Collaboration Meeting DESY, March 30th- April 1st, 2005

TTF Status and Plans

Hans Weise / DESY

Status During Last Collaboration Meeting

Following the long installation and component commissioning phase we

concentrated on lasing.

Collaboration Meeting Orsay, September 6th - 8th, 2004

Monday 6th September

09:00-09:05	B. D'Almagne	Welcome
09:05-10:00	A. Wagner	Update of activities since April meeting
10:00-10:30	J. Schneider	Review of the XFEL - STI Workshop
10:30-11:00	*coffee break*	
11:00-11:20	S. Mishra	SMTF Status and Fermilab Perspectives
11:20-11:40	M. Koerfer	Status of TTF2 Construction
11:40-12:10	K. Floettmann	TTF2 Injector Run
12:10-12:30	P. Castro	TTF2 commissioning and plans
12:30-14:00	*lunch*	
14:00-16:00	Lab. Reports	
	T. Garvey	LAL □ Orsay Laboratory Report
	W. Mueller	TEMF
	O. Napoly	CEA-Saclay Activities
	A. Oppelt	Status report from the Photo Injector Test facility PITZ
	H. Padamsee	Cornell R&D Program on High Gradient
	MIT	MIT Accelerator Science Initiative
16:00-16.30	*coffee break*	
16:30-17:00	D. Proch	CARE JRA-SRF update
17:00-17:30	J. Knobloch	EUROFEL Update
17:30-18:00	N. Walker	EUROTeV
18:00-	A. Wagner (chair)	Collaboration Board Meeting

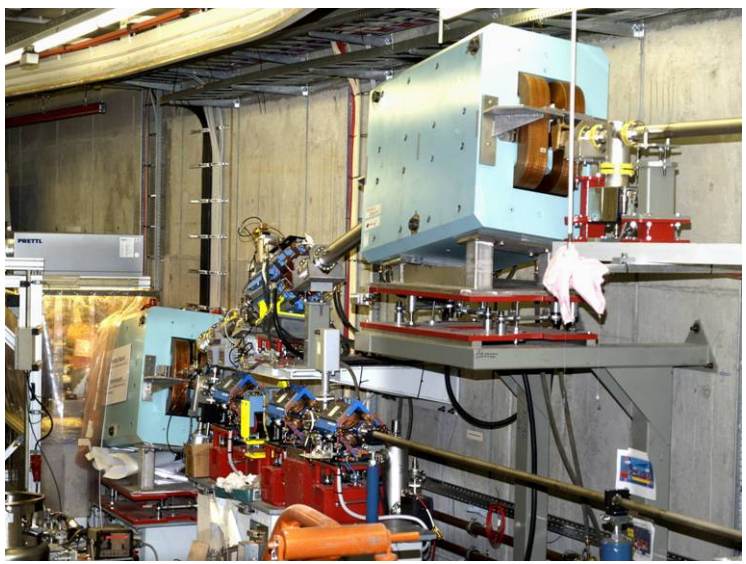
Report on TTF2 Installation: see http://tesla.desy.de

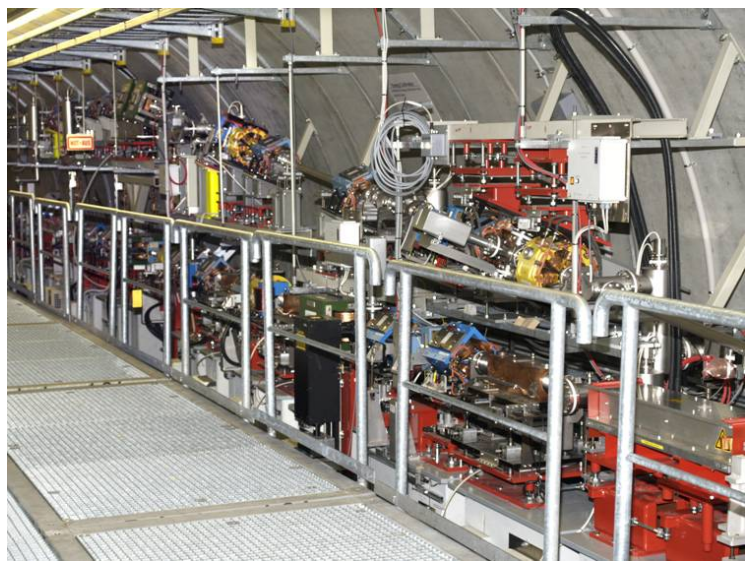
Tuesday 7th September

09:30-13:00	A. Wagner (chair)	Collaboration Board Meeting (cont.)	
09:00-18:00	J.-P. Carneiro (conv.) M. Koerfer (conv.)	Working Group: TTF2	
		R. Lange	Cryogenics Installations TTF2 in 2004 and Future Plans
		D. Kostin	TESLA Cavities in the VUV-FEL LINAC Modules
		K. Zapfe	Status of the TTF Status of the TTF-II Vacuum II Vacuum Systems Systems
		H.-J. Eckoldt	Power Supplies for VUV FEL
		H.-J. Eckoldt	Pulse cables for XFEL
		S. Choroba	Status RF System
		S. Simrock	Commissioning of the LLRF for the UV-FEL
		K. Rehlich	VUV-FEL Controls
		P. Castro	TTF 2 Diagnostics Status and Availability of Toroids, BPMs, □
		M. Castellano	TTF-VUV FEL VUV FEL Optical Optical Systems
		D. Sertore	Photoinjector Laser Operation and Cathode Performance
		V. Miltchev	Beam based alignment, Dark current and Thermal emittance measurements
		K. Honkavaara	Status of Emittance Measurements at the TTF/VUV-FEL Injector
		A. Brandt	Improvements in LLRF Control Algorithms and Automation
		M. Kollewe	TTF2 - Time-Of-Flight Measurements
		N. Baboi	First Measurements on HOM-Based Alignment in the TESLA Cavities
		N. Golubeva	Attempt of measurement of linear dispersion by beam energy variation
		M. Yurkov	Expected properties of the radiation from VUV-FEL
		J.-P. Carneiro	Velocity bunching simulations for TTF2
		P. Castro	TTF2 commissioning strategy
		V. Balandin	Commissioning 445-MeV Optics of the TESLA Test Facility Linac
		T. Jezynski	RF Control Improvement for TTF II with low latency FPGA feedback
16:00-18:00	H. Edwards (chair)	Technical Board Meeting	

TTF2 Installation / Warm Beam Line Sections

Sep	Oct	Nov	Dec	Jan	Feb	Mar

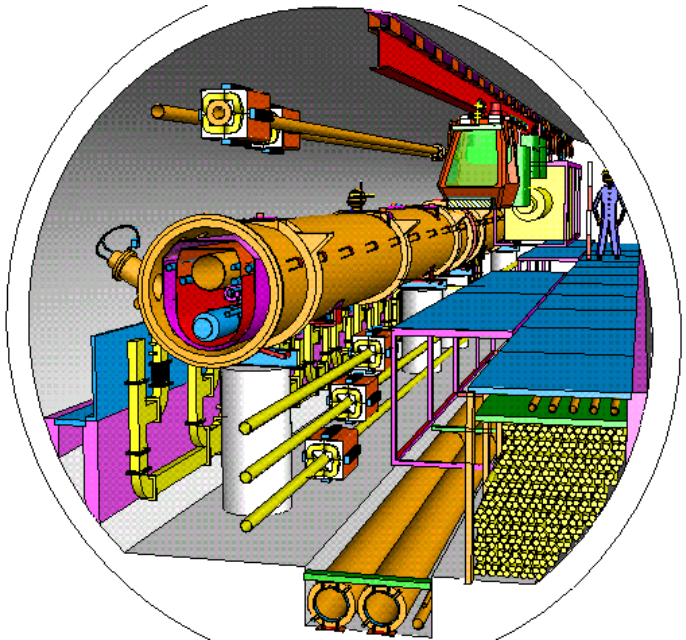


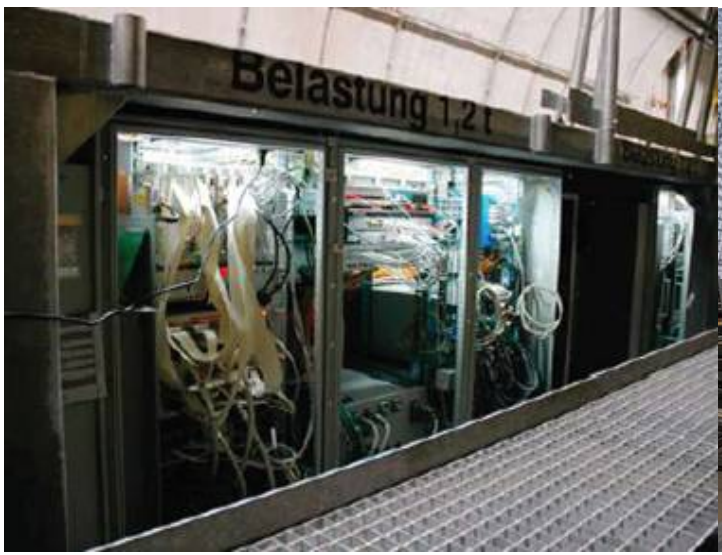


TTF2 / VUV-FEL Tunnel Layout

The TTF2 Tunnel installation basically follows the old TESLA design…

With all its advantages and disadvantages.



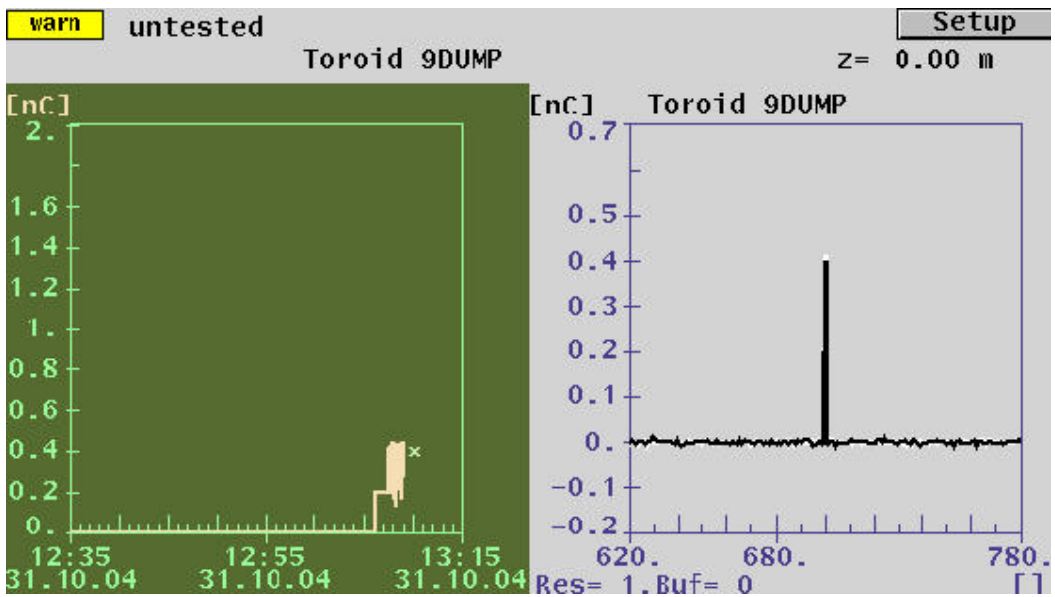


First beam at the dump!

