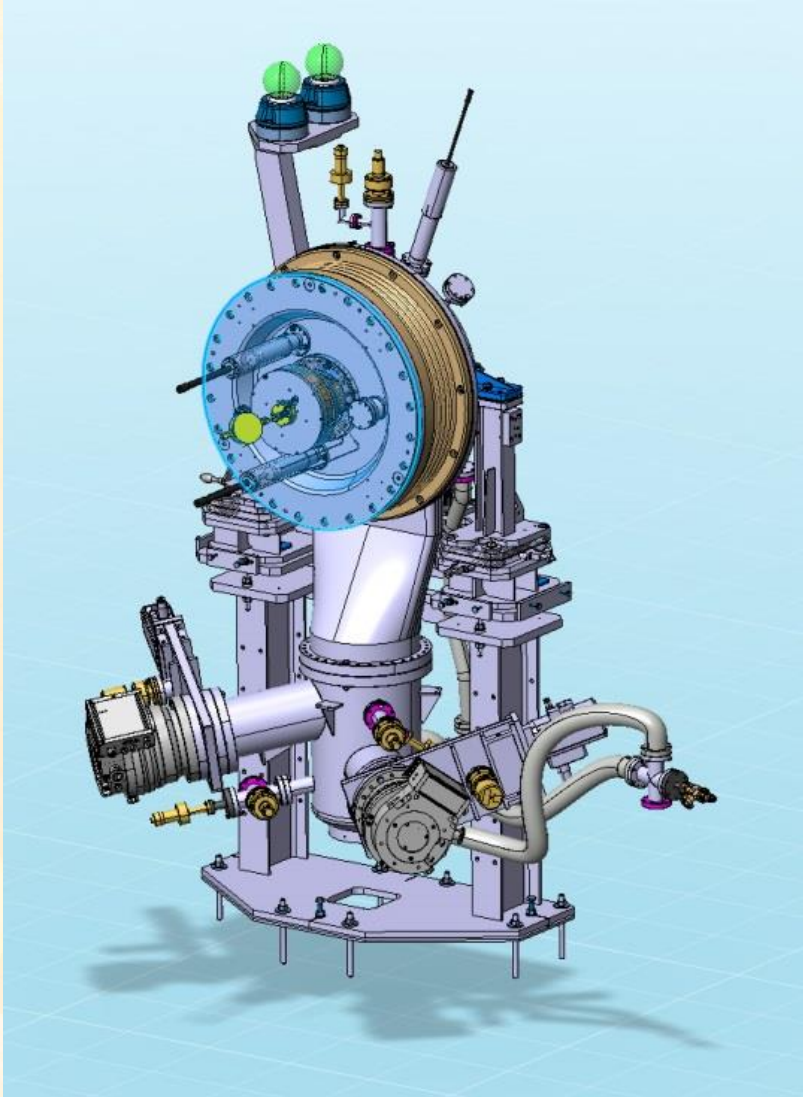


LINAC4 Ion Source Review

Design, Engineering and Production

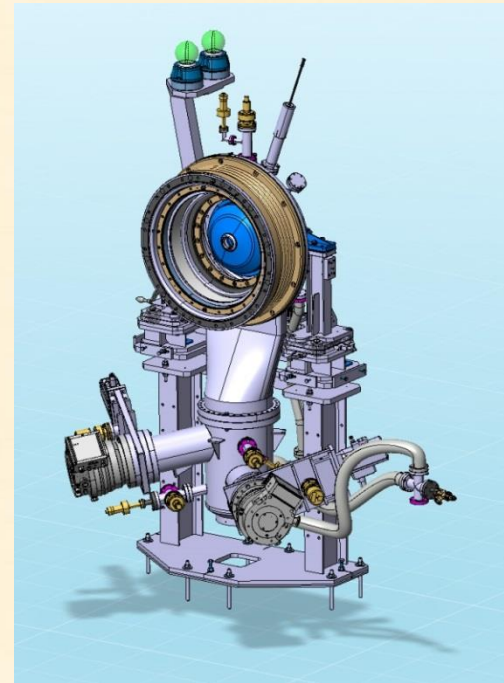
Didier Steyaert – Pierre Moyret – Serge Mathot
On behalf of MME Design Office and Mechanical workshop



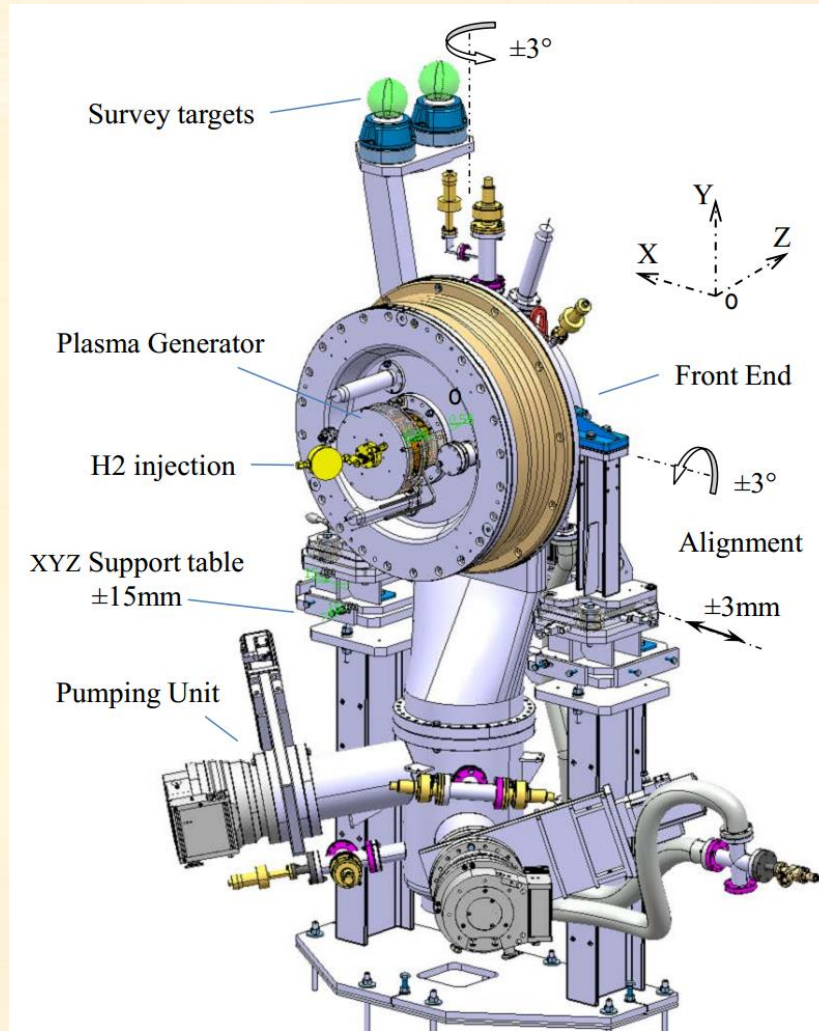
The source has been split into 4 sub elements:

- The Support
- The Front-End
- The pumping Unit
- And the Plasma Generator (PG) + Flange + Electrodes

Common elements to all sources



IS01-1 Installed in Aug. 2012



In August 2012, The first Source was installed.

