



**Berliner Elektronenspeicherring-Gesellschaft  
für Synchrotronstrahlung m.b.H.**

**BESSY GmbH \_ Albert-Einstein-Strasse 15 \_ 12489 Berlin \_ Germany**

Firma  
Ansprechpartner  
Strasse Nr.  
PLZ Stadt

**Dr. Rolf Follath  
Optik**

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**www.bessy.de**

**27.10.2006**

**Invitation to tender for the supply of optical elements**

**BESSY No. UE46-PGM2**

Dear Sirs and Madams,

In the framework of a limited invitation to tender in accordance with § 3 subsection 3.a) of VOL/A ("Verdingungsordnung für Leistungen, Teil A" - Standard contracting terms, part A - General conditions for awarding of contracts), we ask for a binding bid which is free of charge to BESSY for the following items:

.....  
Optional:

*The performance for lots ... should be offered separately. The bidder may, at its own discretion, submit only a single bid for the items listed. If ... lots are offered, the price must be given separately for each lot, and also an overall price if ... lots are awarded to a single bidder. The right to award contracts on a lot by lot basis is reserved.*

If any questions arise in relation to this invitation to tender, please contact the following persons:

For technical questions:

Dr. Rolf Follath, Tel. ++49-30-6392-2996  
Fax. ++49-30-6392-

For commercial questions:

Birgit Wosgien Tel. ++49-30-6392-2917  
Fax. ++49-30-6392-2925

**BESSY GmbH**

Albert-Einstein-Straße 15  
12489 Berlin . Germany  
Fon +49-30 / 63 92 - 29 99  
Fax +49-30 / 63 92 - 29 90

**Geschäftsführung:**

Prof. Dr. Dr. h.c. Wolfgang Eberhardt  
Prof. Dr. Eberhard Jaeschke  
**Aufsichtsratsvorsitzender:**  
Prof. Dr. Dr. h.c. mult. Joachim Treusch

**Sitz der Gesellschaft:**

Berlin  
**Handelsregister:**  
Amtsgericht Charlottenburg  
HRB 14 635

**Bankverbindung:**

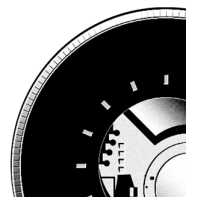
Deutsche Bank AG  
Berlin  
Kto 417 300 101  
BLZ 100 700 00





**Berliner Elektronenspeicherring-Gesellschaft  
für Synchrotronstrahlung m.b.H.**

2114



### III. TECHNICAL SECTION

## 1. Specification of mirror 1

### A. Mirror substrate

quantity, identification  
dimensions (L x W x H), see also fig.1  
material  
coating

thermal properties  
provision for cooling

1, UE46PGM2-M1  
330 x 40 / 25 x 40 mm<sup>3</sup> +/- 0.5 mm  
single crystal silicon  
30 – 40 nm gold  
no other material as interface or contact layer  
bakeout temperature: 150°C  
the long sides should be  
planar and lapped (see fig.1)

### B. Reflecting surface

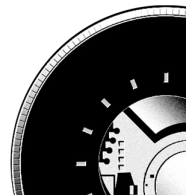
angle of incidence  
surface geometry  
long radius  
short radius  
optically active area  
angle between axis and blank  
reflectivity

88.5°  
**toroidal**  
1 299 000 +/- 10000 mm  
890 +/- 10 mm  
≥ 320 x 20 mm<sup>2</sup>  
≤ 0.3°  
> 80 % of calculated curve  
given in figure 5

### C. Surface quality

surface roughness  
local tangent error, long axis  
  
local tangent error, short axis

≤ 0.5 nm RMS  
≤ 1 arc sec RMS (option1)  
≤ 0.5 arc sec RMS (option 2)  
≤ 2 arc sec RMS (option 1)  
≤ 1 arc sec RMS (option 2)