Sep	Oct	Nov	Dec	Jan	Feb	Mar

31.10.2004 13:10 M. Wendt, Y. Kim **First Beam to DUMP**

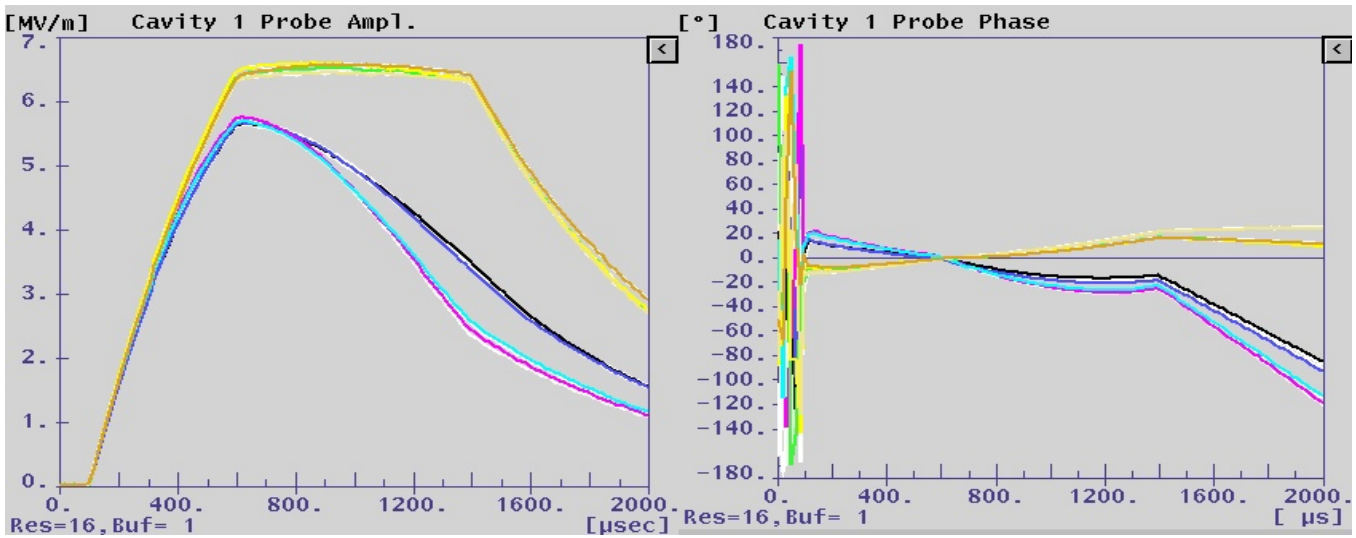
We went to bld. 49, set up a notebook to control the last magnets of the bypass by watching the signals of the BPM's 92BYP and 9DUMP and toroid 9DUMP.
After centering the beam at BPM 9DUMP we empirically changed the setting of the dipole D1DUMP until we saw a raw signal on one of the electrodes of BPM 9DUMP. After it was easy to center the beam also here, and we could finally observe a signal on the toroid 9DUMP.



single bunch of 0.4 nC and it‘s history

Some Problems With Motor Driven Frequency Tuners!

Sep	Oct	Nov	Dec	Jan	Feb	Mar



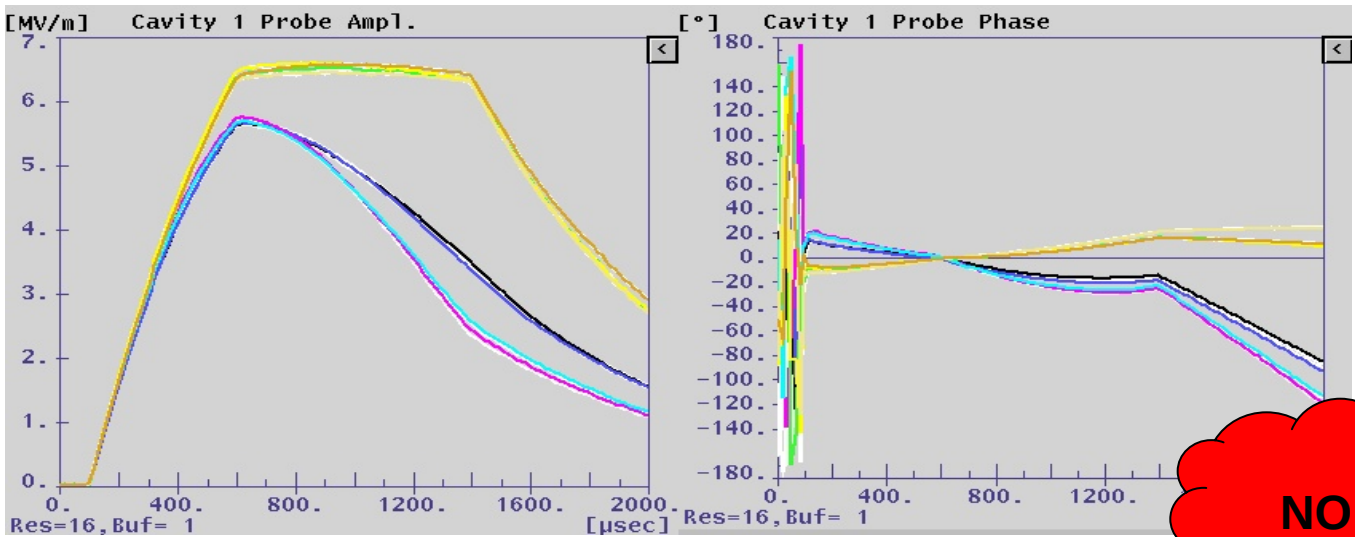
12.11.2004 17:27 N.N. **ACC5 Status**

Cavities 5,6,7,8 at ACC5 tuned, llrf settings adjusted for 5-10 MV/m.
Frequency tuners for cavities 1,2,3,4 are not available. It will be ready Monday.
Current status of the module is OK for the weekend program.
ADCs are calibrated (gradient and phase).
1st bunch at 835 about.

Please don't close the feedback loop for ACC4/5 during weekend.

Big Problems With Motor Driven Frequency Tuners!

Sep	Oct	Nov	Dec	Jan	Feb	Mar



NO!!!

12.11.2004 17:27 N.N. **ACC5 Status**

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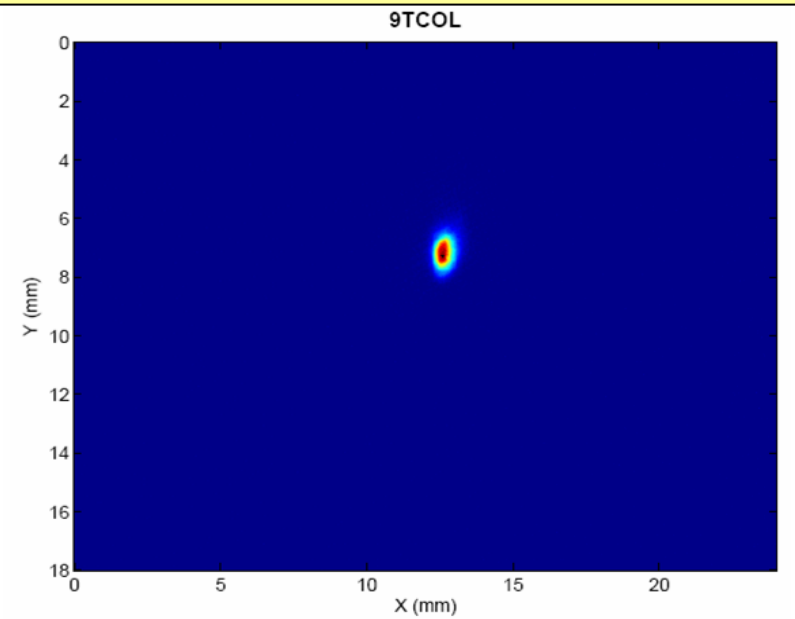
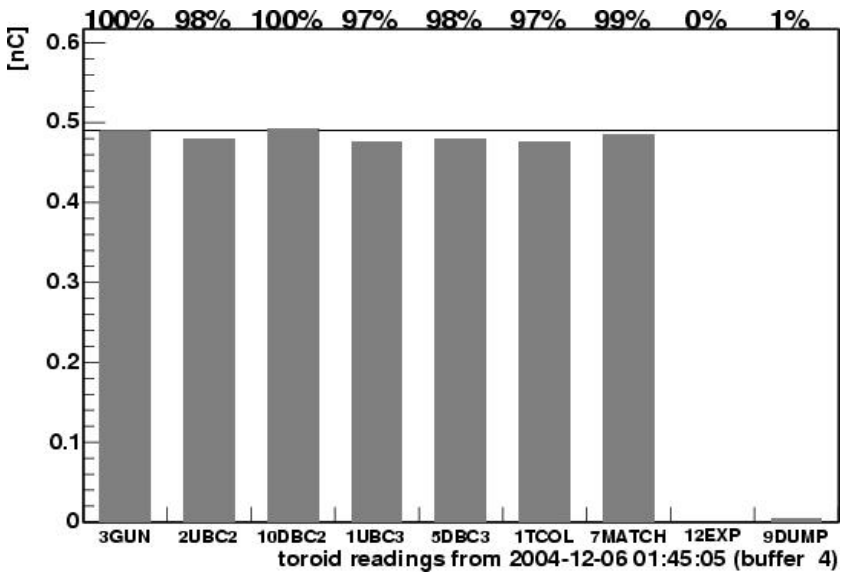
First Beam Through the Collimator

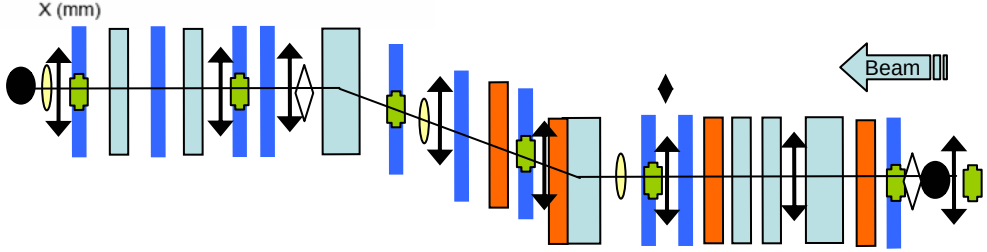
Sep	Oct	Nov	Dec	Jan	Feb	Mar

06.12.2004 07:25 Bolzmann,Saldin,Schneidmiller **extended summary**

We tried to go through collimator and then the undulator using settings of Thursday afternoonas initial conditions. To get a full transmission through linac and collimator system was very easy





