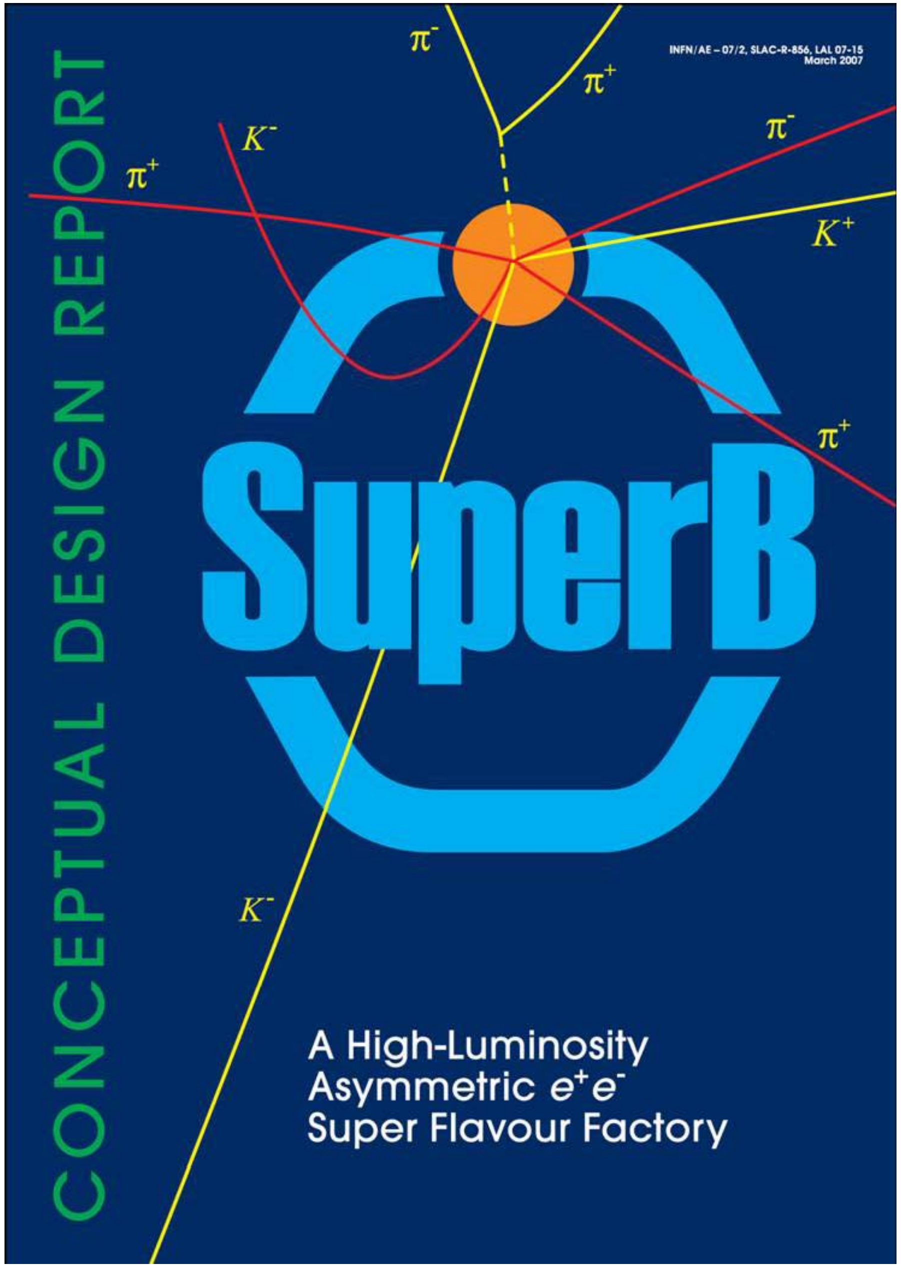


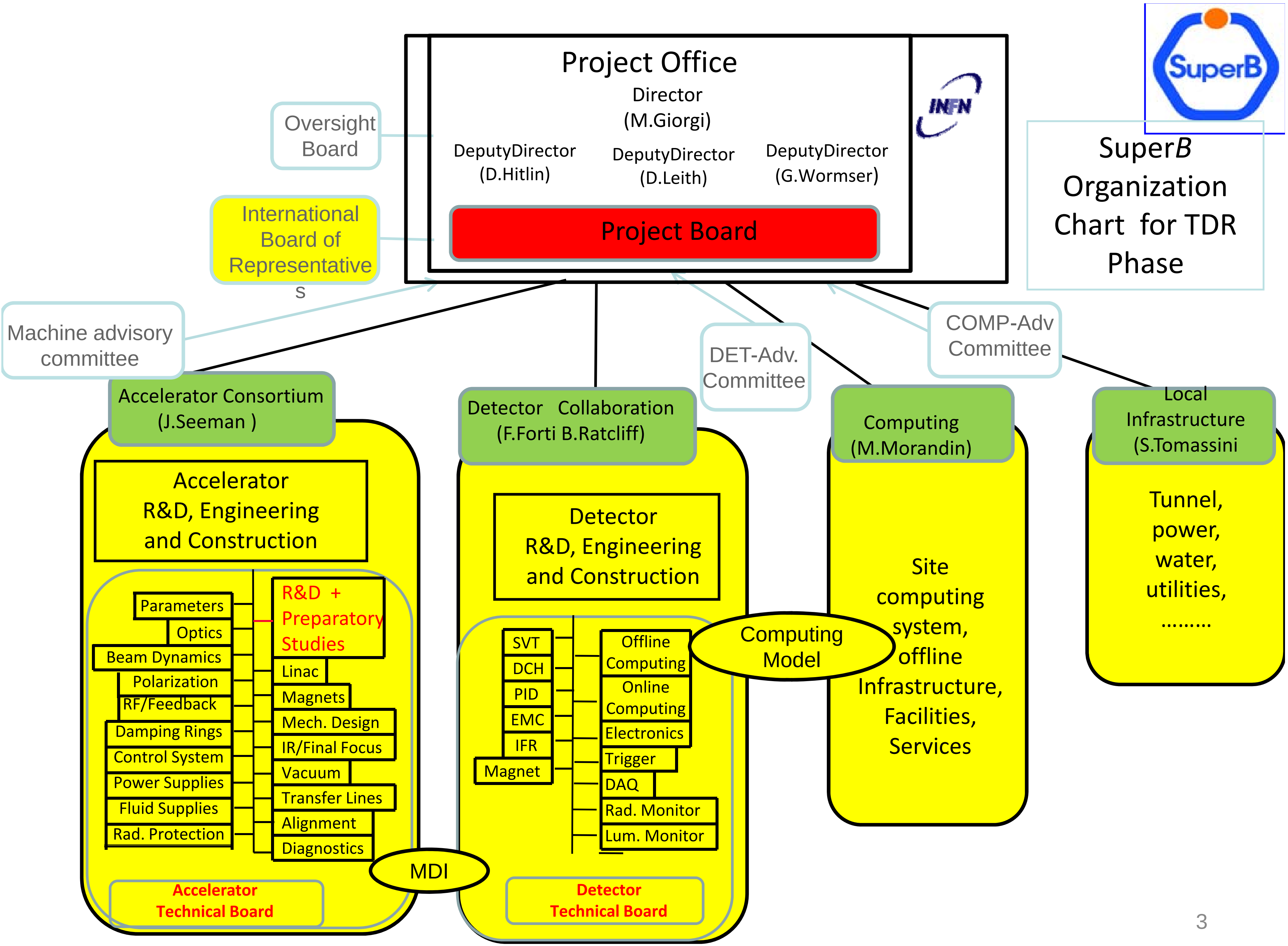
NTA-BBAR

M. Biagini, LNF
Per il SuperB Accelerator Team

Riunione NTA, 16 Luglio 2009

Attività progetto 2009

- 26-30/1 - SuperB Accelerator Workshop, SLAC
- 16-19/2 - SuperB General Workshop, Orsay
- 14-17/4 - Warwick Physics Workshop, UK
- 23-24/4 - Mini-Machine Advisory Committee, LNF
- 29/5 - Approvazione Direttivo INFN struttura progetto speciale
- 18/6 - Presentazione al CERN Council e approvazione dello strategy group per la Preparatory Phase
- 16-20/6 - SuperB Collaboration Meeting, Perugia
- 5-9/10 - SuperB Collaboration Meeting, SLAC (5-9 ottobre)
- 1-5/12 - SuperB Collaboration Meeting, LNF
- Cambiamento di sito da Tor Vergata → LNF ???
- Intensa attività per l’ottimizzazione della macchina
- Ottimizzazione del rivelatore in corso: Detector Geometry Working Group; Detector R&D and engineering



SuperB Organization Chart for TDR Phase
SuperB
INFN
Project Office
Director (M.Giorgi)
DeputyDirector (D.Hitlin)
DeputyDirector (D.Leith)
DeputyDirector (G.Wormser)
Project Board
Oversight Board
International Board of Representatives
Machine advisory committee
DET-Adv. Committee
COMP-Adv Committee
Accelerator Consortium (J.Seeman)
Accelerator R&D, Engineering and Construction
Parameters
Optics
Beam Dynamics
Polarization
RF/Feedback
Damping Rings
Control System
Power Supplies
Fluid Supplies
Rad. Protection
R&D + Preparatory Studies
Linac
Magnets
Mech. Design
IR/Final Focus
Vacuum
Transfer Lines
Alignment
Diagnostics
MDI
Accelerator Technical Board
Detector Collaboration (F.Forti B.Ratcliff)
Detector R&D, Engineering and Construction
SVT
DCH
PID
EMC
IFR
Magnet
Offline Computing
Online Computing
Electronics
Trigger
DAQ
Rad. Monitor
Lum. Monitor
Detector Technical Board
Computing Model
Computing (M.Morandin)
Site computing system, offline Infrastructure, Facilities, Services
Local Infrastructure (S.Tomassini
Tunnel, power, water, utilities, ...

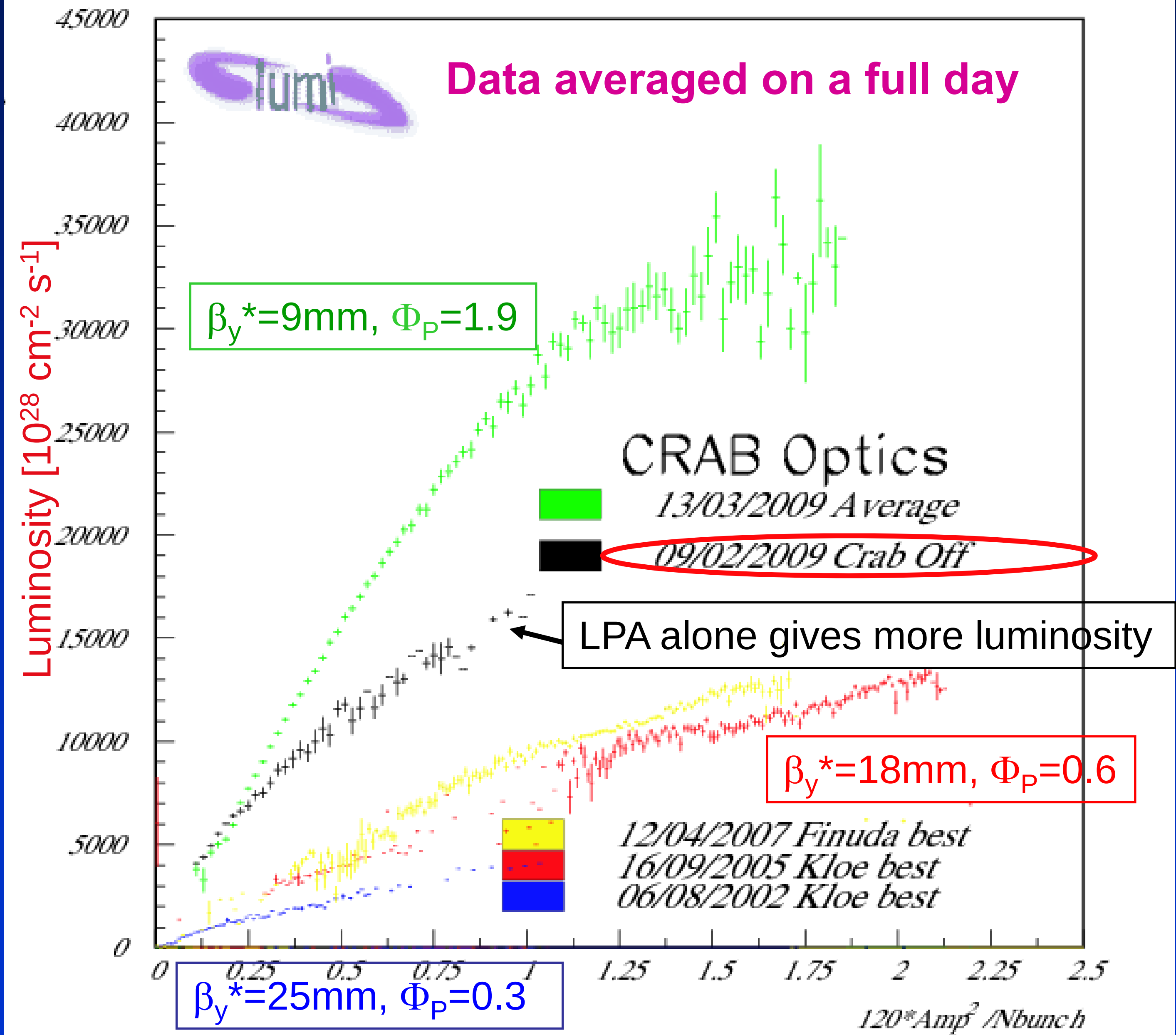
Mini Mac Report – Apr 24

Committee: K. Balewski (DESY), J. Corlett (LBNL), J. Dorfan (SLAC, Chair), S. Henderson (ORNL), T. Himel (SLAC), C. Pellegrini (UCLA) , D. Schulte (CERN), F. Willeke (BNL), A. Wolski (Liverpool), F. Zimmermann (CERN)

