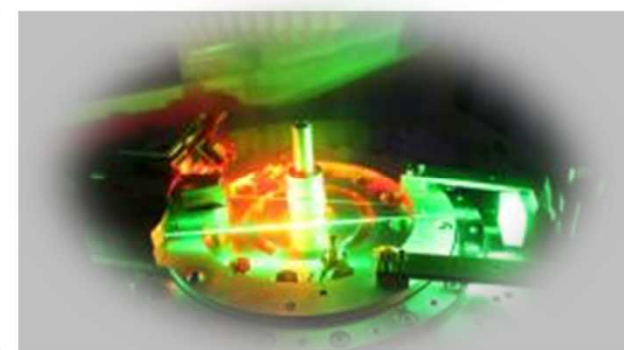
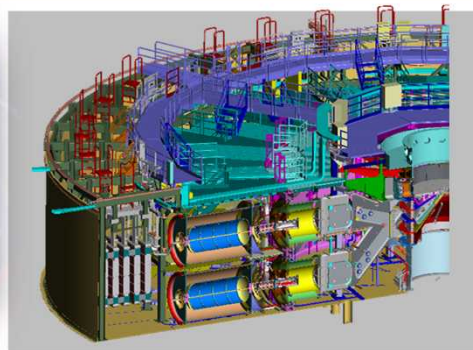
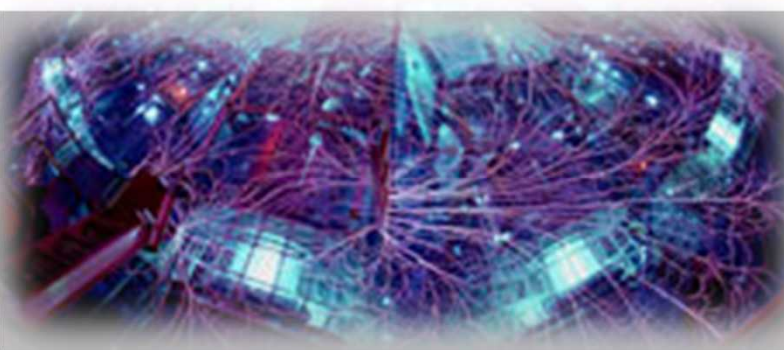


