



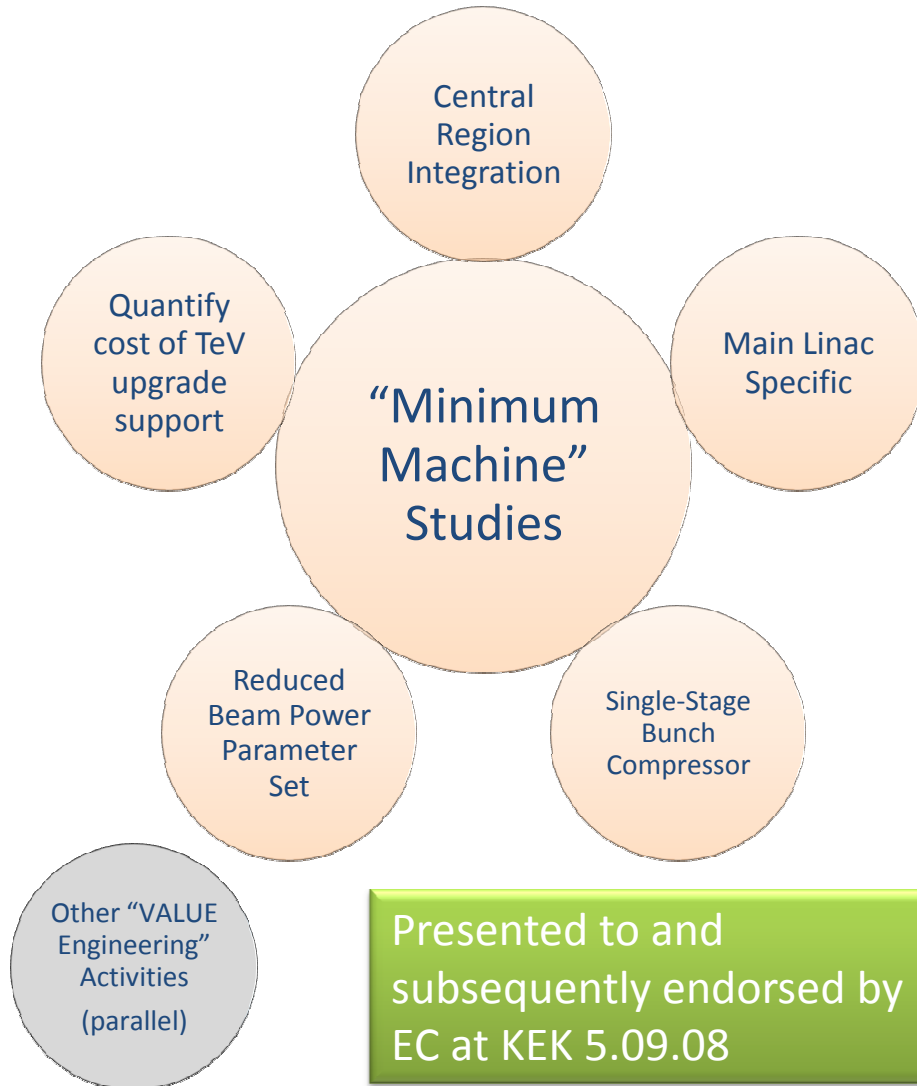
Minimum Machine Update

Nick Walker

CFS TAG leaders meeting
10.10.2008



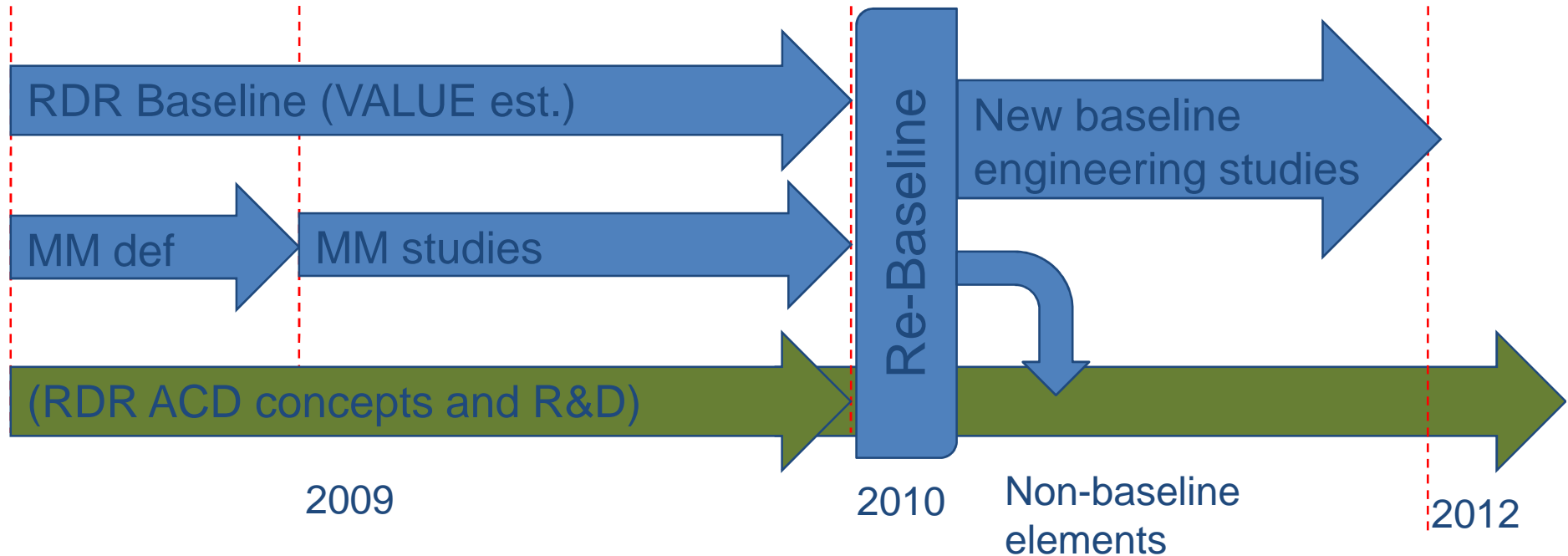
Minimum Machine: Current Definition



- “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)?
- **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