- Design ready within 7 months
 - Manufacturing done in 5 months
- Ready in June 2012

Design: 670 Drawings

Manufacturing: 145 kChF for PG
500 kChF for Common parts
40 kChF for Faraday Cage

drawing SPLNFHR	L4-ISWP			
	E	F	G	
units produced :	DESY	IS01	IS02	IS03
Frontend	0	2	-	-
Extraction optics	0	2	x	x
Plasma Generator	1	2	2	1
Flange	1	2	2	x
Main insulator	0	2	x	x
RF-Transfo-Matching	0	2	-	-
Handling-gear	0	2	x	x

Engineering Department

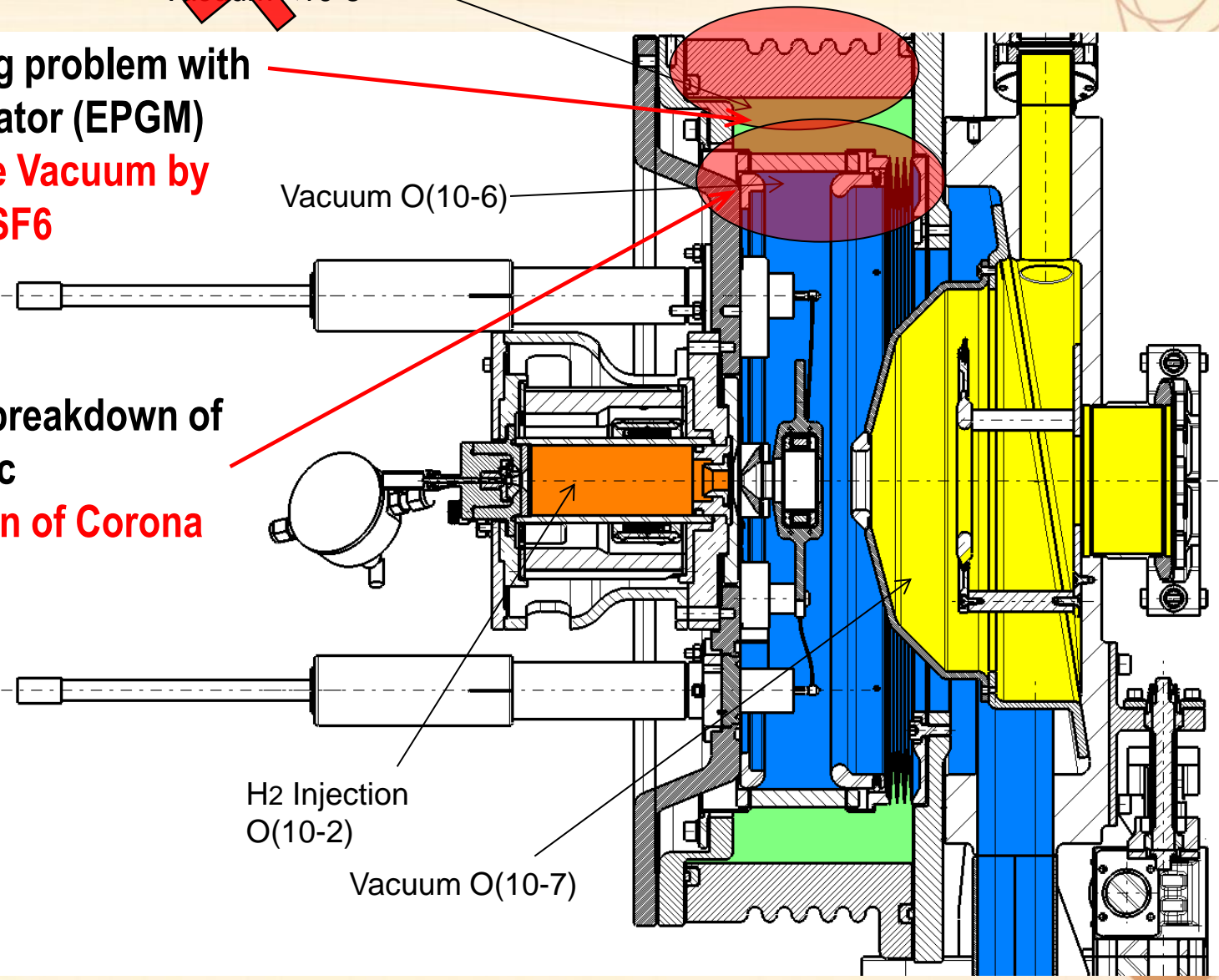


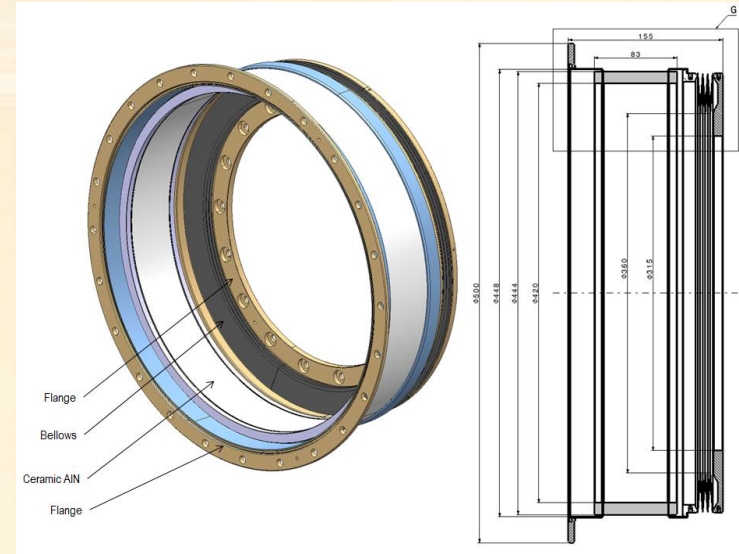
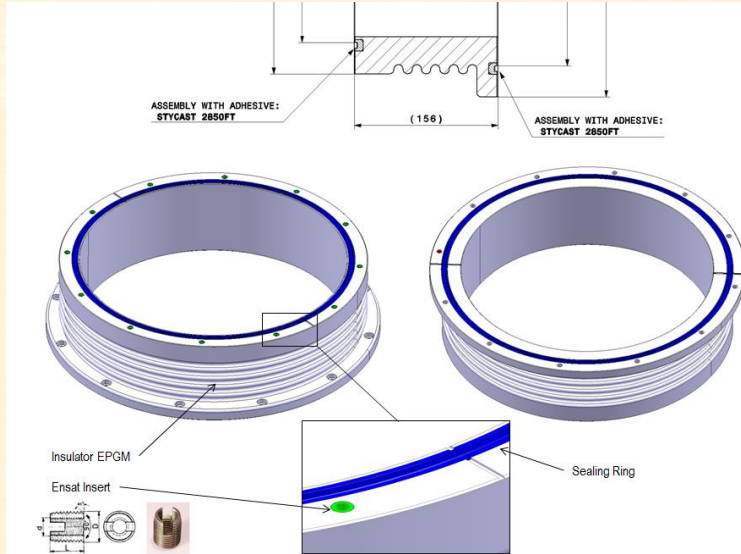
IS01-2 Installed in Dec. 2012

~~Intermediate Vacuum 10^{-5}~~

2011
LINAC4 Ion Source Review
Outgassing problem with main insulator (EPGM)
→ Replace Vacuum by Enclosed SF6

2012
IS01-1 - B152
IS01-2 - B152
2013
IS01-3 - B152
IS01-3 - 400
IS02 - B152
2014
Electrical breakdown of the ceramic
→ Insertion of Corona protection

