report from SLAC visit

SAREC 10-12 January

ATF2 project meeting,

13-14 January

SAREC = SLAC Accelerator Research Experimental program Committee

SAREC shall guide programme for FACET, ESTB, NLCTA, ASTA, etc

First meeting judged and prioritized 8 proposals one letter of intent, and one expression of interest, for the first FACET running which is expected in summer 2011.

SAREC Committee:

Uwe Bergmann (SLAC)
Gerry Dugan (Cornell)
Eric Esarey (LBL)
Jie Gao (IHEP)
Kathy Harkay (ANL)
Carsten Hast (SLAC, Scientific Secretary)
Sergei Nagaitsev (FNAL)
Andrei Seryi (Chair, John Adams Institute)
Vitaly Yakimenko (BNL)
Kaoru Yokoya (KEK)
Frank Zimmermann (CERN)

The **general charge** to the SAREC committee is to:

- Evaluate the **merit of proposed R&D in SLAC's experimental accelerator research facilities** for advancing world-class accelerator science or accelerator technology

- Evaluate the **feasibility of proposed R&D** in SLAC's accelerator research facilities

- Review the **progress of existing R&D** in SLAC's accelerator research facilities

proposals & their ranking

Proposal name	Ranking
Ultrafast processes	Excellent
Plasma Wakefield Acceleration	Excellent
Optical Diffraction Radiation	Fair
Terahertz (expression of interest)	None (full proposal invited)
Bunch Time profile by Smith Purcell	Excellent
PASER	Postponed
CLIC study (Letter Of Intent)	None (full proposals invited)
Metallic Structures	Good (for short pilot run only)
WF Acc in dielectric structures	Very good
Dielectric WF (Euclid)	Good

11th ATF2 Project Meeting

exceptionally held at SLAC

Frank Zimmermann represented CLIC

Daniel Schulte organized CLIC proposals

themes:

- ❑ beaminstrumentation status
- ❑ beam tuning progress in 2010
- ❑ how to reach the first ATF2 goal
- ❑ how to reach the second ATF2 goal
- ❑ proposals for “ATF3” (≥2012)

9 from CLIC

goals of ATF2:

(A) Achievement of a 37 nm beam size

  (A1) Demonstration of a compact final focus system based on a local chromaticity correction scheme

  (A2) Maintenance of the small beam size

(B) Control of the beam position

  (B1) Demonstration of beam orbit stabilization with nano-meter precision at IP.

  (B2) Establishment of a beam jitter controlling technique at the nano-meter level with an ILC-like beam

Parameters at ATF2

T. Tauchi

IP Parameter	nominal	April 2010	May 2010	Dec 2010
Beam energy	1.3GeV	1.3GeV	1.3GeV	1.3GeV
Emittance in x	2 nm	1.7nm	1.7nm	1.8-2.7nm
Emittance in y	12 pm	<10pm	<10pm	28-64pm
Beta function in x	4 mm	4cm	4cm	10mm
Beta function in y	0.1mm	1mm	1mm	0.1mm
beam size in x	2.8 μm	~10 μm	~10 μm	7.5μm
beam size in y	35 nm	900 nm	300 nm	439(247) nm

ATF2 Tuning Shifts Winter 2010

11 2010

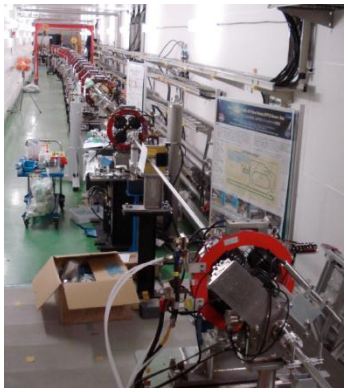
Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

