BDS way forward

summary for GDE-BDS

Andrei Seryi, SLAC

Thanks to all participants of GDE-BDS and ACFA-MDI sessions
and to the BDS design team

TILC08, March 6, 2008, Sendai, Japan

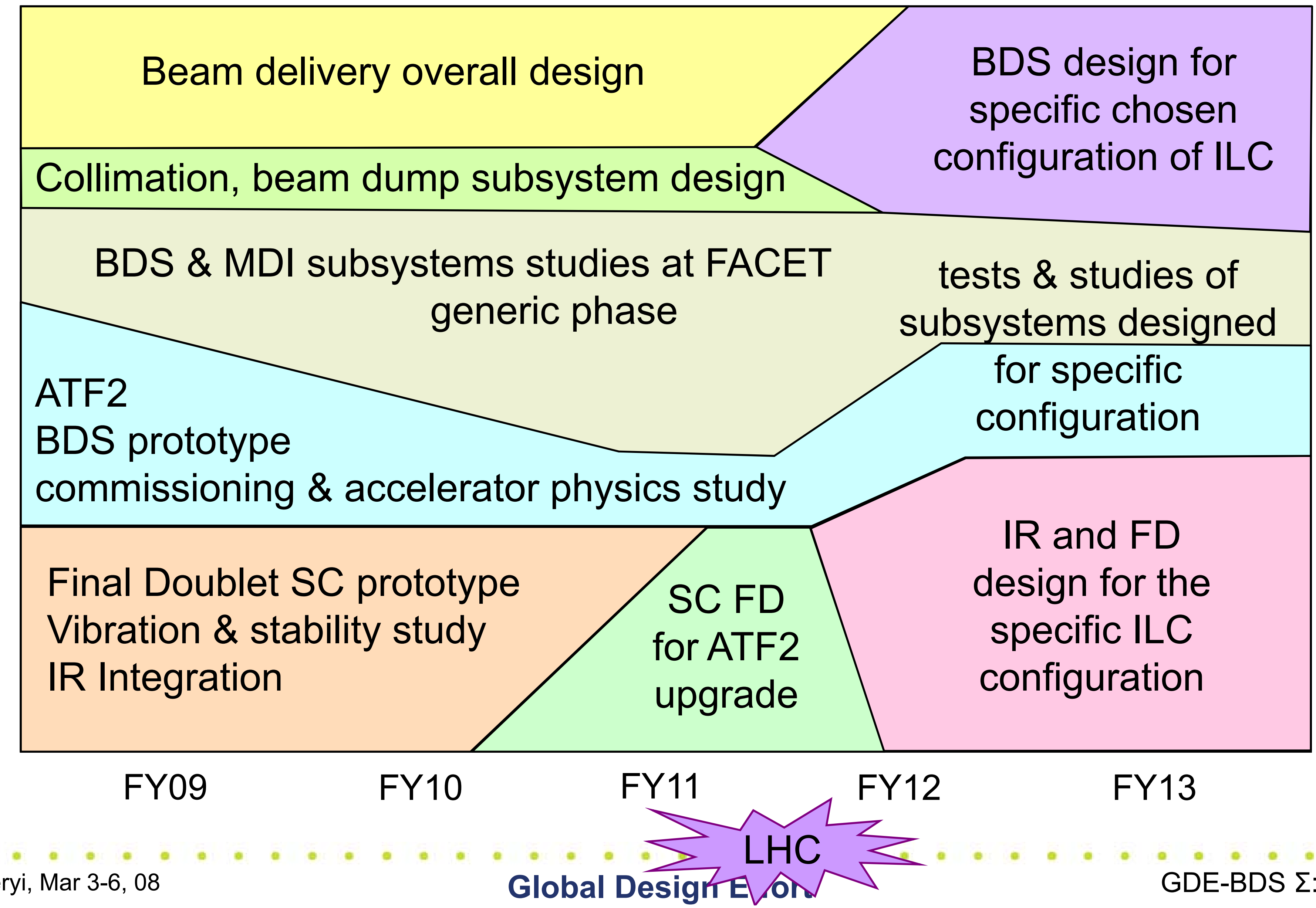
Sessions & summaries:

- All sessions of ACFA-MDI were held jointly with GDE-BDS
- Most of the talks (~15) were in ACFA-MDI part
- GDE-BDS sessions were mostly devoted to discussion
- ACFA-MDI summary was given ~30min ago by Tauchi-san
- In this summary, will focus on next steps with some illustration from discussion (of GDE-BDS or ACFA MDI sessions)

BDS planning strategy

- Do not proceed with:
  - **Design, or engineering of near-standard systems (e.g. beamline vacuum or magnets), or detailed consideration of requirements for CFS**
- Do focus on:
  - **Science, with emphasis on advanced ideas, which promise breakthroughs in performance/cost, reaching higher E, reduction of length, e.g.:**
    - BDS for CLIC, $\gamma\gamma$ design & system tests, crystal collimation, …
  - **Critical areas of design**
    - IR & detector integration, FD, ATF2, …
  - **Areas where new collaborators are joining**
    - Recent work at SLAC with BARC, India, on beam dump design
- Explore synergies
  - **LHC crab cavity design, …**
- Expect to revise strategy:
  - **When LHC results will allow determining the specific configuration of ILC**

