ERL Compton Scheme
Status of the Orsay activity

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DE L'ACCÉLÉRATEUR
LINÉAIRE

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Main problems of the Compton ERL source (all connected) :

1) Few photons per collisions
2) Stacking
3) Schemes

1) We are working on MIGHTYLASER (See Omori san talk) and multi-points collisions
2) We are working on capture optimization to reduce the energy spread
3) We are working on a scheme based on stacking shared in e+ / e- ring

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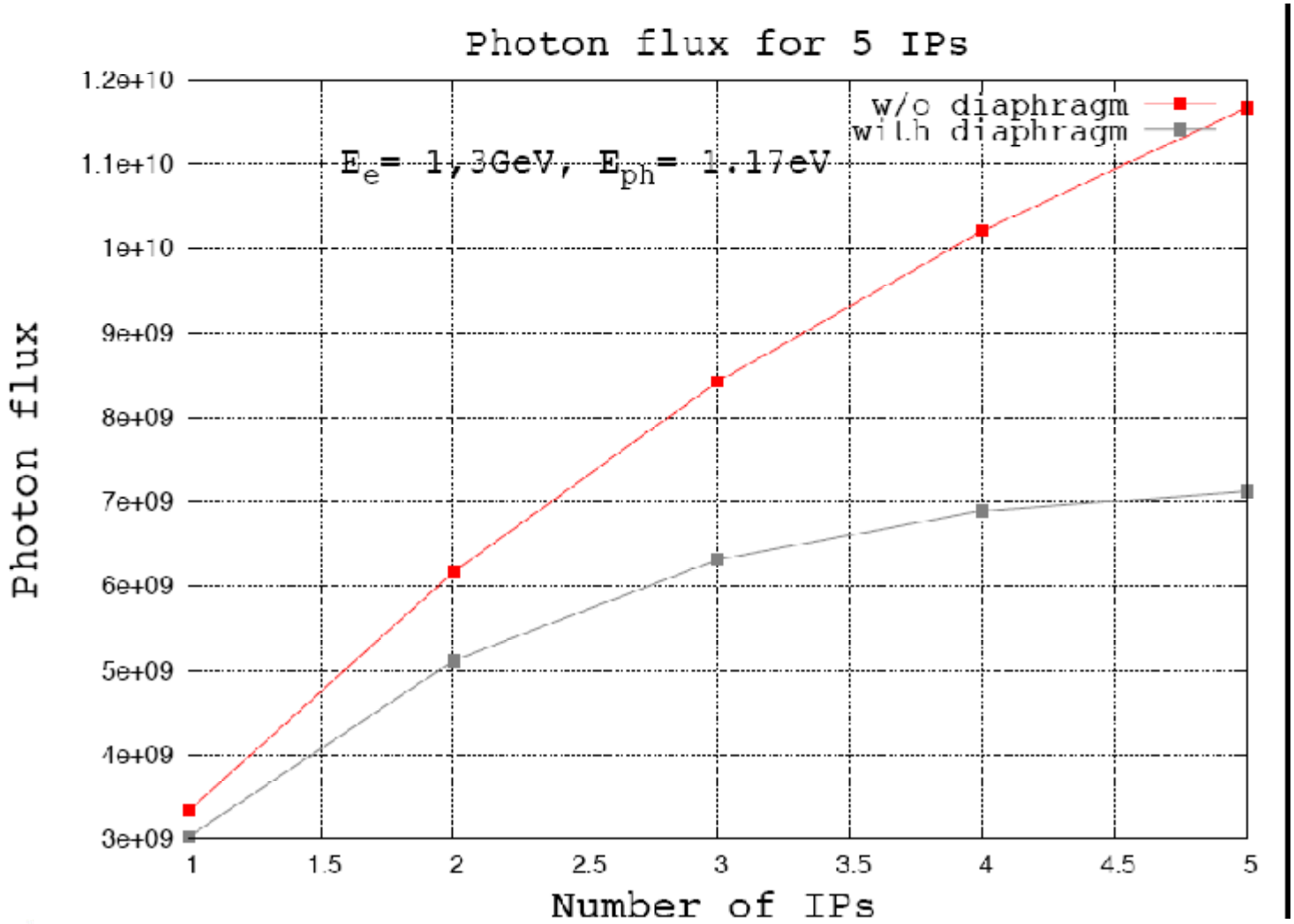
Multipoints collisions, simulations

Parameters:

Electron energy = 1.3 GeV
Electron bunch charge C= 1.6nC
Electron bunch length = 2 ps
ε = 0.675 nm rad
β = 0.16 m
2 crossing LASERS, 5 IPs:
LASER pulse energy = 0.6 J
LASER pulse length = 1ps
Crossing angle = 2°
Photon beam peak energy = 29.48 MeV
Positron yield $N_{e+} / N_\gamma = 1.8$
Y-ray yield $N_\gamma / N_e = 1.2$
Target, W: thickness 3mm

