

WG3a: ILC Sources: Electrons and Positrons

J. Clarke (CCLRC), M. Kuriki (KEK), P. Piot (FNAL/NIU), J. C. Sheppard (SLAC)



2005 International Linear Collider Physics and Detector Workshop
and Second ILC Accelerator Workshop
Snowmass, Colorado, August 14-27, 2005

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Sources

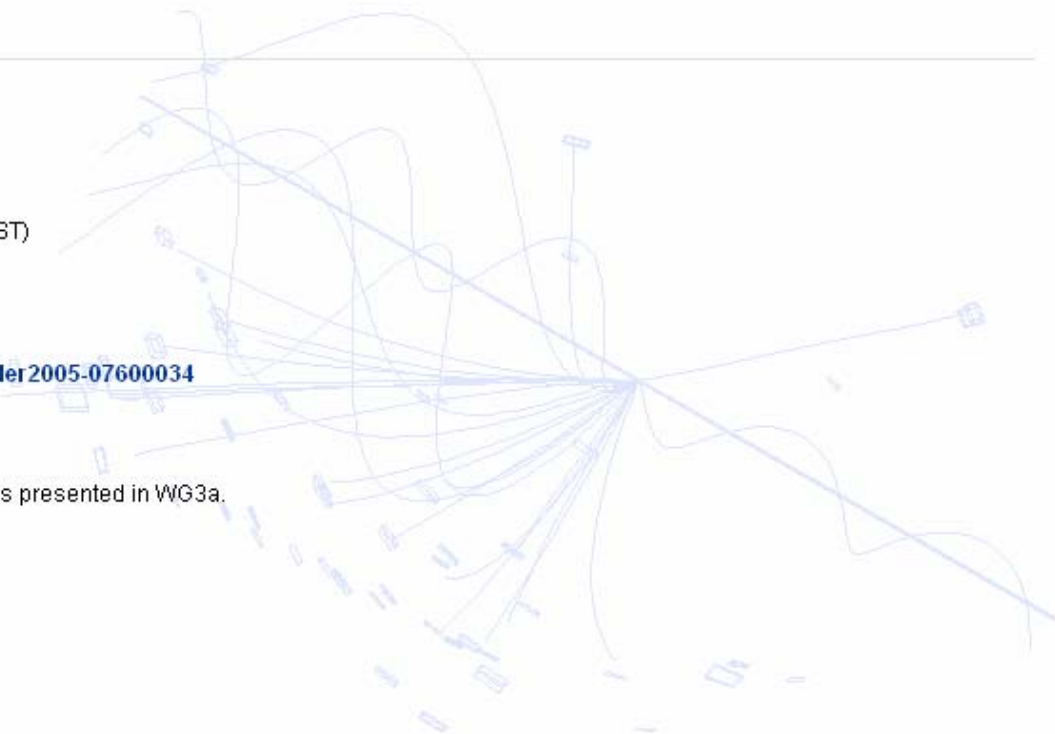
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WG3a (particle source) Agenda
Revised at August 12, 12:00 (JST)

Working Group Leaders

Positron Collection in Linear Collider2005-07600034
Yuri Batygin (SLAC)

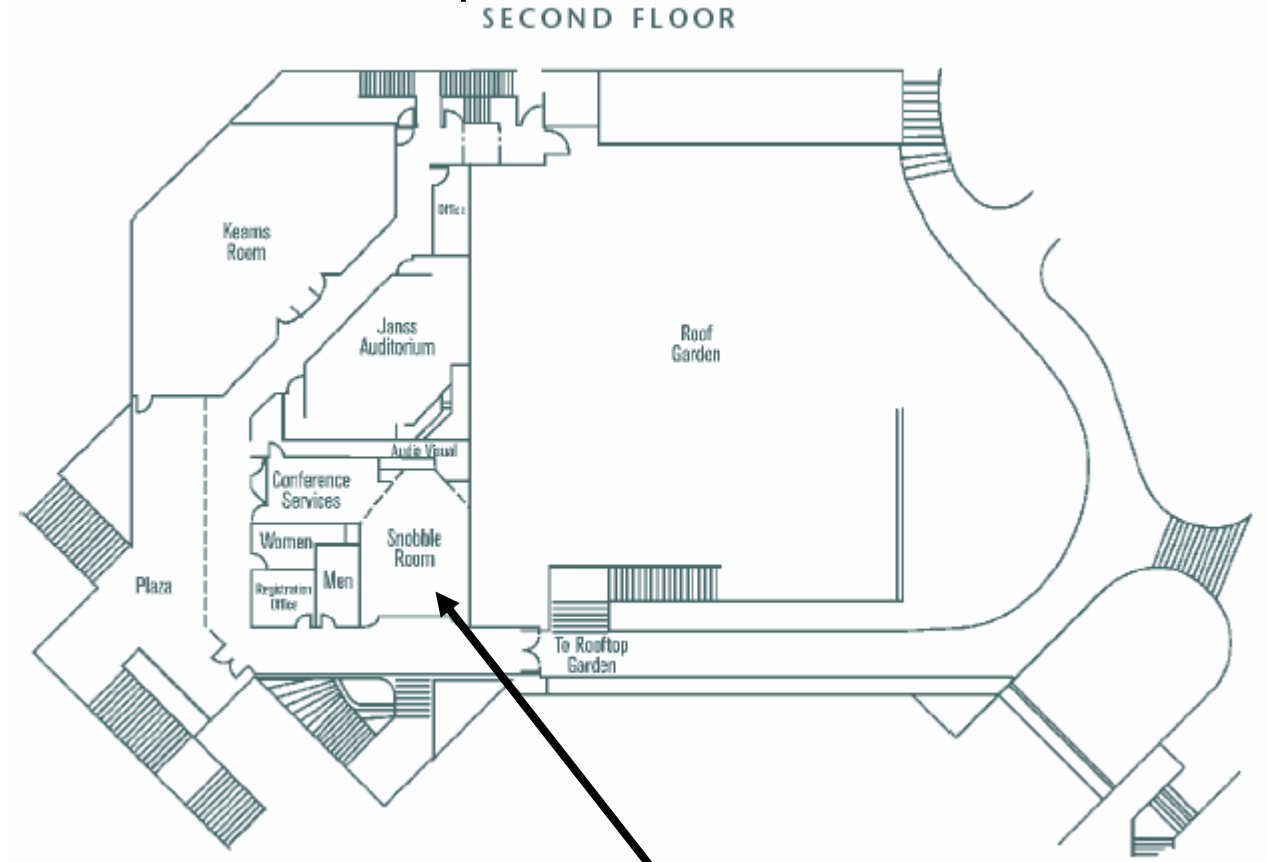
WG3a talks
This folder contains the talk files presented in WG3a.



