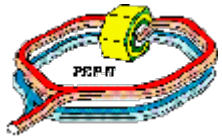


Cost Algorithm for a Super-B Factory

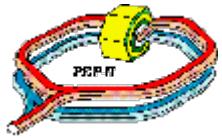
John T. Seeman

SBF Workshop

SLAC

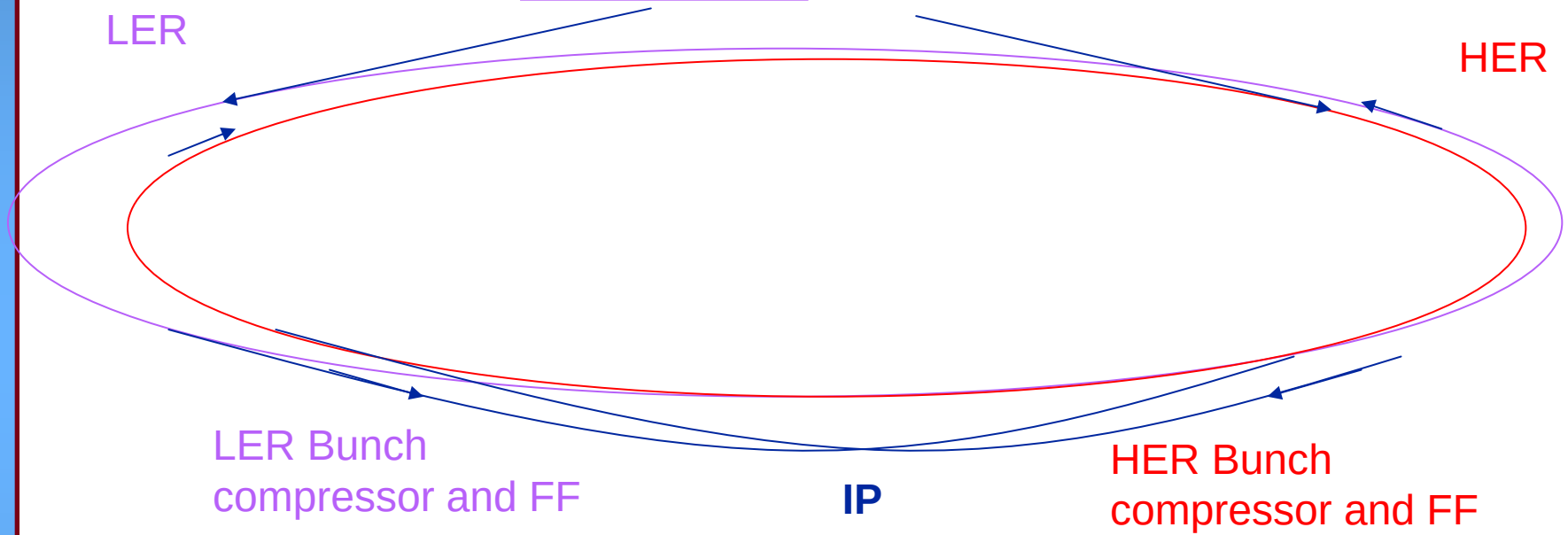
June 15, 2006

Prices



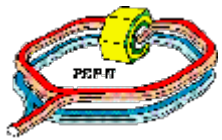
- Costs are approximate and can change easily.
- Oku-yen ~ MEuro ~ M$
- Different geometries have very different estimates.

