

Sources

Parallel Session Summary

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Introduction

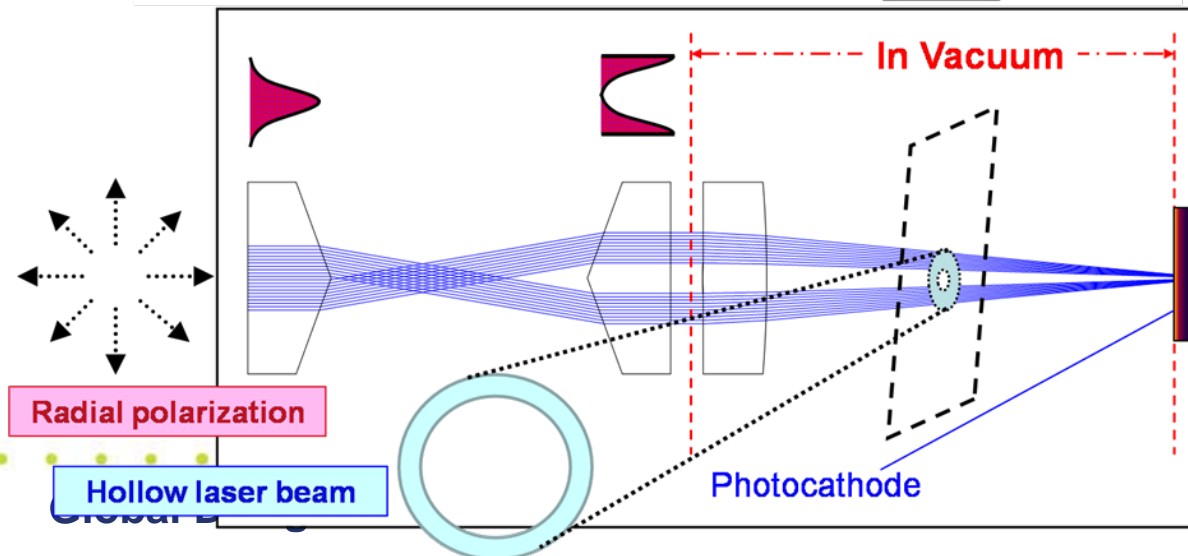
- 14 contributions (5 by Webex) covering wide range of sources
- This summary can't report on every talk!
- Positron Sources:
 - **Undulator based**
 - **Compton**
 - **Conventional**
 - **CLIC**
- Electron Sources:
 - **ILC**
 - **CLIC**



Electron Source Update Summary

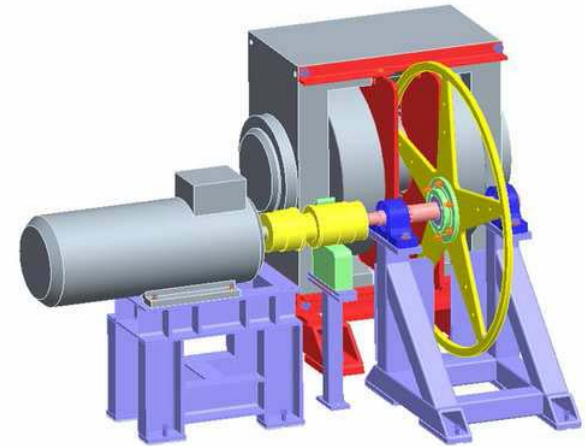
- DC-Gun development at Jlab with CEBAF synergy
 - ‘Joint’ project with ILC to develop a higher voltage DC gun
 - Inverted gun
 - Development of materials and techniques to suppress field emission
- Laser development
 - Progress, but slowed by amplifier pump laser problems
- Photocathode R&D
 - Studies of surface charge limit QE and polarization optimization are ongoing
 - Needs laser system to demonstrate performance of ILC beam