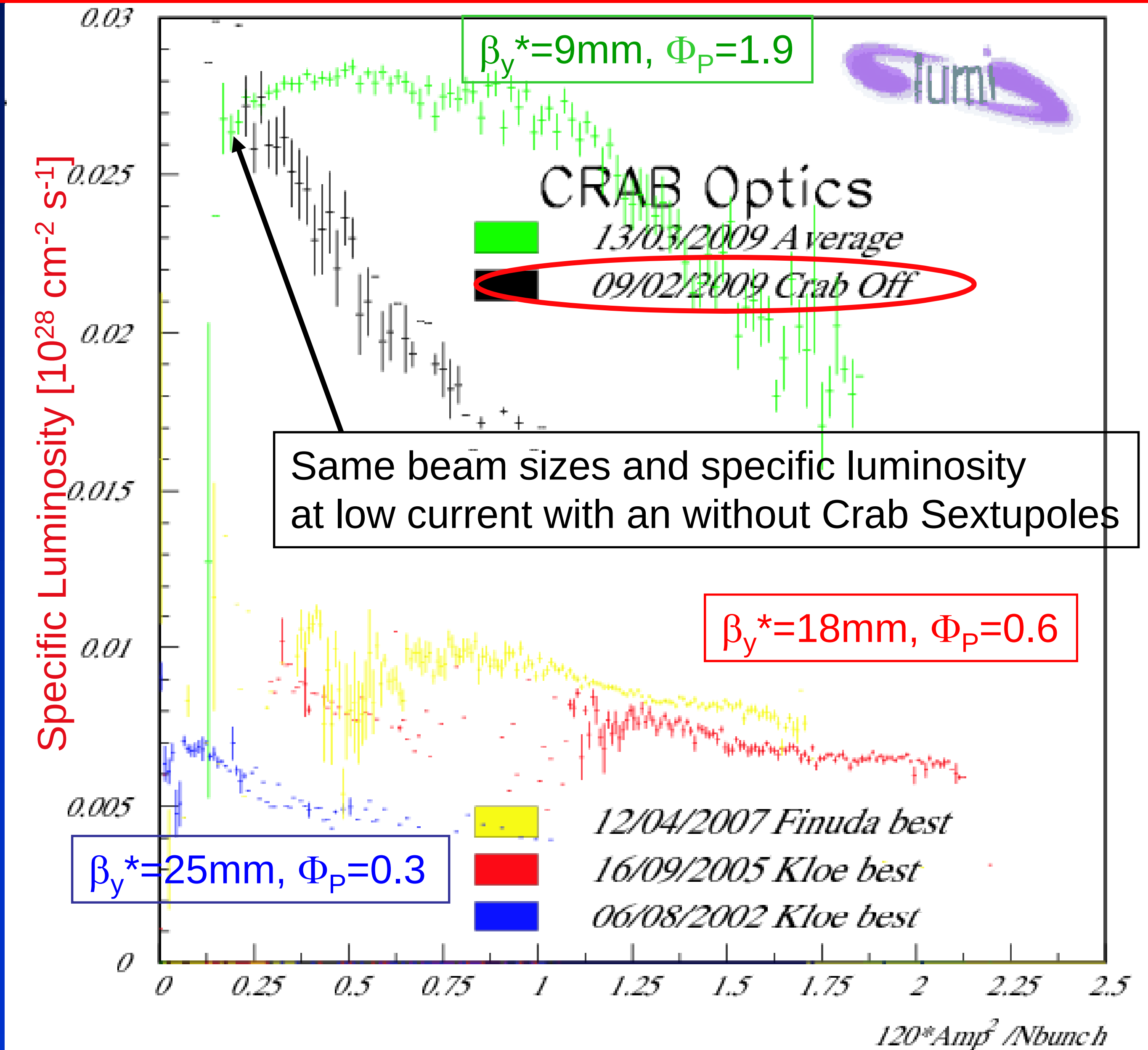
- **“The MAC now feels secure in enthusiastically encouraging the SuperB design team to proceed to the TDR phase, with confidence that the design parameters are achievable”. Recent strong progress**:
  - Crab waist tests at DAFNE
  - Beam-beam measurements (DAFNE) and simulations
  - IR design
  - Lattice
  - Polarization spin rotators
- **“Nonetheless, much detailed work remains to bring the design to the level where (a) *ground-breaking,* (b) *final engineering of accelerator components* can commence”. Further needed work areas:**
  - Emittance tuning and evaluate tolerances
  - Dynamic aperture calculations
  - IR and arc vacuum systems
  - Injection system
  - Vibration studies
  - Polarization lattice

.

DAΦNE Luminosity vs I^+I^-



DAΦNE Specific L vs I^+I^-



Attività 2009
(verde: ok, rossa: in progress, blu: da fare)

- Studio del baseline lattice, sia nella versione "lunga" (sito Tor Vergata) che "corta" (sito LNF) (LNF, SLAC)
- Simulazione emittance blow-up da beam-beam per i parametri SuperB (Pisa, LNF, BINP, KEKB)
- Disegno delle sezioni di polarizzazione per HER (elettroni) versione TV (LNF, BINP, SLAC)
- Apertura dinamica per LER e HER versione TV (LNF, BINP, SLAC)
- Low-emittance tuning (LNF, SLAC)
- Disegno IR per ottimizzarne parametri ottici, aperture e fondi (LNF, Pisa, SLAC)

Attività 2009

(verde: ok, rossa: in progress, blu: da fare)

- Simulazione fondi e riduzione del loro impatto sulle prestazioni del detector (Pisa, LNF)
- Calcolo vite medie Touschek (LNF)
- Simulazione instabilità e-cloud con relativi metodi di mitigazione e disegno della ciambella (LNF, SLAC)
- Progetto sistemi di feedbacks: trasverso, longitudinale, luminosità (LNF, SLAC)
- Simulazione dell'Intra Beam Scattering che provoca un allargamento indesiderato delle emittanze (LNF)
- Disegno del quadrupolo QD0 e caratterizzazione del campo prodotto (Pisa, LNF, CERN)

Attività 2009
(verde: ok, rossa: in progress, blu: da fare)

- Studio ingegneristico del QD0 in vista della realizzazione di un prototipo (Pisa, LNF, CERN)
- Low-emittance tuning (LNF, SLAC)
- Inizio del progetto ingegneristico (tunnel, servizi, impianti) (Pisa, LNF)
- Misura delle vibrazioni sul sito, con relativo studio di stabilizzazione degli anelli (Pisa, LNF, Annecy)
- Studio schema e sistema di iniezione, compreso il disegno dei damping rings (LNF, SLAC)
- Organizzazione e management della collaborazione per la parte Italia/Europa (LNF)
- Organizzazione Worskshops & Meetings (LNF,Pisa)

Incontri scientifici 2009

- Congressi, Workshops, Riunioni generali (Partecipazione/Organizzazione):
  - SuperB Accelerator Workshop, SLAC (26-30 gennaio)
  - SuperB Workshop, Orsay (16-19 febbraio)
  - Mini-Machine Advisory Committee, LNF (23-24 aprile)
  - Presentazione risultati a PAC09, Vancouver (5-9 maggio)
  - SuperB Collaboration Meeting, Perugia (16-20 giugno)
  - SuperB Collaboration Meeting, SLAC (5-9 ottobre)
  - SuperB Collaboration Meeting, LNF (1-5 dicembre)

Possible scenarios for 10^{36} (LER/HER)

	Unit	CDR 2007	June 2008	ε_y X 2	ε_y X 4	ε_y & β_y^* higher	β_y^* higher	σ_z longer	σ_z shorter	ξ_y 0.085
I^+/I^-	Amp	2.28 /1.30	**1.85 /1.85**	2.28 /1.30	2.28 /1.30	4.56 /2.60	3.42 /1.95	2.28 /1.30	2.28 /1.30	**4.56 /2.60**
N_{part}	$x10^{10}$	6.16 /3.52	**5.52 /5.52**	8.71 /4.98	12.4 /7.0	6.16 /3.52	5.0 /2.87	12.4 /7.0	3.1 /1.26	**6.16 /3.52**
N_{bun}		1250	**1250**	884	625	2500	2296	625	2500	**2500**
β_y^*	mm	0.3 /0.3	**0.22 /0.39**	0.3 /0.3	0.3 /0.3	0.6 /0.6	0.45 /0.45	0.3 /0.3	0.3 /0.3	**0.3 /0.3**
ε_y	pm	4/4	**7/4**	8/8	16/16	8/8	4/4	4/4	4/4	**16/16**
σ_y	nm	35/35	**39/39**	49/49	70/70	70/70	42/42	35/35	35/35	**70/70**
ξ_y	Tune shift	0.17 /0.17	**0.15 /0.15**	0.17 /0.17	0.17 /0.17	0.17 /0.17	0.17 /0.17	0.17 /0.17	0.17 /0.17	**0.085 /0.085**
σ_z	mm	6/6	**6/6**	6/6	6/6	6/6	6/6	12/12	3/3	**6/6**

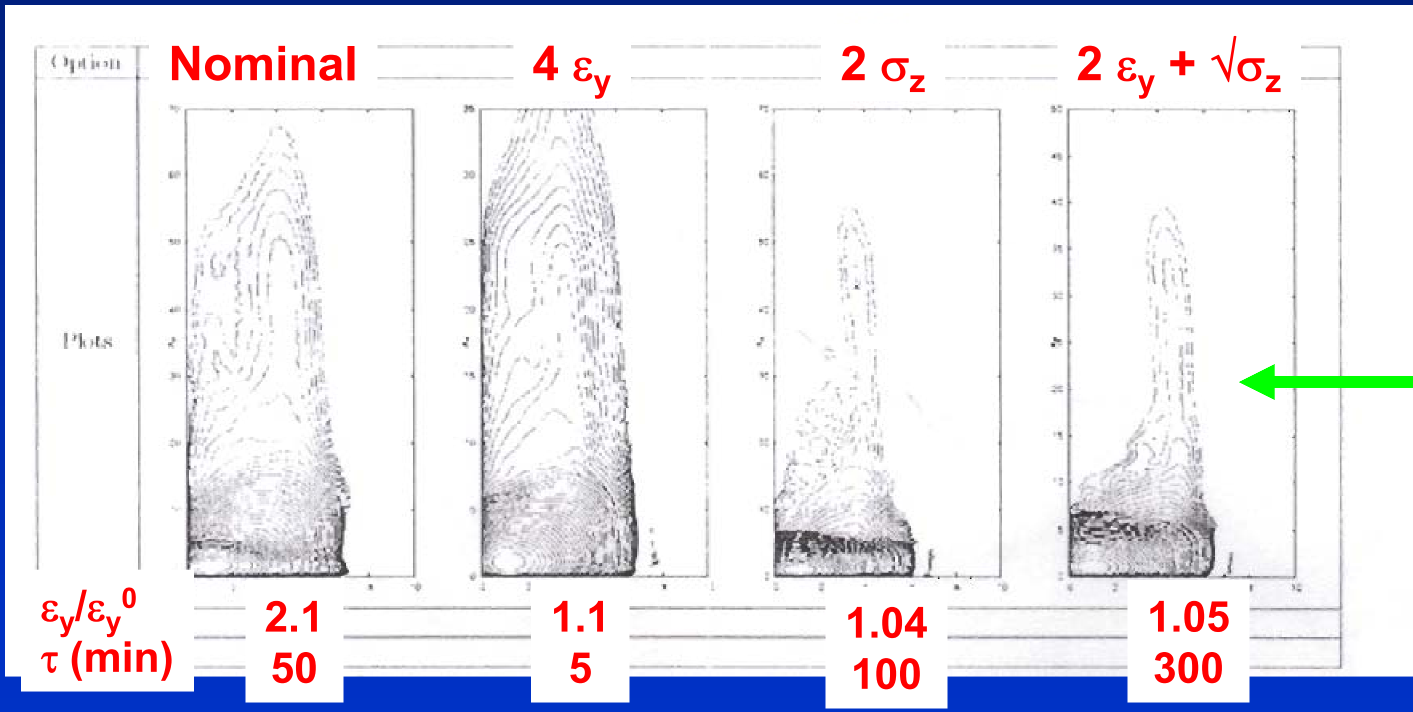
Several parameter sets allow to reach10^{36}.
No scenario has all parameters pushed to limit

Lower ξ_y

Beam-beam simulations

- More bb studies were recently performed by D. Shatilov (BINP) with Lifetrack
- Explored different y-emittances and bunch lengths in order to decrease the vertical tune shift, in case 0.15 is too difficult to reach
- **10^{36}** luminosity can indeed be achieved with reduced ξ_y and relaxed ε_y and σ_z: this means shorter beam tails, longer lifetime, at the price of doubling the currents

