

## FIGURES CONTAINED IN PAPER ENTITLED

### DECAF Cross-device characterization of tokamak disruptions indicated by abnormalities in plasma vertical position and current

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-> **Figure 1 (data contained in categorization.txt file):**

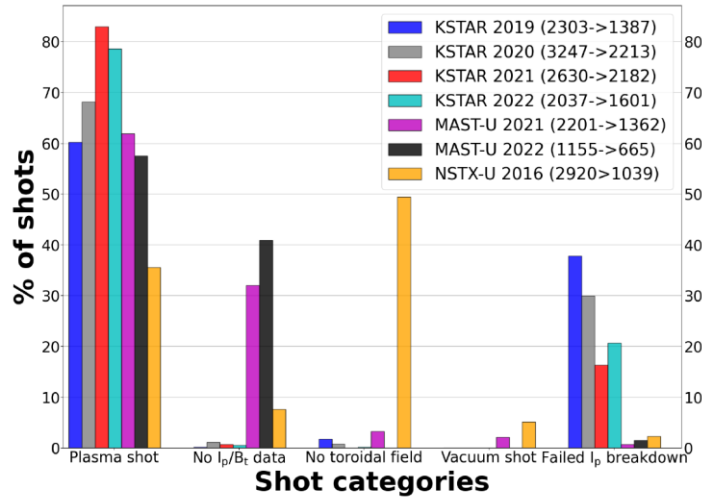


Figure 1: Results of the DECAF shot categorization for the device-experimental year pairs. Shots that passed the  $I_p$  breakdown fall into the ‘Plasma shot’ category (see Table 1). Numbers of Total→Plasma shots are indicated in parentheses.

-> **Figure 2 (example of a plasma shot analyzed for disruptive event chains by DECAF):**

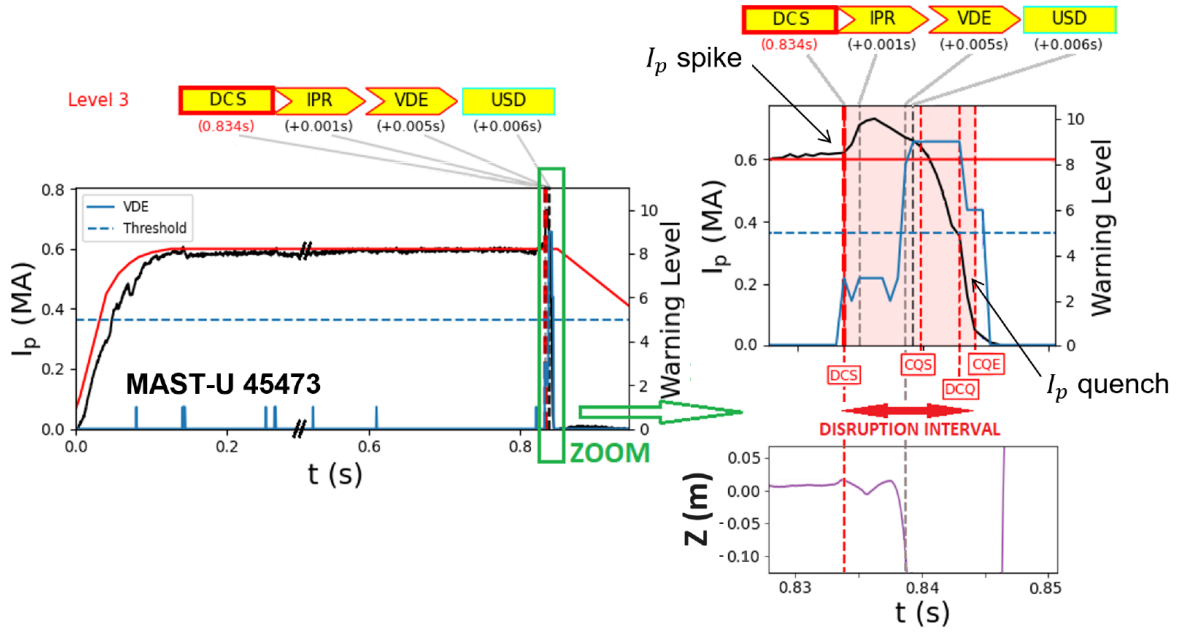


Figure 2: Example of a DEC captured by DECAF in a MAST-U shot 45473 (left) and a zoom into the disruption interval (upper right) and the vertical displacement (lower right). The chain of consecutive events of interest here is DCS  $\rightarrow$  IPR  $\rightarrow$  VDE  $\rightarrow$  USD  $\rightarrow$  CQS.

