17TH ADVANCED BEAM DYNAMICS WORKSHOP ON
FUTURE LIGHT SOURCES

The BESSY II Double Undulator UE-56

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APRIL 6-9, 1999
ARGONNE NATIONAL LABORATORY, ARGONNE, IL U.S.A.

The BESSY II Double Undulator UE-56

- **magnetic structure: APPLE II**

- **period length: 56mm**

- **periods: 2 x 30**

- **minimum magnetic gap: 16mm**

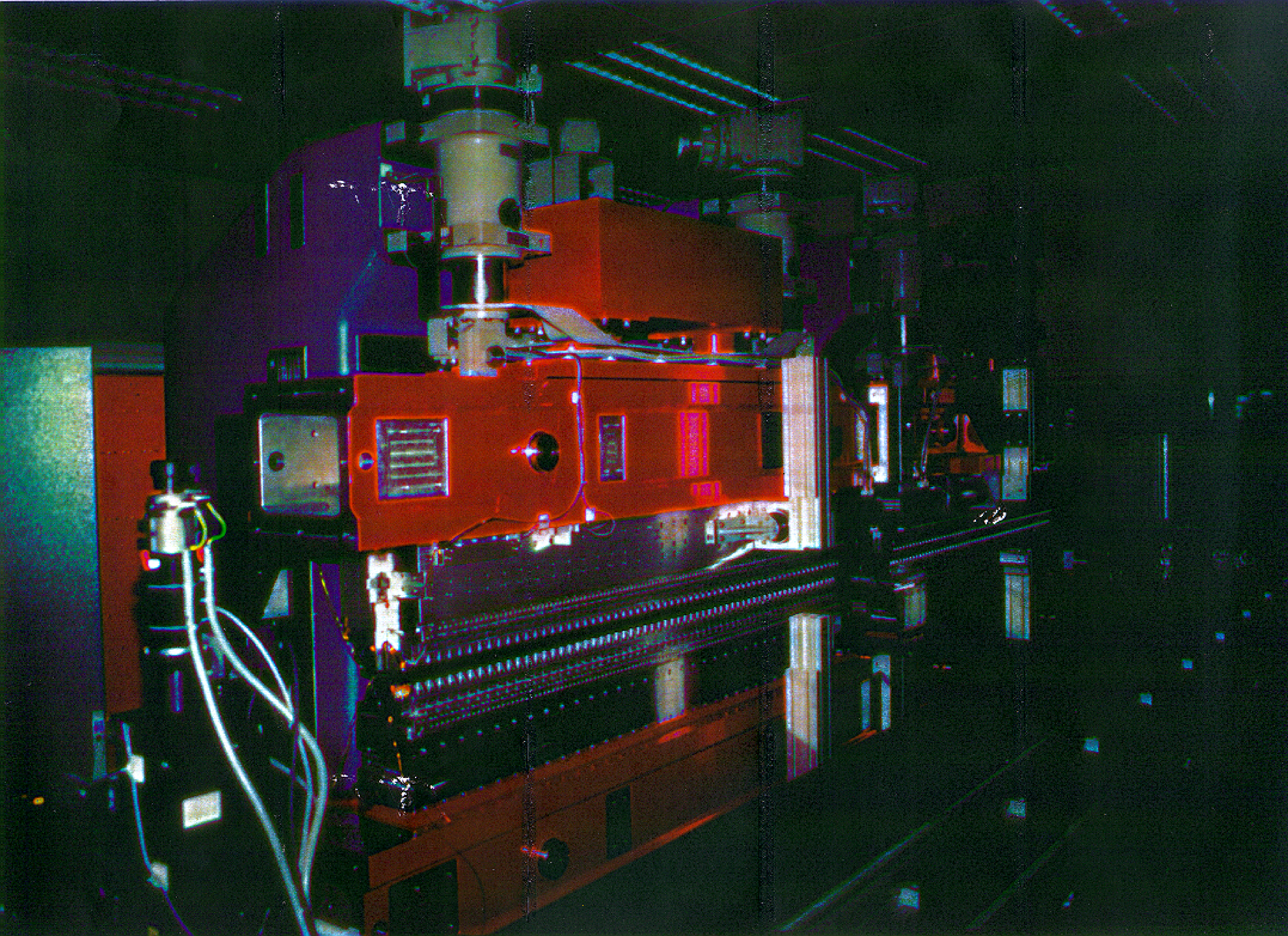
- **magnetic field at minimum gap: vertical: 0.77 Tesla**
  horizontal: 0.53 Tesla

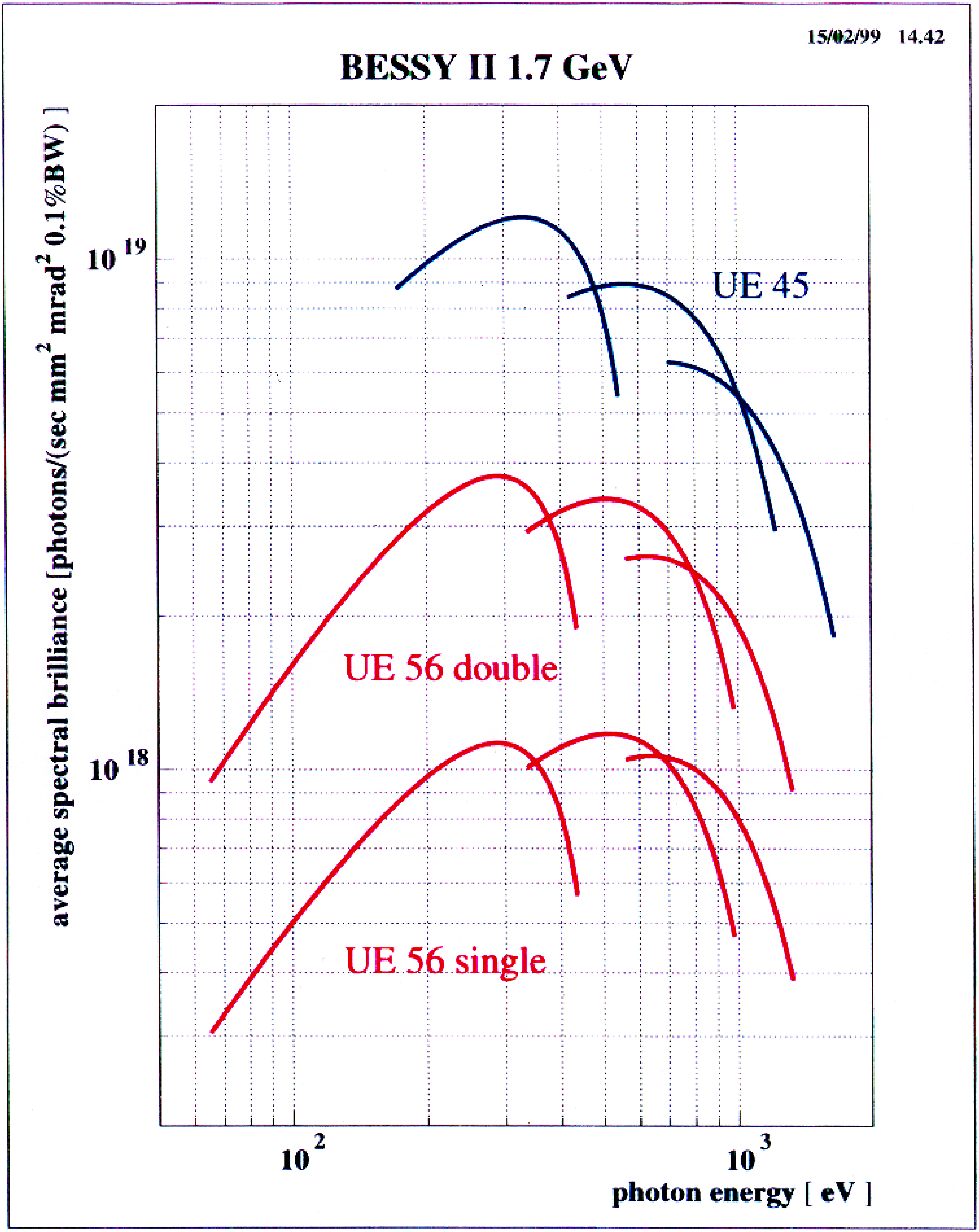
- **multipole shimming (compensation of block inhomogenities):**
  integrated fields (horizontal and vertical) within +- 1.5 Gm

