Beam Delivery System => EDR

Andrei Seryi
for BDS Area leaders
Deepa Angal-Kalinin, A.S., Hitoshi Yamamoto
and for BDS group

LCWS07
June 2, 2007 at DESY

Global Design Effort

Work at this meeting

- ATF2 Project meeting on May 31
  - **~20 presentations focused on various aspects of hardware status and commissioning**
- BDS and MDI reports (~30)
  - **summary of MDI part to be reported tomorrow by Brett Parker**
- And discussion of EDR plans

Focus of EDR work

- EDR planning – focus on cost uncertainty reduction, & performance uncertainty reduction:
  - **design of systems at appropriate level of details**
  - **build & test critical prototypes to ensure performance**
- Major focus in EDR phase will be on system engineering, integration and value engineering
- Schedule: take full schedule into consideration (~3year for EDR, two years for Approval phase and 7 years for construction)
  - **continue optimization and final design after EDR and during earlier years of construction**

Interfaces & specs

- Definition & optimization of interfaces is very important part of EDR work and of the overall optimization

- Interfaces & specs for technical systems
  - **performance**
  - **connections**
  - **functionality …**
- Interfaces for beam parameters

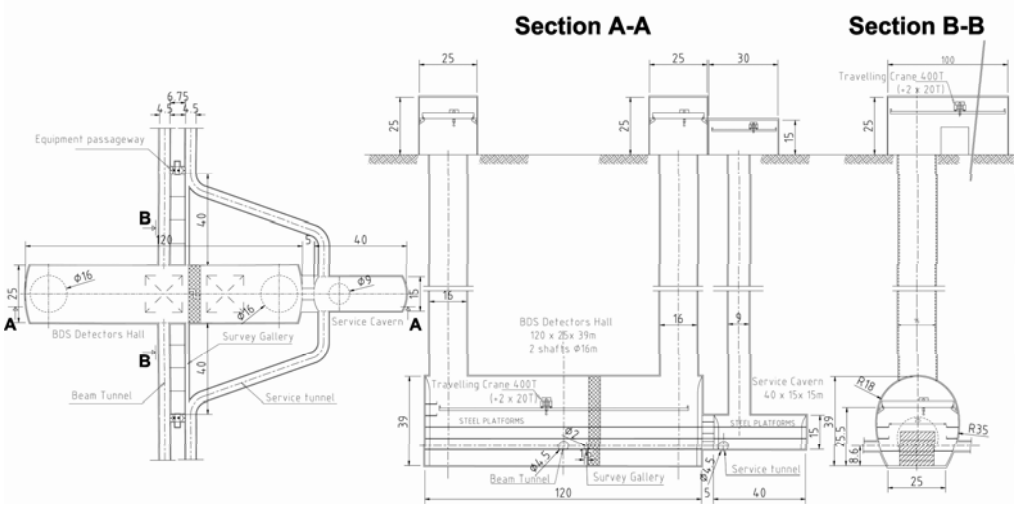
Interfaces for beam parameters

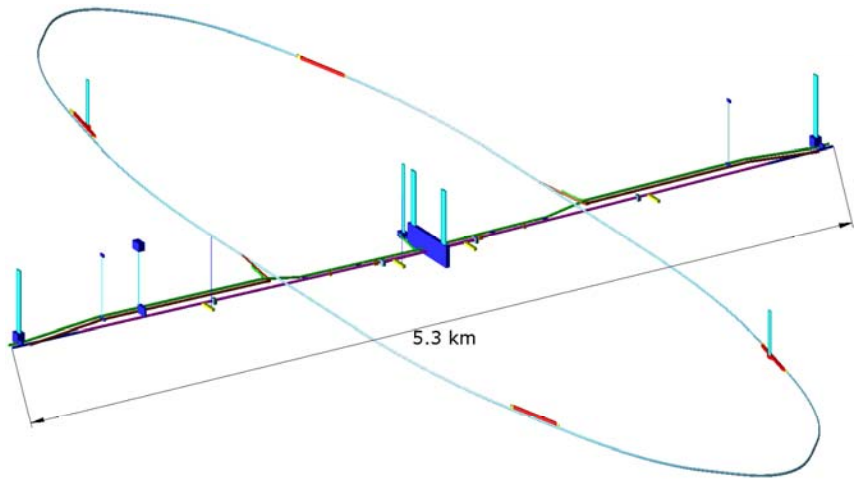
Parameter	Units	Value
Length (linac exit to IP distance)/side	m	2226
Length of main (tune-up) extraction line	m	300 (467)
Max Energy/beam (with more magnets)	GeV	250 (500)
Distance from IP to first quad, L*	m	3.5-(4.5)
Crossing angle at the IP	mrad	14
Nominal beam size at IP, σ^*, x/y	nm	639/5.7
Nominal beam divergence at IP, θ^*, x/y	μrad	32/14
Nominal beta-function at IP, β^*, x/y	mm	20/0.4
Nominal bunch length, σ_z	μm	300
Nominal disruption parameters, x/y		0.17/19.4
Nominal bunch population, N		2×10^{10}
Beam power in each beam	MW	10.8
Preferred entrance train to train jitter	σ_y	< 0.5
Preferred entrance bunch to bunch jitter	σ_y	< 0.1
Typical nominal collimation aperture, x/y		8–10/60
Vacuum pressure level, near/far from IP	nTorr	1/50