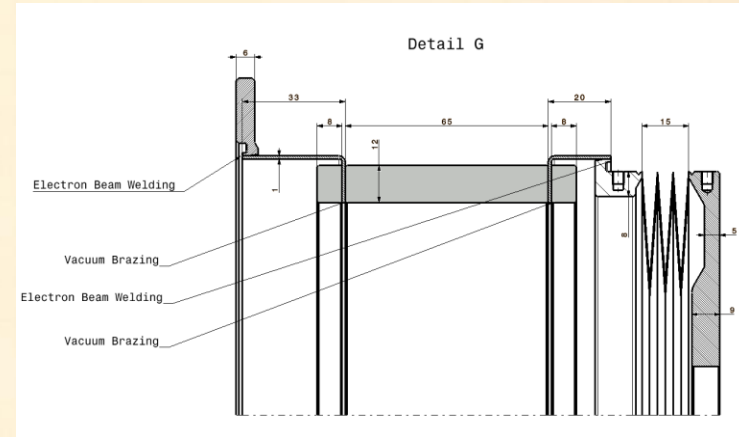


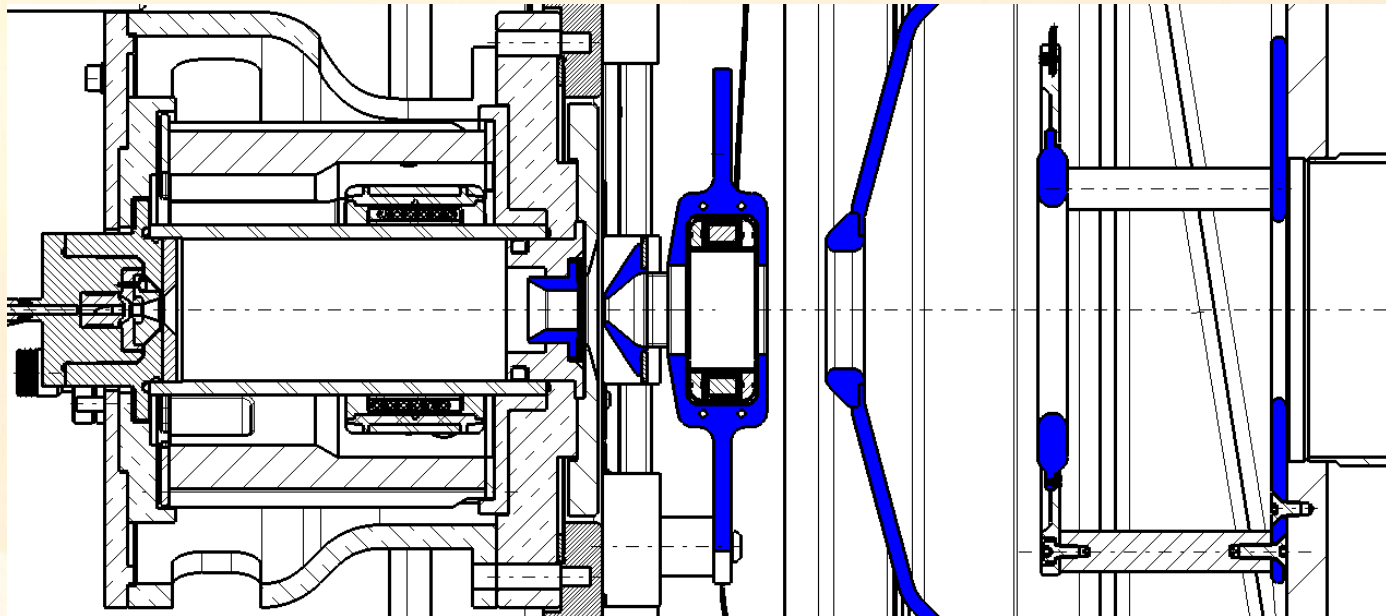
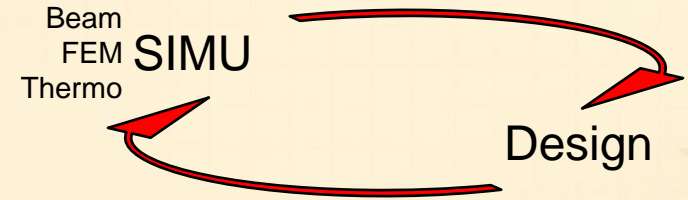
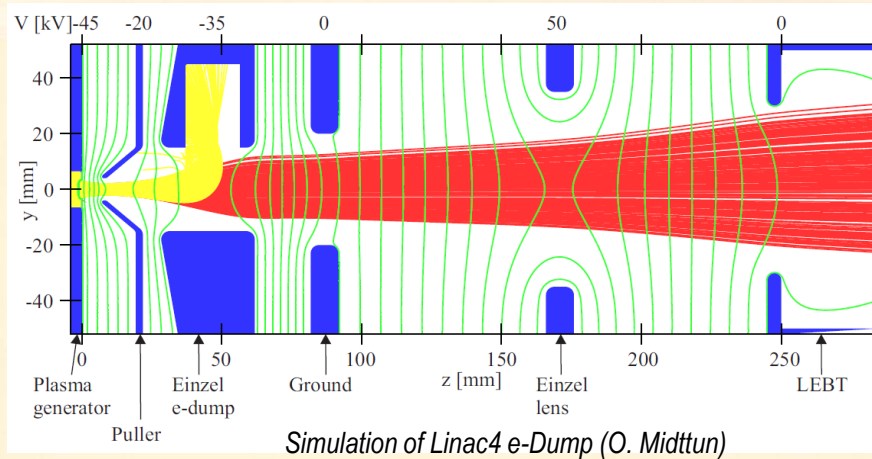


EPGM Insulator



Main Insulator Al₂O₃



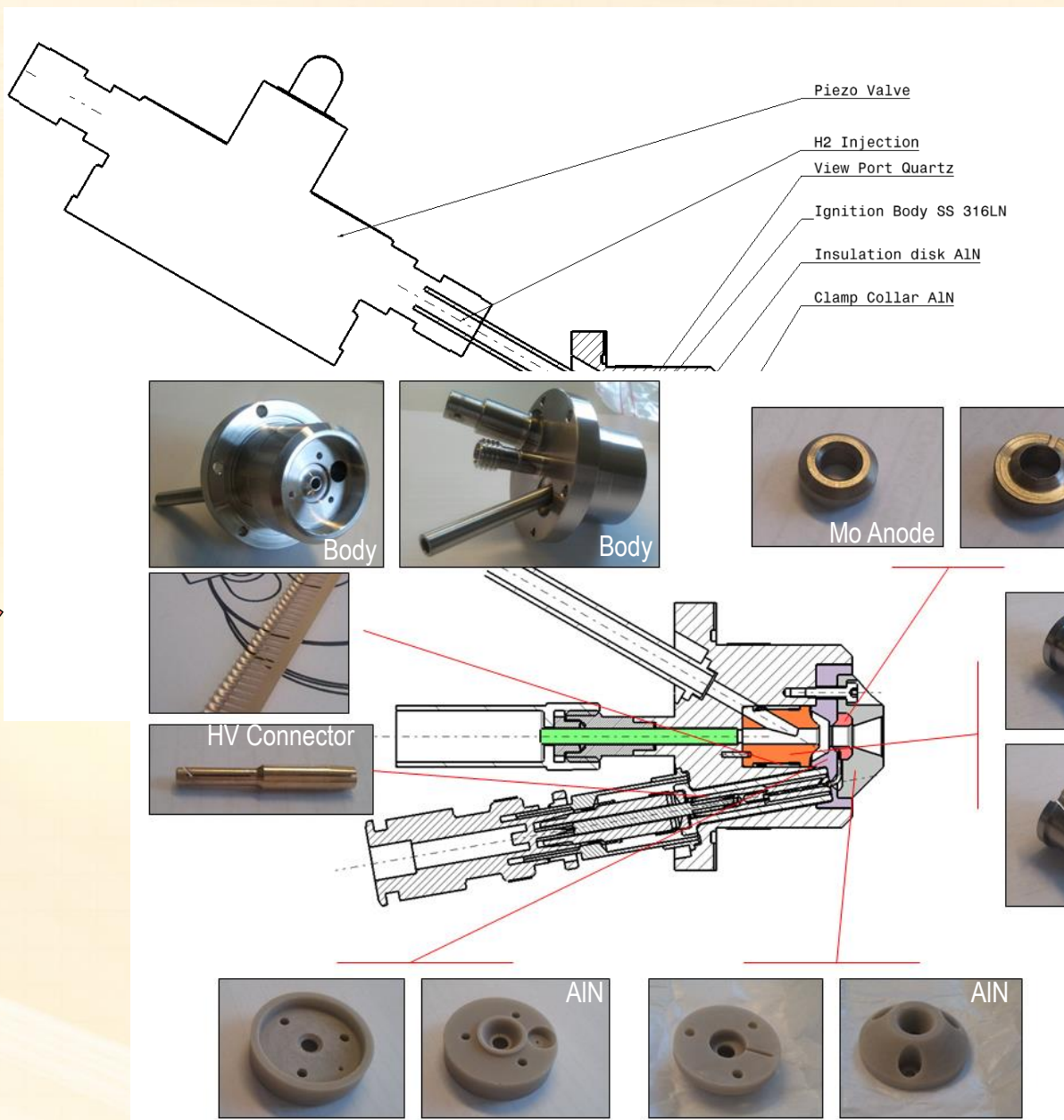


- 2011
- LINAC4 Ion Source Review
- 2012
- IS01-1 - B152
- IS01-2 - B152
- 2013
- IS01-3 - B152
- IS01-3 - 400
- IS02 - B152
- 2014



