High-Voltage Plans in Bern

Florian Piegsa

Albert Einstein Center for Fundamental Physics
University of Bern, Switzerland

UNIVERSITÄT BERN

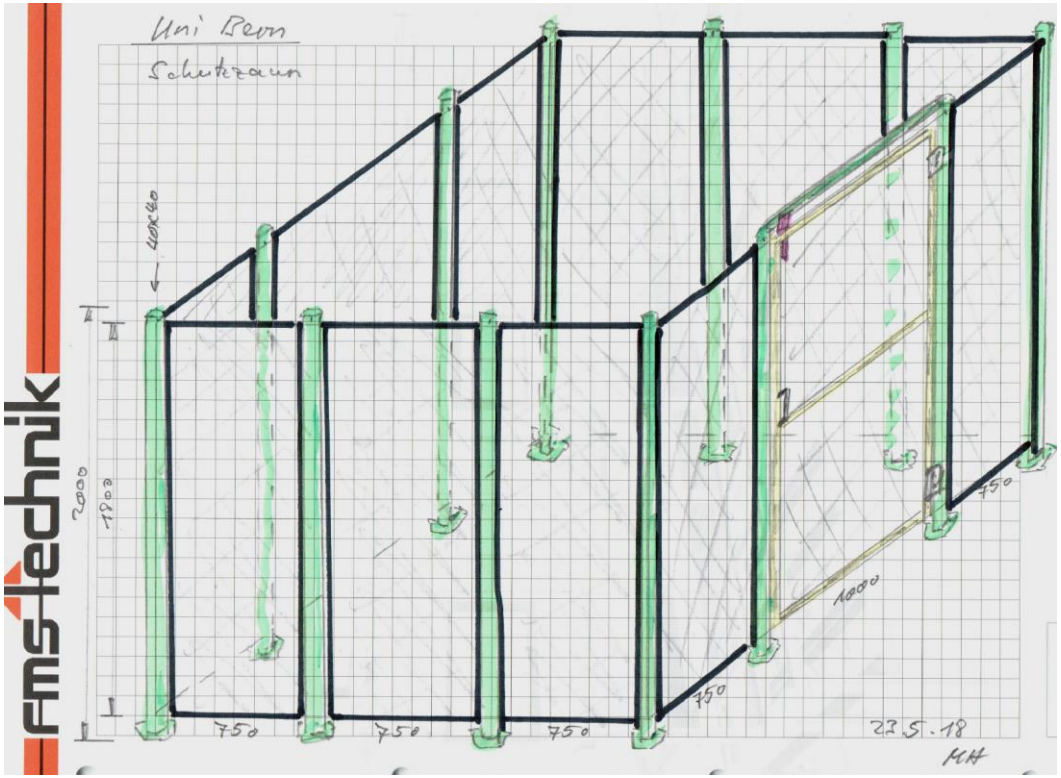
AEC
ALBERT EINSTEIN CENTER
FOR FUNDAMENTAL PHYSICS

- Estelle (about 40%, PhD)
- Jacob Thorne (1. Aug. as PostDoc)
- Andrew Mullins (1. Sept. as Fulbright Fellow / Bachelor)
- Applied for 1 PhD and ½ Postdoc position (SNSF)