Beam tails, ε_y growth and lifetime



Optimal case
10^{36} with $2{*}N_{bunches}$

D. Shatilov, BINP

SuperB

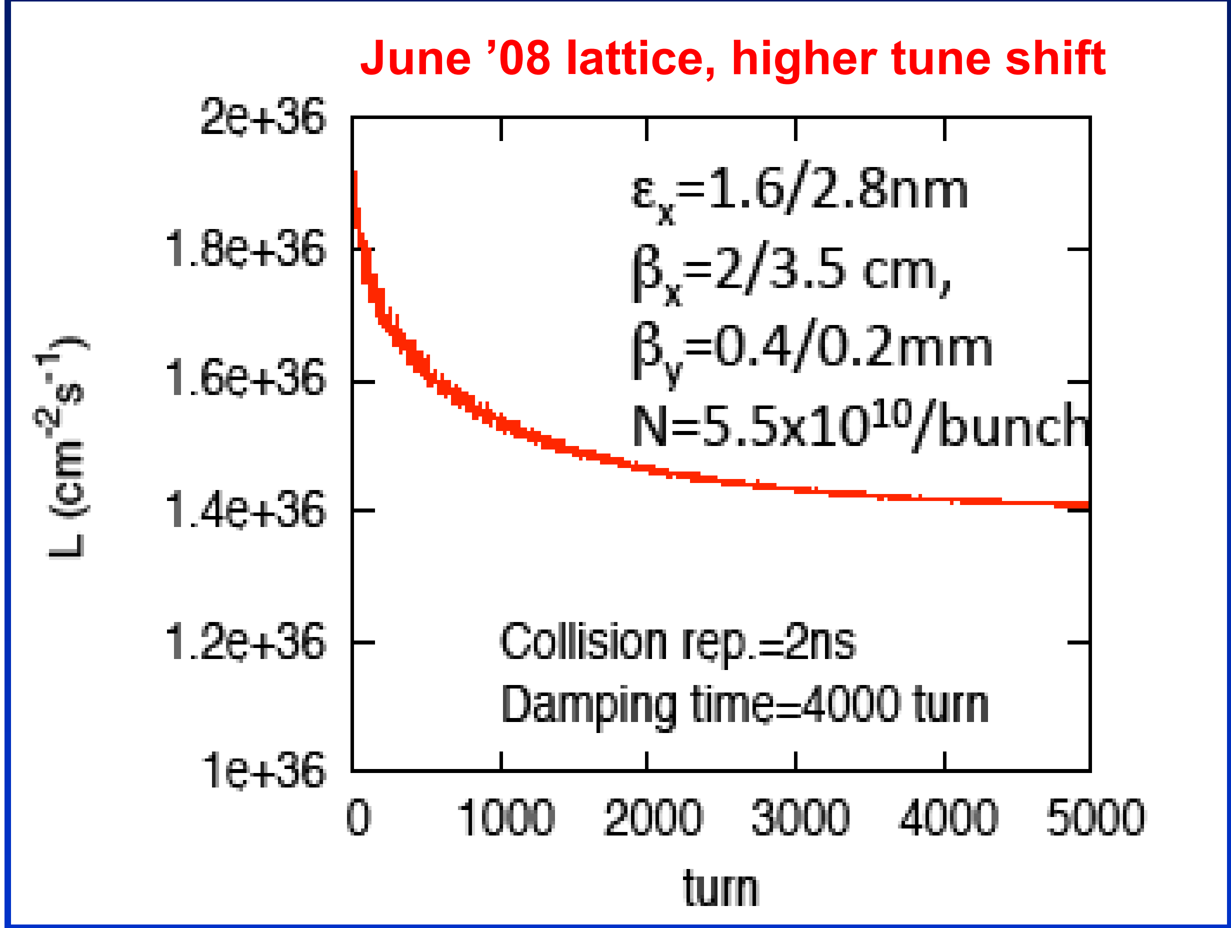
SuperB parameters flexibility

LER/HER	Unit	June 2008	Jan. 2009	March 2009	LNF site
E+/E-	GeV	4/7	4/7	4/7	4/7
L	$cm^{-2}\ s^{-1}$	$1x10^{36}$	$1x10^{36}$	$1x10^{36}$	$1x10^{36}$
I^+/I^-	Amp	1.85 /1.85	2.00/2.00	2.80/2.80	2.70/2.70
N_{part}	$x10^{10}$	5.55 /5.55	6/6	4.37/4.37	4.53/4.53
N_{bun}		1250	1250	2400	1740
I_{bunch}	mA	1.48	1.6	1.17	1.6
$\theta/2$	mrad	25	30	30	30
β_x^*	mm	35/20	35/20	35/20	35/20
β_y^*	mm	0.22 /0.39	0.21 /0.37	0.21 /0.37	0.21 /0.37
ε_x	nm	2.8/1.6	2.8/1.6	2.8/1.6	2.8/1.6
ε_y	pm	7/4	7/4	7/4	7/4
σ_x	μm	9.9/5.7	9.9/5.7	9.9/5.7	9.9/5.7
σ_y	nm	39/39	38/38	38/38	38/38
σ_z	mm	5/5	5/5	5/5	5/5
ξ_x	X tune shift	0.007/0.002	0.005/0.0017	0.004/0.0013	0.004/0.0013
ξ_y	Y tune shift	0.14 /0.14	0.125/0.126	0.091/0.092	0.094/0.095
RF stations	LER/HER	5/6	5/6	5/8	6/9
RF wall plug power	MW	16.2	18	25.5	30.
Circumference	m	1800*	1800*	1800*	1400#

***Antisymmetric Spin Rotators add 300 m, # Symmetric Spin Rotators included**

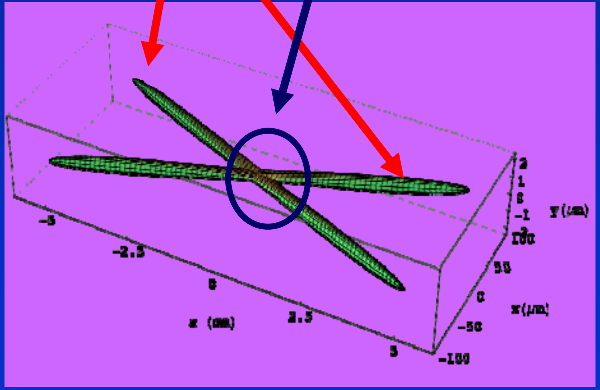
Strong-strong beam-beam simulations

K. Ohmi (KEKB)



➢ **Strong-strong modified code (much faster):**

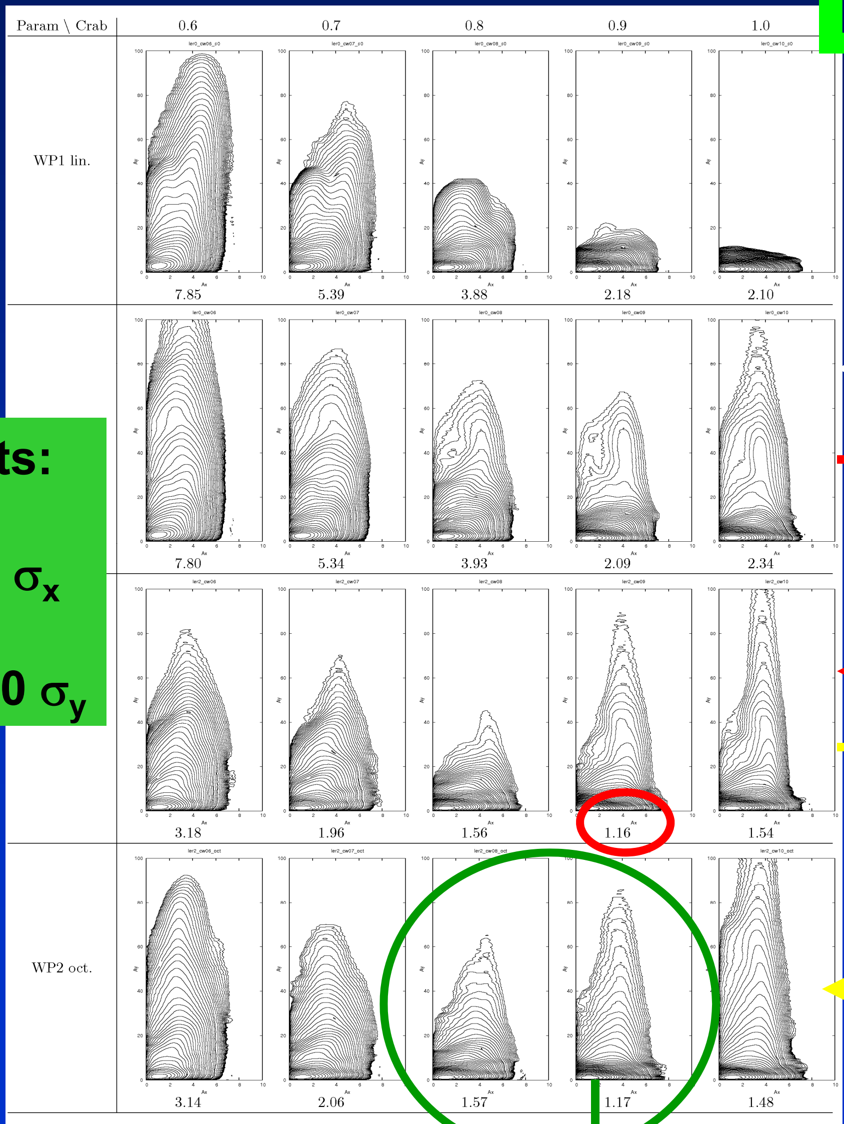
- **PIC for beams overlap area**
- **gaussian for beam tails**



Luminosity of 10^{36} can be reached

BB optimization with lattice nonlinearities (weak-strong Lifetrack code)

Piminov, Shatilov (BINP), Zobov (LNF)



All plots:
X from 0 to 10 σ_x
Y from 0 to 100 σ_y

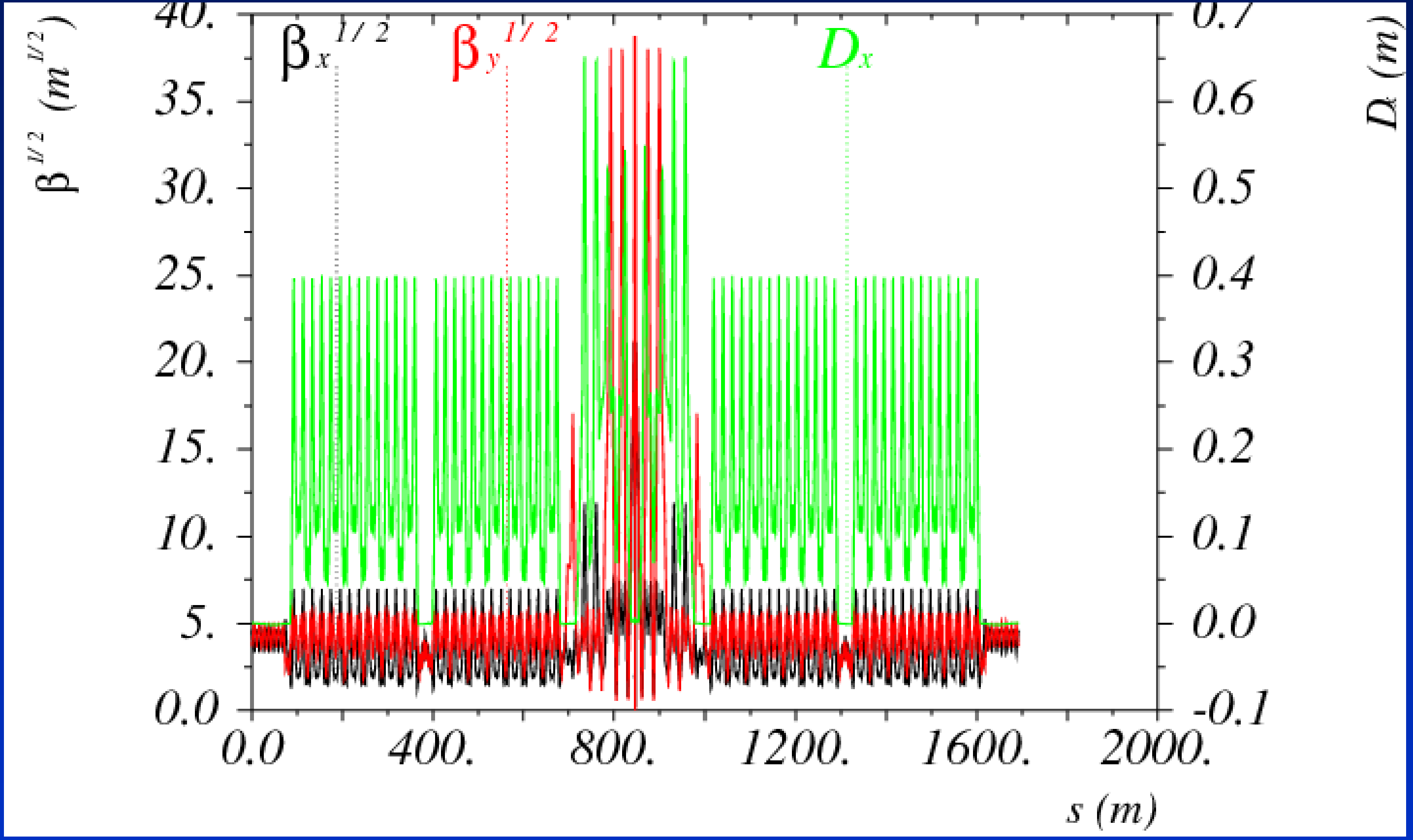
Nonlinear elements included: longer tails affect the lifetime

Change of the working point: emittance blow up almost disappears

Changing the octupole strength: lifetime increased by a factor of 3-4 for CW strength → 0.8 and 0.9

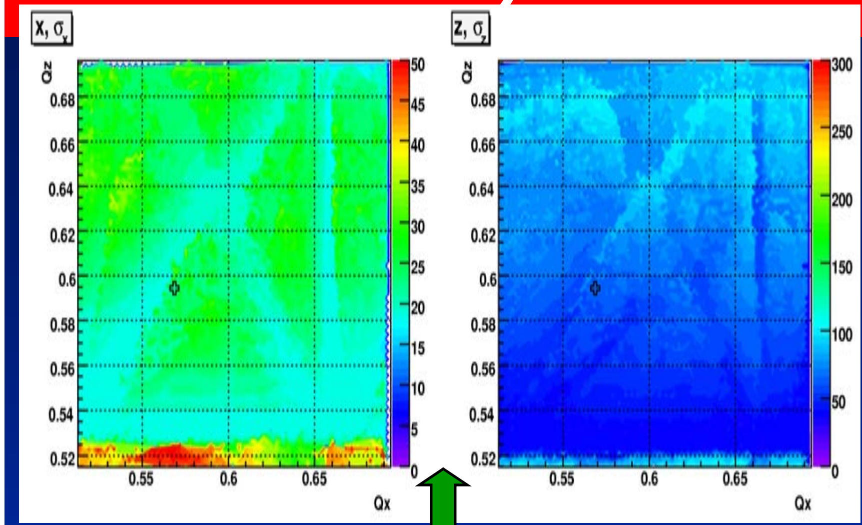
Lifetime 30 min

Ring β-functions, FF included, Spin Rotators not included

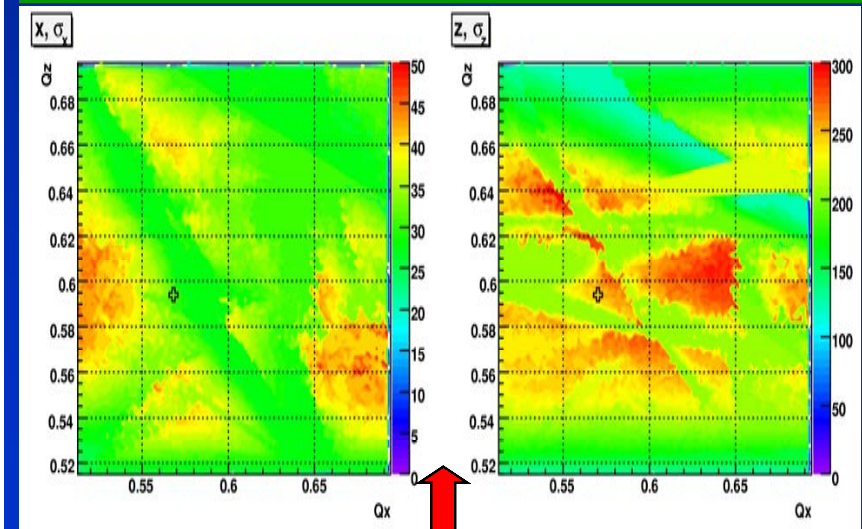


Straights in the middle of the Arcs can host RF, injection, wigglers (in case needed)

