

# **Report of Dubna GDE**

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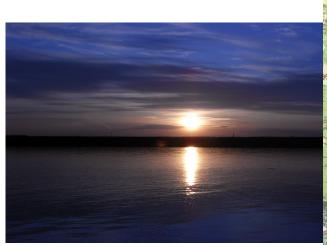
22 July 2008

ILC e+ meeting

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## Dubna GDE

- June 4-6, Dubna, Moscow region, Russia
- DUBNA: JINR (Joint Institute for Nuclear Research).
- It was a thematic GDE meeting focused on site and CFS.





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# Post RDR – ILC

·····(Dubna GDE·closing·by·M.·Ross)

- One year later:
- Focus on R&D
  - to mitigate technical risk
    - (some of which assumed for RDR)
  - to enable cost reduction
- Managing the RDR
  - held kick off meetings
  - working on consolidating cost information
- Strengthening links with partners
  - multi-lateral GDE
  - ca. 400 members

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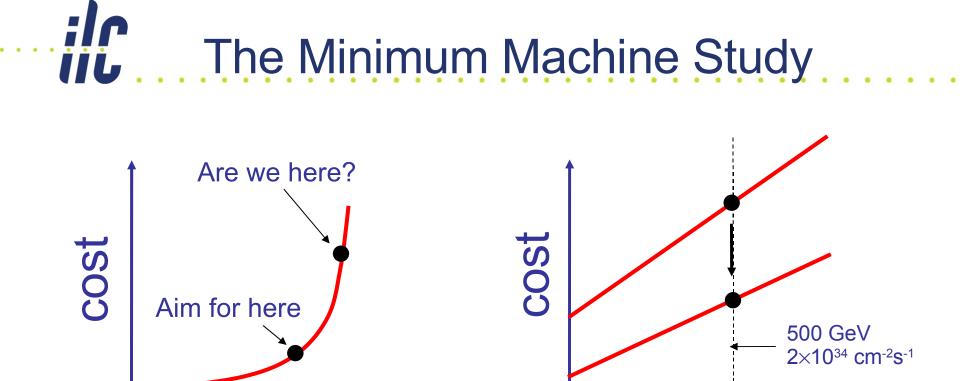
# R&D Plan Release 2



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Towards a 'Minimum Machine' Configuration

- Working Groups:
  - <u>Siting</u>: Examine possible sites and evaluate possible design differences that accommodate features. Includes staging, design modifications and upgrade issues.
  - <u>Accelerator Systems</u>: particular focus on the central injection complex, BDS and RTML.
- Beginning of the process of:
  - Re-thinking the layout of the machine for a lower cost
  - Look for new and innovative ideas particularly staging options
  - Defining the 'minimum machine' layout



Margin, risk reduction, redundancy, ... (*indirect* performance)

Physics "figure of Merit" (*direct* performance)

Minimum cost machine Understand the performance derivatives

## What is the mile-stone?

- TDP-1 is focused on
  - Risk mitigation
  - Cost reduction
- Produce a new baseline for the conceptual machine design, in preparation for more detailed technical design work in TDP-2.
- The re-baseline will take place after careful consideration and review of the results of the TDP-1 studies and the status of the critical R&D.

## TDP-1 (by N. Walker for PM team)

calendar ye	ar 2008	200	9	2010	2011	2012
Tech. Design Phase I						
Tech. Design Phase II						
Siting						
Shallow site option impact studies			0			
Definition of uniform site specs.			C	)		
Collider Design Work						
Definition of minimum machine		0				
Minimum machine & cost-reduction studies			0			
Review TDP-II baseline			C			
Publish TDP-I interim report				•		
Prepare technical specifications				¢		
Technical design work			Minimum machine studies			
Generate cost & schedule		:	Re-baseline in 2010			
Internal cost review		:				
Design and cost iteration		(1	(publish in interim report)			
Technical Design Report						
Cost & Schedule Report						
Project Implementation Plan Report						
Publication final GDE documentation &	submit for	project	арргоу	al		
Project Implementation Plan						
Review and define elements of PIP		0				
Develop mass-production scenarios (models)			C			
Develop detailed cost models					0	
Develop remainder of elements						0