All the multi collisions simulations by I.Chaikovska

E =1.3 GeV, multi collisions



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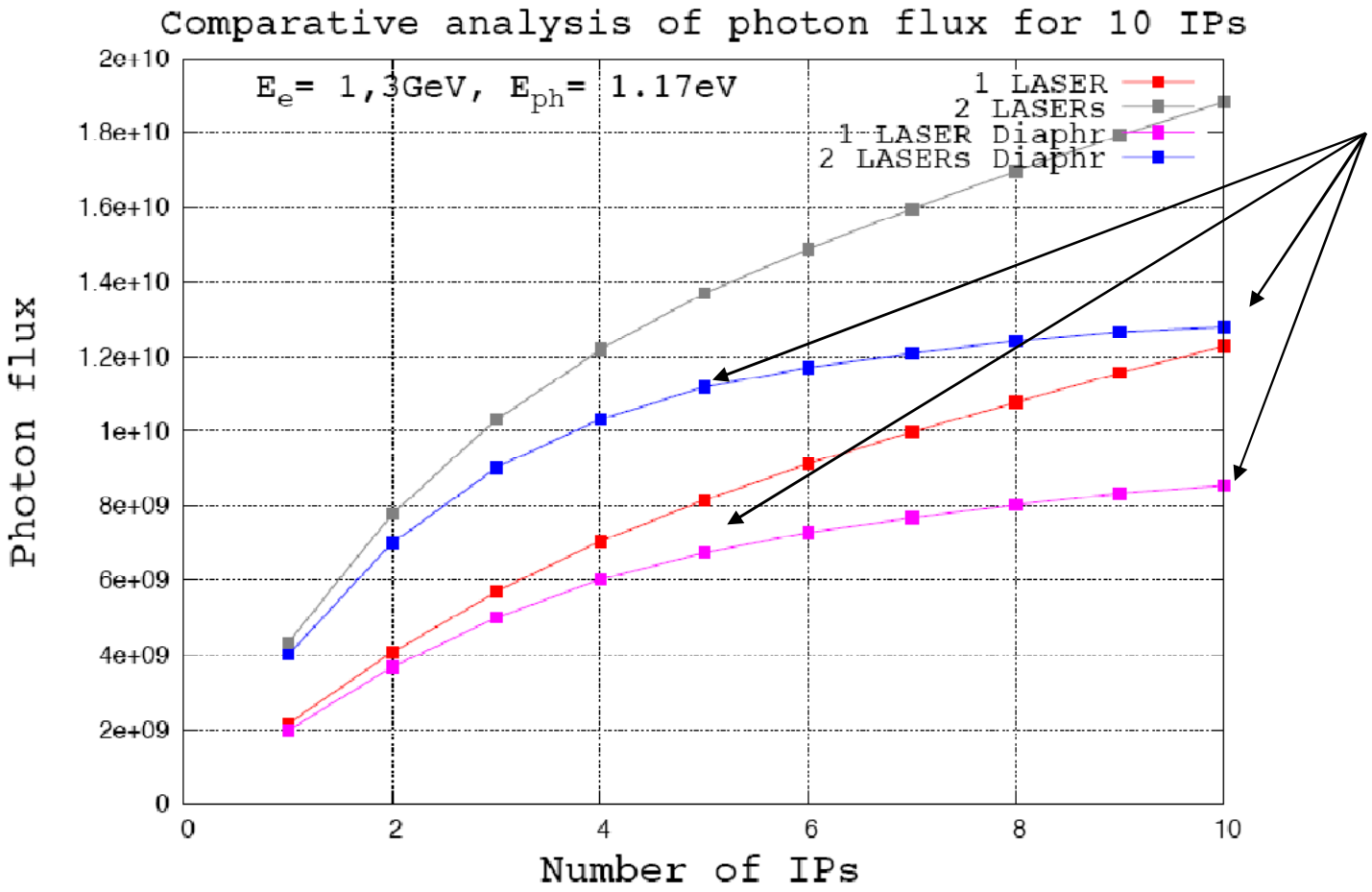
5 and 10 collisions points
No linearity : Chromatism and beam divergence