} alternative options

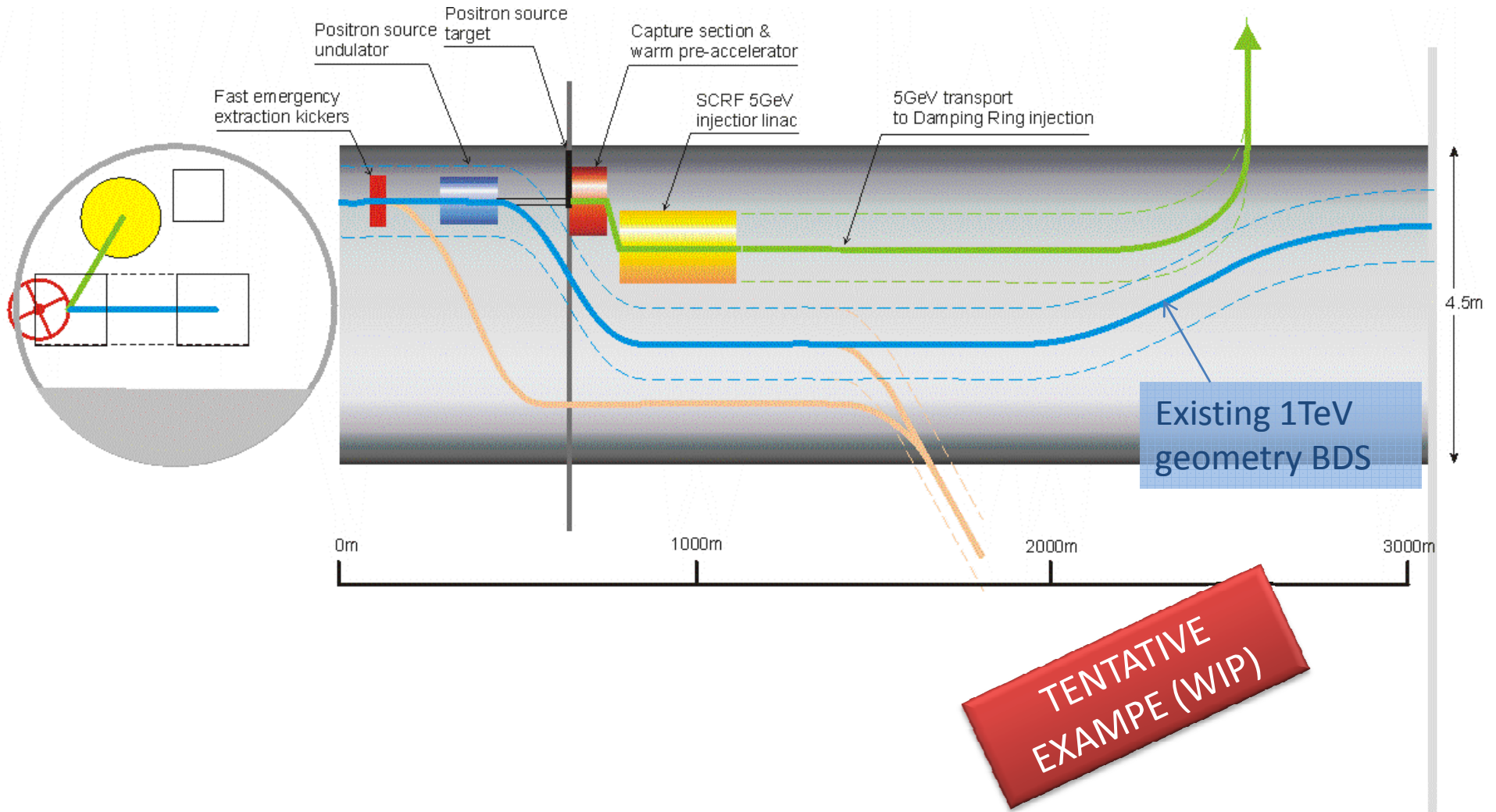


Central Injectors Integration

- **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)

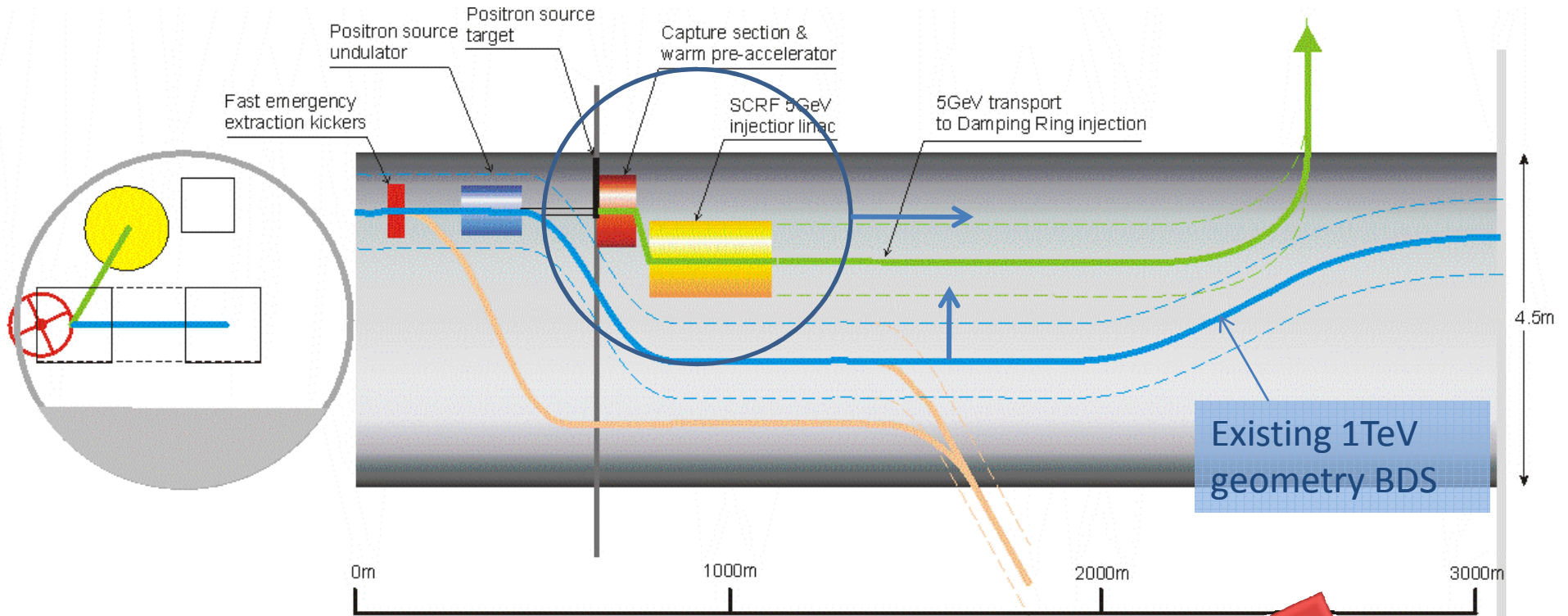


Positron Source & BDS integration





Positron Source & BDS integration



Some optimisation is available
Longer photon drift to target would facilitate smaller transverse offset of primary e- dogleg

TENTATIVE
EXAMPE (WIP)



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 ($\sigma_z \geq 300\mu\text{m}$ @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'
 - ...



Types of Studies (2009)

- **Interference / Integration**

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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)



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)