-> Figure 3a (data contained in CQSstats.txt file):

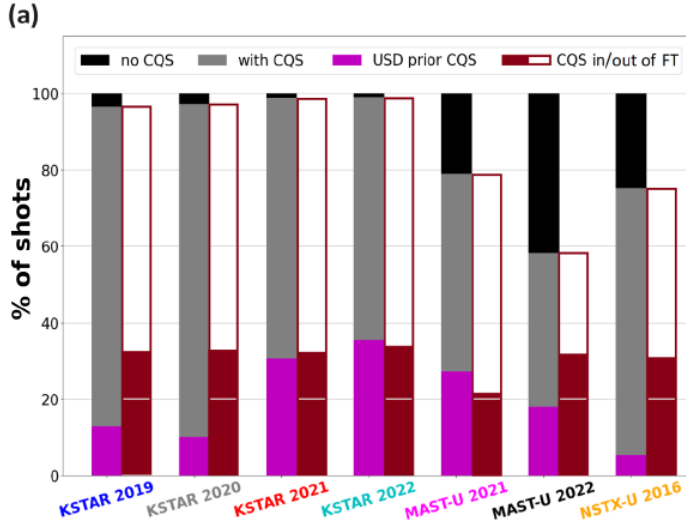
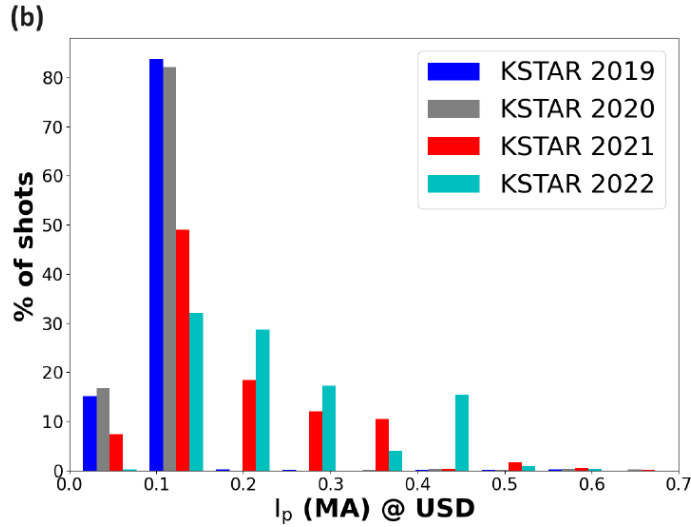


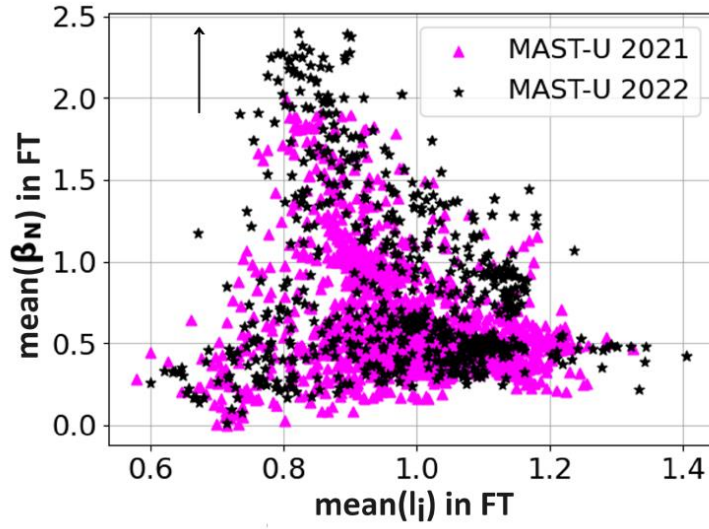
Figure 3: (a) Statistics of automatic DECAF recognition of  $I_p$  quench phase through the CQS event in the full study database. CQS preceded by the USD are indicated, as well as CQS events happening during or outside of the  $I_p$  flat-top (FT) phase. (b)

-> Figure 3b (data contained in USD\_KSTAR.csv file):



(b) Distributions of  $I_p$  calculated at the USD event time in KSTAR 2019-2022.

-> Figure 3c (data contained in betaN\_li\_MASTU.csv file):



(c) Stability diagram  $\beta_N(l_i)$  in the form of mean values of the quantities calculated during the  $I_p$  flat-top phase, MAST-U 2021 and 2022 datasets. Shift towards higher mean( $\beta_N$ ) values in MAST-U 2022 is indicated by an arrow.

