



WPSA Operations: FILD status and commissioning plans

WPSA General Meeting (08-09-2022)

J. Ayllon-Guerola, J. Segado-Fernandez, J. Garcia-Dominguez, J. Hidalgo-Salaverri, D. Garcia-Vallejo, M. Garcia-Munoz, S. Davis, G. Phillips, V. Tomarchio, N. Hajnal, C. Piccinni, M. Wanner, C. Sozzi and the PSFT, WPSA, F4E and QST Teams

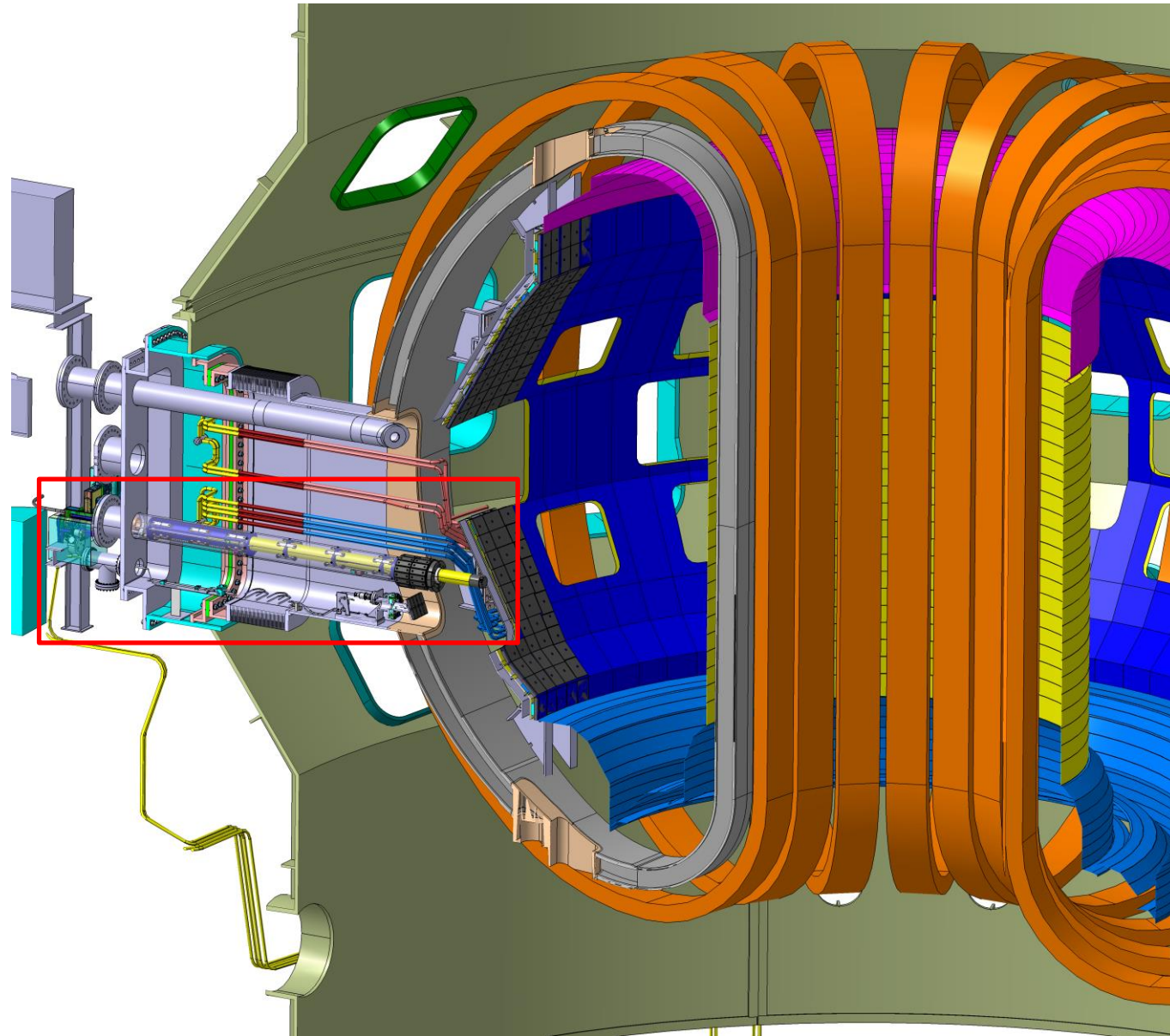


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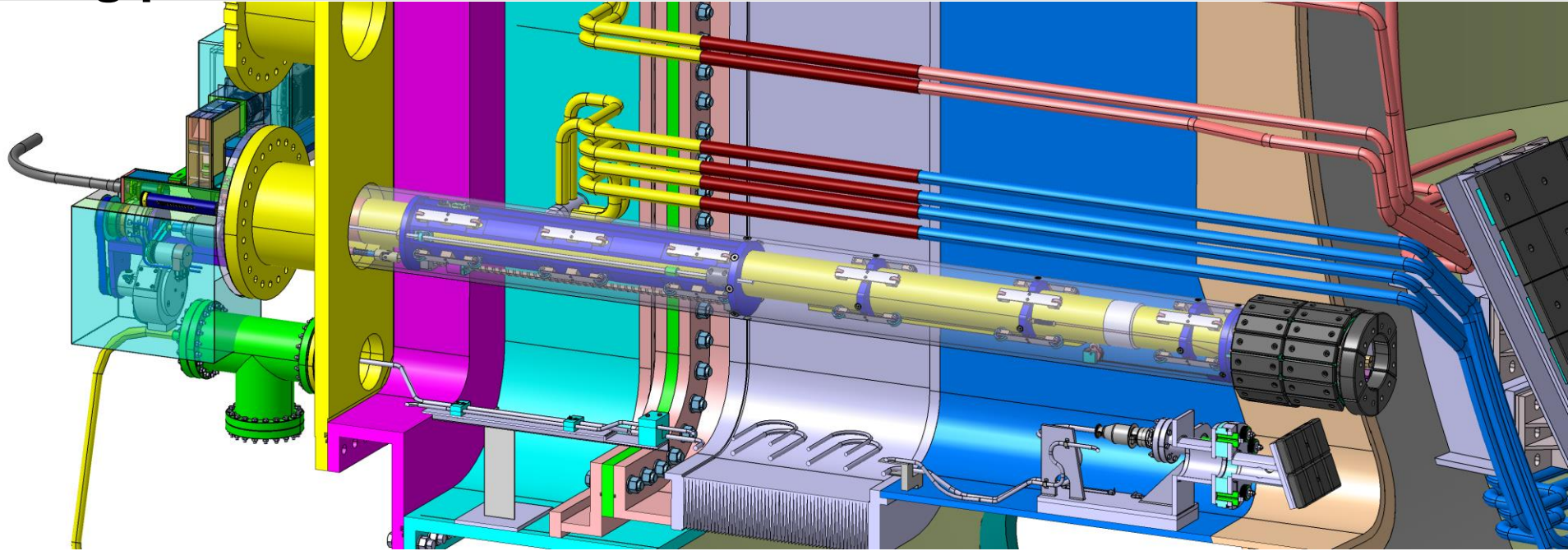


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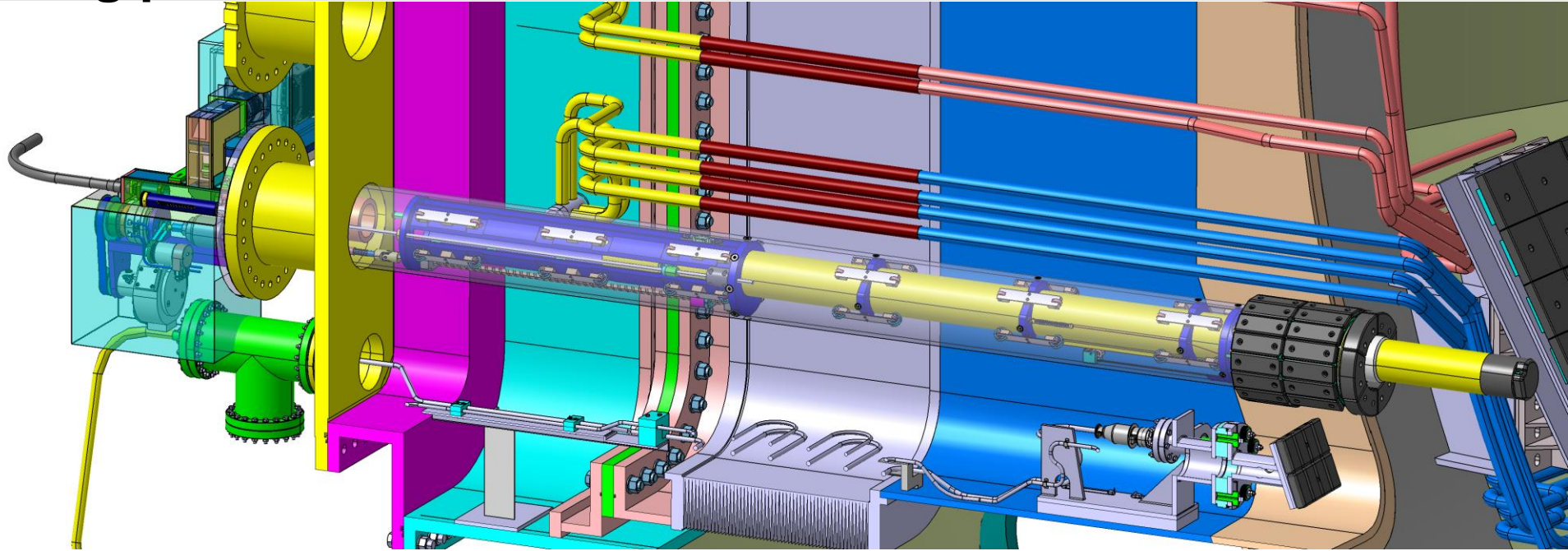
FILD located at equatorial port in Sector 15, slightly below midplane (M/E-2 Diagnostic)



