Photon Linear Collider Gamma-gamma Summary

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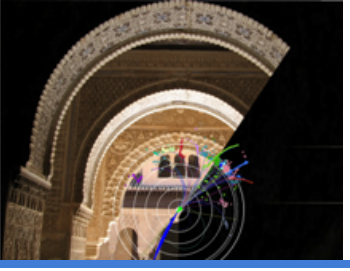
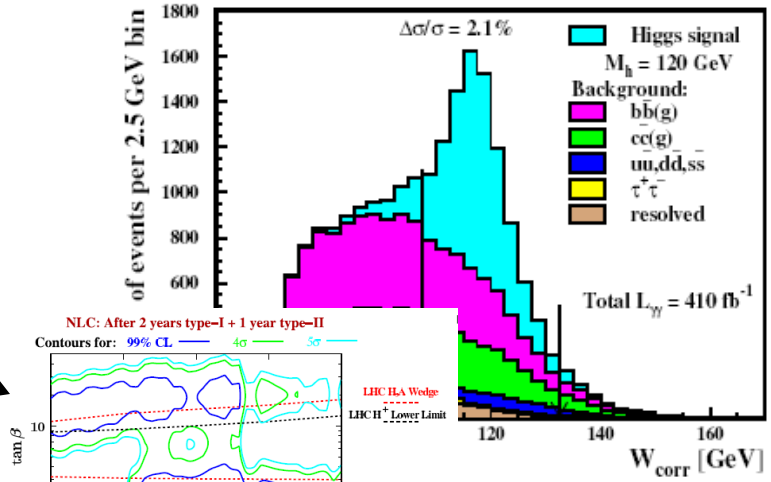
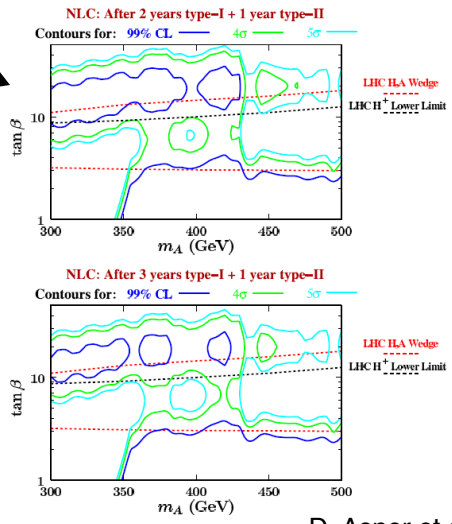


Photon Linear Collider physics is a valuable addition to the base LC program

- PLC allows direct production neutral C=+ parity spin zero objects
  - Higgs
- Greater energy reach for MSSM H and A
  - Covers LHC wedge
- Linear polarization allows initial state of definite CP
- Double and single W production probes anomalous couplings
- eγ provides greater energy reach in SUSY single particle production