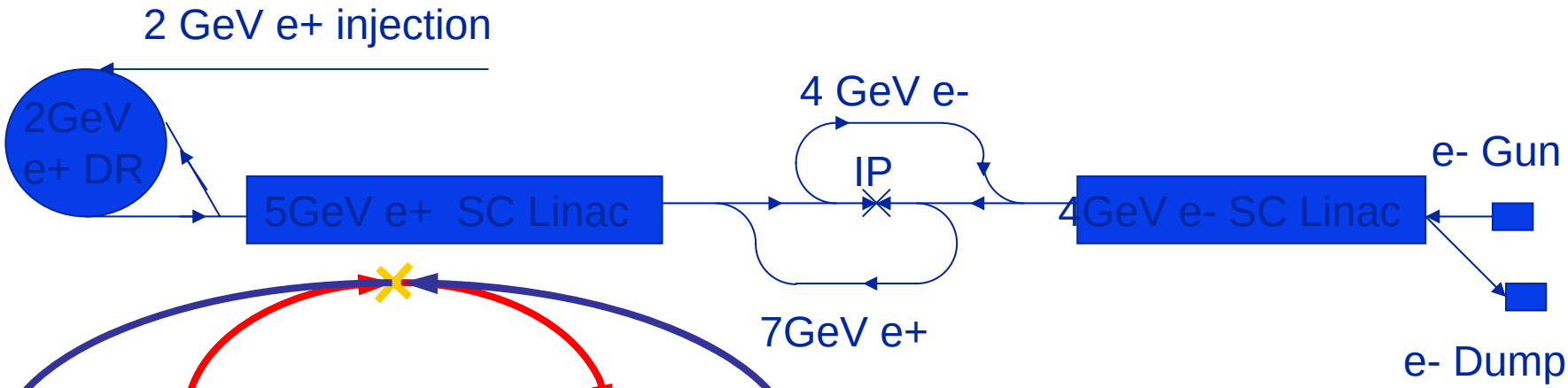
Linear-B scheme

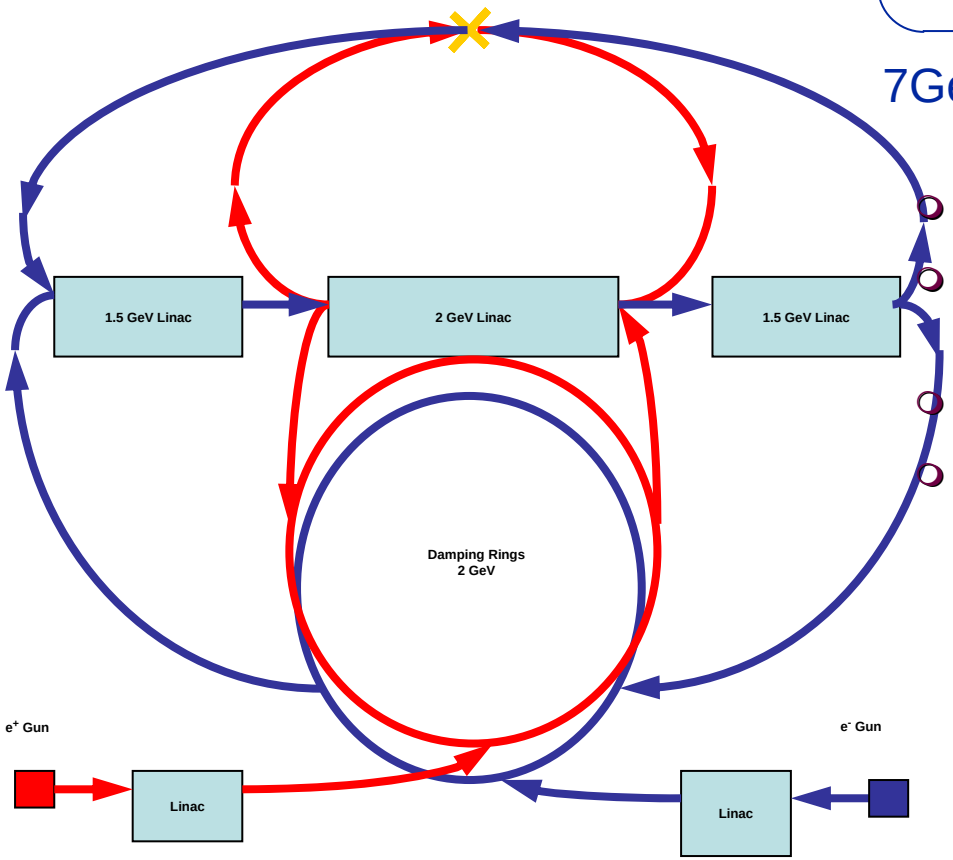


Overall ring length about 6Km,
Collision frequency about 120Hz*10000bunch_trains=1.200MHz
Bunch train stays in the rings for 8.3msec, then is extracted, compressed and focused. After the collision the bunch is reinjected in its ring