Exceptional service in the national interest



The Z Facility: Diagnostic Needs

Chris Bourdon

Manager- Imaging and Spectroscopy Diagnostics

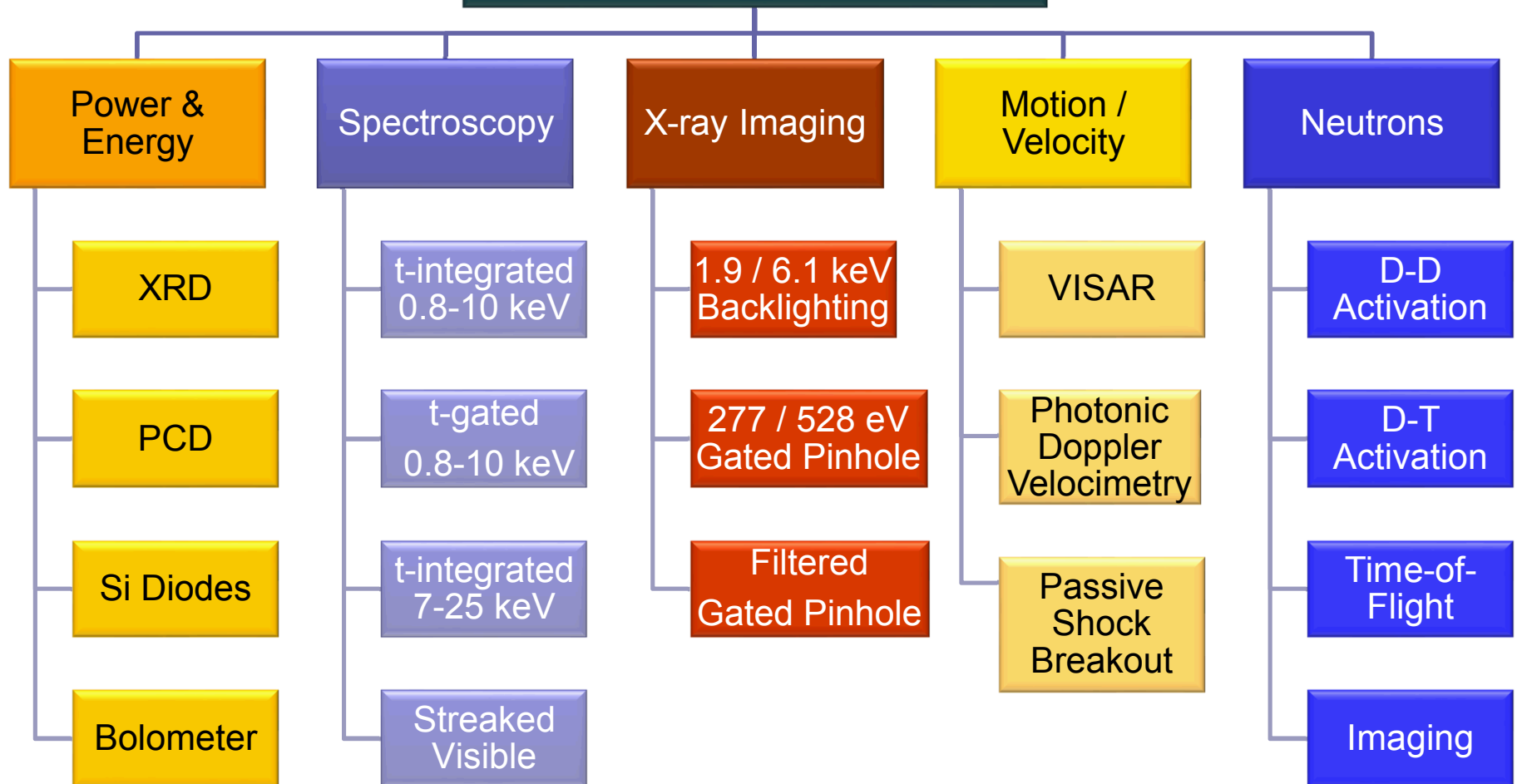


U.S. DEPARTMENT OF
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Z Target Diagnostic Capabilities

