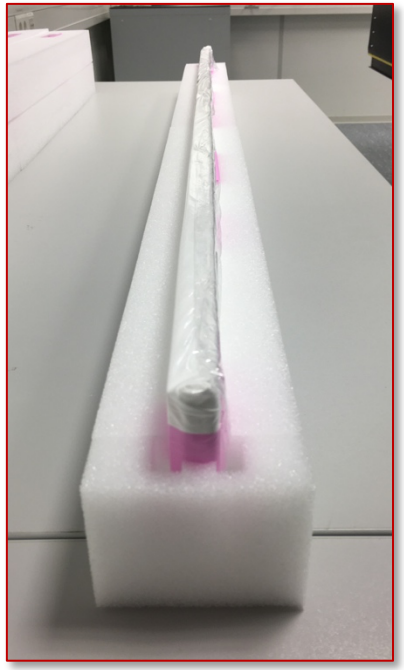
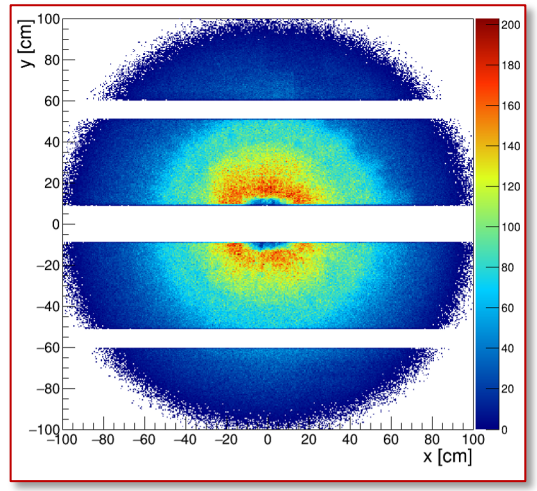
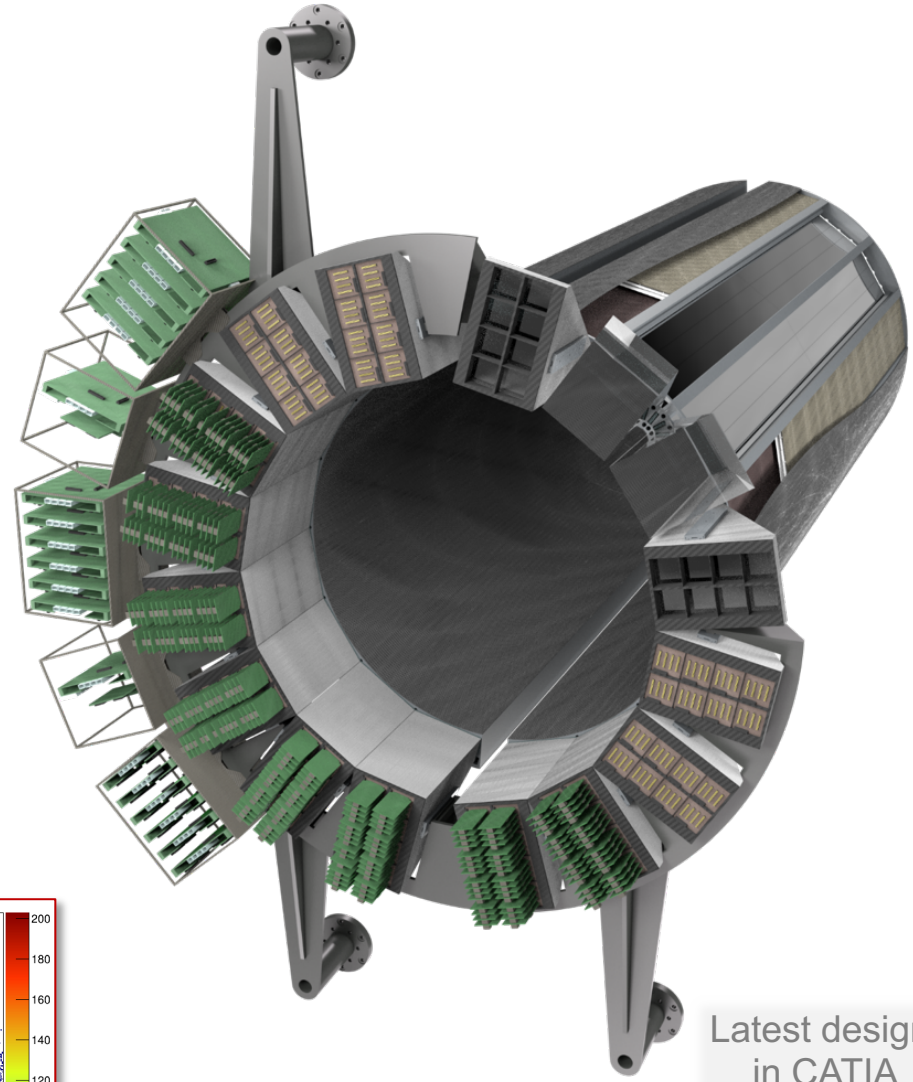
BARREL DIRC STATUS

- Status of call for tenders
- Other progress







Latest design in CATIA

Jochen Schwiening

PANDA CollabMeet
GSI, March 2029

Call for Tenders progress:

GSI issued Call for Tenders for two highest-cost and longest-lead items in Q4/2018:

fused silica radiator bars and microchannel-plate (MCP) PMTs (80% of budget).