Beam Delivery 5yr plan, ART



Interaction region detector-machine integration

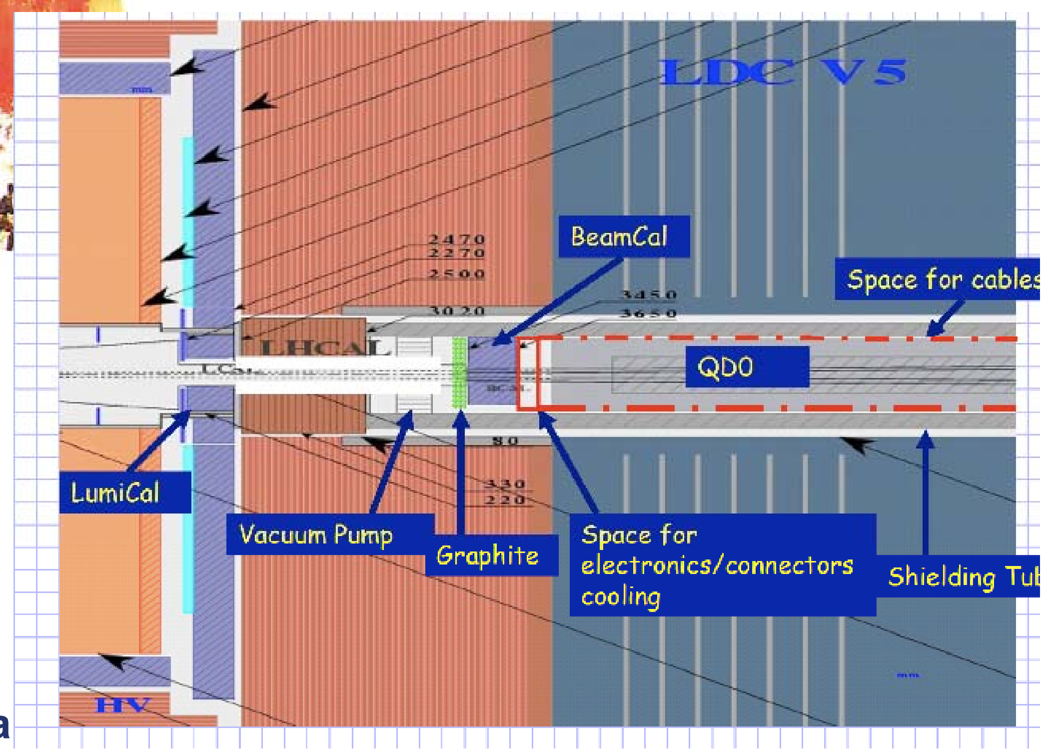
Discussion of IR Beam Space Real Estate

Highly Complex physics/engineering issues

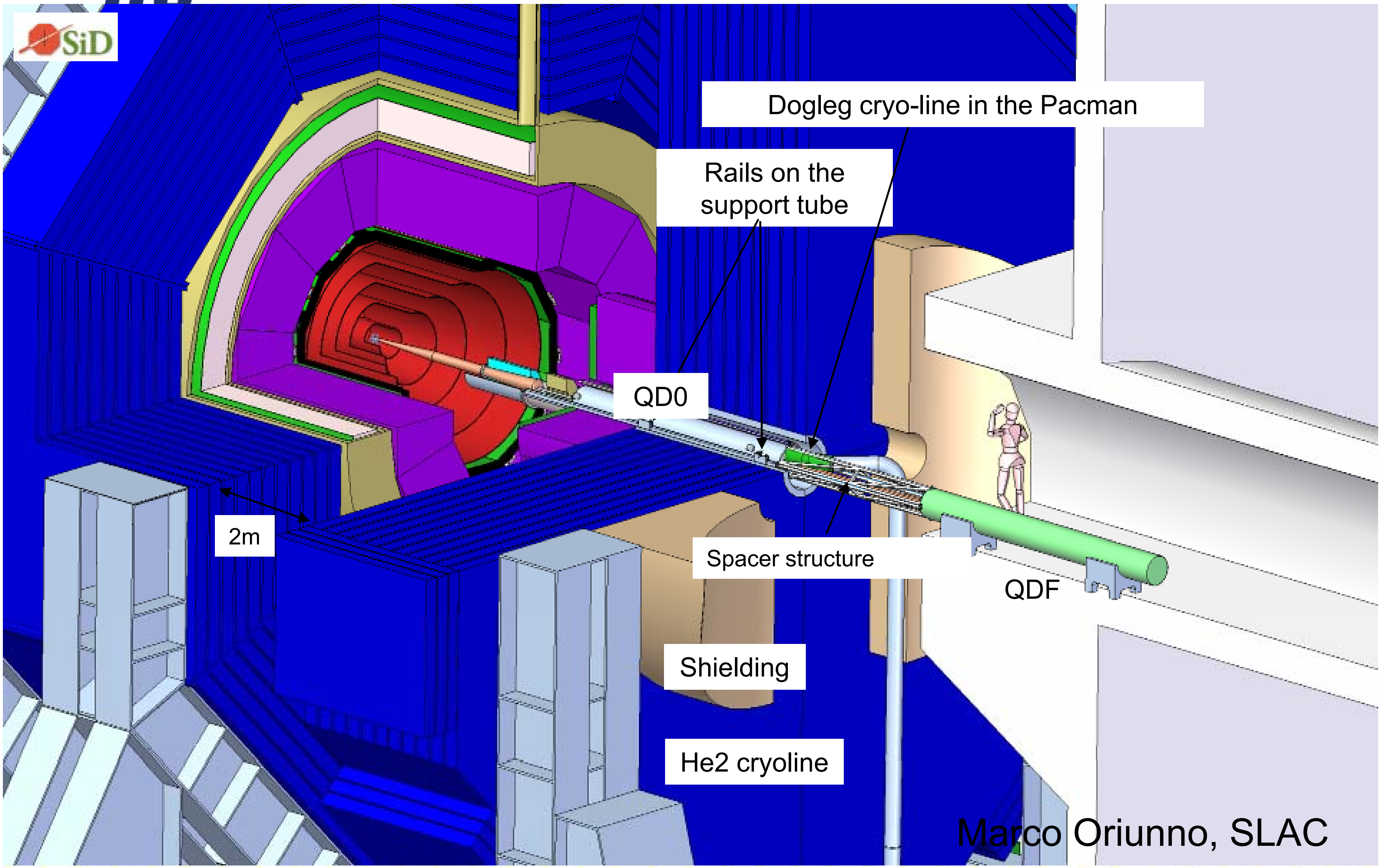
Totally integrated design between machine & detector