## 2. Specification of mirror 2

### A. Mirror substrate

quantity, identification  
dimensions (L x W x H); see also fig. 2  
material  
coating

thermal properties  
provision for cooling

1, UE46PGM2-M2  
310 x 50 / 30 x 60 mm<sup>3</sup> +/- 0.5 mm  
single crystal silicon  
30 - 40 nm platinum  
no other materials as interfaces or contact layers  
bakeout temperature: 120°C  
the long sides should be  
planar and lapped (see fig.2)

### B. Reflecting surface

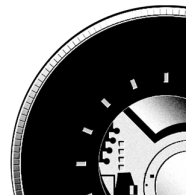
angle of incidence  
surface geometry  
optically active area  
reflectivity

70° - 89°  
**plane, R > 30 km**  
≥ 300 x 20 mm<sup>2</sup>  
> 80 % of calculated curve  
given in figure 5

### C. Surface quality

surface roughness  
local tangent error, long axis  
local tangent error, short axis

≤ 0.5 nm RMS  
≤ 0.1 arc sec RMS  
≤ 0.5 arc sec RMS



### 3. Specification of mirror 3a

#### A. Mirror substrate

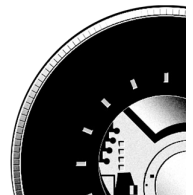
quantity, identification	1, UE46PGM2-M3a
dimensions (L x W x H), see also fig. 3	330 x 40 x 40 mm <sup>3</sup> +/- 0.5 mm
material	single crystal silicon, Zerodur, Suprasil, ULE or similar
coating	30 – 40 nm gold
thermal properties	no other material as interface or contact layer
provision for cooling	bakeout temperature: 150°C no

#### B. Reflecting surface

angle of incidence	88.5°
surface geometry	<b>toroidal</b>
long radius	305 000 +/- 2000 mm
short radius	209 +/- 2 mm
optically active area	≥ 310 x 30 mm <sup>2</sup>
angle between axis and blank	≤ 0.3°
reflectivity	> 80 % of calculated curve given in figure 5

#### C. Surface quality

surface roughness	≤ 0.5 nm RMS
local tangent error, long axis	≤ 1 arc sec RMS (option1) ≤ 0.5 arc sec RMS (option 2)
local tangent error, short axis	≤ 2 arc sec RMS (option 1) ≤ 1 arc sec RMS (option 2)



## **4. Specification of mirror 3b**

### **A. Mirror substrate**

quantity, identification  
dimensions (L x W x H), see also fig. 3  
material  
coating  
  
thermal properties  
provision for cooling

1, UE46PGM2-M3b  
330 x 40 x 40 mm<sup>3</sup> +/- 0.5 mm  
single crystal silicon, Zerodur, Suprasil, ULE or similar  
30 – 40 nm gold  
no other material as interface or contact layer  
bakeout temperature: 150°C  
no

### **B. Reflecting surface**

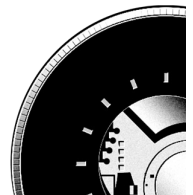
angle of incidence  
surface geometry  
long radius  
short radius  
optically active area  
angle between axis and blank  
reflectivity

88.5°  
**toroidal**  
229 000 +/- 2000 mm  
157 +/- 2 mm  
≥ 310 x 30 mm<sup>2</sup>  
≤ 0.3°  
> 80 % of calculated curve given in figure 5

### **C. Surface quality**

surface roughness  
local tangent error, long axis  
  
local tangent error, short axis

≤ 0.5 nm RMS  
≤ 1 arc sec RMS (option1)  
≤ 0.5 arc sec RMS (option 2)  
≤ 2 arc sec RMS (option 1)  
≤ 1 arc sec RMS (option 2)



## 5. Specification of grating 1

### A. grating substrate

quantity, identification  
dimensions (L x W x H), see also fig.4  
material  
coating  
  
thermal properties  
provision for cooling  
4

1, UE46PGM2-G1  
100 x 40 / 20 x 40 mm<sup>3</sup> +/- 0.5 mm  
single crystal silicon  
30 – 40 nm gold  
no other material as interface or contact-layer  
bakeout temperature: 120°C  
long sides should be planar and lapped , see fig.

