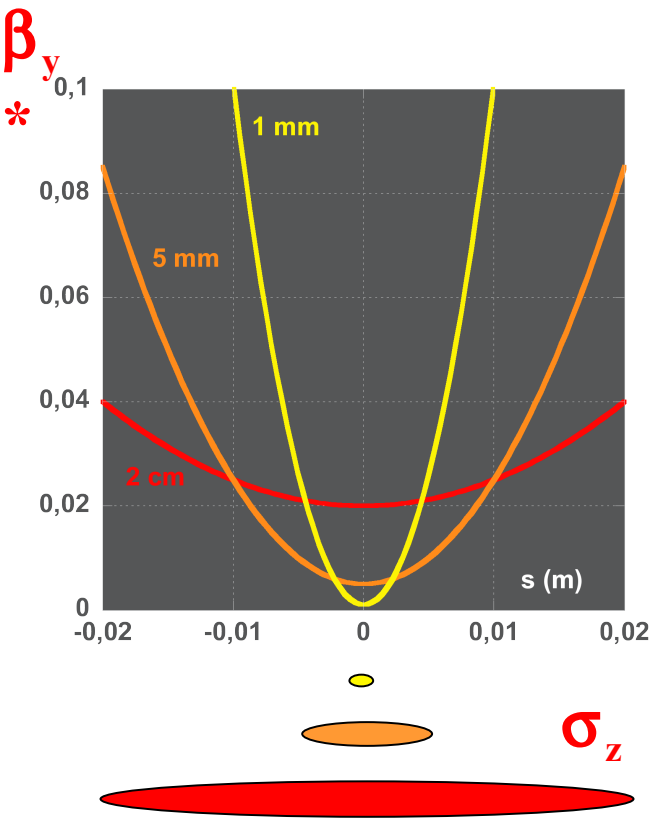
Increasing L: the traditional brute force approach

Upgrades to PEPII and KEK-B have been based on:

- **current increase**
- decreased β_y^*
  - → **decreasead bunch length** to avoid hour glass effect

Consequences:

- challenging machine design and operation (instabilities)
  - HOM power, overheating, smaller dynamic aperture, RF voltage increase
- nasty experimental environment
  - Beam Gas, Sync. Rad., shorter Touschek lifetime, increased Energy spread
- power bill goes up quickly (e.g.: 180 MW for '05 10^{36} SuperPEP-II complex design)



Hour glass effect:

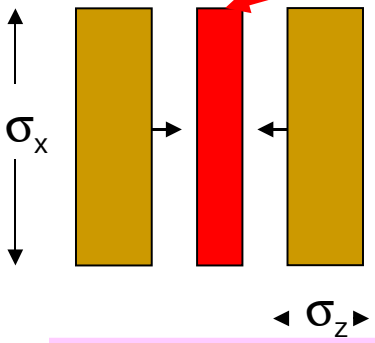
$\sigma_z \approx \beta_y^*$

Large crossing angle, small x-size

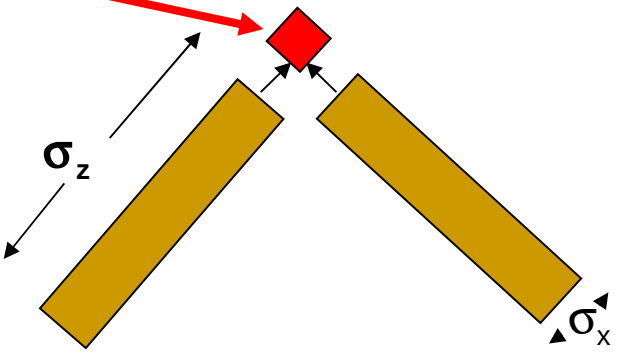
1) Head-on, Short bunches

Overlap region

2) Large crossing angle, long bunches



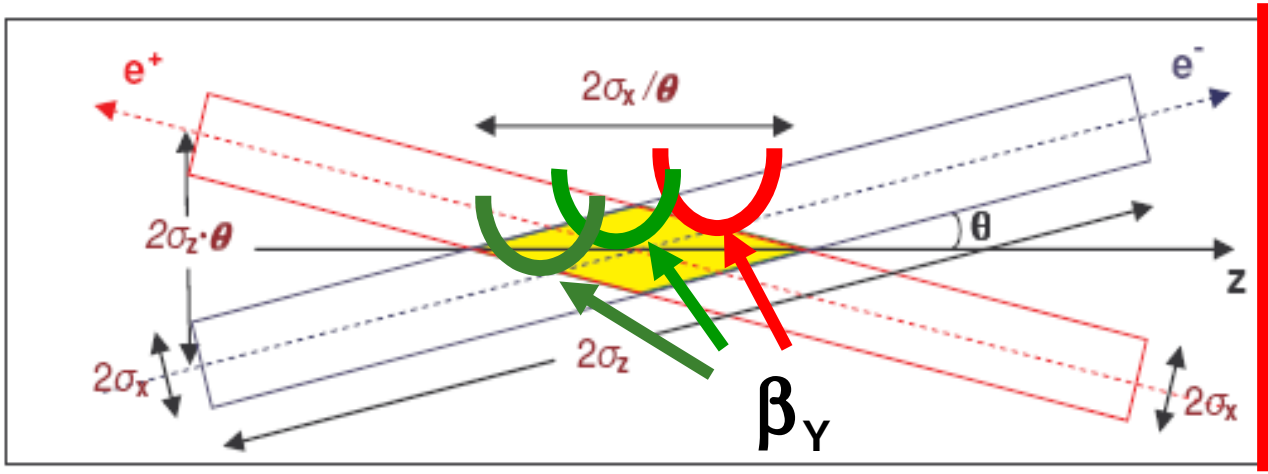
(1) and (2) have same Luminosity, but (2) has longer bunches and smaller σ_x



With large crossing angle the x and z planes are swapped

Large Piwinski angle:

$$\Phi = tg(\theta)\sigma_z/\sigma_x$$



y waist can be moved along z with a sextupole on both sides of IP at proper phase

"Crab Waist"

… but new ideas came into play

P. Raimondi's idea to focus more the beams at IP and have a "large" crossing angle → large Piwinski angle

Ultra-low emittance (ILC-DR like)
Very small β at IP (ILC FF like)

