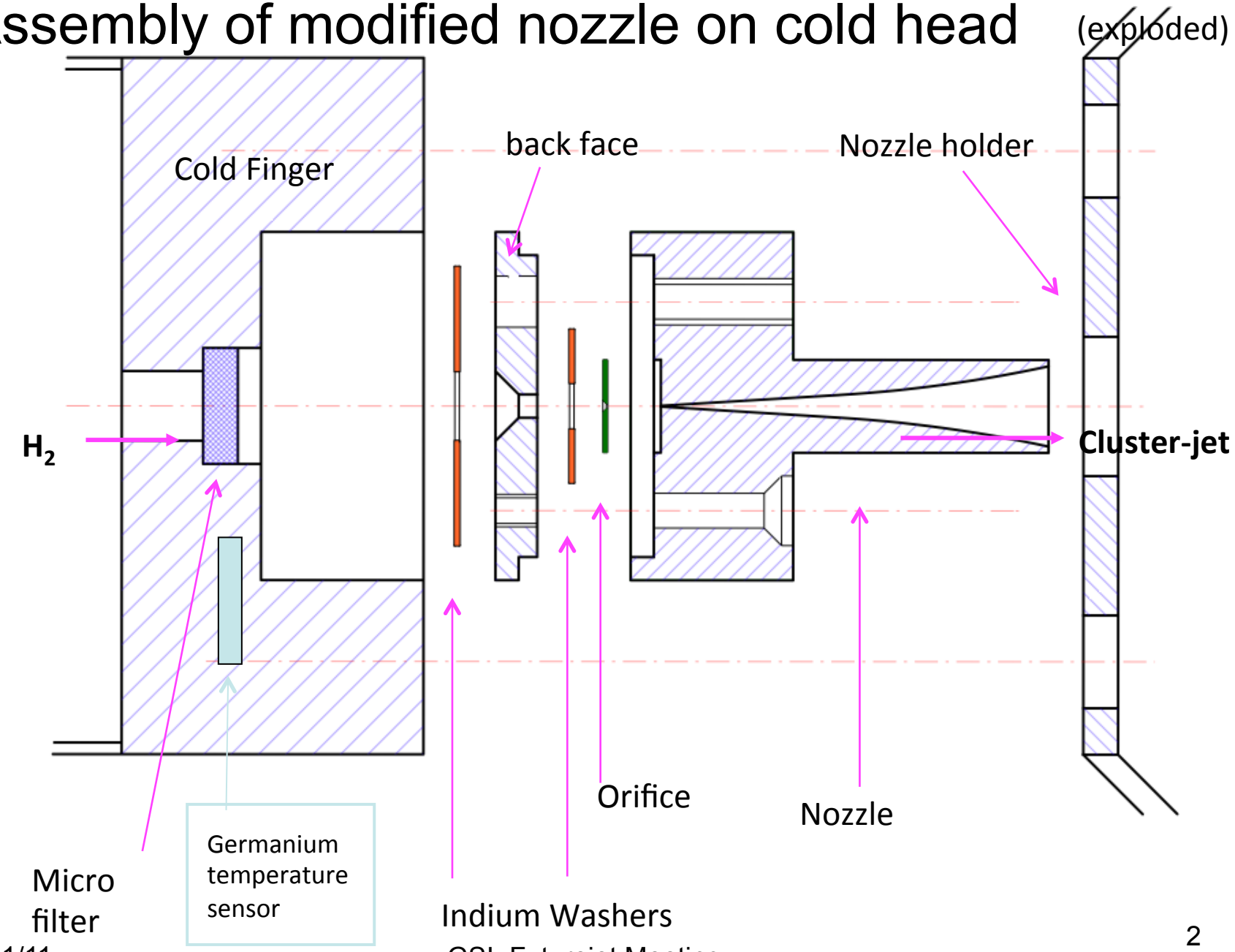
Jet@Genoa

Renzo Parodi
INFN_Genoa

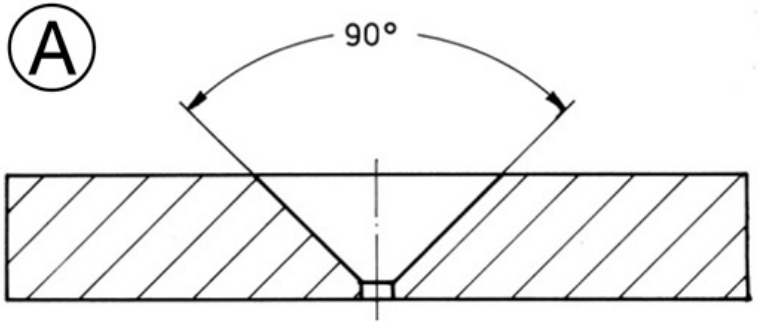
Assembly of modified nozzle on cold head



Composite Nozzle Developement

- The idea is to use a commercial Electron Microscope orifice available from diameter of 5μm up to 1250μm
- And to insert the orifice in a large throat ~100 μm Trumpet Nozzle

Plano Gmbh Electron Microscope orifices



Aus Platin/Iridium:
4 mm Ø, 0,2 mm dick Ⓐ

A0400P	5 µm Lochdurchmesser
A0401P	10 µm Lochdurchmesser
A0402P	20 µm Lochdurchmesser
A0403P	25 µm Lochdurchmesser
A0404P	30 µm Lochdurchmesser
A0405P	40 µm Lochdurchmesser
A0406P	50 µm Lochdurchmesser
A0407P	60 µm Lochdurchmesser
A0408P	70 µm Lochdurchmesser
A0409P	100 µm Lochdurchmesser
A0410P	150 µm Lochdurchmesser
A0411P	200 µm Lochdurchmesser
A0412P	250 µm Lochdurchmesser
A0413P	300 µm Lochdurchmesser
A0414P	400 µm Lochdurchmesser
A0415P	500 µm Lochdurchmesser
A0416P	600 µm Lochdurchmesser
A0417P	750 µm Lochdurchmesser
A0418P	1000 µm Lochdurchmesser
A0419P	1250 µm Lochdurchmesser