LER Dynamic Aperture tune scan



Before the IR sextupoles optimization



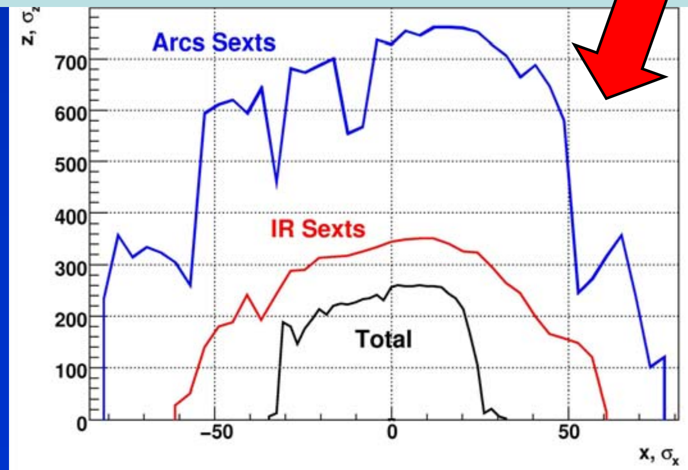
After the IR sextupoles optimization

E. Levichev, P. Piminov (BINP)

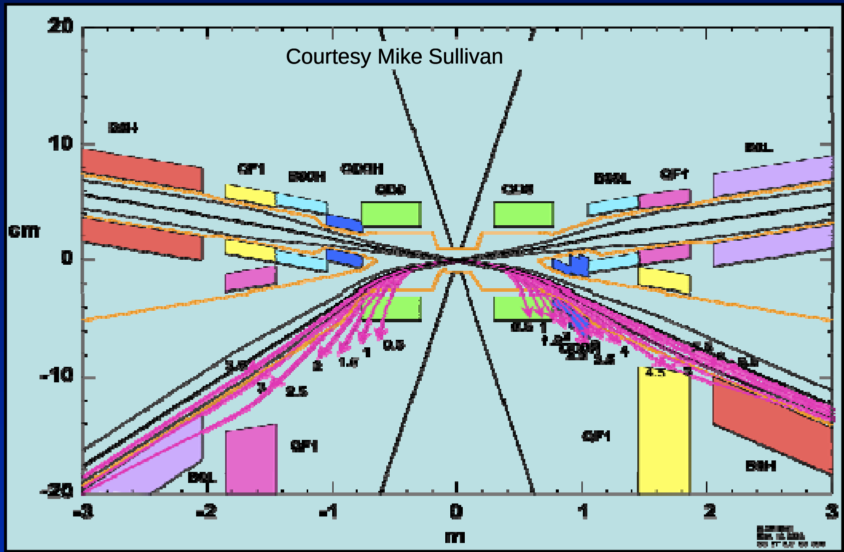
Strong sextupoles (mainly vertical) in IR are the major source of DA limitation, due to –I phase advance detuning for "long" sextupoles → DA recovered by adding weak correction sextupoles (strength <10% of the main ones)

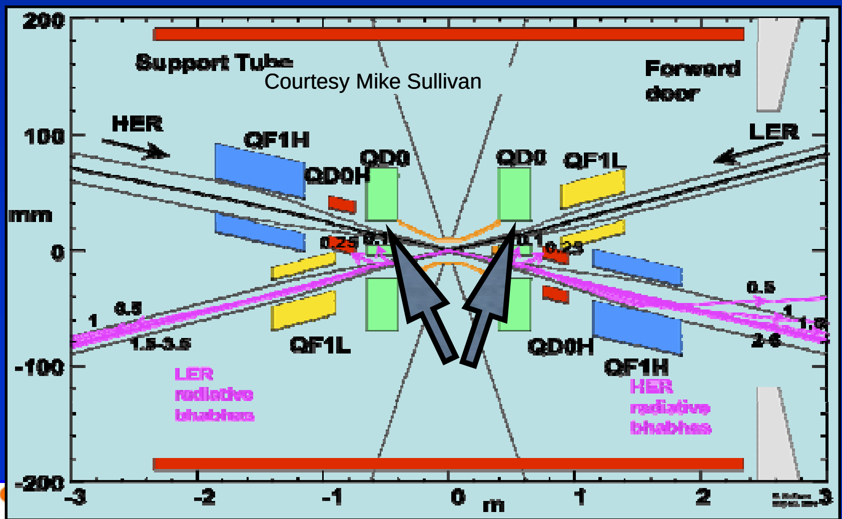
Tune point optimization should be done together with the beam-beam simulation and the luminosity/lifetime optimization

Blue – arc sextupoles alone
Red – IR sextupoles optimized
Black – arc and optimized IR sextupoles together. Additional optimization is necessary



Regione d'Interazione

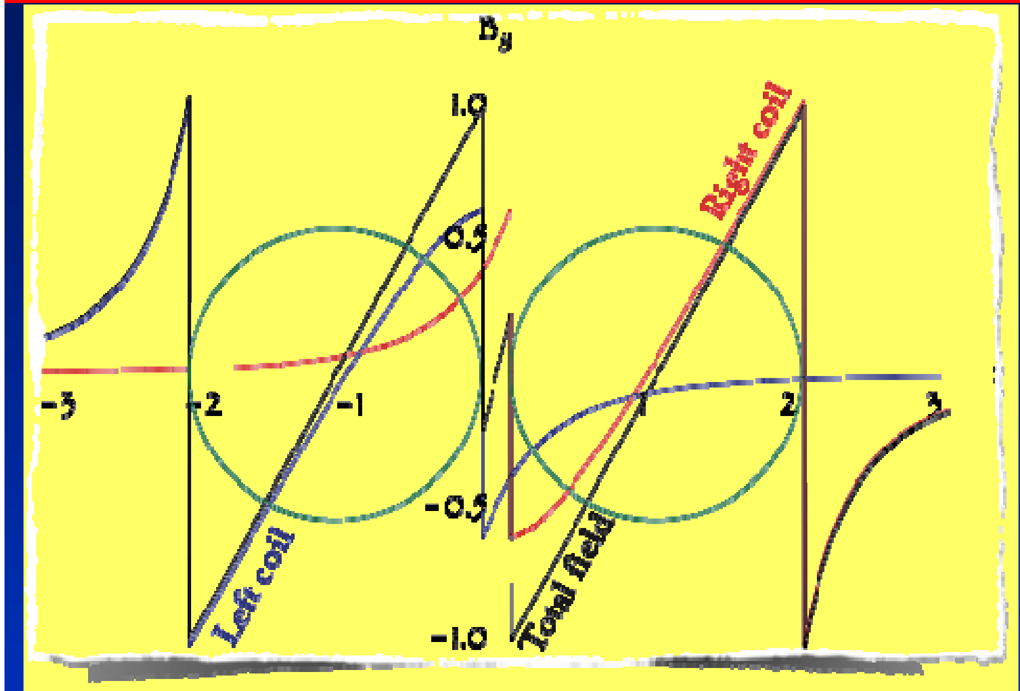


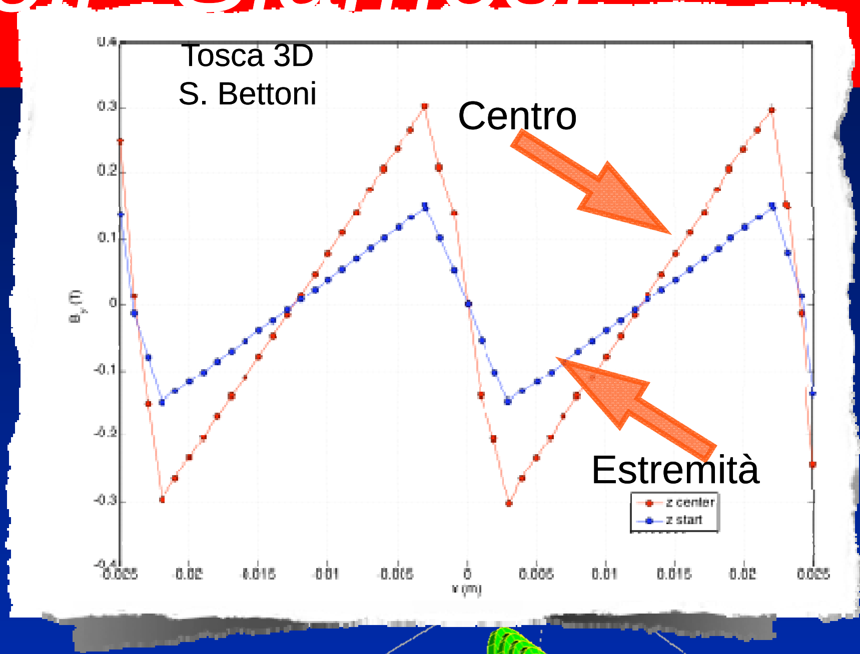


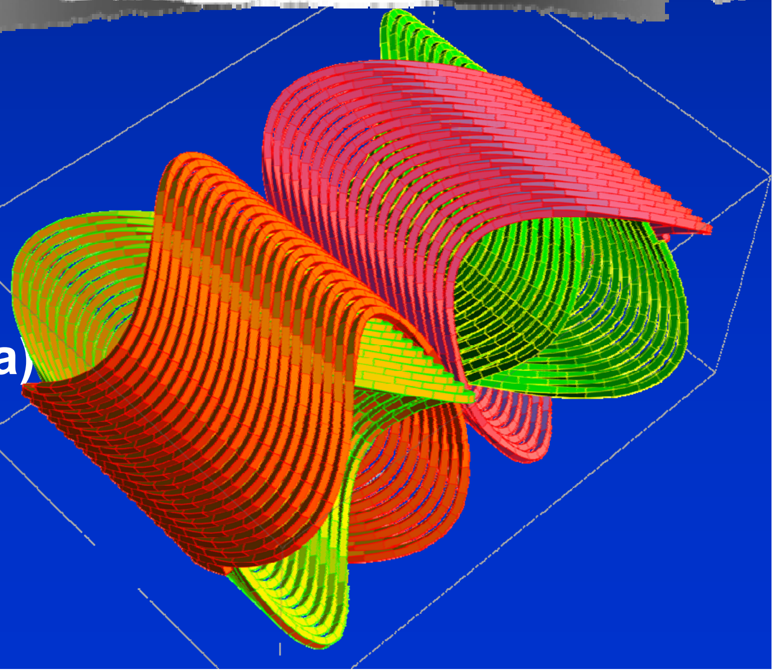
- Primo layout presentato nel CDR
  - Quadrupoli (1.66 T/cm) in comune fra le due linee di fascio
  - fondi: il termine proporzionale alla lum. risulta difficilmente gestibile
- Nuovo layout con quadrupoli separati fra le due linee
  - I fondi prodotti da particelle off-energy sono naturalmente soppressi
  - Quadrupolo a setto di nuova concezione (LNF, *Pisa*, CERN)
- *Pisa:* simulazione Geant4 degli effetti dei fondi e minimizzazione del loro impatto

QD0: Quadrupoli “Siamesi”

Algebraic 2D



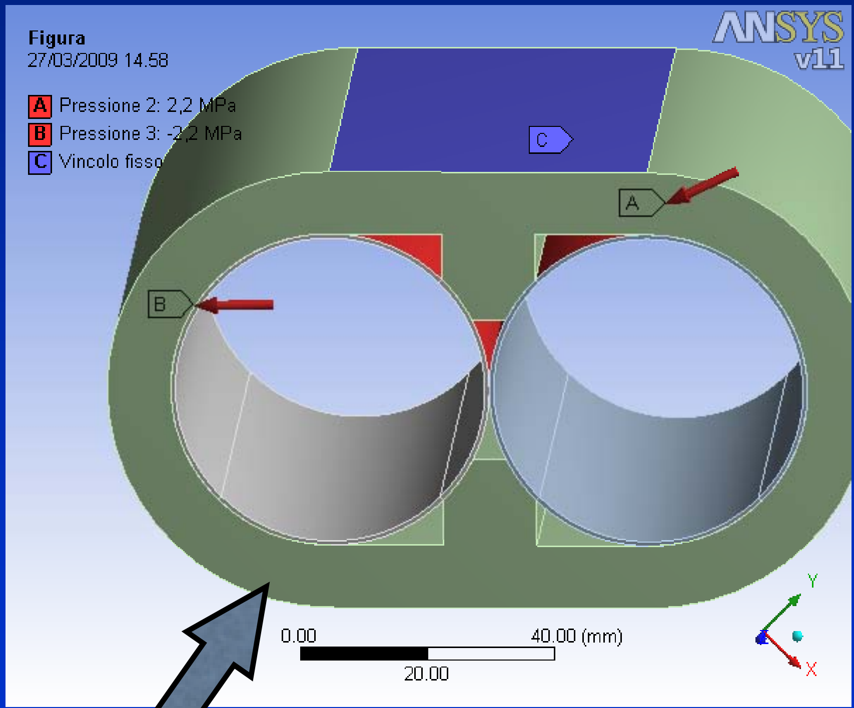




- **Nuovo schema di compensazione**
- **Simulazione agli elementi finiti in 3D (Tosca) LNF/CERN**
- **Ottima qualità del campo di (~10 ppm)**

