Beam Delivery and MDI Summary

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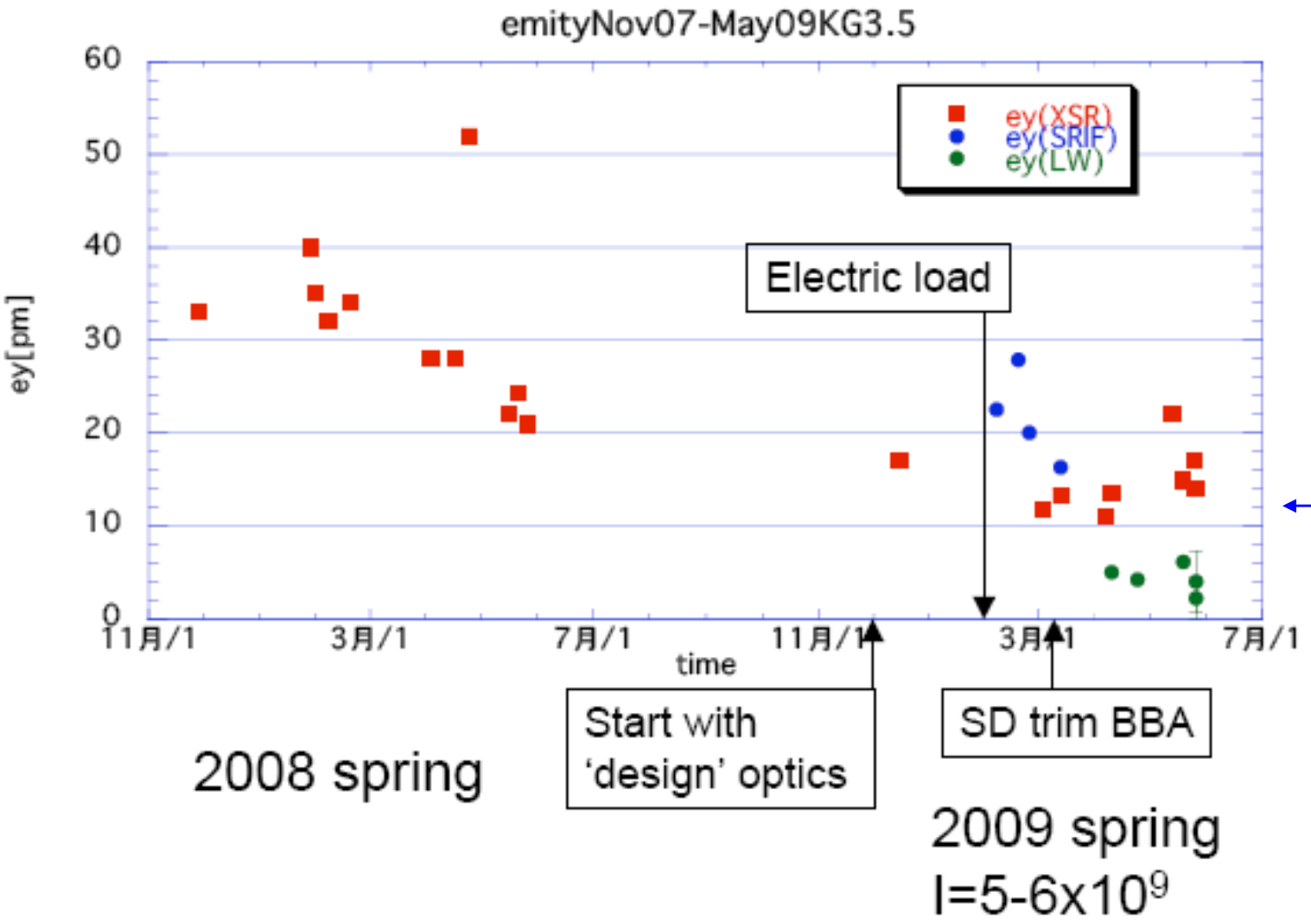
LCWA 09

October 3, 2009

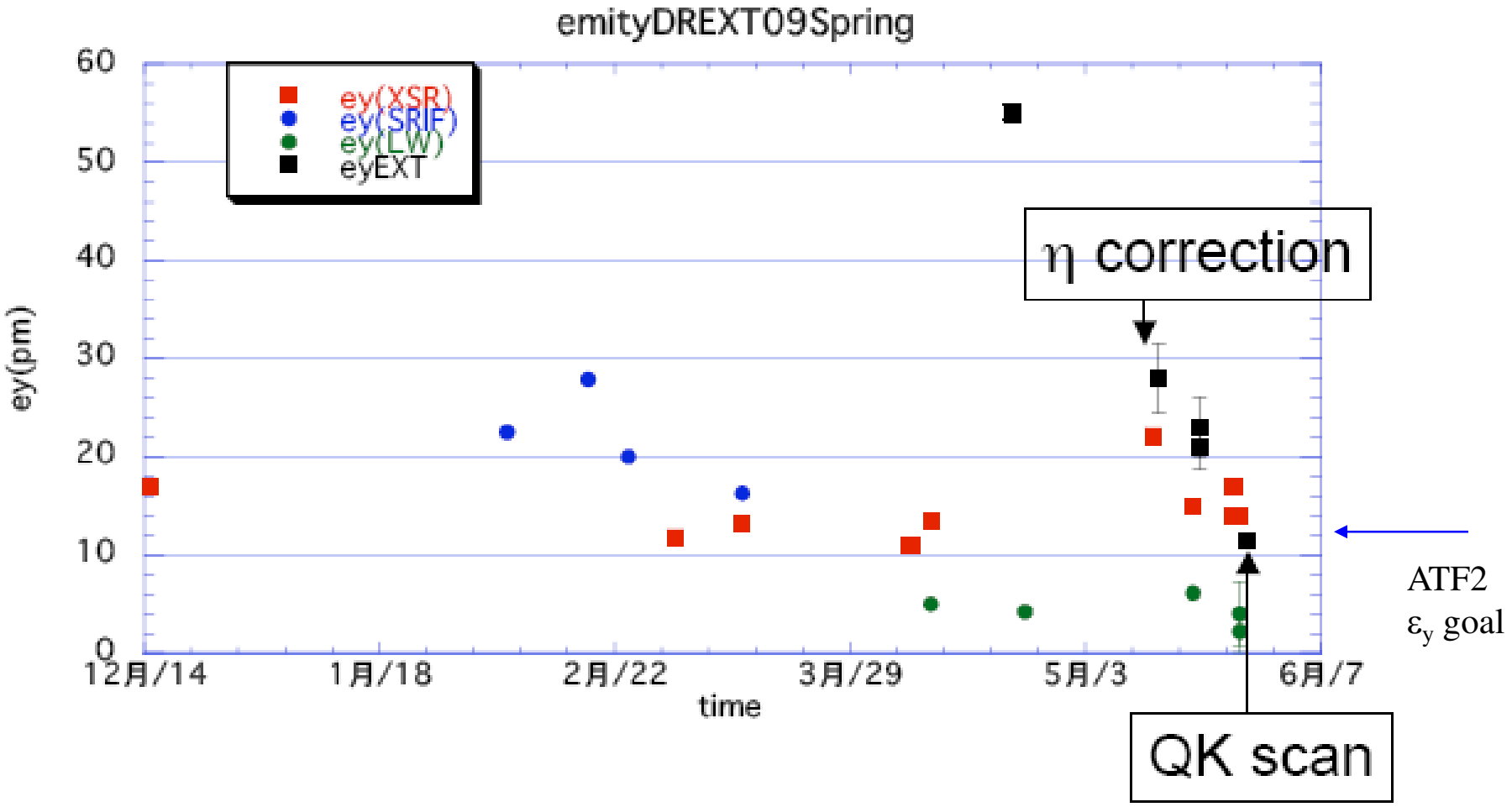
Highlights

- ATF2 progress
- SC FD prototype
- Study of SB2009
- MDI and IR stability
- Beam instrumentation development
- Beam dump design

Measured DR Emittance



Measured EXT Emittance

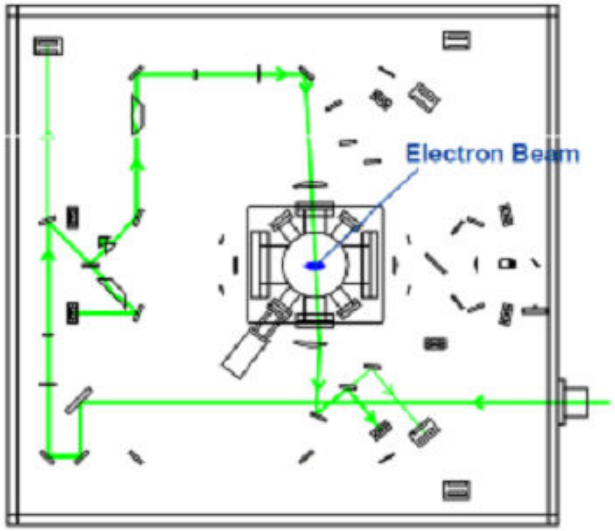


IP σ_x with BSM "laser wire" mode established

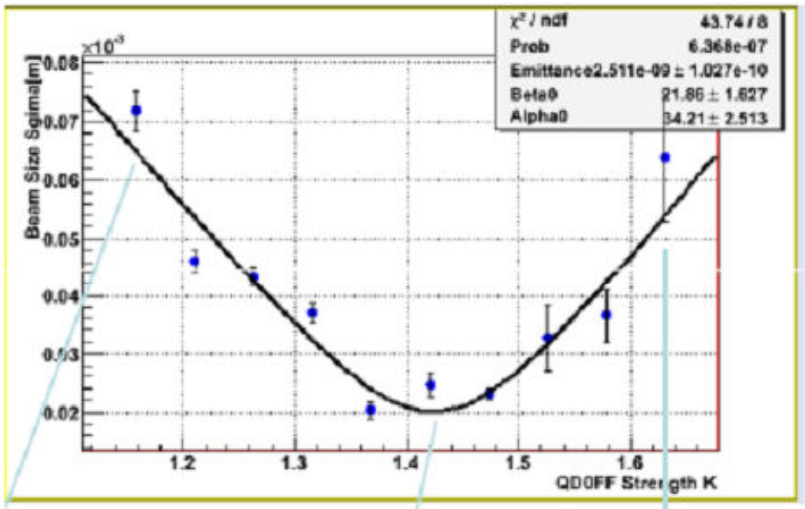
-*First Compton signal was observed in February.*