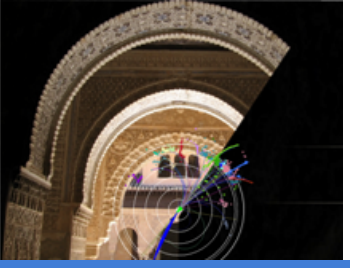
P. Niezurawski et al



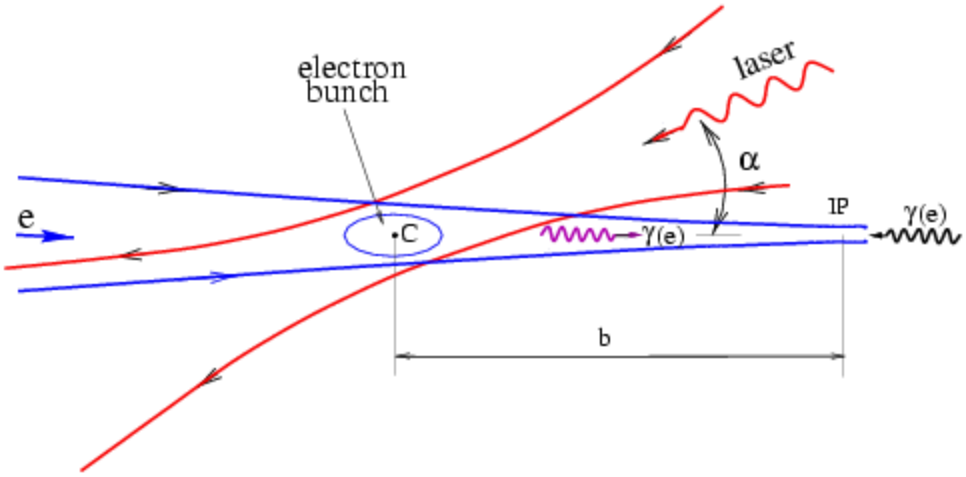


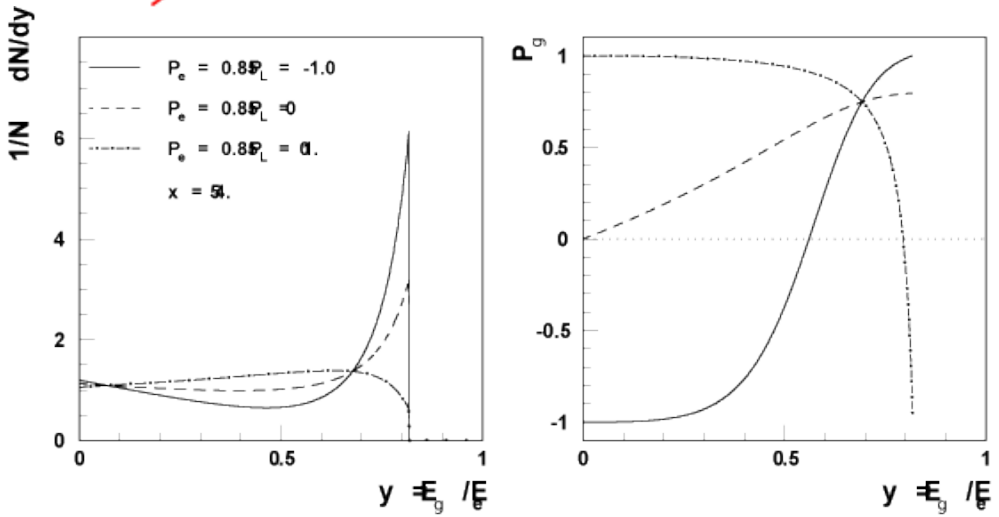
D. Asner et al (2001)

Photon Collider adds real value to the physics program in a complementary fashion to the e+e- experiments



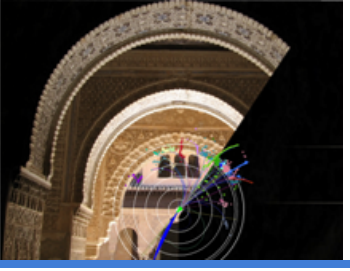
To create a Photon Linear Collider (PLC) just add lasers to the LC





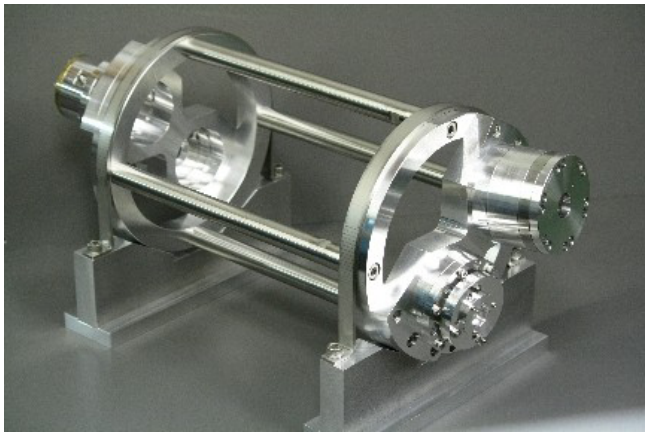
- Laser Compton interaction produces beam of high energy photons
  - Eg <= 0.8 Ebeam
- Peak has high circular polarization
  - Linear polarization is also possible
  - CP studies