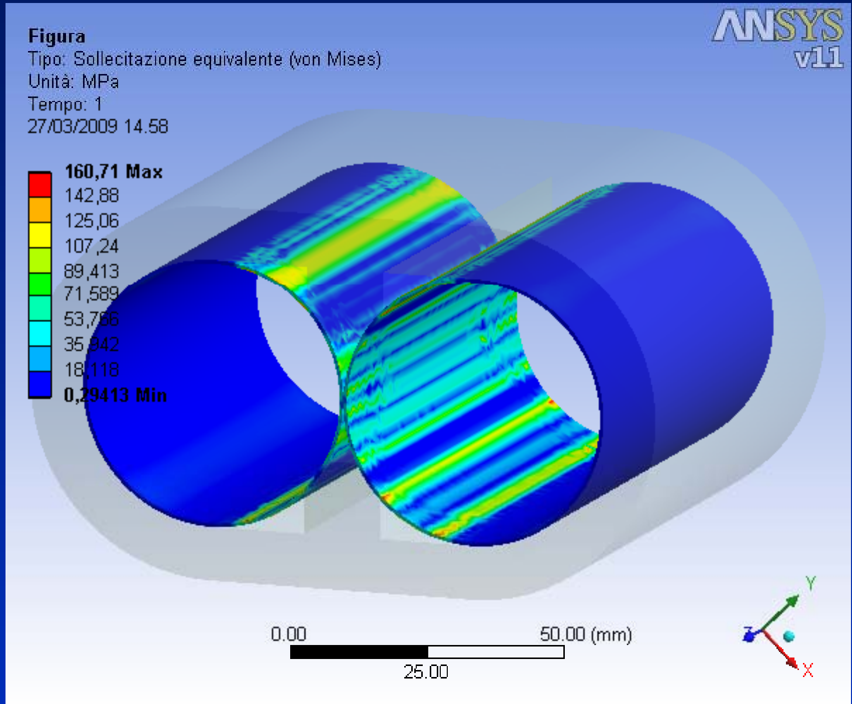
Supporto Meccanico

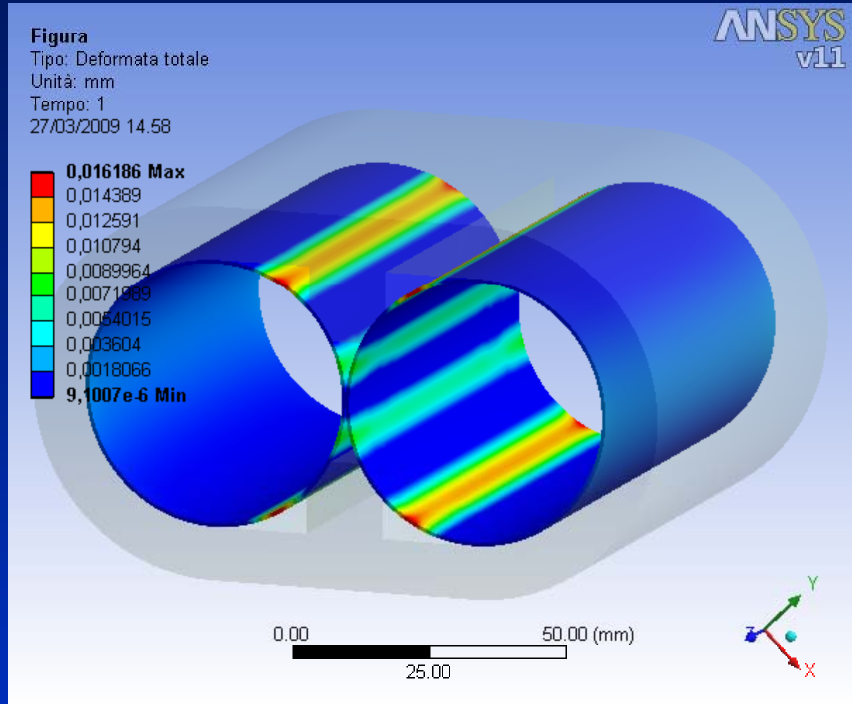
Analisi agli Elementi Finiti (F. Bosi + M. Massa , Pisa)



“Collare di Supporto”, Versione in Piccola Scala Del Doppio Quadrupolo di LHC

Stress & Deformazioni





- Support cylinder thickness 0.7 mm, load 2.2 MPa
  - Von Mises stress < 150 MPa (Steel, high strength alloy ASTM A514 yield strength ~ 690 MPa)
  - Maximum deformation < 0.016 mm

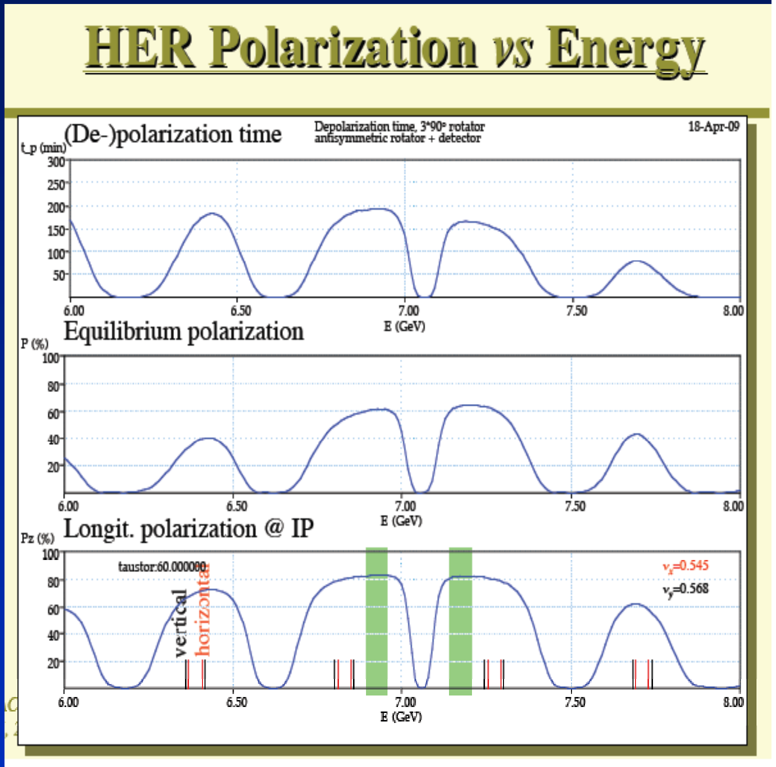
(F. Bosi + M. Massa)

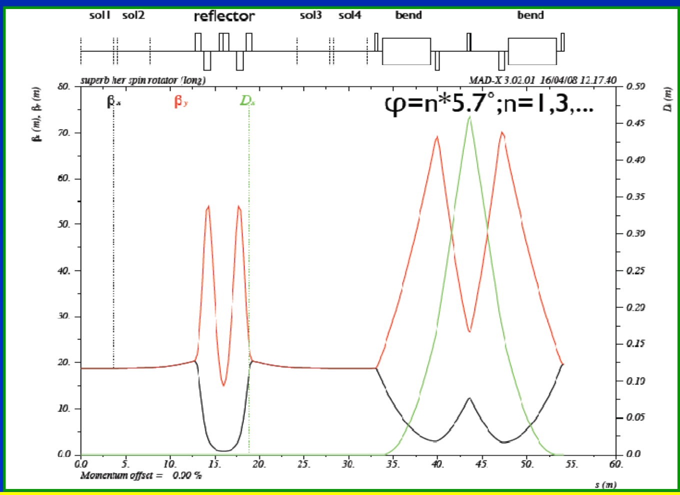
Milestones per il 2010

- Definizione disegno IR:
  - Simulazione dei fondi macchina visti dal detector
  - Masks
  - Compensating solenoids
- Realizzazione di un prototipo di QD0:
  - Struttura Meccanica (LNF, Pisa, SLAC, BINP)
  - Scelta del Materiale SC (CERN, BINP)
  - Avvolgimento (LNF, Pisa)
  - Criostato (SLAC, LNF)
  - Misure di campo (LNF, Pisa, CERN)

Polarization in HER

- Polarization of one beam is included
  - either energy beam could be polarized
  - LER less expensive, HER easier (HER was chosen)
- Longitudinal polarization times and short beam lifetimes indicate a need to inject vertically polarized electrons
  - plan is to use SLC polarized e$^-$ gun
- There are several possible IP spin rotators:
  - solenoids look better (vertical bends give unwanted vertical emittance growth)





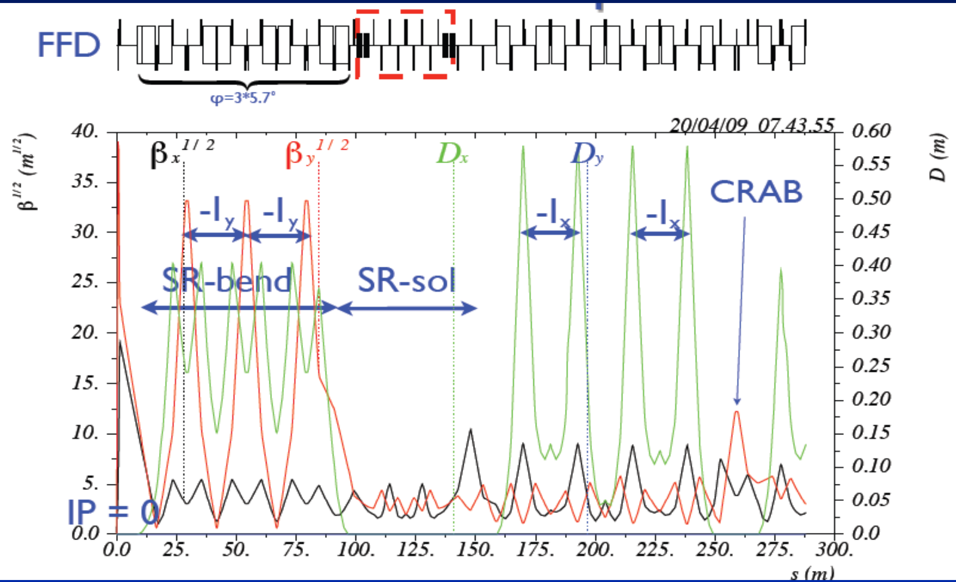
Spin rotator with solenoids and bends

Expected longitudinal polarization at IP ~ 85%(inj) x 95%(ring) = 80%(effective)

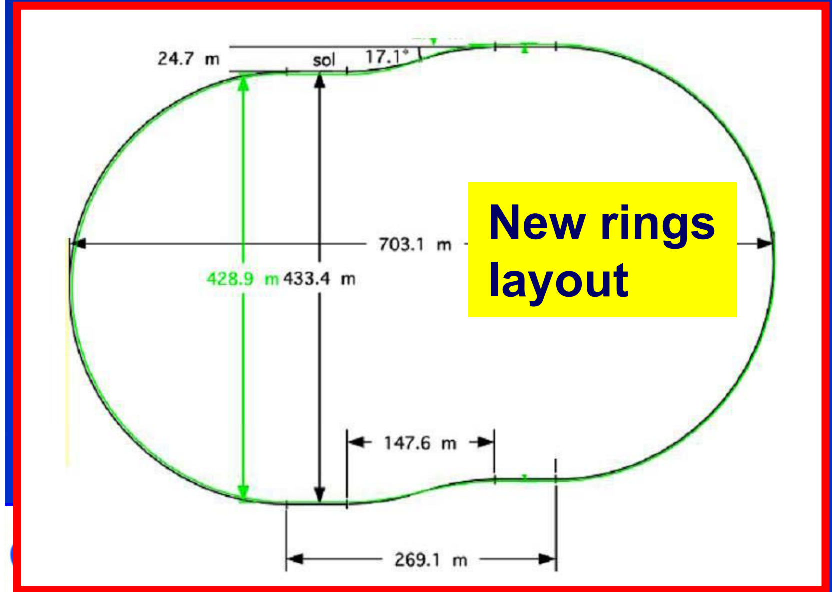
U. Wienands (SLAC)