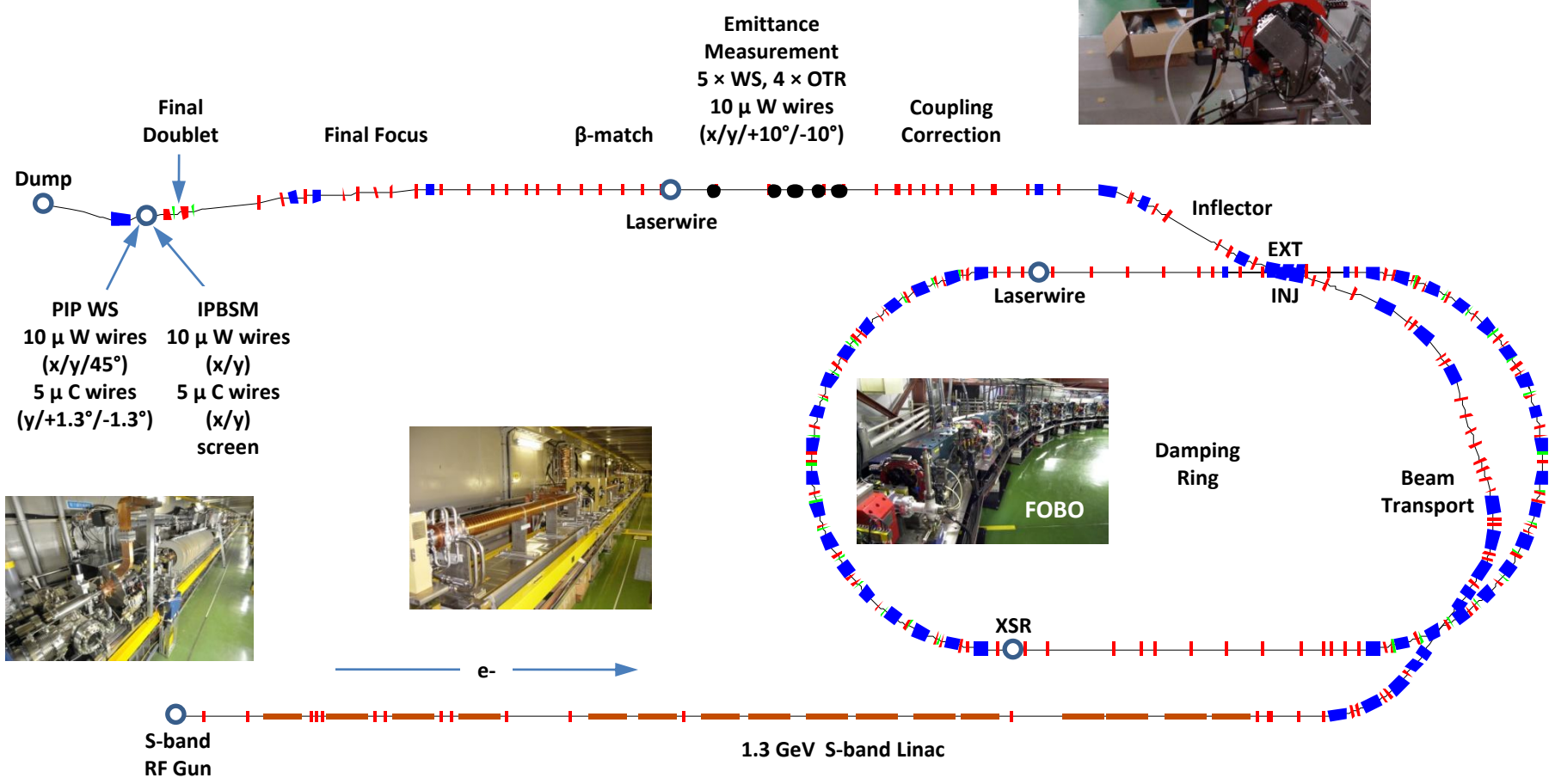
12 2010

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

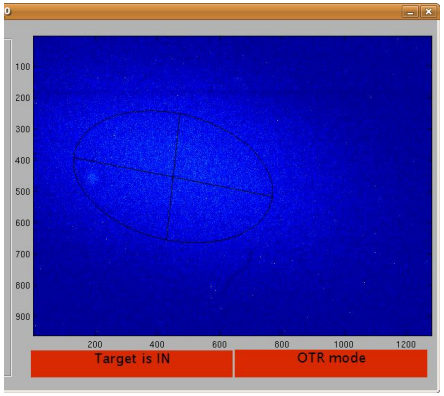
- 5 Weeks of shifts available for ATF2 tuning since spring/summer run
- ~6 shifts per week weeks 1-4 + 1 week dedicated run week 5.