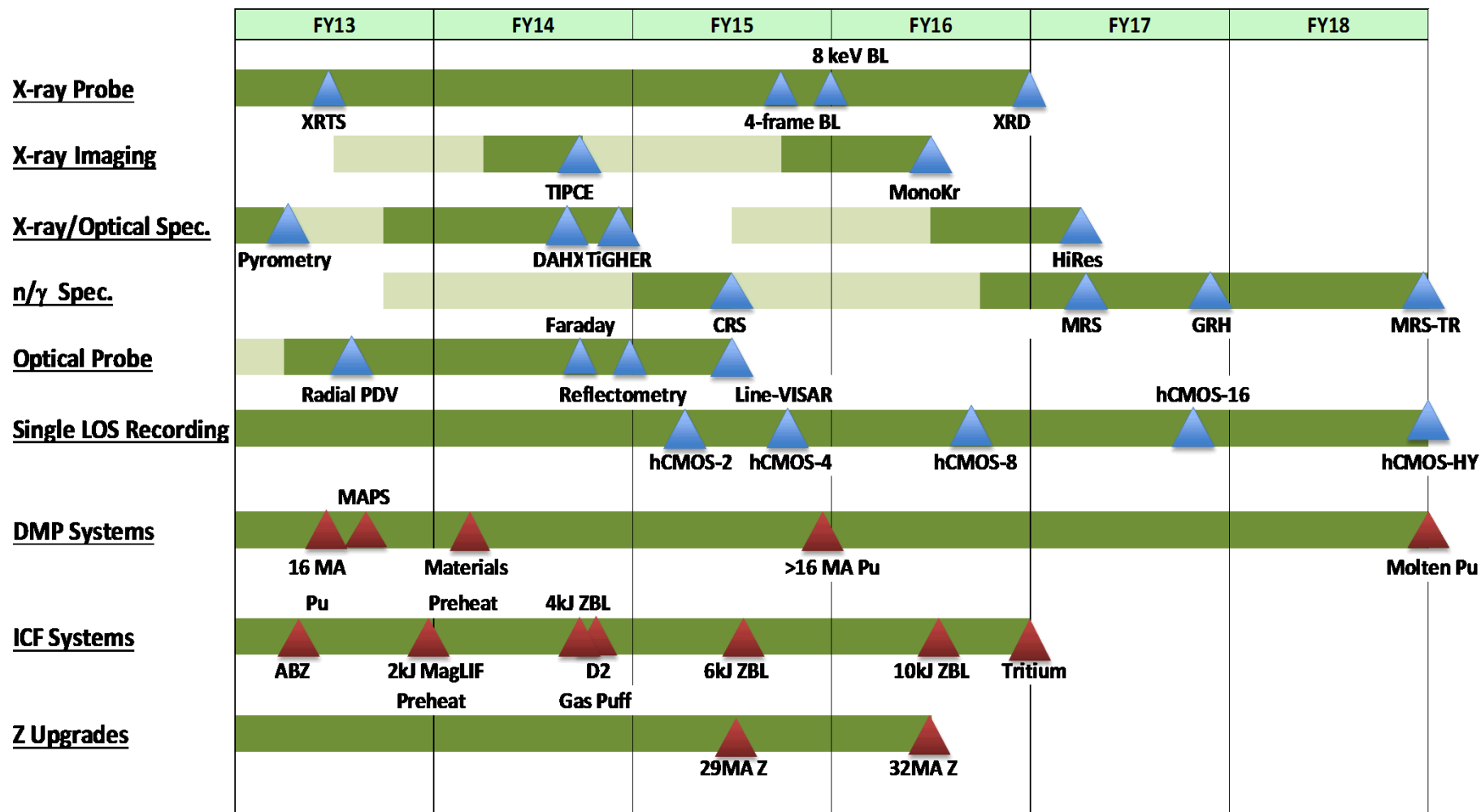


These broad categories represent hundreds of different diagnostic configurations and fielding locations

What are our biggest diagnostic needs?

- Temperature in shock and ramp experiments
 - Pyrometry, XRTS, Reflectometry
- Phase Identification in shock and ramp experiments
 - X-ray Diffraction
- Velocity with spatial resolution
 - Line-VISAR
- Fusion reaction history
 - GRH (needs DT), MRS-TR (needs DT)
- Physical characteristics of the fusing plasma
 - TiGHER, CRS, MRS (needs DT)
- Magnetic flux compression
 - Faraday Rotation
- Liner characteristics at high convergence
 - 4-frame Backlighting, 10 keV Backlighting
- High energy (>20 keV) x-ray emission
 - TIPCE, DAHX
- Temperature history of the laser-heated DD fuel
- 0-degree x-ray power, imaging, and spectroscopy

Z New Capability Roadmap



What's not on the roadmap:

Neutron Diagnostics

- Water/Oil long-distance LOS for nTOF
- Neutron Bang Time
- Neutron Reaction History

X-ray Diagnostics

- 0° flexible diagnostic LOS
- Fast-gated Optical Imaging
- Point-Projection Absorption Spectroscopy
- Step-Filtered Imaging
- Bremsstrahlung Radiography
- Streaked Radiography

Emerging Needs

- Diagnosis of the laser preheat for MagLIF (T_e vs t)
- Very high-energy (>100 keV) spectra