FILD displaces 1m stroke moving between parking and measuring positions

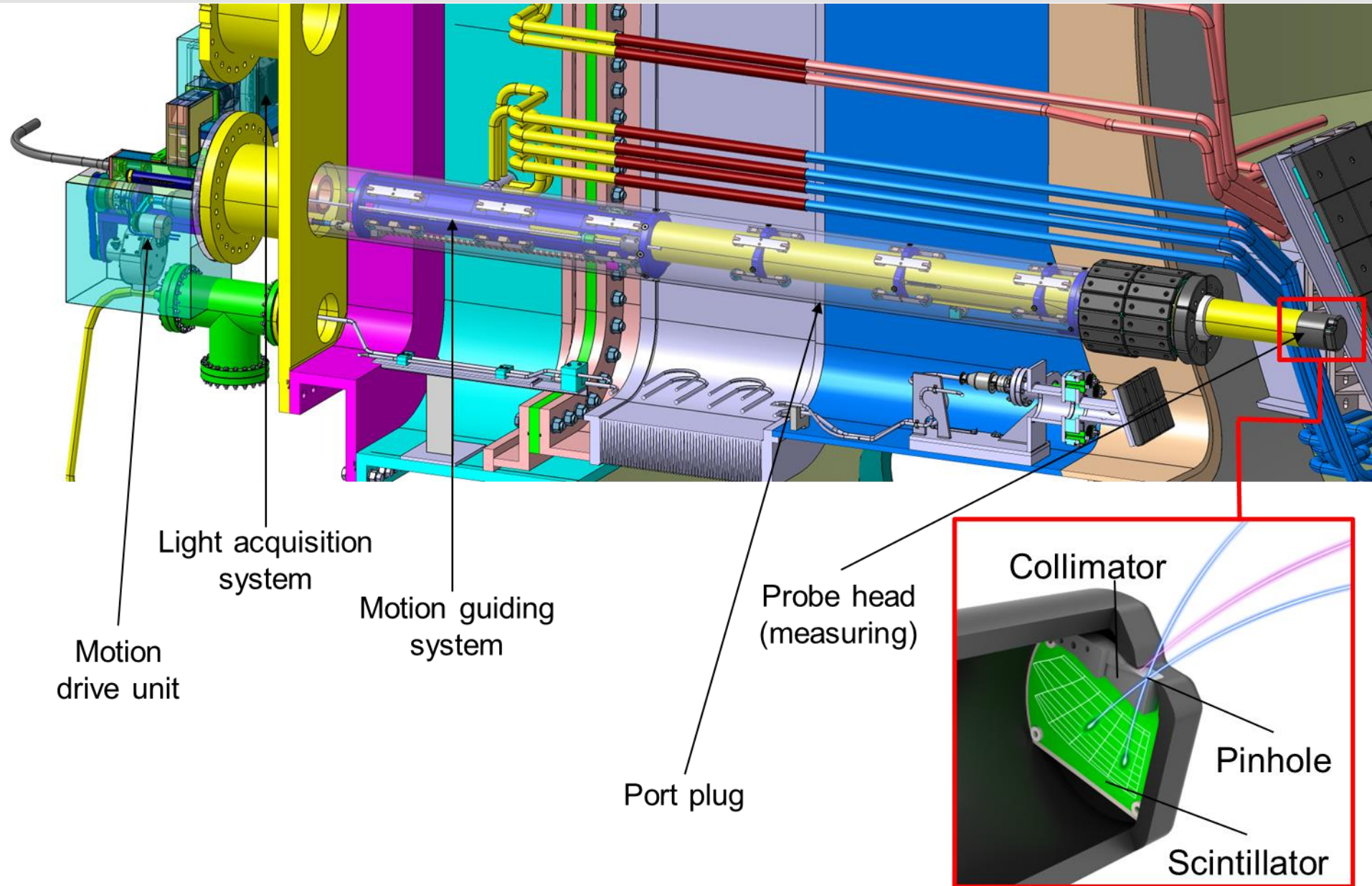


FILD displaces 1m stroke moving between parking and measuring positions





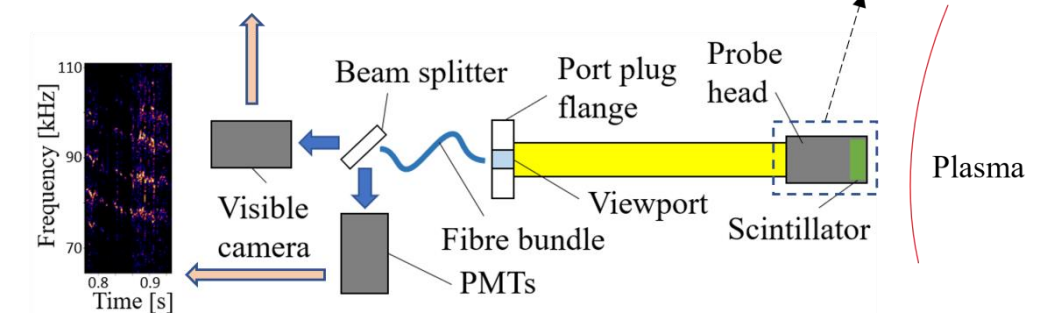
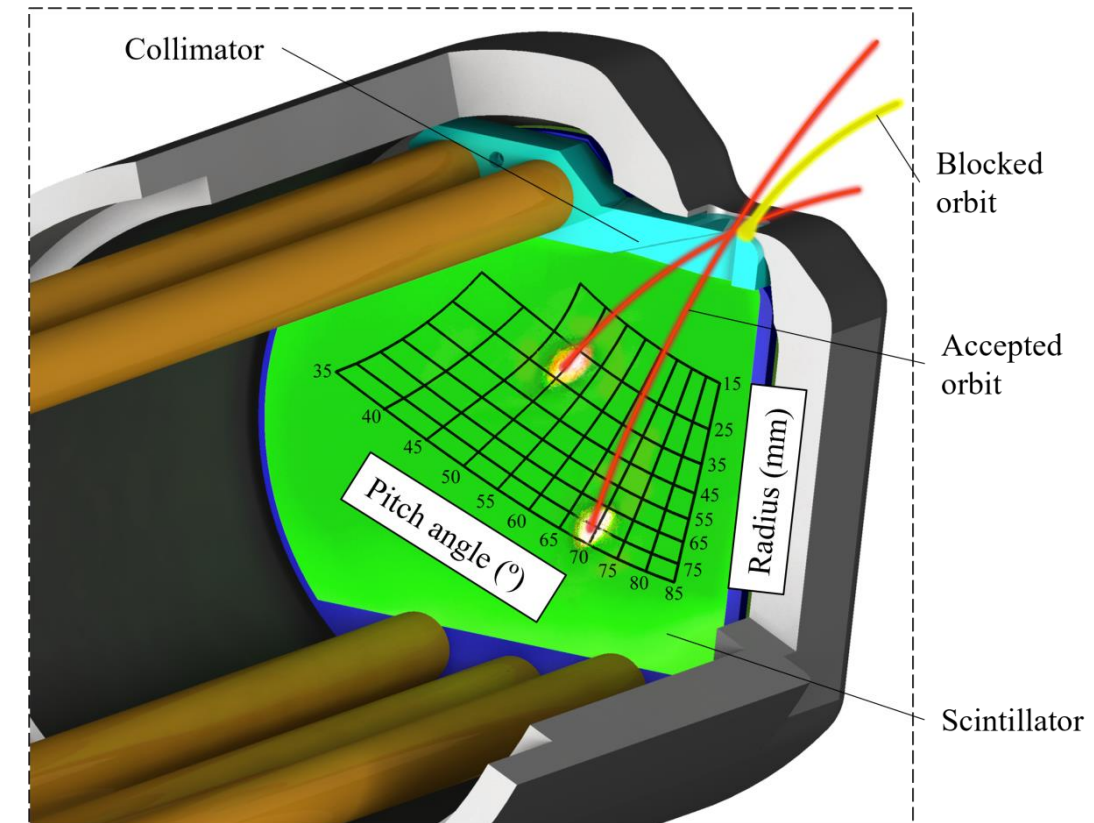
FILD head collects particles escaping from plasma





New WPSA task for FILD synthetic diagnostic development

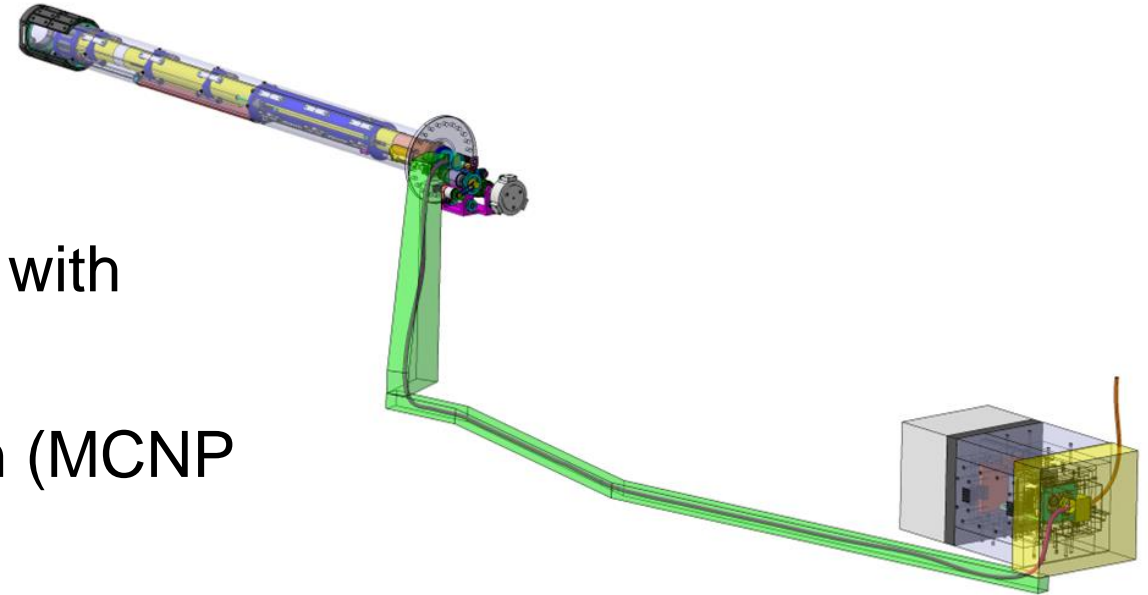
- 2022 task under Code Management and Simulations Area (G. Falchetto)
- Collaboration between UoS, Aalto University, CNR-ISTP and UniMiB
- Run **ASCOT** for selected scenarios to
 - obtain fast-ion losses on first wall
 - estimate thermal plasma heat load on detector head
- Run **FILDSIM** to optimise detector head geometry
 - Iterative process that includes thermomechanical FEM analysis
- Run **MCNP** to estimate background noise in scintillator due to nuclear reactions
- Estimate **optical throughput**
- Construct final **synthetic diagnostic**