High-Voltage Laboratory

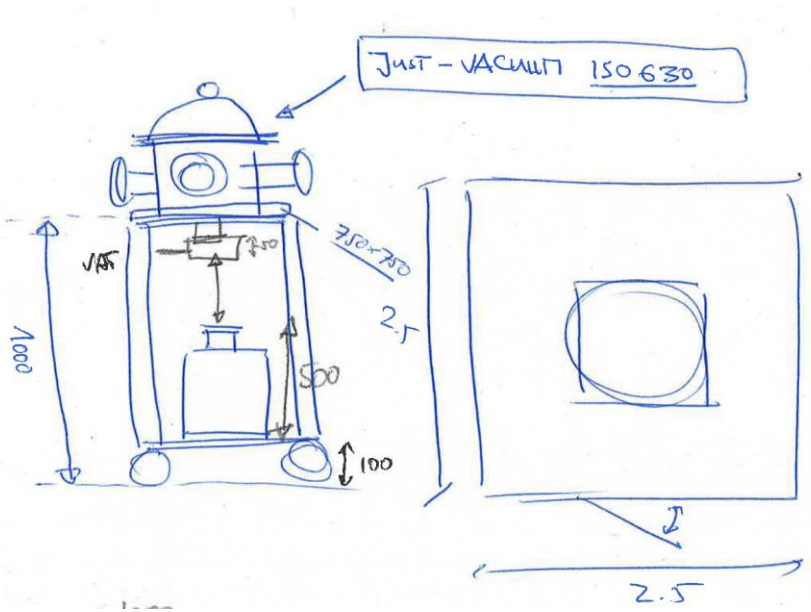
Prototype development and testing

HV-Laboratory

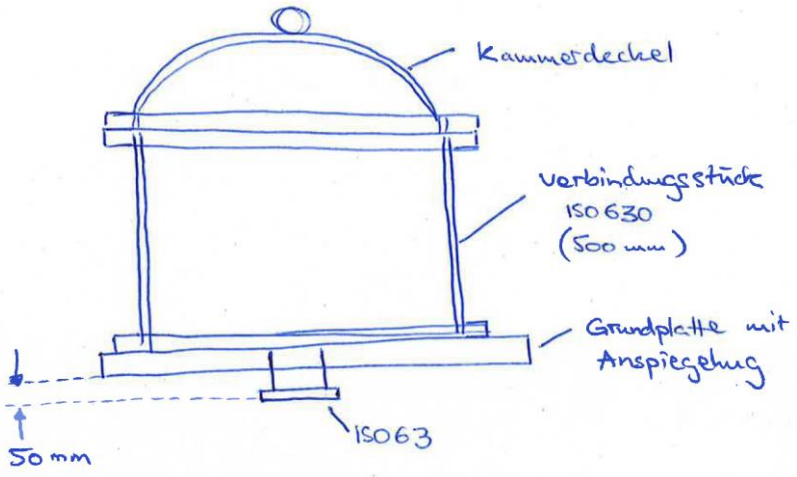


- **Faraday Cage (2.3 x 2.5 m^2)**
- **Vaccum Vessel (ISO-630)**
- **Turbo Pump (Pfeiffer HiPace)**
- **200 fps CCD camera (Thorlabs)**
- **HV-Powersupply (120 kV, ETHZ)**
- **HV-Powersupply (+-35 kV, FUG, 20 weeks)**
- **Leakage current meas. hardware**
- **Crane + Support-Structure/Table**

Support/Table incl. Turbo Pump



ISO-630 Vaccum Test Vessel



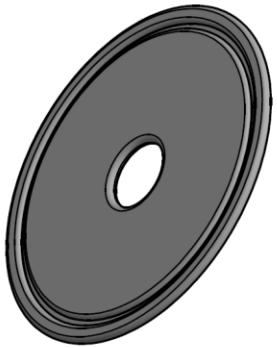
Faraday Cage (top view)

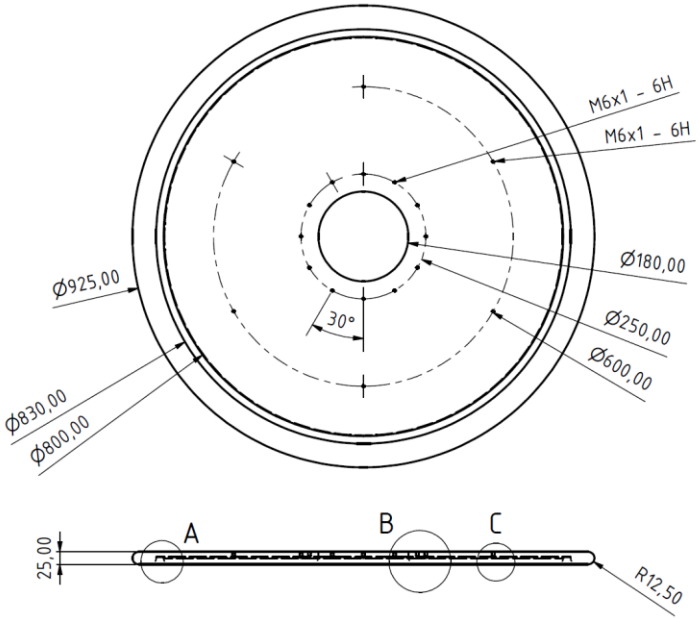
Add several different ISO and KF access flanges