### B. Reflecting surface

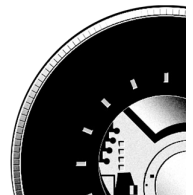
deviation angle  
surface geometry  
optically active area  
groove density  
angle between rulings and long axis  
profile  
blaze angle  
grating efficiency

160° - 178°  
**plane, R > 30 km**  
≥ 95 x 15 mm<sup>2</sup>  
1200 l/mm  
90° +/- 0.2° (see fig.4)  
blazed,  
1.2° +/- 0.1°  
> 60 % of given "1200 l/mm" curve in figure 6

### C. Surface quality

surface roughness  
local tangent error, long axis  
local tangent error, short axis

≤ 0.5 nm RMS  
≤ 0.1 arc sec RMS  
≤ 1 arc sec RMS



## 6. Specification of grating 2

### A. grating substrate

quantity, identification

dimensions (L x W x H), see also fig. 4)

material

coating

thermal properties

provision for cooling

4

1, UE46PGM2-G2

100 x 40 / 20 x 40 mm<sup>3</sup> +/- 0.5 mm

single crystal silicon

30 – 40 nm gold,

no other material as interface or contact-layer

bakeout temperature: 120°C

long sides should be planar, and lapped , see fig.

### B. Reflecting surface

deviation angle

surface geometry

optically active area

groove density

angle between rulings and long axis

profile

blaze angle

grating efficiency

160° - 178°

**plane, R > 30 km**

≥ 95 x 15 mm<sup>2</sup>

600 l/mm

90° +/- 0.2° (see fig.4)

blazed

(0.7° +/- 0.1°) nm

> 60 % of given "600 l/mm" curve in figure 6

### C. Surface quality

surface roughness

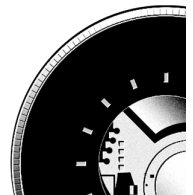
local tangent error, long axis

local tangent error, short axis

≤ 0.5 nm RMS

≤ 0.1 arc sec RMS

≤ 1 arc sec RMS





## 7. Specification of grating 3

### A. grating substrate

quantity, identification  
dimensions (L x W x H), see also fig. 4)  
material  
coating  
  
thermal properties  
provision for cooling  
4

1, UE46PGM2-G3  
100 x 40 / 20 x 40 mm<sup>3</sup> +/- 0.5 mm  
single crystal silicon  
30 – 40 nm gold,  
no other material as interface or contact-layer  
bakeout temperature: 120°C  
long sides should be planar and lapped , see fig.

### B. Reflecting surface

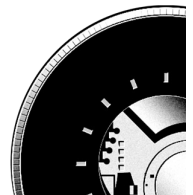
deviation angle  
surface geometry  
optically active area  
groove density  
angle between rulings and long axis  
profile  
blaze angle  
grating efficiency