Experimental demonstration with metal cathodes has begun at Spring-8

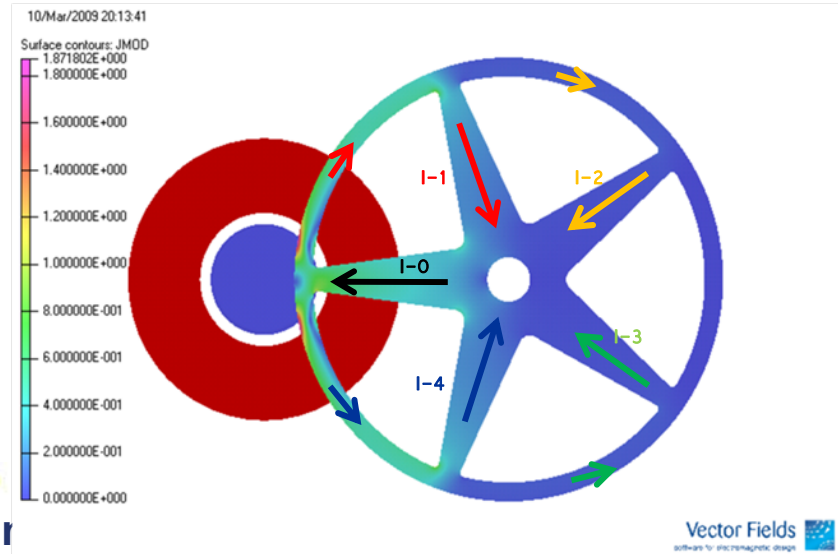
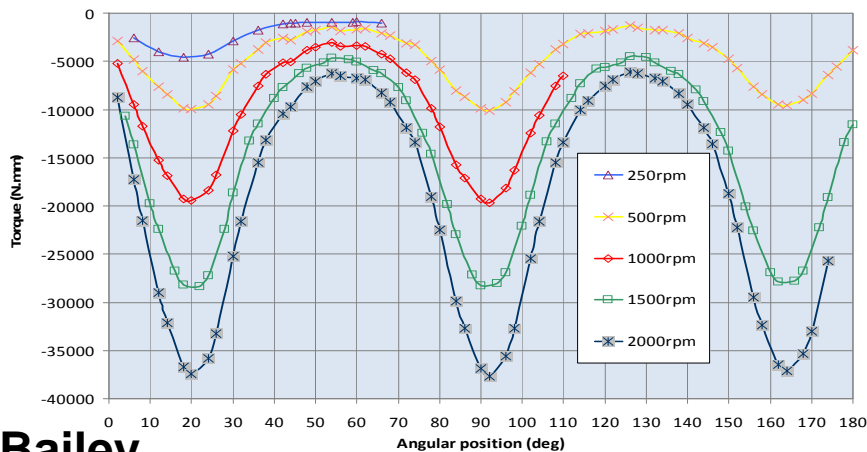


Baseline Target

- Eddy current test at Cockcroft Institute now underway
- More sophisticated model suggests spokes have big effect – so far data does not see this!



Retarding torque for different speeds, Bgap=0.489



Undulator

Powering test

Successful magnet powering test

Magnets @4K He liquid level in bath ~80%

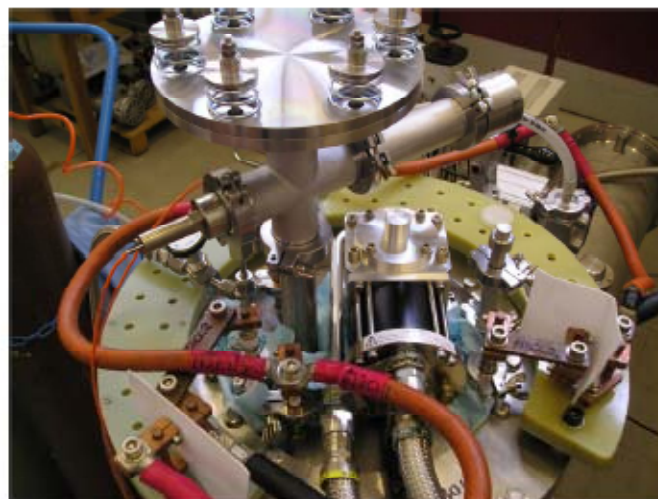
Powered magnet 1 independently straight to 260A no quench (note nominal operating current is 215A)

Powered magnet 2 independently to 260A no quench (note nominal operating current is 215A)

Powered both magnets in series directly to 280A no quench left running for 30mins and powered down.

