Sector7/MHATT-CAT Overview

Eric Dufresne, Sector manager.

TR Group meeting, Sept. 30, 2003

- MHATT-CAT membership: University of Michigan, Howard University, Lucent Technologies-Bell Labs, and the APS XFD.
- Operated by the APS, the University of Michigan and Howard University.
- User base: member institutions (50%) and APS General Users (50%). II/GU on 7ID since 10/2002.

Current sector workforce.

Roy Clarke (Univ. of Michigan): Director

Jin Wang: TR group leader

Eric Dufresne: Sector manager

Dohn Arms: Beamline scientist. (7ID-B, D)

Bernhard Adams: Beamline scientist.

Eric Landahl: Beamline Scientist (7ID-D)

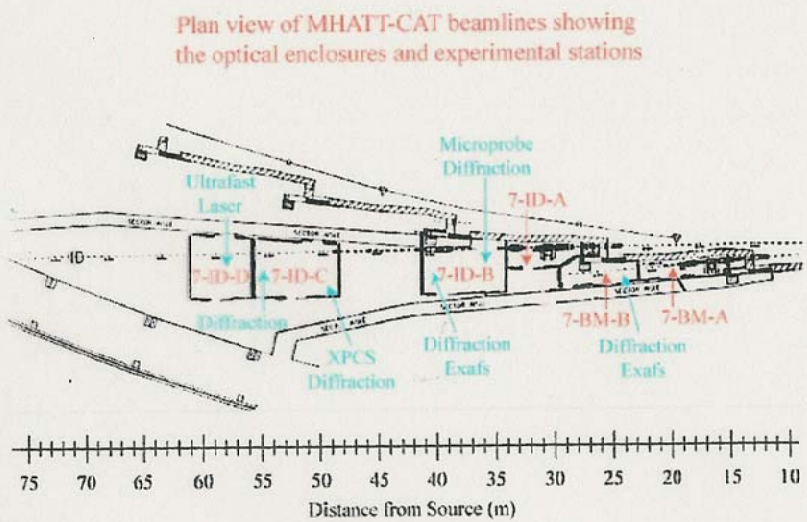
Don Walko: Beamline Scientist (7ID-C)

No technicians, no engineers, …

Scientific focus, possible techniques

- Time-resolved X-ray diffraction and spectroscopy following an Ultrafast fs-laser excitation(7ID-D).
- Coherent Bragg-Rod Analysis, surface and interface diffraction (7ID-C Kappa, 7BM-B)
- Microdiffraction (7ID-B, C) and microfluorescence (BM-B).
- Coherent diffraction experiments.

MHATT-CAT Beamline capabilities

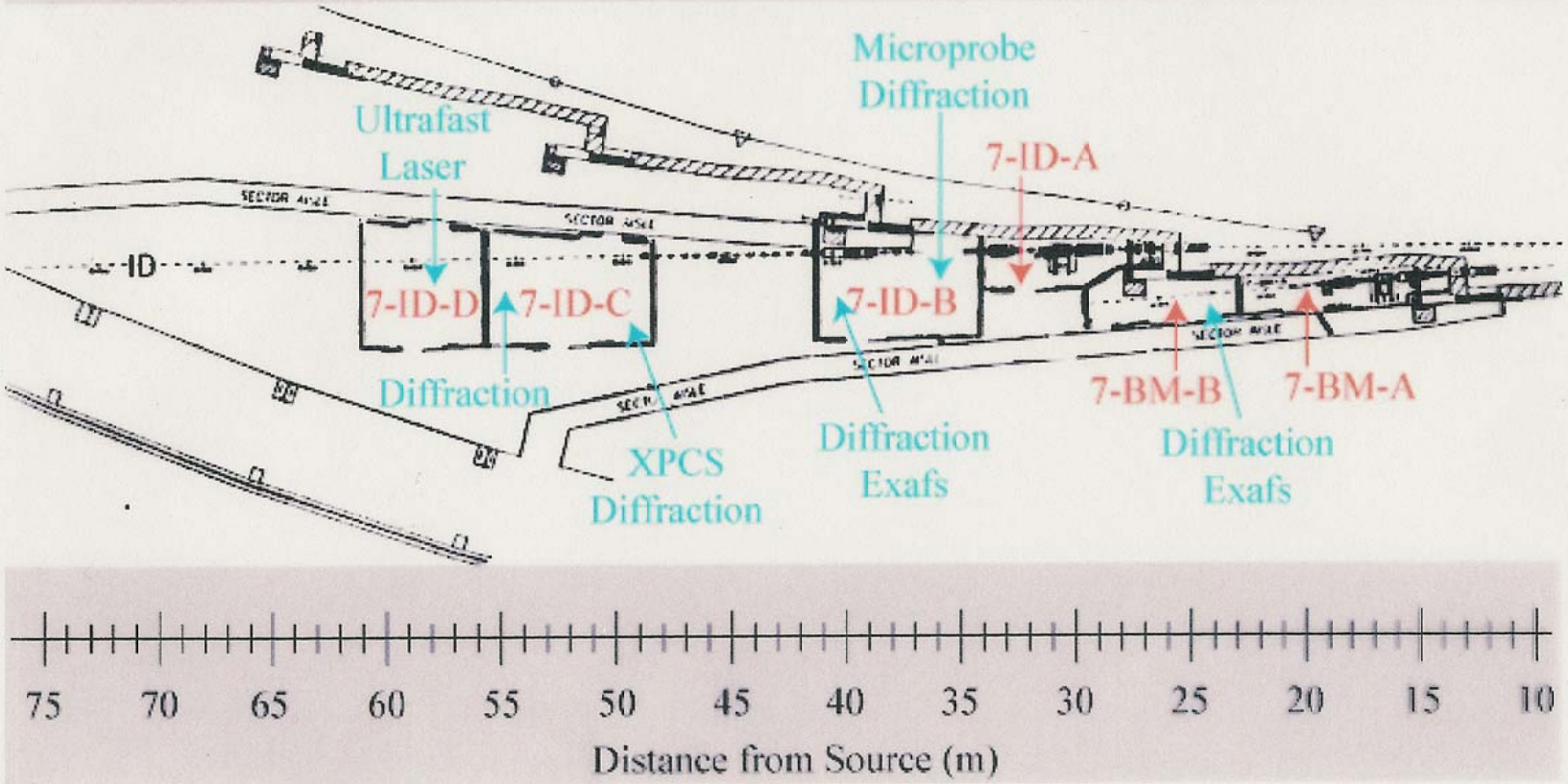


- On 7ID, 3 experimental hutches with white, pink, and monochromatic beam fully operational.
- 7BM, 2 white beam hutches. Commissioning ongoing.