- These are interface beam parameters
- This list is not complete and also may not have corresponding match in the linac outgoing beam parameters
- Standard list of interface beam parameters need to be developed, made consistent, and optimized at the overall level

BDS – CFS optimization

- Clarification & optimization of requirements and interfaces with CFS design will be the major focus of EDR work
  - **sizes, volumes, length, T stability, air, water, penetrations, etc.**





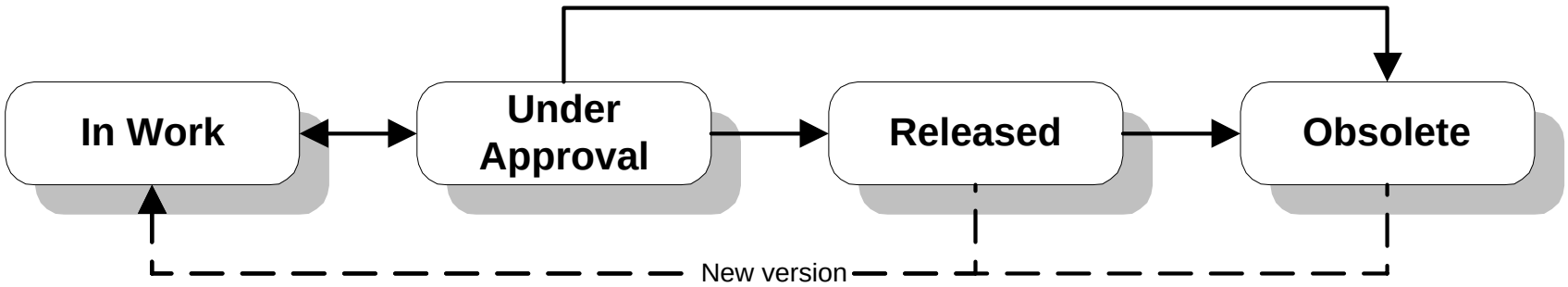
Reviews

- Overall project reviews
  - **reviews of the BDS within the overall ILC**
  - **is a tool for overall optimization**
  - **driven by Project Manager**

- Reviews within BDS area
  - **reviews of BDS technical subsystems => to verify maturity of design and directions of design optimization**
  - **reviews of interfaces => overall optimization**
  - **driven by area managers**

Environment: EDMS

- The new workspace is oncoming
- Should be effective tool to store documents, drawings, tables of interface parameters, will allow to control the work-flow, to make assignments of the tasks, and so on



example of possible flow of a document in EDMS

Balance of R&D and engineering

from S4 & RDB report

- Integrated design of IR, development of IR superconducting magnets, *build engineering prototype of FD magnets*, design study to ensure IR mechanical stability, design of push-pull arrangements
- development of crab cavity systems, *test phase control system with two single cell cavities, build single multi-cell cavity*
- design, *construction, commissioning and operation of ATF2 test facility*
- develop laser wires for beam diagnostics, *prototype laser wires at ATF2*
- development of intra-train feedback, *prototype at ATF2*
- develop beam dump design & *study of beam dump window survivability*
- develop collimator design, *verify collimation wake-fields & beam damage*
- development and *tests of MDI type hardware such as energy spectrometers, IP feedback BPMs, beamcals, etc.*
- and the design work, which does not involve hardware development but use results of the above listed work