Linear Super B schemes with acceleration and energy recovery, to reduce power

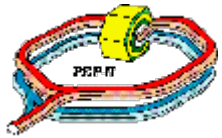






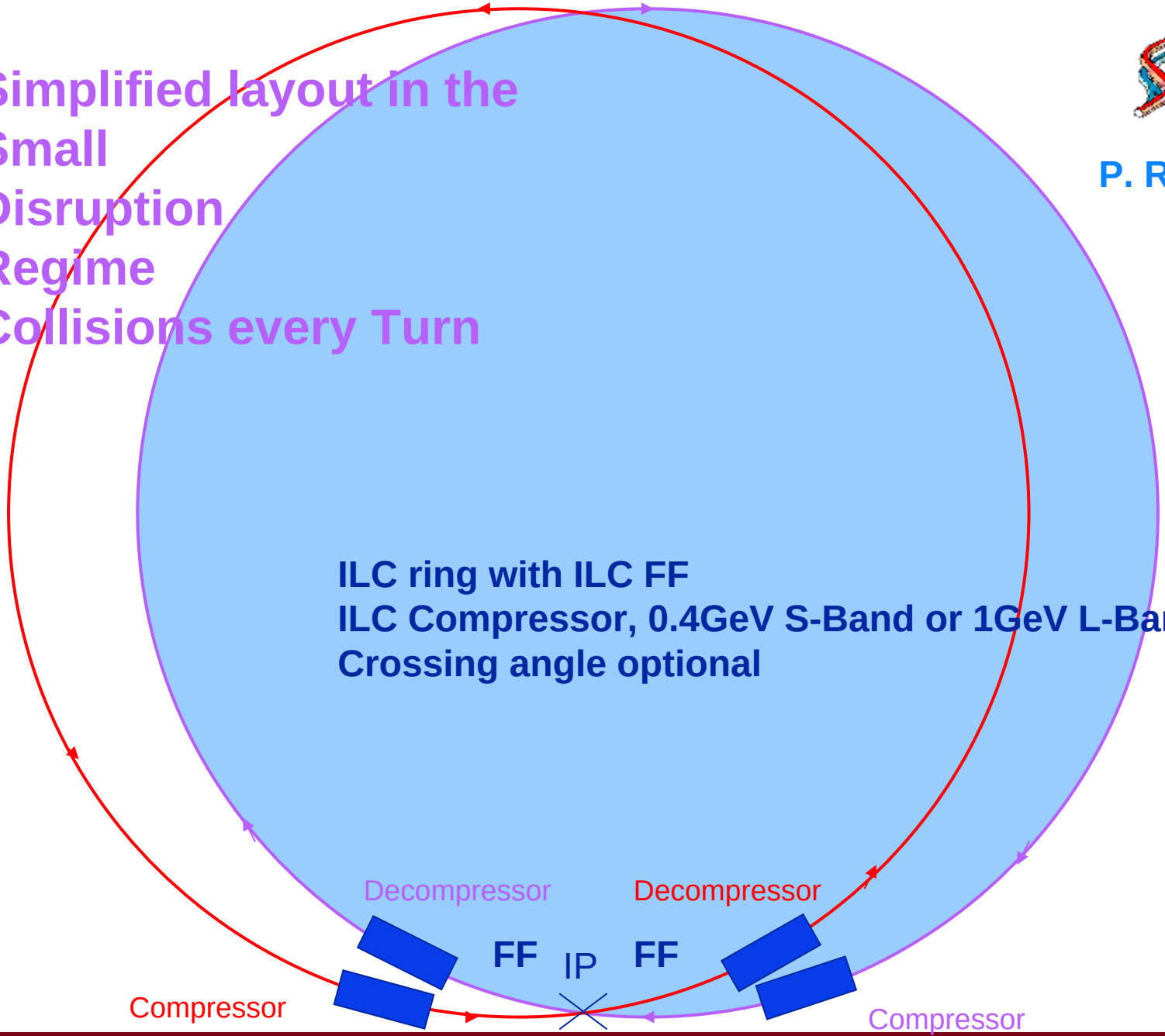
- **Use SC linacs to recover energy**
- **Use lower energy damping rings to reduce synchrotron radiation**
- **No electron damping ring**
- **Make electrons fresh every cycle**
  - **Damping time means time to radiate all energy**
  - **Why not make a fresh beam if storage time is greater than 1 damping time**