5

sector7_floorplan.gif (717x459x256 gif)

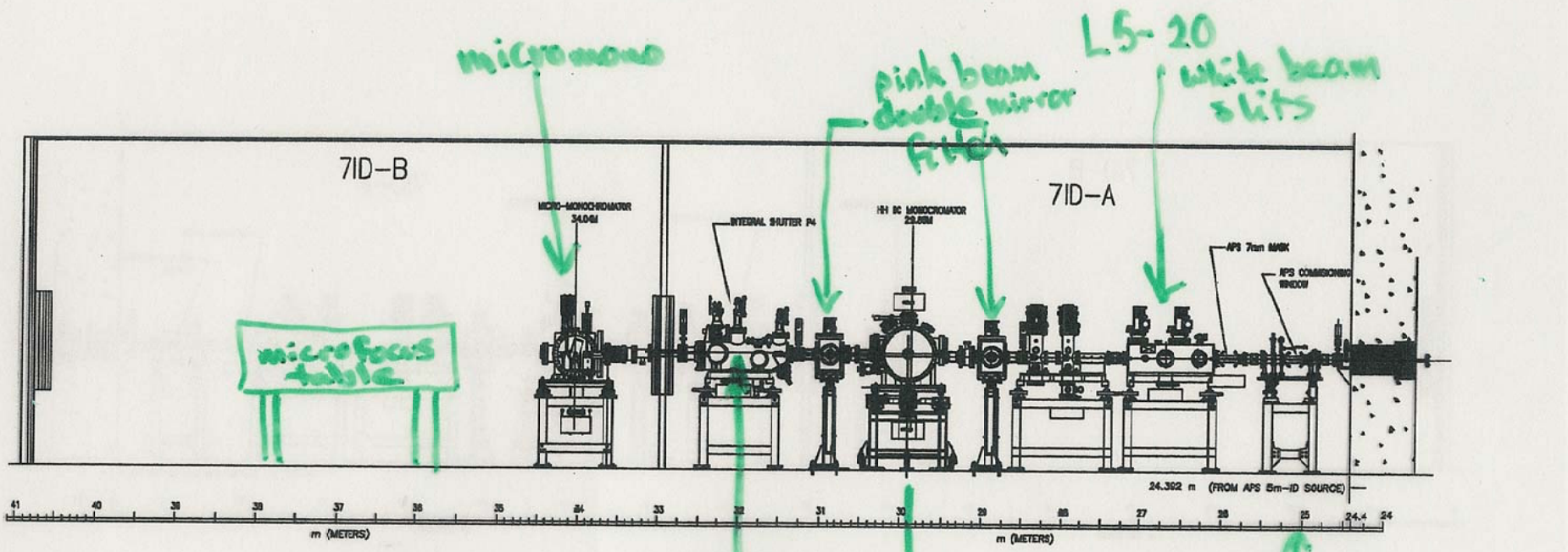
Plan view of MHATT-CAT beamlines showing the optical enclosures and experimental stations