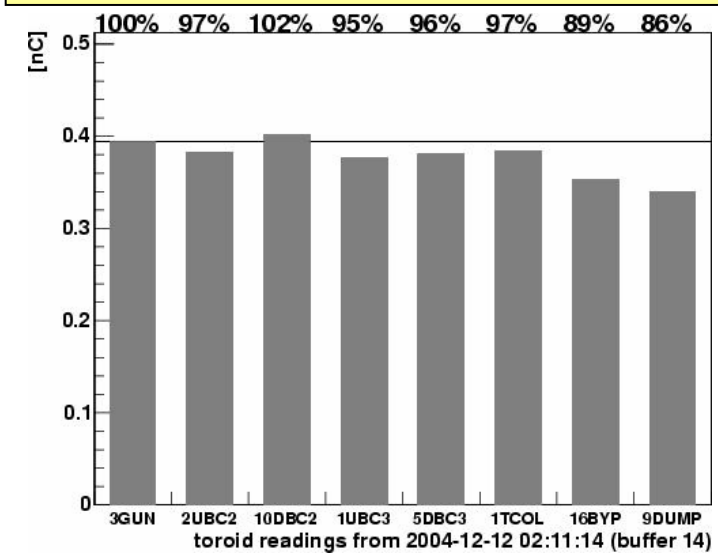


Beam Transport Through the Undulator

Sep	Oct	Nov	Dec	Jan	Feb	Mar

TTF Logbook 10. December 2004 Night

Goal	**Go through the undulator**
Achievements	Checked the magnets in the undulator region: Seem to be OK.
Difficulties	Attempt to steer the beam through the undulator stopped due to high dose in the undulator. Switched of Gun and Laser and let the rest of the machine run. During Access we saw a burned connection of 2 coils in the 21Seed quad (damage seemed to be older, since the quad was cold)
Comments for next shift	**Need a better strategy and more tools** (discuss in the RC Meeting on Monday)



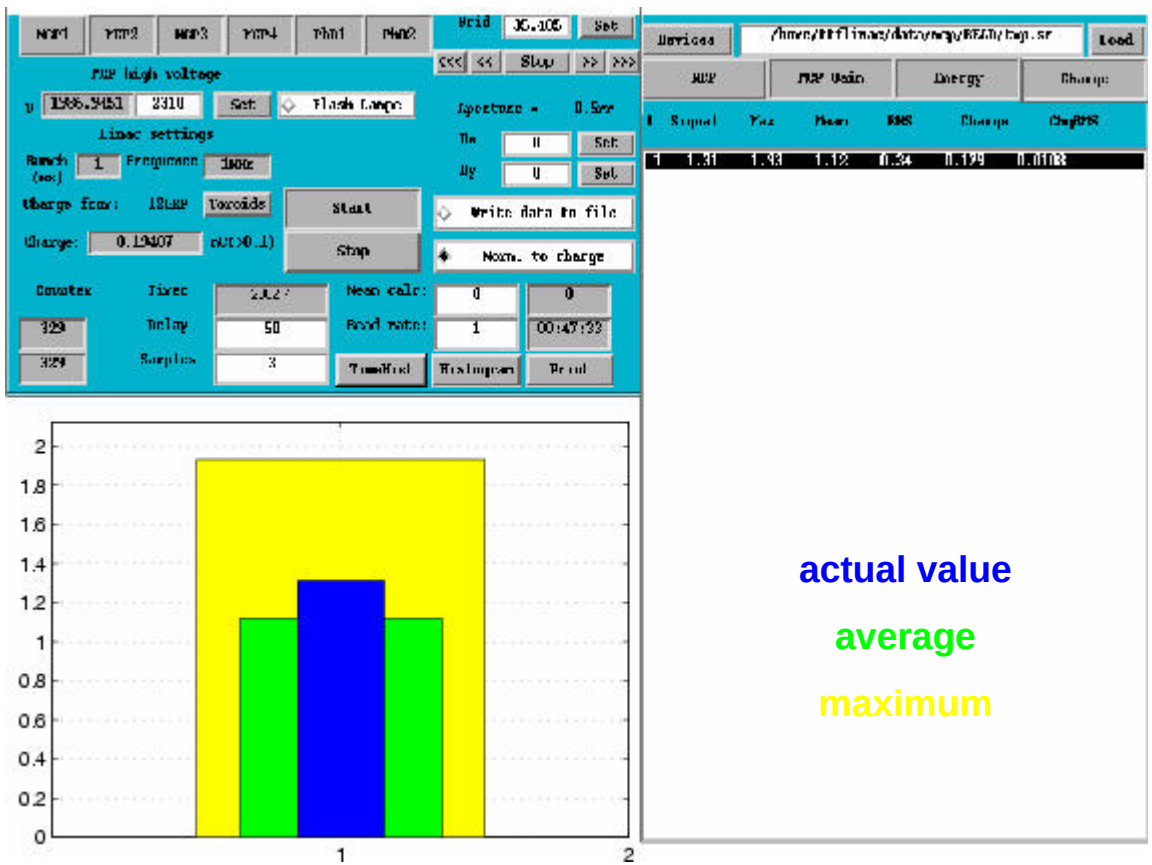
Beam transmission through bypass was fine

The burned connection (and a second problem!!!)

The first Spontaneous Emission Signal !

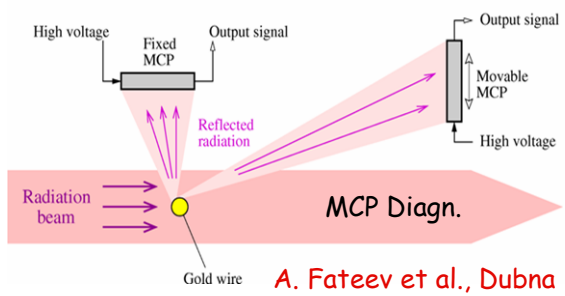
Sep	Oct	Nov	Dec	Jan	Feb	Mar

14.12.2004 00:48 Faatz, Kocharyan, Saldin MCP Tool



Picture taken using a Multi Channel Plate photon detector

(not yet calibrated)



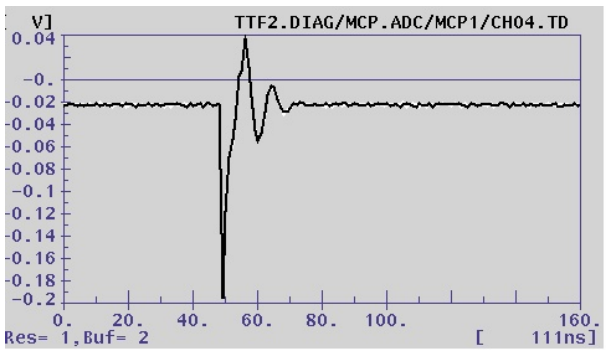
A. Fateev et al., Dubna

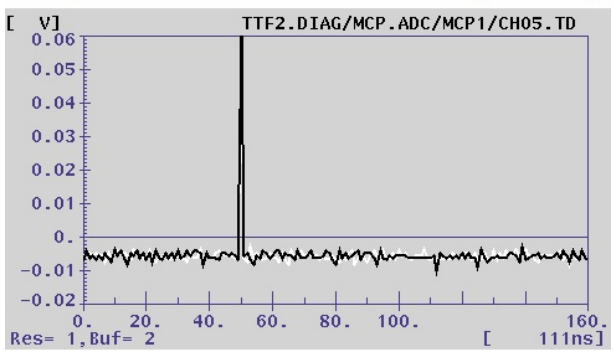
The first Spontaneous Emission Signal !

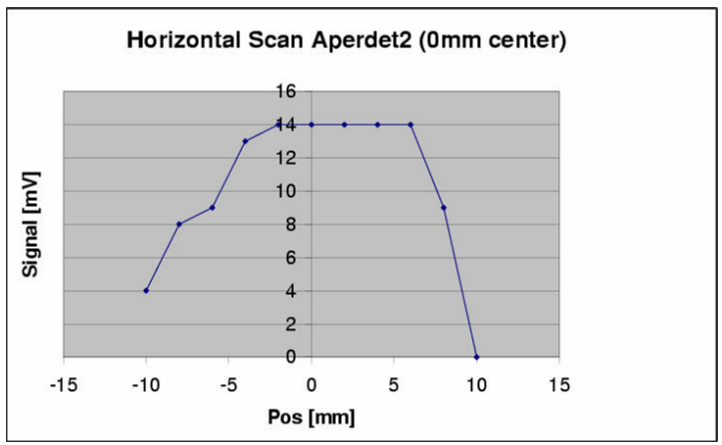
Sep	Oct	Nov	Dec	Jan	Feb	Mar

14.12.2004 02:33 Gerth, Tiedtke **PtSi photodiode signal**

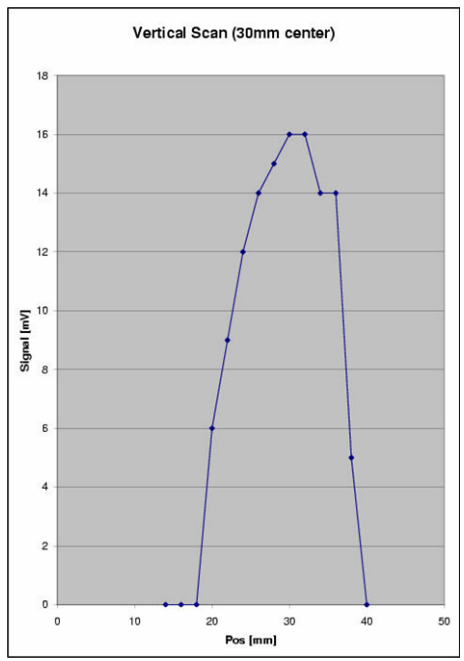
First signal of spontaneous undulator radiation measured with the PtSi photodiode in detector unit
The photodiode has been connected temporarily to the ADC TTF2.DIAG/MCP.ADC/MCP/CH04.TD (usually PtSi photodiode of octopus). The lower plot shows the signal of toroid 9DUMP which was used as a trigger signal.







Horizontal and vertical scan taken shortly after the first spontaneous emission.



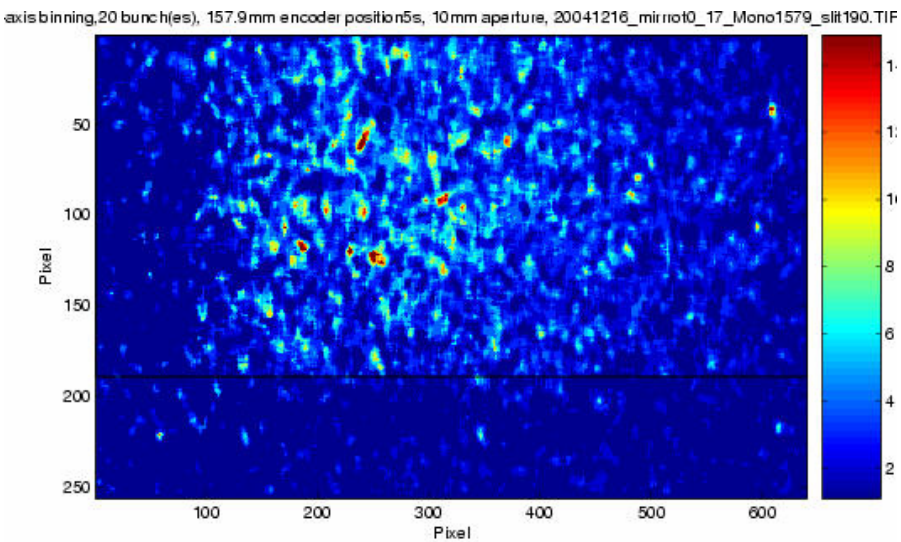
Spectrum of Spontaneous Emission!