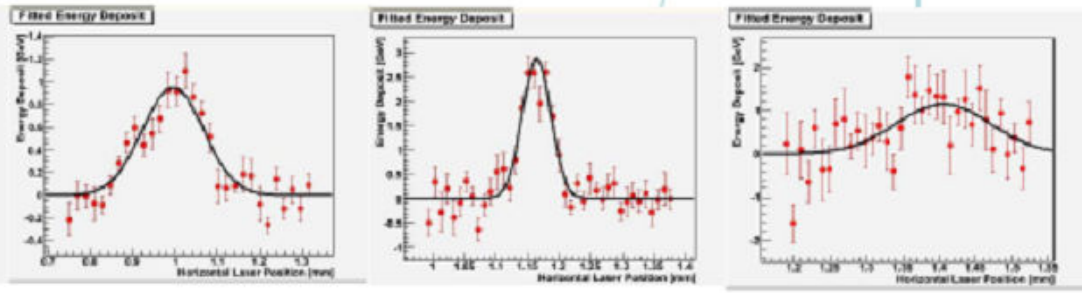
-*Beam size and emittance measurement was done in May.*

- *horizontal beam size at MW1IP was 20um.*
- *laser beam size 10um assumed.*
-*fitted horizontal emittance was 2.5nm.*



laser wire mode optics
(horizontal measurement)





σ_y in interference mode → not yet a convincing signal but good progress made

Goals for October - December 2009

- Continue fast extraction kicker R&D in Damping Ring
- Confirm large β^* optics ($\beta_{x,y}$=8,1cm) ➔ towards sub-μm σ_y
- First signal evidence in interference mode ➔ BSM σ_y measurement

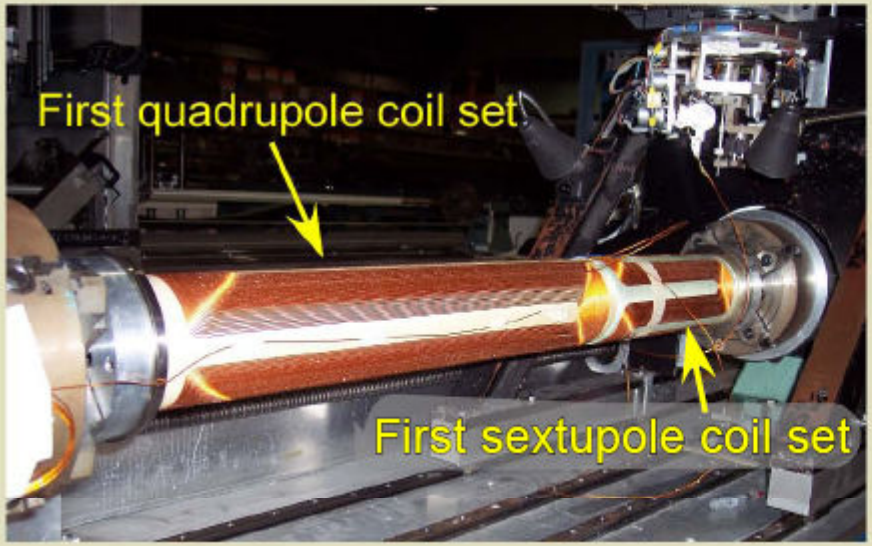
Sub-goals

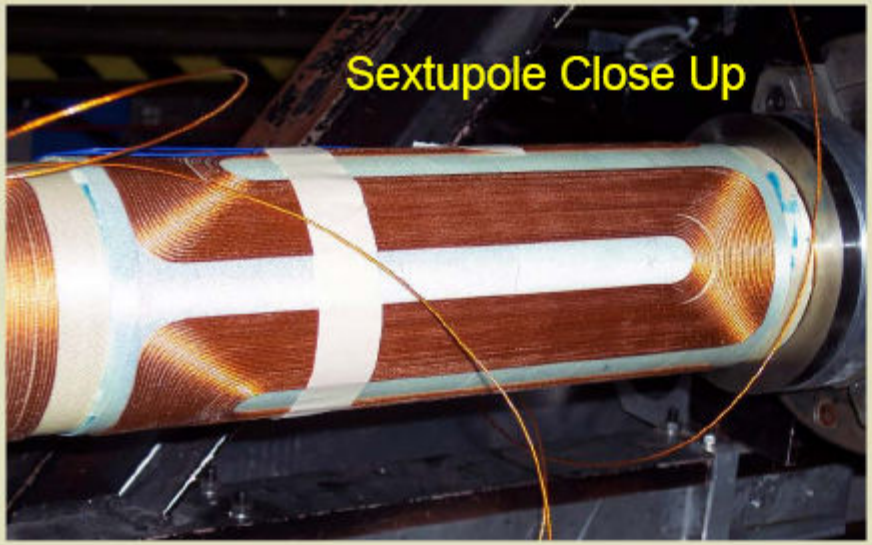
- New BSM hardware
- Carbon wire scanner at IP with 5 μm diameter
- Cavity BPM stability and reproducible calibrations
- Strip-line BPM improved calibration & reproducibility
- Efficient optical tuning strategy in extraction line ➔ IP spot

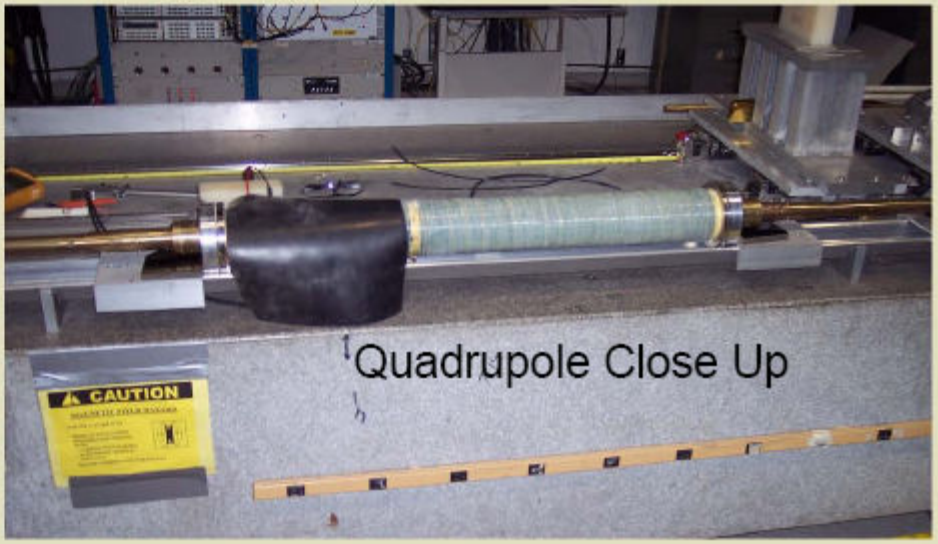
Additional goals preparing for 2010-2011

- New strip-line BPM electronics
- Multi-OTR fast extraction line 4D phase space diagnostics
- Tilt monitor & IP-BPM R&D
- FONT
- Background study at and near IP as function of β^* and FD alignment

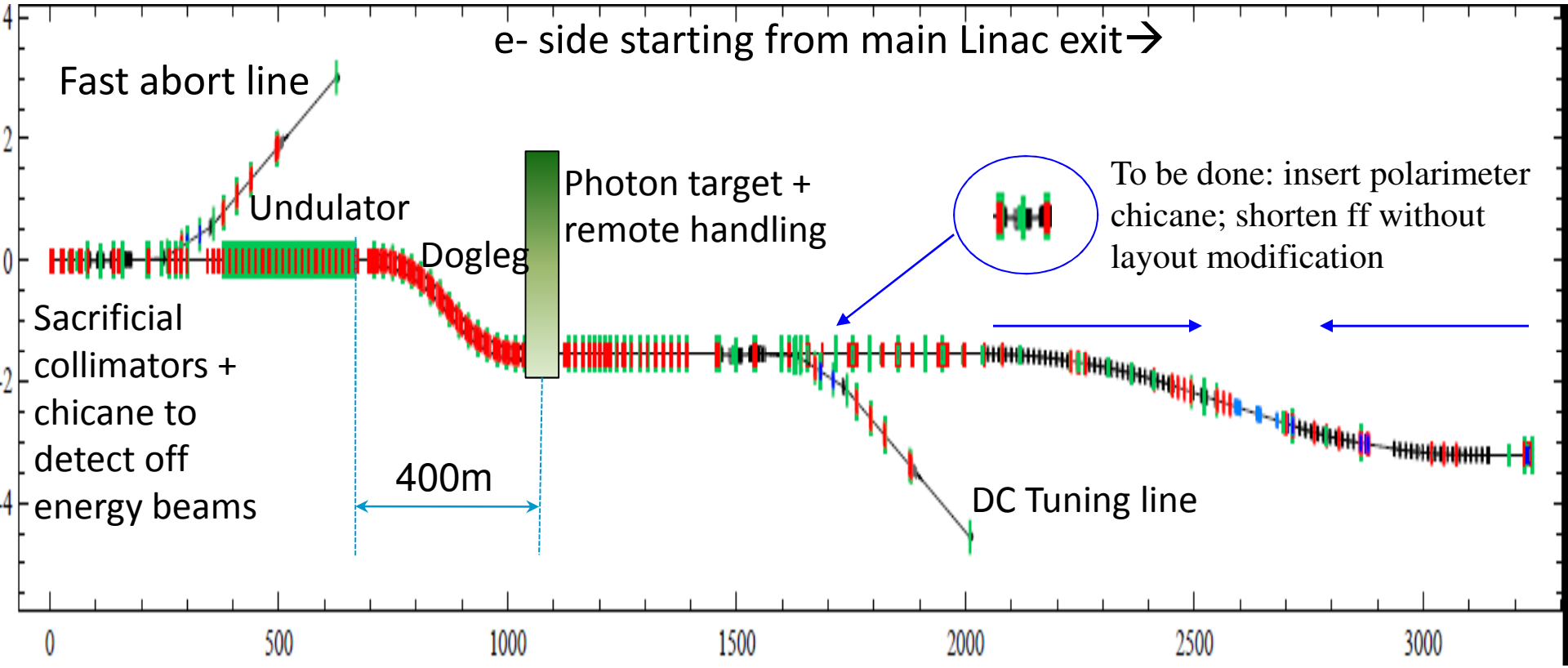
Start of ATF2 Coil Production & Measurement.





