

Some General Comments on the Project 'Beam Energy Measurements'

Yerevan, May 2005

1. Introduction

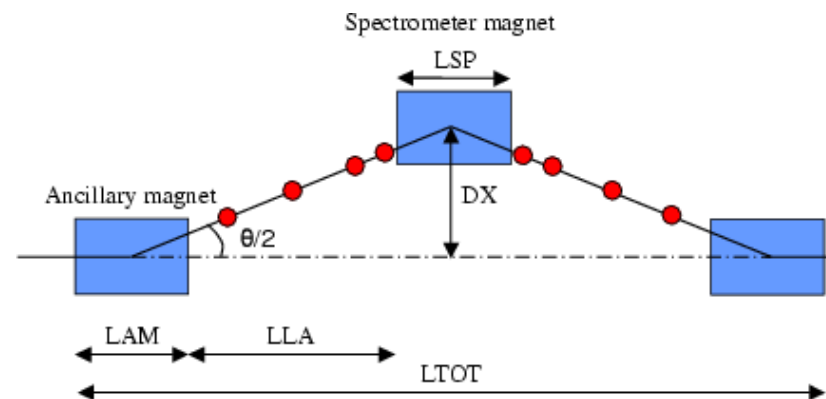
So far we had studied a magnetic chicane of **3 magnets** with some **dedicated BPMs** in order to obtain very precise information on **E_b for each bunch** of the LC

→ most challenging:

- **BPMs**

- **survey, alignment, control**

== > DESY-Dubna-TU Berlin collaboration <==



At present, discussions are ongoing for a larger, more powerful collaboration within Europe

→ Proposal:

University College London (UCL)
University of Cambridge
(supported by EuroTeV)



DESY
Dubna
TU Berlin

+ (volunteers ?)



basic agreement has been achieved

- UCL: BPM development
- Cambridge: alignment, software
- Dubna: (warm) magnets (test bench, B=0 field measurement option)
- DESY: layout, parameter design (emittance growth !) for a 3 magnet chicane spectrometer within the 2 mrad BDS option
- TU Berlin: interested to continue BPM development

The British groups have an agreement with SLAC and US university groups

→ for **beam tests at SLAC** using the End Station A beamline

- Stage 1: BPM tests without magnets
(existing SLAC / KEK BPMs will be used)
in 2005 ! and is denoted as **T474** experiment

- Stage 2: test a chicane (BPMs plus magnets)
to measure E_b ;
this test is prepared together with tests for
of the synchrotron light detector, of WISR-style
in 2006 ! (placed downstream of the IP of the LC);
this experiment is denoted as **T475**

Question: should DESY / Dubna participate at these runs ?

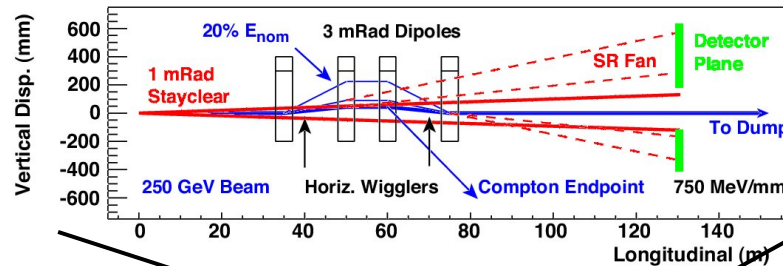
DESY: no decision yet, but **participation in 2005 probably excluded**