NSTec support for Z

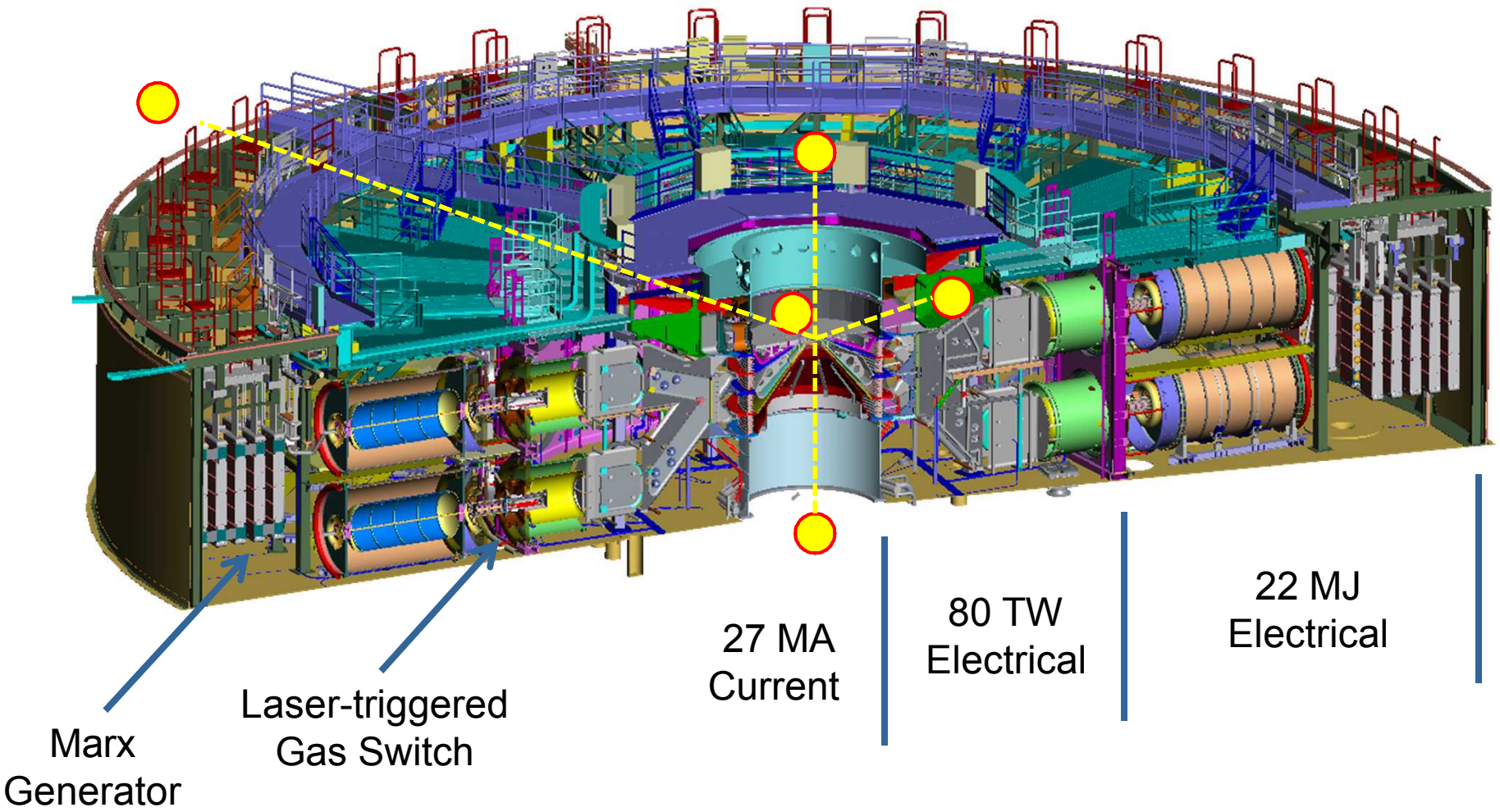
- Current:
 - Fielding NSTec MCPs on I&S diagnostics– 2 Tech, 1 Staff
 - Coating of MCPs
 - Support for Gen-I and Gen-II MCPs and electronics
 - Calibration (eV-7 keV) (Crystals, PCDs, XRDs)
 - EG&G Streak Camera support
 - Circuit development for shock measurements in Z
- Opportunities:
 - Phosphor coatings
 - Absolute calibration of diagnostics
 - In-chamber MCPs
 - 10-30 keV Calibration capability
 - Ruggedized X-Ray Streak capabilities
 - Rad-hardened CCD technology

Proposed scope of work for FY15

- Maintain and field 9 Gen-II and 6 Gen-I MCP framing cameras
 - up from 6 each, due to TiGHER diagnostic and LOS290 coming on-line
 - Support development and modifications to field Gen-II MCP in-chamber on Z
 - Design, assemble, and calibrate new interframe boxes for both Gen-I and II MCP in LOS 50, 170 and 330 (Maybe LOS 290)
- Coatings
 - Continue development of MCP coating capability
 - Initiate development of Phosphor coating capability
- X-Ray Diagnostics Characterization
 - XRD, filter, and PCD absolute response characterization
 - MCP performance (QE)
 - Assist in design and implementation of X-ray crystal characterization in SNL Manson source
- Continue development of detector physics model
- Continue X-Ray crystal calibration in Henke X-ray Lab
- Investigate higher-energy (10keV-30keV) calibration sources
- Assist in shock wave measurements at Z facility

