



(BDS) Lattice Integration Process at ILC

Benno List
DESY –IPP–

BDS Lattice Webex Meeting 30.8.2013



Introductory Remark

I have extended the charge of my talk:

More important than the tool(s) to store the lattices is an overview over

- **The documents that define the design**
- **The process to update the official design**

Anybody is free to investigate new, better lattice solutions for the ILC BDS. But changing the official baseline requires the observation of due process - which is currently not completely defined!

I will cover the SVN repository in the 2nd part of the talk



Technical Design Documentation in EDMS

- EDMS is the authoritative single point of information for the ILC design
- The TDD web pages at <http://www.linearcollider.org/ILC/GDE/technical-design-documentation> provide links into EDMS
- Some documents (not all) require EDMS user ID for full access. If you do work related to the ILC, you will get this EDMS user ID (no DESY user account needed). Just drop me a mail!
- ILC EDMS home page is <http://ilc-edms.desy.de/>

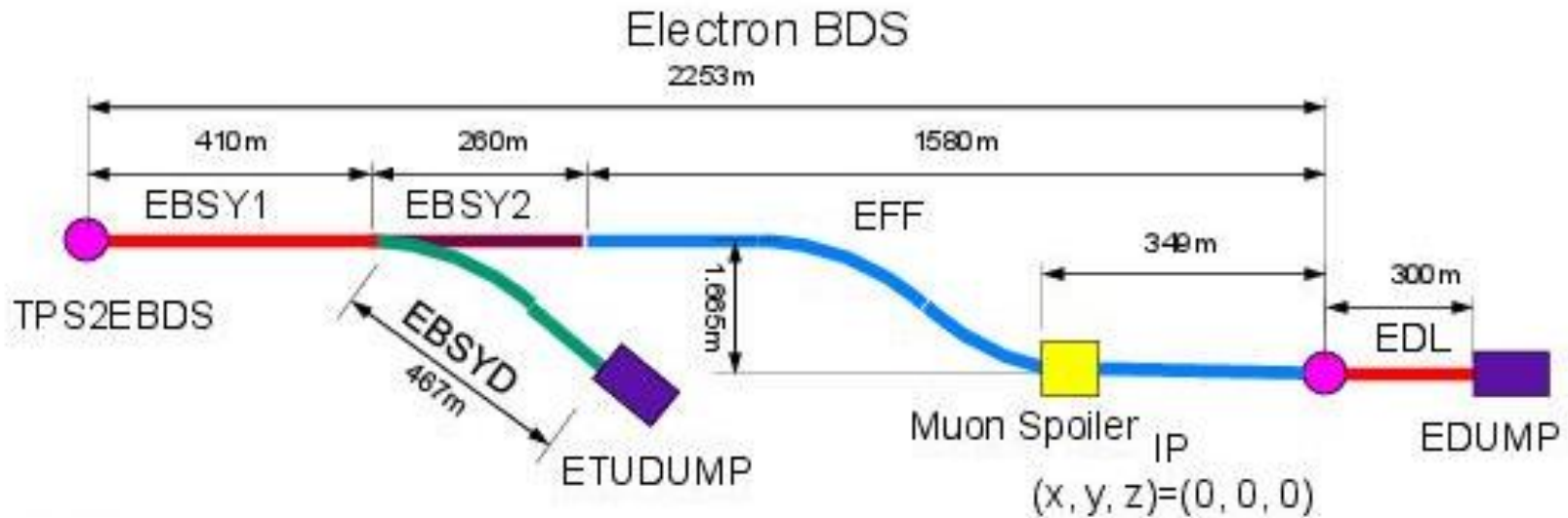


Defining Documents for BDS (in EDMS)

- <http://www.linearcollider.org/ILC/GDE/technical-design-documentation/beam-delivery-system>
- **Treaty Points: [D*0970685 \(Excel\)](#), and [D*0972425](#)**
- **Beamline overview: [D*0976355](#)
(nomenclature of beamlines, markers, dumps etc)**
- **Lattice (as zip file): [D*0972985](#)
provides a reference snapshot of the lattice as used
for further work (component counts, costs, CFS)**