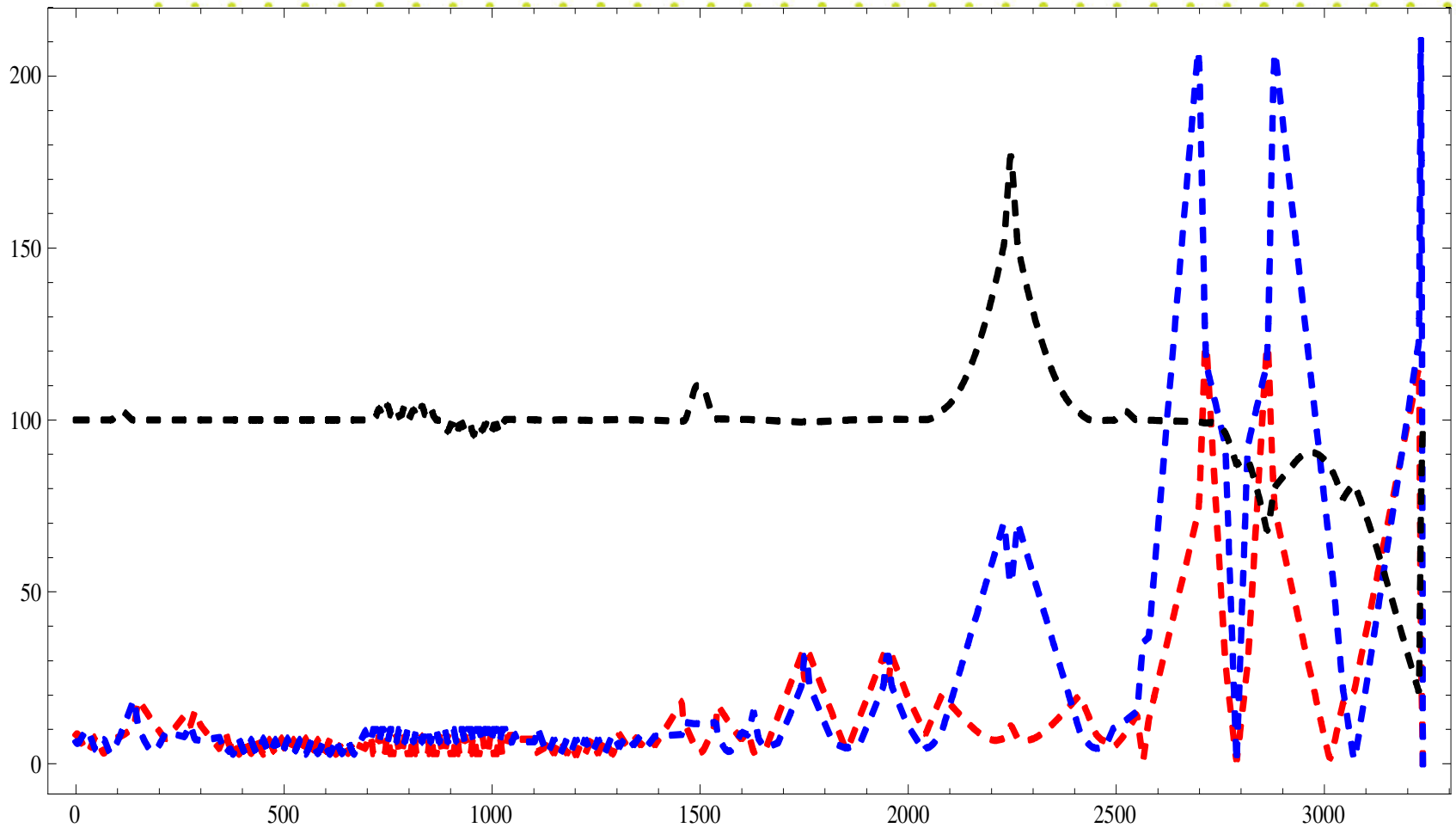


SB2009 lattice, e- side



Deepa Angal-Kalinin & James Jones
ASTeC, Daresbury Laboratory & The Cockcroft Institute

SB09 optics of e- BDS from exit of Linac to IP



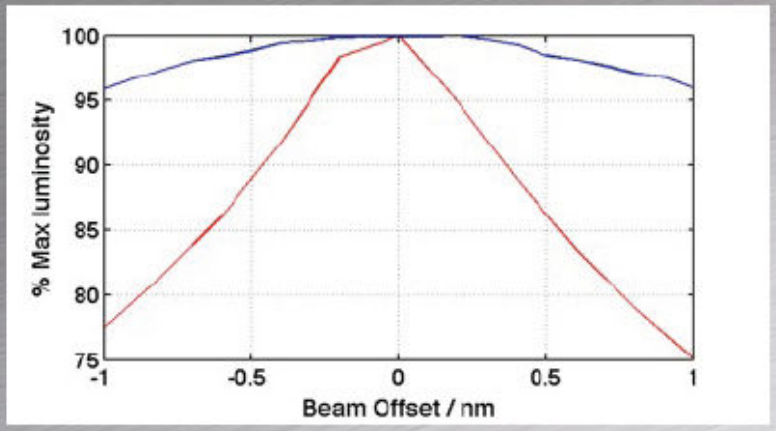
SB2009 Parameters (WA)

		RDR	SB2009	
Beam and RF Parameters				
No. of bunches		2625	1312	
Bunch spacing	ns	370	740	
beam current	mA	9.0	4.5	
Avg. beam power (250 GeV)	MW	10.8	5.4	
Accelerating gradient	MV/m	31.5	31.5	
P_{fwd} / cavity (matched)	kW	294	147	
Q_{ext} (matched)		3×10^6	6×10^6	
t_{fill}	ms	0.62	1.13	
RF pulse length	ms	1.6	2.0	
RF to beam efficiency	%	61	44	
IP Parameters				
Norm. horizontal emittance	mm.mr	10	10	
Norm. vertical emittance	mm.mr	0.040	0.035	
bunch length	mm	0.3	0.3	
horizontal b*	mm	20	11	
horizontal beam size	nm	640	470	
			no trav. focus	with trav. focus
vertical β^*	mm	0.40	0.48	0.2
vertical beam size	nm	5.7	5.8	3.8
D_y		19	25	
dE_{BS}/E	%	2	4	3.6
Avg. P_{BS}	kW	260	200	194
Luminosity	$cm^{-2}s^{-1}$	2×10^{34}	1.5×10^{34}	2×10^{34}

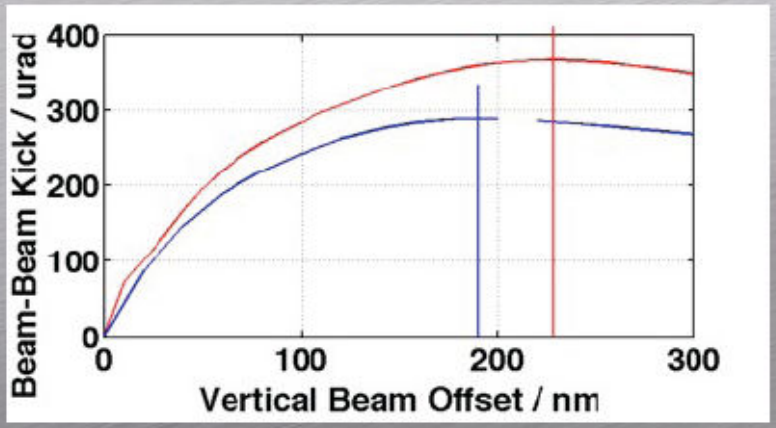
SB09 & collimation

- SB09 parameters have twice smaller beta_x* and for TF case also twice smaller beta_y*
  - Thus, collimation depth need to be increased ~1.4 times (collimate closer to beam core)
    - This may make the bunch-bunch jitter requirement tighter
      - longer bunch-bunch spacing helps
  - This may also increase flux of muons from collimators
    - But remember, we can install muon shield walls which can deal with much more conservative halo than is expected
      - (The muon wall caverns will be oversized, and only fractions of walls installed from the start)
- There is also x-z correlated effect for collimation.
  - Preliminary estimation show that this is not an issue unless there are tails beyond tens of sigma_z in longit. direction