Backup

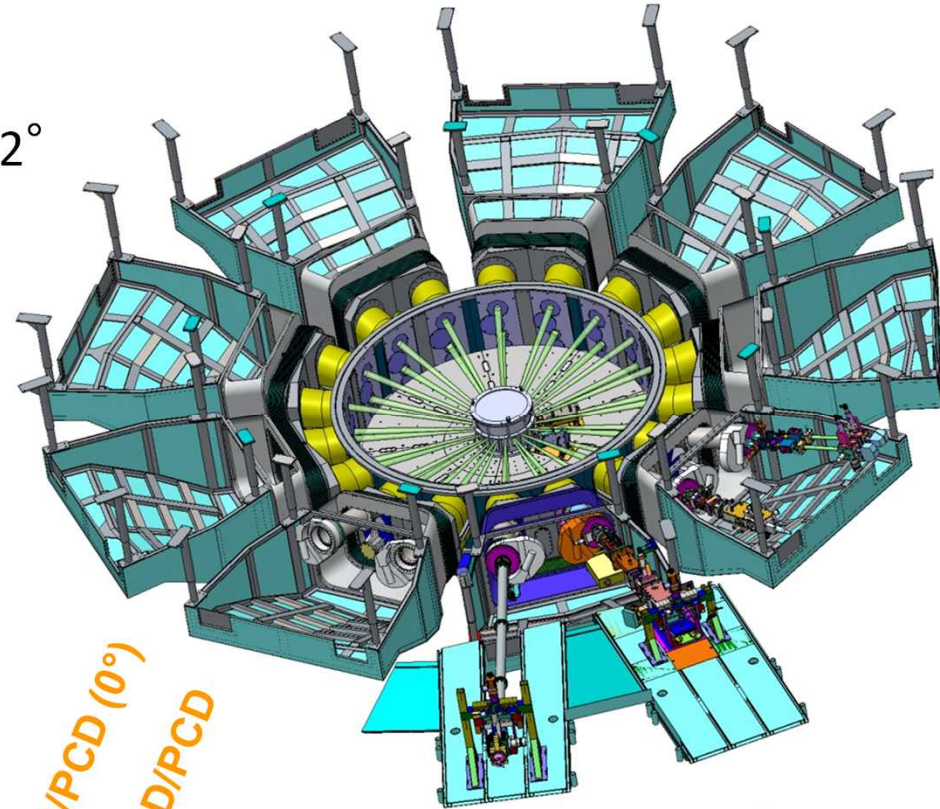
Diagnostic access on Z is limited by the geometry of the pulsed power components



Radial 12°, 0°; Top Axial; Bottom Axial; Chamber

Radial LOS overview of the Z facility

- 18 Radial line of sights access ports at $\sim 12^\circ$
 - 18 fixed radial 12° diagnostic systems
- 18 line of sight access ports at $\sim 0^\circ$
 - 3 fixed radial 0° diagnostic systems



