FE-Power

- FE-power max power is
  - L0: 644mW/cm2, I=1672mA
  - L2: 504mW/cm2, I=1309mA
  - Assumes 10% overhead, including activity
  - 20% OH
    - L0 → 702mW/cm2, I=1824mA
    - L2 → 550mW/cm2, I=1428mA
    - Voff and Rslope need to be updated for 20% OH
- Current assumptions are 800/700mW/cm2 for L0/L1 and L2/L3/L4
  - Reduction of 155mW/cm2 (97mW/cm2) for L0/L1
  - Reduction of 195mW/cm2 (150mW/cm2) for L2/L3/L4
- Uncertainties/questions
  - Do we apply a SF for current as function of fluence and temperature?
  - How are number of o/p lines taken into account – is it relevant?
  - Do we use 20% OH + activity?

Quad hybrid

- Quad hybrid
  - Flex+connector+wire bonds=12.97mOhm
  - Power density = 0.021Wcm-2 for 10% OH, 0.025Wcm-2 for 20% OH
    - Assuming I=1309mA/chip for 10% OH, 1428mA/chip for 20% OH
  - HV resistor = 5kOhm
  - Assume end of life sensor current gives around 6mA @600V at 0C after 3e15ncm-2 for L2
    - Power density is from resistor is 10mWcm-2
    - Similar number for L1
  - Total power density is 38mWcm-2 (including 10% envelope for flex), dominated by the sensor current in the bias resistor
  - Can be accommodated in the 150mWcm-2 saving with 20% OH
  - Would now be 68/550=7% of the FE-power
- Uncertainties/questions
  - Check sensor current
  - How to include bias resistor as it is a hot spot (is it included in FEA models?)
  - Can bias resistance be reduced?
  - What is the envelope of the flex power
  - Reduction to old spec of 35uA/cm2 can be achieved by reducing operating voltage to 500V, hit efficiency still above 97% (but check in-time hit efficiency)

Triplet Hybrid

- Triplet hybrid
  - Resistance is 13.3mOhm
  - Current is 1824mA for 20% OH
  - Power density is 78mWcm-2
  - Assume bias resistor contribution is small
  - Can be accommodated in the 97mW/cm2 saving for L0
  - Would now be 78mWcm-2/702mWcm-2=11%

Next steps

- Meeting on Wed 24/3 to summarise discussion and next steps
- Summarise numbers
  - Summarise in EDMS document
- Propose:
  - Release current quad hybrid design for prototyping
    - Use for FDR measurements
    - Update power specs as we get more information from chip measurements
    - Review design at or just after FDR for pre-production
  - Release triplet hybrid design for prototyping
    - Is Cu thickness ok for bump-stress