For a cost effective laser, photon recirculation is a must



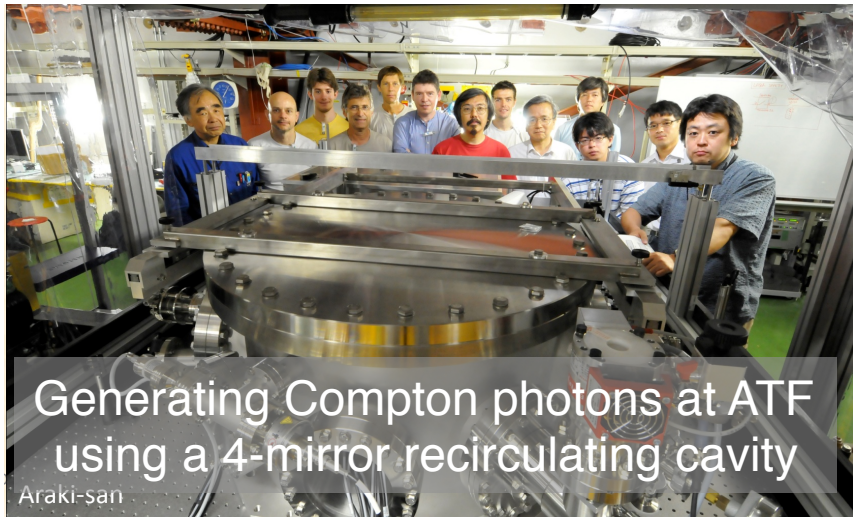
Compton light sources are developing the laser recirculation technology

4-Mirror recirculating laser cavity



T. Takahashi, Posipol 2011

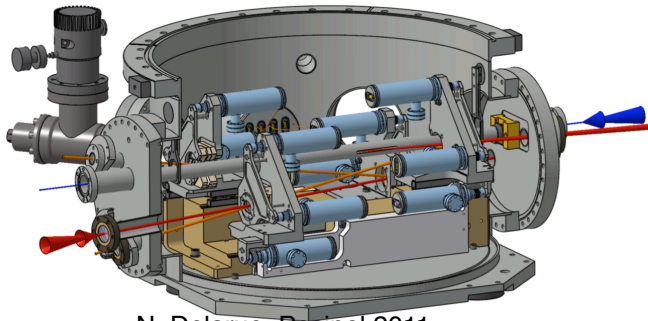
The MightyLaser Collaboration



- Recirculating cavities are being developed for:
  - Polarized positron source
  - Laser wire
  - Beam diagnostics
  - Medical and industrial applications
  - Photon collider

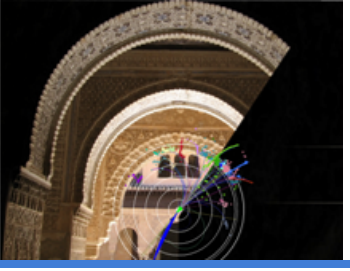
Electron pulse structure	Integrated flux over 0.2 ms	Integrated flux over 1 s (extrapolated)
1 train	1265 γ	6.3E+06 γ
2 trains	1289 γ	6.4E+06 γ
3 trains	1428 γ	7.1E+06 γ