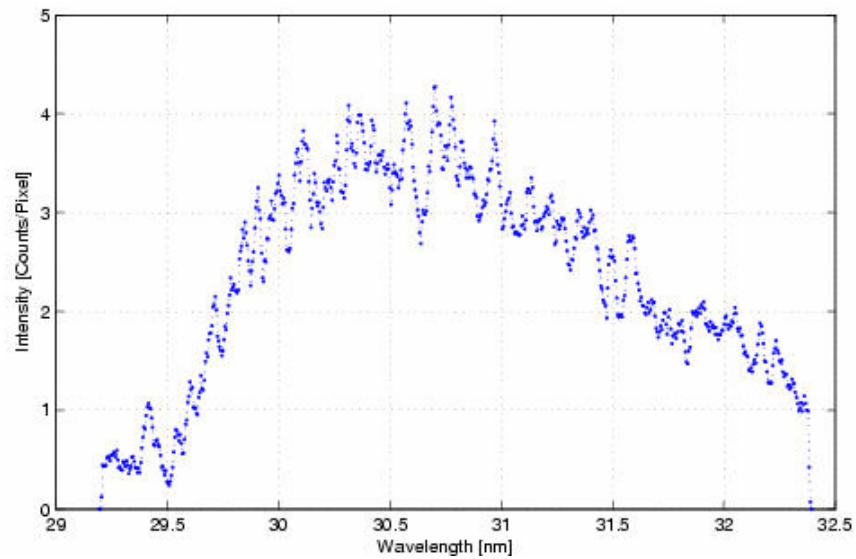
Sep	Oct	Nov	Dec	Jan	Feb	Mar

16.12.2004 01:24 Treusch, Gerth, Yurkov, Kocharyan, Schlarb, Grimm

Spectrum of spontaneous radiation

First measurement of spectral distribution of spontaneous undulator radiation.
Sum of 200 bunches at 0.3nC and taken with focusing mirror.

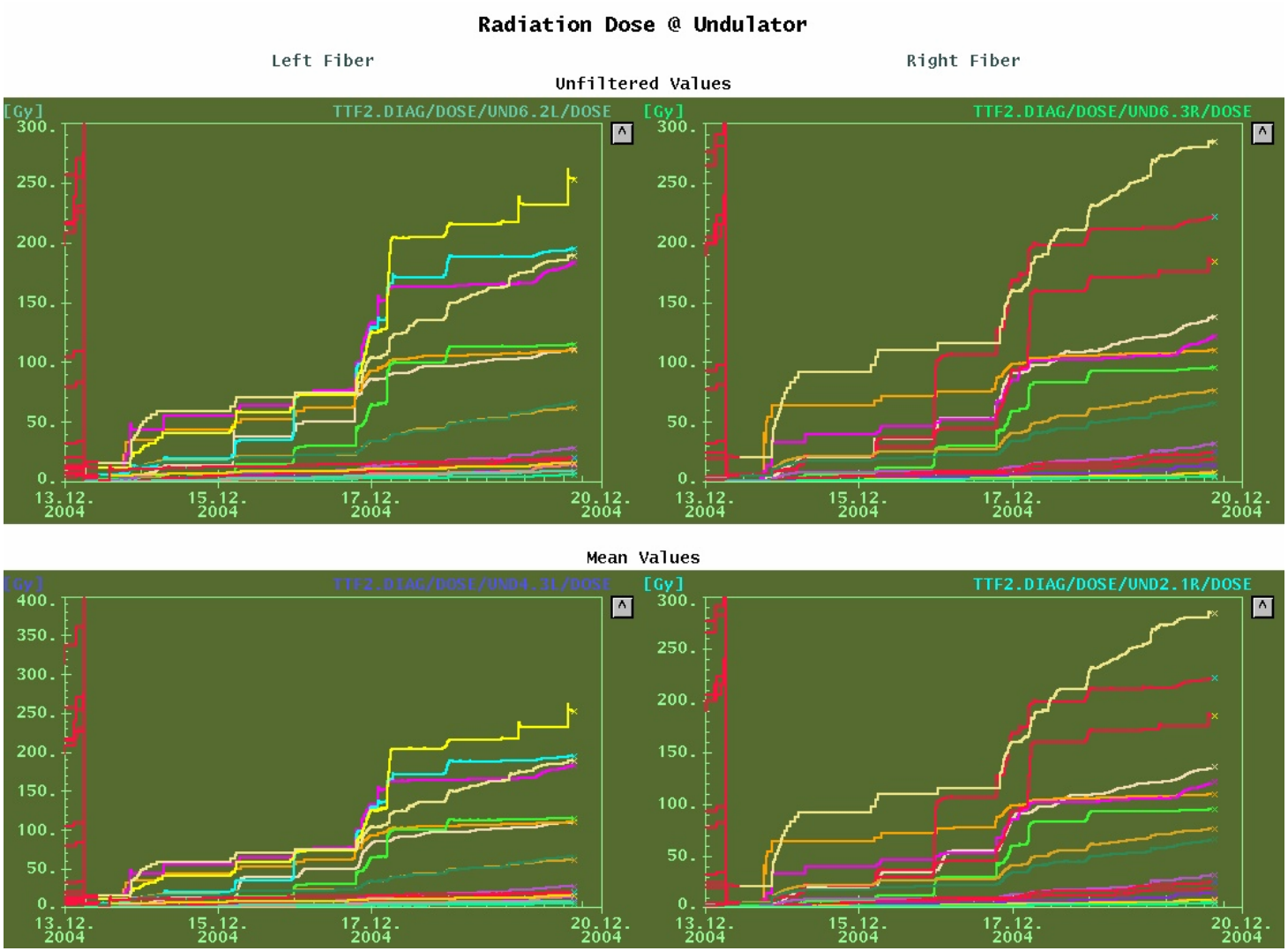




30 nm corresponding to 450 MeV electron beam energy

The Big Problem! We Risk the Undulator!!!!!!!!

Sep	Oct	Nov	Dec	Jan	Feb	Mar



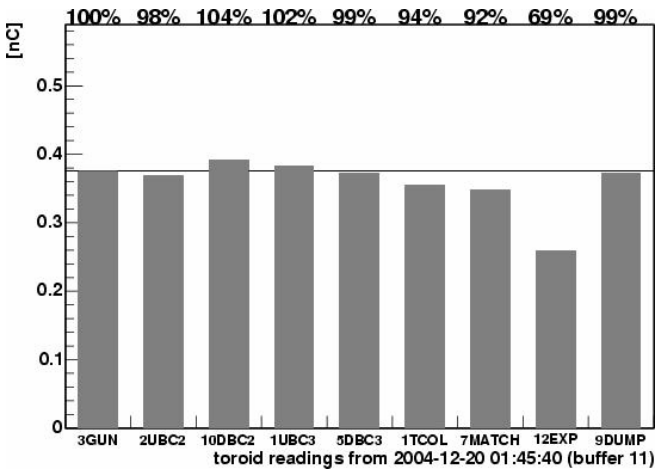
We have typically 100 Gy per shift.

At a local dose of approx. 10 kGy we risk the undulator‘s field quality.

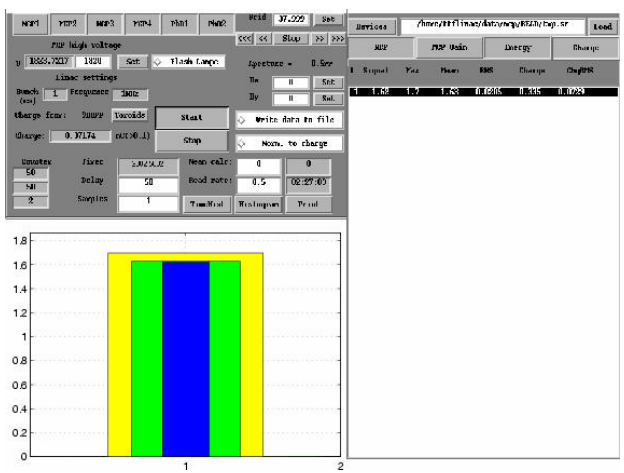
The dose is measured with fiber optics close to the undulator‘s vacuum chamber.

Status Before the Christmas Shutdown!

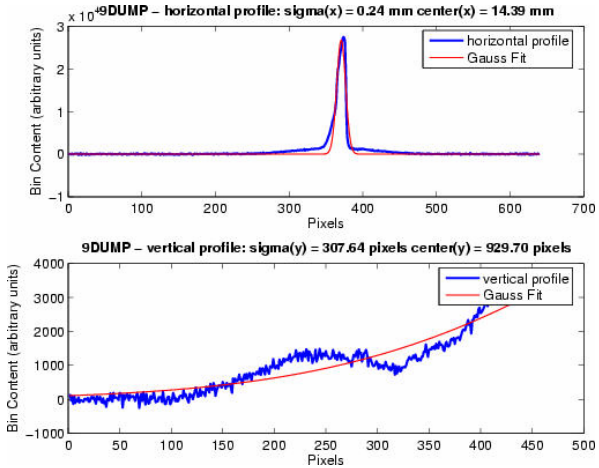
Sep	Oct	Nov	Dec	Jan	Feb	Mar



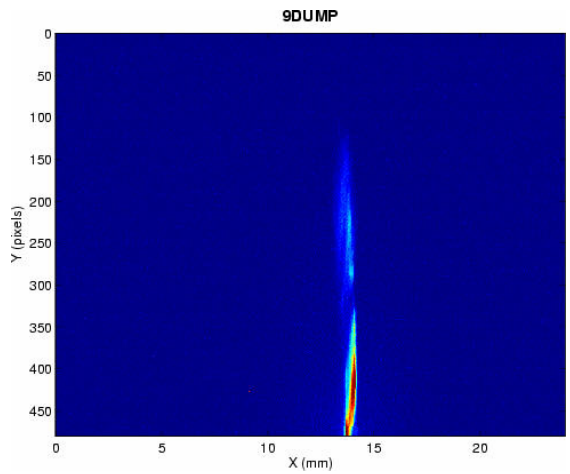
Almost perfect beam transmission



A calibrated MCP detector



Many profiles for compressed electron beams



Status After the Christmas Shutdown!

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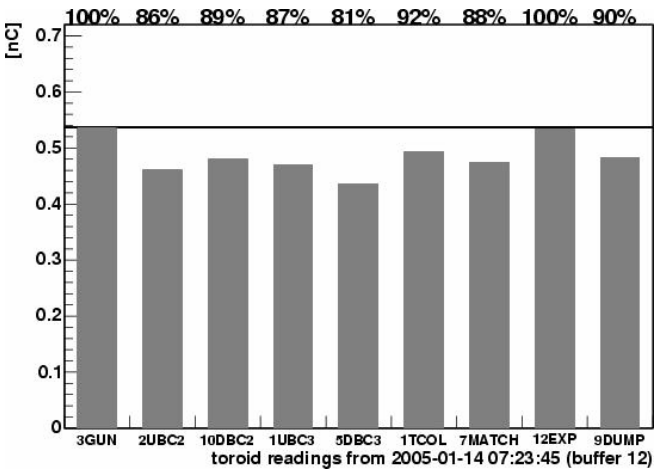
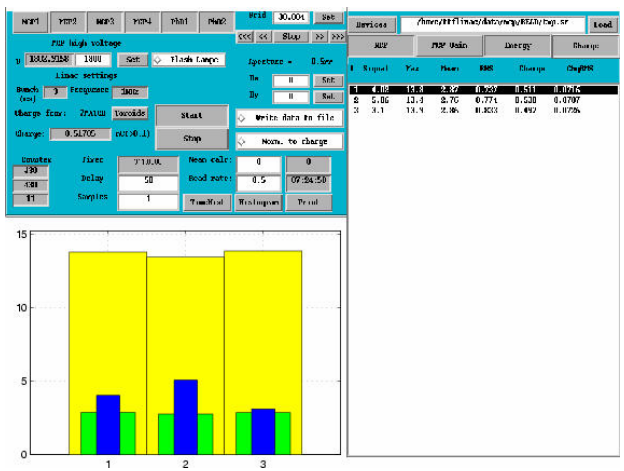
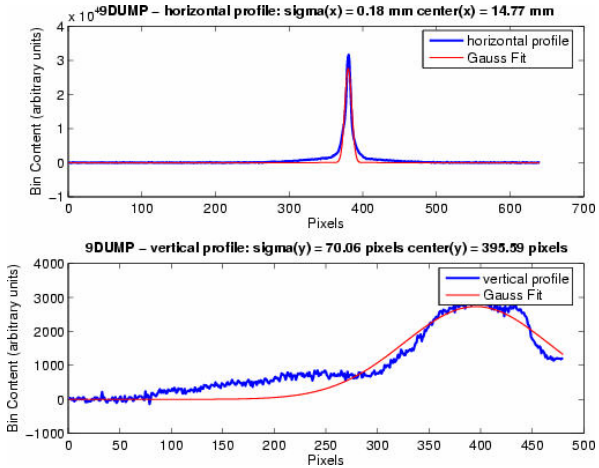