Large crossing angle

"Crab Waist" scheme

→ Small collision area
Lower β is possible

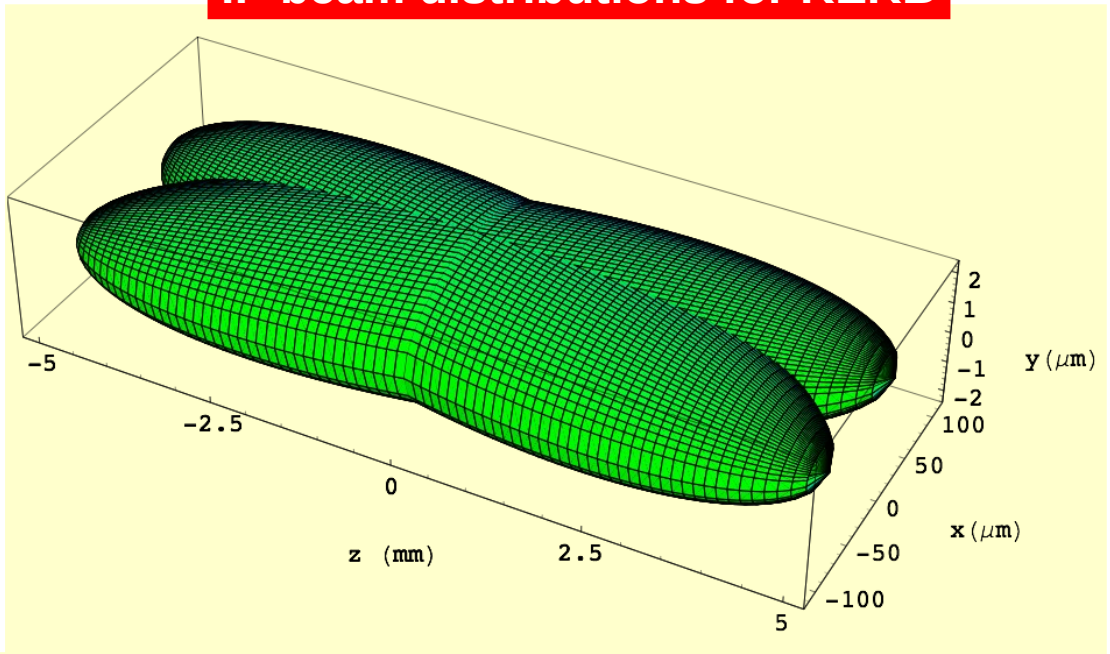
→ NO parasitic crossings

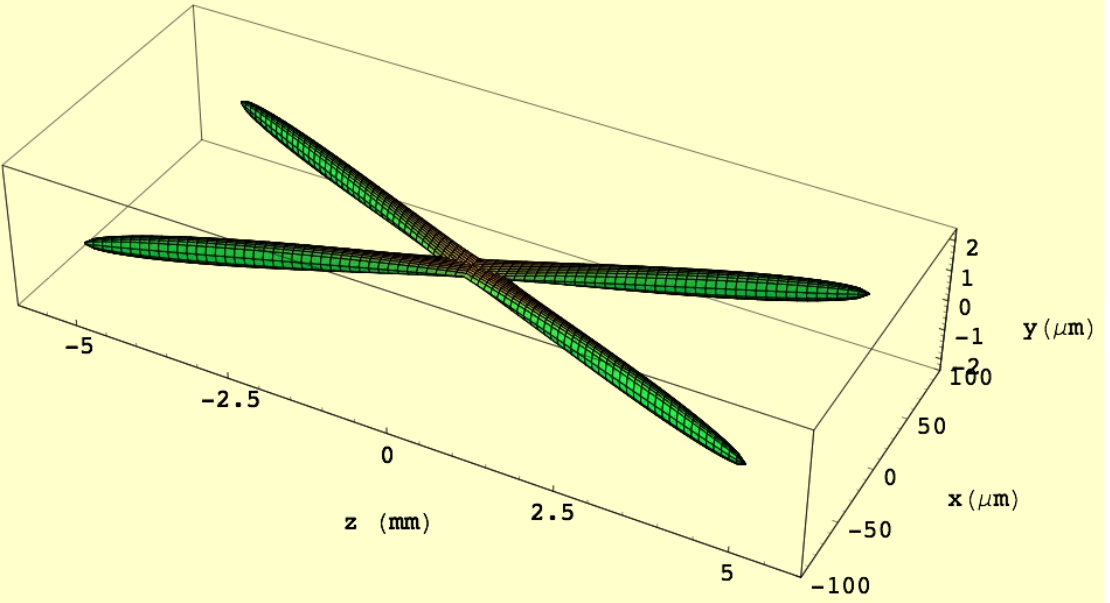
→ NO synchro-betatron resonances due to crossing angle

Test at DAΦNE ongoing !!!

PiwAngle = σ_z/σ_y x Cross Angle/2

IP beam distributions for KEKB





IP beam distributions for SuperB

An example...

