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Application Note

Computing Forming-Limit Curves (FLC ISO 12004) in VIC-3D

VIC-3D 11

2026

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Validate with Confidence

VIC-3D 11

Computing Forming-Limit Curves (FLC ISO 12004) in VIC-3D 11

This application note describes the recommended workflow for computing forming-limit strain pairs (ε_1, ε_2) from DIC measurements using two Correlated Solutions extensions for VIC-3D:

FLC ISO 12004

This per-sample analysis implements the position-dependent method of **DIN EN ISO 12004-2:2021** for a single fractured specimen and returns one (ε_1, ε_2) limit-strain pair per section line.

FLC ISO 12004 Annex F

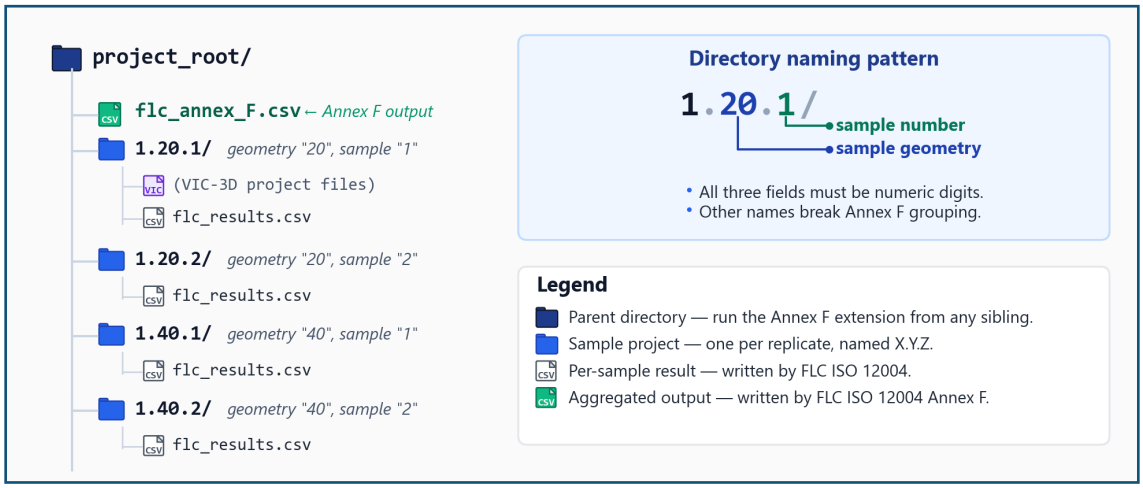
This aggregator combines the per-sample CSV outputs into the consolidated table prescribed by ***Annex F*** of the standard, with means per-sample and per-geometry.

Please note: *This note assumes you are already following the standard for specimen preparation, speckle application, and test execution for your laboratory. It does not provide a step-by-step walkthrough of DIC (test set-up, calibration, image acquisition, normal post-processing, etc.). For a range of resources focused on DIC acquisition and analysis, please visit the Correlated Solutions Support Page at www.correlatedsolutions.com/support or by clicking the QR code to the right.*

Before You Begin

Each sample project must contain:

- A completed correlation through fracture
- The working directory named in the pattern `X.Y.Z` (e.g. `1.20.1`), where the middle field is the ***sample geometry*** and the last is the ***sample number***. Use numeric digits in all three fields — non-numeric values will break the Annex F aggregation.
- A single inspector line drawn on the analysis frame (see *Step 2*).