Some information on studies of the energy spectrometer in the US and in Japan

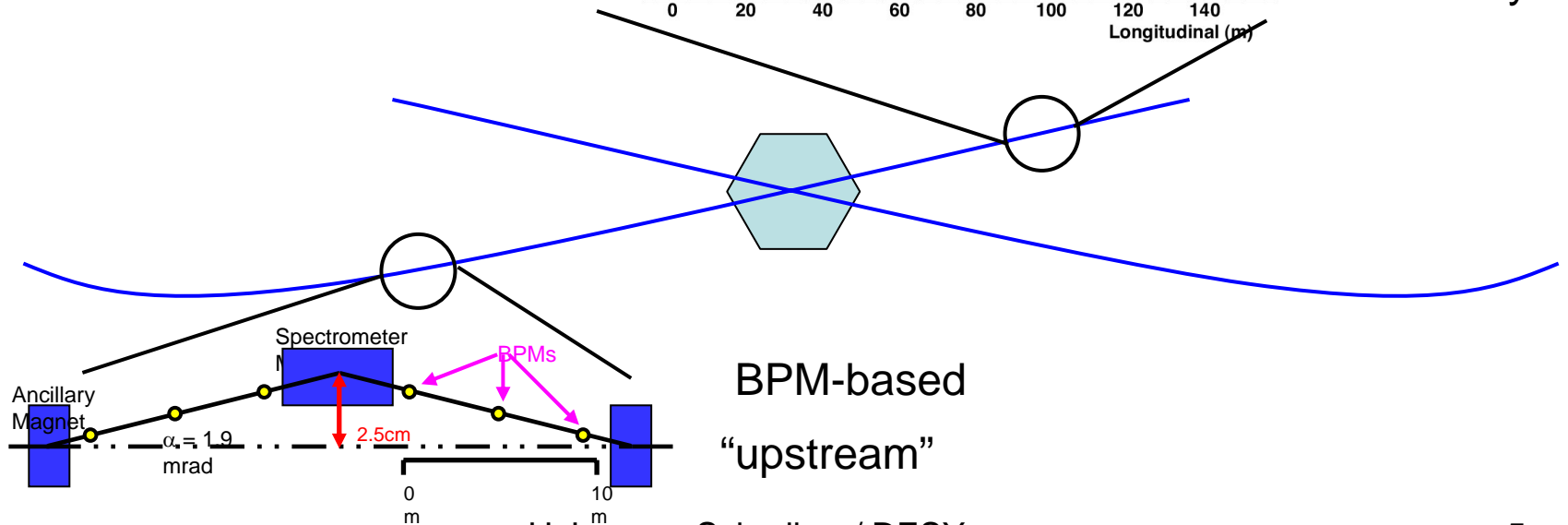
Mike Hildreth reported about this topic at the LCWS'05 at SLAC
and I have taken some transparencies from his talk

Spectrometry: A Reminder

- Required measurement precision is set by the expected statistical and systematic errors of “benchmark” measurements of m_{top} , m_{higgs} :
 - require $\delta E_{\text{beam}}/E_{\text{beam}} \sim 100\text{-}200 \text{ ppm}$
 - (LEP2 achieved $\sim 170 \text{ ppm}$ with a combination of techniques)

