Minimum Machine Update

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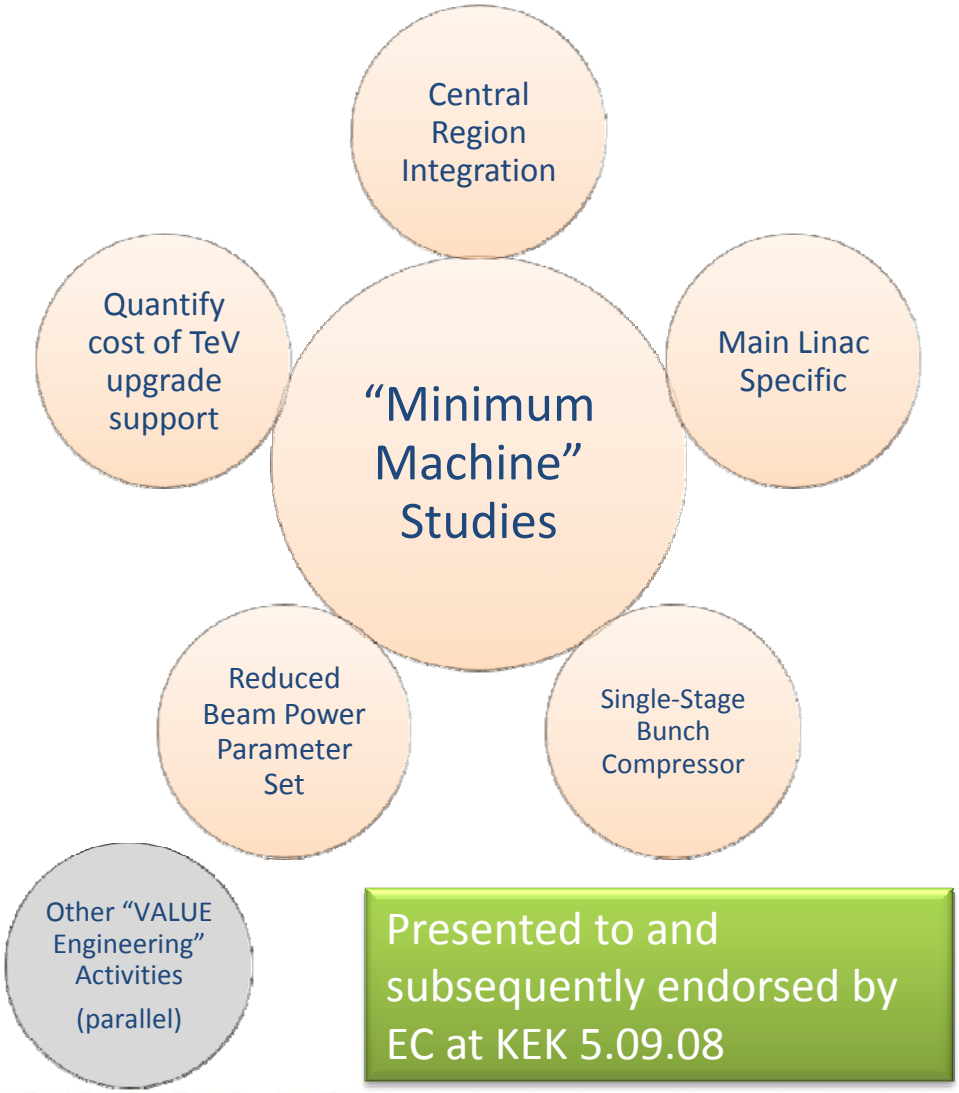
AS TAG leaders meeting
26.08.2008