	KEKB	SuperB
I (A)	1.7	2.
β_y^* (mm)	6	0.3
β_x^* (mm)	300	20
σ_y^* (μm)	3	0.035
σ_x^* (μm)	80	6
σ_z (mm)	6	5
L ($cm^{-2}s^{-1}$)	1.7×10^{34}	$1. \times 10^{36}$

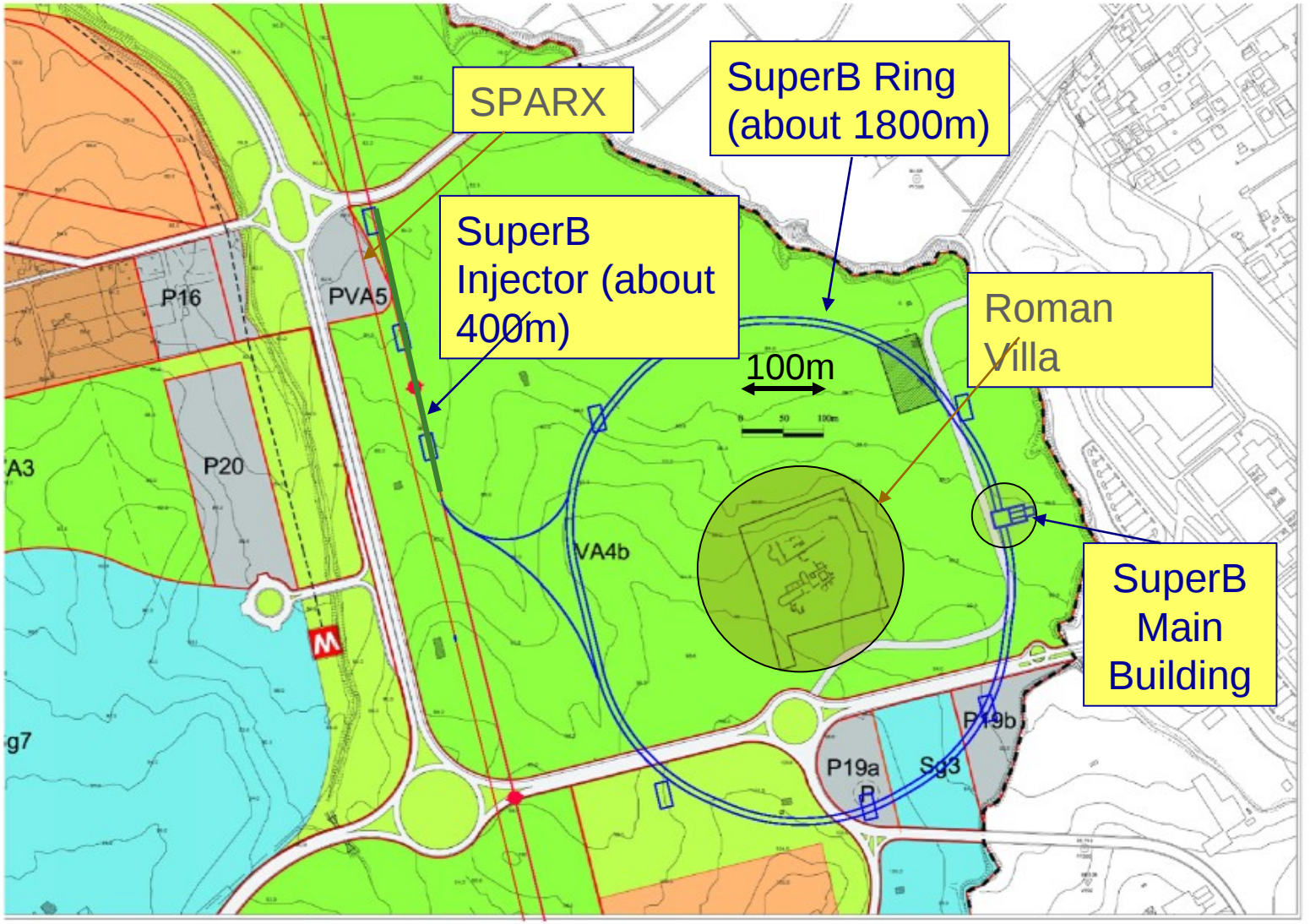
Here is Luminosity gain

The B-factory evolution

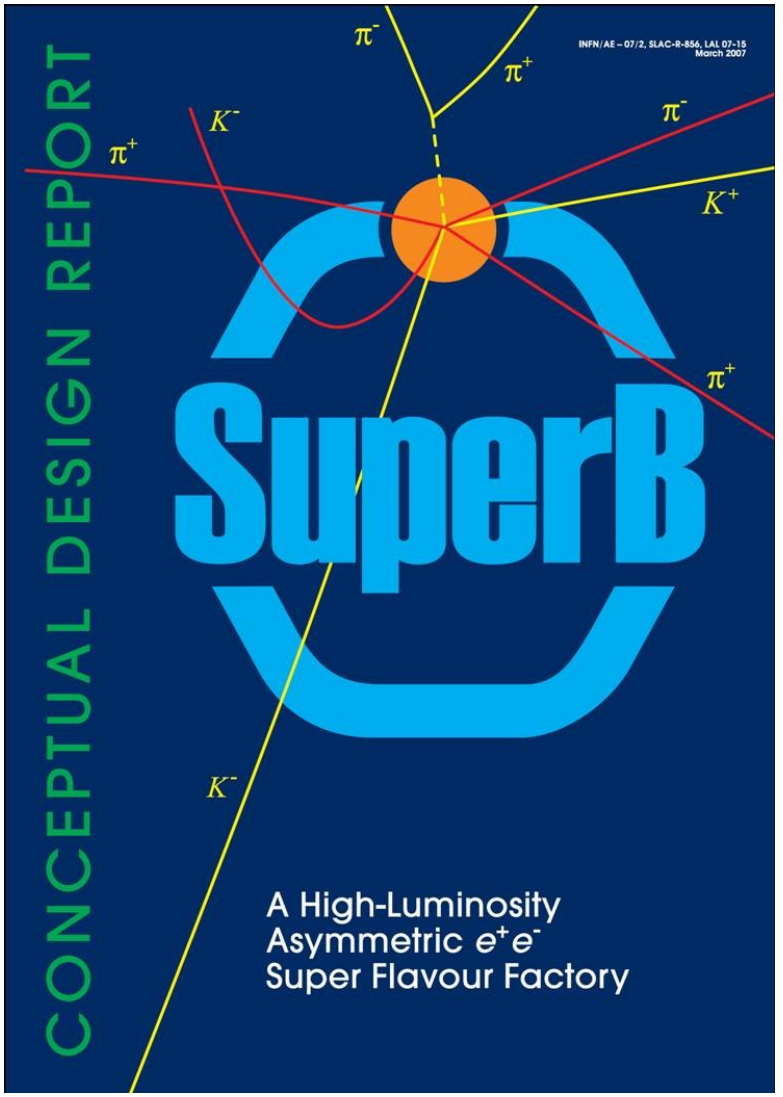
		PEP-II		Super KEK-B '05 (0.4×10^{36})		Super PEP-II '05 (10^{36})		Super-B (10^{36})	
		LER	HER	LER	HER	LER	HER	LER	HER
Energy	(GeV)	3.1	9	3.5	8	3.5	8	4	7
Current	(A)	2.9	1.8	9.4	4.1	23	10	2.3	1.3
HOM losses	(MW)	0.8	2.1	9.0		17.8	2.9	2.3	2.1
SR losses	(MW)	1.6	5.7	26.0		22.3	22.0	4.4	4.3
RF AC power (50% eff.)	(MW)	4.9	15.6	73.0		80.3	49.8	13.4	12.7

SuperB location

SuperB Footprint



Conceptual Design Report



The CDR of SuperB is ready!