Multi Manufacturing technics:

- Wire cutting
- Turning
- BE welding
- TIG Welding
- Brazing



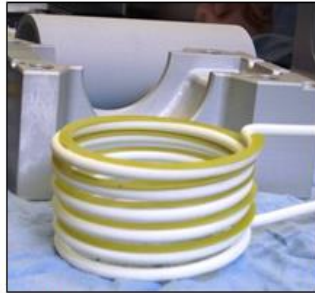
Engineering Department



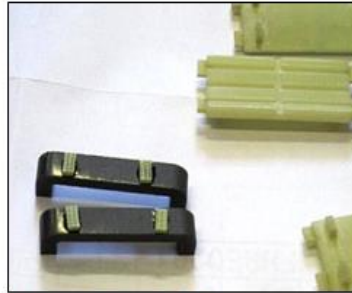
IS01-2 Antenna



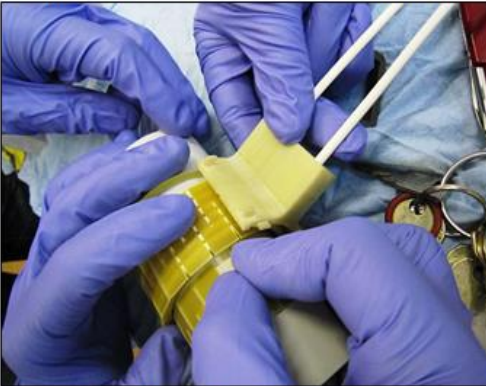
Antenna moulded directly on ceramic chamber including ferrites



Coil Spacers



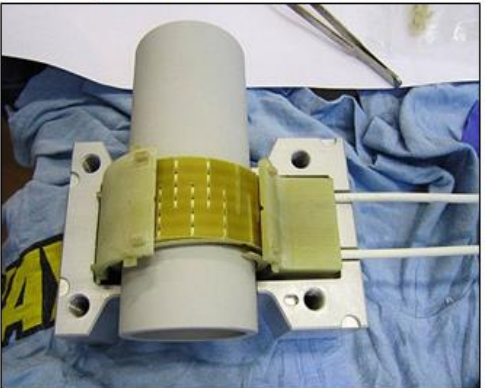
Spacers glued on ferrite



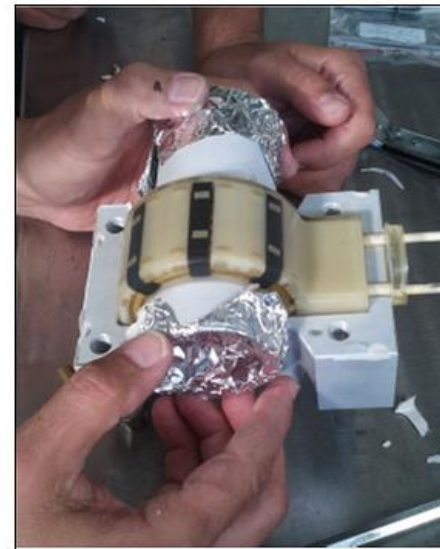
Assembly on AIN Chamber



Ferrite +



Before closing



Demoulding



Final Assembly

2011

LINAC4 Ion Source Review

2012

IS01-1 - B152

IS01-2 - B152

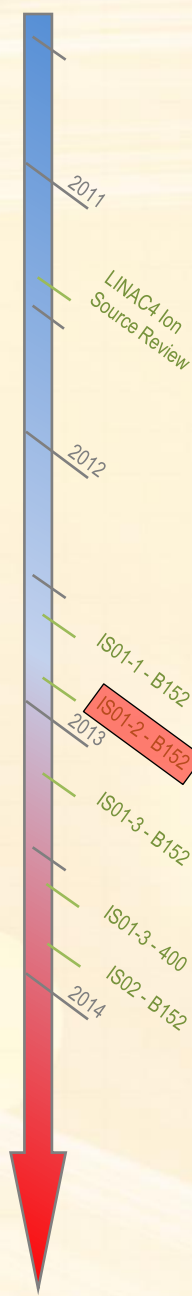
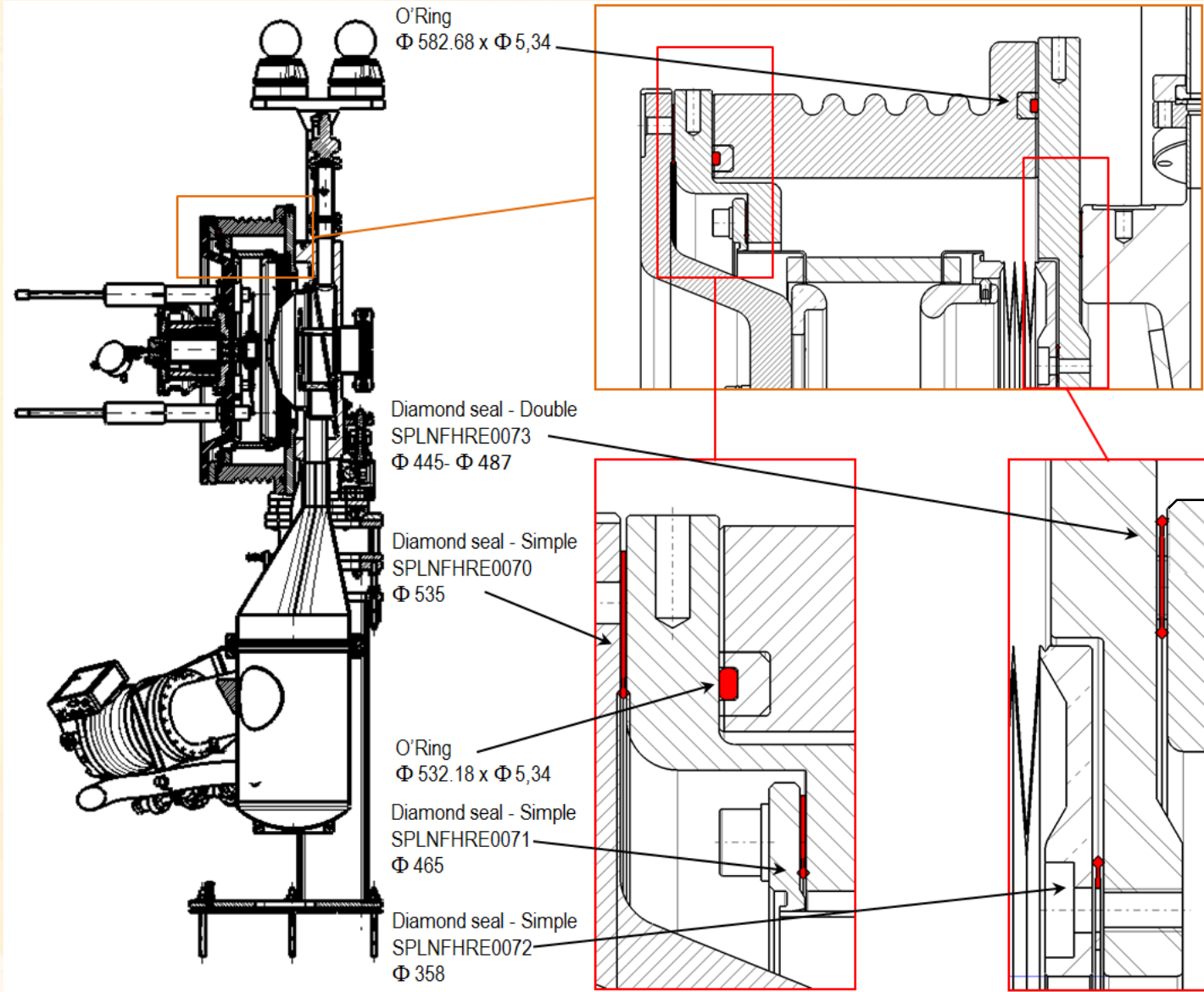
IS01-3 - B152