ATF / ATF2 Schematic Layout

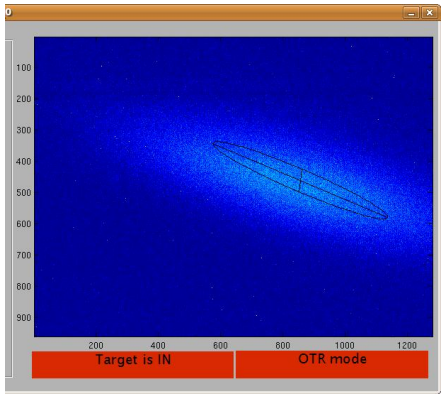




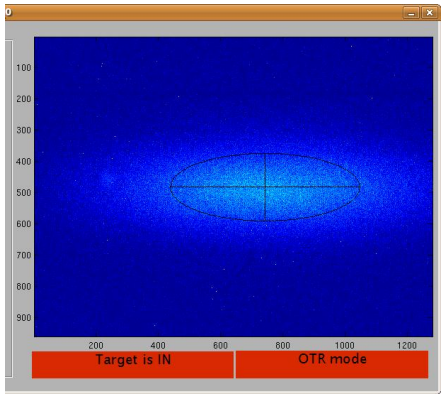
EXT Tuning



OTR0X before corrections



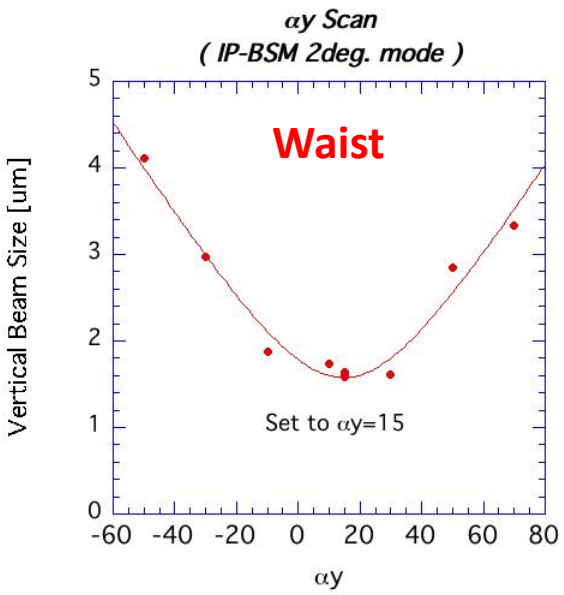
OTR0X after dispersion correction

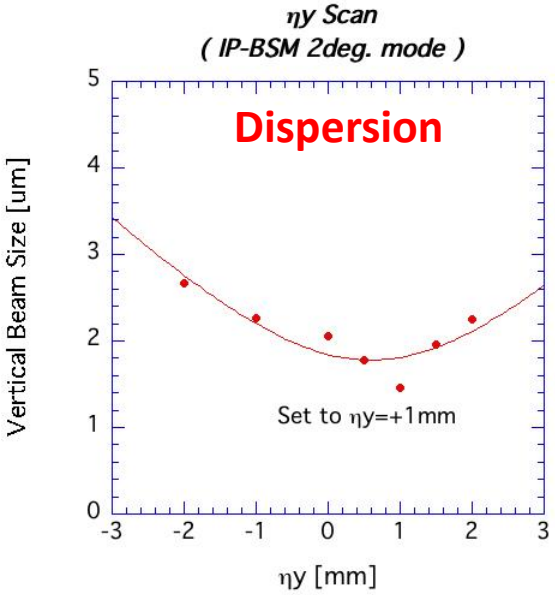


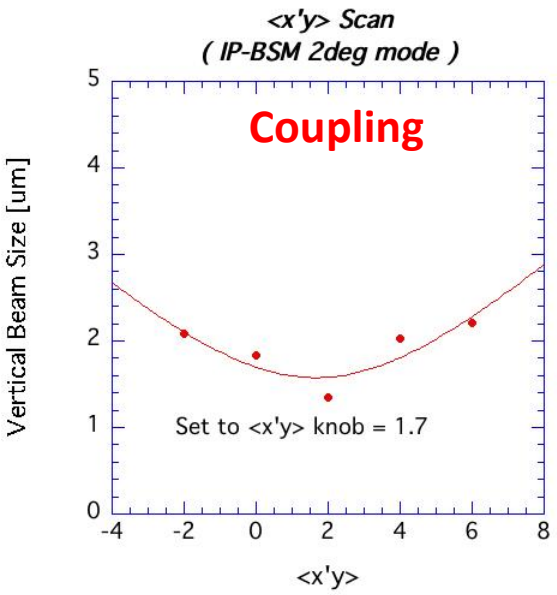
OTR0X after coupling correction

IP-BSM 2 degree mode

At first, we found the minimum beam size point
by using 2 degree mode of IP-BSM.