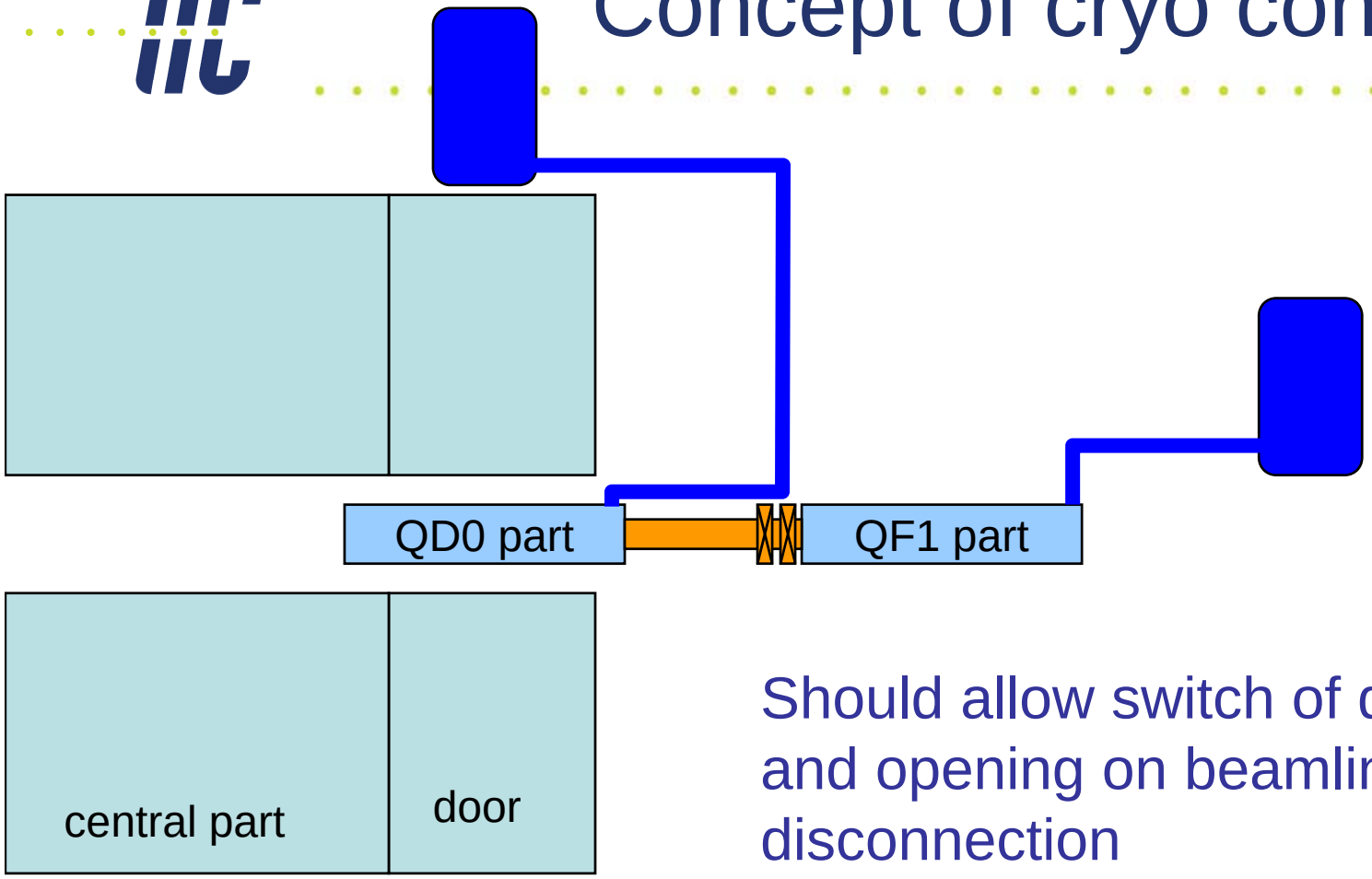
(*hardware in italic*)