I. Chaikovska, Posipol 2011



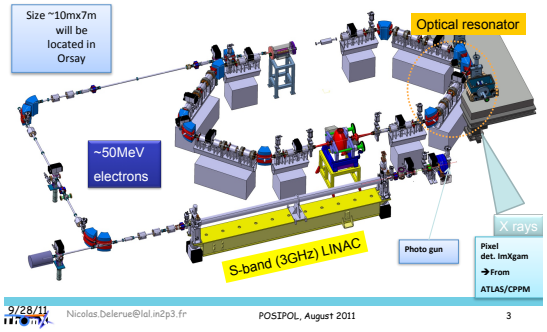
N. Delarue, Posipol 2011

Laser development is being pushed by applications inside and outside of HEP



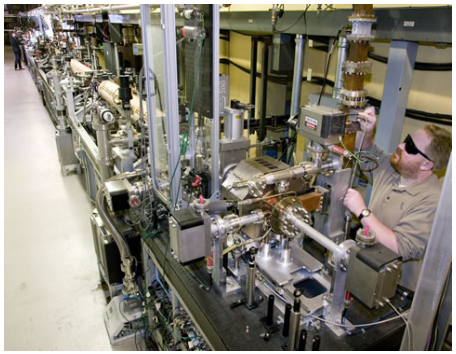
Compton based MeV gamma ray sources are under construction

ThomX (LAL)

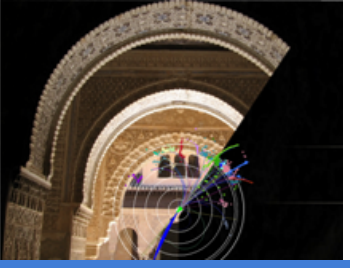


Q-beam (KEK)

T-REX (LLNL)



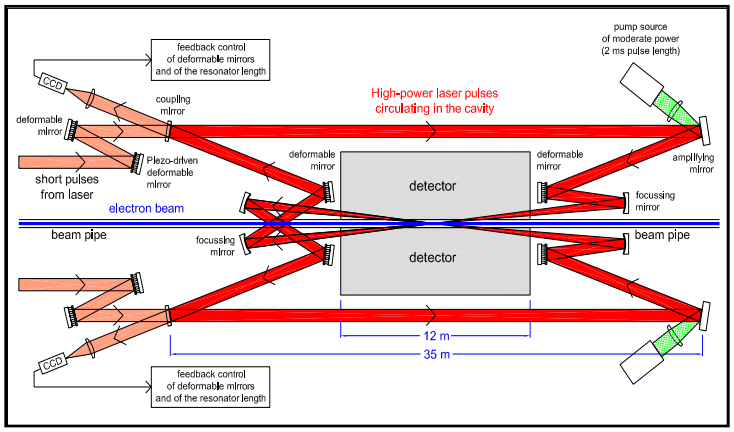
- Real experience with production systems for Compton gamma ray generation using recirculating laser cavities
- Synergistic - funded outside of LC program



Recirculating laser cavity solutions for the LC must respect the beam time structure