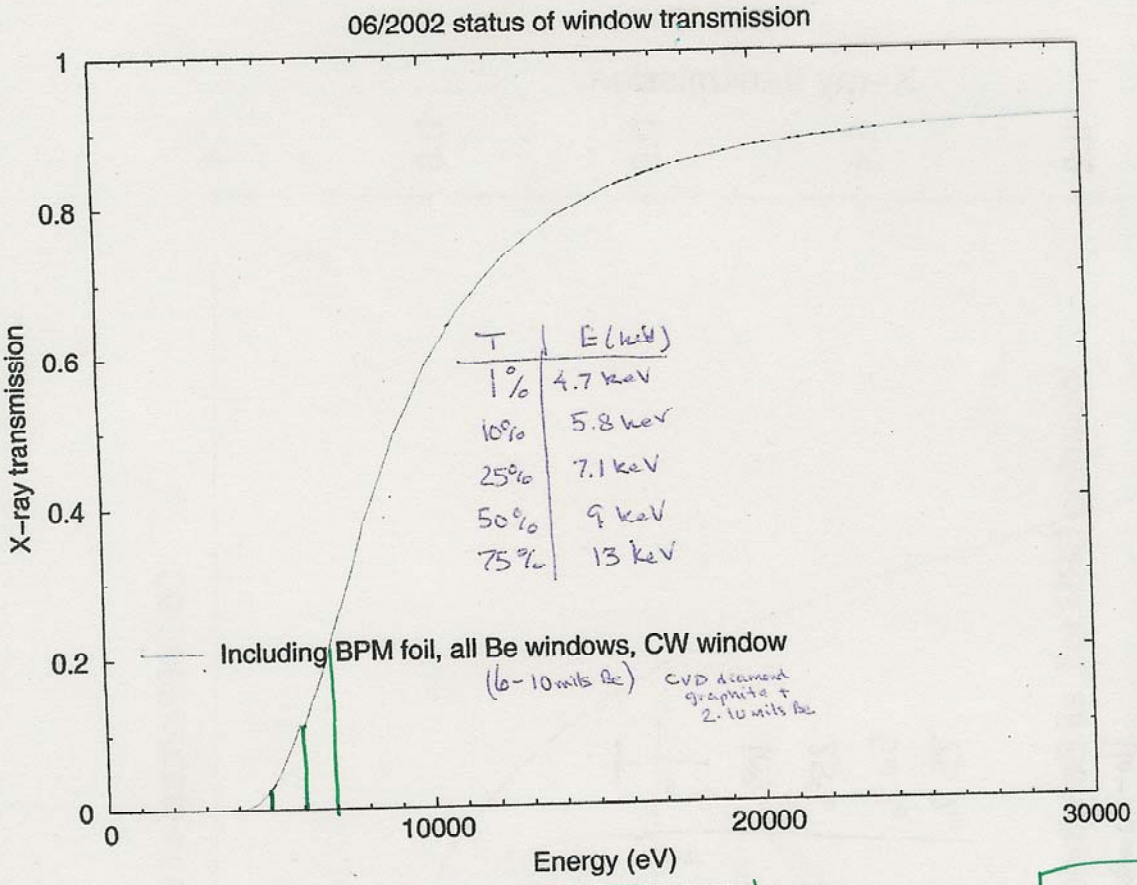


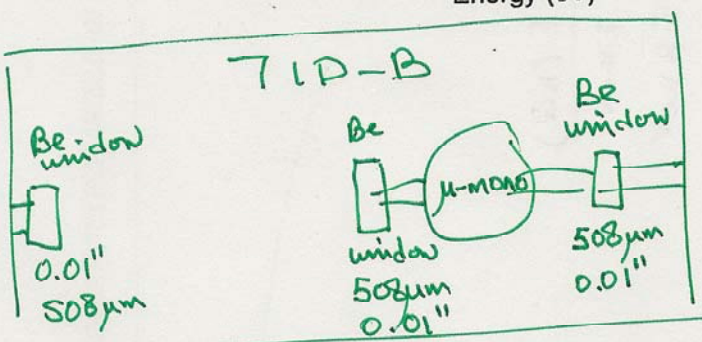
for XRMT in 7ID-C+D

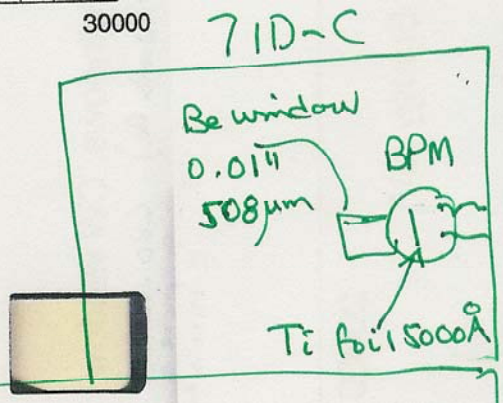
7ID A + B hutches

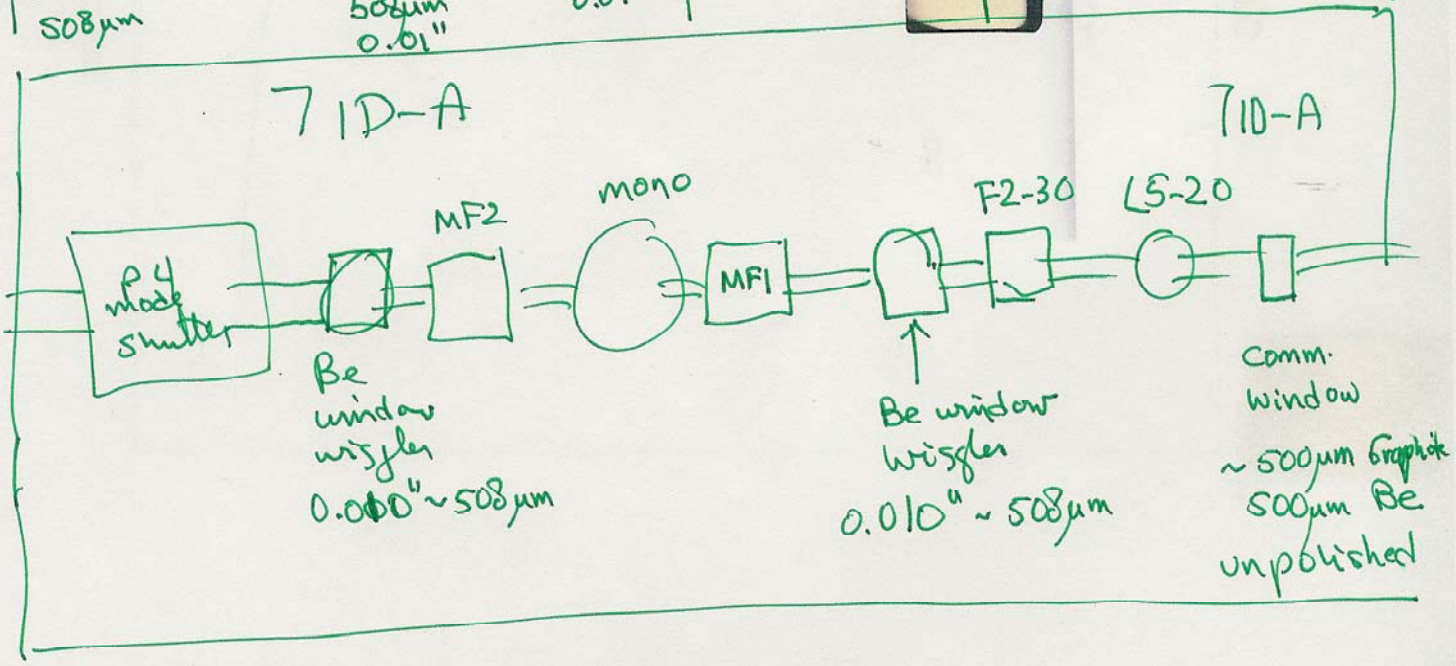
Optics

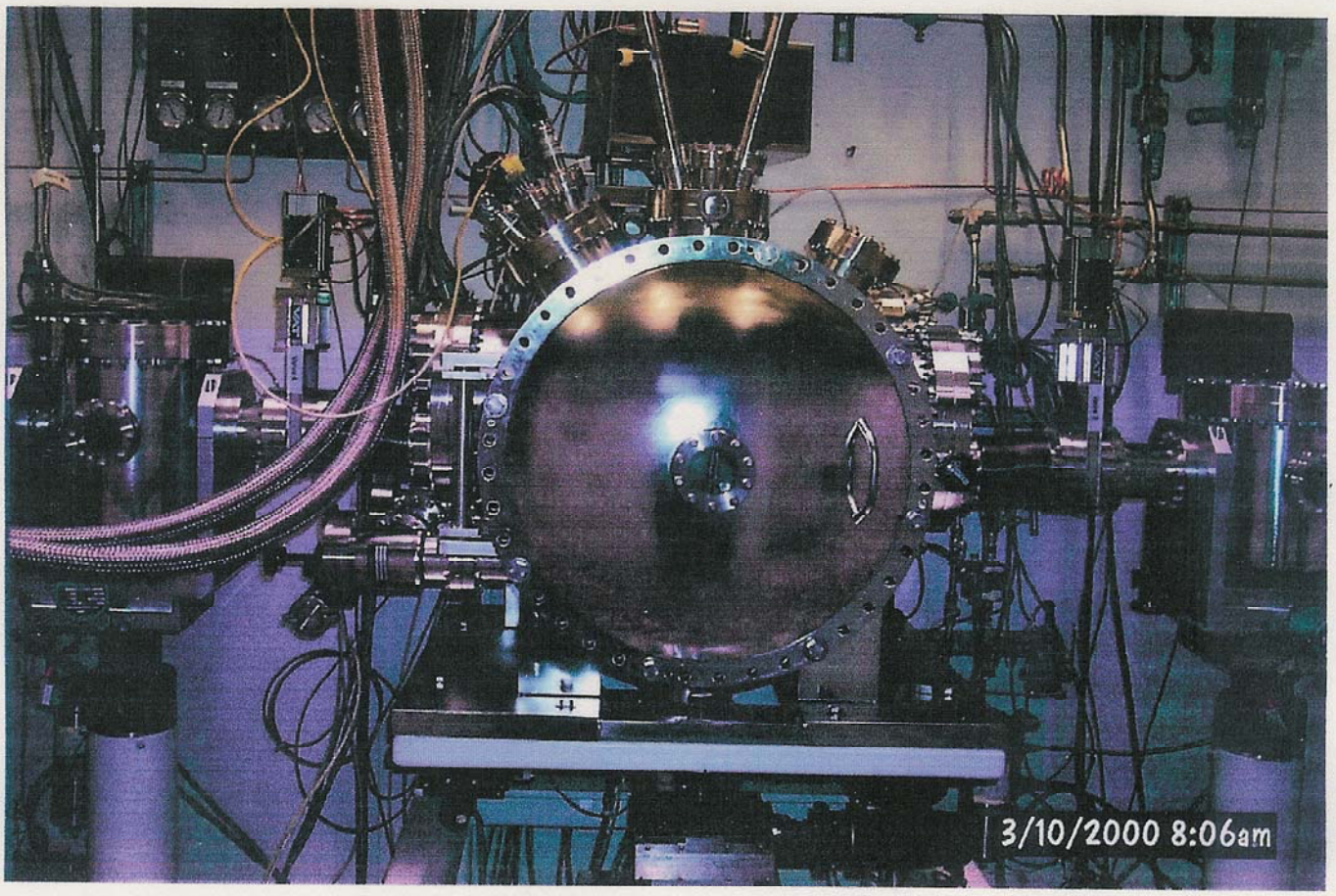



06/2002 status of window transmission
X-ray transmission
Energy (eV)
0
0.2
0.4
0.6
0.8
1
0
10000
20000
30000
Including BPM foil, all Be windows, CW window
(6-10 mils Be)
CVD diamond graphite + 2-10 mils Be
T | E (keV)
1% | 4.7 keV
10% | 5.8 keV
25% | 7.1 keV
50% | 9 keV
