Report from the Accelerator Design & Integration Meeting at DESY

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DESY

PEB Webex Meeting
30 June 2009

The AD&I Meeting

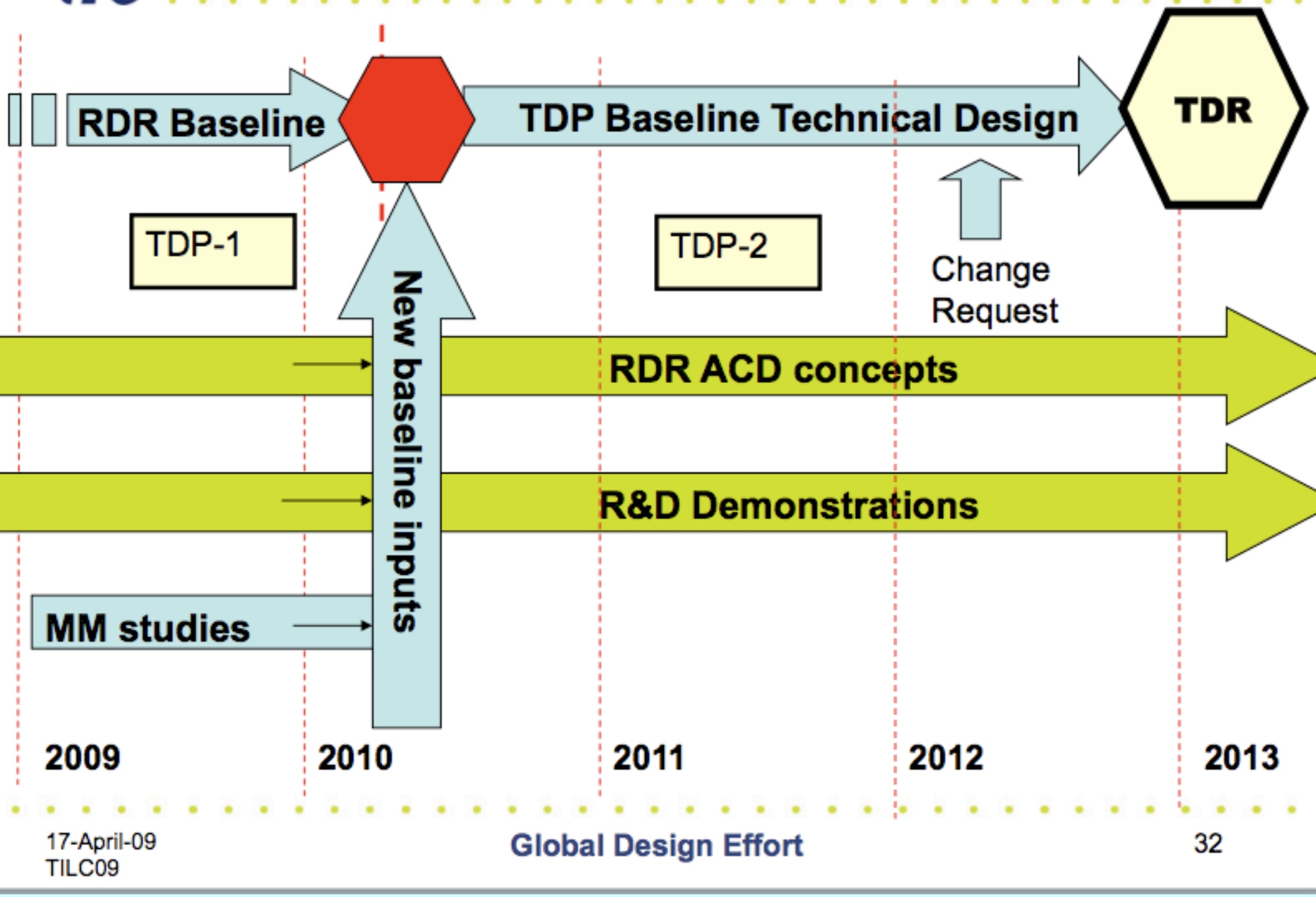
Accelerator Design and Integration Meeting