Current leads stable at predicted operating temperatures

Continually leak checking beam tube no helium leaks above $1\text{e-}12$ mb/ls observed

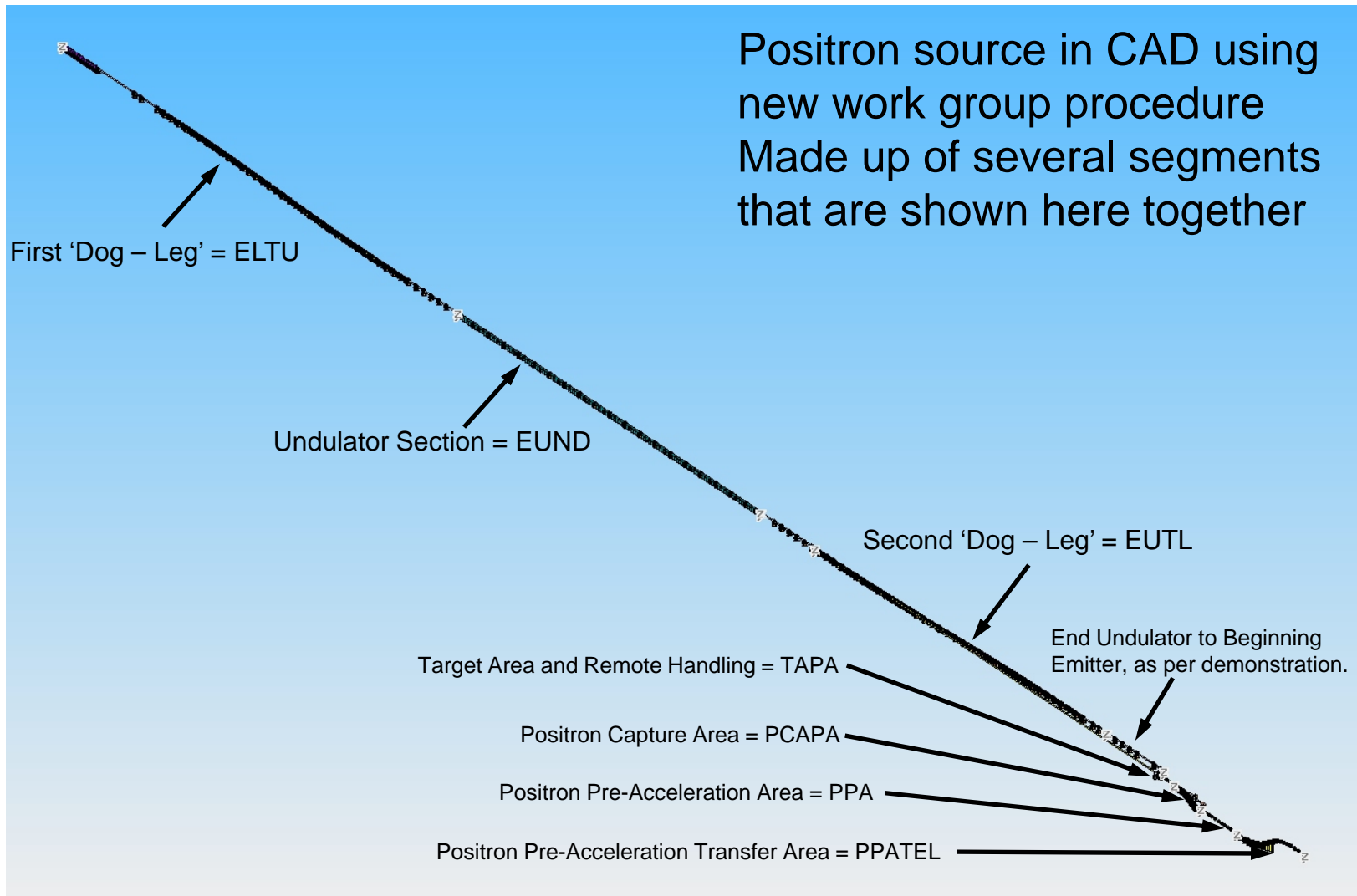




Undulator Beam Dynamics

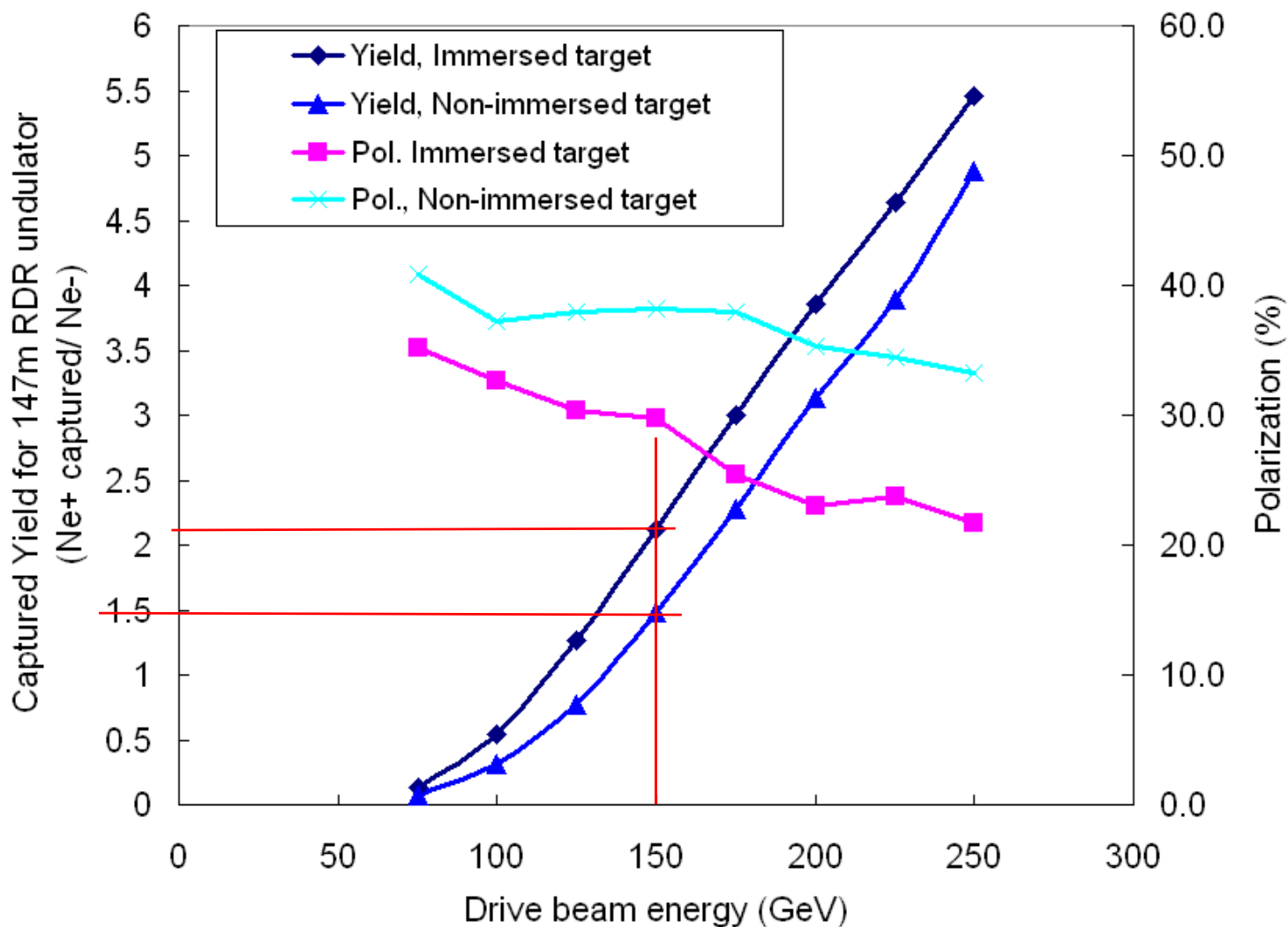
- Emittance increase due to quad misalignment and SR $\sim 0.4\text{nm}$ (average). OK
- Orbit angle change at quads $< 1/\gamma$. OK
- Angular kick due to electron jitter & transverse wakefield \ll electron beam divergence. OK
- Effect of beam pipe misalignment, need y error $\ll 240\mu\text{m}$. All undulators are assumed to be on movers. Online alignment possible. Probably OK.