75% | 13 keV


7ID-B
Be window
0.01"
508μm
Be
window
508μm
0.01"
μ-mono
Be
window
508μm
0.01"

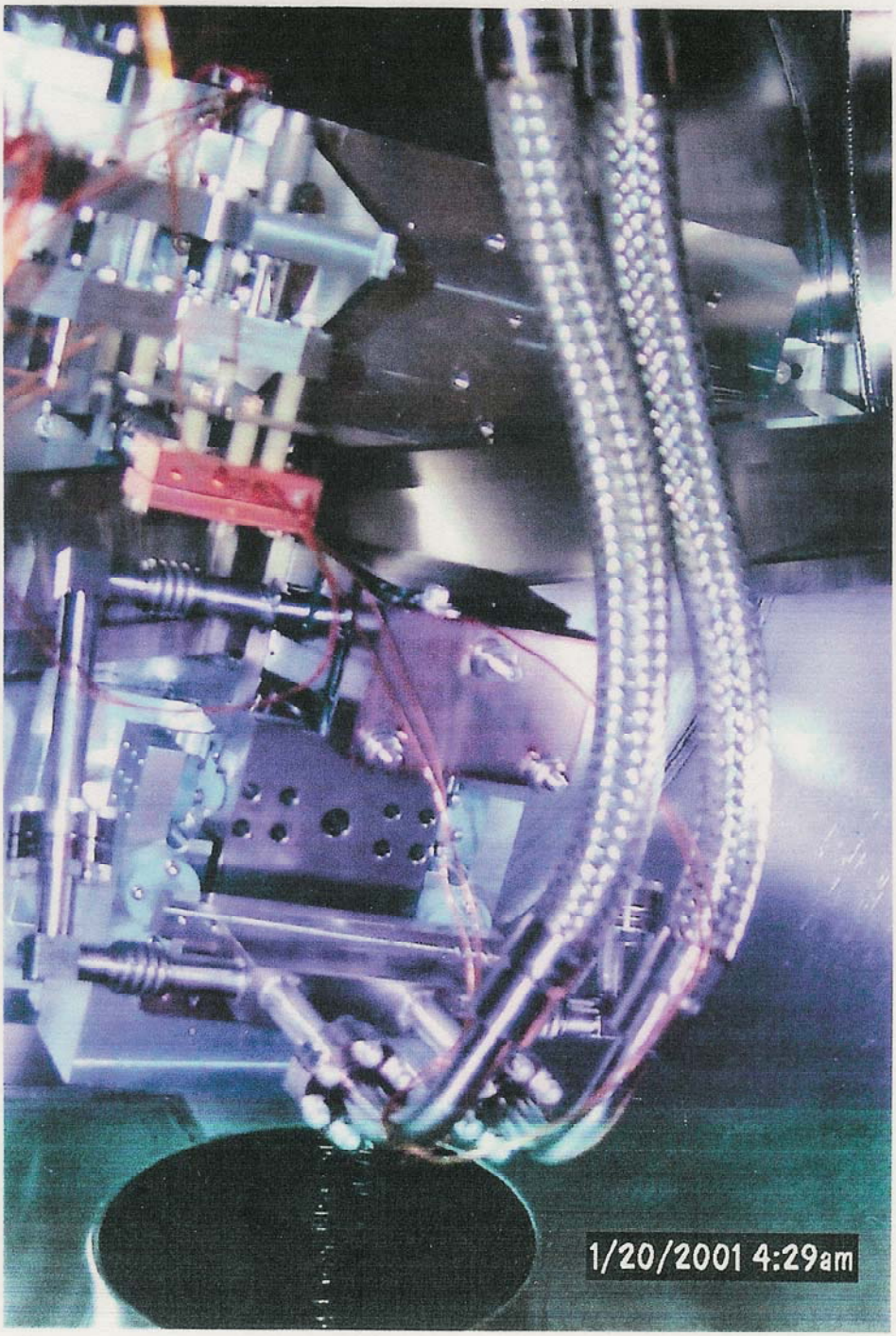

7ID-C
Be window
0.01"
508μm
BPM
Ti foil 5000Å


7ID-A
7ID-A
4 blade shutter
Be window wiggler 0.010" ~ 508μm
MF2
mono
MF1
Be window wiggler 0.010" ~ 508μm
F2-30
LS-20
Comm. window
~ 500μm Graphite
500μm Be
unpolished



Mono Si (111) cryogenically cooled
double crystal Si (111)
Energy range (5-25 keV) on Si (111)

p0000968.jpg (1024x1536x24b jpeg)



New 1st crystal design, 50x more stable.

