

ATF2 commissioning strategy for end of 2009

for discussion

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Overall goals for 2009-2010

BSM Laser Wire mode commissioned
First test of fast kicker
Observe several micron beam size
Achieve $\epsilon_y=24\mu\text{m}$ beam in DR
BSM 8° (0.25-1.5 μm) commissioned
Observe sub micron beam size
BSM 2° mode (1-6 μm) commissioned
Achieve $\epsilon_y=24\mu\text{m}$ beam in DR
Extract and preserve of $\epsilon_y=24\mu\text{m}$
BSM 30° (70-400nm) commissioned
First observation of ILC-scaled $\sigma_y=75\text{nm}$
Achievement of $\epsilon_y < 12\mu\text{m}$ in DR
Repeat observation of 75nm beam
Extract & preserve $\epsilon_y=12\mu\text{m}$ beam
BSM 174° (20-100nm) commissioned
First observation of design 37nm beam
Fast kicker system fully commissioned
Monalisa installed on beamline
Reliable observation of 37nm beam
First tests of mild beta squeeze
Achieve 2nm resolution of IP BPM
Evaluate IR position stability to nm level
Commissioning of Monalisa
Commissioning of FONT feedback
Observe of nm stability of IP position
Initial tests of squeezed β -function

May 2009



Oct – Dec 2010

8° Shintake interference mode
in clear progress...

$\rightarrow \sigma_y \sim 0.3 - 2 \mu\text{m}$

reproducible EXT setup
 $\sim 10-30 \text{ pm}$ $\rightarrow \epsilon_y < 40 \text{ pm}$

174 (or 30) degree mode BSM

$\rightarrow \sigma_y \sim 100 \text{ nm}$

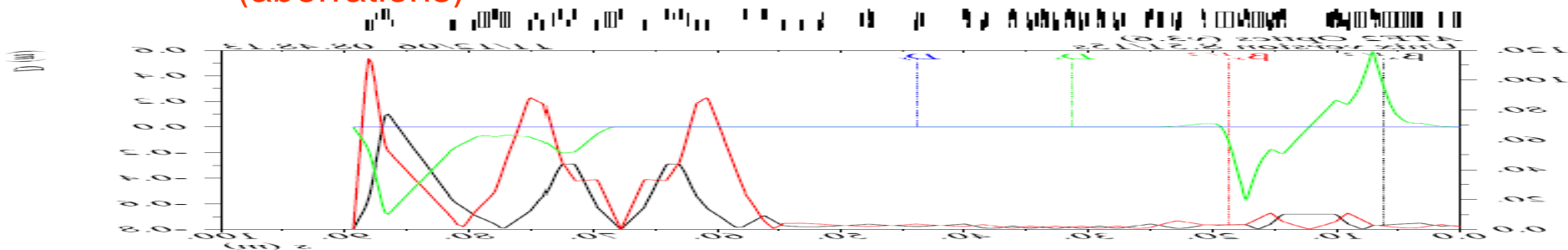
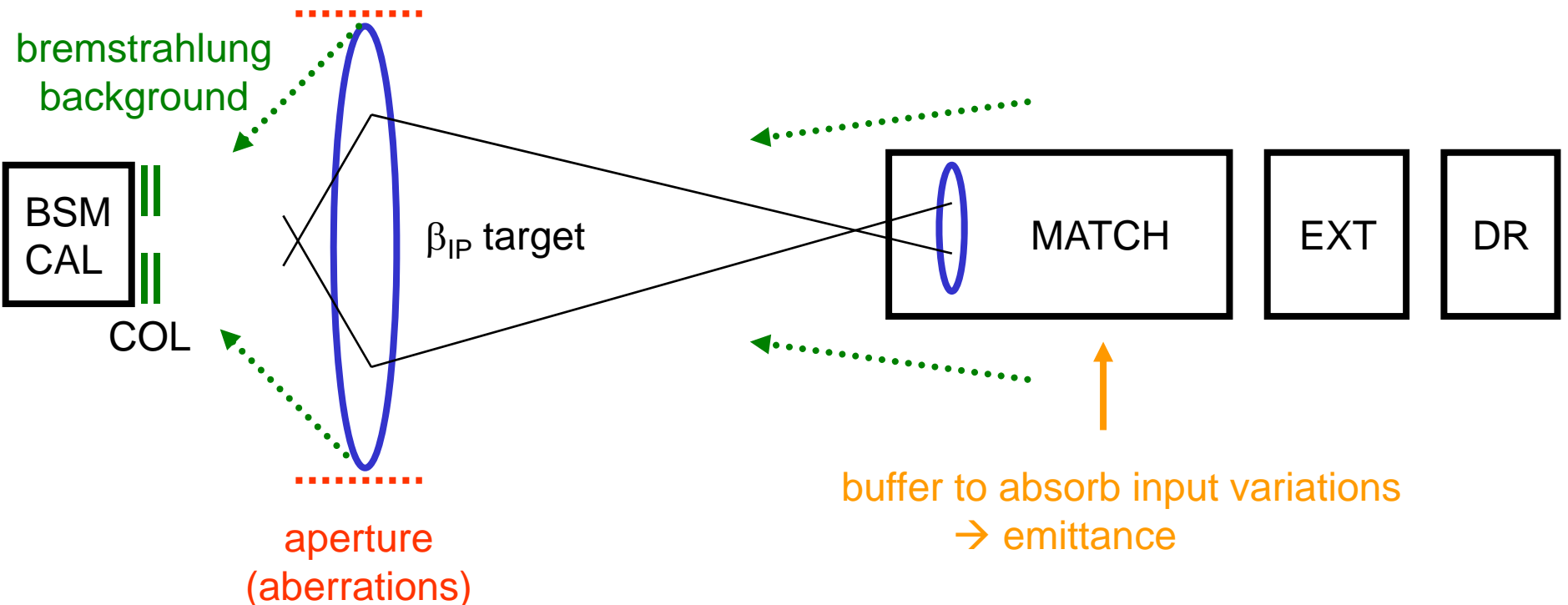
optimization of chromatically
corrected tuned beam spot

