Discussion of BDS workpackages

BDS Area leaders
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for BDS team

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http://bilcw07.ihep.ac.cn/

Tuesday's discussion

- EDR organization
- Work Package distribution
- Suggested WPs
- BDS & Detector WPs
- etc.

EDR definition

- Clear definition of EDR is needed to define the schedule, milestones and deliverables
- Consider EDR as construction proposal, where
  - **most critical system should have R&D mostly completed, drawings done and prototypes studied**
  - **for some other system, after initial R&D and feasibility demonstration at the end of EDR, R&D may still continue after EDR**
  - **more standard systems and components should have specs defined**

Work Package distribution

- How WPs are distributed?
- For BDS, bidding for WP is not appropriate
- WPs are to be distributed in the process of pre-negotiation, optimization, evaluation by BDS team/consortium

WP development

- Yesterday's discussion is a step in the process which is been developing already by many years, where BDS international team/consortium discussed, optimized and distributed work packages among the partners
- Formalization of the process and centralization of responsibilities (and funding) may be crucial
  - **The S4 task force is a step to this direction**
- The process should allow adjustments of WP and also allow new partners to join

WP, vertical & horizontal

- For many of the systems and WP, vertical (within the Area) responsibility and organization is appropriate
- For some system and WP, horizontal organization (across the areas) also has to be present
- I.e, matrix structure has to remain in some form

MDI aspects of WPs

- Many critical BDS and IR systems are dual functions, for BDS and Detector
- Will need to define, agree upon and follow the interfaces
- Description of interfaces would include all the needed parameters
- For example, description of the interface for FD would include
  - **sizes, geometry description**
  - **requirements on stability of supporting detector surface**
  - **etc**

Very high priority R&D => WPs

- Includes items which have major impact on operational performance & need substantial amount of R&D.
  - **Development of IR superconducting magnets, their integration into the IR, and a design study to ensure their mechanical stability**
  - **Development of technical details of the push-pull design**
  - **Development of crab cavities, and related systems to provide phase stability**
  - **Measurements of collimator wakefield and their validation with codes**
  - **Study of collimator beam damage and damage detection**
  - **Accelerator physics design work which enable performance optimization**
  - **Design, construction, commissioning and operation of ATF2**
  - **Development of laser wires for beam diagnostics**
  - **Development of intratrain feedback**
  - **Development and tests of MDI type hardware such as energy spectrometers and polarimeters**
  - **Development of beam dump design and study of beam dump window survivability**

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WP and milestones

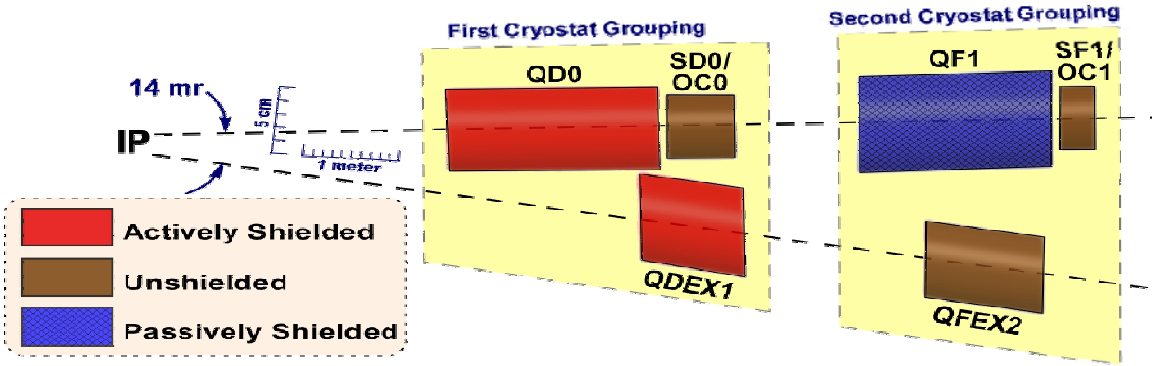
- Discussed many WP
  - **Final Doublet prototype & FD stability**
  - **Crab system**
  - **ATF2**
  - **Collimation**
  - **Laser wire**
  - **Feedback**
  - **Beam dumps**
  - **Instrumentation**
  - **Accelerator physics, etc.**

