



Multi-purpose toroidal optical view AEA21 using CXRS Immersion Tube.

Idea Proposal for OP2.1/2.2?

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CXRS Immersion tube AEA21

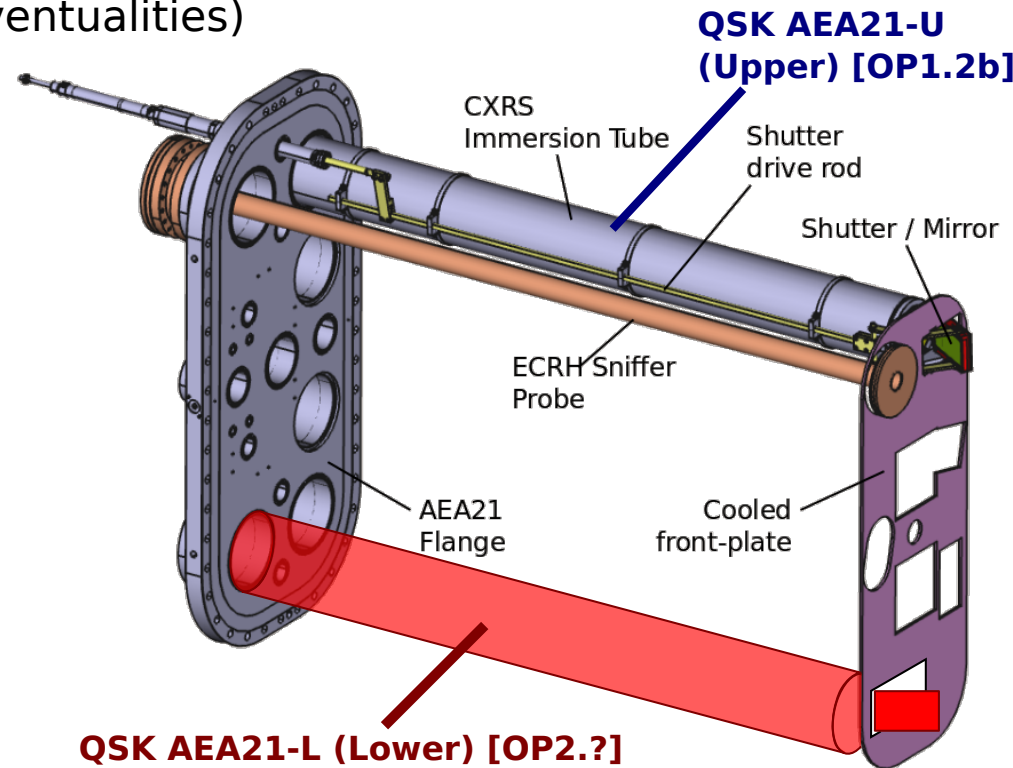
- Several diagnostics require a high-extended toroidal plasma view:
 - E3/QSK: CXRS on NBI for NI20
 - E4/QRI: Doppler CIS
 - E4/Q??: Fast Video (system??) (E4)
 - E3/QST: Motional Stark Effect
 - E5/Q??: Fluctuation Beam Emission Spectroscopy (US Collaboration??)
- } AEA21 in OP1, which may need replacement with pinhole.

Proposal: Build 2nd immersion tube for CXRS.

- Vacuum interface components could be ready for OP2.1 (<15k€):
 - 9.3k€, repeat existing orders. (+5k€ eventualities)
 - One small TD Auftrag.
 - Minimal workload for E3-DIA, PK, QM.
 - Zero workload for DE, AS or CoDAC.

Disadvantages:

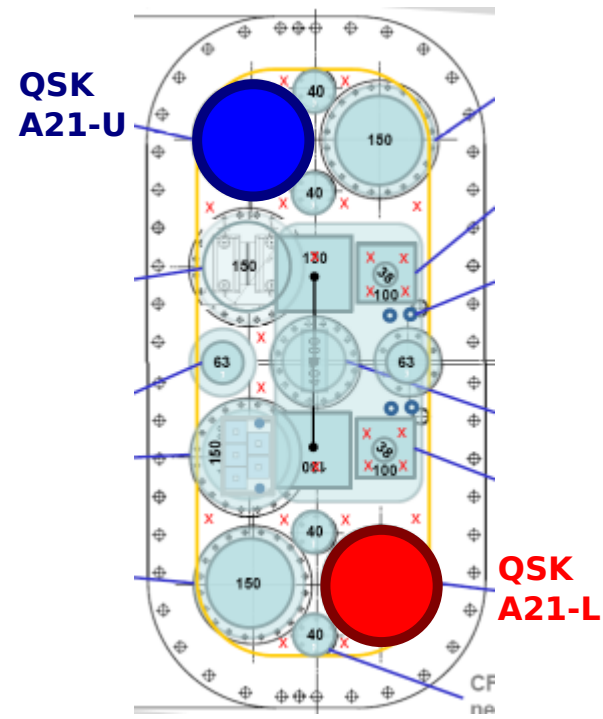
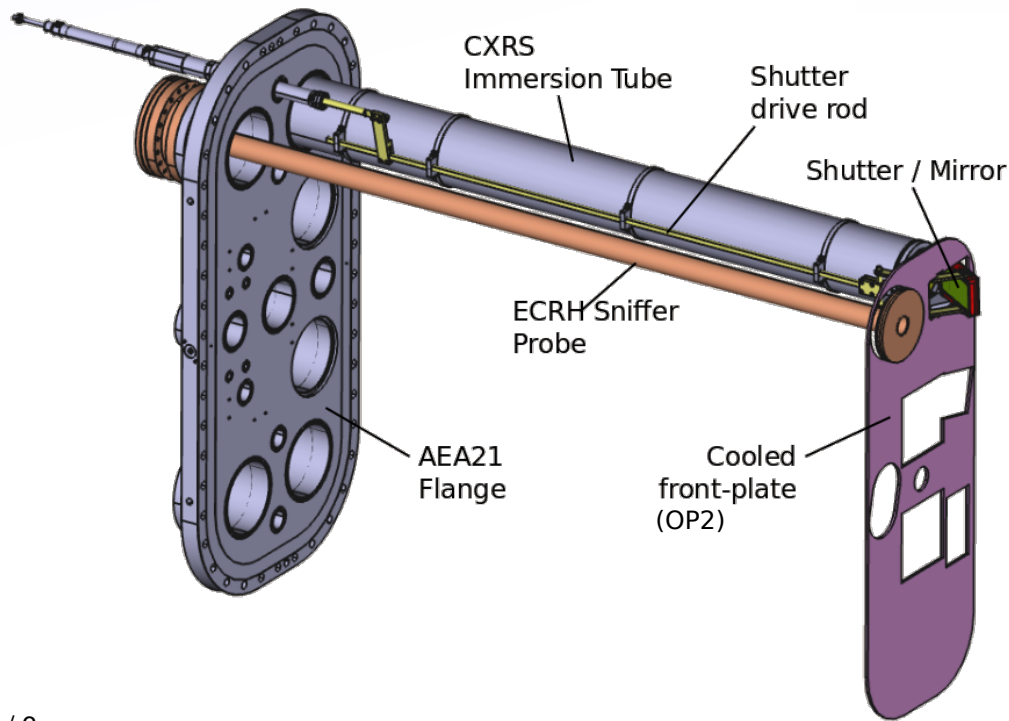
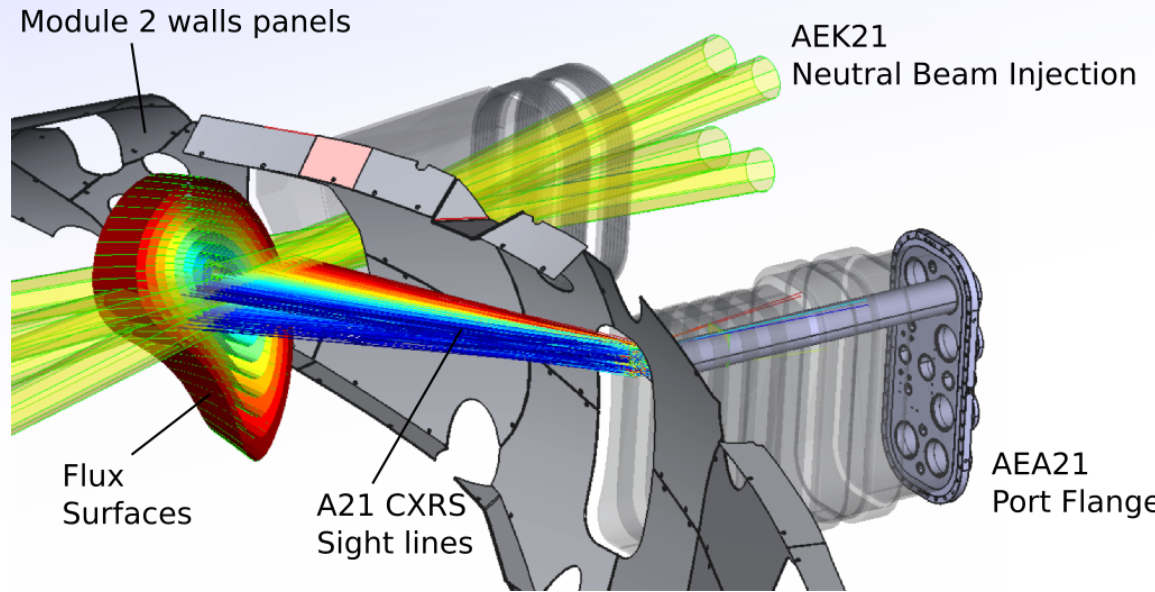
- Limited measurement period in 10MW long-pulse operation (~10secs)
- Optics need to be designed and built.