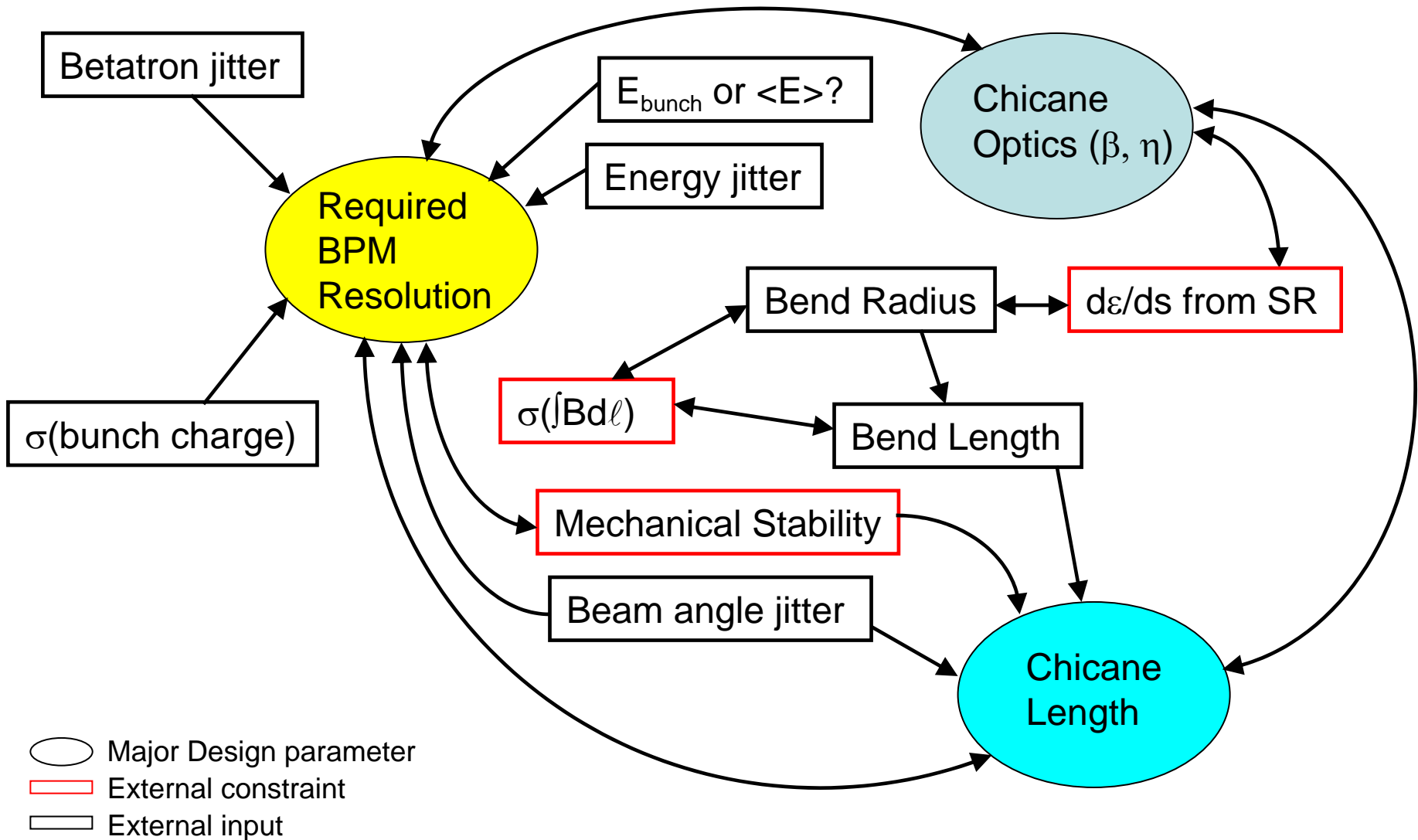


“downstream”
WISR-style