Examples of WP and milestones

- Will show several examples below
- Final Doublet
  - **WP formulated several years ago and is led by BNL**
- Crab cavity work package
  - **design and WP developed by crab cavity design team which include UK and US labs**
- Beam dump work package
  - **a particular example where very complete set of drawings and even approvals from agencies may be needed at the end of EDR**
- Laser wire WP; Feedback WP; ATF2

FD WP

- Design and prototype of the long FD
- Stability study of FD
- A particular concern that funding situation, which pushed out the complete studies, e.g. stability study of the full prototype, would not allow for sufficient time and iterations for optimization of the design



Crab cavity WP & milestones

- **Phase control and cavity synchronisation systems –** (Milestone 1) Q1 2007
- **Input Coupler –** Development, prototyping and testing (Milestone 2) Q2 2008
- **L/S/HOM couplers –** Final designs & prototypes for beam tests. (Milestone 3) Q2 2009
- **Frequency tuner -** (Milestone 4) Q4 2008
- **Crab Cavity –**fabricated, & integrated into cryomodule. (Milestone 5) Q4 2008
- **Cryomodule -** A full engineering design (Milestone 6) Q4 2008
- **Roll tuner and cavity positioning -** (Milestone 7) Q4 2008
- **Final Phase control and cavity synchronisation electronics system –**improvement of the phase control system (Milestone 8) Q3 2009
- **High power testing of cavity with beam** (Milestone 9) Q4 2009
- **Testing of two cavities with beam** (Milestone 10) Q1 2010

Dumps & Collimators milestones

- FLUKA/EGS Energy deposition studies complete
- Design study of candidate window materials.
- Design and optimisation of geometry of window for water dump in order to minimise thermal fatigue, pressure and shock wave stresses. Estimation of window lifetime with reference to radiation damage.
- Specification, design and participation in on-line experiments using electron beams to simulate power deposition, thermal and stress wave profiles in prototype window materials
- Design and full model of internal water circulation system within beam dump vessel using Computational Fluid Dynamic codes in order to maximise efficiency of heat transfer and minimise possibility of local boiling.
- Outline design of remote handling systems for replacement of critical components e.g. window, de-ionising system and catalytic recombination components.
- Specification of services requirements for all beam dump specific items.
- Full costing of baseline design, in accordance with GDE guidelines
- Package of documentation suitable for pre-construction regulatory agency approval

Milestones of laser wire WP

Towards a 1 μm LW

preliminary

Goals/assumptions

Wavelength	266 nm
Mode Quality	1.3
Peak Power	20 MW
FF f-number	1.5
Pointing stability	10 μrad
M^2 resolution	1%
Normalisation (ξ)	2%
Beam Jitter	0.25σ
BPM Resolution	20 nm
Energy spec. res	10^{-4}