Fused silica bars:

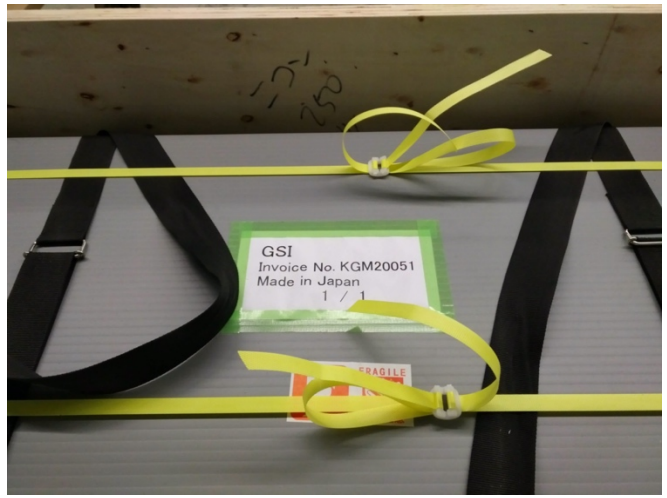
Sep 5, 2019: Placed order for 98 bars with option for up to 8 more bars (need 96) with Nikon Corp, Japan.

Production started in September, target date for first batch (10 bars): July 2020.

Received shipment of first lot (5 bars) last week (4 months ahead of schedule)

First Bar Delivery

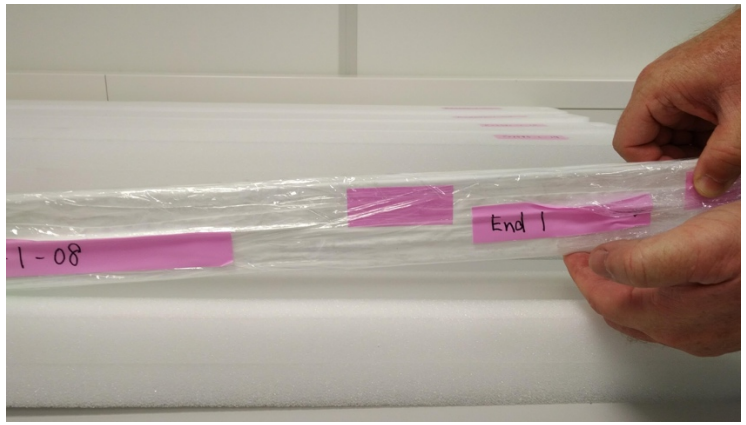
- Wooden shipping box
  - Laminated paper/plastic inner box
    - Foam shells
      - Saran warp
        - Cleanroom cloth



inner box

inner box with 5 bars in polyethylene foam shells

wooden crate in Heckhalle, GSI



bar in saran wrap and cloth

NIKON LOT 1

Certificate of Compliance

THIS IS TO CERTIFY THAT ALL SYNTHETIC FUSED SILICA MATERIALS AND PARTS INCLUDED IN ALL SHIPMENTS ON THE FOLLOWING PURCHASE ORDER(S) HAVE BEEN PRODUCED IN CONFORMITY WITH THE REQUIREMENTS OF SPECIFICATIONS AND DRAWINGS LISTED ON THE PURCHASE ORDERS.

Customer Information			
Customer Name	GSI Helmholtzzentrum fur Schwerionenforschung GmbH		
Customer Part Name	Radiator Bar	PO No.	4500181248

Nikon Material Information			
Material Grade	NIFS-S	Lot No.	YKG04317-1
Nikon Reference No.	YKG04317	Material lot No.	P23595-1-04
		CofC Issue Date	2020/2/17

Raw Material Specifications'			
Internal Transmittance	≧99.9%/cm at 365nm		
Inclusions	No inclusions larger than 2μm		
Homogeneity	High optical homogeneity		
Striae	No significant visible striae		

Dimensional Specifications'			
Length	1200 +0/-0.5mm		
Width	53 +0/-0.5mm		
Thickness	17 +0/-0.5mm		
Parallelism	<0.5mrad		
Squareness	<0.5mrad		
TTV	<25μm		

Polished Specifications'			
Surface roughness (Faces and sides)	<5Å rms		
Surface roughness (Ends)	<10Å rms		
Edges	Sharp no bevel		
Surface quality	Total area of imperfections on bar surfaces and edges <75mm²		

Comments :

Additional Data (Y / N)

Authorized Signature

NIKON CORPORATION
Production Department Production Technology Division
10-1, Asamizodai 1-chome, Minami-ku, Sagamihara-shi, Kanagawa 252-0328 Japan