WG3a: ILC Sources: Electrons and Positrons

Tuesday-Wednesday-Thursday: Morning and Afternoon

Snobble Room: Upstairs in this Conference Center



WG3a: Snobble Room

WG3a: ILC Sources

Tuesday: 08:30-12:00 and 13:30-15:30

WG3a (particle source) Agenda

Revised at August 12, 12:00 (JST)

Room : Conference center Snobble

05/8/15	Monday				
14:45	0:45	Plenary	WG3a goal	J. Sheppard (SLAC)	
05/8/16	Tuesday				
8:30	1:00	WG3a	8:30 0:10	Intro to WG3a	Piot
			8:40 0:35	Positron Targets	W. Stein (LLNL)
			9:15 0:15	Positron Collection in Linear Collider	Y. Batygin (SLAC)
9:30	0:30	Break			
10:00	2:00	WG3a	10:00 0:20	Conventional Scheme overview	V. Bharadwaj (SLAC)
			10:20 0:30	Capture Simulations	W. Gai and W. Liu (ANL)
		Positron source 1	10:50 0:20	Capture RF	J. Wang (SLAC)
			11:10 0:30	Possible risk and R&D Plan / IPPAK	M. Kuriki(KEK)
			11:40 0:20	Discussion	All/Bharadwaj
12:00	1:30	Lunch Time			
13:30	2:00	WG3a	13:30 0:20	Injector overview and design considerations	P. Piot (NIU/FNAL)
			13:50 0:20	Alternative DC photo-injector optimizations	M. Tigner (Cornell)
			14:10 0:20	R&D on HV DC photo-cathode gun	M. Yamamoto (Nagoya)
		Electron source 1	14:30 0:20	R&D on RF N-cooled photo-cathode gun	Fillier (FNAL)
			14:50 0:20	R&D on RF PWT photo-cathode gun	Yu (Duly research Inc)
			15:10 0:20	Discussion	All/Piot
15:30	0:30	Break			

WG3a: ILC Sources

Wednesday: 09:30-12:00 and 13:30-15:30

05/8/17	Wednesday			
8:30	1:00	Preview	8:30 0:10 Summary to Date and Schedule	M. Kuriki (KEK)
9:30	0:30	Break		
10:00	2:00	WG3a	10:00 0:15 E166 Status	A. Mikhailichenko (Cornell)
			10:15 0:30 Undulator Scheme overview	D. Scott (Daresbury)
			10:45 0:15 Middle or End of Linac?	Sheppard/Floettmann
		Positron source 2	11:00 0:30 Possible risk and R&D Plan	Clarke (Daresbury)
			11:30 0:30 Discussion	All/Sheppard
12:00	1:30	Lunch Time		
13:30	2:00	WG3a	13:30 0:20 photo-cathode	N.Yamamoto(Nagoya)
		Electron source 2	13:50 0:20 Laser R&D	A. Brachmann (SLAC)
			14:10 0:30 baseline design	K. Flöttmann (DESY)
			14:40 0:50 Discussion + R&D plan drafting	All/Brachmann
15:30	0:30	Break		

WG3a: ILC Sources

Thursday: 08:30-12:00 and 13:30-15:30

05/8/18		Thursday				
8:30	1:00	WG3a	8:30	1:00	Review of progress and discussion of open issues	Piot and Bharadwaj
9:30	0:30	Break				
10:00	2:00	WG3a	10:00	0:50	Compton Scheme overview	T. Omori(KEK) /K.Moenig(DESY)
			10:50	0:20	Possible risk and R&D Plan	J. Urakawa(KEK)
		Positron source 3	10:50	0:30	Discussion	All
			11:10	0:20	Positron Source Assessment Guide Line	M. Kuriki(KEK)
12:00	1:30	Lunch Time				
13:30	2:00	WG3a	13:30	0:30	Pros and Cons	All/Piot
		Positron source 4	14:00	0:30	Possible scenario	All/Kuriki
			14:30	1:00	Discussion	All/Sheppard
15:30	0:30	Break				

Friday: 14:30 in Main Ballroom: WG3a Week 1 Summary

05/8/19	Friday				
8:30	1:00	Summary Preparation			
9:30	0:30	Break			
10:00	2:00	GG summaries			
12:00	1:30	Lunch Time			
13:30	0:30	WG1 summary			
14:00	0:30	WG2 summary			
14:30	0:30	WG3a summary	WG3a summary	J. Clarke	