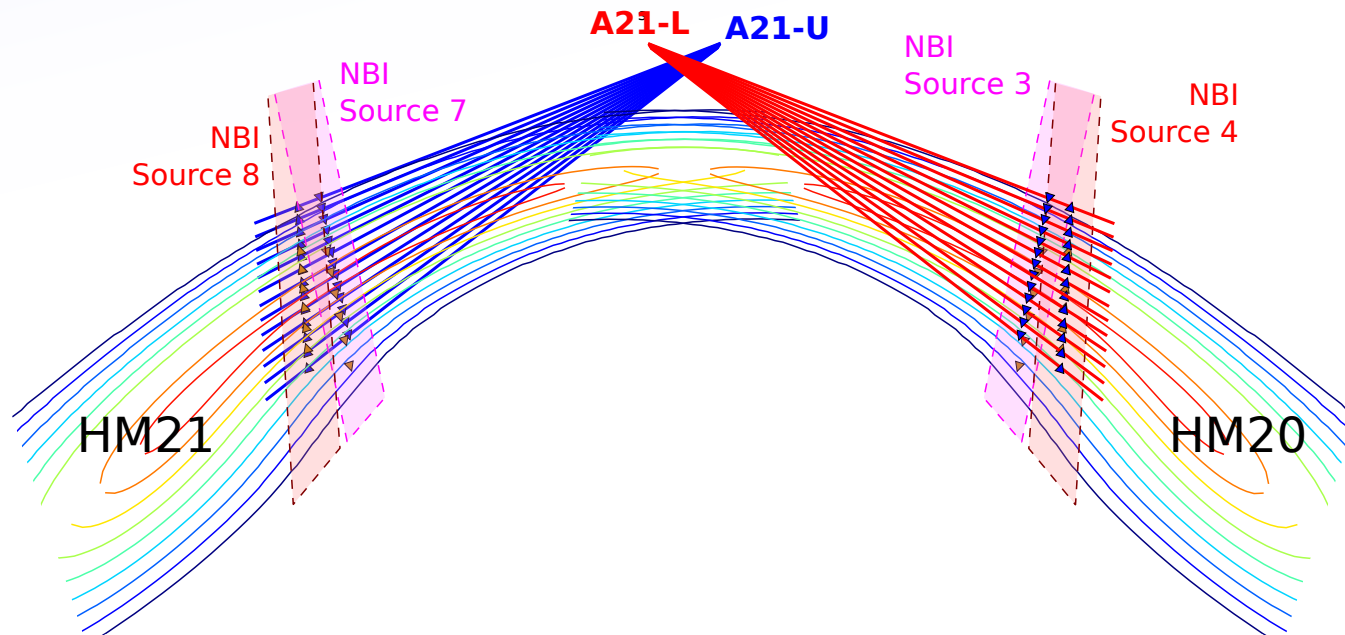
CXRS Immersion tube AEA21

- AEA21 plug-in tube viewing M21 installed and operated in OP1.2b.
- Daughter-flange was reserved for possible opposite system viewing M20.