ILC

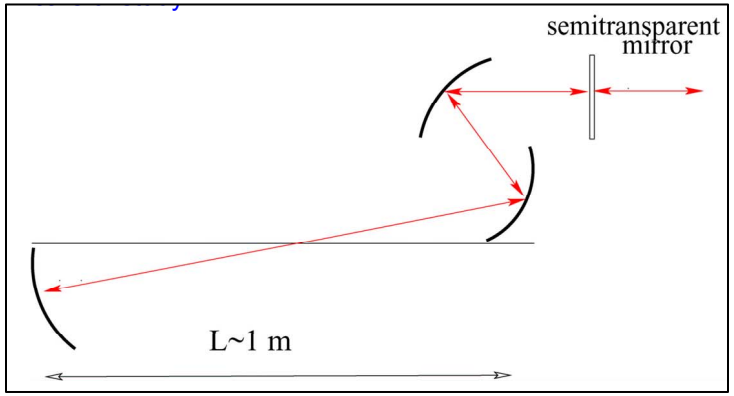
369 ns between bunches



K. Moenig

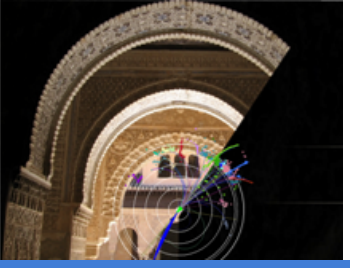
CLIC

0.5 ns between bunches



V. Telnov

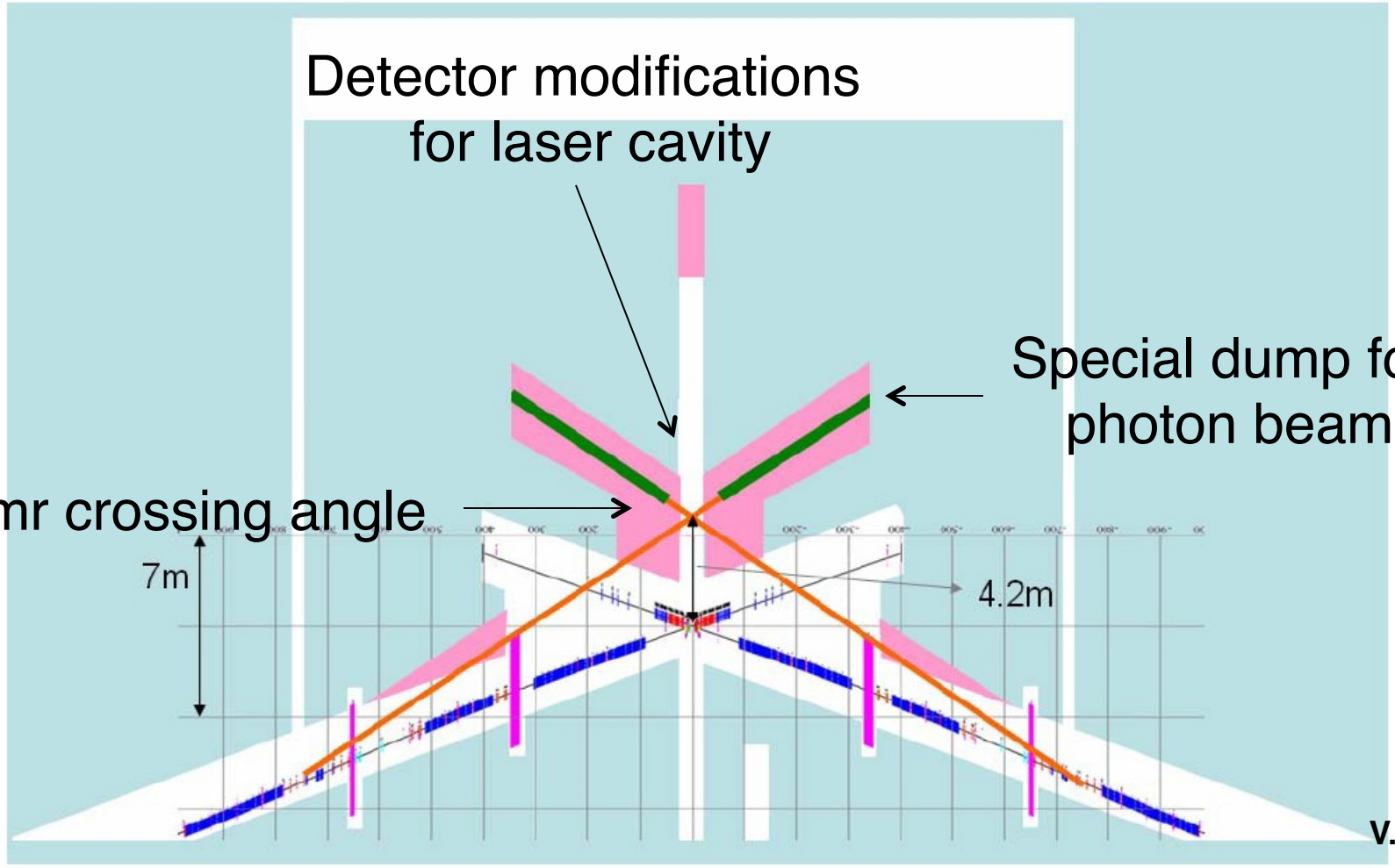
- DESY-Zeuthen/MBI recirculating cavity conceptual design (2001)
- Drive Laser Conceptual design (2010)
  - ~$20M for laser
- Concepts for CLIC being investigated
  - Smaller cavity
  - Multibunch cavity
  - One pass system