IP Beam-Beam Dynamics



SB2009 (lowP with trav focus)
Nominal Parameter Set

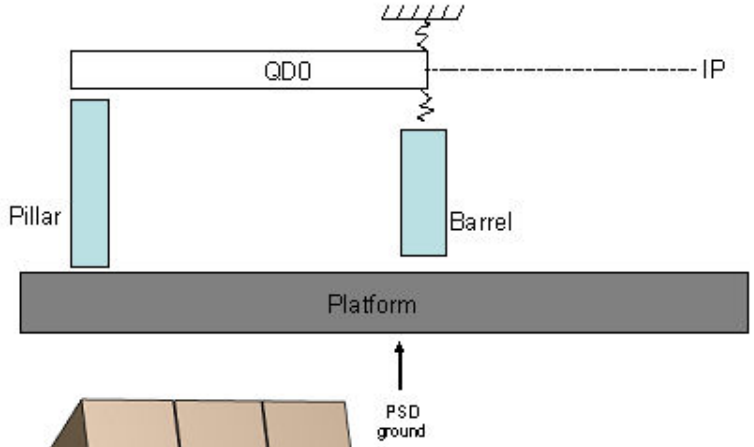


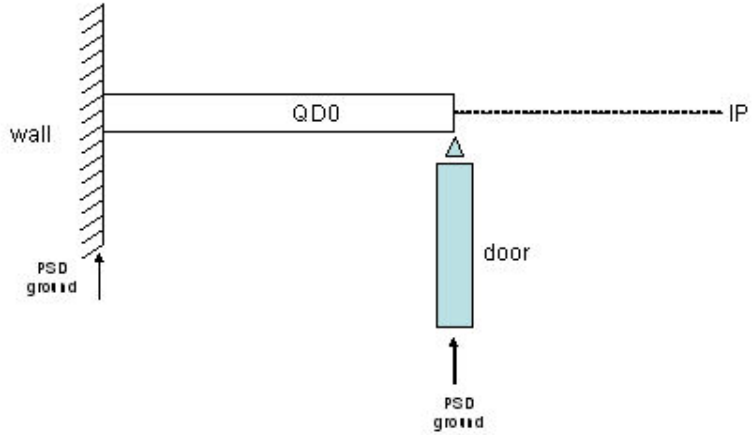
GUINEA-PIG Simulations

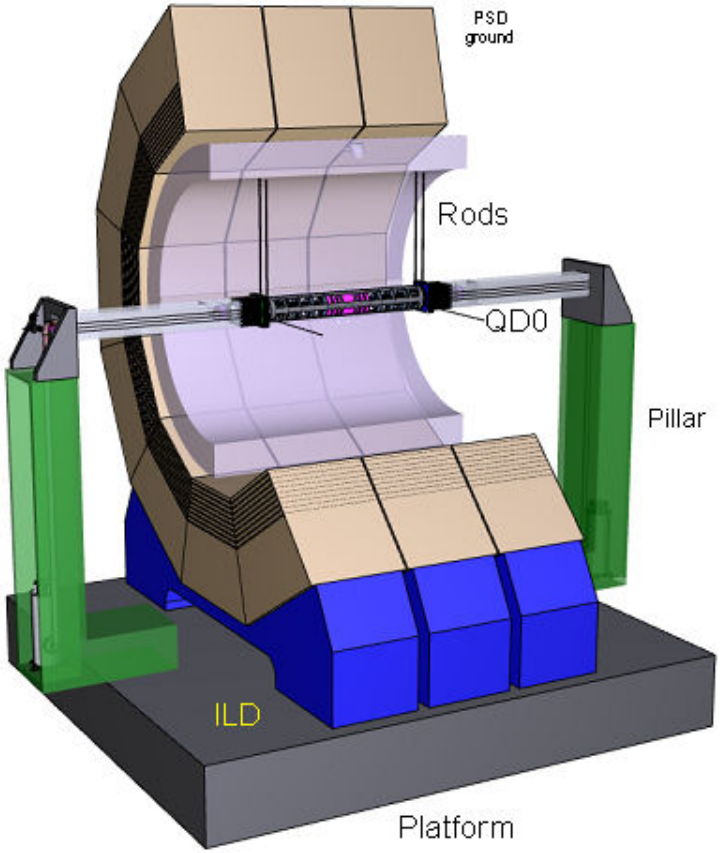
- IP vertical position feedback based on beam-beam kick
- "turn over" point of kick sets desired dynamic range
- SB2009 more sensitive
- Vertical beam offset must be kept <200pm for <5% lumi loss
- SB2009 parameter set gives slightly larger dynamic range for FFB system

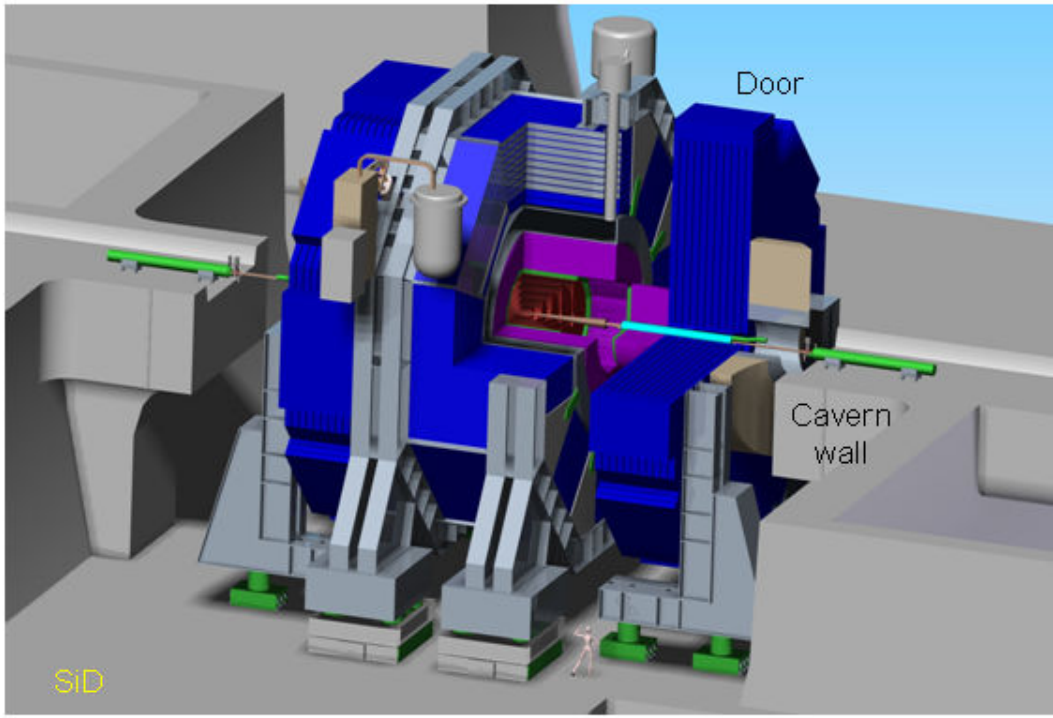
Glen White (SLAC)
Javier Resta-Lopez (JAI)

