m
  - SC, 25MV/m, FODO
  - 6cm aperture
- Conversion rate: ~0.055 positron per photon
- Captured yield: ~0.02 positron per photon, Cut with the damping ring acceptance window (+/-0.5% energy spread, +/-7.5^0 in RF phase, $e_x+e_y<=0.09$p.m.rad) at 5GeV
- Polarization of captured: ~60%

A Conceptual Picture of the CLS

(The 30 cm ruler in the middle is shown for scale.)



CLS animation

lyncean TECHNOLOGIES, INC.

Illuminating X-Ray Science

7

POSIPOL 2007, May 25, 2007

Recommendations

ILC :

- Baseline : need published result for E166 (Important also for simulation benchmark)
  - Find the common work topics
  - Capture section (simulation and prototyping), target (repository as suggested by I. Bailey), polarization generation, transport and manipulation.

- Alternative : Proceed towards stacking simulations,
  - Optimization,
  - Explore the different schemes and converge to a single proposal

CLIC :

- A "polarised" scheme with the new parameters. What could be a demonstrator experiment?

Design study

- Compton ring design
- Collection system design
- Multiple injection schemes

Technological R&D

- High power & high repetition rate lasers
- Fabry-Perot optical cavities in pulsed regime
- Polarimetry

Test Facility Experiments

- Validation at ATF & DAΦNE

POSIPOL 2008

- Hiroshima Univ. has proposed to hold POSIPOL 2008 in Hiroshima with support of KEK.
- The period will be May or June, which will be fixed later.

Itsukushima Shrine

Summary and outlook

- Strong request from the Physics for polarized e^+.
- CLIC parameters redefined and schemes introduced.
- ILC base line is undulator with encouraging results from E-166. Alternative solutions are an important step regarding the potential advantages and possible cost reduction for the project.
- R&D goals well defined. Several programs are already running.
- Advancements in technology are impressive.
- EDR path was illustrated.
- Compton community is rising with many applications.

http://events.lal.in2p3.fr/conferences/Posipol07/