GlueX →Hall D
AC Power & Grounding
Jefferson Lab
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Topics:

- Grounding
- Hall D – AC Mains Distribution
- AC Power Requirements
- Summary

Power & Grounding

Very extensive topic and,

We have good experience with the Hall B [CLAS]

Careful planning of power grid and grounding grid

Extensive review of AC Mains requirements

Must include grounding grid requirements to civil Engineers

Must identify all large "consumers" of AC Mains

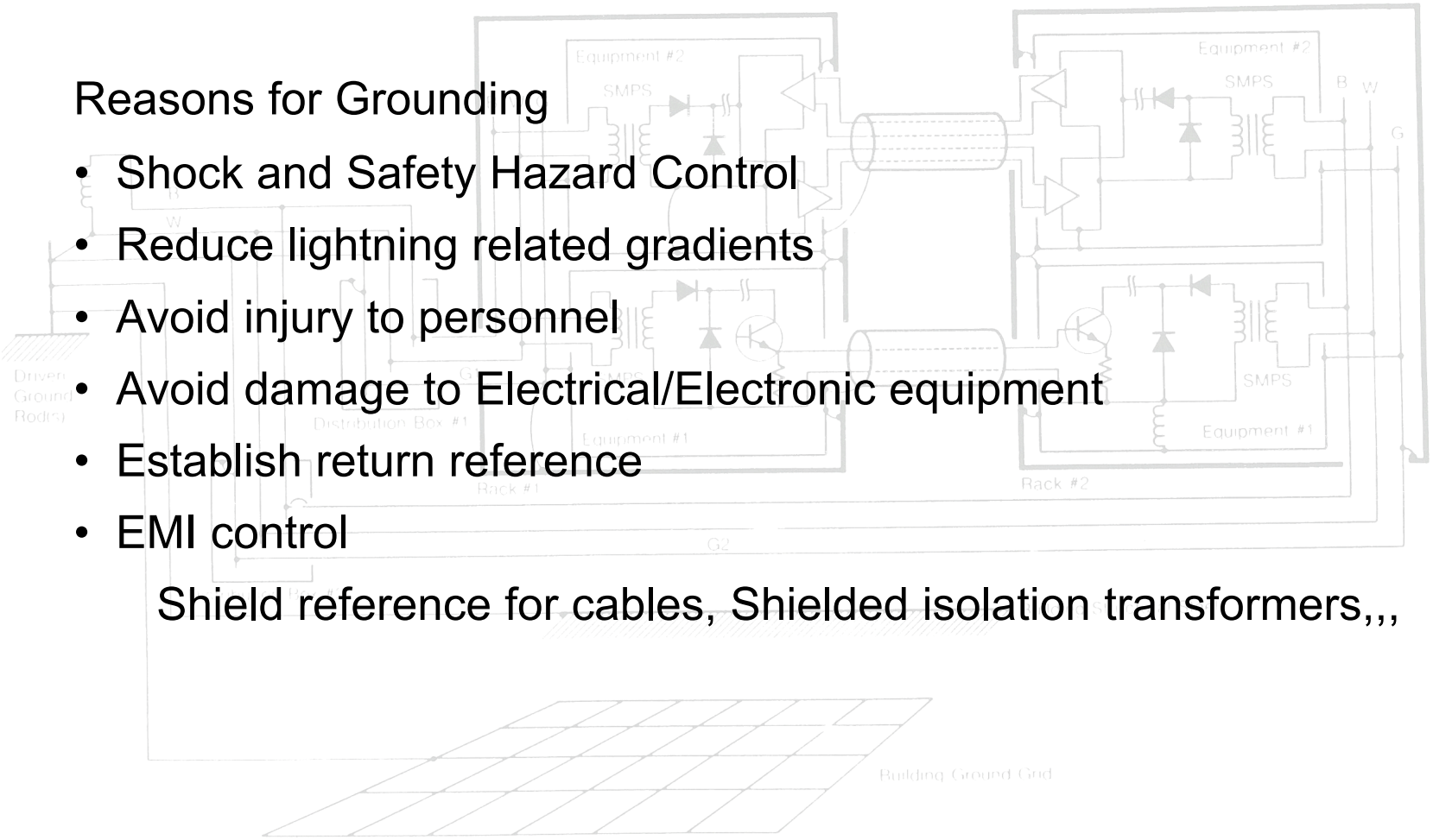
- **Superconducting Magnet system**
- **Building utilities [HVAC, LCW, Pumps, Crane]**

Power & Grounding

Reasons for Grounding

- Shock and Safety Hazard Control
- Reduce lightning related gradients
- Avoid injury to personnel
- Avoid damage to Electrical/Electronic equipment
- Establish return reference
- EMI control

  Shield reference for cables, Shielded isolation transformers,,,



Grounding

- Standards
- IEEE 80-2000

  IEEE Guide for Safety in AC Substation Grounding
- NEC Article 250

  National Electric Code – Grounding
- “Consultants”

  Paul Holik – SNS Experimental Areas

  Marvin Johnson – FNAL D0 and CMS “consultant”

Grounding

- Major Objectives for Grounding
- Ground grid design must withstand a maximum ground fault current without danger of melting ‘open’
- Ground grid must produce very low voltage between any two points on the ground to prevent personnel hazard