Critically important for detector design

Brett Parker and Tom Markiewicz, leaders of GDE-BDS IR Integration work, had opportunity for detailed discussion and planning with RD and detector concepts



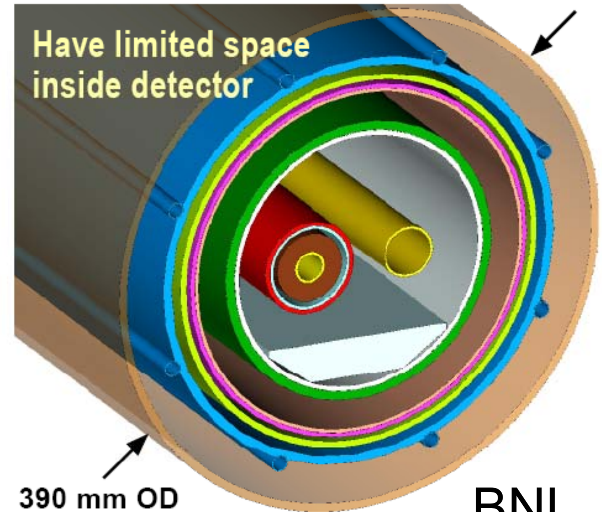
IR integration, SiD example

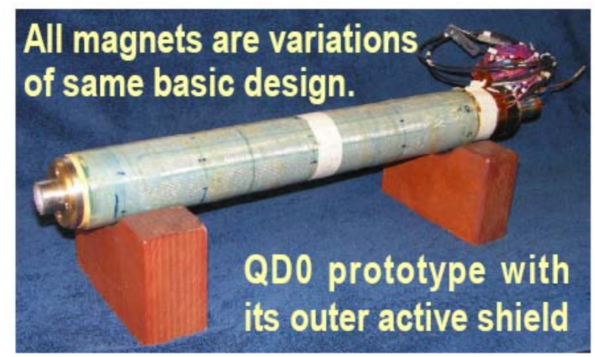


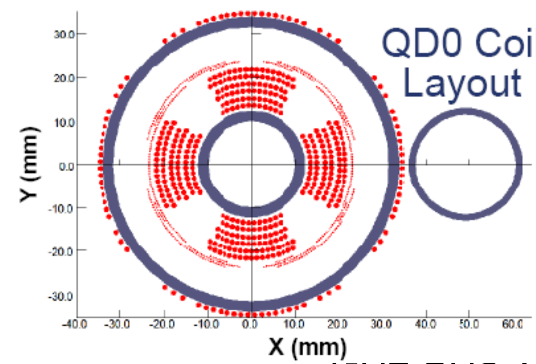
Final Doublet

- Design: address tight space constraints, the need for versatile beam orbit and aberration correction, challenging mechanical stability
- Full length prototype: address performance and system level integration

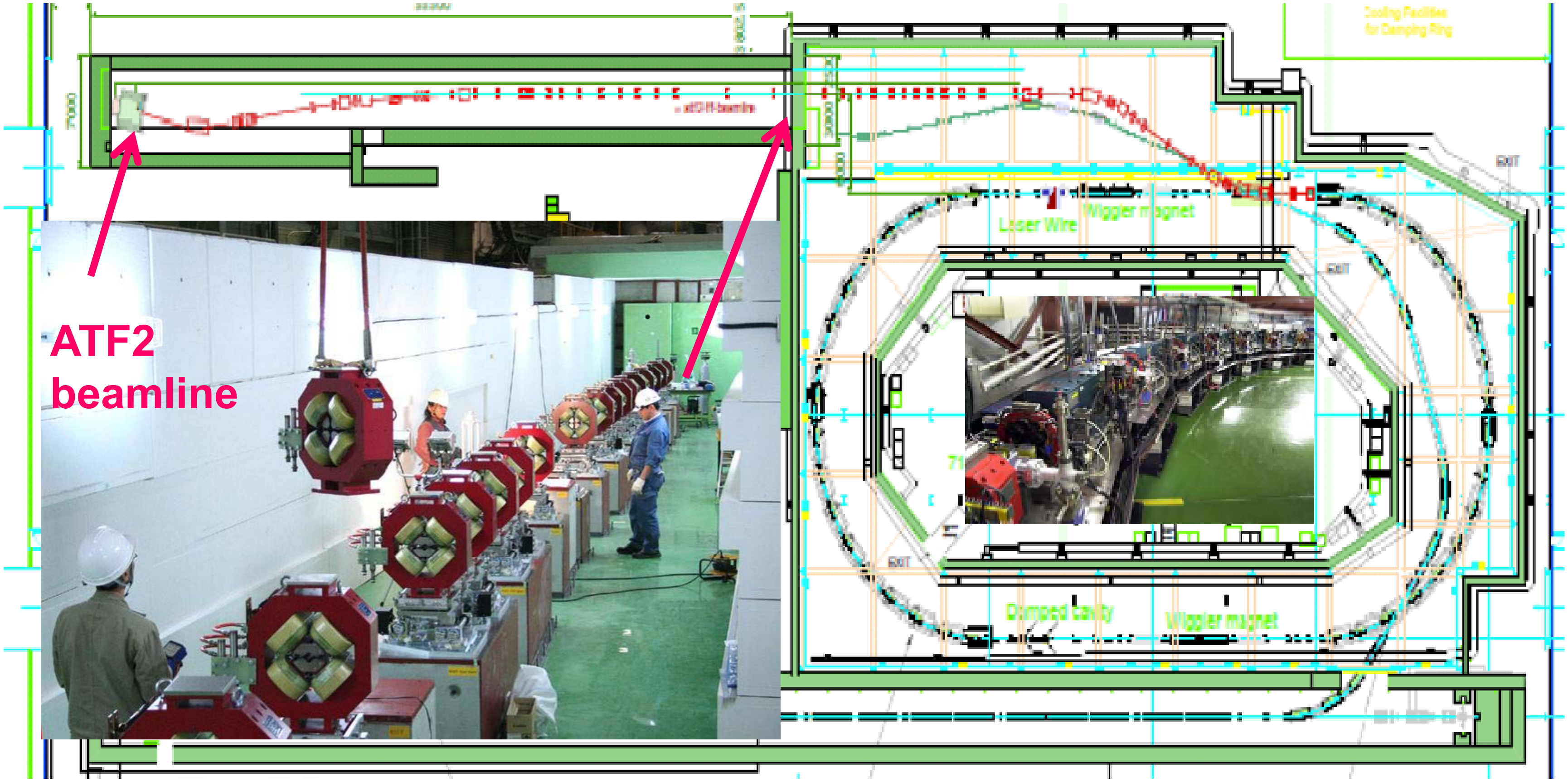
QD0 Cryostat design for L* = 4.5 m.