Simplified layout in the Small Disruption Regime Collisions every Turn

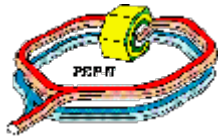


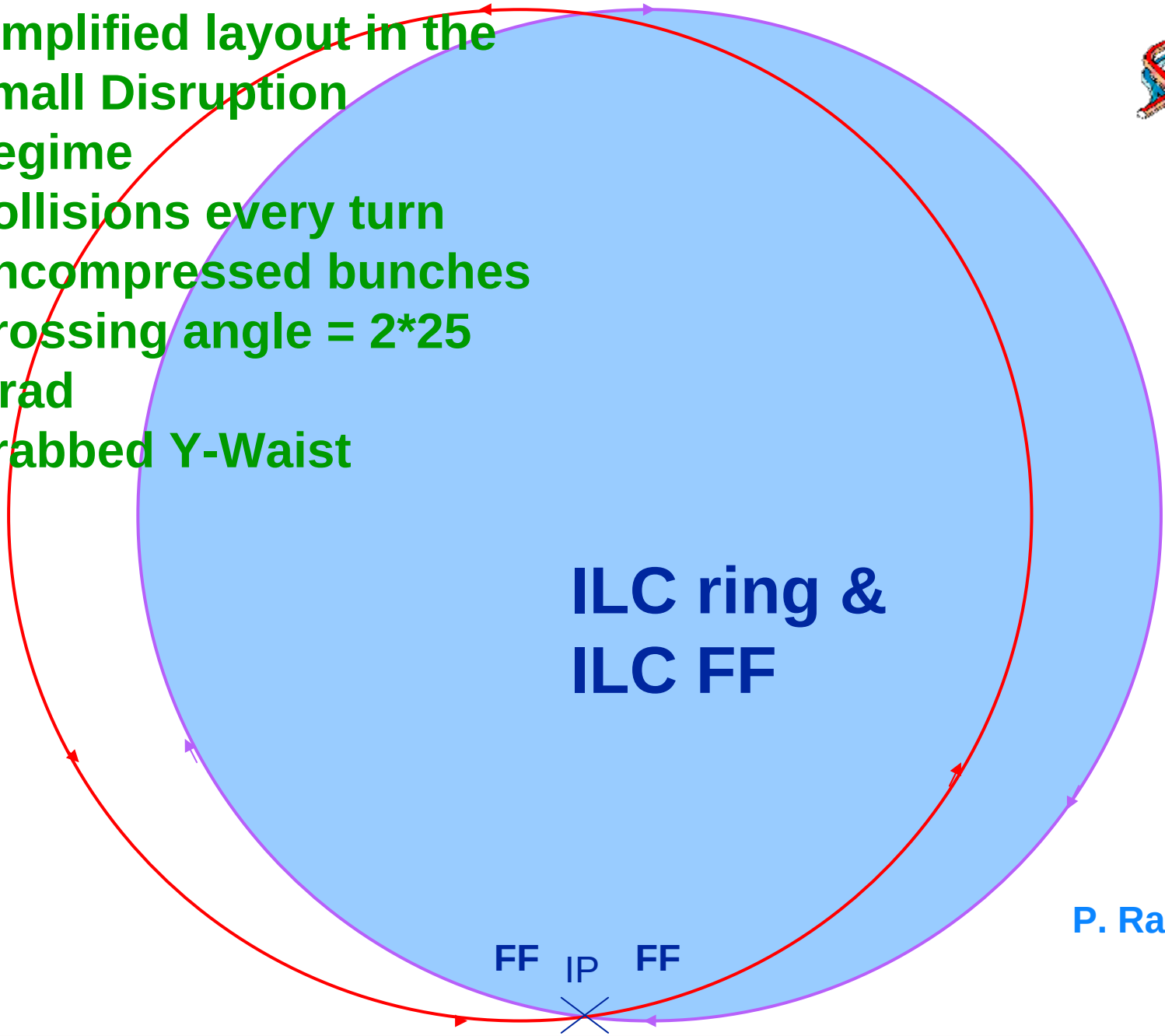
P. Raimondi

ILC ring with ILC FF
ILC Compressor, 0.4GeV S-Band or 1GeV L-Band
Crossing angle optional



Simplified layout in the Small Disruption Regime
Collisions every turn
Uncompressed bunches
Crossing angle = 2*25 mrad
Crabbed Y-Waist