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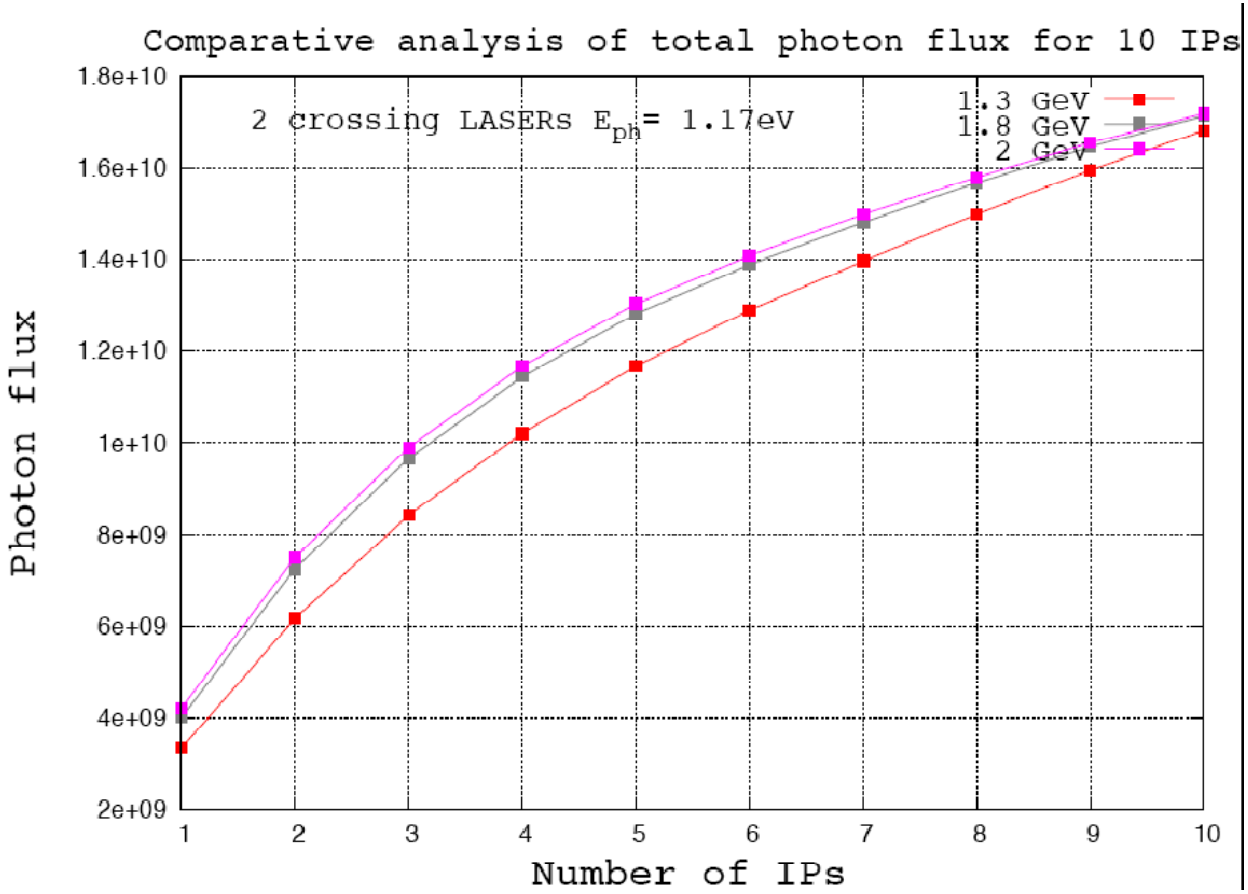
Energy dependence



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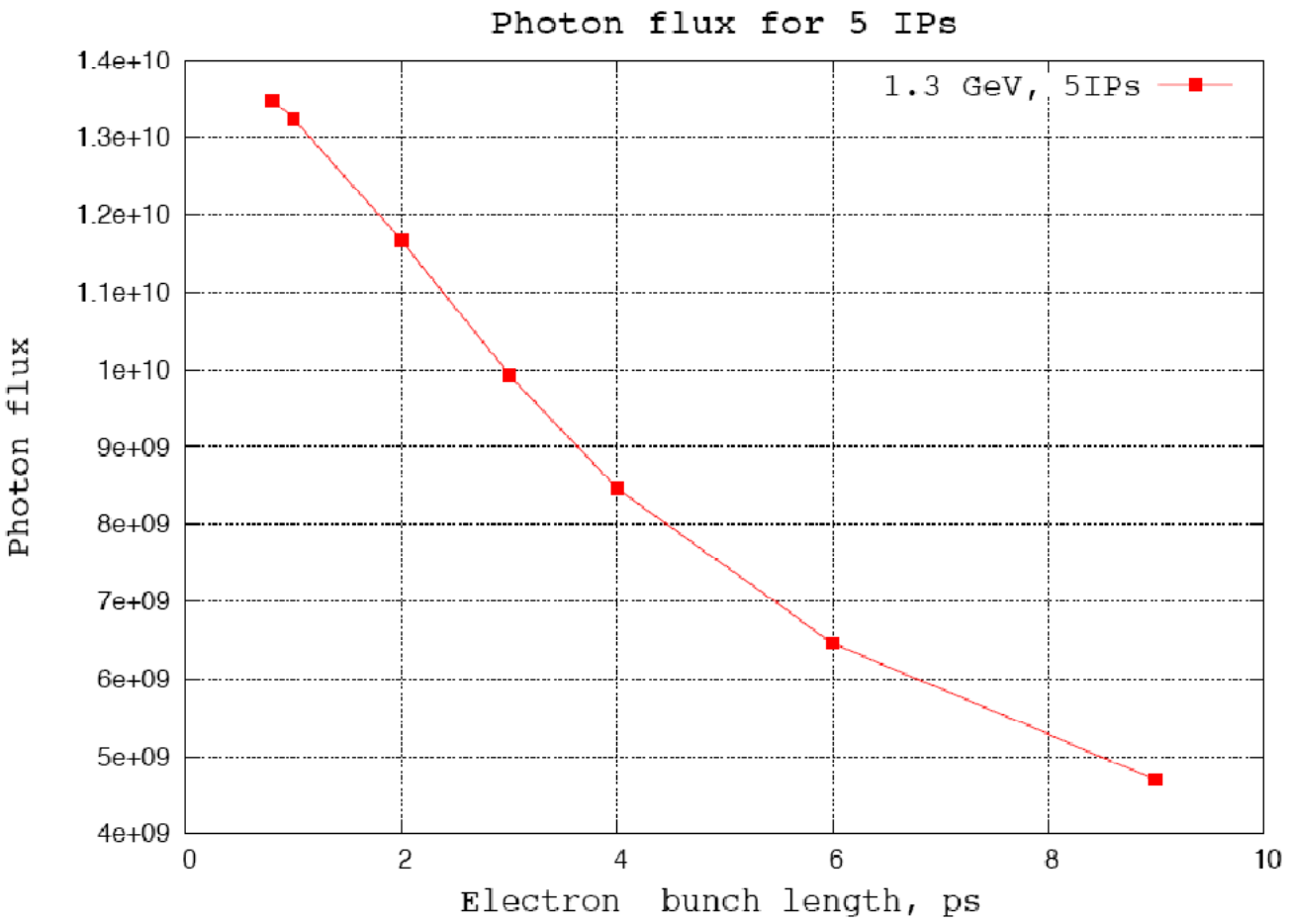
Bunch length dependence