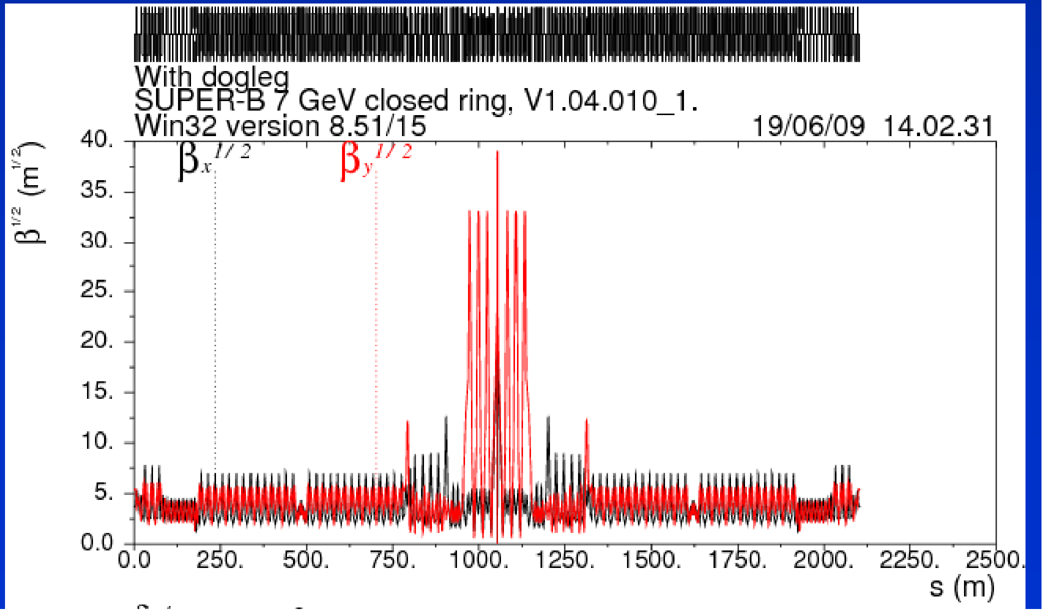
HER with spin rotator

Y. Nosochov, W. Wittmer (SLAC)

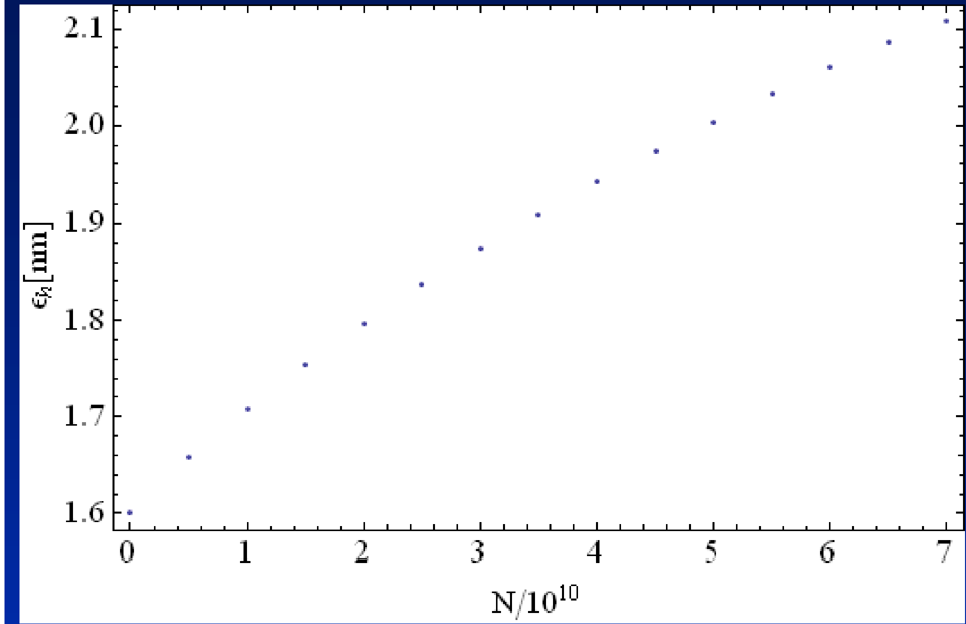


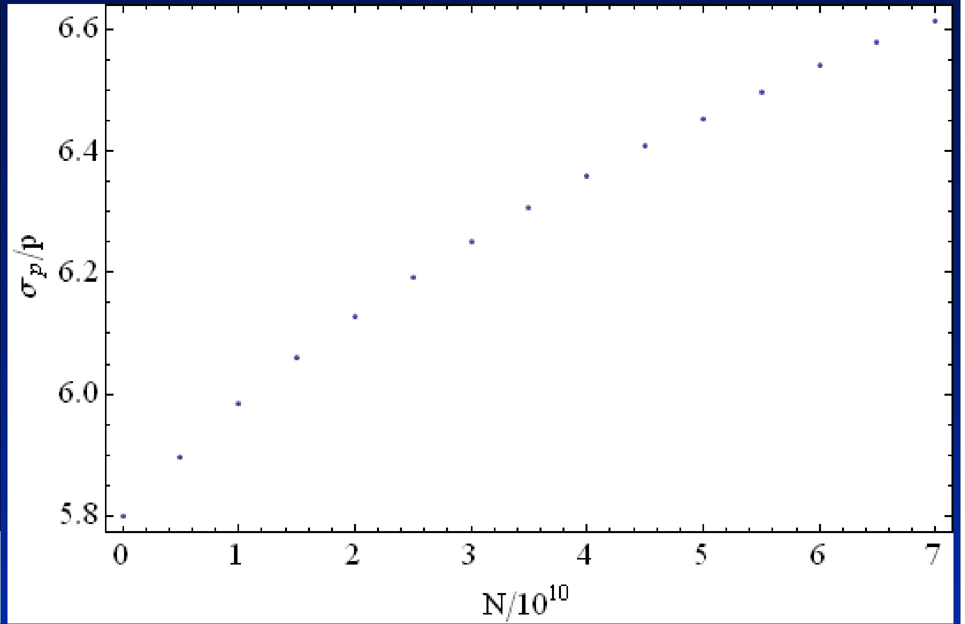
- Introduced spin rotators on both sides of IP in HER to provide longitudinal polarized electrons at IP and maintain the chromatic characteristic of the original design necessary for the crab waist scheme, band width and dynamic aperture
- Bends have opposite sign w.r.t. IP for spin transparency condition

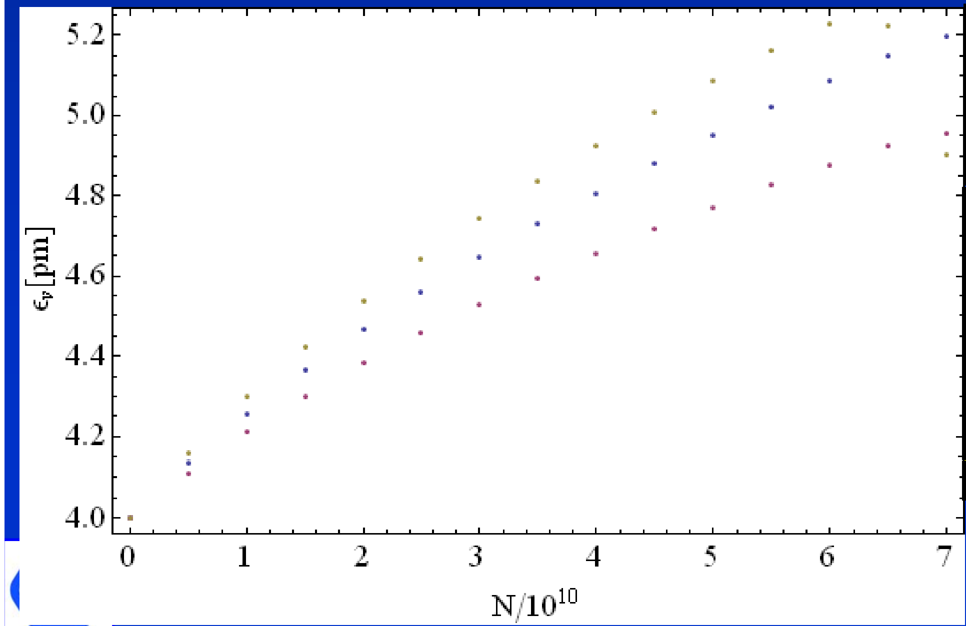




IBS in SuperB LER (LNF configuration)







$\varepsilon_h/\varepsilon_{h0}$=1.20

σ_p/σ_{p0}=1.13

$\varepsilon_v/\varepsilon_{v0}$	r_ε
1.20	**0**
1.25	**0.5**
1.28	**1**

@ N=4.06•10^{10}

Future: develop a MonteCarlo code to study the beam size distribution in the presence of IBS

e- cloud instability

- Simulations indicate that a peak secondary electron yield of 1.2 and 99% antechamber protection result in a cloud density below the instability threshold
- Planned use of coatings (TiN, ?) and solenoids in SuperB free field regions will help
- Studies on mitigation techniques (grooves in the chamber walls, clearing electrodes) offers the opportunity to plan activity for SuperB
- Work is in progress to:
  - estimate other effects: multi-bunch instability, tune-shift, ...
  - compare the results with other codes (PEHTS, PEI, K.Ohmi; POSINST, M.Furman,M.Pivi).

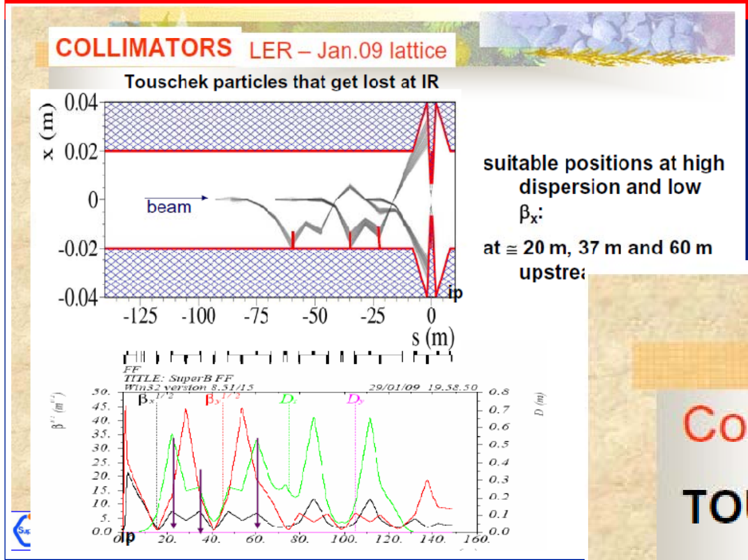
RF system

A. Novokhatski (SLAC)

- SLAC PEP-II RF stations (modulators, klystrons and cavities) showed high performance in achieving very high power level, which is needed for successful operation of *SuperB* project
- *SuperB* smaller momentum compaction requires smaller impedance of the rings in order to avoid large bunch lengthening, single bunch instabilities and other current dependant effects

HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER	HER+
			S.R. energy			Total	Zero I		Max	Number			Total	Total	Total	Power for	LER
Lumi	Beam	Beam	loss	Momen-	Momen-	RF	Bunch	Bunch	voltage	of	S.R.	HOM	cavity	reflected	forward	one	Total
	energy	curren	per turn	um com	tum	voltag	length	spacing	per cavit	cavities	power	power	loss	power	power	cavity	forward
	GeV	A	MeV	paction	spread	MV	mm	nsec	MV	klystr	MW	MW	MW	MW	MW	MW	MW
1E+36	7	2	1.95	3.8E-04	5.8E-04	8	5.1	4.2	0.65	12	3.9	0.386	0.702	0.5912	5.58	0.46	8.98
										6							
1E+36	7	2.82	1.95	3.8E-04	5.8E-04	10	4.5	2.1	0.65	16	5.499	0.4901	0.822	1.2384	8.05	0.50	12.73
										8							
1E+36	7	4	1.95	3.8E-04	5.8E-04	16	3.6	2.1	0.7	22	7.8	1.517	1.531	1.2733	12.12	0.55	19.63
										11							
																	HER+
LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER	LER
			S.R. energy			Total	Zero I		Max	Number			Total	Total	Total	Power for	Supply
Lumi	Beam	Beam	loss	Momen-	Momen-	RF	Bunch	Bunch	voltage	of	S.R.	HOM	cavity	reflected	forward	one	Power
	energy	curren	per turn	um com	tum	voltag	length	spacing	per cavit	cavities	power	power	loss	power	power	cavity	eff.~50%
	GeV	A	MeV	paction	spread	MV	mm	nsec	MV	klystr	MW	MW	MW	MW	MW	MW	MW
1E+36	4	2	1.16	3.2E-04	8.0E-04	6	5.6	4.2	0.65	10	2.32	0.3205	0.474	0.2863	3.40	0.34	17.96
										5							
1E+36	4	2.82	1.16	3.2E-04	8.0E-04	7	5.2	2.1	0.65	10	3.2712	0.3569	0.645	0.4038	4.68	0.47	25.45
										5							
1E+36	4	4	1.16	3.2E-04	8.0E-04	9	4.5	2.1	0.65	14	4.64	0.9391	0.761	1.1691	7.51	0.54	39.26

Single beam backgrounds



M. Boscolo

Conclusions

TOUSCHEK:

- at SuperB: simulations with latest IR design is ongoing with careful collimators studies – soon new tracking of secondaries
- Tracking of secondaries in detectors is ongoing for the June08 lattice, in collaboration with background simulation group
- at DAFNE: background and lifetime evaluations with present crab waist lattice : comparison with data is ongoing both for bkg rates and lifetime

BEAM-GAS:

- simulation code in good progress
- evaluate the effect with Jan09 SuperB IR design and compare with DAFNE result (small effect)

Luminosity backgrounds

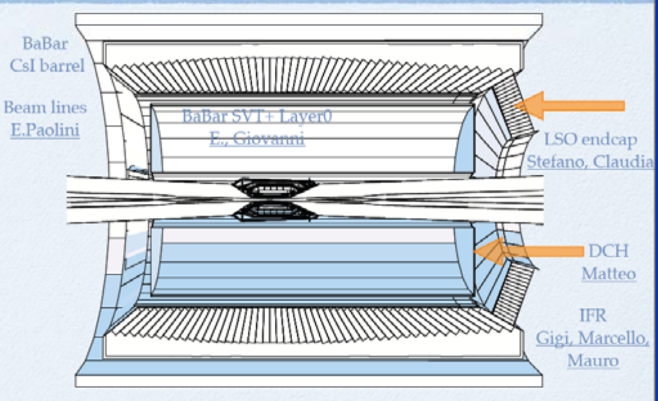
SuperB backgrounds

- Assessment of the background effects
  - Primary particles generators
    - Touchek, beam gas (Manuela)
    - Synchrotron radiation near IP (Mike)
    - Beamstrahlung, pairs production (standard HEP generators)
  - Secondaries generation: Bruno (Andrea di Simone)
  - Farm in Padova for data production and distribution
    - Roberto Stroili, Giuliano Castelli

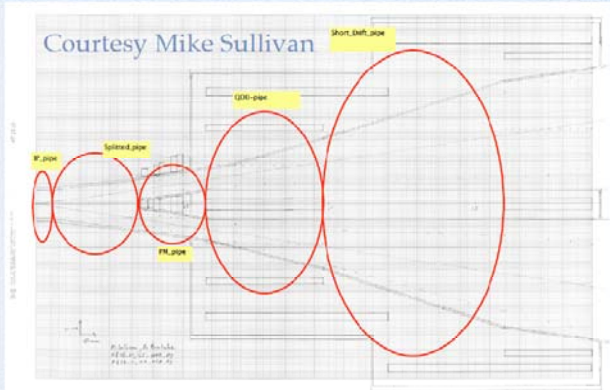
Luminosity Backgrounds

	Cross section	Evt/bunch$_{xing}$	Rate
Beam Strahlung	~ 340 mbarn (Eγ/Ebeam > 1%)	~680	0.3THz
	~ 40 mbarn (Eγ/Ebeam > 50%)	~80	35GHz
pair production	~7.3 mbarn	~15	7GHz
Elastic Bhabha	O(10^{-4}) mbarn (Det. acceptance)	~200/Million	100KHz
Υ(4S)	O(10^{-6}) mbarn	~2/Million	1 KHz

GDML detector Model



New Interaction Region



E. Paoloni

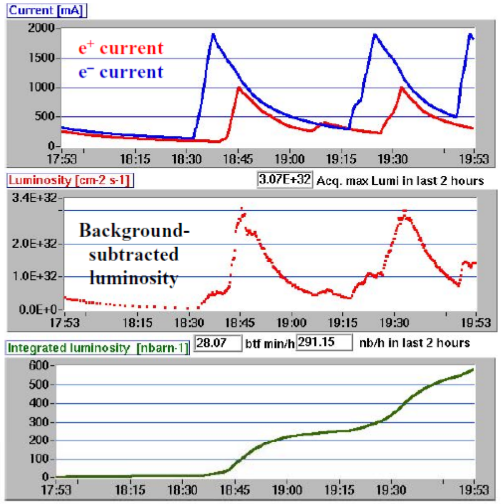
Luminosity monitor & IP feedbacks

Online luminosity measurements

- Example from last Friday
- Correction very stable and working without problem since May last year

N. Arnaud

DAΦNE



Two approaches

- We are evaluating two very different feedback approaches to be used in the SuperB interaction point:
- A) Dither Luminosity feedback
  - Evolution from the dither coil based luminosity feedback designed for PEP-II by SLAC team – see Kirk Bertsche's talk
- B) Fast IP feedback
  - inspired to the IntraTrain IP feedback designed for ILC by Phil Burrows team (Oxford Un.) - see PAC07, "THE FONT4 ILC INTRA-TRAIN BEAM-BASED DIGITAL FEEDBACK"

Fast IP feedback

A. Drago

Two possible implementation

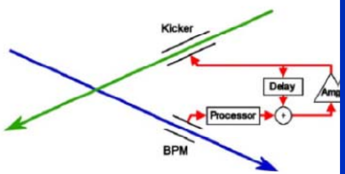


Figure 1: Schematic of IP intra-train feedback system f… an interaction region with a crossing angle. The deflectio… of the outgoing beam is registered in a BPM and correcting kick applied to the incoming other beam.