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# TDP-2

	ar year 2008 2009 2010 2011 2012
Tech. Design Phase I	TDP-2:
Tech. Design Phase II	
Siting	-Technical requirements documentation
Shallow site option impact studies	-Technical design work $\rightarrow$ cost update
Definition of uniform site specs.	-Value Engineering
Collider Design Work	-Cost & Schedule
Definition of minimum machine	
Minimum machine & cost-reduction studi	-18 month period
Review TDP-II baseline	
Publish TDP-I interim report	
Prepare technical specifications	
Technical design work	
Generate cost & schedule	
Internal cost review	
Design and cost iteration	
Technical Design Report	
Cost & Schedule Report	
Project Implementation Plan Report	
Publication final GDE documentatio	n & submit for project approval 🛛 🔷
Project Implementation Plan	
Review and define elements of PIP	
Develop mass-production scenarios (mo	dels)
Develop detailed cost models	
Develop remainder of elements	

## **Critical R&D**

calendar year	ar 2008 2009 2010 2011 2012
Tech. Design Phase I	
Tech. Design Phase II	
SCRF Critical R&D	
CM Plug compatibility interface specifications	<b>O</b>
S0 50% yield at 35 MV/m	0
S0 90% yield at 35 MV/m	•
Review baseline gradient choice	Positron Source is listed as one of th
S1-Global (31.5MV/m cryomodule @ KEK)	
S2 RF unit test at KEK	critical items.
S1 demonstration (FNAL)	<b>O</b>
S2 RF unit at FNAL	•
9mA full-beam loading at TTF/FLASH (DESY)	O 0
Demonstration of Marx modulator	O
Demonstration of cost-reduced RF distribution	O
Other critical R&D	
DR CesrTA program (electron-cloud)	•
DR fast-kicker demonstration	0
BDS ATF-2 demagnification demonstration	O 0
BDS ATF-2 stability (FD) demonstration	•
Electron source cathode charge limit demonstra	ration O
Positron source undulator prototype	
Positron source capture device feasibility studies	es la
RTML (bunch compressor) phase stability demo	

#### 22 July 2008

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#### ILC e+ meeting

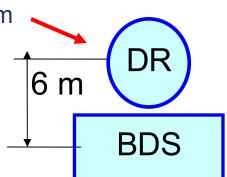
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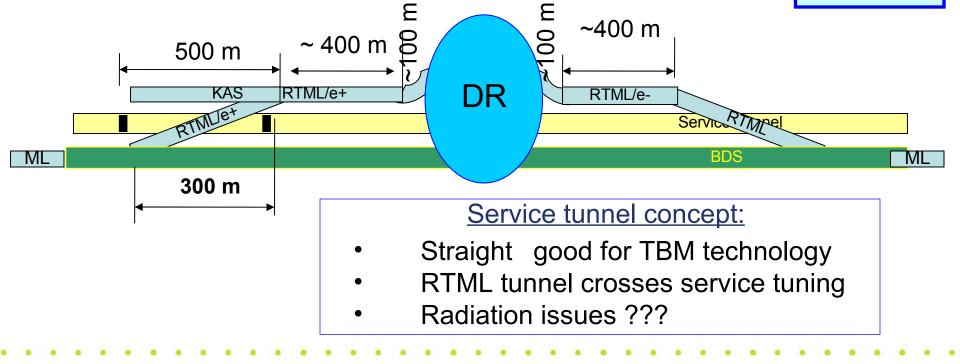
Possible configuration of the RTML/source tunnels

Minimum length of the separate RTML/source tunnel

- Smaller vertical separation of DR and BDS tunnels: 10m -> 6 m
- Length constraints:

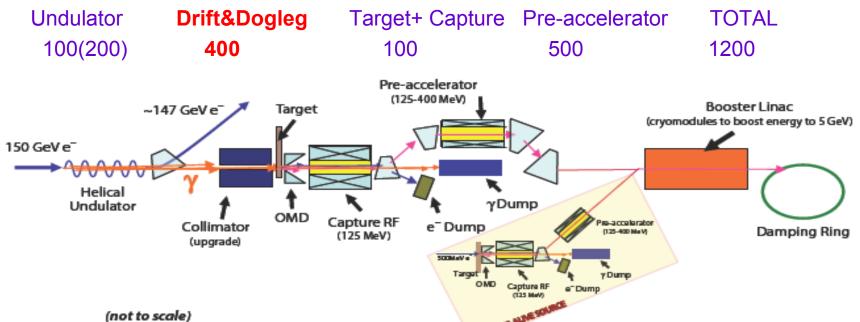
- Electron source side (straight) ~ 500 m
- Positron source: 950m =500m(KAS)+450m (SCL/TRL)
- Min RTML tunnel length here ~ 800 m (now ~1250 m)





# Consider E+ Source Layout (by E. Patterson)

Lengths of the RDR e+ systems in meters



6-2007 8747A21

Q? Can we insert a warm 400 MeV Eaccelerator in the drift/dogleg section and use the same target/capture, preaccelerator as a new type of "*KAS*" YES, WHY NOT?