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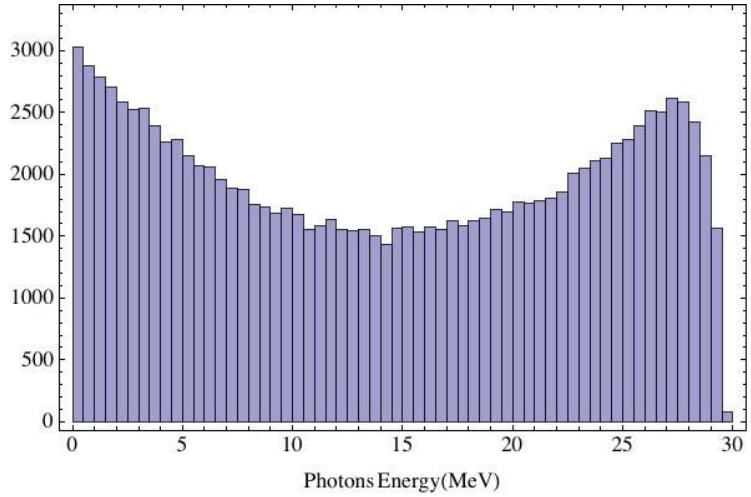
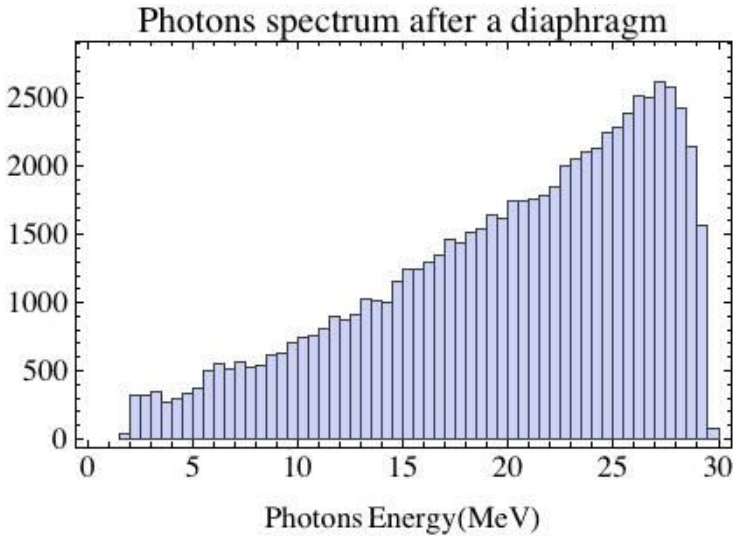
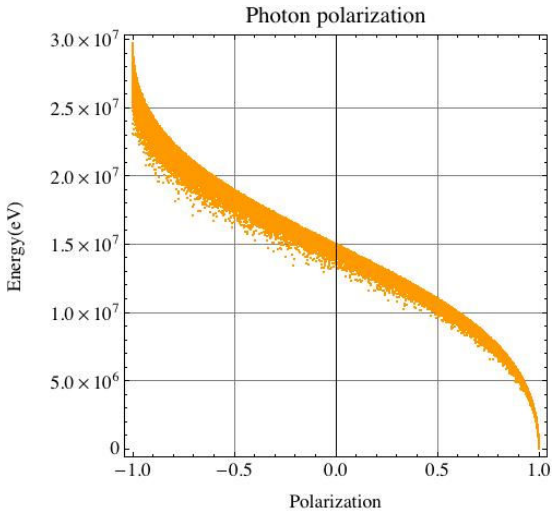
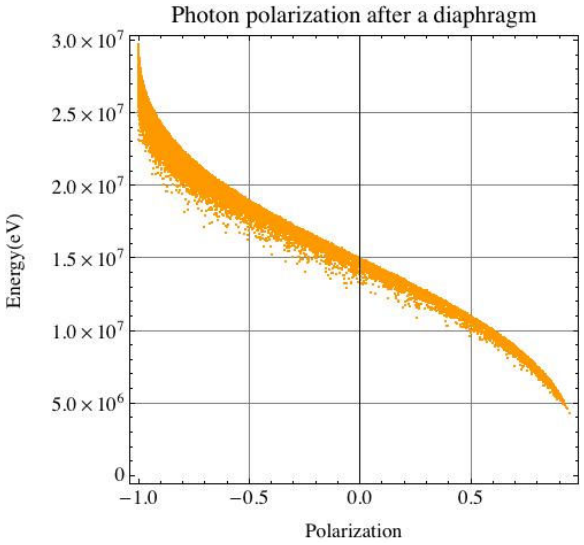
Photon spectrum an polarisation