Increased engineering efforts in all these activities, plus overall system engineering and integration of BDS

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	EDR			Approval		Construction							Commiss.
Constraints				LHC physics	total length frozen		tunnel & optics layout frozen		optics details frozen		tunnels ready for install-n		
Beam dumps	beam dump conceptual design and critical tests			pre approval		beam dump final engineering			b.dump design frozen	beam dump construction		beam dump installed	
crab cavity	design, build & test of conceptual phase control system; cavity fabrication; conceptual cryostat design; LLRF develop and test with single cells			design of cryostat; cavity integration; beam test of one cavity		beam tests of two cavities		final engineering		production		installed	
ATF2	ATF2 construction and installation. Start of commissioning		Commissioning	Beam size and optics results	Beam stability results	2nd phase, e.g. SC FD; smaller emittance & beam size		Instrumentation developments and tests at beamline					
Final Doublet	Engineering design; full length prototype; stability design study and initial stability tests			Stability tests & design optimization		final design		production		lab tests	installation and pre-commissioning		
Detectors	Conceptual design; selection of two concepts; continue design			Design optimization		final design and start of production		Construct, assemble and pre-commission on surface				Lower down & commiss.	
IR integrated	Conceptual eng. design of IR vaccum chambers; supports; pacman and moving shielding; cryogenic; service platform; detector moving system; cranes; etc.			Detailed eng. design of integrated IR with finalized choice of two detectors for final design		final design and start of production		production			installation and pre-commissioning		
Magnets	Optimization of number of styles; conceptual design of most magnets; definition of interfaces; Detailed design of low field and other special magnets; Vibration -wise design			Design and cost optimization; layouts with real space allocation, and detailed interfaces.		final design & needed prototypes		production			installation and pre-commissioning		
Collimation	Tests of collimation wakefields and beam damage tests; conceptual eng. design			Detailed eng. design; optimization & integration into beamline		final design & pre-production prototypes		production			installation and pre-commissioning		
Instrumentation	Develop laser wires; test feedback BPMs with secondary beam; conceptual eng. design			Detailed eng. design; optimization & integration into beamline		final design & pre-production prototypes		production			installation and pre-commissioning		
Vacuum systen	Physics and conceptual eng. design. Detailed design of IR vacuum chamber.			Detailed eng. design; optimization & integration of beamlines		final design		production			installation		