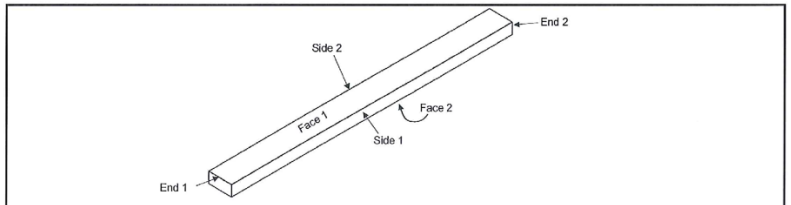
Data Sheet

Date : 2020/2/17

Lot No. YKG04317-1

Material lot No. P23595-1-04

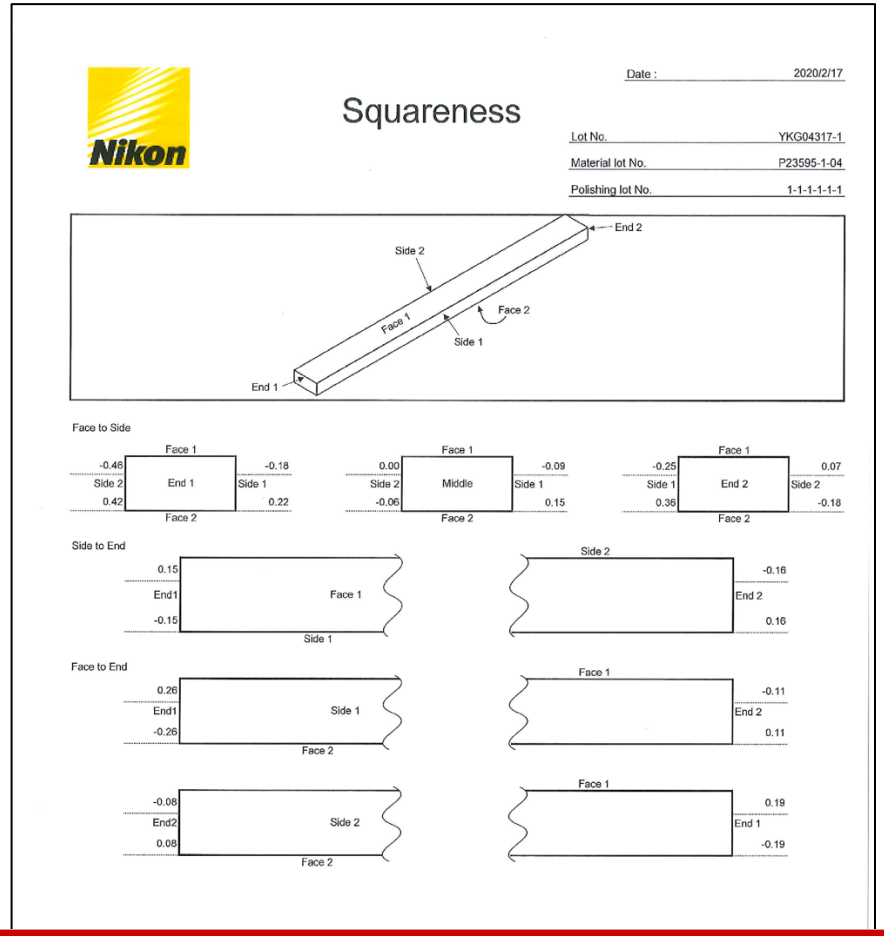
Polishing lot No. 1-1-1-1-1-1



Item		Specification	tool / method	Result
Length [mm]	Side 1	1200+0/-0.5	CNC Measurement System	1199.89
	Side 2	1200+0/-0.5	CNC Measurement System	1199.89
Width [mm]	End1	53+0/-0.5	CNC Measurement System	52.91
	Middle	53+0/-0.5	CNC Measurement System	52.92
	End 2	53+0/-0.5	CNC Measurement System	52.91
Thikness [mm]	End1	17+0/-0.5	CNC Measurement System	16.95
	Middle	17+0/-0.5	CNC Measurement System	16.94
	End 2	17+0/-0.5	CNC Measurement System	16.94
Parallelism [mrad]	Face-Face	<0.5	CNC Measurement System	0.07
	Side-Side	<0.5	CNC Measurement System	0.30
Squareness [mrad]		<0.5	CNC Measurement System	Pass
Surface roughness [Å RMS]	Face 1	<5	Zygo "NewView"	3.5
	Face 2	<5	Zygo "NewView"	2.8
	Side 1	<5	Zygo "NewView"	4.9
	Side 2	<5	Zygo "NewView"	4.5
	End 1	<10	Zygo "NewView"	5.1
	End 2	<10	Zygo "NewView"	6.1
TTV [μm]	Face-Face	<25	CNC Measurement System	13.9
	Side-Side	<25	CNC Measurement System	13.0
Edges		Sharp no bevel	Visual inspection	Pass
Surface quality	Total area of imperfections on bar surface and edges	<75mm²	Visual inspection	Pass
Total				Pass