IS01-3 - 400

IS02 - B152

2014

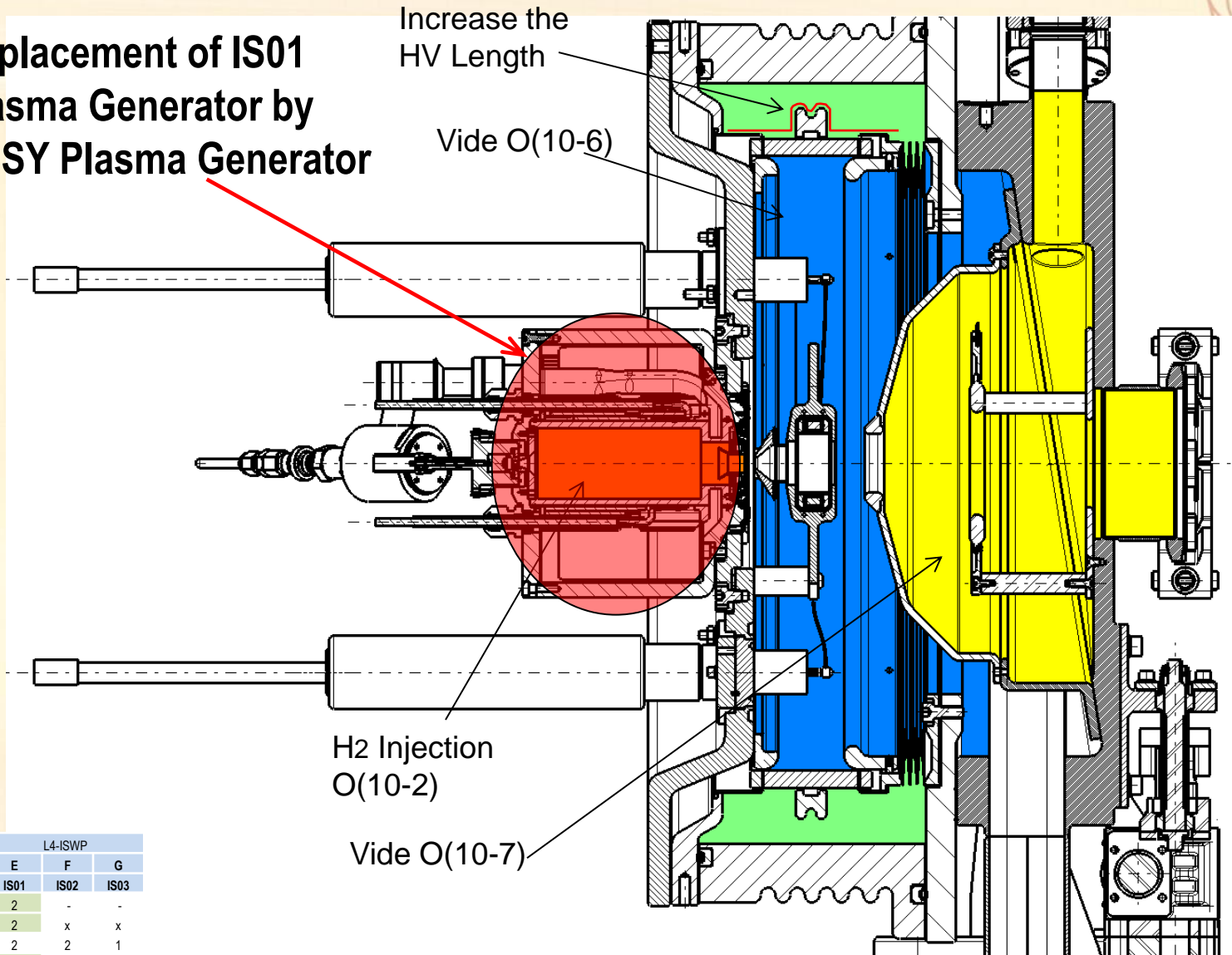
IS01-2 Sealing



EN Engineering Department



Replacement of IS01 Plasma Generator by DESY Plasma Generator

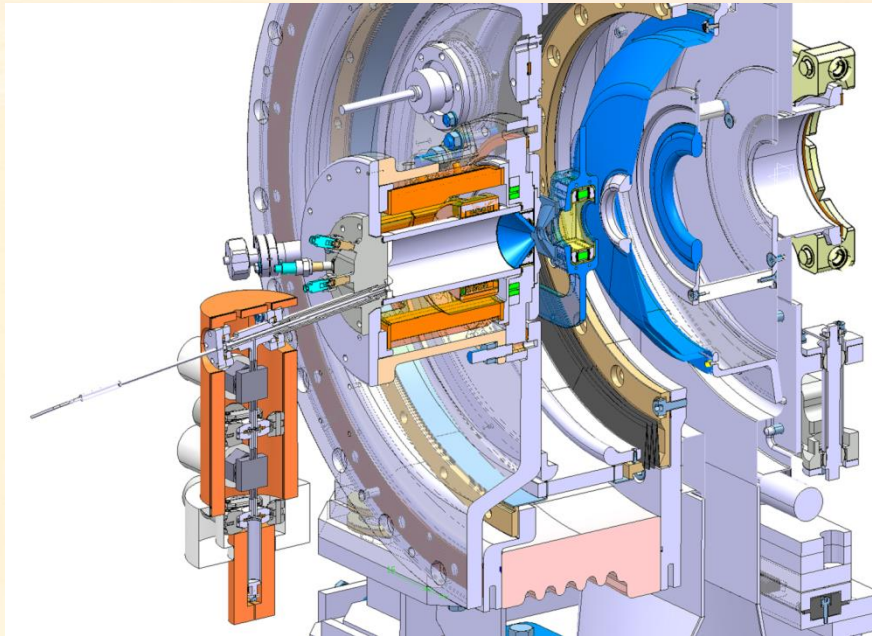


- 2011
- LINAC4 Ion Source Review
- 2012
- IS01-1 - B152
- IS01-2 - B152
- 2013
- IS01-3 - B152
- IS01-3 - 400
- IS02 - B152
- 2014

drawing	SPLNFHR	L4-ISWP			
		E	F	G	
units produced :	DESY	IS01	IS02	IS03	
Frontend	0	2	-	-	
Extraction optics	0	2	x	x	
Plasma Generator	1	2	2	1	
Flange	1	2	2	x	
Main insulator	0	2	x	x	
RF-Transfo-Matching	0	2	-	-	
Handling-gear	0	2	x	x	

EN Engineering Department

IS02 Installed in Sept. 2013



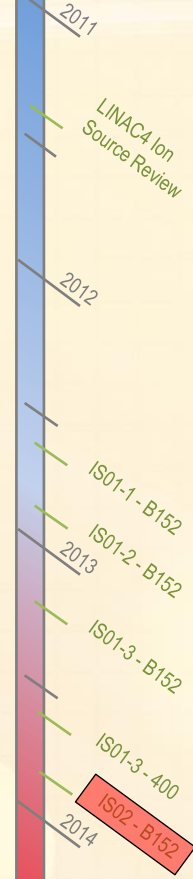
In Sept. 2013, The Source IS02 was installed.