Mono Energy (keV)	nth harmonics	flux ph/s at 100 mA	X-ray photon per laser pulse
8.9	1	1.71×10^{13}	2.565×10^{6}
12.0	1	2.1×10^{13}	3.15×10^{6}
12.0	3	2.7×10^{13}	4.05×10^{6}
15.0	3	2.566×10^{13}	3.85×10^{6}
18.604	3	2.14×10^{13}	3.21×10^{6}
21.0	3	1.772×10^{13}	2.658×10^{6}
24.0	3	5.6×10^{12}	8.4×10^{5}
24.5	3	4.25×10^{12}	6.375×10^{5}
25.0	3	1.04×10^{9}	1.56×10^{2}

Table 1: Monochromatic Flux in a 2 mm (H) by 0.6 mm (V) aperture set by the L5-20 on 7ID measured in 7ID-B on Feb. 14, 2002 in the low emmittance mode.

- long term stability: position stable to 10 μm in top-up mode over a typical day.
- some faster jitter > 1 Hz

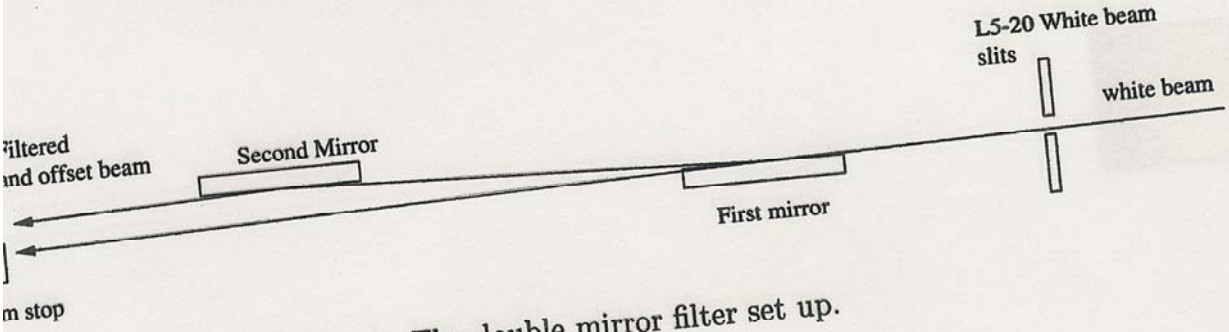


Figure 1: The double mirror filter set up.

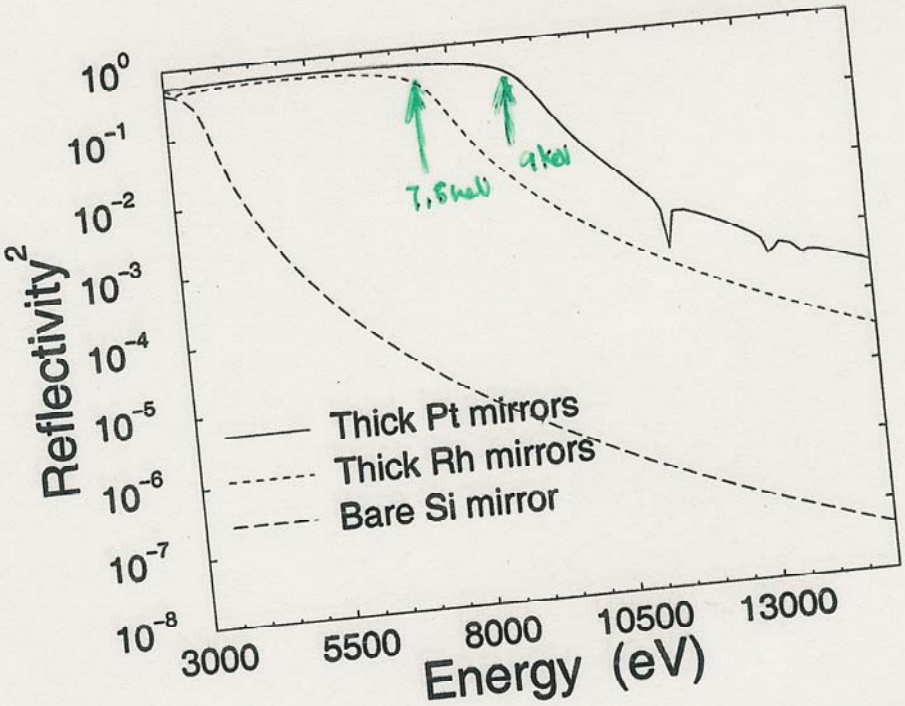


Figure 2: The total reflectivity of two Pt (solid), Rh (dashed) or Si (long dash) mirrors set

