

ILC Beam Instrumentation

– Introduction Remarks –

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- **BCD/RDR Instrumentation Group:**
 - Marc Ross, Phil Burrows, Junji Urakawa, Hans Braun, Manfred Wendt, Graham Blair, Steve Smith, and many others.
- **BCD:**
 - Focus on mission critical beam instrumentation systems, i.e. beam orbit, emittance, bunch length, and machine protection
 - Summarize R&D status of ongoing developments, particular high resolution cavity BPMs.
 - Define requirements for these core instrumentation systems.
- **RDR**
 - Define a core set of beam instruments, and the fundamental requirements.
 - Establish a comprehensive parametric spreadsheet, along areas and instruments for a complete cost analyzes.



RDR Instrumentation Summary



INSTRUMENT requirements (e.g. resolution)	AREA					
	e ⁻ source	e ⁺ source	DR	RTML	ML	BDS
Button/stripline BPM resolution (μm)	69 10-30	400 10-30	2 × 747 <0.5			120 <100
C-Band Cavity BPM (warm) resolution (μm)		109 <0.1-0.5		2 × 649 <0.1-0.5		262 <0.1-0.5
S-Band Cavity BPM (warm) resolution (μm)						14 < 0.1-0.5
L-Band Cavity BPM (warm) resolution (μm)				2 × 27 <1-5		42 <1-5
L-Band Cavity BPM (cold) resolution (μm)				2 × 28 ~0.5-2	2 × 280 ~0.5-2	
Laser-wire IP resolution (μm)	8 <0.5-5	20 <0.5-5	2 × 1 <0.5-5	2 × 12 <0.5-5	2 × 3 <0.5-5	8 <0.5-5
Wirescanner	12	8				
Optical Monitors	6	17	2 × 2	2 × 8		11
DMC resolution $\Delta E \sim 0.1\%$ / $s_x \sim 100 \mu\text{m}$	3	4		2 × 2		2 (cold)
Beam Current Monitors	7	11	2 × 1	2 × 2	2 × 3	10
Beam Phase Monitor	4	2		2 × 3		2
BLM (PMT/IC)	60/2	400/20	2 × 40/4	2 × 75/2	2 × 325/10	100/10
Feedback System	5	10	2 × 2	2 × 1	2 × 10	12

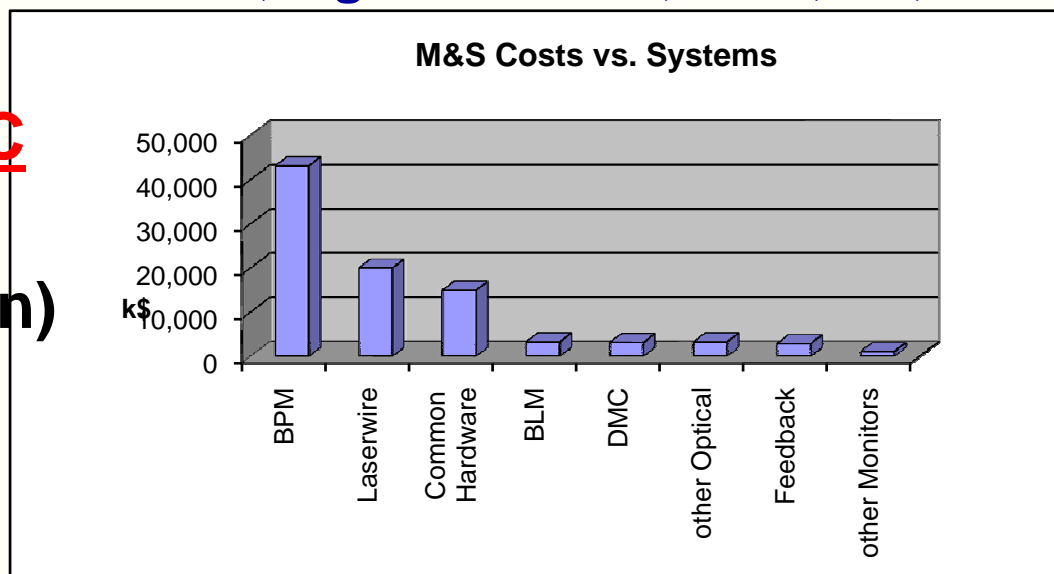
- **Beam Instrumentation:**

- Pickup detectors (mostly vacuum components), e.g. BPMs, toroids, screen monitors, WCMs, F-Cups, etc., also BLMs
- Read-out, control, timing, and other common hard- and software, NOT: racks, PS, CPU, control interface, etc.
- Cables
- Complex integrated instruments, e.g. Laser-wire, DMC, FB, etc.

- **Cost drivers: BPMs, Laser-wires, and DMC**

- **Total costs: (no IP instrumentation)**

- ~93 M\$ M&S
- ~ 257 manyears (FTE)



- **Beam Instrumentation has to:**
 - measure beam (bunch) parameters (Intensity, orbit, tr. & long. emittance, phase, etc.) within areas, and at the transition between areas!
 - provide detectors for machine protection and feedback systems.
 - be based on a limited set of common, exchangeable instruments to optimize costs, R&D efficiency, maintenance, etc. among accelerator areas.
- **Examples of “common” beam instruments:**
 - Toroids (intensity), button and warm cavity BPMs (orbit), screen monitors & ODR (emittance), EOS & DMC (bunch length), read-out hardware, components and subsystems (digitizers, etc.)
- **Examples of area specific beam instrumentation:**
 - Cold BPMs, IP instrumentation, fast IP FB.

- **Needs to follow up the RDR instrumentation lists for each area, refine the requirements, look to cost saving alternatives, define R&D needs, etc.**
- **Spread instrumentation WPs for international contribution, but also keep the “common” aspect in mind throughout the accelerator areas (coordination?).**
- **Clear definition on the WP deliverables!**
- **Beam Instrumentation R&D is linked to active groups and test facilities providing beam time, e.g. ATF, ESA, TTF, (NML),... it is NOT just a management exercise!**
- **Test facility instrumentation needs and R&D interests may not always follow GDE WPs!**