Grounding

- Ground Grid Design and Considerations

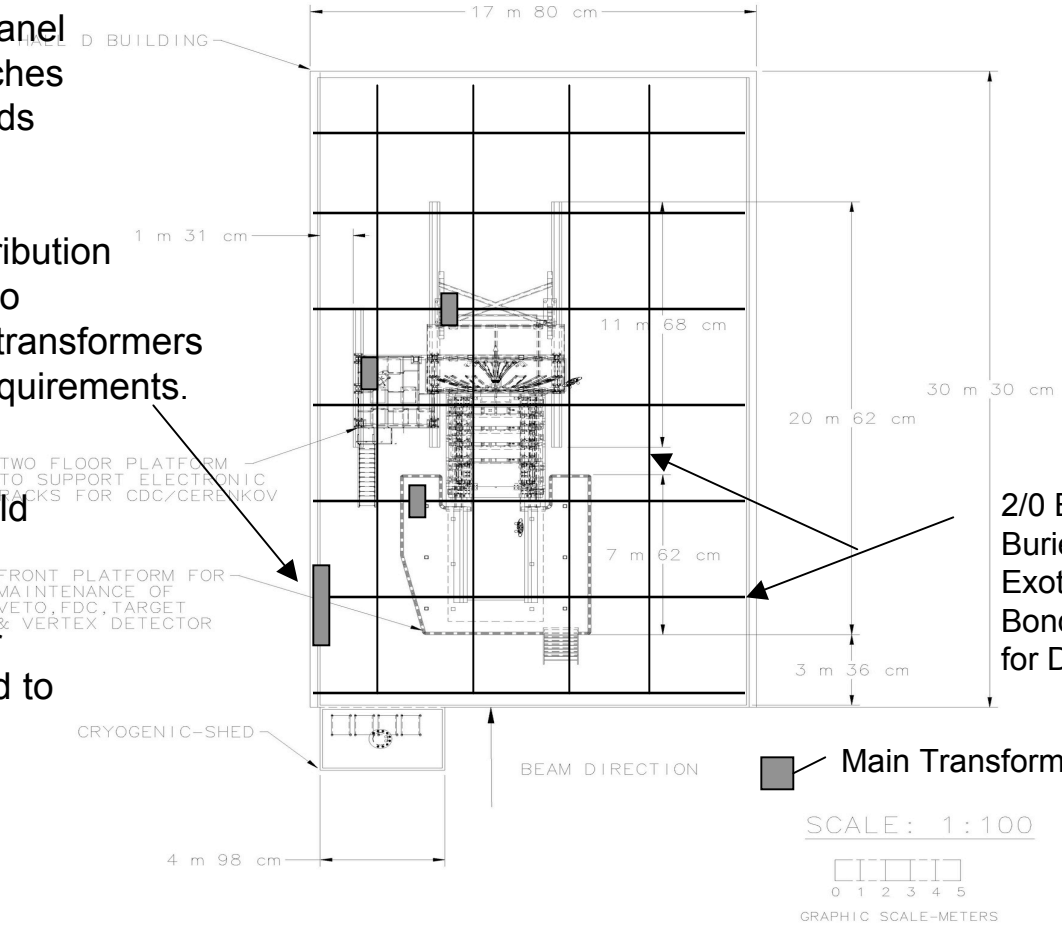
- Soil Resistivity
- AC power distribution network
- Grid Geometry and material selection
  - Hall B uses #2/0 AWG bare copper as grid
- All connections underground are ‘exothermally’ welded
- Building steel and structures will be bonded to the grid
- Consider issues of ground ‘interconnection’ with Accelerator, Tagger Building and Counting Room

Hall D Grounding Grid
AC Mains Distribution

Main Transformer and Panel will feed dedicated branches to the central panel boards in the Hall.

Central panel board distribution will be 480VAC 3phase to 'branches' and isolation transformers for local 'clean' power requirements.

Distribution conduits could be in 'trenches' that run underneath detector. Special consideration for flexible conduits attached to moveable detector platforms.



2/0 Bare Copper
Buried beneath concrete floor
Exothermally welded
Bond points on Hall Floor
for Detector Apparatus

Main Transformer

AC Power Requirements

- Must identify and separate power ‘branches’
- Facility Utilities
  - -- Lighting circuits
  - -- LCW pumps
  - -- HVAC/Fire Controls
- Large ‘Stand-alone’ power supplies
  - -- Solenoid Magnet Power
  - -- Tagger Magnet Power
- Beamline equipment
- Cryogenics & Target Instrumentation/Controls
- Other -- Network gear, Camera Systems,

Preliminary AC Power Budget

	Detector System Description	"# of Crates"	Power/Unit [KVA]	Power [KVA]
1	Tagger Power Supply	1	80	80
2	Solenoid Power Supply	1	25	25
3	Collimator Magnet Supplies	1	5	5
4	Tagging Electronics	2	2	4
5	Tagger HV	1	3	3
6	CDC	21	2	42
7	FDC	36	2	72
8	CDC HV and Bias supplies	2	3	6
9	FDC HV and Bias supplies	2	3	6
10	Barrel Calorimeter	4	2	8
11	BCal HV and Bias supplies	1	3	3
12	Vertex & Start Counters	2	2	4

Preliminary AC Power Budget Continued,

	Detector System Description	"# of Crates"	Power/Unit [KVA]	Power [KVA]
13	Vertex, Start Counter HV & Bias	2	3	6
14	Lead Glass Calorimeter	16	2	32
15	Cockroft Walton DC supplies	2	1	2
16	Cerenkov Readout	1	2	2
17	Cerenkov HV	1	3	3
18	TOF Readout	1	2	2
19	TOF HV	1	3	3
20	Photon Veto Readout, HV	1	2	2
21	Trigger System	2	3	6
22	Network Gear	6	0.5	3
23	Target Instrumentation	1	2	2
	TOTAL	***105***		***321***

Summary

- Excellent references and experience at JLAB for AC Mains distribution and grounding grid design
  - Specific details of AC Mains distribution will continue as detector apparatus develops.
  - Location of clean power transformers and power conduits will need to be determined at time of civil construction
- Integration between detector system electronics needs to be studied to prevent ‘ground loops’ and identify best techniques for shielding against noise sources.
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