Date		bar numer		Lot						Length		Width			Thickness			Parallelism		Surface Roughness						TTV	
Nikon QA	Received	GSI	Nikon	Material	Polishing					Side 1	Side 2	End 1	Middle	End 2	End 1	Middle	End 2	Face-Face	Side-Side	Face 1	Face 2	Side 1	Side 2	End 1	End 2	Face-Face	Side-Side
2/17/2020	3/4/2020	1	P23595-1-04	YK04317-1	1	1	1	1	1	1199.89	1199.89	52.91	52.92	52.91	16.95	16.94	16.94	0.07	0.30	3.5	2.8	4.9	4.5	5.1	6.1	13.9	13.0
2/17/2020	3/4/2020	2	P23595-1-08	YK04317-1	1	1	2	1	1	1199.75	1199.74	52.78	52.78	52.78	16.95	16.95	16.95	0.05	0.08	3.5	2.8	4.2	4.5	5.1	6.9	14.9	14.2
2/17/2020	3/4/2020	3	P23595-1-18	YK04317-1	1	1	2	1	1	1199.89	1199.89	52.90	52.91	52.91	16.95	16.95	16.95	0.01	0.04	3.5	2.8	4.2	4.5	5.1	6.1	16.6	9.3
2/17/2020	3/4/2020	4	P23595-1-19	YK04317-1	1	1	2	1	1	1199.87	1199.87	52.92	52.91	52.92	16.95	16.95	16.95	0.05	0.37	3.5	2.8	4.2	4.5	5.1	6.1	12.9	21.3
2/17/2020	3/4/2020	5	P23595-1-20	YK04317-1	1	1	1	1	1	1199.89	1199.90	52.91	52.92	52.91	16.95	16.94	16.94	0.10	0.12	3.5	2.8	4.9	4.5	5.1	6.1	15.7	9.1

NIKON LOT 1



Nikon

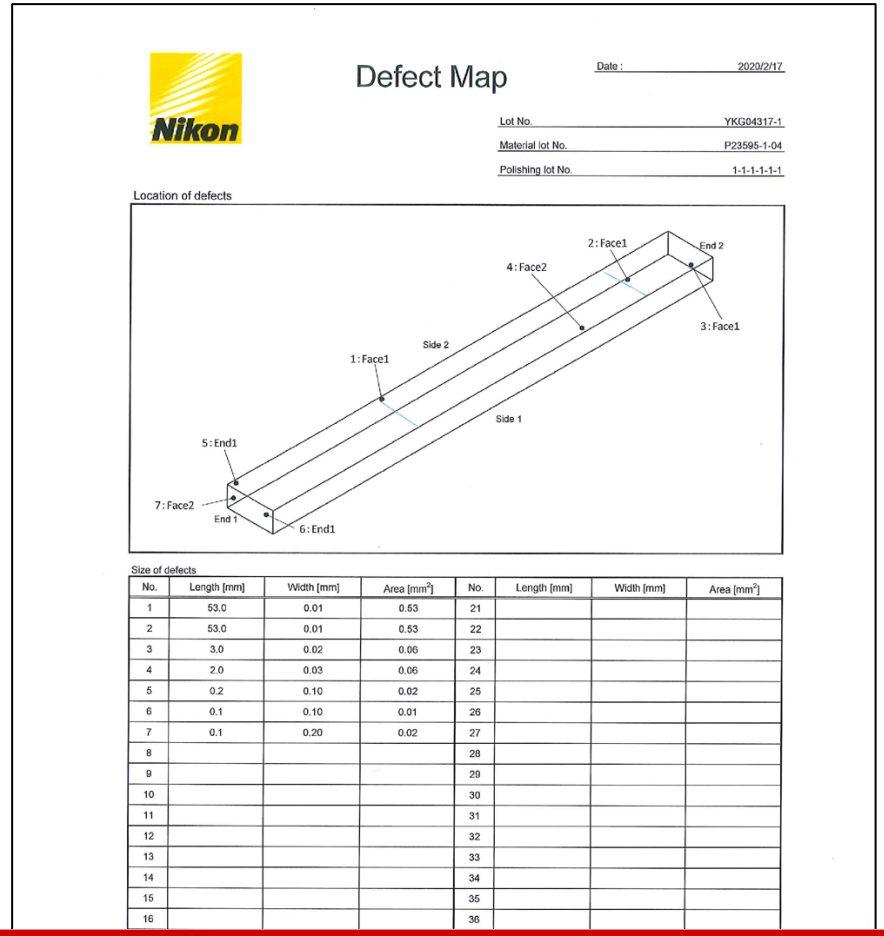
Squareness

Date : 2020/2/17

Lot No. YKG04317-1

Material lot No. P23595-1-04

Polishing lot No. 1-1-1-1-1-1



Nikon

Defect Map

Date : 2020/2/17

Lot No. YKG04317-1

Material lot No. P23595-1-04

Polishing lot No. 1-1-1-1-1-1

Location of defects

Size of defects

No.	Length [mm]	Width [mm]	Area [mm²]	No.	Length [mm]	Width [mm]	Area [mm²]
1	53.0	0.01	0.53	21			
2	53.0	0.01	0.53	22			
3	3.0	0.02	0.06	23			
4	2.0	0.03	0.06	24			
5	0.2	0.10	0.02	25			
6	0.1	0.10	0.01	26			
7	0.1	0.20	0.02	27			
8				28			
9				29			
10				30			
11				31			
12				32			
13				33			
14				34			
15				35			
16				36			