Overall tentative schedule of EDR work in BDS

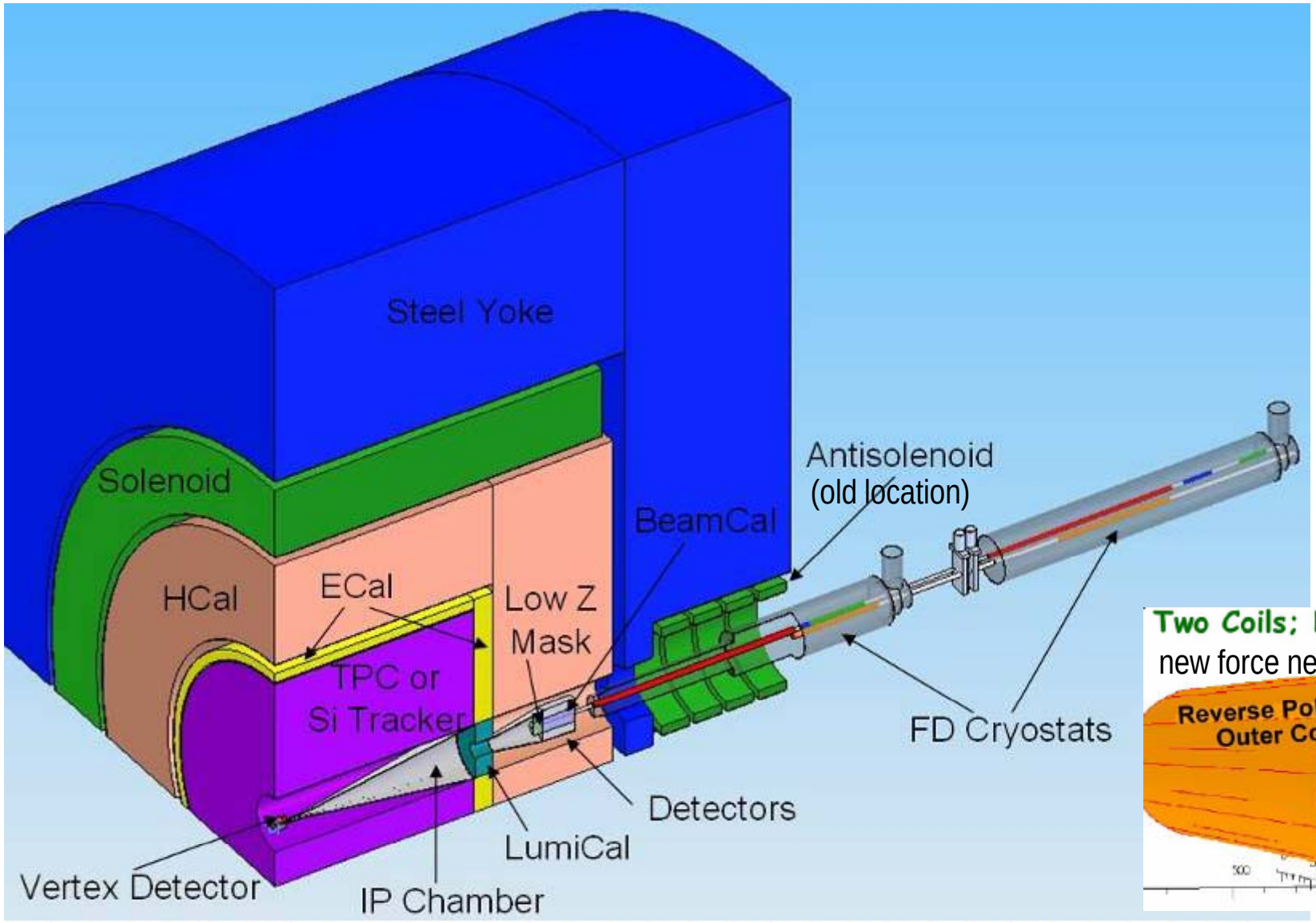
Concept of cryo configuration

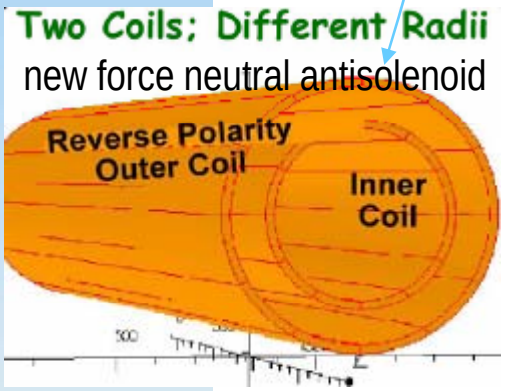


Should allow switch of detectors and opening on beamline without disconnection