Beamline Overview (D*0976355) defines beamline and marker names

B. List, DESY-IPP- 24.2.2012



- File EBDS:
 TPS2EBDS: Treaty Point Positron Source to Electron BDS [1]
 EBSY1: Electron Beam Switchyard 1 (includes emittance measurement and energy measurement chicane)
 EBSY2: Electron Beam Switchyard 2 (includes polarimeter chicane)
 EFF: Electron Final Focus (includes betatron and energy collimation)
 IP: Interaction Point, defines (0, 0, 0)
 EDL: Electron Dump Line
 EDUMP: Electron main Dump (14MW)



Treaty Points (D*0970685)

international linear collider

Main Linac Treaty Points

Version 5.0 23.05.2012

Treaty Point	TERTML2ML		TEML2PS	TPS2EBDS	TPRML2ML		TPML2BDS
	Electron RTML to Main Linac		Electron Main Linac to Positron Source (Undulator Section)	Positron Source (Undulator Section) to Electron BDS	Positron RTML to Main Linac		Positron Main Linac to BDS
Geometry							
HRRF Scheme	KCS	DKS			KCS	DKS	
X [m]	104,52450	104,85593	26,540	17,440	94,6204	94,934	17,433
Y [m]	0	0	0	0	0	0	0
Z [m]	-14471,7801	-14519,1269	-3331,319	-2253,464	13279,10984	13323,9567	2252,514
ϑ [rad]	-0,00700	-0,00700	-0,00700	-0,00700	-3,13459	-3,13459	-3,13459
φ [rad]	0	0	0	0	0	0	0
ψ [rad]	0	0	0	0	0	0	0
d [m]	3,220	3,220	3,220	1,665	1,665	1,665	1,665
Optics Functions							
α_x [1]	-1,142		-2,4018	-2,4018	-1,142		-2,4018
β_x [m]	52,67		51,332	51,332	52,67		51,332
η_x [m]	0		0	0	0		0
η'_x [1]	0		0	0	0		0
α_y [1]	1,279		0,48877	0,4888	1,279		0,48877
β_y [m]	70,74		9,3954	9,395	70,74		9,3954
η_y [m]	0		0	0	0		0
η'_y [1]	0		0	0	0		0



Top Level Parameters (D*0925325)