Squareness																								Damage
Face-Side												Side-End				Face-End								Defect Area
-0.18	0.22	0.42	-0.46	-0.09	0.15	-0.06	0.00	0.07	-0.18	0.36	-0.25	-0.16	0.16	-0.15	0.15	-0.11	0.11	-0.26	0.26	0.19	-0.19	0.08	-0.08	1.23
0.07	-0.03	0.17	-0.21	0.13	-0.08	-0.10	0.05	0.18	-0.24	0.40	-0.33	-0.16	0.16	0.01	0.00	-0.25	0.26	0.01	-0.02	0.04	-0.05	0.09	-0.08	1.06
0.16	-0.14	0.36	-0.39	0.32	-0.31	0.08	-0.10	0.20	-0.19	0.26	-0.28	-0.02	0.02	-0.06	0.06	0.14	-0.13	-0.14	0.13	0.07	-0.08	0.00	0.01	0.47
0.29	-0.15	0.31	-0.45	0.02	0.04	0.06	-0.12	-0.14	0.09	0.29	-0.24	0.02	-0.02	0.00	0.00	-0.06	0.06	-0.05	0.05	0.10	-0.11	-0.02	0.03	0.42
0.35	-0.29	0.43	-0.49	0.20	-0.13	0.18	-0.25	-0.01	-0.07	0.22	-0.13	-0.06	0.06	-0.32	0.32	0.10	-0.09	0.26	-0.26	-0.32	0.32	-0.19	0.20	1.26

First Bar Delivery

Nikon QA data looks very good, all specs are met or exceeded

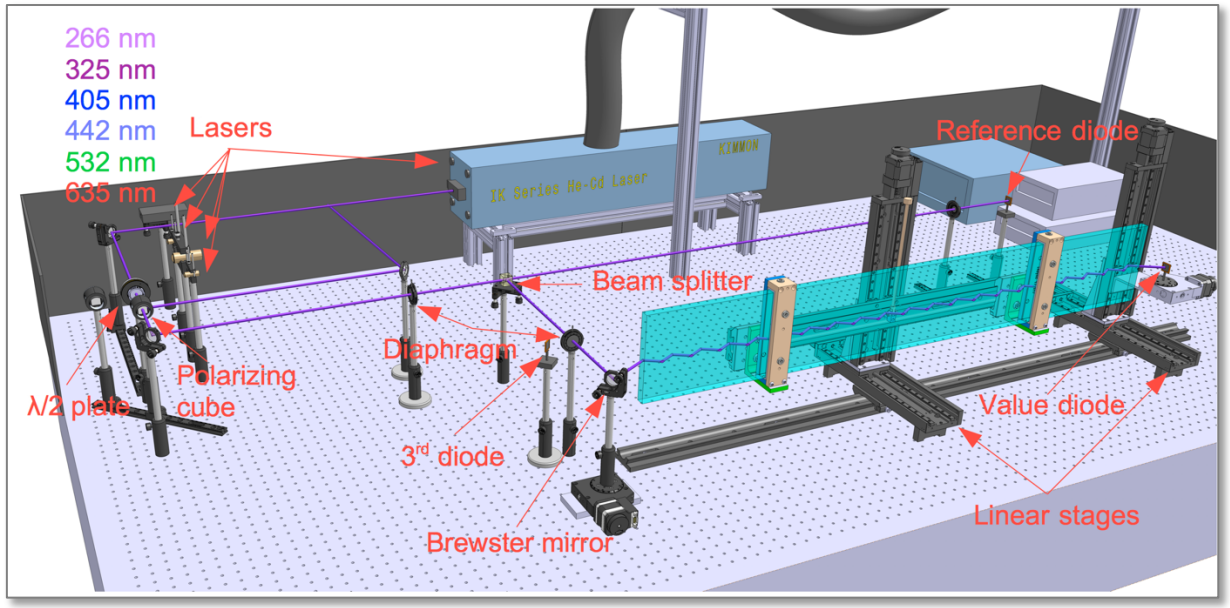
(example: face/side polish spec 5Å, measured 2.8-4.5Å)

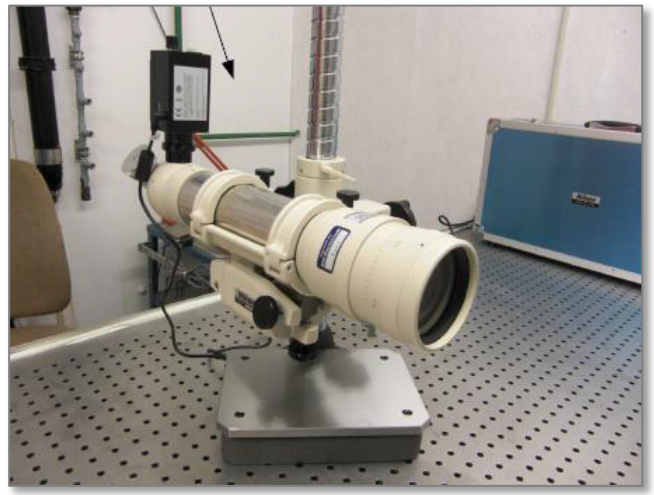
First impression: clean surfaces, no residue from cleaning or packing, very sharp corners