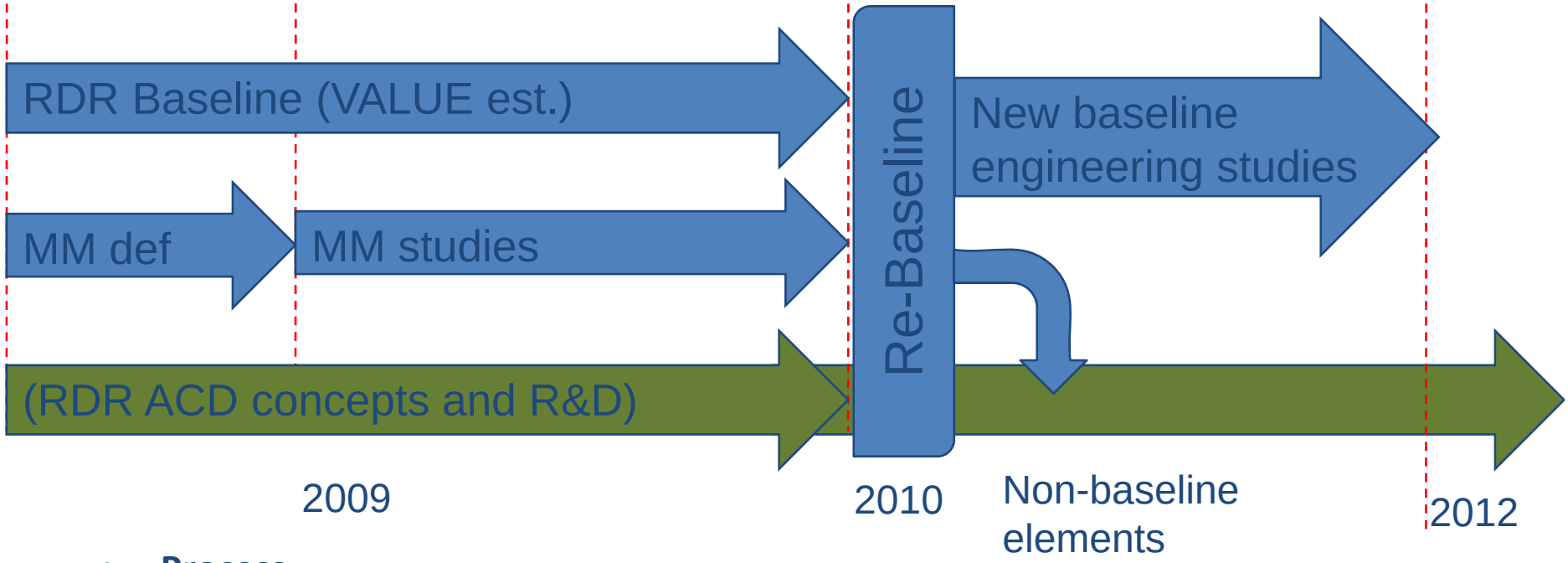
Minimum Machine: Current Definition



Presented to and subsequently endorsed by EC at KEK 5.09.08

- **"Minimum Machine" now refers to a set of identified options (*elements*) to be studied which may reduce the cost.**
- **Not a *minimum* in a definable sense**
  - But a potential reduced-cost solutions…
  - with a potential higher performance risk or operational impact
- **An alternative design (ACD-like) for study purposes**
  - Comparison with RDR baseline
  - Cost (not performance) driven
  - options which were not studied during RDR phase
- **Important to restrict options to manageable levels**
  - available resources
- **Must consider both peak and *integrated* performance**

Towards a Re-Baselining in 2010



- **Process**
  - RDR baseline & VALUE element are maintained
    - Formal baseline
  - MM elements needs to be studies/reviewed internationally
    - Regional balance in the AP&D groups involved
    - Regular meetings and discussions
    - (but top-down control from PM)
  - Formal review and re-baseline process beginning of 2010
    - Exact process needs definition (a PM action item for 2009)
    - Community sign-off mandatory

Main Linac Specific (ML Tech TA)

- **Removal of support tunnel (single tunnel)**
  - klystron cluster
  - XFEL-like
  - Dubna option (surface klystron gallery)?

alternative options

- **Klystron Cluster (HLRF)**
  - 30 klystrons located in localised surface buildings
  - ~300 MW RF power distributed in beam tunnel via over-moded waveguide
  - effectively ~1km RF unit
- **Marx modulator**
- **Reduced cost solution for process-water cooling**
  - Higher ΔT specification

Central Injectors Integration

- **Undulator-based positron source moved to end of linac**
- **e+ and e- sources share same tunnel as BDS**
  - upstream BDS (e.g. integration with collimation section)
  - Including 5GeV injector linacs
- **Removal of RDR "Keep Alive Source"**
  - replace by few PC 'auxiliary' source using main (photon) target
  - 500 MV warm linac, also in same tunnel

- **Damping Rings**
  - in BDS plane but horizontally displaced to avoid IR Hall
  - Injection/Ejection in same straight section
  - Circumference
    - 6.4 km (current RDR baseline)
    - 3.2 km (possible low-P option)

    } alternative options
  - (layout / geometry options under discussion)

Reduced Beam Power Option

- **Reduce n_b by factor of 2 (study scenario)**
  - Maintain luminosity by pushing on beam-beam
    - Similar to RDR Low-P parameter set, but
    - possible use of “travelling focus” concept
- **“Minimum Cost” point of RDR parameter plane**
  - Largest cost leverage of all sets in the table
- **Spectrum of possible savings**
  - Up to ½ number of klystrons and modulators
  - reduced circumference damping ring
  - reduced associated CFS

Remaining MM Study Elements

- **Single-stage compressor**
  - Factor 20 bunch compression ($\sigma_z \geq 300\mu m$ @IP)

- **Quantify cost of TeV support**
  - Minimum length 500 GeV com BDS
  - (High-power dumps?)