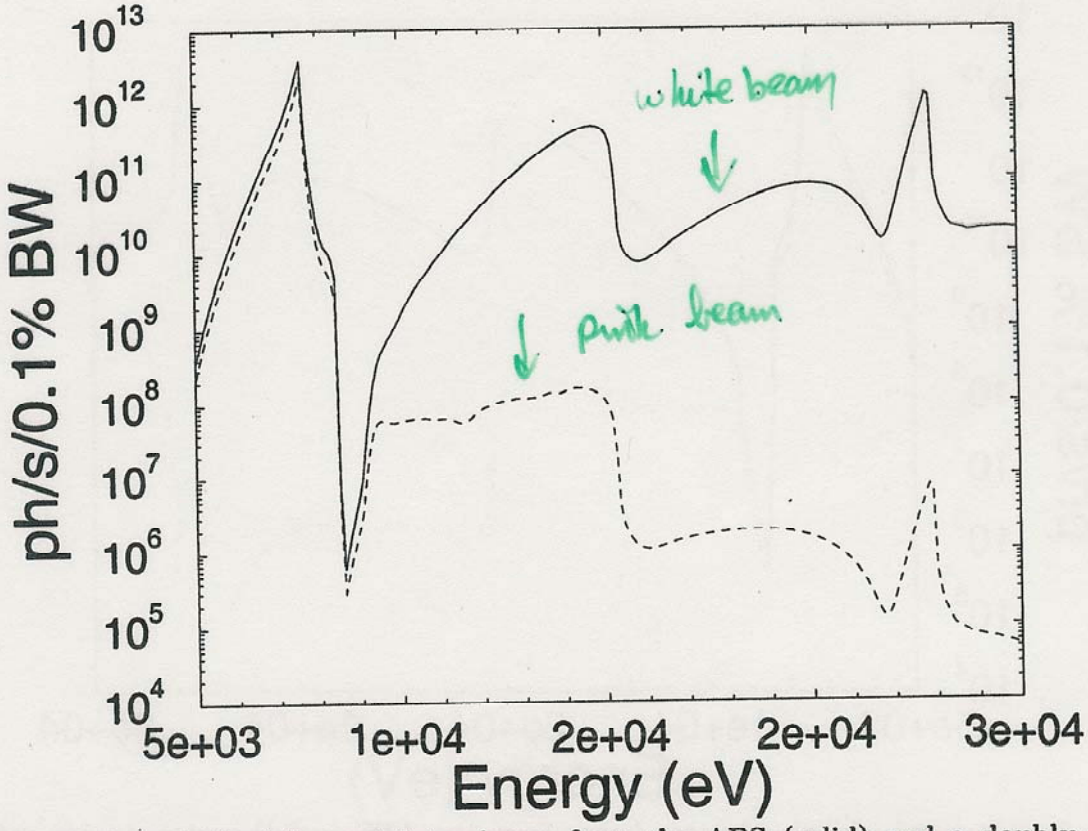


Figure 3: A typical white undulator beam from the APS (solid) and a doubly reflected "pink" beam (dashed), using the Pt coating.

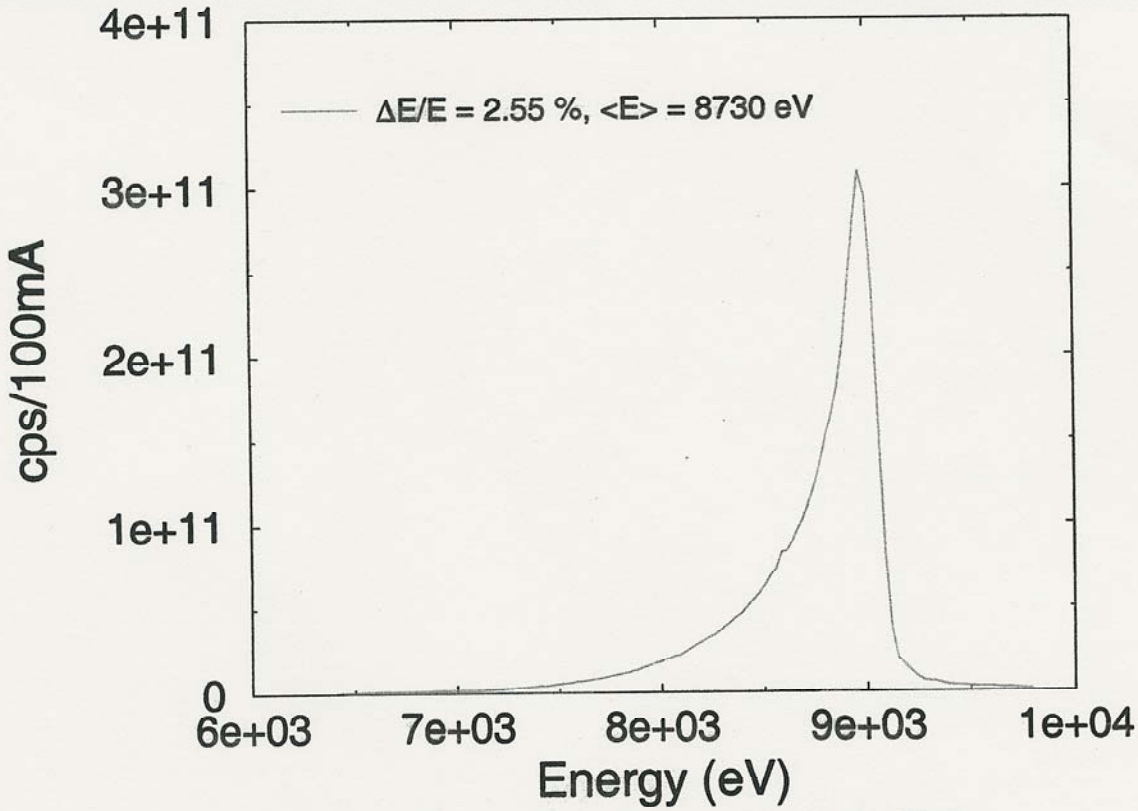
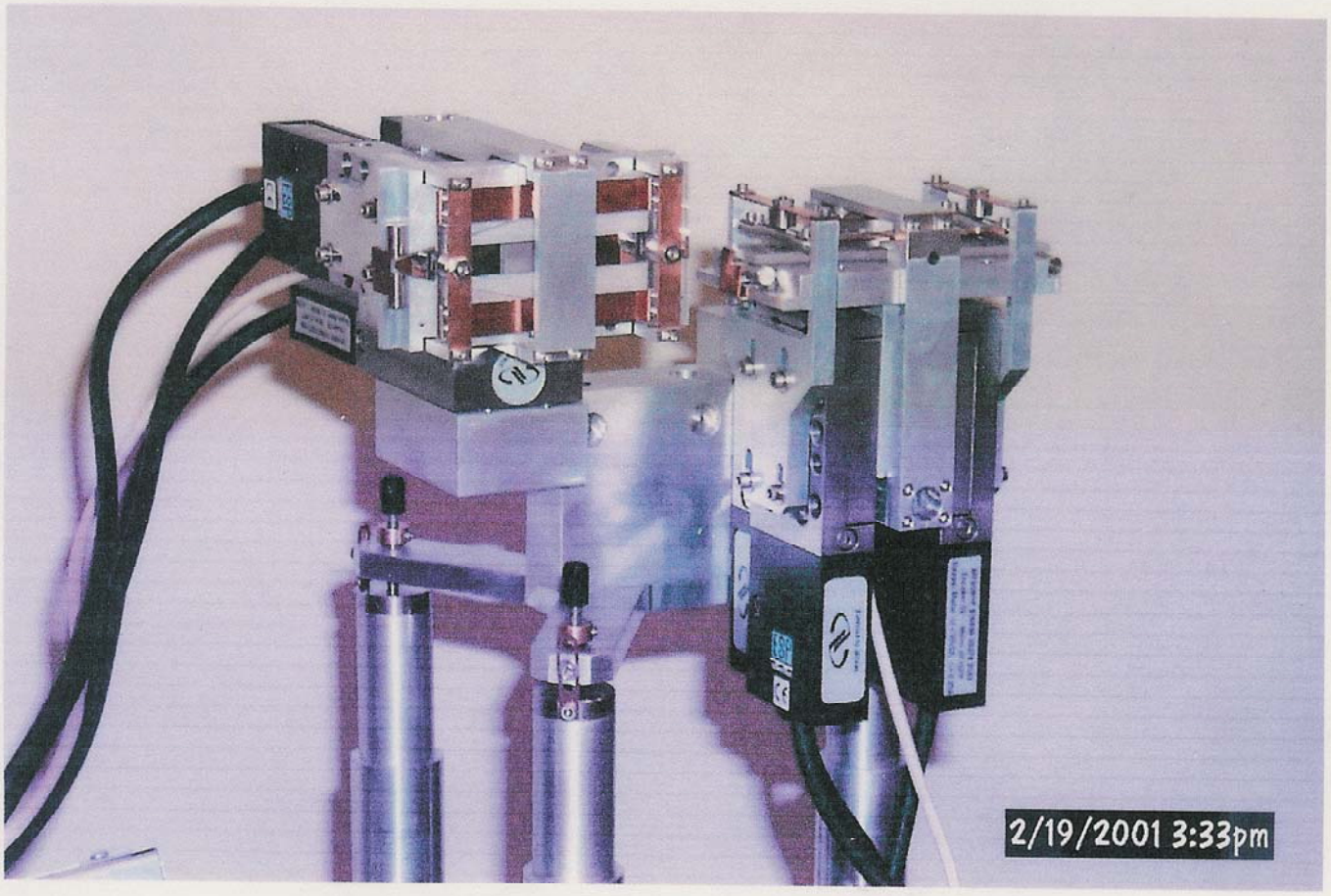