- At DESY May 28/29 2009
- First of a series of re-baselining meetings of the GDE
- Research Director asked Phil Burrows and myself to participate as official observers of the Physics and Detector Organisation

http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3526

Re-Baselining the ILC Machine

Technical Design Phase and Beyond



17-April-09
TILC09

Global Design Effort

32

Updated Baseline Design

- Will reflect choice of new baseline at end of TDP1
  - Layout, integration, gradient etc.
  - Cost-driven
- Level of detail not expected to be beyond RDR
  - Unlikely to have "detailed engineering" resources available
- Better documentation (than for RDR)
  - Structured documents → traceability
  - Use of 3D CAD ("Visualisation")
  - ILC-EDMS
  - Link to TRIAD and ICET (cost)
- More structured project management providing leadership
  - Of design decisions
  - Of cost estimates

More time than RDR (2 years)

Tools & methodology being developed now (TDP1)

Preparing a Proposal 1/2

- Started with MM document (cost reduction)
  - Basically a result of discussions at Dubna June 08

- Formal preparation begins here at this meeting
  - This meeting is fundamentally a scope and planning meeting

- Concluding discussions for proposal: ALCPG (Sept/Oct 09)
  - Conclusion of process begun at this meeting
  - Final consensus (of this group) on scope and structure of Proposal Document

Preparing a Proposal 2/2

- Formal document end 2010 (Draft)
  - October-December for writing
- Review and acceptance process
  - Initial review by AAP January
  - Release to broader community
  - Feedback / Discussion
  - Final “Acceptance Process” TBD
- This group is responsible for producing the new ILC design
  - Ownership during TDP-2

SB-2009 Proposal (PMs)

1. A Main Linac length consistent with an optimal choice of average accelerating gradient
   - RDR: 31.5 MV/m, to be re-evaluated
2. Single-tunnel solution for the Main Linacs and RTML, with two possible variants for the HLRF
   - Klystron cluster scheme
   - DRFS scheme
3. Undulator-based e+ source located at the end of the electron Main Linac (250 GeV)
   - Capture device: Quarter-wave transformer

SB-2009 Proposal (PMs)