Goals for WG3a

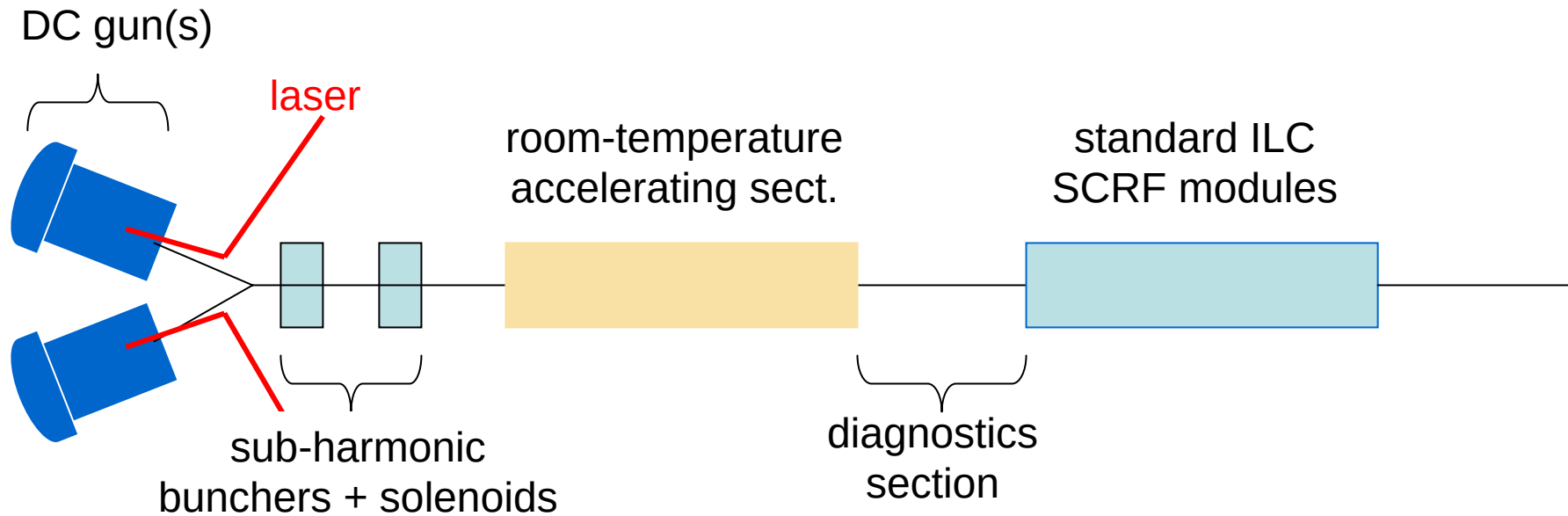
Review ILC electron and positron source requirements. Review proposed source designs. Make recommendation for the baseline reference design. Develop list of R&D tasks. Discuss design options. Propose a timeline for the development of the ILC sources which includes criteria and milestones for technology selection. Make a list of current activities; make a list of institutional interest in future development activities.

(plus more)

ILC Source Requirements

Parameter	Symbol	Value	Units
Particles per bunch	n_b	$2 \times 10^{10} (1 \times 10^{10})^{\dagger}$	e^- or e^+
Bunches per pulse	N_b	$2820 (5600)^{\dagger}$	number
Bunch Spacing	T_b	~ 300	ns
Pulse Repetition Rate	f_{rep}	5	Hz
Energy	E_0	5	GeV
DR Transverse Acceptance	$A=2J$	0.04	m-rad
DR Energy Acceptance	$\Delta E/E$	1	%,FW
Overhead Factor	F_c	1.5	number
Electron Polarization	P_e	>80	%
Positron Polarization (option)	P_p	~ 60	%

ILC polarized electron source (PES), - possible baseline -



Laser requirements:

pulse energy: $\sim 2 \mu\text{J}$
pulse length: $\sim 2 \text{ ns}$
pulses/train: 2820
Intensity jitter: $< 5 \%$ (rms)
pulse spacing: 337 ns
rep. rate: 5 Hz
wavelength: 750-850 nm

DC gun:

$>120 \text{ keV}$ HV (TDR)
VHV gun? JLab, Cornell, Nagoya

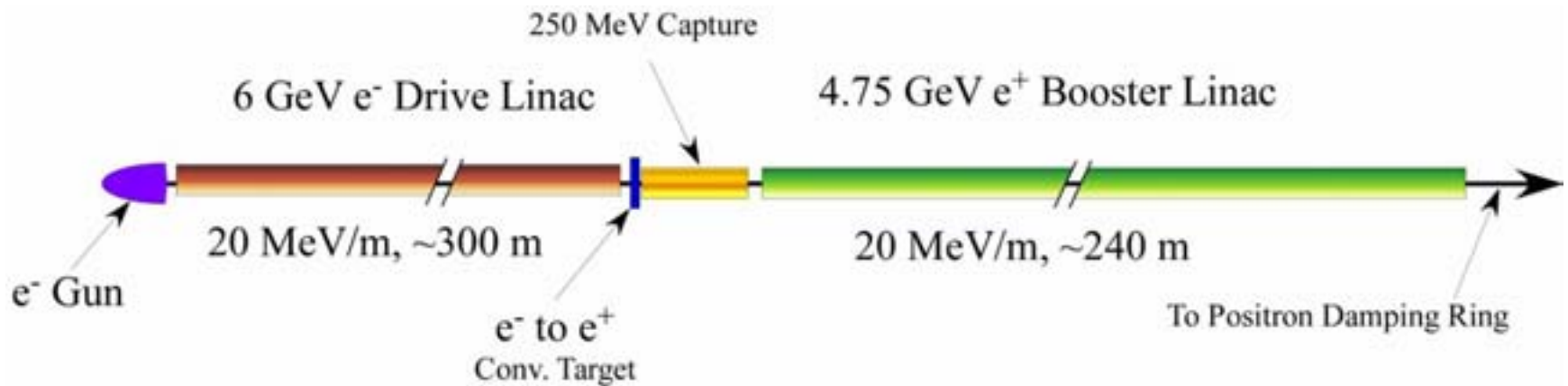
photocathodes:

GaAs/GaAsP

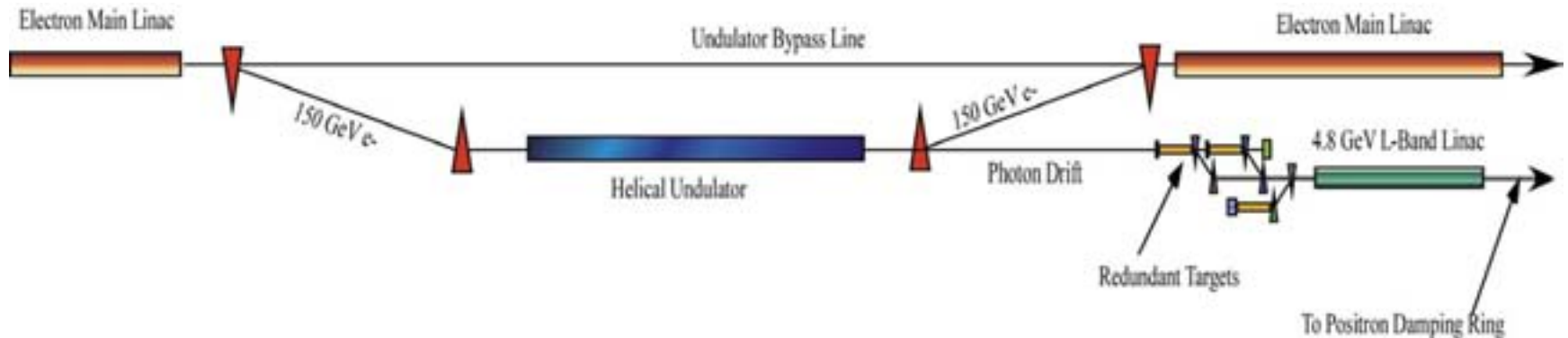
Room temperature linac:

Allows external focusing
by solenoids
Same as e^+ capture linac

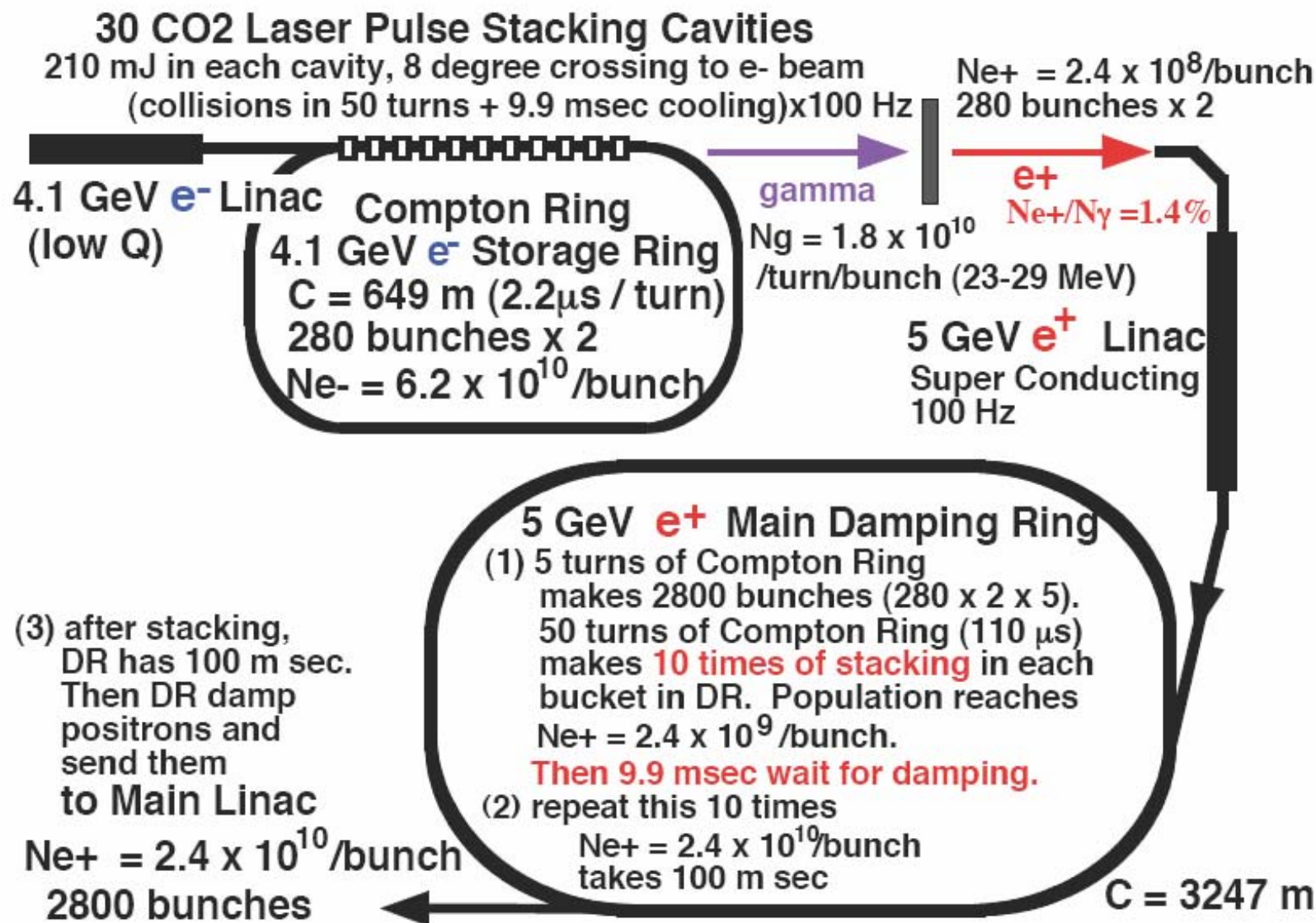
Conventional Non-Polarized Positrons



Undulator-Based Polarized Positrons (Undulator Option 2)