- **no phase shimming, phase errors:**

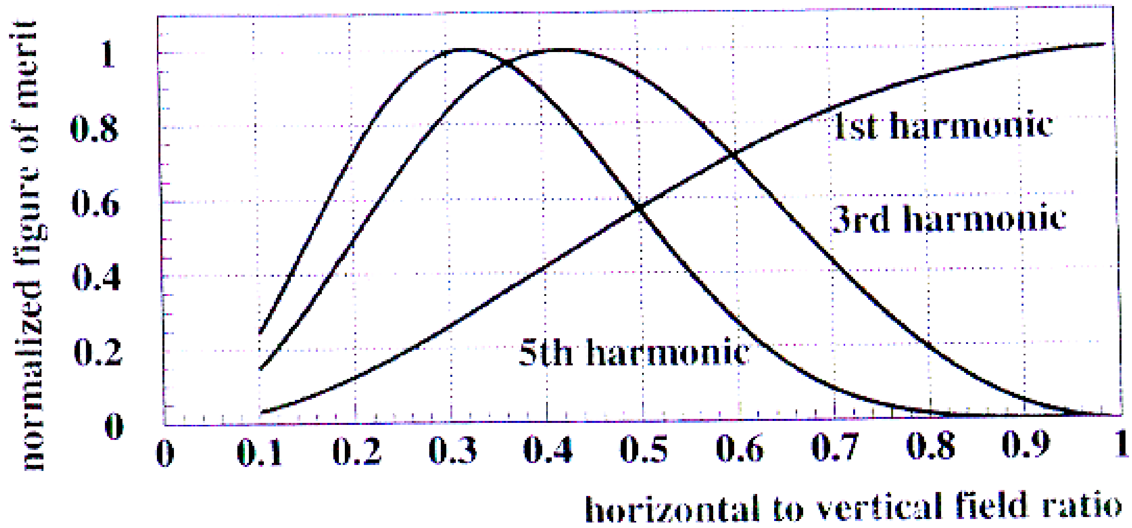
gap	UE-56 downstream undulator		UE-56 upstream undulator	
mm	$phase = 0$	$phase = \pi$	$phase = 0$	$phase = \pi$
16.0	3.4	5.0	5.8	5.8
17.5	3.2	4.8	5.7	5.4
20.0	3.1	4.4	5.8	5.1
30.0	2.7	2.6	4.6	2.4
45.0	1.4	0.7	2.6	0.6

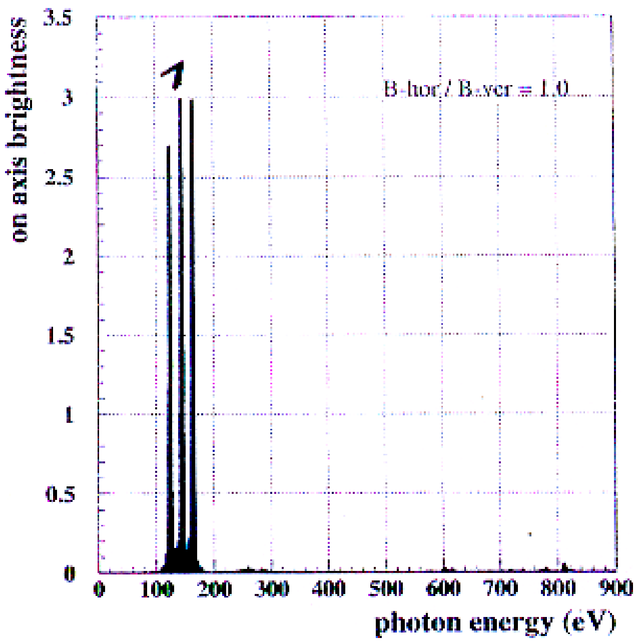
- **rotatable permanent magnets at both ends of each individual undulator for two modes of operation:**
  i) chicane geometry for spatial seperation of both light cones (chopper inside monochromator)
  ii) constructive interference of both light cones (rotatable magnets between undulators used as modulator)

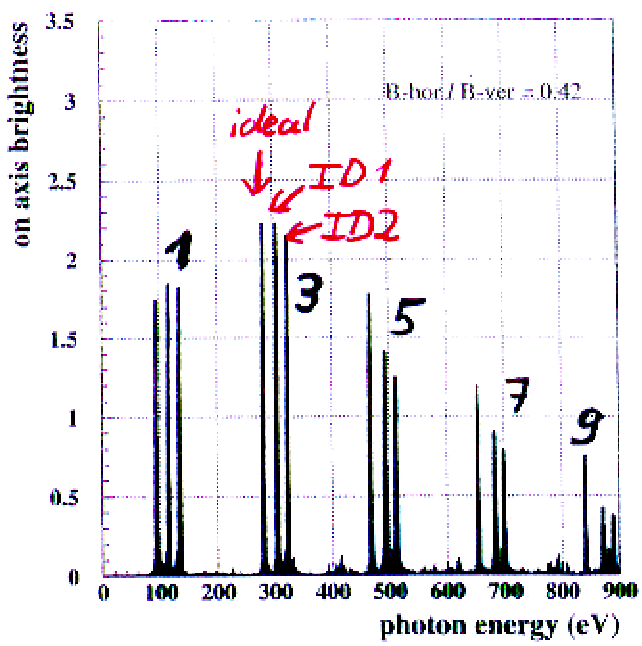


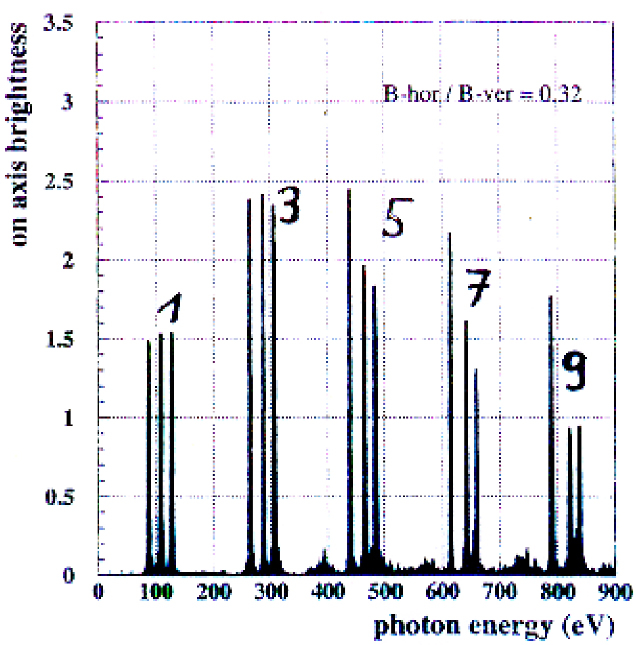

15/02/99 14.42
BESSY II 1.7 GeV
average spectral briliance [photons/(sec mm2 mrad2 0.1%BW)]
10 19
10 18
UE 45
UE 56 double
UE 56 single
10 2
10 3
photon energy [eV]