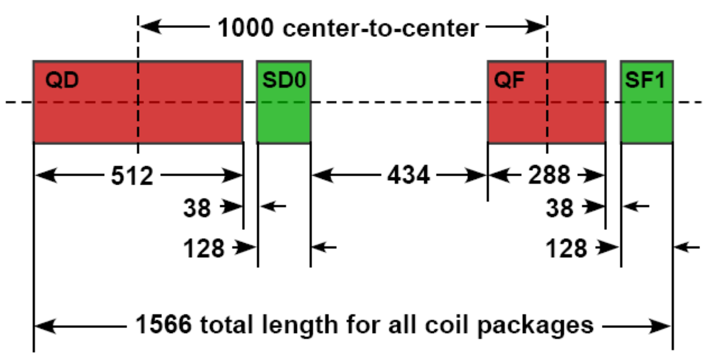
ATF2: Beam delivery model



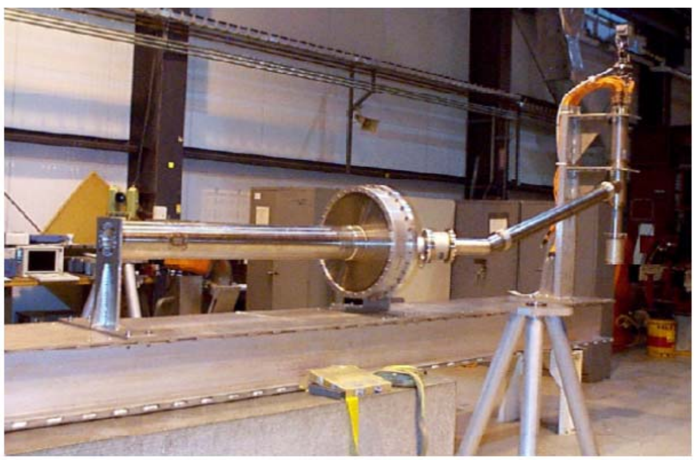
Built for ILC. Advanced accelerator study and beam handling applicable to any single path beamlines such as LCLS, XFEL.