$\rightarrow \sigma_y \sim 40 \text{ nm}$

reproducibility & stability

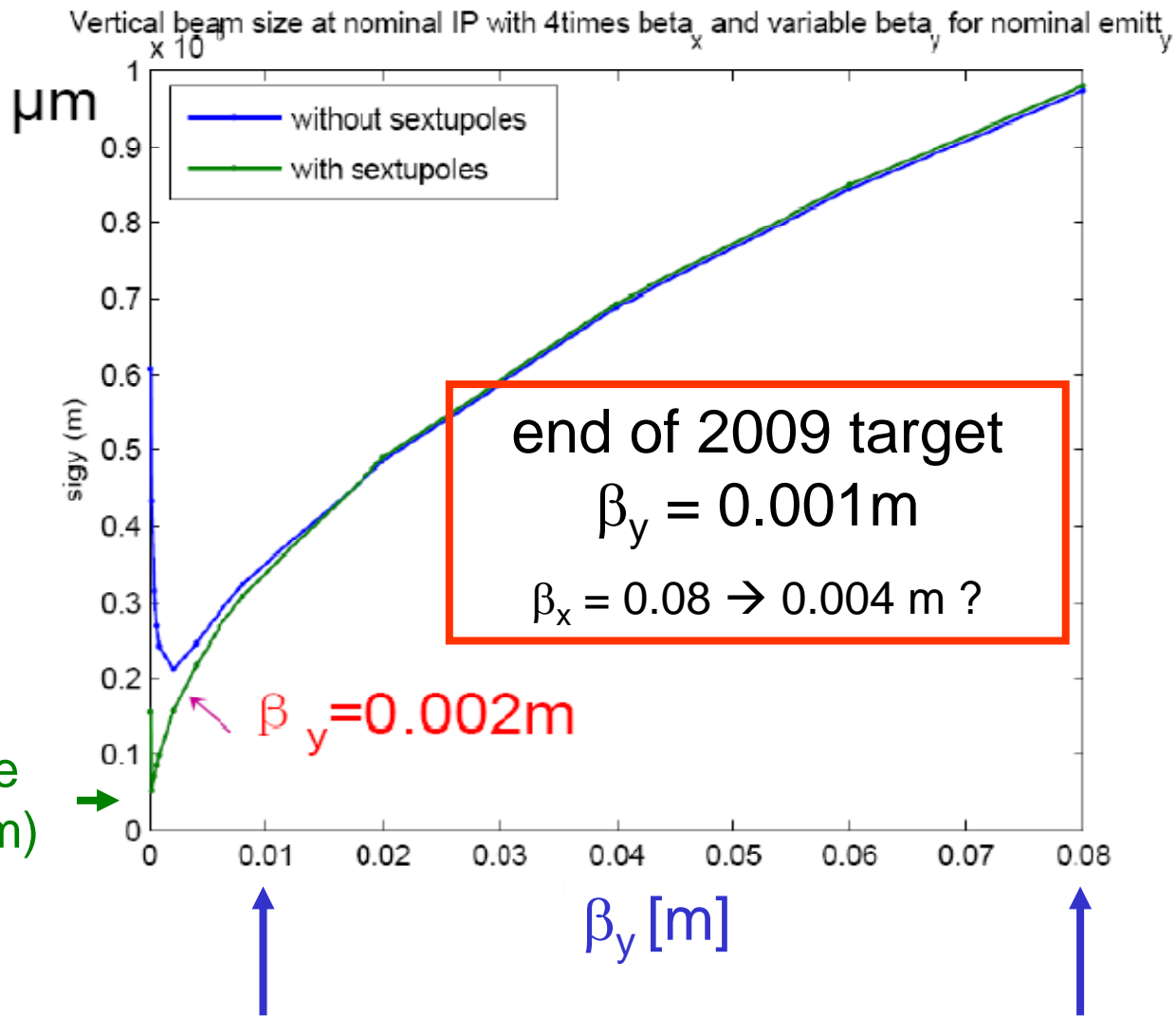
first go at reduced β optics

Concept of final focus tuning process



Gradual demagnification ($\beta_{x,y}$) reduction → paced by progress with :
beam tuning instrumentation (BSM / other) **background study**

Variable β_{IP} at ATF2



April-May 2009 target

March 2009 target

Commissioning periods

May 2009

→ 3 weeks

October – December 2009

→ 7 weeks just 14 ATF2 days ?

January – June 2010

→ 14 weeks

October – December 2010

→ 7 weeks (*extrapolation*)

Beam time scheduling

→ 50% fraction for ATF2 & 4 days per week operation more ?

Individual R&D tasks → common goal

Groups: **KEK**, Tokyo, **SLAC**, IHEP, UK, France, Spain, **CERN**,...

→ ATF2 educational function

Several PhD & young post-doc researchers in accelerator science

General beam tuning sequence

1. Restore beam orbit with chosen / target magnet configuration
2. BBA in EXT & MATCH & FF sections → emittance + BKGD @ IP
3. Horizontal dispersion in EXT & MATCH sections
4. Vertical dispersion in EXT & MATCH sections
5. Vertical emittance → coupling minimization + Twiss parameters
6. Horizontal emittance and Twiss parameters
7. Horizontal & vertical waist scans (+ dispersion) at Post-IP WS
→ rematch IP Twiss for target values ?
8. Vertical spot minimization at Post-IP WS with orthogonal knobs for coupling and dispersion (QK + QS skew quads, sextupoles)
9. Reduce / optimize β_x based on BKGD and β_y based on σ_y

Beam time planning

1. Continuous blocks of 6 shifts for beam tuning + BSM, with other ATF2 work clustered before / after (+ combined where relevant)
2. Limited number of people → must plan “rotation” of crews with ideally one experienced + one junior person “scheduled” in best possible way according to task sequence