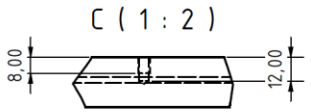
Glass Electrodes

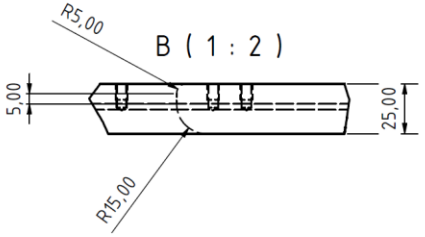
Non metallic – reduce Johnson noise

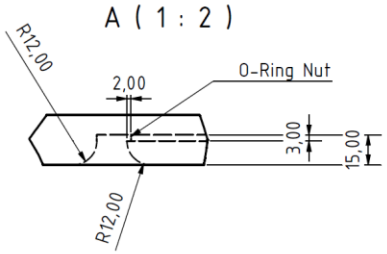
Electrode with typical Features











				Date	Name
			Drawn	05.12.2017	piegsa
			Checked		
			Standard		
State	Changes	Date	Name		

Electrode_25mm+ORing+Loch

1

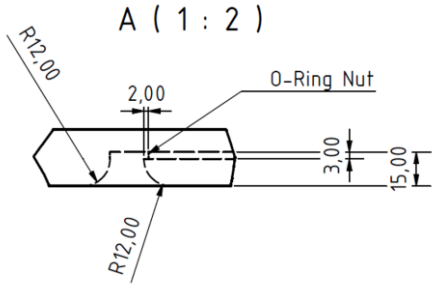
A3

Material:

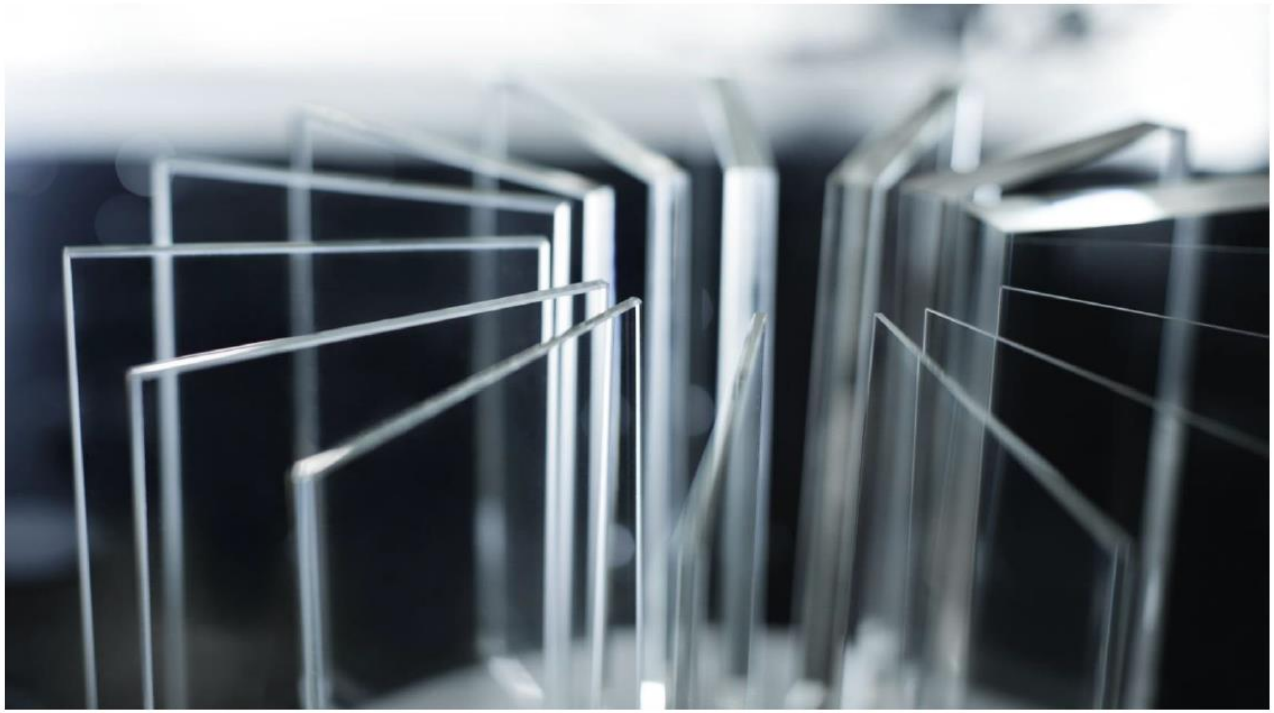
- **Borofloat** is best candidate (price, manchining, and size)
- Zerodur, NBK-7 (BorKron), Fused Silica – all much more expensive and no standard dimensions
- Normal Float (quality worse than Borofloat, Fe impurities)