ATF collaboration: >200 scientists. ATF MOU: 20 institutions worldwide

SC FD for ATF2

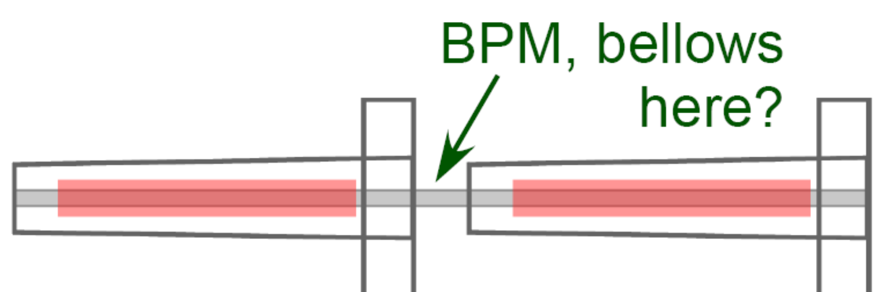


Proposed Super FF ATF2 Layout



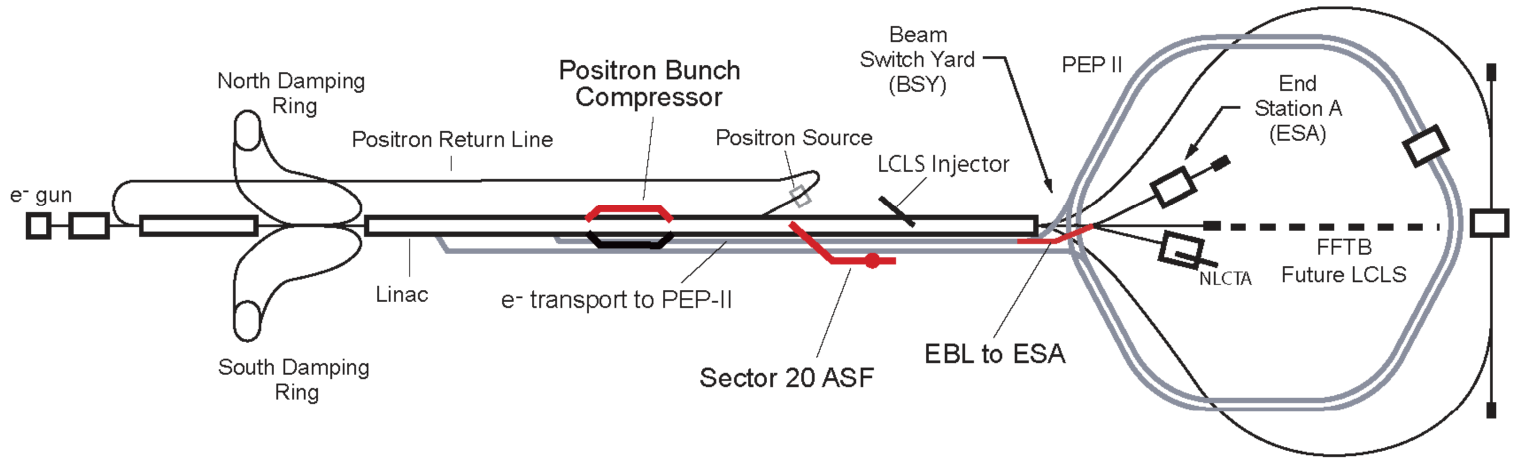
GG Style, HERA-II Upgrade Magnet

- Test of SC FD at ATF2 recommended by MAC
- With stretched schedule, ATF2 SC FD comes too late, if do it after full ILC FD prototype
- Investigating other options for schedule & tests, as well as using Hera-II GG magnets built by similar method



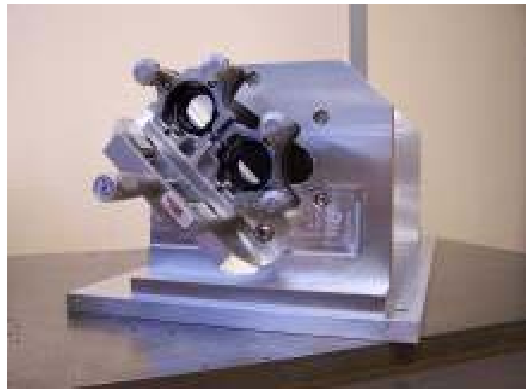
Brett Parker

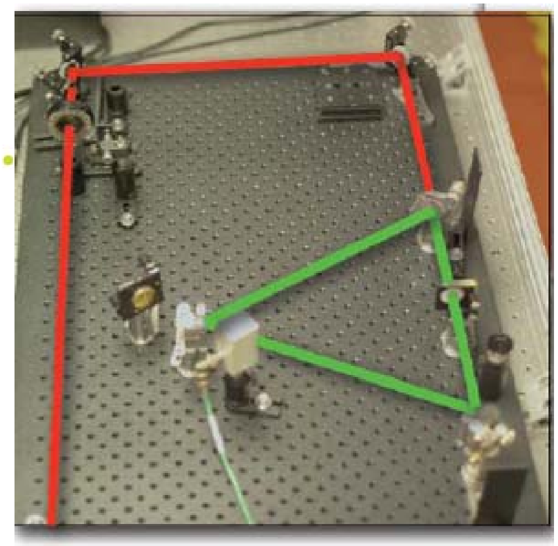
BDS & MDI at FACET



- Proposed FACET includes ESA area primarily dedicated for BDS/MDI subsystem tests
  - **Energy spectrometers and collimation system tests**
  - **Beam diagnostics**
  - **Detector component studies**
  - **System test of e=>γ conversion for γγ option**
  - **Study forward region detector and GAMCAL …**

Options for e→γ cavity





Pulse Stacking Cavity
(R&D for Positron source KEK-LAL-Hiroshima-Waseda-Kyoto-IHEP)

enhancement: 300-1000
tight motion tolerances

RING (Recirculation Injection by Nonlinear Gating) Cavity LLNL

recirculation of a pulse ~50 times
compensation of circulated pulse decay

- Developing R&D plan for e→γ considering ATF2 and FACET (ESA) for the system test