UE-56 working points for higher harmonics





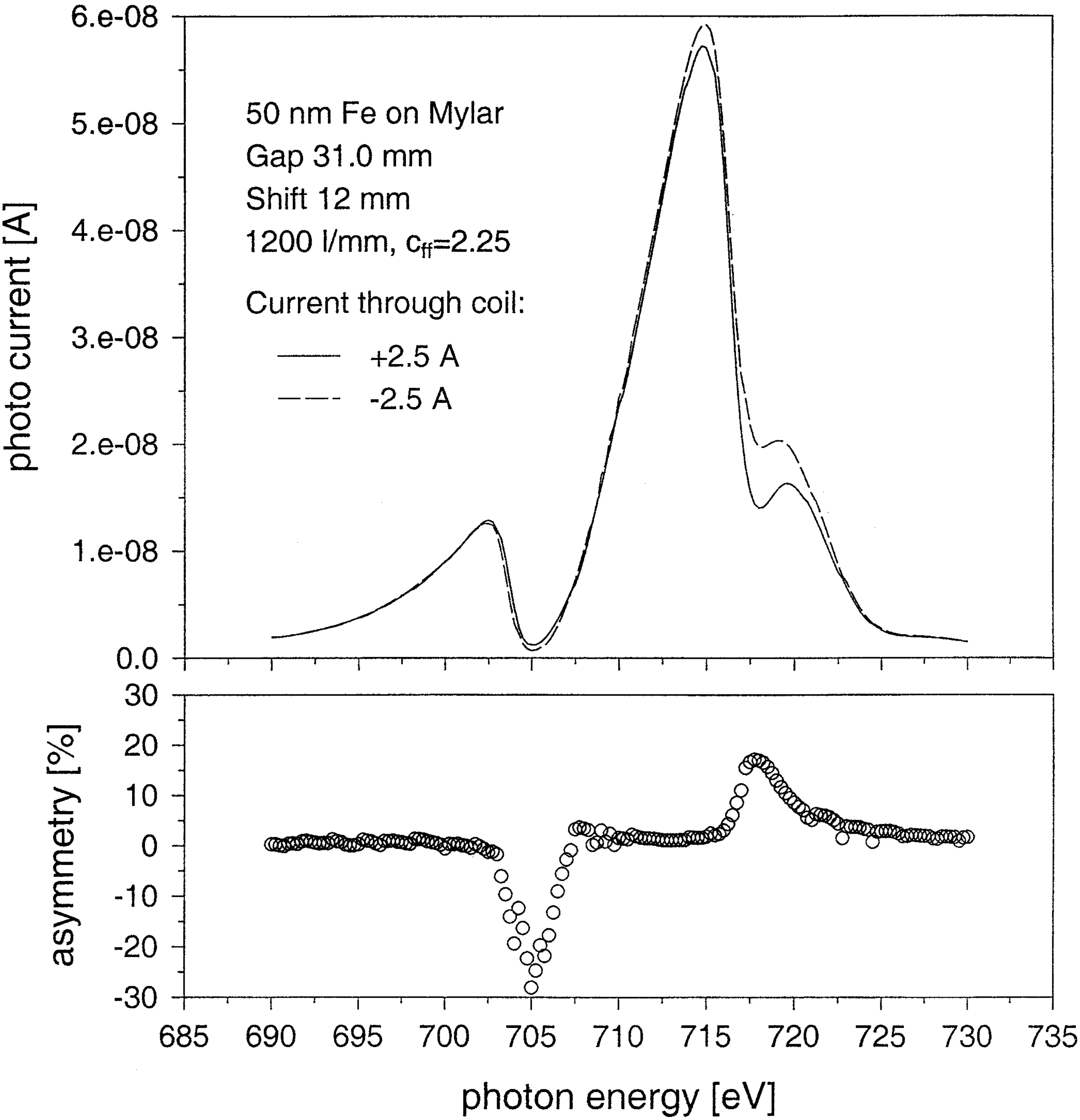




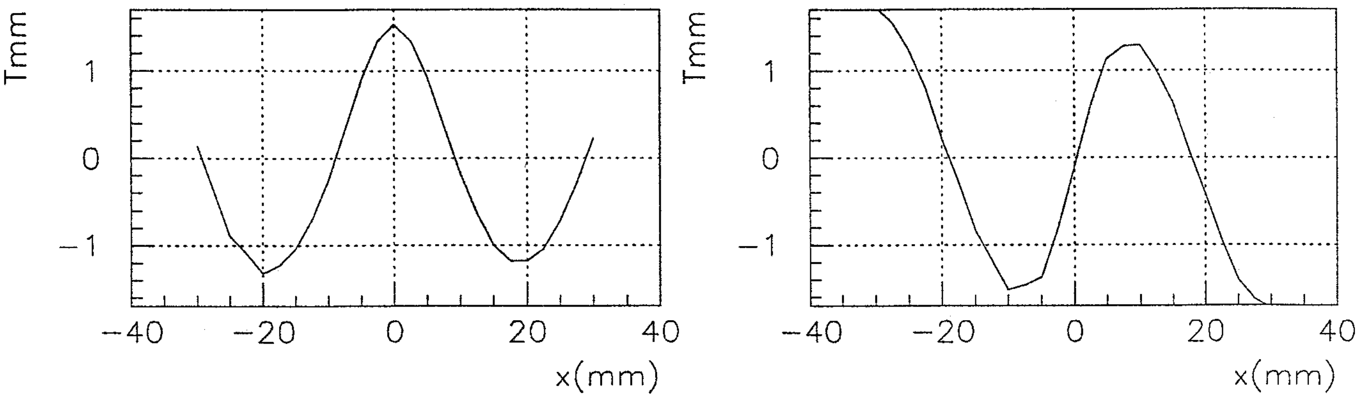
Spectra of ID1 and ID2 shifted by 20/40 eV with respect to ideal spectrum.