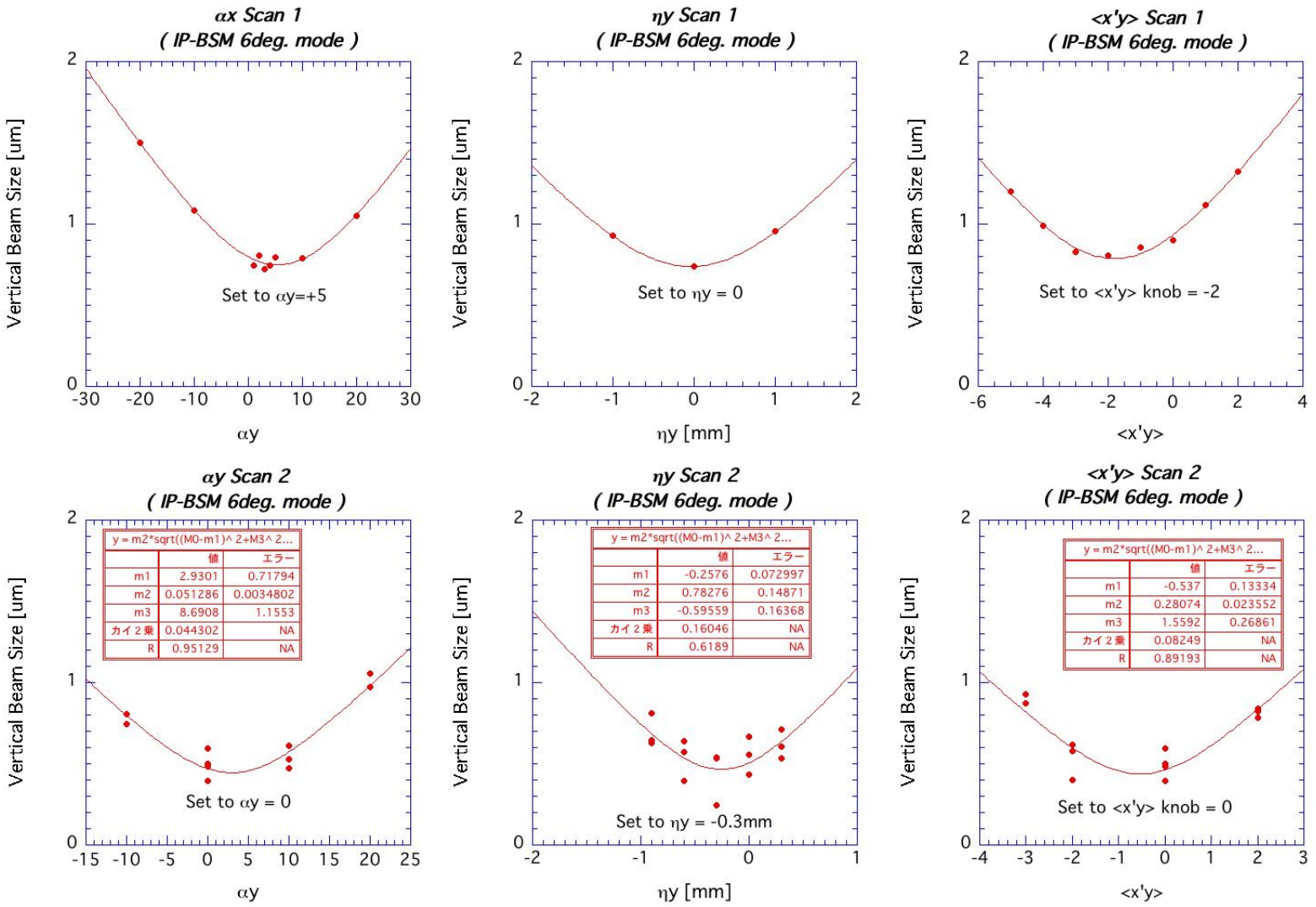




Since the beam size was roughly set to the optimum values,
we switched to the 6 degree mode.