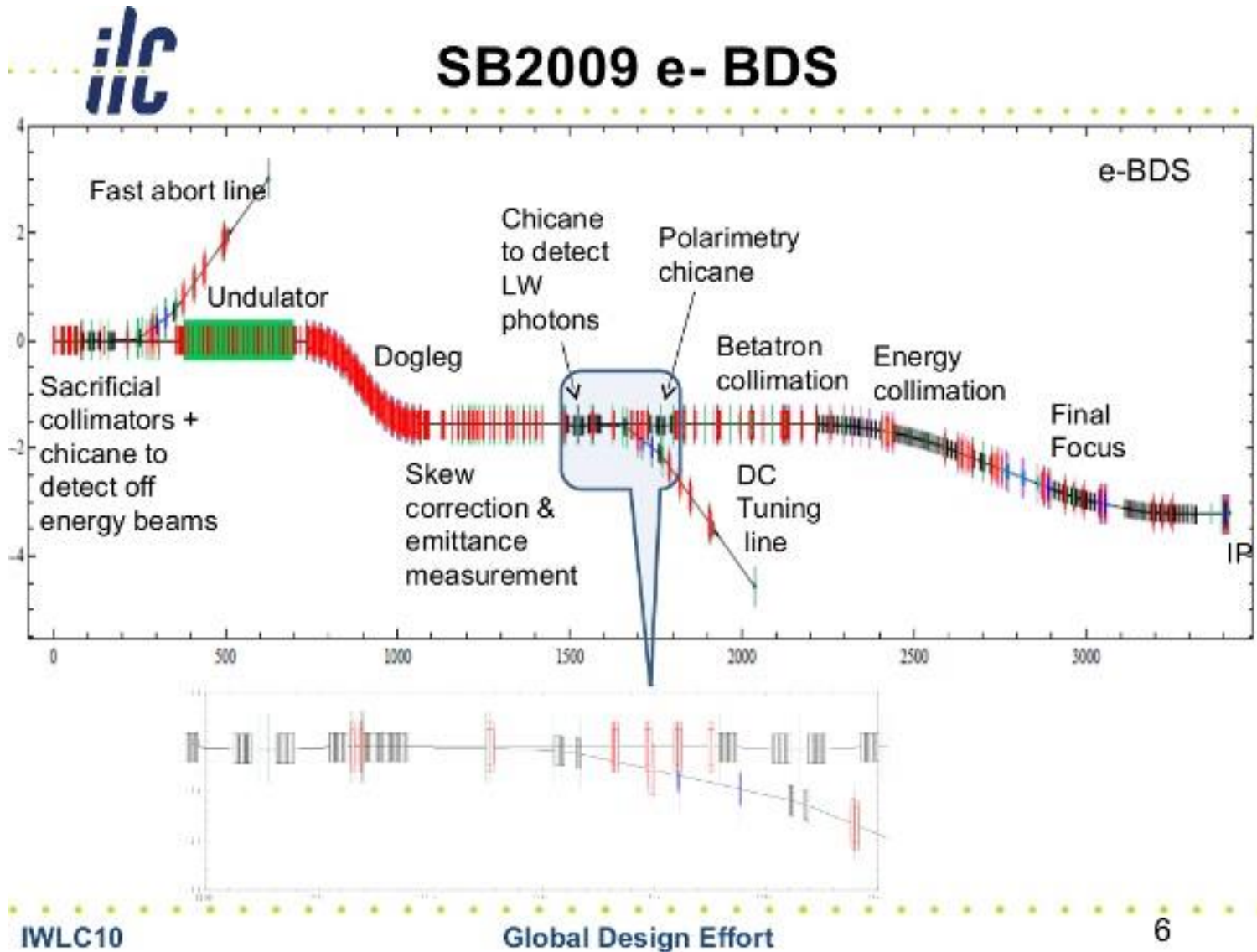
IP and General Parameters			TF = Traveling Focus					<i>L Upgrade</i>	<i>E_{cm} Upgrade</i>	
Centre-of-mass energy	E_{cm}	GeV	200	230	250	350	500	500	1000	1000
Beam energy	E_{beam}	GeV	100	115	125	175	250	500	500	500
Lorentz factor			#####	#####	#####	#####	#####	#####	9,78E+05	9,78E+05
Collision rate	f_{rap}	Hz	5	5	5	5	5	5	4	4
Electron linac rate	f_{imac}	Hz	10	10	10	5	5	5	4	4
Number of bunches	n_b		1312	1312	1312	1312	1312	2625	2450	2450
Electron bunch population	N_-	$\times 10^{10}$	2,0	2,0	2,0	2,0	2,0	2,0	1,74	1,74
Positron bunch population	N_+	$\times 10^{10}$	2,0	2,0	2,0	2,0	2,0	2,0	1,74	1,74
Total average beam power (dumped)	P_{beam}^D	MW	7,4	8,0	8,4	7,4	10,5	42,1	27,3	27,3
Estimated AC power (operational)	P_{AC}	MW	152	155	158	121	163	206	300	300
Bunch separation	t_b	ns	554	554	554	554	554	366	366	366
Bunch separation $\times f_{RF}$	$t_b f_{RF}$		720	720	720	720	720	476	476	476
Pulse current	I_{beam}	mA	5,8	5,8	5,8	5,8	5,79	8,75	7,6	7,6
RMS bunch length	z	mm	0,3	0,3	0,3	0,3	0,3	0,3	0,250	0,225
Electron RMS energy spread	p/p	%	0,206	0,194	0,190	0,158	0,124	0,124	0,083	0,085
Positron RMS energy spread	p/p	%	0,190	0,165	0,152	0,100	0,070	0,070	0,043	0,047
Electron polarisation	P_-	%	80	80	80	80	80	80	80	80
Positron polarisation	P_+	%	31	31	30	30	30	30	20	20