Almost perfect beam transmission



A calibrated MCP detector



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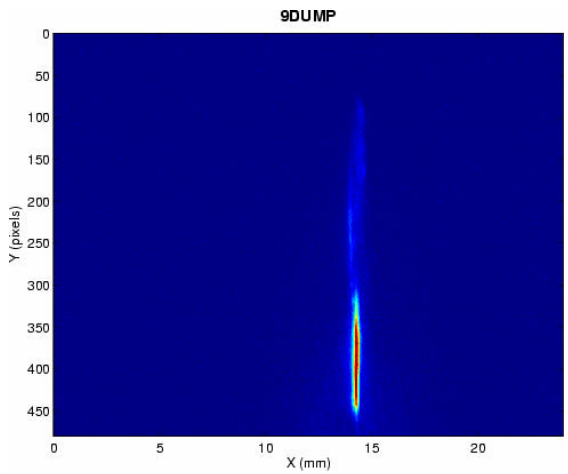
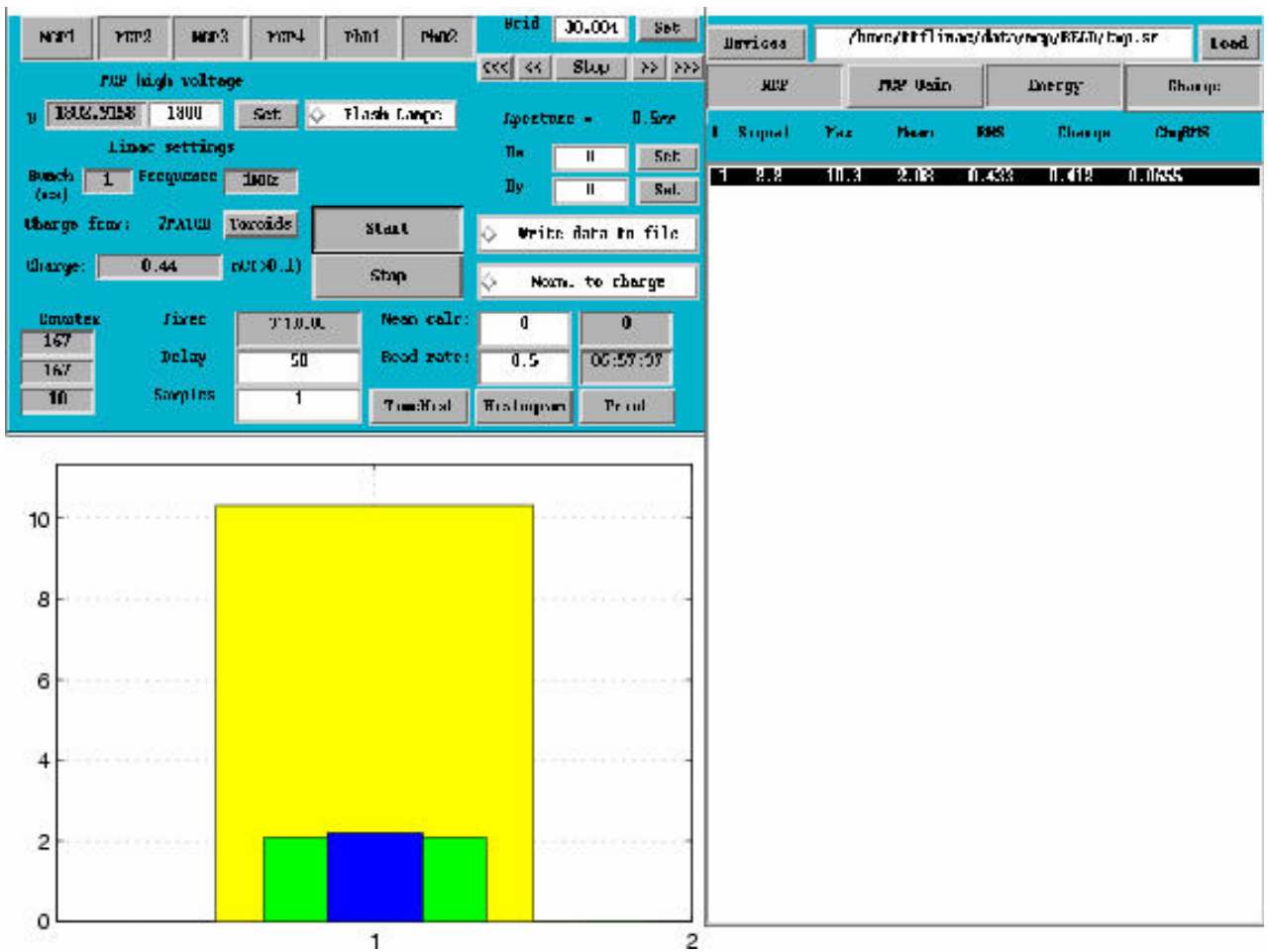


Looks Like First SASE!

Sep	Oct	Nov	Dec	Jan	Feb	Mar

14.01.2005 06:58 Kocharyan, Schneidmiller, Pugachov **Looks like first SASE!**

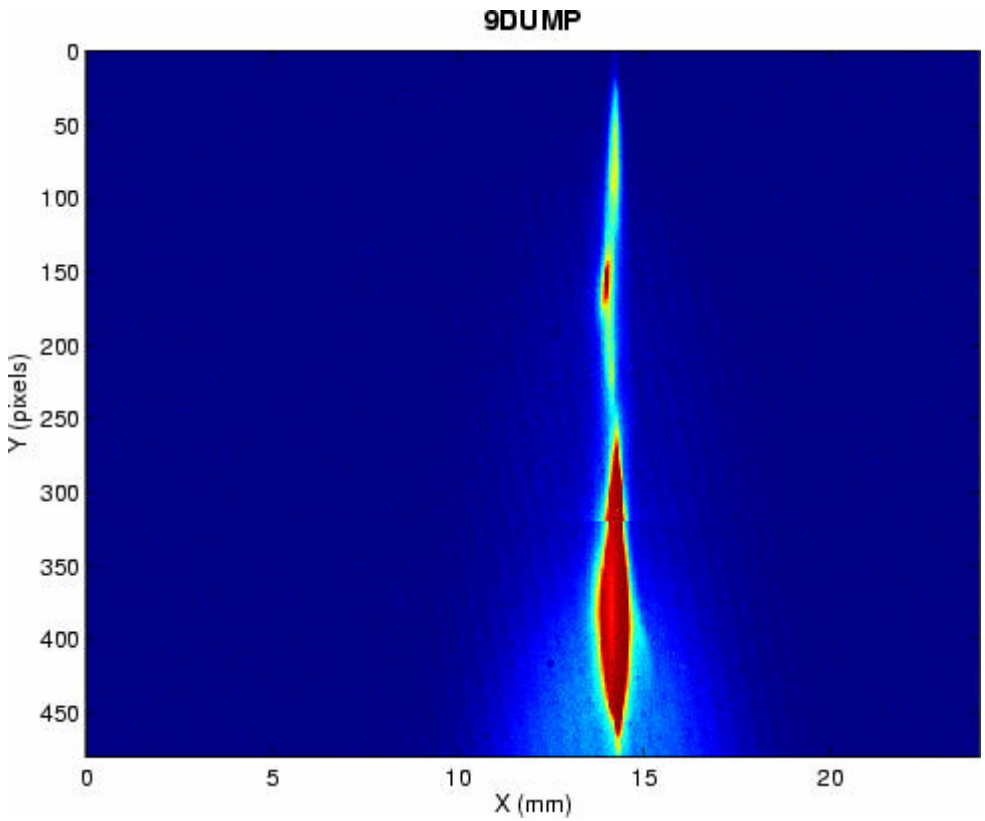


Looks Like First SASE!

Sep	Oct	Nov	Dec	Jan	Feb	Mar

14.01.2005 21:36 ttflinac **/tmp/tp355189.ps**

A good probability to get SASE is there, when there is a fragmentation of the beam on the 9dump screen visible. It means, that there should be bunchlets in the tail, an no homogenously smeared out tail.

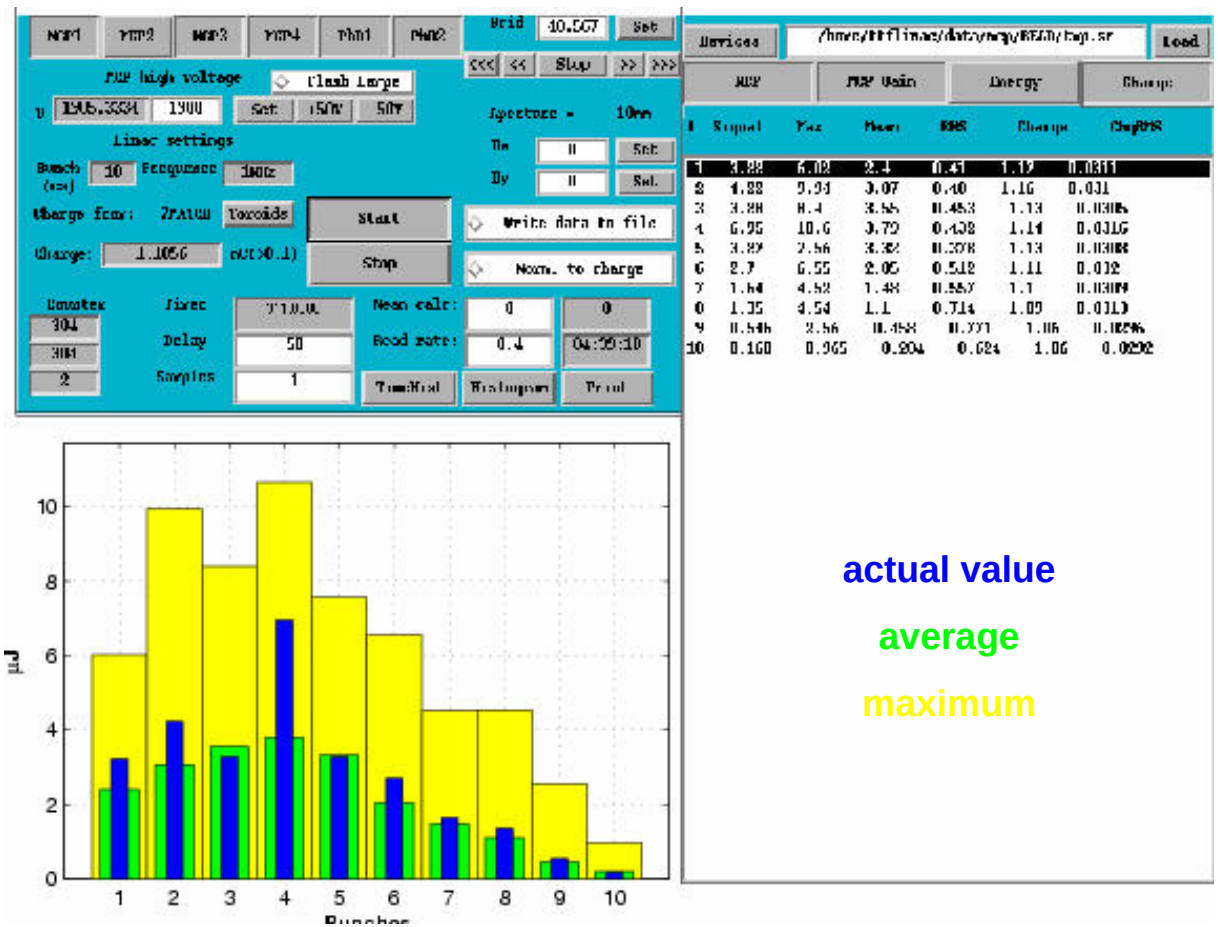


Almost Saturation!