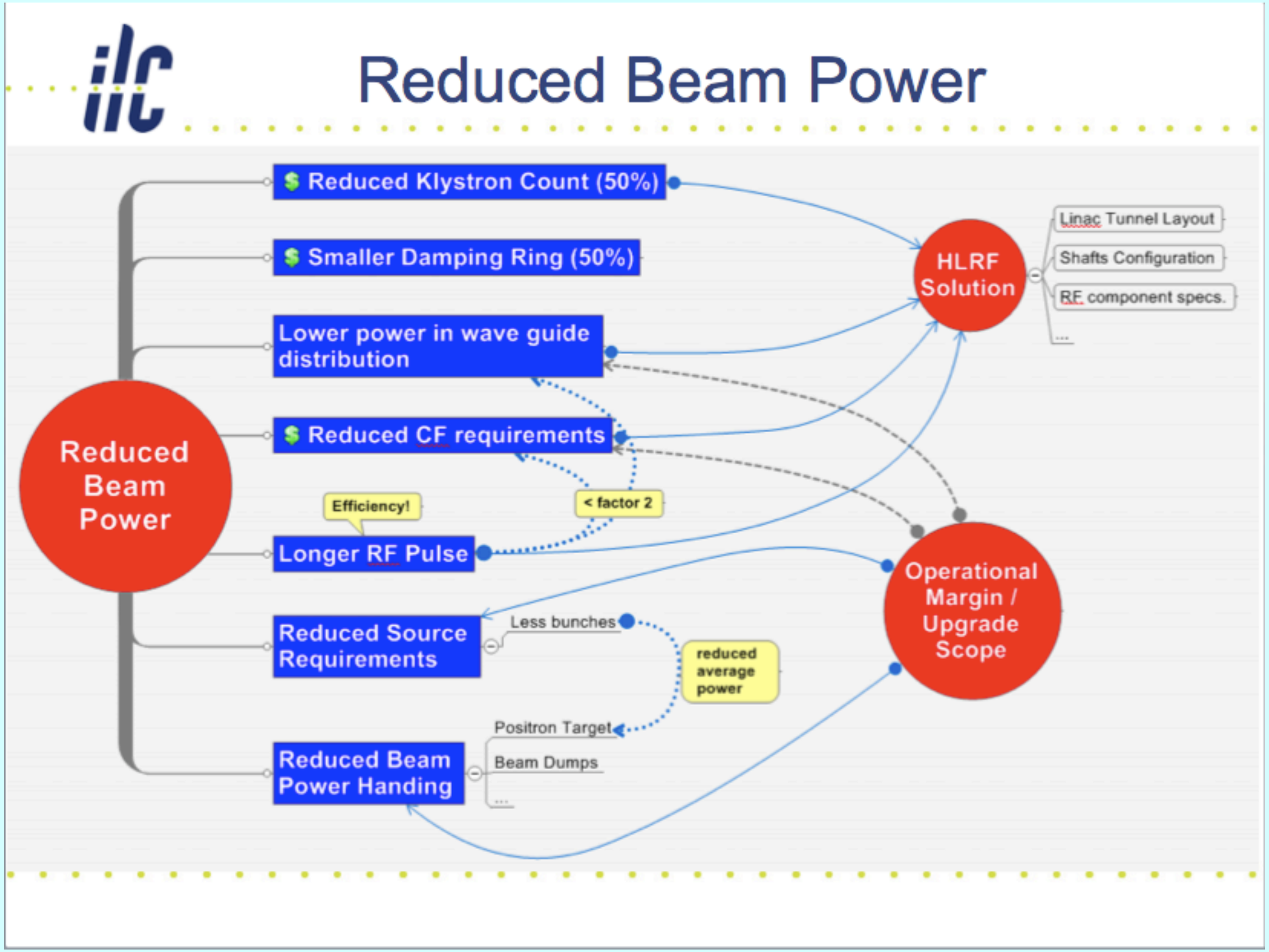
4. Reduced parameter set (with respect to the RDR)
   - n_b = 1312 and a 2ms RF pulse (so-called "Low Power")

5. Approx. 3.2 km circumference damping rings at 5 GeV
   - 6 mm bunch length

6. Single-stage bunch compressor
   - compression factor of 20

7. Integration of the e+ and e- sources into a common "central region beam tunnel", together with the BDS.

Low-P Parameter Sets



Damping Rings

	RDR 2007	TDP TILC08	SB2009	?
# of bunches	2684-5412	2610-5265	1305-2632	**1300**
Bunch population	2-1 · 10^{10}	2-1 · 10^{10}	2-1 · 10^{10}	2 · 10^{10}
Bunch distance (ns)	6.2-3.1	6.2-3.1	6.2-3.1	3.1
C (m)	6695	6476	3238	**1600**
h	14516	14042	7021	3500
Kicker frep MHz (1ms linac pulse)	2.8-5.5	2.7-5.4	1.4-2.7	1.4

- DR could be significantly shorter
- Luminosity upgrades get very difficult
- Rely on travelling focus for lumi

BDS WA

- Maintain support for the 1 TeV geometry (missing magnet or some other suitable scheme)
- Assuming 10-15% (TBD – including e+ target dogleg) synchrotron radiation emittance growth at 1 TeV CM.
- Support for travelling focus IP parameter set (L~2 x 10^{34} with n_b= 1312)

Questions :

1. What is the status of a compact lattice design with the above WA
2. Location of non-beamline components (klystrons, P/S etc)

29th May'09 BDS.: 2

Status of compact lattice design

- RDR lattice : three changes
  - Separate functionality of upstream polarimeter, MPS and laser wire photon detection
  - Design of dogleg : with transverse off-set (~2.5-1.5m)
  - Shortening of BDS : allowing more emittance growth
- Support for travelling focus