FILD current status and future plans

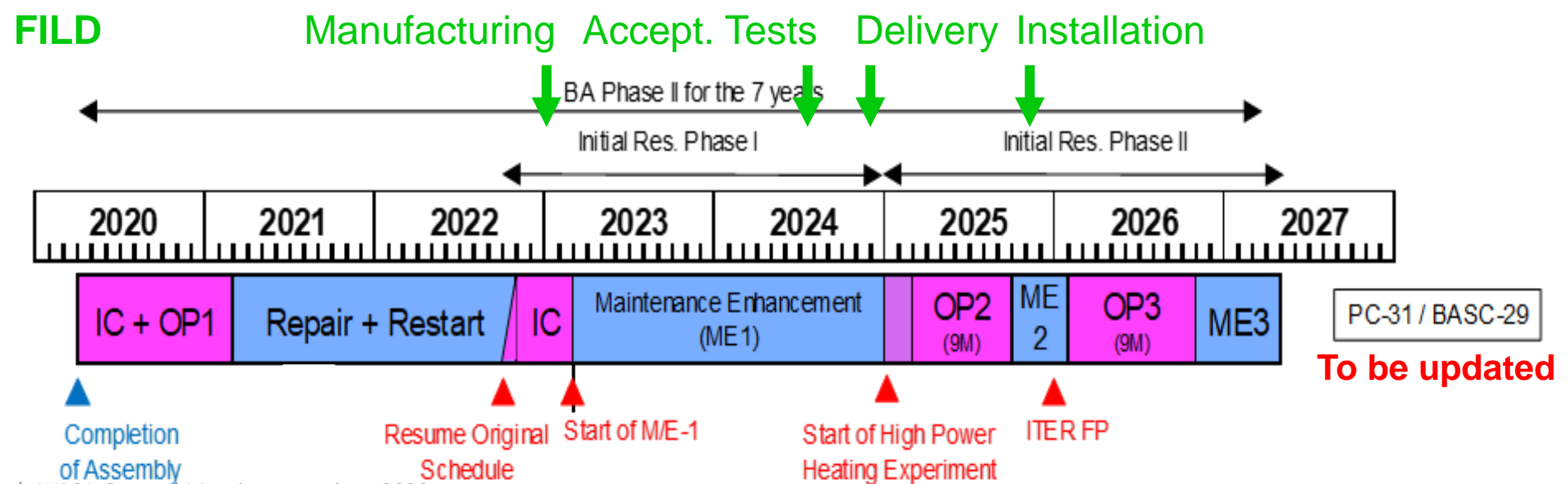
- PA to be finalized and signed during 2022
- Completion of final design during 2022:
 - Finalizing mechanical design (iteration with QST/F4E)
 - Complete camera shielding box design (MCNP assessment ongoing)
- Start procurements planning by end of 2022: new funding scheme being defined between EUROfusion and F4E
 - Contract between F4E and UoS to be signed in Sep 2022 for hardware procurements
- Manufacturing, calibration and laboratory testing during 2023-2024 (at UoS labs)





FILD installed in 2025 (M/E2 phase) and commissioned in 2026 (OP3 phase)

- Manufacturing during 2023-2024
- Acceptance tests by mid 2024 in UoS laboratory
- Delivery to Naka by end 2024
- Installation during 2025 (ME2 phase)
- Commissioning during 2026 (OP3 phase)
- NOTE: Could be installed in M/E1 but port not available (periscope, equatorial 15)