- Design Ready Beginning of 2013
- Manufacturing Ready in July

Design: 230 Drawings

Manufacturing: 210 kChF for PG

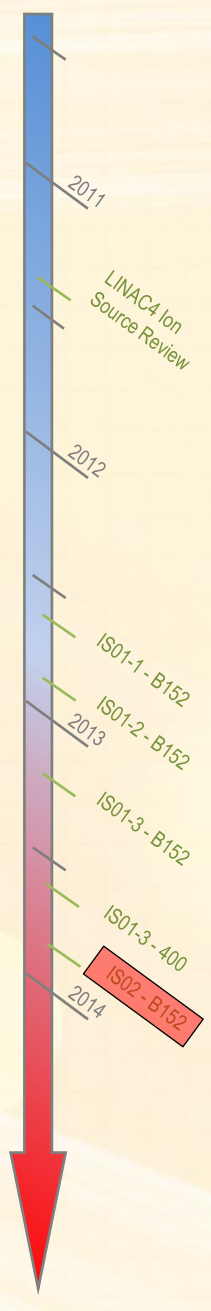
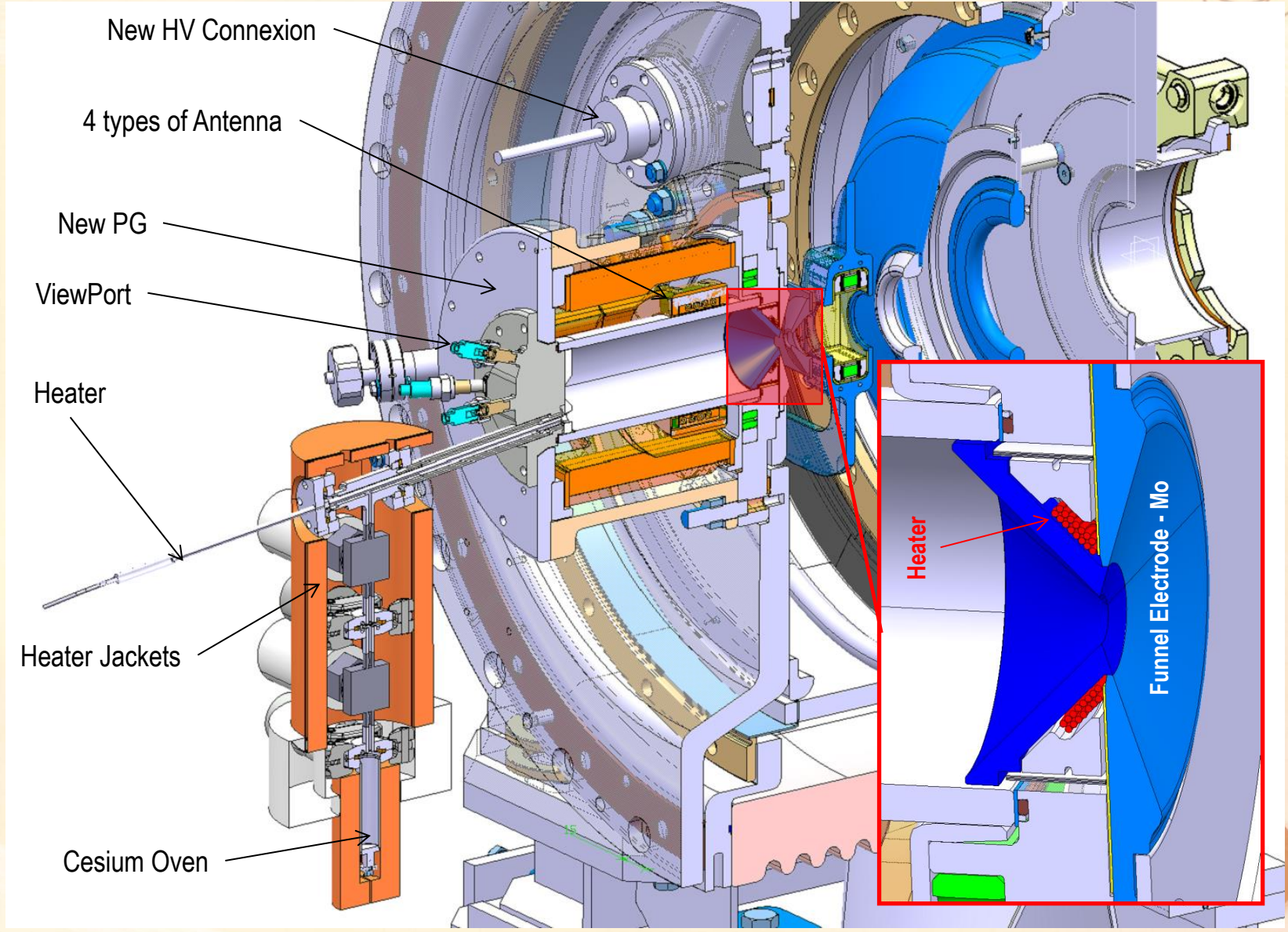
drawing SPLNFHR	L4-ISWP			
	E	F	G	
units produced :	DESY	IS01	IS02	IS03
Frontend	0	2	-	-
Extraction optics	0	2	x	x
Plasma Generator	1	2	2	1
Flange	1	2	2	x
Main insulator	0	2	x	x
RF-Transfo-Matching	0	2	-	-
Handling-gear	0	2	x	x