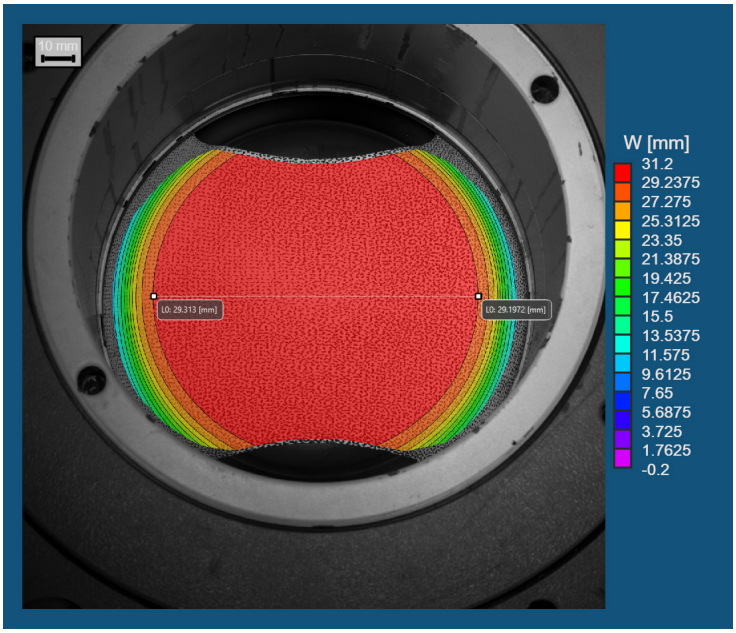
If you have any questions, comments, or concerns about using your DIC system, please contact our Support Team.

support@correlatedsolutions.com
1.803.926.7272

Step 1 - Load the Analysis Frame

The position-dependent method assumes the localized neck is fully developed and the crack has ***not yet*** propagated through the gauge region.

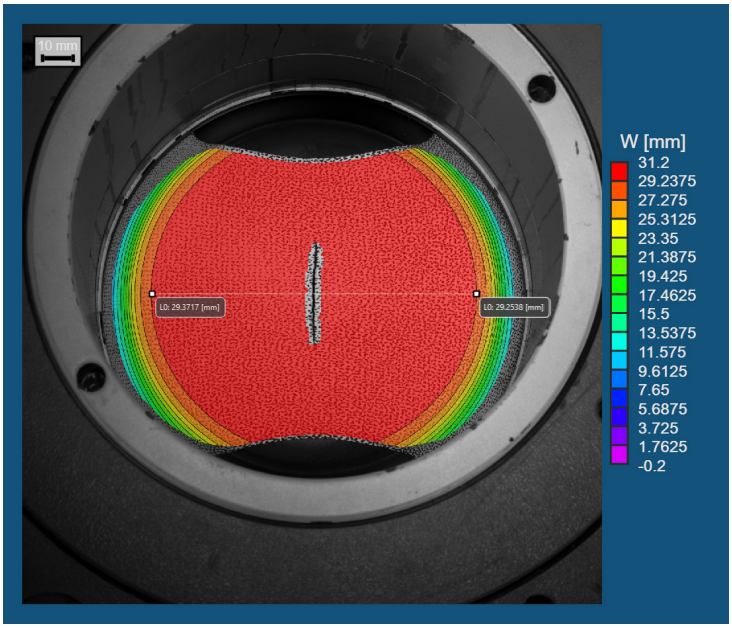
Step backward through the test until you find the ***last frame before crack-through***. Note the frame number, this will be the data file selected within the extension.



Step 2 - Draw the Inspector Line

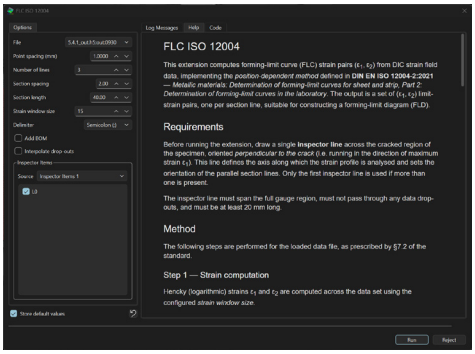
Draw one inspector line across the cracked region. It should be:

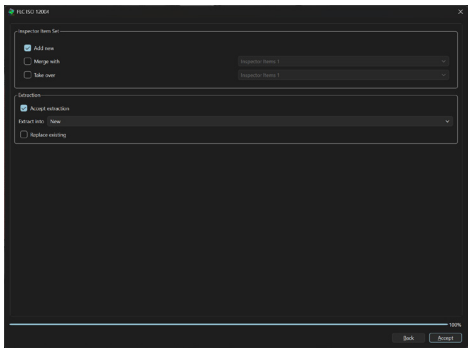
- Perpendicular to the crack (along the direction of maximum ε_1).
- At least 40 mm long. The extension rejects lines shorter than 20 mm and §7.2.2 of the standard requires a 40 mm section length. Draw with at least 20 mm of usable data on each side of the visible crack.