Case a

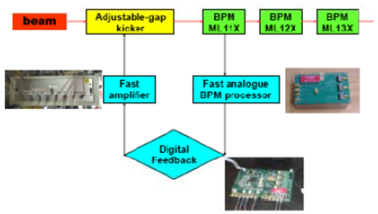


Figure 2: Schematic of FONT4 at the ATF extraction beamline showing the relative locations of the kicker, BPMs and the elements of the feedback system.

Case b

IP Feedback

Dither Coils

SLAC — SuperB

K. Bertsche

- Dither LER at IP in x, y, y'
  - Nominally a few % modulation of lumi
- Frequency: 1-3 kHz
  - Above power supply freqs
  - Below synchrotron and betatron freqs
- 4 coil sets needed (each set has an x and y coil)
  - One near IP on each side
    - Want large $\sqrt{\beta}\sin\psi$
    - About 3.5 m from IP: just outside detector solenoid
  - Another further from IP on each side
    - Want large $\sqrt{\beta}\cos\psi$
    - Between QD2 and SDM2, between B10 and B1

Impedance budget
(“conscientious impedance-budget manager”)

- PEP-II wake function for Super-B wake calculation
- Bunch length changes from 12 mm to 6 mm.
- Check every element to decrease total impedance

Cavity minus Main Mode

Resistive-Wall

BPMs

Interaction Region

Longitudinal Kicker

Transverse Kicker

Injection and Abort Kicker

Transitions

Collimator

A sum

LER	PEP-II					Super-B		
		loss Factor	lengthening	loss Factor	lengthening		loss Factor	lengthening
bunch [mm]		12	12	6			6	6
Element	Quantity					Quantity		
RF cavity minus main mode	8	2.402	-0.569472	3.78088	-0.979572	10	4.7261	
Resistive-wall	1	2.1659	3.88056	6.102	11.04654	1	3	1.7" Cu
Interaction region	1	0.2873	0.729165	1.1244	1.342027	1	1.1244	
Longitudinal Kicker	2	0.472	1.45833	0.69726	-0.364518	2	0.69726	
Transverse Kicker	4	0.61212	-0.284739	0.97684	-0.489786	4	0.97684	
Injection kicker	2	0.02644		0.07482		2	0.07482	
Abort kicker	2	0.02644		0.07482		2	0.07482	
Collimators	6	0.875		3.5		6	3.5	
Transition round to octagonal	12	0.07044		0.613572		12	0.61357	
Other Inductive elements	60	0.3522		3.06786		60	3.06786	
Round BPM	150	0.075						
Octagonal BPM	200	0.354						
Total loss factor		7.71884		20.01245			17.8557	

A. Novokhatski

Bunch-by-bunch feedbacks

Considering a feedback upgrade for low emittance accelerators

- Feedback are active system and can have strong negative impact on very low emittance beams
- The basic ideas of the upgrades consist in making the noise in the feedback loop as low as possible, and this means:
- a) Filtering at the best the external noise, i.e. coming or generated outside the feedback
- b) Reducing the internal noise, i.e. the noise coming from parts in the feedback system
- c) Reduce the crosstalk between bunch signals

Conclusions

- Feedback systems needs internal and beam diagnostics tools
- It is possible manage more power in the feedbacks installing as many systems as necessary
- Two separate feedback systems for the same oscillation plane work in perfect collaboration doubling the feedback damping time

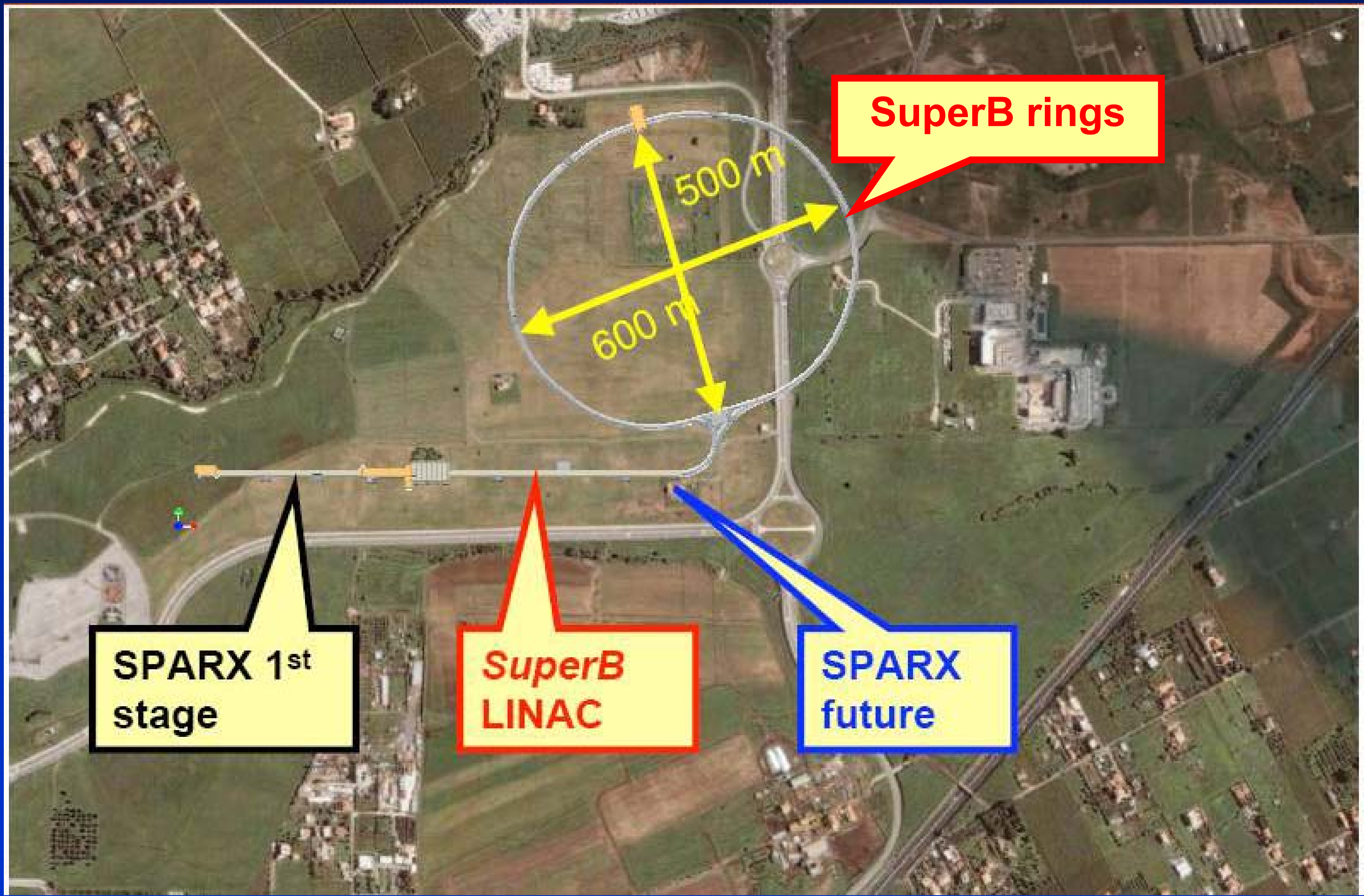
A. Drago

SLAC Response to Super-B Components of INFN Request (September 2008)

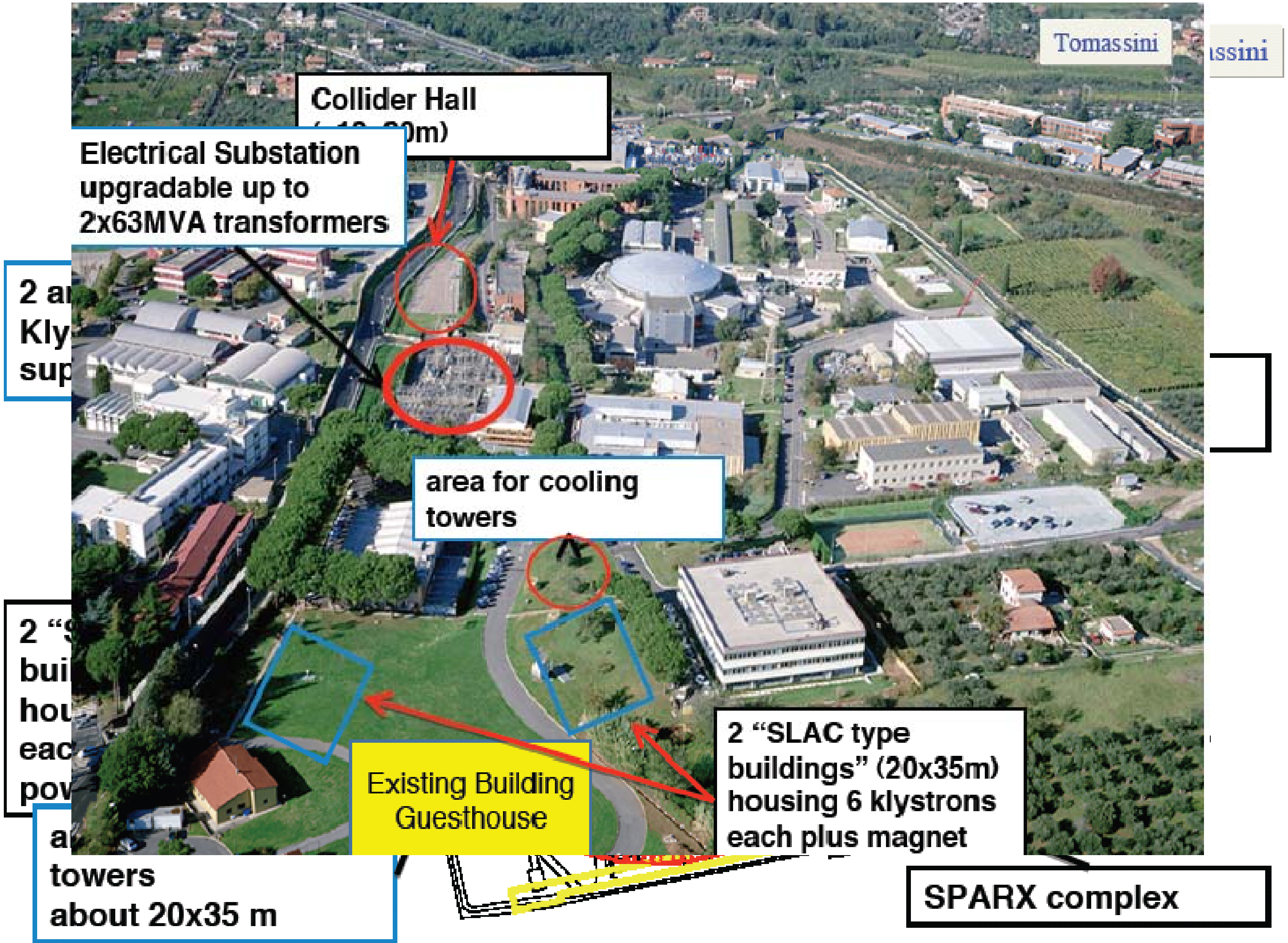
M. Sullivan, J. Seeman

A) North and South Damping ring components and injection/extraction lines → **FACET**
B) Linac accelerator RF distribution waveguide (~72) → **PEP-X**
C) Linac accelerating 3 m sections (~72)→ **PEP-X**
D) Linac klystrons (~36) → **PEP-X**
E) Linac klystron modulators (~36) → **PEP-X**
F) Linac QA and QB quadrupoles (23+13) → **PEP-X**
G) Linac dipole correctors (~40) → **PEP-X**
H) Linac polarized gun system & associated three spin rotators with cryo-systems (~1+3) → **SuperB**
I) Linac e+ target and capture area (~1+spares) → **SuperB**
J) LER and HER dipoles and quadrupoles (~1022) → **SuperB and Project-X**
K) Dipole steering correctors (~836) → **SuperB**
L) Magnet mechanical supports (~1000) → **SuperB and Project-X**
M) Vacuum chambers (~~650) → **SuperB**
N) RF stations (complete) (~15) → **SuperB and PEP-X**
O) Feedback systems (~4) → **SuperB and BEPC-II**
P) Diagnostics (~120) → **SuperB, LCLS, SPEAR-3**
Q) Injection hardware (LER and HER) → **SuperB**
R) Temperature monitors (~2000) → **SuperB**
S) Power supplies (~800) → **SuperB and some SLAC spares**