QD0 supports for ILD and SiD

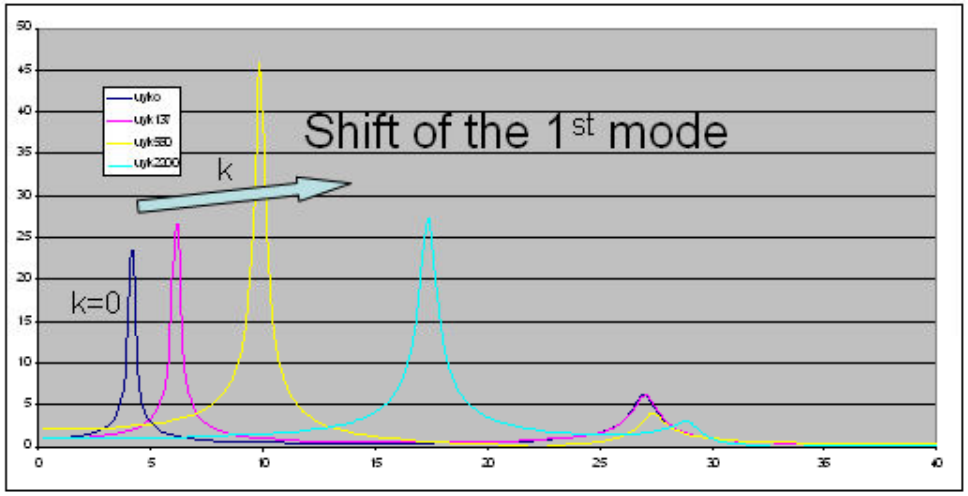


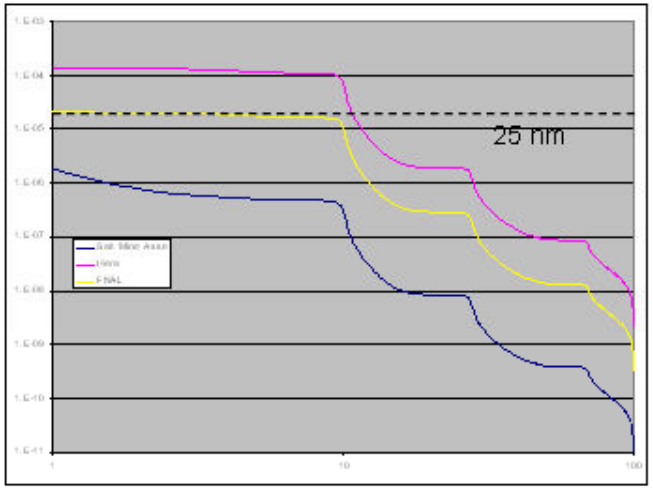


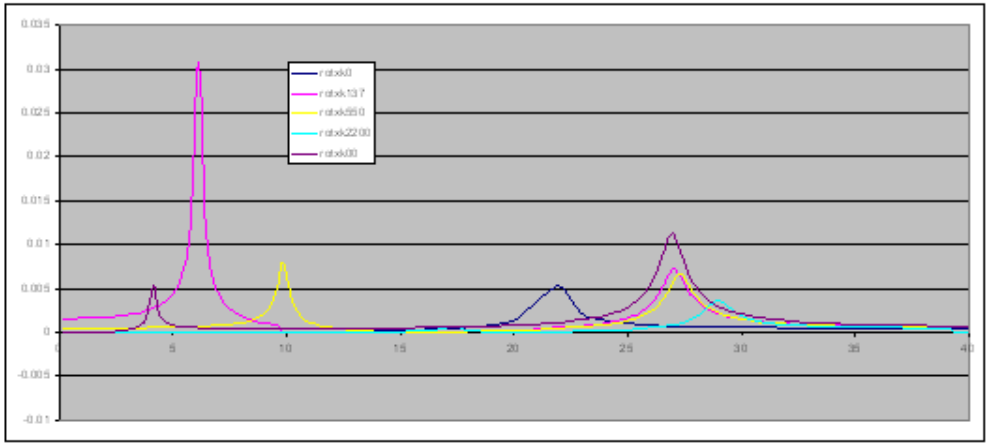


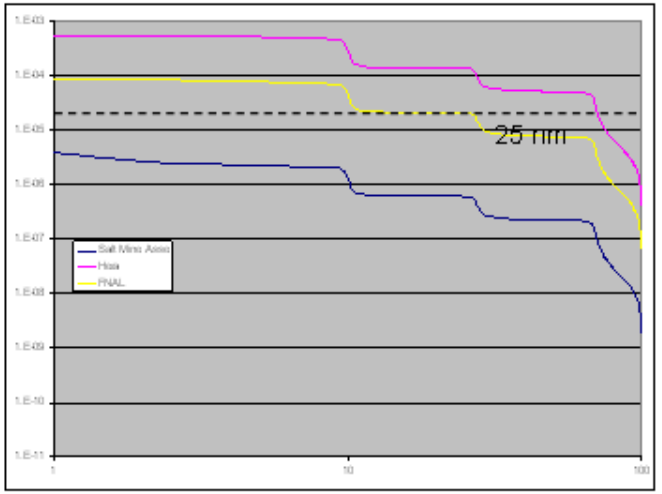


QDO cantilevered + spring suspension from the barrel

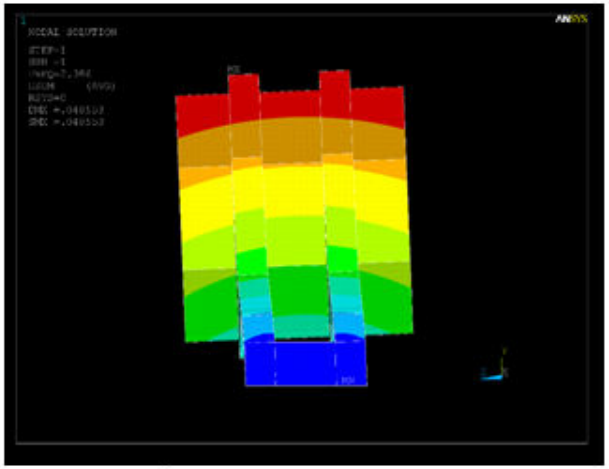




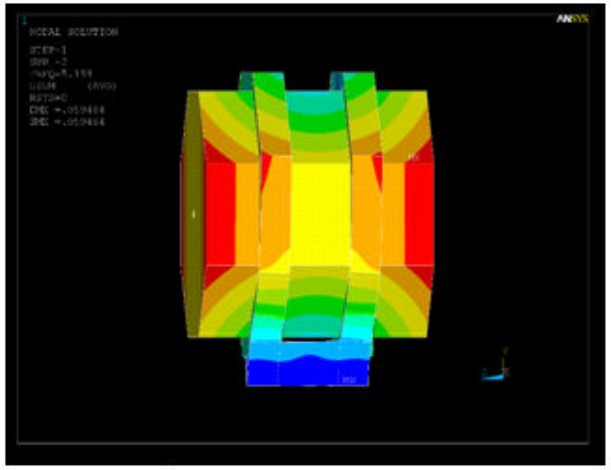




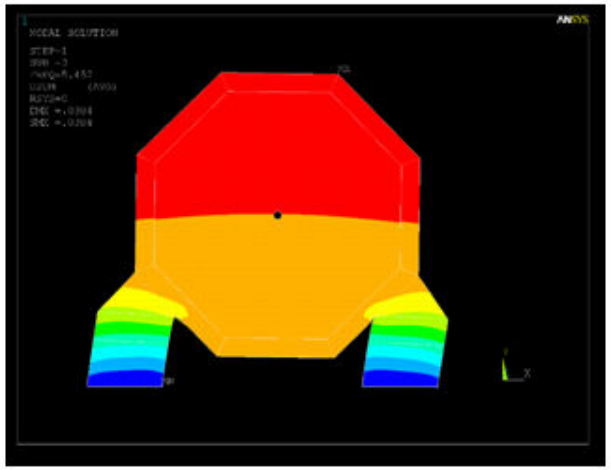
Free Vibration Mode



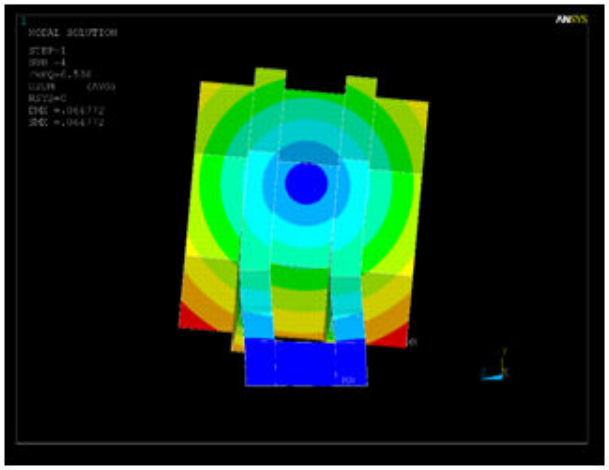
1st Mode, 2.38 Hz



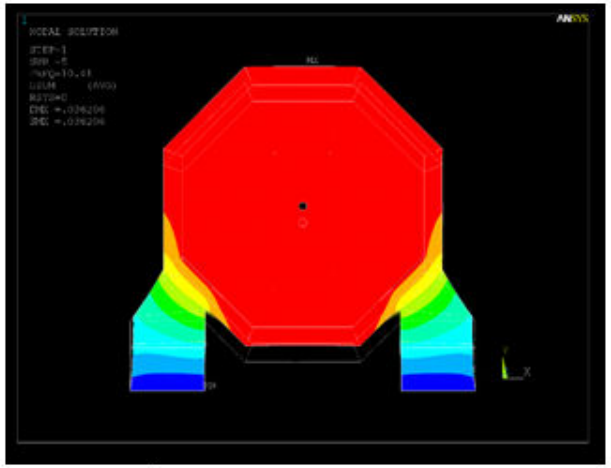
2nd Mode, 5.15 Hz



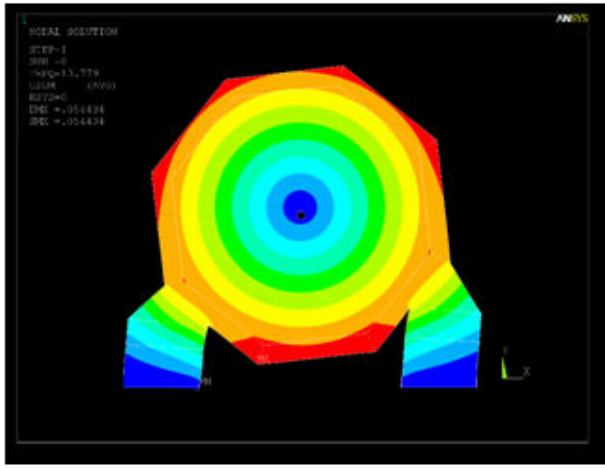
3rd Mode, 5.45 Hz



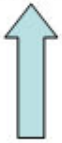
4th Mode, 6.53 Hz



5th Mode, 10.42 Hz



6th Mode, 13.7 Hz



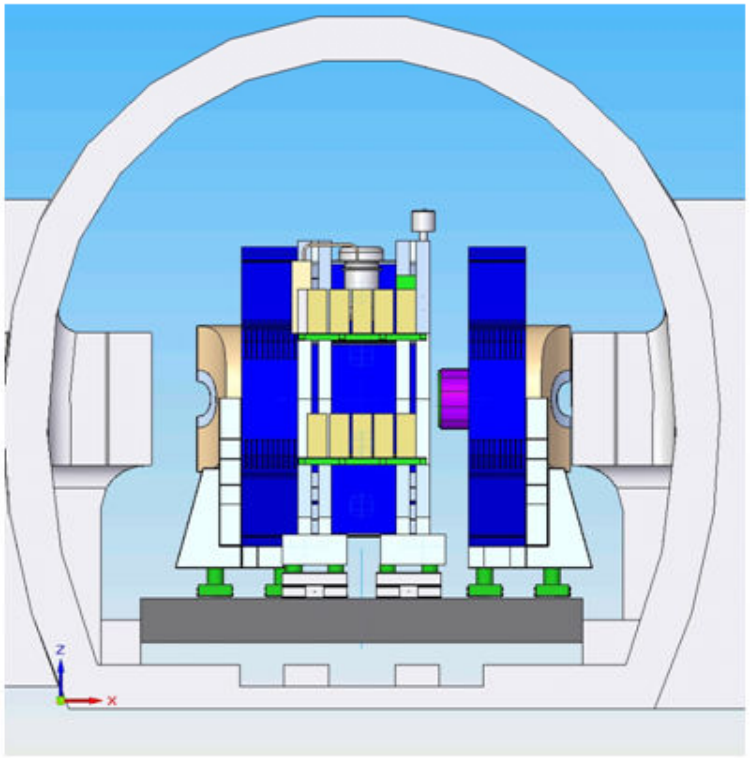
Vertical motion

The platform

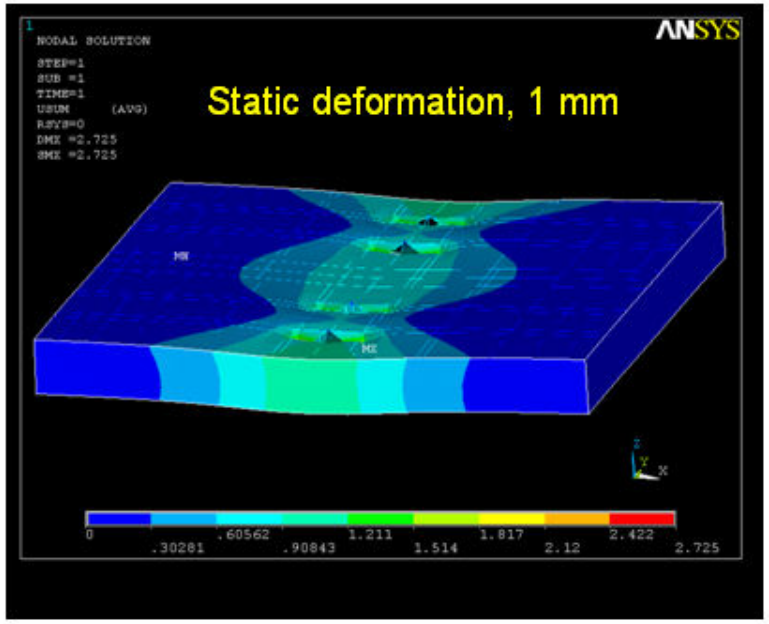
One of main concerns that triggered the stabilization studies of the final focus system is the effectiveness of a platform concept versus the shielding of the ground motions :

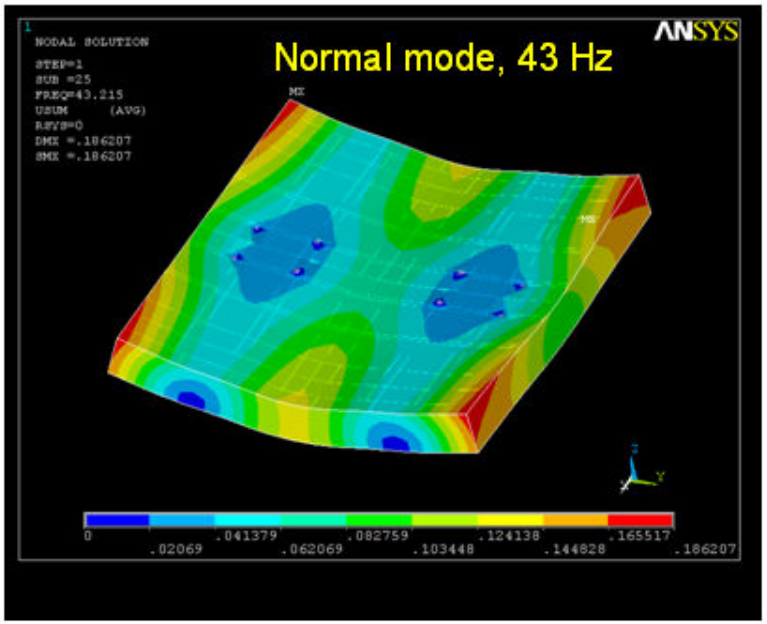
- Is a detector on a platform experiencing amplified, reduced or same levels of ground motion ?