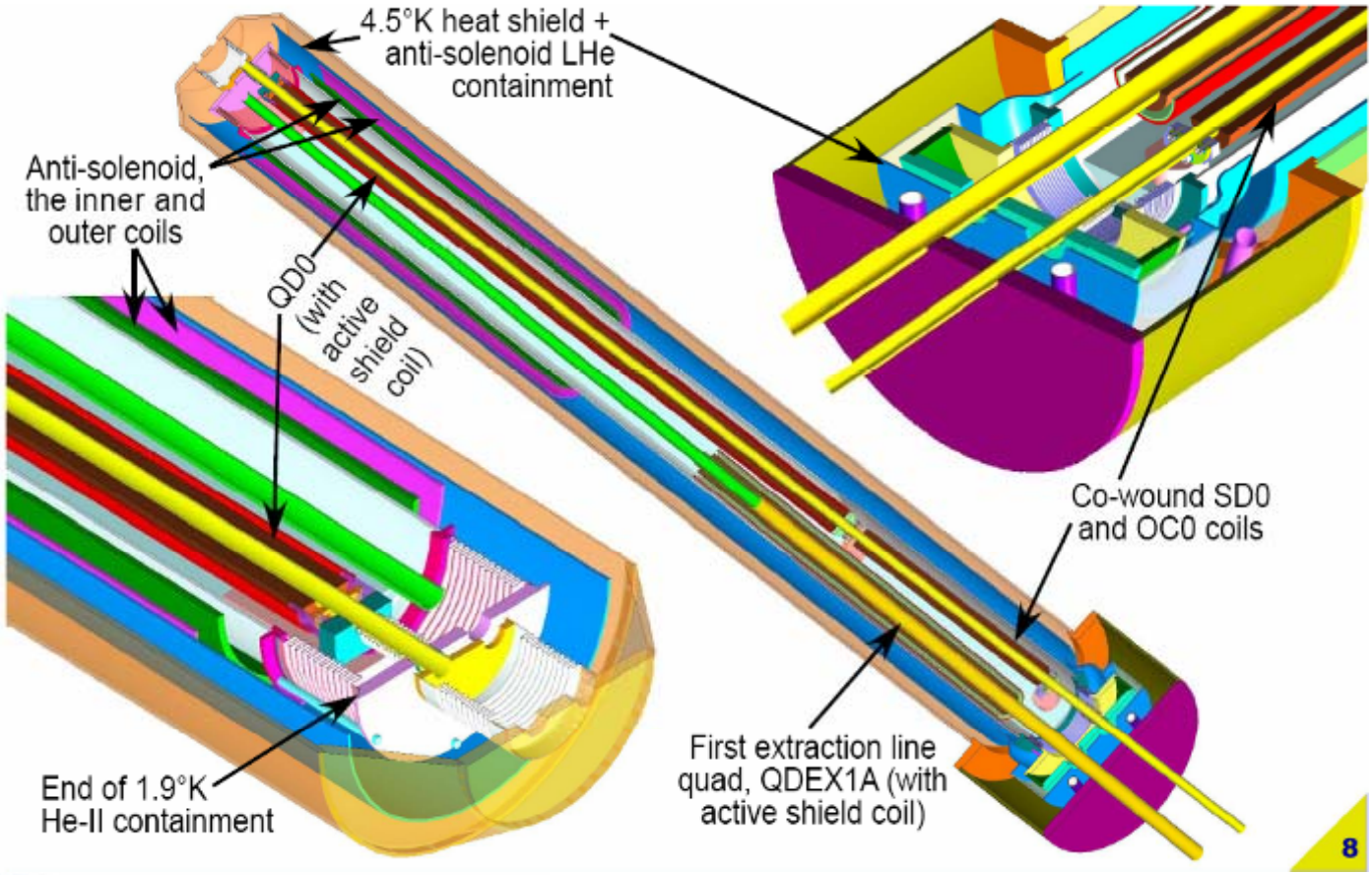
For IR integrated design, the goal, in a nutshell, is to evolve from cartoon-concept level schemes like the one above, to detailed 3d drawings of the system