- **Other "VALUE Engineering"**
  - Water cooling (not Main Linac)
  - Vacuum solutions
  - Magnets & Power supplies
  - …

Encouraged activities

Considered parallel (on-going) to main 'layout' discussions

(not primary cost drivers)

Types of Studies (2009)

- **Interference / Integration**
  - Lattice layouts
  - Tunnel cross-section models (CAD)
  - (Installation related)
  - Component placement *etc*
- **Operations, Commissioning, Availability**
  - Less independent machine operation
  - Reliability issues (accessibility)
  - Commissioning strategies *etc.*
- **Hardware development, R&D**
  - High-power RF distribution concept
  - Marx modulator (on-going)
  - Increased RF pulse length (low-P)
- **Beam Dynamics**
  - Emittance preservation
  - BDS tuning
  - Travelling focus ‘stability’
  - …

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Requires CAD (CFS) engineer(s), optics (accelerator physics) expert(s).
Look for a (conceptual) engineering solution.

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Much more difficult to quantify.
Looks for experienced experts
Brainstorm qualitative concepts (solutions)

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FTE and MS required.
Well defined goals for R&D programme.
Acceptance criteria of proposed solution.

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Beam dynamics and simulation specialists (lc experts).
(good coordination, well defined questions)

Special Relevance to Accelerator Systems

- **Concept has been (originally) designed around focus activities for Accelerator Systems TAG leaders**
  - Significantly reduced resources in 2008
  - Attempt to focus collider *design activities* to complement main focus on
    - SCRF R&D
    - Beam Test Facilities (risk mitigation)

- **Core "Accelerator Physics & Design" team proposed to EC**
  - Together with Cost Management Group
  - Scientific coordination by Ewan (and NJW)
  - Currently 22 names (!) on the list (regional balance)

- **AP&D group still needs to be better engaged**
  - Definition of MM elements with study plans

- **MM Elements now go beyond just AS**
  - cluster-klystron proposal
  - Half-power option
  - CFS impact

Requires better overall coordination (and communication)

(Work for ILC08)

Outstanding Issues (GDE Policy Decisions)

- **TeV upgrade support**
  - Do we have a realistic one?
  - note impact/solutions for TeV upgrade are part of MM studies
- **Alternatives: gamma-gamma and e-e-**
  - Need to define plan to (re-)include gamma-gamma option into TD R&D plan
- **Formal policy to**
  - Evaluate proposals for (additional) MM related R&D
  - Establish new baseline in 2010 for TDP-2
  - …

Topics requiring top-level EC/PM decisions, but certainly worthy of discussion within this forum

Minimum Machine Report Outline

1. **Introduction**
   - MM rationale, scope of document etc.

2. **Minimum Machine Study Elements**
   1. Cluster-Klystron
   2. Central region integration
   3. Low-Power option
   4. AS specific
   5. CFS specific

3. **Critical Issues and 09 Study Plan**
   - AS orientated
     - TAG leaders will be asked to provide relevant sections.
   - Focus of ILC08 MM activity and discussions
   - Outlining of plans for 09 to address
     - layout and design issues, allowing for a better cost saving estimate
     - studies specifically aimed at quantifying (solving) questions and issues raised in the previous sections
     - Resources requires

Reduce section count from original suggestion

Section 1 and 2 draft to be provided before ILC-08

Section 3 to be 'deliverable' for ILC08

(Inclusion of cost-reduction guesstimate still being discussed)

Next steps (tbc)

					Deadline	Responsible
August	**22.08.2008**		**AS TAG**			
	29.08.2008				Finalised draft outline of report - action items for TAG leaders	EJP/NW/MCR/AY
September	05.09.2008	- 06.09.2008		EC F2F (KEK)	Presentation of MM machine proposal	PM(NW)
	12.09.2008					
	19.09.2008		**AS TAG**		**First draft of selected sections (MM description), ready for feedback/discussion**	**EJP/NW/...**
	26.09.2008					
October	03.10.2008					
	10.10.2008					
	17.10.2008		**AS TAG**	**CLIC workshop**	**Reports from AS TAG action items, iteration of existing sections**	
	18.10.2008	- 20.10.2008		PAC (Paris)		
	24.10.2008					
	31.10.2008					
November	07.11.2008					
	14.11.2008		**AS TAG**		**draft - ready for discussion at ILC08**	
	17.11.2008	- 21.11.2008		**ILC08 (Chicago)**	During ILC08, 09 studies should be developed and prioritised. Necessary resources identified etc. This will form the basis of 'planning' section of report.	
	12.12.2008		**AS TAG**		**Final complete draft - submission to EC**	
	19.12.2008				**Publish report.**	

Draft sections will be available by next meeting

Coordination & Communication

- **(Not new issues!)**
- **How best do we communicate and discuss these ideas/issues?**
  - Especially important in the planning/brainstorming stages (i.e. now)
  - Workshops (eg ILC08) will allow us to work together face-to-face, but we must maintain a healthy dialog/communication in between.
- **Once monthly TAG meetings OK but not enough for more technical discussions**
- **What happened to our discussion forum (weblog)?**
  - Something to pursue?
  - Only works if people engage!
  - Advantage that forum is public, and open to all the community?
- **Ideas encouraged!**