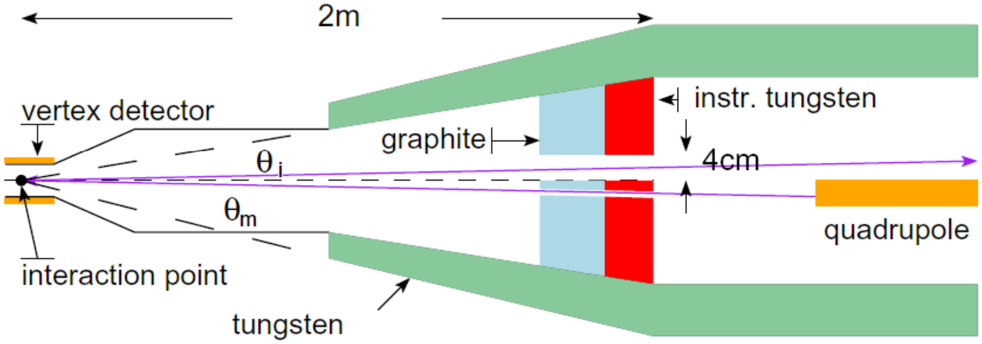
T.Takahashi, et al

Benefits for US of BDS R&D

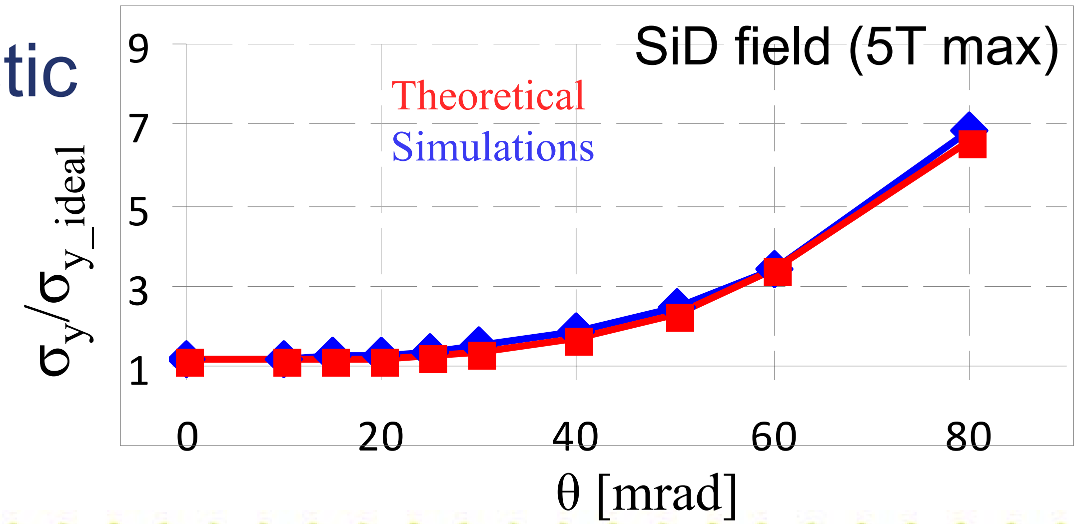
- Direct: maintain leadership in key areas of US expertise, needed to reach the energy frontier
- Indirect: synergy with US science
  - **ATF2: advanced accelerator study and beam handling applicable to any single path beamlines such as LCLS, XFEL…**
  - **Instrumentation, high availability power supplies, etc., are applicable to many future projects such as NSLS-2, LCLS…**
  - **Interaction region integration and FD design: synergy with LHC IR upgrade and Super-B IR**
  - **Collimation research: synergy with LHC, already engaged in design of LHC II-stage collimation system**
  - **Crab cavity design: already engaged in LHC crab.cav. study**
  - **FACET and ESA research: reach out to laser and plasma science communities, engaging them in our scientific quest, thus increasing scientific value of ILC**

Start of CLIC-ILC design work

- Reviewed physics driving CLIC BDS design
  - **coherent pairs; short train; post-collision measurements…**
    - D.Schulte

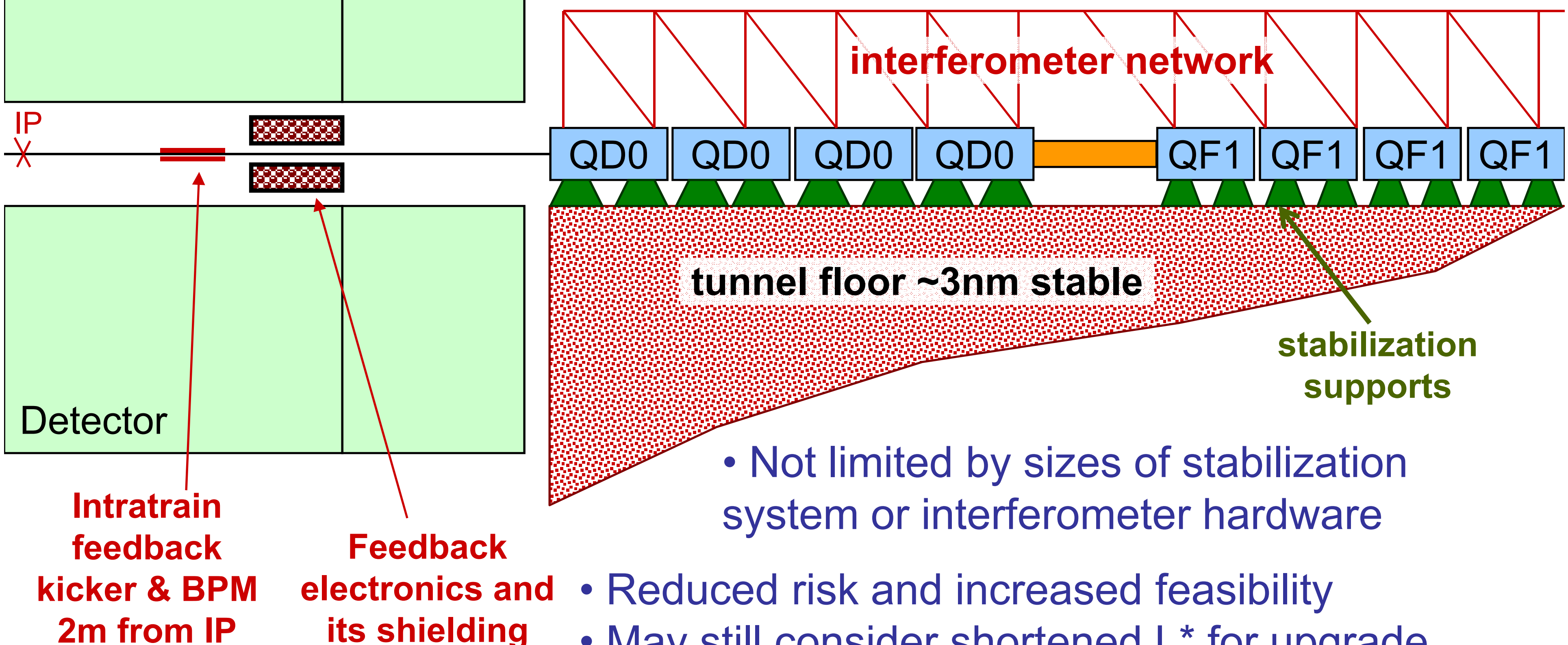


- Started study SR size growth in realistic detector field using tools developed for ILC
    - S.Seletskiy