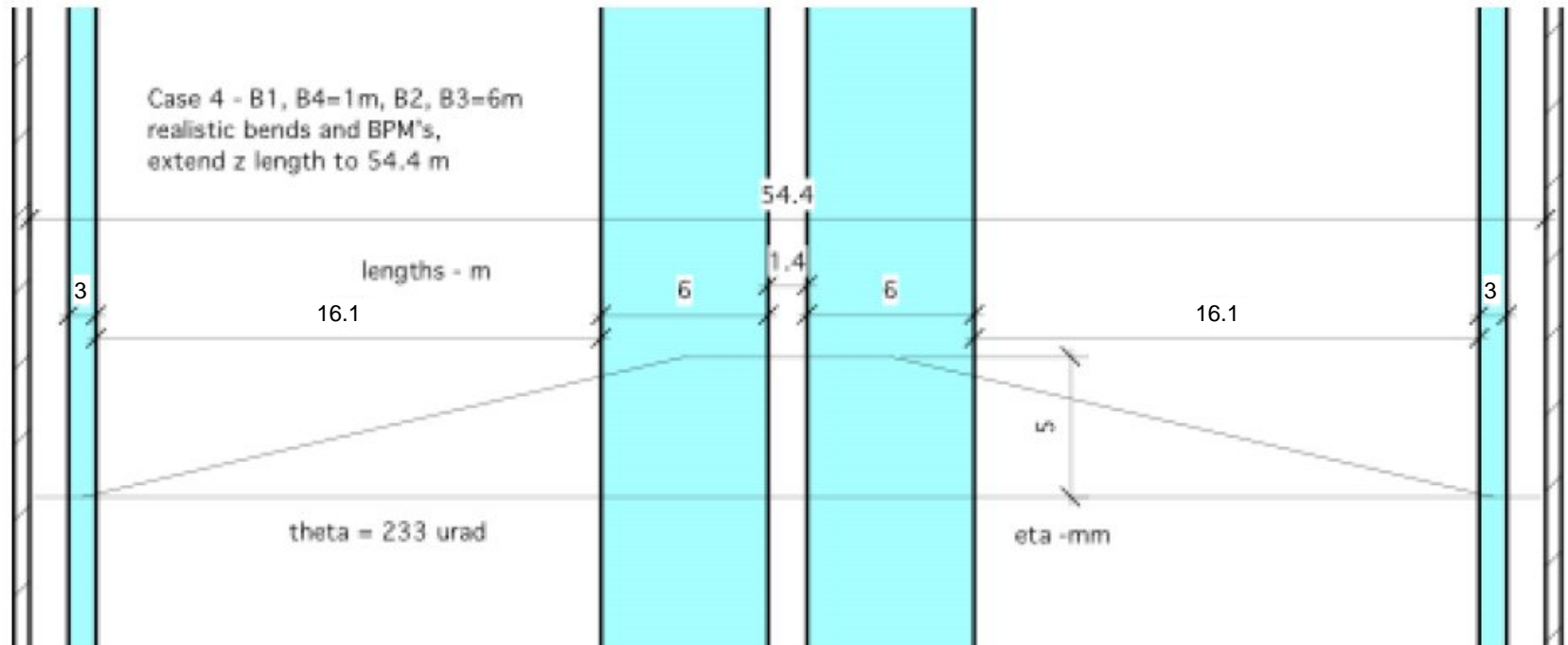
BPM-based
“upstream”