T. Okugi

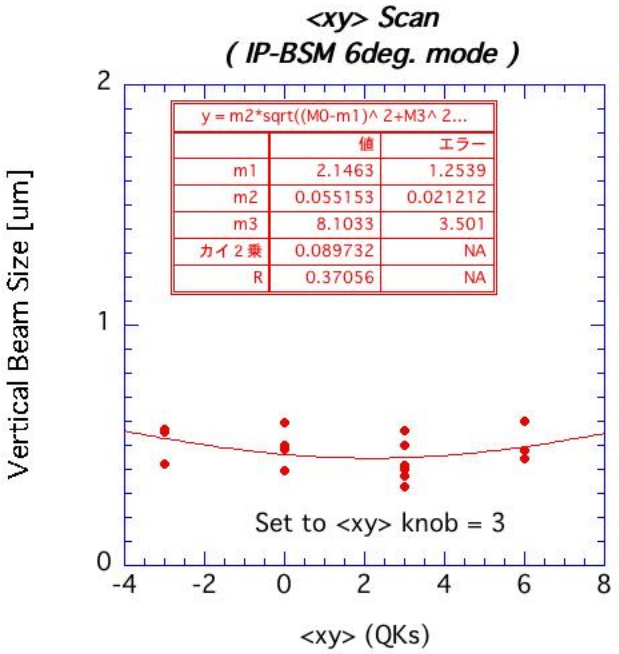
IP-BSM 6 degree mode

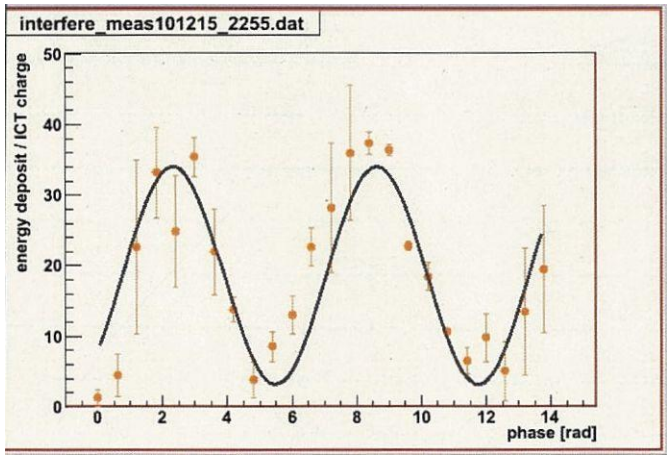


Waiat, dispersion and coupling were scanned twice.

<xy> knob

We also applied the <xy> knob (combination of QK magnets).





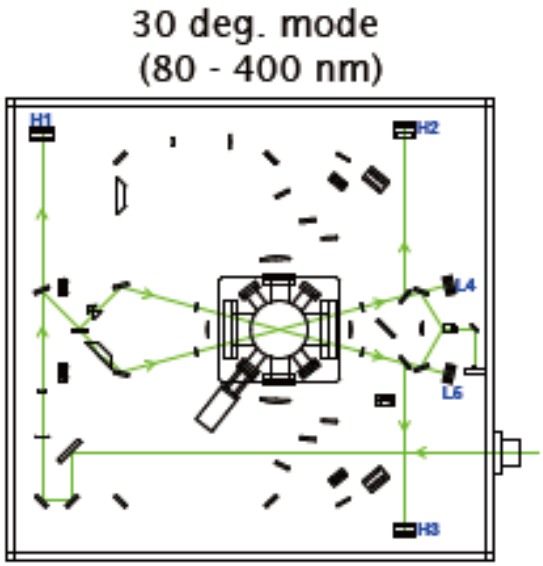
At <xy>=+3,	Ave.	Rms.
modulation	0.860	0.047
vertical beam size	431nm	77nm

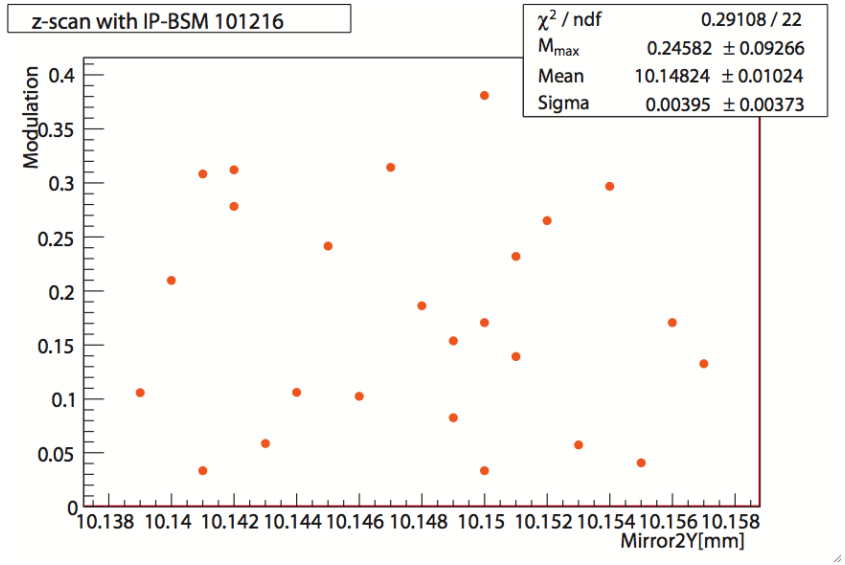
IP-BSM was most stable condition in these scanning.

