

TO: L. Dudek
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SUBJECT: NCSX Job 3601 Edge & Divertor Diagnostic Systems

Date: October 8, 2008

Scope

This job consists of providing a visible TV camera to view the NCSX plasma for first plasma operation. The primary requirement is to obtain images that demonstrate that the first plasma has the expected stellarator shape. This requires a camera view along one of the field periods from one of the neutral beam ports. (See drawing below.) The images could also be useful as an operator aid during initial operation. The plan at the time of NCSX project termination was to borrow a fast-framing visible TV camera from NSTX.

Status

No design work was started at the time of NCSX project termination.

Interfaces

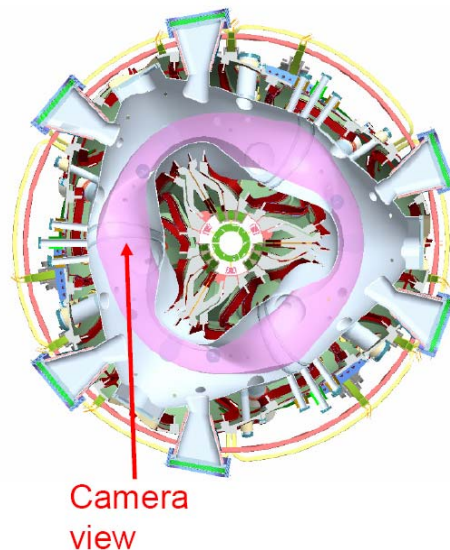
1. The NCSX vacuum vessel. A blank-off flange will be mounted on one of the unused neutral beam ports. A short nipple will be mounted on this flange at an angle suitable for viewing along one field. This nipple will have a Conflat flange (probably 6" diameter) and a fused silica window will be mounted on this flange.
2. The camera to data acquisition, probably a frame grabber card in a PC.

Specifications

A visible TV camera viewing along one field period from one of the neutral beam ports. The camera should have a wide-angle view of the plasma.

Schematics and PIDs

Sketch from WBS 3 presentation to SC Project Review, April 9-10, 2008:



Models

None

Drawings

None

Analyses

None

Testing

None

Costs

No updates

Remaining Work

- Design and fabricate viewport on neutral beam port blank-off flange
- Identify camera to be used
- Design and fabricate camera mount
- Install camera and data acquisition hardware
- Align camera to have desired view of plasma

WBS 3 - Diagnostics

B. Stratton

NCSX WBS 3 Manager

Outline

- Requirements
- Interfaces
- Design, fabrication, and installation status or plans and schedule by job
- Estimates to complete
- Risks and mitigation

Diagnostics requirements-cont.

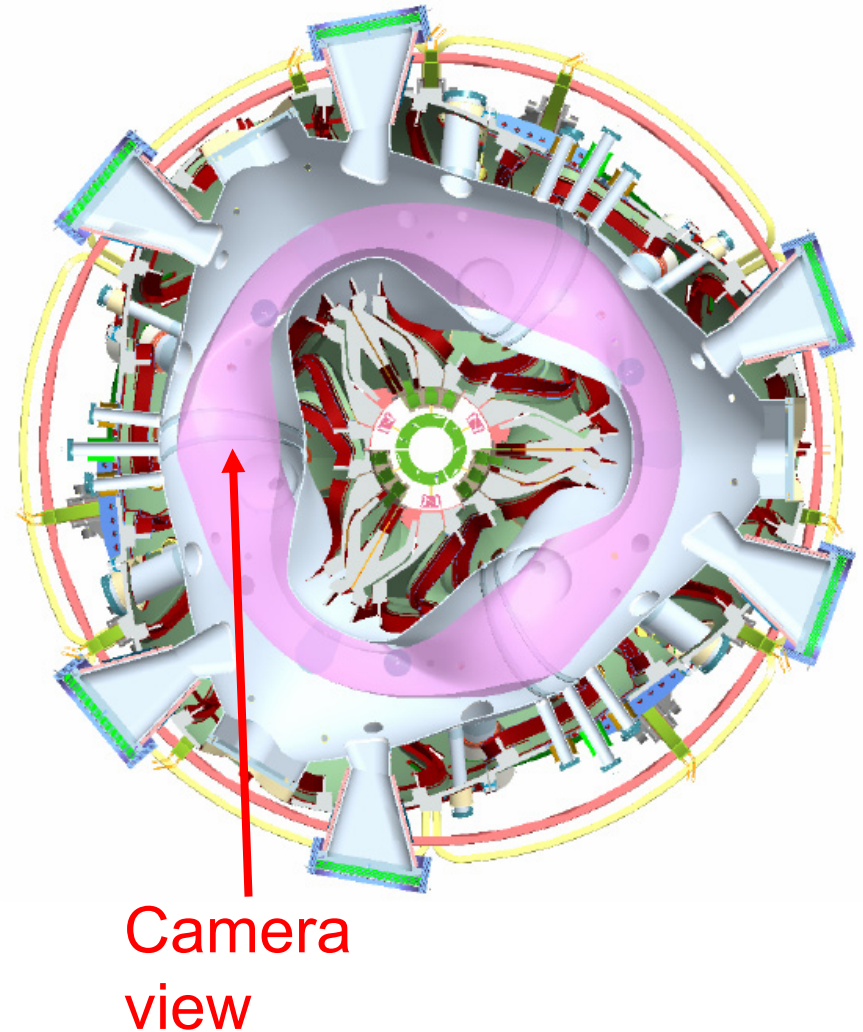
- Visible TV camera system (job 3601)
 - Capable of observing plasma shape during first plasma operation
- Electron beam field line mapping system (job 3801):
 - Capable of field line mapping following first plasma
- Diagnostics integration (job 3901):
 - Management of WBS 3 jobs