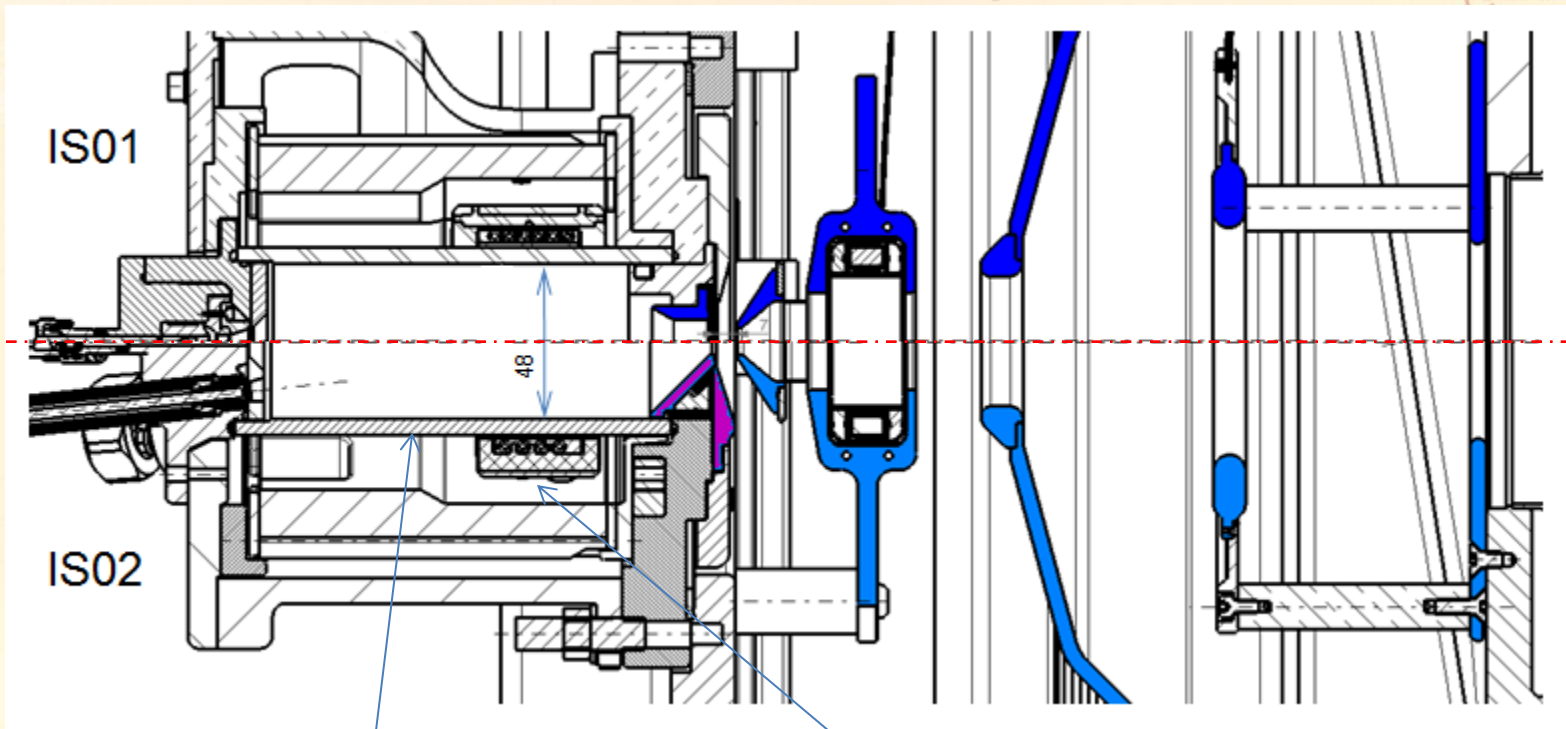
Engineering Department



IS02 Installed in Sept. 2013



Comparison IS01 / IS02



2011
LINAC4 Ion Source Review

2012

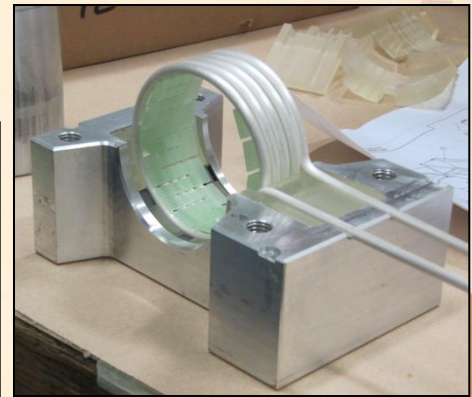
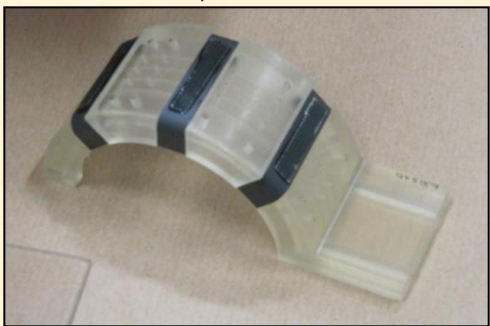
2013
IS01-1 - B152
IS01-2 - B152
IS01-3 - B152

2014
IS01-3 - 400
IS02 - B152

New Ceramic with braze metal ring



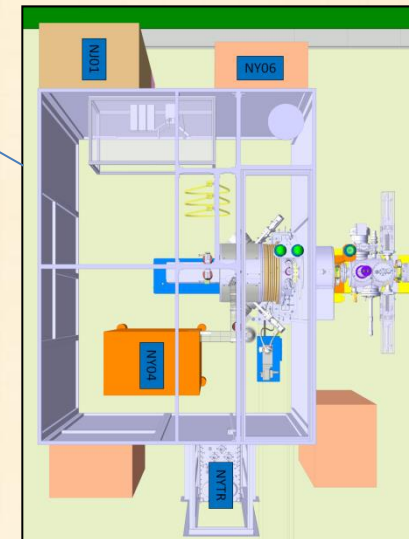
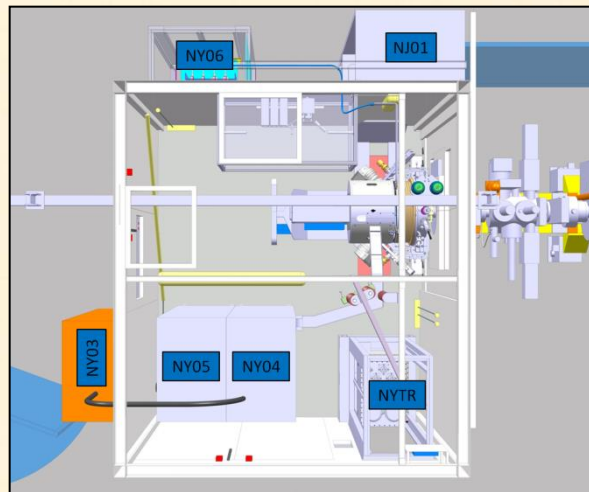
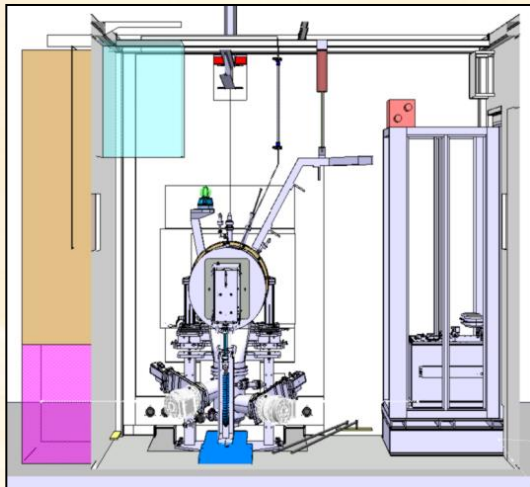
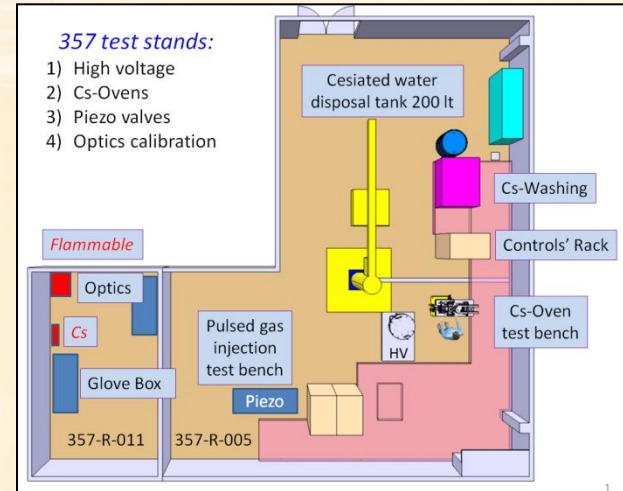
3 New type Antenna IS02
3, 4 and 5 turns



B357 - Cesium test stand
 - Gas test stand
 - Ceramic and insulator HV test stand

