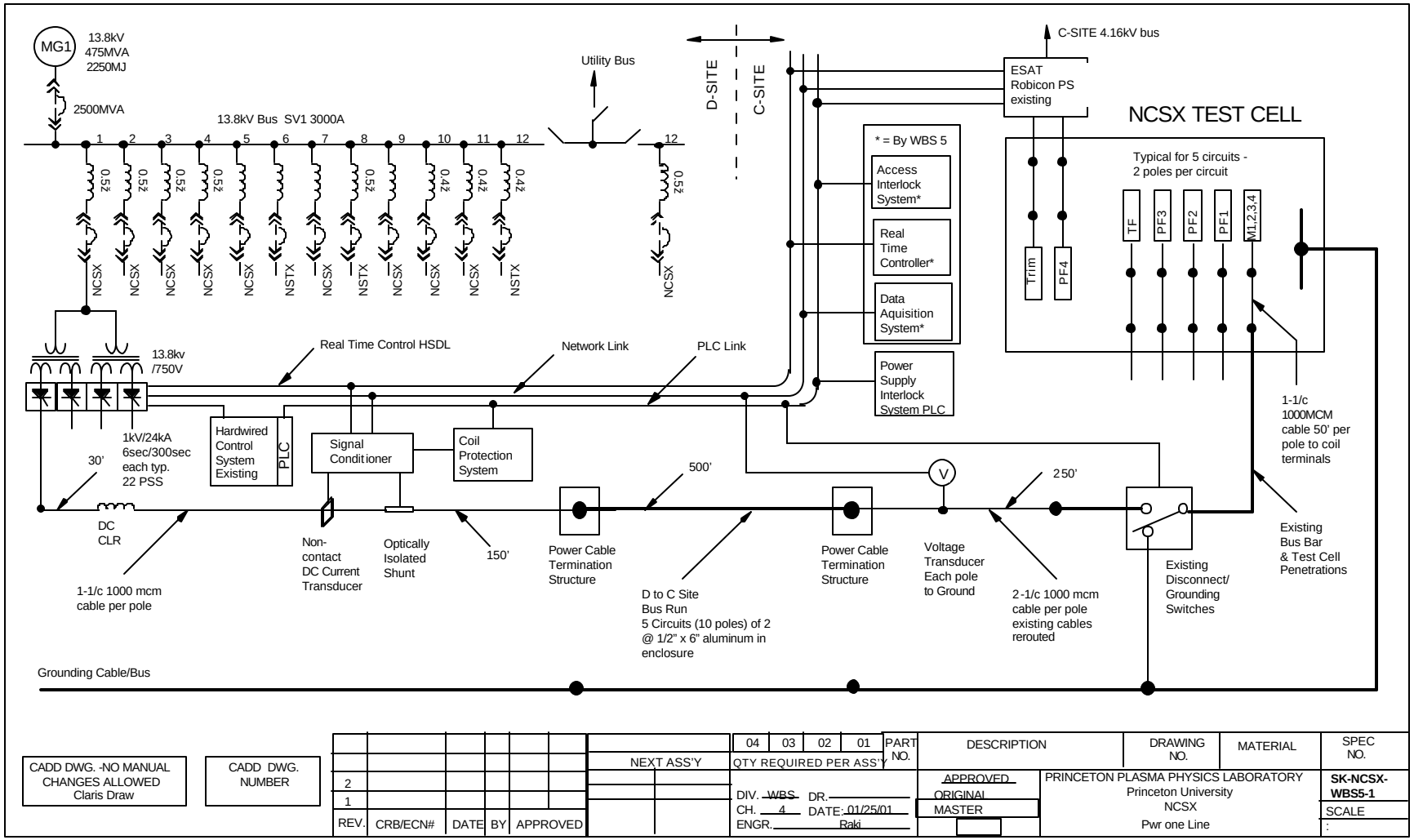
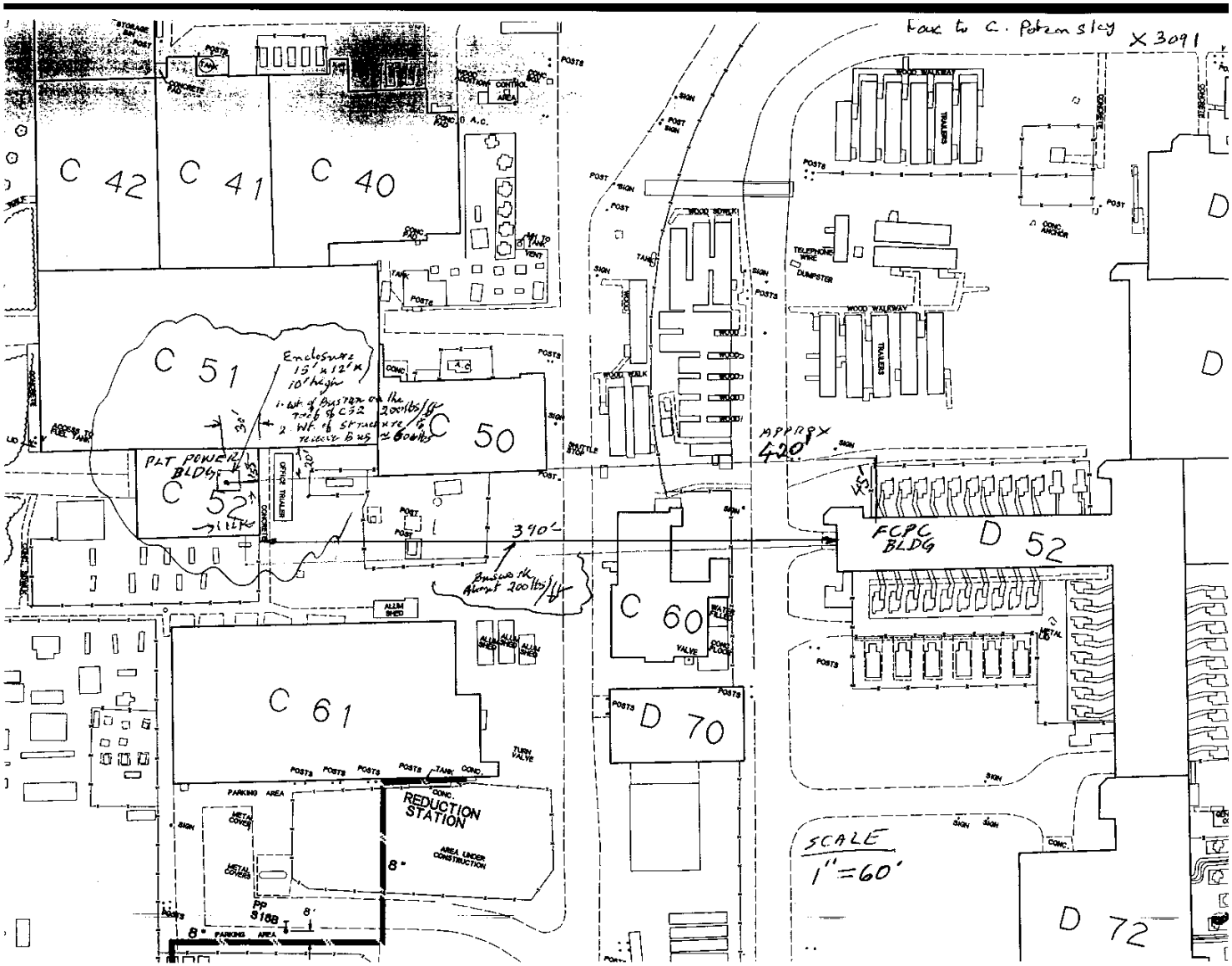
# STATUS OF DESIGN & COST ESTIMATE FOR NCSX POWER SUPPLIES WBS4