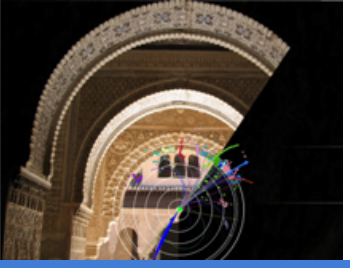
PLC has its own CFS requirements the disrupted beam needs a large crossing angle

14mr => 25mr

A.Seryi, LCWS06



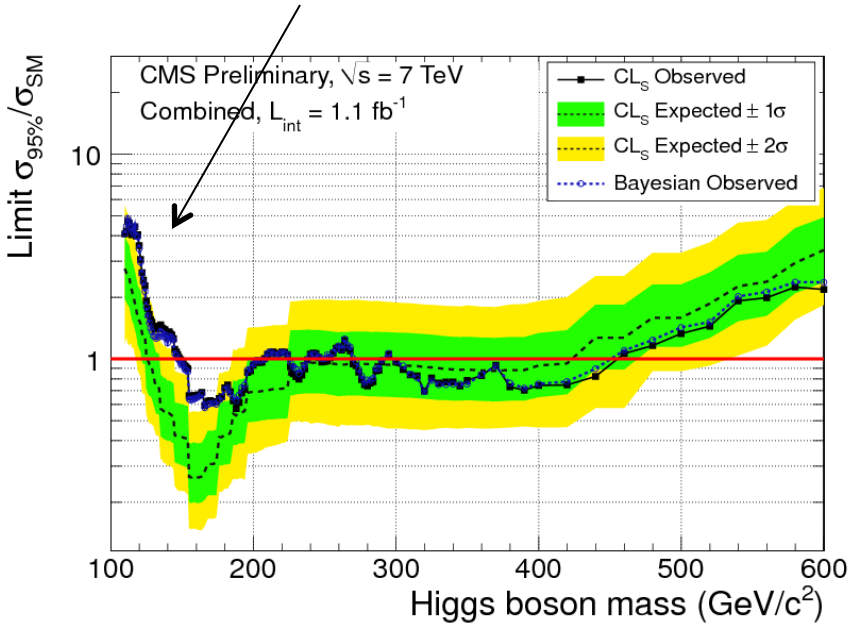
V. Telnov

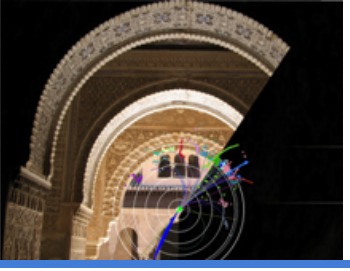


First physics from LHC hints at opportunities for the PLC

- Low energy photon collider Higgs factory can have some cost savings
- Photon collider is an e-e- machine
  - No positrons so don't need positron source
  - Don't need a flat beam, round is fine
  - Can a low-emittance RF electron gun remove the need to build damping rings?
  - Wakefield acceleration works better with electrons than positrons
- Possible first stage of LC?

Do we have a low-mass Higgs?





Summary

- Compton backscattering technology continues to progress driven by gamma-ray source programs
  - Demonstrations with real recirculating cavities
  - Gamma ray production facilities operational and under construction around the world

- First physics from LHC will soon reveal the landscape of the new physics opportunities

- There are scenarios for the physics and the technology where the Photon Linear Collider has a unique role to play