B152 - Ion Source Test Stand
Major modification of Faraday cage

B400 - Ion Source LINAC4
Improve access and Maintenance

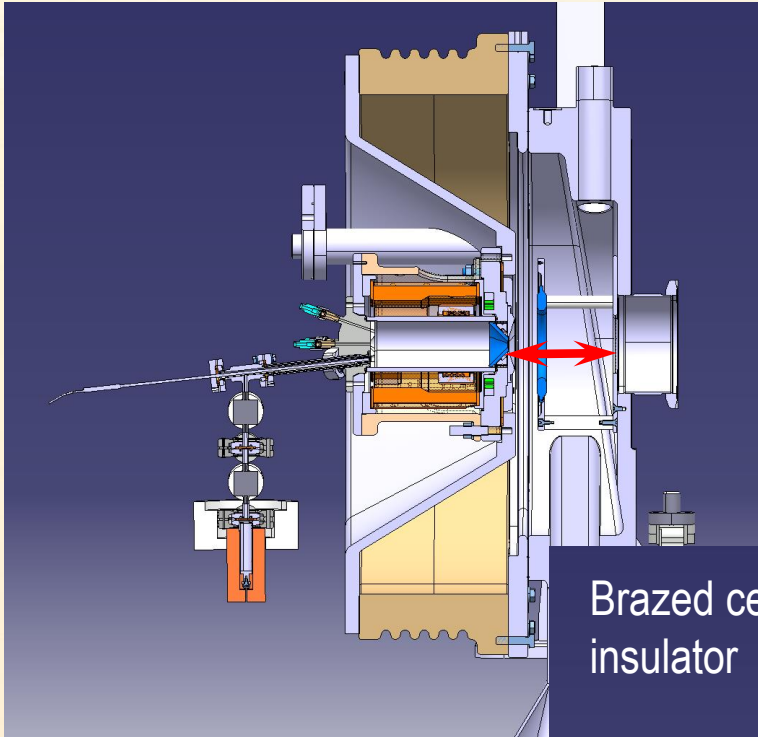


Move forward the PG closer to Solenoid
To reduce emittance and suppress Einzel

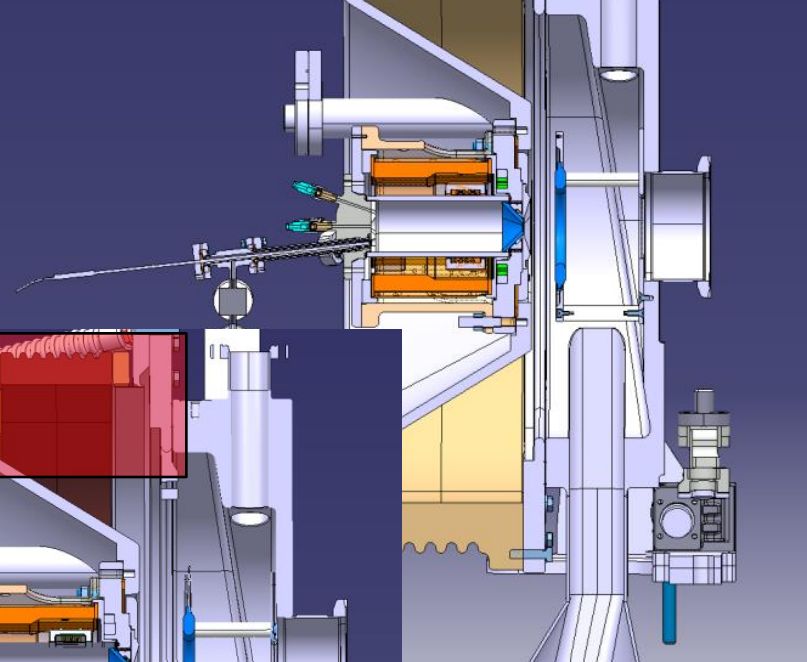
Outlook



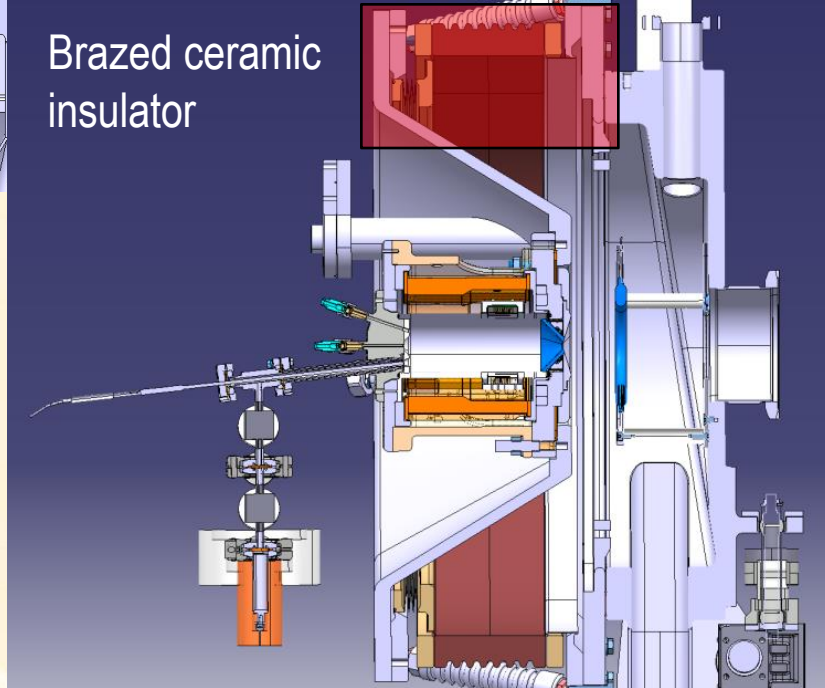
Improve vacuum and HV insulation
Redesign Electron Dump

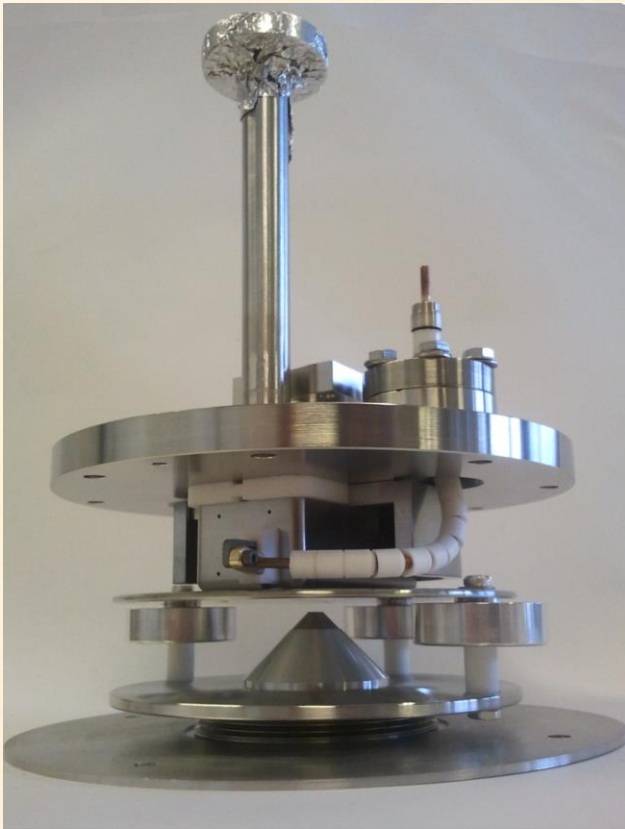


Full ceramic insulator

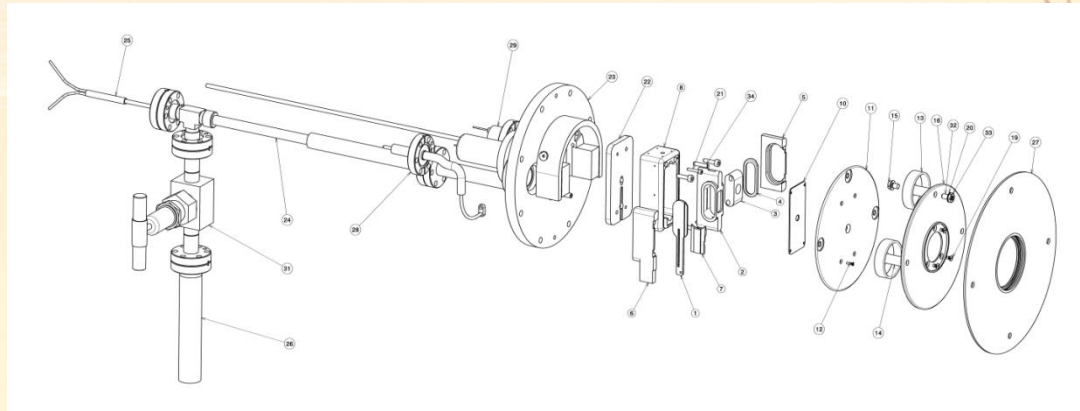


Brazed ceramic insulator





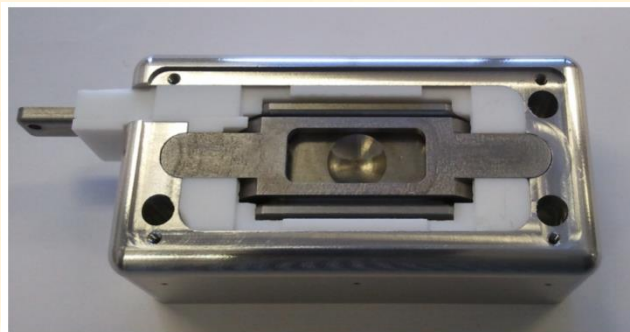
Source Assembled



In October 2013,
The BNL source was tested.

- Design Ready Beginning of 2013
- Manufacturing Ready in July

drawing	SPLNFHR	L4-ISWP			
		E	F	G	
units produced :	DESY	IS01	IS02	IS03	
Frontend	0	2	-	-	
Extraction optics	0	2	x	x	
Plasma Generator	1	2	2	1	
Flange	1	2	2	x	
Main insulator	0	2	x	x	
RF-Transfo-Matching	0	2	-	-	
Handling-gear	0	2	x	x	



Source Body Assembled

Design:

100 Drawings

Manufacturing:

25 kChF for PG

Conclusion on what has been done



IS01

Design: 670 Drawings → 400 Different Parts
→ 1135 Total parts
445 kChF

Manufacturing: 145 kChF for PG
500 kChF for Common parts
40 kChF for Faraday Cages

IS02

Design: 230 Drawings → 137 Different Parts
→ 390 Total parts
150 kChF

Manufacturing: 210 kChF for PG

IS03

Design: 100 Drawings → 60 Different Parts
→ 85 Total parts
33 kChF

Manufacturing: 25 kChF for PG