BOLO/XRD/PCD/TEP
NTOF
VISAR

SVs

TIXTL

Neutron Imager
MLM

Bolo/XRD/PCD (0°)
BOLO/XRD/PCD

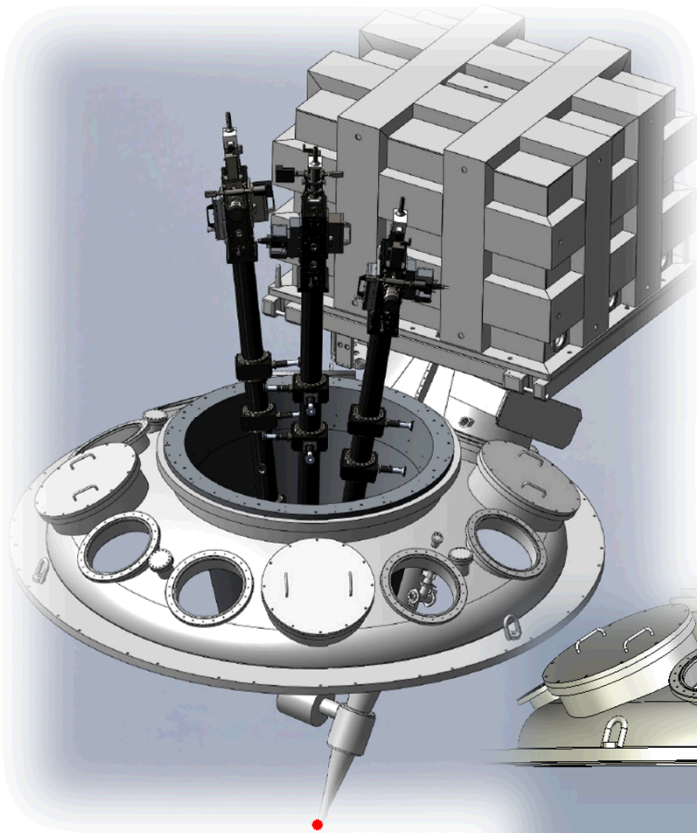
NTOF

Be-Probe
TRES

Blocked by
Backlighter

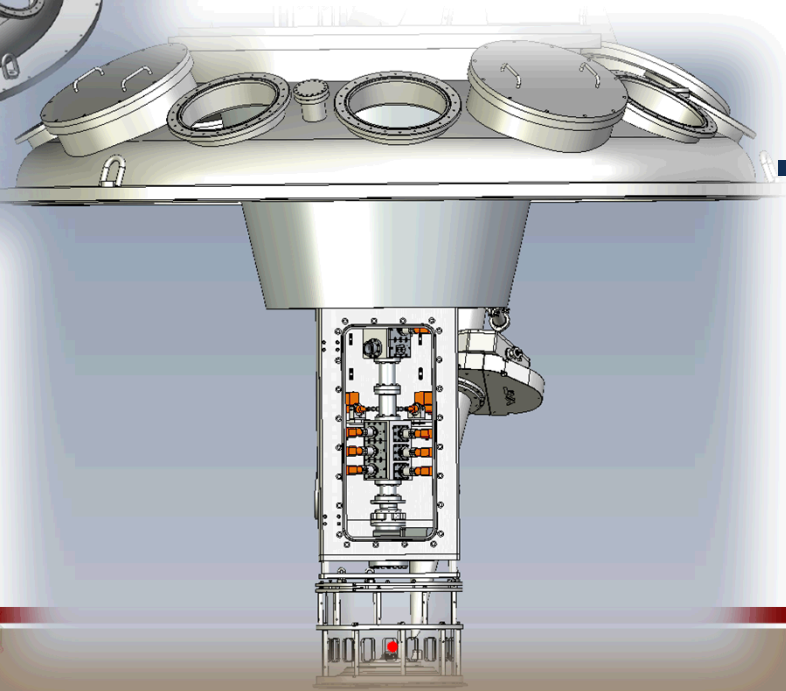
10 30 50 70 90 110 130 150 170 190 210 230 250 270 290 310 330 350

Axial LOS overview of the Z facility



■ 3 Axial LOS:

- 0° : PODD
- 9° E: PODD
- 9° W: PODD



■ 1 Close-Proximity LOS:

- 0° : PODD

Chamber Diagnostics

Fiber-Based Diagnostics

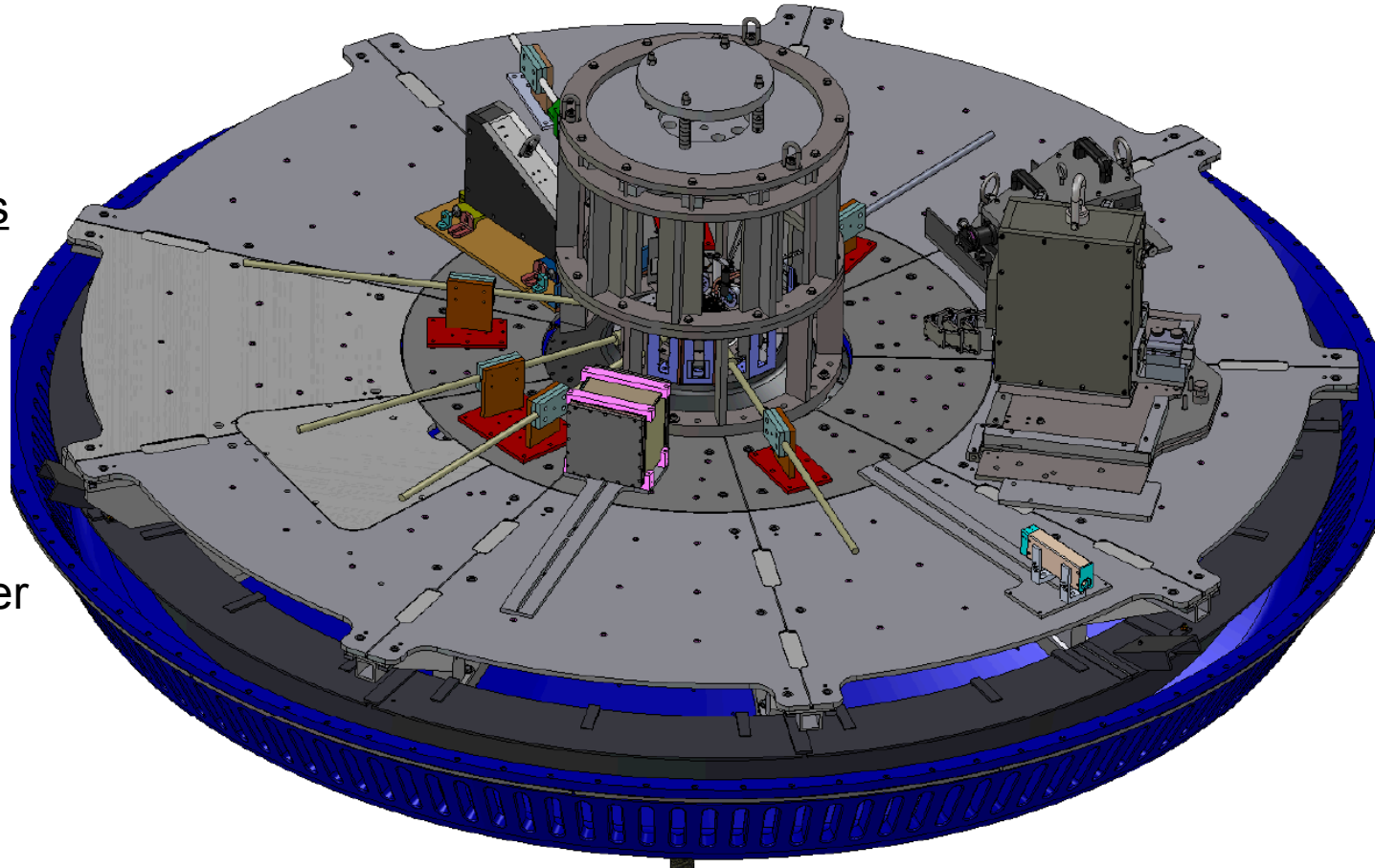
- VISAR
- PDV
- SVS

X-ray Spectrometers

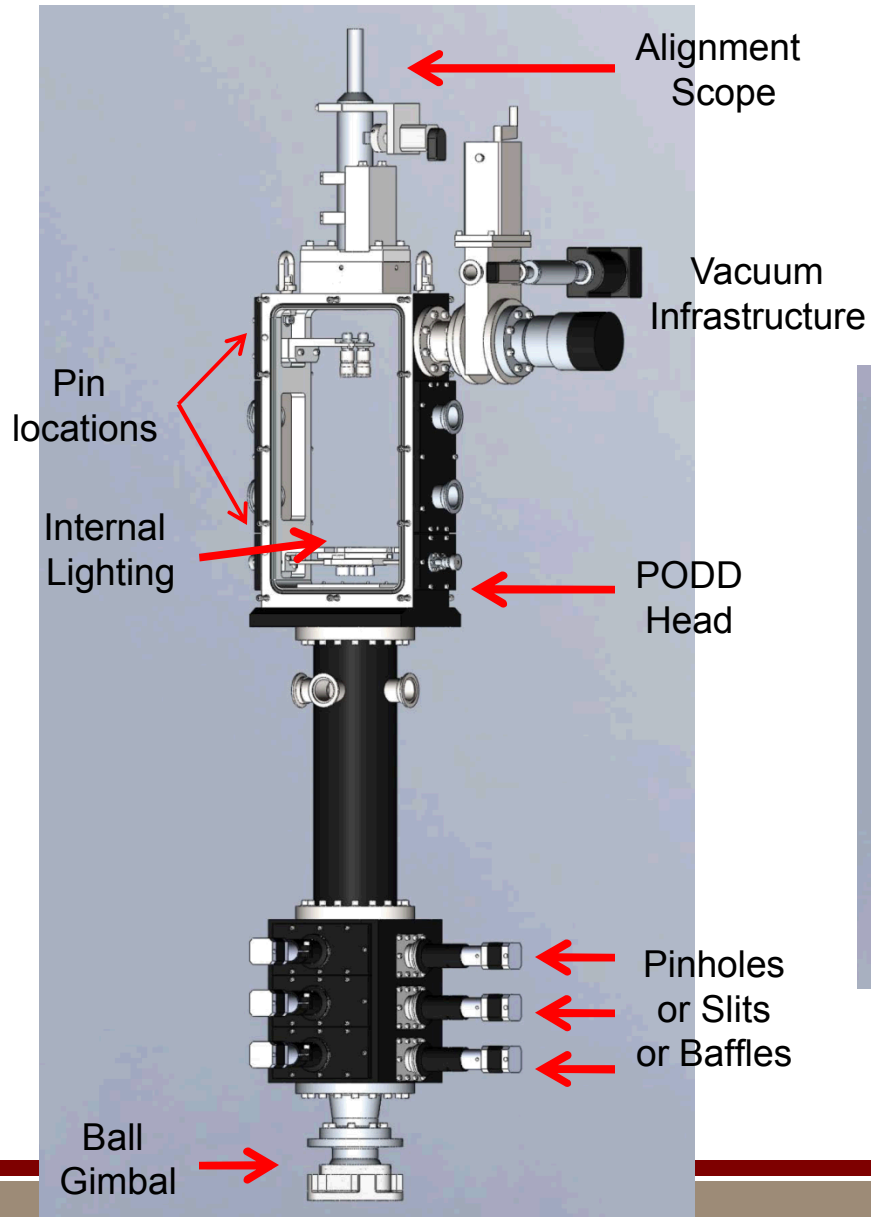
- CRITR-AR
- CRITR-RR
- XRS3

X-ray Imagers

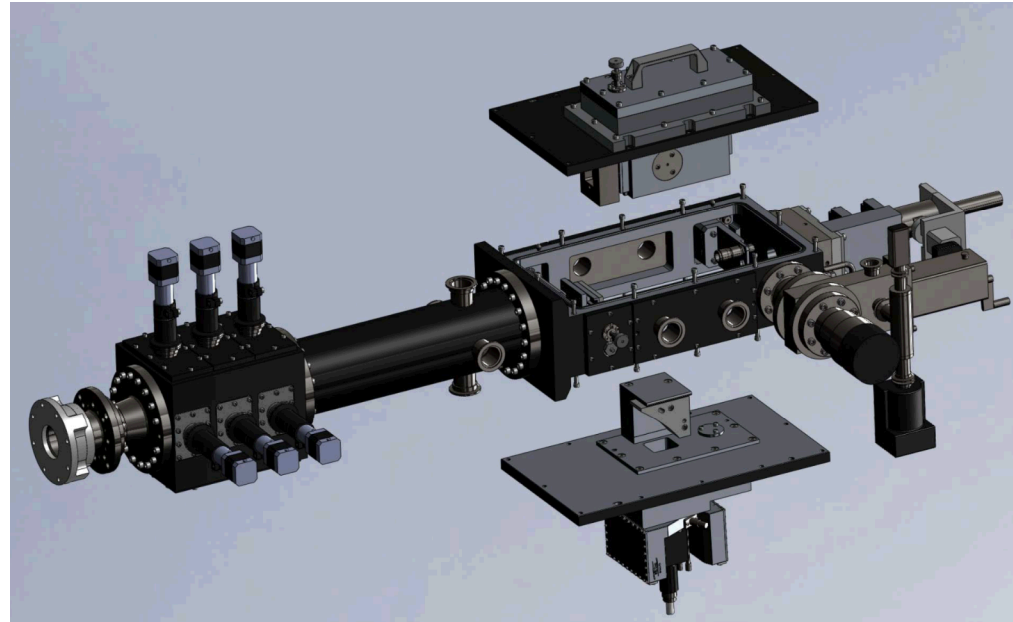
- Monochromatic
Crystal Backlighter



Typically, alignments are done manually, using an optical scope