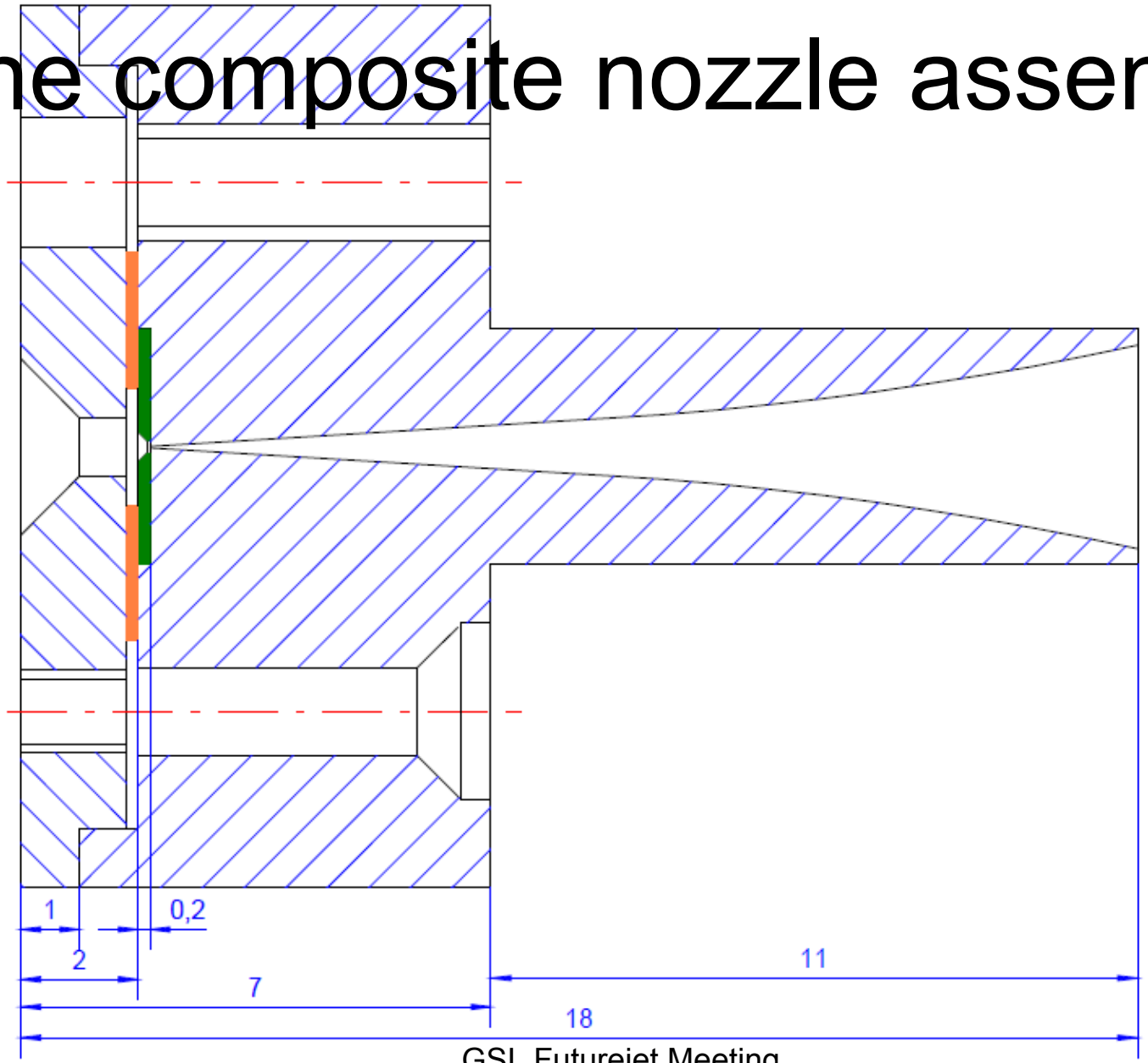
Aus Molybdän:
4 mm Ø, 0,2 mm dick Ⓐ

A0401M	10 µm Lochdurchmesser
A0402M	20 µm Lochdurchmesser
A0403M	25 µm Lochdurchmesser
A0404M	30 µm Lochdurchmesser
A0405M	40 µm Lochdurchmesser
A0406M	50 µm Lochdurchmesser
A0407M	60 µm Lochdurchmesser
A0408M	70 µm Lochdurchmesser
A0409M	100 µm Lochdurchmesser
A0410M	150 µm Lochdurchmesser
A0411M	200 µm Lochdurchmesser
A0412M	250 µm Lochdurchmesser
A0413M	300 µm Lochdurchmesser
A0414M	400 µm Lochdurchmesser
A0415M	500 µm Lochdurchmesser
A0416M	600 µm Lochdurchmesser
A0417M	750 µm Lochdurchmesser
A0418M	1000 µm Lochdurchmesser
A0419M	1250 µm Lochdurchmesser

First attempt in GSI

- Starting from a 50μm Cern Laval Nozzle
- A 100μm throat trumpet was built and a Plano 30μm Orifice inserted.
- The composite nozzle was tested on the GSI jet target test stand showing the same behaviour of a similar 35μm standard CERN Laval Nozzle
- Ask Herbert Orth for more details
- The resulting composite GSI design by Wolfgang Quick and Andreas Gerhardt is shown in the following slide.