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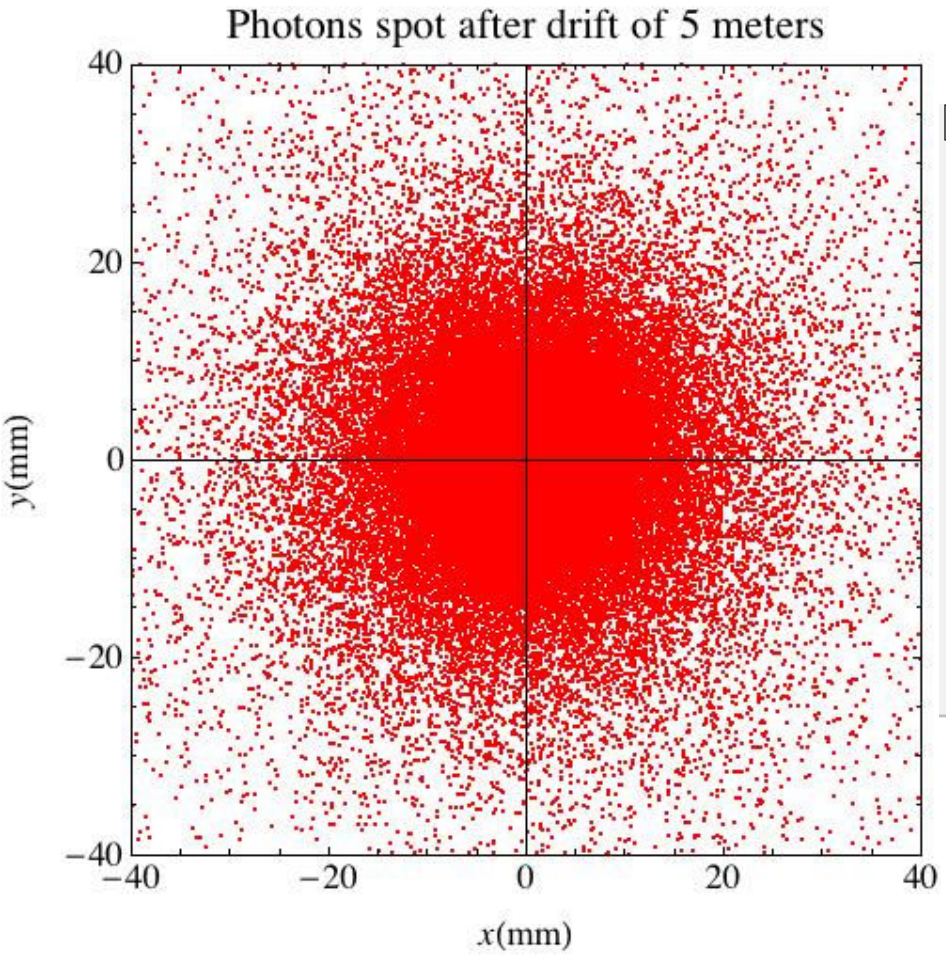
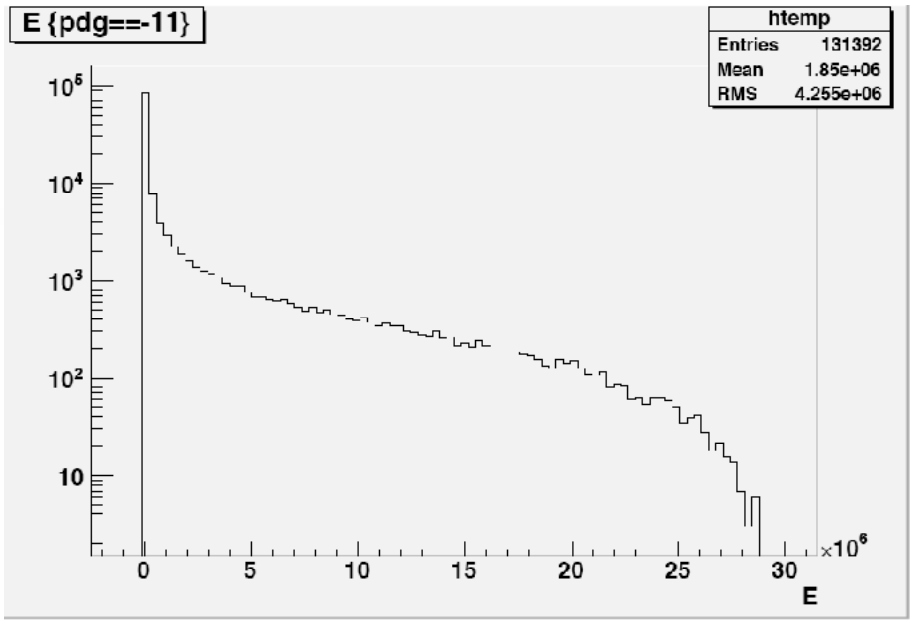
Photon spot and positron spectrum