-> **Figure 4** (data contained in triggerEvents.txt file):

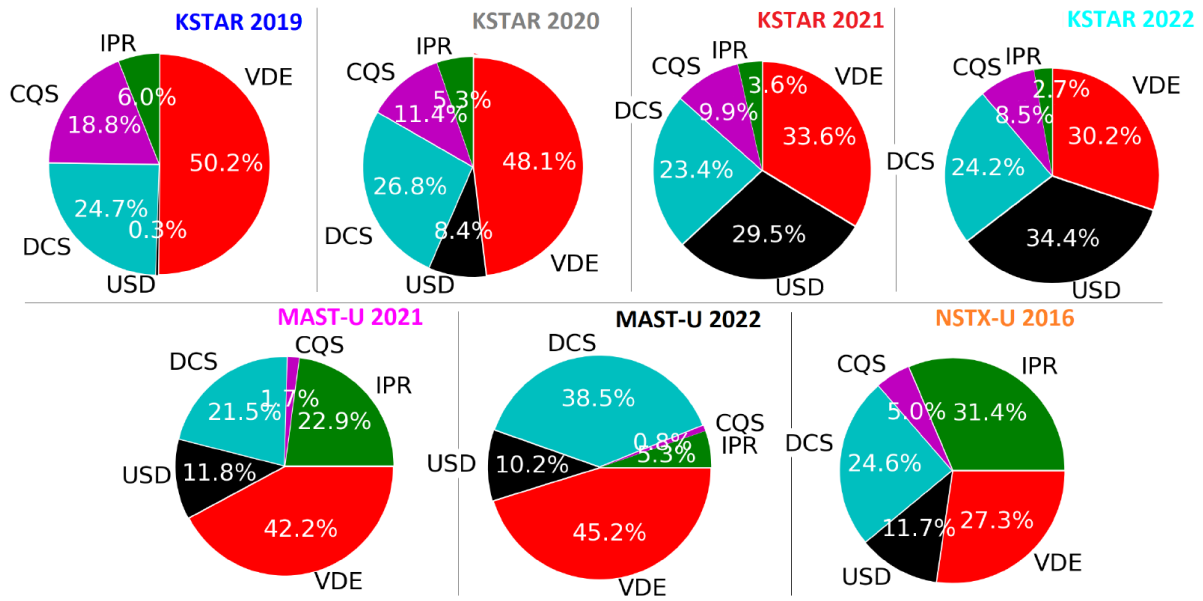


Figure 4: Percentage of all DEC categories grouped per trigger event in the study set.

-> Figure 5 (MAST-U 2021 data for scatter plots contained in MAST-U-2021\_operSpace.txt file, MAST-U 2021 data for scatter plots contained in figureScatter\_li\_elon\_MAST-U\_2022.csv file and histogram data are included in MAST-U\_Rmag\_VDE.csv):