Machining:

- Double sided polishing will not be possible in these dimensions (max. 600 mm, Schott Yverdon has already largest machines in Europe)
- No threads – except metal inlays
- Thickness variation / waviness (next slide)
- O-ring groove (Schott: possible but difficult, Swissneutroncis idea: flat seal)
- Special tools for machining glass – need to be ordered (about 2 kCHF per tool, not too many different radii etc.)
- Coating (Al, Cu, DLC) ?



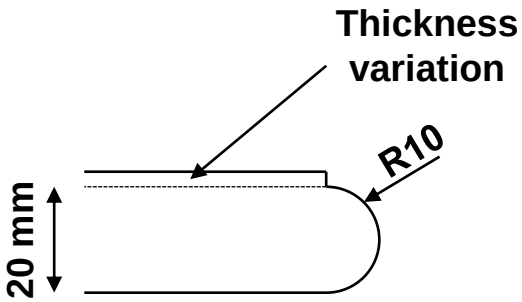
Schott Borofloat



Standard thicknesses	
Nominal thickness (mm)	Tolerance (mm)
0.70	± 0.05
1.10	± 0.05
1.75	± 0.05
2.00	± 0.05
2.25	± 0.05
2.75	± 0.10
3.30	± 0.20
3.80	± 0.20
5.00	± 0.20
5.50	± 0.20
6.50	± 0.20
7.50	± 0.30
9.00	± 0.30
11.00	± 0.30
13.00	± 0.30
15.00	± 0.40
16.00	± 0.50
18.00	± 0.50
19.00	± 0.50
20.00	± 0.70
21.00	± 0.70
25.40	± 1.00

Sheet sizes for standard thicknesses	
Nominal thickness (mm)	Standard size width x length (mm)
0.70 – 25.40	1,150 x 850
16.00 – 21.00	1,700 x 1,300
0.70 – 15.00	2,300 x 1,700