Sep	Oct	Nov	Dec	Jan	Feb	Mar

24.01.2005 04:39 Grimm, Saldin, Schneidmiller, Yurkov

first shot above 10 uJ, fluctuations 38 % for 5th bunch over 5 min.



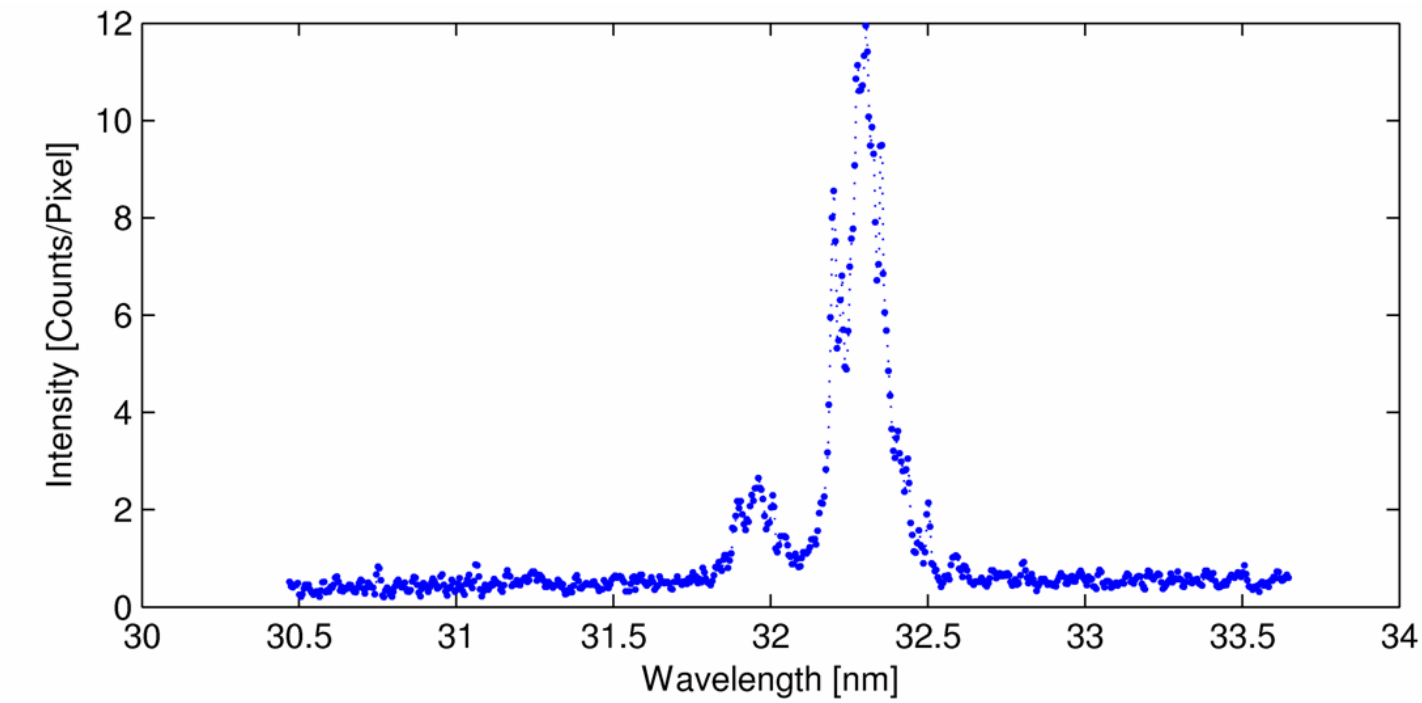
The 10 bunches in each macro pulse produce photon pulse energies of up to 10 μJ.

Many attempts were made to correlate the fluctuating and drifting SASE intensity with accelerator parameters.

VUV-FEL Status As of February, 2005

Wavelength	31.9 nm
Average energy per pulse	5 µJ
Maximum energy per pulse	10 µJ
Peak power	0.5 GW
Radiation pulse duration	20 fs
Spectrum width (FWHM)	0.7-1%
Angular divergence (FWHM)	150 mrad

- We now have the first weeks of SASE operation
- Photon pulse energy increased to typ. 5 µJ (a factor 2 below saturation)
- Photon beam parameters measured with excellent agreement to theoretical predictions
- Stable FEL operation over typ. 15 minutes; then slight tuning necessary



typical spectrum

Excellent to Compare with Actual Results:

TESLA FEL 2004-06 July 2004

Expected properties of the radiation from VUV-FEL at DESY (femtosecond mode of operation)

E.L. Saldin, E.A. Schneidmiller and M.V. Yurkov
Deutsches Elektronen-Synchrotron (DESY), Notkestrasse 85, 22607 Hamburg, Germany

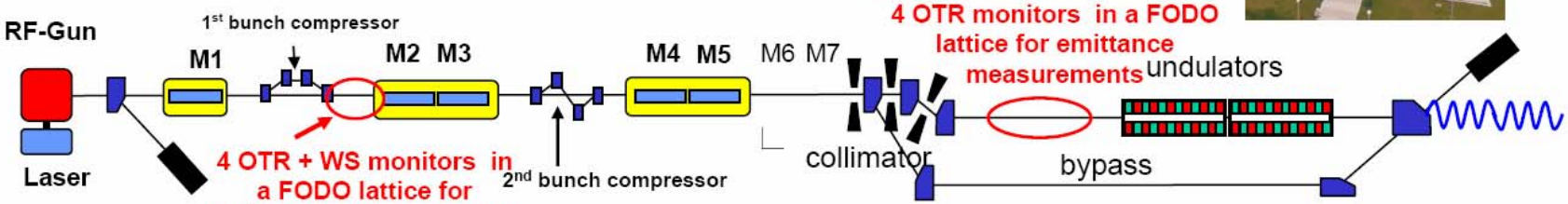
Abstract

For the next three years the nominal ”long pulse” (200 fs) mode of FEL operation at VUVFEL, based on a linearized bunch compression, is not available due to the lack of a key element – a 3rd harmonic RF cavity. Essentially nonlinear compression leads naturally to a formation of a short high-current leading peak (spike) in the density distribution that produces FEL radiation. Such a mode of operation was successfully tested at VUV-FEL, Phase I. In this paper we present optimized parameters of the beam formation system that allow us to get a current spike which is bright enough to get SASE saturation for the VUV-FEL, Phase 2 at shortest design wavelength down to 6 nm. The main feature of the considered mode of operation is the production of short (15-50 fs FWHM) radiation pulses with GWlevel peak power that are attractive for many users. Main parameters of the SASE FEL radiation (temporal and spectral characteristics, intensity distributions, etc.) are presented, too.

Emittance Measurements at TTF (S. Schreiber)