Calculations based on magnetic field measuremen

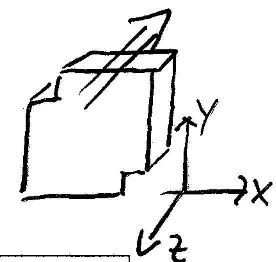
First circularly polarized light at BESSY II
UE56/1, 31.3.1999

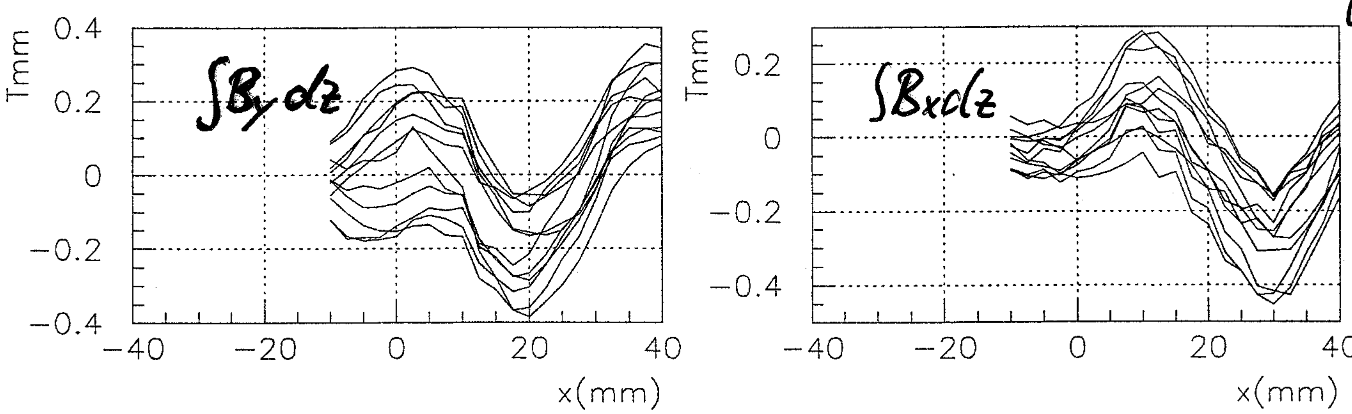


Integrated fields of a single I-beam (30 periods)

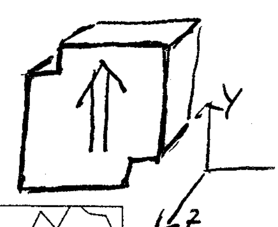


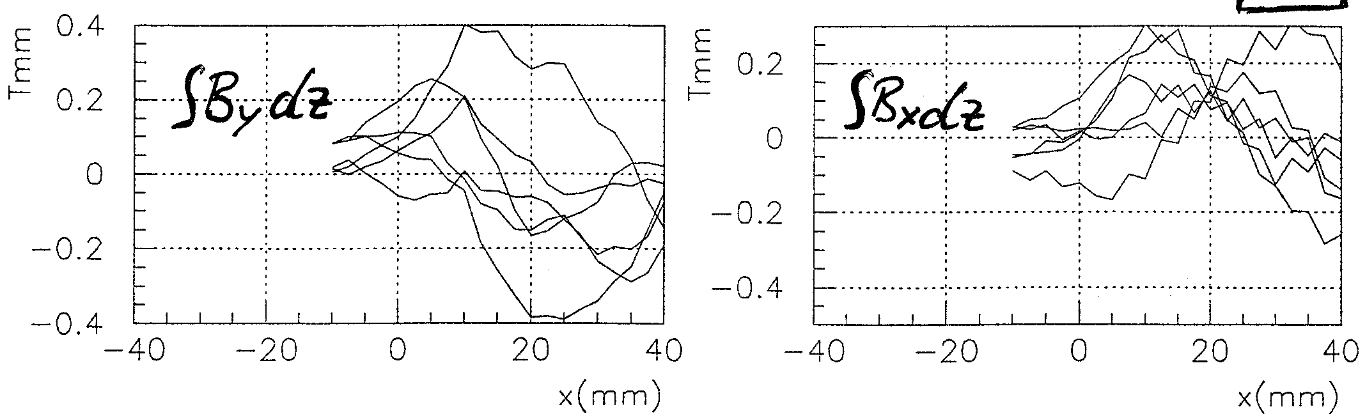
Integrated fields of 3 samples (10 blocks each) of type A magnets measured in four different block orientations





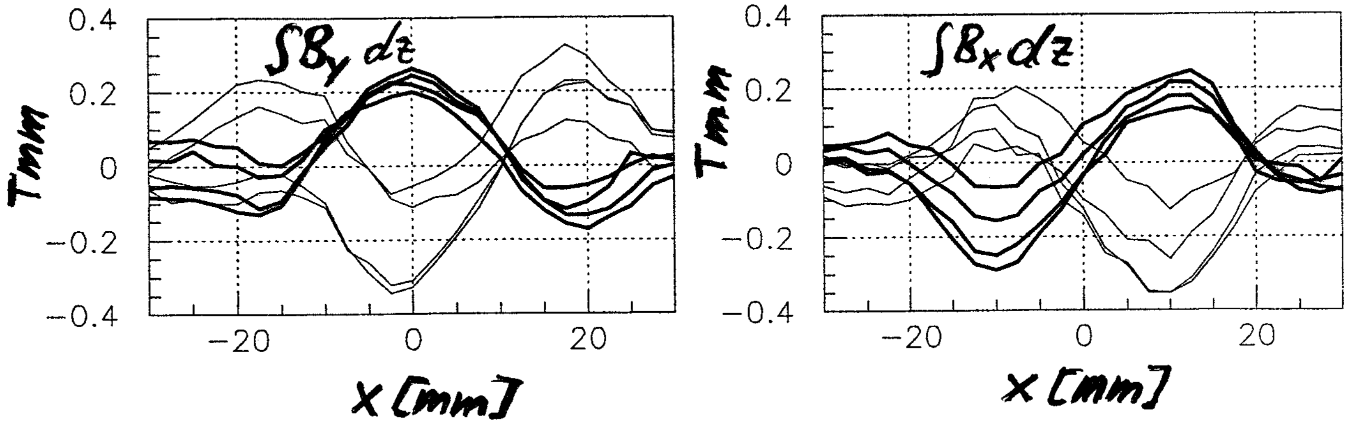
Integrated fields of 3 samples (10 blocks each) of type B magnets measured in two different block orientations