Resultant errors/10^{-3}

E_ξ	2.5
E_{point}	2.2
E_{jitter}	5.0
E_{stat}	4.5
E_{M^2}	2.8
Total Error	8.0

Final fit, including dispersion

Could be used for η measurement
→ E_η

Milestones for Feedback WP

- **Finish intra-train IP prototype work and finalise EDR design**

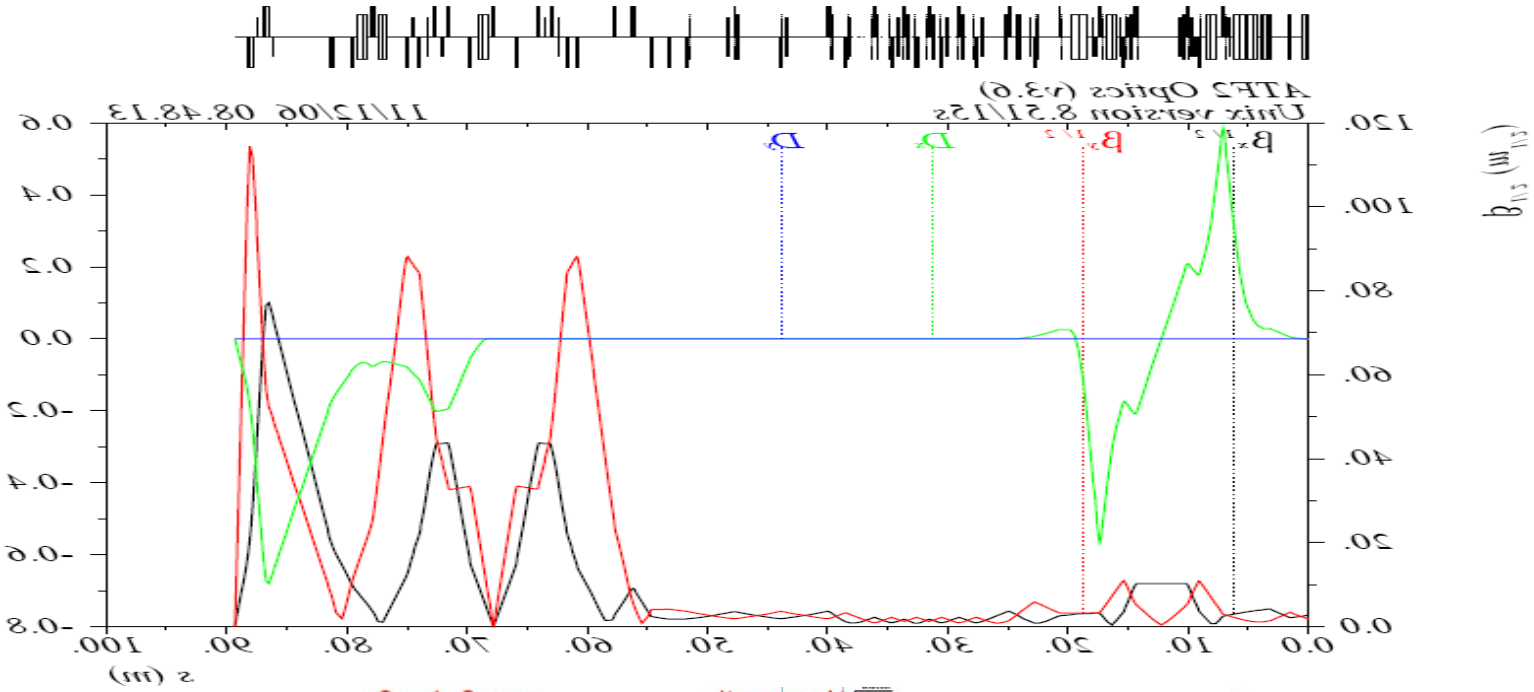
- **Design complete system (via simulations):**
- **BDS / end of linac trajectory FB (3 MHz)**
- **BDS orbit FB (5 Hz)**
- **IP collision FB (5 Hz + 3 MHz)**
- **IP luminosity FB (3 MHz)**
- **Feed-forward systems?**