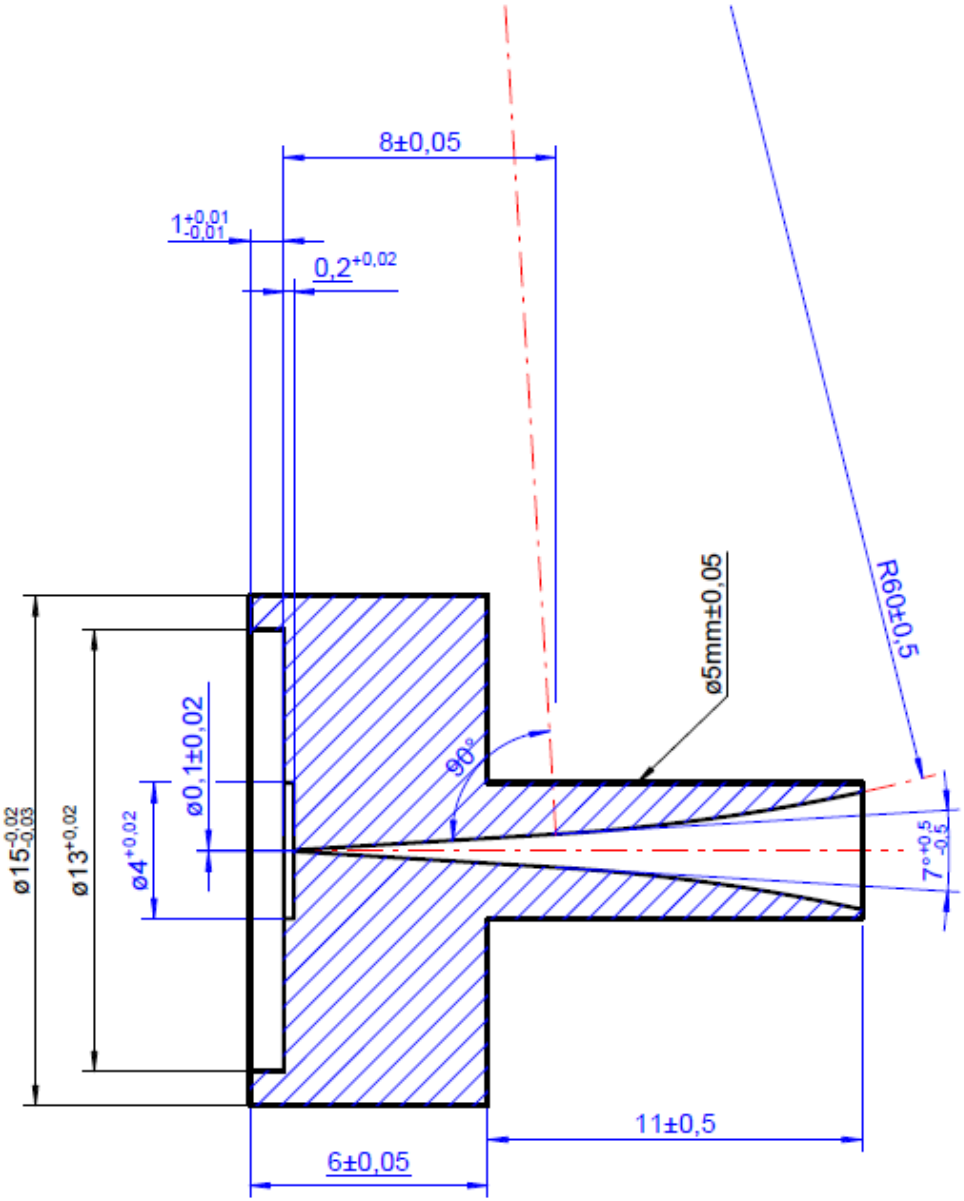
The composite nozzle assembly



The Composite Nozzle Production Process

- On the basis of the test result a design was developed in GSI for the composite Nozzle.

Herbert Ort,Wolfgang Quick, Andreas Gerhardt



Blenden Grundkörper

The Composite Nozzle Production Process(continued)

- The only problem is now to drill a ~100 μm hole at the trumpet end.
- This step need to be done using already available “Industrial Processes” giving the needed reliability and reproducibility.

The Composite Nozzle Production Process (continue)

We tried Sinker Electric Discharge Machining (EDM)