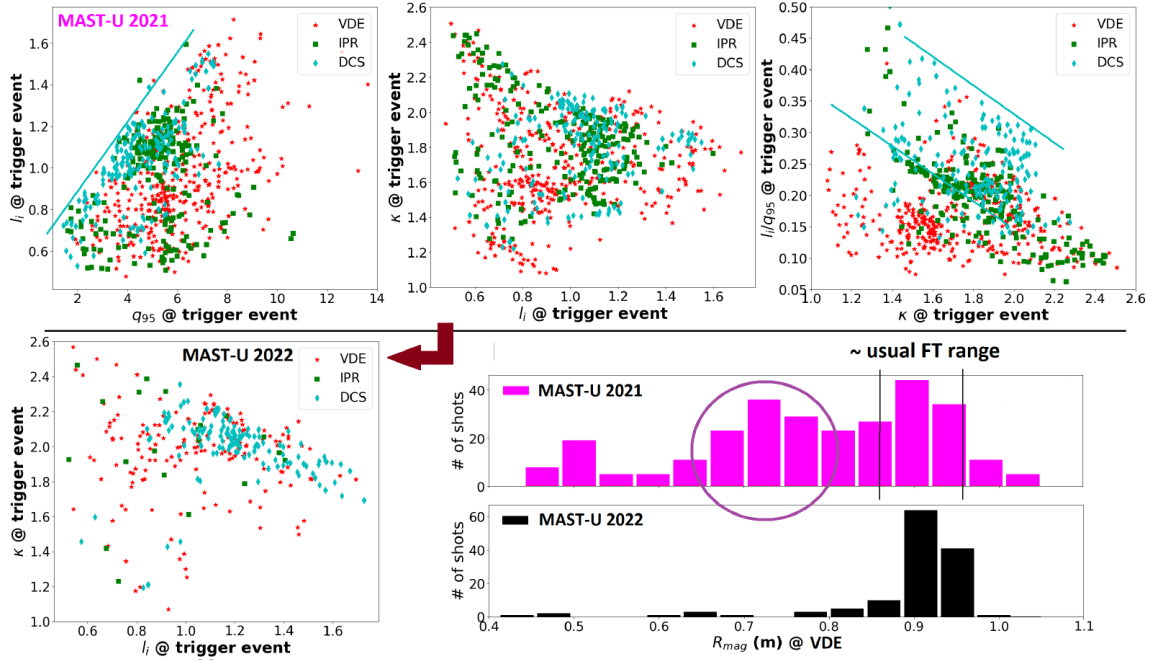
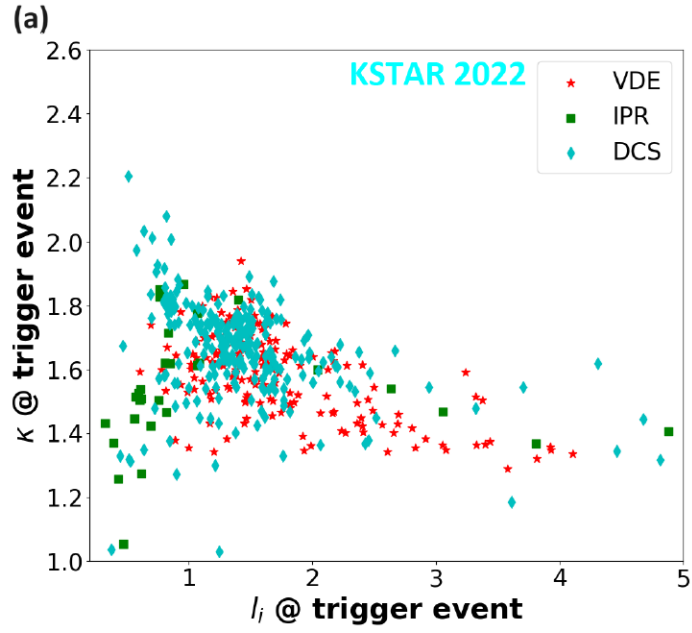


Figure 5: Upper plots and lower left: Trigger events occurrence in selected operation space diagrams, MAST-U 2021-22. Lower right: Radial position of the magnetic axis  $R_{mag}$  calculated at the time of the VDE event in MAST-U 2021-22.

-> Figure 6a (data contained in figureScatter\_li\_elon\_KSTAR\_2022.csv file):



-> Figure 6b (data contained in figureScatter\_li\_elon\_NSTX-U.csv file):

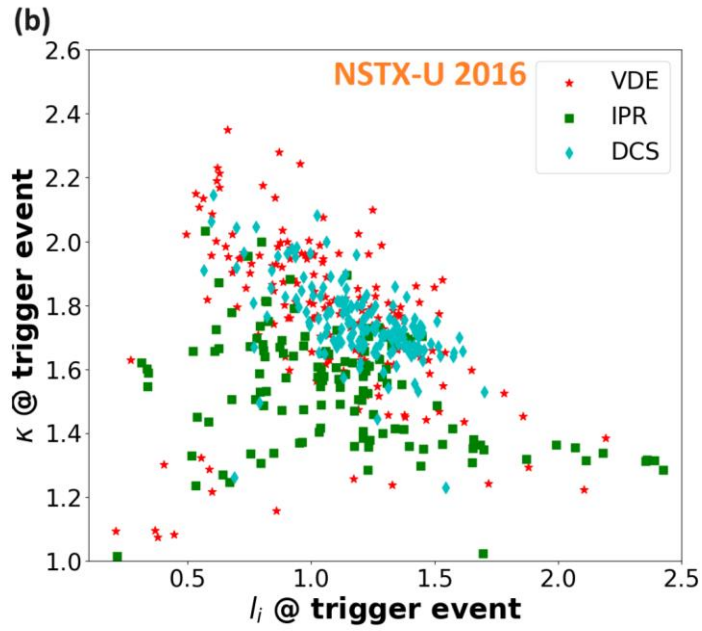


Figure 6: Trigger events occurrence in the  $\kappa(l_i)$  diagram in KSTAR 2022 (a) and NSTX-U 2016 (b).