Approximate view (CXRS optics)

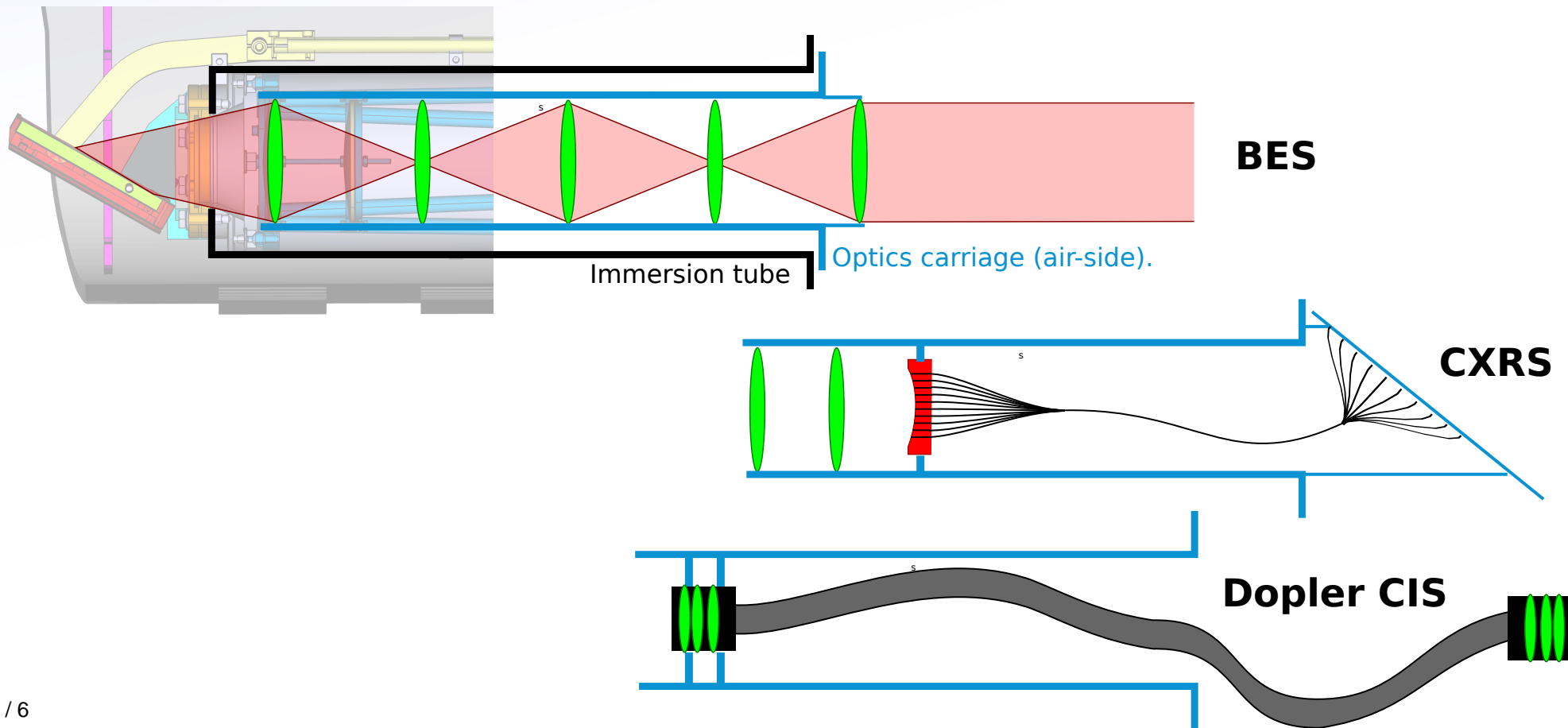
- System uses a in-vacuum mirror to view toroidally.
- Mirror can only be opened for ~ 10 s periods at 10MW - **not steady state capable!**
(This is the design safe estimate. Can probably be increased with some calculations)
- Shutter and tube cooling under development for OP2.1.
Whatever the solution is, can be repeated for A21-L (budgeted 5k€ here).



Optics / Usage

- Optics not covered in 15k€, but would need a redesign required anyway.
- Optics can be completed later (not vacuum-side).
- Could E4, E5, US or Hungary contribute optics?

Concept 1: Separate optic carriage for each diagnostic:
Preliminary, simple mechanical designs.
Time-share diagnostic port through-out campaigns.



Optics / Usage

Concept 2: Image transfer and beam splitters.

- Requires complex detailed optics design.
- Compromise FOV vs etendue between diagnostics.
- No fibre bundle --> Significant upgrade in etendue for CIS.
- Possibly motorised mirrors for full-etendue time-share?
- Could feasibly hi-jack CIS for iMSE and iCXRS studies.