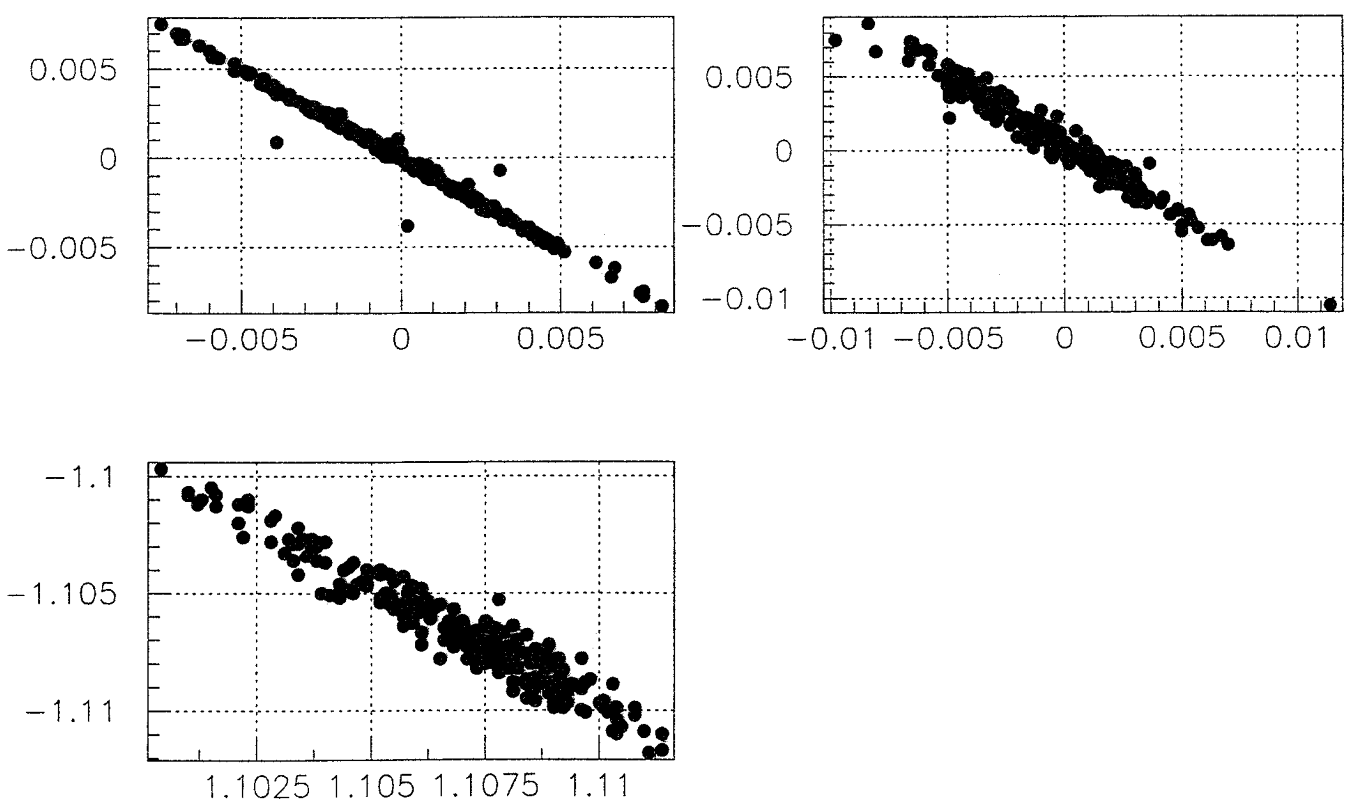


⇒ **Integrated field errors of complete I beam are due to systematic inhomogenities of type A magnets**

Integrated fields of 1 sample (10 blocks) of type A magnets measured in four different block orientations before and after remagnetization



Correlation between dipole components of 200 magnets before and after remagnetization



⇒ **Presorting of die pressed magnets possible if magnet orientation inside die is marked and blocks are magnetized accordingly**

UE-56 Side View of Magnetic Structure

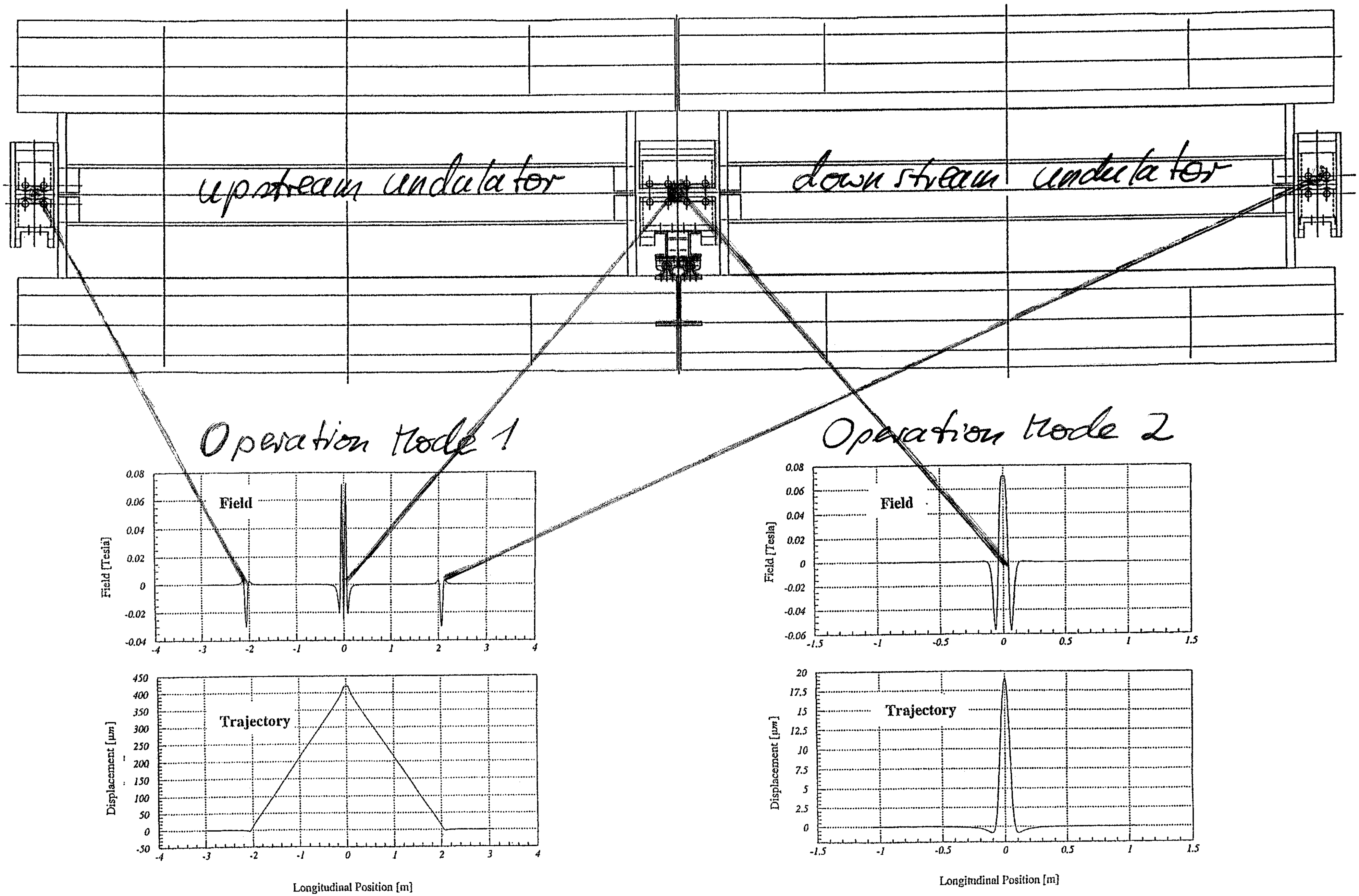
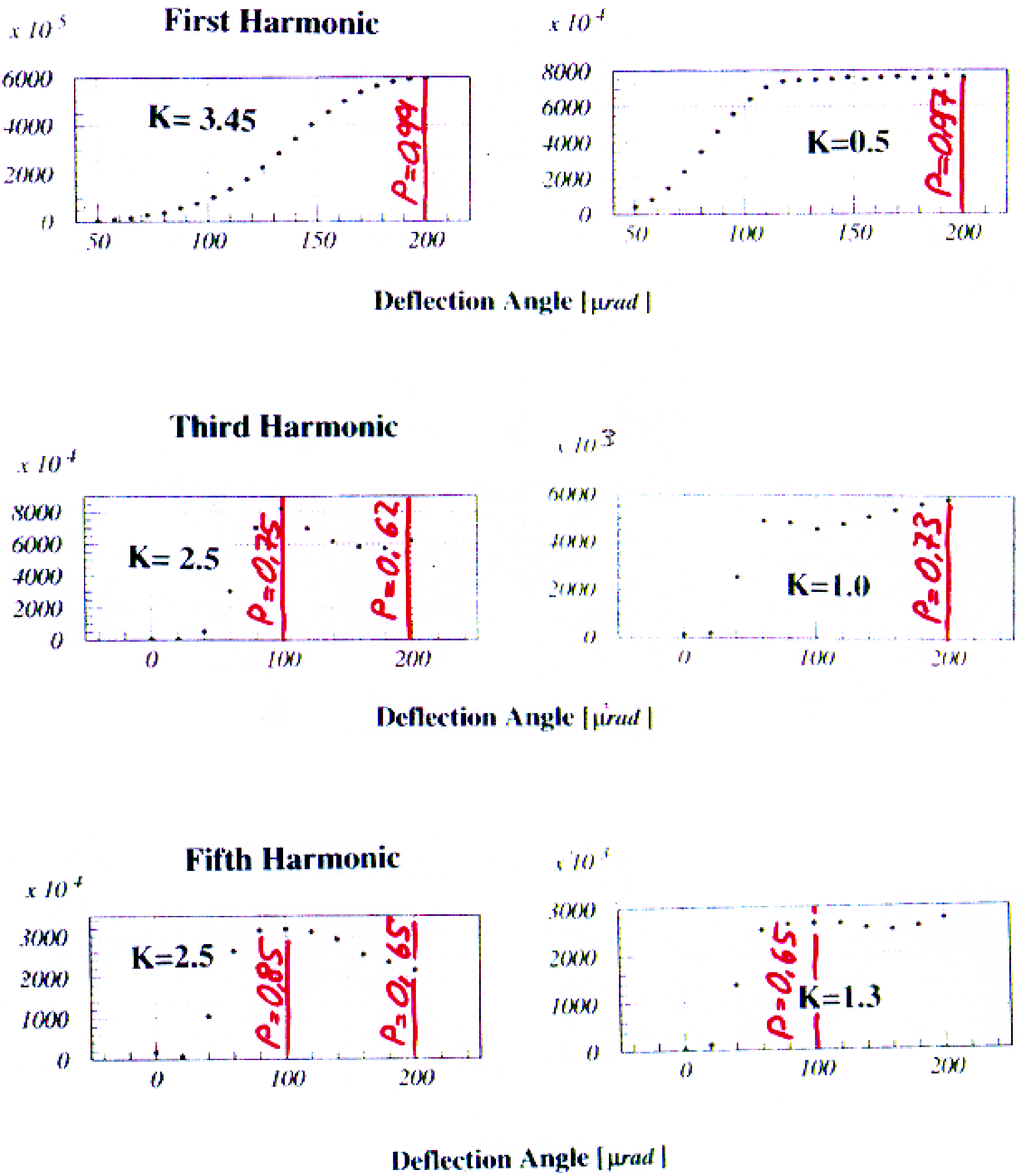