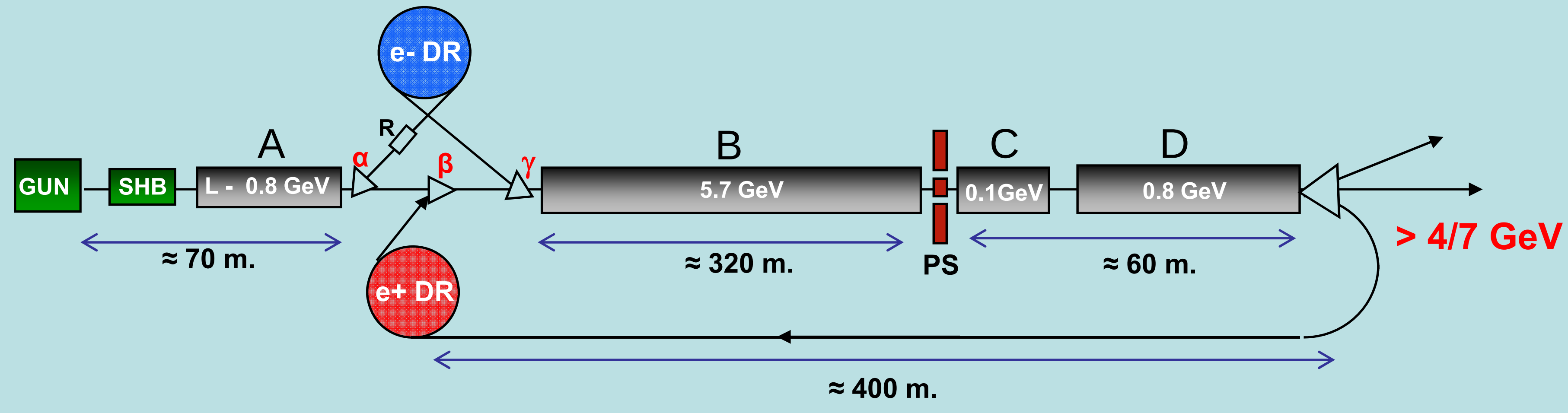
SuperB site Tor vergata



SuperB site LNF



SuperB Injector layout



- Polarised SLC electron gun
- 2 Damping Rings
- S-band Linacs
- Positron converter
- Cycle: 16 Hz e^- injection, 16 Hz e^+ production, 16 Hz e^+ injection

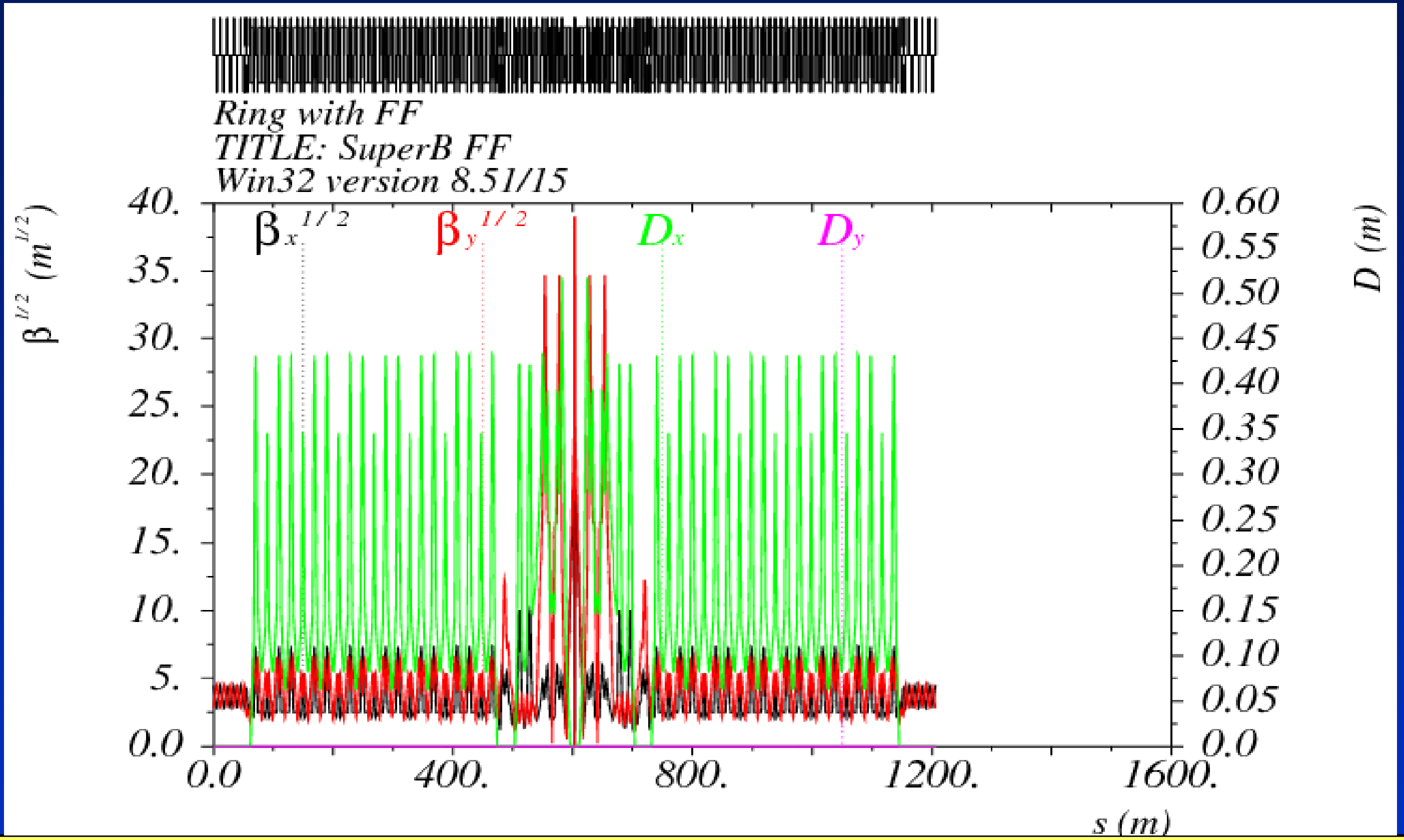
R. Boni, S. Guiducci (LNF), J. Seeman (SLAC)

Lattice studies toward a more compact layout

- Optimized Arc lattice and DA with μ_x=0.75, μ_y=0.25 in ARC cells
- Just two Arcs left with 21 Cells each (from 4 Arcs*14cells)
- 30% Fewer sexts: sext-nosext-sext-sext-nosext-sext etc…
- Arc DA further increased since all sextupoles are at –I in both planes (although x and y sextupoles are nested)
- Emittance smaller and adjustable by varying the β and η in the ARCs
- Magnet spacing now fits with the PEP-II hardware (6% lengthening)
- Damping time 5% shorter than previous design
- Integrated the CDR FF (the shortest) with the shortest lattice
- Emittance 20% higher than design
- HER power 20% higher than design
- With reduced HER energy (6.7 GeV), emittance and power down by 20%
- With Spin Rotators in LER (4.18 GeV) → ring about 1.32 Km long
- <u>Possible to consider a different site for this layout</u>

P. Raimondi, M. Biagini (LNF)

Arcs + FF (no SR)



Straights in the middle of the Arcs are missing
This solution does not requires them for optic properties, but can be added if needed (for RF, Injection etc…)
FF readjusted to match the bending required for polarization
SPIN Rotators can be included just after crab sextupoles, outside FF

New collaborations

- LPSC (F. Meot + student) would like to join the lattice effort.
- D. Barber (DESY) now collaborating on polarization issues.
- Planned visit by BINP physicists at LNF in September.
- One post-doc from Saclay from November will spend few months at LNF

Critical issues

- Need to continue pushing forward with lattices
  - focus on one option, not able to keep several options "in flight"
  - The energy ratio has reared its head again. It will require a concerted effort & communication to settle.
- In order to be able to proceed we are planning to focus in the near term on the option most likely leading to a consistent & buildable design
  - 6.7 on 4.2 GeV, symmetric spin rotators, ≈1320 m length, contained on LNF+ENEA site
  - does not preclude individual "forays" into other options

Piano di lavoro futuro

- 2009
  - Ci si aspetta un segnale chiaro di approvazione da parte del governo.
  - Progetto presentato in Giugno al CIPE
  - In settembre 6 fisici del BINP passeranno circa 1 mese a LNF per finalizzare ottica e studi di beam dynamics
- Fine 2009
  - Preparazione di un “Intermediate Technical Report”, non troppo dettagliato (“white paper”) che riassuma le caratteristiche del progetto (macchina, fisica, detector) da presentare al Governo per la richiesta di finanziamento entro al fine dell’anno:
    - Dimensionamento ingegneria civile
    - Reclutamento nuovi collaboratori
    - Funding di agenzie straniere
- Fine 2010
  - Preparazione del Technical Design Report
    - Dettaglio del progetto di acceleratore e rivelatore

SuperB

Super-B TDR people to hire (full time)

• Senior Physicist	Ring optics
• Senior Physicist	Beam-beam calculations
• Senior physicist	Diagnostics
• Junior Physicist	Beam dynamics, low emittance tuning
• Junior Physicist	Beam dynamics, collective effects
• Junior Physicist	Linac-damping ring-transport line optics
• Junior Physicist	Bunch-by-bunch feedbacks
• Mech engineer	Magnet design (conventional)
• Mech engineer	Magnet design (super-conducting)
• Mech engineer	Linac design
• Mech engineer	Damping ring-transport line design
• Mech engineer	Arc vacuum chamber design
• Mech engineer	Site engineering (including vibrations studies)
• Electronics engineer	RF low level design
• Electronics engineer	Diagnostics
• Electronics engineer	Control system design
• Safety engineer	Radiation safety
• Power engineer	Power supplies
• Power engineer	RF system high power design

- Assume all technicians come from Frascati or other INFN labs (???)

Proposta a INFN da J. Seeman, M. Biagini

Anagrafica NTA

	Ricercatori					
	Nome	Contratto	Qualifica	Aff.	Sez.	%
1	Biagini Maria Enrica	Dip. a tempo indeterminato	Primo Ricercatore	CSN V	LNF	50
2	Guiducci Susanna	Dip. a tempo indeterminato	Dirigente di Ricerca	CSN V	LNF	20
3	Milardi Catia	Dip. a tempo indeterminato	Primo Ricercatore	CSN V	LNF	20
4	Mazzitelli Giovanni	Dip. a tempo indeterminato	Primo Ricercatore	CSN V	LNF	30
5	Raimondi Pantaleo	Associato	Ricercatore	CSN V	LNF	50
6	Giorgi Marcello	Associato	Prof. Ordinario	CSN I	PI	20
7	Paoloni Eugenio	Associato	Ricercatore	CSN I	PI	30
			Numero Totale Ricercatori	7	FTE: 2.2	

	Tecnologi					
	Nome	Contratto	Qualifica	Aff.	Sez.	%
1	Buonomo Bruno	Dip. a tempo determinato	Tecnologo	CSN V	LNF	20
2	Boni Roberto	Dip. a tempo indeterminato	Dirigente Tecnologo	CSN V	LNF	10
3	Boscolo Manuela	Dip. a tempo indeterminato	Tecnologo	CSN V	LNF	40
4	Drago Alessandro	Dip. a tempo indeterminato	Primo Tecnologo	CSN V	LNF	40
5	Alesini David	Dip. a tempo indeterminato	Tecnologo	CSN V	LNF	10
6	Preger Miro Andrea	Dip. a tempo indeterminato	Dirigente Tecnologo	CSN V	LNF	20
7	Tomassini Sandro	Dip. a tempo indeterminato	Tecnologo	CSN V	LNF	20
8	Vaccarezza Cristina	Dip. a tempo indeterminato	Primo Tecnologo	CSN V	LNF	10
9	Zobov Mikhail	Dip. a tempo indeterminato	Primo Tecnologo	CSN V	LNF	30
			Numero Totale Tecnologi	9	FTE: 2.0	

Totale FTE: 4.2

La partecipazione nei LNF è destinata ad aumentare!!!

Finanziamento LNF 2009

- In attesa del finanziamento da parte della Regione Lazio (inizialmente previsto per Aprile 2009) NTA ha concesso a LNF:
  - 1 k€ MI + 15 k€ ME, che in fase di assegnazione si sono ridotte a 1 k€ MI + 11.3 k€ ME = 12.3 k€
- Abbiamo avuto:
  - 26-30 Gennaio: Accelerator Workshop a SLAC (5 p)
  - 15-18 Febbraio: SuperB General Meeting a Orsay (14 p)
  - 16-20 Giugno: SuperB General Meeting a Perugia (10 p)
- Avremo:
  - Luglio/Agosto: Missioni a SLAC (3 p)
  - 5-9 Ottobre: General Meeting (almeno 6 p)

Contributo da DA LNF con promessa di rimborso !!!!

- Si chiede un ulteriore finanziamento per il 2009 di 15 k€ per ME

Finanziamento LNF 2010

- 15 k€ per MI
- 50 k€ per ME
- 20 ke per acquisto licenza codice simulazione impedenza e wake field (MAFIA o simile)

Finanziamento Pisa 2010

- 20 k€ per MI
- 25 k€ per ME
- 20 k€ per costruzione apparati (prototipo QD0)

Conclusioni

- Restanti 6 mesi del 2009: attività concentrata sulla definizione baseline lattice e lo studio dello schema di polarizzazione
- Entro il 2010 si vuole terminare il TDR
- Dovremo reperire un certo numero di ingegneri e tecnici per le infrastrutture e i servizi, e coinvolgere maggiormente la DA dei LNF
- SLAC ha accettato di concedere buona parte delle componenti di PEP-II per l'uso di *SuperB*
- Al momento i fondi NTA ci permettono di mantenere vivi i contatti con i collaboratori stranieri e di organizzare riunioni e Workshops, necessari poichè le responsabilità al momento sono egualmente ripartite tra INFN e SLAC, con l'apporto di altri Laboratori stranieri, il cui coinvolgimento aumenterà
- Sarà necessario usare parte dei fondi reperibili (Regione Lazio?) per contratti