INFN/AE-07/02,
SLAC-R-856,
LAL 07-15

Available at:

www.pi.infn.it/SuperB

arxiv.org/abs/0709.0451

476 pages

Printed and available

Copies can be requested from
Lucia.Lilli@pi.infn.it

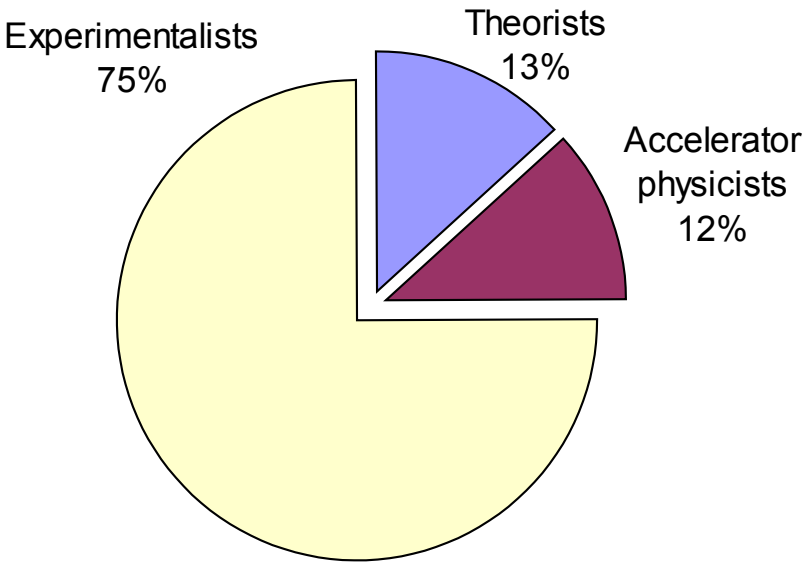
CDR Signatures: some numbers

320 Signatures; 85 institutions

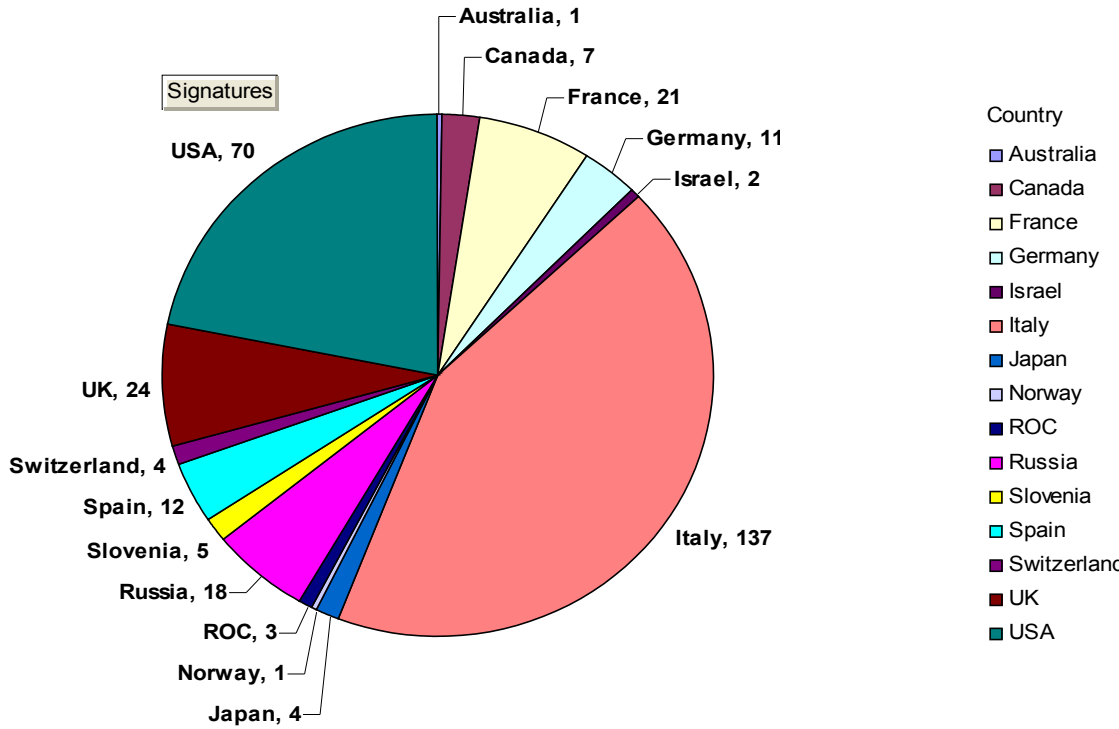
The people on the following list have indicated interest in and support for the SuperB project. It includes a subset who have been directly involved with the preparation of this document, as well as individuals who have contributed in other ways or plan on future involvement.