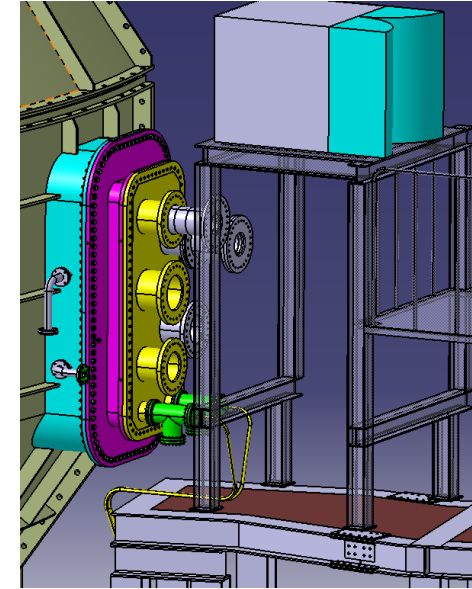


Some installation/operation tasks could start from 2024

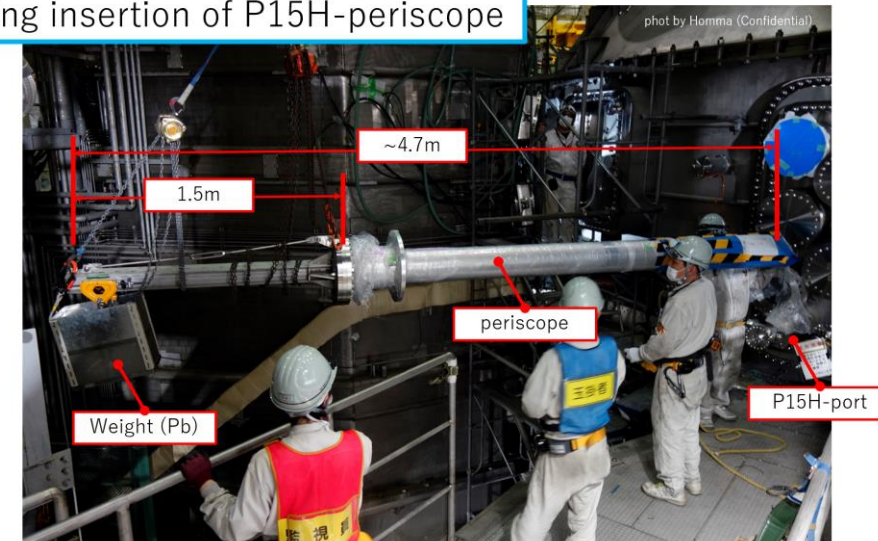
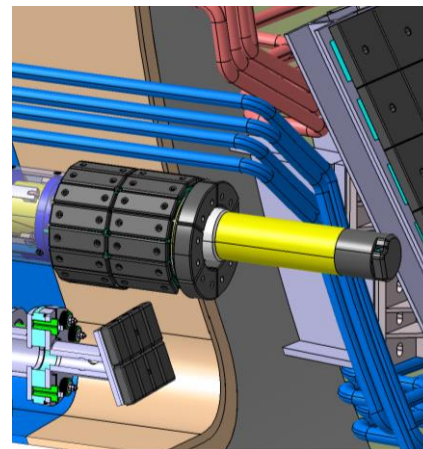
- **Torus hall communications assessment:** Optical converters (A/D converter + optical fibres data transfer) needed for entering/exiting torus hall:
 - Motion control
 - Motion sensors (encoder)
 - Thermocouples
 - Visible camera (Phantom camera)
- **Manuals preparation** for FILD operations and data postprocessing
- **FILD Suit development** (AUG FILDs reference) needed for:
 - FILD operation (motion, data acquisition configuration,...)
 - FILD data postprocessing (during/between shots)
- **FILD remote operation feature development** (FILD Suit expansion)
 - Remote data access
 - Mimic functionalities in control room PCs

FILD installation/commissioning needs (2025-2026)

- Onsite support
 - FILD assembly and calibration in Lab (EU expert needed)
 - FILD installation and calibration In-Vessel (EU expert might be needed)
 - Diagnostics common stage temporal/partial disassembly
 - Crane and special hardware needed for PP installation (EDICAM or Periscope could be reused)
 - FARO measurements for measuring position calibration
 - In-vessel thermal protection installation



During insertion of P15H-periscope

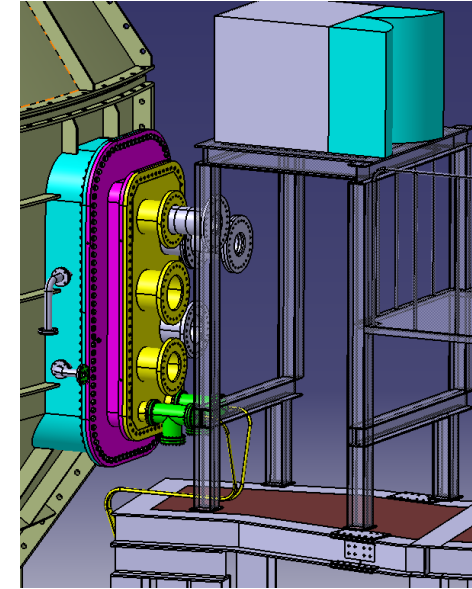


FILD installation/commissioning needs (2025-2026)

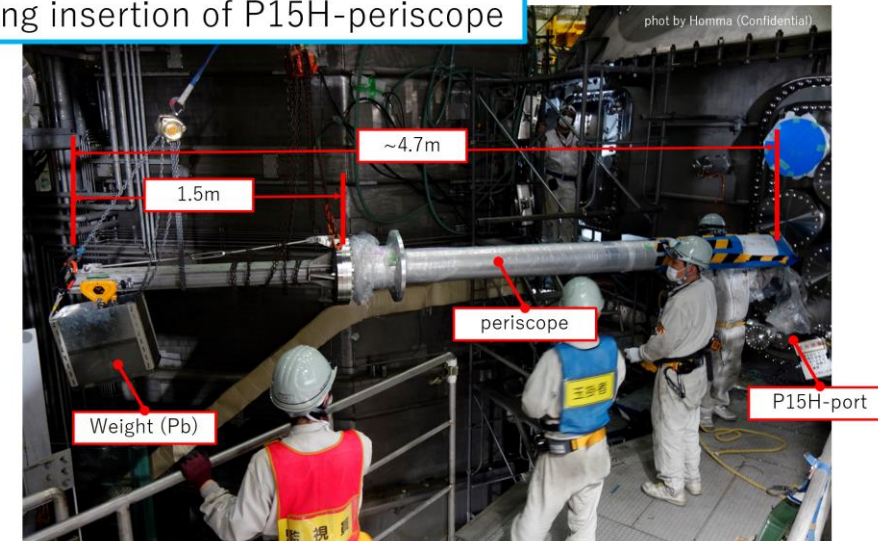


- **Onsite support**

- FILD assembly and calibration in Lab (EU expert needed)
- FILD installation and calibration In-Vessel (EU expert might be needed)
 - Diagnostics common stage temporal/partial disassembly
 - Crane and special hardware needed for PP installation (EDICAM or Periscope could be reused)
 - FARO measurements for measuring position calibration
 - In-vessel thermal protection installation
- PMTs and motion control electronics installation in Diagnostics Room (EU expert needed)
- Pneumatic station installation in Torus Hall
- No special Control Room work (PCs installation and cabling)