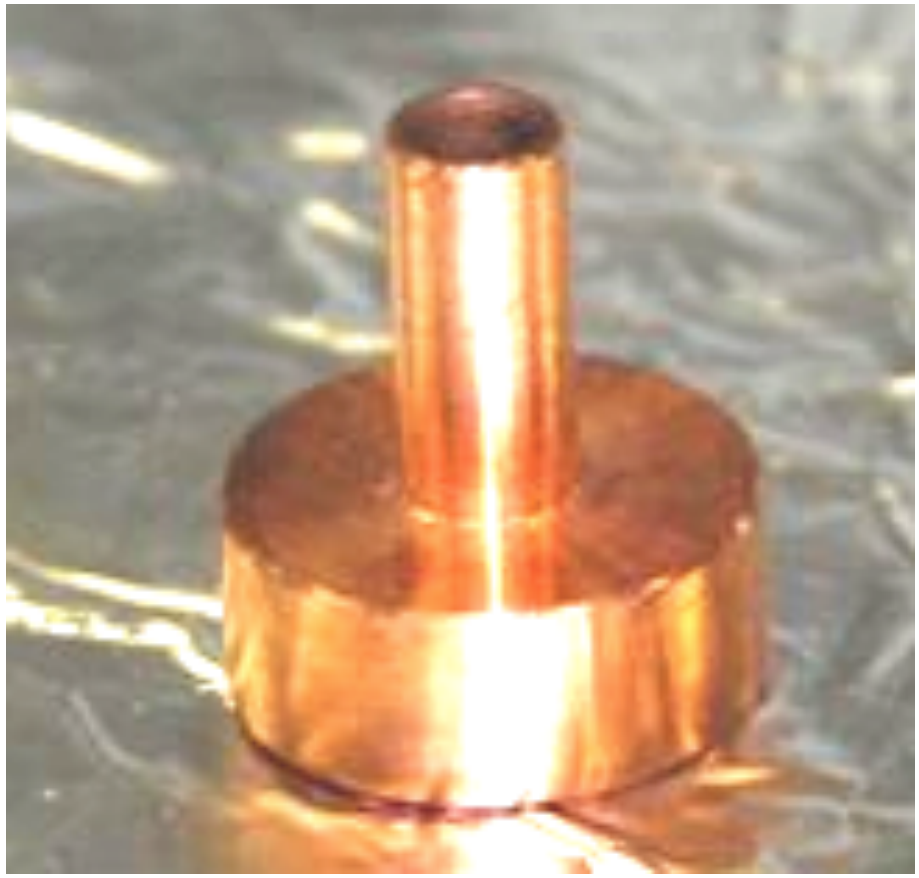
1. A copper Cylinder is lathe machined to the outer dimension of the nozzle
2. The inner shape of the trumpet is formed using a Sinker EDM machine, leaving a ~.5mm copper diafragm at the end of the nozzle
3. The Throat is then obtained using a Sinker EDM with an electrode of~ 70 μm diameter

Trumpet Nozzle Construction

- Step 1: Nozzle blanks production (lathe machining)