Experimentalists:

- 174 Babar members
- 65 non Babar exper.



Signatures breakdown by type



Signatures breakdown by country

Il processo in questo momento

- INFN ha approvato il prossimo passo: la stesura del TDR (macchina + esperimento + infrastrutture)
  - oltre al contributo INFN, assicurato uno speciale contributo della regione Lazio (5 ME x 3 anni)
- ora ci aspettiamo che di rafforzi la componente non italiana (specialmente US)
  - e che si siglino accordi di collaborazione con altre agenzie soprattutto per lo sviluppo della macchina
  - condizione necessaria perchè il progetto possa essere approvato

prossimo passi

- per fine anno dovranno essere preparati i documenti in versione preliminare
  - principalmente per formulare la richiesta di finanziamento al governo italiano
- per fine 2010 dovrà essere pronto il TDR vero e proprio che dovrà poi essere valutato e finanziato
- durante il prossimo meeting a Parigi (15-18/2/'09) si dovrà organizzare il lavoro in vista di tali scadenze

DAQ/Trigger/Electronics

- Stato:
  - in generale al momento si tratta di territori vergini
  - per l'elettronica:
    - un gruppo di Orsay ha iniziato a lavorare sull'elettronica (D. Breton)
  - per il DAQ e il trigger:
    - lavoro iniziale per il CDR espletato da due collaboratori di BaBar ora impegnati in altro
    - interesse fattivo di Bologna (U. Marconi et al.) e Napoli su DAQ e trigger

Babar and SuperB trigger

L1	$L = 1x10^{34}\ cm^{-2}s^{-1}$		$L = 1x10^{36}\ cm^{-2}s^{-1}$	
	c.s. (nb)	rate (Hz)	c.s. (nb)	rate (Hz)
b anti-b	1.1	11	1.1	1100
ucsd	3.4	34	3.4	3400
$\mu^+\mu^-$	1.16	12	1.16	1200
$\tau^+\tau^-$	0.94	9	0.94	900
γ *et al.*	~ 7	70	~ 7	7000
e^+e^-	50	500	50	50000
BKG	250	2500	**25**	**25000**
total		**3136**		**88600**
+ 50%		4704		132900
L3				
total	**30**	**300**	**25**	**25000**

BaBar and SuperB DAQ (I)

Subdetector	Number of ROMs	KB/ROM per Event (Input)	KB/ROM per Event (Output)	Total KB per Event (Input)	Total KB per Event (Output)
SVT	26	0.33	0.33	8.5	8.5
DCH	4	3.5	1.0	14	4.0
EMC_BRL	80	12	108	960	8.5
EMC_ECP	20	8	70	160	1.5
DIRC	12	1	390	12	4.5
IFR	8	1.1	250	9	2.0
Subdetector	Number of ROMs	KB/ROM per Event (Input)	KB/ROM per Event (Output)	Total KB per Event (Input)	Total KB per Event (Output)
TRG_GLT	1	0.5	493	0.5	0.5
TRG_TRK	3	3	770	9	2.0
TRG_ENR	1	3	1360	3	1.0
Total	155	--	--	1176	32.5

BaBar and SuperB DAQ (II)

- readout from FE to ROM
  (event size / total throughput)
  - **BaBar: 1.1 MB / 3.3 GB/s**
  - **SuperB: 3+ MB / 10 GB/s**
- readout from ROM to EB
  (event size /total throughput)
  - **BaBar: 35 kB / 10 MB/s**
  - **SuperB: 75 kB** *(guess)* **/ 2.0 GB/s**