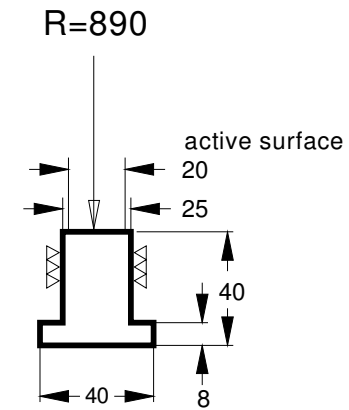
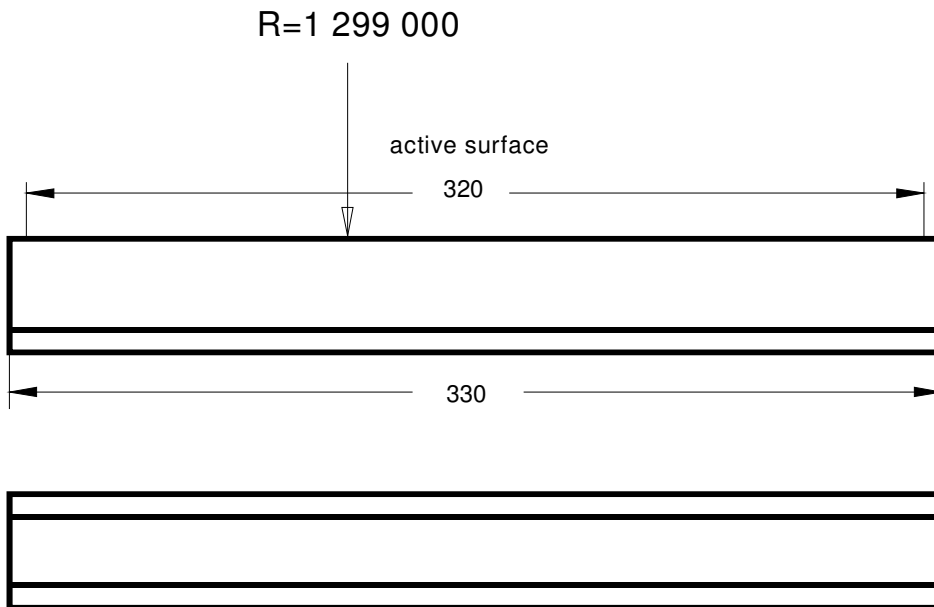
160° - 178°  
**plane, R > 30 km**  
≥ 95 x 15 mm<sup>2</sup>  
300 l/mm  
90° +/- 0.2° (see fig.4)  
blazed,  
0.6° +/- 0.05°  
> 60 % of given "600 l/mm" curve in figure 6

### C. Surface quality

surface roughness  
local tangent error, long axis  
local tangent error, short axis