C. Neumeyer/S. Ramakrishnan

1/31/01




| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CADD DWG. -NO MANUAL CHANGES ALLOWED Claris Draw | CADD DWG. NUMBER | | | | | | NEXT ASS'Y | 04 | 03 | 02 | 01 | PART NO. | DESCRIPTION | DRAWING NO. | MATERIAL | SPEC NO. |
| | | | | | | | | QTY REQUIRED PER ASS'Y | | | | | | | | |
| | | 2 | | | | | | DIV. WBS | DR. | | | | APPROVED | PRINCETON PLASMA PHYSICS LABORATORY | | SK-NCSX-WBS5-1 |
| | | 1 | | | | | | CH. 4 | DATE: 01/25/01 | | | | ORIGINAL | Princeton University | | |
| | | REV. | CRB/ECN# | DATE | BY | APPROVED | | ENGR. Raki | | | | | MASTER | NCSX | | SCALE |
| | | | | | | | | | | | | | | Pwr one Line | | : |

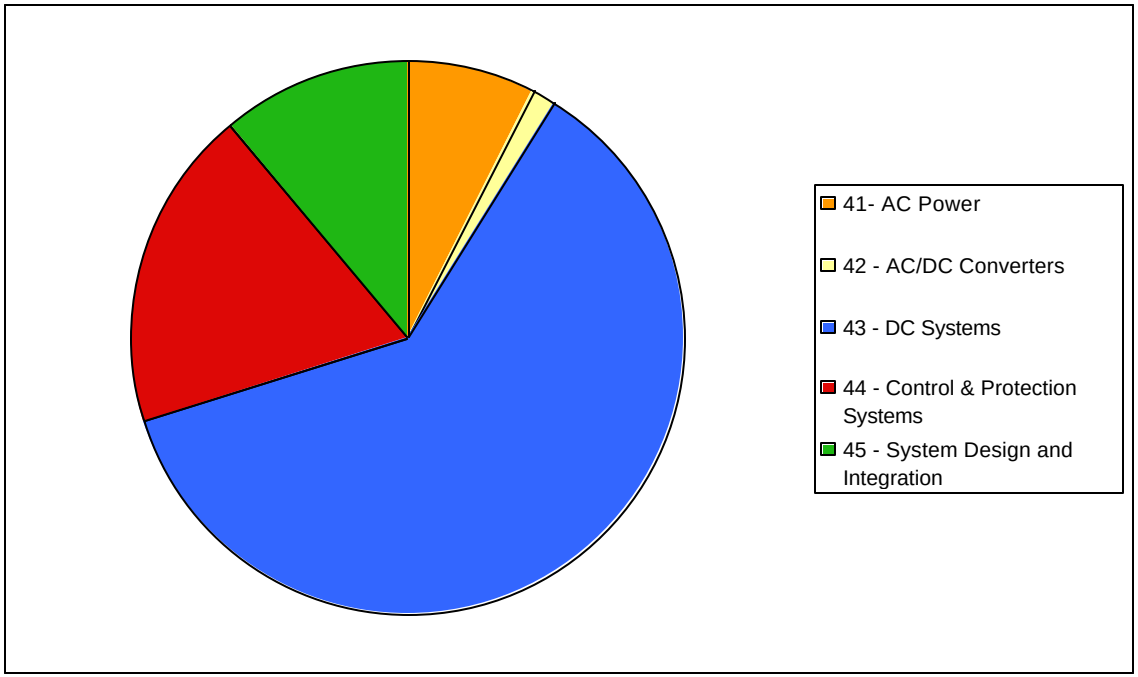


Fax to C. Potemsky X 3091
C 42
C 41
C 40
C 51
C 50
C 52
C 60
C 61
D 70
D 52
D 72
PLT POWER BLDG
FCPC BLDG
REDUCTION STATION
AREA UNDER CONSTRUCTION
APPROX 420'
390'
SCALE 1"=60'

- Baseline Cost Estimate for Day -1

| | | | |
|---|---|---|---|
| 41- AC Power | | | 598 |
| | 411 - Auxiliary AC Power | 486 | |
| | 412 - Experimental AC Power | 112 | |
| 42 - AC/DC Converters | | | 111 |
| | 421 - C-site AC/DC Converters | 74 | |
| | 422 - D-site AC/DC Converters | 37 | |
| 43 - DC Systems | | | 4919 |
| | 431 - C-site DC Systems | 339 | |
| | 432 - D-to-C-Site DC Systems | 3340 | |
| | 433 - D-site DC Systems | 1240 | |
| 44 - Control & Protection Systems | | | 1515 |
| | 441 - Electrical Interlocks | 566 | |
| | 442 - Kirk Key Interlocks | 91 | |
| | 443 - Real Time Control | | |
| | 444 - Instrumentation | 541 | |
| | 445 - Coil Protection | 264 | |
| | 446 - Ground Fault Monitor | 54 | |
| 45 - System Design and Integration | | | 896 |
| | 451 - System Design | 264 | |
| | 452 - Electrical Systems Support | 461 | |
| | 453 - System Testing | 171 | |
| | | Total | 8038 |