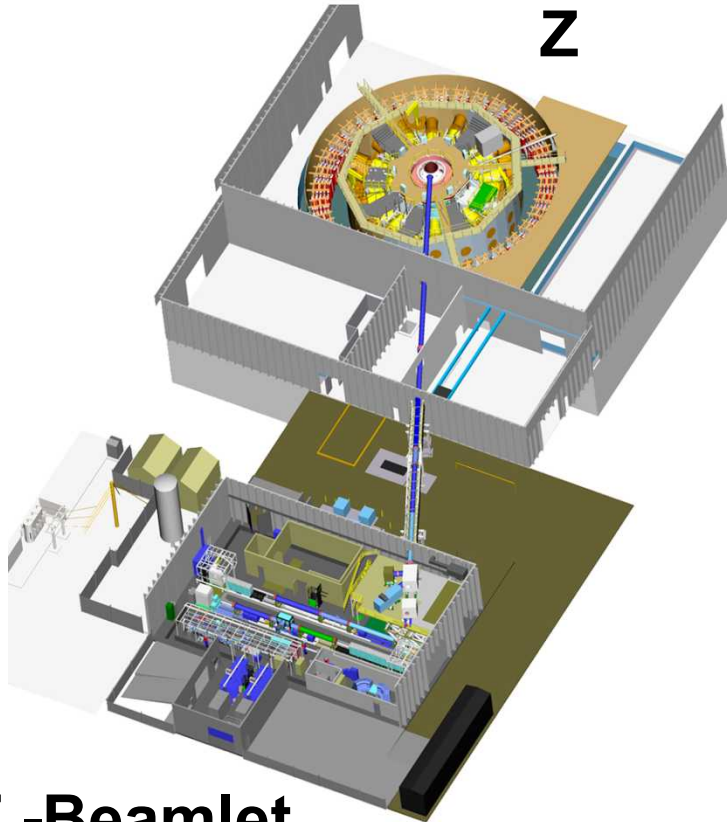


Pinned Optically-aligned Diagnostic Dock
PODD



X-ray Backlighting on Z

Z



Z -Beamlet

- ~ 2 kJ at 2ω in up to a four-post picket at ≤ 2 TW peak power.
- $> 80\%$ of the 2ω energy into a focal spot of $50\text{-}\mu\text{m}$ -diam
- 1 or 2-frame Monochromatic Radiography
 - 1.865 keV
 - 6.151 keV
- 2-color Monochromatic Radiography
 - 1.865 and 6.151 keV