≤ 0.5 nm RMS  
≤ 0.1 arc sec RMS  
≤ 1 arc sec RMS





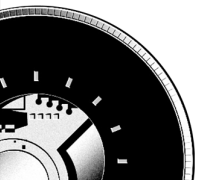
toroidal mirror

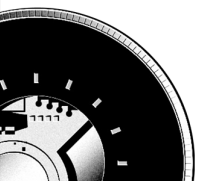
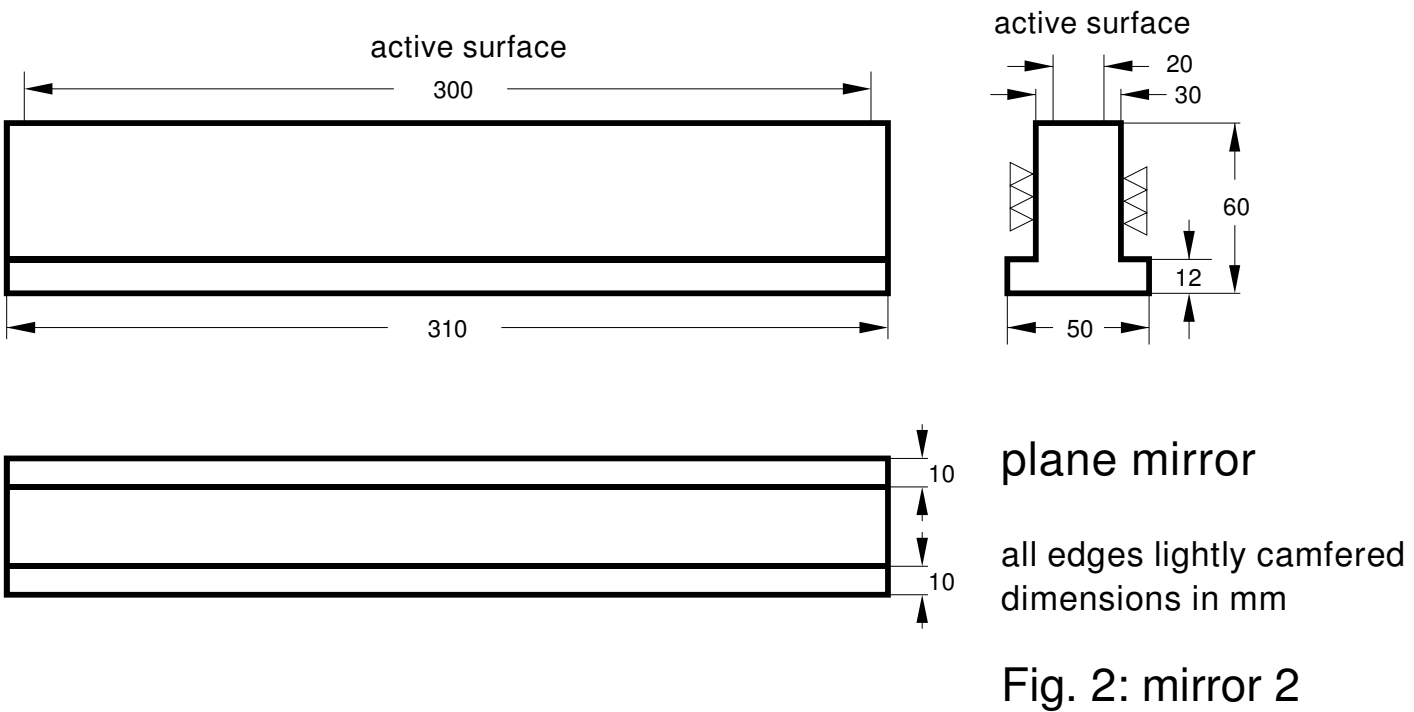
all edges lightly camfered  
dimensions in mm

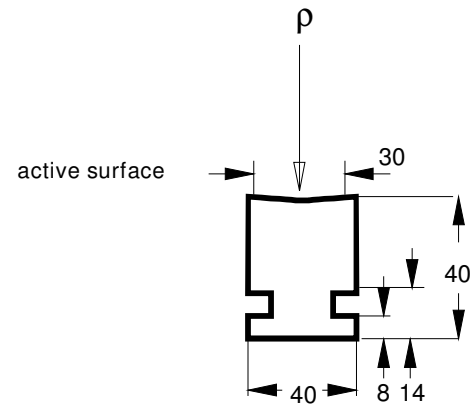
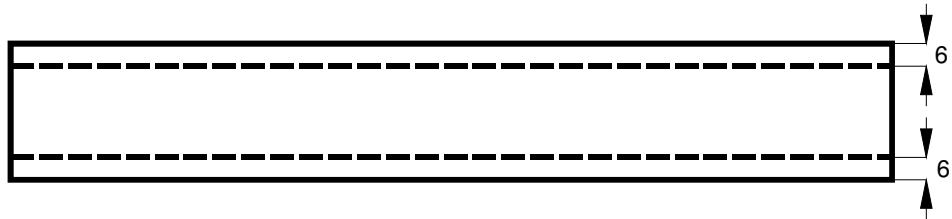
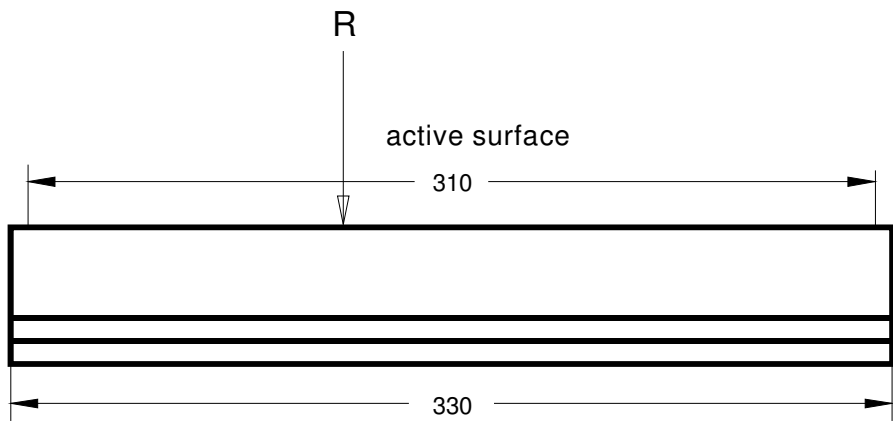
Fig. 1: mirror 1