Figure 4: Measured pink beam spectrum in 7ID-B.



CARS style KB mirror system

100 mm long Rh coated Si mirrors

up to ≈ 350 μm acceptance

focal spot ~ 2 μm x 2 μm

commissioned last run

- We are planning to purchase the longer version which are 200 mm long

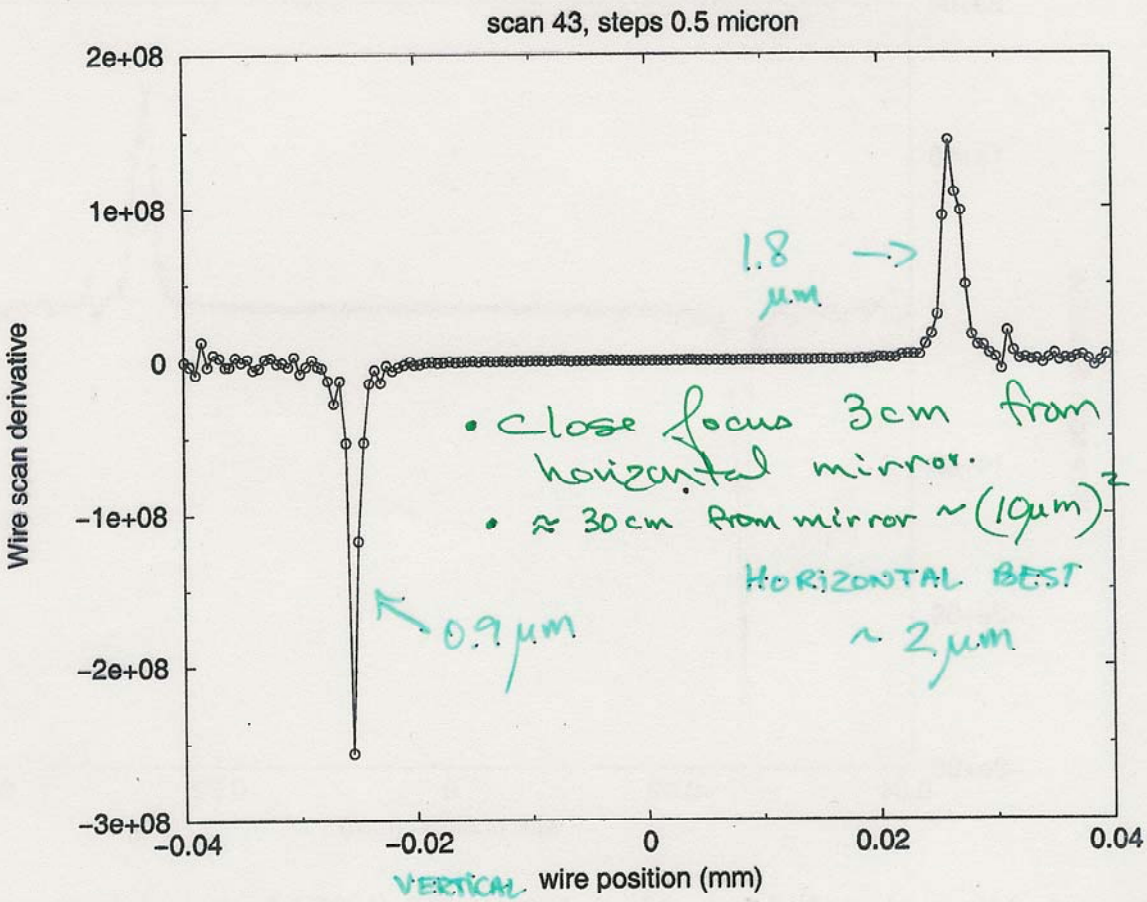


Figure 5: Measured vertical focus March 2002 in 7ID-C. The horizontal focus was a bit wider.