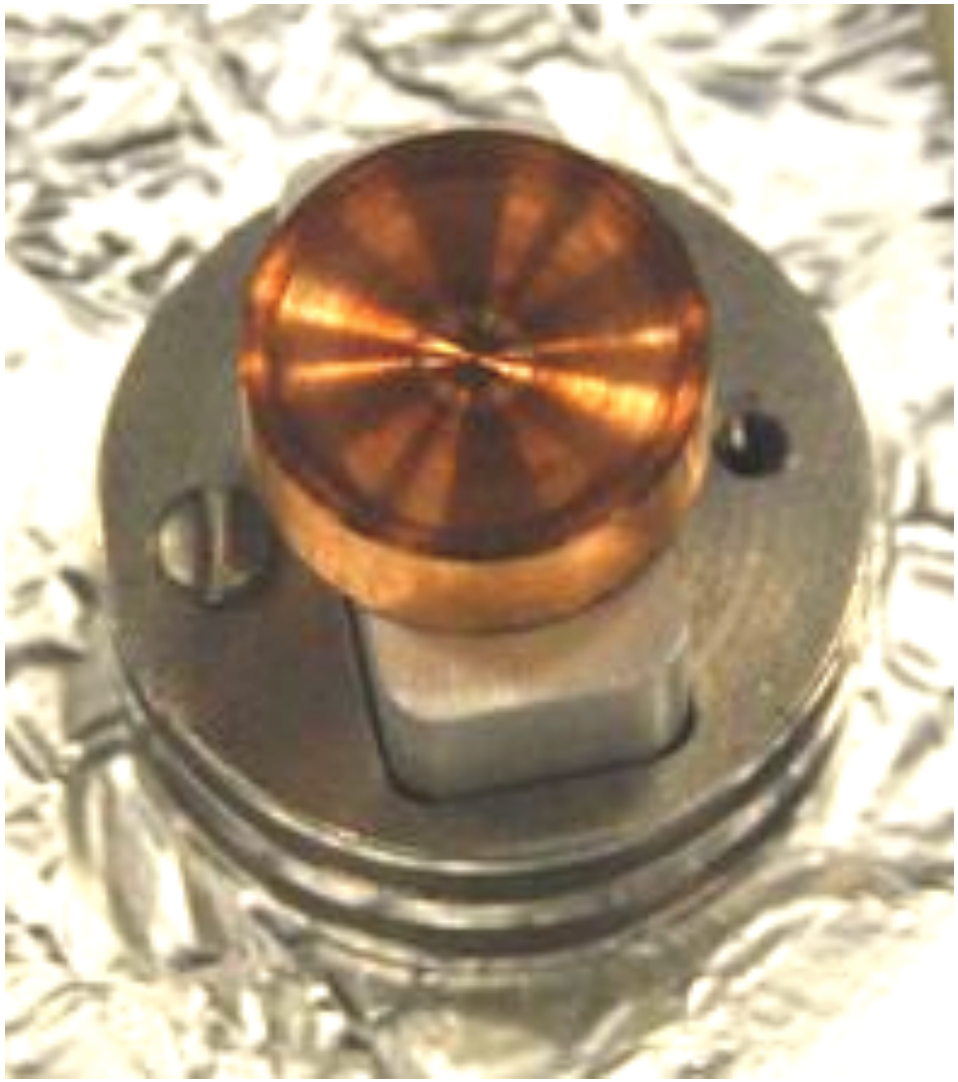
Trumpet Nozzle Construction

- Step 2: Nozzle Trumpet production (Sinker EDM)