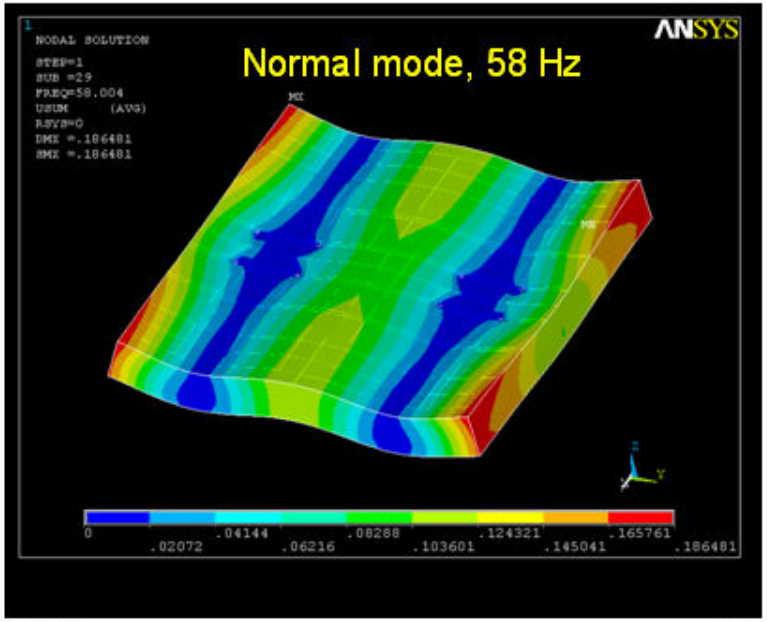
The question is subordinate to the availability of an the engineering design of the platform and how the detector and the QD0s are secured on board.