Upstream: Design Constraints



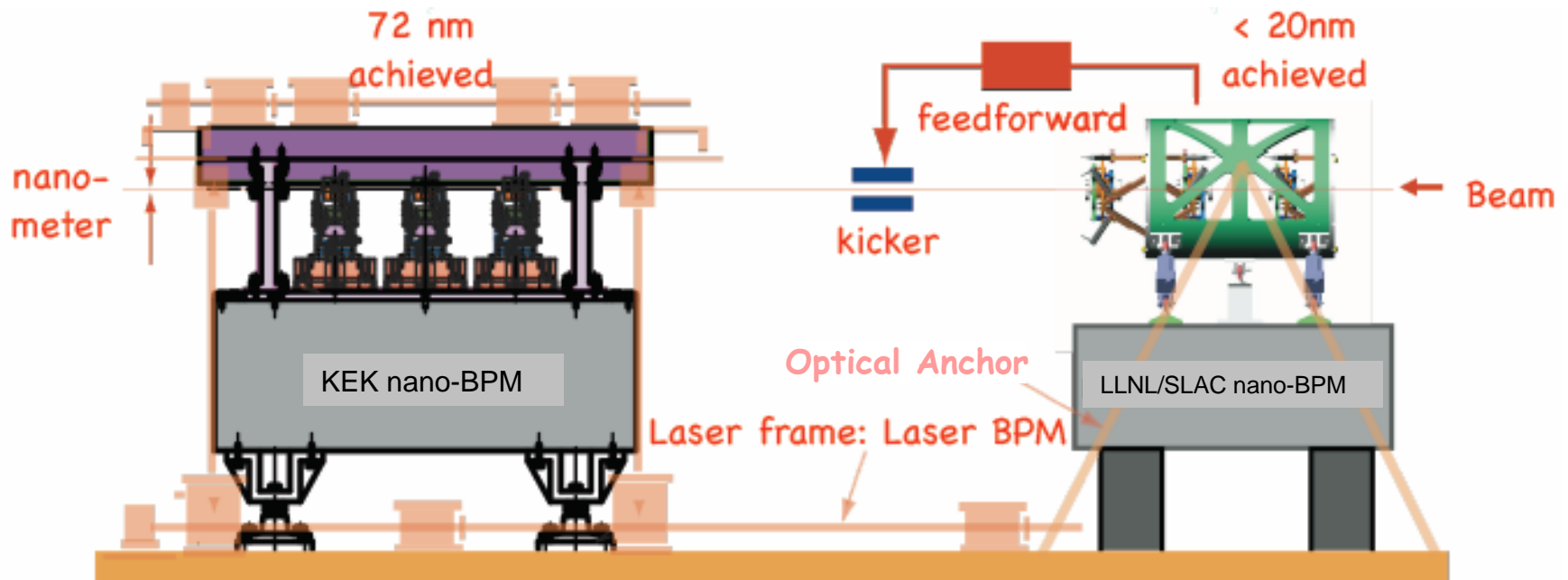
Prototype

- Presented at Jan MDI Workshop at SLAC in Jan. 2005
 - first attempt at an optimization within the available parameter space
 - large, softer bends at high-dispersion point to minimize emittance growth from synchrotron radiation



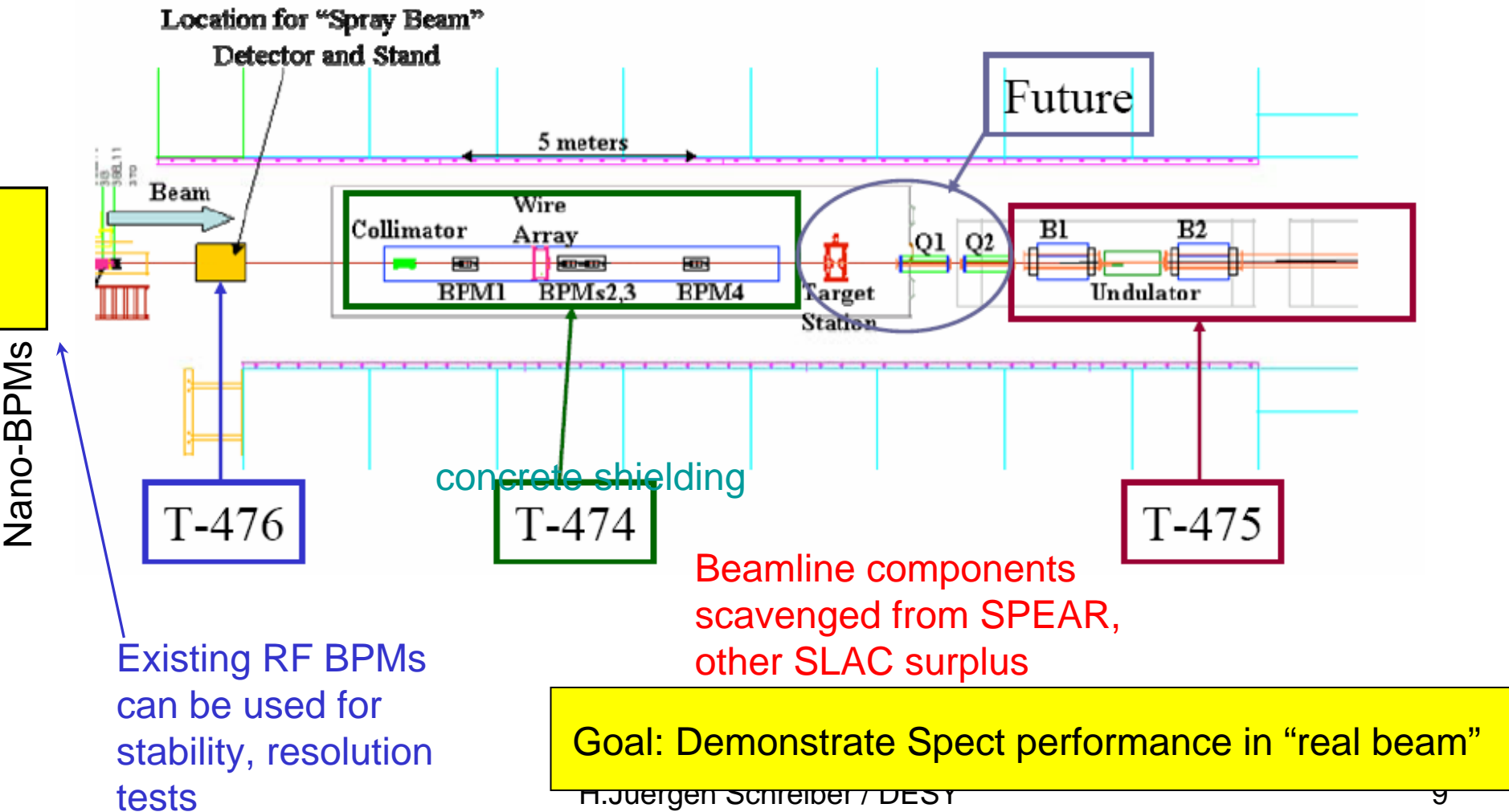
News from ATF (at KEK):