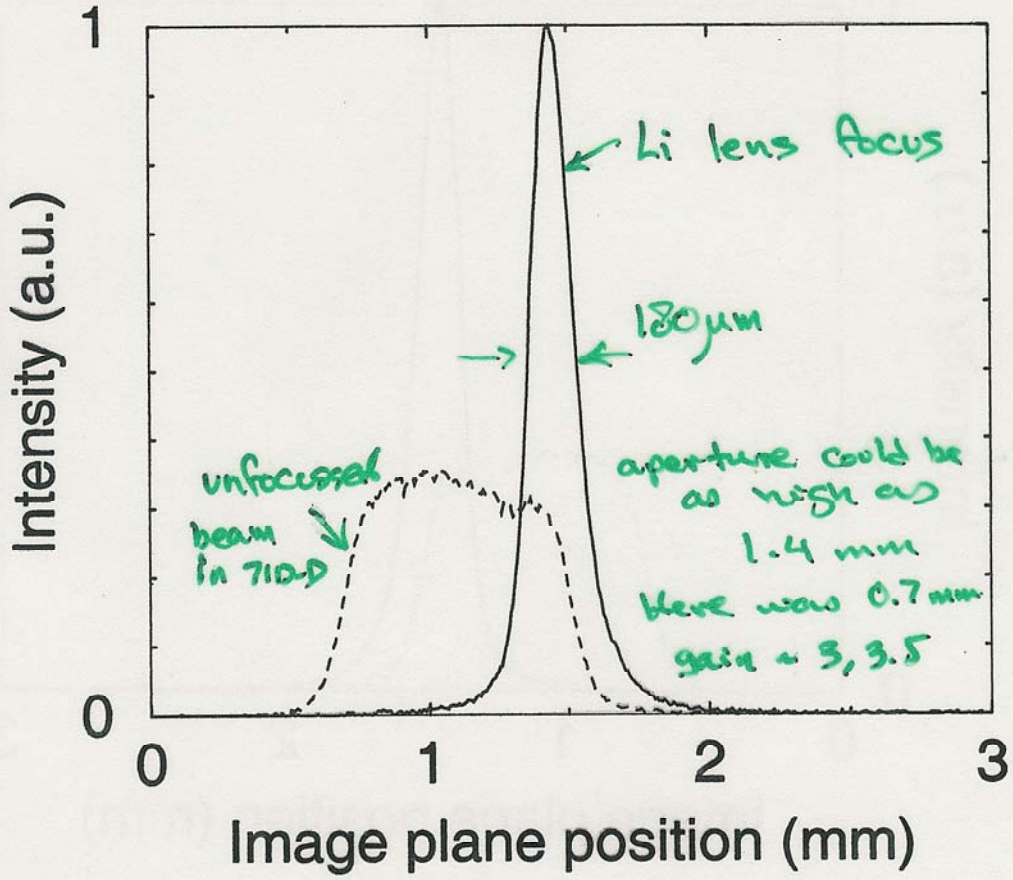
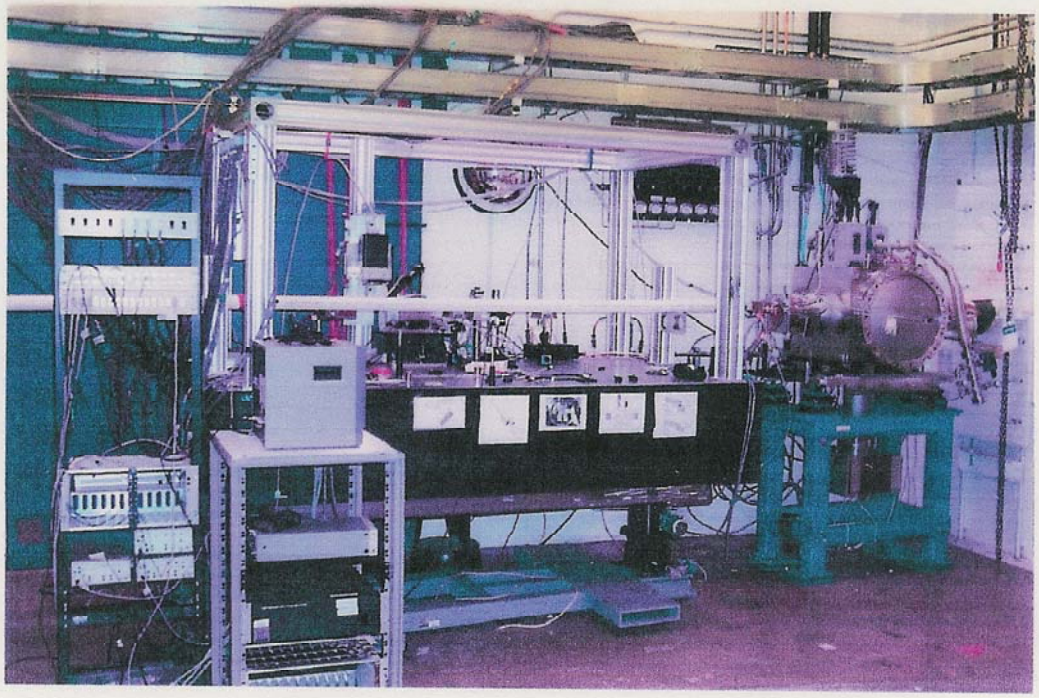
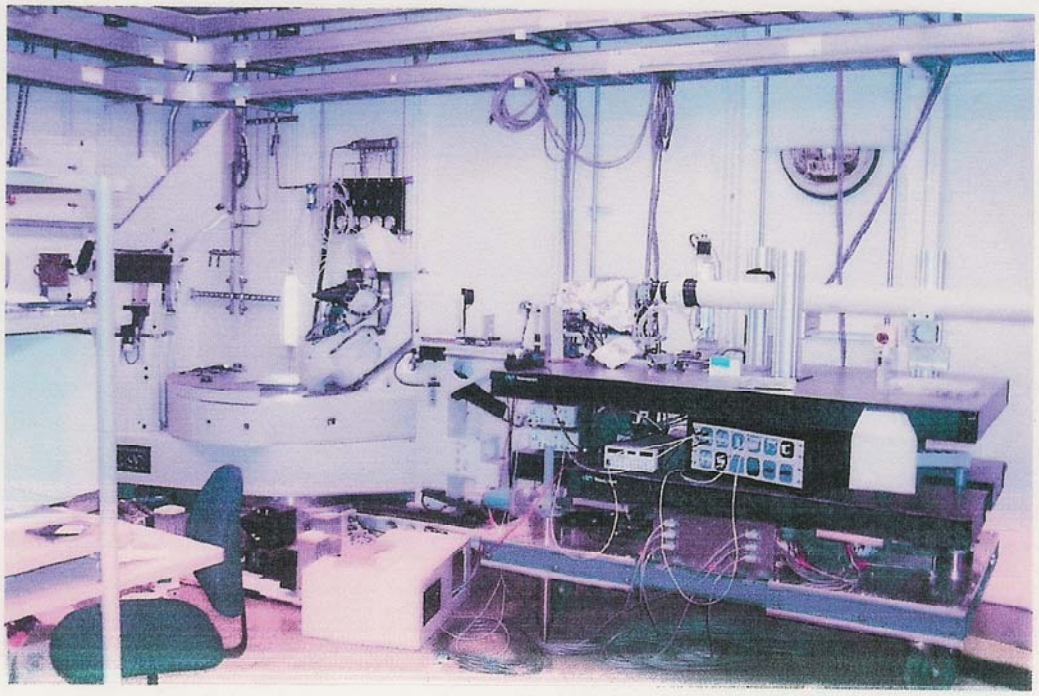


Figure 6: Measured horizontal focus in 7ID-D with a Li lens(solid). Unfocussed beam (dashed)

7ID-B Microdiffraction set up



17

7ID-C Newport Kappa and optical table