The minimum beam size in this operation was 247nm (M=0.950) at 2nd ηy scan.

Since the knobs were optimized,
we switched to the 30 degree mode.

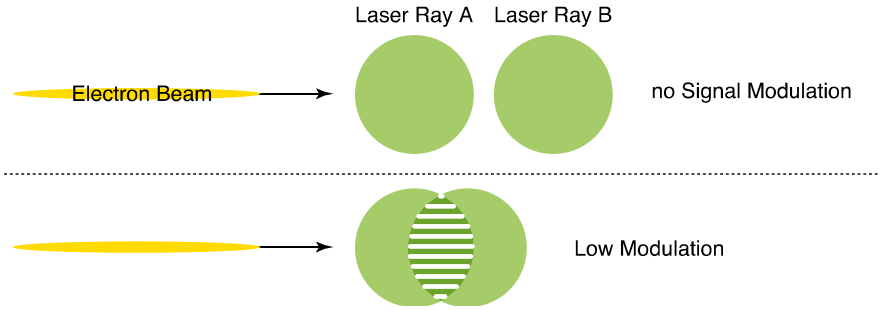
30 degree mode





Z scan result

- Could not see modulation

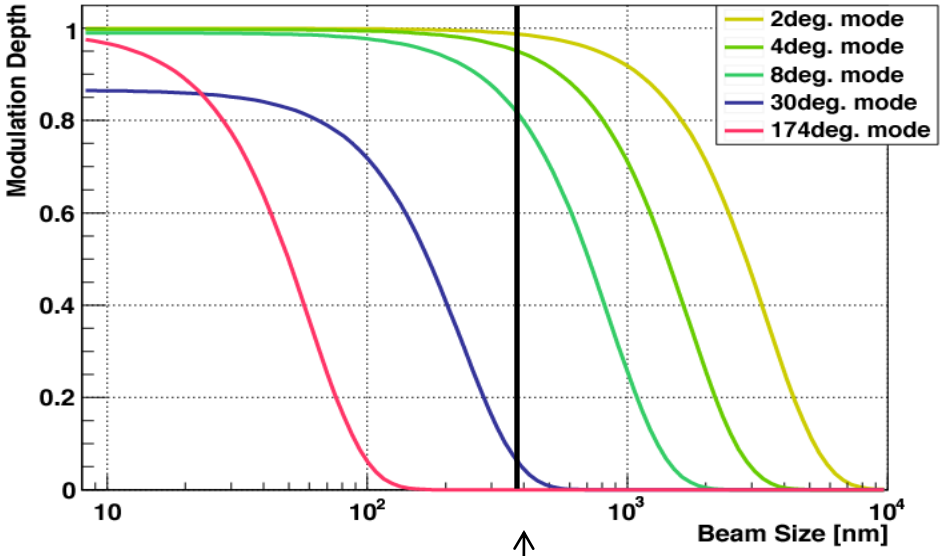


J. Yan

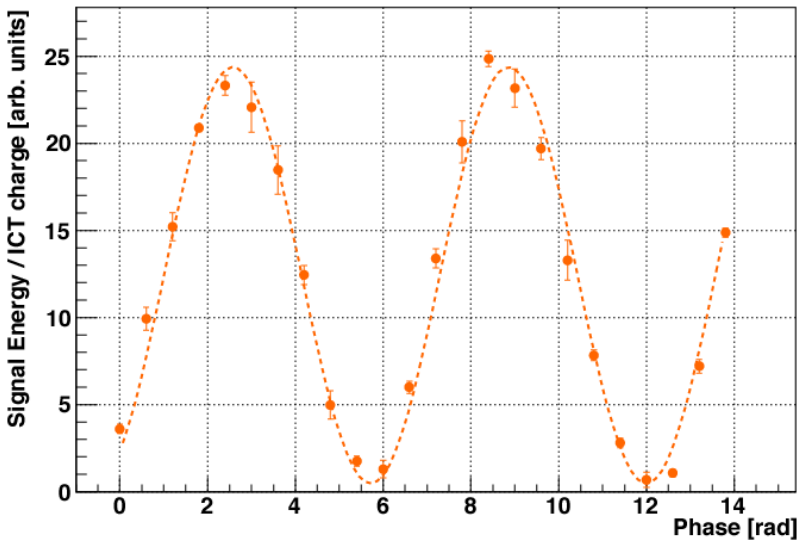
Contrast measurement

Large interference fringe pitch, small beam size M nearly 1

Contrast ~ offset from ideal modulation



$$\sigma_y < 380\,\mathrm{nm}$$