Interfaces

- Ex-vessel magnetic sensors:
 - Vacuum vessel (WBS 12)
 - Conventional coils (WBS 13)
 - Modular coils (WBS 14)
 - Cryostat (WBS 17)
 - Data acquisition (WBS 53)
 - Field period assembly (WBS 18)
- Extension and termination of thermocouple and heater tape leads:
 - Vacuum vessel (WBS 12)
- Visible TV camera system:
 - Vacuum vessel (WBS 12)
 - Data acquisition (WBS 53)
- Electron beam field line mapping system:
 - Vacuum vessel (WBS 12)
 - Data acquisition (WBS 53)
 - Cryostat (WBS 17)

Visible TV camera plan

- Will view along one vacuum vessel period
 - Requires window mounted on neutral beam port and camera mount
- Camera and data acquisition hardware to be re-used from NSTX



Visible TV camera status

Job: 3601 - Edge Divertor Diagnostics-STRATTON

361-001	Design Visible Camera sys	40	01OCT09*	25NOV09	309	13,234.20
361-015	Procure flange,window and material	65	30NOV09	10MAR10	309	4,679.50
361-016	fabricate and assemble Visible tv camera sys	20	11MAR10	07APR10	309	12,205.96

EA/SB = 80hr ;em/em=20

41=04\$K ;

EMT/TB = 128 ;ee/tb=16; em/em=20

- Start design in October 2009
- Low risk: simple system similar to installations on NSTX

Estimates to complete

Job	Mech. Eng. (hrs)	Sr. Mech. Tech. (hrs)	Mech. Tech. (hrs)	Design. (hrs)	Elect. Tech. (hrs)	Elect. Eng. (hrs)	Comp. Eng. (hrs)	Res. Staff (hrs)	Travel (k\$)	M&S (k\$)
Ex-vessel Mag.	1023	1816	460	188	128	32	0	0	0	29.7
Visible Camera	40	0	88	80	16	0	0	0	0	3.5
E-beam Mapping	160	0	576	196	16	8	300	480	3.0	19.0
Diag. Integ.	0	0	0	0	0	0	0	778	0	0
TOTAL	1223	1816	1124	464	160	40	300	1258	3.0	52.2

- Estimates to complete based on:
 - Ex-vessel magnetics: experience to date on these tasks; vendor quotes
 - Visible TV camera: experience with similar systems on NSTX; vendor quotes
 - Electron beam field line mapping system: discussion with Auburn University personnel, in-house estimates for specific components; vendor quotes
 - Diagnostics integration: experience to date

Risks and mitigation plans

- Electron beam mapping system design not started-could be complex
 - Mitigate risk by starting design soon-summer 2008
 - This job will be transferred to ORNL in collaboration with Auburn University and University of Wisconsin
 - Plan takes advantage of extensive shared experience in field line mapping at Auburn, UW, and ORNL, who worked as a team on this task for ATF
- There is some risk of damage to VV flux loops, spacer flux loops, Rogowski coils, and heater and thermocouple leads when modular coil three-packs are placed over VVSAs and during machine assembly. Repairs could be on the critical path.