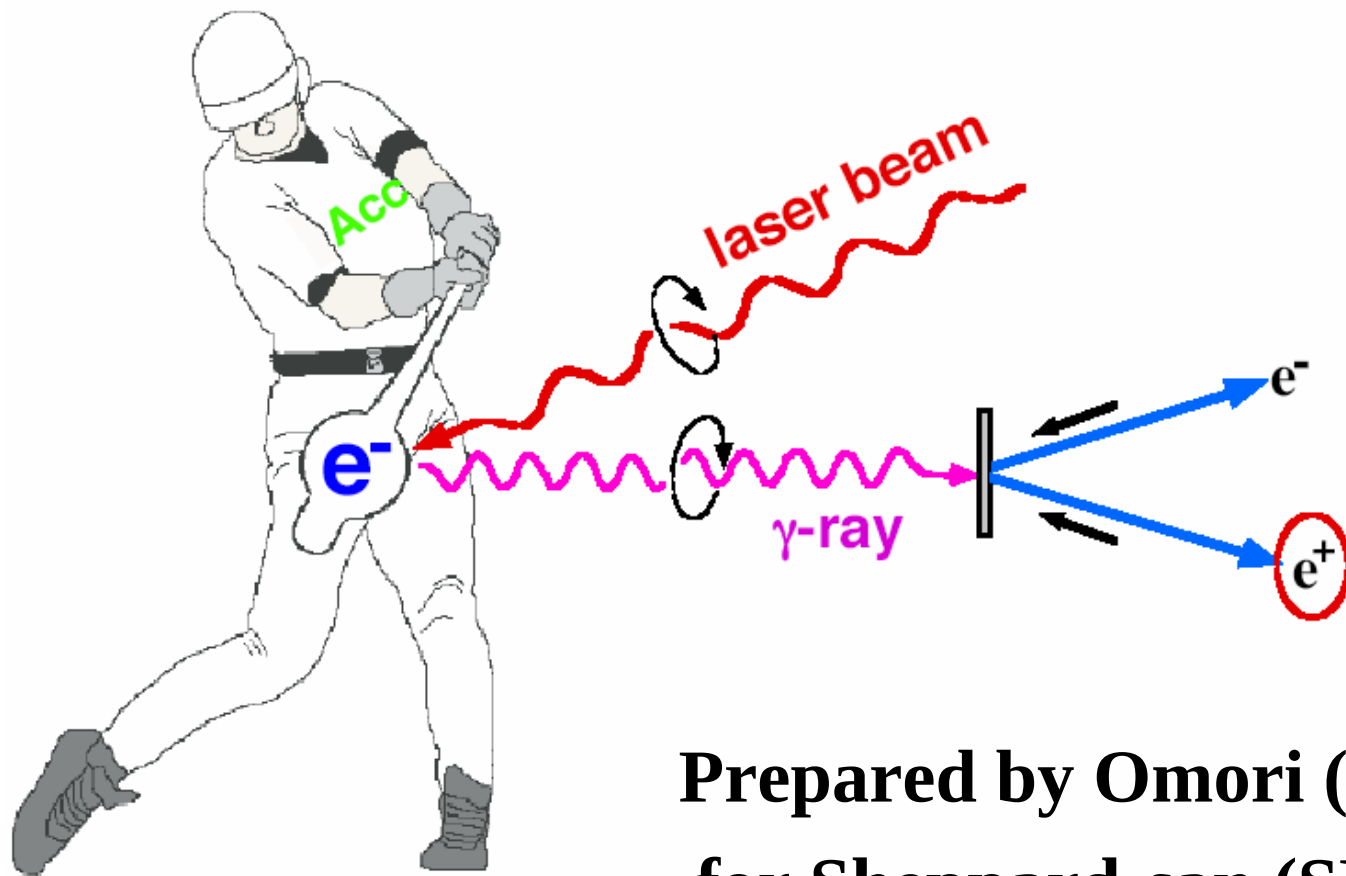


Polarized Positron Production: Compton Scheme: CO₂ Version (Omori, et al.)



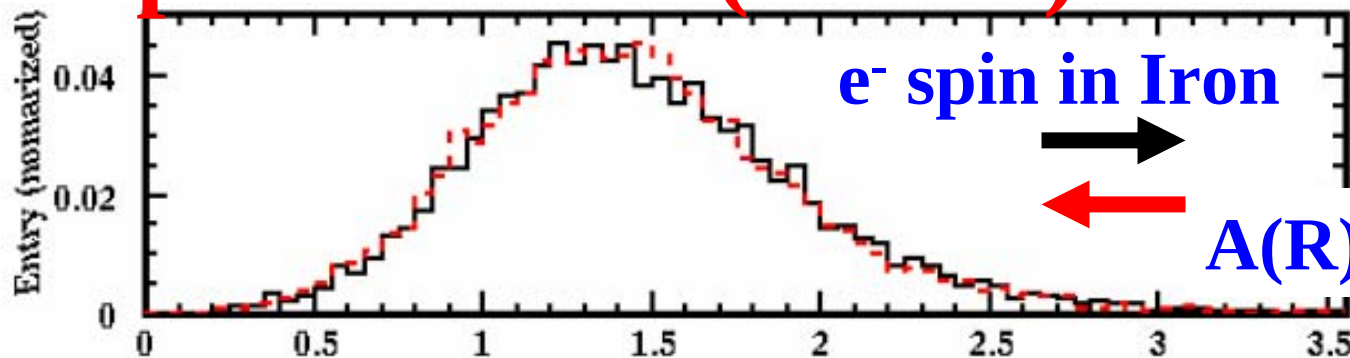
Compton experiment at ATF

Polarized ~~e^+~~ Source for ILC

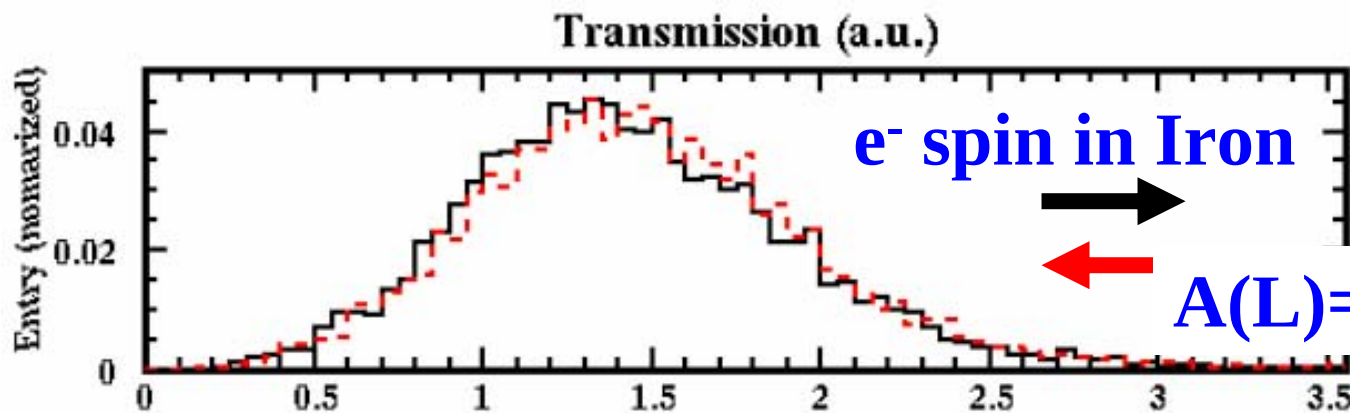


Prepared by Omori (KEK)
for Sheppard-san (SLAC)