Horizontal emittance	x	m	10	10	10	10	10	10	10	10
Vertical emittance	y	nm	35	35	35	35	35	35	30	30
IP horizontal beta function	x^*	mm	16,0	14,0	13,0	16,0	11,0	11,0	22,6	11,0
IP vertical beta function (no TF)	y^*	mm	0,34	0,38	0,41	0,34	0,48	0,48	0,25	0,23
IP RMS horizontal beam size	x^*	nm	904	789	729	684	474	474	481	335
IP RMS vertical beam size (no TF)	y^*	nm	7,8	7,7	7,7	5,9	5,9	5,9	2,8	2,7
Horizontal disruption parameter	D_x		0,2	0,2	0,3	0,2	0,3	0,3	0,1	0,2
Vertical disruption parameter	D_y		24,3	24,5	24,5	24,3	24,6	24,6	18,7	25,1
Horizontal enhancement factor	H_{Dx}		1,0	1,1	1,1	1,0	1,1	1,1	1,0	1,0
Vertical enhancement factor	H_{Dy}		4,5	5,0	5,4	4,5	6,1	6,1	3,5	4,1
Total enhancement factor	H_D		1,7	1,8	1,8	1,7	2,0	2,0	1,5	1,6
Geometric luminosity	L_{geom}	$\times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$	0,30	0,34	0,37	0,52	0,75	1,50	1,77	2,64
Luminosity	L	$\times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$	0,50	0,61	0,68	0,88	1,47	2,94	2,71	4,32
Average beamstrahlung parameter	av		0,013	0,017	0,020	0,030	0,062	0,062	0,127	0,203
Maximum beamstrahlung parameter	max		0,031	0,041	0,048	0,072	0,146	0,146	0,305	0,483
Average number of photons / particle	n		0,95	1,08	1,16	1,23	1,72	1,72	1,43	1,97
Average energy loss	E_{BS}	%	0,51	0,75	0,93	1,35	3,65	3,65	5,33	10,20