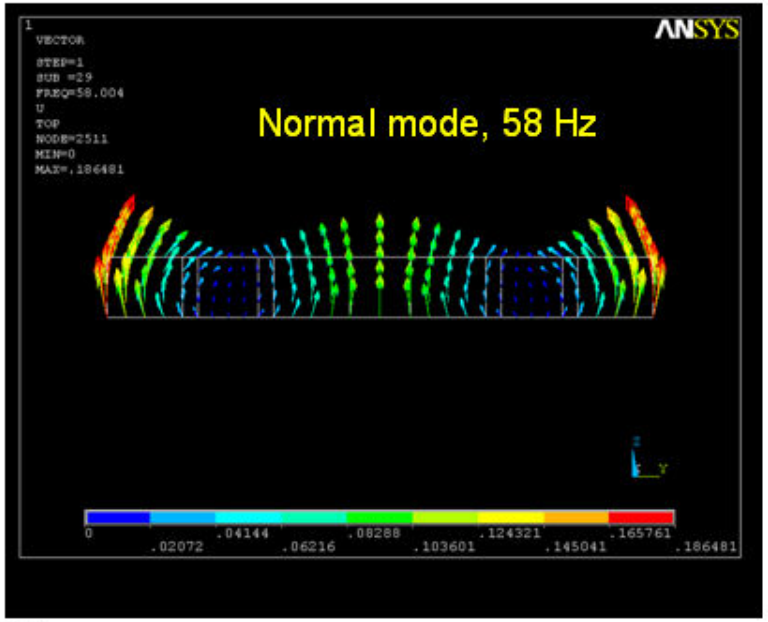


Modal analysis

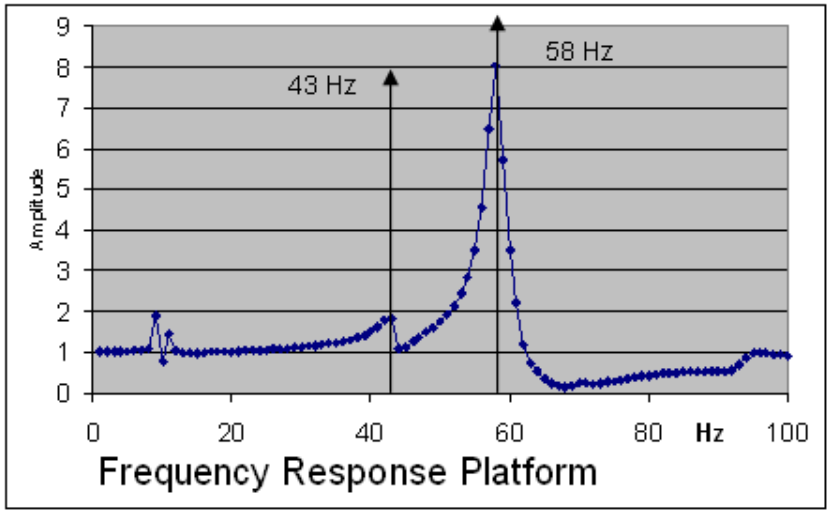


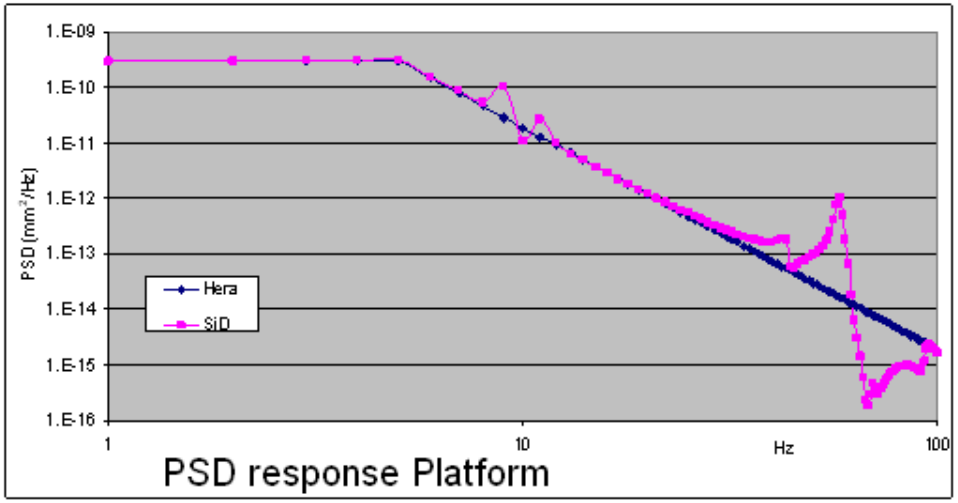


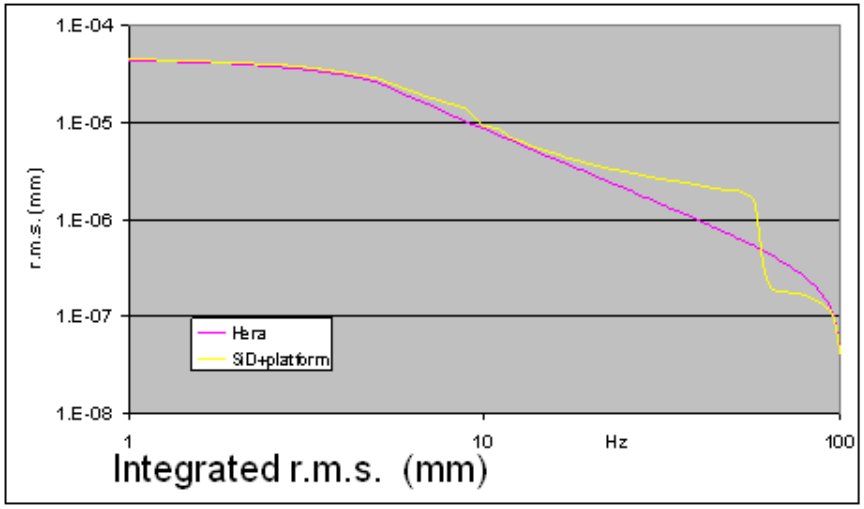


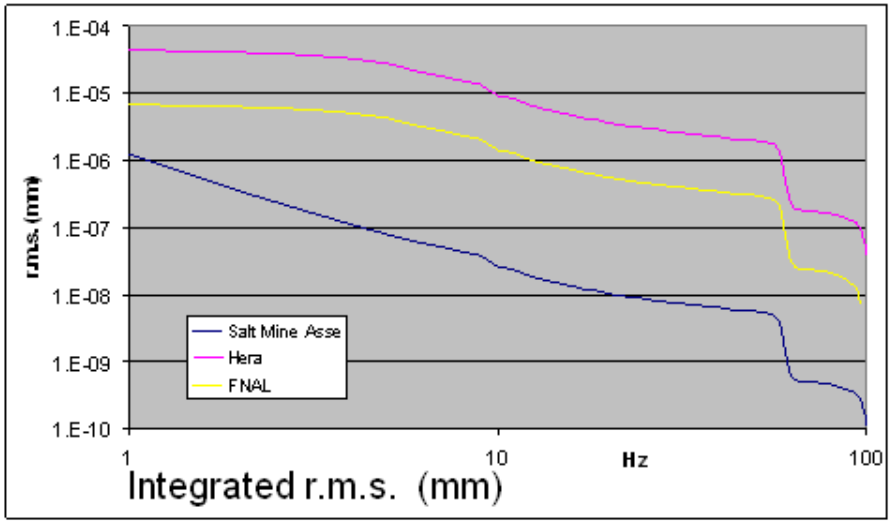


Random vibrations





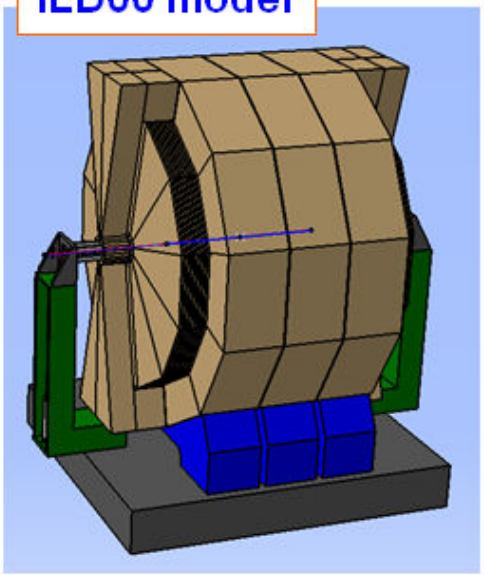




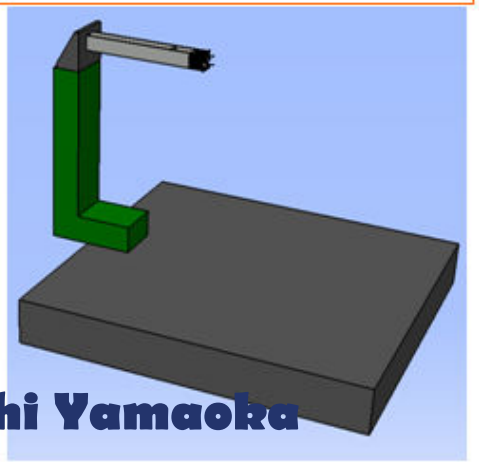
Introduction

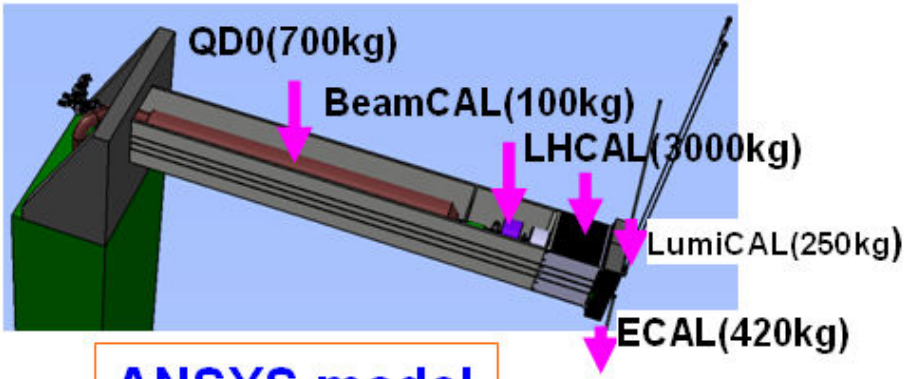
Vibration properties of the ILD QD0 support system has been studied.

ILD00 model

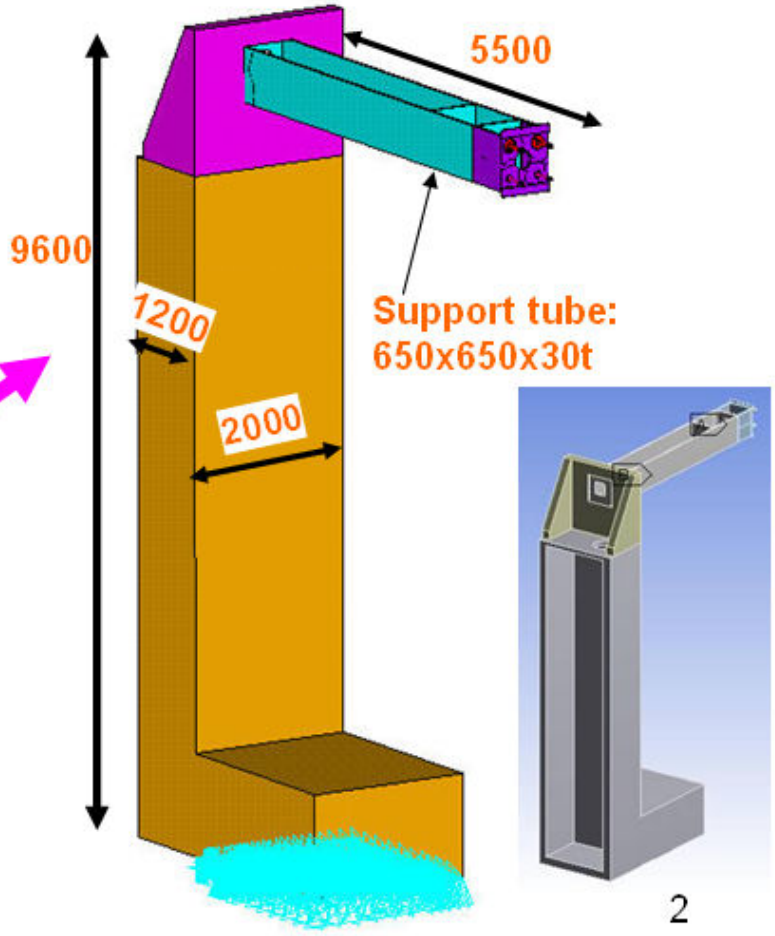


ILD QD0 support system





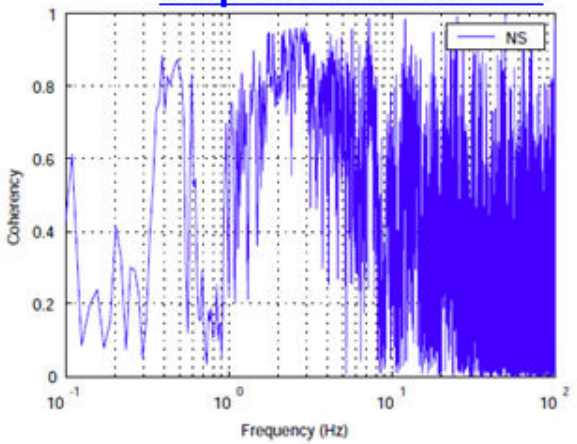
ANSYS model



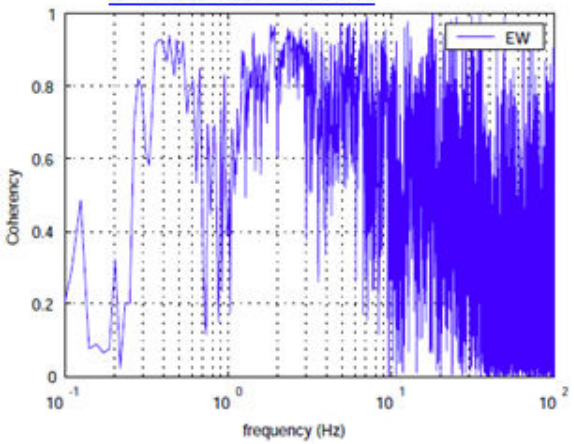
Measurement: B

How is the coherency between the tunnel and floor?