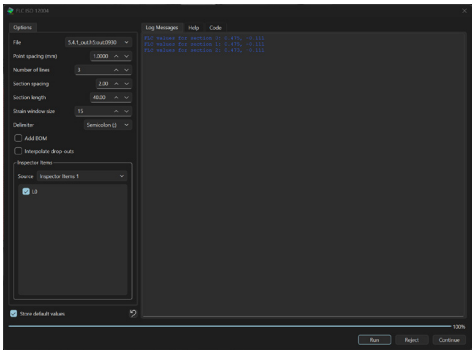


Step 3 - Run the FLC ISO 12004 Extension

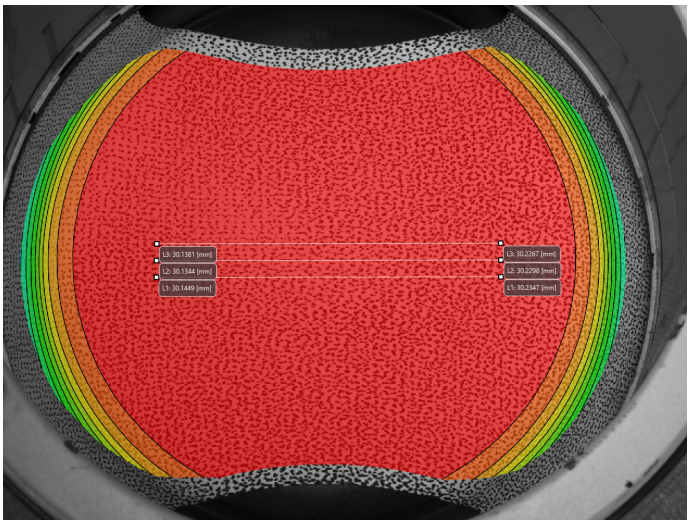
- The FLC ISO 12004 Extension default settings are set according to the standard.
- Options are well documented within the extensions Help page.
- The only inputs required will be the 'File' that was noted previously as the last frame before crack-through, and the inspector item drawn across the crack in Step 2.
- Complete this step for all of the samples in the series.

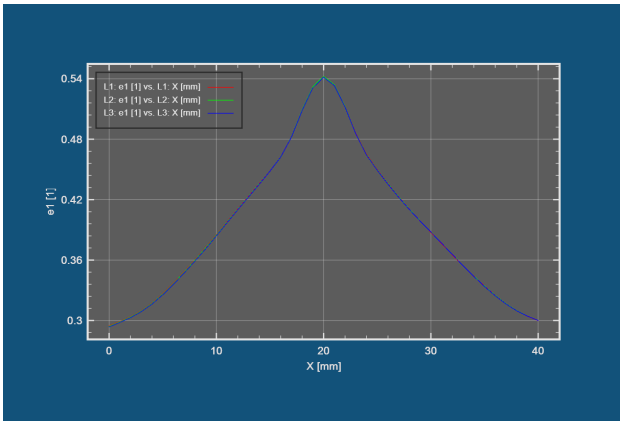






Once this is complete, **Section lines (right)** should be visible in the data viewer, centered on the crack and perpendicular to it.





Additionally, Line Extractions are added to the project. These contain the ε_1 and ε_2 profiles for each section line. Each ε_1 profile should show a single sharp peak as shown in the example (left).

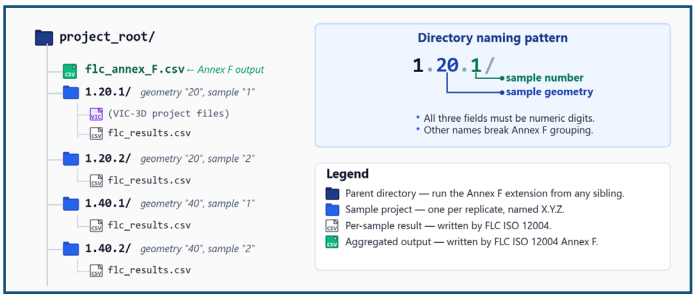
In addition to these new values within the project there will also be two CSV files written to the working directory:

- ***flc_profile_data.csv*** — full ε_1 and ε_2 profiles for every section line
- ***flc_results.csv*** — one (ε_1, ε_2) limit-strain pair per successfully analyzed section line.