Figure of Merit (I*P**2)
Versus Chicane Deflection Angle

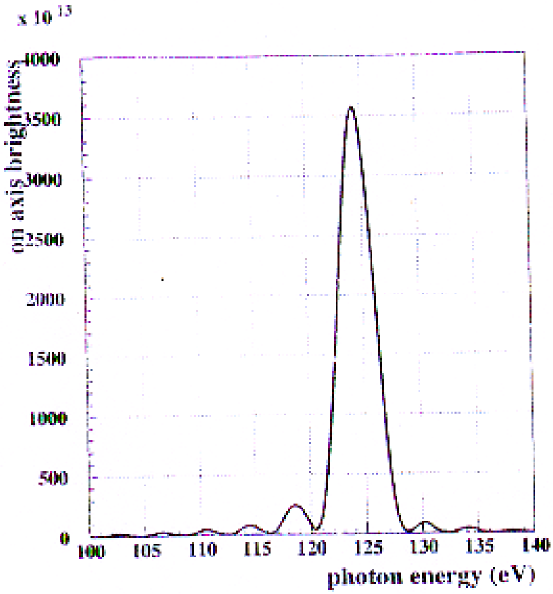


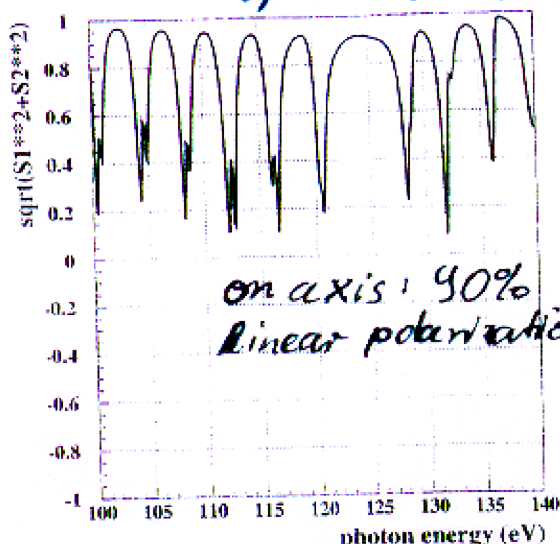
Calculations done by M. Scheer, program WAVE, beam emittance and energy spread included

UE56 in "crossed undulator" mode

(1% coupling)