29th May'09

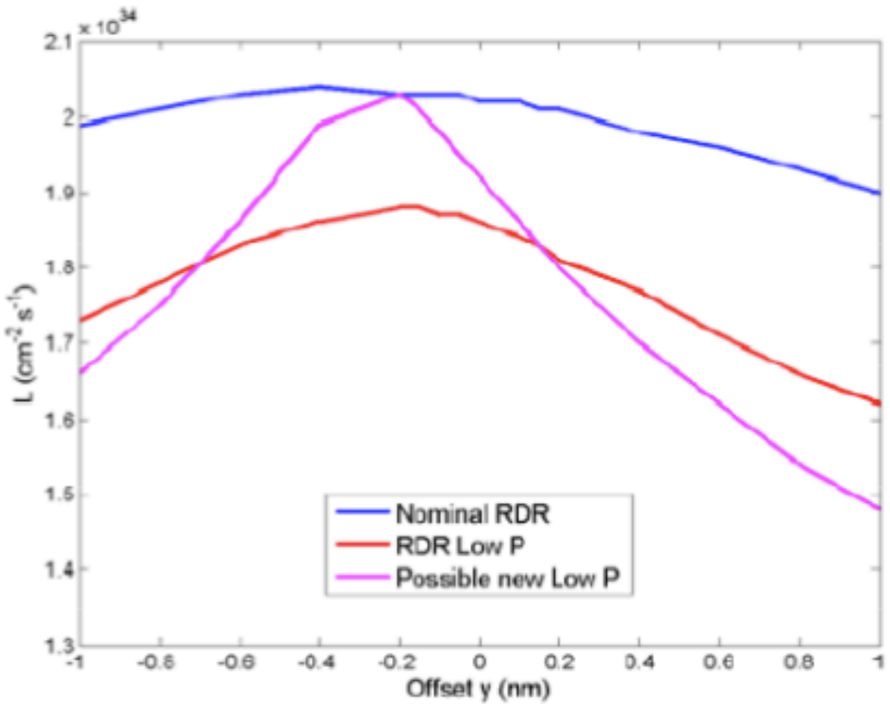
BDS.: 3

Support for travelling focus

- Travelling focus can be created in two different ways: PAC09 Paper WE6PFP082
  - small uncompensated chromaticity and coherent E-z energy shift dE/dz along the bunch.
    - $\delta E \; k \; L^{*}_{eff} = \sigma_z$; k=relative uncompensated chromaticity. δE needs to be 2-3 times the incoherent spread in the bunch.
      Possible set : δE=0.3%, k=1.5%, L*eff=6m
  - Use a transverse deflecting cavity giving a z-x correlation in one of the FF sextupoles and thus provide z-correlated focusing.
    - The cavity will be located about 100m upstream of the final doublet, at the $\pi/2$ betatron phase from the FD.
    - The strength required will be ~20% of the nominal crab cavity.
- Tracking studies and possibly mitigation of higher order aberrations are needed for both the schemes.
- Evaluation by detector concepts?