During insertion of P15H-periscope



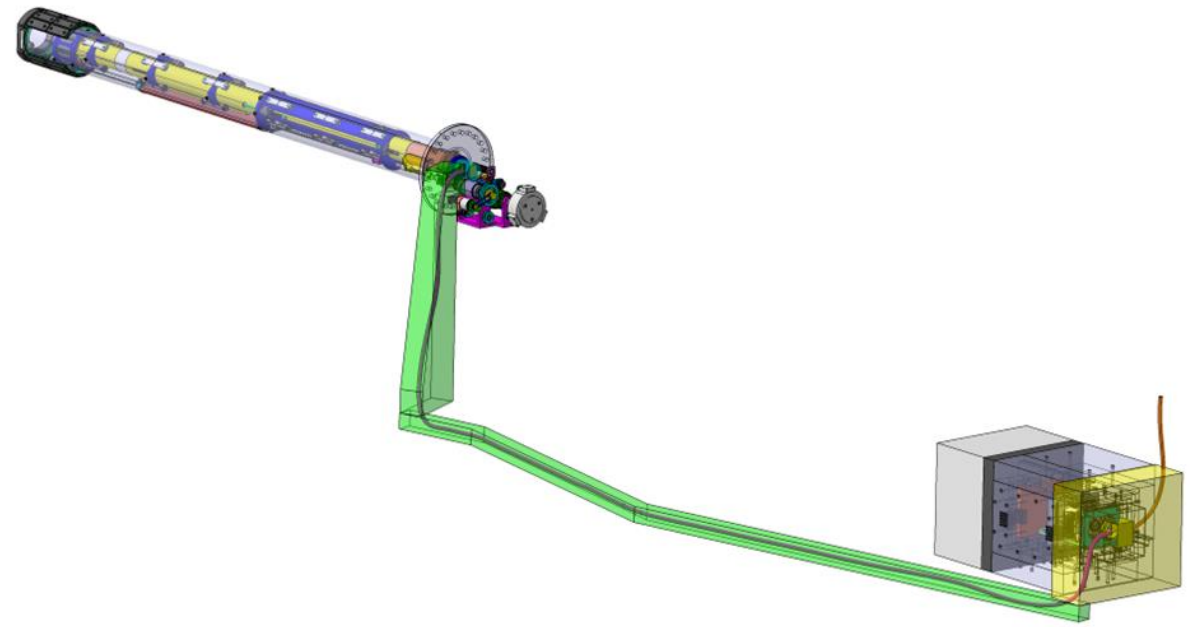
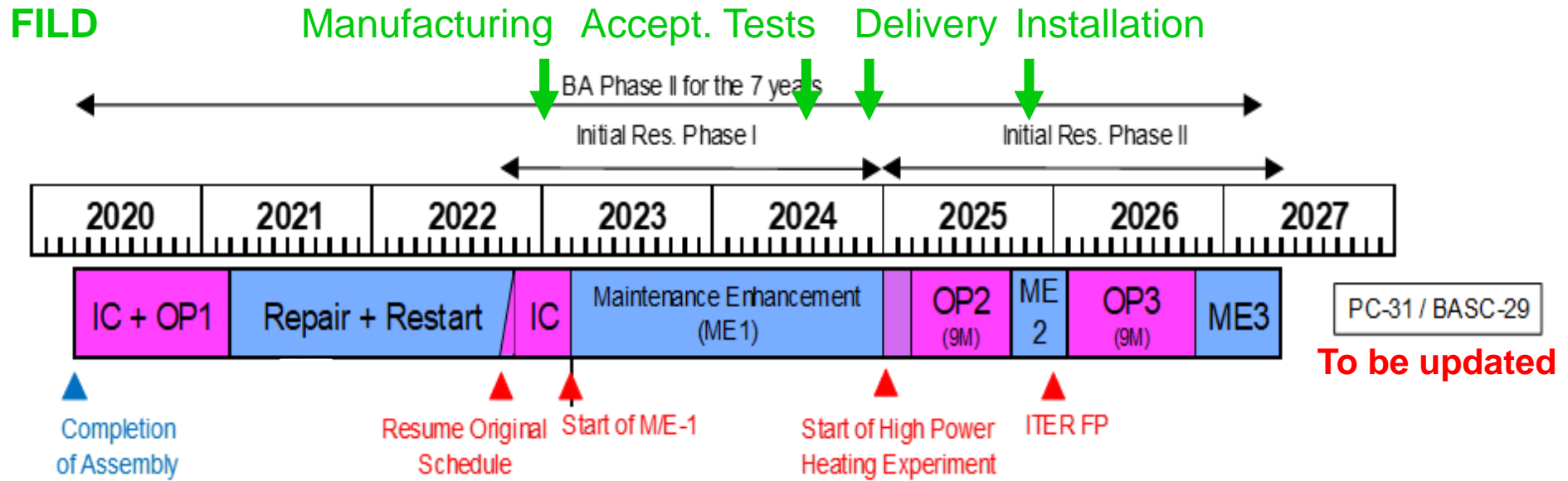


FILD installation/commissioning needs (2025-2026)

- **Software needs**
 - FILD Suite (Different versions available: Fortran, IDL, Matlab, Python)
- **Knowledge management and transfer** (reports, publication, training)
 - FILD operation manual/training
 - FILD post-processing tools manual/training
- **Remote operation** / maintenance / commissioning or **Remote support**
 - FILD remote operation being done (AUG) with onsite support (1 trained person)
- **Acceptance tests** (in UoS Lab - 2nd half 2024)
 - Vacuum leak tests
 - Baking test
 - Physical dimensions measuring
 - System actuation
 - Camera operation in high magnetic field
 - Optics and imaging quality
 - Grounding and electrical insulation



