ILC Beam Instrumentation

– Introduction Remarks –

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Past Activities

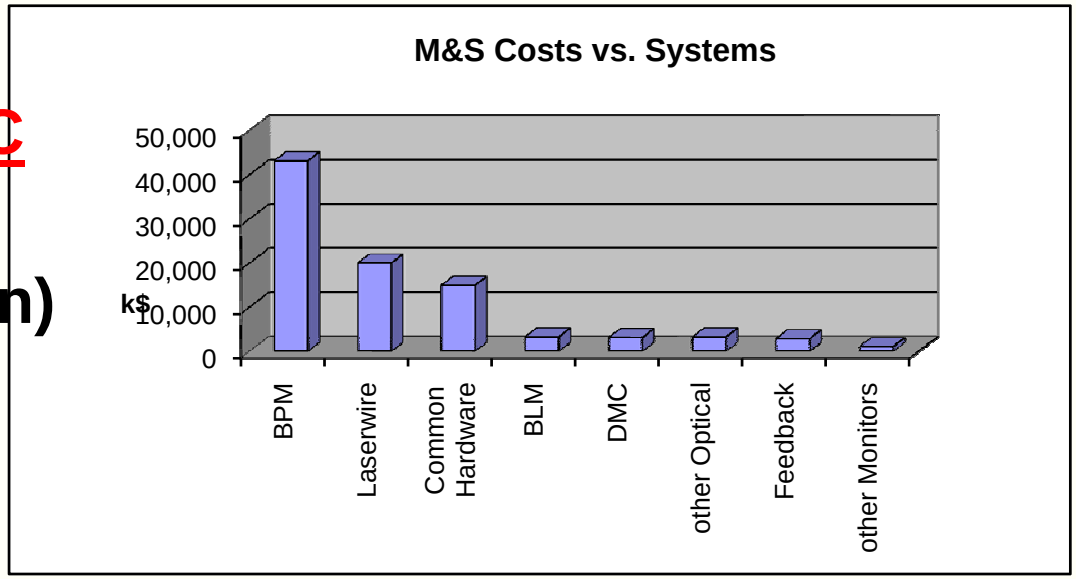
- **BCD/RDR Instrumentation Group:**
  - Marc Ross, Phil Burrows, Junji Urakawa, Hans Braun, Manfred Wendt, Graham Blair, Steve Smith, and many others.
- **BCD:**
  - Focus on mission critical beam instrumentation systems, i.e. beam orbit, emittance, bunch length, and machine protection
  - Summarize 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	AREA					
requirements (e.g. resolution)	e^- source	e^+ source	DR	RTML	ML	BDS
Button/stripline BPM	69	400	2 × 747			120
resolution (μm)	10-30	10-30	<0.5			<100
C-Band Cavity BPM (warm)		109		2 × 649		262
resolution (μm)		<0.1-0.5		<0.1-0.5		<0.1-0.5
S-Band Cavity BPM (warm)						14
resolution (μm)						< 0.1-0.5
L-Band Cavity BPM (warm)				2 × 27		42
resolution (μm)				<1-5		<1-5
L-Band Cavity BPM (cold)				2 × 28	2 × 280	
resolution (μm)				∼0.5-2	∼0.5-2	
Laser-wire IP	8	20	2 × 1	2 × 12	2 × 3	8
resolution (μm)	<0.5-5	<0.5-5	<0.5-5	<0.5-5	<0.5-5	<0.5-5
Wirescanner	12	8				
Optical Monitors	6	17	2 × 2	2 × 8		11
DMC	3	4		2 × 2		2 (cold)
resolution ΔE ∼0.1% / s_z ∼100 μm						
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

RDR Costing

- **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)



Area "Common" Instruments

- **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.

EDR Activities & Issues

- 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!