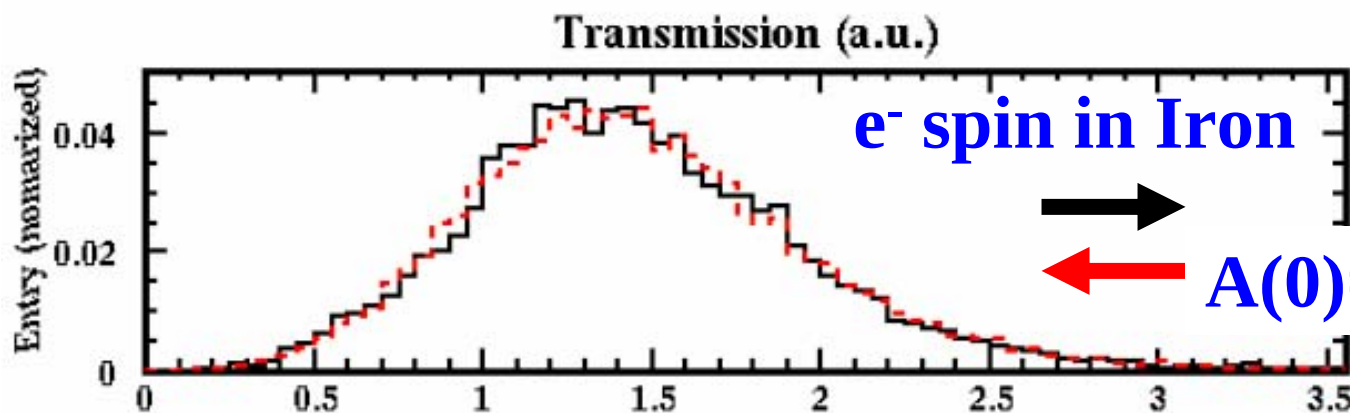
e^+ polarization (e^+ run)