Verify that the **Sample geometry** and **Sample number** columns contain the expected values from your directory name. If they read `NA`, the directory does not match the `X.Y.Z` pattern. If this is the case, rename it and rerun.

Step 4 - Aggregating Multiple Samples - FLC ISO 12004 Annex F

Upon execution of the FLC ISO 12004 extension on every sample, use the Annex F extension to combine the results.



All sample projects must sit as siblings under a common parent directory. Each directory name must follow the `X.Y.Z` pattern with ***numeric digits*** in all three fields — the middle field groups by geometry; the last groups duplicates within a geometry.

Open any of the sample projects (or a dedicated summary project in the same parent), then **Run** the extension *Extensions → Forming limit curve → FLC ISO 12004 Annex F.*

Executing the extension triggers the following actions:

- Scan of all sibling directories in the current project for ***flc_results.csv***.
- Concatenation of all rows into a single table.
- Computation of the **mean ε_1 and ε_2 per-sample** (grouped by sample geometry + sample number).
- Computation of the **mean ε_1 and ε_2 per-geometry** (grouped by sample geometry).
- Write the aggregated CSV to the parent directory.

The per-sample and per-geometry mean columns appear on the last row of each sample / each geometry, matching the Annex F table format.

ε1	ε2	ε1 - Mean sample	ε2 - Mean sample	ε1 - Mean geometry	ε2 - Mean geometry	Sample geometry	Sample number	Section line
0.494407922	-0.225146781					1	1	0
0.506876114	-0.223545249					1	1	1
0.509517531	-0.218689753	0.502319698	-0.217805425			1	1	2
0.513156183	-0.222643733					1	2	0
0.510168945	-0.221764868					1	2	1
0.505709023	-0.218790681	0.508633404	-0.224630386			1	2	2
0.504590419	-0.227966258					1	3	0
0.514275835	-0.218908373					1	3	1
0.508939729	-0.219885998	0.500240587	-0.22112135	0.507233338	-0.223956257	1	3	2
0.50700477	-0.196351904					2	1	0
0.50974718	-0.190808476					2	1	1
0.515660284	-0.196738648	0.517861947	-0.19449056			2	1	2
0.507910866	-0.192325528					2	2	0
0.500300642	-0.187504554					2	2	1
0.509630786	-0.188902173	0.511095606	-0.188715061			2	2	2
0.505007439	-0.194574429					2	3	0
0.500668963	-0.194513781					2	3	1
0.505139678	-0.196753829	0.505402118	-0.193219563	0.498657334	-0.189648007	2	3	2
0.49219864	-0.149559934					3	1	0
0.477852984	-0.151189535					3	1	1
0.495020844	-0.152946243	0.483870237	-0.149331878			3	1	2
0.489586922	-0.154504271					3	2	0
0.492980555	-0.153637104					3	2	1
0.4848902	-0.155433138	0.483710037	-0.154981313			3	2	2
0.479746162	-0.150662225					3	3	0
0.478401955	-0.149486863					3	3	1
0.495532284	-0.154415315	0.483566701	-0.149531801	0.476313346	-0.148869363	3	3	2
0.468239144	-0.109827418					4	1	0
0.471797648	-0.110587062					4	1	1
0.475653772	-0.110075452	0.480388754	-0.113552745			4	1	2
0.467065382	-0.110620216					4	2	0
0.47853246	-0.108331976					4	2	1
0.466576395	-0.109573597	0.466987543	-0.108948812			4	2	2
0.470888475	-0.107964886					4	3	0
0.470888413	-0.109463485					4	3	1
0.46474947	-0.107399829	0.464888696	-0.108539252	0.473714219	-0.107738746	4	3	2
0.473107847	0.44404994					8	1	1
0.470867027	0.453531939	0.466224424	0.446863907			8	1	2
0.479000504	0.453032846					8	3	0
0.477430641	0.462096254					8	3	1
0.465308673	0.460181149	0.481602157	0.451110939	0.475176919	0.44949313	8	3	2

Support

If you have any questions about this document or any other questions, comments, or concerns about our software, please contact us at support@correlatedsolutions.com, or visit our website at correlatedsolutions.com/support.

The powerful extensions feature is available exclusively in VIC-3D 11.2. Contact one of our Sales Engineers at sales@correlatedsolutions.com for information on updating your software.