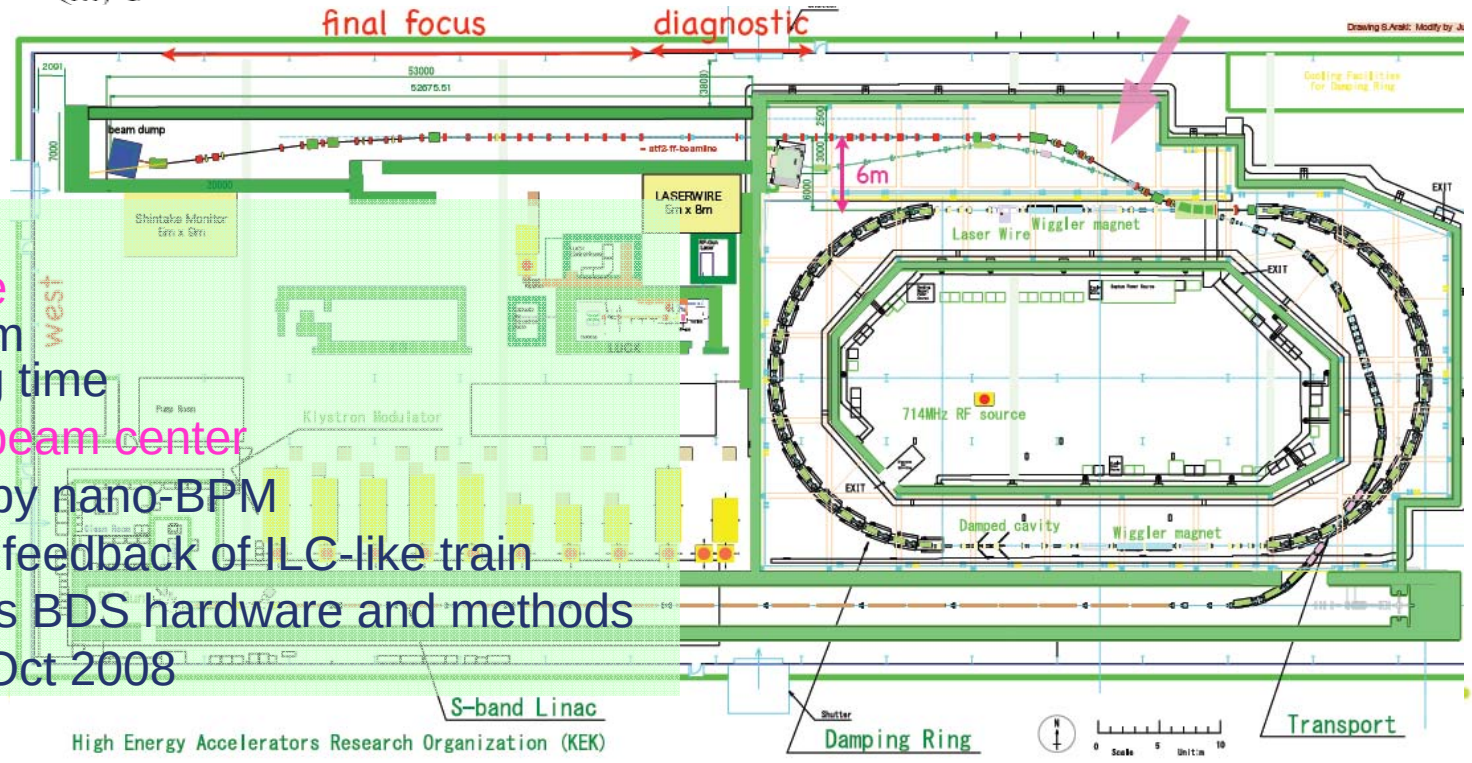
- **Specify hardware locations, # loops etc, define performance specs for hardware: BPM resolution, kick strength …**

- **Understand integrated FB performance machine-wide (linacs, RTML …)**

- **Engineering designs of all components**

ATF2





ATF2 goals

(A) Small beam size
- Obtain σ_y ~ 35nm
- Maintain for long time

(B) Stabilization of beam center
- Down to < 2nm by nano-BPM
- Bunch-to-bunch feedback of ILC-like train

Test area for various BDS hardware and methods

Start of beams in ~Oct 2008

Transformation of BDS group to EDR

- BDS group, during many years, defined and started to work on subsystems or tasks, which one can now call Work Packages
- BDS group can naturally transform to EDR phase, with more formal structure and centralized responsibilities
- Structure of the center, its functions and parameters are critical for the overall efficiency and success