Measured contrast at **2.29 deg**

$$\frac{M_{\mathrm{meas.}}}{M_{\mathrm{ideal}}} = 0.98\,^{+0.01}_{-0.03}$$

CERN/CLIC proposal: ultra-low beta-function

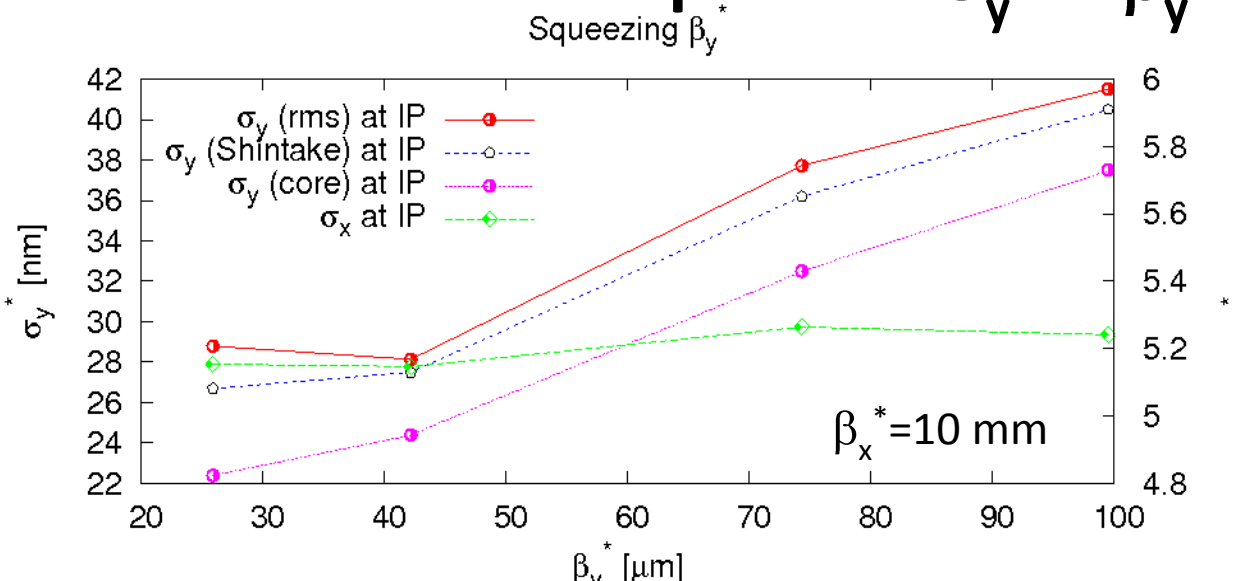
R. Tomas, E. Marin

motivation

project	L^*[m]	β_y^* [μm]	ξ_y
ATF2 nominal	1.0	100	~19000
ILC design	3.5	400	~15000
ATF2 ultra-low	1	25	~76000
CLIC 3 TeV	3.5	90	~63000

To prove CLIC chromaticity levels in ATF2 requires a factor 4 lower IP beta function. The main obstacle is the field quality (already issue for ATF2 nominal)