Positron source in CAD using
new work group procedure
Made up of several segments
that are shown here together



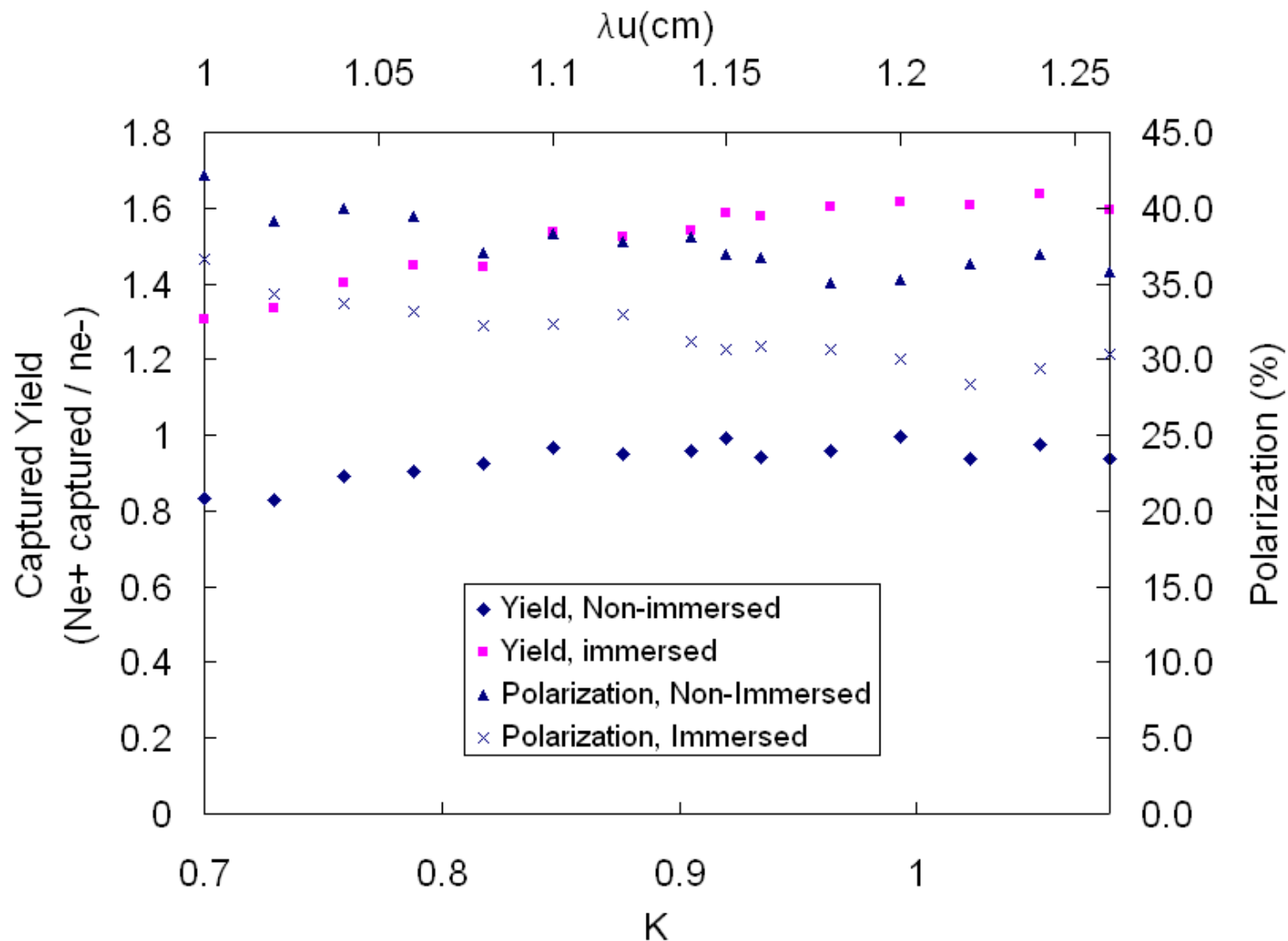
Minimum Machine

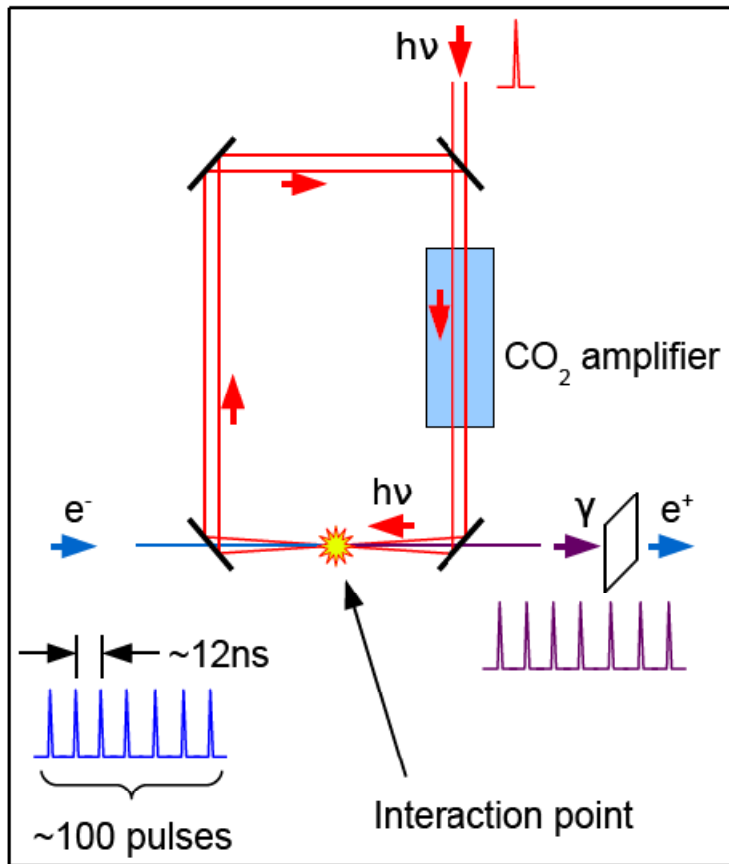
- RDR undulator, 147m long



Minimum Machine

- 120GeV Drive Beam. 210m undulator



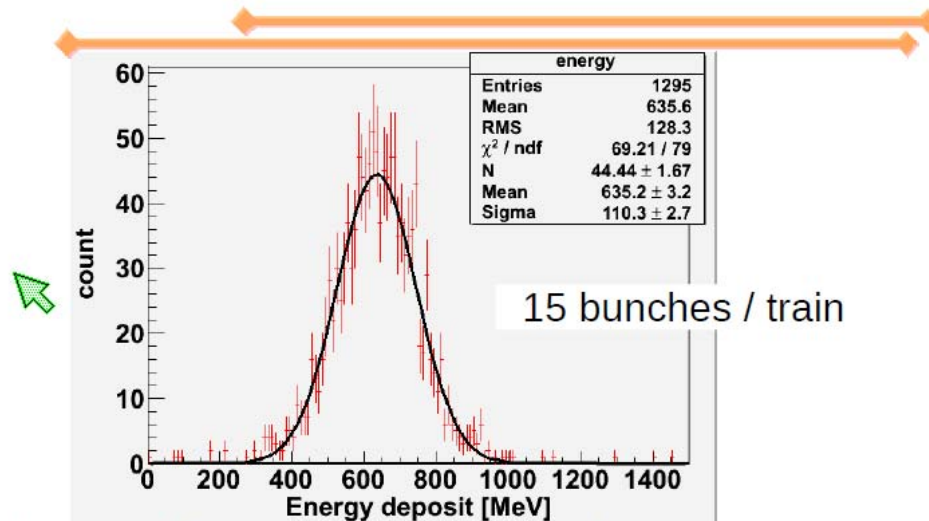


- Advanced computer program for simulation of short pulse amplification in multipass cavity is developed
- Diagnostics tools for measuring (sub-) picosecond pulse duration and time profile are implemented
- Preferred regimes of picosecond pulse amplification in multipass cavity are determined using a newly developed simulation software
- Advantage of isotopic CO_2 mixture is demonstrated in computer simulations
- Qualitative agreement between proof-of-principle experiment results and computer simulations is achieved


Compton Experiment on ATF

- Test of 2 mirror cavity
 - feedback system recently demonstrated lock of 3 separate conditons
 - Gammas counted for various bunch numbers per train