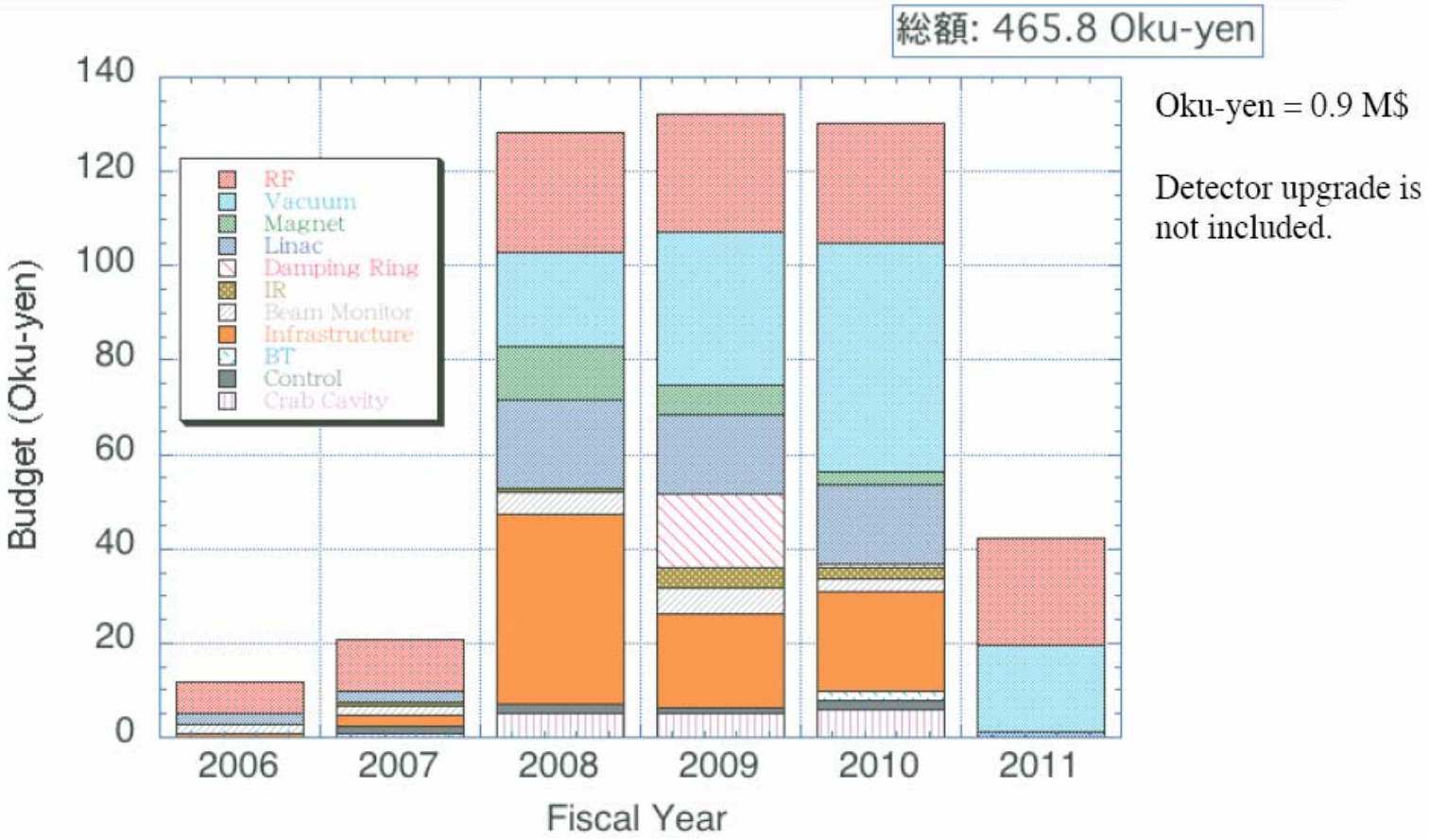
P. Raimondi

SBF projected cost in 2004 for 15 A on 8 A.

WBS item	PEP-II Actual (M$)	Proposed SBF (M$)
HER Ring	55.0	35
LER Ring	48.4	30
Interaction Region	7.3	7
Injector	16.6	1
Controls	6.7	2
Utilities	7.4	5
Safety and Protection	1.8	1
Management	7.3	9
Machine RF (add'tnl 42 stations)	22.9	110
Indirects	3.4	35
Contingency	-	70
Sub-total (FY2001 $)	177	305
Escalation factor to FY2008	-	1.21
Total (FY2008 $)	-	370

K. Oide at CERN Meeting May 2006

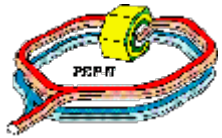
How much do we need?