FILD Schedule



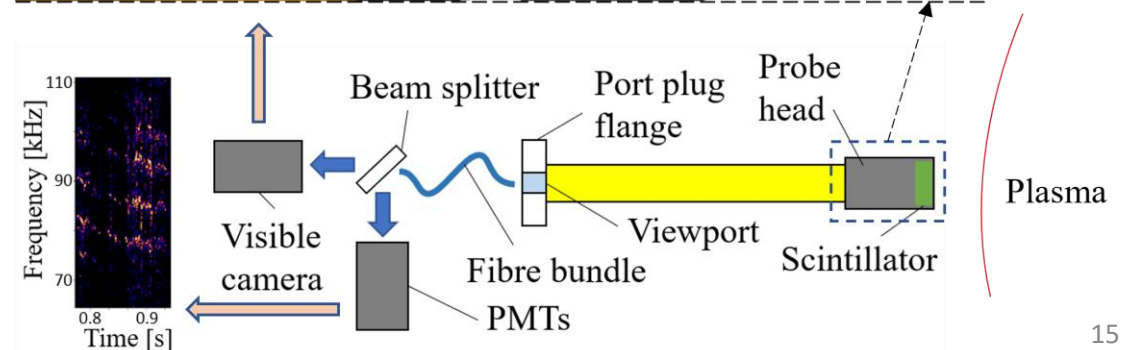
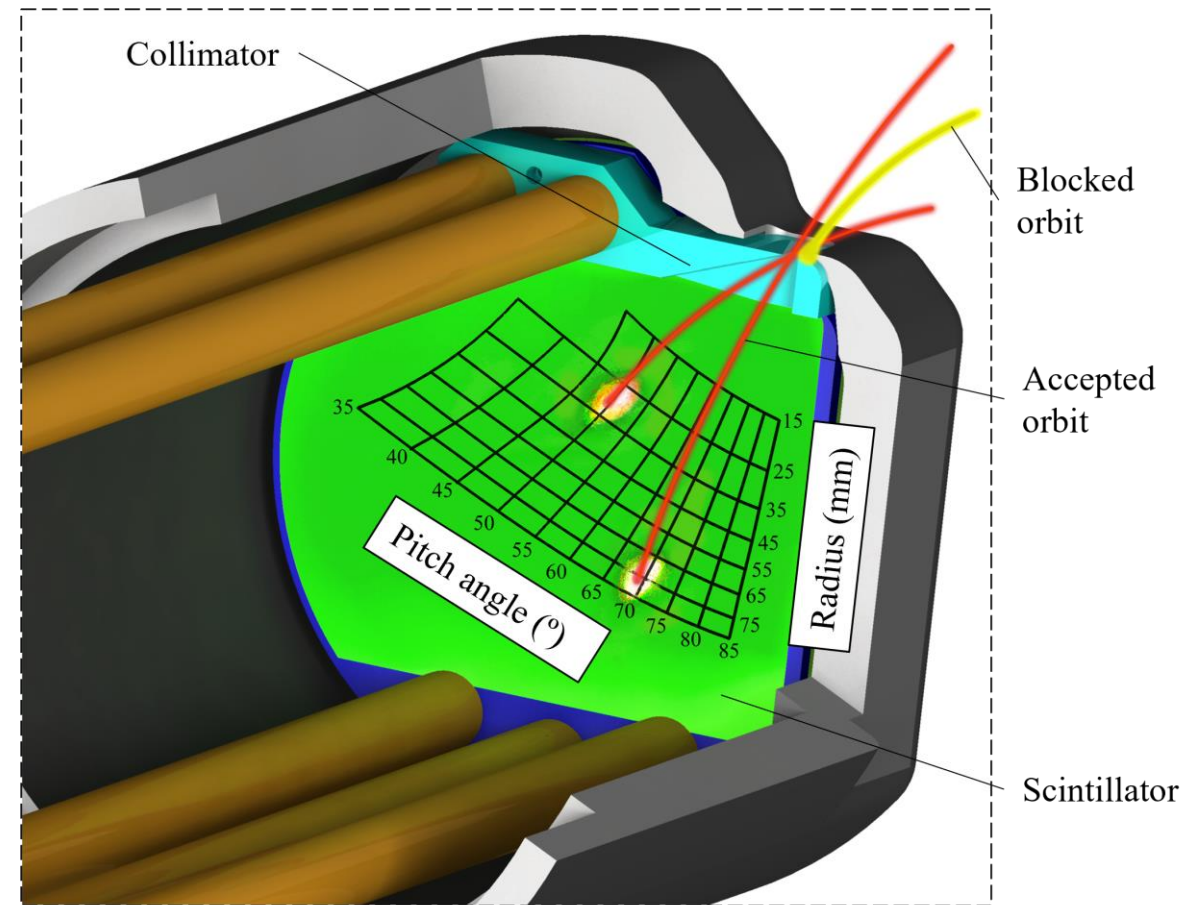


BACKUP SLIDES



FILD operation principle

- FILD used in mostly all major devices to study fast ions losses
- Works as a magnetic spectrometer collimating and dispersing ions onto a scintillator plate
- Strike points on the scintillator plate depend on particle gyroradius and pitch-angle
- FILD provides local time-resolved energy and pitch angle measurements of escaping ions
- Allows studying transport mechanisms provoking fast ions losses



FILD connections scheme