Discussed an approach to CLIC IR stability

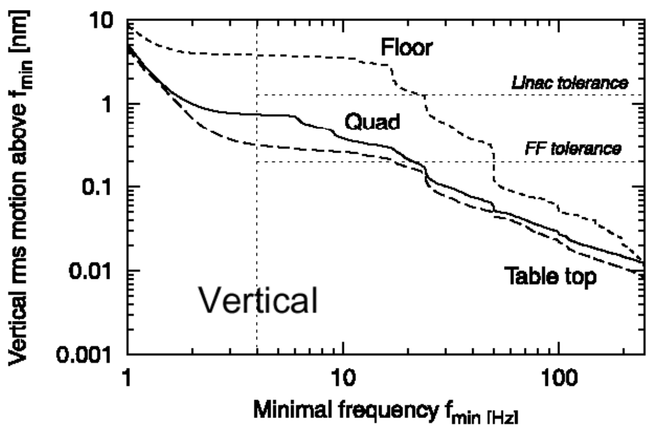
- Slower than 1/L* dependence of Lum => ↑L*
- Reduced feedback latency – several iteration of intratrain feedback over 150ns train
- FD placed on tunnel floor, which is ~ten times more stable than detector – easier for stabilization



- Not limited by sizes of stabilization system or interferometer hardware
- Reduced risk and increased feasibility
- May still consider shortened L* for upgrade

L(L*); achievements & sizes of hardware

Quadrupole vibration:



On magnet top:

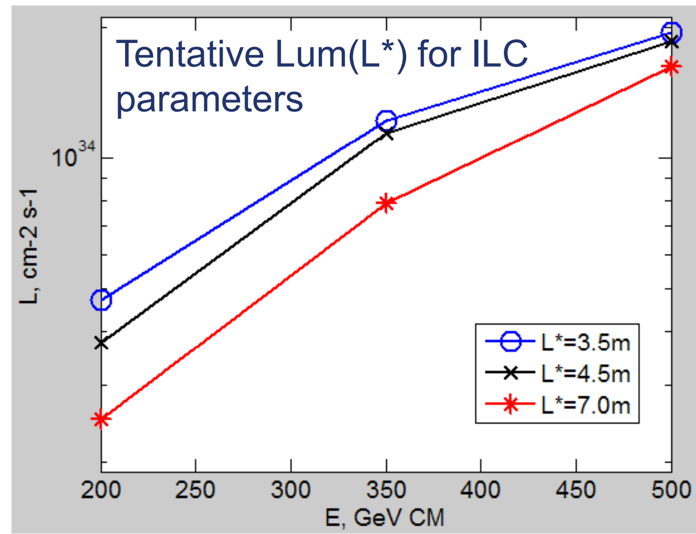
X: (0.4 ± 0.1) nm

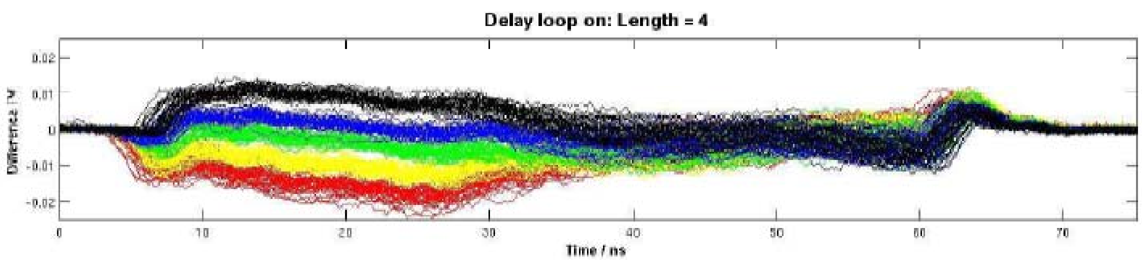
Y: (0.9 ± 0.1) nm
(0.3 nm on table top)

Z: (3.2 ± 0.4) nm

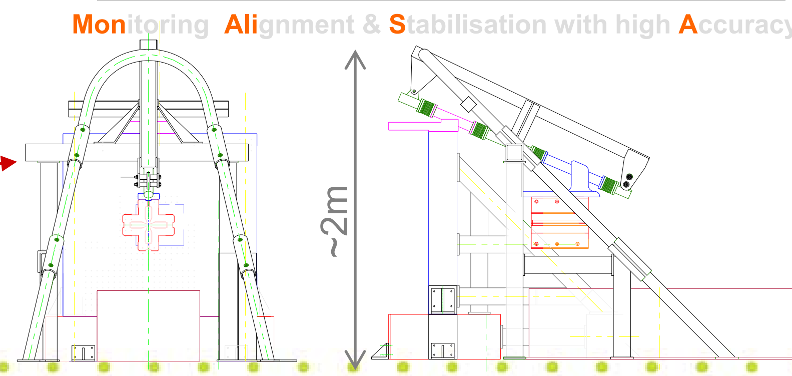
without cooling water.