# IC KAS OF KAS (by E. Patterson)

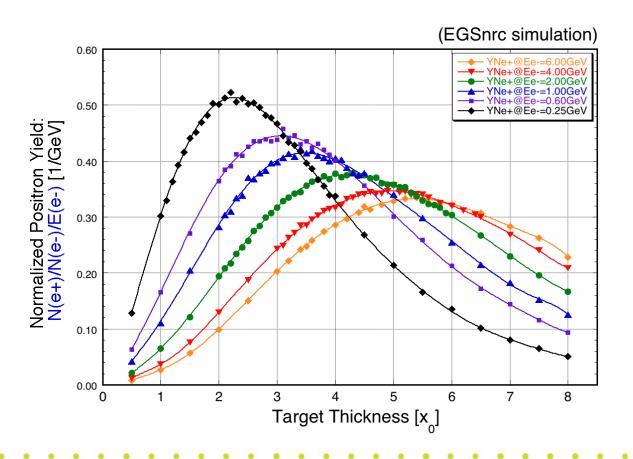
- We need to review the design *requirements* for a KAS and its cost/benefits to overall ILC operation.
- RDR design has everything (except polarization) at 10% intensity...Injector, L-band linac, tgt/capture section and pre-accelerator. *Large and expensive!*
- An extreme alternate *kas* could be a compact S-band single bunch linac whose e- beam uses the photon E+ tgt, capture and pre-accelerator, producing single bunches at a few % intensity.
- Inexpensive, compact and could fit between the undulator and target alongside the photon and high energy e beam!



•600 MeV driver with 0.4X<sub>0</sub> target makes ~3% intensity.

•The same driver with 3X<sub>0</sub> target makes >20% intensity.

•0.4X<sub>0</sub> Ti alloy and 4X<sub>0</sub> W has same thickness, which can be replaced.



#### • Start up e+ source is very important in MD phase.

- In the initial phase, 3X<sub>0</sub> W-Re instead of 0.4X<sub>0</sub> Ti alloy improves the e+ intensity.
  - 600 MeV single bunch S-band accelerator (30m) can generate >20 % intensity e+ beam.
- This single bunch can be accumulated in DR forming the ILC format beam with 20% bunch charge.
- This beam is more useful for commissioning.
- The target can be replaced when undulator e+ is ready for the commissioning. KAS becomes a small backup with a few % intensity.

### 400m drift space is enough to accommodate 6 GeV e- linac.

- It could be driver linac for conventional e+ source with the full intensity.
- It also compatible to Linac based laser compton e+ source.
- Tunnel for undulator section is therefore compatible to all schemes which we have considered. Even after completion of tunnel, we can switch e+ scheme among them.

IIL

# e+ source with Liquid Lead Target<br/>J. Urakawae+ creationgo to main linac100 bunches/train x 300 Hz3000 bunches/train x 5 Hz $T_{b_t to_b} = 6.15$ nsec $T_{b_t to_b} = 300$ nsec

We create 3000 bunches in 100 m sec

#### **DR** T<sub>b\_to\_b</sub> = 6.15 nsec

- The operation (105 bunches) is acceptable for BN window.
- Lead move 32 mm in 3.3 ms pulse interval, then the heat is removed (Speed of lead = 10 m/sec)
- It takes 83 ms (25 pulses) to generate 2625 e+ bunches. 117 ms is for damping.

# BINP activity in Liq Pb target and Matching Device

- 20000 h of liquid lead contour successful run with cog-wheel pump has been reached (90% Pb, 10% (mass)Sn alloy, 300°C).
- The test of window braising technology successfully finished.
- The prototype of liquid lead positron production target is under commissioning now.
- The successful test of VEPP-5 positron production system was performed. Flux Concentrator magnet (FC) was tested up to 70 kG (30 µs pulse duration) without saturation in positron yield.
- The investigation of the technical limit for maximum FC pulse duration is in progress.
- Flat face FC for 30 µs pulse duration, 10 T maximum field and good field quality for KEKB is under the tests now at BINP.



• TDP is now activated.

•Re-baseline for risk mitigation and cost-reduction are central issues for TDP-1.

•TDP-2 is technical design phase based on the rebaselined design.

- Our task is brushing up our design to minimize the risk and cost.
- Discussion for minimum machine has been started in Dubna-GDE.
  - •To be continued.