3. BSM work needs > 1.5 shifts → 3 shifts / week, so Tokyo group presence @ KEK must be reinforced (KEK staff + others ?)
4. Detailed shift plans with task sequences discussed each week posted on beam time schedule / wiki → improves performance
5. Regular reporting of results:
Friday meeting + brief memos / slides with analysis results in the days after must be our good practice & is in everyone’s interest
→ how to arrange / encourage it ? → dedicated web repository

Priority tasks for ATF2 beam time in Oct.-Dec. 2009

Reviewing *our progress* and *where we need to go*

1. EXT + MATCH : manual screen-based BBA for reproducible correctable nominal vertical emittance → automated BPM-based BBA mimicking present method
2. EXT + MATCH: automated lattice diagnostics → improve combined usage of strip-line and cavity BPMs to re-establish orbits, stabilisation, dispersion measurement; this implies dedicated beam time for continued monitoring and calibrations of both kinds of BPMs
3. EXT + MATCH: quasi automated dispersion, coupling, Twiss and emittance measurement and correction → improve software for speedier procedure including averaging
4. IP: quasi automated waist scanning & dispersion with post-IP wires → improve software for speedier procedure including averaging and on-line analysis + C wire commissioning
5. IP: first optical correction trials → minimise σ_y with dedicated dispersion & coupling knobs
6. IP: BSM horizontal laser wire mode, hints of signal in vertical scanning, background studies → interference with 8,30,174 degree ? (laser diagnostics & backgrounds), more work on common beam tuning procedures, in particular Twiss parameter matching for background minimisation
7. BKGD: measurements with dedicated instrumentation
8. FONT: beam program towards achieving ATF2 goal 2 (not covered here)
9. LASER WIRE: beam program towards LC instrumentation R&D goals (not covered here)