R.Assmann et al, Stabilization with STACIS give ~10 reduction of tunnel floor vibration



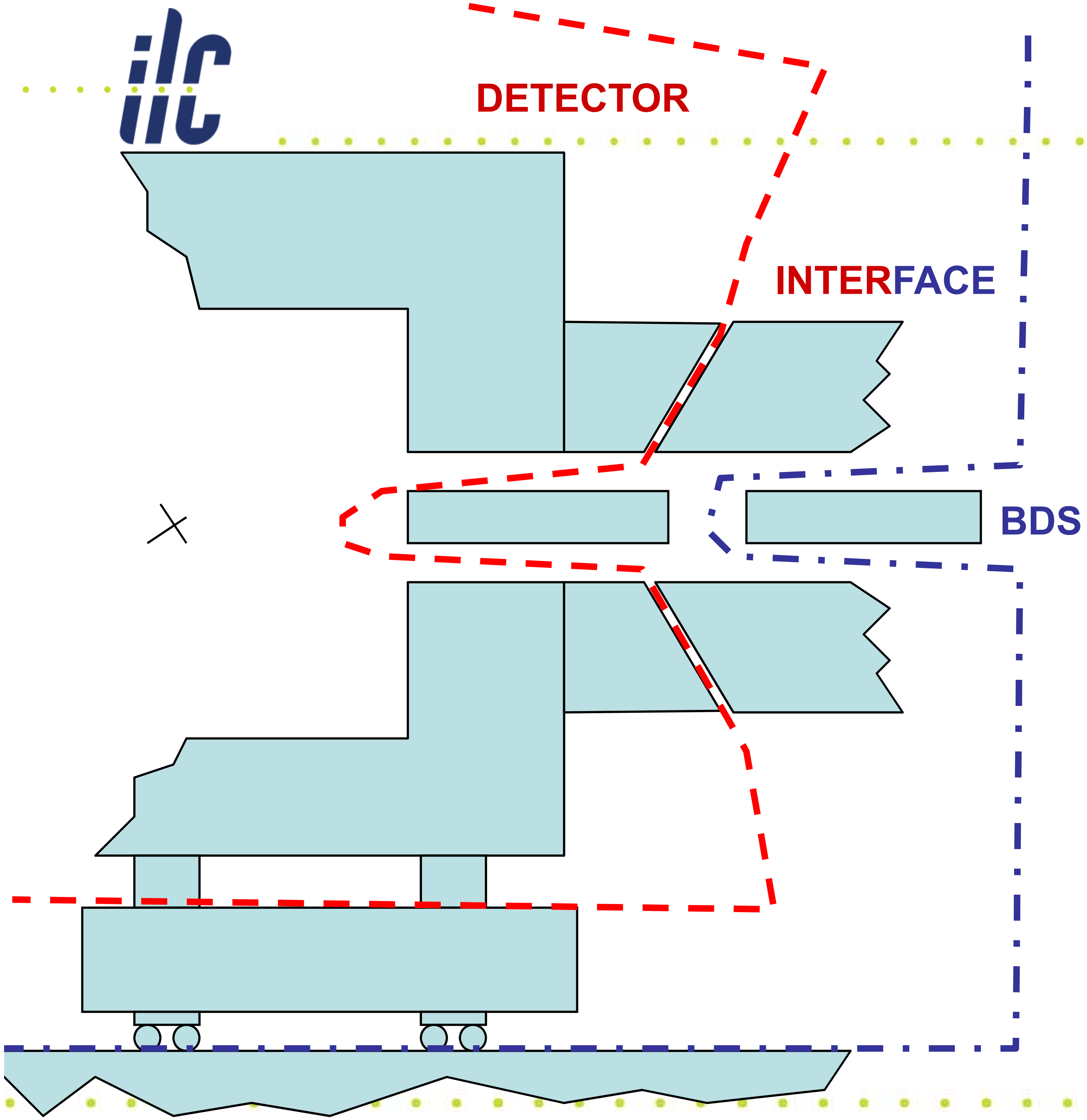


P.Burrows et al, FONT3 demonstrated latency of 23ns, including 10ns of irreducible time-of flight



D.Urner et al, MONALISA interferometer system for ATF2 final doublet: space availability matters

IR Interface boundaries



- Boundaries, parameters at interface will be defined in details and iterated
- Foresee larger shift of technical responsibility (e.g. for moving system) towards detectors, with the goal of achieving more cost effective design

IR integration timescale

- EPAC08 & Warsaw-08
  - **Interface document as of IRENG-07**
- LCWS 2008
  - **Interface document, draft**
- LOI, April 2009
  - **Interface document**
- Apr.2009 to ~May 2010
  - **design according to Interface doc.**
- ~May 2010: LHC & start of TDP-II
  - **design according to Interf. doc and adjust to specific configuration of ILC**

IR integration & topics for Dubna mtg

		Dubna?	Who?
Items which interface each concept to the BDS			
	Push-Pull Time Constraints		
	Baseline IR Hall Model (Dimension, Cranes, Shafts, etc)	x	ILC CFS
	QF1 Support Model		
	QD0 Alignment Specifications (coarse, fine)		
	Where is detector vs. BDS dividing line		
	Pair monitor input to luminosity feedback system		
	Machine/Detector DAQ compatibility		
	DID or Anti-DID or nothing?		
	MONALISA interferometer system through the detector		
	Stray field outside of detector		
Items which are unique to each detector concept and which must be mutually compatible for push pull			
	QD0 magnetic system (cryostat & feed boxes) for each L*		
	QD0 support model		
	Shielding schemes: walls, PACMAN	x	ILC/ILD team, Dubna
	Motion system: Platform versus rollers/air pads on floor	x	Dubna
	Cryogen distribution system	x	Emmanuel Tsesmelis
	Vacuum requirements and solutions	x	Emmanuel Tsesmelis

Names: tentative

Summary

- Priorities discussed
- Started re-planning
- Topics for Dubna GDE meeting identified