Result



We detected 27 gamma-rays / bunch train.
generation 60 gamma-rays / train to all angle.

 $60 \times 2.16 \text{ MHz} \sim 1.2 \times 10^8$ [gamma / second]
Revolution

KEK have now
started 4 mirror
cavity R&D – higher
enhancement,
smaller spot size

Two Proposals

- **LowE e- driven: e+ generation in 1 ms**
 - Liquid Pb target + Li lens
 - Drive e- beam: 2.2 GeV, 4.5 nC, 5 Hz, SC Linac
 - e+ booster : 5 GeV, 5 Hz, SC Linac
 - Aiming cheap.
 - Timing structure in source&inj is the same as the baseline.
 - Risks in target & Li lens --> need R/D
- **300 Hz generation: e+ generation in 63 ms**
 - (a) Liquid Pb target + Flux concentrator
 - Drive e- beam: 2.2 GeV, 5.9 nC, (LowE) 300 Hz, NC Linac
 - e+ booster : 5 GeV, 300 Hz, NC Linac
 - (b) Hybrid Target + Flux concentrator
 - Drive e- beam: 10 GeV, 2.1 nC, 300 Hz, NC Linac
 - e+ booster : 5 GeV, 300 Hz, NC Linac
 - Aiming mature and low risk.
 - Need R/D of targets

- Low E option

ANL's study shows that Pb boiling is a serious issue. Larger spot size and higher flow speed avoid the boiling.

Brazing of the BN window will melt much lower than Pb boiling, if Pb flow is touching. We need the design to protect the window brazing.

- 300Hz, 63ms option

- **Requires advanced lead or hybrid target technology otherwise multiple targets**
- **~7 damping times in DR should be ok**



KEK Beam Test Plans

- Window tests on KEKB now in doubt
- Liquid lead target tests on ATF Linac to go ahead

Energy density on target

0.006 to 48 $\times 10^{10}$ GeV/mm²

Power deposit on target

0.004 to 300 $\times 10^{10}$ GeV/mm² s

Acceptable beam rep. rate?

**What is meaningful
beam experiments for
ILC liquid target?
This is under discussion.**

- Hybrid target tests also to go ahead on ATF Linac



KEK Beam Test Plans

- Liquid Lithium Lens – Need a design work for ILC positron beam by BINP. Just need the design. Hardware R&D is impossible at present.
- 4m undulator on ATF Linac now under discussion. Need to check beam quality compatible