Planned measurements at GSI:

Quality of internal bar surface (laser scanning system)

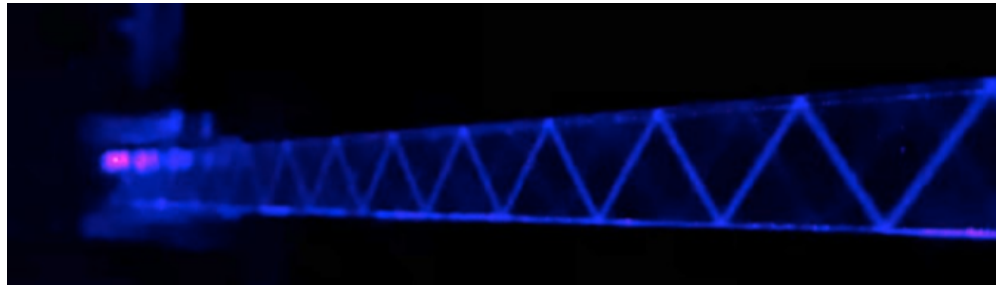
Bar shape (autocollimator)





Nikon bar
under halogen light

Motion-controlled laser scanning setup at GSI



Scan internal bar surface using internal laser beam reflections

(~50 bounces) at up to 6 laser wavelengths

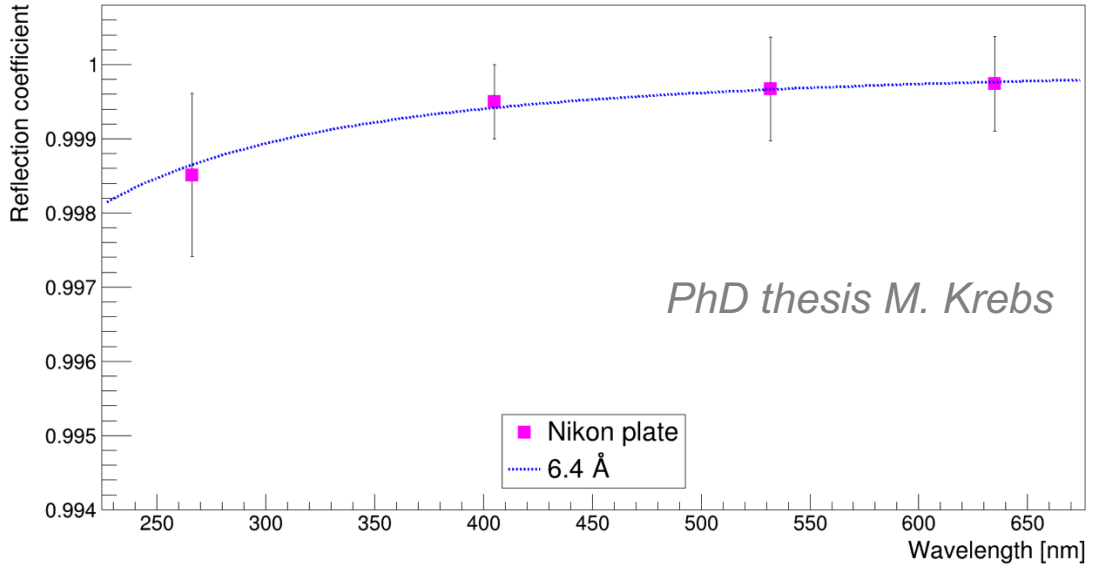
→ determine quality of internal surface finish with few Å accuracy, sensitive to sub-surface damage.

Example for the Nikon prototype plate (2017)

Production spec: surface roughness <10Å

Interferometer measurement (Nikon) 2.8-4.2Å

Laser scanning result: 6.4±2Å



Photon transport efficiency of critical importance to success of Barrel DIRC

Call for Tenders progress:

GSI issued Call for Tenders for two highest-cost and longest-lead items in Q4/2018:

fused silica radiator bars and microchannel-plate (MCP) PMTs (80% of budget).

Fused silica bars:

Sep 5, 2019: Placed order for 98 bars with option for up to 8 more bars (need 96) with Nikon Corp, Japan.

Production started in September, target date for first batch (10 bars): July 2020.

Received shipment of first lot (5 bars) last week (4 months ahead of schedule)

MCP-PMTs: received initial offers from 3 companies, negotiations with two vendors still ongoing.

Concerns about technical qualification of one of the vendors, ordered two sample units from both vendors in Nov 2019, will measure them in detail at Erlangen as basis for technical evaluation.

Received two evaluation tubes from first vendor in late January, expect tubes from second vendor in April.

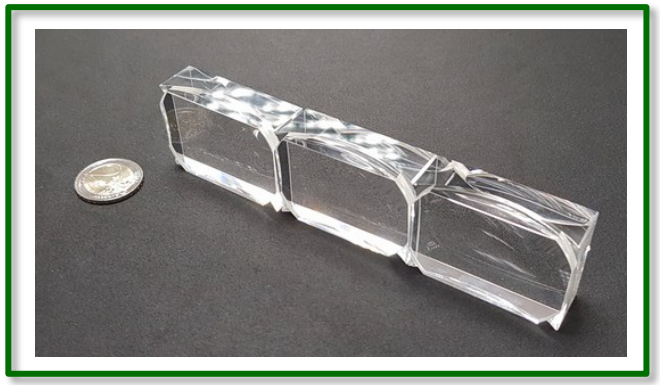
(Today: first results from Erlangen?)