- Cost Breakdown



- Possible Design Variants for Cost Savings

1) C-site MG (1 shaft, 4 generators) for M-coils

   a. all M-coils in series (as existing day-1 concept)

   - or -

   b. independent M-coils (increase total # ckts to 8)

2) C-site MG (2 shaft, 8 generators) for M-coils and TF

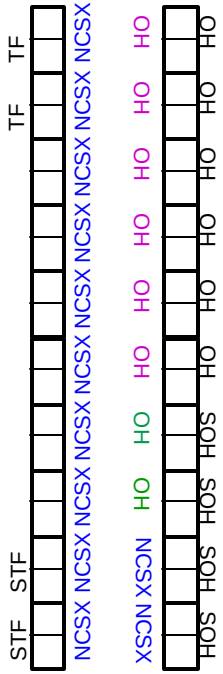
- Savings

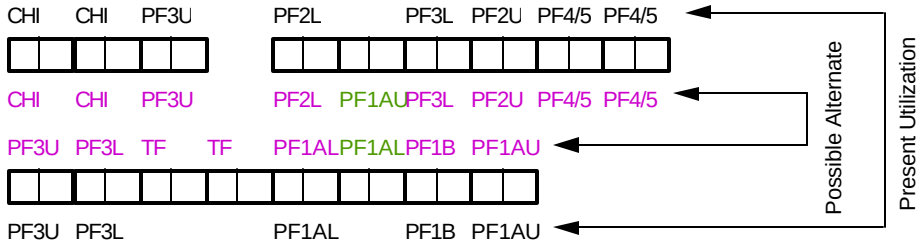
  - Fewer PSS and bus runs initially required from D-site

    - for 1) need 18 PSS and 4 circuits
    - for 2) need 14 PSS and 3 circuits

  - delay full clearing of FCPC 2nd floor (relocation of vacuum prep lab) in second case

- Issues
  - control response
  - operating costs (electrical demand/energy, operators)
  - spares, documentation, training
  - obsolete equipment



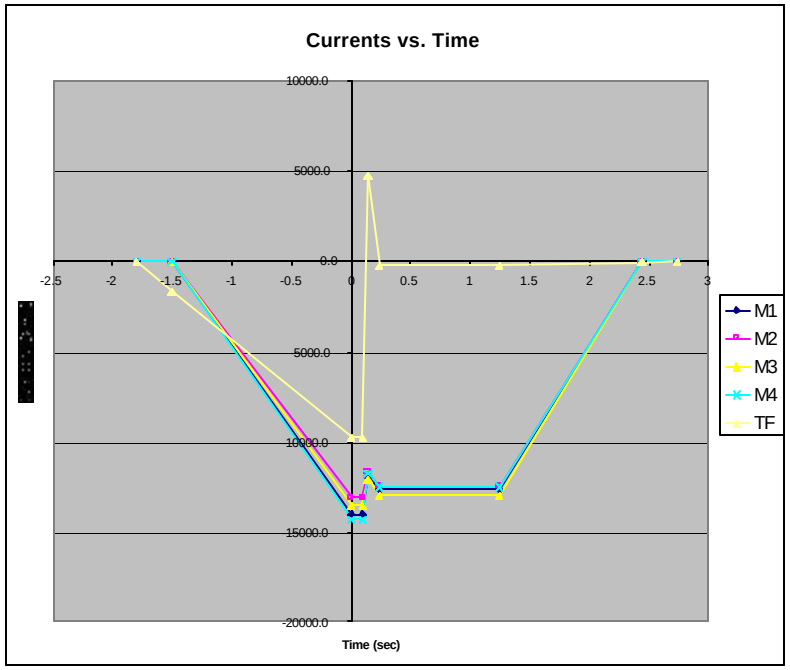

NSTX:

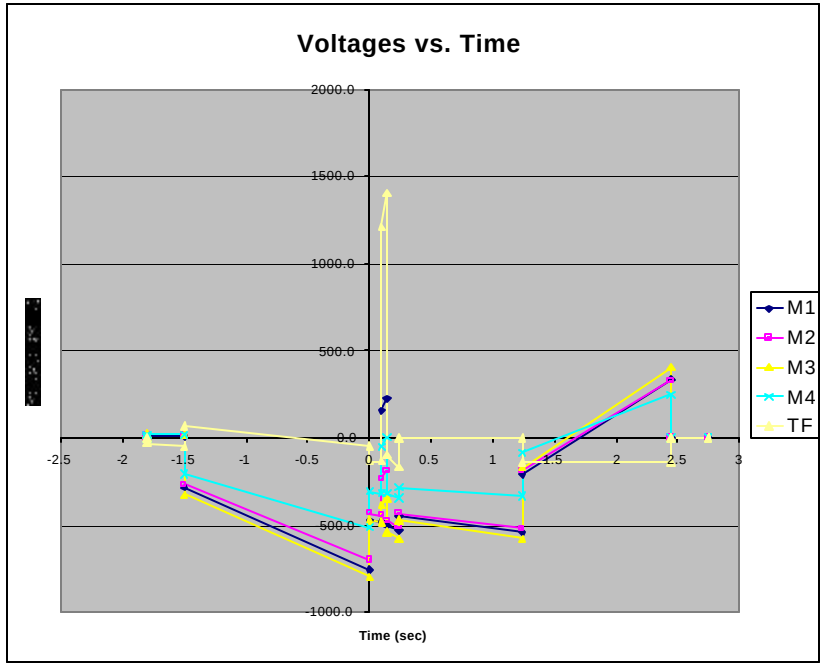
- now using 21 PS (42 PSS) not counting spares;
- requries  25 PS (50 PSS) for known upgrades.

NCSX:

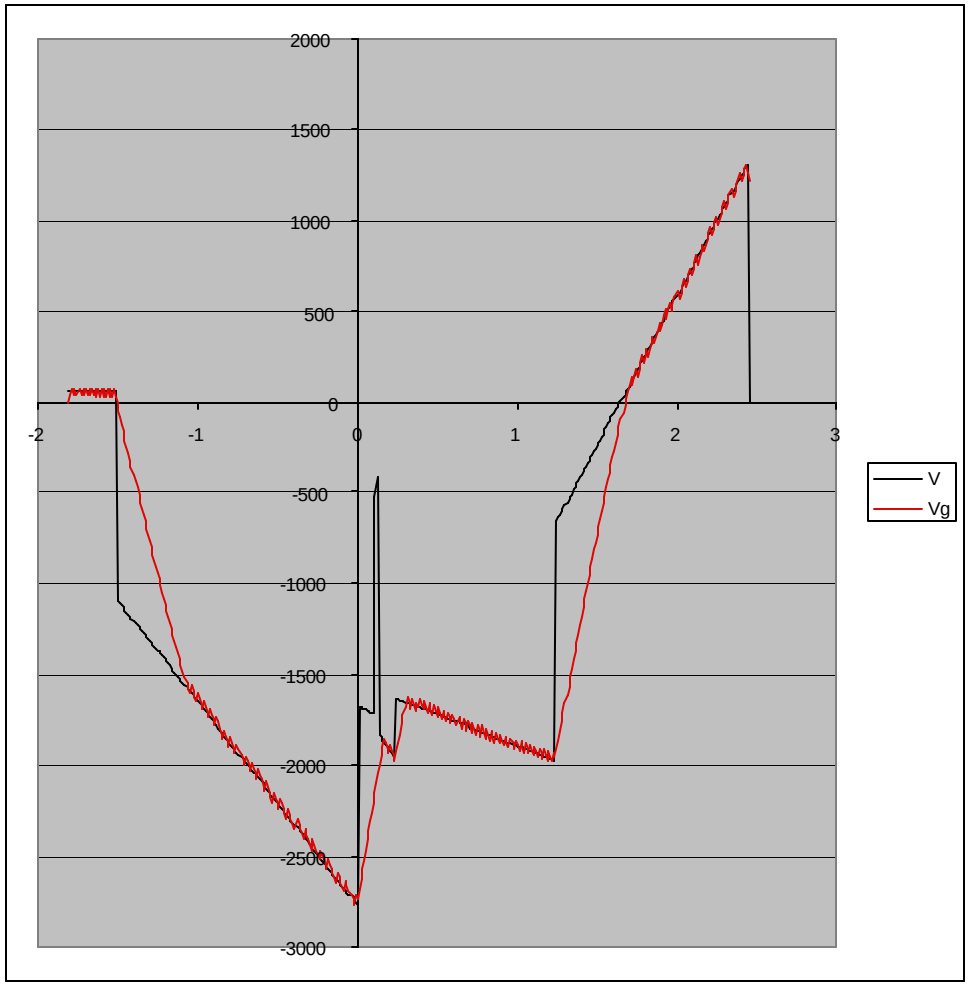
- 12 PS( 24PSS) are available.