analytical estimates

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B. List, (BDS) Lattice Integration at ILC

BDS Lattice (D*0972985)





From Lattice to Tunnels

- **For TDR, we have established a process to translate the MAD lattice files to conceptual 3D models of the accelerator and provide them for the tunnel design**
 - **We have a geometrically consistent global for the ILC in the TDR configuration**
 - **Changes in the lattice geometry cause changes in the tunnel layout!**
- > All future lattice design must incorporate / respect**
- **Boundary conditions from CFS (site-dependent!)**
 - **Layout of the “rest” of the accelerator!**

From Lattice to Tunnels, cont'd

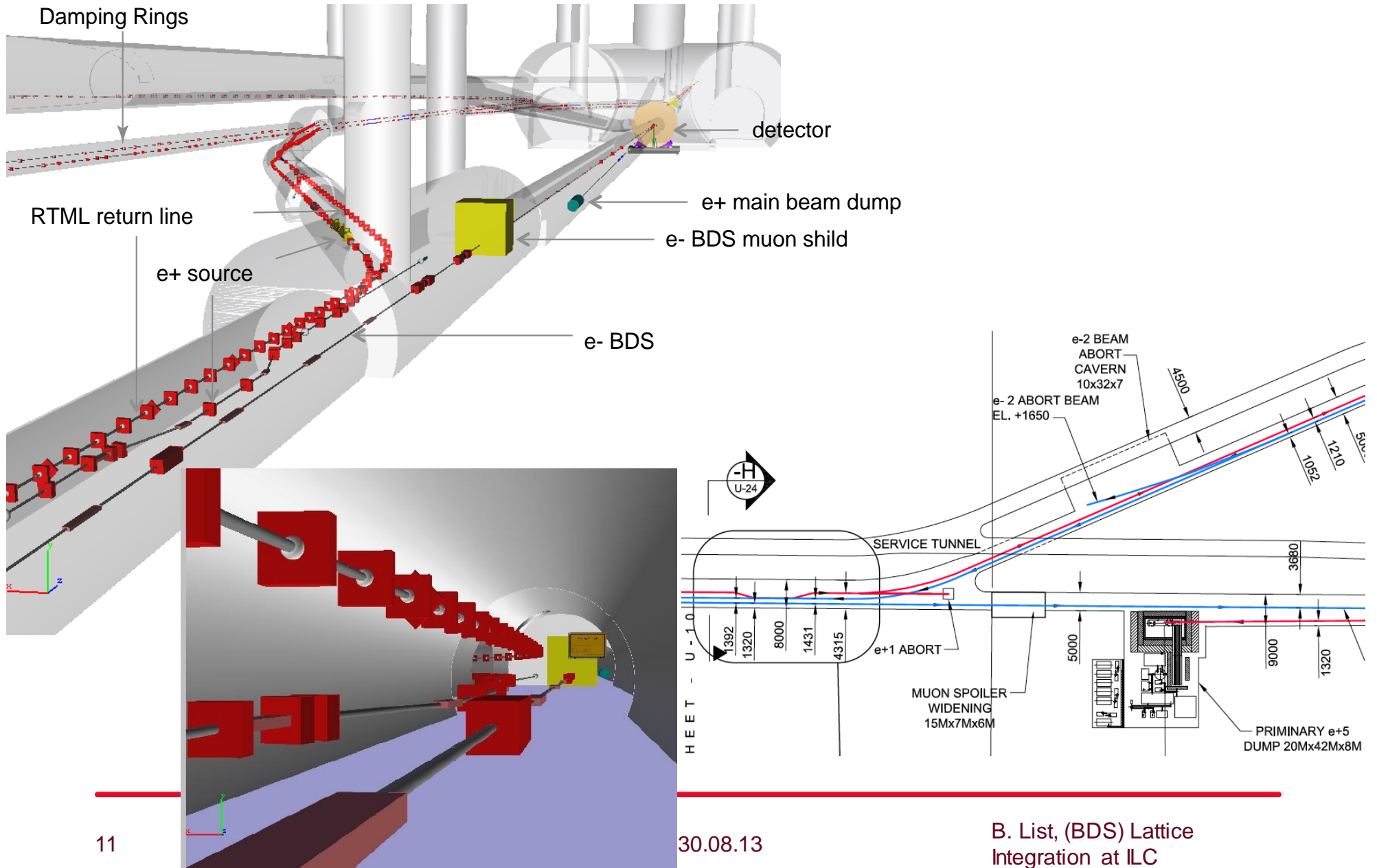
Technically:

- **Run MAD-8 (not MAD-X, not BMAD, but MAD-8), with initial conditions for SURVEY from treaty point document**
- **Map MAD-Elements to physical components (needs conventions for lattices, e.g. TYPE attribute)**
- **Generate Excel-files and 3D-models (VRML) with positions and counts of all components**





Example: Transfer Tunnel Branch-Off





Lattice Integration Process

For a new lattice version:

- Integration team checks lattice for
 - Geometry (clashes with other beamlines)
 - Formalities (type attributes, apertures given, markers)
- For geometry changes (start/end points, location of dump, muon shield etc) or changes in functionality (diagnostics, corrections) a formal **change request** must be issued before lattice can be considered
- If lattice fulfills geometric and functional specs, a **change request** can be issued to make the new lattice official



EDMS and SVN

- **For lattice development, EDMS provides**
 - Specification documents
 - The lattice as zip-file for reference
- **EDMS is not a lattice development platform**
- **For this, we have SVN**
- **The ILC lattice resides in**
<https://svnsrv.desy.de/basic/ilclattice>
- **Browser interfaces (read access for everyone!):**
<https://svnsrv.desy.de/websvn/wsvn/General.ilclattice?>
Or <https://svnsrv.desy.de/viewvc/ilclattice/>
- **Based on Mark Woodley's ILC2006e lattice**
- **retains Mark's directory and include file structure**
- **Send me an email to get an account to check out/in!**



SVN repository at DESY

- **“ilclattice” is the repository for the integrated ILC lattice**
- **Development work on new lattices should be done in a separate repository**
- **We offer to create such a repository (takes <1 day) and give full access to all interested parties**



Summary

- **ILC has an integrated lattice as basis for further planning**
- **We have to keep it that way -> new lattices need formal review&approval to become official**
- **EDMS is authoritative source of information**
- **SVN repository is available**