TTF Linac

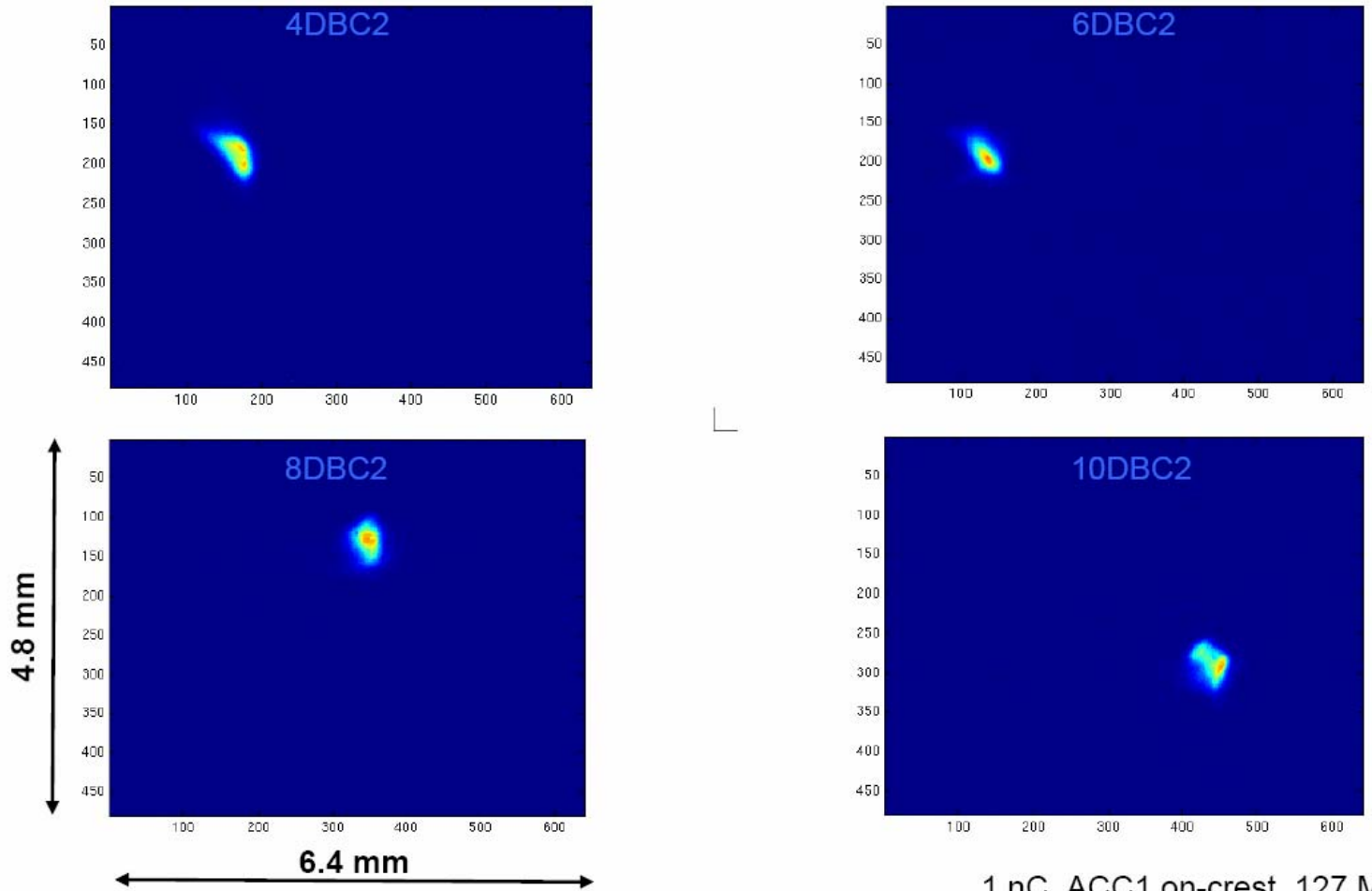





250 m

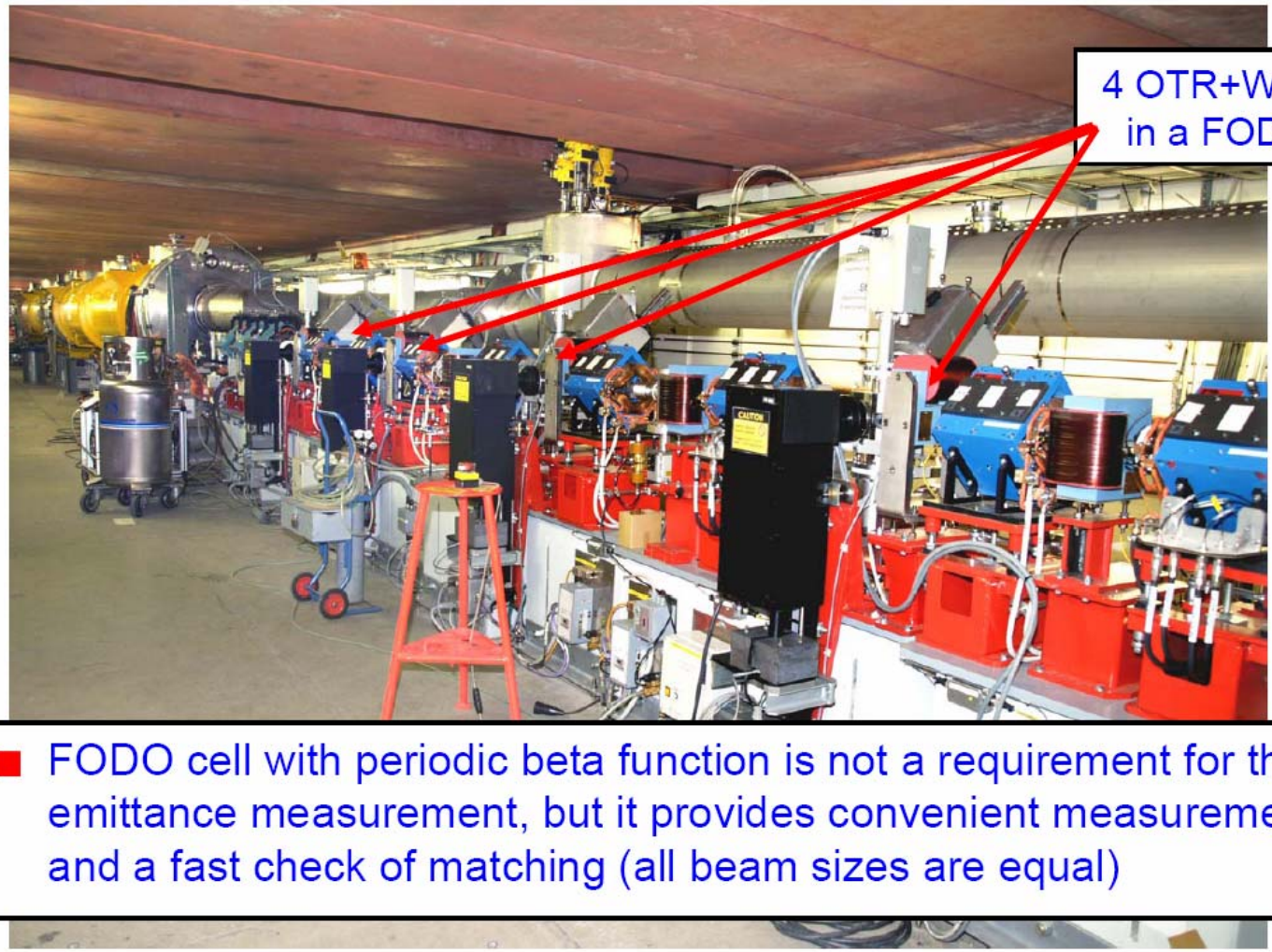
Example of beam images, ACC1 on-crest



1 nC, ACC1 on-crest, 127 MeV

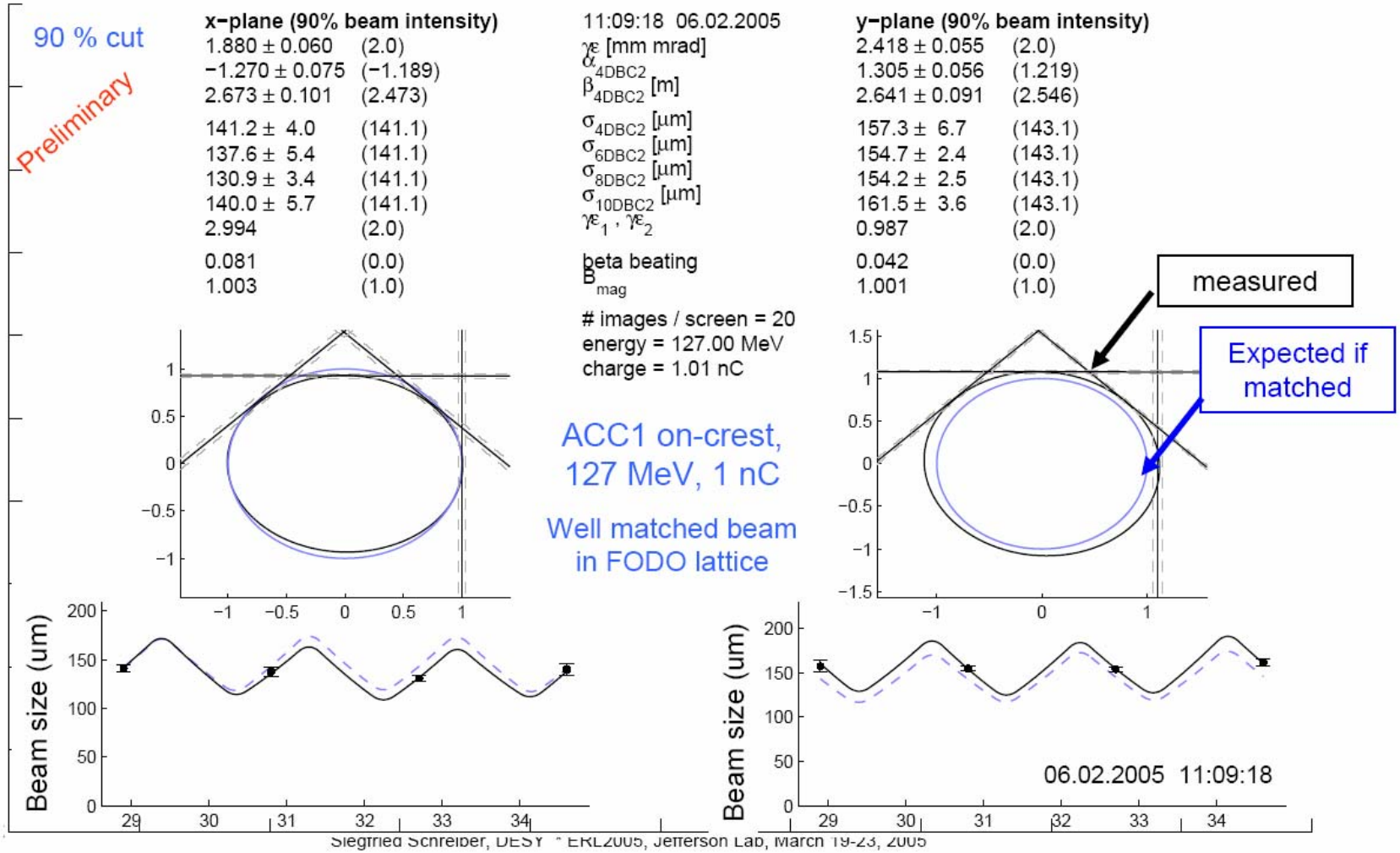
06.02.2005 11:09:18

Emittance Measurement Setup Injector



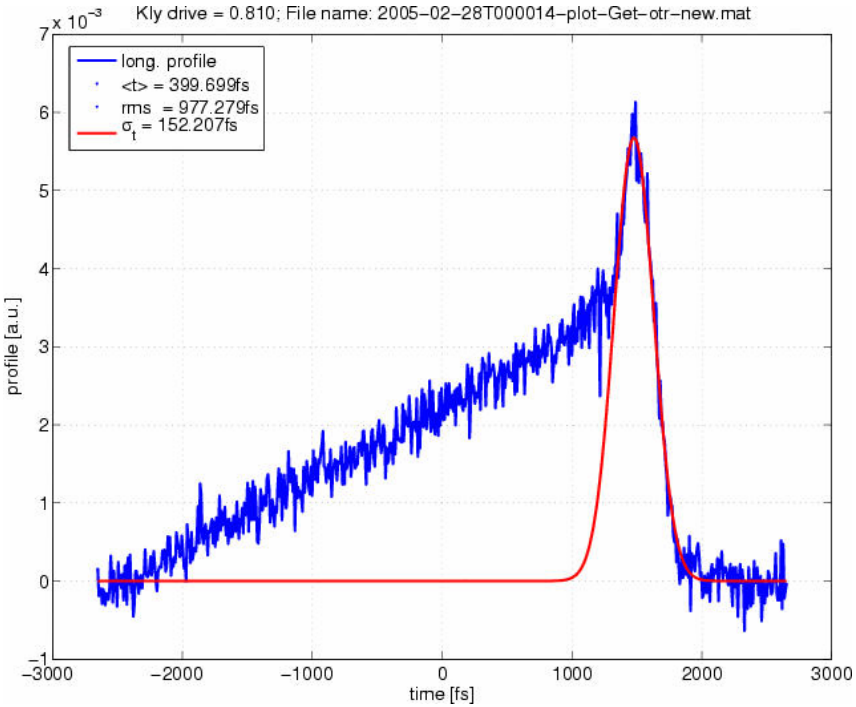
- FODO cell with periodic beta function is not a requirement for the emittance measurement, but it provides convenient measurements and a fast check of matching (all beam sizes are equal)

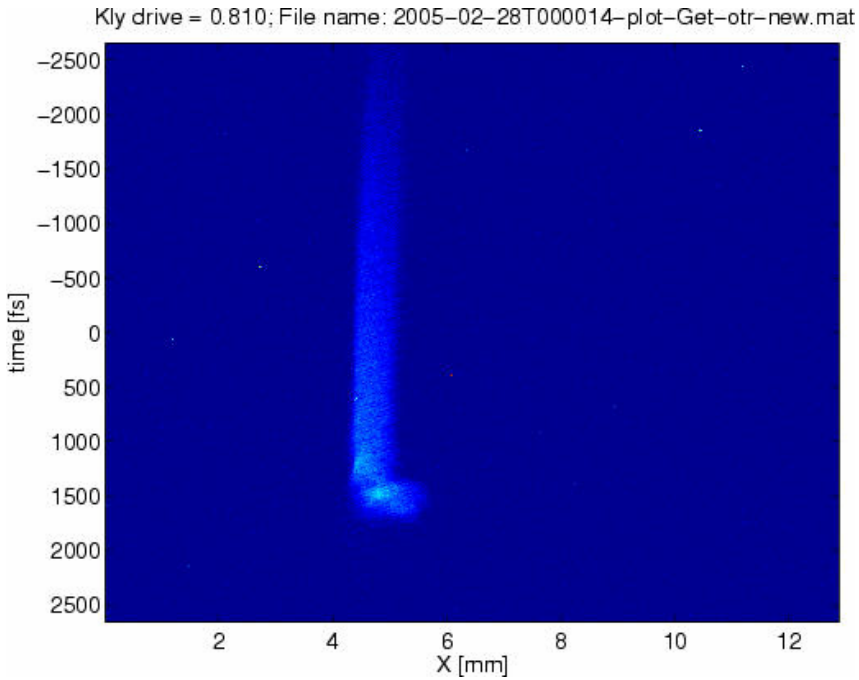
Example of emittance measurement



Optimum: 1.5 mrad mm (w/o compression, 1 nC) results in stable SASE operation

And the First LOLA Results





The LOLA Operation is going to be continued next week. SLAC colleagues will join the shift crew as well as DESY experts.

