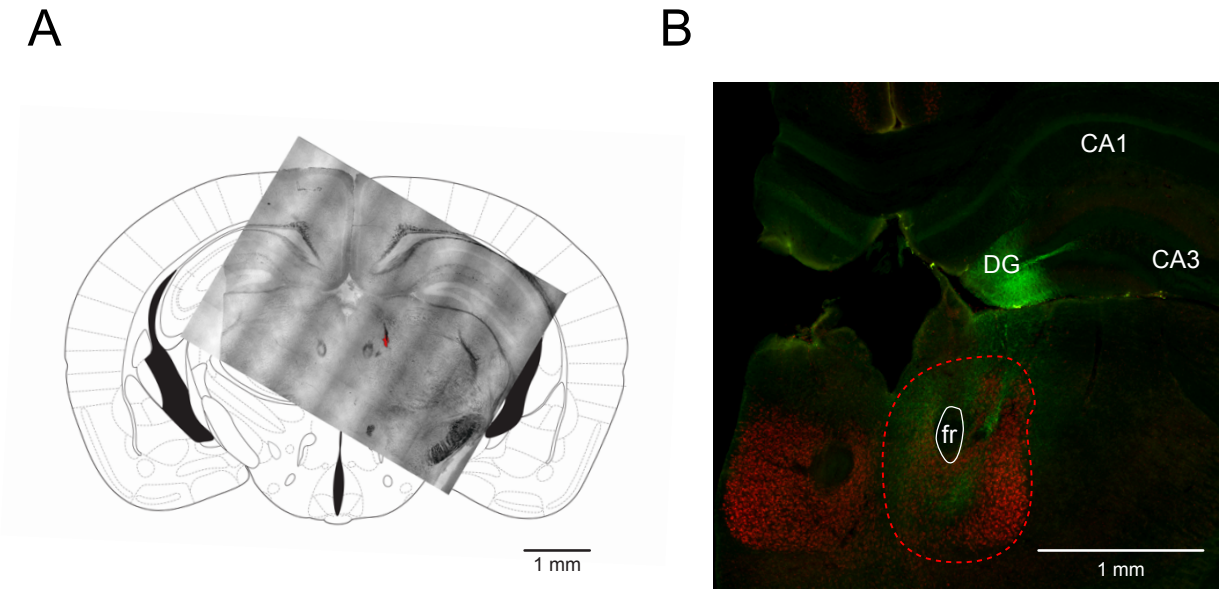
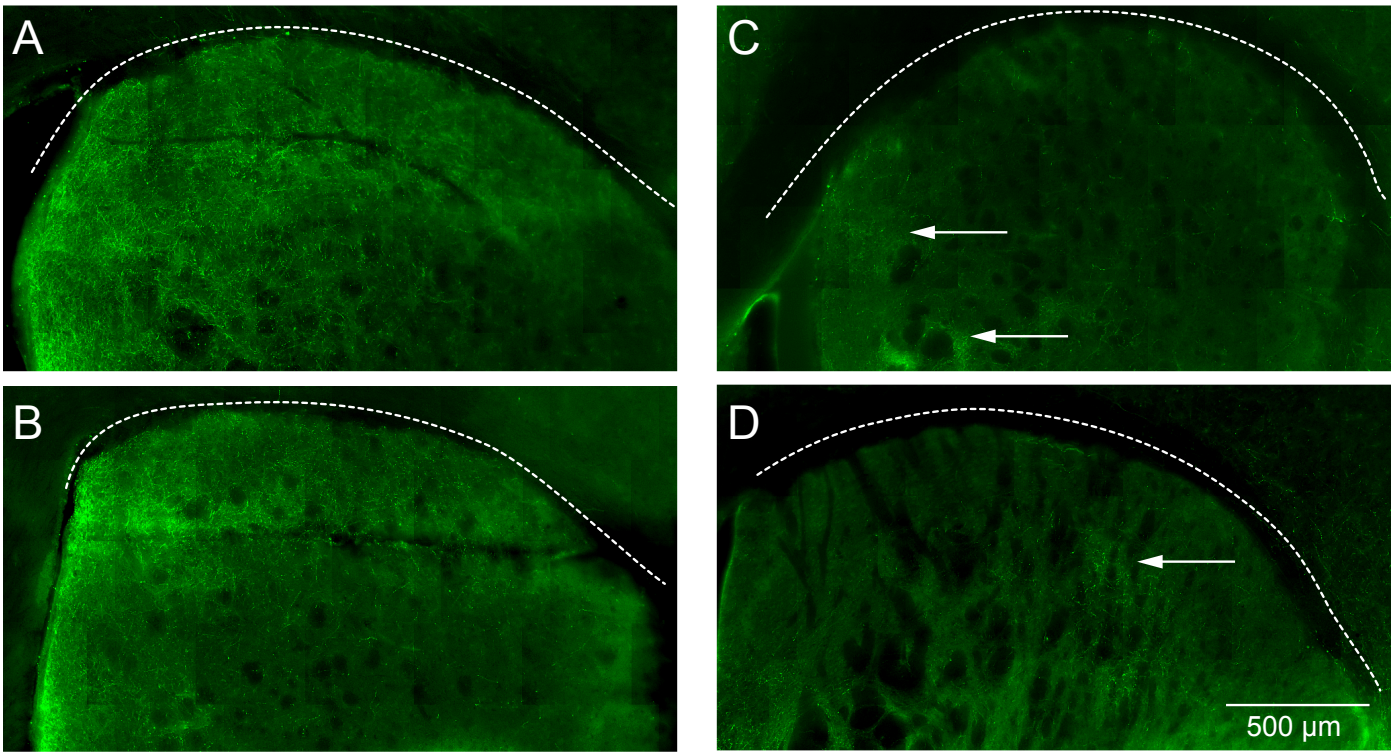
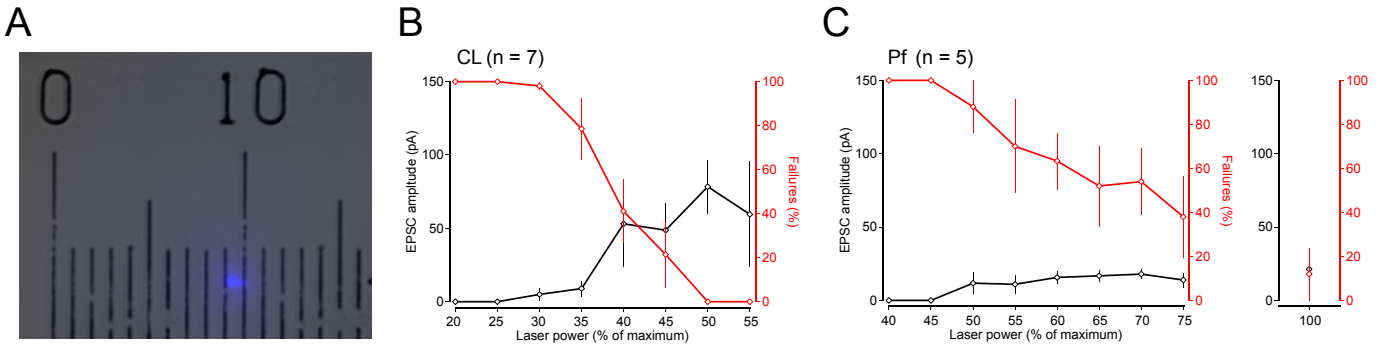