- nano-BPMs being used to test some spectrometer concepts
 - optical link under construction to connect two pairs of BPM triplets
 - optical straightness monitor with $\sim 10\text{nm}$ resolution under development
 - promising resolutions!
 - stability will be key issue



End Station A Test Beams

- T-474 (BPM Spectrometer) and T-475 (Wisrd Spectrometer) **approved**
 - will also incorporate collimator wake-field studies, other experiments



ESA Program

- ESA provides “ILC-like” beam in “realistic” conditions:

Parameter	SLAC ESA	ILC-500
Repetition Rate	10 Hz	5 Hz
Energy	28.5 GeV	250 GeV
e ⁻ Polarization	(85%)	>80%
Train Length	up to 400 ns	1 ms
Microbunch spacing	20-400 ns	337 ns
Bunches per train	1 or 2	2820
Bunch Charge	2.0×10^{10}	2.0×10^{10}
Energy Spread	0.15%	0.1%

- Can always tweak jitter parameters to make things worse
- Can “simulate” beamstrahlung pair production by using radiators
- **Complementary to ATF tests**

Conclusions

- Spectrometer designs advancing
 - Test beam work necessary **SOON** to meet CDR time goal
 - ESA + ATF = complementary R&D program
 - many parameters to consider
 - Emphasis is currently on hardware
 - don't lose sight of physics cross-checks
 - built-in redundancy will be key
 - in monitoring *and* measurement systems
 - Truly international collaborations
- “Trust, but Verify”
 - Beam Tests are critical for these systems
 - tolerances are very tight, many surprises are possible

INTAS Call

In April 2005, INTAS, the International Association for the promotion of Cooperation with scientists from the New Independent States (NIS) of the former Soviet Union, launched a call for Research Projects Proposals 2005-2006

After some discussions at DESY → few proposals are considered, one of them concerns the topic

Beam Diagnostics at the ILC

including the 3 items: - ***positron polarization***
- ***beam energy measurement***
- ***beam parameters from the forward calorimeter***

{ In June 2005 a series of calls for application of Young Scientist Fellowship will be launched, including calls in cooperation with ..., CERN and DESY. }

The institutions being involved are

ULC (D.Miller)

Univ Cambridge (D.Ward)

DESY (J.Schreiber)

TU Berlin (H.Henke) ?

Dubna (LJAP) (A.Olshevsky)

YerPhI (V.Nikoghosian)

any volunteers

Similar activities are ongoing on the topics 'Positron Polarization' and 'Forward Calorimeter'

PRE-POPOSAL SUBMITTED JUNE 14 !

(final proposal only if passed the first stage)

Duration: 2-years (+ 0.5 ?),

with the hope to get

- some financial support for the 'GUS' people involved
- travel support
- and (hopefully) some hardware