The excellent electron beam quality is also due to the fact that we have centered the beam inside the accelerator modules using HOM signals. Equipment from SLAC was exteremely useful!

Problem: Dose Rate and Orbit Inside the Undulator

Undulator dose:

The Dose Rate in the undulator section is due to the RF gun dark current!

- we have done beam based alignment of the injector area
- re-Alignment of the Gun Section allows the use of the gun collimator
- the BC2 energy collimator is in operation
- collimator downstream of ACC5 is used with a 4mm aperture
- 1 MHz-Kicker downstream of ACC1 installed (to be commissioned in April 05)
- cathode studies are under discussion (larger diameter (INFN Milano))

Orbit in undulator section:

Some hints to an additional dipole component

- we have checked dc and ac magnetic fields
- Strange behaviour of undulator quadrupoles at low current
- Is the ‚magnetische Rohrschelle' (magnetic pipe clip) responsible for the strange orbit?

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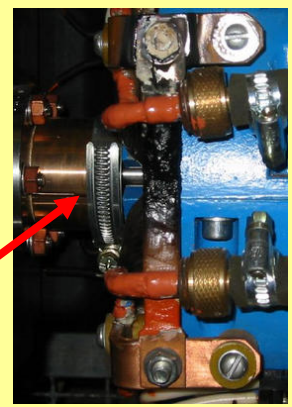

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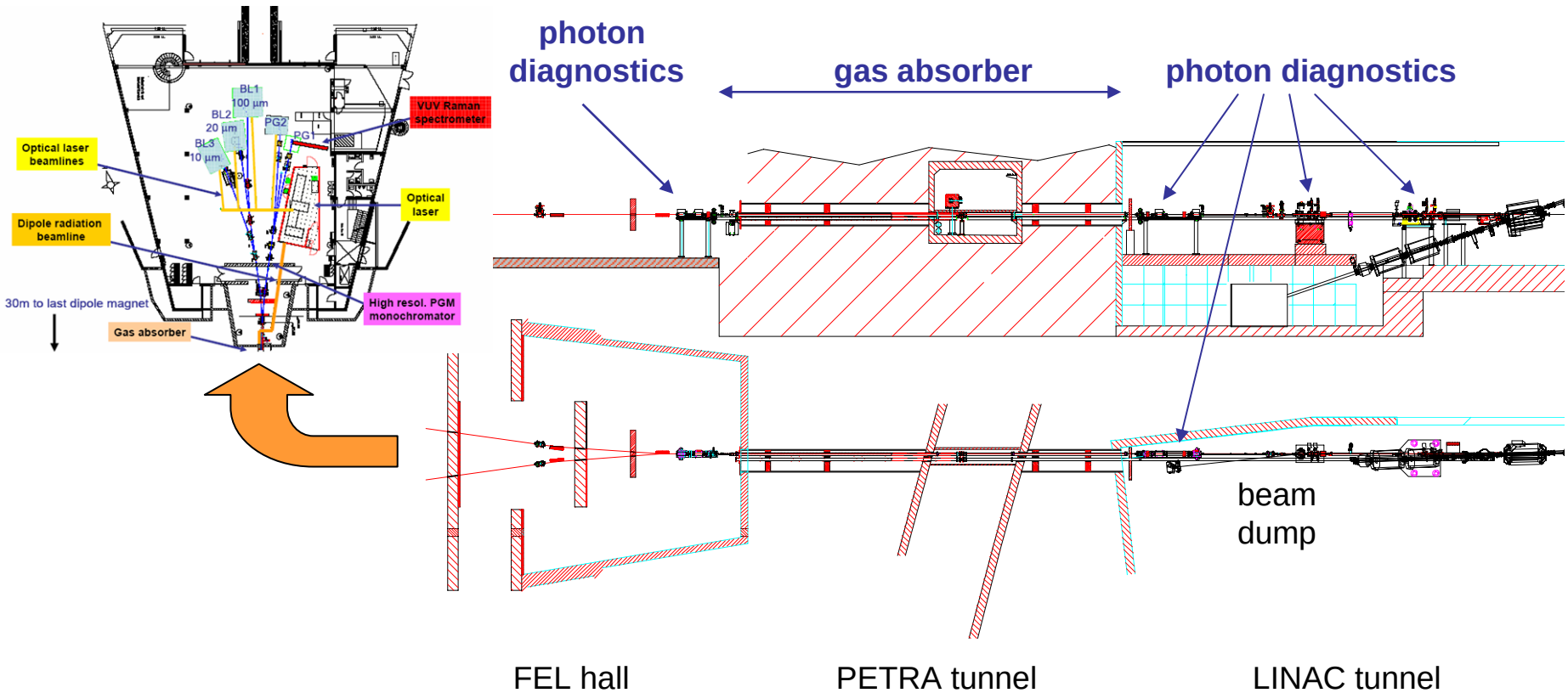
TTF2 / VUV-FEL Beam Commissioning

The photon beamlines are now connected to the VUV-FEL vacuum system. The personnel interlock system was modified. We have some delay in setting up the experimental beam lines. The goal is to avoid strong impact on the accelerator R&D program. At present, orbit studies in the undulator have highest priority.



TTF / VUV-FEL Schedule 2005 (Status 04.01.2005)

	week	dates		conferences
January	1	03.01. - 09.01.	VUV FEL commissioning, 30 nm, single bunch	
	2	10.01. - 16.01.		
	3	17.01. - 23.01.		
	4	24.01. - 30.01.		
February	5	31.01.- 06.02.	VUV FEL commissioning, 30 nm, single bunch	
	6	07.02. - 13.02.	continue and get saturation	
	7	14.02. - 20.02.		
	8	21.02. - 27.02.	FEL Studies, evtl. incl. reaching shortest wavelengths	
March	9	28.02. - 06.03.	Shutdown for installation of beamline components into the tunnel and interlock tests	
	10	07.03. - 13.03.	work on modulators?	
	11	14.03. - 20.03.		
	12	21.03. - 27.03.	FEL Studies, evtl. incl. reaching shortest wavelengths	
April	13	28.03. - 03.04.		
	14	04.04. - 10.04.	Commissioning of beamlines: 2 Shifts per day	
	15	11.04. - 17.04.	including first tests of diagnostics: HASYLAB	
	16	18.04. - 24.04.	II-02-048 FEL, M. Richter and II-02-037 FEL, M. Meyer	Zeuthen
	17	25.04. - 01.05.	3rd shift for FEL studies	
May	18	02.05. - 08.05.	FEL studies	
	19	09.05. - 15.05.	II-02-052 FEL, W. Wurth and II-02-048 FEL, M. Richter	
	20	16.05. - 22.05.	P. Zeitoun: I3-JRA2 and II-02-042 FEL	PAC 2005
	21	23.05. - 29.05.	LLRF studies at moderate gradients	
June	22	30.05. - 05.06.		
	23	06.06. - 12.06.	Maintenance incl. MBK + addl. Klystron/Modulator (Choroba)	DIPAC
	24	13.06. - 19.06.		
	25	20.06. - 26.06.	II-02-052 FEL, W. Wurth and II-02-050 FEL, A. Wolf	
	26	27.06. - 03.07.	II-02-037 FEL, M. Meyer and II-02-047 FEL, K.-H. Meiwes-Broer	Ferienzeit
July	27	04.07. - 10.07.	High gradient studies incl. Cryo and LLRF	Ferienzeit
	28	11.07. - 17.07.		Ferienzeit
	29	18.07. - 24.07.	Accelerator Studies (e.g. HOM studies cav. alignment)	Ferienzeit
	30	25.07. - 31.07.	FEL studies	Ferienzeit
August	31	01.08. - 07.08.	II-02-050 FEL, A. Wolf and II-02-051 FEL, U. Becker and II-02-052 FEL, T. Möller	Ferienzeit
	32	08.08. - 14.08.		Ferienzeit
	33	15.08. - 21.08.	II-02-049 FEL, R. Lee, R. Fedosejevs and II-02-039 FEL, J. Hajdu, H. Chapman and II-02-042	Snowmass
	34	22.08. - 28.08.	FEL, M. Drescher	FEL/Snowmass
September	35	29.08. - 04.09.	LLRF Studies	
	36	05.09. - 11.09.		
	37	12.09. - 18.09.	Maintenance e.g. modulators	
	38	19.09. - 25.09.		
	39	26.09. - 02.10.	Accelerator Studies (to be defined)	
October	40	03.10. - 09.10.	II-02-054 FEL, K. Starke and II-02-044 FEL, L. Kipp	
	41	10.10. - 16.10.	II-02-043 FEL, M. Kirm	
	42	17.10. - 23.10.	II-02-049 FEL, R. Lee, K. Sokolowski-Tinten and II-02-049 FEL, R. Lee, P. Zeitoun	
	43	24.10. - 30.10.	II-02-047 FEL, K.-H. Meiwes-Broer	
November	44	31.10. - 06.11.	LLRF (high gradients)	
	45	07.11. - 13.11.		
	46	14.11. - 20.11.	Accelerator studies (full beam loading)	
	47	21.11. - 27.11.	II-02-045 FEL, J.R. Crespo Lopez-Urrutia	
December	48	28.11. - 04.12.	II-02-046 FEL, J. Ullrich, Moshammer	
	49	05.12. - 11.12.	II-02-041 FEL, H. Zacharias	
	50	12.12. - 18.12.		
	51	19.12. - 25.12.	Accelerator studies (full beam loading)	
	52	26.12. - 01.01.	Maintenance	

FEL studies	13 weeks
User operation	19 weeks
accelerator studies	12 weeks
maintenance	8 weeks + 44 days

normal weeks might not include the maintenance day (Tuesday), i.e. each week has 18 shifts only

adjust schedule???

ICFA WS Zeuthen	16.04. - 22.04.
PAC	16.05. - 20.05.
DIPAC 2005	06.06. - 08.06.
Snowmass	14.08. - 27.08.
FEL Conference	21.08. - 26.08.
Schulferien HH	30.06. - 10.08.
Schulferien SH	27.06. - 06.08.
Schulferien NS	14.07. - 24.08.

We started with very successfull weeks and are looking forward to offering beam to users but also to ourselves.