Oku-yen = 0.9 M$

Detector upgrade is not included.

SuperKEKB (May 2006)



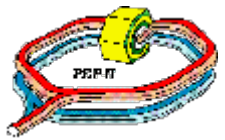
RF	105 M$
Vacuum	112 M$
Magnet	19 M$
Linac	49M$
Damping Ring	15 M$
IR	7 M$
Beam Monitor	15$
Intrastructure	76 M$
Beam transport	2 M$
Control	6 M$
Crab cavities	14 M$
Total	420 M$

SuperKEKB: June 2006

Oku-yen

Fiscal Year		2007	2008	2009	2010	2011		
RF		17.6	25.4	25.1	25.1	22.8		116
Vacuum			19.9	32.5	48.7	18.5		120
Magnet			14.1	5.21	5.49	0		24.8
Linac		4.8	18.5	16.8	16.8	1.1		58
Damping Ring			0.2	15.5	1.1	0		16.8
IR		0.6	0.8	4.5	2.1	0		8
Beam Monitor		0.65	5.61	5.86	5.25	0		17.4
Infrastructure		3.4	40	19.9	21	0		84.3
BT		0.1	0.2	0.2	2	0		2.5
Control		2.2	2.1	2.5	2.1	0.5		9.4
Crab Cavity		1	5	5	6	0		17
	0	30.3	132	133	136	42.9		474

Funakoshi



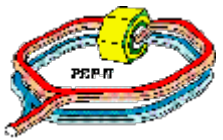
Preliminary Super B-Factory Cost Estimate with 952 MHz SC RF

J. Seeman 5/13/2005

Note: FY 2005 dollars. Prices below include contingency.

System	Item	Number of units	Cost per unit (k$)	Sub-total (M$)
Management	Project management (man-yr)	200	150	30.0
Injector	Upgrades	1	5000	5.0
Utility	12 KV AC distribution	1	5000	5.0
Utility	Cooling water	1	5000	5.0
Utility	Cable upgrades	1	5000	5.0
Utility	New plumbing	1	5000	5.0
Control	Computer upgrades	8	50	0.4
Feedback	Transverse feedback	2	2000	4.0
Feedback	Longitudinal feedback	2	2000	4.0
RF	952 klystrons	42	500	21.0
RF	RF cavity and cryostat	42	2000	84.0
RF	HV power supply	42	900	37.8
RF	Circulator	42	150	6.3
RF	Controls and feedback	42	250	10.5
RF	HOM absorbers	42	200	8.4
Magnet	HER dipole modifications	192	15	2.9
Magnet	LER dipole modifications	200	15	3.0
Magnet	LER new dipoles	200	25	5.0
Magnet	New supports	200	10	2.0
Vacuum	New LER vacuum system (m)	2100	20	42.0
Vacuum	New HER vacuum system (m)	2100	20	42.0
IR	New SC quads and cyrostats	4	2000	8.0
IR	IR Vacuum system (m)	200	40	8.0
IR	New IR supports	10	200	2.0
IR	Controls for SC quads	4	250	1.0
IR	Beam control	2	300	0.6
Instrumentation	Position monitor electronics	600	3	1.8
Instrumentation	Injection control	2	250	0.5
Instrumentation	Collimation	6	800	4.8
Instrumentation	Beam abort	2	700	1.4
			Total =	356.4

Draft: top down cost estimate without specific engineering knowledge



SBF Top Down Cost Estimate: New site 3 km collider			June 6, 2006	
Subsystem	Unit dimension	Number of units	Cost per unit (M units)	Total cost (M units)
Project management, engineering, safety	FTE-years	200	0.10	20.0
Particle e- source	units	1	10.00	10.0
Particle e+ source	units	1	10.00	10.0
Injector linac technical components	GeV	11	3.00	33.0
Injector linac tunnel and facilities	meters	800	0.05	40.0
Injector transport technical components	meters	500	0.03	15.0
Injector transport tunnel and facilities	meters	500	0.03	15.0
Storage ring technical components	meters	5700	0.05	285.0
Storage ring tunnel and facilities	meters	3000	0.05	150.0
RF stations	units	27	4.00	108.0
Final focus technical components	meters	150	0.20	30.0
Total project cost				716.0

This is for illustration only and not an official cost estimate.