-> **Figure 7** (data contained in figureScatter\_li\_q95\_all.csv file):

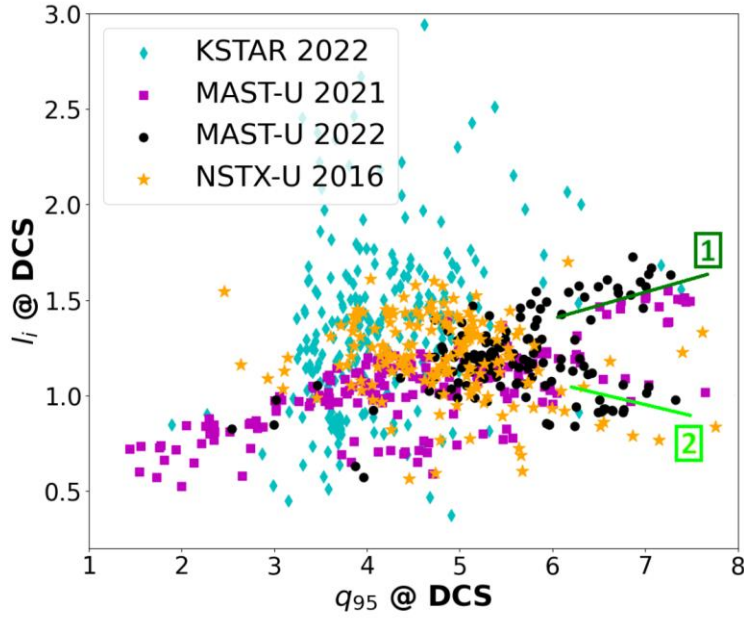


Figure 7: Multi-device location of the DCS trigger event in the  $l_i(q_{95})$  diagram. Two distinguishable branches of MHD instabilities (MAST-U case) are highlighted in green color.



-> **Figure 8a** (data contained in figureScatter\_li\_q95\_all.csv file, columns *MAST-U\_2021\_DCS\_Shot*, *q95*, *li*):

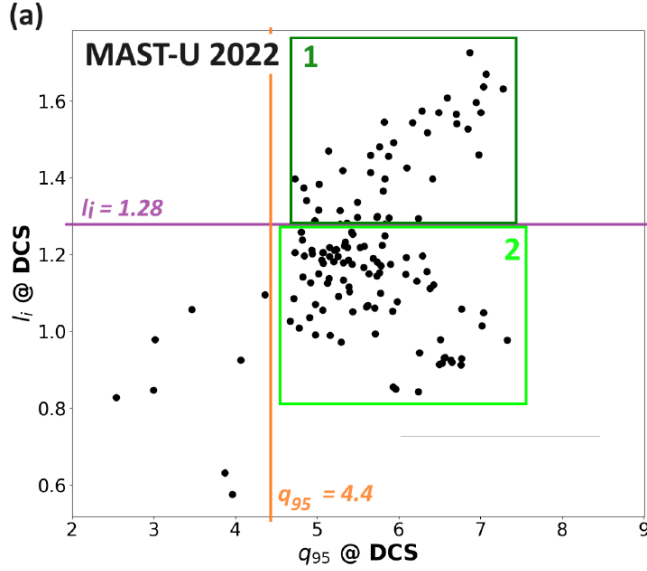
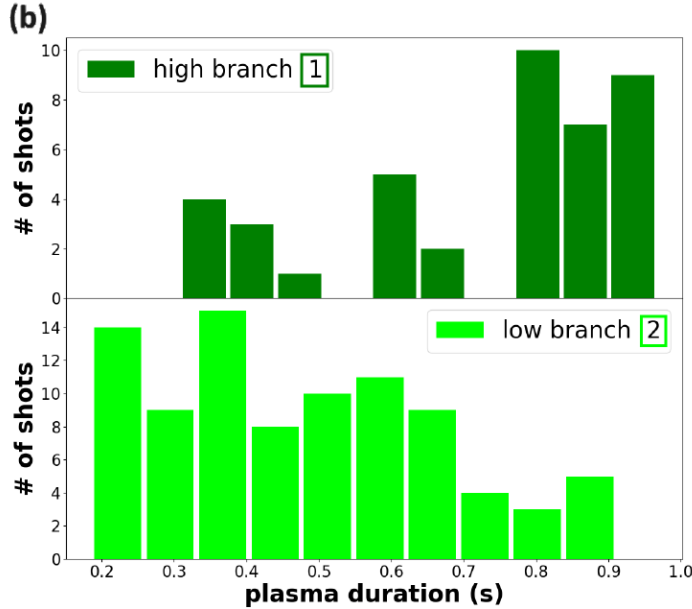