29th May'09 BDS.: 13

New Low P parameter option



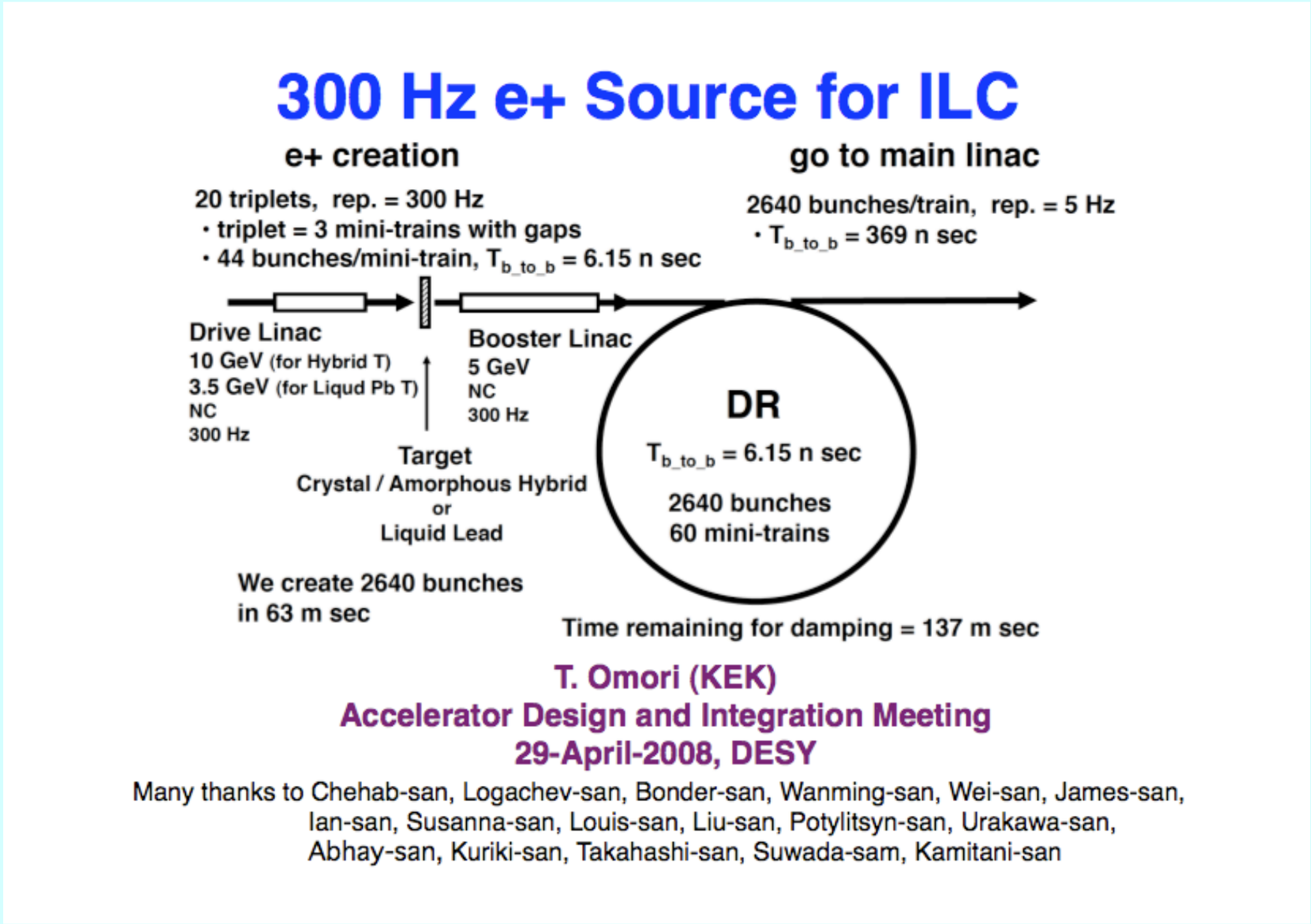
Luminosity vs beam offset

High sensitivity to any beam offset => operation of the intra-train feedback and intra-train luminosity optimization will be more challenging.

29th May'09

BDS.: 14

Positron Source



Options discussed without undulators

Polarised positrons not straight-forward

Not in the suggestions of the PMs for the new basline

Direct Impact on Physics and Detectors

Low-P Parameter Sets

- Potential loss of luminosity
- Potential increase of detector backgrounds
- Depends on novel focussing schemes („travelling focus“)
- Potentially quasi-irreversable actions: e.g. reducing damping rings circumference

Positron Sources

- Alternative designs are not easily convertible to polarised positron production
- NB: Polarised positrons are just an option in the baseline parameter document (Heuer report)
- Current working assumption for SB-2009 is still the undulator source

We (MDI-D) will follow the discussions in the future ALCPG meeting in Albuquerque will be a milestone