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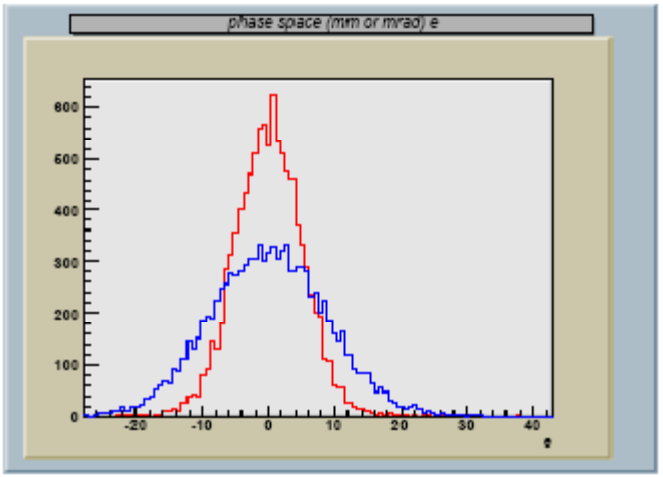
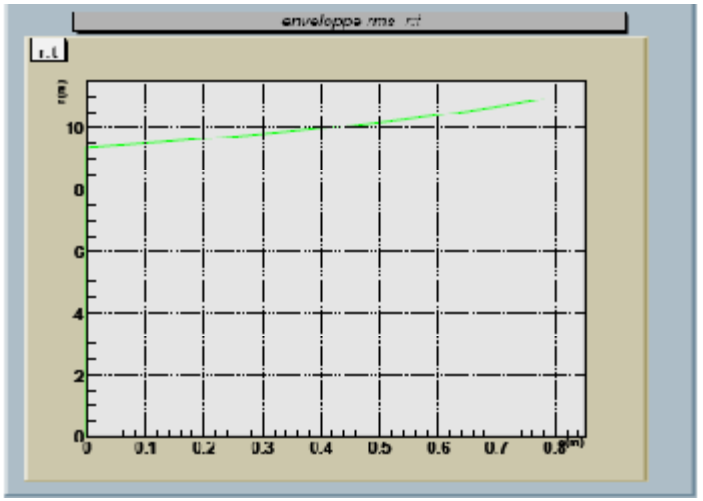
Stacking

- Longitudinal stacking.
- The main difficulties is to capture and transport wit a reduced energy spread
- We are working on a energy compressor

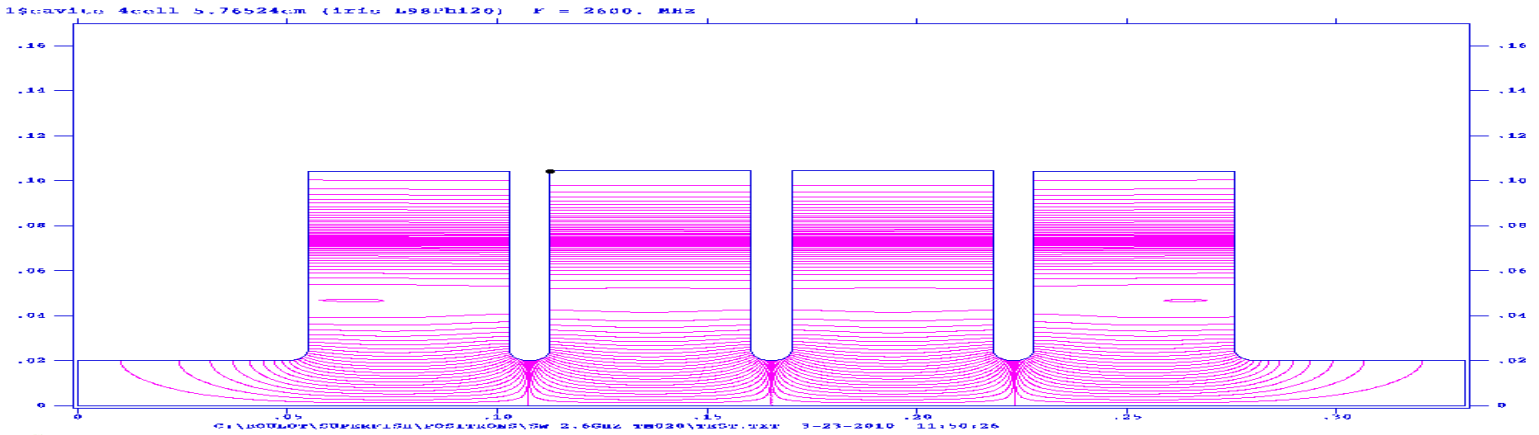
(G LeMeur, R Chehab)