Supplemental Figure 1: *AAV injection location*
(**A**) Coronal brain section of a CAMKII-cre mouse injected with red fluorescent latex beads. This method was initially used to find the optimal coordinates for the injection of AAV particles. (**B**) Coronal section of an AAV-ChR2-YFP injected CAMKII-cre mouse stained for cerebellin-1 which was used as a marker of the parafascicular nucleus. This method was initially used to ascertain the degree of localization of the infected neurons using different injection volumes. DG = dentate gyrus, CA3 and CA1 = CA3 and CA1 field of the hippocampus, fr = fasciculus retroflexus.



Supplemental Figure 2: *Expression patterns of ChR2-YFP fibres in the striatum*

In CL-injected animals, YFP-positive fibres were fairly evenly distributed across the dorsal striatum (**A & B**), but in the Pf-injected animals YFP-positive fibres were often distributed in patches intermingled with regions of less dense labelling (**C & D**). Dashed lines indicate the external capsule. The midline is to the left.



Supplemental Figure 3: *Laser spot minimal stimulation*
(**A**) The spot size using laser stimulation is ~10 um as measured with a glass graticule. (**B**) The amplitude of evoked EPSCs (black) and failure rate (red) with increasing laser stimulation at CL synapses. (**C**) The amplitude of evoked EPSCs (black) and failure rate (red) with increasing laser stimulation at Pf synapses.