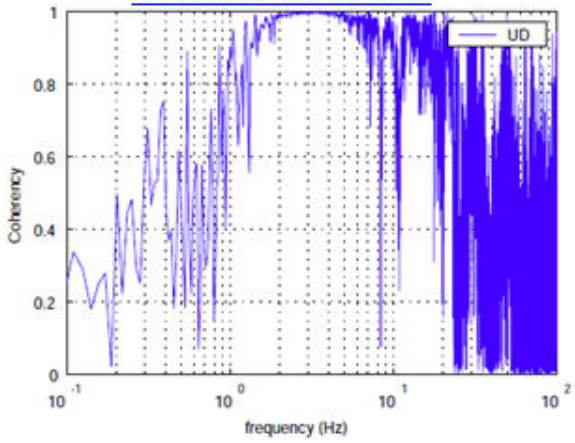
Perpend. to beam line

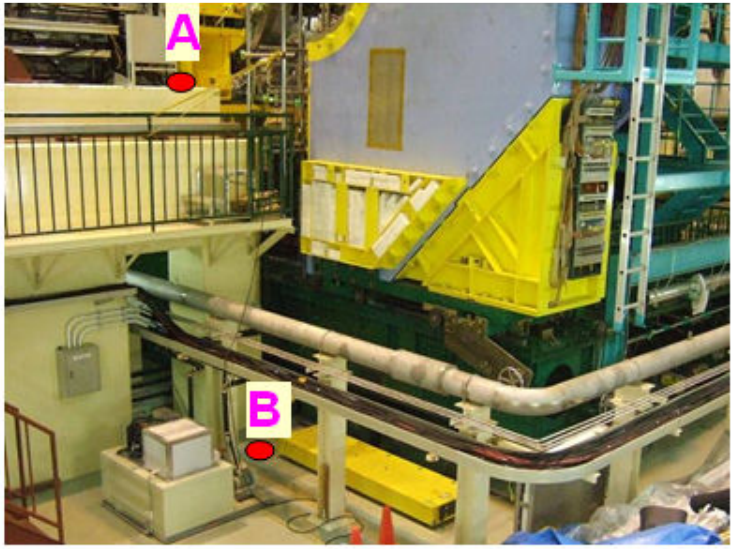


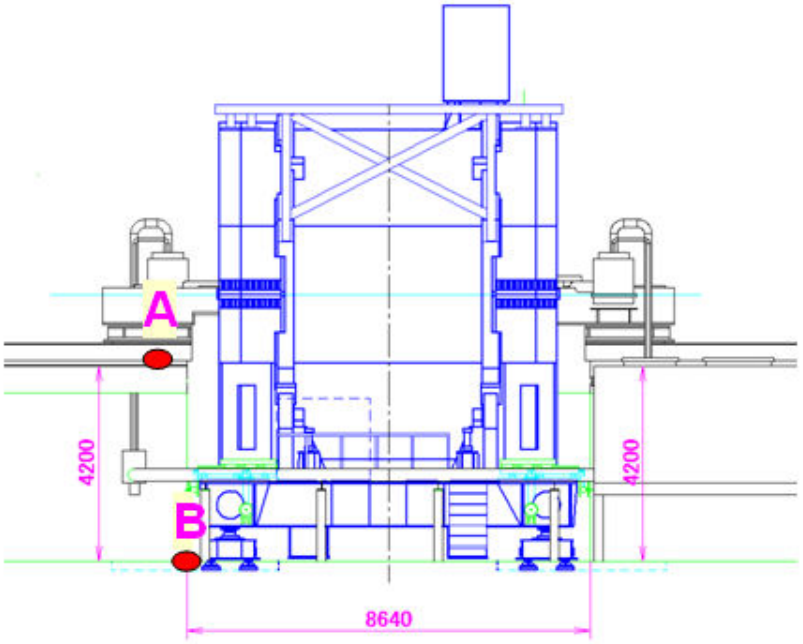
Beam direction



Vertical direction

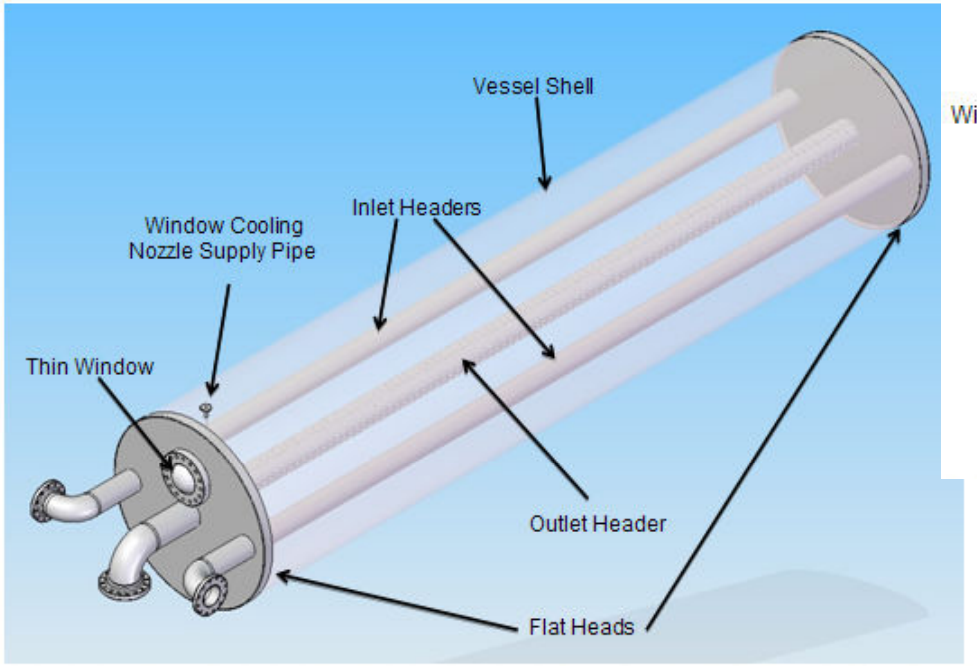


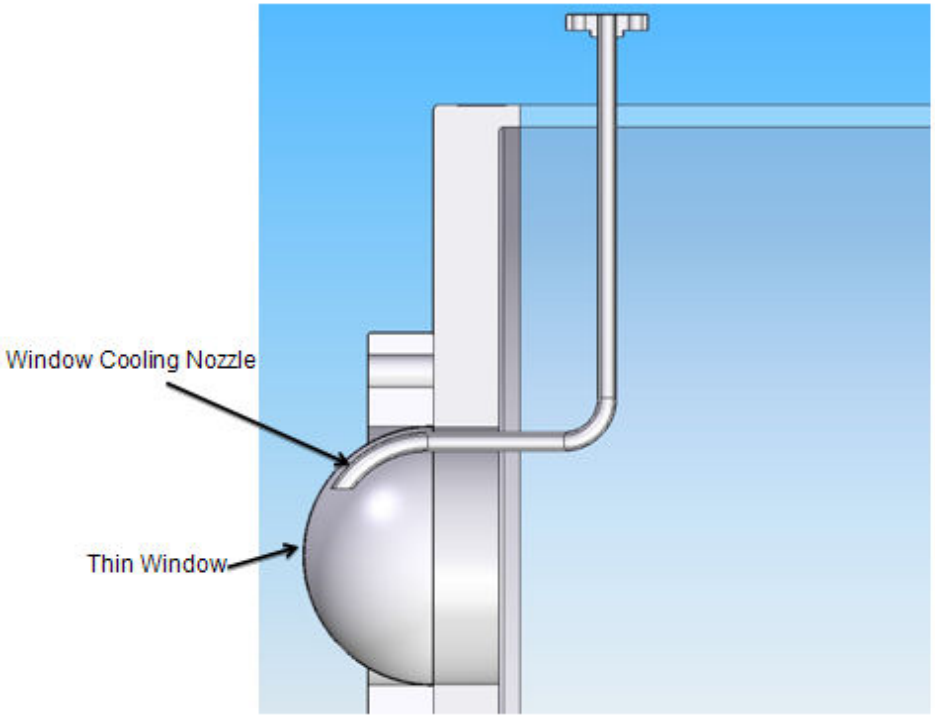


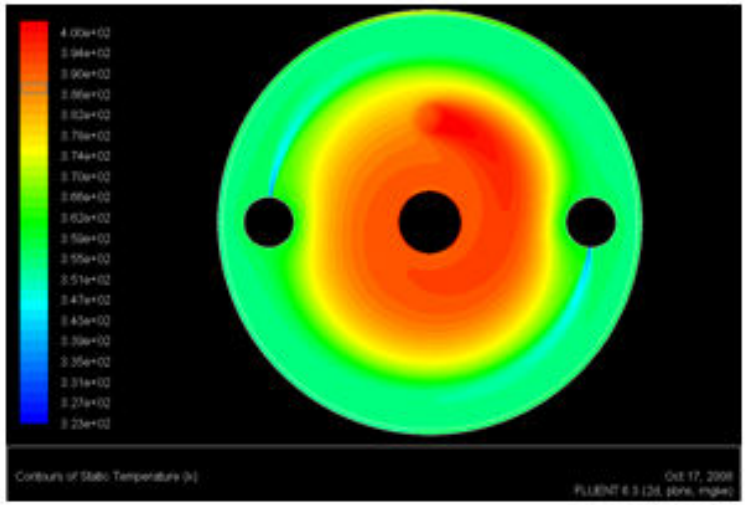


- Horizontal dir.: 0.~Hz, ~3Hz
- Vertical dir.: 1 ~ 20Hz

Beam dump design

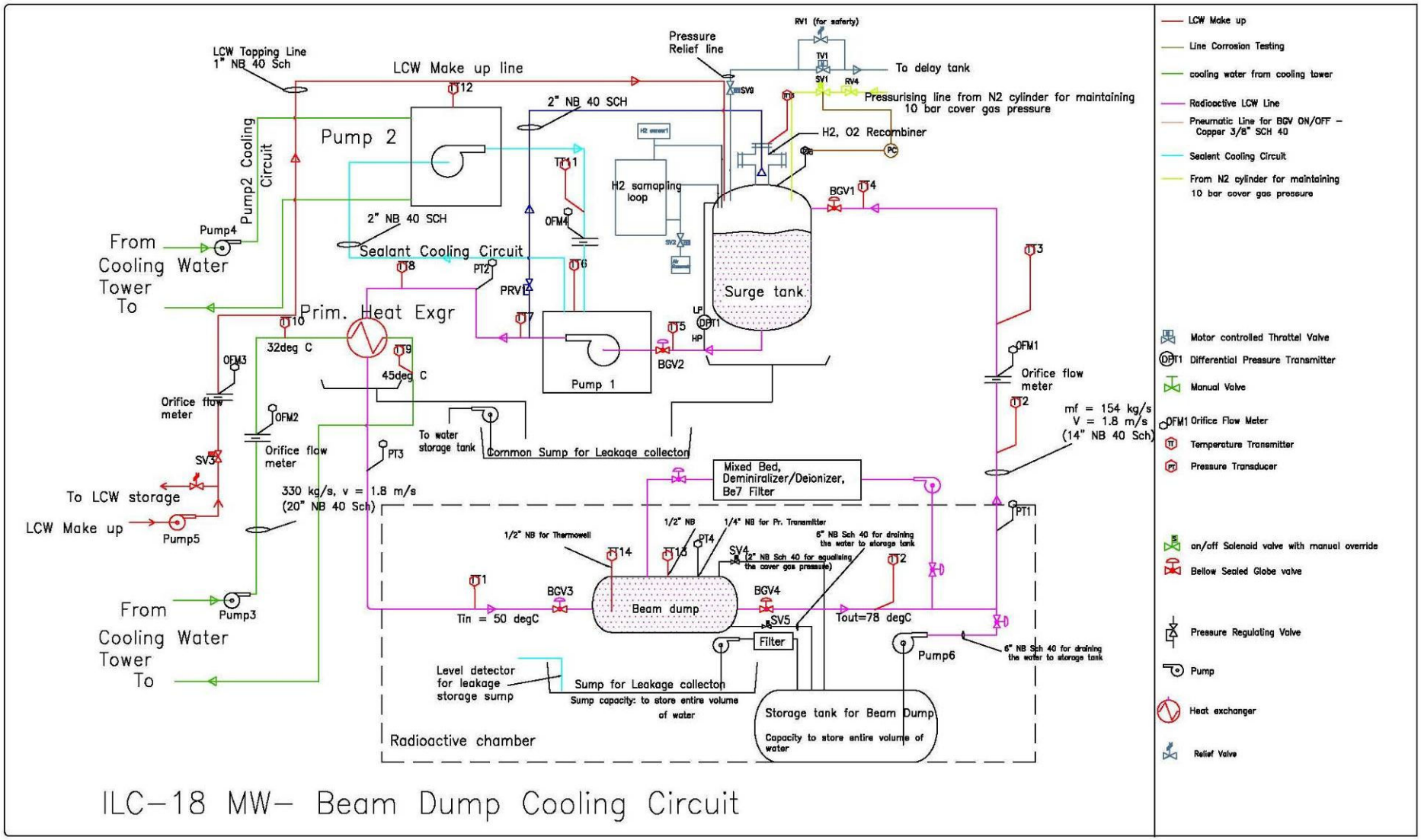






Steady state temperature distribution at z = 2.9m
(Max average temperature : 127^{0}C)

SLAC National Accelerator Laboratory:
J. Amann, R. Arnold, D. Walz, A. Seryi
Bhabha Atomic Research Centre:
P. Satyamurthy, P. Rai, V. Tiwari, K. Kulkarni



ILC–18 MW– Beam Dump Cooling Circuit

Summary

- Preparing for next ATF2 run
- SC FD prototype is being manufactured
- SB2009 design study continue, layout fixed
- MDI: detector and IR stability study started with detailed models
- Beam instrumentation development continue
- Beam dump: design report being prepared