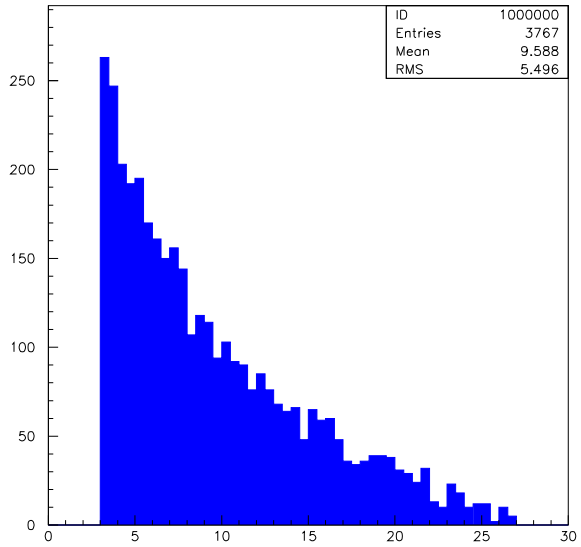


And on ΔE reduction in the capture phase Deceleration (SLAC type)

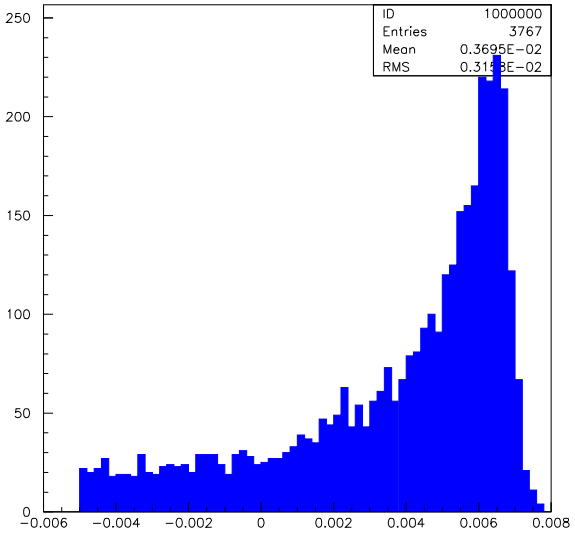
- Cavity used for deceleration
  - Standing Wave cavity
  - 4 Cells
  - 33.061 cm long
  - 4 MV/m (for deceleration)



Preliminary results : At exit of 1st Cavity



Energy (MeV)



Z (m)

Cavity Gradient = 4MV/m

Cavity phase = 250°

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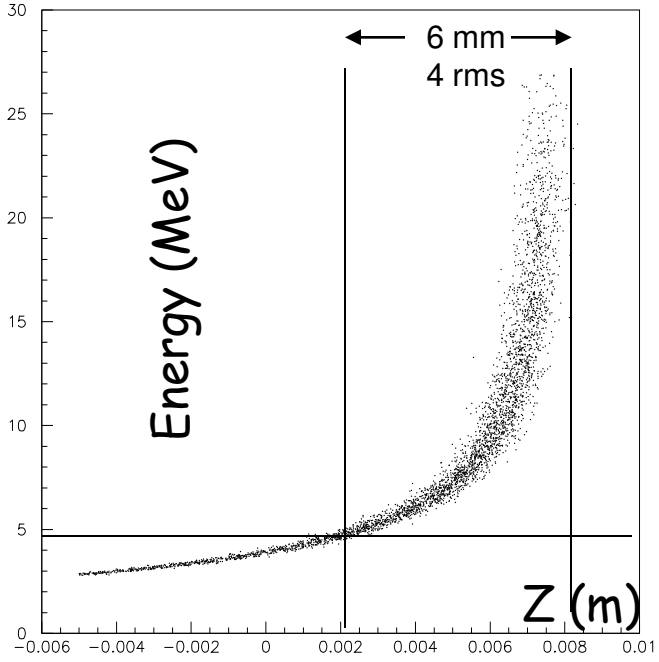
F. Poirier (LAL)