- Day –1 Current and Voltage Requriements for M & TF Coils



- Estimated Response of 4 Series MG to ? V Modular Coils



- In order to consider the use of C-site MG:

  - M & TF waveforms need to be simplified

  - M & TF control requirements need to be relaxed because MG will not respond to perturbations e.g. due to mutual coupling from other coil circuits

  - Simulation code needs to be resurrected and adequate performance verified

- Potential Cost Deferral via MG

  - Costs of using MG for ? M (series) and for TF were estimated by scaling the PSS related work by 18/22 and 14/22, and the DC bus related work by 4/5 and 3/5 *(this also scales the engineering work which is anti-conservative)*

  - There is also a deferral in the FCPC building clearing

| M Coils | | M & TF Coils | |
|---|---|---|---|
| Base Cost | 7303.9 | Base Cost | 6157.1 |
| Reactivate MG | 199.2 | Reactivate MG | 398.4 |
| Total Cost | 7503 | Total Cost | 6555 |
| Base ? | 535 | Base ? | 1483 |
| Facilities ? | 0 | Facilities ? | 500 |
| ? | 535 | ? | 1983 |

  - Use of M coils independently would have an additional instrumentation and interlock cost not included in the above table

- NCSX <-> NSTX Cost Comparison

| | | NCSX | | NSTX | | Comments |
|---|---|---|---|---|---|---|
| 41- AC Power | | | 598 | | 190 | |
| | 411 - Auxiliary AC Power | 486 | | 169 | | More work to ready C-site test cell and bring C-site infrastructure into operation, compared to D-site |
| | 412 - Experimental AC Power | 112 | | 21 | | NSTX was underestimated |
| 42 - AC/DC Converters | | | 111 | | 41 | |
| | 421 - C-site AC/DC Converters | 74 | | | | Not req'd for NSTX |
| | 422 - D-site AC/DC Converters | 37 | | 41 | | Approx equal |
| 43 - DC Systems | | | 4919 | | 1154 | |
| | 431 - C-site DC Systems | 339 | | 0 | | Not req'd for NSTX |
| | 432 - D-to-C-Site DC Systems | 3340 | | 0 | | Not req'd for NSTX |
| | 433 - D-site DC Systems | 1240 | | 1154 | | NCSX has more work per circuit but fewer circuits |

| | | | | | | |
|---|---|---|---|---|---|---|
| 44 - Control & Protection Systems | | | 1515 | | 727 | |
| | 441 - Electrical Interlocks | 566 | | 209 | | NCSX system new, NSTX was modification of existing |
| | 442 - Kirk Key Interlocks | 91 | | 50 | | NCSX requires interface between C- and D-sites |
| | 443 - Real Time Control | | | 260 | | NCSX is covered in different WBS |
| | 444 - Instrumentation | 541 | | 128 | | NCSX system new, NSTX was modification of existing |
| | 445 - Coil Protection | 264 | | 80 | | NCSX system new, NSTX was modification of existing |
| | 446 - Ground Fault Monitor | 54 | | | | Not costed in NSTX baseline |

| | | | | | | |
|---|---|---|---|---|---|---|
| 45 - System Design and Integration | | | 896 | | 784 | |
| | 451 - System Design | 264 | | 784 | | NCSX design plus test approx equal to NSTX |
| | 452 - Electrical Systems Support | 461 | | 0 | | NSTX was covered in different WBS |
| | 453 - System Testing | 171 | | 0 | | In system design on NSTX |
| | | NCSX Total | 8038 | NSTX Total | 2896 | |