e^+ beam spin
→



e^+ beam spin
←

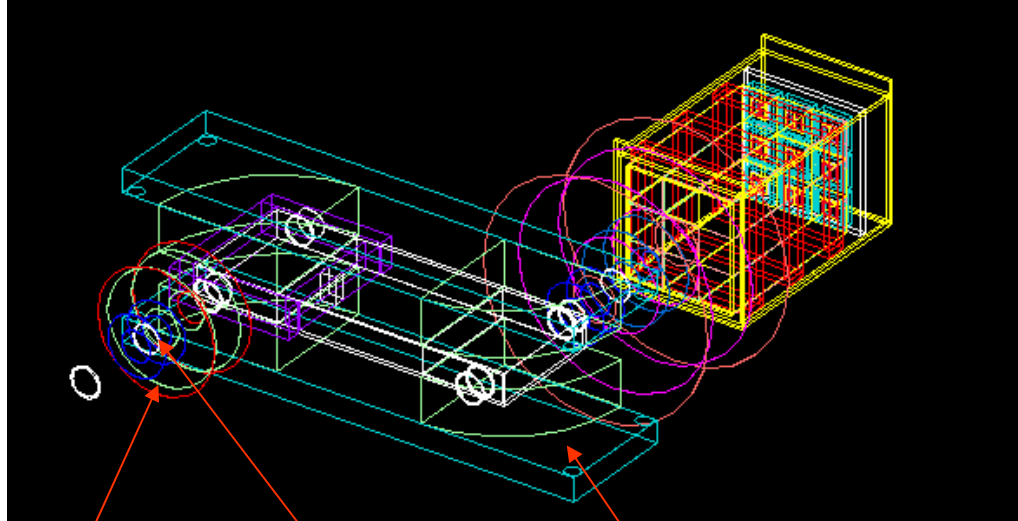


e^+ beam spin
non



E166:
Demonstration of
Undulator Based
Polarized Positron
Production

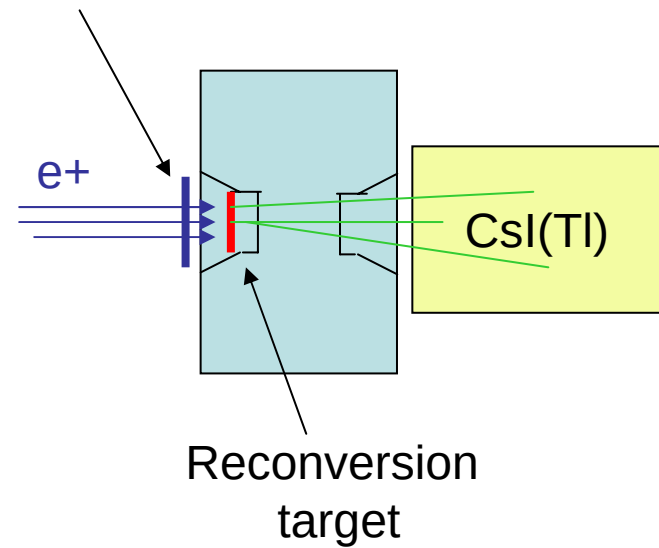




Solenoid

Conversion target

Bill's Si detector



E166 Polarized Positron Production Demo

1% e^+ yield

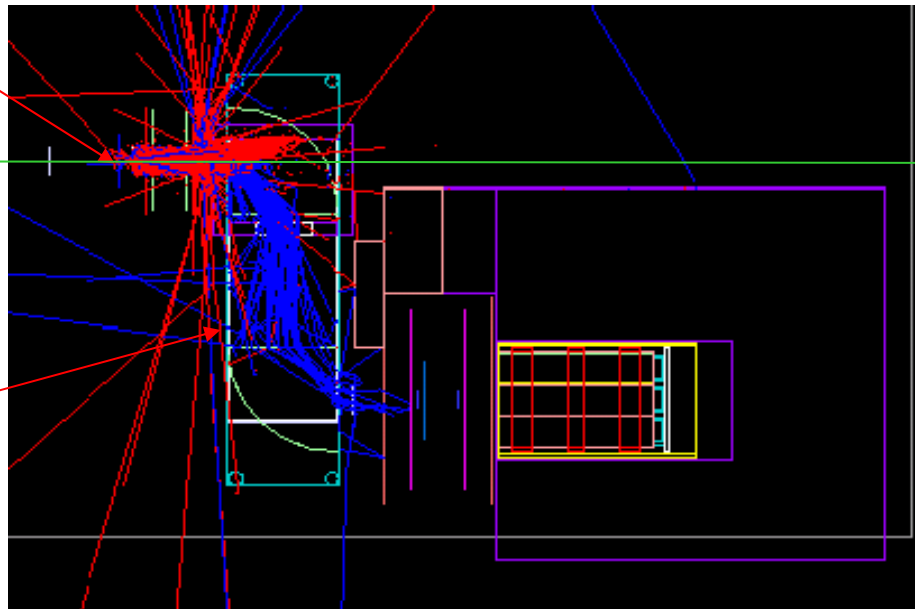
Spectrometer

Undulator gamma

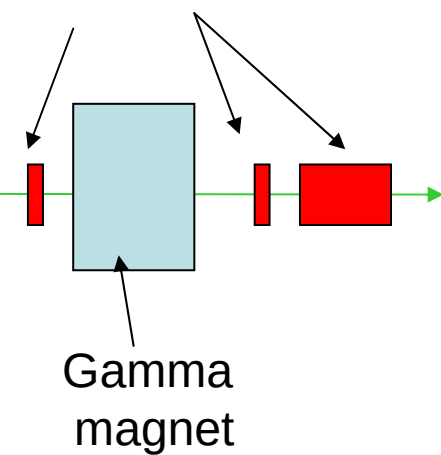
Simulated events

<2%

e^+ transmission



Bill's Si detector

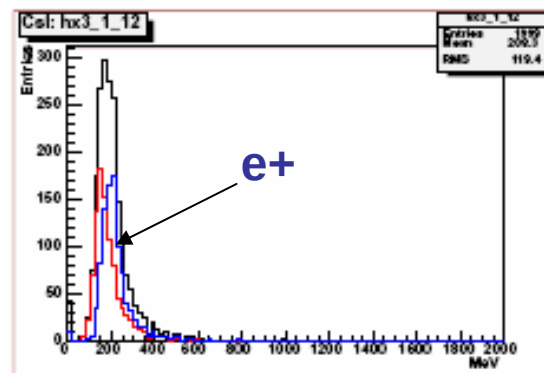
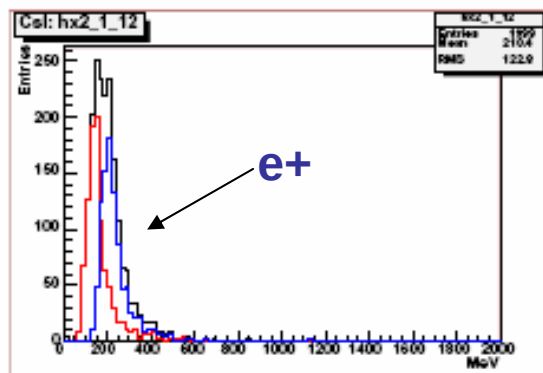
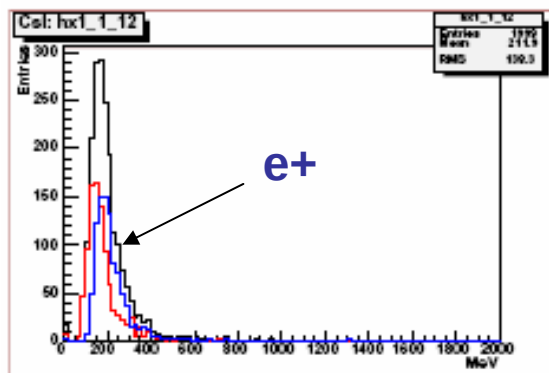
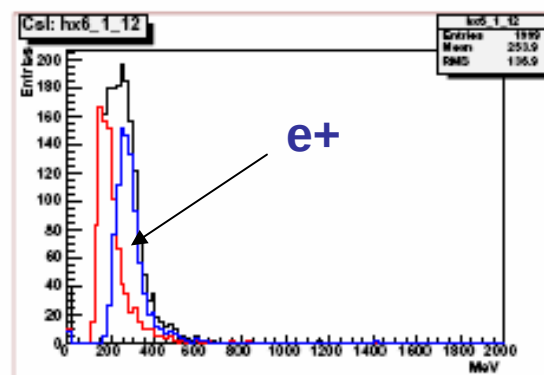
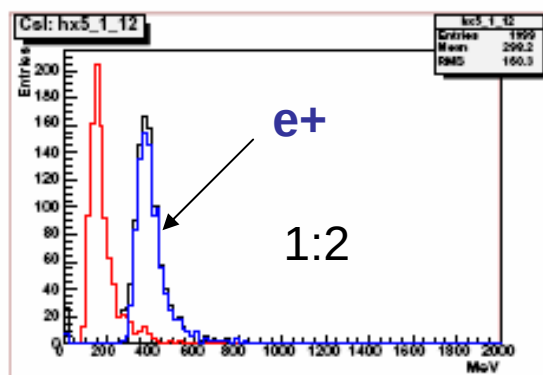
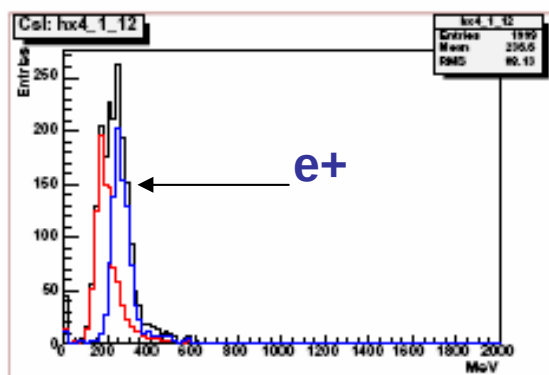
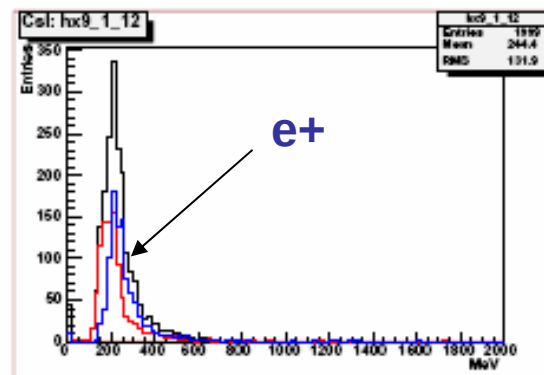
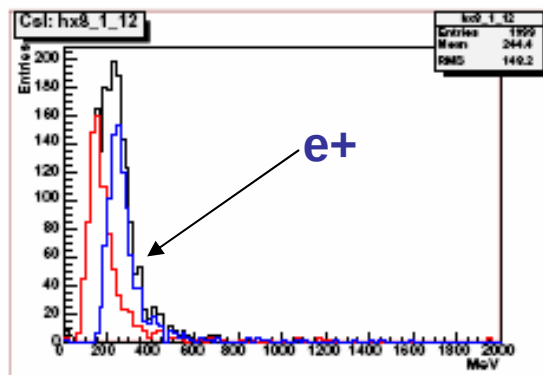
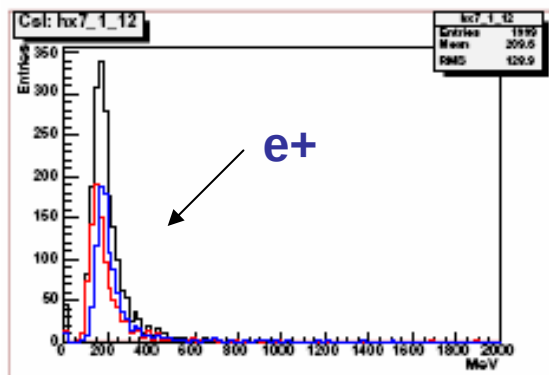