limitation from multipoles: σ_y^* vs β_y^*



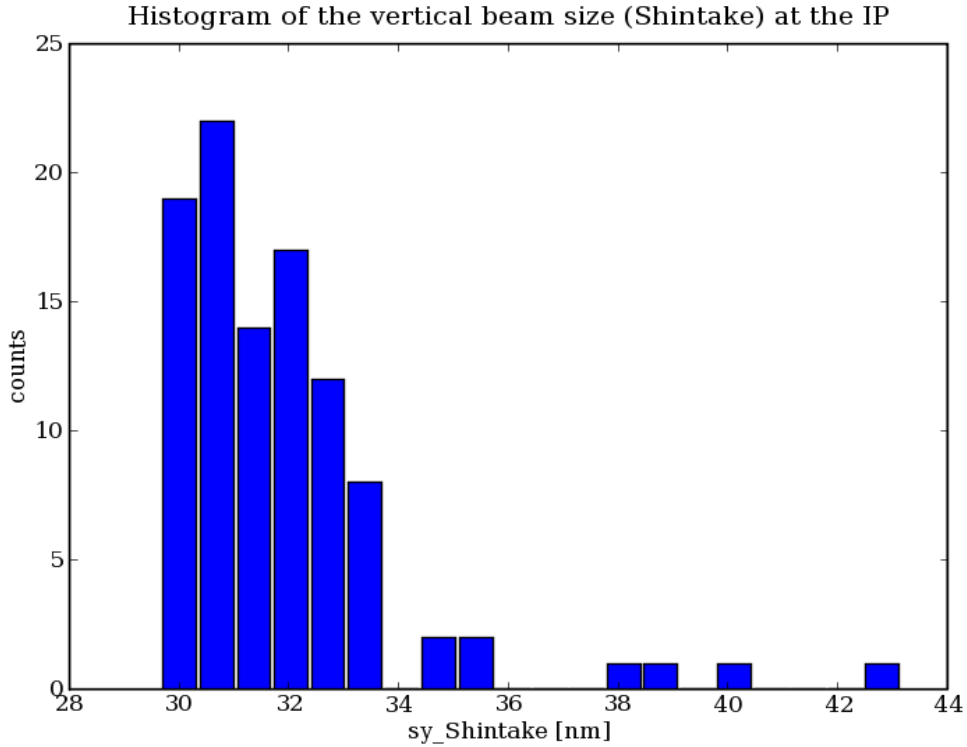
with measured magnetic multipoles; optimization with MAPCLASS; no further reduction when decreasing β_y^* below 40 μm

ultra-low beta-function cont'd

tuning ATF2 ultra-low β_y

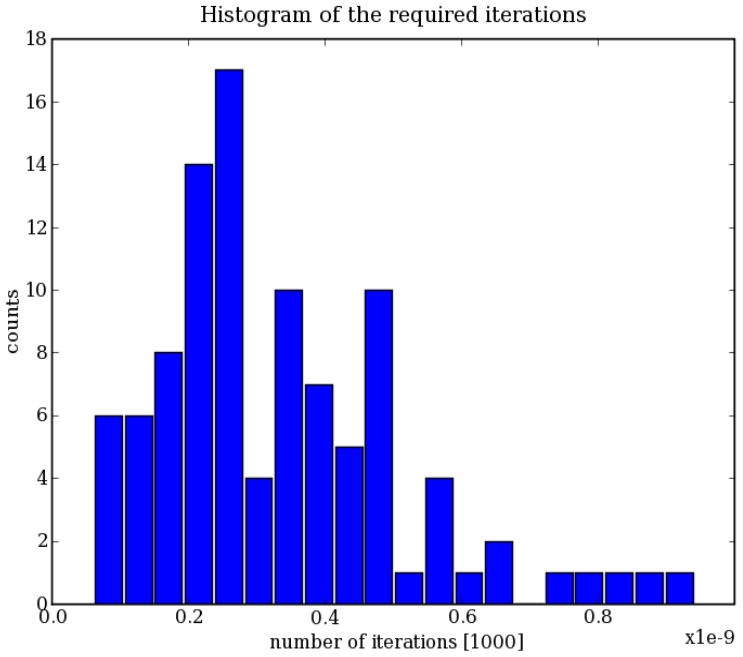
R. Tomas,
E. Marin

β_y^*=40 μm; β_x^*=10 mm



90% seeds reached a $\sigma_y^* < 34$ nm

Tuning based on an iterative application of knobs. All seeds converge below 1000 iterations.



all elements misaligned and tuning knobs applied; beam sizes after tuning not as good as design; work in progress to improve further

proposed CERN/CLIC contributions at ATF3

1) Ultra-low beta-function
   CLIC considers providing **warm QF1 with larger aperture**
2) **Ground motion feedback/feed-forward**
   Ground motion sensors on each relevant magnet to predict beam orbit
3) Test of **quadrupole stabilisation** in ATF extraction
   Verify stabilisation performance with beam
4) Developing damping ring **extraction kickers systems**
   Would need ATF3 to verify kicker performance
5) **CSR induced beam instability in ATF-DR**
   Experiments to distinguish between theories
6) **DR optics, emittance tuning & IBS studies**
7) **Superconducting wiggler for ATF-DR**
8) BPM tests
   CLIC main linac **BPMs** developed by FNAL tested at ATF2
9) **Contributions to ATF2/3 operation**