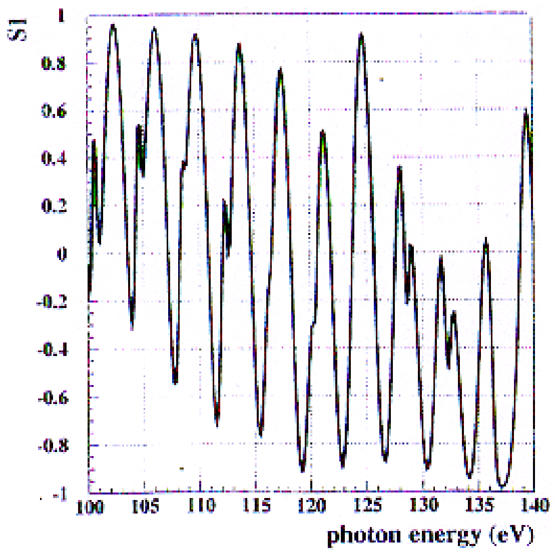
not designed for the operation mode

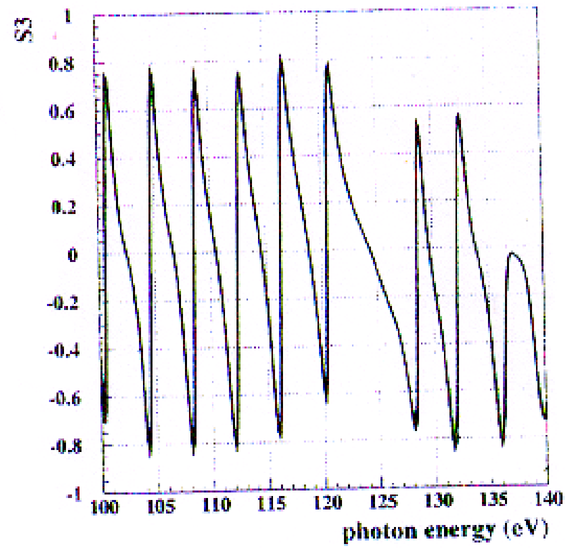


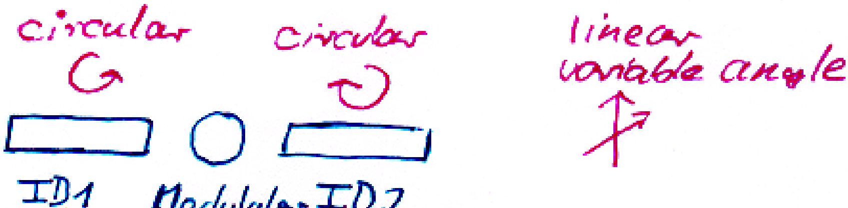


on axis: 90%
linear polarization

degree of polarization (linear)
in pinhole: 80% : 70x70μm
50% : 140x140μm







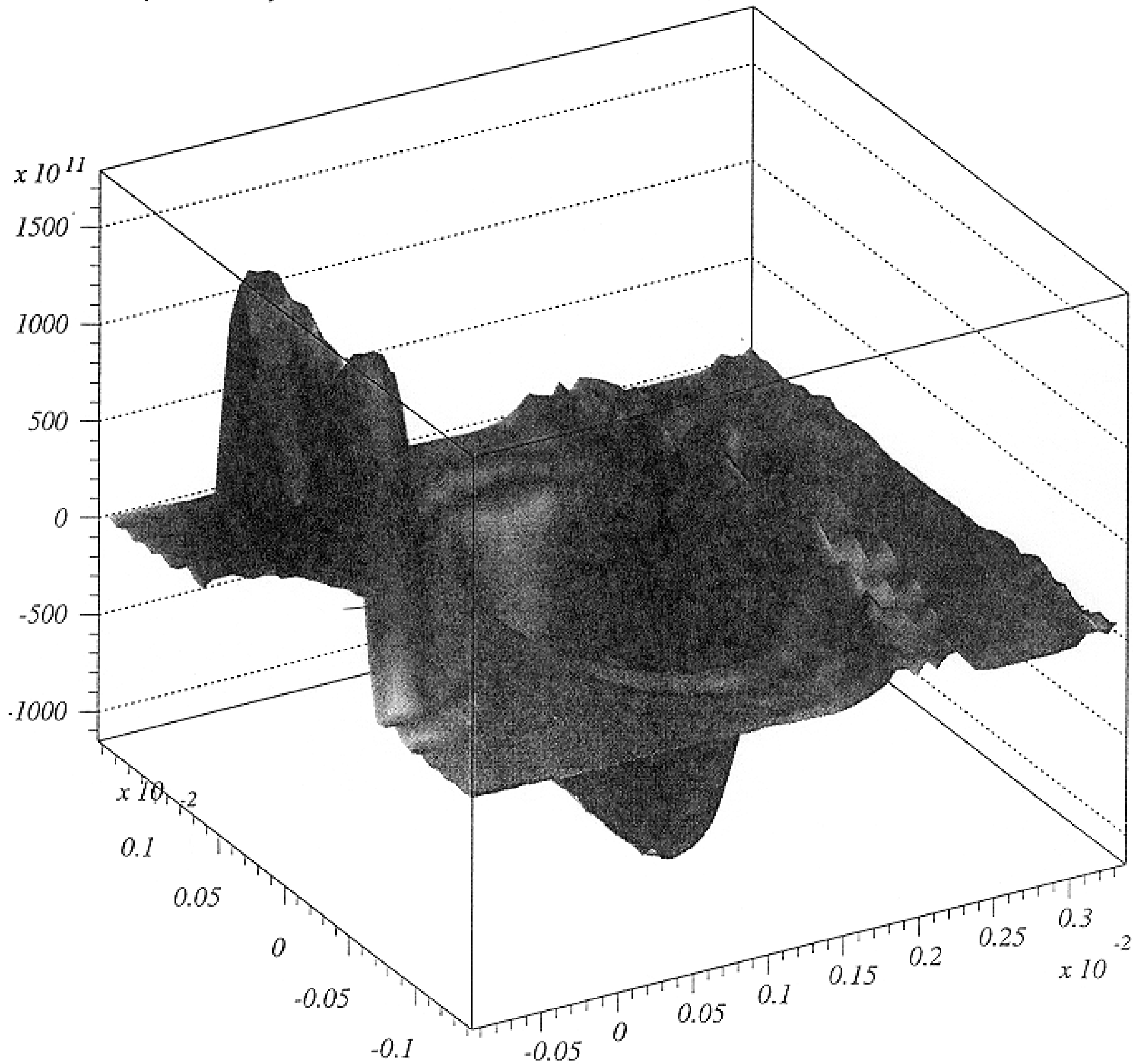
⇒ fast ~~switching~~ rotation of polarization vector

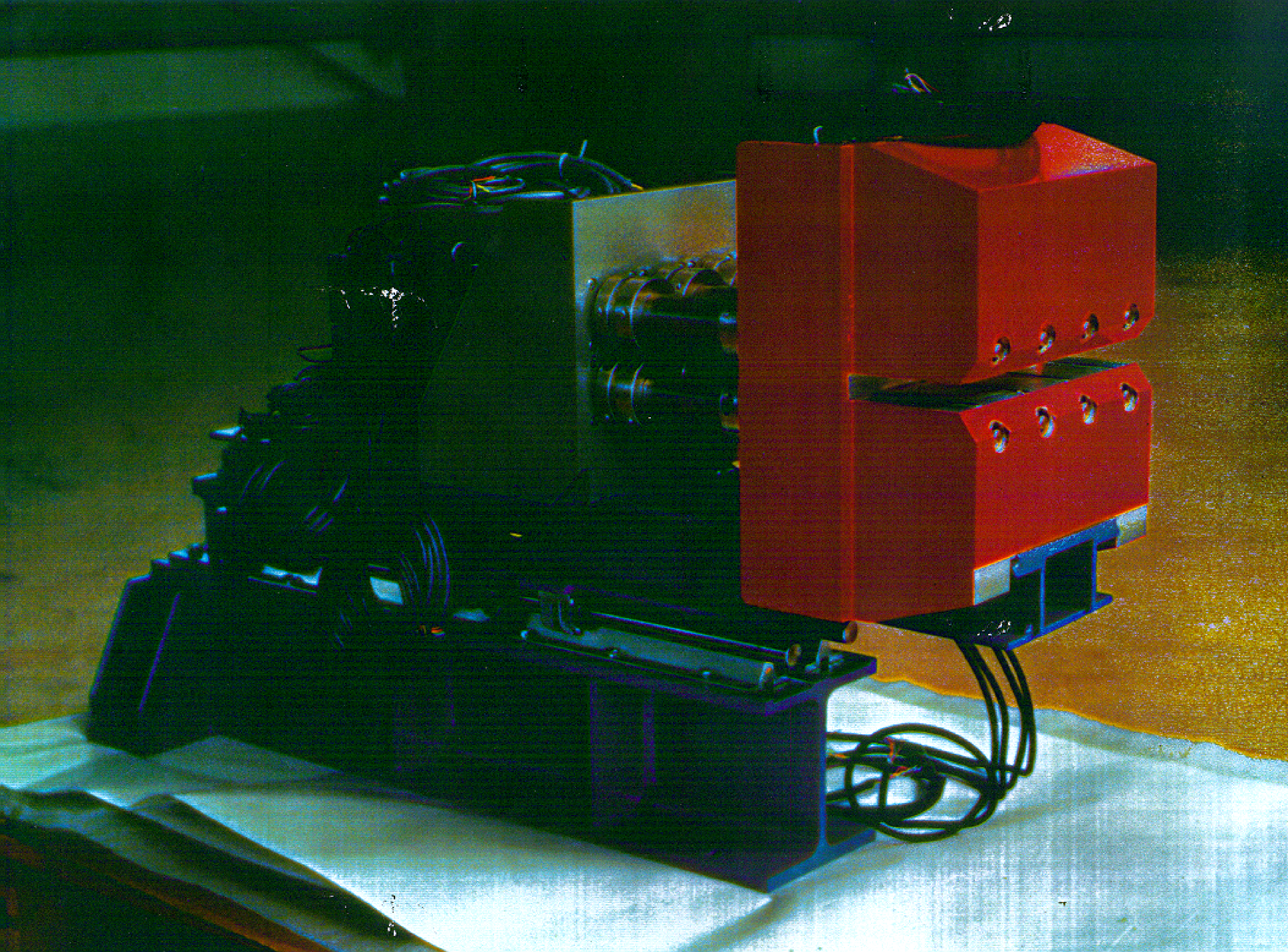
⇒ low contamination from higher harmonics