K. Laihem

E166 June, 2005 Data Run

Positrons Signal in CsI(Tl) Calorimeter

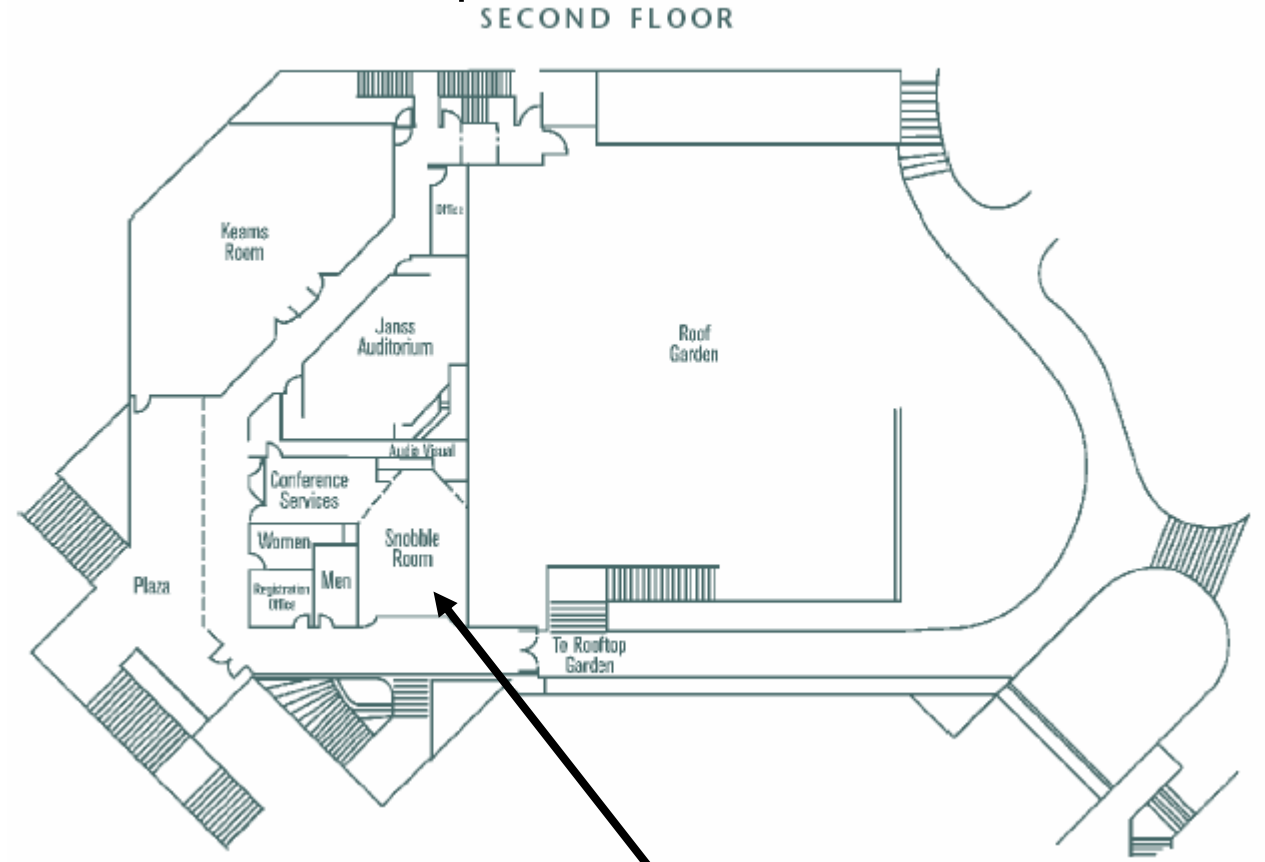
Low Background conditions



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