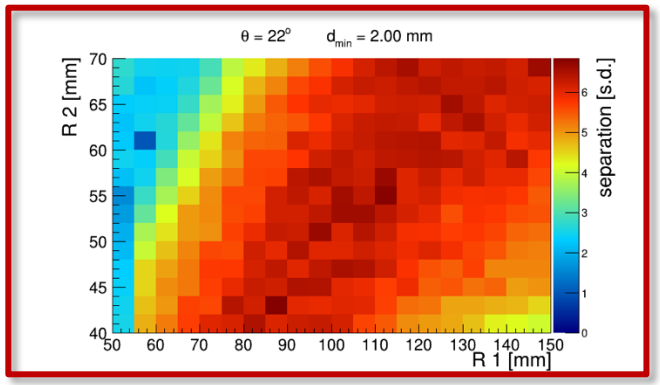
Expect complete results by July 2020, place order soon after.

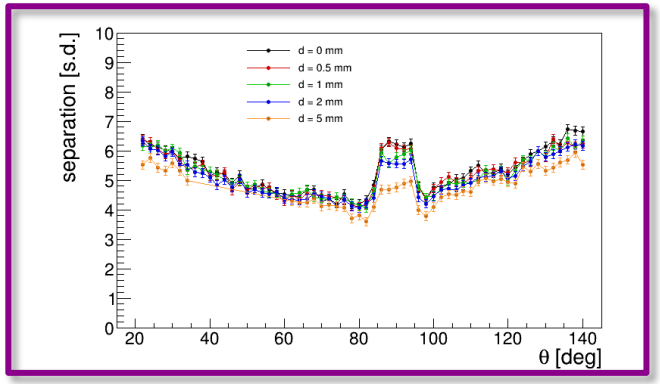
BARREL DIRC STATUS

Other activity highlights:

- Received three 3-layer spherical lens prototypes from German optical company to avoid sole vendor issue, looks very good, will be studied in detail at ODU and CUA in the U.S. (via joint EIC R&D activity).
- Simulation of lens parameters shows no strong dependence of PID performance on lens thickness and multiple possible radii configurations – room for spec discussion with vendors.
- Simulation of prism bevel/chamfer showed that up to 2mm bevel can be tolerated – possible room for cost reduction in mass production.
- Measurements with DiRICH at GSI and Erlangen ongoing.
- Phase-0: commission of second half of GlueX DIRC detector took place in December 2019, GSI team again involved in calibration, reconstruction, simulation, performance studies.