01/10/97 09.49

JOB 1730;K=2.5, 3. harm, opt chic, 352.7245 - 360.3924 eV, 100murad

S3*(IENE.EQ.9)

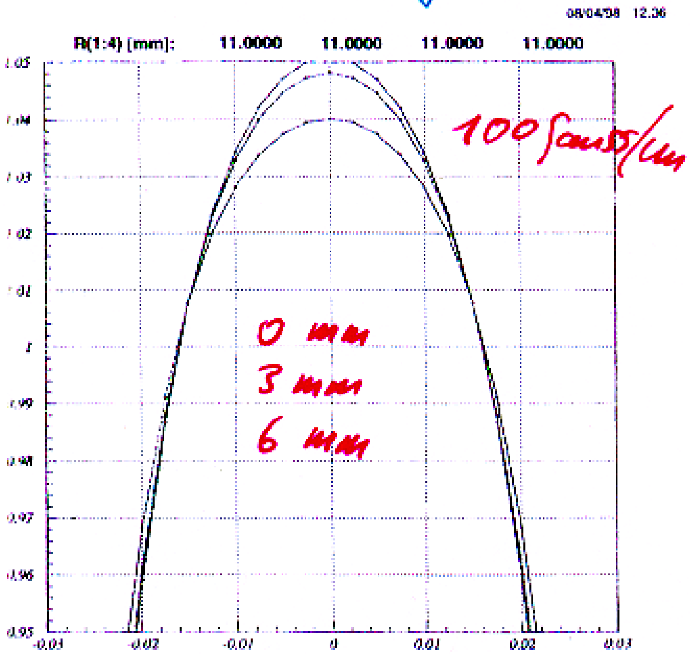




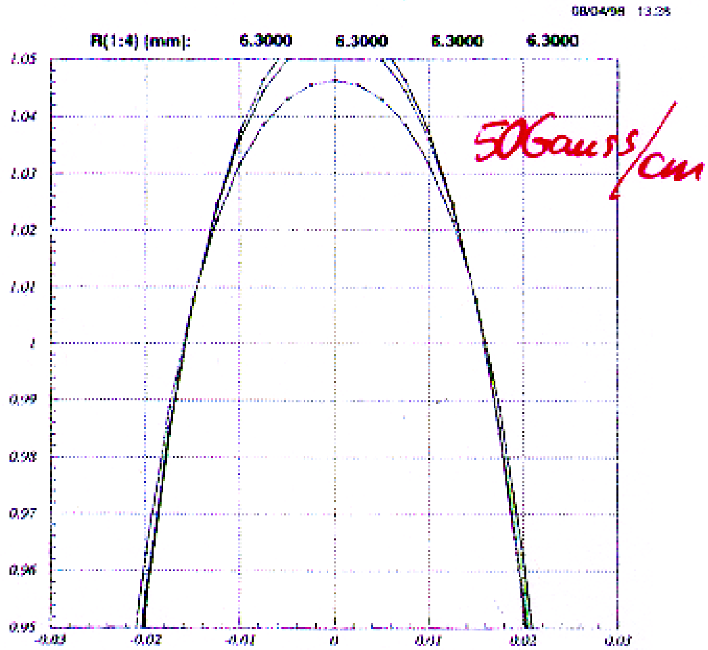
Transverse Distribution of Integrated Fields

Modulator Magnets

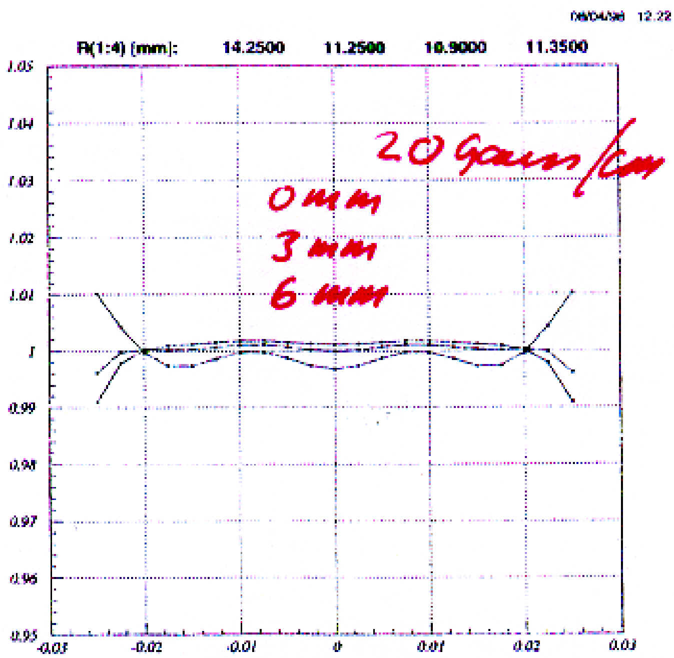
Chicane Magnets



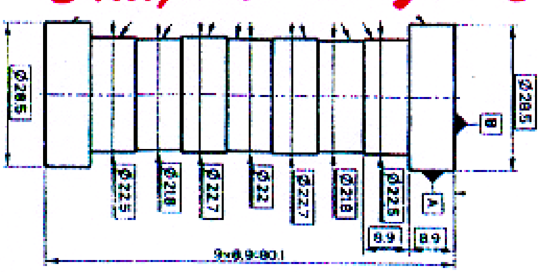
straight columns

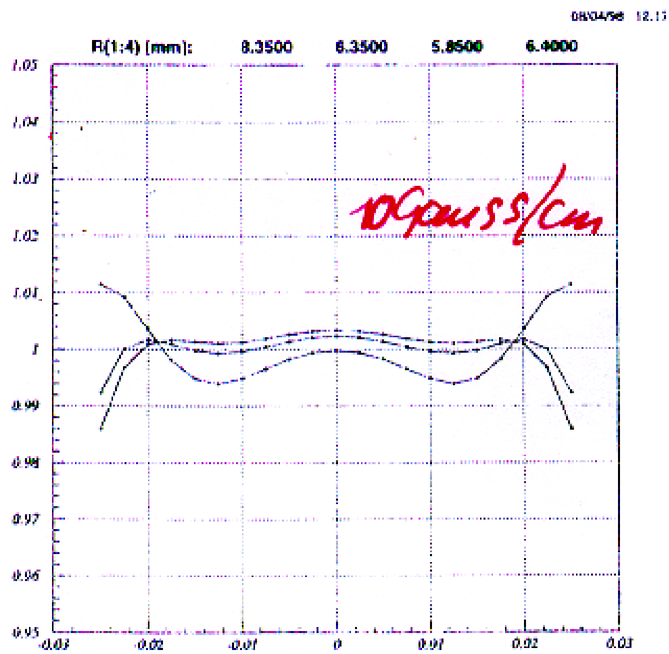


straight columns



shaped magnets





shaped magnets