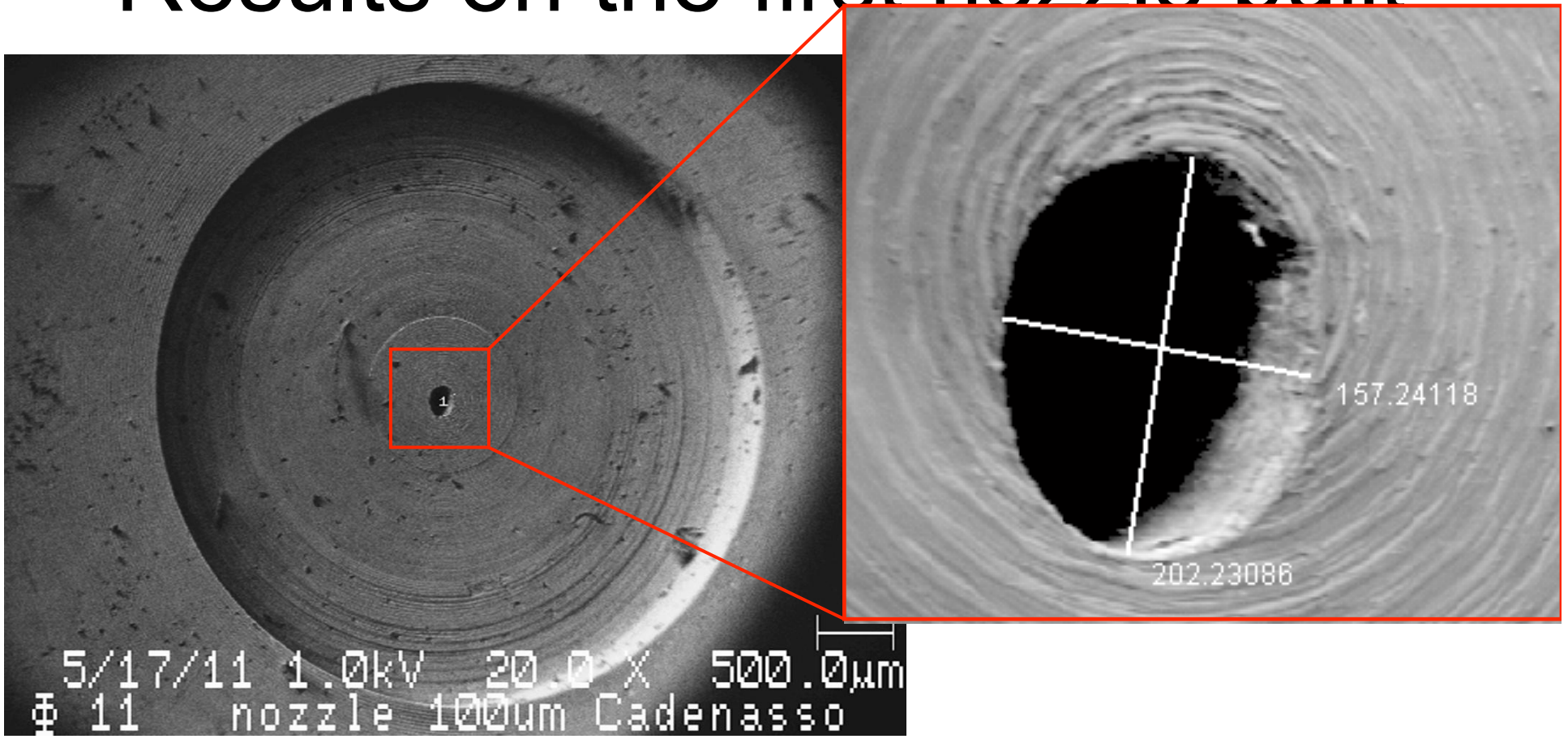


Trumpet Nozzle Construction

- Step 3: Nozzle Throat Hole (Sinker EDM)



Results on the first nozzle built



The throat is a bit off centre

The throat is elliptic with axes 157x 202 μm

We need to improve (a better EDM machine)

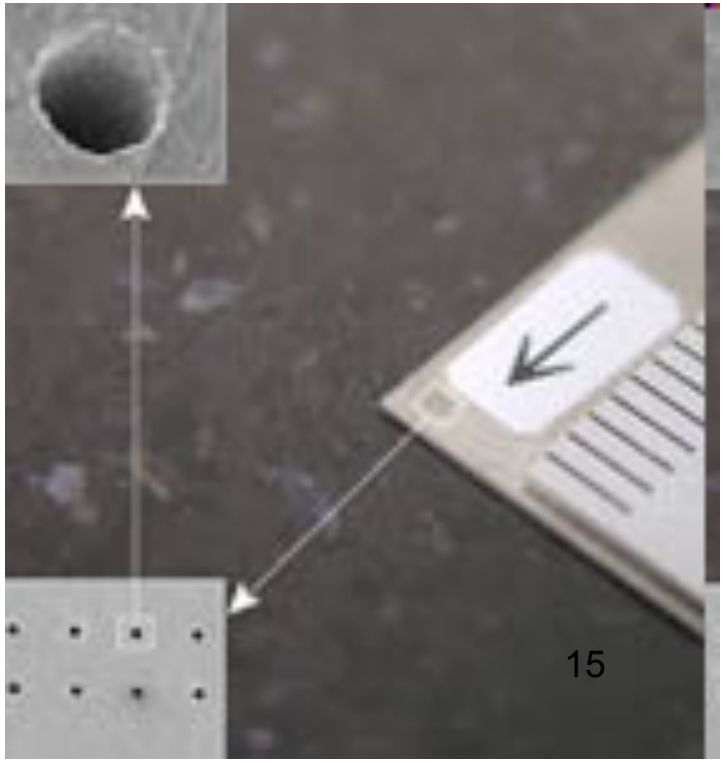
and check the reproducibility.

Precision sinker EDM are available

- Material: WC/G5
  Thickness: 3 mm
- Electrode Material: Tungsten Rod
  Electrode Diameter: Φ 20 μm
- Hole Diameter: In - 37 ~ 38 μm
- Out - 38 ~ 40 μm

Sodick

K1BL
SMALL HOLE EDM



Developments

- We placed in June an order for 5 nozzles using the tooling and the machining system used for the first prototype.
- The aims is to check the average quality of the production both for nozzle diameter and position reproducibility.
- The samples will be delivered by the end of the month.
- We hope for more info on the quality of the resulting nozzles by the time of the December Panda Meeting

Smaller Orifices ~ 30μm

- Gainsonic, the small firm producing the prototypes, is not equipped with Precision EDM Sinkers for ~ 30 μm nozzles.
- We are checking the availability and quality of such EDM sinkers in the network of EDM shops in the surrounding of Turin and Milan