Semi-Circle



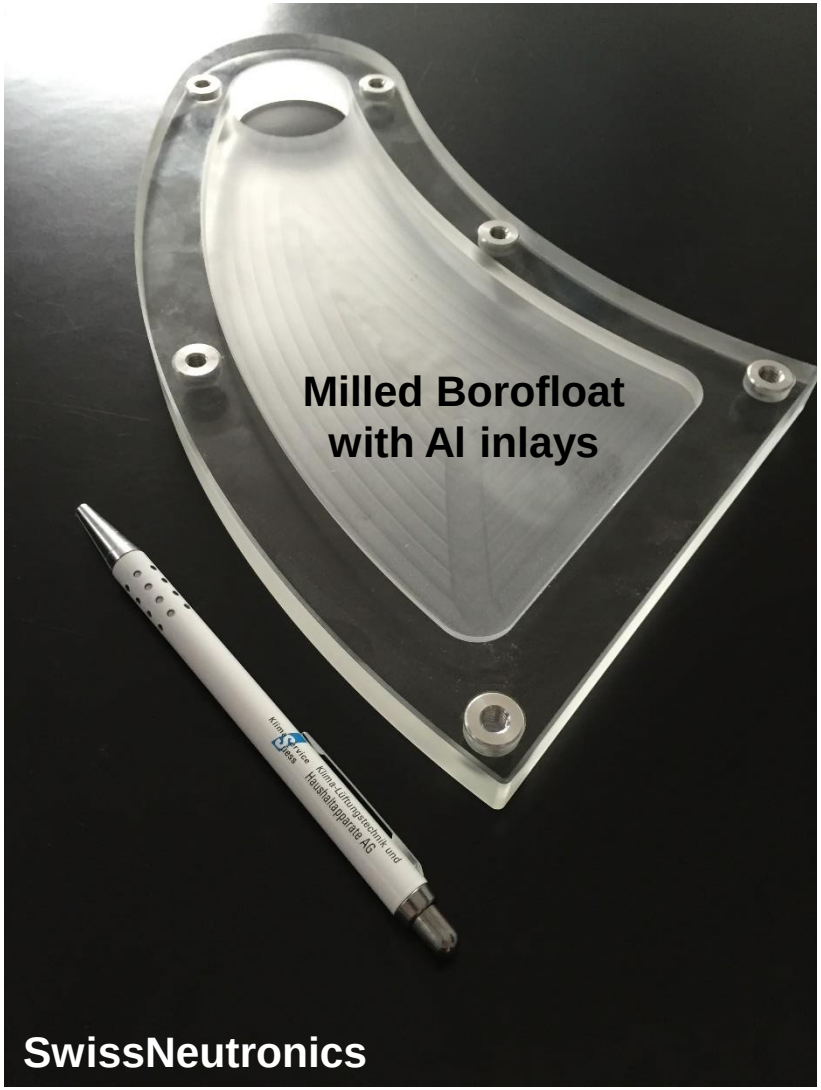
Disadvantage: potential steps at the edges

C-shaped edge

Disadvantage: not perfect tangential edges

Glass Electrodes – Companies

Huge experience but maybe less skills than SwissNeutronics (also concerning neutron optics)



Get new machine in Jan. 2019 - then 1 m possible
Can glue glass (UV-glue) – stacks of glass plates

IFASO GmbH (spin-off TH Deggendorf)

Polishing of glass blanks for ELT, but no further machining

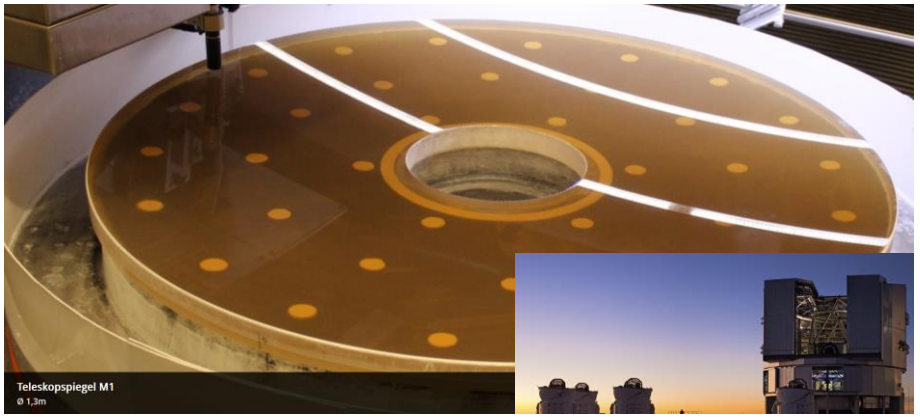
No definate offer yet

Nice surfaces, but expensive, long delivery and:

“Sehr geehrter Herr Piegsa,

bei unserer Anwendung ist der Bezug von Vorder- zu Rückseite nicht erheblich maßgeblich, da die Spiegel bei der Montage ausjustiert werden. Bei 1 m Durchmesser würde ich von einem Keilfehler von etwa 0,4 mm ausgehen. Die Seiten an sich alleine betrachtet können natürlich besser 10 µm in der Form/ Welligkeit gefertigt werden.

Mit freundlichen Grüßen
Heiko Biskup”



- **Continue Setting up High-Voltage Lab and Infrastructure (Faraday cage, vacuum vessel, support table …)**
- **Start building HV tools/parts (ballast resistor, leakage current, feedthrough, …)**
- **Start designing/building prototypes - Al and glass electrodes**
- **Question/Discussion: Is waviness/distance variation of the glass electrodes a problem ? Can it cause a systematic effect (1 mm / 120 mm < 1%) ?**

Thank you for your attention.