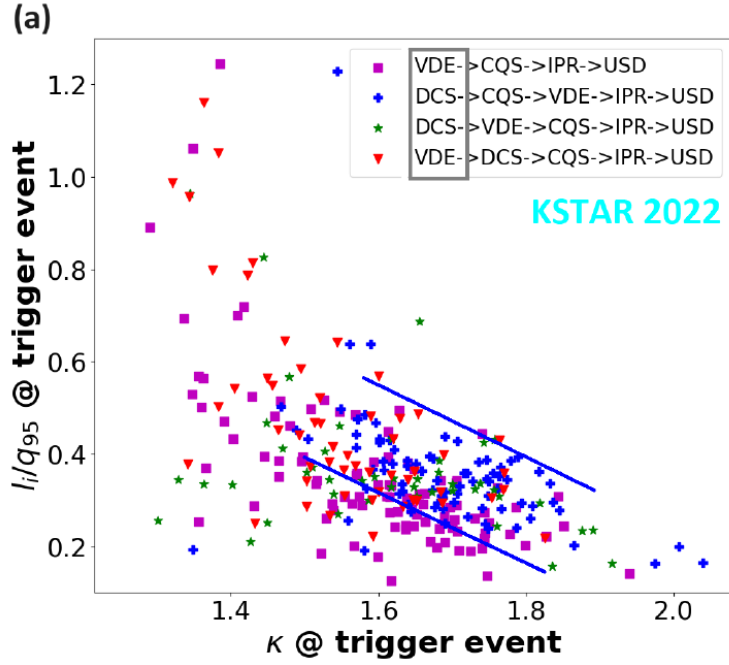
Figure 8: (a) Location of the DCS trigger event in the  $l_i(q_{95})$  diagram for the MAST-U 2022 database. The two branches of  $l_i(q_{95})$  points (delimited by the  $l_i$  and  $q_{95}$  limits visualized by magenta and orange lines) are highlighted in green colors.

-> **Figure 8b** (data contained in histoPlasmaDurMAST-U\_2022.csv file):



(b) Plasma durations (in seconds) of shots belonging into the two branches.

-> Figure 9a (data contained in figureScatter\_DCE\_KSTAR\_2022.csv file):



-> Figure 9b (data contained in figureScatter\_DCE\_MAST-U\_2021.csv file):

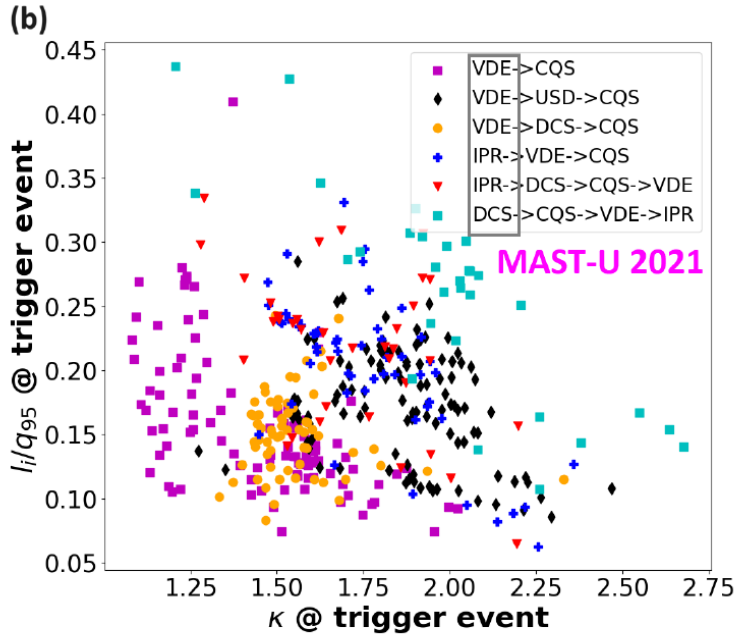


Figure 9: Location of dominant DEC trigger events in the  $l_i/q_{95}(\kappa)$  diagram: (a) KSTAR 2022, (b) MAST-U 2021. DEC trigger events are highlighted by a gray rectangle.