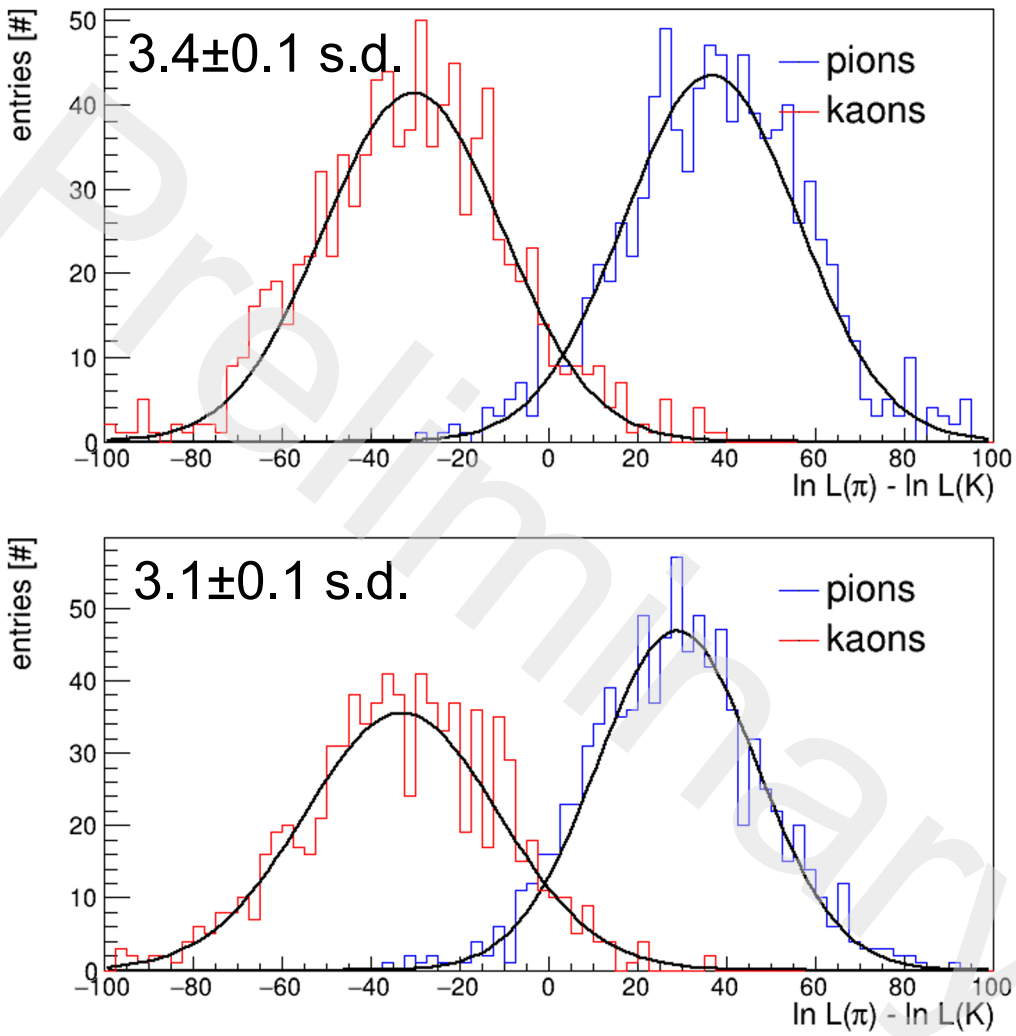




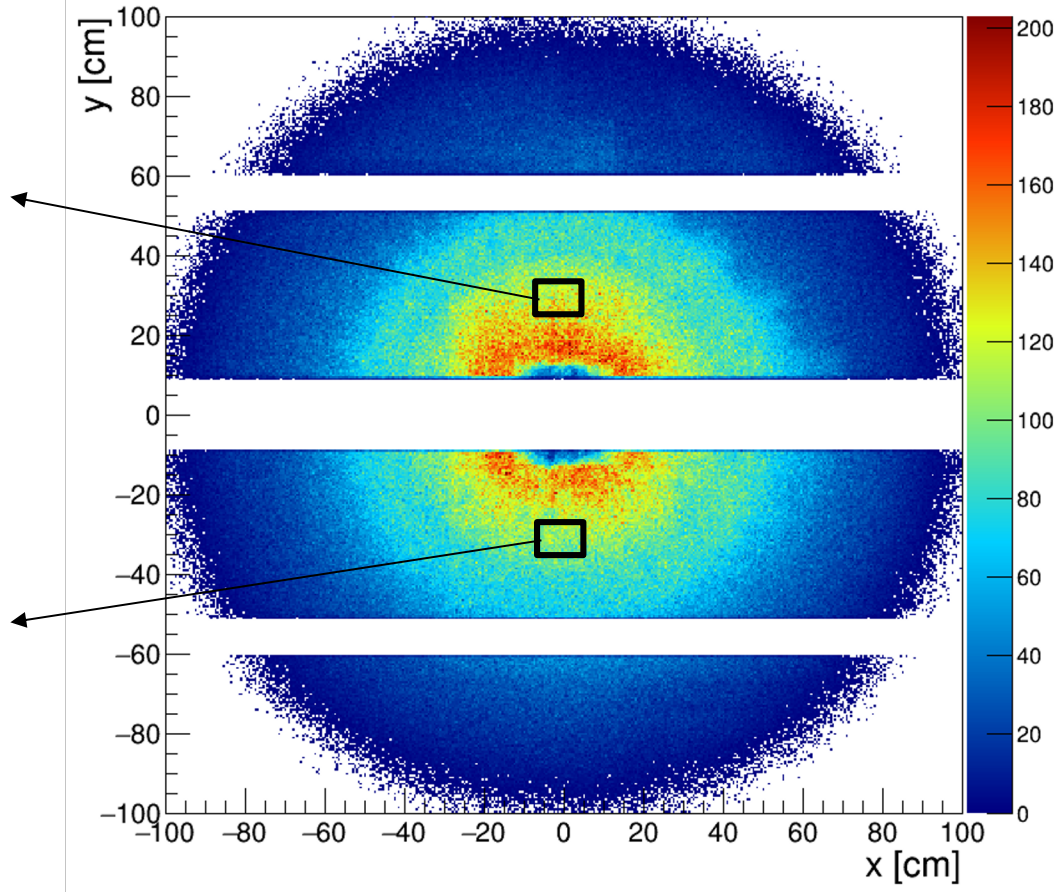


Separation Power (LUT Method)

pions / kaons @ 3 GeV/c momentum



Hit position of the charged tracks on the radiator wall:



(BaBar DIRC: 4 s.d. π/K separation at 3 GeV/c)

Other activity highlights:

- Received three 3-layer spherical lens prototypes from German optical company to avoid sole vendor issue, looks very good, will be studied in detail at ODU and CUA in the U.S. (via joint EIC R&D activity).
- Simulation of lens parameters shows no strong dependence of PID performance o
  – room for spe
- Simulation of prism bevel/chamfer showed that up to 2mm bevel can be tolerated – possible room for cost reduction in mass production.
- Measurements with DiRICH at GSI and Erlangen ongoing.
- Phase-0: commission of second half of GlueX DIRC detector took place in December 2019, GSI team again involved in calibration, reconstruction, simulation, performance studies.

THANK YOU FOR YOUR ATTENTION