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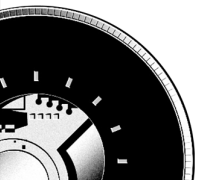
toroidal mirror

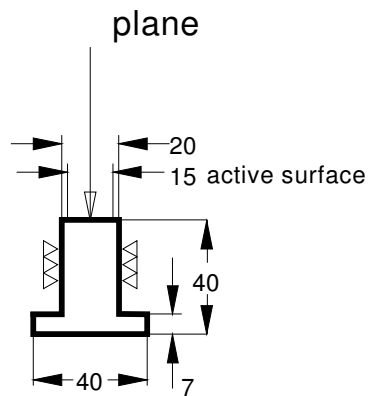
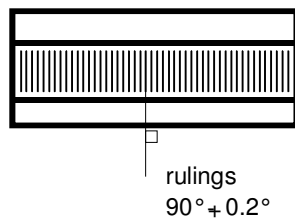
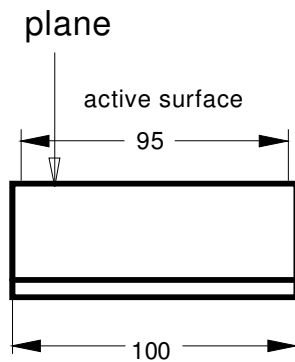
all edges lightly camfered  
dimensions in mm

Fig 3: mirror 3



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## plane gratings

all edges lightly camfered  
dimensions in mm

grating	N [l/mm]
1	1200
2	600
3	300

Fig. 4: grazing incidence gratings

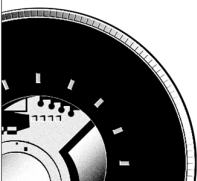


Fig. 5: Calculated reflectance (s-pol)