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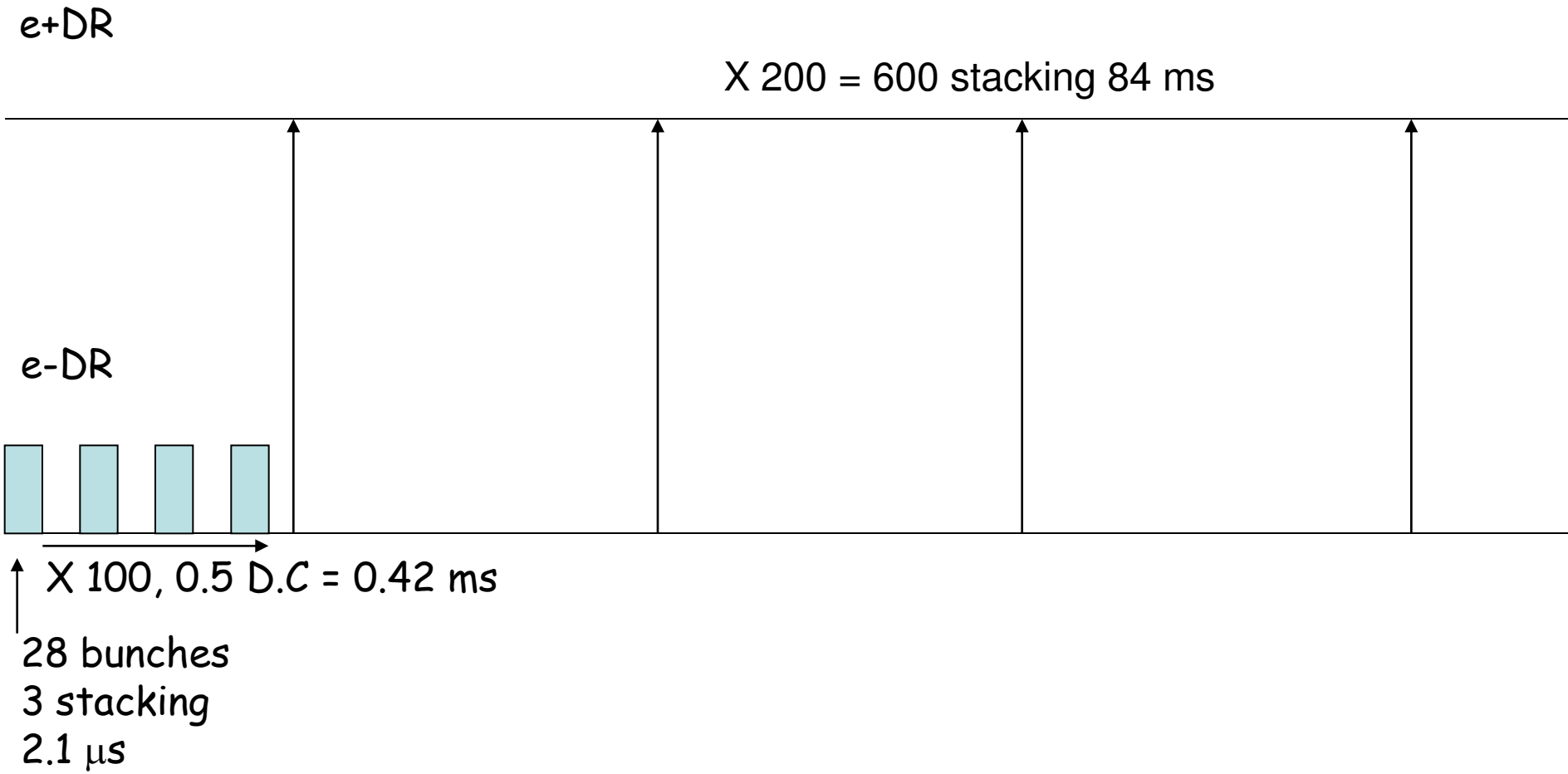
Stacking ILC scheme

- ERL re-circulating loop. So Duty cycle 0.5 if ERL CW
- Using e- and e+ damping ring
- 1) e- DR. 3 stacking X 26 bunches at 40 MHz = 1.95 μs
- 2) 0.5 DC => other 26 after 3.9 ms
- 3) 2600 bunches = 0.39 msec (3 stacking)
- 4) Everything in the e+ DR
- 5) Restart with the e- DR for 100 times
- 6) In e+ DR 100 stacking but beam cooled for 3.9 ms before stacking
- 7) Total 300 stacking in 39 ms – 750 in ~100 ms
- 8) 2 10 exp 10/ 750 ~2.5 10exp7 e+ bunch
- 9) If capture 2.5% ~ 1. 10exp9 gamma per crossing. 5 IP/2 lasers needs 0.05J pulse


e+DR
X 200 = 600 stacking 84 ms
e-DR
X 100, 0.5 D.C = 0.42 ms
28 bunches
3 stacking
2.1 μs

Conclusions

- We are working for the Compton source (ERL) with an experimental program and different ideas and simulations.
- Multiple collision point: works but limited to 5-6 with two crossing lasers
- Some scheme seems promising, but still need more thinking and a lot of work before to attend a engineering study.
- At present we have a little group working part time on LC (ILC and CLIC) and SuperB on both polarised and unpolarised sources.
- It is determinant that a strong effort is spent on these topics and we have not , at present, the available resources to study all the scheme and ideas that we can propose. It is important that the LC community realises the importance and the criticality of the positron sources and that the consequent resources are allocated.