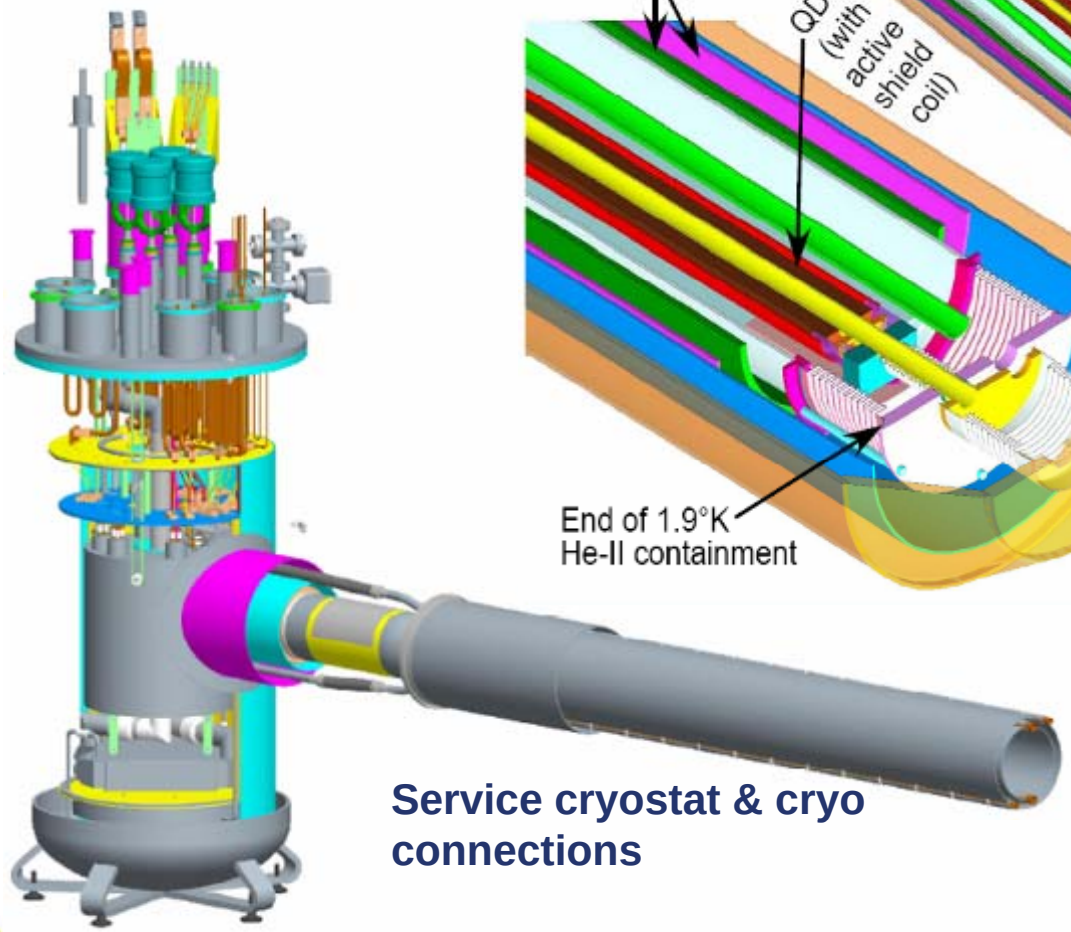
IR integration, a start





FD & IR cryo design, start





Service cryostat & cryo connections

BNL

Workshop on ILC Interaction Region Engineering Design

SLAC, September 17-21, 2007

http://www-conf.slac.stanford.edu/ireng07/

- **Goal: To review and advance the design of the subsystem of the Interaction Region of ILC, focusing in particular on their integration, engineering design and arrangements for push-pull operation.**

- **… goal is to make progress on the design of the ILC IR through focused preparation before and during the workshop…**

- **The International Program and Advisory Committee is being formed. Its charge includes organization of preparatory work before the workshop and production of conceptual solutions and drawings that could be further discussed and reviewed at the workshop…**
  - **this is an attempt to align the organization of the workshop with EDR organization**

IR Eng. workshop: tentative working groups

Group A	**Overall detector design, assembly, detector moving, shielding.** Detector design for on-surface assembly and underground assembly procedures. Beamline pacman shielding, detector shielding design.
Group B	**IR magnets design and cryogenics system design.** Cryogenic system design, connections, flexible cryo lines, safety issues. IR magnet engineering design, support, integration with IR, masks, Luminosity & Beam calorimeters, deign of IR vacuum chamber, connection to elements, assembly-disassembly procedures, integration of near IR masks and overall integration of crab cavity.
Group C	**Conventional construction of IR hall and external systems.** Lifting equipment, IR electronics hut, cabling plant, services, shafts, service caverns, utilities, movable shielding; design solutions to meet alignment and vibration tolerances
Group D	**Accelerator and particle physics requirements.** Including masking, collimation, shielding requirements, image charges, wakes, external radiation, accelerator physics & optics design and constraints on IR engineering design, on alignment tolerances and stability for the IR components and IR hall floor.

Working groups are to study the issues in advance of the workshop

Summary

- EDR work in BDS will focus on cost uncertainty reduction, and performance uncertainty reduction
- Major focus in EDR phase will be on system engineering and value engineering
- The major breakdown of Work Packages become clearer and the fine structure being worked on