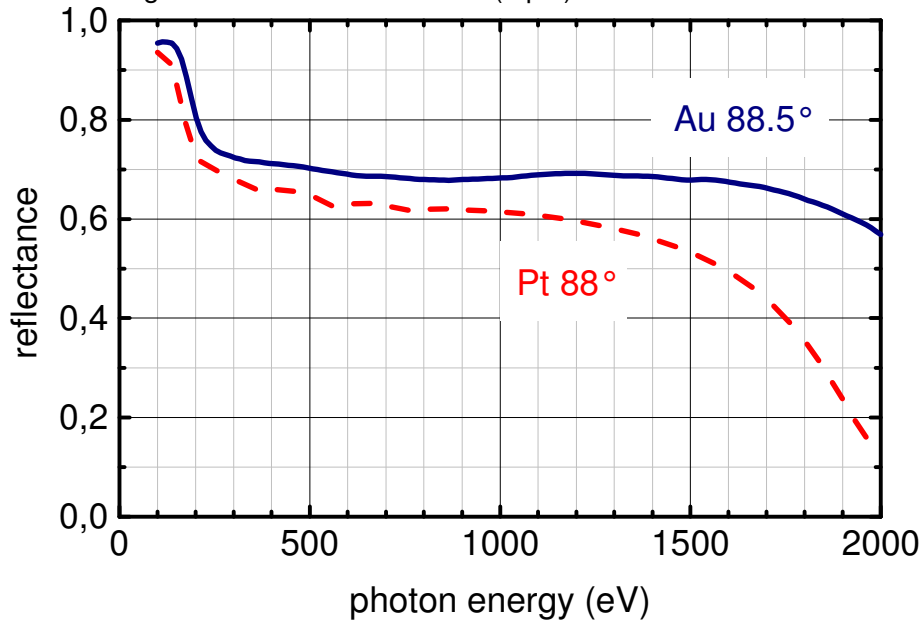
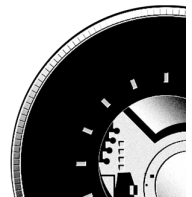
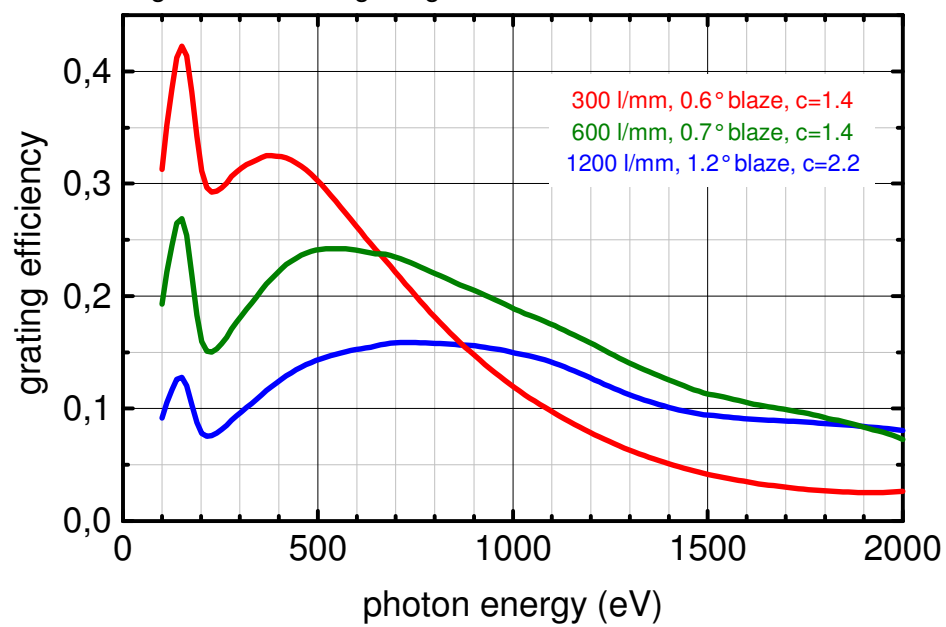


Fig. 6: Calculated grating efficiencies



## BESSY-bid form

BESSY-No: ..UE46-PGM2.....Options 1.....

( please use this form to make your offer)

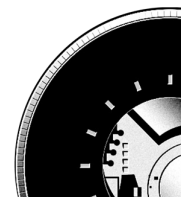
position	item	description		Delivery time	total price EUR
1	1	M1	Toroidal mirror	7 month	
2	1	M2	Plane mirror		
3	1	M3a	Toroidal mirror		
4	1	M3b	Toroidal mirror		
5	1	G1	Plane grating 1200/mm		
6	1	G2	Plane grating 600/mm		
8	1	G3	Plane grating 300/mm		
Total EUR:					

**We acknowledge the BESSY conditions of the contract and the specifications.**

company: \_\_\_\_\_

signature: \_\_\_\_\_

date: \_\_\_\_\_





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## BESSY-bid form

BESSY-No: ..UE46-PGM2.....Options 2.....  
( please use this form to make your offer)

position	item	description		delivery time	total price EUR
1	1	M1	Toroidal mirror	7 month	
2	1	M3a	Toroidal mirror		
3	1	M3b	Toroidal mirror		

**We acknowledge the BESSY conditions of the contract and the specifications.**

company: \_\_\_\_\_

signature: \_\_\_\_\_

date: \_\_\_\_\_

